TML

PRODUCT CATALOG 2025-2026



STRAIN GAUGES
STRAIN GAUGE TRANSDUCERS
MEASURING INSTRUMENTS

Tokyo Measuring Instruments Laboratory Co., Ltd.

A Constant Pioneer in the Field of Measurement

Since its establishment, Tokyo Measuring Instruments Laboratory Co., Ltd. has consistently contributed to society as a comprehensive provider of strain measurement solutions. Centered on strain gauges, our development and provision of measuring instruments and software reflect our enduring commitment to innovation and excellence. Over the years, we have cultivated rich creativity and amassed sophisticated technological capabilities through dedicated research and development.

In 1956, the company achieved a global first by successfully developing a polyester strain gauge. This breakthrough significantly enhanced moisture resistance compared to conventional paper gauges, thereby expanding the practical applications of strain measurement. Leveraging the advanced technologies cultivated through strain gauge development, we have subsequently introduced a wide array of related products, including transducers, measuring instruments, and software, further advancing the field of strain measurement.

In an era marked by increasing diversity and a growing emphasis on harmony with the global environment, manufacturing that supports sustainable societies has emerged as a central theme. The evolution of the Internet of Things (IoT), spanning from production to logistics systems, is now fostering the creation of next-generation industries. Amidst these developments, we remain committed to delivering highly reliable measurement solutions even under the most demanding conditions, and to the ongoing development of advanced technologies and products.

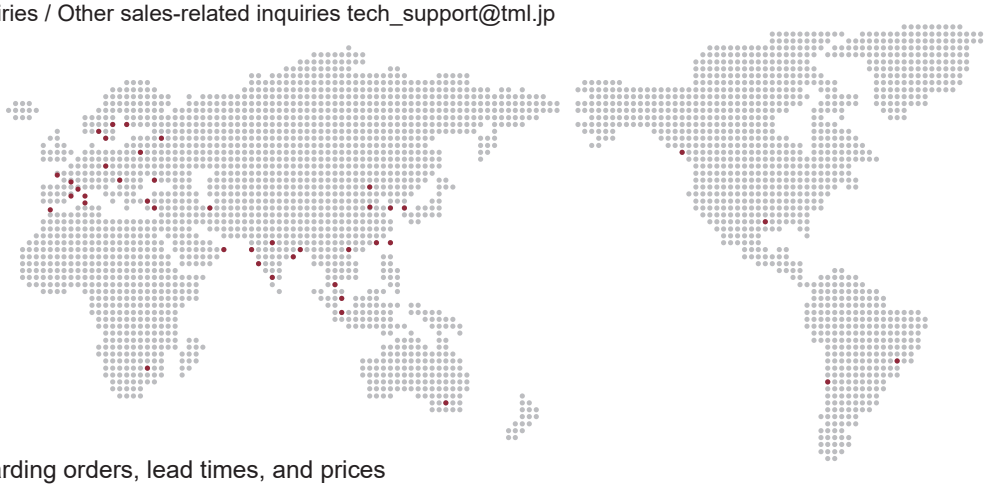
Panoramic View of Kiryu Plant (Photographed in 2016)



Company Profile

JAPAN

Tokyo Measuring Instruments Laboratory Co., Ltd.
Technical inquiries / Other sales-related inquiries tech_support@tml.jp



Inquiries regarding orders, lead times, and prices

Asia	sales_asia@tml.jp	Europe	sales_europe@tml.jp
America	sales_america@tml.jp	Middle East	sales_mideast@tml.jp
Oceania	sales_oceania@tml.jp	Africa	sales_africa@tml.jp

Overseas Subsidiary

KOREA

TML Korea Co., Ltd.

Overseas Distributors

America

BRASIL
Instronic Instrumentos de Testes Ltda.

CANADA
Hoskin Scientific Limited.

CHILE, PERU, BOLIVIA
EDUSMART SERVICIOS INTEGRALES DE ED. Y TEC SPA

U.S.A., MEXICO
Texas Measurements, Inc.

Africa

EGYPT (Dealer)
UNITED GROUP

SOUTH AFRICA
Amtec Techniquip Pty Ltd.

Oceania

AUSTRALIA, NEW ZEALAND
Bestech Australia Pty. Ltd.

Europe

DENMARK
WEA Technology A/S

FINLAND
Elkome Oy

FRANCE
Acal BFi France SAS

GERMANY, CZECHIA, AUSTRIA, SWITZERLAND LIECHTENSTEIN
ALTHEN GmbH

GREECE, CYPRUS
EOTEK – P. XYSTRIS & Co. E.E.

ITALY
Acal BFi Italy SRL

NETHERLANDS
ALTHEN Sensors & Controls BV

NORWAY, SWEDEN
Caseb as

POLAND (Dealer)
TENMEX

SERBIA, MONTENEGRO
DieMMe

SWITZERLAND, LIECHTENSTEIN
GSI GeoSolutions International Ltd

SPAIN, PORTUGAL
Europavia-Espana, S.A.

U.K., IRELAND
Techni Measure Ltd.

Asia

BANGLADESH
Sterling Multi Technologies Ltd.

CHINA
AR BROWN (Shanghai) Co., Ltd. Earth Products China Limited

INDIA
BIO-SCAN INSTRUMENTS (Dealer)
D&M Technologies
Proact IMS Private Limited
Record Tech Electronics

INDONESIA
PT.Soliton Intak Sinergi

OMAN (Dealer)
Modern East Trading & Contracting LLC

SINGAPORE, MALAYSIA, MYANMAR, BRUNEI
Sensorcraft Technology.(S)Pte Ltd.

TAIWAN
Bright Stone Enterprises Co.
System Access Company Ltd.
U-Soft Technology Co., Ltd.

THAILAND
Industrial Electrical Co., Ltd.
Research Equipment Co., Ltd.

TURKEY
NEL Elektronik Cihazlar Imalat Ve Ticaret A.S.

VIETNAM
INOTECH JOINT STOCK COMPANY

Strain Gauge

Stress measurement technologies are indispensable for ensuring the safety and efficiency of all kinds of structures. Since its founding in 1954, Tokyo Measuring Instruments Laboratory Co., Ltd. has been a specialized manufacturer of stress measuring instruments including strain gauges and related products. Throughout the history of more than 60 years, the company has striven to meet the needs of the times and to provide trustworthy products that can be used with full reliability.
Strain Gauges are our main products,and we unveiled the world's first polyester strain gauge in 1956. This new gauge brought about a great improvement in the humidity resistance of gauge backings compared to the strain gauges with paper backings which were popular at that time. Since then, our various technologies represented by the development of foil strain gauges and high temperature strain gauges have enabled reliable measurements under diverse conditions.

INTRODUCTION

This catalog presents the full range of Our standard strain gauges and associated products including bonding adhesives and coating materials manufactured by Tokyo Measuring Instruments Laboratory Co., Ltd.
It also describes how to find specific strain gauges, introduces typical applications, and defines the most commonly used technical terms.

Prior to using the catalog, please check the information listed below.

CHANGES IN SPECIFICATIONS

In the interest of product improvement, the specifications in this catalog are subject to change without prior notice.

DIMENSIONS

Dimensions are mainly given in milimeter. Strain gauge patterns are in actual size, with enlargements of some miniature patterns.

PRICES

Prices are not listed in this catalog. For price information or orders, please contact us or your local representative.

HANDLING STRAIN GAUGES

1. The technical data supplied herein do not reflect the influence of the leadwire. The data must be corrected in accordance with the effect caused by the leadwire.
2. The service temperature of a strain gauge depends on the operating temperature of the adhesive, etc.
3. Insulation resistance should be checked at a voltage of 50V or less.
4. Do not apply an excessive force to the gauge leads.
5. Apply adhesive to the back of the strain gauge and attach the gauge to the specimen.
6. The back of each strain gauge has been washed and degreased. Do not contaminate it by touching it directly.
7. For maintaining quality, store products in a dry place.

HANDLING BONDING ADHESIVES AND COATING MATERIALS

1. Read the operation manual carefully before using bonding adhesives and coating materials.
2. After using an adhesive, wipe all remaining adhesive off the container and nozzle with a cloth, and replace the cap.
3. After using an adhesive, put the container back in the package and store it in a cool, dark place away from fire.
4. If an adhesive contacts skin or clothing, wash well with soap and water.

If you have any questions about this catalog, please contact us or your local representative.

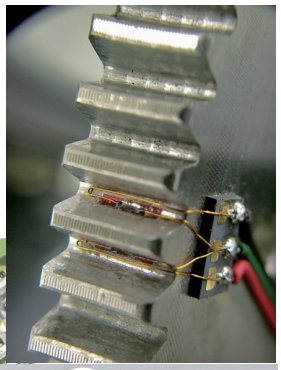
TABLE OF CONTENTS

STRAIN GAUGE APPLICATIONS....2
Strain Gauges General Description....4
Technical Terms....6
Temperature Compensation for Leadwires in Quarter Bridge....8
Complete Compensation Method of Strain with Wheatstone Bridge - COMET....9
Application Example of Complete Compensation Method of Strain....10
1-gauge 4-wire Strain Measurement Method....11
Measuring Method of Strain and Temperature....13
Strain Gauge Bridge Circuit....14
Strain Gauge Coding System....16
Strain Gauge Selection....18
Measuring Purpose....22
Operating Temperature Range....23
Package Designation....24
Primary Installations - Bonding Strain Gauges....26
Primary Installations - Overcoating Strain Gauges....27
Strain Gauge Installation....28
Strain Gauge Extension Leadwires....29
How are Integral Leadwires Jointed....32
Combination Use of Strain Gauges and Dedicated Leadwires....36
GOBLET series....38
Foil Strain Gauges F series (GOBLET)....39
F series (GOBLET)....40
F series....42
Waterproof Strain Gauges WF series....44
High Temperature Strain Gauges QF series (GOBLET)....45
High Temperature Strain Gauges QF series....46
High Temperature Strain Gauges ZF series....47
High Temperature Strain Gauges EF series....48
High Temperature Strain Gauges HZF series....48
High & Low Temperature Strain Gauges CEF series....49
Cryogenic Temperature Strain Gauges CF series....50
Weldable Strain Gauges AW series (AWM / AWMD / AWH / AWHU / AW / AWF /AWC)....51
AW series (AWM/AWMD)....52
AW series (AWH/AWHU)....53
AW series (AW/AWC)....54
Accessories/Options/Installation example (for weldable strain gauges)....56
Polyester Strain Gauges P series....57
Polyester Foil Strain Gauges PF series....58
Metal Backing Strain Gauges FLM/WFLM series....59
Mold Strain Gauges PMF series....60
Asphalt Mold Strain Gauges PMFLS series....61
Strain Gauges UBF series....62
Strain Gauges BF series (GOBLET)....63
Strain Gauges GF series (GOBLET)....64
Strain Gauges LF series (GOBLET)....65
Strain Gauges PFLW/PLW series....66
Non-inductive Strain Gauges QMF series....67
Non-inductive Strain Gauges MF series (For Concrete)....69
Post-yield Strain Gauges YEF series (GOBLET)....70
Post-yield Strain Gauges YF series....71
Post-yield Strain Gauges YHF series....71
High Endurance Strain Gauges DSF series....73
One-side Strain Gauges DD series....73
Strain Gauges CTE series....74
Crack Detection Gauges FAC series....75
Stress Gauges SF series....75
Temperature Gauges TF series....76
Platinum RTD / Thermocouple....76
Bolt Strain Gauges BTM series....77
Bolt Strain Gauges BTMC series....78
Bolt strain gauge installation/calibration service....79
Transducer-specific Strain Gauge....80
Frictional Strain Checker FGMH series....82
Frictional Axial Strain Transducer FGAH-1B....85
Frictional Torque Sensor FGDH-4A....86
Residual Stress Measurement....88

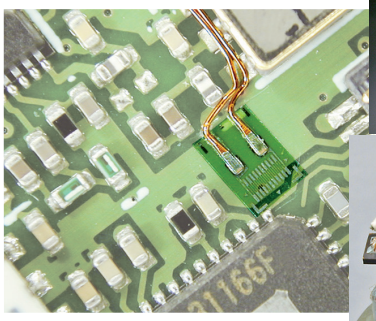
Miniature strain gauges

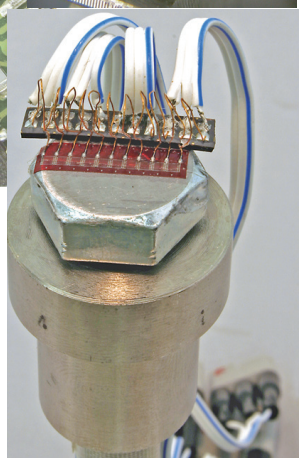
Printed circuit boards and surface mounting parts of automobile, computers and industrial machinery are getting smaller. Miniature strain gauges can be installed in a very limited gauge installation space.

Strain gauges in the valley of gear



Strain gauges on printed circuit board

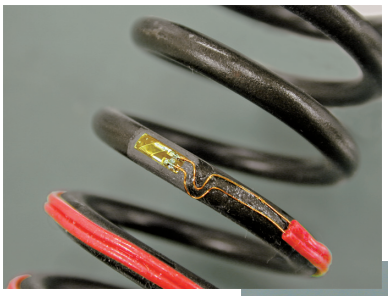


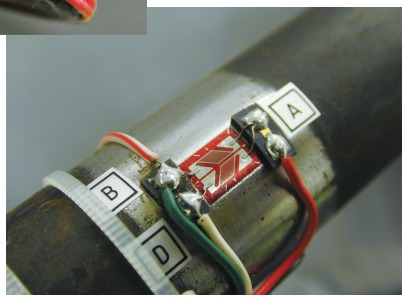


10-element chain type strain gauges on bolt head

Shearing strain and torque measurements

Shearing strains in 45-degree direction generated by shearing stress.



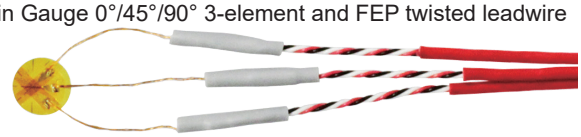


Magnetic field use

Strain Gauge single element and twisted leadwire



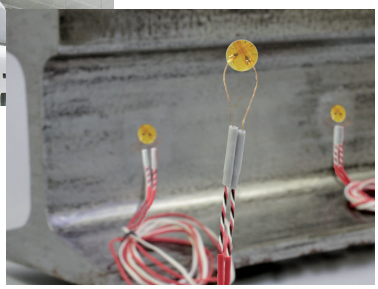
Strain Gauge 0°/45°/90° 3-element and FEP twisted leadwire





Strain measurement less influenced by EM noise between pantograph and trolley wire of electrified railway system

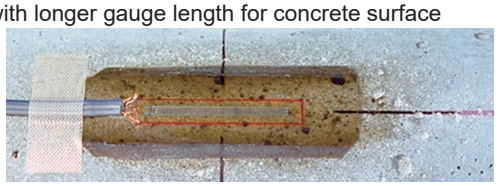
Railway axle load measurement



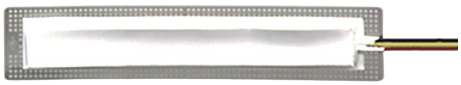
Concrete/Mortar measurements

Surface strain measurement of concrete and mortar

Strain Gauge with longer gauge length for concrete surface



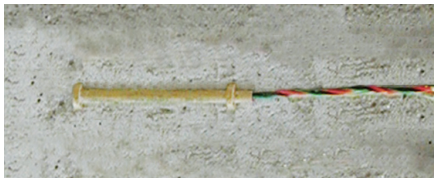
Strain Gauges with longer gauge length and metal backing for concrete surface



Internal strain measurement of concrete and mortar

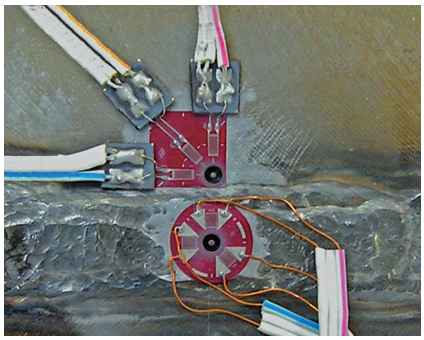
Mold strain gauges

PMF series available with temperature sensor integrated



Residual stress measurement

3-element residual stress measurement by center-hole drilling method

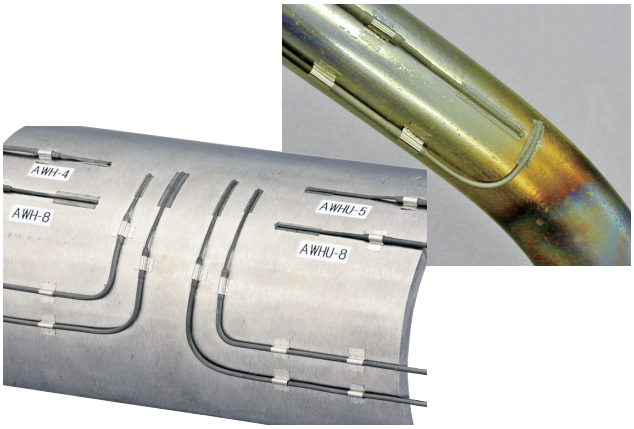


Bolt tensile force by emebedment type gauges

For measurement of tensile strain in a bolt. Simply inserted into a pre-drilled hole in the bolt head together with bonding adhesive. BTM and BTMC gauge series are recommendable if an ordinary strain gauge cannot be mounted on the bolt surface. Accurate tensile force measurement is possible by calibrating the bolt after installing the bolt gauges.



Weldable strain gauges



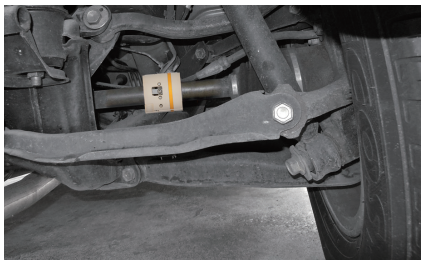
Frictional Strain Checker, Axial Strain Transducer, Torque Sensor System

Strain Checker FGMH series for single and 3-directional measurement. Re-usable with installation by magnet.

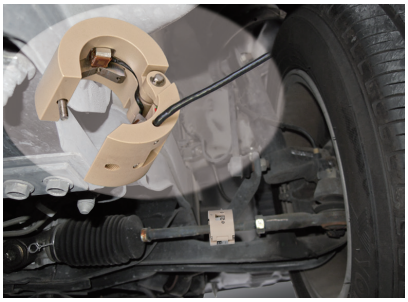


Torque Sensor System FGDH series applicable to driving shaft with split and cover-up system. With built-in telemetry transmitter, no wiring is required.

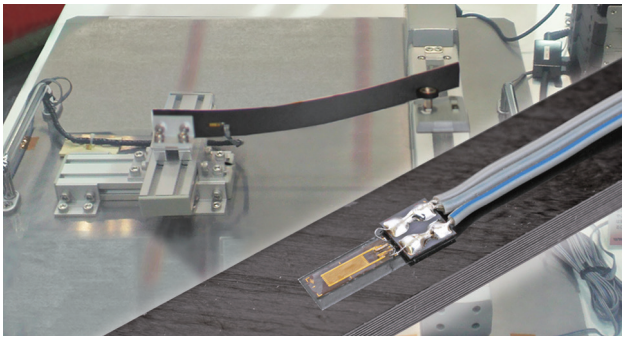




Axial Strain Transducer FGAH series applicable to steerling shaft with cover-up system
Different from the above FGDH, wire connection is required.



High Endurance Strain Gauge bonded on composite materials



Composite materials on which High Endurance Strain Gauge DSF is bonded are demonstrated for fatigue test over 10^7 cycles at strain level of ±3,000 microstrain.

Long term measurement

For construction measurement and maintenance.



Demolition of Buildings

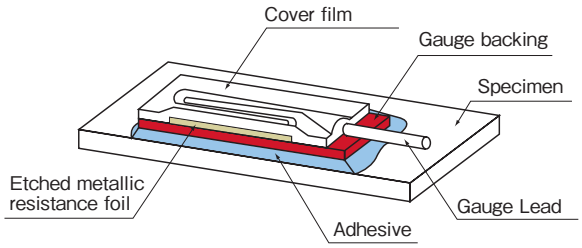


Strain Gauges General Description

Strain gauges are generally used for one of three reasons:

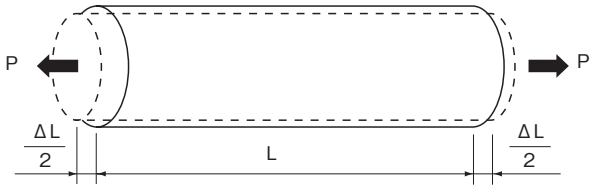
- To ascertain the amount of deformation caused by strain
- To ascertain the stress caused by strain and the degree of safety of a material or of a structural element that uses that material.
- To indirectly ascertain various physical quantities by converting them to strain.

There are a number of ways of measuring strain mechanically and electrically, but the vast majority of stress measurement is carried out using strain gauges due to their superior measurement characteristics.



What is Strain?

External force applied to an elastic material generates stress, which subsequently generates deformation in the material. At this time, the length of the material L extends to L+ΔL if the applied force is a tensile force. The ratio of ΔL to L, that is ΔL/L, is called strain. On the other hand, if a compressive force is applied, the length L is reduced to L−ΔL. Strain at this time is (−ΔL/L).



$$\varepsilon = \frac{\Delta L}{L}$$

where
- ε : Strain
- L : Original length of material
- ΔL : Change in length due to force P

Example) when a material of 100mm long deforms by 0.1mm in its length, the resulting strain is as follows.

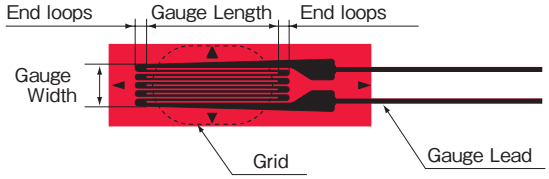
$$\varepsilon = \frac{\Delta L}{L} = \frac{0.1}{100} = 0.001 = 1000 \times 10^{-6}$$

What is a Strain Gauge?

The electric resistance of a metal changes proportionally to the mechanical deformation caused by an external force applied to the metal. By bonding a thin metal to a measurement object through a thin electrical insulator, the metal deforms depending on deformation of the measurement object and its electric resistance changes. The strain gauge (electric resistance strain gauge) is a sensor to measure the strain by means of measuring the resistance change.

Strain Gauge Configuration

A strain gauge is constructed by forming a grid made of fine electric resistance wire or photographically etched metallic resistance foil on an electrical insulation base (backing), and attaching gauge leads.



Strain Gauge Principles

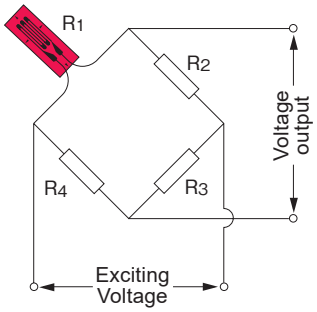
When strain is generated in a measurement object, the strain is transferred to the resistance wire or foil of the strain gauge via the gauge base (backing). As a result, the wire or foil experiences a resistance change. This change is exactly proportional to the strain as in the equation below.

$$\varepsilon = \frac{\Delta L}{L} = \frac{\Delta R/R}{K}$$

where
- ε : Strain measured
- L : Original length of material
- ΔL : Change in length due to force P
- R : Gauge resistance
- ΔR : Resistance change due to strain
- K : Gauge Factor as shown on package

Normally, this resistance change is very small and requires a Wheatstone bridge circuit to convert the small resistance change to a more easily measured voltage change.

The voltage output of the circuit is given as follows.



$$e = \frac{R_1R_3 - R_2R_4}{(R_1+R_2)(R_3+R_4)}E$$

where
- e : Voltage output
- E : Exciting voltage
- R_1 : Gauge resistance
- R_2~R_4 : Fixed resistance

Here, if R=R1=R2=R3=R4 the resistance of the strain gauge changes to R+ΔR due to strain. Thus, the output voltage Δe (variation) due to the strain is given as follows.

$$\Delta e = \frac{\Delta R}{4R + 2\Delta R}E$$

When $\Delta R \ll R$

$$\Delta e = \frac{\Delta R}{4R}E = \frac{E}{4}K\varepsilon$$

When measuring with a strain gauge, it is connected to an instrument called a strainmeter. The strainmeter configures a Wheatstone bridge circuit and supplies exciting voltage. Measured strain is indicated on a digital display and/or output as analog signals.

Plane Stress and Strain

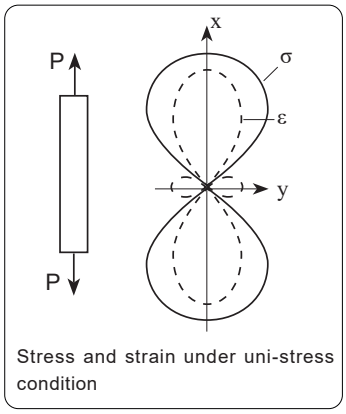
The stress in a material balanced with an applied external force can be considered a combination of more than one simple stress. In other words, these stresses can be divided into simple stress in the respective axial directions; however, measurement with ordinary strain gauges is restricted to the plane strain. In case that the stress exists in uniaxial direction like tension of a bar illustrated below, the following equation are applicable.

$$\varepsilon_x = \frac{\sigma}{E}$$

$$\varepsilon_y = -\nu\varepsilon_x = -\frac{\nu\sigma}{E}$$

where

σ : Stress
E : Elastic modulus
ε_x : Strain in x direction
ε_y : Strain in y direction
ν : Poisson's ratio

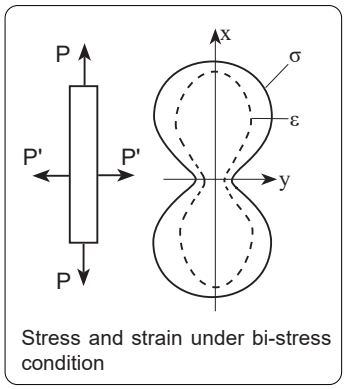


Stress and strain under uni-stress condition

The biaxial stresses generated by pulling the bar in both normal and transversal directions are:

$$\varepsilon_x = \varepsilon_x' - \nu\varepsilon_y' = \frac{\sigma_x}{E} - \frac{\nu\sigma_y}{E} = \frac{1}{E}(\sigma_x - \nu\sigma_y)$$

$$\varepsilon_y = \varepsilon_y' - \nu\varepsilon_x' = \frac{\sigma_y}{E} - \frac{\nu\sigma_x}{E} = \frac{1}{E}(\sigma_y - \nu\sigma_x)$$



Stress and strain under bi-stress condition

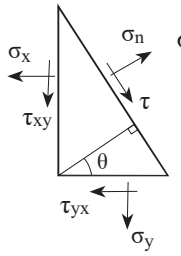
ε_x' : strain in the x direction due to σ_x

ε_y' : strain in the y direction due to σ_y

$$\sigma_x = \frac{E}{1-\nu^2}(\varepsilon_x + \nu\varepsilon_y)$$

$$\sigma_y = \frac{E}{1-\nu^2}(\varepsilon_y + \nu\varepsilon_x)$$

For the stress in other than the crossed biaxial directions, it is shown according to its angle as follows.



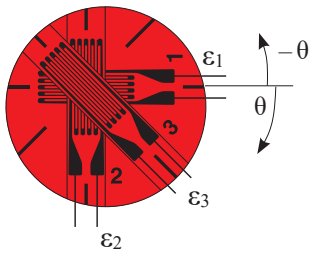
$$\sigma_n = \sigma_x\cos^2\theta + \sigma_y\sin^2\theta + \tau_{xy}\sin 2\theta = \frac{1}{2}(\sigma_x + \sigma_y) + \frac{1}{2}(\sigma_x - \sigma_y)\cos 2\theta + \tau_{xy}\sin 2\theta$$

$$\tau = \frac{1}{2}(\sigma_x - \sigma_y)\sin 2\theta - \tau_{xy}\cos 2\theta$$

As noted from the above equations, in a certain direction, the maximum value of the resultant stress appears in the uniaxial diretion. The axial direction is called a principal direction of stress and the stress in that direction a principal stress. In this direction, the shearing stress is zero. The maximum value of shearing stress is generated in the direction of 45° against the principal direction of stress. It can also be applied to the strain. The strain in such a direction is called a principal strain.

Measurement of principal strain and stress using 3-element rectangular rosette gauge

When strain is generated in the surface of material and the principal direction of the strain and its extent are unknown, the principal strain, stress and their directions and shearing strain and stress can be obtained by measuring the strains in three directions over the surface. In order to simplify calculation, the relative angle in the three directions are determined as follows.



1st axis : ε_1
2nd axis : ε_2 at 90° position
3rd axis : ε_3 at 45° position

Maximum principal strain

$$\varepsilon_{max} = \frac{1}{2}\left[\varepsilon_1 + \varepsilon_2 + \sqrt{2\{(\varepsilon_1 - \varepsilon_3)^2 + (\varepsilon_2 - \varepsilon_3)^2\}}\right]$$

Minimum principal strain

$$\varepsilon_{min} = \frac{1}{2}\left[\varepsilon_1 + \varepsilon_2 - \sqrt{2\{(\varepsilon_1 - \varepsilon_3)^2 + (\varepsilon_2 - \varepsilon_3)^2\}}\right]$$

Maximum shearing strain

$$\gamma_{max} = \sqrt{2\{(\varepsilon_1 - \varepsilon_3)^2 + (\varepsilon_2 - \varepsilon_3)^2\}}$$

Angle from ε_1 gauge to direction of principal strain

$$\theta = \frac{1}{2}\tan^{-1}\left\{\frac{2\varepsilon_3 - (\varepsilon_1 + \varepsilon_2)}{\varepsilon_1 - \varepsilon_2}\right\}$$

If ε1>ε2, the angle to the maximum principal strain is rotated by θ clockwise from the 1st axis, and the minimum principal strain is located at θ+90°. If ε1<ε2, the angle to the maximum principal strain is rotated by θ+90° clockwise from the 1st axis, and the minimum principal strain is located at θ.

Maximum principal stress

$$\sigma_{max} = \frac{E}{1-\nu^2}(\varepsilon_{max} + \nu\varepsilon_{min}) = \frac{E}{2}\left[\frac{\varepsilon_1 + \varepsilon_2}{1-\nu} + \frac{1}{1+\nu}\sqrt{2\{(\varepsilon_1 - \varepsilon_3)^2 + (\varepsilon_2 - \varepsilon_3)^2\}}\right]$$

Minimum principal stress

$$\sigma_{min} = \frac{E}{1-\nu^2}(\varepsilon_{min} + \nu\varepsilon_{max}) = \frac{E}{2}\left[\frac{\varepsilon_1 + \varepsilon_2}{1-\nu} - \frac{1}{1+\nu}\sqrt{2\{(\varepsilon_1 - \varepsilon_3)^2 + (\varepsilon_2 - \varepsilon_3)^2\}}\right]$$

Maximum shearing stress

$$\tau_{max} = \frac{E}{2(1+\nu)}\gamma_{max} = \frac{E}{2(1+\nu)}\sqrt{2\{(\varepsilon_1 - \varepsilon_3)^2 + (\varepsilon_2 - \varepsilon_3)^2\}}$$

note

The above rosette analysis equations are based on the 3-element strain gauge shown in the diagram. When the order of the axis numbers is different or when the gauge is not a 90° rosette gauge, different equations must be used. Check the axis numbers of applicable strain gauge before performing rosette analysis.

Technical Terms

●Gauge Length

This dimension represents the actual grid length in the sensitive direction.

●Gauge Resistance

The gauge resistance is the electrical resistance of an unbonded gauge at room temperature and subject to no external stress. The gauge resistance generally used is 120Ω but gauges are also produced with gauge resistance of 60Ω, 350Ω and 1000Ω. High-resistance gauges yield a high bridge output when high voltages are applied but they are also susceptible to noise. The majority of the strain gauges used in the production of transducers have a gauge resistance of 350Ω.

●Gauge Factor

The amount shown in the following equation is called the gauge factor. In this equation, ε indicates the strain generated due to uniaxial stress in the direction of the strain gauge axis. ΔR/R shows the ratio of resistance change due to strain ε.

$$K = \frac{\Delta R/R}{\varepsilon}$$

where K : Gauge Factor
ε : Mechanical strain
R : Gauge Resistance
ΔR : Resistance change

●Longitudinal Sensitivity

Longitudinal sensitivity is very similar to the gauge factor and refers to the sensitivity of the gauge when no strain is applied in the direction perpendicular to the gauge axis.

●Transverse Sensitivity

The gauge also exhibits sensitivity in the direction perpendicular to the axial direction. The amount shown in the following equation due to the uniaxial strain (ε_t) in the direction perpendicular to the gauge axis, and the resistance variation generated thereby, is called transverse sensitivity (K_t).

$$K_t = \frac{\Delta R/R}{\varepsilon_t} \times 100$$

where K_t : Transverse Sensitivity
ε_t : Uniaxial strain perpendicular to the gauge axis

●Transverse Sensitivity Ratio

This refers to the ratio of transverse sensitivity to longitudinal sensitivity. This is usually 1% or less and does not usually pose a problem except in high-precision measurement or in locations with biaxial strain.

●Gauge Hysteresis

When a strain gauge is bonded to a test specimen and strain is applied, resistance change for identical strain in increase and decrease processes may differ. This difference is referred to as hysteresis. Gauge hysteresis varies depending on factors such as grid configuration, base material, adhesive and temperature.

●Thermal Hysteresis

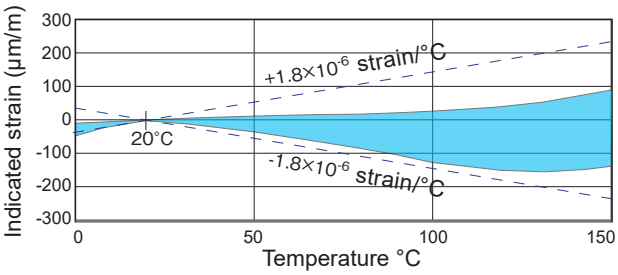
Thermal hysteresis refers to hysteresis that occurs in the heating or cooling cycle such that the respective cycles do not pass through the same point. Thermal hysteresis poses an ongoing problem in strain measurement where temperature change occurs. This hysteresis must be removed by applying heat treatment to stabilize the characteristic of the strain gauge and the adhesive.

●Gauge Zero Drift with Temperature

At high temperature, effects such as thermal oxidation of the sensing elements in a strain gauge cause the zero point of the gauge in a no-load state to gradually drift. This is one of the characteristics that determine a strain gauge's resistance to heat. Above 200°C, Ni-Cr alloy performs far better than Cu-Ni alloy, and alloys such as Pt-W are used in 500°C to 800°C environments.

●Self Temperature Compensated Gauge

A change in the ambient temperature may cause a variation of strain gauge resistance. The variation is ascribable to the thermal expansion of both strain gauge material and specimen, together with the thermal coefficient of resistance of the gauge material. Self-temperature compensated gauges are commonly used to minimize the gauge thermal output when bonded to test specimens having a specific linear thermal expansion coefficient in the specified temperature range. The following graph shows an example of thermal output.

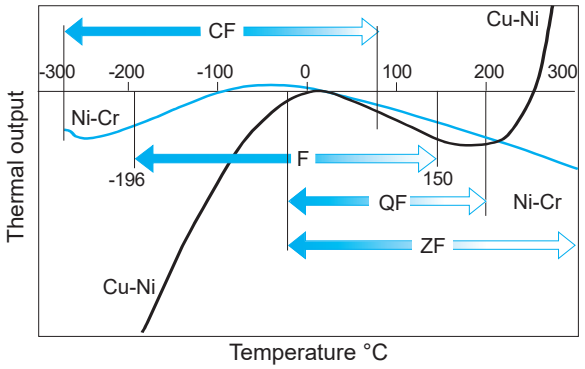


●Temperature Compensation Range

This refers to a temperature range in which the thermal output of a self-temperature compensated gauge should be within the given range. Compensation is accurate within approximately ±1.8×10^{-6} strain/°C. For greater accuracy, corrections can be made using the curves for apparent strain vs. temperature which is supplied with each package of gauge.

●Operating Temperature Range

This range is the temperature range within which a strain gauge can be used continuously under appropriate conditions. The figure below shows thermal output characteristics for Cu-Ni and Ni-Cr alloys used for the sensing elements in TML strain gauges. Most strain gauges use Cu-Ni alloy, while Ni-Cr alloy is used in strain gauge series that have a wider operating temperature range.



●Gauge Length Selection

Different gauge lengths should be selected depending on specimens. Gauges with short gauge lengths are used to measure local strain, while gauges with long lengths can be used to measure averaged strain over a larger area. For a heterogenous material, a gauge length is required that can average out irregular strain in the material. For example, as concrete is composed of cement and aggregate (gravel or sand, etc.) the length of a gauge used is more than three times the diameter of the aggregate so as to give an averaged evaluation of the concrete.

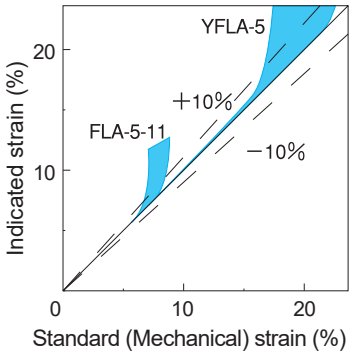
Gauge length (mm)	Gauge Applications
0.2 ~ 1	For stress concentration measurement
2 ~ 6	For metal and general use
10 ~ 20	For mortar, wood, FRP, etc.
30 ~ 120	For concrete

●Strain Limit

The strain limit is the maximum amount of strain under which a strain gauge can operate under a given condition without suffering damage. At TML, the strain limit is the smallest value of mechanical strain at which the indicated strain exceeds the mechanical strain by 10%.

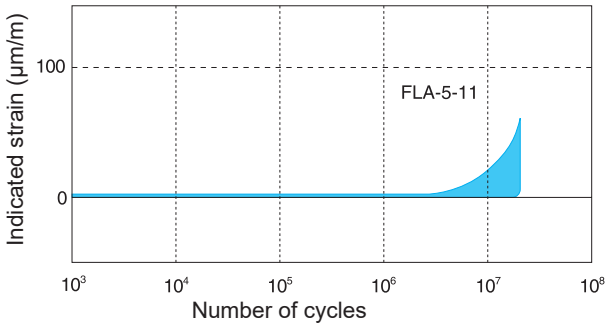
General use strain gauge
F series : FLA-5-11

Post-Yield strain gauge
YF series : YFLA-5



●Fatigue Life

When strain is applied repeatedly to a strain gauge, as the amount of strain becomes large, the gauge resistance increases and disconnection or peeling-off of the gauge occurs to make the gauge useless. In general, the fatigue life is determined by the amount of applied strain and speed of cyclic loading and expressed by the number of repetitions. At our company, a constant mechanical strain is applied repeatedly to the bonded strain gauge and the fatigue life is indicated by the number of repetitions at which the indicated strain value without load exceeds 100×10^{-6} strain. A typical calibration result is shown below. Even if the number of repetitions exceeds the specified life, the gauges will not necessarily fail. The fatigue life of most of our strain gauges under a cyclic strain of $\pm1,500\times10^{-6}$ strain is between 10^6 and 10^7 cycles. Under cyclic strain of less than 500, the fatigue life of most gauges is infinite. Post-yield strain gauges should not be subjected to cycle loading in elastic range as well as in large strain range.



●Permissible Current (Permissible Voltage)

The current flowing in a strain gauge is related to the output voltage of the gauge bridge, and the larger the current, the larger the voltage is obtained. However, depending upon the material of a specimen and the area of the gauge, Joule's heat is generated by the current to raise the temperature of gauge and as a result apparent strains are produced. In general, a current less than 30mA is recommended for metallic specimens and less than 10mA for wooden and plastic specimens which dissipate heat less efficiently.

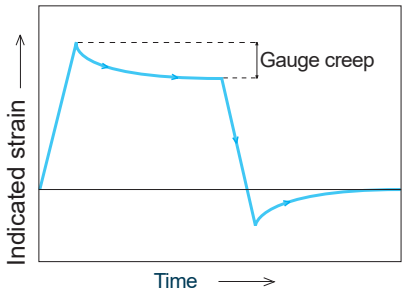
●Strain Gauge Frequency Response

The frequency response of a strain gauge is determined by the gauge length and the longitudinal elastic wave speed of the test specimen. Frequency response limits are typically only a concern under impact conditions.

Gauge length (mm)		0.2	1	3	5	10	30	60
Steel	[kHz]	660	530	360	270	170	-	-
Concrete	[kHz]	-	-	-	-	120	50	20

●Gauge Creep

A bonded strain gauge subjected to a constant strain will give a decreasing indicated value as time progresses. This phenomenon is referred to as creep. In general, the shorter the gauge length, the greater the gauge creep becomes. Also, this tendency exhibits well if the strain gauge or adhesive absorbs moisture.



Gauge creep

●Strain Gauge Shape

TML also supplies strain gauge in different patterns for a range of applications. Select the appropriate gauge patterns for your application.

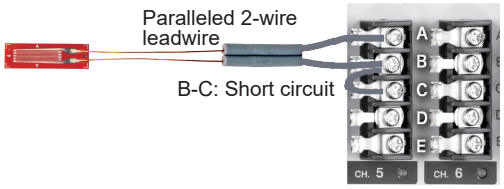
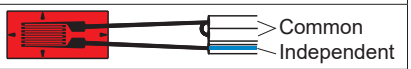
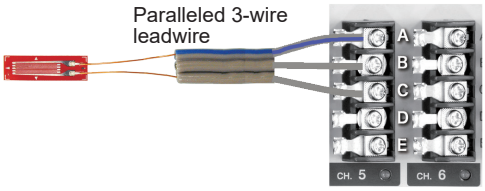
Qty. of axis	1	2	2
Gauge Pattern			
Nomenclature	Single axis	0°/90° 2-axis	0°/90° 2-axis
Grid layout	—	Stacked type	Plane type
Qty. of axis	3	3	5
Gauge Pattern			
Nomenclature	0°/45°/90° 3-axis	0°/45°/90° 3-axis	5-element Single-axis
Grid layout	Stacked type	Plane type	—

Temperature Compensation for Leadwires in Quarter Bridge

For strain gauge measurement, the Wheatstone bridge circuit is used to convert resistance change of the strain gauge into voltage output. The simplest bridge method is a quarter bridge, where one arm is composed of the strain gauge while the other three arms are composed of fixed resistors in the instrument. A 2-wire leadwire may be used for connecting the strain gauge to the instrument. However, if the temperature of the leadwire changes, thermal output of the bridge is caused even if there is no change in actual strain. For this reason, the quarter bridge 2-wire method should be used only when temperature change is not expected during the measurement or for a dynamic measurement in which the thermal output can be disregarded. A quarter bridge 3-wire method is available as a mean to eliminate the thermal output of the leadwire, when a 3-wire leadwire is used for connection of the strain gauge. In this method, the influence of resistance change of the leadwire caused by temperature change is cancelled. In addition, the effect of the leadwire on gauge factor is half as large as that of the quarter bridge 2-wire method. The quarter bridge 3-wire method is recommended over the 2-wire method, especially when temperature change is expected during the measurement and/or comparatively long leadwires are used.

Other bridge methods including half bridge and full bridge are also available. Refer to p.16~17 for details.

Strain Gauge and leadwire connection

Bridge Circuit	Connection
Quarter bridge with 2-wire	
	
Quarter bridge with 3-wire	
	

●Thermal output caused by temperature change

In a quarter bridge 2-wire method, changes in leadwire temperature cause changes in the leadwire resistance, which result in thermal output. Use the equation below to compensate for this thermal output.

$$\text{Leadwire thermal output} \quad \varepsilon L = \frac{r \cdot L \cdot \alpha \cdot \Delta T}{K \cdot (R + r \cdot L)}$$

where

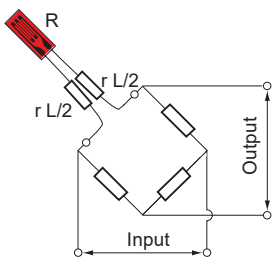
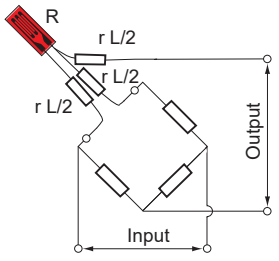
- εL : Leadwire thermal output
- K : Gauge factor indicated on the strain gauge package
- α : Thermal coefficient of resistance of leadwire (3.9×10^{-3}/°C for copper)
- r : Total resistance of leadwire per 1 meter (Ω/m)
- L : Leadwire length (m)
- ΔT : Temperature change of leadwire (°C)

Note)

- Compensation is possible on condition that the temperature change is uniform for whole length of the leadwire.
- In a quarter bridge 3-wire method, compensation is not necessary because the influence of change in leadwire resistance caused by temperature change is cancelled.
- Also our 1-Gauge 4-Wire Strain measuremet method does not require above correction because it is not influenced at all by the leadwire resistance. Refer to following page for details.

●Gauge Factor (Gauge sensitivity) correction for leadwire connection

The leadwire resistance between the strain gauge and strainmeter noticeably lowers the gauge factor. Calculation for the correction is required depending on the measurement method and on the leadwire type and length.

Quarter Bridge with 2-wire	Quarter Bridge with 3-wire
	
Correction coefficient of lead-wire : A $A = \frac{R}{R + rL}$ Corrected Gauge Factor : K_0 $K_0 = \frac{R}{R + rL} K = A \cdot K$	Correction coefficient of lead-wire : A $A = \frac{R}{R + \frac{rL}{2}}$ Corrected Gauge Factor : K_0 $K_0 = \frac{R}{R + \frac{rL}{2}} K = A \cdot K$

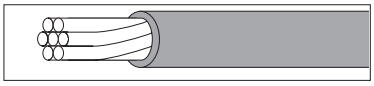
where

- R : Nominal gauge resistance in Ω
- r : Total resistance per meter of leadwire (Ω/m)
- K : Gauge Factor shown on package
- L : Length of leadwire in meter

●Total resistance per meter of our typical pre-attached leadwire

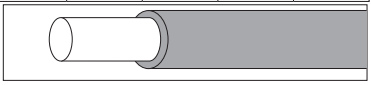
In strain gauge, the leadwire resistance produces a deterioration of gauge sensitivity and thermal drift. The leadwire should be as thick and as short as possible.

Twisted leadwire



Number of cores /Diameter (mm)	7/0.12	10/0.12	7/0.16	7/0.18	12/0.18	20/0.18
Cross section area of lead wire (mm^2)	0.08	0.11	0.14	0.18	0.3	0.5
Total resistance of leadwire per meter (Ω)	0.44	0.32	0.24	0.20	0.12	0.07

Single-core leadwire



Construction	Polyimide wire (0.14mm-dia.)	Polyimide wire (0.18mm-dia.)
Cross section area of leadwire	0.015 mm^2	0.025 mm^2
Total resistance of leadwire per meter	2.5 Ω	1.5 Ω

¶ Setting the Gauge Factor to Data Loggers*

$$Cs = \frac{2.00}{K_0}$$

- Cs : Coefficient set
- K_0 : Gauge Factor corrected with leadwire attached

Complete Compensation Method of Strain with Wheatstone Bridge - COMET

COMET: Abbreviation of Complete Compensation Method of Strain

When measuring strain using a strain gauge, quarter bridge method is commonly used. Quarter bridge 2-wire method is the easiest for strain measurement, while quarter bridge 3-wire method has an advantage of eliminating thermal output caused by the temperature change of the lead wire. It is known that there may be some small errors in measured values obtained by these methods, which are caused by initial unbalance and non-linearity of the bridge circuit. Most of our strainmeters already have a function of correcting non-linearity of quarter bridge circuit. However, if we look into the matter more closely, this function is not enough to completely correct the measured values, for example when the initial unbalance of the bridge is significant. Our unique technique "Complete Compensation Method of Strain" is a method which is capable of fully correcting the errors in measured values obtained by quarter bridge method without being influenced by initial unbalance and non-linearity of the bridge circuit. This method is available in our instruments listed below.

Data loggers

TS-963, TS-960, TS-560, TDS-630, TDS-540, TS-360, TDS-150, TDS-530, TDS-602, TDS-303, TDS-102, TC-37K, TC-32K, TC-31K

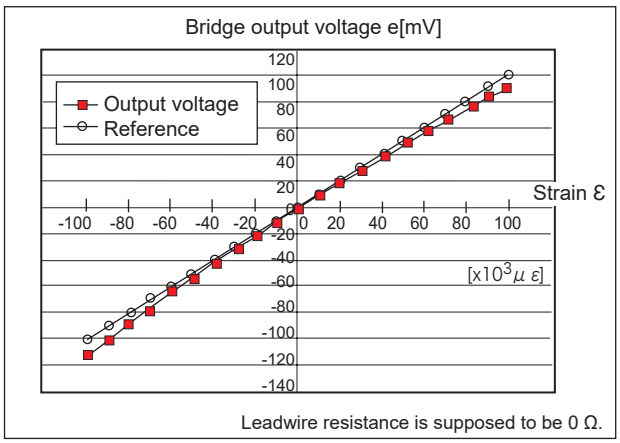
Measurement error is not caused by initial unbalance of bridge

If the resistance of strain gauge and bridge completion resistors is not exactly the same when the strain is zero, an output voltage is yielded. This should more or less occur in actual bridge circuits. The output voltage is treated as an initial unbalance and deducted from the output voltage when strain is applied. However, it causes some error in measured strain values. This error becomes zero by using the Complete Compensation Method of Strain.It is especially effective in cases as follows, in which a large initial unbalance is expected.

- The leadwire is extended during the measurement.
- The strain gauge is mounted on a curved surface.
- Strain gauges having uneven resistance are used.
- Temperature change is large during the measurement.

Non-linearity error of bridge circuit is completely corrected

The relation between the output voltage of bridge circuit and the strain is not exactly linear. Non-linearity error becomes larger with increase of strain. Conventional method for correcting the non-linearity is based on condition that the initial unbalance of bridge is zero. The Complete Compensation Method of Strain works to correct the non-linearity error even when the initial unbalance of bridge is large. It is also effective in the following cases in addition to the cases mentioned in former clause.



- Strain gauge is replaced with a new one when measuring large strain.
- Initial unbalance is readjusted during the measurement.

Descent of sensitivity caused by the leadwire resistance is corrected

The strain gauge sensitivity is influenced by the resistance of the leadwire. In quarter bridge 3-wire method, the lead- wire resistance is measured and the sensitivity is corrected automatically by using a data logger having the Complete Compensation Method of Strain. When measuring multiple points of strain gauges, it is not necessary to use lead wires of the same length for the purpose of simplifying the correction calculation.

Complete Correction of thermal output of strain gauge

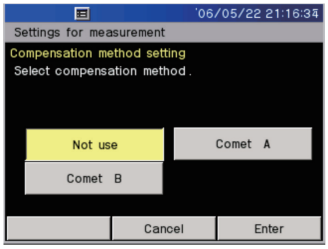
Thermal output of strain gauge is given as data under no strain, and it may somewhat differ under strained condition. The Complete Compensation Method of Strain compensates thermal output by taking the applied strain into consideration. This is especially effective when the thermal output is large.
(This compensation is available in TS-963/960.)

Correction of error caused by replacement of strain gauge

When measuring a large strain, it is a common practice to replace the strain gauge with a new one when the strain comes close to strain limit of the strain gauge. In this case, accurate strain after the replacement can be known by correcting the measured values referring to the strain value at the time of replacement. The Complete Compensation Method of Strain makes this correction automatically.

Setting of true strain measurement (COMET)

This is the setting for performing a measurement correcting the error of strain value using the function called "COMET".
When the sensor mode is quarter bridge 3-wire method, the measurement value is displayed by implementing non-linear correction even if [Not use] is selected. By selecting Comet, it is possible to obtain more correct strain value.
Half bridge common dummy can be used only for Comet A.



COMET A

This is the correction method to correct the non-linearity error by initial unbalance of the bridge, and this is effective when the initial unbalance value is large. The bridge output voltage eo is measured at initial in and memorized internally. The bridge output voltage e when the strain is generated is calculated when the measurement is performed, and the correction calculation below is implemented.

$$\varepsilon m = \frac{e - e_0}{(1-e) \times (1+e_0)}$$

COMET B (Quarter bridge 3-wire method only)

This is used when correcting the descent of sensitivity by leadwire at the same time as the correction method of Comet A.
The bridge output voltage eo at initial unbalance and both-ends voltage of lead wire resistance er are measured at initial in, and memorized internally. The bridge output voltage e when the strain is generated is measured at the measurement, and the calculation below is implemented.

$$\varepsilon m = \frac{e - e_0}{(1-e) \times (1+e_0-er)}$$

When Comet B calculation is implemented, the correction calculation that includes initial unbalance value that is recorded at initial in and both-ends voltage of leadwire resistance is implemented from the formula above, so only the measure measurement is available. Be sure to perform the measurement after implementing the initial in at the initial unbalanced status for starting measurement.

Application Example of Complete Compensation Method of Strain

Measurements using our data loggers equipped with Complete Compensation Method of Strain have the advantages of the followings.

- Complete compensation of non-linearity
- No influence of strain gauge resistance
- No influence of dummy resistance
- No need of using leadwires of the same length saving costs and space for unnecessary leadwires
- No need of correcting sensitivity change caused by leadwire resistance

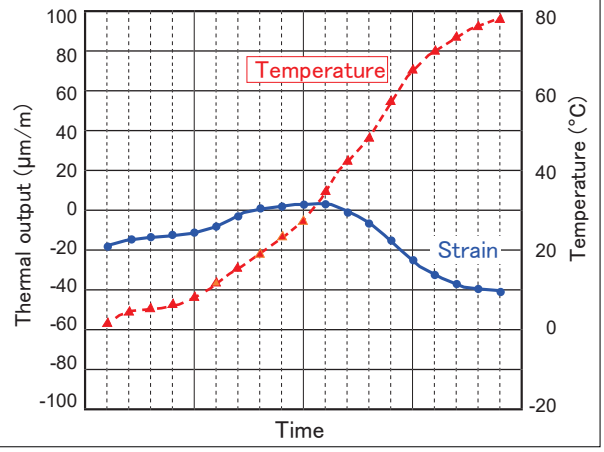
Accurate strain measurement is possible owing to the features above. Furthermore, measurements as in the following examples become possible by the use of Complete Compensation Method of Strain.

Application example 1:

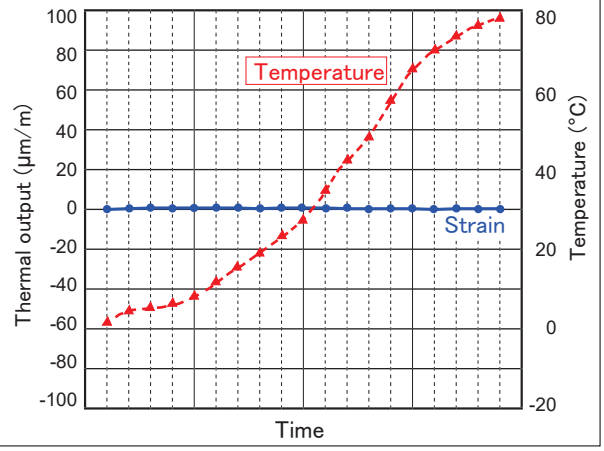
Compensation of thermal output when using a temperature-integrated strain gauge

Thermal output of strain gauge is automatically compensated when measuring a temperature-integrated strain gauge with data logger TS-963/960. A polynomial representing the thermal output is attached to each strain gauge, and coefficients of the polynomial are input to TS-963/960 before starting the measurement. Thermal output of the strain gauge caused by the change of environmental temperature is calculated and corrected by the TS-963/960 with better accuracy than conventional method.

Real temperature and apparent strain measurement



True strain after thermal output correction

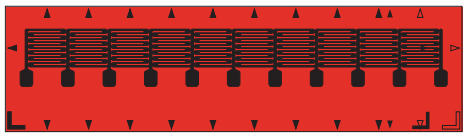


Application example 2:

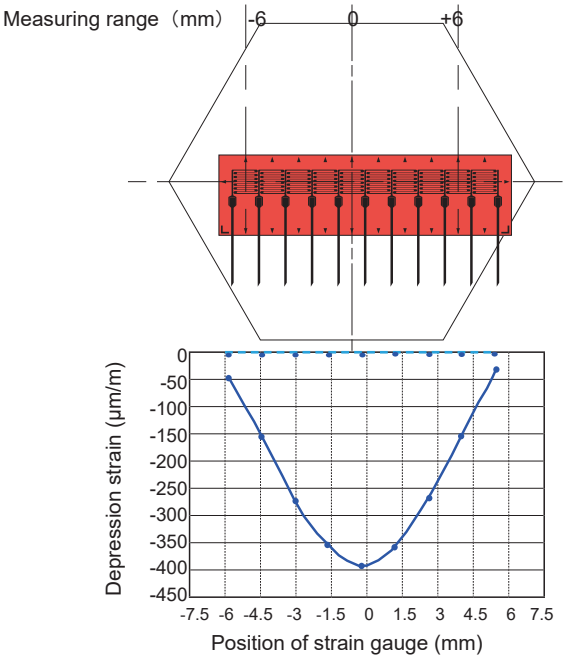
Measurement of stress concentration gauge CCFXX, CCFYX

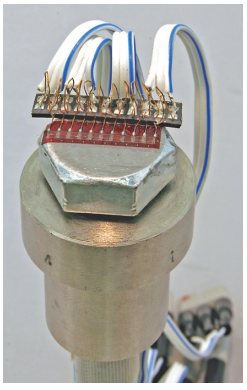
The CCFXX and CCFYX are newly developed strain gauges having 10 grids aligned continuously without interval between each adjoining grids. Different from the conventional stress concentration gauge having individual grids aligned with small intervals, it can measure strain distribution of the specimen more precisely. This strain gauge should be measured using our data logger with Complete Compensation Method of Strain. The number of leadwires is reduced to 11.

CCFXX



Measurement example
Strain caused by depression of bolt head (M10)





The number of leadwires is 30 which is required for measuring a conventional 10-element strain gauge with quarter bridge 3-wire method. The number is reduced to 11 in CCFXX/CCFYX strain gauge. This is achieved by using one leadwire for measurement of two or three grids. The adjacent grid is connected in series with one leadwire of 3-wire connection. The resistance of this adjacent grid can be ignored by using our data logger with Complete Compensation Method of Strain.

1-gauge 4-wire Strain Measurement Method

Abstract

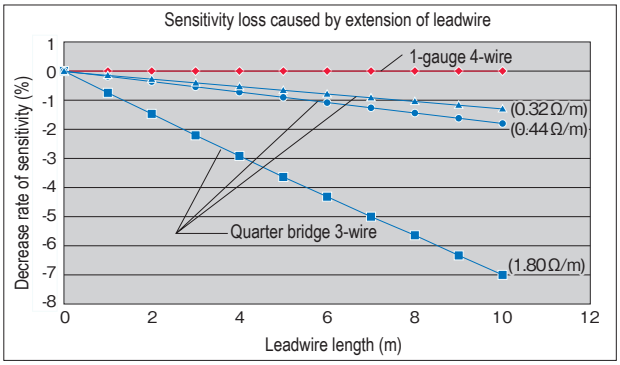
When measuring strain gauges, various connection methods are available according to the number of strain gauges used and the purpose of measurement. In quarter bridge method, 3-wire connection is widely used to remove the effect of temperature change in the resistance of the strain gauge leadwire. However in the method, gauge factor correction is required depending on the leadwire resistance. In addition, some measurement error may be caused by the contact resistance in the connection part such as between the strain gauge leadwire and the instrument terminal. The 1-gauge 4-wire strain measurement is our unique method which eliminates the need of gauge factor correction depending on the leadwire resistance and the measurement error caused by the contact resistance.

Since a new leadwire and a simple connector (modular plug) can be used, it helps to streamline the wiring works and to prevent wiring mistakes, and also to reduce the cost of strain measurement by reusing the leadwires. Furthermore, since soldering works are not necessary, it can save wiring materials and realize lead-free connections.

Advantage over quarter bridge 3-wire method

●Leadwire resistance

In the conventional method, leadwires as thick and short as possible are recommended to keep the resistance of the leadwire as small as possible. However, since there is no influence of the leadwire resistance in 1-gauge 4-wire method, it is possible to use thin and/or long leadwires for connecting strain gauges.

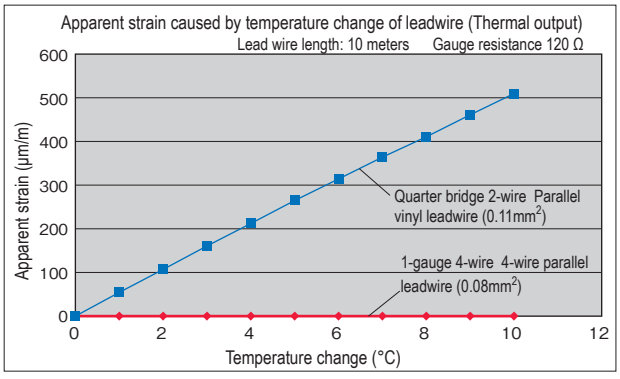


Comparison of strain measurement method between Quarter bridge 3-wire and 1-gauge 4-wire
Advantage of not being affected by leadwire resistance

	Quarter bridge 3-wire (Wheatstone bridge circuit)	1-gauge 4-wire strain measurement method
Thickness of leadwire	Thick	Thin
Weight of leadwire	Heavy	Light
Material of leadwire	The same material must be used	No need of using the same material
Sheath color of leadwire	Must be the same color depending on the measurement	No need of using the same color
Load on the specimen	Heavy	Light
Transportation cost	High	Low

●Not influenced by thermal output of leadwire

When a 10 meter long leadwire having cross sectional area of 0.11mm^2 is used for measurement of 120 Ω strain gauge in quarter bridge (2-wire) method, thermal output of about 50×10^{-6} strain/°C will be resulted if there is a temperature change during the measurement. Therefore, compensation is necessary. Even if the quarter bridge 3-wire method is used, compensation is necessary when the type, length, cross sectional area, or temperature environment of the three wires is not the same. In 1-gauge 4-wire strain measurement method, compensation is not necessary even under such conditions.



●Contact resistance

Conventionally, leadwire extension and connection to a measuring instrument are done by soldering or by the use of specially designed connectors in order to eliminate the influence of contact resistance. Since the 1-gauge 4-wire method is not affected at all by contact resistance, a modular plug which is installed by crimping can be used. The modular plug makes easy connection of the leadwire to an instrument or to an extension leadwire, and efficient connection works without wiring mistakes become possible. Furthermore, since soldering is not necessary, lead-free connection is actualized.

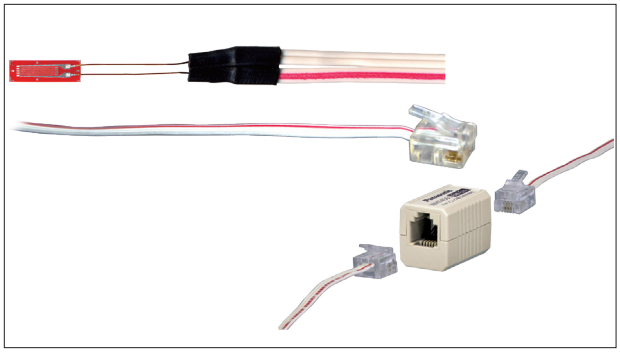
Comparison of strain measurement method between Quarter bridge 3-wire and 1-gauge 4-wire
Advantage of not being affected by the variation of contact resistance at the connection point

	Quarter bridge 3-wire (Wheatstone bridge circuit)	1-gauge 4-wire strain measurement method
Connection using easy connector	Not possible	Possible
Soldering	Necessary (for long-term measurement) For short-term measurement, screwing is possible	Not necessary
Time required for wiring works	Long	Short
Wiring mistakes	Care must be taken	Largely decreased

Strain gauge with leadwire and modular plug

This is a strain gauge applicable to our newly developed 1-gauge 4-wire strain measurement method. Most of our strain gauges can be supplied with the exclusive leadwire and the modular plug (RJ12) pre-attached. Because the modular plug is attached to the end of the leadwire, neither soldering nor screwing is necessary when connecting the strain gauge to a measuring instrument. The strain gauge is connected by simply inserting the modular plug into the modular connector receptacle which is equipped in data logger TDS-630, TDS-540 (with option), TDS-150, TC-37K and TC-32K, and switching box IHW-50H, IHW-50G, ISW-50G, SSW-50D and FSW-10. The sheath of the 4-wire leadwire is made of polypropylene, which does not generate noxious gas even if exposed to fire. A vinyl sheathed leadwire is also available at a lower cost.

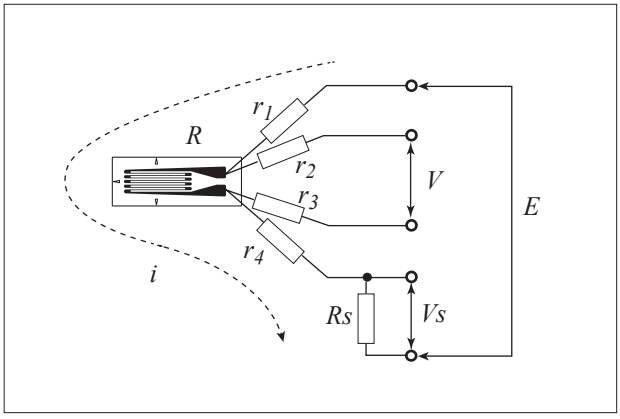
Easy leadwire extension using modular connectors



1-gauge 4-wire Strain Measurement Method

Measurement principle

The 1-gauge 4-wire strain measurement method uses a simple series circuit which is composed of a resistance of strain gauge (R) and a reference resistance (Rs) to measure strain. The voltage (E) is applied to the both ends of the series circuit to flow the current (i). The strain is obtained from the voltage (V) generated by the strain gauge resistance and the voltage (Vs) generated by the reference resistance. As the path where the current flows and the path where the voltage is measured are different, measurement is possible without being affected by the leadwire resistance or the contact resistance (r).



where

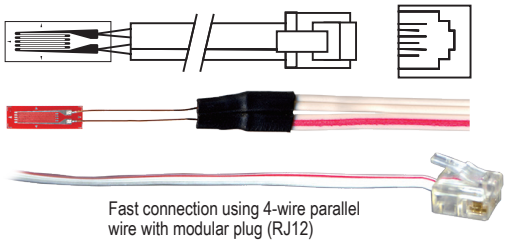
R	: Gauge resistance
Rs	: Reference resistance
r_1~r_4	: Leadwire resistance and contact resistance
i	: Current flowing in strain gauge resistance and reference resistance
E	: Excitation voltage
V	: Voltage generated by gauge resistance
Vs	: Voltage generated by reference resistance

Connection / Applicable instruments

The 1-gauge 4-wire method is a new strain measurement method that does not need gauge factor correction for the leadwire resistance and does not cause measurement error by the contact resistance. In addition, the method can remove the initial unbalance caused by the leadwire resistance and also can remove the influence of leadwire resistance change caused by the temperature change. While the use of a leadwire as thick and short as possible is recommended for quarter bridge 3-wire method, a thin leadwire and/or connectors for connection and extension of the leadwire can be used for 1-gauge 4-wire method. Correction of the measured values is not necessary even if leadwires of various types and/or of different length for each strain gauge are used.

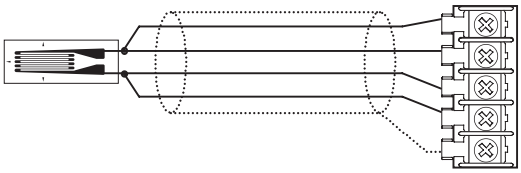
The 1-gauge 4-wire strain measurement method is available only by the data loggers and switching boxes made by our company.

1-gauge 4-wire strain gauge with modular plug



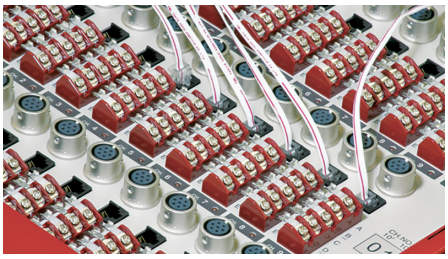
Fast connection using 4-wire parallel wire with modular plug (RJ12)

4-core shielded cable is connected directly if a modular plug is not used



Built-in switching box of data logger TDS-540 is not applicable

The exclusive laedwire with modular plug (RJ12) can be attached to most of our strain gauges. It enables efficient wiring works without mistakes. The leadwires can be used repeatedly to reduce the cost of the measurement.



Fast connection to the modular jack provided to the built-in switching box of data logger or the switching box

Applicable sensor mode

1G4W 120Ω Gauge resistance 120 Ω
1G4W 240Ω Gauge resistance 240 Ω
1G4W 350Ω Gauge resistance 350 Ω

Applicable instruments

Data logger TDS-540(with option)/TS-560 /TDS-630/TDS-150/TC-37K/TC-32K

1-gauge 4-wire strain measurement is possible by fast connection to the modular jack of the switching box

Switching box IHW-50H/IHW-50G/ISW-50G/SSW-50D/FSW-10

●3-element rosette strain gauge (shrinkable tube type)

This is a 3-element rosette strain gauge having a 4-wire parallel leadwire with modular plug attached to each element in 1-gauge 4-wire connection. Fast connection of the leadwires are possible to each channel of a data logger or switching box for static strain measurement.

Note: This strain gauge is not applicable to dynamic strain meters.





・3-element 0° /45° /90° stacked type
Used leadwire
0.08mm^2 vinyl sheathed leadwire with modular plug
Applicable temperature -20~+80° C
FRA-2-11-○LQM (modular plug 4-wire RJ12 6-4)
○ shows the lead wire length in meter

Measuring Method of Strain and Temperature

Temperature measurement is necessary for strain measurement involving temperature change. In addition to the thermocouples and platinum RTDs which are generally used for measuring temperature, our product line includes temperature gauges which may be used in a same way as strain gauges, and temperature integrated strain gauges which are capable of measuring strain and temperature simultaneously. We will provide you with the introduction of their features and applications.

Temperature measurement applications to our strain measuring instruments

Temperature measurement means	Application to static strain measuring instruments	Application to dynamic strain measuring instruments	Temperature measurement range (°C)	Features
Thermocouple (T, K, etc.)	Applicable	Applicable	-269 ~ +1760	Wide temperature range
Platinum RTD Pt100	Applicable	Not applicable	-40 ~ +400	High accuracy. Can be used only with data loggers
Temperature integrated strain gauges	Applicable	Not applicable	-20 ~ +200	Applicable to most of the foil strain gauges
Temperature gauges TF Series	Applicable	Applicable	-20 ~ +200	A dedicated adapter necessary
Temperature gauge KT-110A	Applicable	Applicable	-30 ~ +80	Robust structure, mainly for civil engineering

THERMOCOUPLE

Wide range of temperature can be measured by selecting the types of thermocouple wire and sheath material. In this catalog, the following sheath material for thermocouples are introduced (the temperatures indicated are upper temperature limits):

Vinyl: 80 °C
Fluorinated resin: 200 °C
Glass fiber : 350 °C
See page 76 for the details of thermocouples.

By using static strain measuring instruments such as data logger TDS series, TC-37K and TC-32K, temperature measurement using various thermocouples can be carried out. As for DC dynamic strain measuring instrument DC-96A/DC-97A, DC-204R, DC-004P, DH-14A, TMR-300 and DS-50A, temperature measurement can be carried out by thermocouples K and T through Dedicated unit or thermocouple adapter TA-01KT.

PLATINUM RTD

Temperature measurement can be carried out by bonding the platinum RTD to the surface of an object to be measured, just like when using strain gauges. The measurement accuracy is high, and the measurement can be done by connecting to lead wires for strain gauges. Platinum RTD is connected to static strain measuring instruments such as data logger TDS series, TC-37K or TC-32K when measuring. Platinum RTD is not applicable to dynamic strain measuring instruments.

TEMPERATURE-INTEGRATED STRAIN GAUGES

Temperature measurement function can be mounted to almost any foil strain gauge. (See the chart in pages 36 - 37 for combination of strain gauges and dedicated lead wires.) The temperature measurement point is the tab of a strain gauge, so the temperature shown is as same as the temperature of the strain gauge. The temperature can be measured using our data logger.

The applicable lead wires with temperature measuring function are as follows:

- Single core 3-wire twisted fluorinated resin (FEP) lead wire 6FB_TLT
  Applicable temperature: -269 °C ~ +200 °C
- 3-wire paralleled vinyl lead wire -TLJBT/-TLJBT-F
  Applicable temperature: -20 °C ~ +80 °C
- 4-wire paralleled vinyl lead wire TLQ
  Applicable temperature: -20 °C ~ +80 °C

(See page 31 for details of lead wires.)

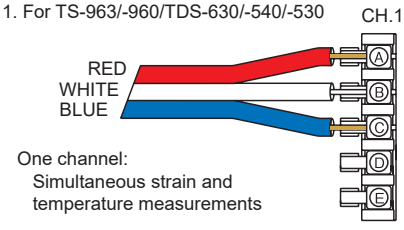
If you wish to mount the temperature measuring function on the strain gauge of your choice, insert a “T” after the number indicating the length of the gauge, and then designate the length and type of the lead wire. For example, if you want to add temperature measuring function and a 3 meters vinyl lead wire to FLA-2-11, the type name should be written as:

FLA-2 T -11 -3 TLJBT
- TLJBT: 3-wire paralleled vinyl lead wire TLJBT
- 3: Desired length of the lead wire: 3m
- T: With temperature measuring function

Temperature integrated strain gauges are not applicable to measurements by dynamic strain measuring instruments.

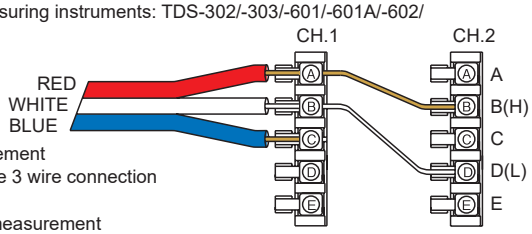
Wire connection methods

1. For TS-963/-960/TDS-630/-540/-530



One channel:
Simultaneous strain and temperature measurements

2. For other applicable measuring instruments: TDS-302/-303/-601/-601A/-602/-101R/-150/-102/-300



Channel 1: Strain measurement
Quarter bridge 3 wire connection method
Channel 2: Temperature measurement
T thermocouple
(Use two adjacent channels)

TEMPERATURE GAUGES TF SERIES

Temperature gauge TF series is used for measuring surface temperature by bonding it to the surface of structural object just like strain gauges. By using adapter TGA for temperature gauge and strain measuring instrument in combination, the measurement will be performed and represented in the unit of 100×10^{-6}/°C. See page 76 for details of TF series and adapter TGA.

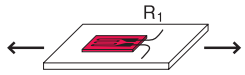
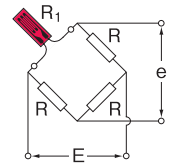
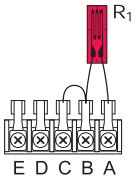
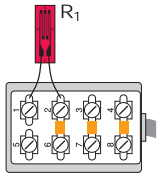
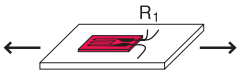
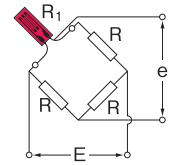
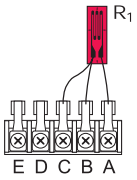
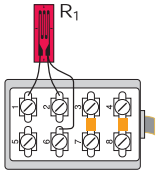
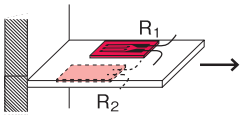
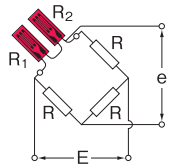
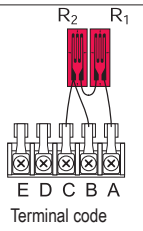
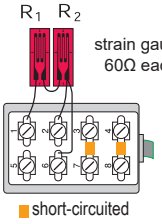
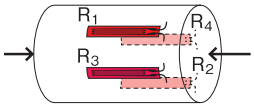
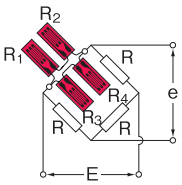
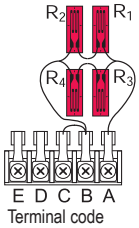
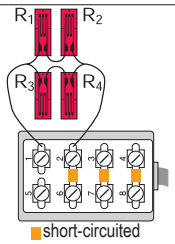
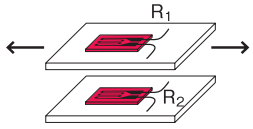
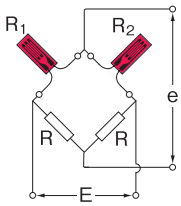
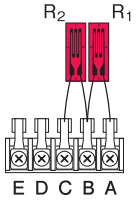
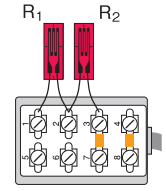
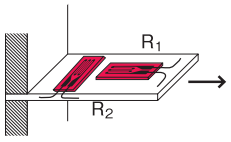
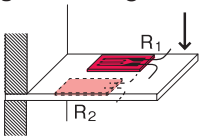
TEMPERATURE GAUGES KT-110A

KT-110A is a temperature sensor using full bridge method. It is used in civil engineering and construction sites for its robustness. KT-110A can carry out measurement as temperature sensor using full bridge method (also used by transducers) by using strain measuring instruments. Consult us for details of KT-110A.

Strain Gauge Bridge Circuit

STRAIN GAUGE BRIDGE CIRCUIT

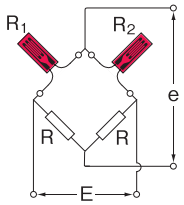
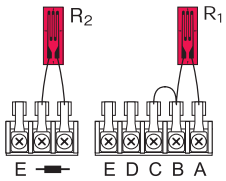
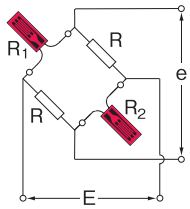
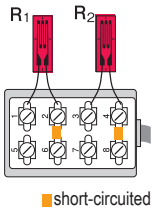
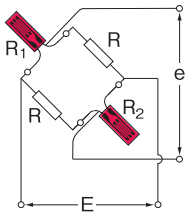
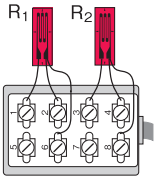
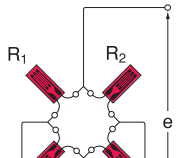
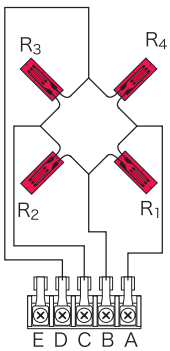
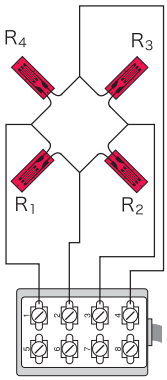
Connection diagram varies according to strainmeter type.

Measuring mode	Bridge circuit	Wiring connection to		Bridge Output
		Switching Box	Bridge Box	
Quarter bridge (with 2-wire) 				E : Excitation voltage e : Output voltage Δe : Output voltage due to strain e_0 : Output voltage before strain generation R_0 : Resistance change due to generation ΔR : Resistance change due to strain ε : strain K : Gauge Factor of strain gauge $e = e_0 + \Delta e$ $R_1 = R_0 + \Delta R$ $R = R_0$ $\Delta e = \frac{E}{4} K\varepsilon$
Quarter bridge with 3-wire Thermal output of leadwire is cancelled. 				
Quarter bridge 3-wire with two gauges connected in series in one arm, eliminating bending strain 				$R_1 = R_0 + \Delta R$ $R_2 = R_0 + \Delta R$ $R = 2R_0$ $\Delta e = \frac{E}{4} K\varepsilon$
Quarter bridge with four gauges connected in series and paralleled in one arm 				$R_1 = R_2 = R_3 = R_4 = R_0 + \Delta R$ $R = R_0$ $\Delta e = \frac{E}{4} K\varepsilon$
Half bridge with 1-active and 1-dummy gauge 				$R_1 = R_0 + \Delta R$ $R_2 = R_0 = R$ $\Delta e = \frac{E}{4} K\varepsilon$
Half bridge with two active gauges 				$R_1 = R_0 + \Delta R$ $R_2 = R_0 - \nu\Delta R$ $\Delta e = \frac{E(1+\nu)}{4} \cdot K\varepsilon$ ν : Poisson's ratio
Half bridge with 2 active gauges : Bending strain 				$R_1 = R_0 + \Delta R$ $R_2 = R_0 - \Delta R$ $R = R_0$ $\Delta e = \frac{E}{2} K\varepsilon$

Output voltage due to strain is based on the condition that output voltage before strain generation (e_0) is zero.

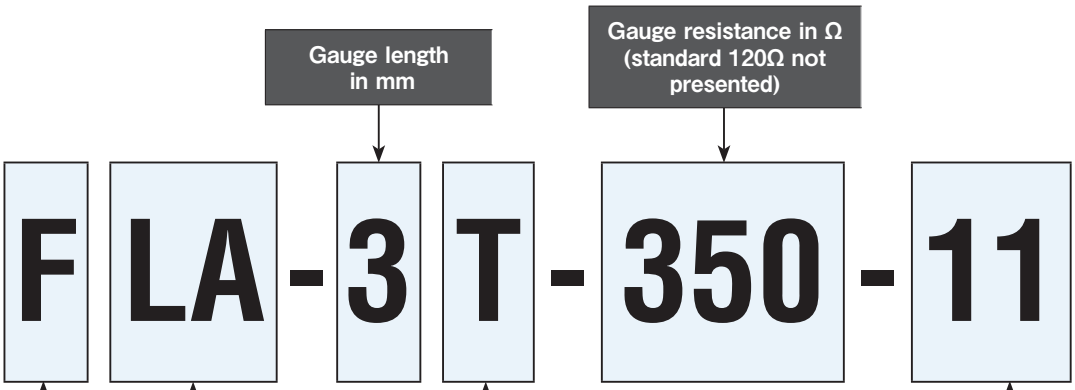
STRAIN GAUGE BRIDGE CIRCUIT

Connection diagram varies according to strainmeter type.

Measuring mode	Bridge circuit	Wiring connection to		Bridge Output
		Switching Box	Bridge Box	
Half bridge common dummy R_2 is used for two or more channels as a common dummy active dummy			Available only by switching box	$R_1 = R_0 + \Delta R$ $R_2 = R_0 = R$ $\Delta e = \frac{E}{4} K\varepsilon$
Opposite arm Half bridge with 2 active gauges		Available only by bridge box Applicable type SB-120B SB-350B SB-128A SB-123A SB-353A		$R_1 = R_0 + \Delta R$ $R_2 = R_0 + \Delta R$ $R = R_0$ $\Delta e = \frac{E}{2} K\varepsilon$
Opposite arm Half bridge with 3-wire 2 active gauges		Available only by bridge box Applicable type SB-120B SB-350B SB-128A SB-123A SB-353A		$R_1 = R_0 + \Delta R$ $R_2 = R_0 + \Delta R$ $R = R_0$ $\Delta e = \frac{E}{2} K\varepsilon$
Full bridge with 4 active gauges : Uniaxial strain				$R_1 = R_3 = R_0 + \Delta R$ $R_2 = R_4 = R_0 - v \cdot \Delta R$ $\Delta e = \frac{E(1+v)}{2} \cdot K\varepsilon$ v : Poisson's ratio
Full bridge with 4 active gauges : Bending strain				$R_1 = R_3 = R_0 + \Delta R$ $R_2 = R_4 = R_0 - \Delta R$ $\Delta e = EK\varepsilon$
Full bridge with 4 active gauges : Torque				$R_1 = R_3 = R_0 + \Delta R$ $R_2 = R_4 = R_0 - \Delta R$ $\Delta e = EK\varepsilon$
Full bridge with 2 active gauges and 2 dummy gauges 2 active 2 dummy				$R_1 = R_3 = R_0 + \Delta R$ $R_2 = R_4 = R$ $R = R_0$ $\Delta e = \frac{E}{2} K\varepsilon$

Output voltage due to strain is based on the condition that output voltage before strain generation (e_0) is zero.

Strain Gauge Coding System



Gauge series	Applications
F	General purpose
	Residal stress, Stress concentration, Chain gauge
WF	Waterproof construction
PF	Concrete use, Polyester foil gauge
P	Concrete use, Polyester wire gauge
FLM / WFLM	Contrete use, Metal backing strain gauge
MF / QMF	Magnetic field use
PMF	Concrete use, Embedment type strain gauge
YEF / YF / YHF	Post-yield strain (Large strain) measurement
PMFLS	Asphalt use, Embedment type strain gauge
LF	Low elastic material use, Wood, Gypsum
PFLW / PLW	Low elastic material use, Wood, Gypsum
GF	Low elastic material use, Plastics
BF / UBF	Composite material use
DSF	High endurance use, Fatigue test
CTE	Linear Expansion Coefficient Measurement strain gauge
CF	Cryogenic temperature use
CEF	Wide range temperature use
QF / ZF / EF / HZF	High temperature use
SFA	Stress measurement
AW	Weldable strain gauge
BTM	Bolt axial strain measurement
DD	One-side gauge
FAC	Crack detection gauge
TF	Strain gauge type temperature measurement
KM	Concrete/Asphalt embedment use, strain transducer
FGMH	Frictional Strain Checker
FGAH	Frictional Axial strain transducer
FGDH	Frictional Torque Sensor System

The following strain gauges are CE marked.

For strain gauge without integral lead wire
- Strain gauge with "-F" appended to the type number
- Strain gauge indicated with "CE" mark in this catalog

Pattern configuration (*1)	
L/LA/LK/LX/LG/BX/BY	Single-axis
LAB/LKB/LGB GOBLET	
C/CA/LC/CS/CB	2-axis Rosette (0°/90°)
CAB GOBLET	
R/LR/RA/RAS/RS	3-axis Rosette (0°/45°/90°)
RAB GOBLET	
XV/YV/BXV/BYV	5-element Single
CV	5-element Rosette (0°/90°)
CT	Torque
LT	45° Single-axis

(*1) Not always coded
0°/90° 2-axis
0°/45°/90° 3-axis

Functions (*2)		Applicable gauge
T	Integrated with thermocouple	Applicable to most of strain gauges
A	Left 45°	QFLT
B	Right 45°	QFLT
W	Large width	FLAB, QFLAB, Some of 350Ω strain gauges

(*2) Not indicated for general strain gauges

Compensation material ppm/℃ (*3)

3	Composite material		17	Stainless steel/Copper alloy	
	Ceramic (Si_3N_4)	2.6~3.3		SUS 304	16.2
	CFRP	3 ~ 5		SUS 310	15.8
5	Composite material			SUS 316	16
	Ceramic (SiC)	4.6		SUS 321	16.7
	CFRP	3 ~ 5		Copper	16.7
8	Composite material			Beryllium copper	16.6
	Glass	7.9		Brass	16.7
	Titanium	8.9		Bronze	17
	Titanium alloy (Ti-6Al-4V)	8.8		Constantan	14.9
11	Mild steel		23	Aluminium	
	Mild steel (0.1~0.2C)	11.8		Aluminium	23.4
	Hard steel (0.4~0.5C)	11.2		Aluminium 2024-T4	23
	Cast iron	10.5		Lead and its alloy	29
	Hastelloy-276	11.2		Gypsum	25
	Inconel 600	13.3		Polyimide	20~30
	Inconel 750	12.1	28	Magnesium	
	Monel	13.5		Magnesium alloy	27
	SUS 630 (17-4PH)	10.8	50	Plastics	
	SUS 631 (17-7PH)	10.6		Epoxy (Cast)	45~65
	Concrete	7~13	70	Plastics	
				Acrylics	70
				ABS	74
				Polyacetal (POM)	80
				Polycarbonate (PC)	66~70
				Polystyrene (PS)	60~80

(*3) Indicated only for self-temperature-compensated strain gauges.
For other materials, contact TML or your local representative.

Length of leadwire pre-attached (*4)	
with 2-wire	Standard length 1 , 3 , 5 m
with 3-wire	Standard length 3 , 5 m

(*4) These strain gauges are available with integral leadwires attached. (made to order)

Option –F

The leadwire pre-attachment is available using lead-free solder. For the leadwire pre-attached strain gauges using lead-free solder, the option code "-F" is appended to the type number to discriminate them from conventional leadwire pre-attached strain gauges using leaded solder.

(-F) - 3 LJB (-F)

Option –F

Strain gauges using leaded solder as standard specifications are optionally available with lead-free solder used. The option code "-F" is appended to the type number of lead-free solder used gauges to discriminate them from conventional strain gauges using leaded solder. The option code "-F" is omitted for strain gauges with CE marking such as GOBLET series.

Suffix codes of pre-attached leadwires Option -F for CE marking	
LJB / LJB-F	0.08mm^2 paralleled vinyl leadwire
LJBT / LJBT-F	0.08mm^2 3-wire parallel vinyl leadwire
LJC / LJC-F	0.11mm^2 paralleled vinyl leadwire
LJCT / LJCT-F	0.11mm^2 3-wire paralleled vinyl leadwire
LJD	0.3mm^2 paralleled vinyl leadwire
LJDT	0.3mm^2 3-wire paralleled vinyl leadwire
LH / LH-F	0.02mm^2 twisted vinyl leadwire
LHT / LHT-F	0.02mm^2 3-wire twisted vinyl leadwire
LS / LS-F	3.2mm-dia. shielded vinyl leadwire
LTSA / LTSA-F	3mm-dia. shielded 3-wire vinyl leadwire
LTSB / LTSB-F	5mm-dia. shielded 3-wire vinyl leadwire
LQM / LQM-F	0.08mm^2 polypropylene 4-wire paralleled leadwire with modular plug
LXT / LXT-F	3-wire parallel special vinyl leadwire
LJRA / LJRA-F	2-wire twisted cross-linked vinyl leadwire
LJRTA / LJRTA-F	3-wire twisted cross-linked vinyl leadwire
LJQTA / LJQTA-F	3-wire twisted cross-linked polyethylene leadwire
TLJBT / TLJBT-F	Temperature-integrated 3-wire paralleled vinyl leadwire
6FB□TLT / 6FB□TLT-F	Temperature-integrated 3-wire twisted fluorinated resin (FEP) single-core leadwire
LP / LP-F	0.14mm / 0.18mm polyurethane leadwire
LU / LU-F	0.14mm / 0.18mm polyester leadwire
LE / LE-F	0.14mm / 0.18mm polyeimide leadwire
6FA□LT / 6FA□LT-F	3-wire twisted fluorinated resin (FEP) leadwire
6FAS□LT / 6FAS□LT-F	3-wire twisted fluorinated resin (FEP) leadwire (Surface treatment (tetra-etching) is not required)
6FB□LT / 6FB□LT-F	3-wire twisted fluorinated resin (FEP) single-core leadwire
6FC□LT / 6FC□LT-F	3-wire twisted fluorinated resin (FEP) leadwire
6FCS□LT / 6FCS□LT-F	3-wire twisted fluorinated resin (FEP) leadwire (Surface treatment (tetra-etching) is not required)
6FD□LTS	1.5mm-dia. 3-wire twisted fluorinated resin (FEP) leadwire with shield
4FA□LT / 4FA□LT-F	3-wire twisted fluorinated resin (PTFE) leadwire
4FB□LT / 4FB□LT-F	3-wire twisted fluorinated resin (PTFE) single-core leadwire

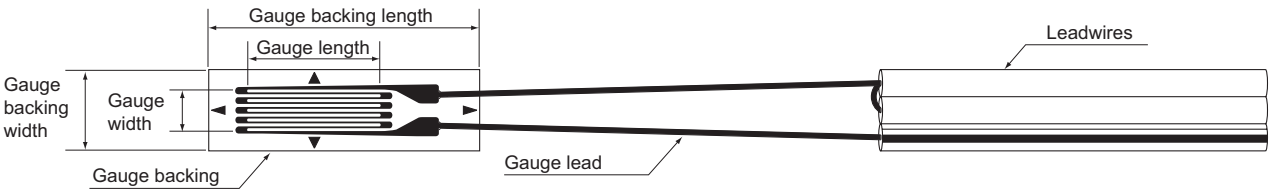
For further information on combination use with strain gauges, refer to pages 36~37.

Color coding for test specimen

Most of our strain gauges are self-temperature-compensated.
The backings of F, WF and CF series strain gauges are classified into three colors according to the objective material for measurement.

Objective material for measurement	Coefficient of linear thermal expansion	Backing color	Type number (example)
Mild steel	11×10^{-6}/°C	Red	FLAB-3-11
Stainless steel Copper alloy	17×10^{-6}/°C	Brown	FLAB-3-17
Aluminium	23×10^{-6}/°C	Green	FLAB-3-23

Name of each part of strain gauge



Strain Gauge Selection

Strain Gauge Characteristics

Strain gauge series (usage)	Shape	Objective material for measurement	Applicable coefficient of linear thermal expansion ($\times 10^{-6}$/°C)	Operating temperature range (°C)	Temperature compensation range (°C)	Main applicable adhesive	Material		RoHS2 Directive compliance
							Backing	Grid	
Strain gauge for general use									
F GOBLET	Single/Multi-axis	Metal Glass Ceramic	8,11,17,23	−196~+150°C	+10~+100°C	CN,P-2 EB-2	Special plastics	Cu-Ni	CE marked
F	Stress concentration Shearing/Torque	Metal Glass Ceramic	8,11,17,23	−196~+150°C	+10~+100°C	CN,P-2 EB-2	Special plastics	Cu-Ni	CE marked
Strain gauge with waterproof construction									
WF	Single/Multi-axis	Metal Glass Ceramic	11,17,23	0~+80°C	+10~+80°C	CN,P-2	Epoxy	Cu-Ni	CE marked
Strain gauge for high temperature use									
QF GOBLET	Single/Multi-axis	Metal Ceramic	11,17,23,28	−30~+200°C	+10~+100°C	CN,C-1 NP-50B	Polyimide	Cu-Ni	CE marked
QF	Stress concentration Shearing/Torque	Metal Ceramic	11,17,23,28	−20~+200°C	+10~+100°C	CN,C-1 NP-50B	Polyimide	Cu-Ni	CE marked
ZF	Single/Multi-axis	Metal Ceramic	11,17,23	−20~+300°C	+10~+100°C	CN,C-1 NP-50B	Polyimide	Ni-Cr	Not applicable (high melting point solder) CE marked
EF	Single	Metal	11	−196~+300°C	+10~+150°C	CN,C-1 EB-2 NP-50B	Polyimide	Ni-Cr	Not applicable (high melting point solder) CE marked
	Multi-axis			−196~+200°C	0~+150°C				Not compliant
HZF	Single	Metal	11,17,23	−196~+350°C	+10~+300°C	C-1 NP-50B	Polyimide	Ni-Cr	CE marked
Strain gauge for high and low temperature use									
CEF	Single	Metal Ceramic	11,17,23	−269~+200°C	−196~+80°C *1	CN,C-1 EA-2A	Polyimide	Special alloy	Not applicable (high melting point solder) CE marked
Strain gauge for cryogenic temperature use									
CF	Single/Multi-axis	Metal Ceramic	11,17,23	−269~+80°C	−196~+80°C *1	CN,C-1 EA-2A	Special plastics	Special alloy	Not applicable (high melting point solder) CE marked
Weldable strain gauge									
AWM	Single	Metal	11,17	−196~+300°C	RT~+300°C	Spot welding	SUS304 Inconel 600	Special alloy	CE marked
AWMD	Single	Metal	12	−196~+800°C	****	Spot welding	Inconel 600	Special alloy	CE marked
AWH	Single	Metal	11,17	−196~+650°C *2	RT~+600°C	Spot welding	SUS304 Inconel 600	Special alloy	CE marked
AWHU	Single	Metal	11	−196~+800°C	RT~+800°C	Spot welding	Inconel 600	Special alloy	CE marked
AW-2/AW-6	Single	Metal	11	−196~+300°C	+10~+100°C	Spot welding	SUS304	Special alloy	Not applicable (high melting point solder) CE marked
AWF	Single	Metal	11	-40~+200°C	+10 ~ +100°C	Spot welding	SUS304	Special alloy	CE compliant
AWC-8B	Single	Metal	11	−20~+100°C	+10~+100°C	Spot welding	SUS304	Special alloy	Not compliant
Strain gauge for concrete and mortar									
P	Single/Multi-axis	Concrete Mortar	11	−20~+80°C	+10~+80°C	CN-E RP-2,PS	Polyester	Cu-Ni wire	CE marked
PF	Single/Multi-axis	Metal Mortar	11	−20~+80°C	+10~+80°C	CN-E RP-2,PS	Polyester	Cu-Ni	CE marked
FLM/WFLM	Single	Concrete Mortar	11	−20~+80°C	+10~+80°C	PS	SUS304	Ni-Cr	Not compliant
Mold strain gauge									
PMF	Single	Concrete Mortar	****	−20~+60°C	****	Embedment	Special plastics	Cu-Ni	Compliant with Option -F
PMFLS	Single	Asphalt	****	−20~+60°C	****	Embedment	Special plastics	Cu-Ni	Compliant with Option -F

*1: Approximately temperature compensated range *2: Up to +600° C for static measurement, Up to +650° C for dynamic measurement

		Strain limit in room temperature (με)	Fatigue life Strain level Number of cycles	Description
	F	5% (50,000)	±1,500με $1x10^6$	These are CE marked strain gauges (compliant to RoHS2 Directive) for general use having a new series name "GOBLET". They have joined to our well proven F-series general-use strain gauges. CE marked leadwires are also available in combination with the strain gauges.
	F	5% (50,000)	±1,500με $1x10^6$	These are foil strain gauges for general use having expanded operating temperature range of -196 to +150°C by the employment of special plastics backings. The backing is color coded to identify the objective material for self temperature compensation. Strain gauges using lead-free solder are available with option code -F. Various leadwires are also available for this series to meet diverse measurement conditions.
	WF	3% (30,000)	±1,500με $3x10^4$	These are F-series strain gauges with integral vinyl leadwires. Whole area of the strain gauge and the leadwire junction are coated with epoxy resin for water proofing. The coating is transparent and flexible, so the positioning and bonding works are very easy. By merely bonding the gauge with an adhesive, outdoor or underwater measurement for a short-term becomes possible.
	QF	3% (30,000)	±1,500με $1x10^6$	These are CE marked strain gauges (compliant to RoHS2 Directive) with backings made of polyimide resin. They are suited to strain measurement in high temperature up to 200°C. They are also used for strain gauge type transducers such as load cells.
	QF	3% (30,000)	±1,500με $1x10^6$	These are strain gauges utilizing polyimide resin as the backing material . They are suited to strain measurement in high temperature up to 200°C. They are also used as the strain sensing element in strain gauge type transducers such as load cells.
	ZF	1% (10,000)	±1,500με $1x10^6$	These strain gauges utilize specially designed Ni-Cr alloy foil for the grid and polyimide resin for the gauge backing. Owing to the construction, these strain gauges are successfully used for measurement in high temperature up to 300°C.
	EF	1% (10,000)	±1,500με $1x10^6$	These are extremely small strain gauges enabling strain measurement in narrow space. Single element gauge is applicable to measurement in high temperature up to 300°C. Two or three element gauge is applicable to measurement up to 200°C. In cryogenic temperature range, all gauges are applicable down to -196°C.
	HZF	1% (10,000)	±1,500με $1x10^6$	This adhesive-type high-temperature strain gage is capable of measuring temperatures up to 350°C. It is RoHS compliant because of the welded connection of dedicated leads. And the C-1 adhesive can be used up to 350°C for one short cycle.
	CEF	1% (10,000)	±1,500με $1x10^6$	These strain gauges feature a wide range of operating temperature from cryogenic temperature to +200°C. They utilize polyimide resin for the gauge backing. This series is available only in single axis configuration with gauge length of 1,3 and 6mm.
	CF	1% (10,000)	±1,500με $1x10^6$	These are strain gauges designed for measurement in cryogenic temperature. They are available in single element, 2-element and 3-element configurations with 350Ω resistance. The thermal output is stable even under cryogenic conditions.
	AWM	1% (10,000)	±1,000με $1x10^6$	This strain gauge has a strain sensing element fully encapsulated in a metal tube. The connection method is quarter bridge 3-wire. It is suited to measurement in high temperature up to 300°C and/or in harsh environment. This strain gauge is installed using our spot welder W-50RC.
	AWMD	1% (10,000)	±1,000με $1x10^6$	This strain gauge has a sensing element of quarter bridge 3-wire connection which is fully encapsulated in a metal tube. It is measured in full bridge method using the attached high pass filter. It is suited to measurement in high temperature up to 800°C and/or in harsh environment. This strain gauge is applicable only for dynamic strain measurement using DC exciting dynamic strain meter. It is installed using our spot welder W-50RC.
	AWH	0.6% (6,000)	±1,000με $1x10^6$	The sensing element is made of special alloy and is fully encapsulated in a corrosion-resistant metal tube such as Inconel 600. The sensing part has half bridge configuration with active element and dummy element, and it is measured in full bridge method using the attached temperature compensation circuit board. This gauge is suited to static measurement in high temperature up to 600°C (650°C for dynamic measurement). It is applicable to use in various environment including gas or liquid. Installation is made using our spot welder W-50RC.
	AWHU	1% (10,000)	±1,000με $1x10^6$	The sensing element is made of special alloy and is fully encapsulated in a corrosion-resistant metal tube such as Inconel 600. The sensing part has half bridge configuration with active element and dummy element, and it is measured in full bridge method using the attached temperature compensation circuit board. This gauge is available for use in high temperature up to 800°C for both of static and dynamic measurement. It is applicable to use in various environment including gas or liquid. Installation is made using our spot welder W-50RC.
	AW2/AW6	0.5% (5,000)	±1,000με $1x10^6$	The construction of this strain gauge is that a high temperature strain gauge is bonded on a thin stainless steel sheet (0.08mm thick) with heat-curing adhesive. Strain measurement in temperature up to 300°C is possible by this strain gauge. It is suited to measurement of a specimen on which strain gauge bonding is not possible, and/or to a long term measurement. Installation is made using our spot welder W-50RC.
	AWF	0.5% (5,000)	±1,000με $1x10^6$	This strain gauge incorporates a full bridge configuration and features a gauge factor of approximately 4. It is specifically designed for use in high-temperature environments up to 200°C, in locations where adhesive bonding is impractical, and in applications requiring stable, long-duration strain measurement.
	AWC	0.5% (5,000)	±1,000με $1x10^6$	The sensing element of this strain gauge is encapsulated in a stainless steel tube with adhesive. Owing to the sealed construction, this strain gauge is suited to measurement under water and/or for a long term. It is installed by spot welding the stainless steel backing using our spot welder W-50RC.
	P	2% (20,000)	±1,000με $1x10^5$	These strain gauges utilize a thin wire as the sensing element and have comparatively long gauge lengths. They are mainly used for measurement on concrete. Since the backing is transparent, the bonding position can easily be checked in the installation works. Strain gauges with integral leadwires are available with CE marking.
	PF	2% (20,000)	±1,500με $1x10^6$	These strain gauges have polyester resin backings which are the same as P series, while they have sensing elements made of foil. They can be handled as easily as P series gauges. They are applicable to various materials including concrete, mortar and metals. Strain gauges with integral leadwires are available with CE marking.
	FLM/WFLM	0.5% (5,000)	±1,000με $1x10^5$	These strain gauges have resin backings lined with metal foil for the purpose of preventing the penetration of moisture from the reverse side. They are exclusively used for the measurement of strain on concrete surface. The WFLM gauges have moisture proofing over-coating and integral leadwire in addition to the metal backing. It is suited to long term measurement or measurement on underwater-curing concrete.
	PMF	****	****	These gauges are designed for measurement of internal strain of concrete or mortar. They are embedded into the measurement position when the concrete or mortar is placed. These gauges are exclusively used for short term measurement such as a loading test. For long term measurement, the use of strain transducer [KM] is recommended. (see page 184~185)
	PMFLS	****	****	This strain gauge utilizes super engineering plastics for the backing material, whice exhibit excellent water and heat resistance. It withstands the high temperature of 200°C when the asphalt is placed. This strain gauge is manufactured using lead-free solder with option code -F.

Strain Gauge Selection

Strain Gauge Characteristics

Strain gauge series (usage)	Shape	Objective material for measurement	Applicable coefficient of linear thermal expansion ($\times 10^{-6}$/°C)	Operating temperature range (°C)	Temperature compensation range (°C)	Main applicable adhesive	Material		RoHS2 Directive compliance
							Backing	Grid	
Strain gauge for composite material									
UBF	Single	Composite material	****	Static −30~+120°C Dynamic −30~+150°C	****	CN,EB-2 NP-50B	Polyimide amide	Cu-Ni	CE marked
BF GOBLET	Single/Multi-axis	Composite material	3, 5, 8	−30~+200°C	+10~+80°C	CN,EB-2 NP-50B	Polyimide	Cu-Ni	CE marked
Strain gauge for low elastic modulus material									
GF GOBLET	Single/Multi-axis	Plastics	50, 70	−30~+80°C	+10~+80°C	CN	Special plastics	Cu-Ni	CE marked
LF GOBLET	Single	Wood Gypsum	11	−30~+80°C	+10~+80°C	CN-E	Special plastics	Cu-Ni	CE marked
Strain gauge for long-term measurement on wood									
PFLW PLW	Single	Wood	11	−20~+80°C	+10~+80°C	PS	Polyester	Cu-Ni foil Cu-Ni wire	CE marked
Strain gauge for magnetic field use									
QMF	Single/Multi-axis	Metal	11, 17, 23	−30~+200°C	0~+150°C	CN NP-50B	Polyimide	Ni-Cr	CE marked
MF	Single	Concrete	****	−20~+80°C	****	CN,CN-E RP-2	Special plastics	Ni-Cr	Not compliant
Strain gauge for post-yield (large strain) measurement									
YEF GOBLET	Single/Multi-axis	Metal	****	−30~+80°C	****	CN CN-Y	Special plastics	Cu-Ni	CE marked
YF	Single	Metal	****	−20~+80°C	****	CN CN-Y	Special plastics	Cu-Ni	CE marked
YHF	Single	Metal	****	−30~+80°C	****	CN CN-Y	Special plastics	Special alloy	CE marked
High endurance strain gauge									
DSF	Single	Metal Composite material	****	−60~+200°C	****	CN,EB-2 C-1	Polyimide	Special alloy	Not compliant
One-side strain gauges									
DD	Single axis (2-element)	Metal	****	−10~+70°C	****	CN P-2	Acrylic	Cu-Ni	Compliant with Option -F
Linear Expansion Coefficient Measurement strain gauge									
CTE	Single	General materials	****	−30~+200°C	+10~+100°C	CN,NP-50 C-1,EB-2	Polyimide	Ni-Cr	CE marked
Crack detection gauges									
FAC	****	Metal Concrete	****	−30~+80°C	****	CN RP-2	Special plastics	Cu-Ni	CE marked
Stress gauges									
SF	****	Metal	11, 17, 23	−20~+200°C	+10~+100°C	CN,NP-50B C-1	Polyimide	Cu-Ni	CE marked
Temperature gauge									
TF	Single	General materials	****	−20~+200°C	****	CN,NP-50B C-1	Polyimide	Ni	CE marked
Bolt strain gauges									
BTM	Single	Bolt M10 or larger	****	−10~+80°C	****	A-2	Special plastics	Cu-Ni	Not applicable (high melting point solder) CE marked
BTMC	Single	Bolt	****	−10~+80°C	****	CN	Special plastics	Cu-Ni	Not applicable (high melting point solder) CE marked
Frictional strain gauges									
CBF	Single/Multi-axis Torque	Metal Steel	11	0~+60°C	****	Not required	Special resin	Cu-Ni	Partly compliant

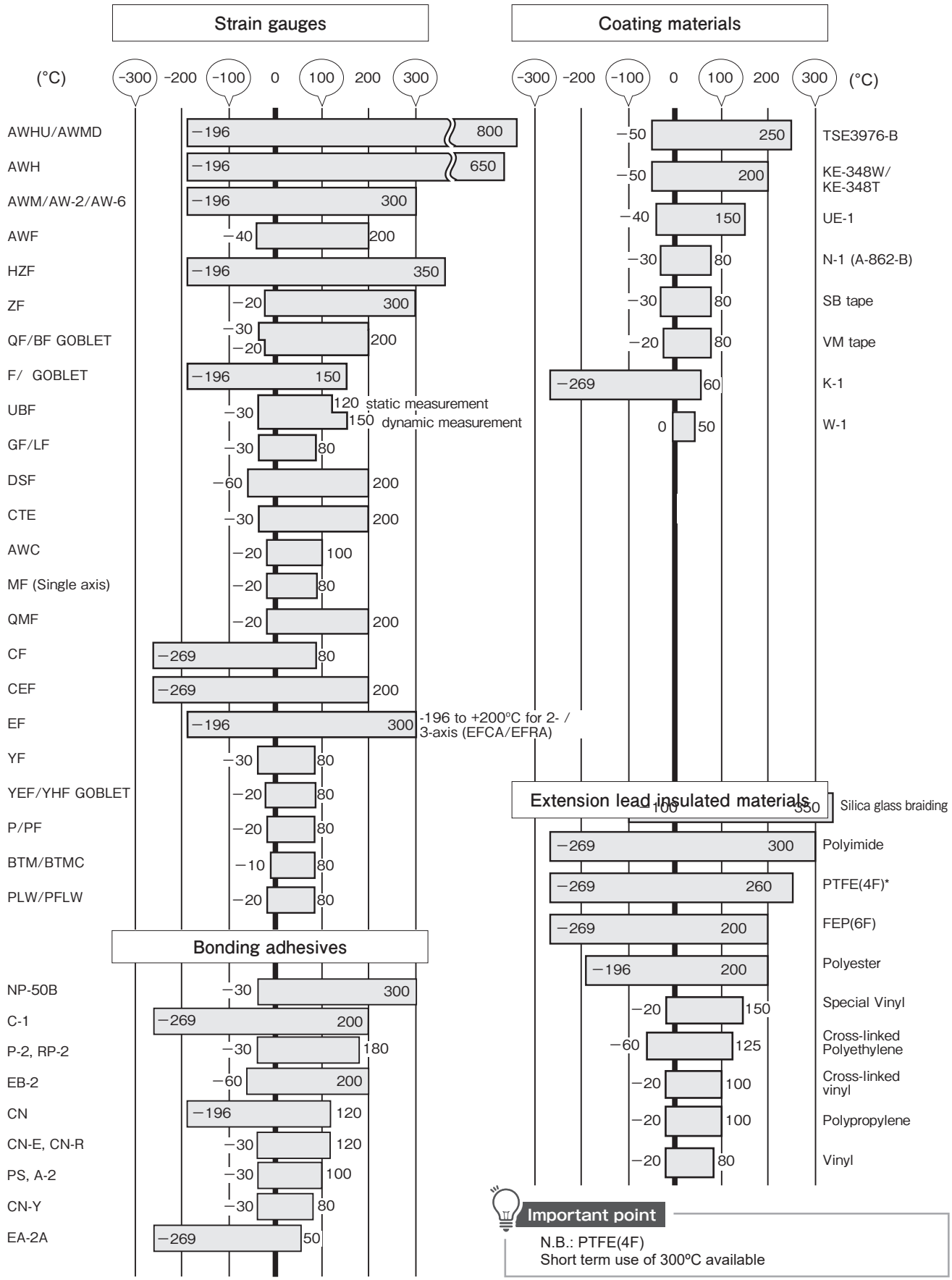
		Strain limit in room temperature (με)	Fatigue life Strain level Number of cycles	Description
	UBF	3% (30,000)	±1,500με $1x10^6$	These are strain gauges developed for measurement on composite materials. Owing to the development of gauge backing with better compliance, the number of repetition in thermal cycling test and the creep characteristics have been significantly improved compared to conventional strain gauges.
	BF	3% (30,000)	±1,500με $1x10^6$	These are strain gauges designed for measurement on composite materials. They have a specially designed grid pattern to reduce the stiffening effect to the measurement object.
	GF	3% (30,000)	±1,500με $1x10^6$	These strain gauges are suited to the measurement on materials such as plastics, which have low elastic modulus compared to metal. The specially designed grid reduces the stiffening effect of strain gauge to the specimen material, and also reduces the effect of Joule heat in the strain gauge.
	LF	3% (30,000)	±1,500με $1x10^6$	This strain gauge is designed for measurement on materials having low elastic modulus such as wood or gypsum. Its specially designed grid reduces the stiffening effect of the strain gauge to the specimen material.
	PFLW	2% (20,000)	±1,000με $1x10^5$	These are polyester strain gauges whose backings lined with metal foil. The metal foil prevents the penetration of moisture to the strain gauge and makes it suited to the use for long term measurement.
	QMF	1% (10,000)	±1,500με $1x10^5$	These gauges are designed for strain measurement in magnetic field. They are applicable to the measurement in high temperature up to 200°C. The sensing element of the gauge is made of a material which exhibits low magnetoresistance effect. In addition, the sensing element is constructed to make the strain gauge less sensitive to the influence of electromagnetic induction.
	MF	1% (10,000)	±1,500με $1x10^6$	These gauges are designed for strain measurement in magnetic field. The sensing element of the gauge is made of a material which exhibits low magnetoresistance effect. In addition, the sensing element is constructed to make the strain gauge less sensitive to the influence of electromagnetic induction.
	YEF	10~15% (100,000~ 150,000)	±1,500με $5x10^5$	These strain gauges are applicable to the measurement of large strain up to 10~15%. Also they withstand the repeated strain in elastic range (strain level of about $\pm1500\times10^{-6}$) like ordinary strain gauges.
	YF	15~20% (150,000~ 200,000)	****	These strain gauges are applicable to the measurement of large strain up to 15~20%. They are not applicable to the measurement of repeated strain in elastic range as well as in large strain range.
	YHF	30~40% (300,000~ 400,000)	±1,500με $2x10^4$	These strain gauges are developed for the measurement of very large strain up to 30~40%. They are not applicable to the measurement of repeated strain in elastic range as well as in large strain range.
	DSF	1% (10,000)	±3,000με $1x10^7$	These strain gauges are developed for measurement in fatigue test. They satisfy the fatigue life over 10 million times at a strain level of $\pm3000\times10^{-6}$ strain. It can save the labour and cost for replacing strain gauges during the fatigue test.
	DD	0.15% (1,500)	±1,000με $1x10^5$	These strain gauges are intended for measuring the bending and tensile strains separately by simply bonding the gauge on one side of a plate or beam. They are effectively used for the measurement of a box construction in structures such as bridges or pressure vessels, where the reverse side of the measurement object is not accessible for strain gauge installation. Strain gauges using lead-free solder are newly introduced with option code -F.
	CTE	1% (10,000)	±1,500με $1x10^5$	This product is a strain gauge with the temperature-compensated material of the strain gauge adjusted to 0×10^{-6}/°C so that the coefficient of linear expansion of any material can be easily calculated using a simple formula. In addition, the total elongation occurring in the measured material can be measured as it is.
	FAC	****	****	These gauges are designed to measure the propagation speed of fatigue crack in a metal specimen. The gauge is bonded with an adhesive on the position where the crack is initiated or the crack initiation is expected. The gauge is used together with the crack gauge adapter CGA-120B for the measurement.
	SF	****	±1,500με $1x10^6$	These gauges are intended to measure the stress in an optional direction of the specimen in plane stress field. The gauge is sensitive not only in its axial direction but also in its transverse direction, and the sensitivity ratio of the transverse direction to the axial direction is equal to the Poisson's ratio of the specimen material. In addition, the gauge is not sensitive to the shearing strain. Therefore, the output of the gauge is proportional to the stress in the direction of the gauge axis.
	TF	****	****	These gauges are bonded on the specimen surface like ordinary strain gauges, and measure the surface temperature. By combining with the dedicated temperature gauge adapter (TGA-1A or TGA-1B), actual temperature can be measured easily using a strain meter. Gauges using lead-free solder are newly introduced with option code -F.
	BTM	****	****	These gauges are used for measurement of tensile strain of bolt. The gauge is simply inserted into a pre-drilled hole in the bolt shank together with A-2 bonding adhesive and cured. Installation service of bolt strain gauge from drilling till bonding and calibration service after the installation are also available.
	BTMC	****	****	These gauges are used for measurement of tensile strain of bolt. The BTMC gauges have a tube shape sensing element, and they are installed with fast-curing CN adhesive. The installation is easily made at room temperature.
	CBF	****	****	The frictional strain gauge measures strain using frictional force working on the contact surface between the strain gauge and the measurement object by pressing the gauge to the object with a constant force. It is utilized in the Strain Checker FGMH series which is mounted on a steel structure using magnet, and in the Torque Sensor System FGDH series and Axial Strain Transducer FGAH series which enable measurement of torque or axial force by merely being mounted on a drive shaft or tie rod.

Measuring Purpose

Gauge series selection chart

Material - Purpose	Gauges series & Operating temperature (° C)	Bonding adhesive	Coating materials	Lead wire insulator recommended
Metal				
General use — Mid-high temperature	−196 / F/ GOBLET / +150	CN/P-2/EB-2	W-1/N-1/SB tape	Vinyl, FEP(6F)
	−20 / PF / +80	CN/P-2/EB-2	W-1/N-1/SB tape	Vinyl, Enamel
Underwater	0 / WF / +80	CN/P-2/EB-2	W-1/N-1/SB tape	-LDBB, -LDBTB
General use — High temperature	−30 / −20 / QF/ GOBLET / +200	CN/C-1/NP-50B	KE-348	FEP(6F), PTFE(4F)
High temperature	−20 / ZF / +300	CN/C-1/NP-50B	TSE-3976-B	PTFE(4F)
Miniature, High Miniature, High	−196 / EF(Single) / +300 −196 / EF(2-/3-axis) / + 200	CN/EB-2/C-1/NP-50B	KE-348/TSE-3976-B	FEP(6F), PTFE(4F)
High temperature	−196 / HZF / +350	C-1	—	Silica glass braiding
Wide range temp. Cryogenic temp.	−269 / CEF / + 200 −269 / CF / +80	EA-2A/CN/C-1	K-1	FEP(6F), PTFE(4F)
Spot welding	−196 / AWM(Quarter with 3-wire) / + 300 −196 / AWMD(Full bridge) / for dynamic / +800 −196 / AWH(Full bridge) / for static +600 / for dynamic +650 −196 / AWHU(Full bridge) / +800 −196 / AW2/AW-6(Quarter with 3-wire) / +300 −40 / AWF / +200 −20 / AWC / +100	Spot welding (Welder W-50RC)	Consult TML	MI cable
Long-term	−20 / ZF / +300	C-1/NP-50B	W-1/SB tape	Vinyl/Cross-linked vinyl / PTFE(4F)
	−196 / AW-6(Quarter with 3-wire) / +300	Spot welding		
Stress concentration	−196 / F / +150	CN/P-2/EB-2	W-1/SB tape	Vinyl
	−20 / QF / +200	CN/C-1/NP-50B	KE-348	FEP(6F)
Residual stress	−196 / F / +150	CN	KE-348/N-1	Vinyl
Torque	−196 / F / +150	CN/P-2/EB-2	W-1/SB tape	Vinyl
	−20 / QF / +200	CN/C-1/NP-50B	KE-348	FEP(6F)
Shear strain	−20 / QF / +200	CN/C-1/NP-50B	KE-348	Vinyl, FEP(6F)
Bending/Tensile strain	−10 / DD / +70	CN/P-2	---	Vinyl
Bolt axial strain	−10 / BTM / +80	A-2	---	Vinyl
Large strain	−20 / YF / +80	CN/CN-Y	SB tape	Vinyl
	−30 / YEF/YHF / +80 YEF GOBLET			
Metal or Concrete				
Magnetic field use	−20 / MF(Single) / +80	CN/CN-E/RP-2	W-1/SB tape	Twisted vinyl with shield
	−20 / QMF / +200	CN/NP-50B/EB-2/C-1	KE-348	Twisted FEP with shield
Concrete or Mortar				
Surface strain	−20 / P/PF / +80	CN-E/RP-2/PS	W-1/SB tape	Vinyl, Cross-linked polyethylene
	−20 / +80 FLM/WFLM	PS		
Internal strain	−20 / +60 PMF	Embedment	—	Cross-linked vinyl
Asphalt				
Internal strain	−20 / +60 PMFLS	Embedment	—	Chloroprene
Plastics				
General purpose	−30 / GF / +80 GOBLET	CN	W-1/N-1/SB tape	Vinyl
Composite				
General purpose	−30 / BF GOBLET / +200	CN/NP-50B/EB-2	W-1//SB tape	Vinyl, FEP(6F)
	−30 / UBF / for static +120 / for dynamic +150	CN/EB-2		
Fatigue test	−60 / DSF / +200	CN/C-1/EB-2	—	Vinyl, FEP(6F)
Printed circuit board				
General purpose	−196 / EF(Single) / +300 −196 / EF(2-/3-axis) / + 200	CN/NP-50B/EB-2	—	Vinyl, FEP(6F), PTFE(4F)
Wood long-term/Gypsum				
General purpose	−30 / LF / +80 GOBLET	CN-E	W-1/N-1/SB tape	Vinyl
	−20 / +80 PFLW/PLW	PS/CN-E		
General use				
Temperature	−20 / TF / +200	CN/C-1/NP-50B	W-1/SB tape	Vinyl, FEP(6F)

Operating Temperature Range



Important point

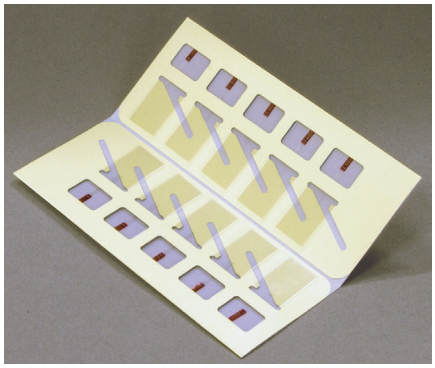
N.B.: PTFE(4F)
Short term use of 300°C available

Package Designation

TML strain gauges are delivered together with TML Strain Gauge Test Data (example shown below). The evaluation methods conform to the National Aerospace Standard NAS942 (modified). For installation, handling and bonding procedures, please see the data sheet.

GAUGE PACKAGE





CE compliance

Affixing the CE marking and our logo mark of strain gauge GOBLET series to a container package

Batch No.

Production code for procedure and history.

Environment

Temperature in degrees centigrade and relative humidirty in % at which the test data are obtained.

TEST DATA

TYPE	FLAB-5-11		TEST CONDITION 23℃ 50%RH
LOT NO.	A516611	BATCH NO. RK32C	GAUGE FACTOR
GAUGE LENGTH	5 mm		2.10 ±1 %
GAUGE RESISTANCE	120±0.3 Ω	TEMP. COMPENSATION FOR	11 ×10⁻⁶/℃
QUANTITY	10	TRANSVERSE SENSITIVITY	0.3 %

Gauge type

Lot No.

Quantity

Number of gauges contained in a package.

Gauge resistance

Electrical resistance of the strain gauge under free conditions at room temperature, unbonded as supplied. Various range (60, 120, 350 or 1000Ω) are available.

Gauge length

This represents the actual grid length in the axial direction. Within this length, the measured strain is averaged.

Ratio of transverse sensitivity

The sensitivity in the direction perpendicular to the axial direction in percent.

Applicable temperature compensation

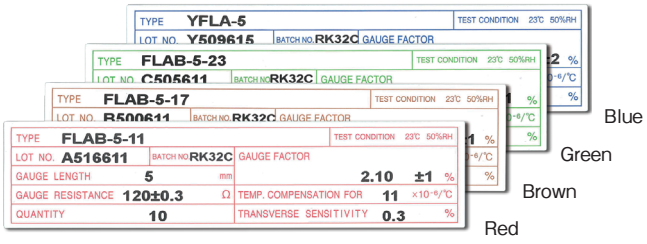
Various temperature compensation values are available (3, 5, 8, 11, 17, 23, 28, 50, 70ppm/° C)
(Blank indicates temperature compensation not available.)

Gauge factor with tolerance

This factor is a ratio of the resistance variation to the strain generated due to the uniaxial stress in the direction of the gauge axis.

COLOR CODING FOR TEST SPECIMEN

Colors of package label differ depending on the test specimen material for temperature compensation.



Test specimen	Linear thermal expansion coefficient	Coloring	Gauge type exampled
Mild steel	11×10^{-6}/° C	Red	FLAB-5-11
Stainless steel Copper alloy	17×10^{-6}/° C	Brown	FLAB-5-17
Aluminium	23×10^{-6}/° C	Green	FLAB-5-23
Others	-	Blue	YFLA-5

LEADWIRE-INTEGRATED STRAIN GAUGE PACKAGE

LJCT : 3-wire system

TYPE	FLAB-5-11-1LJCT-F		
LOT NO.	A519611	GAUGE LENGTH	5 mm
GAUGE FACTOR	2.10 ±1 %		
GAUGE RESISTANCE	120±0.5 Ω	QUANTITY	50
TEMP. COMPENSATION FOR	11 ×10⁻⁶/℃	TEST CONDITION	23℃ 50%RH
TRANSVERSE SENSITIVITY	0.4 %	BATCH NO.	XF13C
LEAD WIRES	10/0.12 3W 1m		

LJB : 2-wire system

TYPE	FLAB-5-11-5LJB-F		
LOT NO.	A518611	GAUGE LENGTH	5 mm
GAUGE FACTOR	2.13 ±1 %		
GAUGE RESISTANCE	117.7±0.3 Ω	QUANTITY	10
TEMP. COMPENSATION FOR	11 ×10⁻⁶/℃	TEST CONDITION	23℃ 50%RH
TRANSVERSE SENSITIVITY	−0.1 %	BATCH NO.	AA01K
LEAD WIRES	7/0.12 2W 5m r=0.44Ω/m		



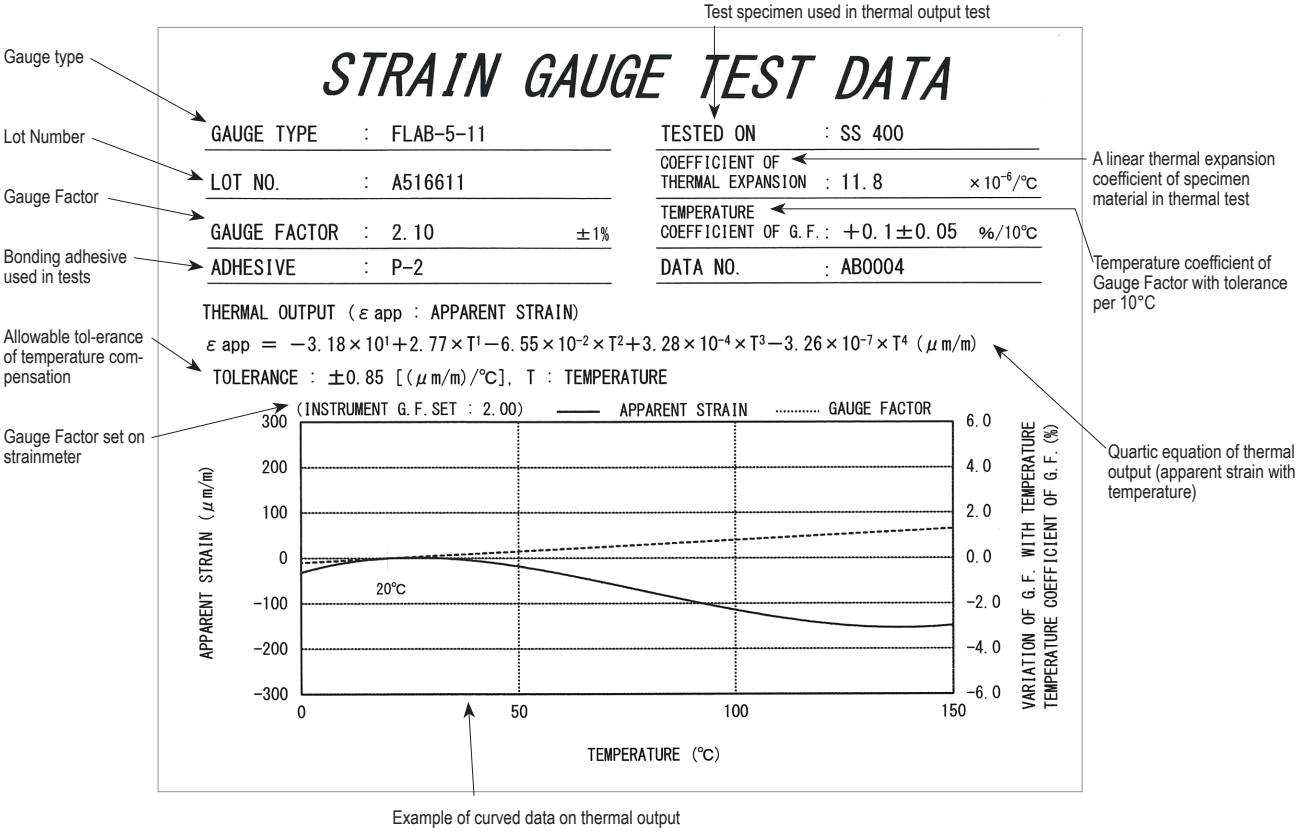
LEADWIRES

Core number/diameter Wiring system Length of leadwire
FLAB-5-11-3LJCT-F (Left)
10/0.12 3W 3m : 10-core 0.12mm diameter, 3-wire, 3-meter long.
FLAB-5-11-5LJB-F (Right)
7/0.12 2W 5m r=0.44Ω/m : 7-core 0.12mm diameter, 2-wire, 5-meter long, leadwire resistance per meter 0.44Ω above

GAUGE RESISTANCE

For pre-attached strain gauge, the gauge resistance value does not include the lead wire resistance. For correction of gauge factor due to the prolonged leadwire resistance, refer to the resistance per meter (r value) given in LEAD WIRES.

STRAIN GAUGE TEST DATA



GAUGE FACTOR OF LEADWIRE PRE-ATTACHED STRAIN GAUGES

The gauge factor of a leadwire pre-attached strain gauge given in its STRAIN GAUGE TEST DATA and package label is a value of the strain gauge itself. Since the given gauge factor does not include the influence of the leadwire resistance, it should be corrected referring to the description of “Gauge factor correction due to leadwire” in “Handling of strain gauge” which is found in the attached test data. The correction should be made considering the influence of all leadwires that are actually connected.

Primary Installations - Bonding Strain Gauges

When bonding the strain gauges, the most suitable adhesive should be selected for each application. A typical installation procedure is described below using the fast-curing adhesive CN.

1. Preparation

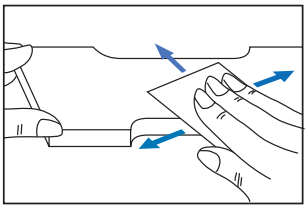
The following items are required for bonding and leadwire connection: Strain gauges, bonding adhesive, connecting terminals, test specimen, solvent, cleaning tissue for industrial use, soldering iron, solder, abrasive paper (120 - 320 grit), marking pencil, scale, tweezers, extension leadwire, polyethylene sheet, nippers.

2. Positioning

Roughly determine a location on the test specimen where the strain gauge is to be bonded.

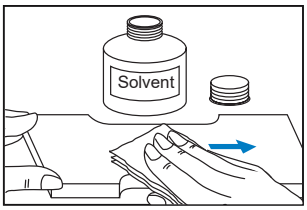
3. Surface preparation

Before bonding, remove all grease, rust, paint, etc., from the bonding area to provide a shinny metallic surface. Use abrasive paper to abrade an area somewhat larger than the bonding area uniformly and finely with abrasive paper. Finish the surface with #120 to 180 abrasive paper for steel, or #240 to 320 for aluminium.



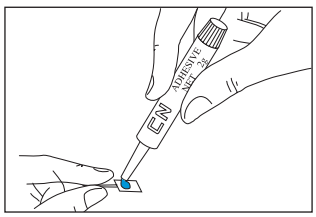
4. Fine cleaning

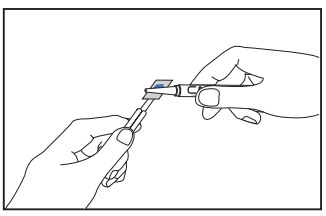
Clean the abraded surface with industrial tissue or cloth soaked in a small quantity of chemical solvent such as acetone. Continue cleaning until a new tissue or cloth comes away completely free of contamination. Following the suface preparation, be sure to attach the gauge before the surface becomes covered with an oxidizing membrane or becomes newly contaminated.



5. Applying bonding adhesive

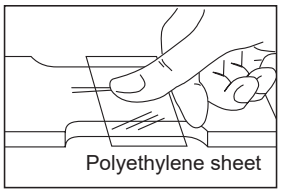
Drop a proper amount of adhesive onto the back of the gauge base. Usually one drop of adhesive will suffice, but you may increase the number of drops according to the size of the gauge. Use the adhesive nozzle to spread the adhesive over the back surface thinly and uniformly.





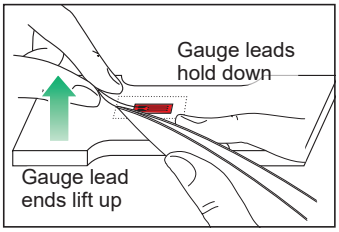
6. Curing and pressing

Place the gauge on the position, place a polyethylene sheet onto it and press down on the gauge constantly using your thumb or a gauge clamp. This should be done quickly as the curing process is completed very fast. The curing time varies depending on the gauge, test specimen, temperature, humidity and pressing force. The curing time under normal conditions is 20-60 seconds.



7. Raising gauge leads

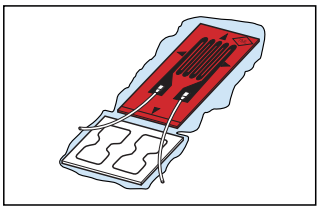
After the adhesive beneath the polyethylene sheet has been perfectly cured, raise the gauge leads. Raise the leads up to a bit inside the gauge base while pressing down the foot of the leads by tweezers not to damage the leads..



8. Bonding connecting terminals

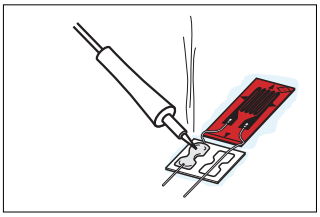
Bond the terminal close to the gauge base.

Foil type connecting terminals



9. Soldering the gauge leads

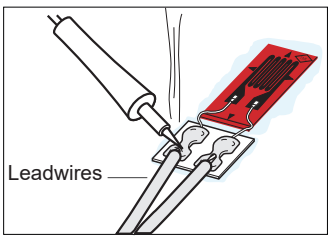
Place the gauge leads on the gauge terminal with a little slack and apply solder so that the metal foil of terminal is covered with the solder. An excess gauge leads should be twisted off by tweezers.



10. Soldering leadwires

It is recommended to plate the exposed core wires of the extension leadwires with solder preliminarily.

Solder the end of leadwire to the terminals. Take care not to excessively heat the terminal to peel off the metal foil.



Primary Installations - Overcoating Strain Gauges

Water- and Moisture-proofing with SB tape and VM tape

Requirement in strain gauge coatings

- Excellent resistance to moisture and water and good electrical insulation
- Good adhesion to the strain gauge, leadwires and test specimen surface
- No constriction of the test specimen

Both of the SB and VM tapes are butyl rubber tape generally referred to as pressure-sensitive adhesive. These coating tapes are applied by being pressed onto the test specimen, and they provide excellent resistance to moisture and water.

SB tape

Butyl rubber
Temperature : -30 to +80°C
Contents : 10mm×3mm
5m long/roll

VM tape

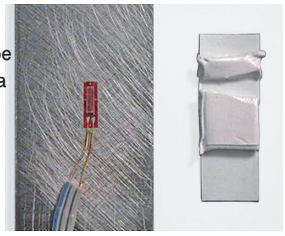
Butyl rubber
Temperature : -20 to +80°C
Contents : 38mm×1mm
6m long/roll



Example for leadwire integrated strain gauge

First coating with SB tape

Trimming the SB tape
With scissors, cut off one piece of tape large enough to cover the coating area and another piece 5mm to 10mm in length to fit under the leadwires.



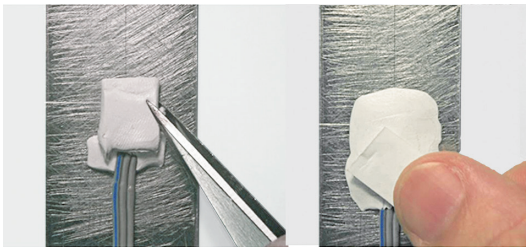
Under-laying

Lift up the leadwires and press the smaller piece of tape onto the test specimen surface under the leadwires.



Overall coating

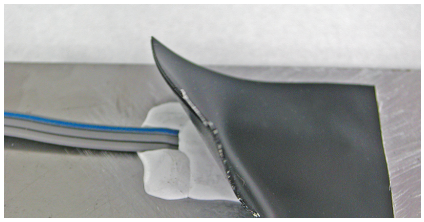
Press the leadwires back down onto the piece of SB tape and then press the larger piece of coating tape down onto the strain gauge.



Finish coating with VM tape

Cut a piece of VM tape slightly larger than the layer of SB tape coating and press it down onto the place so that the first coating is fully covered by the VM tape.



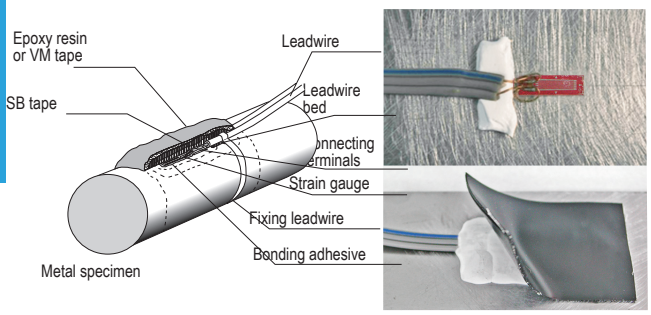


Strain Gauge Installation

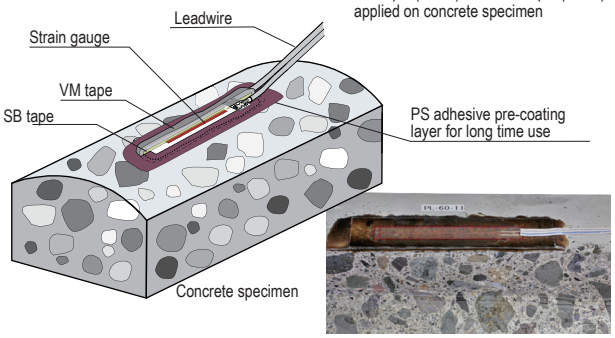
TML strain gauge series are roughly classified into 4 types depending on the method of installation.

1. Adhesive bonding type

In general, most of strain gauges are installed on the surface of test specimen with adhesive. Measurement is possible as far as the specimen material is bondable with adhesive. This method can be applied to various materials including metal, concrete, wood and composite material. After installation, coatings should be applied to protect the strain gauges and leadwires from various environmental conditions. The availability of this bonding type depends on the operating temperature of adhesive. The maximum operating temperature is 300°C.

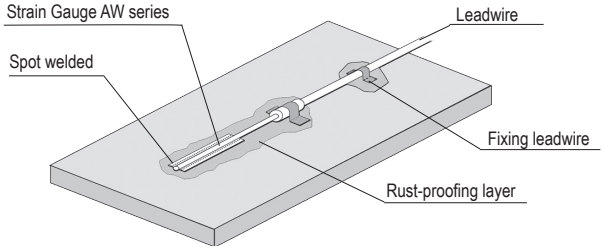


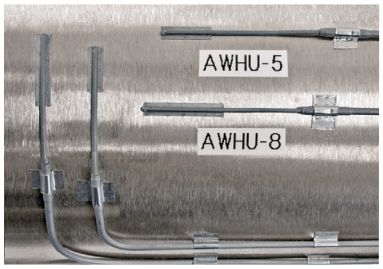
SB tape (white) and VM tape (black) applied on concrete specimen



2. Electrical Spot weldable type

The strain gauge of this type is fully encapsulated in a corrosion-resisting metal tube for use in various conditions, such as gas-filled and underwater environments. It is constructed heat resistive, and the installation is made by electrical spot welding which maintains excellent fixation even in high temperature. The operating temperature range is from -196°C to +800°C. The spot welder W-50RC is developed exclusively for installation of strain gauges of this type, and it can be used without any qualifications or special skill. Naturally, the specimen material must be a metal which allows electrical spot welding.

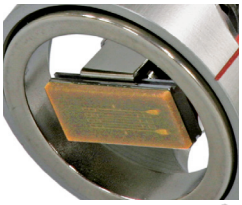


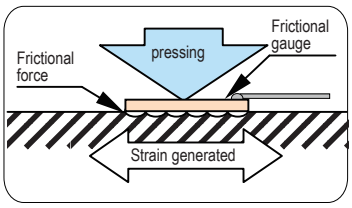


Metal specimen

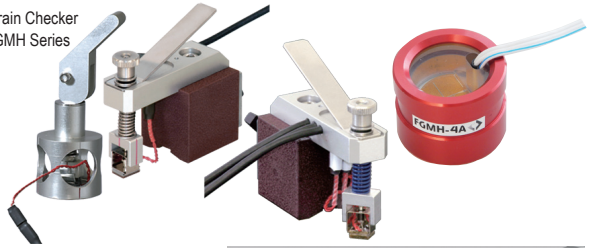
3. Frictional gauge type (Re-usable type)

This gauge consists of a soft rubber layer on its contact surface and a magnet which presses the strain gauge against the specimen surface by magnetic force. It measures strain by friction which is caused between the contact surface of strain gauge and the measurement surface of the metal specimen. It has the advantage of being usable repeatedly because it is attached by magnetic force without using adhesive. Since the measurement point can be moved easily, it is useful for preparatory or supplemental measurement. The maximum operating temperature is 60°C because of adopting magnetic force.

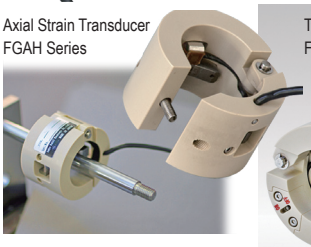




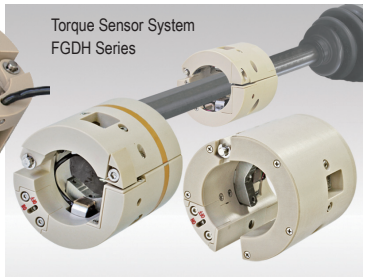
Strain Checker FGMH Series



Axial Strain Transducer FGAH Series



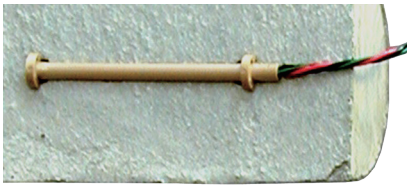
Torque Sensor System FGDH Series



4. Internal strain measurement using embedment type

Above strain gauges of three types measure surface strains of test specimen. This strain gauge measures internal strain of concrete, mortar or asphalt by being embedded into the material before its hardening. It makes possible with measurement in the early stage of hardening of the material. Some series of this type are applicable to measurement in asphalt in high temperature of 200°C. We also have a method to measure axial force of bolt by embedding a bolt strain gauge which is specially prepared for this purpose.

Mold strain gauges PMF series for use in concrete and mortar



Bolt gauge BTM series installed into bolt with bonding adhesive



Strain Gauge Extension Leadwires

Strain gauges are connected to strain measuring instruments using extension leadwires. We offer various types of leadwires to be selected depending on the usage conditions. In addition, most of strain gauges are available with extension leadwires preattached at our factory. Those leadwire-integrated strain gauges greatly save the leadwire connection works during the strain gauge installation. Please feel free to contact our company or local representative for the extension leadwires and the leadwire-integrated strain gauges.

Standard leadwire length for leadwire-integrated strain gauges

Standard length of our integral leadwires is 1m, 3m and 5m except enamel leadwires. The standard length of enamel leadwires are 0.3m, 0.5m and 1m. Other lengths than the standard length may be available on request. The enamel leadwires are not available in a length more than 1m.

·OPTION -F Leadwire with CE marking
Leadwire with CE marking (compliant to RoHS2 Directive)
Identification code "-F" is appended to the type number of the leadwire.

Leadwire selection

¶ Vinyl leadwires (Standard lengths: 1m, 3m, 5m)

Vinyl leadwires are widely used as strain gauge leadwires, and are available in a variety of types. Because the vinyl insulation can be colored, these wires allow color-coding for rosette gauges. Stranded core wires are flexible and easy to handle, and allow easy wire connection and terminal attachment.

·Small diameter vinyl wires (Code to order -LH, -LHT)

These leadwires feature a thin vinyl insulated materials and small diameter core wires to achieve an outside diameter of 0.4mm. They are used for wiring in tight spaces. The stranded wires are flexible and minimize breakage due to repeated bending.

·Shielded vinyl wires (Code to order -LTSA, -LTSB)

These are 3-core wires with shield made of aluminium foil or braided copper wire. The outer insulation is made of vinyl. These leadwires offer a noise shielding function.

Type number of leadwires (Option code -F for CE marking)	Core/Diameter (cross section) (mm)	Applicable temperature	Total resistance of lead wire	Outer insulated dimensions (mm)	Length per roll	Colors
0.08mm^2 paralleled vinyl lead wire LJB/LJB-F 	7/0.12 (0.08mm^2)	-20~+80°C	0.44Ω/m	1.1×2.2	200m	Red, White, Green, Black, Yellow Blue, Red-White
0.08mm^2 3-wire paralleled vinyl leadwire LJBT/LJBT-F 	7/0.12 (0.08mm^2)			1.1×3.3		White wire and whichever color Blue, Orange, Red, Green, Black or Yellow stripe is selectable.(*)
0.11mm^2 paralleled vinyl lead wire LJC/LJC-F 	10/0.12 (0.11mm^2)	-20~+80°C	0.32Ω/m	1.4×2.8	200m	Grey
0.11mm^2 3-wire paralleled vinyl leadwire LJCT/LJCT-F 	10/0.12 (0.11mm^2)			1.4×4.2	100m	Grey, One wire with Blue stripe (*)
0.3mm^2 paralleled vinyl leadwire LJD 	12/0.18 (0.3mm^2)	-20~+80°C	0.12Ω/m	1.9×3.8	200m	Grey
0.3mm^2 3-wire paralleled vinyl leadwire LJDT 	12/0.18 (0.3mm^2)			1.9×5.7	100m	White, One wire with Red stripe (*)
0.02mm^2 twisted vinyl leadwire LH	5/0.07 (0.02mm^2)	-20~+80°C	1.8Ω/m	Φ0.8	—	Red, Green, White
0.02mm^2 3-wire twisted vinyl leadwire LHT/LHT-F 	5/0.07 (0.02mm^2)			Φ1.0		Red-Green-White
3.2mm-dia. 2-core shielded vinyl leadwire LS 	7/0.12 (0.08mm^2)	-20~+80°C	0.44Ω/m	Φ3.2	200m	Outer : White Core wire : Green-Green
3mm-dia. 3-core shielded vinyl leadwire LTSA 	7/0.12 (0.08mm^2)	-20~+80°C	0.44Ω/m	Φ3	200m	Outer : Red, White or Green Core wire : Red-Black-White
5mm-dia. 3-core shielded vinyl leadwire LTSB 	7/0.26 (0.3mm^2)	-20~+80°C	0.1Ω/m	Φ5	200m	Outer : Black Core wire : Red-Black-White
0.08mm^2 polypropyrene 4-wire paralleled leadwire LQM/ LQM-F 	7/0.12 (0.08mm^2)	-20~+100°C	0.44Ω/m	0.9×4.0	200m	White, One wire with Red, Black, or Blue stripe
3-wire paralleled special vinyl leadwire LXT/ LXT-F 	7/0.12 (0.08mm^2)	-20~+150°C	0.44Ω/m	0.9×2.7	—	Red-Black-White

N.B.: * Stripe is for distinction of independent wire in quarter bridge 3-wire connection.

Strain Gauge Extension Leadwires

¶ Enamel leadwires (Standard lengths: 0.3m, 0.5m, 1m)

Enamel leadwires have a single core insulated with a resin. Heat resistance and handling methods vary depending on resin. Because the wire mass and diameter are small, enamel leadwires are used for strain measurement of rotating specimens and/or measurement of multiple points located in close proximity. Since the enamel leadwire contains one core covered with a thin resin, it must be handled with care.

·Polyurethane leadwires

Polyurethane leadwires allow easy post-processing because the resin can be removed with a soldering iron. The resin is not strong, therefore, polyurethane wires must be handled with special care.

·Polyester leadwires

Polyester leadwires are harder than polyurethane wires. It cannot be removed with a soldering iron.

·Polyimide leadwires

Polyimide leadwires are harder than the polyester wire. A soldering iron cannot be used for post-processing.

Leadwire type	Core/Diameter(*1)	Applicable temperature	Total resistance of leadwire	Outer insulated dimensions	Colors
Polyurethane leadwire(*2) LP/LP-F 	1/0.14 1/0.18	-10～+120°C	2.5Ω/m 1.5Ω/m	Φ0.16mm Φ0.20mm	Red, Brown, Green
Polyester leadwire(*2) LU/LU-F 	1/0.14 1/0.18	-196～+200°C	2.5Ω/m 1.5Ω/m	Φ0.16mm Φ0.20mm	Brown
Polyimide leadwire LE/LE-F 	1/0.14 1/0.18	-269～+300°C	2.5Ω/m 1.5Ω/m	Φ0.16mm Φ0.20mm	Brown

N.B.: *1: Two types with different core diameters, which are 0.14 mm and 0.18 mm, are available for each enamel wire.
*2: Attachment of lead wire cannot be performed on stacked-type two-element or three-element gauges.

¶ Cross-linked Vinyl leadwires (Standard lengths: 1m, 3m, 5m)

The cross-linked vinyl insulation provides improved resistance against environmental elements. It is often used for underwater measurement in ordinary temperature.

¶ Cross-linked Polyethylene leadwires (Standard lengths: 1m, 3m, 5m)

The cross-linked polyethylene leadwire offers higher durability than the cross-linked vinyl leadwire. Cross-linked polyethylene leadwires can be used in steam, warm water and concrete with virtually no insulation degradation.

Leadwire type	Core/Diameter (Cross section)	Applicable temperature	Total resistance of leadwire	Outer insulated dimensions	Length per roll	Colors
2-wire twisted cross-linked vinyl leadwire LJRA 	7/0.16 (0.14mm^2)	-20~+100°C	0.24Ω/m	Φ3.0mm	—	White
3-wire twisted cross-linked vinyl leadwire LJRTA 	7/0.127 (0.09mm^2)	-20~+100°C	0.4Ω/m	Φ2.0mm	200m	Red-Green-Black
3-wire twisted cross-linked polyethylene leadwire LJQTA 	7/0.127 (0.09mm^2)	-65~+125°C	0.4Ω/m	Φ2.0mm	—	Red-Yellow-Black Red-Yellow-White Red-Yellow-Blue

¶ Special leadwire for temperature-integrated gauge (Standard lengths: 1m, 3m, 5m)

Special leadwire for temperature-integrated gauge consists of 2-core copper and 1-core constantan. To extend this wire, the exclusive leadwire should be applied propely.

Leadwire type	Core/Diameter (Cross section)	Applicable temperature	Total resistance of leadwire	Outer insulated dimensions	Length per roll	Colors
Temperature-integrated 3-wire paralleled vinyl leadiwre TLJBT/TLJBT-F 	7/0.12 (0.08mm^2)	-20~+80°C	0.44Ω/m(*1)	1.2×3.6mm	—	Red-White-Blue
Temperature-integrated 3-wire twisted fluorinated resin (FEP) leadwire 6FB□TLT(*2) 	1/0.2	-269~+200°C	1.2Ω/m(*1)	Φ1.1mm	—	Red-White-Blue

N.B.: *1: Total resistance of copper wire per meter
*2: □ is filled with the lead wire length in meter
*: For the method of connection to a strainmeter, refer to the operation manual of the strainmeter.

¶ Fluorinated resin leadwire (Standard lengths: 1m, 3m, 5m)

With a fluorinated resin leadwires, these leadwires can be used in a wide range of temperature from extremely low to high temperatures. Fluorinated resin resists most chemicals. A surface treatment (tetra-etching) is not required by 6FAS_LT(-F).

Leadwire type	Core/Diameter (Cross section)	Applicable temperature	Total resistance of leadwire	Outer insulated dimensions	Length per roll	Suffix code of leadwire	Colors
3-wire twisted fluorinated resin (FEP) leadwire 6FA□LT/6FA□LT-F (*1)(*3) 	7/0.18 (0.18mm^2)	-269~+200°C	0.2Ω/m	Φ2.0mm	100m	-6FA_LT	Red-Green-Blue
3-wire twisted fluorinated resin (FEP) leadwire 6FAS□LT/6FAS□LT-F (*1)(*3)(*4) 	7/0.18 (0.18mm^2)	-269~+200°C	0.2Ω/m	Φ2.0mm	100m	-6FAS_LT	Red-Green-Blue
3-wire twisted fluorinated resin (FEP) single-core leadwire 6FB□LT/6FB□LT-F (*1)(*3) 	1/0.2	-269~+200°C	1.2Ω/m	Φ1.1mm	—	-6FB_LT	Red-Green-Blue
3-wire twisted fluorinated resin (FEP) leadwire 6FC□LT/6FC□LT-F (*1)(*3)	7/0.08 (0.04mm^2)	-269~+200°C	1.1Ω/m	Φ1.0mm	—	-6FC_LT	Red-Black-White
3-wire twisted fluorinated resin (FEP) leadwire 6FCS□LT/6FCS□LT-F (*1)(*3)(*4)	7/0.08 (0.04mm^2)	-269~+200°C	1.1Ω/m	Φ1.0mm	—	-6FCS_LT	Red-Black-White
3-wire twisted fluorinated resin (FEP) leadwire 6FD□LTS/6FD□LTS-F (*1)(*3) 	7/0.08 (0.04mm^2)	-269~+200°C	1.1Ω/m	Φ1.5mm	—	-6FD_LTS	Red-Black-White
3-wire twisted fluorinated resin (PTFE) leadwire 4FA□LT/4FA□LT-F (*1)(*3) 	7/0.16 (0.14mm^2)	-269~+260°C(*2)	0.24Ω/m	Φ1.9mm	100m	-4FA_LT	Red-Grey-White
3-wire twisted fluorinated resin (PTFE) single-core leadwire 4FB□LT/4FB□LT-F (*1)(*3) 	1/0.2	-269~+260°C(*2)	1.05Ω/m	Φ1.1mm	—	-4FB_LT	Red-Black-White

N.B.: *1: □ is filled with the lead wire length in meter
*2: PTFE leadwire is available for use in 300°C for a short term
*3: Suffix code LT(CT) means connecting terminal joint, while LT(TA) means insulation with film
*4: for easy application of coating: Surface treatment (tetra-etching) is not required when applying coating

How are Integral Leadwires Jointed

Most TML strain gauges are available with extension leadwires pre-attached for customer convenience. We have several methods for connecting leadwires to be chosen depending on conditions such as the type of strain gauge and leadwire, measurement environments and so on.

Different joints

·Integral type

A vinyl leadwire is jointed to polyimide insulated gauge leads of a strain gauge. The solder joints are covered with the vinyl insulation of the leadwire. This is our standard method of integral leadwire attachment.

·Heat-shrinkable tubing

A soldered joint between gauge leads and leadwire is protected with a heat shrinkable tube. The heat shrinkable tubes are available in three ratings of temperature among 80°C, 200°C and 260°C.

·Connecting terminals joint type

Gauge leads and leadwires are jointed using foil shape connecting terminals. Measurement in high temperature is possible by using a high temperature solder with melting point of 300°C or more for the joint.

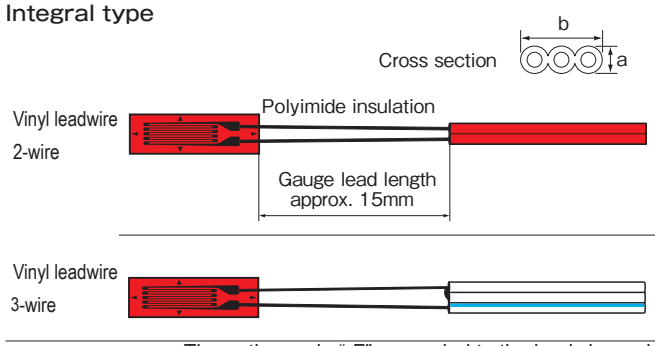
·Insulation film type

A soldered joint between gauge leads and leadwires is covered with an insulation film of glass cloth base. The film is resistive to heat up to 300°C, so this method is suited to measurement in high temperature.

·Direct type

A vinyl leadwire is jointed directly to gauge leads, which are made of nickel plated copper. The solder joints are covered with vinyl insulation of a leadwire up to the end of the gauge base.

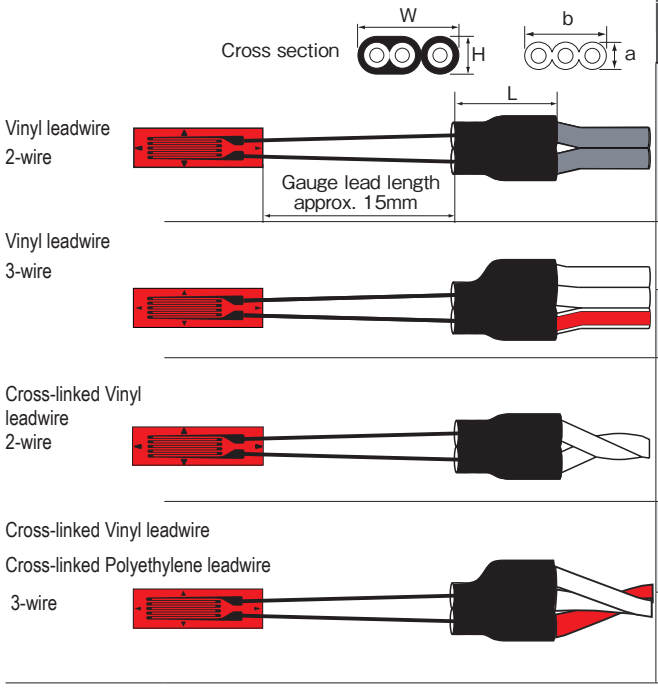
Integral type



Leadwire				
Construction		Dimension a	Dimension b	Code to order
2-wire paralleled	7/0.12	1.1	2.2	-LJB/-LJB-F
	10/0.12	1.4	2.8	-LJC/-LJC-F
2-wire twisted	5/0.07	0.4	–	-LH
3-wire paralleled	7/0.12	1.1	3.3	-LJBT/-LJBT-F
	10/0.12	1.4	4.2	-LJCT/-LJCT-F

The option code "-F" appended to the leadwire code indicates that lead-free solder is used for the leadwire.

Heat-shrinkable tubing



Leadwire				Heat-shrinkable tube			Code to order
Construction		Dimension a	Dimension b	Dimension L	Dimension H	Dimension W	
2-wire paralleled	12/0.18	1.9	3.8	11	3	6	-LJD
3-wire paralleled	12/0.18	1.9	5.7	11	3	7	-LJDT
3-wire twisted	5/0.07	0.4	–	5	0.8	1.6	-LHT -LHT-F
Cross-linked vinyl 2-wire twisted	7/0.16	0.9	–	11	2	4	-LJRA
Cross-linked vinyl 3-wire twisted	7/0.127	1.1	–	11	2	4	-LJRTA
Cross-linked polyethylene 3-wire twisted	7/0.12	0.8	–	11	2	4	-LJQTA -LJQTA-F

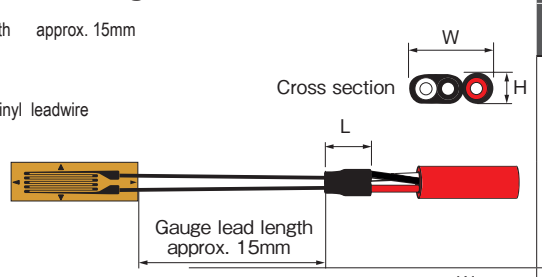
The option code "-F" appended to the leadwire code indicates that lead-free solder is used for the leadwire.

Heat-shrinkable tubing

Gauge lead length approx. 15mm

3-core shielded Vinyl leadwire

3-wire

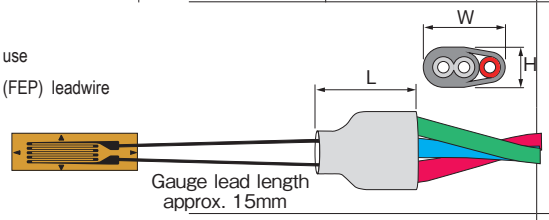


Leadwire Construction	Leadwire Dimension	Heat-shrinkable tube Dimension L	H	W	Code to order
3-wire twisted 7/0.12	Φ3	10	2	4	-LTSA -LTSA-F
3-wire twisted 7/0.26	Φ5	12.5	3	6	-LTSB

High temperature use

Fluorinated resin (FEP) leadwire

3-wire

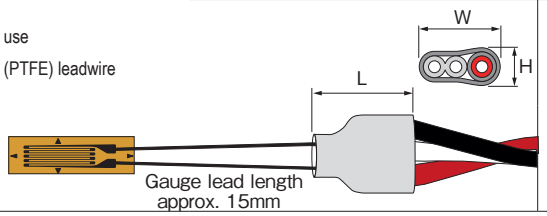


Leadwire Construction	Leadwire Dimension	Heat-shrinkable tube Dimension L	H	W	Code to order
FEP (Fluorinated-ethylenepropylene) 3-wire twisted 1/0.2	Φ1.1	11	2	2	-6FB○LT -6FB○LT-F
FEP (Fluorinated-ethylenepropylene) 3-wire twisted 7/0.18	Φ2	11	3	4	-6FAS○LT -6FAS○LT-F

High temperature use

Fluorinated resin (PTFE) leadwire

3-wire



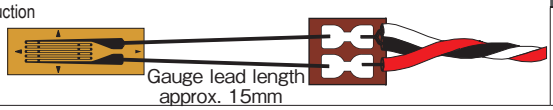
Leadwire Construction	Leadwire Dimension	Heat-shrinkable tube Dimension L	H	W	Code to order
PTFE (Polytetra-fluoroethylene) 3-wire twisted 1/0.2	Φ1.1	11	2	2	-4FB○LT -4FB○LT-F
PTFE (Polytetra-fluoroethylene) 3-wire twisted 7/0.16	Φ1.9	11	2.5	4	-4FA○LT -4FA○LT-F

Connecting terminals joint type

Fluorinated resin (PTFE) leadwire

Special construction

3-wire



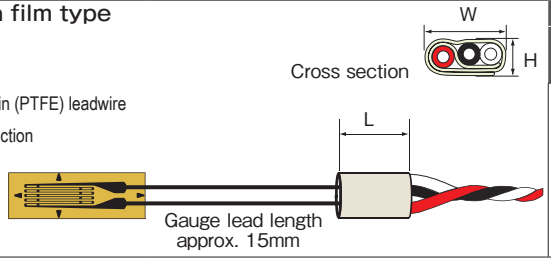
Leadwire Construction	Leadwire Dimension	Code to order
PTFE(Polytetrafluoro-ethylene) 3-wire twisted 1/0.2	Φ1.1	-4FB○LT(CT) -4FB○LT-F(CT)

Insulation film type

Fluorinated resin (PTFE) leadwire

Special construction

3-wire



Leadwire Construction	Leadwire Dimension	Heat-shrinkable tube Dimension L	H	W	Code to order
PTFE(Polytetrafluoro-ethylene) 3-wire twisted 7/0.16	Φ1.9	13	1.5	4	-4FA○LT(TA) -4FA○LT-F(TA)

N.B.:
Figures in Leadwire construction column show "Number of cores/ Diameter of one conductor leadwire in mm". For example, "7/0.12" represents "7core / 0.12mm diameter for one conductor leadwire". All dimensions of the Leadwire Heat-shrinkable tube and Film are approximate values in mm.
"○" in the "Code to order" is filled with the leadwire length in meter.

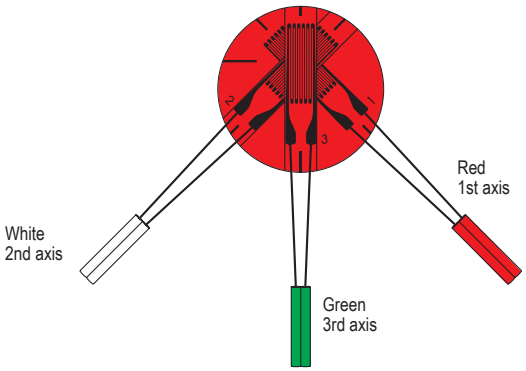
How are Integral Leadwires Jointed

Leadwire colors of 3-element Rosette strain gauge

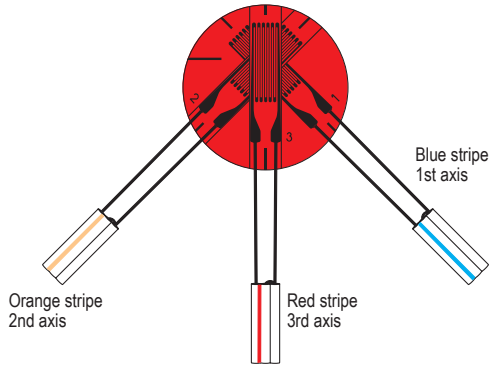
These are generally used leadwires.

The option code "-F" appended to the leadwire type indicates that lead-free solder is used for the leadwire.

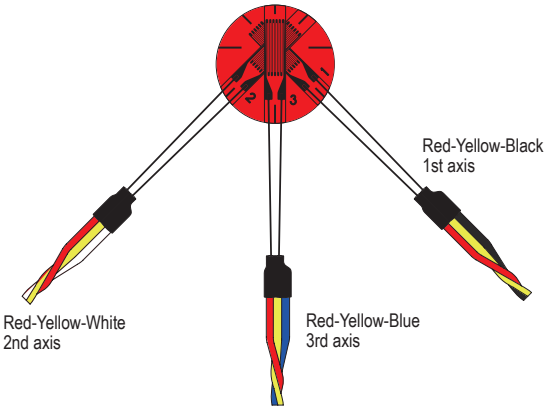
7/0.12 (0.08mm^2) Paralleled vinyl leadwire
Suffix code : -LJB/-LJB-F



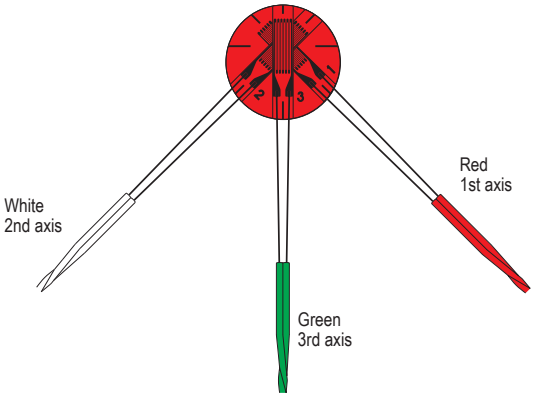
7/0.12 (0.08mm^2) 3-wire Paralleled vinyl leadwire
Suffix code : -LJBT/-LJBT-F



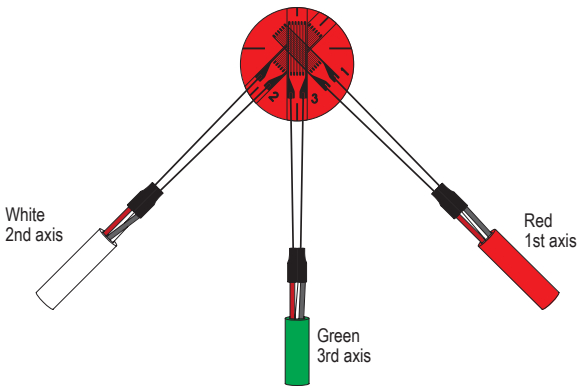
7/0.127 (0.09mm^2) 3-wire twisted cross-linked polyethylene leadwire
Suffix code : -LJQTA/-LJQTA-F



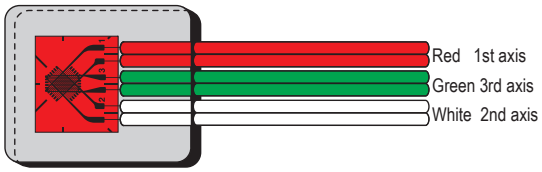
5/0.07 (0.02mm^2) 2-wire twisted vinyl leadwire
Suffix code : -LH



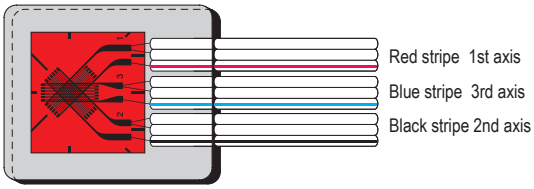
3mm-dia. 3-core shielded vinyl leadwire
Suffix code : -LTSA/-LTSA-F



7/0.12 (0.08mm^2) Paralleled vinyl leadwire
Suffix code : -LDBB-F



7/0.12 (0.08mm^2) 3-wire Paralleled vinyl leadwire
Suffix code : -LDBTB-F



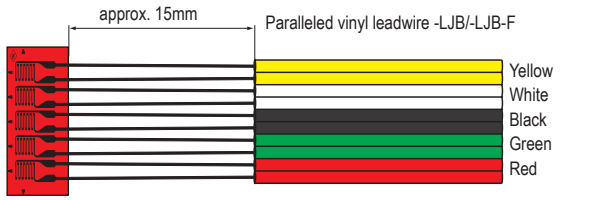
Insulated leadwire colors

These are generally used leadwires.

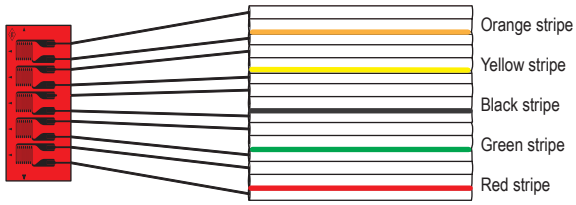
The option code “-F” appended to the leadwire type indicates that lead-free solder is used for the leadwire.

Stress concentration measurement use

FXV 5-element single axis integrated

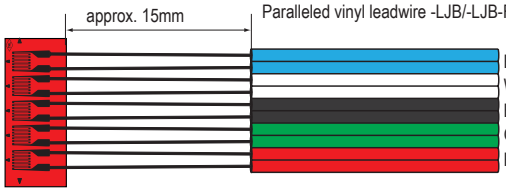


3-wire paralleled vinyl leadwire -LJBT/-LJBT-F

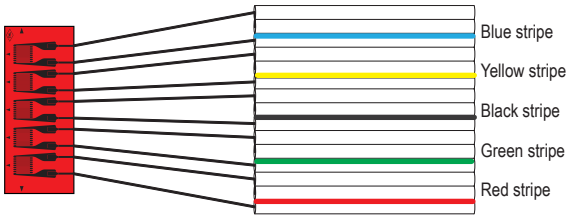


Color stripes are marked on independent wire of each axis with 3-wire system.

FYV 5-element single axis integrated

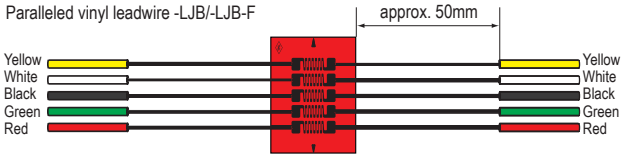


3-wire paralleled vinyl leadwire -LJBT/-LJBT-F

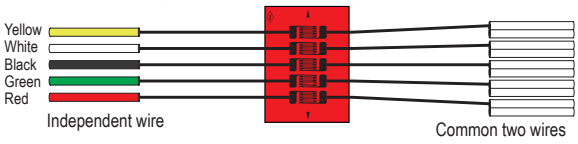


Color stripes are marked on independent wire of each axis with 3-wire system.

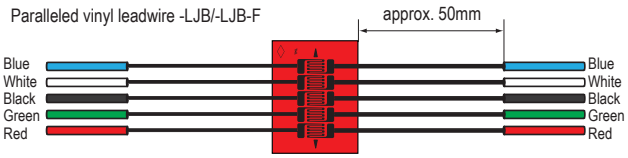
FBXV 5-element single axis integrated



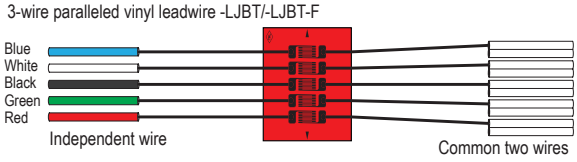
3-wire paralleled vinyl leadwire -LJBT/-LJBT-F



FBYV 5-element single axis integrated

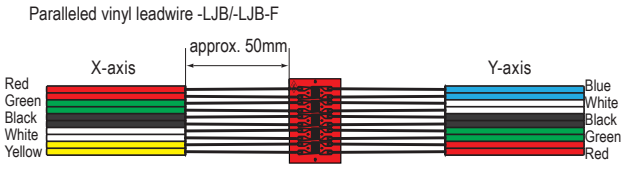


3-wire paralleled vinyl leadwire -LJBT/-LJBT-F

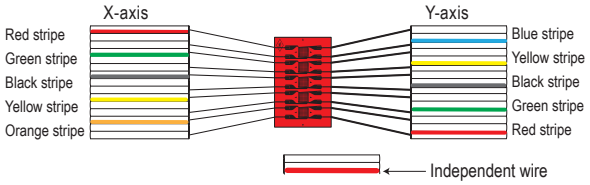


Stress concentration measurement use

FCV 10-element 2-axis cross integrated

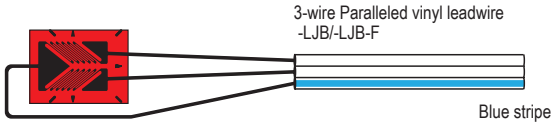


3-wire paralleled vinyl leadwire -LJBT/-LJBT-F



Color stripes are marked on independent wire of each axis with 3-wire system.

Torque measurement use (Integral type) LJB



Temperature gauge

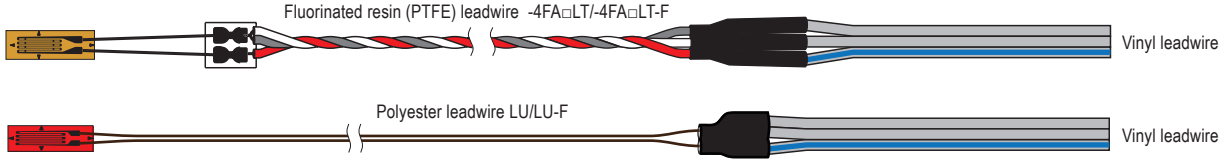
TFL (Connecting terminal joint type) -6FB□LT(CT)



Color of leadwire insulation may vary depending on the leadwire type.

Single element strain gauge with different leadwire

Color of leadwire insulation may vary depending on the leadwire type.



Combination Use of Strain Gauges and Dedicated Leadwires

Option –F: Lead-free solder
Use of lead-free solder is selectable for strain gauges and leadwires. When it is selected, the option code "-F" is added to the type number of strain gauge and leadwire separately.
The GOBLET and PF/P/YEF/YF/PFLW/PLW/UBF/FAC series gauges are only available with the use of lead-free solder because they are CE marked with their exclusive leadwires. The CF/CEF/ZF/EF/BTM series gauges are CE marked because they use high melting point solder and RoHS2 Directive is not applied.
A strain gauge with option code "–F" is a RoHS-compliant product. Since the issuance of technical document is required for the RoHS compliance, please contact us for the details of CE marking availability for the product.

Leadwire name	Paralleled vinyl leadwire	3-wire paralleled vinyl leadwire	Paralleled vinyl leadwire	3-wire paralleled vinyl leadwire	Paralleled viny leadwire	3-wire paralleled vinyl leadwire	Twisted vinyl leadwire	3-wire twisted vinyl leadwire	Twisted vinyl leadwire	3.2mm-dia. 2-core shielded vinyl leadwire	3mm-dia. 3-core shielded vinyl leadwire	5mm-dia. 3-core shielded vinyl leadwire
Suffix code	LJB	LJBT	LJC	LJCT	LJD	LJDT	LH	LHT	LJAY	LS	LTSA	LTSB
Option (-F)	-F	-F	-F	-F			-F	-F	-F	-F	-F	-F
Number of cores/ Core diameter(mm)	7/0.12	7/0.12	10/0.12	10/0.12	12/0.18	12/0.18	5/0.07	5/0.07	7/0.12	7/0.12	7/0.12	7/0.26
Cross sectional area (mm^2)	0.08	0.08	0.11	0.11	0.3	0.3	0.02	0.02	0.08	0.08	0.08	0.3
Operating temperature range (°C)	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80

Strain Gauge Series	CE compliance	Operating temperature range °C	Temperature compensation range °C	The table below shows the maximum operating temperature of the strain gauge in combined use with the dedicated leadwire. (°C)											
F	CE	-196 ~ +150	+10 ~ +100	80	80	80	80	80	80	80	80	-	-	80	80
GOBLET	CE	-196 ~ +150	+10 ~ +100	80	80	80	80	-	-	-	80	-	-	80	80
PF	CE	-20 ~ + 80	+10 ~ +80	80	80	80	80	-	-	-	-	-	-	80	80
P	CE	-20 ~ + 80	+10 ~ +80	80	80	80	80	-	-	-	-	-	-	80	80
FLM	Non	-20 ~ + 80	+10 ~ +80	-	80	-	80	-	80	-	80	-	-	80	80
QMF	CE	-30 ~ + 200	0 ~ +150	-	-	-	-	-	-	-	-	80	80	80	-
MF(Single)	Non	-20 ~ + 80	-	-	-	-	-	-	-	-	-	80	80	80	-
YEF GOBLET	CE	-30 ~ + 80	-	80	80	80	80	-	-	-	80	-	-	80	80
YF	CE	-20 ~ + 80	-	80	80	80	80	80	80	80	80	-	-	-	-
YHF	CE	-30 ~ + 80	-	80	80	80	80	80	80	80	80	-	-	-	-
LF GOBLET	CE	-30 ~ + 80	+10 ~ +80	80	80	80	80	-	-	-	80	-	-	80	80
PFLW	CE	-20 ~ + 80	+10 ~ +80	80	80	80	80	80	80	80	80	-	-	80	80
PLW	CE	-20 ~ + 80	+10 ~ +80	80	80	80	80	80	80	80	80	-	-	80	80
GF GOBLET	CE	-30 ~ + 80	+10 ~ +80 (approx.)	80	80	80	80	-	-	-	80	-	-	80	80
BF GOBLET	CE	-30 ~ + 200	+10 ~ +80	80	80	80	80	-	-	-	80	-	-	80	80
UBF	CE	(Static) :-30 ~ +120 (Dynamic):-30~+150	-	80	80	80	80	80	80	80	80	-	-	80	80
DSF	CE	-60 ~ + 200	-	80	80	80	80	80	80	80	80	-	-	80	80
CF	CE	-269 ~ +80	-196 ~ +80(approx.)	80	80	80	80	80	80	80	80	-	-	80	80
CEF	CE	-269 ~ +200	-196 ~ +80(approx.)	80	80	80	80	80	80	80	80	-	-	80	80
QF/CTE	CE	-20 ~ +200	+10 ~ +100	80	80	80	80	80	80	80	80	-	-	80	80
GOBLET	CE	-30 ~ +200	+10 ~ +100	80	80	80	80	-	-	-	-	-	-	80	80
ZF	CE	-20 ~ +300	+10 ~ +100	80	80	80	80	80	80	80	80	-	-	80	80
EF(Single)	CE	-196 ~ +300	+10 ~ +150	80	80	80	80	80	80	80	80	-	-	80	80
EF(Rosette)	Non	-196 ~ +200	0 ~ +150	80	80	80	80	80	80	80	80	-	-	80	80
BTM	CE	-10 ~ + 80	-	80	80	80	80	-	-	-	-	-	-	-	-
FAC	CE	-30 ~ + 80	-	-	-	-	-	-	-	-	-	-	-	-	-
TF	CE	-20 ~ +200	-	-	80	-	80	-	-	-	-	-	-	-	-

Remarks: Strain gauges of the following series are available only with the dedicated leadwires which are the most suited to the series. Please also refer to the description about each series in this catalog. The option –F (use of lead-free solder) is available. To specify this option, attach the suffix "-F" to the end of each type number of the dedicated leadwire.

Series WF	Operating temperature	0~+80°C	Leadwire :	LDBB-F	Parallel vinyl leadwire
				LDBTB-F	3-wire paralleled vinyl leadwire 7/0.12(0.08mm^2)
Series WFLM	Operating temperature	-20~+80°C	Leadwire :	LJQTA	3-wire twisted cross-linked polyethylene leadwire 2 meters 7/0.127(0.09mm^2)
Note) WFLM series is not available with option –F.					
Series PMF	Operating temperature	-20~+60°C	Leadwire :	LJRTA	3-wire twisted cross-linked vinyl leadwire 2 metersl 7/0.127(0.09mm^2)
Temperature-integrated PMF			Leadwire :	TLJBT	3-wire parallel vinyl leadwire 7/0.12 (0.08mm^2)
Series PMFLS	Operating temperature	-20~+60°C	Leadwire :	LTSC	4-wire shielded Chloroprene cable (3-wire connection) 2 meters, 6mm dia.

	Polypropylene 4-wire parallel leadwire (with modular plug)	3-wire parallel special vinyl leadwire	2-wire twisted cross-linked vinyl leadwire	3-wire twisted cross-linked vinyl leadwire	3-wire twisted cross-linked polyethylene leadwire	Temperature-integrated 3-wire parallel vinyl leadwire	Temperature-integrated 3-wire twisted fluorinated resin (FEP) single-core leadwire	Polyurethane leadwire	Polyester leadwire	Polyimide leadwire	3-wire twisted fluorinated resin (FEP) leadwire	3-wire twisted fluorinated resin (FEP) leadwire (Surface treatment (tetra-etching) is not required)	3-wire twisted fluorinated resin (FEP) single-core leadwire	3-wire twisted fluorinated resin (FEP) leadwire	3-wire twisted fluorinated resin (FEP) leadwire (Surface treatment (tetra-etching) is not required)	1.5mm dia. 3-core shielded fluorinated resin (FEP) leadwire	3-wire twisted fluorinated resin (PTFE) leadwire	3-wire twisted fluorinated resin (PTFE) single-core leadwire	
	LQM	LXT	LJRA	LJRTA	LJQTA	TLJBT	6FB □TLT	LP	LU	LE	6FA □LT	6FAS □LT	6FB □LT	6FC □LT	6FCS □LT	6FD □LTS	4FA □LT	4FB □LT	
	-F	-F	-F	-F	-F	-F	-F	-F	-F	-F	-F	-F	-F	-F	-F	-F	-F	-F	
	7/0.12	7/0.12	7/0.16	7/0.127	7/0.127	7/0.12	1/0.2	1/0.14 1/0.18	1/0.14 1/0.18	1/0.14 1/0.18	7/0.18	7/0.18	1/0.2	7/0.08	7/0.08	7/0.08	7/0.16	1/0.2	
	0.08	0.08	0.14	0.09	0.09	0.08					0.18	0.18		0.04	0.04	0.04	0.14		
	-20 ~ +100	-20 ~ +150	-20 ~ +100	-20 ~ +100	-65 ~ +125	-20 ~ +80	-269 ~ +200	-10 ~ +120	-196 ~ +200	-269 ~ +300	-269 ~ +200	-269 ~ +200	-269 ~ +200	-269 ~ +200	-269 ~ +200	-269 ~ +200	-269 ~ +260	-269 ~ +260	
	The table below shows the maximum operating temperature of the strain gauge in combined use with the dedicated leadwire. (°C)																		Strain Gauge Series
	100	150	100	100	125	80	150	120	150	150	150	150	150	150	150	-	150	150	F (-F)
	100	150	-	-	125	80	150	120	150	150	150	150	150	150	150	-	150	150	GOBLET
	80	80	-	-	80	80	-	80	80	80	-	-	-	-	-	-	-	-	PF
	80	80	-	-	80	-	-	80	80	80	-	-	-	-	-	-	-	-	P
	80	80	-	80	80	80	80	-	-	-	80	80	80	80	80	-	80	80	FLM
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	QMF
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	-	-	MF(Single)
	80	80	-	-	80	80	80	80	80	80	80	80	80	80	80	-	80	80	YEF GOBLET
	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	-	80	80	YF
	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	-	80	80	YHF
	80	80	-	-	80	80	80	80	80	80	80	80	80	80	80	-	80	80	LF GOBLET
	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	-	80	80	PFLW
	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	-	80	80	PLW
	80	80	-	-	80	80	80	80	80	80	80	80	80	80	80	-	80	80	GF GOBLET
	100	150	-	-	125	80	200	120	200	200	200	200	200	200	200	-	200	200	BF GOBLET
	100	120 150	100	100	120 125	80	120 150	120	120 150	120 150	120 150	120 150	120 150	120 150	120 150	- -	120 150	120 150	UBF
	100	150	100	100	125	80	200	120	200	200	200	200	200	200	200	-	200	200	DSF
	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	-	80	80	CF
	100	150	100	100	125	80	200	120	200	200	200	200	200	200	200	-	200	200	CEF
	100	150	100	100	125	80	200	120	200	200	200	200	200	200	200	-	200	200	QF (-F)/CTE
	100	150	-	-	125	80	200	120	200	200	200	200	200	200	200	-	200	200	GOBLET
	100	150	100	100	125	80	200	120	200	300	200	200	200	200	200	-	260	260	ZF
	100	150	100	100	125	80	200	120	200	300	200	200	200	200	200	-	260	260	EF(Single)
	100	150	100	100	125	80	200	120	200	200	200	200	200	200	200	-	200	200	EF(Rosette)
	-	-	80	80	80	-	-	80	-	80	80	80	80	-	-	-	80	80	BTM
	-	-	-	-	-	-	-	80	-	80	-	-	-	-	-	-	-	-	FAC
	-	-	-	100	125	-	-	120	-	200	200	200	200	200	200	-	200	200	TF

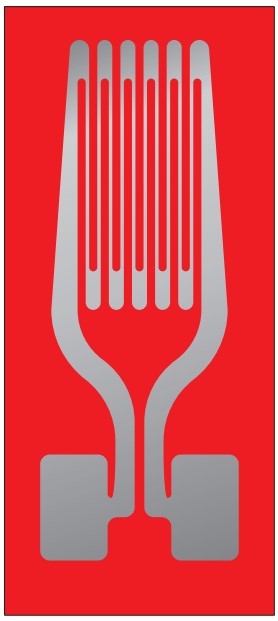
Standard length of the leadwire is 1 m, 3 m or 5 m.

Designation of leadwire-integrated strain gauge exampled

FLT-05A -11 -F -3 LJCT -F

- FLT-05A: Strain Gauge F series (FLT: for shearing strain measurement)
- -11: Self-temperature-compensated material (-11: Mild steel Thermal expansion 11ppm/°C)
- -F: Option F : LEAD-free soldering of strain gauge
- -3: Length of leadwire LJCT 3: 3m
- LJCT: 3-wire paralleled vinyl leadwire
- -F: Option F : LEAD-free soldering of leadwire

GOBLET series



In a conventional strain gauge, the gauge leads, which conduct electrical signal to the metal foil called gauge element, are soldered using leaded solder. The leaded solder is an alloy composed of lead and tin, and the lead is effective to reduce the stress because it is soft. On the other hand, the lead is not only harmful to human bodies but may cause adverse effects on the natural environment. Use of lead-free solder is required according to the RoHS Directive. However, in the combination of lead-free solder and conventional strain gauge pattern, fatigue life conforming to the NAS 942 is not satisfied for some strain gauges. We have developed a new gauge pattern that does not cause stress concentration even if the lead-free solder is used. We propose our next generation strain gauge GOBLET, which maintains the conventional strain gauge performance while considering the environment by the adoption of the new gauge pattern.

The concept of development of GOBLET is “Gauges Of Brilliant Lifespan and Environmentally Thoughtful”, which represents the excellent fatigue life and small environmental effect of these strain gauges. The GOBLET is series of our strain gauges which are compliant to RoHS Directive and CE marked.

The GOBLET is currently available for the series below. The dedicated leadwires which use lead-free solder are also available.

- Strain gauge for general use F-series (partly not compliant)
- Strain gauge for high temperature use QF-series (partly not compliant)
- Strain gauge for composite material BF-series
- Strain gauge for plastics GF-series
- Strain gauge for wood and gypsum LF-series
- Strain gauge for post-yield (large strain) measurement YEF-series

GOBLET Logo (Registered design)

GOBLET ®
Gauges Of Brilliant Lifespan and Environmentally Thoughtful Series

Package of GOBLET series strain gauges (example)



The GOBLET strain gauges bear the logo and the CE mark on their package.

Dedicated leadwires (using lead-free solder)

Leadwire name	Suffix code	Number of cores/Core diameter(mm)	Cross sectional area (mm^2)	Operating temperature range (Leadwire only)
Parallel vinyl leadwire	LJB-F	7/0.12	0.08	-20 ～ +80°C
3-wire parallel vinyl leadwire	LJBT-F	7/0.12	0.08	-20 ～ +80°C
Parallel vinyl leadwire	LJC-F	10/0.12	0.11	-20 ～ +80°C
3-wire parallel vinyl leadwire	LJCT-F	10/0.12	0.11	-20 ～ +80°C
Polypropylene 4-wire parallel leadwire	LQM-F	7/0.12	0.08	-20 ～ +100°C
3-wire parallel special vinyl leadwire	LXT-F	7/0.12	0.08	-20 ～ +150°C
3-wire twisted fluorinated resin (FEP) leadwire	6FA □ LT-F	7/0.18	0.18	-269 ～ +200°C
3-wire twisted fluorinated resin (FEP) leadwire (Surface treatment (tetra-etching) is not required)	6FAS □ LT-F	7/0.18	0.18	-269 ～ +200°C
3-wire twisted fluorinated resin (FEP) single-core leadwire	6FB □ LT-F	1/0.2	0.03	-269 ～ +200°C
3-wire twisted fluorinated resin (FEP) leadwire	6FC □ LT-F	7/0.08	0.04	-269 ～ +200°C
Polyurethane leadwire	LJP-F	1/0.14	0.015	-10 ～ +120°C
Polyester leadwire	LJU-F	1/0.14	0.015	-196 ～ +200°C
Polyimide leadwire	LJE-F	1/0.14	0.015	-269 ～ +300°C

Foil Strain Gauges F series (GOBLET)

GOBLET

Strain gauges compliant to RoHS2 Directive 2011/65/EU are added to the lineup in F series. They are supplied with CE marking as standard specification. Our logo GOBLET, which is an abbreviation of “Gauges Of Brilliant Lifespan and Environmental Thoughtful”, is marked on the package of these gauges.

CE

Operating temperature range
−196～+150℃
Temperature compensation range
+10～+100℃

Applicable adhesives	
CN	−196～+120℃
P-2	−30～+150℃
EB-2	−60～+150℃

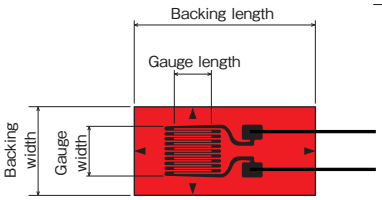
Please specify the type number as shown in the example below.

FLAB -5 (-350) -11 -3LJC-F

- FLAB: Gauge series name
- -5: Gauge length
- (-350): Gauge resistance (blank for 120Ω)
- -11: Objective material for temperature compensation
- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Mild steel -17: Stainless steel -23: Aluminium

●Single axis

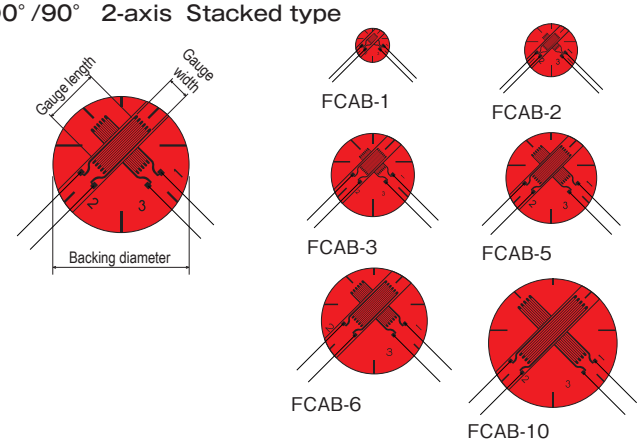


Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
General use	FLGB-02	0.2	1.4	3.5	2.5	120
	FLGB-1	1	1.1	6	2.5	120
	FLAB-03	0.3	1.4	3	2	120
	FLAB-05	0.5	1.2	4.3	2.2	120
	FLAB-1	1	1.3	5	2.5	120
	FLAB-2	2	1.5	6.5	3	120
	FLAB-3	3	1.7	7.7	3.5	120
	FLAB-3-60	3	1.2	7.7	3	60
	FLAB-5	5	1.5	10	3	120
	FLAB-6	6	2.2	11	4.3	120
	FLAB-10	10	2.5	15.4	5	120
	FLAB-30	30	2	35	5	120
FLK pattern with narrow gauge width	FLKB-1	1	0.7	4.5	1.4	120
	FLKB-2	2	0.9	5.5	1.5	120
	FLKB-6	6	1	11	2.2	120
	FLKB-10	10	1.6	15	3.8	120
●350Ω Single axis						
Gauge resistance 350Ω	FLAB-1-350	1	1.6	4.5	3	350
	FLAB-1W-350	1	2	4.7	3.6	350
	FLAB-2-350	2	1.9	6	3.5	350
	FLAB-3-350	3	1.6	7.2	3	350
	FLAB-3W-350	3	3.2	8.5	5	350
	FLAB-5-350	5	1.8	9.4	3.8	350
Gauge resistance 1000Ω	FLAB-6-1000	6	4.6	11	7	1000

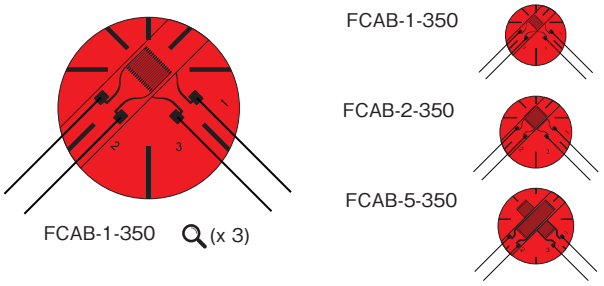
Minimum order quantity is 10 strain gauges.

F series (GOBLET)

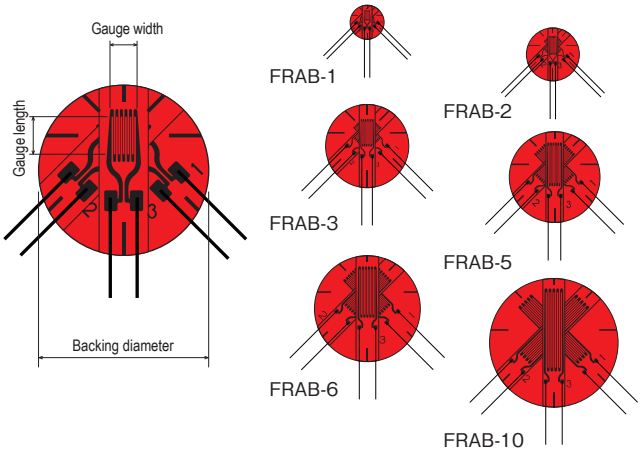
●0° /90° 2-axis Stacked type



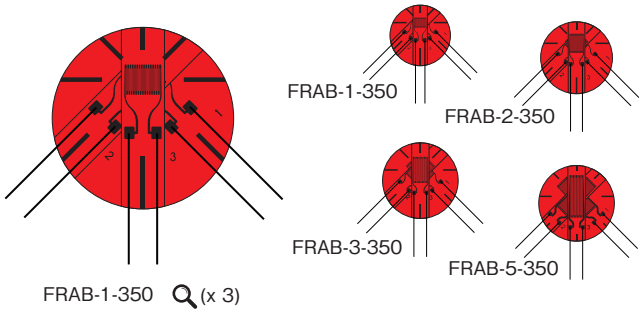
●350Ω 0° /90° 2-axis Stacked type



●0° /45° /90° 3-axis Stacked type



●350Ω 0° /45° /90° 3-axis Stacked type



Minimum order quantity is 10 strain gauges.

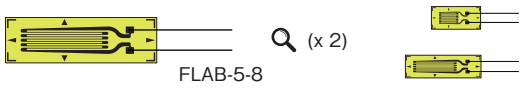
Type	Gauge size(mm) Length	Width	Backing size(mm) Length	Width	Resistance Ω
FCAB-1	1	0.7	φ4.5		120
FCAB-2	2	0.9	φ7		120
FCAB-3	3	1.7	φ11		120
FCAB-5	5	1.9	φ12		120
FCAB-6	6	2.4	φ14		120
FCAB-10	10	2.5	φ17		120
FCAB-1-350	1	1.6	φ8		350
FCAB-2-350	2	1.9	φ9.5		350
FCAB-3-350	3	2	φ10		350
FCAB-5-350	5	1.8	φ10		350
FRAB-1	1	0.7	φ4.5		120
FRAB-2	2	0.9	φ7		120
FRAB-3	3	1.7	φ11		120
FRAB-5	5	1.9	φ12		120
FRAB-6	6	2.4	φ14		120
FRAB-10	10	2.5	φ17		120
FRAB-1-350	1	1.6	φ8		350
FRAB-2-350	2	1.9	φ9.5		350
FRAB-3-350	3	2	φ10		350
FRAB-5-350	5	1.8	φ10		350

GOBLET

GLASS, CERAMIC USE CE

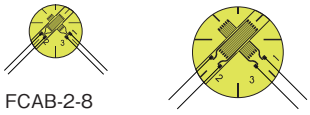
Please specify the type number as shown in the example below.
-8: Glass, Ceramic

●Single axis



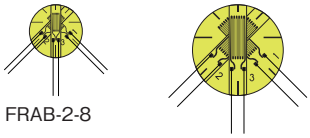
FLAB-5-8

●0° /90° 2-axis Stacked type



FCAB-2-8 FCAB-5-8

●0° /45° /90° 3-axis Stacked type



FRAB-2-8 FRAB-5-8

Minimum order quantity is 10 strain gauges.

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
	FLAB-2-8	2	1.5	6.5	3	120
	FLAB-5-8	5	1.5	10	3	120
	FCAB-2-8	2	0.9	φ7		120
	FCAB-5-8	5	1.9	φ12		120
	FRAB-2-8	2	0.9	φ7		120
	FRAB-5-8	5	1.9	φ12		120

Dedicated leadwires recommendable for F series strain gauge(GOBLET)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked GOBLET series strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires (GOBLET)

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Paralleled vinyl LJB-F Paralleled vinyl LJC-F	−20 ～+80	FLAB-5-11-3LJB-F FLAB-5-11-3LJC-F
General use	3-wire paralleled vinyl LJBT-F 3-wire paralleled vinyl LJCT-F	−20 ～+80	FLAB-5-11-3LJBT-F FLAB-5-11-3LJCT-F
Mid-high tempeature	3-wire paralleled vinyl LXT-F	−20 ～+150	FLAB-5-11-3LXT-F
1-Gauge 4-Wire measurement	Polypropyrene 4-wire paralleled LQM-F	−20 ～+100	FLAB-5-11-3LQM-F (modular plug attached)

NB: For use with CE compliant GOBLET strain gauges , specify leadwire with option -F having lead-free solder on order.

Dedicated leadwires recommendable for F series strain gauge

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Paralleled vinyl LJB/LJB-F Paralleled vinyl LJC/LJC-F	−20 ～+80	FLA-5-11-3LJB FLA-5-11-3LJC
General use	3-wire paralleled vinyl LJBT/LJBT-F 3-wire paralleled vinyl LJCT/LJCT-F	−20 ～+80	FLA-5-11-3LJBT FLA-5-11-3LJCT
Mid-high tempeature	3-wire paralleled vinyl LXT/LXT-F	−20 ～+150	FLA-5-11-3LXT
Temperature integration	3-wire paralleled vinyl TLJBT/TLJBT-F	−20 ～+80	FLA-5T-11-3TLJBT
1-Gauge 4-Wire measurement	Polypropyrene 4-wire paralleled LQM/LQM-F	−20 ～+100	FLA-5-11-3LQM (modular plug attached)

F series

In the F series, strain gauges dedicated to a special usage (shearing strain measurement, torque measurement, residual stress measurement or stress concentration measurement) and 2-axis plane type strain gauges are compliant to RoHS Directive when they are supplied with Option-F.

CE

Operating temperature range	−196～＋150℃
Temperature compensation range	＋10～＋100℃

Applicable adhesives	
CN	−196～＋120℃
P-2	−30～＋150℃
EB-2	−60～＋150℃

Please specify the type number as shown in the example below.

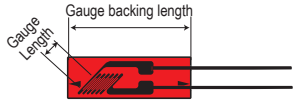
FLT-05A (-350) -11 (-F) -3LJC (-F)

- Option F : LEAD-free soldering of leadwire
- Length in meter and type of integral leadwire
- Option F: LEAD-free soldering of strain gauge
- Objective material for temperature compensation
- Gauge resistance (blank for 120Ω)
- Gauge series name

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Mild steel ■ -17: Stainless steel ■ -23: Aluminium ■

Shearing・Torque・Plane

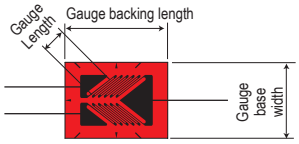
●Shearing strain measurement

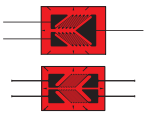



Left 45°

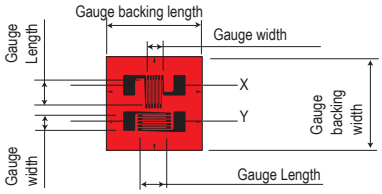

Right 45°

●Torque measurement





●0° /90° 2-axis Plane type



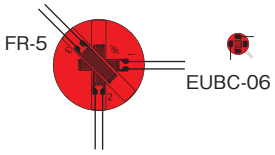


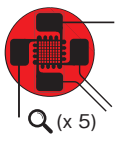
Minimum order quantity is 10 strain gauges.

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
	FLT-05A	0.55	0.66	4	1.3	120
	FLT-05B	0.55	0.66	4	1.3	120
	FCT-2	2	1.5	8.7	6.5	120
	FCT-2-350	2	1.5	7.6	5.3	350
	FCB-2	2	1.5	X / Y axis 8.2	8	120
	FCB-6-350	6	2	X / Y axis 10	11.9	350

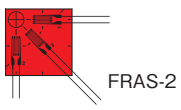
Residual stress measurement

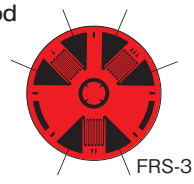
●Residual stress measurement





●Residual stress measurement using hole drilling method





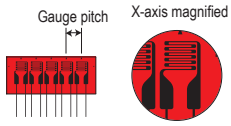
Minimum order quantity is 10 strain gauges.

Gauge pattern	Gauge center diameter	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
	Φ7.0mm	FRAS-2	2	1.1	9	9	120
	Φ2.56mm	FRS-08	0.8	0.7	Φ7		120
	Φ5.14mm	FRS-2	1.5	1.3	Φ9.5		120
	Φ10.26mm	FRS-3	3	2.6	Φ17.5		120

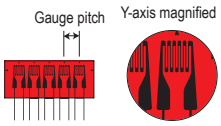
Stress Concentration Measurement

●5-element Single-axis

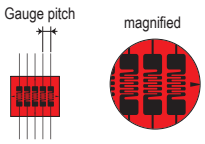
FXV-1-11-002LE



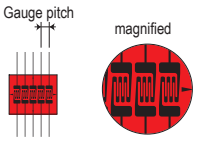
FYV-1-11-002LE



FBXV-04

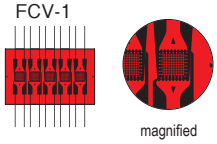


FBYV-06



●10-element 2-axes

FCV-1

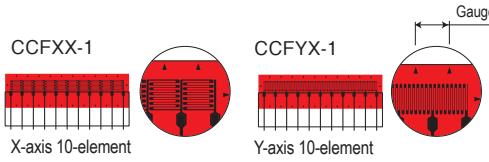


X and Y axes
Y-axis leadwire is marked for identification.

●Chain Strain Gauges

CCFXX-1

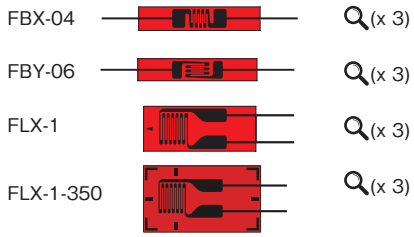
CCFYX-1



These gauges are specially designed to use Complete Compensation Method of Strain and need our Data Logger TDS-540 for the measurement. For details, contact TML.

●Single axis

Single element cut away from the above Stress Concentration gauge



Minimum order quantity is 10 strain gauges.

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
Gauge pitch 2mm	FXV-1-11-002LE	1	1.3	5	12	120
	FYV-1-11-002LE	1	1.4	5	12	120
	-002LE: Polyimide insulated gauge lead of 2-cm pre-attached					
Gauge pitch 1mm	FBXV-04-11-005LE	0.4	1.3	5.4	7.4	120
	FBYV-06-11-005LE	0.6	0.8	5.3	7	120
	-005LE: Polyimide insulated gauge lead of 5-cm pre-attached					
Gauge pitch 2mm	FCV-1-11-005LE	1	1.4	7.5	12	120
	-005LE: Polyimide insulated gauge lead of 5-cm pre-attached					
Gauge pitch 1.5mm	CCFXX-1-11-002LE	1	1.5	4.5	16.4	120
	CCFYX-1-11-002LE	1	1.5	4.5	16.4	120
	-002LE: Polyimide insulated gauge lead of 2-cm pre-attached					
	FBX-04-11-005LE	0.4	1.3	5.4	1	120
	FBY-06-11-005LE	0.6	0.8	5.3	1	120
	FLX-1-11-002LE	1	1.3	5	2	120
	FLX-1-350-11-002LE	1	1.3	5.5	3	350
	-005LE: Polyimide insulated gauge lead of 5-cm pre-attached -002LE: Polyimide insulated gauge lead of 2-cm pre-attached					

Important point

Option F
This code is appended to the basic strain gauge type for strain gauges with lead-free solder in place of leaded solder. Fatigue life of the strain gauge may become shorter by the use of the lead-free solder.

Note

These gauges are specially designed to use Complete Compensation Method of Strain and need our Data Logger TDS-540 for the measurement. For details, contact TML.

Waterproof Strain Gauges WF series

CE

These gauges eliminate the need for moisture-proofing coating, which is sometimes troublesome in a field test. They have an integral vinyl leadwire, and whole area of the strain gauges and the leadwire junction are coated with epoxy resin. The coating is transparent and flexible, so the positioning and bonding works are very easy. By merely bonding the gauges with CN or P-2 adhesive, outdoor or underwater measurement for a short-term becomes possible. These gauges are also effective in omitting primary coating in case of applying a multi-layer coating.

Operating temperature range
0～+80℃
Temperature compensation range
+10～+80℃

Applicable adhesives

CN	0～+80℃
P-2	0～+80℃
EB-2	0～+80℃

Example of type number designation

WFLA -3 -350 -11 -3LDBB

- WFLA: Basic gauge type
- -3: Gauge length
- -350: Gauge resistance (blank for 120Ω)
- -11: Self-temperature-compensation number
- -3LDBB: Length in meter and type of integral leadwire CE compliant leadwire

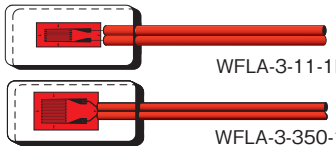
Suffix code for temperature compensation materials
-11: Mild steel ■ -17: Stainless steel ■ -23: Aluminium ■

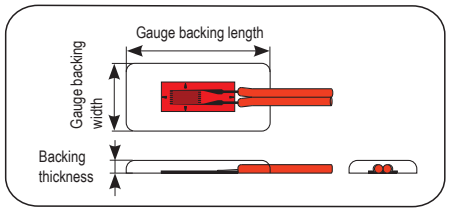
For ordering, the above suffix code should be added to the basic gauge type

●Single axis

0.08mm² integral vinyl leadwire
Total leadwire resistance per meter : 0.44Ω

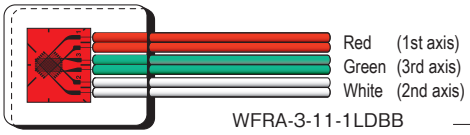
2-wire system





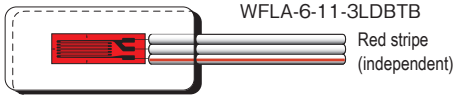
●0° /45° /90° 3-axis Stacked type

2-wire system



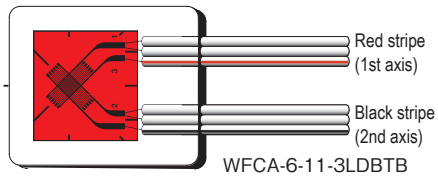
●Single axis

3-wire system



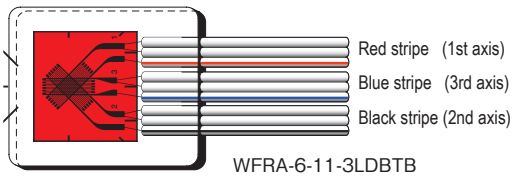
●0° /90° 2-element stacked Rosette

3-wire system



●0° /45° /90° 3-axis Stacked type

3-wire system



Gauge pattern		Type	Gauge size(mm) Length	Width	Backing size(mm) Length	Width	Thickness	Resistance Ω
2-wire system	Single element	WFLA-3	3	1.7	17	8	1.5	120
		WFLA-3-350	3	3.2	17	8	1.5	350
		WFLA-6	6	2.2	25	11	1.5	120
	2-element Rosette 0°/90°	WFCA-3	3	1.7	19	16	1.5	120
		WFCA-6	6	2.3	25	21	1.5	120
	3-element Rosette 0°/45°/90°	WFRA-3	3	1.7	19	16	1.5	120
		WFRA-6	6	2.3	25	21	1.5	120
3-wire system	Single element	WFLA-3	3	1.7	17	8	1.5	120
		WFLA-6	6	2.2	25	11	1.5	120
	2-element Rosette 0°/90°	WFCA-3	3	1.7	19	16	1.5	120
		WFCA-6	6	2.3	25	21	1.5	120
	3-element Rosette 0°/45°/90°	WFRA-3	3	1.7	19	16	1.5	120
		WFRA-6	6	2.3	25	21	1.5	120

Minimum order quantity is 10 strain gauges.

High Temperature Strain Gauges QF series

CE GOBLET

These are CE marked strain gauges (compliant to RoHS2 Directive) for high temperature use. They have joined to our well proven QF-series strain gauges with a new series name "GOBLET". These are foil strain gauges utilizing polyimide resin as the backing material.
Measurement in high temperature is easily possible by using our room-temperature-curing adhesive NP-50B for bonding.

Operating temperature range
−30～+200℃
Temperature compensation range
+10～+100℃

Applicable adhesives

NP-50B	−30～+200℃
C-1/EB-2	−30～+200℃
CN	−30～+120℃

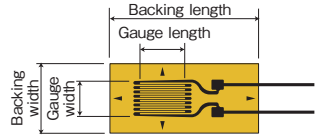
Please specify the type number as shown in the example below.

QFLAB -6 (-350) -11 -3LJC-F

- QFLAB: Gauge series name
- -6: Gauge length
- (-350): Gauge resistance (blank for 120Ω)
- -11: Objective material for temperature compensation
- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire

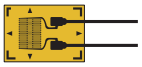
Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Mild steel -17:Stainless steel -23:Aluminium -28:Magnesium

Note: The backing color of QF series gauges are the same for every material for temperature compensation.



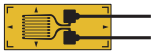
●Single axis

QFLGB-02



(x 3)

QFLAB-1



(x 3)

●0° /90° 2-axis Stacked type

●0° /45° /90° 3-axis Stacked type

Minimum order quantity is 10 strain gauges.

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
General purpose	QFLGB-02	0.2	1.4	3.5	2.5	120
	QFLAB-03	0.3	1.4	3	2	120
	QFLAB-1	1	1.1	4.7	2	120
	QFLAB-2	2	1.5	6.5	3	120
	QFLAB-3	3	1.7	7.7	3.5	120
	QFLAB-5	5	1.5	10	3	120
	QFLAB-6	6	2.2	11	4.3	120
	QFLAB-30	30	2	35	5	120
FLK type with narrow backing	QFLKB-1	1	0.7	4.5	1.4	120
	QFLKB-2	2	0.9	5.5	1.5	120
for magnesium alloy	QFLKB-2-28	2	0.9	5.5	1.5	120
gauge resistance 350Ω	QFLAB-1-350	1	1.6	4.5	3	350
	QFLAB-1W-350	1	2	4.7	3.6	350
	QFLAB-2-350	2	1.9	6	3.5	350
	QFLAB-3-350	3	1.6	7.2	3	350
	QFLAB-3W-350	3	3.2	8.5	5	350
	QFLAB-6-350	6	2.6	10.8	4.5	350
High gauge resistance 1000Ω	QFLAB-6-1000	6	4.6	11	7	1000
QFCAB-1 / QFCAB-3	QFCAB-1	1	0.7	φ4.5		120
	QFCAB-3	3	1.7	φ11		120
QFRAB-1 / QFRAB-3	QFRAB-1	1	0.7	φ4.5		120
	QFRAB-3	3	1.7	φ11		120

Dedicated leadwire recommended for QF series strain gauges (GOBLET) (made to order)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked GOBLET series strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Parallel vinyl leadwire LJC-F	−20～+80	QFLAB-1-11-3LJC-F
General purpose	3-wire parallel vinyl leadwire LJCT-F	−20～+80	QFLAB-1-11-3LJCT-F
High temperature	3-wire twisted FEP leadwire 6FA□LT-F 3-wire twisted FEP single-core leadwire 6FB□LT-F	−269～+200	QFLAB-1-11-6FA3LT-F QFLAB-1-11-6FB3LT-F

NB: □ shows the lead wire length in meter

High Temperature Strain Gauges QF series

These are foil strain gauges having a polyimide resin backing, which exhibits excellent performance in high temperature up to 200°C. Stress concentration measurement gauges and shear stress measurement gauges are also available in this series. Integral leadwires using lead-free solder are available with option –F.

Operating temperature range −20～+200℃
Temperature compensation range +10～+100℃

Applicable adhesives	
NP-50B	−20～+200℃
C-1/EB-2	−20～+200℃
CN	−20～+120℃

Please specify the type number as shown in the example below.

QFCT -2 (-350) -11 (-F) -3LJC (-F)

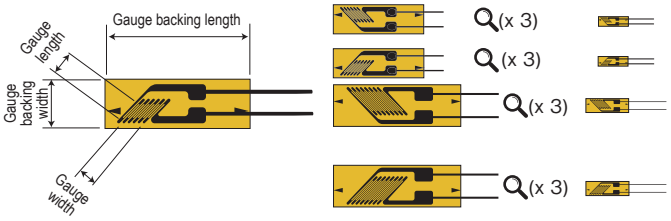
- QFCT: Gauge series name
- -2: Gauge length
- (-350): Gauge resistance (blank for 120Ω)
- -11: Objective material for temperature compensation
- (-F): Option F: LEAD-free soldering of strain gauge
- -3LJC: Length in meter and type of integral leadwire
- (-F): Option F : LEAD-free soldering of leadwire

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Mild steel -17:Stainless steel -23:Aluminium -28:Magnesium

Note: The backing color of QF series gauges are the same for every material for temperature compensation.

Shearing・Torque・Plane

●Shearing strain measurement



●Torque measurement


QFCT-2


QFCT-2-350

●0° /90° 2-axis Plane type

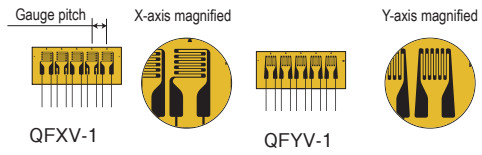


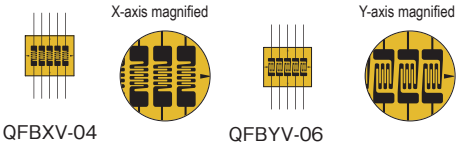
Minimum order quantity is 10 strain gauges.

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
	QFLT-05A-11-002LE	0.55	0.66	4	1.3	120
	QFLT-05B-11-002LE	0.55	0.66	4	1.3	120
	QFLT-1A-11-002LE	1.2	1.1	5.7	2	120
	QFLT-1-350A-11-002LE	1.2	1.1	5.7	2	350
	QFLT-1B-11-002LE	1.2	1.1	5.7	2	120
	QFLT-1-350B-11-002LE	1.2	1.1	5.7	2	350
	-002LE: Polyimide insulated gauge lead of 2-cm pre-attached					
	QFCT-2	2	1.5	8.7	6.5	120
	QFCT-2-350	2	1.5	7.6	5.3	350
	QFCB-2	2	1.5	X / Y axis 8.2	8	120

Stress Concentration Measurement

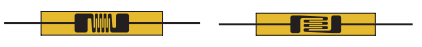
●5-element Single-axis





●Single axis

Single element cut away from the above Stress Concentration gauge


QFBX-04 (×3) QFBY-06 (×3)

Minimum order quantity is 10 strain gauges.

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
Gauge pitch 2mm	QFXV-1-11-002LE	1	1.3	5	12	120
	QFYV-1-11-002LE	1	1.4	5	12	120
	-002LE: Polyimide insulated gauge lead of 2-cm pre-attached					
Gauge pitch 1mm	QFBXV-04-11-005LE	0.4	1.3	5.4	7.4	120
	QFBYV-06-11-005LE	0.6	0.8	5.3	7	120
	-005LE: Polyimide insulated gauge lead of 5-cm pre-attached					
Single axis	QFBX-04-11-005LE	0.4	1.3	5.4	1	120
	QFBY-06-11-005LE	0.6	0.8	5.3	1	120
	QFLX-1-11-002LE	1	1.3	5	2	120
	-005LE: Polyimide insulated gauge lead of 5-cm pre-attached -002LE: Polyimide insulated gauge lead of 2-cm pre-attached					

High Temperature Strain Gauges ZF series

These strain gauges are designed for measurement in high temperature up to 300°C. It utilizes specially designed Ni-Cr alloy foil for the grid and polyimide resin for the gauge backing. Owing to the construction, the strain gauges are successfully used for measurement in high temperature.

Operating temperature range
−20～+300℃
Temperature compensation range
+10～+100℃

Applicable adhesives

NP-50B	−20～+300℃
C-1/EB-2	−20～+200℃
CN	−20～+120℃

Please specify the type number as shown in the example below.

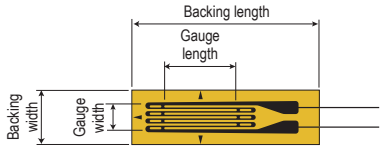
ZFLA -6 (-350) -11 -6FA3LT-F

- -6FA3LT-F: Length in meter and type of integral leadwire CE compliant leadwire
- -11: Objective material for temperature compensation
- (-350): Gauge resistance (blank for 120Ω)
- -6: Gauge length
- ZFLA: Gauge series name

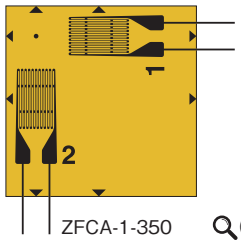
Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Mild steel -17:Stainless steel -23:Aluminium

Note: The backing color of ZF series gauges are the same for every material for temperature compensation.

●Single axis

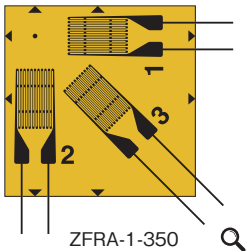


●0° /90° 2-axis Plane type



ZFCA-1-350 (×3)

●0° /45° /90° 3-axis Plane type



ZFRA-1-350 (×3)

Minimum order quantity is 10 strain gauges.

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
Single axis	ZFLK-2	2	0.5	5.4	1.4	120
	ZFLA-1	1	1.8	7	3	120
	ZFLA-3	3	1.8	10.5	3.5	120
	ZFLA-6	6	2.5	15.5	4.5	120
	ZFLA-3-60	3	0.7	7.7	2.6	60
	ZFLA-1-350	1	1.7	6.6	3.2	350
	ZFLA-3-350	3	3.1	10.2	5.2	350
	ZFLA-6-350	6	2.8	16	5.3	350
0°/90° 2-axis Plane type	ZFCA-1-350	1	1.7	8.5	8.5	350
	ZFCA-3-350	3	1.4	10.5	10.5	350
Stacked type	ZFCAL-1	1	1.1	Φ5.4		120
0°/45°/90° 3-axis Plane type	ZFRA-1-350	1	1.7	8.5	8.5	350
	ZFRA-3-350	3	1.4	10.5	10.5	350
Stacked type	ZFRAL-1	1	1.1	Φ5.4		120

Dedicated leadwire recommended for ZF series strain gauges

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
High temperature	3-wire twisted fluorinated resin (FEP) leadwire 6FA □ LT-F 3-wire twisted fluorinated resin (FEP) single-core leadwire 6FB □ LT-F	−269～+200	ZFLA-3-350-11-6FA3LT-F ZFLA-3-350-11-6FB3LT-F
	3-wire twisted fluorinated resin (PTFE) leadwire 4FA □ LT-F 3-wire twisted fluorinated resin (PTFE) single-core leadwire 4FB □ LT-F	−269～+260 For short term use, +300°C is available.	ZFLA-3-350-11-4FA3LT-F ZFLA-3-350-11-4FB3LT-F

NB: □ shows the lead wire length in meter

High Temperature Strain Gauges EF series

These gauges have a small grid pattern required for measurement of printed circuit boards and surface mounted devices, which are getting smaller and smaller. The backing of the gauges is made of polyimide resin. The maximum operaing temperature is +300°C for single element gauges and +200°C for two and three elements gauges. The lowest operating temperature is –196°C for both gauges.

Operating temperature range
For more information, please see below.
Temperature compensation range
For more information, please see below.

Applicable adhesives

CN	−196～+120℃
EB-2	−60～+200℃
C-1	−196～+200℃
NP-50B	−30～+300℃

Please specify the type number as shown in the example below.

EFLK -02 -11 -4FA3LT-F

- Length in meter and type of integral leadwire CE compliant leadwire
- Objective material for temperature compensation
- Gauge length
- Gauge series name

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Mild steel

Gauge pattern	Type	Gauge size(mm) Length	Width	Backing size(mm) Length	Width	Resistance Ω
●Single axis CE Operating temperature range −196～+300℃ Temperature compensation range +10～+150℃ Backing length, Gauge width, Backing width, Gauge length EFLX-02-11 (×3) ●0°/90° 2-axis Stacked Operating temperature range −196～+200℃ Temperature compensation range 0～+150℃ ●0°/45°/90° 3-axis Stacked Operating temperature range −196～+200℃ Temperature compensation range 0～+150℃ EFRA-05-11 (×3) Minimum order quantity is 10 strain gauges.						
	EFLK-02-11	0.2	0.8	1.6	1.2	120
	EFLX-02-11	0.2	0.8	1.8	1.2	120
	EFCA-05-11-002LE	0.5	0.4	φ3.8		120
	-002LE: Polyimide insulated gauge lead of 2-cm pre-attached					
	EFRA-05-11-002LE	0.5	0.4	φ3.8		120
	-002LE: Polyimide insulated gauge lead of 2-cm pre-attached					

High Temperature Strain Gauges HZF series CE

These adhesive bonded high-temperature strain gages are capable of measuring temperatures up to 350°C. The gage leads are welded to the high-temperature lead wires, making them RoHS compliant.
Please specify the desired lead length and place an order.

Operating temperature range −196～+350℃
Temperature compensation range +10～+300℃

Applicable adhesives

NP-50B	−30～+300℃
C-1	−20～+200℃

*C-1 adhesives can be used up to 350°C for short cycle. For long-term or repeated measurements, please consult our sales representative.

Please specify the type number as shown in the example below.

HZFLA -2 -11 -1LJKT

- Length in meter and type of integral leadwire CE compliant leadwire
- Objective material for temperature compensation
- Gauge length
- Gauge series name

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Mild steel -17:Stainless steel -23:Aluminium

Note: All HZF series base colors will be the same regardless of the target material.

Gauge pattern	Type	Gauge size(mm) Length	Width	Backing size(mm) Length	Width	Resistance Ω
●Single axis (×5) Minimum order quantity is 10 strain gauges.						
	HZFLA-2	2	0.5	5.4	1.4	120

Dedicated lead wires φ0.9mm 3 stranded silica glass braided single core wires

Dedicated lead wires for HZF series strain gauges (made to order)

These strain gage leads are suitable for strain measurement up to a maximum operating temperature of 350°C. They are mainly used for the HZF series strain gages.
The connection method between gage leads and lead wires is spot welding.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
High temperature	3 stranded silica glass braided single core wires LJKT	−100～+350	HZFLA-2-3LJKT

Standard lead lengths are 1, 3, 5, and 10 m. Lead wires alone are not available.

High & Low Temperature Strain Gauges CEF series CE

These are strain gauges utilizing polyimide resin for the gauge backing and special alloy foil for the grid. It features a wide range of operating temperature from cryogenic temperature to +200°C. This series is available only in single axis configuration with gauge length of 1,3 and 6mm.

Operating temperature range
−269～＋200℃
Temperature compensation range
(approx.)−196～＋80℃

Applicable adhesives	
EA-2A	−269～+50℃
CN	−196～+120℃
C-1	−269～+200℃
EB-2	−60～+200℃

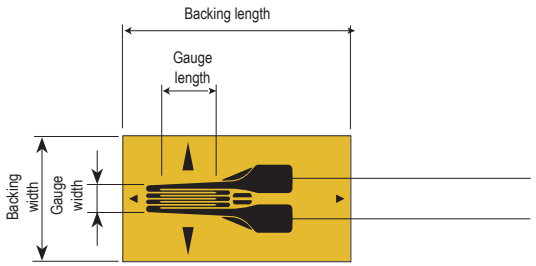
Please specify the type number as shown in the example below.

CEFLA -6 -11 -6FA3LT-F

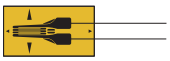
- CEFLA: Gauge series name
- -6: Gauge length
- -11: Objective material for temperature compensation
- -6FA3LT-F: Length in meter and type of integral leadwire CE compliant leadwire

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Mild steel -17:Stainless steel -23:Aluminium

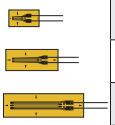
Note: The backing color of CEF series gauges are the same for every material for temperature compensation.



Single axis



CEFLA-1 (×3)



Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
Single axis	CEFLA-1	1	0.5	4	2.2	120
	CEFLA-3	3	0.6	6.9	2.8	120
	CEFLA-6	6	1	10.6	3.1	120

Minimum order quantity is 10 strain gauges.

Dedicated leadwire recommended for CEF series strain gauges (made to order)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
High & Low temperature	3-wire twisted FEP leadwire 6FA □ LT-F	−269～+200	CEFLA-1-11-6FA3LT-F
	3-wire twisted FEP single-core leadwire 6FB □ LT-F		CEFLA-1-11-6FB3LT-F
	3-wire twisted fluorinated resin (PTFE) leadwire 4FA □ LT-F	−269～+260	CEFLA-1-11-4FA3LT-F
	3-wire twisted fluorinated resin (PTFE) single-core leadwire 4FB □ LT-F		CEFLA-1-11-4FB3LT-F

NB: □ shows the lead wire length in meter

Cryogenic Temperature Strain Gauges CF series

These are foil strain gauges with epoxy backing designed for measurement under cryogenic conditions. They are available in single element, rectangular 2-element and rectangular 3-element configurations with 350Ω resistance. The specially selected and heat treated grid of the gauges shows very small zero shift under cryogenic temperature compared to conventional strain gauges.

Operating temperature range −269～+80℃
Temperature compensation range (approx.)−196～+80℃

Applicable adhesives	
EA-2A	−269～+50℃
CN	−196～+80℃
C-1	−269～+80℃

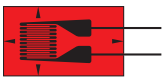
Please specify the type number as shown in the example below.

CFLA -6 -350 -11 -6FA3LT-F

- CFLA: Gauge series name
- -6: Gauge length
- -350: Gauge length
- -11: Objective material for temperature compensation
- -6FA3LT-F: Length in meter and type of integral leadwire CE compliant leadwire

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Mild steel -17: Stainless steel -23: Aluminium

●Single axis



CFLA-1-350 (x3)

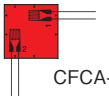


CFLA-1-350



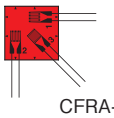
CFLA-6-350

●0° /90° 2-axis Plane type



CFCA-1-350

●0° /45° /90° 3-axis Plane type



CFRA-1-350

Minimum order quantity is 10 strain gauges.

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
●Single axis						
	CFLA-1-350	1	1.6	5.4	3.2	350
	CFLA-3-350	3	1.7	8.8	3.5	350
	CFLA-6-350	6	2.2	12.5	4.3	350
●0° /90° 2-axis Plane type						
	CFCA-1-350	1	1.3	7.2	7.2	350
	CFCA-3-350	3	1.7	11	11	350
●0° /45° /90° 3-axis Plane type						
	CFRA-1-350	1	1.3	7.2	7.2	350
	CFRA-3-350	3	1.7	11	11	350

Dedicated leadwire recommended for CF series strain gauges (made to order)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
Cryogenic	3-wire twisted FEP leadwire 6FA □ LT-F 3-wire twisted FEP single-core leadwire 6FB □ LT-F	−269 ～+200	CFLA-1-350-11-6FA3LT-F CFLA-1-350-11-6FB3LT-F
	3-wire twisted fluorinated resin (PTFE) leadwire 4FA □ LT-F 3-wire twisted fluorinated resin (PTFE) single-core leadwire 4FB □ LT-F	−269 ～+260	CFLA-1-350-11-4FA3LT-F CFLA-1-350-11-4FB3LT-F

NB: □ shows the lead wire length in meter

Weldable Strain Gauges AW series (AWM / AWMD / AWH / AWHU / AW / AWF /AWC)

These strain gauges have strain sensing elements fully encapsulated in corrosion-resisting metal tubes made of stainless steel or Inconel (except AW-6-350). The strain gauge backings are also made of the same material, and the gauges are installed by spot welding to metal specimens using a dedicated spot welder.

Spot welding

The W-50RC is a charge discharge type spot welder designed to minimize thermal damage to the metal material being measured. Welding energy is not affected by fluctuations in the power supply because of the stabilizing circuit.

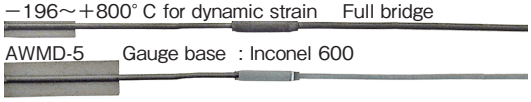
Type

AWM −196～+300° C Quarter bridge 3-wire



AWM-8-1A Gauge base : Inconel 600
AWM-8-1B Gauge base : SUS304

AWMD −196～+800° C for dynamic strain Full bridge



AWMD-5 Gauge base : Inconel 600
AWMD-8 Gauge base : Inconel 600

AWH −196～+600° C for static strain Full bridge
−196～+650° C for dynamic strain



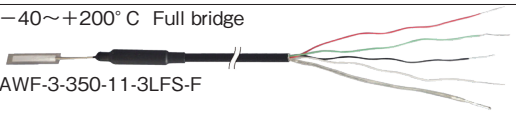
AWH-4-7A/AWH-8-7A Gauge base: Inconel 600
AWH-4-7B/AWH-8-7B Gauge base: SUS304

AW-2/AW-6 −196～+300° C Quarter bridge 3-wire



AW-2-350-11-4FB01LT
AW-6-350-11-4FB01LT
AWCA-6-350-11-4FB01LT
AWRA-6-350-11-4FB01LT

AWF −40～+200° C Full bridge



AWF-3-350-11-3LFS-F

AWC −20～+100° C Quarter bridge 3-wire



AWC-8B-11-3LTSB

AWHU −196～+800° C Full bridge



AWHU-5 Gauge base: Inconel 600
AWHU-8 Gauge base: Inconel 600

AW series coding system

①	②	③	④	⑤	⑥	⑦	⑧
AWM	-8	-1	B		-2		-17.0
AWMD	-5	-	A	KM	-2	(6F)	-1.6Hz*
AWMD	-8	-	A		-2		-1.6Hz*
AWH	-8	-7	A		-2		-11.0
AWHU	-5	-9	A	KM	-2	(6F)	-12.7

*: High-pass filter only for AWMD Either one available among 1.6, 7.2 or 16Hz.

①Type	②Gauge length	③Temperature compensation range	④Gauge base*1	⑤Option
AWM : static/dynamic 300℃	8 : 8mm	0 : −196℃～ RT 1 : RT ～+300℃ 2 : RT ～+350℃ 3 : RT ～+400℃ 4 : RT ～+450℃ 5 : RT ～+500℃ 6 : RT ～+550℃ 7 : RT ～+600℃ 8 : RT ～+650℃ 9 : RT ～+800℃ 10 : Others NB1: Dynamic use AWMD is not applicable. NB2: RT Room temperature	A : Inconel 600 Applicable thermal expansion coefficient of 11ppm/°C or closer B : SUS304 Applicable thermal expansion coefficient of 17ppm/°C or closer	E: Ground earth F: Compression fittings K: Narrow gauge width W=3mm (excluding AWHU) M: Small junction type of sleeve B Φ 2.0mm L=20mm AWHU and AWMD-5 are normally provided with small junction P: NDIS type plug attached*2 R: Bend of gauge backing or pipe Z: Filter-less (AWMD)
AWMD : dynamic only 800℃	5 : 5mm 8 : 8mm			
AWH : static 600℃ dynamic 650℃	4 : 4mm 8 : 8mm			
AWHU : static/dynamic 800℃	5 : 5mm 8 : 8mm			

⑥MI cable	⑦Supplied cable length	⑧Temperature compensation materials or High-pass filter
2 : Φ1.6mm 2m Core cable of heat-resistive copper	No marks: Φ 4.1mm shielded vinyl cable of 0.5m Except for standard length, required length is given in bracket Example: 4.5m long to (4.5) (6F): Φ 1.6mm shielded fluoroethylene propylene cable (FEP) of 0.5m for AWHU-5/-8, AWMD-5 Except for standard length, required length is given after suffix 6F. Example: 4.5m long to (6F4.5)	Materials available for temperature-compensation 10.9: SUS430 or equivalent 11.0: Mild steel (ferritic) or equivalent 12.7: INCONEL 600 or equivalent 17.0: SUS304 or equivalent High-pass filter for only AWMD 1.6Hz 7.2Hz 16Hz

*1: Select code A for thermal expansion coefficient of 11ppm/°C or closer, or B for coefficent of 17ppm/°C

*2: For option code P, NDIS plug is attached to the end of cables following Temperature-compensation board or High-pass filter.

AW series (AWM/AWMD)

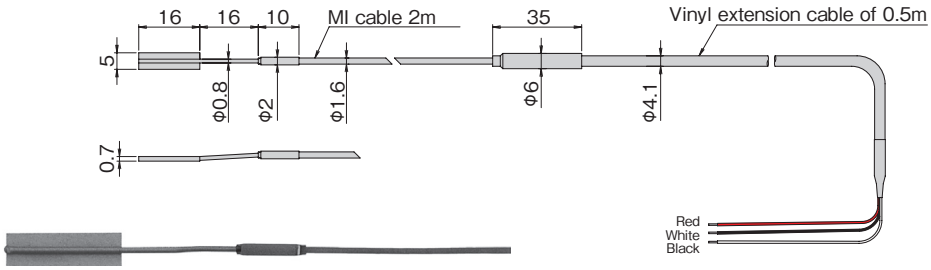
AWM-8 CE

The AWM is usable up to 300° C for both static and dynamic strain measurement. The backing material is available in Inconel 600 or SUS304 which should be selected according to the test specimen material.

Type	Gauge length (mm)	Gauge base Dimension (mm)	Gauge base Materials	Operating temperature (°C)	Temperature compensation range (°C)	Test specimen	Applicable coefficient of linear thermal expansion (×10^{-6}/°C)	Resistance in (Ω)
AWM-8-1A-2-11.0	8	L16xW5xT0.7	Inconel 600	For static/dynamic use −196~+300°C	Room-temperature ~ +300°C	Mild steel equivalent	11×10^{-6}/°C	120
AWM-8-1B-2-17.0			SUS304			SUS304 equivalent	17×10^{-6}/°C	

Leadwire 1.6 mm dia. MI cable 2 m, 4.1 mm dia. shielded vinyl cable 0.5 m (Quarter bridge with 3-wire)
Minimum order quantity is 1 strain gauge.

External dimensions



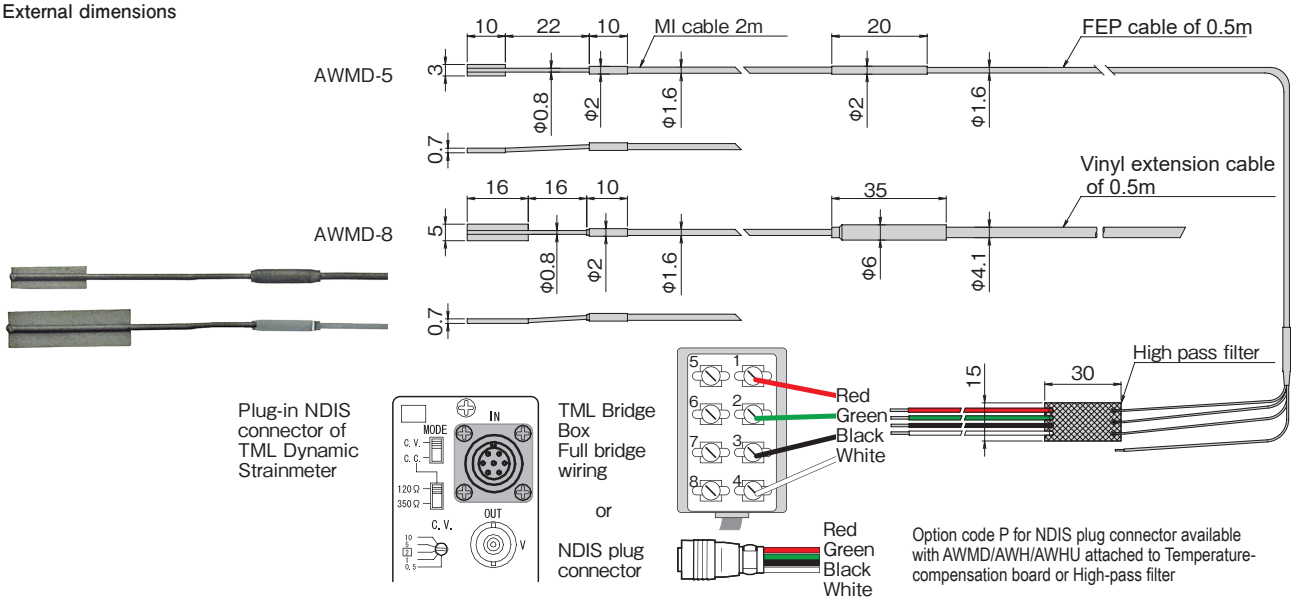
AWMD-5 / AWMD-8 CE

The AWMD is applicable up to 800° C and it is dedicated to dynamic strain measurement. A high pass filter is a standard accessory. Using the high pass filter, unnecessary direct current component or low frequency component (thermal output, drift etc.) in the measurement signals can be neglected.

Type	Gauge length (mm)	Gauge base Dimension (mm)	Gauge base Materials	Operating temperature (°C)	Temperature compensation range (°C)	Test specimen	Applicable coefficient of linear thermal expansion (×10^{-6}/°C)	Resistance in (Ω)
AWMD-5-AKM-2(6F)-1.6Hz*	5	L10xW3xT0.7	Inconel 600	for dynamic use −196~+800°C	N/A	Inconel 600 equivalent	12×10^{-6}/°C	60
AWMD-8-A-2-1.6Hz*	8	L16xW5xT0.7	Inconel 600					120

*High-pass filter only for AWMD Either one available among 1.6, 7.2 or 16Hz.
Leadwire AWMD-5 : 1.6 mm dia. MI cable 2 m, 1.6 mm dia. shielded fluorinated resin (FEP) cable 0.5 m (Full bridge)
AWMD-8 : 1.6 mm dia. MI cable 2 m, 4.1 mm dia. shielded vinyl cable 0.5 m (Full bridge)
Minimum order quantity is 1 strain gauge.

External dimensions



AW series (AWH/AWHU)

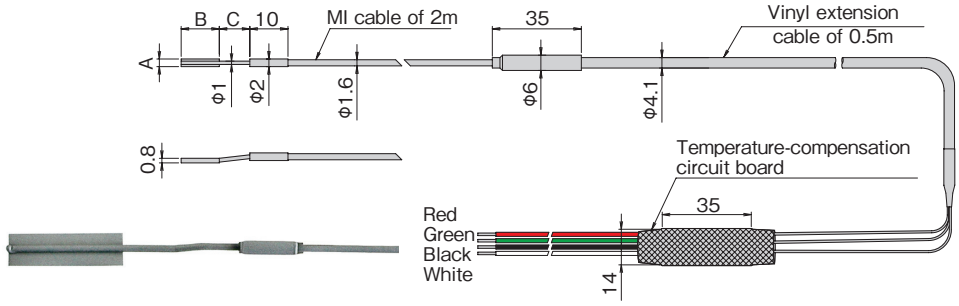
AWH-4 ／ AWH-8 CE

The backing material of these gauges is available in either of Inconel 600 or stainless steel to be selected according to the material to be measured. The sensing part has half bridge configuration with active element and dummy element, and it is measured in full bridge method using the attached temperature compensation circuit board. This gauge is applicable to static measurement in temperature up to 600°C and applicable to dynamic measurement up to 650°C.

Type	Gauge length (mm)	Gauge base Dimension (mm)	Gauge base Materials	Operating temperature (°C)	Temperature compensation range (°C)	Test specimen	Applicable coefficient of linear thermal expansion ($\times 10^{-6}$/°C)	Resistance in (Ω)
AWH-4-7A-2-11.0	4	L10xW3xT0.8	Inconel 600	static : –196~+600°C dynamic : –196~+650°C	static : RT~+600°C dynamic : N/A	Mild steel equivalent	11×10^{-6}/°C	60
AWH-4-7B-2-17.0			SUS304			SUS304 equivalent	17×10^{-6}/°C	
AWH-8-7A-2-11.0	8	L16xW5xT0.8	Inconel 600			Mild steel equivalent	11×10^{-6}/°C	120
AWH-8-7B-2-17.0			SUS304			SUS304 equivalent	17×10^{-6}/°C	

Leadwire 1.6 mm dia. MI cable 2 m, 4.1 mm dia. shielded vinyl cable 0.5 m (Full bridge)
Minimum order quantity is 1 strain gauge.

External dimensions



Type	A	B	C
AWH-4	3	10	8
AWH-8	5	16	16

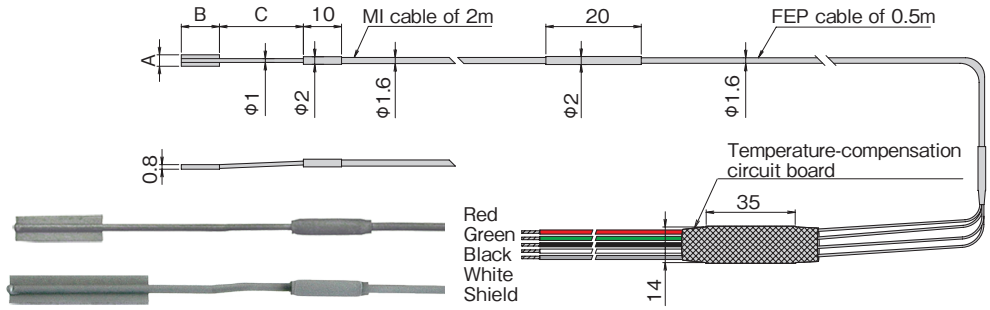
AWHU-5 ／ AWHU-8 CE

These gauges can be used in temperature up to 800°C for both static and dynamic measurement. However, owing to the construction of the sensing element, measurement is recommended in temperature at 600°C or above. The sensing part has half bridge configuration with active element and dummy element, and it is measured in full bridge method using the attached temperature compensation circuit board. Since these gauges have small backings and thin sleeves and cables as standard specifications, they are applicable to narrow and/or curved areas.

Type	Gauge length (mm)	Gauge base Dimension (mm)	Gauge base Materials	Operating temperature (°C)	Temperature compensation range (°C)	Test specimen	Applicable coefficient of linear thermal expansion ($\times 10^{-6}$/°C)	Resistance in (Ω)
AWHU-5-9AKM-2(6F)-12.7	5	L10xW3xT0.8	Inconel 600	For static/dynamic use –196~+800°C	Room-temperature ~ +800°C	Inconel 600 equivalent	11×10^{-6}/°C	60
AWHU-8-9AKM-2(6F)-12.7	8	L16xW3xT0.8						120

Leadwire 1.6 mm dia. MI cable 2 m, 1.6 mm dia. shielded fluorinated resin (FEP) cable 0.5 m (Full bridge)
Minimum order quantity is 1 strain gauge.

External dimensions



Type	A	B	C
AWHU-5	3	10	22
AWHU-8	3	16	16

Note

Our AWH and AWHU series strain gauges are adjusted to make the thermal output as small as possible in consideration of the material to be measured, the MI cable length and the range of measurement temperature. These strain gauges will be supplied on made-to-order basis except AWH-4-7A-2-11.0 and AWH-8-7A-2-11.0.

* Lead wire lengths other than the standard length are available on request. (Made to order: MI cable length is in increments of 1 meter. Vinyl cable length is in increments of 0.5 meters.)

AW series (AW/AWC)

AW-2-350/AW-6-350/AWCA-6-350/AWRA-6-350 CE

These gauges have corrosion-resisting stainless steel backing with thickness of 0.08mm. They are easily installed by using the dedicated spot welder W-50RC. are suited for strain measurement in high temperature up to 300° C, for measurement of specimen to which adhesion is not applicable or for long term measurement.

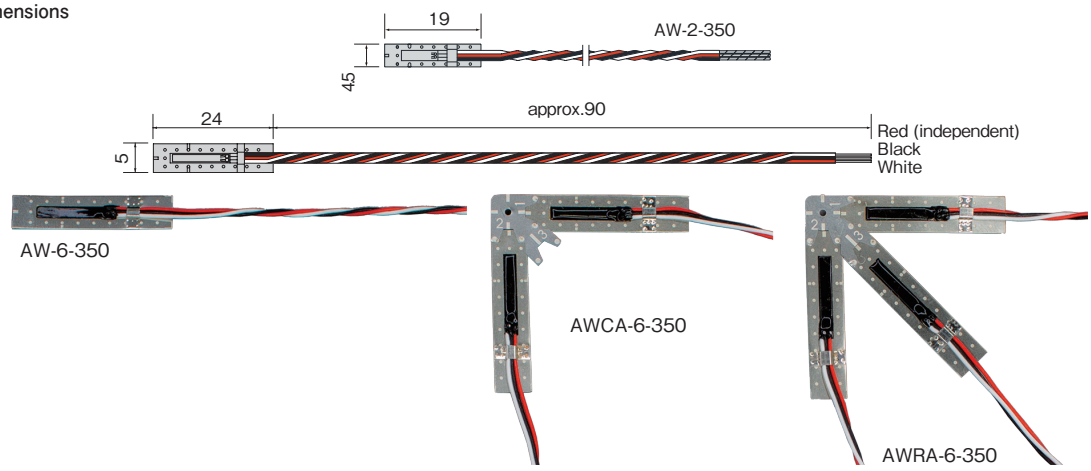
Type	Gauge length (mm)	Gauge base		Operating temperature (°C)	Temperature compensation range (°C)	Test specimen	Applicable coefficient of linear thermal expansion ($\times10^{-6}$/°C)	Resistance in (Ω)
		Dimension (mm)	Materials					
AW-2-350-11-4FB01LT	2	L19×W4.5	SUS304	–196~+300°C	+10 ~ +100°C	Mild steel	11×10^{-6}/°C	350
AW-6-350-11-4FB01LT	6	L24xW5	SUS304	–196~+300°C	+10 ~ +100°C	Mild steel	11×10^{-6}/°C	350
AWCA-6-350-11-4FB01LT	6	29x29	SUS304	–196~+300°C	+10 ~ +100°C	Mild steel	11×10^{-6}/°C	350
AWRA-6-350-11-4FB01LT	6	29x29	SUS304	–196~+300°C	+10 ~ +100°C	Mild steel	11×10^{-6}/°C	350

Leadwire Φ0.2mm Twisted cross-linked fluorinated resin(PTFE) sheathed leadwire of 0.1m standard (Quarter bridge with 3-wire)

* Lead wire lengths other than the standard length are available on request. (Made to order.)

Minimum order quantity is 5 strain gauges .

External dimensions



AWF-3-350 CE

This strain gauge incorporates a full bridge configuration and features a gauge factor of approximately 4. It is specifically designed for use in high-temperature environments up to 200°C, in locations where adhesive bonding is impractical, and in applications requiring stable, long-duration strain measurement

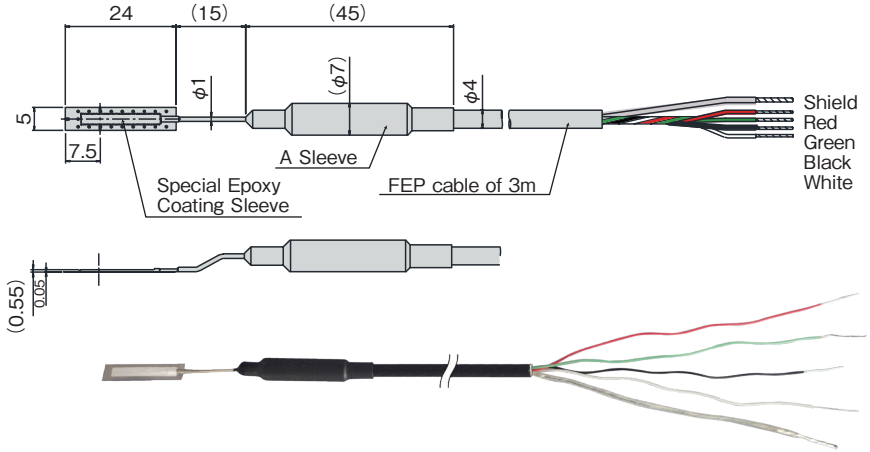
Type	Gauge length (mm)	Gauge base		Operating temperature (°C)	Temperature compensation range (°C)	Test specimen	Applicable coefficient of linear thermal expansion ($\times10^{-6}$/°C)	Resistance in (Ω)
		Dimension (mm)	Materials					
AWF-3-350-11-3LFS-F	3	L24×W5×T0.05	SUS304	-40~+200°C	+10 ~ +100°C	Mild steel	11×10^{-6}/°C	350

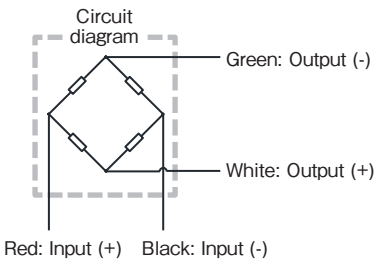
Leadwire Φ4mm 0.08mm²4-core shielded fluorinated resin(PTFE) sheathed leadwire of 3m

* Lead wire lengths other than the standard length are available on request. (Made to order)

Minimum order quantity is 1 strain gauge.

External dimensions





AWC-8B CE

These gauges are fully encapsulated in a stainless steel tube. It enables long term strain measurement in harsh environment.

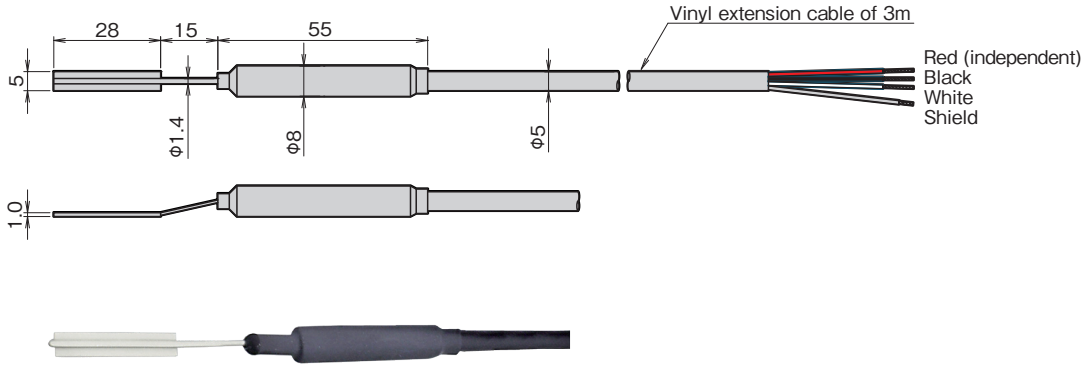
Type	Gauge length (mm)	Gauge base Dimension (mm)	Gauge base Materials	Operating temperature (°C)	Temperature compensation range (°C)	Test specimen	Applicable coefficient of linear thermal expansion (×10^{-6}/°C)	Resistance in (Ω)
AWC-8B-11-3LTSB	8	L28×W5×T1	SUS304	–20~+100°C	+10 ~ +100°C	Mild steel	11×10^{-6}/°C	120

Leadwire Φ5mm 0.3mm² 3-core shielded vinyl leadwire of 3m standard (0.1Ω/m) (Quarter bridge with 3-wire)

∗ Lead wire lengths other than the standard length are available on request. (Made to order.)

Minimum order quantity is 1 strain gauge.

External dimensions



Accessories/Options/Installation example (for weldable strain gauges)

W-50RC SPOT WELDER



This is a spot welder used for installing weldable strain gauges and fixing leadwires. The welding energy is controlled in two ranges of 1~10 and 5~50 watt second. Its short welding pulse width of approximately 5 millisecond causes very little thermal damage on the material to be welded. The welding energy is not influenced by changes in the power source voltage owing to the adoption of stabilizing circuit. Electrical cables are stored inside the housing for convenience in field applications.

Specifications

Welding energy	Two ranges of 1 to 10 watt second and 5 to 50 watt second (continuously variable) 60 watt second at maximum (AC110V 50Hz)
Output voltage	Approx. 32 V at maximum
Output pulse width	Approx. 5 millisecond
Welding interval	2 welds/second at maximum (at 50 watt second)
Continuous use time	Approx. 15 minutes (at 1 weld/second, 30 watt second, 23°C±5°C)
Welding holder	Holder type III
Welding force	4.9 to 19.6 N
Welding tip	Fixing part Φ3 mm, Tip Φ1 mm
Welding cable length	2m
Environment	0 to 50°C, 85%RH or less (no condensation)

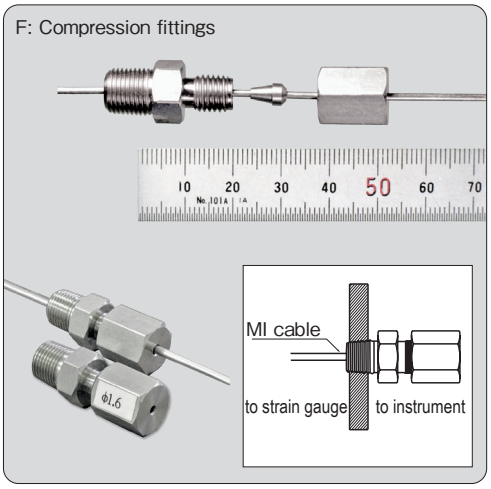
Power supply Rated voltage Maximum power consumption	AC90 to 110V 50/60Hz or AC220V±10% 50/60Hz 550 VA peak (160 millisecond) 210 VA/ 2 times/second
Dimensions	300(W) × 200(H) ×195(D) mm (except projecting parts)
Weight	Approx. 13 kg

Standard accessories

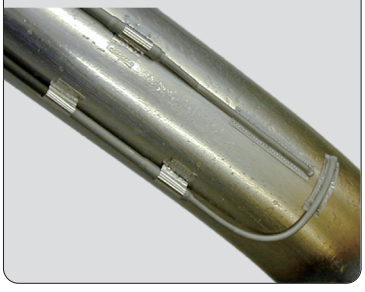
- Operation manual 1
- AC power cable 1
- Welding tip 3
- Abrasive paper(#400) 5
- Hexagonal wrench (width across flats 2.5 mm) 1
- Shoulder belt 1

Examples of option

F: Compression fittings



R: Bend of gauge backing or pipe



Weldable gauge
AWHU and MI cable



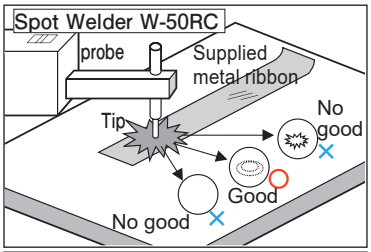
Stainless steel ribbon
Designed to fix cables

Size 5mm x 10m x 0.08mm
10mm x 10m x 0.08mm

Strain gauge installation by resistance welding

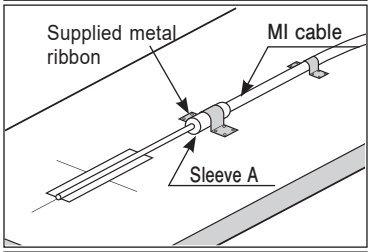
Trial Welding (peeling test)

The dedicated spot welder is used for the installation of weldable strain gauges.
In order to securely install the weldable strain gauge on the test object, it is necessary to find the welding conditions suited to the test object



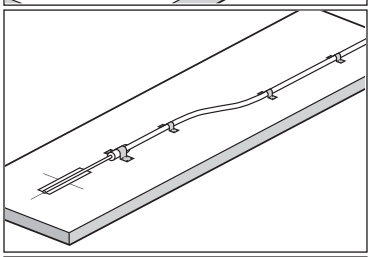
Fixing the sleeve A

Align the center of the strain gauge with the positioning mark, and press down on the gauge so that the gauge is flush against the test object. Fix the sleeve A using the supplied metal ribbon as shown in the figure.



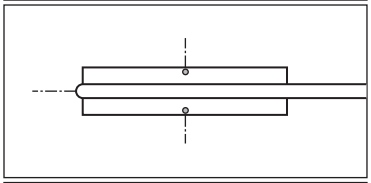
Fixing the cable

Fix the MI cable and the vinyl cable so as to avoid any load applied to the fixed sleeve A. Slightly curve the cable and fix it toward the direction of the cable end so that any excessive load is not applied to the cable. Especially, if the MI cable is fixed along a straight line, the sensing element may be damaged by a kink in the leadwire.



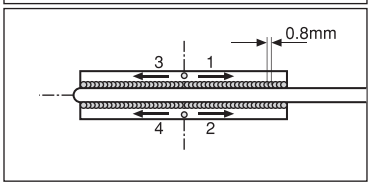
Temporarily fixing the gauge sensing part

Align the gauge sensing part with the positioning mark, and temporarily fix each one point on both sides of the strain gauge as shown in the figure by resistance welding.



Order of resistance welding

Perform resistance welding in the order shown in the figure. The appropriate welding interval is approximately 0.8mm. Refer to the operation manual for the details.



Polyester Strain Gauges P series

These are wire strain gauges with a grid made of fine electric resistance wire formed on a polyester resin backing. They are used for measurement of surface strain on concrete, mortar or rocks, and also for short-term measurement on wood.

Operating temperature range −20～+80℃
Temperature compensation range +10～+80℃

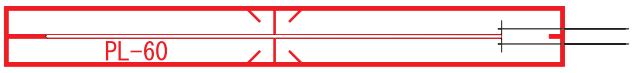
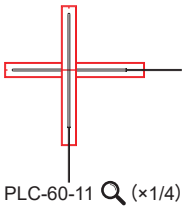
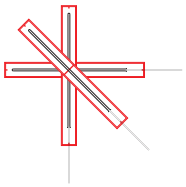
Applicable adhesives	
CN-E	−20～+80℃
RP-2	−20～+80℃
PS	−20～+80℃

Please specify the type number as shown in the example below.

PL -60 -11 -3LJC-F

- PL: Gauge series name
- -60: Gauge length
- -11: Objective material for temperature compensation
- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire

Objective material for temperature compensation (coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Concrete

Gauge pattern		Type	Gauge size(mm) Length	Width	Backing size(mm) Length	Width	Resistance Ω
●Single axis							
	Single axis	PL-60-11	60	1	74	8	120
		PL-90-11	90	1	104	8	120
		PL-120-11	120	1	134	8	120
 PL-60-11							
●0° /90° 2-axis							
	0°/90° 2-axis	PLC-60-11	60	1	74	74	120
 PLC-60-11 (×1/4)							
●0° /45° /90° 3-axis							
	0°/45°/90° 3-axis	PLR-60-11	60	1	74	74	120
 PLR-60-11 (×1/4)							

Minimum order quantity is 10 strain gauges.

Dedicated leadwire recommended for P series strain gauges

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Paralleled vinyl LJB-F Paralleled vinyl LJC-F	−20 ～+80	PL-60-11-3LJB-F PL-60-11-3LJC-F
General use	3-wire paralleled vinyl LJBT-F 3-wire paralleled vinyl LJCT-F	−20 ～+80	PL-60-11-3LJBT-F PL-60-11-3LJCT-F
1-Gauge 4-Wire measurement	Polypropyrene 4-wire paralleled LQM-F	−20 ～+100	PL-60-11-3LQM-F (modular plug attached)

NB: No integral leadwire is available for rosette strain gauges PLC and PLR.

Polyester Foil Strain Gauges PF series

CE

These are foil strain gauges utilizing a polyester resin backing which is the same as the P series. The gauge length is available in 3 ranges of 10, 20 and 30mm, so it is suited mainly to strain measurement on concrete or mortar.

Operating temperature range −20～+80℃
Temperature compensation range +10～+80℃

Applicable adhesives	
CN-E	−20～+80℃
RP-2	−20～+80℃
PS	−20～+80℃

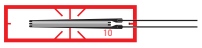
Please specify the type number as shown in the example below.

PFL -30 -11 -3LJC-F

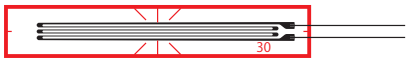
- PFL: Gauge series name
- -30: Gauge length
- -11: Objective material for temperature compensation
- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Concrete

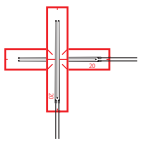
●Single axis

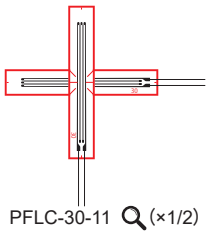

PFL-10-11


PFL-20-11

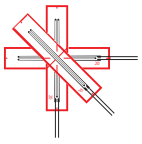

PFL-30-11

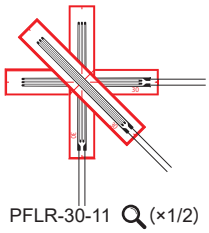
●0°/90° 2-axis


PFLC-20-11 (×1/2)


PFLC-30-11 (×1/2)

●0°/45°/90° 3-axis


PFLR-20-11 (×1/2)


PFLR-30-11 (×1/2)

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
Single axis	PFL-10-11	10	0.9	17.5	5	120
	PFL-20-11	20	1.2	28	6	120
	PFL-30-11	30	2.3	40	7	120
0°/90° 2-axis	PFLC-20-11	20	1.2	28	28	120
	PFLC-30-11	30	2.3	40	40	120
0°/45°/90° 3-axis	PFLR-20-11	20	1.2	28	28	120
	PFLR-30-11	30	2.3	40	40	120

Minimum order quantity is 10 strain gauges.

Dedicated leadwire recommended for PF series strain gauges

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Paralleled vinyl LJB-F Paralleled vinyl LJC-F	−20～+80	PFL-10-11-3LJB-F PFL-10-11-3LJC-F
General use	3-wire paralleled vinyl LJBT-F 3-wire paralleled vinyl LJCT-F	−20～+80	PFL-10-11-3LJBT-F PFL-10-11-3LJCT-F
1-Gauge 4-Wire measurement	Polypropyrene 4-wire paralleled LQM-F	−20～+100	PFL-10-11-3LQM-F (modular plug attached)

NB: No integral leadwire is available for rosette strain gauges PFLC and PFLR.

Metal Backing Strain Gauges FLM/WFLM series

These strain gauges have thin stainless steel backings which prevent the penetration of moisture from the reverse sides. This construction is aimed for successful strain measurement on concrete surface. The WFLM gauges have moisture proofing over-coating and integral leadwire in addition to the stainless steel backing. It is intended for long term measurement or measurement on underwater-curing conctrete.

Operating temperature range
−20～+80℃
Temperature compensation range
+10～+80℃

Applicable adhesives
PS −20～+80℃

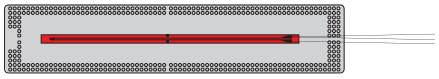
Please specify the type number as shown in the example below.

FLM -30 -11 -2LJCT

- FLM: Gauge series name
- -30: Gauge length
- -11: Objective material for temperature compensation
- -2LJCT: Length in meter and type of integral leadwire

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Concrete

Gauge pattern		Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Backing size(mm) Thickness	Resistance Ω
●Single axis								
	Single axis	FLM-30-11	30	0.5	60	18	0.12	120
		FLM-60-11	60	0.7	90	18	0.12	120
●Waterproof Type Single axis 0.09mm² 3-wire twisted cross-linked polyethylene integral leadwire of 2m -2LJQTA Total leadwire resistance per meter : 0.4Ω NB: Integral leadwire length longer than 2m is available.	Waterproof type Single axis	WFLM-30-11	30	0.5	60	18	4	120
		WFLM-60-11	60	0.7	90	18	4	120



FLM-60-11 (×1/2)

Minimum order quantity is 10 strain gauges.
These strain gauges are available with integral leadwires attached. (made to order)

3-wire system



WFLM-60-11-2LJQTA (×1/2)

Minimum order quantity is 10 strain gauges.

Mold Strain Gauges PMF series

These gauges are designed for the measurement of internal strain of concrete or mortar under loading test. These can also be used for short-term measurement of the behavior of concrete. These are embedded into the measurement position when the concrete or mortar is placed. The gauges employ super engineering plastics as the backing for sealing the sensing element, which provides excellent waterproofing.
A temperature-integrated type PMFL-T is available for measurement of both strain and temperature using our data loggers.

Please specify the type number as shown in the example below.

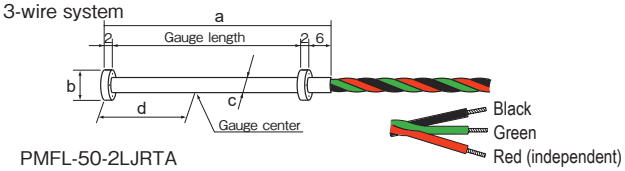
PMFL -50 (-F) -2LJRTA (-F)

- PMFL: Gauge series name
- -50: Gauge length
- (-F): Option F: LEAD-free soldering of strain gauge
- -2LJRTA: Length in meter and type of integral leadwire
- (-F): Option F : LEAD-free soldering of leadwire

Operating temperature range —20～+60℃

●Single axis

3-wire system

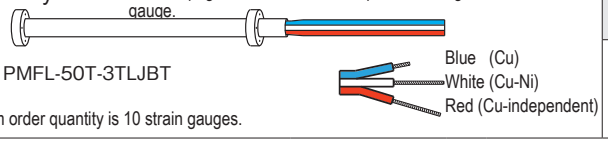


PMFL-50-2LJRTA

●Temperature sensor integrated

3-wire system

Refer to page 13 for details of Temperature-integrated strain gauge.



PMFL-50T-3TLJBT

Minimum order quantity is 10 strain gauges.

Gauge pattern	Type	Gauge Length(mm)	Backing (mm) a	b	c	d	Resist-ance Ω
	PMFL-50	50	60	Φ8	Φ4	27	120
	PMFL-60	60	70	Φ8	Φ4	32	120
	0.09mm² 3-wire cross-linked vinyl leadwire of 2m -2LJRTA Total leadwire resistance per meter : 0.4Ω						
	PMFL-50T	50	60	Φ8	Φ4	27	120
	PMFL-60T	60	70	Φ8	Φ4	32	120
	0.08mm² integral cross-linked vinyl leadwire of 3m -3TLJBT Total leadwire resistance per meter : 0.44Ω (Loop resistance for copper core wires) ＊These gauges are made to order.						

Note

For long-term measurement of concrete structure, use Strain Transducer KM

Asphalt Mold Strain Gauges PMFLS series

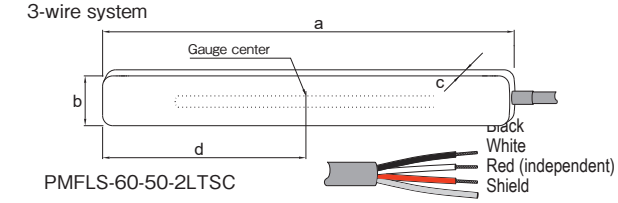
These gauges are embedded in asphalt and used for strain measurement in loading test such as rolling compaction. The material of the backing is super engineering plastics featuring high temperature resistivity and waterproofing performance. The gauges withstand a high temperature up to 200°C during placement of asphalt, and the operating temperature range is –20 to +60°C.

Please specify the type number as shown in the example below.

PMFLS -60 -50 (-F) -2LTSC (-F)

- PMFLS: Gauge series name
- -60: Gauge length
- -50: Objective material for temperature compensation
- (-F): Option F: LEAD-free soldering of strain gauge
- -2LTSC: Length in meter and type of integral leadwire
- (-F): Option F : LEAD-free soldering of leadwire

Operating temperature range —20～+60℃

Gauge pattern	Type	Gauge Length(mm)	Backing (mm) a	b	c	d	Resistance Ω
●Single axis 3-wire system  PMFLS-60-50-2LTSC Minimum order quantity is 1 strain gauge.	PMFLS-60-50	60	120	13	Approx. 7	60	120

Φ6mm 3-wire shielded chloroprene cable of 2m -2LTSC
Total leadwire resistance per meter : 0.11Ω

Strain Gauges UBF series CE

These are foil strain gauges developed for measurement on composite materials. They have a specially designed grid pattern to reduce the stiffening effect of the strain gauges. In addition, owing to the development of gauge backing with better compliance, the number of repetition in thermal cycling test and the creep characteristics have been significantly improved compared to conventional strain gauges.

∗ The strain gauge of this series is not self-temperature-compensated. The thermal output should be measured prior to the actual measurement using a dummy test piece.

Please specify the type number as shown in the example below.

UBFLA -1 -F -3LJB-F

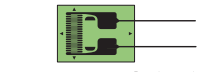
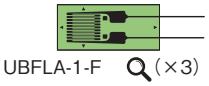
- -3LJB-F: Length in meter and type of integral leadwire CE compliant leadwire
- -F: LEAD-free soldering of strain gauge
- -1: Gauge length
- UBFLA: Gauge series name

Operating temperature range −30～+150℃

Temperature compensation range N/A

Applicable adhesives

CN	−30～+120℃
EB-2	−30～+150℃

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
●Single axis						
 UBFLA-03-F (×3)	UBFLA-03-F	0.3	1.9	3.4	2.5	120
 UBFLA-1-F (×3)	UBFLA-1-F	1	1.3	4.5	2	120

Minimum order quantity is 10 strain gauges.
These strain gauges are available with integral leadwires attached. (made to order)

Important point

Composite materials made of plastics reinforced with glass fibers (GFRP), carbon fibers (CFRP) or aramid fibers (AFRP) have different elastic modulus and coefficient of linear thermal expansion depending on the direction of the fibers. When measuring strain on composite materials, pay enough attention to its components and the direction of the fibers.

Dedicated leadwires recommendable for UBF series strain gauge (made to order)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked GOBLET series strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Parallel vinyl leadwire LJB / LJB-F	−20～+80	UBFLA-1-3LJB-F
General purpose	3-wire parallel vinyl leadwire LJBT / LJBT-F	−20～+80	UBFLA-1-3LJBT-F
Medium high temperature	3-wire parallel special vinyl leadwire LXT / LXT-F	−20～+150	UBFLA-1-3LXT-F

Strain Gauges BF series (GOBLET)

CE GOBLET

These are strain gauges designed for measurement on composite materials. They have a specially designed grid pattern to reduce the stiffening effect of the strain gauge to the measurement object. Coefficient of linear thermal expansion for temperature compensation is available in 3, 5, and 8×10^{-6}/°C, which are applicable to ceramic, carbon or composite materials. These strain gauges are CE marked (compliant to RoHS2 Directive). They have joined to our "GOBLET" series.

Operating temperature range −30～+200℃
Temperature compensation range +10～+80℃

Applicable adhesives	
CN-E	−30～+120℃
NP-50B	−30～+200℃
EB-2	−30～+200℃

Please specify the type number as shown in the example below.

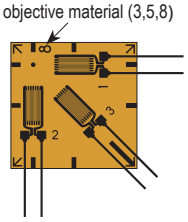
BFLAB -2 -3 -3LJC-F

- BFLAB: Gauge series name
- -2: Gauge length
- -3: Objective material for temperature compensation
- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire

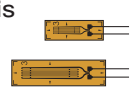
Objective material for temperature compensation (coefficient of linear thermal expansion ×10^{-6}/°C)
-3, -5, -8: Composite material (marked on the backing)

Note: The backing color of BF series gauges are the same for every material for temperature compensation.

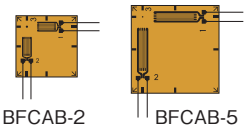
Coefficient of linear thermal expansion of objective material (3,5,8)



●Single axis

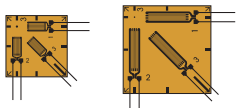


●0° /90° 2-axis Plane type



BFCAB-2 BFCAB-5

●0° /45° /90° 3-axis Plane type



BFRAB-2 BFRAB-5

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
Single axis	BFLAB-2	2	0.9	7.6	2.5	120
	BFLAB-5	5	1.5	12.3	3.3	120
0°/90° 2-axis	BFCAB-2	2	1.3	8	8	120
	BFCAB-5	5	1.5	11.5	11.5	120
0°/45°/90° 3-axis	BFRAB-2	2	1.3	8	8	120
	BFRAB-5	5	1.5	11.5	11.5	120

Important point

Composite materials made of plastics reinforced with glass fibers (GFRP), carbon fibers (CFRP) or aramid fibers (AFRP) have different elastic modulus and coefficient of linear thermal expansion depending on the direction of the fibers. When measuring strain on composite materials, pay enough attention to its components and the direction of the fibers.

Minimum order quantity is 10 strain gauges.
These strain gauges are available with integral leadwires attached. (made to order)

Dedicated leadwires recommendable for BF series strain gauge (made to order)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked GOBLET series strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Parallel vinyl leadwire LJC-F	−20～+80	BFLAB-2-3-3LJC-F
General purpose	3-wire parallel vinyl leadwire LJCT-F	−20～+80	BFLAB-2-3-3LJCT-F
Medium high temperature	3-wire parallel special vinyl leadwire LXT-F	−20～+150	BFLAB-2-3-3LXT-F
High temperature	3-wire twisted FEP leadwire 6FA□LT-F 3-wire twisted FEP single-core leadwire 6FB□LT-F	−269～+200	BFLAB-2-3-6FA3LT-F BFLAB-2-3-6FB3LT-F

NB: □ shows the lead wire length in meter

Strain Gauges GF series

CE GOBLET

These strain gauges are suited to the measurement on materials such as plastics, which have low elastic modulus compared to metal. Our original specially-designed grid lowers the rigidity of the strain gauge and reduces the stiffening effect to the specimen material.
These strain gauges are CE marked (compliant to RoHS2 Directive) and have joined to our "GOBLET" series.

Operating temperature range −30～+80℃
Temperature compensation range +10～+80℃

Applicable adhesives
CN −30～+80℃

Please specify the type number as shown in the example below.

GFLAB -3 (-350) -50 -3LJC-F

- GFLAB: Gauge series name
- -3: Gauge length
- (-350): Gauge resistance (blank for 120Ω)
- -50: Objective material for temperature compensation
- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
−50: Epoxy resin　−70: Acrylic resin, ABS resin

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
●Single axis	GFLAB-3	3	2.3	9.5	4	120
	GFLAB-6	6	2.5	14	5	120
	GFLAB-3-350	3	2.9	9.5	5	350
	GFLAB-6-350	6	2.7	14	5	350
●0° /90° 2-axis Plane type GFCAB-3	GFCAB-3	3	1.4	10.5	10.5	120
GFCAB-3-350	GFCAB-3-350	3	2.9	14.5	14.5	350
●0° /45° /90° 3-axis Plane type GFRAB-3	GFRAB-3	3	1.4	10.5	10.5	120
GFRAB-3-350	GFRAB-3-350	3	2.9	14.5	14.5	350

Minimum order quantity is 10 strain gauges.

Dedicated leadwires recommendable for GF series strain gauge (made to order)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked GOBLET series strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Parallel vinyl leadwire LJC / LJC-F	−20～+80	GFLAB-3-50-3LJC-F
General purpose	3-wire parallel vinyl leadwire LJCT / LJCT-F	−20～+80	GFLAB-3-50-3LJCT-F
1-Gauge 4-Wire measurement	Polypropyrene 4-wire paralleled LQM / LQM-F	−20～+80	GFLAB-3-50-3LQM-F (modular plug attached)

Important point

●Influence of elastic modulus

A strain gauge bonded on a material having low elastic modulus such as plastics may disturb the stress distribution of the material around the area where the strain gauge is bonded. It may cause an apparent lowering of the gauge factor of the strain gauge. This is called a stiffening effect of strain gauge. The lower the elastic modulus is, the larger the stiffening effect becomes. The gauge factor correction is necessary if the elastic modulus of the test object is approx. 2.9 GPa (300 kgf/mm^2) or lower.

●Effect of Joule heat

The strain gauge of this series has a specially designed grid to reduce the effect of Joule heat in the strain gauge. The allowable current for a strain gauge is 30 mA when it is bonded on a metal. However, if the strain gauge is bonded on plastics, it is recommended to keep the current at 10 mA or less.

Strain Gauges LF series

CE GOBLET

This is a foil strain gauge utilizing special plastics for the backing. It has a grid designed for materials with low elastic modulus, and the stiffening effect on the measurement object is reduced. This strain gauge is CE marked (compliant to RoHS2 Directive) and has joined to our "GOBLET" series.

Operating temperature range
−30～+80℃
Temperature compensation range
+10～+80℃

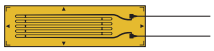
Applicable adhesives
CN-E −30～+80℃

Please specify the type number as shown in the example below.

LFLAB -10 -11 -3LJC-F

- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire
- -11: Objective material for temperature compensation
- -10: Gauge length
- LFLAB: Gauge series name

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
−11: Wood, Gypsum

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
●Single axis						
 LFLAB-10-11	LFLAB-10-11	10	3.1	18.5	5.3	120

Minimum order quantity is 10 strain gauges.
These strain gauges are available with integral leadwires attached. (made to order)

Dedicated leadwire recommended for LF series strain gauges (made to order)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked GOBLET series strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires (GOBLET)

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Paralleled vinyl LJB-F Paralleled vinyl LJC-F	−20～+80	LFLAB-10-11-3LJB-F LFLAB-10-11-3LJC-F
General use	3-wire paralleled vinyl LJBT-F 3-wire paralleled vinyl LJCT-F	−20～+80	LFLAB-10-11-3LJBT-F LFLAB-10-11-3LJCT-F
1-Gauge 4-Wire measurement	Polypropyrene 4-wire paralleled LQM-F	−20～+80	LFLAB-10-11-3LQM-F (modular plug attached)

Strain Gauges PFLW/PLW series CE

These gauges are specially designed for long term measurement on wood. They have a metal foil lined on the back of the PFL or PL strain gauges. The metal foil is effective to protect the strain gauges from an influence of moisture in the wood. These gauges should be bonded with PS adhesive to make the best of their performance.

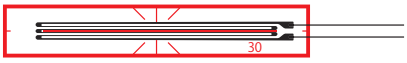
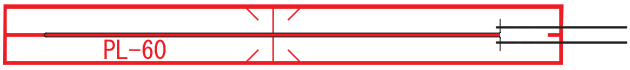
Operating temperature range
−20～+80℃
Temperature compensation range
+10～+80℃

Applicable adhesives
PS −20～+80℃

Please specify the type number as shown in the example below.

PFLW -30 -11 -3LJC-F

- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire
- -11: Objective material for temperature compensation
- -30: Gauge length
- PFLW: Gauge series name

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
●Single axis						
 PFLW-30-11	PFLW-30-11	30	2.3	40	7	120
 PLW-60-11	PLW-60-11	60	1	74	8	120

Minimum order quantity is 10 strain gauges.

Dedicated leadwire recommended for PFLW/PLW series strain gauges

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Paralleled vinyl LJB-F Paralleled vinyl LJC-F	−20 ～+80	PFLW-30-11-3LJB-F PFLW-30-11-3LJC-F
General use	3-wire paralleled vinyl LJBT-F 3-wire paralleled vinyl LJCT-F	−20 ～+80	PFLW-30-11-3LJBT-F PFLW-30-11-3LJCT-F
1-Gauge 4-Wire measurement	Polypropyrene 4-wire paralleled LQM-F	−20 ～+80	PFLW-30-11-3LQM-F

Non-inductive Strain Gauges QMF series

These are non-inductive strain gauges suited to the measurement in magnetic field. The sensing element of this gauge consists of two identical grids with one grid folded back on another. This construction makes to cancel the electromagnetically induced noise each other. The twisted leadwire is also effective to cancel the induced noise in the same way. Accordingly, this strain gauge is less sensitive to the influence of noise induced in changing magnetic field.

Operating temperature range
−30～+200℃
Temperature compensation range
0～+150℃

Applicable adhesives

CN	−30～+120℃
NP-50B	−30～+200℃
EB-2	−30～+200℃

Please specify the type number as shown in the example below.

QMFLA -2 (-350) -11 -005LET-6FD1LTSS-F

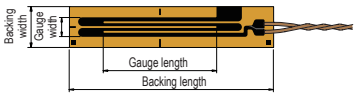
- Length in meter and type of integral leadwire CE compliant leadwire
- 3-wire from the root of gauge leads (blank for 2-wire)
- Objective material for temperature compensation
- Gauge resistance (blank for 120Ω)
- Gauge length
- Gauge series name

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Mild steel -17:Stainless steel -23:Aluminium

Note: The backing color of QMF series gauges are the same for every material for temperature compensation.

Single axis/Multi-axis (for steel)

●Single axis

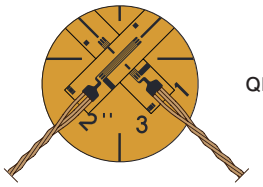


(×3)



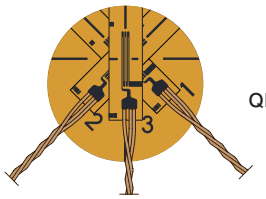
・Minimum order quantity is 10 strain gauges.
・These strain gauges need to be supplied with integral leadwires (made-to-order).

●2-axis 0° /90° Stacked type



QMFCA-2-11 (×3)

●3-axis 0° /45° /90° Stacked type



QMFRA-2-11 (×3)

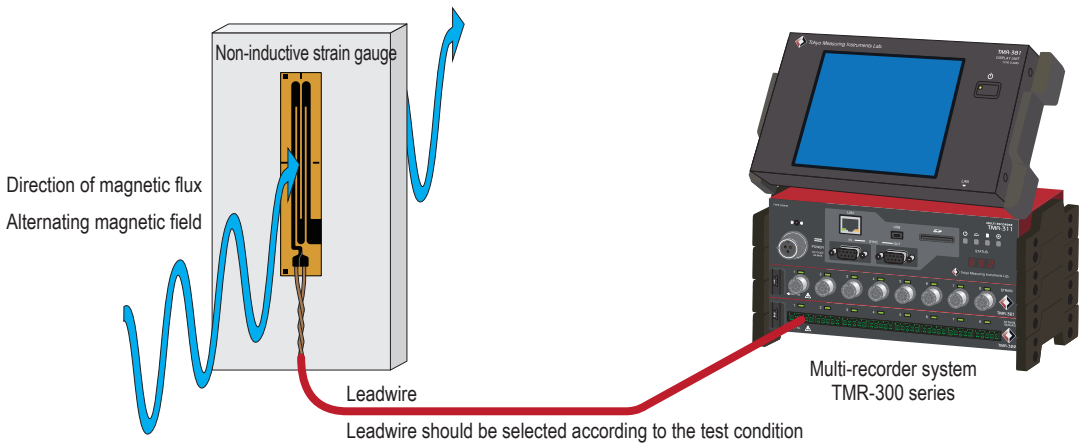
・Minimum order quantity is 10 strain gauges.
・The length of integral leadwire for multi-axis strain gauges of this series is available up to 1 meter (made to order)

Gauge pattern	Type	Gauge size (mm) Length	Gauge size (mm) Width	Backing size (mm) Length	Backing size (mm) Width	Resistance (Ω)
	QMFLA-2	2	0.5	5	1.5	120
	QMFLA-5	5	0.8	9	1.8	120
	QMFLA-2-350	2	0.3	4.5	1.5	350
	QMFLA-5-350	5	0.3	7.8	1.5	350
	QMFCA-2-11	2	0.5	φ7		120
	QMFCA-5-11	5	0.8	φ11		120
	QMFCA-2-350-11	2	0.3	φ7		350
	QMFCA-5-350-11	5	0.3	φ11		350
	QMFRA-2-11	2	0.5	φ7		120
	QMFRA-5-11	5	0.8	φ11		120
	QMFRA-2-350-11	2	0.3	φ7		350
	QMFRA-5-350-11	5	0.3	φ11		350

Non-inductive Strain Gauges QMF series

CE

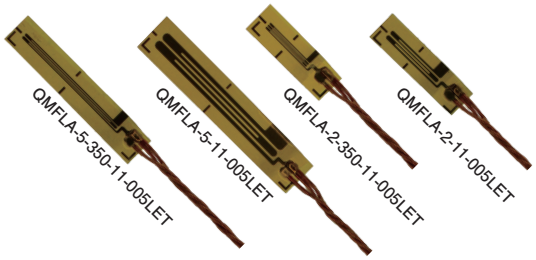
Important point

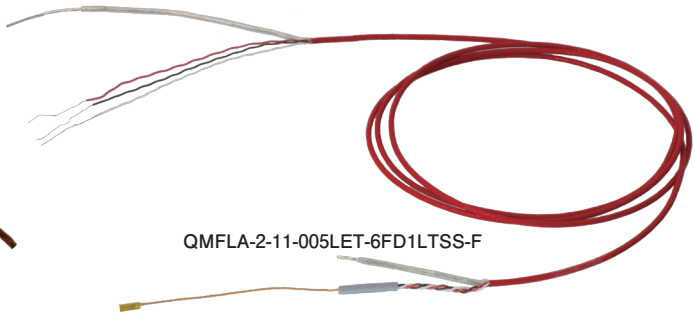


●Features

- 2-axial: Measurement of tension and compression, Tri-axial: Rosette analysis is possible
- Gauge lengths of 2mm and 5mm and gauge resistances of 120Ω and 350Ω are selectable
- Selectable Measuring method from 1-Gauge 2-Wire, 1-Gauge 3-Wire, and 1-Gauge 3-Wire (3-Wire root specification) depending on test environment
- Operating temperature range extended to -30 to +200°C (temperature compensation range: 0 to +150°C)
- Gauge lead wire length is approx. 50mm, The length of the gauge lead wire is approximately 50 mm, making it easy to affix (only for the 3-wire root type).
- CE compliant

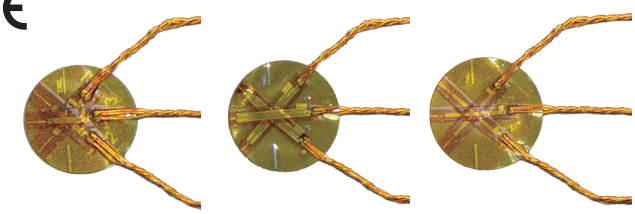
CE



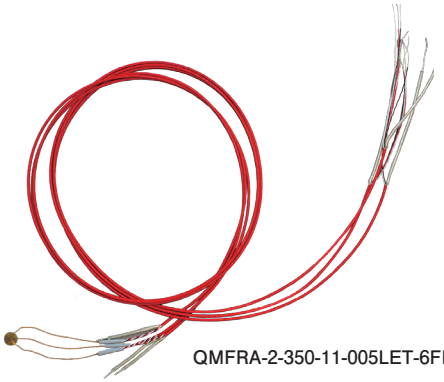


QMFLA-2-11-005LET-6FD1LTSS-F

CE



QMFRA-2-350-11-005LET　QMFRA-5-11-005LET　QMFRA-5-350-11-005LET



QMFRA-2-350-11-005LET-6FD1LTSS-F

Dedicated leadwire recommended for QMF/MF series strain gauges

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire.

Type and designation of leadwires

Application	Leadwire name	Operating temperature range of leadwire (°C)	Loop resistance per 1 meter (Ω)	Example of type number
Magnetic field Room temperature (without temperature change)	2-wire twisted vinyl leadwire LJAY-F QMFLA-2-[a]-[z]LJAY-F、QMFCA-2-[a]-[z]LJAY-F、QMFRA-2-[a]-[z]LJAY-F	-20 ～+80	0.44	QMFLA-2-11-1LJAY-F QMFCA-2-11-1LJAY-F QMFRA-2-11-1LJAY-F MFLA-60-350-11-1LJAY
	3.2mm-dia. 2-core shielded vinyl leadwire LS-F Shield QMFLA-2-[a]-[z]LS-F、QMFCA-2-[a]-[z]LS-F、QMFRA-2-[a]-[z]LS-F	-20 ～+80	0.44	QMFLA-2-11-1LS-F QMFCA-2-11-1LS-F QMFRA-2-11-1LS-F MFLA-60-350-11-1LS
Magnetic field Room temperature	3mm-dia. 3-core shielded vinyl leadwire LTSA-F Red (independent) Black White Shield QMFLA-2-[a]-[z]LTSA-F、QMFCA-2-[a]-[z]LTSA-F、QMFRA-2-[a]-[z]LTSA-F	-20 ～+80	0.44	QMFLA-2-11-1LTSA-F QMFCA-2-11-1LTSA-F QMFRA-2-11-1LTSA-F
Magnetic field High temperature	1.5mm-dia. 3-core shielded fluorinated resin (FEP) leadwire 6FDOLTS-F Red (independent) Black White Shield QMFLA-2-[a]-6FD[z]LTS-F、QMFCA-2-[a]-6FD[z]LTS-F、QMFRA-2-[a]-6FD[z]LTS-F	-30 ～+200	1.1	QMFLA-2-11-6FD1LTS-F QMFCA-2-11-6FD1LTS-F QMFRA-2-11-6FD1LTS-F
Magnetic field Room temperature (with 3-wire from the root of gauge leads)	3mm-dia. 3-core shielded vinyl leadwire LTSAS-F Red (independent) Black White Shield QMFLA-2-[a]-005LET-[z]LTSAS-F、QMFCA-2-[a]-005LET-[z]LTSAS-F、QMFRA-2-[a]-005LET-[z]LTSAS-F	-20 ～+80	0.44	QMFLA-2-11-005LET-1LTSAS-F QMFCA-2-11-005LET-1LTSAS-F QMFRA-2-11-005LET-1LTSAS-F
Magnetic field High temperature (with 3-wire from the root of gauge leads)	1.5mm-dia. 3-core shielded fluorinated resin (FEP) leadwire 6FDOLTSS-F Red (independent) Black White Shield QMFLA-2-[a]-005LET-6FD[z]LTSS-F、QMFCA-2-[a]-005LET-6FD[z]LTSS-F、QMFRA-2-[a]-005LET-6FD[z]LTSS-F	-30 ～+200	1.1	QMFLA-2-11-005LET-6FD1LTSS-F QMFCA-2-11-005LET-6FD1LTSS-F QMFRA-2-11-005LET-6FD1LTSS-F
Magnetic field High temperature (with no temperature change)	2 stranded wire shielded (FEP) sheathed single core wire 6FBOLS-F Shield QMFLA-2-[a]-6FB[z]LS-F、QMFCA-2-[a]-6FB[z]LS-F、QMFRA-2-[a]-6FB[z]LS-F	-30 ～+200	1.05	QMFLA-2-11-6FB1LS-F QMFCA-2-11-6FB1LS-F QMFRA-2-11-6FB1LS-F

[a] : Objective material for temperature compensation (coefficient of linear thermal expansion × 10^{-6}/ ℃)
[z] : Leadwire length (m)

Non-inductive Strain Gauges MF series (For Concrete)

These are non-inductive strain gauges suited to the measurement in magnetic field. The sensing element of this gauge consists of two identical grids with one grid folded back on another. This construction makes to cancel the electromagnetically induced noise each other. The twisted leadwire is also effective to cancel the induced noise in the same way. Accordingly, this strain gauge is less sensitive to the influence of noise induced in changing magnetic field.

Operating temperature range
−20～＋80℃

Applicable adhesives	
CN	−20～+80℃
CN-E	−20～+80℃
RP-2	−20～+80℃

Please specify the type number as shown in the example below.

MFLA -60 -350 -11 -1LJAY

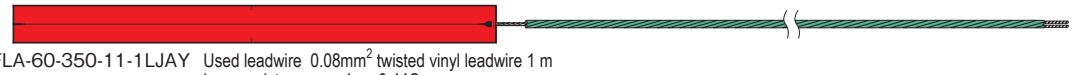
- -1LJAY: Length in meter and type of integral leadwire
- -11: Objective material for temperature compensation
- -350: Gauge resistance (blank for 120Ω)
- -60: Gauge length
- MFLA: Gauge series name

Objective material for temperature compensation
(coefficient of linear thermal expansion ×10^{-6}/°C)
-11: Mild steel

Single axis (for concrete)

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
	MFLA-60-350	60	0.1	64	5	350

●Single axis (for concrete)



MFLA-60-350-11-1LJAY Used leadwire 0.08mm^2 twisted vinyl leadwire 1 m
Loop resistance per 1 m: 0.44Ω



MFLA-60-350-11-1LS (Shielded leadwire)
Used leadwire 3.2 mm dia. 2-core twisted shielded vinyl leadwire 1 m
Loop resistance per 1 m: 0.44Ω

Minimum order quantity is 10 strain gauges.

Post-yield Strain Gauges YEF series

CE GOBLET

These gauges are applicable to the measurement of large strain up to 10~15%. Also these withstand the repeated strain in elastic range (at strain level ±1500×10^{-6} strain) like ordinary strain gauges. However, these are not applicable to the measurement of repeated strain in a large range. Integral leadwires using lead-free solder are available with option –F. This strain gauge is CE marked (compliant to RoHS2 Directive) and has joined to our "GOBLET" series.

Please specify the type number as shown in the example below.

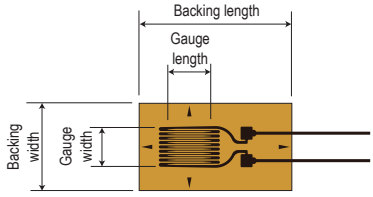
YEFLAB -2 -3LJC-F

- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire
- -2: Gauge length
- YEFLAB: Gauge series name

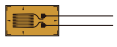
Operating temperature range −30～+80℃

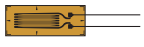
Strain limit in room-temperature 10～15%

Applicable adhesives	
CN	−30～+80℃
CN-Y	−30～+80℃

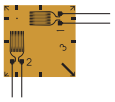


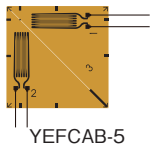
●Single axis


YEFLAB-2

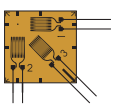

YEFLAB-5

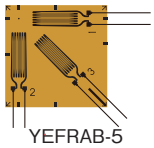
●0° /90° 2-axis Plane type


YEFCAB-2


YEFCAB-5

●0° /45° /90° 3-axis Plane type


YEFRAB-2


YEFRAB-5

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
Single axis	YEFLAB-2	2	1.8	7	4	120
	YEFLAB-5	5	2	10.5	4	120
0°/90° 2-axis Plane type	YEFCAB-2	2	1.8	9.5	9.5	120
	YEFCAB-5	5	2	13.5	13.5	120
0°/45°/90° 3-axis Plane type	YEFRAB-2	2	1.8	9.5	9.5	120
	YEFRAB-5	5	2	13.5	13.5	120

Minimum order quantity is 10 strain gauges.
These strain gauges are available with integral leadwires attached. (made to order)

Dedicated leadwires recommendable for YEF series strain gauge (made to order)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire. For CE marked GOBLET series strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Parallel vinyl leadwire LJC-F	−20～+80	YEFLAB-2-3LJC-F
General purpose	3-wire parallel vinyl leadwire LJCT-F	−20～+80	YEFLAB-2-3LJCT-F

Post-yield Strain Gauges YF series CE

These gauges are applicable to the measurement of large strain up to 15 to 20%. These are not applicable to the measurement of repeated strain in elastic range as well as in large range.

Operating temperature range −20～+80℃
Strain limit in room-temperature 15～20%

Applicable adhesives	
CN	−20～+80℃
CN-Y	−20～+80℃

Please specify the type number as shown in the example below.
YFLA -2 -3LJC-F
- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire
- -2: Gauge length
- YFLA: Gauge series name

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
●Single axis						
YFLA-2-F	YFLA-2-F	2	1.8	7.5	4	120
YFLA-10-F	YFLA-5-F	5	1.9	12	4	120
YFLA-5-F	YFLA-10-F	10	2.6	16.6	4.9	120
YFLA-20-F	YFLA-20-F	20	1.8	26	3.7	120

Minimum order quantity is 10 strain gauges.
These strain gauges are available with integral leadwires attached. (made to order)

POST-YIELD (Large strain)

Post-yield Strain Gauges YHF series CE

These gauges are developed for the measurement of very large strain up to 30~40%. These are not applicable to the measurement of repeated strain in elastic range as well as in large range.

Operating temperature range −30～+80℃
Strain limit in room-temperature 30～40%

Applicable adhesives	
CN	−30～+80℃
CN-Y	−30～+80℃

Please specify the type number as shown in the example below.
YHFLA -2 -3LJC-F
- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire
- -2: Gauge length
- YHFLA: Gauge series name

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
●Single axis						
YHFLA-2 (×3)	YHFLA-2	2	1.5	8	2.7	120
YHFLA-5 (×3)	YHFLA-5	5	1.7	11	3	120

Minimum order quantity is 10 strain gauges.
These strain gauges are available with integral leadwires attached. (made to order)

Important point

●Strain compensation method for YHF series plastic range gauges

When a tensile test is conducted using the YHF series, the gage factor after temperature change and the strain correction factor described in "TML STRAIN GAUGE TEST DATA" are required as correction values for the measured values in the data arrangement.
In this case, the test temperature range is 0 to +40°C.
For the calculation of true strain, refer to the instruction manual supplied with the YHF plastic range gauge.

Post-yield Strain Gauges

Dedicated leadwire recommended for YEF/YF/YHF series strain gauges

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose (without temperature change)	Paralleled vinyl LJC-F	−20 ～+80	YEFLAB-2-3LJC-F YFLA-2-3LJC-F YHFLA-2-3LJC-F
General use	3-wire paralleled vinyl LJCT-F	−20 ～+80	YEFLAB-2-3LJCT-F YFLA-2-3LJCT-F YHFLA-2-3LJCT-F

Important point

●Performance of YEF/YF/YHF

Series	Strain measurement	Fatigue limit at room temperature*1	Change of apparent strain due to cyclic loading of large strains*2	Self-temperature compensation	Applications
YEF	10~15%	5×10^5 cycles	2000×10^{-6} strain/10 cycles	No	• Measurement of 10 to 15% elongation • Measurement of repeated strain in elastic range.
YF	15~20%	1×10^2 cycles	2000×10^{-6} strain/10 cycles	No	• Measurement of 15 to 20% elongation
YHF	30~40%	2×10^4 cycles	N/A	No	• Measurement of 30 to 40% elongation
F	5%	1×10^6 cycles	400×10^{-6} strain/10 cycles	Yes	• Measurement of repeated strain in elastic range. • Measurement of 5% elongation

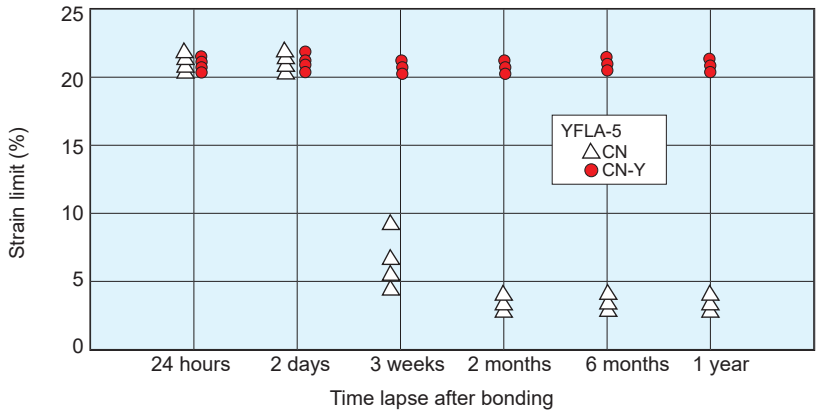
*1 : The number of repetitions at which the indicated strain value changes by 100×10^{-6} strain or more by applying repeated strain of approx. $\pm 1{,}500 \times 10^{-6}$ strain at 15Hz
*2 : Change of indicated strain by applying a repeated strain of approx. $\pm 10{,}000 \times 10^{-6}$ strain at a speed of 4 minutes per cycle.

●Adhesive for YEF/YF/YHF series gauges

These strain gauges should be bonded with CN or CN-Y adhesive. If measurement is made a few days or longer after the strain gauge bonding, the CN-Y should be used. Measurement of large strain is possible even after one year of bonding the strain gauge with the CN-Y adhesive, provided that the specimens are stored at room temperature without any unfavorable conditions (moisture, direct sunlight, etc.).

●CN adhesive variation with time

Though CN adhesive is normally used for large elongation strain measurement, the strain limit gradually decreases with the number of days following strain gauge installation. This variation with time occurs as a consequence of exposure to direct sunlight (UV), temperature and humidity, as well as the number of days after installation. The following shows an example of the results of testing performed by TML for the effects of adhesive variation with time. While these results show marked differences due to the exposure conditions of the test specimens (temperature and humidity), they also show that the strain limits for strain gauges decrease as time passes after installation. While this does not pose a problem in ordinary strain measurement, TML recommends that the measurement ends in 1 or 2 days after installation in the case of large elongation strain measurement. If the strain gauge is to be left for a long period after being installed, use the CN-Y adhesive.



●Countermeasure in case there is a span between gauge installation and start of measurement

Store the test specimen with the attached strain gauge in a cool, dark and dry location.
Use the CN-Y adhesive. (Refer to the instructions provided).

●Repeatability of Post-Yield strain gauges

Post-Yield strain gauges can be used once to measure large elongation strain, but cannot be used for measurement of repeated large elongation strain. When repeated testing is performed in a strain range exceeding 5000×10^{-6}, the strain gauge experiences zero drift. Note that the amount of drift varies depending on factors such as the type of strain gauges and the level and frequncy of strain.

High Endurance Strain Gauges DSF series

These gauges are designed for fatigue tests, and can reach a fatigue life of over 10 million times at a strain level of ±3000 με. Compared to previously (1 million times at ±1500×10^{-6} strain), these are gauges of exceptionally high durability.
In aviation and other areas, repeated load tests of large elongation of composite materials are conducted. However, it had been necessary to adhere a new strain gauge frequently as a gauge reached its fatigue life. The DSF series greatly reduces time and cost of adhering gauges.

Operating temperature range
−60～+200℃

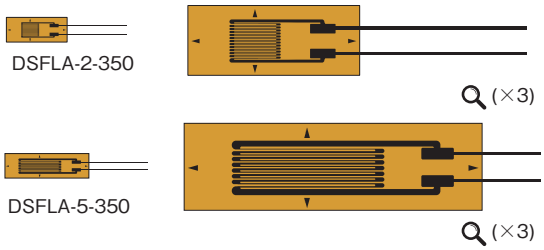
Applicable adhesives
CN −60～+120℃
EB-2／C-1 −60～+200℃

Please specify the type number as shown in the example below.

DSFLA -2 -350 -3LJB

- Length in meter and type of integral leadwire
- Gauge resistance
- Gauge length
- Gauge series name

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
DSFLA-2-350	DSFLA-2-350	2	2	8	3.3	350
DSFLA-5-350	DSFLA-5-350	5	2	11	3.2	350

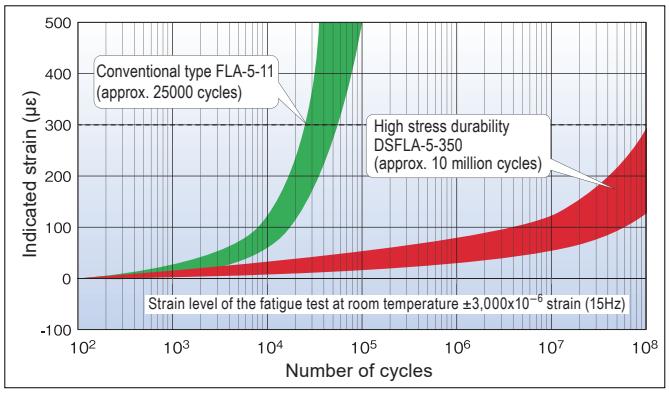


The strain gauge of this series is not self-temperature-compensated. It is recommended to measure the thermal output prior to the actual measurement using a dummy test piece made of the same material as the object to be measured.

Fatigue Limit
This number is determined as the number of cycles in case a mechanically repeated strain of ±3000x10^{-6} strain is applied to the strain gauge before the strain changes by ±300x10^{-6} strain.

Minimum order quantity is 10 strain gauges.
These strain gauges are available with integral leadwires attached. (made to order)

Example of strain gauge fatigue test results



BENDING STRAIN

One-side Strain Gauges DD series

These gauges are intended for measuring the bending and tensile strains separately by simply bonding the gauges on one side of a plate or beam. It works on the assumption that the strain distribution in the section of the specimen is linear along the height of the section when the section is subjected to both tensile and bending stress. The gauges are effectively used for the measurement of a box construction in structures such as bridges or pressure vessels, where the reverse side of the measurement object is not accessible for strain gauge installation.

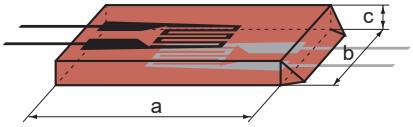
Operating temperature range
-10～+70℃

Applicable adhesives
CN −10～+70℃
P-2 −10～+70℃

Please specify the type number as shown in the example below.

DD -1 -15 (-F)

- Option F: LEAD-free soldering of strain gauge
- Gauge backing length
- Gauge length
- Gauge series name

Gauge pattern	Thickness of applicable specimen (mm)	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length (a)	Backing size(mm) Width (b)	Backing size(mm) Thickness (c)	Resistance Ω
	Approx. 5 or less	DD-1-15	3	2.9	15	7	1	350
	Approx. 5 to 10	DD-2-30	3	2.9	30	7	2	350

These strain gauges are not self-temperature-compensated. It may be necessary to measure a thermal output using a dummy specimen prior to the measurement.
Minimum order quantity is 5 strain gauges.

Strain Gauges CTE series

The CTE series of strain gauges for measuring the coefficient of linear expansion is a product in which the temperature-compensated material of the strain gauge is adjusted to 0×10^{-6}/°C so that the coefficient of linear expansion of any material can be easily calculated.
They can also measure total elongation (strain due to external force + thermal strain), making them effective for measuring strain on electronic circuit boards.

Operational temperature range −30～+200°C
Temperature compensation range +10～+100°C

Applicable adhesive	
NP-50	−30～+200℃
C-1/EB-2	−30～+200℃
CN	−30～+120℃

Please specify the type number as shown in the example below.

CTELA -3 (-350) -3LCT (-F)

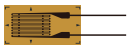
- CTELA: Gauge series name
- -3: Gauge length
- (-350): Gauge resistance (blank for 120Ω)
- -3LCT: Length in meter and type of integral leadwire
- (-F): Option F : LEAD-free soldering of leadwire

Linear Expansion Coefficient Measurement

●Single axis


CTELA-3


CTELA-6


CTELA-3-350


CTELA-6-350

Gauge pattern	Type	Gauge size(mm) Length	Width	Backing size(mm) Length	Width	Resistance Ω
	CTELA-3	3	1.8	10.5	3.5	120
	CTELA-6	6	2.5	15.5	4.5	120
	CTELA-3-350	3	3.1	10.2	5.2	350
	CTELA-6-350	6	2.8	16	5.3	350

When calculating the linear expansion coefficient of the material to be measured, the test should be carried out in a free-expansion state so that no distortion is caused by external forces
Errors may occur on curved specimens
General strain measurement is also possible, but note the thermal output as the strain gauge adjusts the temperature-compensated material to 0 x 10^{-6}/°C

Dedicated leadwire recommended for CTE series strain gauges (made to order)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 29 to 37 for the details of combination of a strain gauge and a leadwire.

Type and designation of leadwires

Usage	Leadwire name	Operating temperature range of leadwire (°C)	Type number example
General purpose	3-wire paralleled vinyl LJCT-F	−20 ～+80	CTELA-6-3LJCT-F
High temperature	3-wire twisted FEP leadwire 6FA □ LT-F 3-wire twisted FEP single-core leadwire 6FB □ LT-F	−269 ～+200	CTELA-3-6FA3LJC-F CTELA-3-6FB3LJC-F

NB: □ shows the lead wire length in meter

Simplified formula for calculating the linear expansion coefficient of the measured material

In case of this product ($\Delta\varepsilon_{appT} \fallingdotseq 0$)

$$\beta_r = \frac{\Delta\varepsilon_{measT}}{\Delta T}$$

Normal calculation formulae

$$\beta_r = \beta_S + \frac{\Delta\varepsilon_{measT} - \Delta\varepsilon_{appT}}{\Delta T}$$

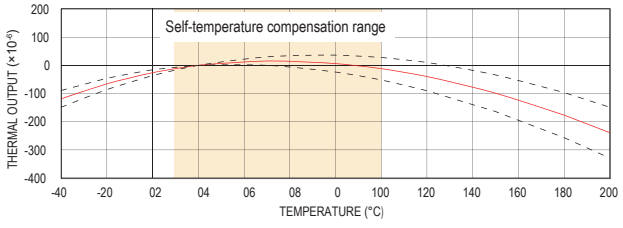
β_r : Linear expansion coefficient of the object material between two measurement points
β_s : Linear expansion coefficient on the data sheet
$\Delta\varepsilon_{measT}$: Difference of actual measured value of thermal output between two measurement points
$\Delta\varepsilon_{appT}$:Difference in the value of thermal output on the data sheet between two measurement points
ΔT : Temperature difference between two measurement points (T1-T2)

Example of CTE series thermal output

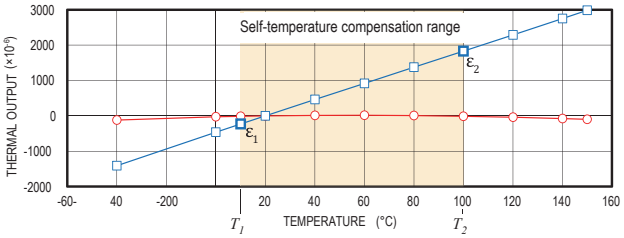
THERMAL OUTPUT (ε_{app} : APPARENT STRAIN)

$\varepsilon_{app} = -2.62 \times 10^{1} + 1.62 \times T^{1} - 1.68 \times 10^{-2} \times T^{2} + 2.29 \times 10^{-5} \times T^{3} - 2.98 \times 10^{-8} \times T^{4}$

TOLERANCE : ±0.5[×10^{-6}/°C)], T : TEMPERATURE



The thermal output of a CTE strain gauge when affixed to aluminium material (A2024) is shown in the diagram below



Thermal output when CTE gauges are used on aluminium materials
Thermal output when using a CTE gauge on a material with a coefficient of linear expansionβs≒0×10^{-6}/°C → Regard as almost flat

Linear thermal expansion coefficient calculated over the self-temperature compensation range of 10 to 100°C.

Linear expansion coefficient $= \frac{\varepsilon_2 - \varepsilon_1}{T_2 - T_1}$

$= \frac{1831 - (-231)}{100 - 10}$

$\fallingdotseq 22.9 \times 10^{-6}$/°C

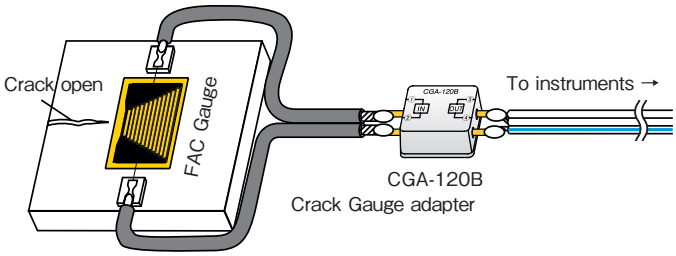
Test temperature (°C)	Thermal output when affixed to aluminium
T_1= 10	ε_1= -231
T_2=100	ε_2=1831

Crack Detection Gauges FAC series CE

These gauges are designed to measure the propagation speed of fatigue crack in a metal specimen. The gauges are bonded with an adhesive on the position where the crack is initiated or the crack initiation is expected. The grids of the gauges, which are aligned at interval of 0.1mm or 0.5mm, are disconnected one by one with the propagation of the crack. The gauges are used together with the crack gauge adapter CGA-120B, and the disconnection of one grid is measured as the change of approx. 45 or 40×10^{-6} strain by a strainmeter.

Operating temperature range
−30～+80℃

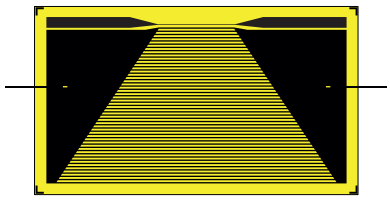
Applicable adhesives	
CN	−30～+80℃
RP-2	−30～+80℃



●Crack Gauges



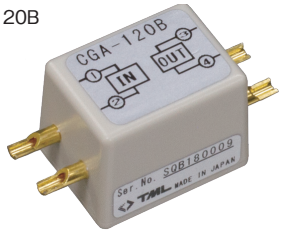
FAC-5



FAC-20

Minimum order quantity is 10 crack gauges.

●Crack Gauge adapter CGA-120B



Minimum order quantity is 1 crack gauge adapter.

CRACK GAUGES

Gauge type	FAC-5	FAC-20
Measuring range	4.5mm	20mm
Gauge resistance	approx. 1Ω	
Grid interval	0.1mm	0.5mm
Number of grids	46	41
Output per grid	approx. 45×10^{-6} strain	approx. 40×10^{-6} strain
Operating temperature	−30～+80°C	
Backing size	28 x 5mm	43 x 25mm

Crack Gauge adapter CGA-120B

Measuring point	1 point
Allowable temperature	−30～+80°C
Bridge connection	Quarter bridge 3-wire method 120Ω
Dimensions	20(W) x 15(H) x 15(D) mm (except projection parts)
Weight	5g

・Option F: LEAD-free soldering
Example) Crack gauge FAC-5-F / FAC-20-F
adapter CGA-120B-F

AXIAL STRESS MEASUREMENT

Stress Gauges SF series CE

These gauges are intended to measure the stress in an optional direction of the specimen in plane stress field. The gauges are sensitive not only in these axial direction but also in the transverse direction, and the sensitivity ratio of the transverse direction to the axial direction is equal to the Poisson's ratio of the specimen material. In addition, the gauges are not sensitive to the shearing strain. Accordingly, the output of the gauges is proportional to the stress in the axial direction. The gauges are available in three types depending on the Poisson's ratio of the specimen material.

Operating temperature range
−20～+200℃
Temperature compensation range
+10～+100℃

Applicable adhesives	
NP-50B	−20～+200℃
C-1	−20～+200℃
CN	−20～+120℃

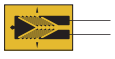
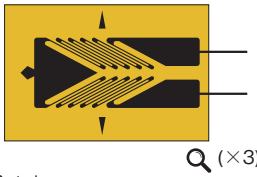
Please specify the type number as shown in the example below.

SFA -285 -11 -3LJC-F

- -3LJC-F: Length in meter and type of integral leadwire CE compliant leadwire
- -11: Objective material for temperature compensation
- -285: Poisson's ratio of specimen
- SFA: Gauge series name

Objective material for temperature compensation
(coefficient of linear thermal expansion $\times10^{-6}$/°C)
-11: Mild steel -17:Stainless steel -23:Aluminium

Note: The backing color of SF series gauges are the same for every material for temperature compensation.

Gauge pattern	Poisson's ratio of specimen	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
●Single axis							
 SFA-285  (×3)	0.285	SFA-285-11	4	3	9	6	120
	0.305	SFA-305-17					
	0.330	SFA-330-23					

Minimum order quantity is 10 strain gauges.
These strain gauges are available with integral leadwires attached. (made to order)

Temperature Gauges TF series CE

These gauges are bonded on the specimen surface like ordinary strain gauges, and measure the surface temperature. By combining with the dedicated temperature gauge adapter (TGA-1A or TGA-1B), actual temperature can be measured easily using a strainmeter.

Operating temperature range −20～+200℃

Applicable adhesives	
NP-50B	−20～+200℃
C-1	−20～+200℃
CN	−20～+120℃

Please specify the type number as shown in the example below.

TFL -2 (-60) (-F) -3LJB (-F)

- Option F : LEAD-free soldering of leadwire
- Length in meter and type of integral leadwire
- Option F: LEAD-free soldering of strain gauge
- Gauge resistance (blank for 120Ω)
- Gauge length
- Gauge series name

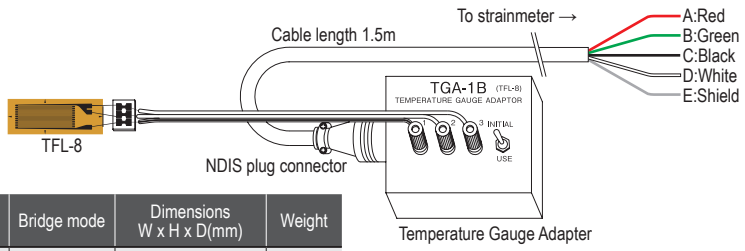
Gauge pattern	Type	Sensitivity (Ω/℃)	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
TFL-2-60	TFL-2-60	0.34 approx.	2	1.9	6.1	3.5	60
TFL-8	TFL-3-60	0.34 approx.	3	3.2	8.5	5	60
	TFL-6-60	0.34 approx.	6	2.6	12.4	4.5	60
	TFL-8	0.68 approx.	8	3.5	14	5.5	120

Minimum order quantity is 10 gauges.
These gauges are available with integral leadwires attached. (made to order)

TGA-1A/TGA-1B Temperature Gauge Adapter

This adapter is used with temperature gauges TF series for direct reading of temperature with a strainmeter, and converts output to 100x10^{-6} strain/°C.

Minimum order quantity is 1.



Type of adapter	Applicable gauge	Temperature °C	Sensitivity (x10^{-6} strain/°C)	Accuracy (°C)	Bridge mode	Dimensions W x H x D(mm)	Weight
TGA-1A	TFL-2-60 TFL-3-60 TFL-6-60	−20～+200	100	±1 or less	Full bridge	100×40×70	370g
TGA-1B	TFL-8	−20～+200	100	±1 or less	Full bridge	100×40×70	370g

TEMPERATURE MEASURUREMENT

Platinum RTD / Thermocouple

PLATINUM RTD

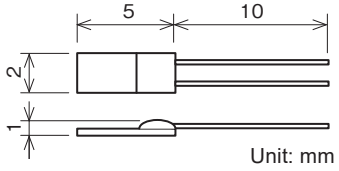
■PLATINUM RTD (Pt 100)

The Platinum RTD is mounted on a specimen and connected to a Data logger(TS-963/-960/-360/TDS-540/-150, TC-37K/-32K etc.) to measure temperature. Easy measurement of temperature by bonding to specimen with strain gauge adhesive. Units equipped with leadwire are also available upon request.

Type	Rated current	Base size (mm)	Resistance	Operating temperature
CRZ-2005	1mA or less	5.0×2.0×1.1	100Ω (at 0°C)	−40～+400 °C

Minimum order quantity is 10.

External dimensions



Unit: mm

THERMOCOUPLE

A thermocouple configures the closed circuit in which a small electric current flows in the circuit composed of a pair of dissimilar conductors, and measures temperature using thermoelectric effect produced at both ends of conductors in different temperatures.

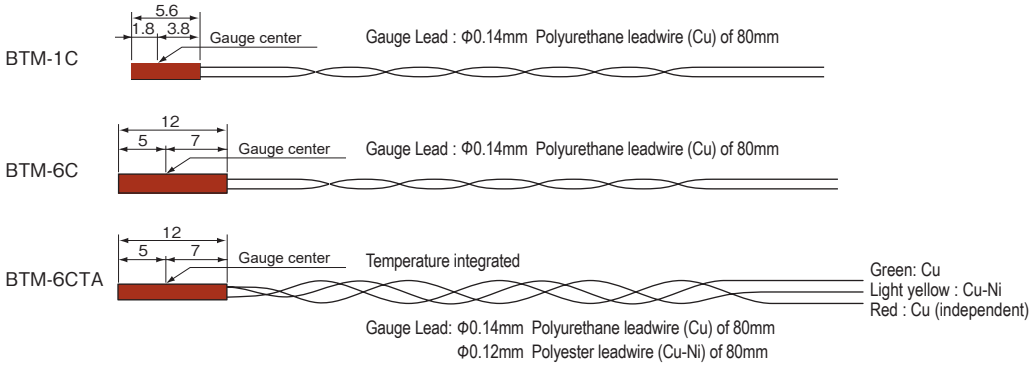
Type	Thermo-couple	Core diameter (mm)	Outer dimension (mm)	Sheath materials	Sheath color Insulator +	Sheath color Insulator −	Sheath color Outer sheath	Heat-resistive temperature (°C)	Length per roll (m)	Remarks
T-G-0.32	T	0.32	2.1×3.2	Heat-resistive vinyl	Red	White	Brown	approx.100	100	
T-G-0.65	T	0.65	2.6×4.0	Heat-resistive vinyl	Red	White	Brown	approx.100	100	
T-6F-0.32	T	0.32	1.0×1.6	Fluoroethylene propylene	Red	White	Brown	approx.200	100	
T-6F-0.65	T	0.65	1.5×2.5	Fluoroethylene propylene	Red	White	Brown	approx.200	100	
T-GS-0.65	T	0.65	Φ7.2	Heat-resistive vinyl	Red	White	Brown	approx.100	100	Shielded
K-H-0.32	K	0.32	1.4×2.3	Glass fiber	Red	White	Blue	approx.250	100	
K-H-0.65	K	0.65	2.0×3.4	Glass fiber	Red	White	Blue	approx.250	100	

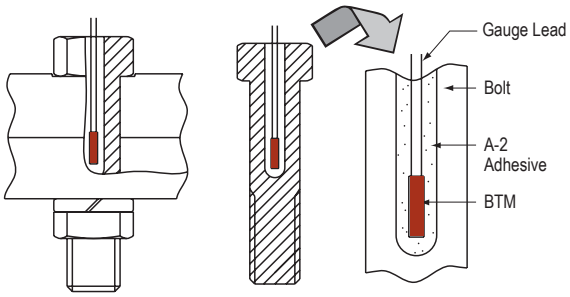
Bolt Strain Gauges BTM series CE

These gauges are used for measurement of tensile strain of bolt. They are simply inserted into pre-drilled hole in the bolt with exclusive adhesives. This method is recommendable when an ordinary strain gauges can not be mounted on the bolt surface. Accurate tensile force measurement is possible by calibrating the bolt after installing the bolt gauges.
The BTM bolt gauges use heat-curing A-2 adhesive for installation, which provides better long-term stability.

Operating temperature range −10～+80℃

Applicable adhesives
A-2 −10～+80℃

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
●Single axis						
						
BTM-1C		1	0.7	5.6	1.4	120
BTM-6C		6	1	12	1.7	120
BTM-6CTA		6	1	12	1.7	120



BTM-1C (Hole drilled : Φ1.6mm) | 1 | 0.7 | 5.6 | 1.4 | 120

BTM-6C (Hole drilled : Φ2.0mm) | 6 | 1 | 12 | 1.7 | 120

BTM-6CTA (Hole drilled : Φ2.0mm) | 6 | 1 | 12 | 1.7 | 120
Temperature integrated applicable in -10~+80°C

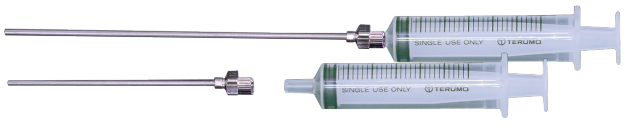
NB : Polyurethane insulation of the gauge leads is easily removed by heat of soldering iron, while Polyester sheath is removed by chemical solvent.

Minimum order quantity is 10 strain gauges.
These strain gauges are available with integral leadwires attached. (made to order)

Optional syringe and needle

Exclusive syringe for injecting A-2 adhesive into the pre-drilled hole before BTM gauge is embedded.

Applicable to	Needle diameter	Needle length
BTM-1C	1.5mm-dia.	60mm
BTM-6C	1.8mm-dia.	100mm

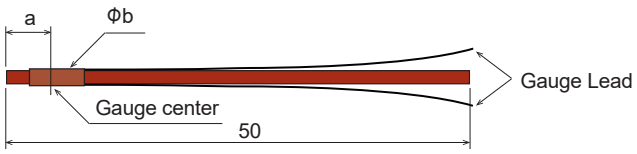


Bolt Strain Gauges BTMC series CE

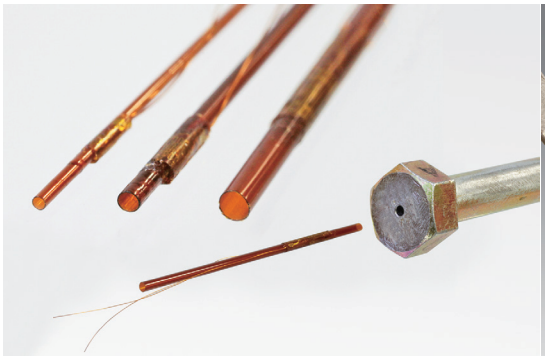
These gauges are used for measurement of tensile strain of bolt. They are simply inserted into pre-drilled hole in the bolt with exclusive adhesives. This method is recommendable when an ordinary strain gauges can not be mounted on the bolt surface. Accurate tensile force measurement is possible by calibrating the bolt after installing the bolt gauges.
The BTMC gauges have a tube shape sensing element, and they are installed with fast-curing CN adhesive. The installation is easily made at room temperature.

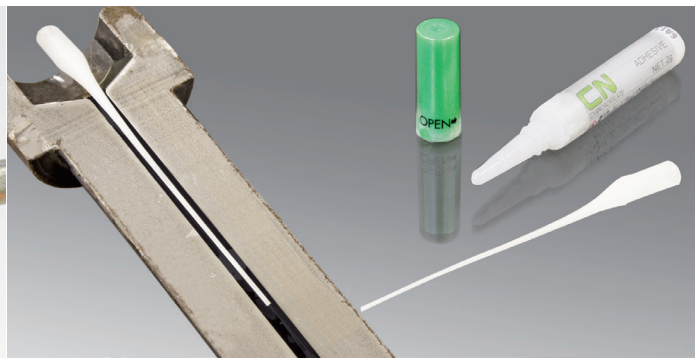
Operating temperature range
-10～+80℃

Applicable adhesives
CN −10～+80℃

Gauge pattern	Type	Gauge Length (mm)	Gauge Center a(mm)	Backing diameter Φb (mm)	Resist-ance Ω
●Single axis 	BTMC-05-D10-003LE (Hole drilled : Φ1.0mm)	0.5	5	Φ0.9	120
	BTMC-1-D16-003LE (Hole drilled : Φ1.6mm)	1	5	Φ1.5	120
	BTMC-3-D20-006LE (Hole drilled : Φ2.0mm)	3	10	Φ1.9	120

Gauge Lead: Φ0.1mm Polyimide insulated of 30mm for BTMC-05 and BTMC-1, 60mm for BTMC-3





Bolt strain gauge installation/calibration service

Currently, bolts are used in various fields for connecting structural members. Confirmation and management of the fixing condition are possible by measuring axial force applied to the bolt in machine structures, cars, airplanes, expressways, bridges, fixing of segments and so on. Also the axial force measurement is useful for knowing the strength of bolt and designing the bolt connection.

TML offers strain gauging service for measurement of axial force acting on bolts. The service includes drilling a hole, fixing the gauge, connecting the cable, and applying load calibration to the bolt supplied by the customer. Strain gauge installation service for high temperature is also available.

Processing method

There are two methods in strain gauge installation service. One is embedding, and the other is bonding.

Embedding BTM/BTMC series

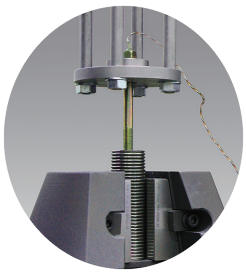
A hole of 1.0mm, 1.6mm or 2mm in diameter is drilled in the center of the bolt. The strain gauge is inserted into the hole and embedded with an exclusive adhesive. This method has the advantage of avoiding the gauge being damaged by a washer, etc. while fastening the bolt.



Bonding F, QF, ZF, CF series

Two strain gauges are bonded on both sides of the bolt shaft in axially symmetric positions to cancel the influence of bending. It is required to slightly scrape off the surface of the bolt shaft where the strain gauges are bonded, for the purpose of avoiding strain gauges being damaged while fastening the bolt or by contact of a washer. Choose strain gauges according to the usage conditions including temperature.







Important point

Embedment or installation service of strain gauges on bolts for high temperature use is available including the calibration work. Please contact us for the details.

Calibration service

In order to achieve accurate measurement, we offer calibration service in which the bolt is calibrated with specified load. Instruments and calibration machines used for the calibration service are periodically calibrated and inspected by public institutions traceable to the national standards.

Example)

Tensile test of bolt (bolt size : M10×1.25 L=65)

Load (KN)	0.0	4.6	9.2	13.8	18.4	23.0	Non-linearity (%RO)	Calibration coefficient ($kN/1\times10^{-6}$)
Strain output ($\times10^{-6}$)	0	378	747	1129	1518	1916	1.1	0.0120

Transducer-specific Strain Gauge CE

TML strain gauges are used not only for the purpose of knowing strain/stress but also as sensors for strain gauge type transducers. A strain gauge type transducer converts physical quantity such as load, pressure or displacement into mechanical strain on the strain generating body (elastic body), and the mechanical strain is converted into electrical output using strain gauges mounted on the elastic body. We offer various types of transducer-specific strain gauges featuring highly reliable and stable performance.

Force transducers (Load Cells)
Pressure transducers
Acceleration transducers
Displacement transducers
Torque transducers

VARIOUS TYPES OF TML TRANSDUCER-SPECIFIC STRAIN GAUGES

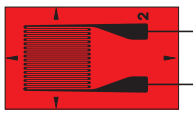
GAUGE PATTERN AND GAUGE LENGTH

Single, Rectangular 2-element, Torque (Shearing) strain measurement.

Pattern	Gauge length (mm)
Single axis	2、3
0°/90° 2-axis	2、3、6
Torque measurement	2

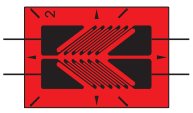
Pattern

Single axis



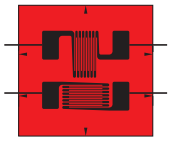
(LA)

Torque



(CT)

0°/90° 2-axis



(CB)

0°/90° 2-axis



(CM)

2 types of 0°/90° 2-axis gauge are lined-up with different pattern of gauge tab. CM-type has half-bridge configuration.

GAUGE RESISTANCE

Pattern	Gauge resistance (Ω)
Single axis	350, 1000
0°/90° 2-axis	120, 350
Torque measurement	350

Please note that 1000Ω gauge has less power consumption in bridge circuit comparing to 350Ω gauge's and limits Joule heat generation.

GAUGE BACKING MATERIALS

Unlike stress measurement gauges, the gauge backing materials for transducer-specific strain gauge cannot be determined based solely on the operating temperature and bonding method. To ensure maximum transducer performance, it is necessary to test various combinations using different stress-generating bodies (elastic bodies) to select the most suitable backing mateirals.

OPERATING TEMPERATURE

Operating temperature range differs from heat-resistive temperature. F series gauge (with epoxy backing) is also available for use of heat-curing type bonding adhesives. Refer to pages 90 and 91 for the details.

Gauge series	Gauge backing materials	Operating temperature
F	Special plastic resin	−20~+80℃
QF	Polyimide resin	−20~+200℃
EF	Polyimide resin	−20~+200℃

TEMPERATURE COMPENSATION

Similarly as general purpose strain gauges, self-temperature-compensated gauges are available in three types for mild steel, stainless steel and aluminium. Better temperature compensation is available by configuring a bridge circuit using self-temperature-compensated strain gauges. More precise temperature compensation is achieved by adding a resistor for zero point compensation in the bridge circuit.

Note) EF series gauges are self-temperature-compensated for mild steel only.

Gauge series	Self-temperature-compensation materials (Linear thermal expansion coefficient in ppm/°C)
F	-11: Mild steel -17: Stainless steel -23: Aluminium

CREEP ADJUSTMENT

The creep characteristic is particularly important in force transducers. The most common compensation system uses the material creep (+) of the stress-generating body (elastic body) and the gauge creep (–) to cancel each other. Various TML strain gauges are available for creep adjustment and are selectable by creep code.

Creep code

Gauge creep	Large ⟶ Small
Creep code	C2 > C4 > C6 > C8

TEMPERATURE SENSITIVITY COMPENSATION

Elastic modulus of strain-generating body (elastic body) varies with temperature. In the same manner, as ambient temperature around the strain-generating body varies, it results in a change of measured strain under loaded condition. To reduce such temperature influence, sensitivity compensation resistor is assembled in bridge circuit.

Coding system of Transducer-specific strain gauges

FLA -2 -350 -C2 -11 (-F)

- -2: Gauge length
- -350: Gauge length
- -C2: Creep code
- -11: Self-temperature-compensation number
  - 11: Mild steel
  - 17: Stainless steel
  - 23: Aluminium
- (-F): Option F : LEAD-free soldering of leadwire

Other Strain Gauges for Transducers

Operating temperature range
−80～+150℃

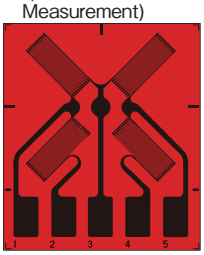
Applicable adhesives
C1 −80～+150℃
EB-2 −80～+150℃

Please specify the type number as shown in the example below.

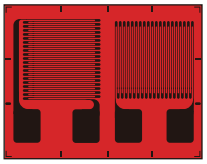
FT - 6 - 350 - 4S - 11 - NOL

- Gauge resistance
- Gauge length
- Gauge series name

Gauge pattern	Type	Gauge size(mm) Length	Gauge size(mm) Width	Backing size(mm) Length	Backing size(mm) Width	Resistance Ω
Single axis 4-Element (for Shear Strain Measurement) / 0° /90° 2-axis Distributed Type	FT-6-350-4S	6	2.6	20	30	350
	FT-6-1000-4S	6	2.6	20	30	1000
	FCB-6W-350-4S	6	7.4	14	18	350
	FCB-6W-1000-4S	6	7.4	14	18	1000



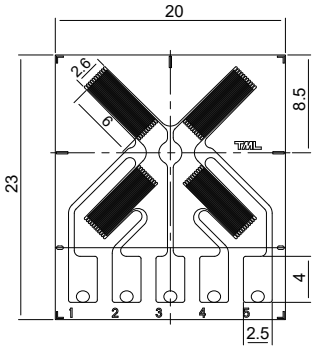
(FT)



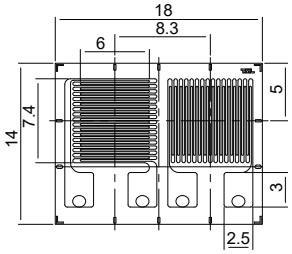
(FCB)

*Scale is not 1:1

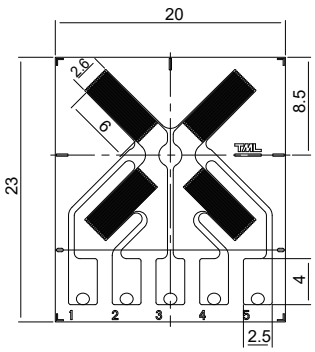
●External Dimensions



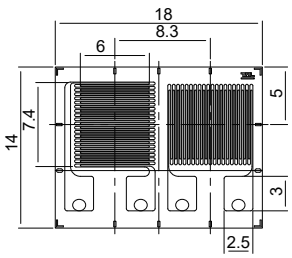
FT-6-350-4S-[a]-NOL



FCB-6W-350-[a]-NOL



FT-6-1000-4S-[a]-NOL



FCB-6W-1000-[a]-NOL

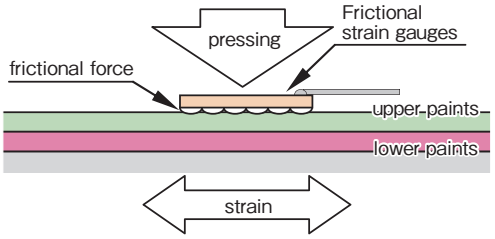
Frictional Strain Checker FGMH series

CE

No bonding is required for strain measurement on steel

Features

- Easy mounting and detaching by lever operation
- Paint removal, grinding, bonding and curing are not necessary
- Can be used repeatedly
- Strain measurement in three directions (FGMH-3A)

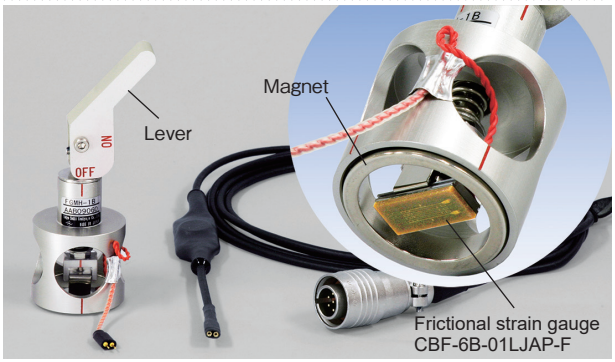


The Strain checker FGMH series measures strain using frictional force working on the contact surface of the frictional strain gauge by pressing the gauge against the structure with magnetic force. Unlike bondable strain gauges, surface preparation and bonding works are not required for this gauge, thus the works required for strain measurement are largely reduced. In combined use with a handheld type strainmeter, the strain checker



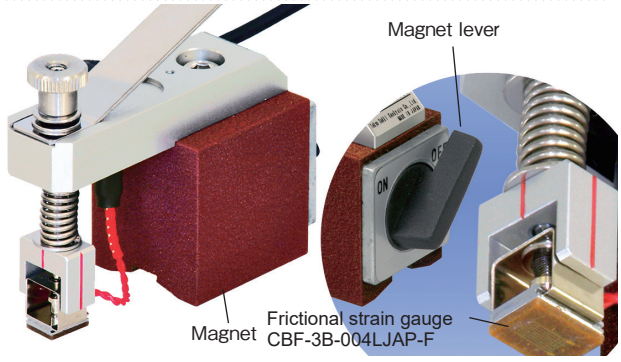
can easily measure strains on steel materials such as bridges by changing measurement point one after another. It is the most suited to preparatory measurements before starting a long term measurement.
In the FGMH series, three types are available. They are FGMH-1B and FGMH-2A both for single axis measurement and FGMH-3A for 0°/45°/90° three-axis measurement.

FGMH-1B (Single axis measurement)



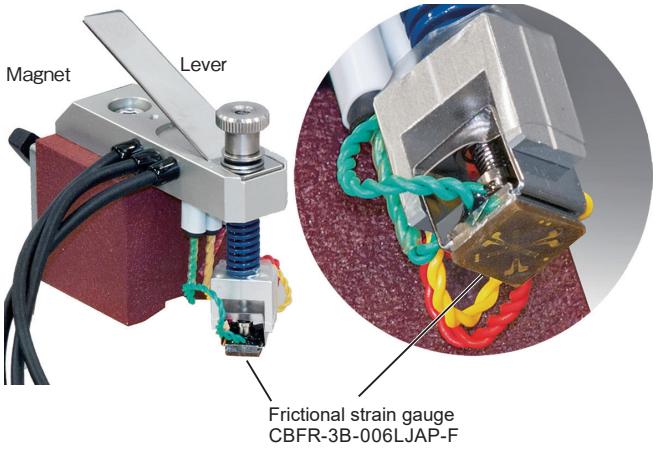
The FGMH-1B is a strain checker constructed small and light. The frictional strain gauge is set to on, off and replacing position by the operation of lever, thus allowing easy handling of the strain checker.

FGMH-2A (Single axis measurement)



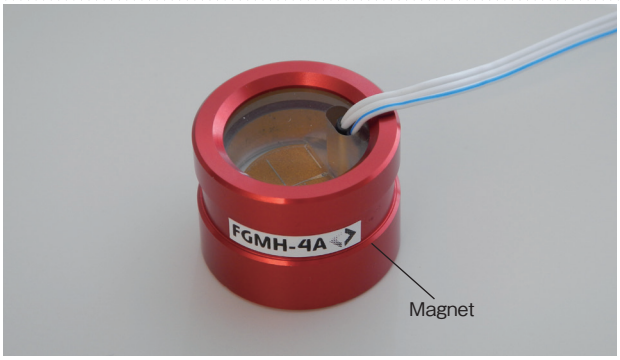
The FGMH-2A is a strain checker especially designed for measurement on a small area such as the vicinity of a welded part. It can be easily attached to and detached from measurement object by the operation of magnet lever. In addition, a lever is provided on the upper part to slightly lift the frictional strain gauge from the measurement surface by pushing the lever downward. It enables easy adjustment of the direction of the strain gauge.

FGMH-3A (Three-axis measurement 0°/45°/90°)



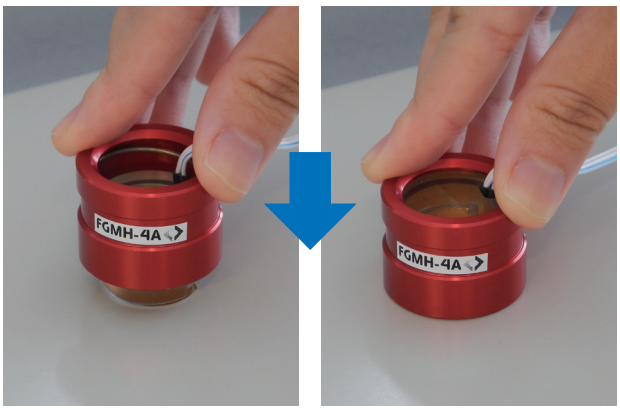
The FGMH-3A is a strain checker for three-axis measurement in 0°/45°/90°. Principal stress (principal strain) and its direction can be found by applying rosette analysis calculation to the measured strain values in three directions. It is applicable to measurement in the vicinity of weld bead like as the FGMH-2A. Also similarly as the FGMH-2A, it can be easily attached to and detached from a measurement object by the operation of magnet lever. Another lever is provided for easy adjustment of the direction of the strain gauge.

FGMH-4A (Single axis measurement)



The FGMH-4A is a new, smaller and lighter Frictional Strain Checker that is an evolution of the FGMH-1B.
Compared with the Frictional Strain Checker FGMH-1B, the overall holder length has been reduced by approximately 55% (from 65 mm to 29 mm) and the holder mass by approximately 50% (from approximately 60 g to 30 g).
*Frictional strain gauges are available with a gauge resistance of 120 Ω and a gauge length of 3 mm or 6 mm

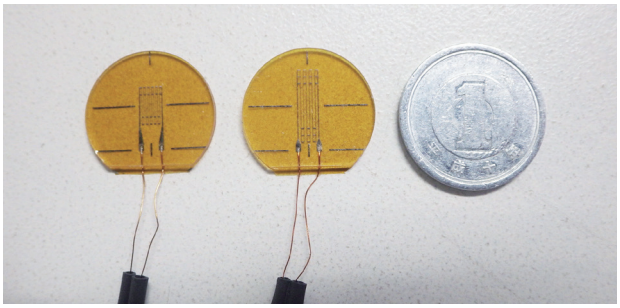
● One touch operation
Pressed from above and fitted in the measuring position



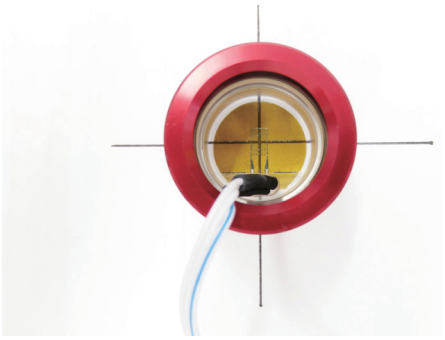
The magnetic attraction presses the friction-type gauge against the measuring section for measurement

Measurement image of steel girder section





Frictional strain gauge
CBF-3C-02LJBT-F
CBF-6C-02LJBT-F



The frictional strain gauge is a consumable part.
If it is stained, deteriorated or damaged, replace it with a new one.

Option : Applicable frictional strain gauge

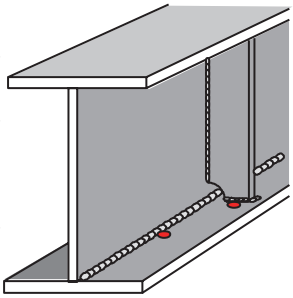
Type	Applicable frictional strain gauge (CE compliant)
FGMH-1B	CBF-6B-01LJAP-F
FGMH-2A	CBF-3B-004LJAP-F
FGMH-3A	CBFR-3B-006LJAP-F
FGMH-4A	CBF-3C-02LJBT-F CBF-6C-02LJBT-F

Application examples

- Preparatory measurement of bridge which will undergo a long term measurement
- Investigation of neutral axis position of composite girder bridge
- Stress direction of structural member of bridge on which fatigue crack is initiated
- Stress measurement of newly built bridge where paint removal is not available.

Strain measurement in a narrow area

Stress concentration is caused in the vicinity of weld bead, which is deposit of welded materials along the welding pass. The strain checker FGMH-2A/FGMH-3A is capable of strain measurement in a narrow area such as the vicinity of weld bead because it is easily attached and detached by ON/OFF operation of the magnet lever. Strain in three directions can be measured simultaneously by the use of FGMH-3A.



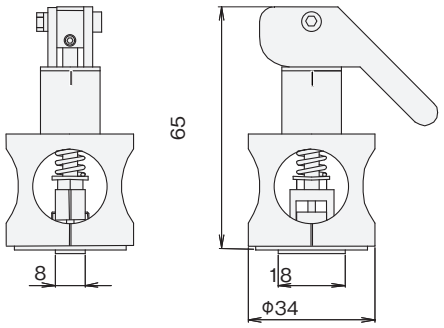
Specifications

Type	FGMH-1B	FGMH-2A	FGMH-3A	FGMH-4A
Number of axes	Single axis		Three-axis	Single axis
Gauge length	6mm	3mm		3mm or 6mm
Operating temperature	0 ～ +60℃			
Compensated temperature range	0 ～ +60℃			
Objective material	Metal, Steel (Coefficient of thermal expansion 11ppm/ºC)			
Gauge factor	Approx. 2.00			
Input/Output resistance	120Ω			
Measurement mode	Full bridge			
Input/Output cable	–	Φ3mm 0.05mm^2 4-core shielded chloroprene cable of 2m NDIS 7-pin plug attached		–
Supplied cable	Leadwire with bridge circuit board 2m, NDIS 7-pin plug attached	–		Φ3mm 0.05mm^2 4-core shielded chloroprene cable 2m with NDIS-plug(Type : FGL-2B)
Weight (excluding cable)	Approx. 60 g	Approx. 260g		Approx. 30g

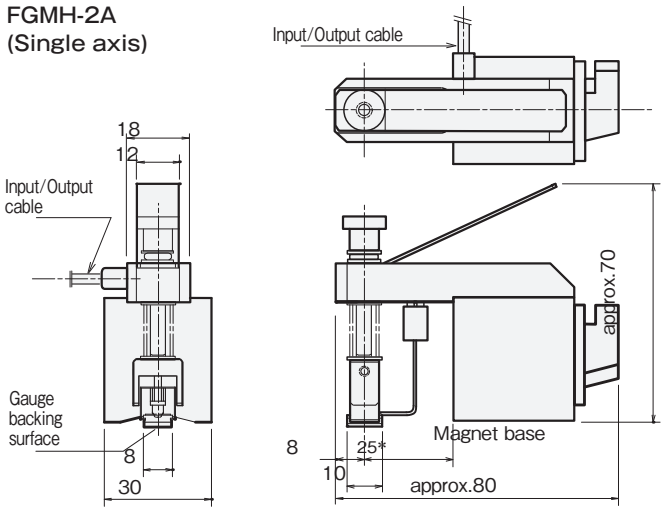
Note:
・The strain checker is installed on a measurement object by magnetic force. It is not applicable to measurement on non-magnetic materials.
・The strain checker is not applicable to the use on a curved or uneven surface.
・If the vicinity of the strain checker is hit strongly with a hammer or equivalent, a shift in the measured value may be caused.
・Correct measurement may not be possible by the strain checker on a machine or structure experiencing strong vibration.
・For more precise measurement, it is recommended to remove the paint and to bond an ordinary strain gauge on the base metal surface.

Dimensions

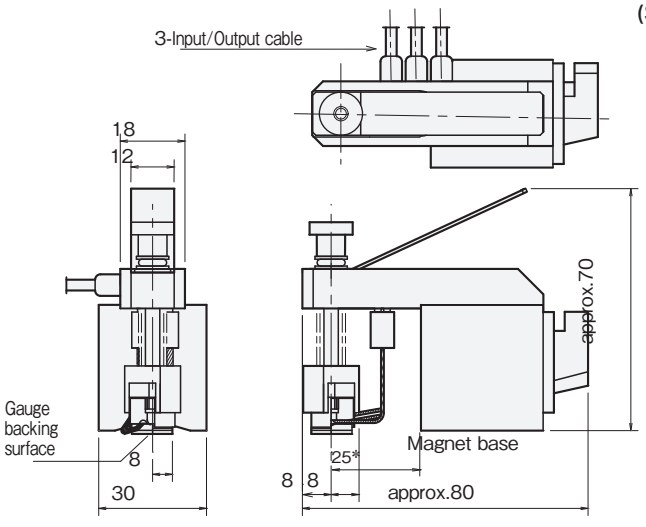
FGMH-1B
(Single axis)



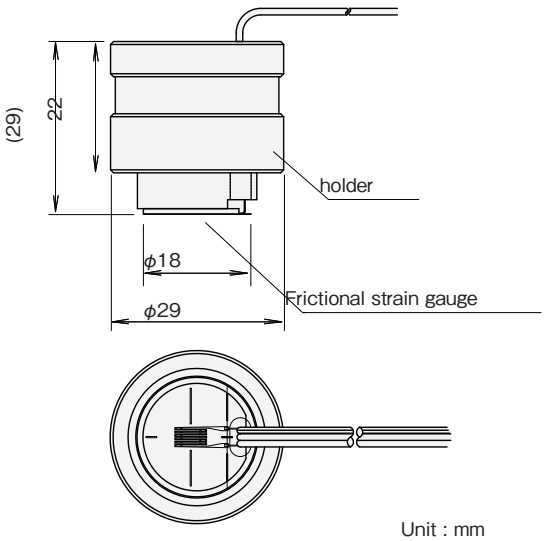
FGMH-2A
(Single axis)



FGMH-3A(0°/45°/90° Three-axis)



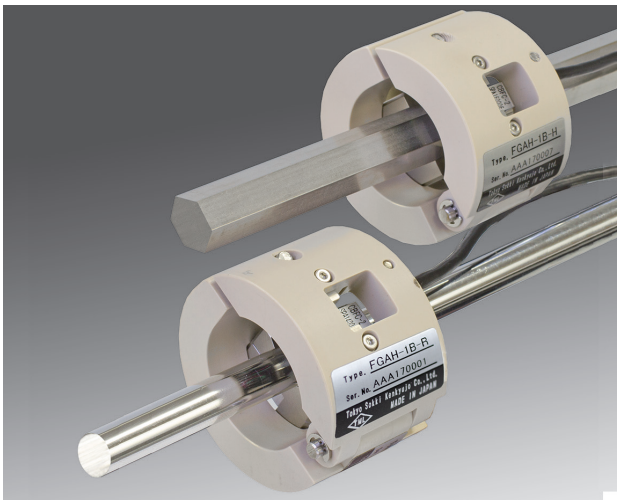
FGMH-4A
(Single axis)



Unit : mm

*: Where the gauge backing surface is in parallel with the magnet base. (FGMH-2A, FGMH-3A)

Frictional Axial Strain Transducer FGAH-1B



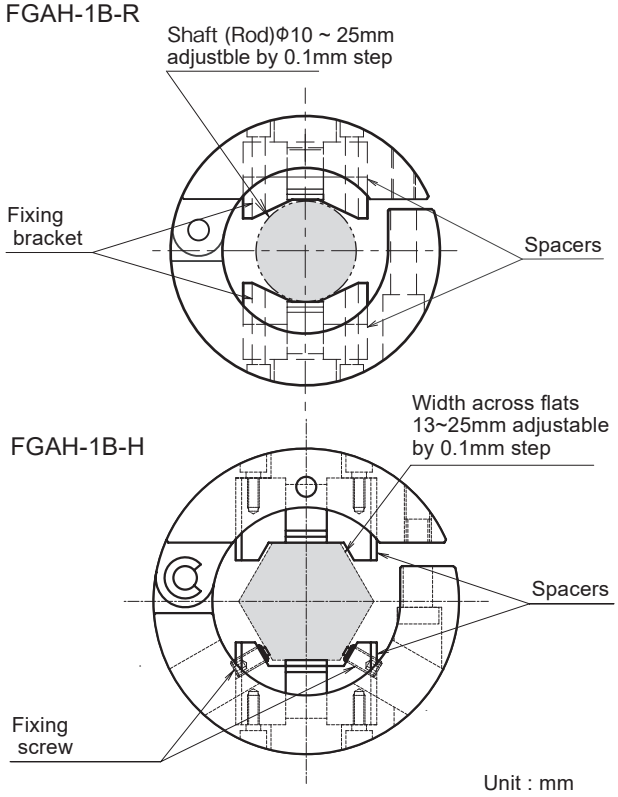
Applicable not only for tie-rod of motor cars but also for tension rod of architectural structures

Features

- Easily installed by just clamping-on without detaching the existing tie-rod
- Tensile force management of rod between sheet piles or in architectural structures is easily achieved – The transducer can be used repeatedly
- Applicable rod:
  FGAH-1B-R : Diameter is 10 to 25mm
  FGAH-1B-H : Width cross flats 13 to 25mm
  (Optional spacers are required)
- Small and light construction which allows installation in a narrow space

Dimensions

FGAH-1B-R



This transducer measures axial strain of steering tie-rod of a car and consists of two types FGAH-1B-R and FGAH-1B-H for which a cross section of the rod is round shape or hexagon's. It is also suited to measure axial strain of a tension rod used in aseismic reinforcement structure or in steel frame structure. Since frictional strain gauges are used in this transducer, installation is completed and it gets ready for measurement by merely pinching the rod with the transducer, without detaching the rod. There is no need of technical skill and complicated works for attaching strain gauges on the rod.

NB:

- Frictional strain gauges are consumable parts.
  Applicable type of frictional strain gauges is CBFC-2 (option).

Specifications

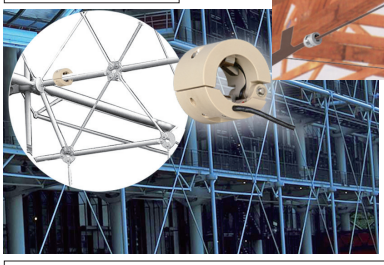
Type	FGAH-1B-R	FGAH-1B-H
Applicable shaft	Round shape Φ10 ~ 25mm	Hexagon shape Width across flats 13 ~ 25mm
Capacity	±1000×10^{-6} strain	
Rated output	Approx. 2600×10^{-6} strain	
Non-linearity	1%RO	
Allowable temperature range	-30 ~ +60°C (no dew condensation)	
Frequency response	Approx. 6.5kHz	
Input/output resistance	1000Ω±3%	
Dimensions	Approx. Φ52x35mm	
Weight	Approx.55g(excluding spacers and cable)	
Protection rating	Equivalent to IP51	
Recommended exciting voltage	2V	
Allowable exciting voltage	5V	
Input/output cable	Φ3.2mm 0.08mm² 4-core shielded vinyl cable 5m	

Installation image

Installation on tension rod of aseismic reinforcement structure



Turnbuckle part



Installation on steering tie-rod of a car





Frictional Torque Sensor FGDH-4A

Easy torque measurement by simply fitting!

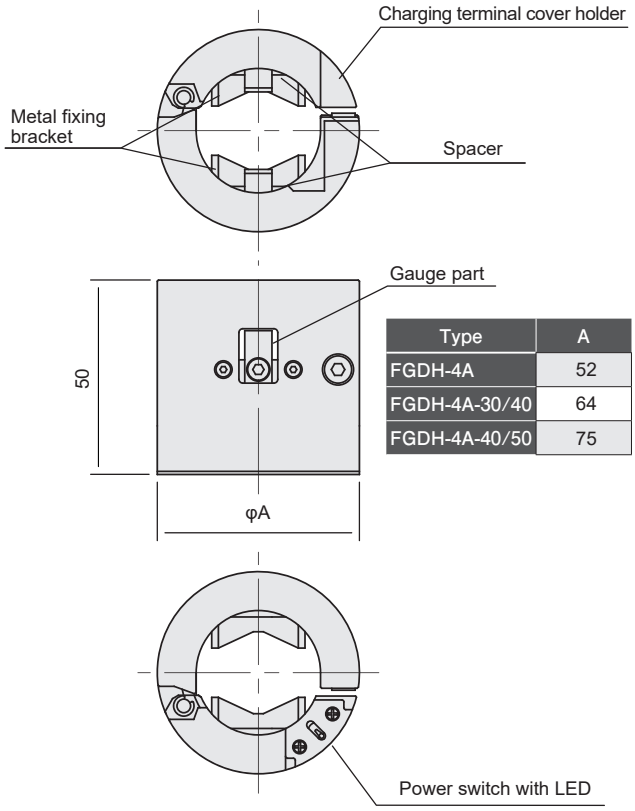
Features

- Longer measurement time! (Conventional FGDH-3A: 6 hours, New product FGDH-4A: 10 hours) Lasts approx. 1.7 times longer!
- Switchable between three ranges of ±3200, ±6400, ±16000×10^{-6}
- Available as a transmitting unit for affixed strain gauges!
- High-speed processing means that the delay time for digital telemetry is less than 1/10th of that of conventional systems!



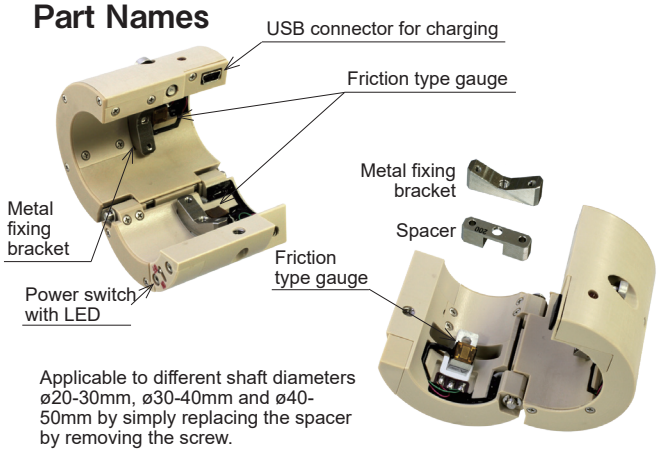
The FGDH-4A friction-type torque sensor system measures the torque generated on a rotating shaft and transmits the digital data wirelessly.
The radio bandwidth of 2.4 GHz allows for long transmission distances and easy installation of a receiving antenna.
The sensor is simply mounted by clamping the shaft and fastening with screws.
The applicable shaft diameter is ø20-30mm, ø30-40mm and ø40-50mm.

Exterior Dimension



Type	A
FGDH-4A	52
FGDH-4A-30/40	64
FGDH-4A-40/50	75

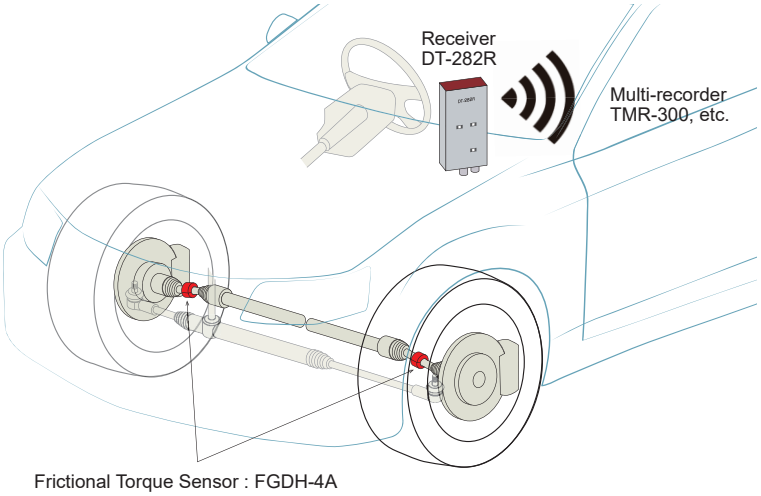
Part Names



Applicable to different shaft diameters ø20-30mm, ø30-40mm and ø40-50mm by simply replacing the spacer by removing the screw.

Frictional Torque Sensor System





Frictional Torque Sensor : FGDH-4A

Specifications

Type	FGDH-4A	FGDH-4A-30/40	FGDH-4A-40/50
Applicable shaft diameter	φ20.0 to 30.0mm	φ30.0 to 40.0mm	φ40.0 to 50.0mm
Capacity	Depends on the diameter (outer and inner), material, surface roughness and surface treatment of the shaft*		
Output	Depends on the diameter (outer and inner), material, surface roughness and surface treatment of the shaft*		
Allowable temperature	-20 to +60 °C (No dew condensation)		
Sampling frequency	5kHz		
Frequency response	1kHz		
Wireless specifications	2.4 GHz band advanced low power data communication system		
Number of radio channels	16 channels (paired with receiver radio channels)		
External Dimensions	φ52×50mm	φ64×50mm	φ75×50mm
Weight(spacer excluded)	Approx. 85 g (Excluding spacers)	Approx. 130 g (Excluding spacers)	Approx. 160 g (Excluding spacers)
Protection rating	Equivalent to IP51		
Continuous operating time	Approx. 10 hours (23 °C ±5°C)		
Power supply	lithium-ion rechargeable battery		
Accessory	USB charger (FGDHF-51) / USB cable (mini-B-A) CR-6187		

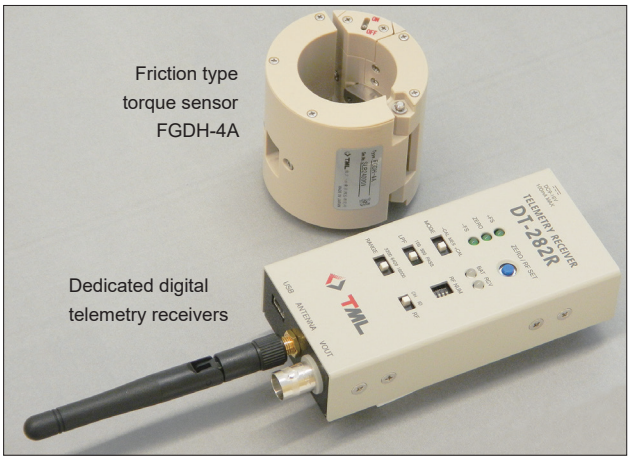
Option :

- AC Adapter (CR-1869)
- AC Adapter [For China] (CR-1869-C)

* Some shafts may not be applicable depending on the shaft material, surface roughness and surface treatment.
Please contact the sales person in charge in advance.

Test conditions

- Torque 500N·m
- Output 2500mV(equivalent to 8000 x 10^{-6} strain)
- Non-linearity 1%RO(when output is 8000 x 10^{-6} strain)
- Conditions of test piece
  1. Diameter 20mm
  2. Material SNCM439
  3. Elastic Modulus 210000 N/ mm^2(test result by TML)
  4. Poisson's Ratio 0.29(test result by TML)
  5. Surface roughness Ra3.2
  6. Hardness HRC38



Specifications Dedicated digital telemeter receiver DT-282R

Radio part	
Received point	1
Wireless specification	2.4 GHz band advanced low power data communication system
Number of radio channels	16 channels (Switching by radio channel switching SW)
Wireless antenna connection terminal	SMA connector
Power output section	
Voltage output connector	BNC connector
Voltage output	±5V Selected by strain output range selector switch ±16000×10^{-6} strain ±6400×10^{-6} strain ±3200×10^{-6} strain
Voltage output accuracy	±0.5% FS (whole system)
Stability Zero point	±0.55mV/°C (whole system)
Stability Sensitivity	±0.05% FS/°C (whole system)
Calibration output level	±5V
Low-pass filter	100Hz, 500Hz, PASS (1kHz)(-3dB±1dB)
Equilibrium adjustment range	±6000×10^{-6} strain
Equalization accuracy	±5mV
Display and operation	Strain output range selector switch, LPF selector switch, calibration output selector switch, balance adjustment switch, output level LED

General	
Rated voltage	DC9 to 16 V
Current consumption	80mA MAX (DC12V supply +23 °C±5°C
Operating temperature /humidity range	0 to +50°C 85%RH or less (excluding condensation)
External dimension	48(W)×23.5(H)×100(D)mm (Excluding projections)
Weight	Approx. 140 g
Accessory	BNC coaxial cable (CR-31)

* DT-282R is not compatible with DT-182R

Option :

- AC Adapter (CR-1869)
- AC Adapter [For China] (CR-1869-C)

Dedicated digital
telemeter receiver
DT-282R



Residual Stress Measurement

Residual stress, which is caused in structural parts by heat treatment, welding or loading of the parts, lowers the strength and fatigue strength of the structures because the residual stress is added to the actual load even if the actual load is within the allowable range. Evaluation of residual stress is an important factor for improving the machining accuracy, evaluating the integrity and diagnosing the surplus life of the structural parts.
Residual stress measurement using a strain gauge has the advantage of directly measuring strain as nominal stress value. However, it is difficult to know residual stress in general strain measurement. There are two methods for measuring residual stress using strain gauges. One is a partial release method (mainly drilling method) to release the residual stress locally by making a slit or hole in the vicinity of the strain gauge. Another is a full release method (mainly cutting method) to release the residual stress by cutting around the strain gauge by machining. We supply strain gauges dedicated to residual stress measurement.

Method using partial release

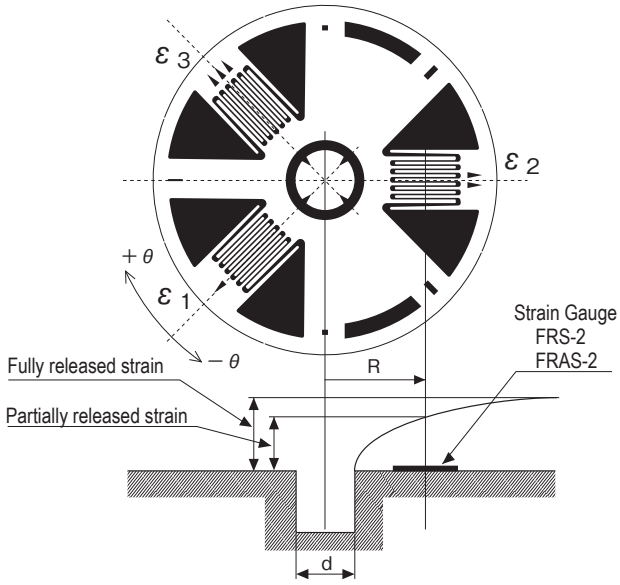
This method is applied when a slight mechanical destruction (semi-destruction) is allowed for the specimen even though it cannot be fully destroyed. A hole of approximately 2 mm in diameter and 3 mm in depth will be made. A strain gauge dedicated to residual stress measurement is bonded on the measurement position and a hole is drilled in the center of the strain gauge. Partial release strain generated by the drilling is measured, and residual stress is calculated using the strain and parameters such as drilling diameter and elastic modulus and Poisson's ratio of the specimen. Since the hole must be drilled exactly in the center of the strain gauge, and strain by machining must not be induced, dedicated tools and drilling apparatus are used.

Residual stress measurement using drilling method

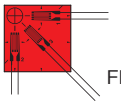
In the partial release method using FRS strain gauge, residual stress is calculated from the partially released strain generated by drilling a small hole on the specimen. This method is introduced in ASTM Standard E837 (Determining Residual Stress by the Hole-Drilling Strain Gage Method).

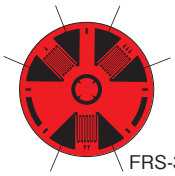
Applicable strain gauge	FRS-2 (gauge length : 1.5mm) FRAS-2 (gauge length : 2mm)
Operating temperature range	–196 ~+150°C
Temperature compensation range	+10 ~+100°C
Applicable adhesives	CN

Please refer to page 42, 90 and 91 for the detailed specifications.

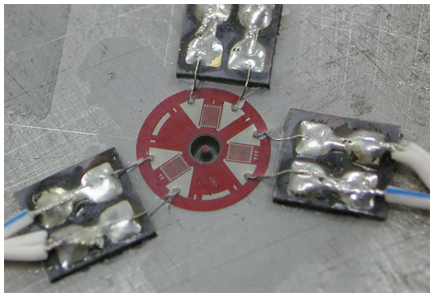


Strain gauges for residual stress measurement by hole drilling method


FRAS-2


FRS-3

Type	Gauge size(mm) Length	Width	Backing size(mm) Length	Width	Gauge center diameter (mm)	Resistance (Ω)
FRAS-2	2	1.1	9	9	Φ7.0	120
FRS-2	1.5	1.3	Φ9.5		Φ5.14	120
FRS-3	3	2.6	Φ17.5		Φ10.26	120



Maximum residual stress

$$\sigma_{max} = \frac{\varepsilon_1 + \varepsilon_3}{4A} + \frac{\varepsilon_1 - \varepsilon_3}{4B\ cos2\theta}$$

Minimum residual stress

$$\sigma_{min} = \frac{\varepsilon_1 + \varepsilon_3}{4A} - \frac{\varepsilon_1 - \varepsilon_3}{4B\ cos2\theta}$$

Angle from ε_1 axis to the direction of Maximum residual stress (positive (+) for clockwise direction from ε_1 axis)

$$\theta = \frac{1}{2} \tan^{-1} \frac{\varepsilon_1 + \varepsilon_3 - 2\varepsilon_2}{\varepsilon_3 - \varepsilon_1}$$

Here, A and B are constants determined by the drilled hole diameter and the gauge center radius.

$$4A = -\frac{(1+\nu)d^2}{2ER^2} \qquad 4B = -\frac{2d^2}{ER^2} + \frac{3(1+\nu)d^4}{8ER^4}$$

ν : Poisson's ratio
d : Drilled hole diameter
$\varepsilon_1 \sim \varepsilon_3$: Measured strain
R : Gauge center radius
E : Young's modulus

Method using full release

When the specimen is allowed to be destroyed, a strain gauge is bonded on the measurement position and whole circumference of the position is cut to fully release the residual stress. The residual stress is calculated by stress analysis using the change of strain resulted from the cutting.

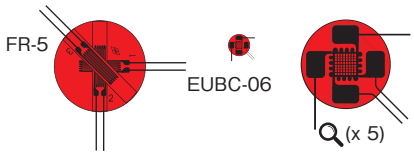
Residual stress measurement using cutting method

Strain gauge to be used is selected from single-axis gauge, 2-axis gauge, 3-axis gauge and stress concentration measurement gauge according to the condition.
Also in the full release method, care must be taken not to allow any strain by machining is induced and not to damage the strain gauge during the cutting.
As the cutting method, cutting grinder with a thin cutter or electrical discharge machining is utilized. These methods cause little machining stress.
Generally, measurement is made using a data logger (static strain meter).
A strain gauge is installed on the measurement position, and initial unbalance value is measured. If the strain gauge and its wiring are exposed to cutting fluid, protective coatings are applied, or the leadwire is once detached and only the strain gauge part is coated before the cutting process. Cut the specimen so as not to induce machining stress.
If temperature change is caused by the cutting, carry out measurement after the temperature returns to normal.
Use the same channel of the same instrument for measurements before and after the cutting. This is because initial unbalance values are not consistent for different channels or instruments.

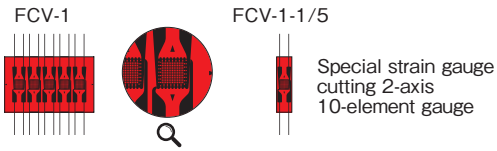
Applicable strain gauge	FR-5 (gauge length : 5mm 3-axis) EUBC-06 (gauge length : 0.6mm 2-axis) FCV-1 (gauge length : 1mm 2-axis × 5 paralleled)
Operating temperature range	–196 ~+150°C
Temperature compensation range	+10 ~+100°C
Applicable adhesives	CN

Please refer to page 42, 43, 90 and 91 for the detailed specifications.

For residual stress measurement



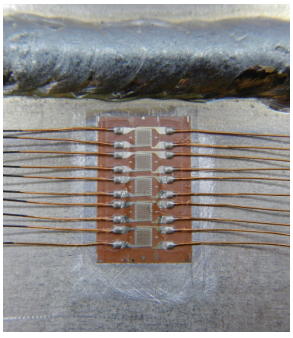
2-axis 10-element (5 paralleled)



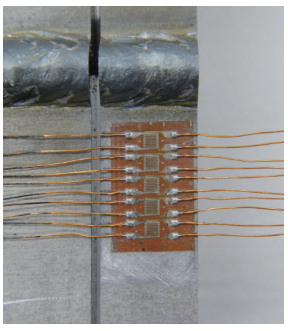
-005LE: With polyimide leadwire 5 cm



Weld bead (rosette strain gauge)



Weld bead (strain gauge for stress concentration)



After cutting and releasing

Strain Gauge Adhesives



CN CN-E CN-Y CN-R P-2 RP-2

Type		Contents	Component	Applicable specimen	Operating temperature	Curing temperature and time	Shelf life
CN	Single component Room-temperature-curing	Single 2g x 5	Cyanoacrylate	Metal, Plastics Composite	–196~+120°C	Room temperature 20sec.~1 min. (thumb pressure)	6 months
CN-E	Single component Room-temperature-curing	Single 2g x 5	Cyanoacrylate	Concrete Mortar, Wood	–30~+120°C	Room temperature 40sec.~2 min. (thumb pressure)	6 months
CN-R	Single component Room-temperature-curing	Single 2g x 5	Cyanoacrylate	Metal, Plastics Composite	–30~+120°C	Room temperature 10~30sec. (thumb pressure)	3 months
CN-Y	Single component Room-temperature-curing	Single 2g x 5	Cyanoacrylate	Metal, Plastics Composite	–30~+80°C	Room temperature 60 sec.~2 min. (thumb pressure)	6 months
P-2	Two-component Room-temperature-curing Mixing ratio: 2~6%	A: 25g * B: 3g *	Polyester	Metal	–30~+180°C	Room temperature Pressure 50~300kPa 2~3 hrs.	6 months
RP-2	Two-component Room-temperature-curing Mixing ratio: 2~4%	A: 25g * B: 3g *	Polyester	Concrete Mortar	–30~+180°C	Room temperature Pressure 50~300kPa 2~3 hrs.	3 months
PS	Two-component Room-temperature-curing Mixing ratio: 2~4%	A: 25g * B: 3g *	Polyester	Concrete Mortar Wood	–30~+100°C	Room temperature 2~3 hrs.	3 months
NP-50B	Two-component Room-temperature-curing Mixing ratio: 3~4%	A: 25g * B: 3g *	Polyester	Metal Composite	–30~+300°C	Room temperature Pressure 50~300kPa 16 hrs.	6 months
C-1	Single component Heat-curing	Single 25g *	Phenol	Metal	–269~+200°C	Pre-curing at 130°C 1 hr., pressure 200~300kPa. Post-curing at 200°C 1 hr. without pressure	3 months
EA-2A	Two-component Room-temperature-curing Mixing ratio: 2:1	A: 25g * B:12.5g*	Epoxy	Metal, Concrete Composite	–269~+50°C	Pressure at 50~300kPa. Room temperature 1 day, or at 50°C 2 hrs.	3 months
EB-2	Two-component Room-temperature-curing Mixing ratio: 10: 3	A: 10g x3 B: 3g x3	Epoxy	Metal Composite	–60~+200°C	Room temperature 1 day Pressure 50~200kPa.	3 months
A-2	Two-component Heat-curing Mixing ratio: 10: 1	A: 25g * B: 5g *	Epoxy	Bolt	–30~+100°C	Room temperature 12 hrs. and 140°C 3 hrs.	3 months

NB: Shelf life

Effective storing duration on condition that the adhesive is properly kept in a cool, dry and dark place such as a refrigerator (+5~+10°C, do not store in a freezer).

Thumb pressure 100~300kPa

SDS : Safety Data Sheet

TML supplies SDS for all its strain gauge adhesives and coatings. Contact your TML supplier for more information.

For two-component adhesives, use the supplied mixing vessles.

Mixing vessles: Polyethylene make
75mm-diameter, 10mm depth

* These contents are for outside Japan
(Dangerous Goods in Excepted Quantities)



PS　NP-50B　C-1　EA-2A　EB-2　A-2

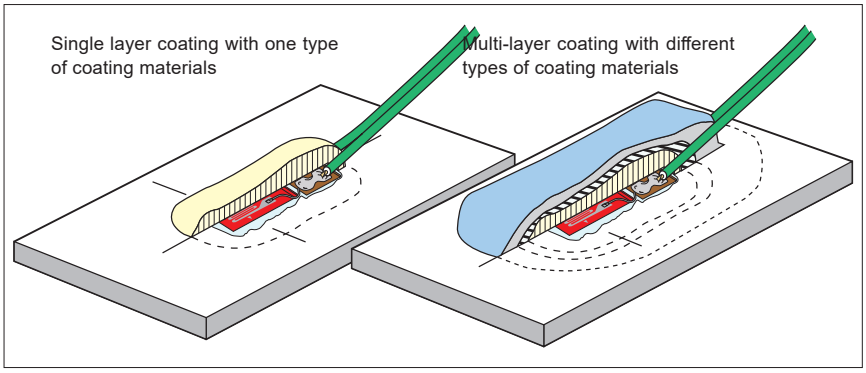
	Applications
	Single component adhesive for strain gauges. The time required to bond the gauge is extremely short and handling is very easy. The thin bonding layer allows adhesion to plastic objects as well as metal. Measurement of large strain (post-yield measurement) is possible until the next day of bonding of the strain gauge. Note) Use protective eyewear when using this adhesive.
	Single component adhesive featuring high viscosity for bonding strain gauges to porous materials such as concrete and mortar. Note) Use protective eyewear when using this adhesive.
	Single component adhesive for accelerating cures in lower ambient temperature, or lower relative humidity. Note) This adhesive is sold only for a limited time. (from October to the next April) Note) Use protective eyewear when using this adhesive.
	Single component adhesive designed exclusively for use on post-yield strain gauge. Offers minimum degradation in bonding performance (peel strength) due to aging. Suitable when a large strain measurement is made after a few days or more of bonding the strain gauge. Measurement of large strain (post-yield measurement) is possible even after one year of bonding. Note) Use protective eyewear when using this adhesive.
	Two-component room-temperature-curing polyester adhesive for bonding PF, P and F series strain gauges. Put the necessary quantity of drug A in the supplied mixing vessel, then add drug B by drops to total 1~3% in weight of drug A. Use the mixed adhesive within 10~20 minutes.
	Two-component room-temperature-curing polyester adhesive for bonding PF and P series strain gauges. The mixing procedure is the same as above for P-2 adhesive. Put the necessary quantity of drug A in the supplied mixing vessel, then add drug B by drops to total 2~4% by weight of drug A. Use the mixed adhesive within 10~20 minutes.
	Two-component room-temperature-curing polyester adhesive. Use as a surface precoating agent for bonding P and PF series gauges to concrete and also as an adhesive for WFLM series gauges. The special filler contained exhibits alkali resistance and effectively shuts off moisture and gas from inside of the concrete. Its high viscosity enables use on vertical walls or ceilings.
	Two-component room-temperature-curing polyester adhesive for bonding QF, ZF and BF series strain gauges. Put the necessary quantity of drug A into the supplied mixing vessel then add drug B by drops to total 2~3% by weight of drug A. Use the mixed adhesive within 5~20 minutes.
	Single-component heat-curing type adhesive. For use on strain gauges that are suited to heat curing. Enables reliable measurement for long periods and in high temperature up to 200°C.
	Two-component room-temperature-curing epoxy adhesive for bonding CF series strain gauges for use in temperature from cryogenic (–269°C) up to 50°C.
	Two-component room-temperature-curing epoxy adhesive for bonding strain gauges for use in temperature from –60 to +200°C. Enables stable measurement for a long period of time.
	Two-component heat-curing epoxy adhesive for bonding BTM strain gauges.

Important point

- In general, curing time of an adhesive called "room temperature curing type" is largely affected by environmental conditions such as temperature and humidity. Referring to the curing conditions described in the supplied operation manual, it is recommended to carry out a "test curing" on the site.
- A trace of water in the air is required to cure the CN adhesive (cyanoacrylate). Therefore the curing time is largely affected by humidity rather than temperature.

Coating Materials

The type of coating required and the application method differ depending on the environment in which the strain gauge is used. In general, if one type of coating is not sufficient, multiple coatings can be combined to protect the strain gauges. At TML, the coating applied directly to the surface of the strain gauge is referred to as the first coating with subsequent coating layers referred to sequentially as the second coating, third coating, etc. Multi-layer coatings offer better strain gauge protection.



Type	Materials	Color	Contents	Operating temperature	Curing conditions	
W-1	Microcrystalline wax solid	Light yellow	500g	0~+50°C	Hot melting +100~+120°C Hardening in room temperature	
N-1	Chloroprene rubber based solvent thinned	Light yellow	25g *	–30~+80°C	Air-drying A half day in room temperature	
K-1	Special rubber based solvent thinned	White	25g *	–269~+60°C	Air-drying A half day in room temperature	
UE-1	Special rubber based solvent thinned	Brown	25g *	–40~+150°C	Air-drying A half day in room temperature	
SB tape	Butyl rubber	White	10mm(wide)x3mm (thick) 5m long/roll	–30~+80°C	Pressure sensitive	
VM tape	Butyl rubber	Black	38mm(wide) x1mm (thick) 6m long/roll	–20~+80°C	Pressure sensitive	
KE-348W	Silicone rubber	White	100g	–50~+200°C	Air-drying A half day in room temperature	
KE-348T		Transparent	100g			
TSE3976-B	Silicone rubber	Black	100g	–50~+250°C	Air-drying One day in room temperature	

SDS : Safety Data Sheet

TML supplies SDS for all its strain gauge adhesives and coatings. Contact your TML supplier for more information.

Coatings in special substances

For use in special substances such as acids, alkalis and alcohols, contact TML or your local representatives.

* These contents are for outside Japan (Dangerous Goods in Excepted Quantities)

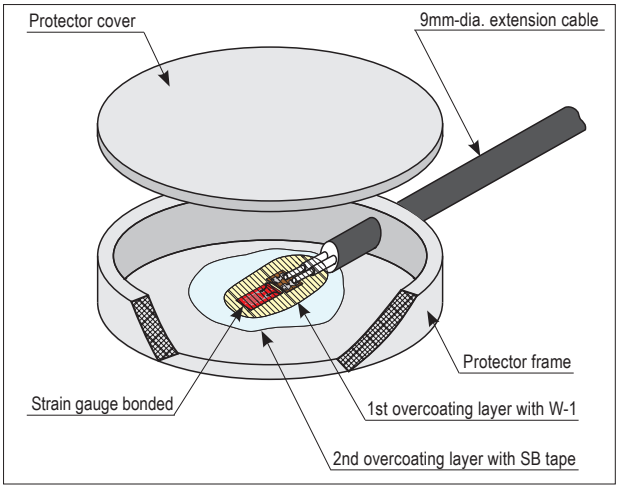


	Purpose	Applications
	Moisture- and water-proofing coating for laboratory and field requirements where mechanical protection is not needed, or used as the first coating for multi-layer coating.	The solid W-1 is put into a heating appratus (temperature-regulated oil bath is recommended) and completely melted at 100 to 120°C. The hot melted W-1 is applied over the area to be coated with a brush. The W-1 cools down and turns into solid as soon as applied. It is usually applied repeatedly till the cooled W-1 forms an adequate thickness.
	Moisture- and water-proofing coating for laboratory and less severe field requirements where mechanical protection is not needed.	A layer of N-1 is applied directly from the tube or with a brush over the area to be coated. Curing time is about half a day in room temperature, but it depends on conditions such as the specimen material, temperature, and so on. If the coating layer is too thin, apply another layer to make an adequate thickness.
	Moisture-proofing coating from cryogenic to room temperature for laboratory requirements. Does not provide a high degree of mechanical protection.	A layer of K-1 is applied directly from the tube or with a brush over the area to be coated. Curing time is about half a day in room temperature, but it depends on conditions such as the specimen material, temperature, and so on. If the coating layer is too thin, apply another layer to make an adequate thickness.
	Oil-resistant coating for laboratory and field requirements. Does not provide a high degree of mechanical protection.	A layer of UE-1 is applied directly from the tube or with a brush over the area to be coated. Curing time is about half a day in room temperature, but it depends on conditions such as the specimen material, temperature, and so on. If the coating layer is too thin, apply another layer to make an adequate thickness.
	Moisture- and water-proofing coating for laboratory and field requirements where mechanical protection is not needed, or used as the first coating for multi-layer coating. Offers excellent moisture and water resistant characteristics and is very convenient for use.	The SB tape is cut in an appropriate length and applied over the area to be coated. The application is completed by pressing down the SB tape firmly with a spatula or your finger covered with the separating paper. It is also applied under the leadwire prior to the overcoating.
	Used as the second coating or later for multi-layer coating. Offers excellent moisture and water resistant characteristics. Very convenient for use.	The VM tape is cut in an appropriate length and applied over the area to be coated with finger pressure. The VM tape must not be applied directly over a strain gauge as a first coating.
	Suitable for laboratory requirements with high temperature conditions where high degree of mechanical protection is not needed.	The KE-348 is applied directly from the tube over the area to be coated. Curing time is about half a day in room temperature, but it depends on conditions such as temperature, humidity and so on.
	Suitable for laboratory requirements with high temperature conditions where high degree of mechanical protection is not needed.	The TSE3976-B is applied directly from the tube over the area to be coated. Curing time is about one day in room temperature, but it depends on conditions such as temperature, humidity and so on.

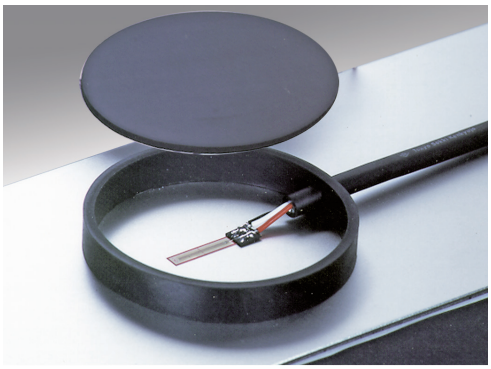
Important point

The application of coating material has an effect on test results when repeated strain is applied in the test such as a fatigue test (strain level of $\pm 1500 \times 10^{-6}$).
Give careful consideration before the test, and apply the coating carefully. Please contact us for further information if necessary.

Gauge Protecter



This rubber protector is designed to protect gauges which are bonded onto metal surface from the environment for long-term measurement. The strain gauge is packed inside together with the applied adhesive and overcoating materials. The protector is also provided with a hole for cable intake. It allows the entire area to be isolated from ambient conditions which may affect reliable measurement, and enhances the coating performance.



Specifications

Dimensions	Frame: 100mm-dia. (Inner Φ92mm) x 15mm (Height) Cover: 100mm-dia. x 3mm (Thick)
Operating temperature	−20~+80°C
Extension cable	9mm-dia. cable recommendable

COATING

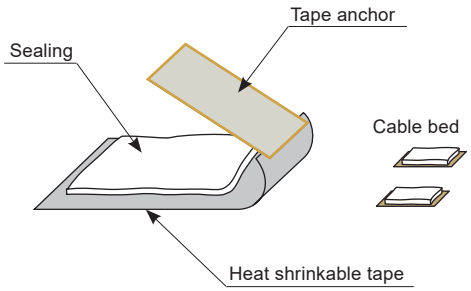
COATING TAPE for reinforcing bar

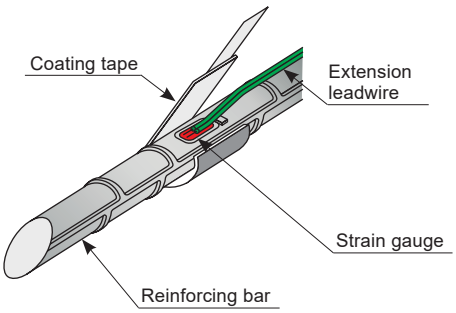
This tape is specially designed for use as a waterproof coating for stain gauges bonded onto reinforcing bars or other cylindrical surfaces. Coating is achieved by simply taping it onto the surface to save considerable time in comparison with coventional procedures. (A heat gun is required for application.)



Operating temperature: –20~+80°C

Type	Applicable reinforcing bar	Qty. per box	Strain gauges	Size finish (example)	
				Reinforcing bar	Dia. x Width (mm)
CT-D04	D4	10	FLKB-2-11	D4	Φ10×21
CT-D06	D6	10	FLKB-2-11	D6	Φ12×21
CT-D10	D10	10	FLKB-2-11	D10	Φ15×21
CT-D13	D13	10	FLAB-3-11	D13	Φ19×26
CT-D16	D16	10	FLAB-3-11	D16	Φ21×26
CT-D25	D19~D25	10	FLAB-3-11	D25	Φ31×31
CT-D35	D29~D35	10	FLAB-3-11	D32	Φ37×35

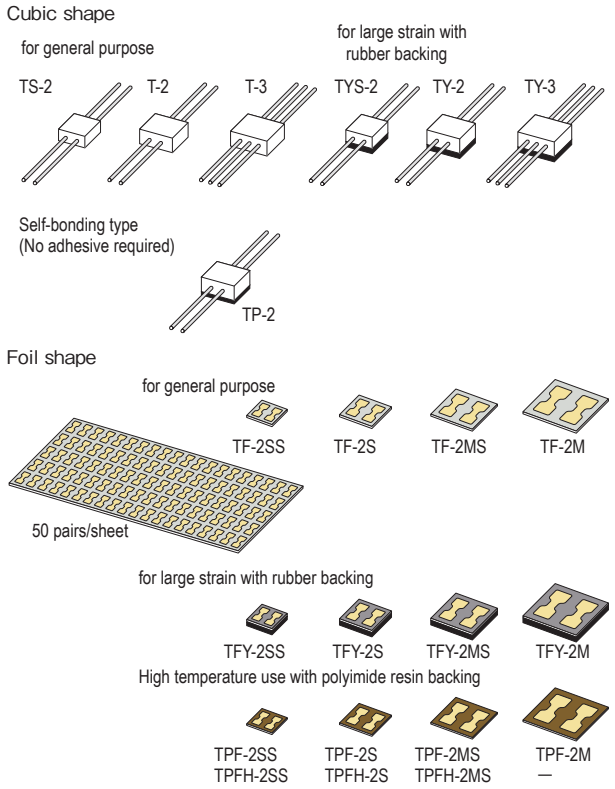




Connecting Terminals/Pressing Jig

Connecting Terminals

TML Connecting Terminals provide convenient junction points to connect strain gauges to instrumentation leadwires.



NB: TPFH series are heat-resistive connecting terminals with polyimide resin backing to TPF. It allows high temperature measurement using QF/ZF series gauges and bonding repetition on the terminals.

T series is made of a cubic plastic and two or three wires of approximately 0.8mm diameter are fixed to the cube. TY is laminated with rubber sheet and suitable for large strain measurement. TP-2 is a self-bonding terminal with two wires. TF is made of a 0.03mm thick copper foil and a glass-epoxy insulation base of approx. 0.15mm thick. TFY is laminated with rubber sheet approx. 0.8mm thick over the back side of TF series terminals.

Cubic type

Type	Dimensions (mm)	Operating temperature (°C)	Quantity (pcs/box)
T-2	10×10×5	−20~+90	100
T-3 (3-wire method)	10×10×5	−20~+90	100
TS-2	7.5×7.5×5	−20~+90	100
TYS-2	7.5×7.5×7	−20~+90	100
TY-2	10×10×7	−20~+90	80
TY-3 (3-wire method)	10×10×7	−20~+90	80
TP-2	10×10×6	−20~+60	100

Foil type

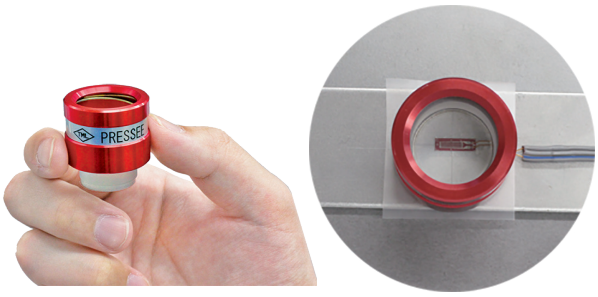
Type	Dimensions (mm)	Operating temperature (°C)	Quantity (pairs/sheet)
TF-2SS	4.6×3.8×0.2	–196~+180	50
TF-2S	6×5.3×0.2	–196~+180	50
TF-2MS	8×7.2×0.2	–196~+180	50
TF-2M	10×9.2×0.2	–196~+180	50
TFY-2SS	4.6×3.8×0.8	–20~+120	50
TFY-2S	6×5.3×0.8	–20~+120	50
TFY-2MS	8×7.2×0.8	–20~+120	50
TFY-2M	10×9.2×0.8	–20~+120	50
TPF-2SS	4.6×3.8×0.2	–196~+200	50
TPF-2S	6×5.3×0.2	–196~+200	50
TPF-2MS	8×7.2 ×0.2	–196~+200	50
TPF-2M	10×9.2×0.2	–196~+200	50
TPFH-2SS	4.6×3.8×0.1	–269~+350	50
TPFH-2S	6×5.3×0.1	–269~+350	50
TPFH-2MS	8×7.2×0.1	–269~+350	50

Pressing Jig

PRESSEE PM-19

PRESSEE is a pressing jig capable of not only pressurizing the strain gauge but also checking adhesion status from the clear pressing part with eyes. The use of PRESSEE saves time to keep pressing the strain gauge with your finger in the bonding work. In addition, since the PRESSEE can apply a constant pressure to the strain gauge, bonding quality is expected to be higher than a finger pressure.

Applicable strain gauge	Gauge length of 6mm or less and backing dimension of 15mm-dia. or less
Applicable adhesive	CN/CN-R/CN-Y, P-2, NP-50B, EA-2A, EB-2
Pressing method	Magnetic method by permanent magnet
Object to be bonded	Flat surface of magnetic body (1mm thick or over)
Dimensions	29mm-dia. x Approx. 30mm height



Transducers

INTRODUCTION

Strain gauge type transducers electrically measure physical quantities such as load and displacement. They operate by converting the physical quantities into mechanical stress, and then detecting that stress with a strain gauge. TML offers a number of products according to the item and quantity measured. Since our products use strain gauges, they can be connected to all types of measuring instruments for strain gauges, such as Data Loggers and Dynamic Strainmeters, for taking measurements. This enables capabilities like automatic multiple-point measurement as well as measurement via computer. Our strain gauge type transducers offer a variety of features like compact size, light weight and easy operation, high-precision measurements with excellent linearity and consistency, as well as dynamic measurement capability that is available in many of our products. These features led to widespread use of our strain gauge transducers not only for testing and research, but for control in all types of industrial and civil engineering fields as well. Among these products, transducers recommendable for civil engineering use are guided with the designation.

CHANGES TO THE CATALOG

Changes to this catalog due to product improvements may occur without prior notice.

DIMENSIONS

All dimensions are given in millimeters unless otherwise stated.

PRICES

This catalog does not list product prices. Customers must request a price list separately.

TRANSDUCER HANDLING

Read the Transducer Operation Manual carefully for proper use, and be sure to set up safety measures in case the transducer is damaged by overload or fatigue.

UNITS AND COVERSION FACTORS

Force	1N=0.102kgf	1kN=102kgf	1MN=102tf
Torque	1N·m=0.102kgf·m		
Pressure	1MPa=10.2kgf/cm^2		
Acceleration	1m/s^2=0.102G		

TABLE OF CONTENTS

LOAD CELL OVERVIEW
- General Description ... 98
- Transducer terminology ... 99
- HOW TO USE ... 100
- Important Points ... 101

COMPRESSION LOAD CELL
- CLS-NA (2 - 100N) / CLS-NB (200N - 10kN) ... 103
- CLA-NA (500N - 20kN) ... 104
- CLG-NB (10 - 200kN) ... 105
- CLP-NB (10kN - 10MN) ... 106
- CLU-NA (10kN - 1MN) ... 107
- CLM-NB (10kN - 500kN) ... 108
- CLJ-NA (5 - 30kN) ... 109
- CLJ-NB (50kN - 10MN) ... 110
- CLF-NA (500kN - 2MN) ... 111
- CLF-NA (3 - 10MN) ... 111
- CLR-NAH (500N - 200kN) ... 112
- CLC-NA (50kN - 5MN) ... 113

< Civil Engineering design >
- KCM-NA - Pullout testing and axial force measurement. ... 114
- KCE-NA - Strand tension measurement ... 115
- KCH-NA - Strand tension measurement ... 116
- KCC-NA - Anchoring strand measurement ... 117
- KCG-200KNA - Anchoring strand measurement ... 117
- KCK-NA - Strand post-tension measurement ... 118
- CLL-NA - Concrete loading test ... 119
- CLH-NA - Concrete loading test ... 119

TENSION / COMPRESSION LOAD CELL
- TCLZ-NA/-NB (10N - 10kN) ... 120
- TCLB-NA(50 - 200N) ... 121
- TCLA-NB (500N - 20kN) ... 121
- TCLY-NA (300kN - 10MN) ... 122
- TCLN-NA (500N - 5kN) ... 122
- TCLK-NA (5 - 50kN) ... 123
- TCLU-NA (10 - 200kN) ... 124
- TCLM-NB (10 - 200kN) ... 125
- TCLP-NB (10kN - 2MN) ... 126

TENSION LOAD CELL
- TLJ-NA (10 - 100kN) ... 127
- TLP-NB (10kN - 1MN) ... 128

WATERPROOF LOAD CELL / 3-COMPONENT LOAD CELL
- WTCLP-NA (500N - 10kN) ... 129
- SLP-NA-T (100N - 1kN) ... 129

TORQUE TRANSDUCER
- LTA-NA (50 - 500N·m) ... 130
- LTB-NA (10N·m - 1kN·m) ... 130
- Load Cell Fitting Accessory ... 131

DISPLACEMENT TRANSDUCERS
- Displacement transducer selection ... 135
- CDP (5 - 100mm) ... 136
- CDP-M (5 - 100mm) ... 137
- CDP-B (5 - 25mm) ... 138
- CDP-D (50 / 100mm) ... 138
- CDP-T (25mm) ... 139
- SDP-E (50 / 100 / 200 / 300mm) ... 140
- SDP-ET (50 / 100mm) ... 141
- DDP-A (10 - 50mm) ... 141
- DP-G / E (500 - 5000mm) ... 142
- WD-A (250/500/1000mm) ... 142
- FDP-A (10 - 100mm) ... 143
- PI (±2 / ±5mm) ... 144
- OU (10 - 30mm) ... 145
- CE Cantilever type Displacement Transducer (2- 10mm) ... 145
- RA / RA-L (2 / 5mm) ... 146
- UB / UB-A (2 / 5mm) ... 146
- Displacement Transducers Accessories ... 147

EXTENSOMETER
- EDP-A / EDP-B (5mm) ... 148

< Civil Engineering design >
- KJA-A/KJB-A - Mass concrete opening displacement. ... 149
- KG-A - Concrete crack displacement ... 150
- KG-B - Concrete crack displacement ... 151
- KLG-A/NKLG-AB- Land slide measurement ... 152
- KLG-B/NKLG-BB - Land slide measurement ... 153
- KLA-A/NKLA-B - Ground level settlement. ... 154
- CM - Concrete strength testing ... 155
- CM-H - Concrete strength testing ... 155

PRESSURE TRANSDUCERS
- Pressure transducer selection. ... 156

Pressure Transducer ... 158

Cavity type
- PW-PA (100kPa - 50MPa) ... 158
- PWH-PA (70 - 200MPa) ... 158
- PW-PAH (2 - 50MPa) ... 159
- PWFA-PA (2 - 20MPa) ... 159

Flush Diaphragm type
- PWF-PB (1 - 50MPa) ... 160
- PWFC-PB (2 - 50MPa) ... 160
- PWFD-PB (2 - 20MPa) ... 161
- PWFE-PA (2 - 20MPa) ... 161

Miniature type
- PDA-PB / PDB-PB (50kPa - 3MPa) ... 162
- PDC-PA/PDD-PA (100 - 300kPa) ... 162

ACCELERATION TRANSDUCERS
- Acceleration transducer selection ... 163
- ARS-A (10m/s^2) ... 164
- ARM-A-T (100m/s2 / 400m/s^2) ... 164
- ARF-A (10 - 500m/s^2) ... 165
- ARF-A-T (20 - 500m/s^2) ... 165
- ARE-A (1000 - 10000m/s^2) ... 166
- ARE-A-T (1000 - 5000m/s^2) ... 166
- ARH-A (10 - 500m/s^2) ... 167
- ARJ (50 - 2000m/s^2) ... 168
- ARGH-A (500 - 2000m/s^2) ... 169
- ARGL-A (20 - 200m/s^2) ... 169
- ARGH-A-T (500/1000m/s^2) ... 170
- ARGL-A-T (20 - 200m/s^2) ... 171
- Acceleration transducers accessories. ... 172
- Transducer Output Polarity. ... 173

< Civil Engineering design >

Soil Pressure at consrtuction site
- KDA-PA/KDB-PA ... 174
- KDC-PA/KDD-PA ... 174
- KDE-PA/KDF-PA Soil Pressure Gauge ... 175
- KDG-PA/KDH-PA Load Cell type Soil Pressure Gauge ... 175
- KDJ-PA/KDK-PA Load Cell type Soil Pressure Gauge ... 176

Pore water pressure in ground
- KPC-PA/KPD-PA Pore Pressure Gauge ... 176

Pore water pressure in model testing
- KPE-PB Small Pore Pressure Gauge ... 177
- KPG-PA/KPH-PA Ultracompact Pore Pressure Gauge ... 177
- PP-200KPA High-sensitivity compact pore water pressure Transducer ... 178

Level of water in dam, river and under-ground water
- KW-C Water Level Transducer ... 178

Inclination/Slope of structures
- KB-AB/KB-AC Inclinometer ... 179
- KB-DB/KB-EB Inclinometer ... 180

Network CompatibleMulti-layer inclinometer
- IM-10UA/BA Network CompatibleMulti-layer inclinometer 181

Stress of reinforcing bars arranged
- KSAT-A Reinforcing Bar Meter ... 183

Internal strain of concrete, synthetic resin
- KM Strain Transducers ... 184

Internal strain of asphalt pavement
- KM-HAS Strain Transducers ... 185

Internal strain of concrete, mortar, asphalt, synthetic resin
- KM-M Compact Size Strain Transducer ... 186

Friction force on concrete caisson
- KKA-PC Caisson skin-friction meter ... 188

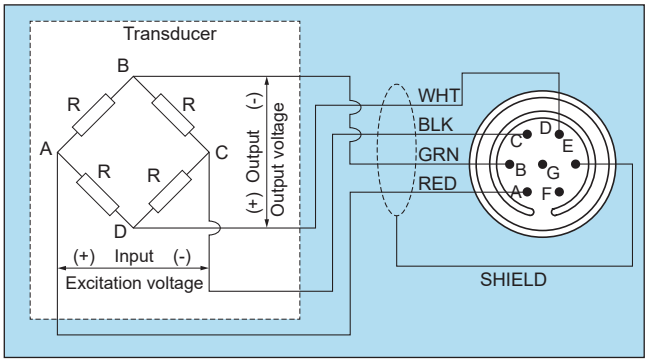
Subgrade reaction force of caisson
- KKB-PC Caisson cutting-edge reaction meter ... 189

Subgrade reaction and elasticcity modulus
- FWD-Light TML Small Falling Weight Deflectometer ... 190

Load Cells

■Transducer bridge circuit and connector alignment

Bridge circuit inside and wiring system are given as follows, but not applicable to some products. When connector plug is required, specify it on order to install the plug to the transducer cable.



■Transducer Input/Output resistance

Input/Output resistance (Ω)	Pin alignment of connector and resistance between cables (Ω)					
	A-C RED-BLK	B-D GRN-WHT	A-B RED-GRN	A-D RED-WHT	B-C GRN-BLK	C-D BLK-WHT
120	120	120	90	90	90	90
350	350	350	263	263	263	263

■Measurements with constant voltage method and constant current methods

Constant voltage method

In this method, the bridge excitation voltage (voltage applied between A and C terminals of the strain measuring instrument) is kept constant. Our instruments commonly use this method, and our transducers are usually calibrated using this method. When the transducer cable is extended, sensitivity (calibration coefficient) of the transducer needs correction.

Constant current method

In this method, the bridge excitation current (current flows between A and C terminals of the strain measuring instrument) is kept constant. This method has the advantage that the output of the transducer does not decrease even if the transducer cable is extended. However, the input/output resistance of the transducer must be a specified value (usually, 120 or 350 ohm). It must also be noted that the sensitivity (calibration coefficient) of the transducer may differ for constant voltage method and constant current method.

■Rated output and strain value

The output (rated output) of a transducer is expressed as mV/V. It is the output voltage when a maximum load is applied to the transdcuer. It shows the output voltage generated when 1V is applied.

Example:

1.5mV/V means that 1.5mV is output when a load of the transducer's full capacity is applied while 1V is applied as bridge excitation. If 2V is applied (bridge excitation of a strain measuring instrument):

1.5mV/V × 2V = 3mV

Therefore, if the gauge factor is set at 2.00 (coefficient set at 1.000) the output voltage of the transducer is 3mV and the value to be shown on a strain measuring instrument can be calculated by the following expression, which is formultated based on the voltage-to-strain relational expression:

$$\Delta e = E/4 \times K \times \varepsilon \qquad \varepsilon = 4\Delta e/KE$$

where, Δe: Output voltage (V) of a transducer
E : Excitation voltage (V)
K : Gauge factor of a strain measuring instrument
ε : Reading on a strain measuring instrument

With K, E and Δe defined as 2.00, 2V, and 3mV, respectively, 3mV is equal to 0.003V and therefore,

$$\varepsilon = 0.003 = 3000 \times 10^{-6} \text{ strain}$$

By setting the gauge factor of a strain instrument at 2.00 and expressing the output voltage of a transducer at 1V excitation, we have the following:

$2\Delta e = \varepsilon$, then
$1\text{mV/V} = 2000 \times 10^{-6}$ strain
$2\text{mV/V} = 4000 \times 10^{-6}$ strain

■Decreased sensitivity due to a long cable used to connect to a transducer

When a measuring instrument with constant voltage method is used and the transducer cable is extended from the original cable used for the calibration (shown in the test data), the output of the transducer is decreased. The output (calibration coefficient) will be as in the following formula. Correction should be made using this formula when necessary.

$$\varepsilon_s = \varepsilon_m \times \frac{R}{R + r \times L}$$

ε_s : Corrected output (calibration coefficient)
ε_m : Original output (calibration coefficient) given on the test data
R : Input resistance (Ω) of the transducer
r : Total resistance of the input side of the extended cable per meter (Ω/m)
L : Length of the longer cable (m)

■Resistance per meter of a cable used to connect to a transducer

Cross section area (sq. mm)	Total resistance per meter (Ω)
0.005	7.2
0.05	0.63
0.08	0.44
0.09	0.40
0.14	0.25
0.3	0.12
0.35	0.11
0.5	0.07
0.75	0.048

■TEDS support

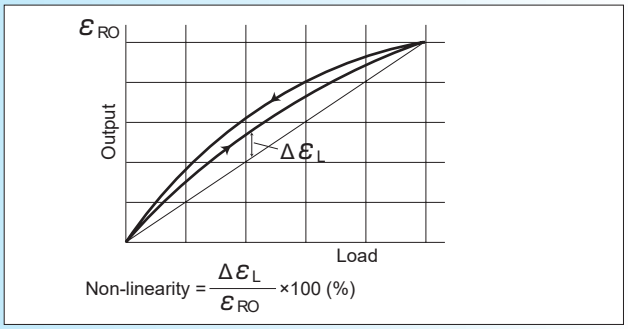
TEDS is an abbreviation of Transducer Electronic Data Sheet. A TEDS compatible transducer has sensor information conforming to IEEE1451.4 as electronic data inside. It enables automatic input of sensor information including the sensitivity and serial number into the measuring instrument. This automation eliminates wrong settings, significantly reduces the time required for settings and realizes efficient and simple works.
For more details of TEDS compatible transducers and measuring instruments, please contact us.

Transducer terminology

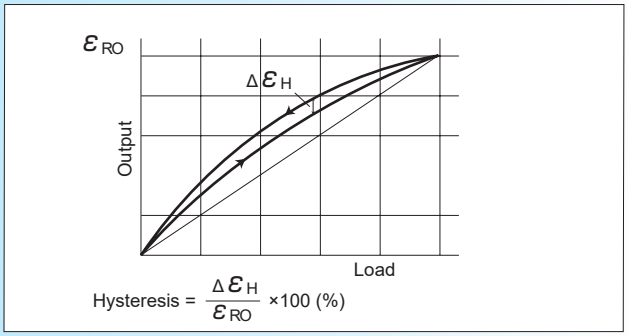
Capacity
Maximum load that a transducer can measure and still maintain specifications.

Rated Output (RO)
Output at the rated load minus output under no-load conditions. Rated output is expressed per volt applied to the transducer (mV/V).

Non-linearity
Maximum distance of the transducer's output from a line connecting the calibration curve origin and the rated load point with increasing loads. Non-linearity is expressed as a percentage of rated output (%RO).



Hysteresis
Maximum difference between transducer output with increasing and decreasing loads. Hysteresis is expressed as a percentage of rated output (%RO).



Repeatability
Maximum difference in output when the same rated load is measured repeatedly under identical load and environmental conditions. Repeatability is expressed as a percentage of rated output (%RO).

Temperature effect on zero
Transducer output due to changes in ambient temperature. Temperature effect on zero expresses change per degree of ambient temperature as a percentage of rated output (%RO/°C).

Temperature effect on span
Rate of change in rated output due to changes in ambient temperature. Temperature effect on span is expressed per degree of ambient temperature (%/°C).

Compensated temperature range
Range of temperatures compensated for temperature effect on zero and span. (°C).

Allowable temperature range
Range of temperatures that can be applied continuously without causing permanent destructive change to the transducer (°C).

Overload
Load that can be applied continuously without causing permanent destructive change exceeding specifications (%).

Ultimate overload rating
Maximum load that can be applied continuously without causing permanent destructive change mechanically (%).

Recommended exciting voltage
Voltage that can be applied to the transducer and still maintain specifications (V).

Allowable exciting voltage
Maximum voltage that can be applied continuously to the transducer without causing permanent destructive damage (V).

Zero balance
Output strain while unloaded (%RO)

Frequency response
Maximum frequency at which the transducer can output within a specified range using a sine wave load (Hz).

Natural frequency
Approximate frequency under no-load conditions at which a transducer oscillates freely (Hz).

Allowable bending moment
Maximum bending moment that can be applied continuously to the transducer without causing permanent destructive damage (kN·m).

Sensitivity
Transducer output with a fixed load. Sensitivity expresses strainmeter output per millimeter ($\times 10^{-6}$ strain/mm) when the strainmeter coefficient on the displacement transducer is set at 1.000 (2.00 gauge factor fixed).

Gauge length
Distance between two points used to measure displacement or strain.

Spring force
Approximate force required to displace capacity on the displacement tansducer (N).

Input/Output resistance
Resistance between input and output terminals measured under no-load conditions with input and output terminals disconnected (Ω).

Input/Output cable
Cable that cannot be disconnected from the transducer.

Supplied cable
Standard cable accessory that can be disconnected from the transducer.

Weight
Approximate weight of the main unit minus I/O cable and cable accessories.

Cross-Talk
In a transducer that measures multiple physical quantities with a single unit, cross-talk is the output observed when a load is applied in a direction other than the intended measurement axis. It is expressed as a percentage of the rated output (%RO).

About IP ratings

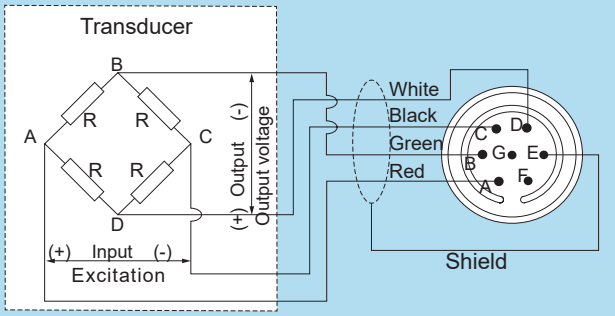
A classification system rates how well enclosures and package for electrical components seal against intrusion by foreign materials such as dust and moisture. It conforms to JIS C0920, or IEC 60529, and entails various levels of ingress protection afforded against solid objects and water.

Load Cells

TML load cells are used to convert force and load to electrical signals. The detecting element for force and load is a strain gauge that TML developed especially for load cells. With our extensive field-proven record and experience applied to structures and materials in all load cell areas, our cells have earned widespread trust as high-precision products offering excellent consistency and durability. Our line includes a number of compression, tension and tension/compression universal models with high to low capacities. Since our load cells are so widely used, we also offer all types of products related to load cells that allow customers to choose exactly what they need for their particular purpose. In addition to load cells, we also carry a line of products for measuring torque, such as torque transducers for socket wrenches, etc.

OUTPUT POLARITY WITH A LOAD

The measured value changes in negative (-) direction with increase of compressive force. It changes in positive (+) direction with increase of tensile force. (This does not apply to KCK-NA load cell.)

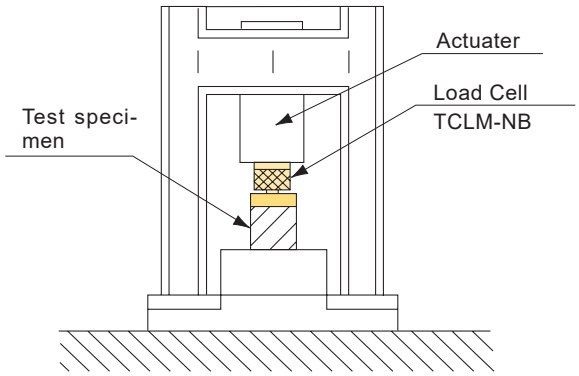


Not applicable to some products.

HOW TO USE

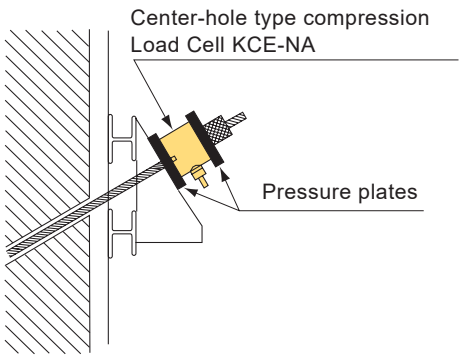
Fatigue test

Measuring a load in material fatigue testing using load or displacement parameters



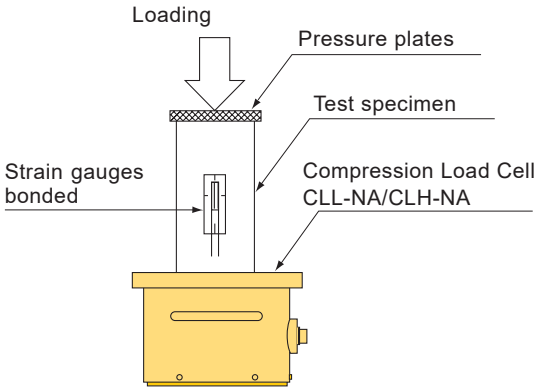
Ground and Rock anchors

Measuring force on steel bar or wire for PC -Pre-stressed concrete - like ground anchors and rock anchors



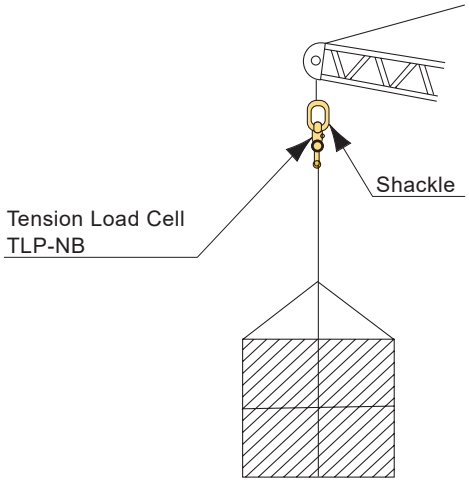
Loading test

A load test on concrete column specimen



Suspension force

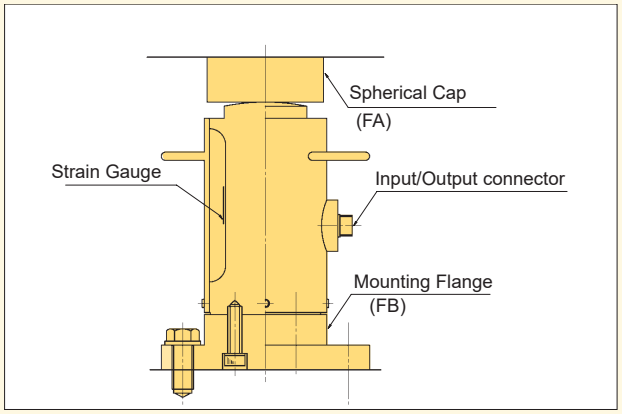
Measuring weight with a load suspended by crane



Important Points

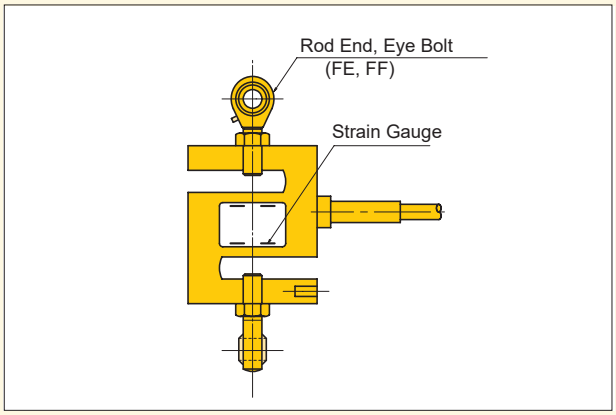
The load cell is a transducer to detect the load which is directly applied to the load cell itself. Therefore, the load cell itself has to be treated as part of the structure. The load cell is calibrated to vertical load in the sensing direction. Eccentric load, transverse load, bending or shearing force may deteriorate accuracy and in the worst case cause damage.

■ In case of compression use



- A structure where a load cell is installed must sufficiently withstand loading. The base must be deformation or deflection free due to loading. In addition, the contact pressure of the bottom of load cell should be noted.
- The load cell should be installed so that the load can be applied vertically to the load cell. The top of load cell is so spherical that bending moment or distortion is not applied to the load cell. The use of a spherical cap is recommended.
- As the need arises, set up a safety device for breaking of the load cell.
- Load cell accessories such as spherical cap and mounting flange are available.
- In case the load cell is used for impact testing, larger capacity load cell has to be selected considering its shock acceleration component. In case of cyclic loading such as fatigue life test, the applied load should be 1/2 or less of the load cell capacity.
- All load cells are self-temperature-compensated, but a sharp temperature variation makes the output instable. Take note not to receive direct sunlight.

■ In case of tension use



- In case the tension/compression load cell is used for tension, force is received by the screw thread. The strength of the thread is very important, and if fully loaded up to the rated capacity, stress at the thread becomes high. Therefore, a screw thread with 8 to 10 in strength gets necessary.
- For lifting load measurement, a measure for preventing the screw from rotating should be taken. In addition to high safety ratio, some safety device in case of breaking of the load cell should be also taken into account.
- Load Cell accessories such as Rod End and Eye Bolt are available.

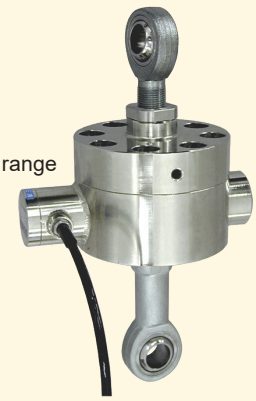
- The load cell has hermetically sealed structure but the use in adverse environments may badly influence its water-proofness and corrosion resistance. Please consult us.
- The shield of the load cell cable is not connected to the load cell body. For noise protection, connect the shield to the E (earth) terminal of a measuring instrument.

Load Cells for Material Testing Machine JIS B 7728

The force measuring system used for the calibration is this load cell. The load cell has to be calibrated in accordance with Japanese standard JIS B 7728 "Calibration of force-proving instruments used for the verification of uniaxial testing machines". The load cell conforms to JIS B 7728 and meets its requirement in accuracy, and has rod end and bearing plate as loading jigs. The load cell is produced according to the capacity, accuracy class and shape of a testing machine for calibration.



Compression load cell
CLJ-20KNA, 20kN range



Tension load cell
TLJ-50KNA 50kN range

FEATURES

►Conforms to JIS B 7728:2013
►JIS B-7728 is based on ISO376:2011, Metallic materials - Calibration of force-proving insturments used for the verifiation of uniaxial testing machines (MOD), and thus it conforms to ISO376.
►For compression and tension
►Capacity at your option
►With loading jigs
►Remote sensing available

Load Cells

Load Cell selection

Type \ Capacity	N								kN										MN					
	2	5	10	20	50	100	200	500	1	2	5	10	20	30	50	100	200	300	500	1	1.5	2	3	5	10
COMPRESSION TYPE																									
CLS-NA	●	●	●	●	●	●																			
CLS-NB							●	●	●	●	●	●													
CLA-NA								●	●	●	●	●	●												
CLG-NB												●	●		●	●	●								
CLP-NB												●	●	●	●	●	●	●	●	●		●	●	●	●
CLU-NA												●	●		●	●	●		●	●					
CLM-NB												●	●		●	●	●		●						
CLJ-NA											●	●	●	●											
CLJ-NB															●	●	●	●	●	●		●	●	●	●
CLF-NA																			●	●	●	●			
CLF-NA																							●	●	●
CLR-NAH								●	●	●	●	●	●		●	●	●								
CLC-NA															●	●	●	●	●	●		●	●	●	
KCM-NA												●	●		●	●	●	●	●	●		●	●	●	
KCE-NA																			●	●	●	●			
KCH-NA																			●	●	●	●			
KCC-NA																	●		●	●					
KCG-NA																	●								
KCK-NA																			●	●					
CLL-NA																			●	●					
CLH-NA																				●	●	●			
TENSION/COMPRESSION UNIVERSAL TYPE																									
TCLZ-NA								●	●	●	●	●													
TCLZ-NB			●	●	●	●	●																		
TCLB-NA					●	●	●																		
TCLA-NB								●	●	●	●	●	●												
TCLY-NA																		●	●	●	●	●		●	●
TCLN-NA								●	●	●	●														
TCLK-NA											●	●	●		●										
TCLU-NA												●	●		●	●	●								
TCLM-NB												●	●		●	●	●								
TCLP-NB												●	●	●	●	●	●	●	●	●	●	●			
WTCLP-NA								●	●	●	●	●													
TENSION TYPE																									
TLJ-NA												●	●		●	●									
TLP-NB												●	●	●	●	●	●	●	●	●					
3-Component Load Cell																									
SLP-NA-T						●	●	●	●																

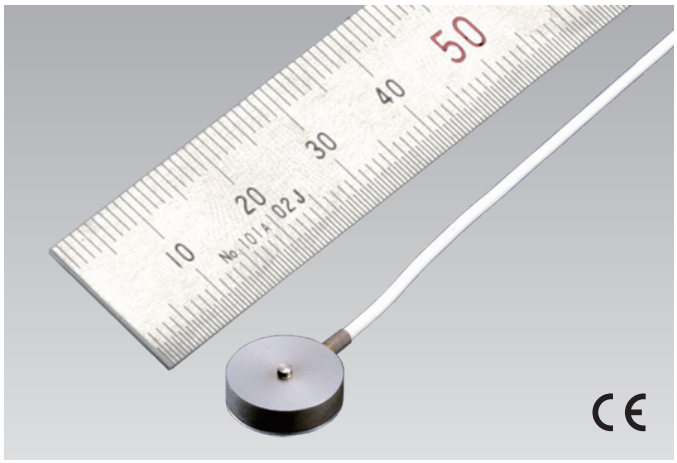
Load Cell Fitting accessory

Fitting accessory	Applicable load cells	
Spherical Cap FA	Compression Load Cell	CLA-NA, CLP-NB, CLG-NB, CLM-NB, CLU-NA, CLR-NAH
	Tension/Compression Universal Load Cell	TCLN-NA, TCLB-NA, TCLA-NB, TCLP-NB, TCLK-NA, TCLZ-NB, TCLU-NA, TCLM-NB
Mounting Flange FB	Compression Load Cell	CLA-NA, CLP-NB, CLG-NB, CLM-NB, CLU-NA, CLR-NAH
	Tension/Compression Universal Load Cell	TCLB-NA, TCLM-NB
Slide Support FC	Compression Load Cell	CLA-NA, CLP-NB, CLG-NB, CLM-NB, CLU-NA, CLR-NAH
Rotary Attachment FD	Tension/Compression Universal Load Cell	TCLB-NA, TCLZ-NB, TCLU-NA, TCLM-NB
Rod End FE	Tension/Compression Universal Load Cell	TCLN-NA, TCLB-NA, TCLA-NB, TCLA-NB, TCLP-NB, TCLK-NA, TCLZ-NB, TCLU-NA, TCLM-NB
	Tension Load Cell	TLJ-NA
Eye Bolt FF	Tension/Compression Universal Load Cell	TCLP-NB, TCLZ-NB, TCLU-NA, TCLM-NB
Load Button FG	Tension/Compression Universal Load Cell	TCLB-NA, TCLP-NB, TCLK-NA, TCLZ-NB,TCLU-NA, TCLM-NB
Sackle FH	Tension/Compression Universal Load Cell	TCLP-NB, TCLZ-NB, TCLU-NA, TCLM-NB
	Tension Load Cell	TLP-NB,

Torque transducer selection

Type \ Capacity	N·m								kN·m
	10	20	30	50	100	200	300	500	1
LTA-NA				●	●	●		●	
LTB-NA	●	●	●	●	●	●	●	●	●

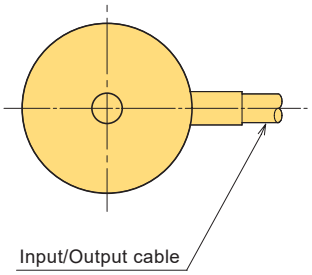
CLS-NA/CLS-NB Compression Load Cell 2N~10kN



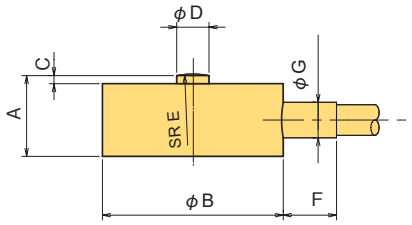
The CLS-NA and CLS-NB Load Cells are ultracompact load cells with capacities ranging from 2N to 10kN. They are widely used for measuring load distribution or loads in structural mockup testing and as a sensor for industrial machinery.

Protection ratings: IP41 equivalent CLS-2NA/CLS-5NA
IP53 equivalent Others

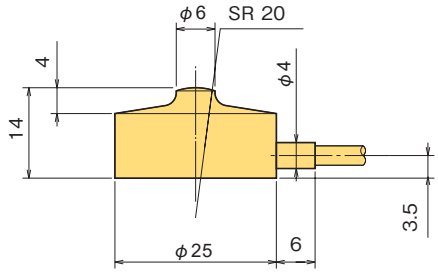
Ultracompact
Light weight



CLS-2NA~5KNB



CLS-10KNB



■ DIMENSIONS

TYPE	A	ϕB	C	ϕD	E	F	ϕG
CLS-2NA	4	12	0.7	1.5	2	4	1.8
CLS-5NA	4	12	0.7	1.5	2	4	1.8
CLS-10NA	4	12	0.7	1.5	2	4	1.8
CLS-20NA	4	12	0.7	1.5	2	4	1.8
CLS-50NA	4	12	0.7	1.5	2	4	1.8
CLS-100NA	4	12	0.7	1.5	2	4	1.8
CLS-200NB	9	20	1	2.5	8	6	4
CLS-500NB	9	20	1	2.5	8	6	4
CLS-1KNB	9	20	1	2.5	8	6	4
CLS-2KNB	10	20	1.5	3	8	6	4
CLS-5KNB	12.5	25	2	4	10	6	4
CLS-10KNB	As per the figure						

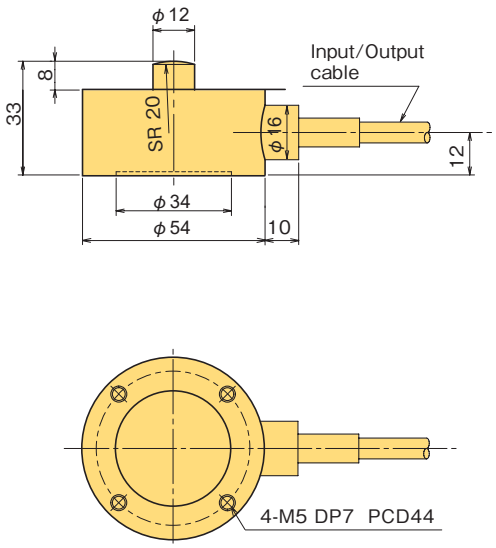
■ SPECIFICATIONS

TYPE	CLS-2NA	CLS-5NA	CLS-10NA	CLS-20NA	CLS-50NA	CLS-100NA	CLS-200NB	CLS-500NB	CLS-1KNB	CLS-2KNB	CLS-5KNB	CLS-10KNB
Capacity	2N	5N	10N	20N	50N	100N	200N	500N	1kN	2kN	5kN	10kN
Rated Output	1mV/V (2000×10^{-6} strain) +50%, -20%*						1.5mV/V (3000×10^{-6} strain) ±10%					
Non-linearity	1%RO		0.5%RO									
Hysteresis	1%RO		0.5%RO									
Natural frequency	10kHz	20kHz	16kHz	30kHz	40kHz	50kHz	40kHz	50kHz	50kHz	60kHz	50kHz	40kHz
Temperature effect on zero	0.2%RO/°C		0.1%RO/°C									
Temperature effect on span	0.05%/°C											
Compensated temperature range	-10 ~ +60°C											
Allowable temperature range	-10 ~ +60°C											
Over load	150%											
Ultimate overload rating	300%		500%				300%					
Input/Output resistance	350Ω±2%						350Ω±1%					
Recommended exciting voltage	2V or less											
Allowable exciting voltage	5V											
Zero balance	200%RO		150%RO				100%RO					
Weight	1g	1g	3g	3g	3g	3g	12g	12g	12g	12g	40g	40g

Input/Output cable : CLS-NA ϕ1.3mm 0.03mm^2 4-core vinyl cable 2m
: CLS-NB ϕ3mm 0.05mm^2 4-core shielded chloroprene cable 2m
NB * : Tolerance of rated output for CLS-2NA and CLS-5NA is ±30%.

CLA-NA Compression Load Cell 500N~20kN





The CLA-NA Load Cell has a diaphragm type strain sensing element. It is compact, easy to operate and can be used to take consistent measurement.

Protection ratings: IP67 equivalent

Small size
Hermetically sealed

■ FITTING ACCESSORY

TYPE	Spherical Cap FA	Mounting Flange FB	Slide Support FC
CLA-500NA~ 20KNA	FA-20	FB-2-44	FC-2-20

Refer to pages 131~134 for load cell fitting accessories.

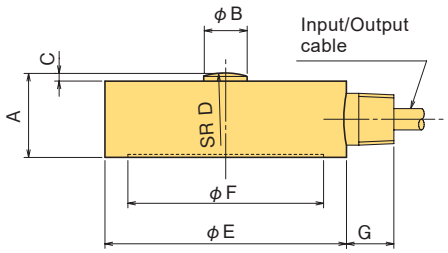
■ SPECIFICATIONS

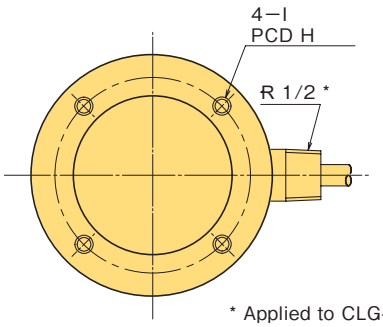
TYPE	CLA-500NA	CLA-1KNA	CLA-2KNA	CLA-5KNA	CLA-10KNA	CLA-20KNA
Capacity	500N	1kN	2kN	5kN	10kN	20kN
Rated Output	1.5mV/V (3000×10^{-6} strain) ±0.5%					
Non-linearity	0.2%RO					
Hysteresis	0.1%RO					
Natural frequency	6.1kHz	8.9kHz	13kHz	19kHz	24kHz	28kHz
Temperature effect on zero	0.01%RO/°C					
Temperature effect on span	0.01%/°C					
Compensated temperature range	-10 ~ +60°C					
Allowable temperature range	-20 ~ +70°C					
Over load	150%					
Input/Output resistance	350Ω±2%					
Recommended exciting voltage	6V or less					
Allowable exciting voltage	15V					
Zero balance	5%RO					
Weight	0.36kg					0.38kg

Input/Output cable : φ6mm 0.35mm^2 4-core shielded chloroprene cable 5m

CLG-NB Compression Load Cell 10~200kN







* Applied to CLG-50KNB ~ CLG-200KNB

The CLG-NB is a high precision load cell in a thin, hermetically sealed package. It is widely used in tight spaces and as a system sensor for industrial machinery.

Protection ratings: IP67 equivalent

Low profile
Hermetically sealed

■ DIMENSIONS

TYPE	A	ϕ B	C	D	ϕ E	ϕ F	G	H	I
CLG-10KNB	25	12	3	60	84	59	10	70	M5 DP8
CLG-20KNB	25	12	3	60	84	59	10	70	M5 DP8
CLG-50KNB	35	18	3	60	102	67	20	82	M8 DP10
CLG-100KNB	40	22	5	80	117	71	20	90	M8 DP10
CLG-200KNB	50	28	7	100	127	77	20	100	M8 DP10

■ FITTING ACCESSORY

TYPE	Spherical Cap FA	Mounting Flange FB	Slide Support FC
CLG-10KNB,-20KNB	FA-60	FB-2-70	FC-5-60
CLG-50KNB	FA-60	FB-5-82	FC-5-60
CLG-100KNB	FA-80	FB-10-90	FC-20-80
CLG-200KNB	FA-100	FB-20-100	FC-20-100

Refer to pages 131~134 for load cell fitting accessories.

■ SPECIFICATIONS

TYPE	CLG-10KNB	CLG-20KNB	CLG-50KNB	CLG-100KNB	CLG-200KNB
Capacity	10kN	20kN	50kN	100kN	200kN
Rated Output	2mV/V (4000×10^{-6} strain) ±0.5%				
Non-linearity	0.2%RO				
Hysteresis	0.2%RO				
Natural frequency	10kHz	13kHz	13kHz	13kHz	13kHz
Temperature effect on zero	0.01%RO/°C				
Temperature effect on span	0.005%/°C				
Compensated temperature range	-10 ~ +60°C				
Allowable temperature range	-20 ~ +70°C				
Over load	150%				
Input/Output resistance	350Ω±1%				
Recommended exciting voltage	6V or less				
Allowable exciting voltage	15V				
Zero balance	5%RO				
Weight	0.9kg	0.9kg	1.8kg	2.6kg	3.8kg

Input/Output cable : CLG-10KNB, 20KNB : ϕ6mm 0.35mm^2 4-core shielded chloroprene cable 5m
: CLG-50KNB~ 200KNB : ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 5m

CLP-NB Compression Load Cell 10kN~10MN



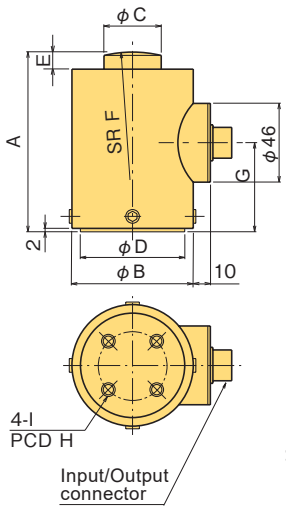
General purpose
Various capacities

The CLP-NB has a column type strain sensing element. With a full line of products with capacities ranging from 10kN to 10MN, customers can select a model for any load level.

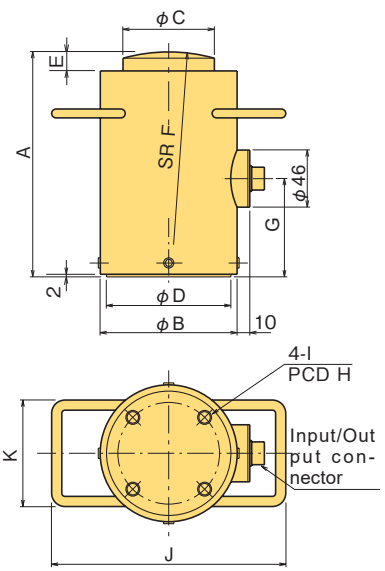
NB: Available with built-in two isolated I/O ports at option

Protection ratings: IP65 equivalent

CLP-10~ 500KNB



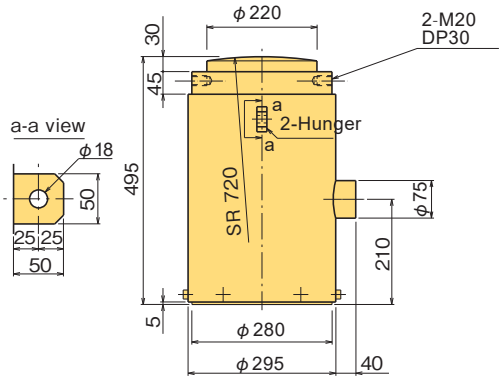
CLP-1~ 5MNB

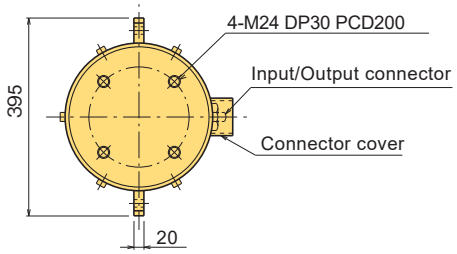


■ DIMENSIONS

TYPE	A	ϕ B	ϕ C	ϕ D	E	F	G	H	I	J	K
CLP-10KNB	80	60	22	50	8	60	40	30	M8DP10	-	-
CLP-20KNB	80	60	22	50	8	60	40	30	M8DP10	-	-
CLP-30KNB	80	60	22	50	8	60	40	30	M8DP10	-	-
CLP-50KNB	80	60	22	50	8	60	40	30	M8DP10	-	-
CLP-100KNB	80	60	24	50	8	80	40	30	M8DP10	-	-
CLP-200KNB	105	70	34	60	10	100	52	40	M8DP10	-	-
CLP-300KNB	145	90	50	80	15	140	72	60	M8DP15	-	-
CLP-500KNB	145	90	50	80	15	140	72	60	M8DP15	-	-
CLP-1MNB	180	110	74	100	15	160	80	80	M12DP15	186	86
CLP-2MNB	230	140	100	130	15	250	100	100	M16DP18	240	120
CLP-3MNB	275	160	120	150	15	360	135	120	M16DP18	260	120
CLP-5MNB	345	200	155	185	20	360	165	140	M20DP25	300	120
CLP-10MNB	As per the figure										

CLP-10MNB





■ FITTING ACCESSORY

TYPE	Spherical Cap FA	Mounting Flange FB	Slide Support FC
CLP-10KNB~ 50KNB	FA-60	FB-10-30	FC-5-60
CLP-100KNB	FA-80	FB-10-30	FC-20-80
CLP-200KNB	FA-100	FB-20-40	FC-20-100
CLP-300KNB,-500KNB	FA-140	FB-50-60	FC-50-140
CLP-1MNB	FA-160	FB-100-80	-
CLP-2MNB	FA-250	FB-200-100	-
CLP-3MNB	FA-360	FB-300-120	-
CLP-5MNB	FA-360B	FB-500-140	-
CLP-10MNB	FA-720	FB-1000-200	-

Refer to pages 131~134 for load cell fitting accessories.

■ SPECIFICATIONS

TYPE	CLP-10KNB	CLP-20KNB	CLP-30KNB	CLP-50KNB	CLP-100KNB	CLP-200KNB	CLP-300KNB	CLP-500KNB	CLP-1MNB	CLP-2MNB	CLP-3MNB	CLP-5MNB*	CLP-10MNB*
Capacity	10kN	20kN	30kN	50kN	100kN	200kN	300kN	500kN	1MN	2MN	3MN	5MN	10MN
Rated Output	1.5mV/V (3000×10^{-6} strain) ±0.2%												
Non-linearity	0.1%RO											0.2%RO	
Hysteresis	0.1%RO												
Natural frequency	7.5kHz	9.2kHz	11kHz	14kHz	19kHz	16kHz	11kHz	13kHz	13kHz	7.0kHz	5.8kHz	4.5kHz	2.7kHz
Temperature effect on zero	0.01%RO/°C												
Temperature effect on span	0.005%/°C												
Compensated temperature range	-10 ~ +60°C												
Allowable temperature range	-20 ~ +70°C												
Over load	150%												
Input/Output resistance	350Ω±1%												
Recommended exciting voltage	10V or less												
Allowable exciting voltage	20V												
Zero balance	5%RO												
Weight	1.1kg	1.1kg	1.1kg	1.1kg	1.2kg	2.0kg	4.2kg	4.6kg	10kg	24kg	33kg	70kg	190kg

Input/Output cable : CT9-4N10/WP-STB (ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 10m) *Made-to-order

CLU-NA Compression Load Cell 10kN~1MN



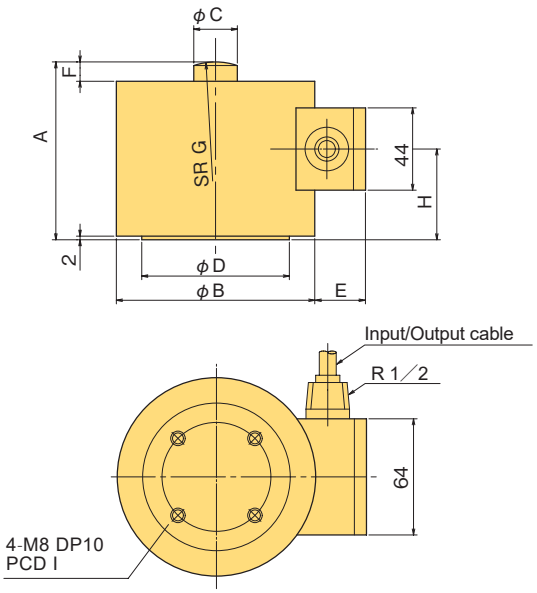
The CLU-NA is an inert-gas encased load cell in a hermetically sealed package. It can take highly precise and consistent measurements over long periods of time.

NB: Available with built-in two isolated I/O ports at option

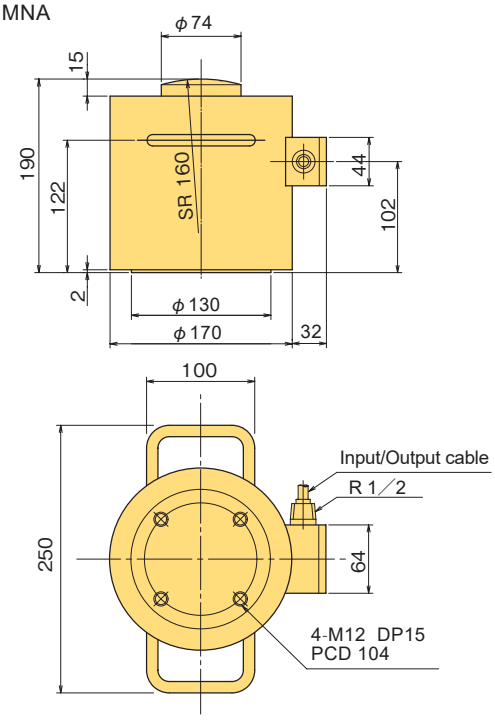
Protection ratings: IP65 equivalent

Inert gas hermetically sealed

CLU-10~500KNA



CLU-1MNA



■ DIMENSIONS

TYPE	A	ϕB	ϕC	ϕD	E	F	G	H	I
CLU-10KNA	84	92	22	68	28	10	60	42	54
CLU-20KNA	84	92	22	68	28	10	60	42	54
CLU-50KNA	84	92	22	68	28	10	60	42	54
CLU-100KNA	96	108	24	80	28	10	80	49	60
CLU-200KNA	114	118	34	90	29	12	100	57	70
CLU-500KNA	158	160	50	120	31	15	140	82	100
CLU-1MNA	As per the figure								

■ FITTING ACCESSORY

TYPE	Spherical Cap FA	Mounting Flange FB	Slide Support FC
CLU-10KNA~ 50KNA	FA-60	FB-5-54	FC-5-60
CLU-100KNA	FA-80	FB-10-60	FC-20-80
CLU-200KNA	FA-100	FB-20-70	FC-20-100
CLU-500KNA	FA-140	FB-50-100	FC-50-140
CLU-1MNB	FA-160	FB-100-104	-

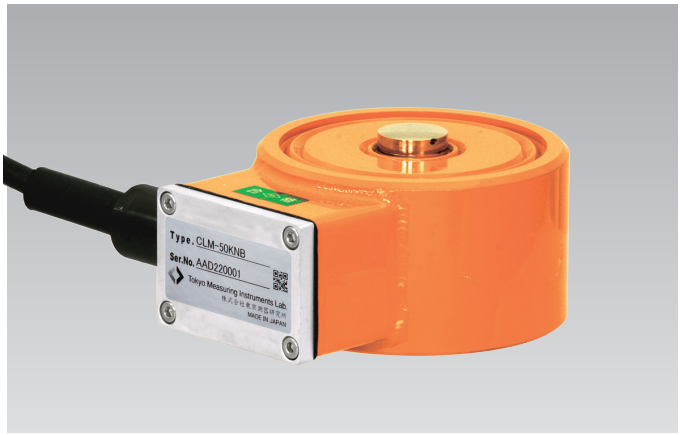
Refer to pages 131~134 for load cell fitting accessories.

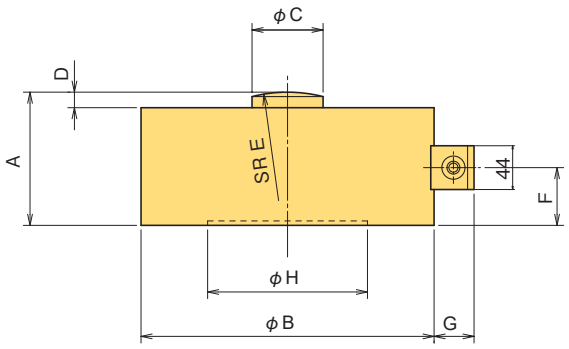
■ SPECIFICATIONS

TYPE	CLU-10KNA	CLU-20KNA	CLU-50KNA	CLU-100KNA	CLU-200KNA	CLU-500KNA	CLU-1MNA
Capacity	10kN	20kN	50kN	100kN	200kN	500kN	1MN
Rated Output	2mV/V (4000×10^{-6} strain) ±0.2%						
Non-linearity	0.15%RO						
Hysteresis	0.05%RO						
Natural frequency	5.2kHz	9.5kHz	12kHz	13kHz	11kHz	9kHz	7kHz
Temperature effect on zero	0.005%RO/°C						
Temperature effect on span	0.005%/°C						
Compensated temperature range	-10 ~ +60°C						
Allowable temperature range	-30 ~ +80°C						
Over load	150%						
Input/Output resistance	350Ω±1%						
Recommended exciting voltage	10V or less						
Allowable exciting voltage	20V						
Zero balance	5%RO						
Weight	2.2kg	2.2kg	2.2kg	3.2kg	4.3kg	11kg	15kg

Input/Output cable : ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 5m

CLM-NB Compression Load Cell 10kN~500kN

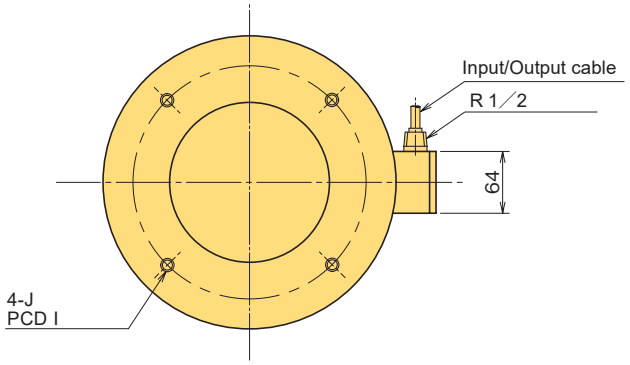




The CLM-NB is an inert-gas encased load cell in a hermetically sealed package. It offers high precision, high output characteristics and excellent consistency because it uses a shear beam for the strain sensing element. This model is widely used in applications like test equipment.

Protection ratings: IP65 equivalent

High precision
Inert gas hermetically sealed



■ DIMENSIONS

TYPE	A	ϕB	ϕC	D	E	F	G	ϕH	I	J
CLM-10KNB	60	98	22	5	60	27.5	31	64	80	M8 DP10
CLM-20KNB	60	98	22	5	60	27.5	31	64	80	M8 DP10
CLM-50KNB	60	98	22	5	60	27.5	31	64	80	M8 DP10
CLM-100KNB	70	118	24	5	80	32.5	34	68	90	M8 DP10
CLM-200KNB	90	157	34	10	100	40	37	86	120	M8 DP15
CLM-500KNB	110	187	50	10	140	50	38	110	150	M8 DP15

■ FITTING ACCESSORY

TYPE	Spherical Cap FA	Mounting Flange FB	Slide Support FC
CLM-10KNB~50KNB	FA-60	FB-5-80	FC-5-60
CLM-100KNB	FA-80	FB-10-90	FC-20-80
CLM-200KNB	FA-100	FB-20-120	FC-20-100
CLM-500KNB	FA-140	FB-50-150	FC-50-140

Refer to pages 131~134 for load cell fitting accessories.

■ SPECIFICATIONS

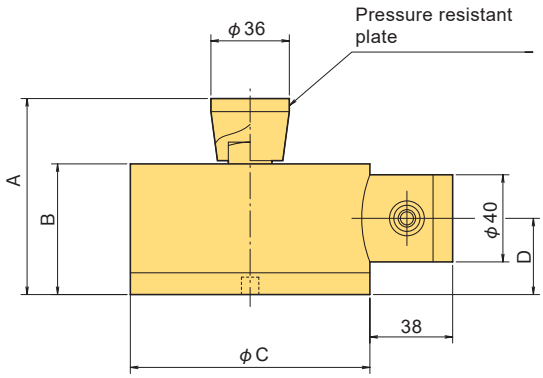
TYPE	CLM-10KNB	CLM-20KNB	CLM-50KNB	CLM-100KNB	CLM-200KNB	CLM-500KNB
Capacity	10kN	20kN	50kN	100kN	200kN	500kN
Rated Output	2.5mV/V (5000×10^{-6} strain) ±0.2%					
Non-linearity	0.03%RO					
Hysteresis	0.03%RO					
Natural frequency	5.3kHz	7.1kHz	10kHz	12kHz	7.5kHz	7.5kHz
Temperature effect on zero	0.002%RO/°C					
Temperature effect on span	0.002%/°C					
Compensated temperature range	-10 ~ +60°C					
Allowable temperature range	-30 ~ +80°C					
Over load	150%					
Input/Output resistance	350Ω±1%					
Recommended exciting voltage	10V or less					
Allowable exciting voltage	20V					
Zero balance	5%RO					
Weight	2.5kg	2.5kg	3kg	5kg	11kg	18kg

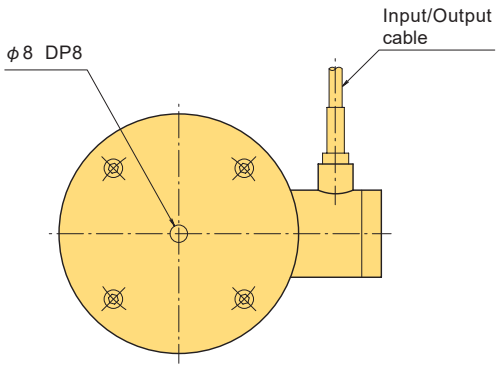
Input/Output cable : ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 5m

CLJ-NA Compression Load Cell 5~30kN

Made-to-order







The CLJ-NA is designed considering JIS B 7728"Calibration of force-proving instruments used for the verification of uniaxial testing machine" and is the most suitable for verification of single axis compression testing machine. Calibration in accordance with JIS B 7728 is available at extra cost.

Protection ratings: IP65 equivalent

High stability
Remote sensing compatible

■ DIMENSIONS

TYPE	A	B	ϕC	D
CLJ-5KNA	90	60	110	35
CLJ-10KNA	90	60	110	35
CLJ-20KNA	90	60	110	35
CLJ-30KNA	95	65	125	40

■ SPECIFICATIONS

TYPE	CLJ-5KNA	CLJ-10KNA	CLJ-20KNA	CLJ-30KNA
Capacity	5kN	10kN	20kN	30kN
Rated Output	2mV/V (4000×10^{-6} strain) or more			
Non-linearity	0.05%RO			
Hysteresis	0.05%RO			
Natural frequency	5.6kHz	6.9kHz	8.5kHz	7.7kHz
Temperature effect on zero	0.005%RO/°C			
Temperature effect on span	0.005%/°C			
Compensated temperature range	-10 ~ +60°C			
Allowable temperature range	-30 ~ +80°C			
Over load	150%			
Ultimate overload rating	300%			
Input/Output resistance	350Ω±2%			
Recommended exciting voltage	6V or less			
Allowable exciting voltage	15V			
Zero balance	5%RO			
Weight	4kg	4kg	4kg	6kg

Input/Output cable : ϕ6mm 0.08mm^2 6-core shielded polyurethane cable 5m (Remote-sensing compatible)

CLJ-NB Compression Load Cell 50kN~10MN

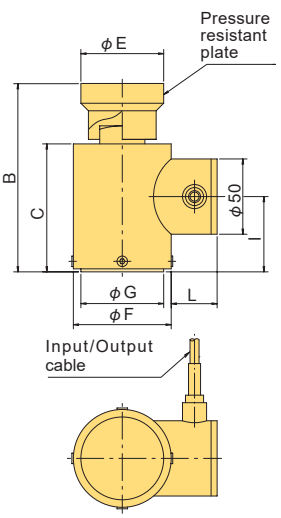


The CLJ-NB is designed considering JIS B 7728 "Calibration of force-proving instruments used for the verification of uniaxial testing machine" and is the most suitable for verification of single axis compression testing machine. Calibration in accordance with JIS JIS B 7728 is available at extra cost.

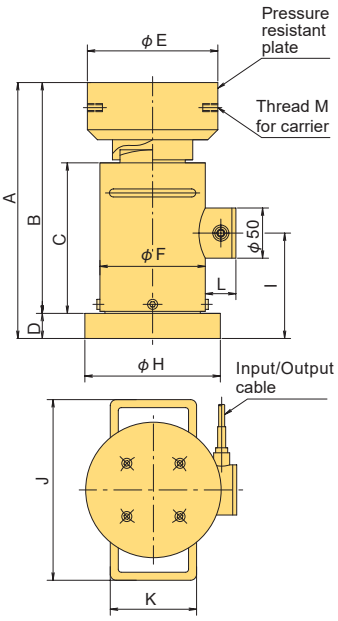
Protection ratings: IP67 equivalent

High stability
Remote sensing compatible

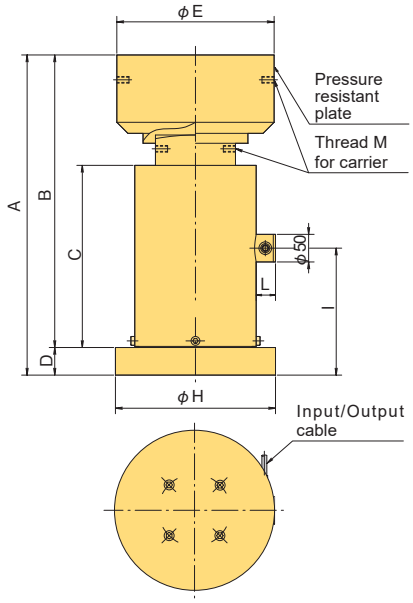
CLJ-50~ 200KNB



CLJ-300KNB~ 3MNB



CLJ-5MNB, -10MNB



■ DIMENSIONS

TYPE	A	B	C	D	ϕE	ϕF	ϕG	ϕH	I	J	K	L	M
CLJ-50KNB	–	110	73	–	40	60	50	–	41	–	–	31	–
CLJ-100KNB	–	110	73	–	40	60	50	–	41	–	–	31	–
CLJ-200KNB	–	125	85	–	55	65	55	–	50	–	–	31	–
CLJ-300KNB	175	160	105	15	80	75	–	80	75	–	–	31	–
CLJ-500KNB	195	180	120	15	90	85	–	95	80	–	–	31	–
CLJ-1MNB	255	230	150	25	130	105	–	135	105	180	86	35	2-M8 DP15
CLJ-2MNB	340	305	200	35	180	130	–	185	145	230	120	35	2-M10 DP18
CLJ-3MNB	420	370	240	50	225	155	–	225	190	255	120	35	2-M12 DP22
CLJ-5MNB	580	530	330	50	285	220	–	290	230	–	–	35	4-M12 DP22
CLJ-10MNB	790	710	425	80	410	270	–	410	325	–	–	35	4-M20 DP30

■ SPECIFICATIONS

TYPE	CLJ-50KNB	CLJ-100KNB	CLJ-200KNB	CLJ-300KNB	CLJ-500KNB	CLJ-1MNB	CLJ-2MNB	CLJ-3MNB*	CLJ-5MNB*	CLJ-10MNB*
Capacity	50kN	100kN	200kN	300kN	500kN	1MN	2MN	3MN	5MN	10MN
Rated Output	2mV/V (4000×10^{-6} strain) or more									
Non-linearity	0.05%RO									
Hysteresis	0.05%RO									
Natural frequency	6.1kHz	8.5kHz	8.1kHz	5.5kHz	5.4kHz	4.1kHz	3.0kHz	2.4kHz	1.7kHz	1.3kHz
Temperature effect on zero	0.0005%RO/°C									
Temperature effect on span	0.0005%/°C									
Compensated temperature range	-10 ~ +60°C									
Allowable temperature range	-20 ~ +70°C									
Over load	150%									
Ultimate overload rating	300%									
Input/Output resistance	350Ω±2%									
Recommended exciting voltage	10V or less									
Allowable exciting voltage	20V									
Zero balance	5%RO									
Weight	2kg	2kg	2.5kg	5kg	7kg	20kg	45kg	85kg	175kg	470kg

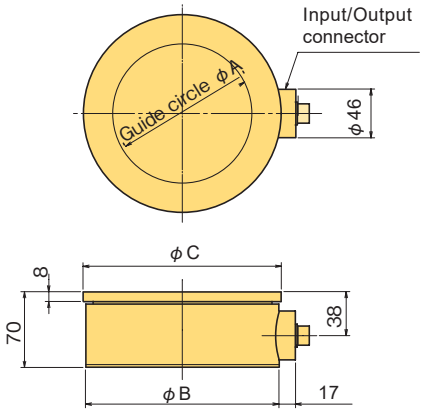
Input/Output cable : CLJ-50KNB~ -500KNB ϕ6mm 0.08mm^2 6-core shielded polyurethane cable 5m (Remote-sensing compatible)
: CLJ-1MNB~ -10MNB ϕ9mm 0.3mm^2 6-core shielded vinyl cable 5m (Remote-sensing compatible)

*Made-to-order

CLF-NA Compression Load Cell 500kN~2MN



Low profile
Flat surface



The CLF-NA is a thin load cell with a flat load bearing surface. It is widely used as a load sensor for industrial machinery, especially when measuring loads on rolling machines or measuring compression force on presses.

Protection ratings: IP65 equivalent

N.B.: Force should be applied uniformly to the sur-face including guide circle.

■ SPECIFICATIONS

TYPE	CLF-500KNA	CLF-1MNA	CLF-1.5MNA	CLF-2MNA
Capacity	500kN	1MN	1.5MN	2MN
Rated Output	2mV/V (4000×10^{-6} strain) ±0.5%			
Non-linearity	0.3%RO			
Hysteresis	0.2%RO			
Temperature effect on zero	0.01%RO/°C			
Temperature effect on span	0.005%/°C			
Compensated temperature range	-10 ~ +60°C			
Allowable temperature range	-20 ~ +70°C			
Over load	150%			
Input/Output resistance	350Ω±5%			
Recommended exciting voltage	10V or less			
Allowable exciting voltage	20V			
Zero balance	5%RO			
Weight	6kg	8kg	10kg	13kg

Supplied cable : CT9-4N10/WP-STB (ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 10m)

■ DIMENSIONS

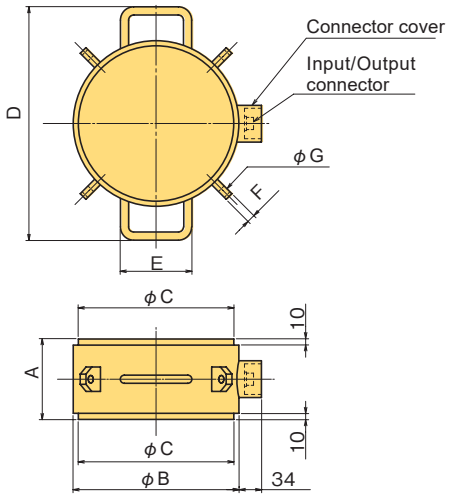
TYPE	ϕA	ϕB	ϕC
CLF-500KNA	95	140	145
CLF-1MNA	130	180	185
CLF-1.5MNA	150	200	205
CLF-2MNA	170	220	225

CLF-NA Compression Load Cell 3~10MN

Made-to-order



Low profile
Flat surface



The CLF-NA is a thin load cell with a flat load bearing surface. It is widely used as a load sensor for industrial machinery, especially when measuring loads on rolling machines or measuring compression force on presses.

Protection ratings: IP65 equivalent

N.B.: Force should be applied uniformly to the sur-face.

■ SPECIFICATIONS

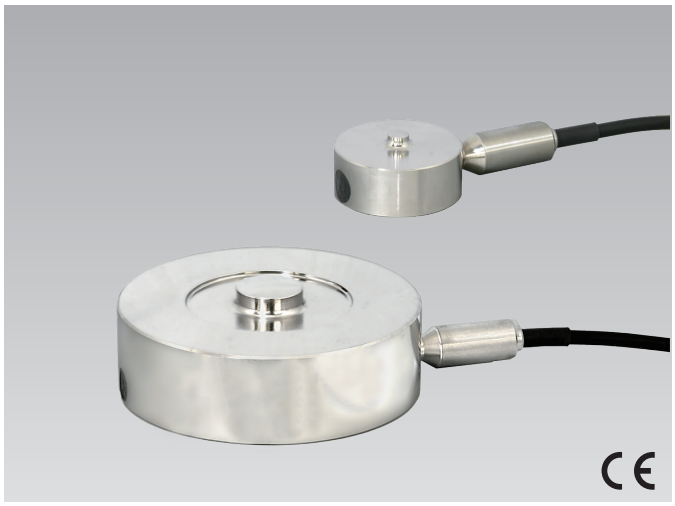
TYPE	CLF-3MNA	CLF-5MNA	CLF-10MNA
Capacity	3MN	5MN	10MN
Rated Output	1.5mV/V (3000×10^{-6} strain) ±0.5%		
Non-linearity	0.3%RO		
Hysteresis	0.2%RO		
Temperature effect on zero	0.01%RO/°C		
Temperature effect on span	0.005%/°C		
Compensated temperature range	-10 ~ +60°C		
Allowable temperature range	-20 ~ +70°C		
Over load	150%		
Input/Output resistance	350Ω±5%		
Recommended exciting voltage	10V or less		
Allowable exciting voltage	20V		
Zero balance	5%RO		
Weight	40kg	66kg	150kg

Supplied cable : CT9-4N10/WP-STB (ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 10m)

■ DIMENSIONS

TYPE	A	ϕB	ϕC	D	E	F	ϕG
CLF-3MNA	125	255	240	355	110	13	11
CLF-5MNA	135	320	300	430	120	16	13
CLF-10MNA	170	415	390	555	130	27	22

CLR-NAH Compression Load Cell 500N~200kN

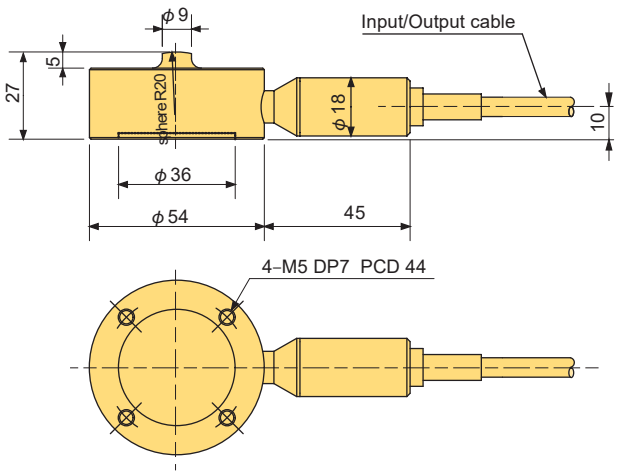


The CLR-NAH compression load cell can be used at high temperatures. The inert gas-filled and hermetically sealed structure offers stable measurement.

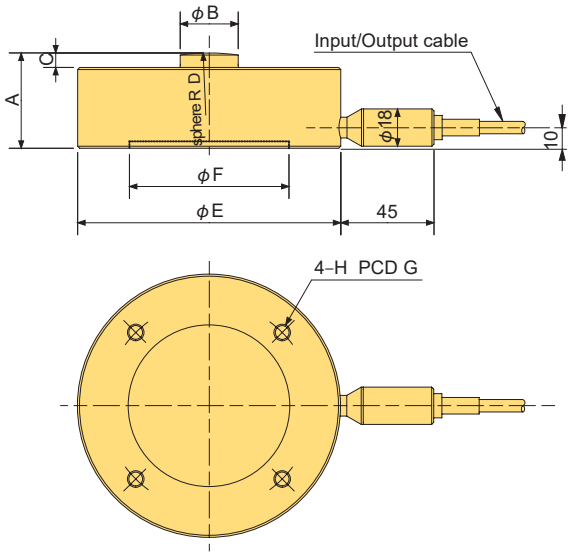
Protection ratings: IP67 equivalent

High temperature upto 160°C
Inert gas hermetically sealed

CLR-500NAH~ 20KNAH



CLR-50~ 200KNAH



■ FITTING ACCESSORY

TYPE	Spherical Cap FA	Mounting Flange FB	Slide Support FC
CLR-500NAH CLR-1KNAH~ 20KNAH	FA-20	FB-2-44	FC-2-20
CLR-50KNAH	FA-60	FB-5-82	FC-5-60
CLR-100KNAH	FA-80	FB-10-90	FC-20-80
CLR-200KNAH	FA-100	FB-20-100	FC-20-100

Refer to pages 131~134 for load cell fitting accessories.

■ DIMENSIONS

TYPE	A	ϕB	C	D	ϕE	ϕF	G	H
CLR-50KNAH	31	18	3	60	102	67	82	M8 DP10
CLR-100KNAH	36	22	5	80	117	71	90	M8 DP10
CLR-200KNAH	46	28	7	100	127	77	100	M8 DP10

■ SPECIFICATIONS

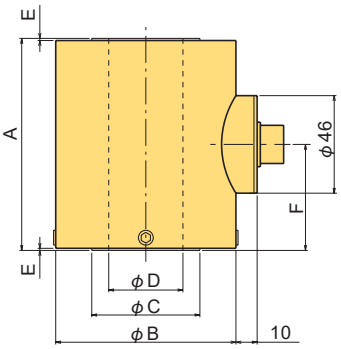
TYPE	CLR-500NAH	CLR-1KNAH	CLR-2KNAH	CLR-5KNAH	CLR-10KNAH	CLR-20KNAH	CLR-50KNAH	CLR-100KNAH	CLR-200KNAH
Capacity	500N	1kN	2kN	5kN	10kN	20kN	50kN	100kN	200kN
Rated Output	2mV/V (4000×10^{-6} strain) ±25%								
Non-linearity	0.5%RO								
Hysteresis	0.5%RO								
Natural frequency	6.1kHz	8.9kHz	13kHz	19kHz	24kHz	28kHz	13kHz	13kHz	13kHz
Temperature effect on zero	0.005%RO/°C								
Temperature effect on span	0.01%/°C								
Compensated temperature range	-10 ~ +160°C								
Allowable temperature range	-10 ~ +160°C								
Over load	150%								
Input/Output resistance	350Ω±2%								
Recommended exciting voltage	10V or less								
Allowable exciting voltage	20V								
Zero balance	±5000×10^{-6} strain or less								
Weight	0.3kg						1.4kg	2.2kg	3.6kg

Input/Output cable : ϕ6mm 0.3mm^2 4-core shielded fluorocarbon resin cable 5m

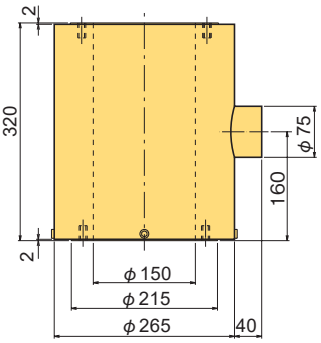
CLC-NA Center-hole type Compression Load Cell 50kN~5MN

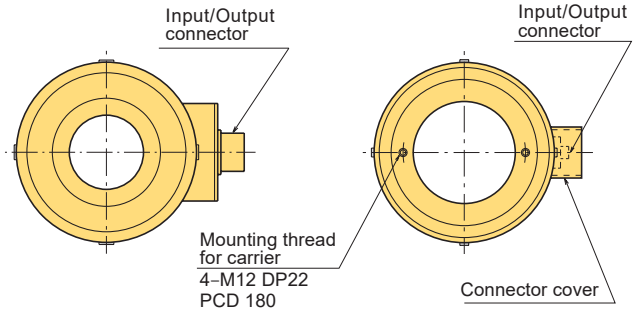


CLC-50KNA~ 3MNA



CLC-5MNA





The CLC-NA is a center-hole-type load cell with a strain gauge mounted on a cylindrical strain sensing element. It is used to conduct pullout tests on anchors or laboratory experiments.

Protection ratings: IP65 equivalent

High precision

■ DIMENSIONS

TYPE	A	ϕB	ϕC	ϕD	E	F
CLC-50KNA	60	50	21	15	1	30
CLC-100KNA	70	60	29	20	1	35
CLC-200KNA	90	70	42	30	1	45
CLC-300KNA	100	85	51	35	1	50
CLC-500KNA	100	100	62	40	1	50
CLC-1MNA	150	130	90	60	2	75
CLC-2MNA	200	170	132	90	2	100
CLC-3MNA	250	205	164	115	2	125
CLC-5MNA	As per the figure					

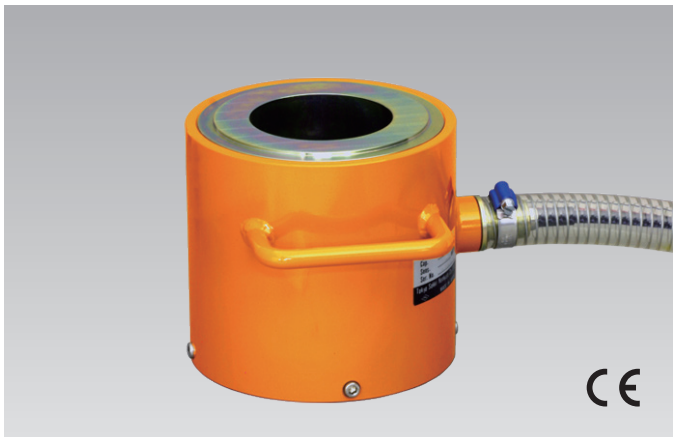
■ SPECIFICATIONS

TYPE	CLC-50KNA	CLC-100KNA	CLC-200KNA	CLC-300KNA	CLC-500KNA	CLC-1MNA	CLC-2MNA	CLC-3MNA	CLC-5MNA*
Capacity	50kN	100kN	200kN	300kN	500kN	1MN	2MN	3MN	5MN
Rated Output	1.5mV/V (3000×10^{-6} strain) ±0.5%								
Non-linearity	0.3%RO				0.5%RO				
Hysteresis	0.3%RO				0.5%RO				
Natural frequency	20kHz	20kHz	17kHz	15kHz	15kHz	10kHz	7.7kHz	6.2kHz	4.7kHz
Temperature effect on zero	0.01%RO/°C								
Temperature effect on span	0.005%/°C								
Compensated temperature range	-10 ~ +60°C								
Allowable temperature range	-20 ~ +70°C								
Over load	150%								
Input/Output resistance	350Ω±1%								
Recommended exciting voltage	10V or less								
Allowable exciting voltage	20V								
Zero balance	5%RO								
Weight	1kg	2kg	2kg	3kg	4kg	8kg	19kg	34kg	67kg

Input/Output cable : CT9-4N10/WP-STB Waterproof plug (ϕ9mm $0.5mm^2$ 4-core shielded chloroprene cable 10m) *Made-to-order

KCM-NA Center-hole type Compression Load Cell

Civil engineering design

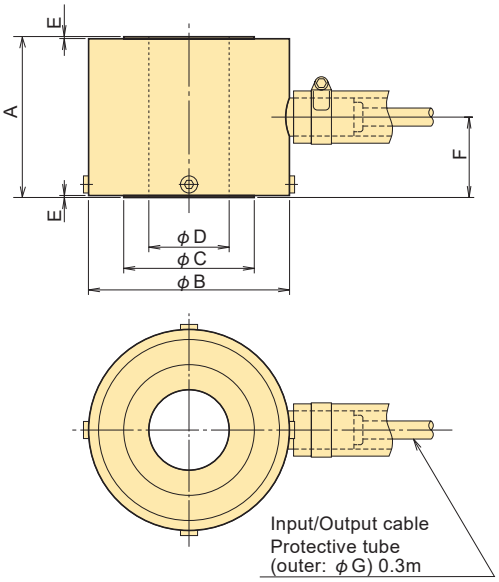


The KCM-NA is a center-hole-type load cell with a strain gauge mounted on a cylindrical strain sensing element. It is used to measure prestress or tension force on ground anchors, pullout testing and measuring axial force on tie rods. The model is especially well suited for measuring on site.

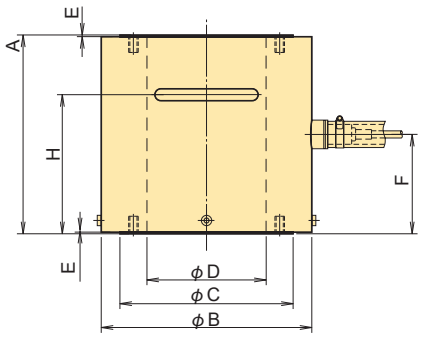
Protection ratings: IP67 equivalent

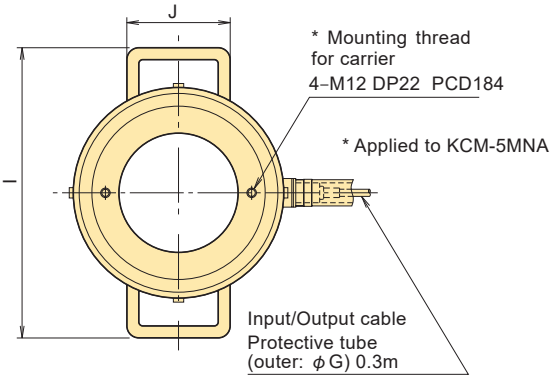
Small type
Easy handling

KCM-10KNA~ 1MNA



KCM-2MNA~ 5MNA





■ DIMENSIONS

TYPE	A	ϕB	ϕC	ϕD	E	F	ϕG	H	I	J
KCM-10KNA	50	50	18	15	1	29	26	–	–	–
KCM-20KNA	50	50	18	15	1	29	26	–	–	–
KCM-50KNA	50	50	22	15	1	29	26	–	–	–
KCM-100KNA	60	60	30	20	1	33	26	–	–	–
KCM-200KNA	70	70	44	30	1	35	26	–	–	–
KCM-300KNA	80	85	53	35	1	40	26	–	–	–
KCM-500KNA	80	100	65	40	1	40	26	–	–	–
KCM-1MNA	120	130	94	60	2	60	33	–	–	–
KCM-2MNA	160	170	135	90	2	80	33	110	234	124
KCM-3MNA	195	205	169	115	2	97.5	33	130	285	124
KCM-5MNA	250	265	218	150	2	125	33	175	365	130

■ SPECIFICATIONS

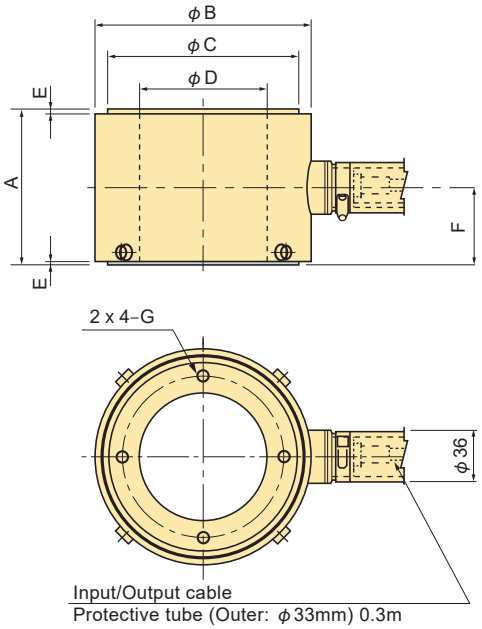
TYPE	KCM-10KNA	KCM-20KNA	KCM-50KNA	KCM-100KNA	KCM-200KNA	KCM-300KNA	KCM-500KNA	KCM-1MNA	KCM-2MNA*	KCM-3MNA*	KCM-5MNA*
Capacity	10kN	20kN	50kN	100kN	200kN	300kN	500kN	1MN	2MN	3MN	5MN
Rated Output	1.5mV/V (3000×10^{-6} strain) ±20%		1.5mV/V (3000×10^{-6} strain) ±10%								
Non-linearity	0.5%RO								1%RO		
Hysteresis	0.5%RO								1%RO		
Temperature effect on zero	0.1%RO/°C										
Temperature effect on span	0.05%/°C										
Compensated temperature range	-10 ~ +60°C										
Allowable temperature range	-20 ~ +70°C										
Over load	150%										
Input/Output resistance	350Ω±1%										
Recommended exciting voltage	10V or less										
Allowable exciting voltage	20V										
Zero balance	5%RO										
Weight	0.5kg	0.5kg	0.8kg	1.1kg	1.4kg	2kg	2.8kg	6.2kg	16kg	29kg	55kg

Input/Output cable : ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 5m *Made-to-order

KCE-NA Center-hole type Compression Load Cell

Civil engineering design





The KCE-NA is a center-hole-type load cell designed to use in tension measurement of anchoring strand. It can deliver stable measurement performance under somewhat eccentric load. An extra model with built-in temperature sensor is available.

Protection ratings: IP67 equivalent

Small effect of eccentric load

■ DIMENSIONS

TYPE	A	ϕB	ϕC	ϕD	E	F	G
KCE-500KNA	77.5	130	113	82	2	39	M8 DP10 PCD 98
KCE-1MNA	109	150	134	90	2	54.5	M10DP12 PCD112
KCE-1.5MNA	115	185	160	110	4	57.5	M12DP15 PCD136
KCE-2MNA	155	215	188	140	5	77.5	M12DP15 PCD164

■ SPECIFICATIONS

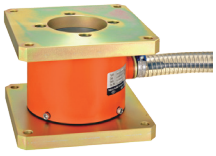
TYPE	KCE-500KNA	KCE-1MNA	KCE-1.5MNA	KCE-2MNA
Capacity	500kN	1MN	1.5MN	2MN
Rated Output	1.25mV/V (2500×10^{-6} strain) ±10%			
Non-linearity	0.5%RO			
Hysteresis	0.5%RO			
Natural frequency	16kHz	12kHz	12kHz	9.2kHz
Temperature effect on zero	0.1%RO/°C			
Temperature effect on span	0.05%/°C			
Compensated temperature range	-10 ~ +60°C			
Allowable temperature range	-20 ~ +70°C			
Over load	120%			
Input/Output resistance	350Ω±1%			
Recommended exciting voltage	10V or less			
Allowable exciting voltage	20V			
Zero balance	5%RO			
Weight	4.0kg	8.5kg	12.2kg	21kg

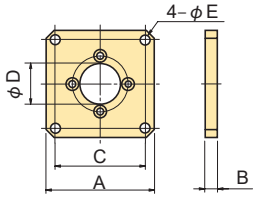
Input/Output cable : ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 5m

■ ACCESSORY

● FLANGE KCEF-11

This flange is a pressure plate used to secure a load cell to a structure.





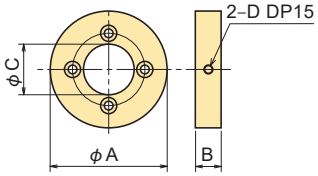
■ Dimensions

Type	Applicable Load Cell	A	B	C	ϕD	ϕE	Weight
KCEF-11-50	KCE-500KNA	180	20	150	82	12.5	4.1kg
KCEF-11-100	KCE-1MNA	200	20	170	90	12.5	5.1kg
KCEF-11-150	KCE-1.5MNA	220	35	190	110	12.5	10.4kg
KCEF-11-200	KCE-2MNA	250	35	220	140	12.5	13 kg

● FLANGE KCEF-12

This flange is a pressure plate used to consistently measure eccentric loads although with limitations.



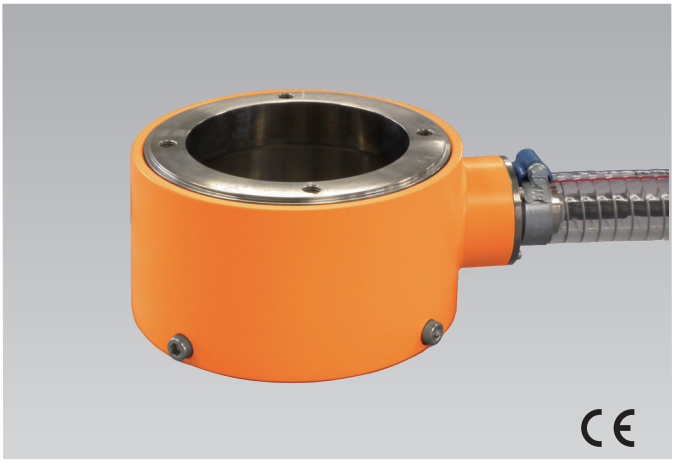


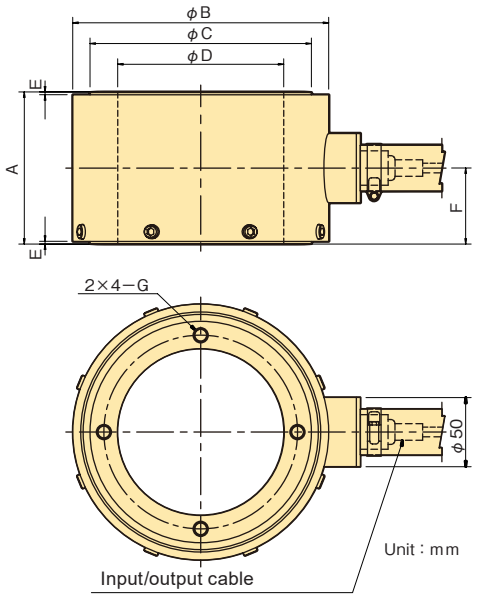
■ Dimensions

Type	Applicable Load Cell	ϕA	B	ϕC	D	Weight
KCEF-12-50	KCE-500KNA	156	26	82	M 8	2.8kg
KCEF-12-100	KCE-1MNA	176	35	90	M10	4.9kg
KCEF-12-150	KCE-1.5MNA	206	43	110	M10	7.9kg
KCEF-12-200	KCE-2MNA	236	47	140	M12	10 kg

KCH-NA Center-hole type Compression Load Cell

Civil engineering design





The KCH-NA is a center-hole type load cell used for the management of tensile force acting on a rod or strand in various anchor methods. The diameter of its center-hole is larger than that of our conventional type KCE-NA.

Protection ratings: IP68 equivalent

Large center-hole
Waterproof construction
(IP68 equivalent)
Small effect of eccentric load

■ DIMENSIONS

TYPE	A	ϕB	ϕC	ϕD	E	F	G
KCH-500KNA	80	140	125	95	2	40	M 8 DP10 PCD110
KCH-1MNA	110	185	160	120	2	55	M10DP12 PCD140
KCH-1.5MNA	135	210	185	145	4	67.5	M12DP15 PCD165
KCH-2MNA	Made-to-order manufacturing						

■ SPECIFICATIONS

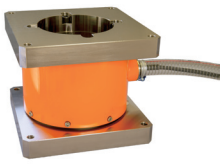
Type	KCH-500KNA	KCH-1MNA	KCH-1.5MNA	KCH-2MNA
Capacity	500kN	1MN	1.5MN	2MN
Rated output	1.25mV/V (2500×10^{-6} strain) ±10%			Made-to-order manufacturing
Non-linearity	0.5%RO			
Hysteresis	0.5%RO			
Natural frequency	16kHz	12kHz	11kHz	
Temperature effect on zero	0.1%RO/℃			
Temperature effect on span	0.05%/℃			
Compensated temperature range	−10～+60℃			
Allowable temperature range	−20～+70℃			
Overload	120%			
Ultimate overload rating	200%			
Input/output resistance	350Ω			
Recommended exciting voltage	10V or less			
Allowable exciting voltage	20V			
Zero balance	5%RO			

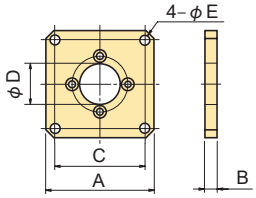
Input/Output cable : Φ9mm 0.5mm2 4-core shielded Chloroprene cable 5m
*Output polarity (note) : The output polarity of this load cell changes to positive polarity as the compression force increases.
In addition to the above, custom-made products will also be available. Please contact us for the details.

■ ACCESSORY

● FLANGE KCHF-11

This flange is a pressure plate used to secure a load cell to a structure.



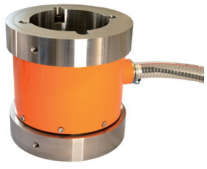


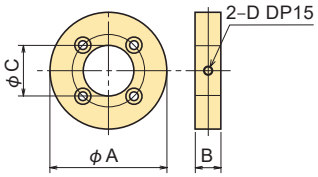
■ Dimensions

Type	Applicable Load Cell	A	B	C	ϕD	ϕE	Weight
KCEF-11-50	KCH-500KNA	190	20	160	95	12.5	4.4kg
KCEF-11-100	KCH-1MNA	235	20	205	120	12.5	6.7kg
KCEF-11-150	KCH-1.5MNA	245	35	215	145	12.5	11.4kg
KCEF-11-200	KCH-2MNA	Made-to-order manufacturing Please contact us for the details.					

● FLANGE KCHF-12

This flange is a pressure plate used to consistently measure eccentric loads although with limitations.





■ Dimensions

Type	Applicable Load Cell	ϕA	B	ϕC	D	Weight
KCHF-12-50	KCH-500KNA	160	30	95	M10	2.9
KCHF-12-100	KCH-1MNA	200	40	120	M10	6.0
KCHF-12-150	KCH-1.5MNA	230	47	145	M12	8.8
KCHF-12-200	KCH-2MNA	Made-to-order manufacturing Please contact us for the details.				

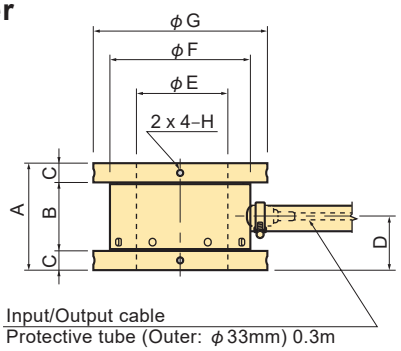
KCC-NA Center-hoe type Compression Load Cell

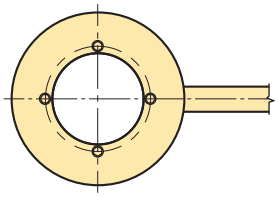
Civil engineering design

Made-to-order



Large center-hole diameter
Flange-mounted





The KCC-NA is a center-hole-type load cell with flanges. The large diameter of its center hole makes this load cell suitable for use in almost all anchoring methods. It can deliver stable measurement performance under a relatively high eccentric load.
Protection ratings: IP67 equivalent

■ SPECIFICATIONS

TYPE	KCC-200KNA	KCC-500KNA	KCC-1MNA
Capacity	200kN	500kN	1MN
Rated Output	1mV/V (2000×10^{-6} strain) ±10%		
Non-linearity	1%RO		
Hysteresis	1%RO		
Temperature effect on zero	0.1%RO/°C		
Temperature effect on span	0.05%/°C		
Compensated temperature range	-10 ~ +60°C		
Allowable temperature range	-20 ~ +70°C		
Over load	120%		
Input/Output resistance	350Ω±1%		
Recommended exciting voltage	10V or less		
Allowable exciting voltage	20V		
Zero balance	5%RO		
Weight	13kg	20kg	32kg

Input/Output cable : ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 5m

■ DIMENSIONS

TYPE	A	B	C	D	ϕE	ϕF	ϕG	H
KCC-200KNA	108	68	20	54	90	145	190	–
KCC-500KNA	140	90	25	70	120	185	230	M 8 DP20
KCC-1MNA	183	123	30	92	140	220	250	M12 DP20

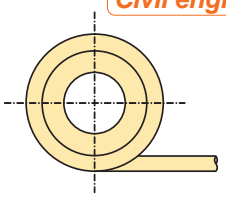
KCG-200KNA Center-hole type Compression Load Cell 200kN

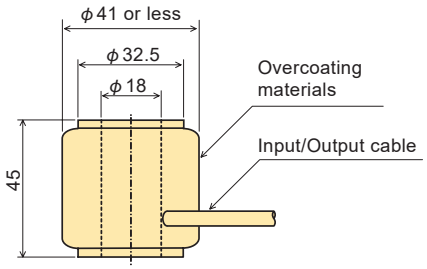
Civil engineering design



Small size
Light weight
Low price

Protection ratings: IP67 equivalent



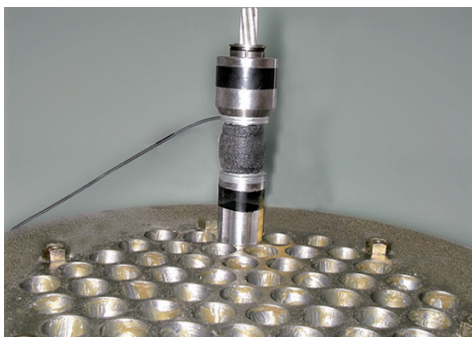


Small and inexpensive center-hole load cell enabling installtion at the strand anchoring part in bridges, etc.

■ SPECIFICATIONS

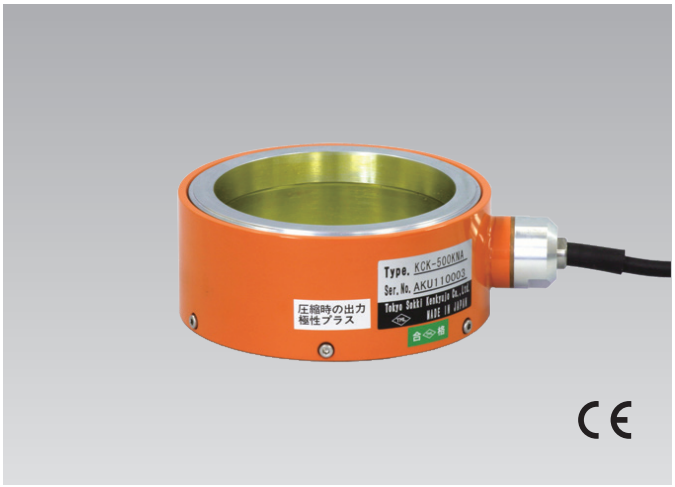
TYPE	KCG-200KNA
Capacity	200kN
Rated Output	2.25mV/V(4500×10^{-6} strain) ±10%
Non-linearity	0.5%RO
Hysteresis	0.5%RO
Temperature effect on zero	0.1%RO/°C
Temperature effect on span	0.05%/°C
Compensated temperature rangte	-10 ~ +60°C
Allowable temperature range	-30 ~ +70°C
Over load	120%
Ultimate overload rating	200%
Input/Output resistance	350Ω
Recommended exciting voltage	10V or less
Allowable exciting voltage	20V
Zero balance	5%RO
Weight	250g

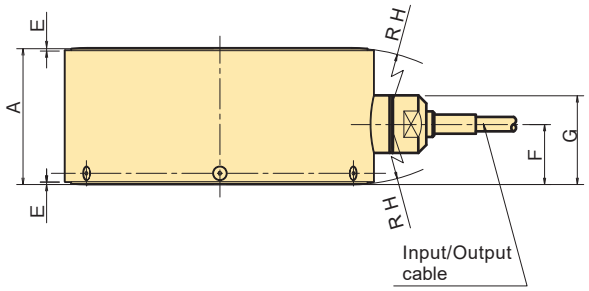
Input/Output cable : ϕ3mm 0.05mm^2 4-core shielded chloroprene cable 2m

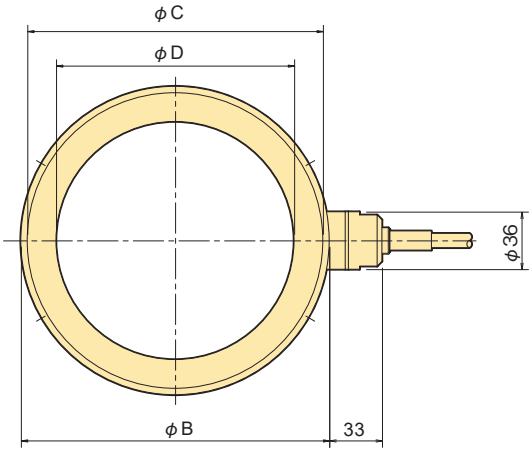


KCK-NA Center-hole type Compression Load Cell

Civil engineering design







The KCK-NA is a center-hole type load cell designed to use in tension measurement of strand post-tensioning anchor such as lift-off testing and monitoring of existing anchor.

Protection ratings: IP67 equivalent

N.B.: The measured value of this load cell shows "+" polarity with increase in compression load.

Large center-hole
Lightweight
Low profile

■ DIMENSIONS

TYPE	A	φB	φC	φD	E	F	G	H
KCK-500KNA	65	155	140	120	1.5	32.5	50.5	75
KCK-1MNA	85	193	185	149	1.5	37.5	55.5	110

■ SPECIFICATIONS

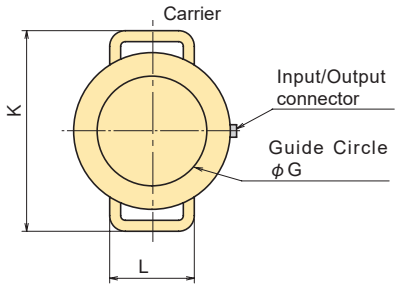
TYPE	KCK-500KNA	KCK-1MNA
Capacity	500kN	1MN
Rated Output	1.25mV/V (2500×10^{-6} strain) ±10%	1.4mV/V (2800×10^{-6} strain) ±10%
Non-linearity	1%RO	
Hysteresis	1%RO	
Temperature effect on zero	0.1%RO/°C	
Temperature effect on span	0.05%/°C	
Compensated temperature range	-10 ~ +60°C	
Allowable temperature range	-30 ~ +70°C	
Over load	120%	
Ultimate overload rating	200%	
Input/Output resistance	350Ω±1%	
Recommended exciting voltage	10V or less	
Allowable exciting voltage	20V	
Zero balance	5%RO	
Weight	3.0kg	5.5kg

Input/Output cable : φ9mm 0.5mm^2 4-core shielded chloroprene cable 5m

CLL-NA Compression Load Cell 500kN~1MN



Loding test on cylindrical concrete specimen

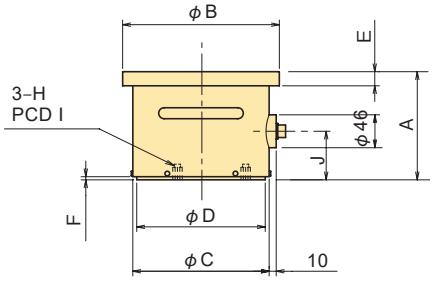


The CLL-NA with a flat loading platform is used to conduct loading tests on cylindrical concrete test specimens. A cylindrical concrete specimen can be directly set on the surface of the loading platform.

Protection ratings: IP65 equivalent

■ DIMENSIONS

TYPE	A	ϕB	ϕC	ϕD	E	F	ϕG	H	I	J	K	L
CLL-500KNA	115	160	140	130	25	1	102	M10 DP10	80	45	–	–
CLL-1MNA	155	220	190	180	25	2	153	M12 DP15	124	65	280	120



■ SPECIFICATIONS

TYPE	CLL-500KNA	CLL-1MNA
Applicable specimen	ϕ 10 x 20cm	ϕ 15 x 30cm
Capacity	500kN	1MN
Rated Output	1.5mV/V (3000×10^{-6} strain) ±0.5%	
Non-linearity	0.2%RO	
Hysteresis	0.2%RO	
Temperature effect on zero	0.01%RO/°C	
Temperature effect on span	0.01%/°C	
Compensated temperature range	-10 ~ +60°C	
Allowable temperature range	-20 ~ +70°C	
Over load	150%	
Input/Output resistance	350Ω±5%	
Recommended exciting voltage	10V or less	
Allowable exciting voltage	20V	
Zero balance	5%RO	
Weight	9kg	22kg

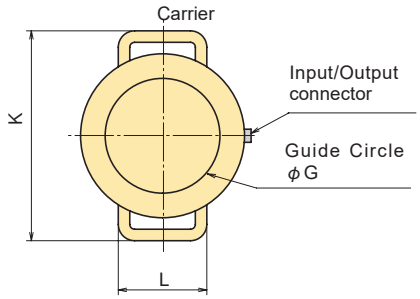
Supplied cable :
CT9-4N10/WP-STB (ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 10m)

CLH-NA Compression Load Cell 1~2MN

Civil engineering design



Loding test on cylindrical concrete specimen

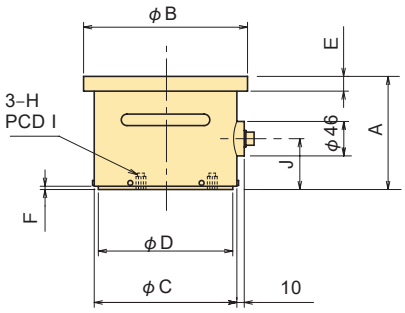


The CLH-NA is designed mainly to test a cylindrical test specimen made of high-strength concrete. By using this load cell together with the compressometer, it is possible to measure load and strain simultaneously.

Protection ratings: IP65 equivalent

■ DIMENSIONS

TYPE	A	ϕB	ϕC	ϕD	E	F	ϕG	H	I	J	K	L
CLH-1MNA	115	160	140	130	25	1	102	M10 DP10	80	45	–	–
CLH-1.5MNA	137	195	170	160	25	2	127	M10 DP12	96	55	254	114
CLH-2MNA	155	220	190	180	25	2	153	M12 DP15	124	65	280	120

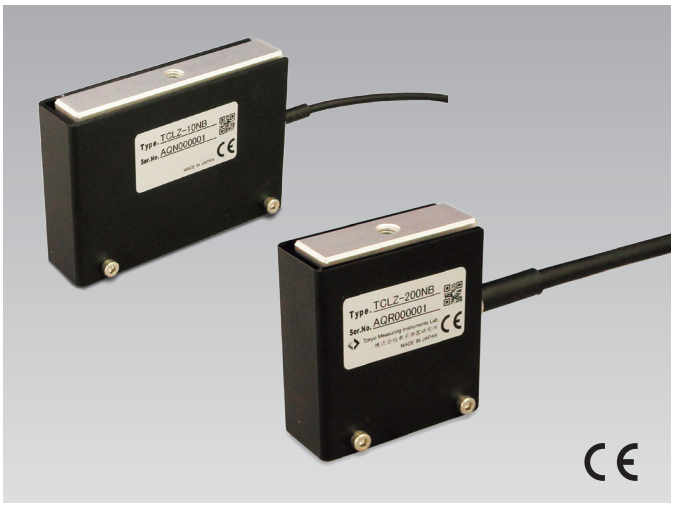


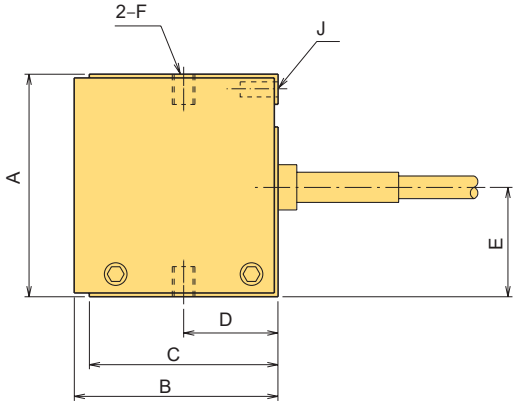
■ SPECIFICATIONS

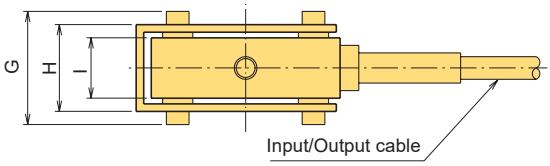
TYPE	CLH-1MNA	CLH-1.5MNA	CLH-2MNA
Applicable specimen	ϕ 10 x 20cm	ϕ 12.5 x 25cm	ϕ 15 x 30cm
Capacity	1MN	1.5MN	2MN
Rated Output	1.5mV/V (3000×10^{-6} strain) ±0.5%		
Non-linearity	0.2%RO		
Hysteresis	0.2%RO		
Temperature effect on zero	0.01%RO/°C		
Temperature effect on span	0.01%/°C		
Compensated temperature range	-10 ~ +60°C		
Allowable temperature range	-20 ~ +70°C		
Over load	150%		
Input/Output resistance	350Ω±5%		
Recommended exciting voltage	10V or less		
Allowable exciting voltage	20V		
Zero balance	5%RO		
Weight	10kg	14kg	26kg

Supplied cable :
CT9-4N10/WP-STB (ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 10m)

TCLZ-NA/-NB Tension / Compression Load Cell 10N~10kN







The TCLZ-NB Tension/Compression Universal Load Cell is a high precision load cell that is compact and light weight. With its beam type internal structure, it is widely used as a sensor for controlling industrial machinery.

Protection ratings: IP41 equivalent

High precision
Various capacities

■ DIMENSIONS

TYPE	A	B	C	D	E	F	G	H	I	J
TCLZ-10NB	59	84	80	40	29.5	M6 x 1 DP8	28	21	14	ϕ4 DP10
TCLZ-20NB	59	84	80	40	29.5	M6 x 1 DP8	28	21	14	ϕ4 DP10
TCLZ-50NB	59	54	50	25	29.5	M6 x 1 DP8	30	23	16	ϕ4 DP10
TCLZ-100NB	59	54	50	25	29.5	M6 x 1 DP8	30	23	16	ϕ4 DP10
TCLZ-200NB	59	54	50	25	29.5	M6 x 1 DP8	30	23	16	ϕ4 DP10
TCLZ-500NA	67	54	50	25	33.5	M12 x 1.75 DP12	34	27	20	ϕ6 DP12
TCLZ- 1KNA	67	54	50	25	33.5	M12 x 1.75 DP12	34	27	20	ϕ6 DP12
TCLZ- 2KNA	67	54	50	25	33.5	M12 x 1.75 DP12	34	27	20	ϕ6 DP12
TCLZ- 5KNA	75	60	56	28	37.5	M12 x 1.75 DP14	34	27	20	ϕ6 DP12
TCLZ-10KNA	75	60	56	28	37.5	M12 x 1.75 DP14	34	27	20	ϕ6 DP12

■ FITTING ACCESSORY

TYPE	Rotary attach-ment FD	Rod End FE	Eye Bolt FF	Load Button FG	Shackle FH
TCLZ-10NB~-200NB	FD-002	FE-002A	–	FG-002	–
TCLZ-500NA~5KNA	FD-05A	FE-05A	FF-1	FG-05	FH-1B
TCLZ-10KNA	FD-1A	FE-1A	FF1	FG-05	FH-1B

Refer to pages 131~134 for load cell fitting accessories.

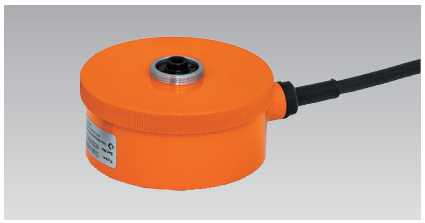
■ SPECIFICATIONS

TYPE	TCLZ-10NB	TCLZ-20NB	TCLZ-50NB	TCLZ-100NB	TCLZ-200NB	TCLZ-500NA	TCLZ-1KNA	TCLZ-2KNA	TCLZ-5KNA	TCLZ-10KNA
Capacity	10N	20N	50N	100N	200N	500N	1kN	2kN	5kN	10kN
Rated Output	1.5mV/V(3000×10^{-6} strain) ±0.5%		2.5mV/V (5000×10^{-6} strain) ±0.5%			2mV/V (4000×10^{-6} strain) ±0.5%				
Non-linearity	0.05%RO		0.03%RO				0.03%RO			0.05%RO
Hysteresis	0.05%RO		0.03%RO				0.03%RO			0.05%RO
Natural frequency	0.14kHz	0.21kHz	0.45kHz	0.59kHz	0.87kHz	1.2kHz	1.7kHz	2.9kHz	3.5kHz	3.6kHz
Temperature effect on zero	0.01%RO/°C		0.006%RO/°C			0.005%RO/°C				
Temperature effect on span	0.005%/°C									
Compensated temperature range	-10 ~ +60°C									
Allowable temperature range	-20 ~ +70°C									
Over load	150%									
Input/Output resistance	350Ω±2%		350Ω±1%							
Recommended exciting voltage	6V or less									
Allowable exciting voltage	15V									
Zero balance	5%RO									
Weight	0.2kg	0.2kg	0.1kg	0.1kg	0.1kg	0.4kg	0.4kg	0.4kg	0.6kg	0.6kg

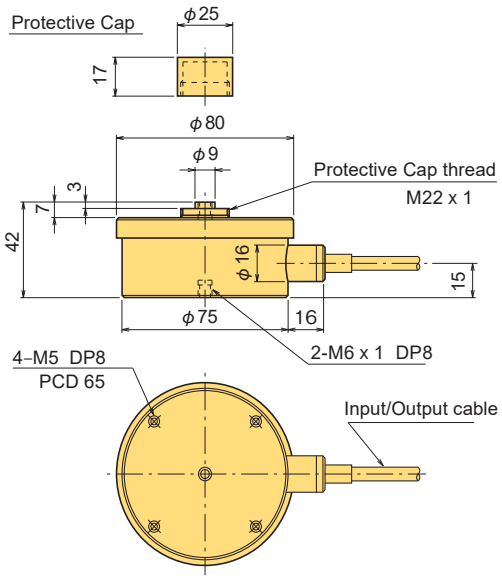
Input/Output cable : TCLZ-10NB/-20NB ϕ3mm 0.05mm^2 4-core shielded chloroprene cable 5m
: Others ϕ6mm 0.35mm^2 4-core shielded chloroprene cable 5m

TCLB-NA Tension/Compression Load Cell 50~200N

Made-to-order



Low capacity
High precision



The TCLB-NA Tension/Compression Universal Load Cell is a low capacity load cell. It can be used for high precision measurement because the internal structure uses both ends fixed beam for the strain sensing element.

Protection ratings: IP40 equivalent TCLB-50NA
IP42 equivalent TCLB-100NA/-200NA

■ SPECIFICATIONS

TYPE	TCLB-50NA	TCLB-100NA	TCLB-200NA
Capacity	50N	100N	200N
Rated Output	1.5mV/V(3000×10^{-6} strain) ±0.5%		
Non-linearity	0.1%RO		
Hysteresis	0.1%RO		
Natural frequency	0.9kHz	1.4kHz	2kHz
Temperature effect on zero	0.01%RO/°C		
Temperature effect on span	0.01%/°C		
Compensated temperature range	-10 ~ +60°C		
Allowable temperature range	-20 ~ +70°C		
Over load	150%		
Input/Output resistance	350Ω±2%		
Recommended exciting voltage	6V or less		
Allowable exciting voltage	15V		
Zero balance	5%RO		
Weight	0.45kg		0.9kg

■ FITTING ACCESSORY

Spherical Cap FA	Mounting Flange FB	Rotary attachment FD	Rod End FE	Load Button FG
FA-20	FB-002-65	FD-002	FE-002A	FG-002

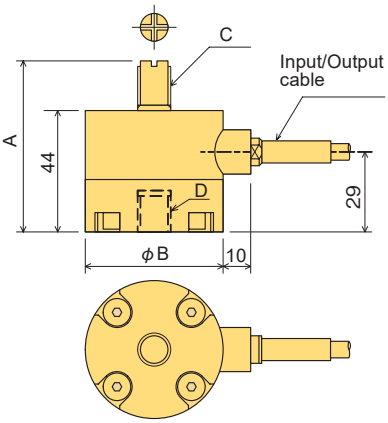
Refer to pages 131~134 for load cell fitting accessories.

Input/Output cable :
ϕ9mm 0.5mm² 4-core shielded chloroprene cable 5m

TCLA-NB Tension/Compression Load Cell 500N~20kN



Small size
Hermetically sealed



The TCLA-NB Tension/Compression Universal Load Cell comes to much smaller and lightweight than conventional TCLA-NA. High capacity ranges of 10kN and 20kN are added on the line. It is hermetically sealed, enabling highly precise and consistent measurement.

Protection ratings: IP67 equivalent

■ SPECIFICATIONS

TYPE	TCLA-500NB	TCLA-1KNB	TCLA-2KNB	TCLA-5KNB	TCLA-10KNB	TCLA-20KNB
Capacity	500N	1kN	2kN	5kN	10kN	20kN
Rated Output	1.5mV/V(3000×10^{-6} strain) ±2%	1.5mV/V(3000×10^{-6} strain) ±1%	2.0mV/V(4000×10^{-6} strain) ±1%			
Non-linearity	0.3%RO	0.2%RO				
Hysteresis	0.1%RO					
Natural frequency	4.5kHz	6.7kHz	8.5kHz	13kHz	17kHz	16kHz
Temperature effect on zero	0.01%RO/°C					
Temperature effect on span	0.01%/°C					
Compensated temperature range	-10 ~ +60°C					
Allowable temperature range	-20 ~ +70°C					
Over load	150%		120%			
Input/Output resistance	350Ω±2%					
Recommended exciting voltage	6V or less					
Allowable exciting voltage	15V					
Zero balance	5%RO					
Weight	0.6kg					0.7kg

■ DIMENSIONS

TYPE	A	ϕB	C	D
TCLA-500NB ~ 10KNB	62	50	M12 x 1.75	M12 x 1.75 DP15
TCLA-20KNB	64	55	M18 x 1.5	M18 x 1.5 DP15

■ FITTING ACCESSORY

TYPE	Rotary attachment FD	Rod End FE
TCLA-500NB ~ 5KNB	FD-05B	FE-05A / FE-05B
TCLA-10KNB	FD-1B	FE-1A/FE-1B
TCLA-20KNB	FD-2B	FE-2A/FE-2B

Refer to pages 131~134 for load cell fitting accessories.

Input/Output cable :
ϕ6mm 0.35mm² 4-core shielded chloroprene cable 5m

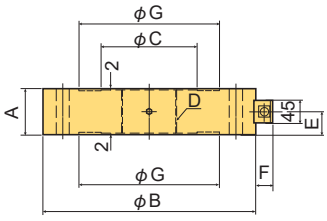
TCLY-NA Tension/Compression Load Cell 300kN~10MN



The TCLY-NA is a Tension/Compression Universal Load Cell with low-profile construction and high-capacity. It offers high precision, high output characteristics and an excellent stability because it uses a shear beam for the strain sensing element. This model is widely used in applications like one-axis loading test machine.

Low profile
High capacities

Protection ratings: IP40 equivalent

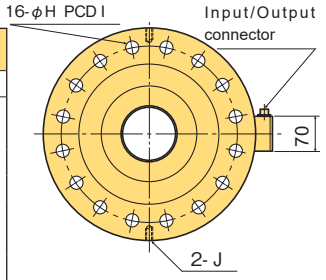


■DIMENSIONS

TYPE	A	ϕB	ϕC	D	E	F	ϕG	ϕH	I	J
TCLY-300KNA	70	295	120	M65x3	35	33	198	17	245	M12 DP22
TCLY-500KNA	75	320	140	M85x3	37.5	33	220	22	270	M12 DP22
TCLY-1MNA	90	420	190	M110x3	45	34	278	26	350	M12 DP22
TCLY-1.5MNA	100	470	230	M140x4	50	34	318	32	395	M16 DP27
TCLY-2MNA	110	500	250	M160x4	55	34.5	338	38	420	M20 DP30

■ SPECIFICATIONS

TYPE	TCLY-300KNA	TCLY-500KNA	TCLY-1MNA	TCLY-1.5MNA	TCLY-2MNA	TCLY-5MNA	TCLY-10MNA
Capacity	300kN	500kN	1MN	1.5MN	2MN	5M	10M
Rated Output	2mV/V(4000×10^{-6} strain) ±0.5%					Build-to-order manufacturing	
Non-linearity	0.2%RO						
Hysteresis	0.2%RO				0.5%RO		
Natural frequency	4.8kHz	5.4kHz	4.8kHz	4.9kHz	5.2kHz		
Temperature effect on zero	0.01%RO/°C						
Temperature effect on span	0.005%/°C						
Compensated temperature range	0 ~ +40°C						
Allowable temperature range	-10 ~ +60°C						
Over load	150%						
Ultimate overload rating	300%						
Input/Output resistance	700Ω±1%						
Recommended exciting voltage	10V or less						
Allowable exciting voltage	20V						
Zero balance	5%RO						
Weight	35kg	40kg	80kg	100kg	125kg		

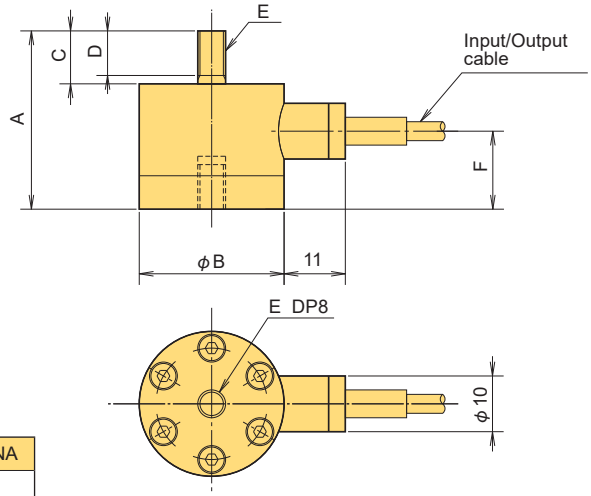


Supplied cable : CT9-4N10/NP-STB NDIS plug(ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 10m)

TCLN-NA Tension/Compression Load Cell 500N~5kN



Small size
Hermetically seald



Compared with TML ordinary Tension/Compression Universal Load Cells, the TCLN-NA is very small and light model. The Input/Output cable is as thin as 3mm in diameter for easiness to handle.

Protection ratings: IP67 equivalent

■ SPECIFICATIONS

TYPE	TCLN-500NA	TCLN-1KNA	TCLN-2KNA	TCLN-5KNA
Capacity	500N	1kN	2kN	5kN
Rated Output	1mV/V(2000×10^{-6} strain) ±20%			
Non-linearity	0.5%RO			
Hysteresis	0.1%RO			
Natural frequency	10kHz	12kHz	14kHz	14kHz
Temperature effect on zero	0.05%RO/°C			
Temperature effect on span	0.05%/°C			
Compensated temperature range	-10 ~ +60°C			
Allowable temperature range	-20 ~ +70°C			
Over load	150%			
Ultimate overload rating	200%			
Input/Output resistance	350Ω±2%			
Recommended exciting voltage	6V or less			
Allowable exciting voltage	15V			
Zero balance	10%RO			
Weight	80g	80g	80g	140g

■ DIMENSIONS

TYPE	A	ϕB	C	D	E	F
TCLN-500NA	32	26	9.5	8	M5 x 0.8	14
TCLN-1KNA	32	26	9.5	8	M5 x 0.8	14
TCLN-2KNA	32	26	9.5	8	M5 x 0.8	14
TCLN-5KNA	42	32	14	12	M8 x 1.25	15

■ FITTING ACCESSORY

TYPE	Rod End FE
TCLN-500NA~ 2KNA	FE-002C/FE-002D
TCLN-5KNA	FE-05C/FE-05D

Refer to pages 131~134 for load cell fitting accessories.

Input/Output cable : ϕ3mm 0.05mm^2 4-core shielded chloroprene cable 5m

TCLK-NA Tension/Compression Load Cell 5~50kN

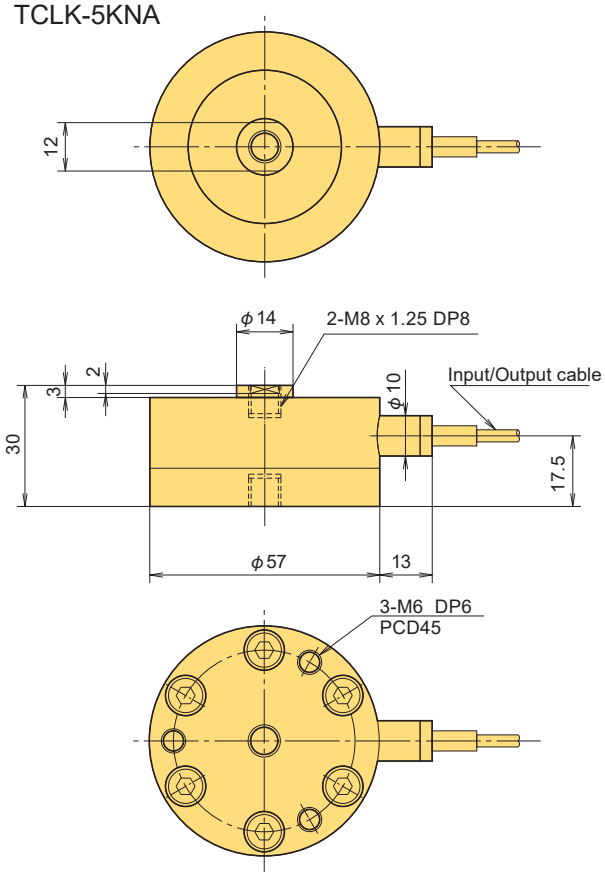


Low profile
Hermetically sealed

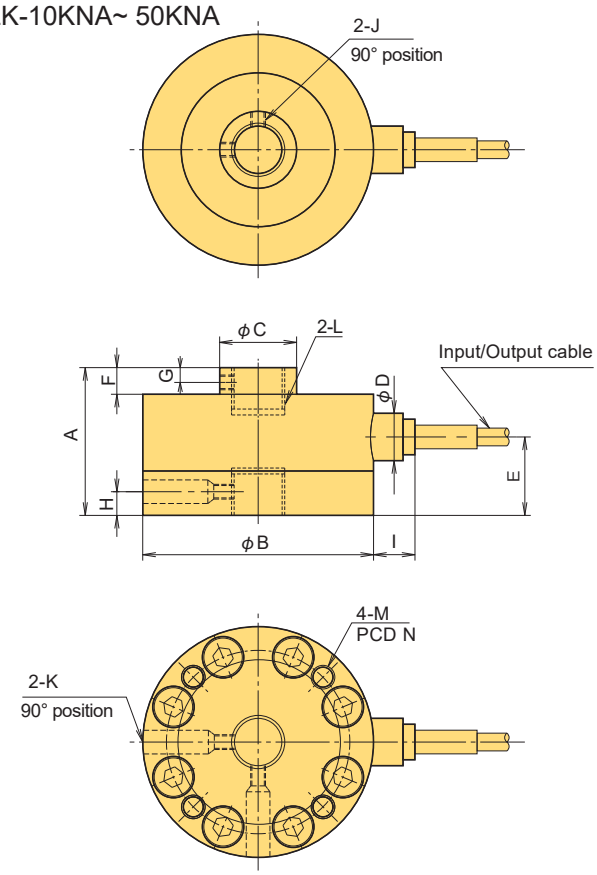
The TCLK-NA Tension/Compression Universal Load Cell has a low profile construction that serves to save installation space.

Protection ratings: IP67 equivalent

TCLK-5KNA



TCLK-10KNA~ 50KNA



■ DIMENSIONS

TYPE	A	ϕB	ϕC	ϕD	E	F	G	H	I	J	K	L	M	N
TCLK-5KNA	As per the figure													
TCLK-10KNA	40	68	20	16	22	6	3	6	14	M3	M4 ϕ6 DP22	M12 x 1.75 DP13	M6 DP8	55
TCLK-20KNA	50	78	26	16	26.5	9	5	8	14	M5	M5 ϕ8 DP22	M18 x 1.5 DP16	M8 DP10	62
TCLK-50KNA	62	100	33	16	31	9	5	10	14	M5	M5 ϕ8 DP22	M24 x 2 DP20	M8 DP10	80

■ SPECIFICATIONS

TYPE	TCLK-5KNA	TCLK-10KNA	TCLK-20KNA	TCLK-50KNA
Capacity	5kN	10kN	20kN	50kN
Rated Output	2mV/V(4000×10^{-6} strain) ±1%			
Non-linearity	0.1%RO			
Hysteresis	0.1%RO			
Natural frequency	18kHz	17kHz	17kHz	14kHz
Temperature effect on zero	0.01%RO/°C			
Temperature effect on span	0.01%/°C			
Compensated temperature range	-10 ~ +60°C			
Allowable temperature range	-20 ~ +70°C			
Over load	150%			
Input/Output resistance	350Ω±2%			
Recommended exciting voltage	6V or less			
Allowable exciting voltage	15V			
Zero balance	5%RO			
Weight	0.45kg	0.8kg	1.3kg	2.6kg

■ FITTING ACCESSORY

TYPE	Spherical Cap FA	Rod End FE	Load Button FG
TCLK-5KNA	FA-20	FE-05C	FG-05B
TCLK-10KNA	FA-60	FE-1A	FG-1
TCLK-20KNA	FA-80	FE-2A	FG-2
TCLK-50KNA	FA-100	FE-5A	FG-5

Refer to pages 131~134 for load cell fitting accessories.

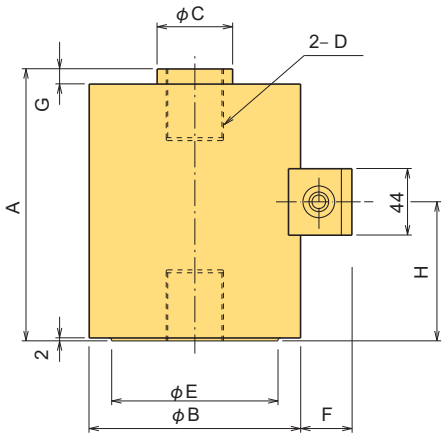
Input/Output cable :

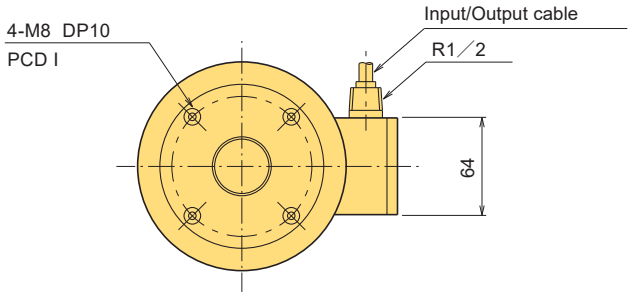
TCLK-5KNA ϕ3mm 0.05mm^2 4-core shielded chloroprene cable 5m

TCLK-10KNA~-50KNA ϕ6mm 0.35mm^2 4-core shielded chloroprene cable 5m

TCLU-NA Tension/Compression Load Cell 10~200kN







The TCLU-NA Tension/Compression Universal Load Cell is an inert-gas encased load cell in a hermetically sealed package. It can take highly precise and consistent measurements over long periods of time, and is used primarily in applications such as measuring crane and jack loads.

Protection ratings: IP65 equivalent

Inert gas hermetically sealed

■ DIMENSIONS

TYPE	A	ϕB	ϕC	D	ϕE	F	G	H	I
TCLU-10KNA	101	88	20	M12 x 1.75 DP15	70	28	8	49	58
TCLU-20KNA	111	100	26	M18 x 1.5 DP20	80	27	8	55	66
TCLU-50KNA	131	100	32	M24 x 2 DP30	80	26.8	8	65	66
TCLU-100KNA	181	138	50	M39 x 2 DP45	110	33	10	92	94
TCLU-200KNA	255	176	64	M50 x 2 DP65	150	34	12	130	130

■ FITTING ACCESSORY

TYPE	Spherical Cap FA	Rotary attachment FD	Rod End FE	Eye Bolt FF	Load Button FG	Shackle FH
TCLU-10KNA	FA-60	FD-1A	FE-1A	FF-1	FG-1	FH-1B
TCLU-20KNA	FA-80	FD-2A	FE-2A	FF-2	FG-2	FH-2B
TCLU-50KNA	FA-100	FD-5	FE-5A	FF-5	FG-5	FH-5B
TCLU-100KNA	FA-140	FD-10	FE-10A	FF-10	FG-10	FH-10B
TCLU-200KNA	FA-140	FD-20	FE-20A	FF-20B	FG-20	FH-20B

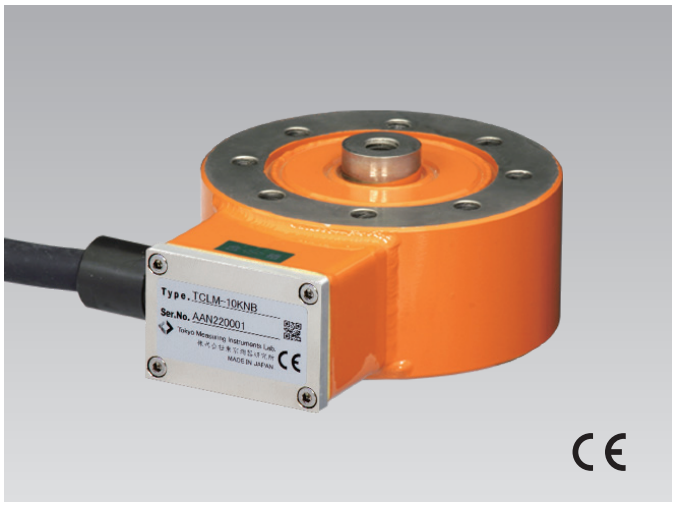
Refer to pages 131~134 for load cell fitting accessories.

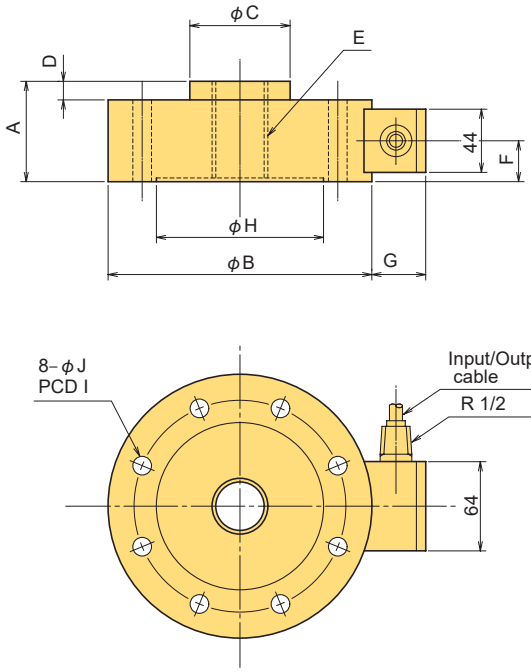
■ SPECIFICATIONS

TYPE	TCLU-10KNA	TCLU-20KNA	TCLU-50KNA	TCLU-100KNA	TCLU-200KNA
Capacity	10kN	20kN	50kN	100kN	200kN
Rated Output	2mV/V(4000×10^{-6} strain) ±0.5%				
Non-linearity	0.15%RO				
Hysteresis	0.05%RO				
Natural frequency	4.8kHz	5.3kHz	6.0kHz	4.8kHz	2.4kHz
Temperature effect on zero	0.005%RO/°C				
Temperature effect on span	0.005%/°C				
Compensated temperature range	-10 ~ +60°C				
Allowable temperature range	-30 ~ +80°C				
Over load	150%				
Input/Output resistance	350Ω±1%				
Recommended exciting voltage	10V or less				
Allowable exciting voltage	20V				
Zero balance	5%RO				
Weight	4kg	4kg	4kg	11kg	18kg

Input/Output cable : ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 5m

TCLM-NB Tension/Compression Load Cell 10~200kN





The TCLM-NB Tension/Compression Universal Lod Cell is an inert-gas encased load cell in a hermetically sealed package. It offers high precision, high output characteristics and excellent stability because it uses a shear beam for the strain sensing element. The model is widely used in applications like test equipment

Protection ratings: IP65 equivalent

High precision
Inert gas hermetically sealed

■ DIMENSIONS

TYPE	A	ϕB	ϕC	D	E	F	G	ϕH	I	ϕJ
TCLM-10KNB	60	118	26	8	M12 x 1.75	26	37	68	90	8.5
TCLM-20KNB	60	118	26	8	M18 x 1.5	26	37	68	90	8.5
TCLM-50KNB	60	127	32	8	M24 x 2	26	37	76	100	8.5
TCLM-100KNB	70	187	70	12	M39 x 2	29	38	116	150	13
TCLM-200KNB	85	226	94	12	M50 x 2	37	38.3	146	185	17

■ FITTING ACCESSORY

TYPE	Spherical Cap FA	Mounting Flange FB	Rotary attach-ment FD	Rod End FE	Eye Bolt FF	Load Button FG	Shackle FH
TCLM-10KNB	FA-60	FB-1M	FD-1A	FE-1A	FF-1	FG-1	FH-1B
TCLM-20KNB	FA-80	FB-2M	FD-2A	FE-2A	FF-2	FG-2	FH-2B
TCLM-50KNB	FA-100	FB-5M	FD-5	FE-5A	FF-5	FG-5	FH-5B
TCLM-100KNB	FA-140	FB-10M	FD-10	FE-10A	FF-10	FG-10	FH-10B
TCLM-200KNB	FA-140	FB-20M	FD-20	FE-20A	FF-20B	FG-20	FH-20B

Refer to pages 131~134 for load cell fitting accessories.

■ SPECIFICATIONS

TYPE	TCLM-10KNB	TCLM-20KNB	TCLM-50KNB	TCLM-100KNB	TCLM-200KNB
Capacity	10kN	20kN	50kN	100kN	200kN
Rated Output	2.5mV/V(5000×10^{-6} strain) ±0.5%				
Non-linearity	0.05%RO				
Hysteresis	0.05%RO				
Natural frequency	1.4kHz	6.3kHz	8.2kHz	6.9kHz	5.6kHz
Temperature effect on zero	0.002%RO/°C				
Temperature effect on span	0.002%/°C				
Compensated temperature range	-10 ~ +60°C				
Allowable temperature range	-30 ~ +80°C				
Over load	150%				
Input/Output resistance	350Ω±1%				
Recommended exciting voltage	10V or less				
Allowable exciting voltage	20V				
Zero balance	5%RO				
Weight	4kg	4kg	6kg	10kg	17kg

Input/Output cable : ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 5m

TCLP-NB Tension/Compression Load Cell 10kN ~2MN



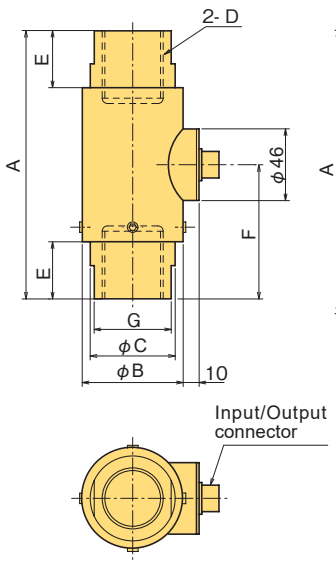
General purpose
Various capacities

The TCLP-NB Tension/Compression Universal Load Cell is a load cell widely used in applications such as measuirng crane and jack loads because it offers excellent consistency.

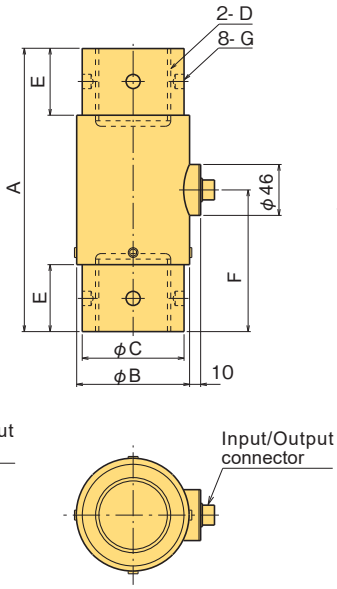
Two independent output type is available on request.

Protection ratings: IP65 equivalent

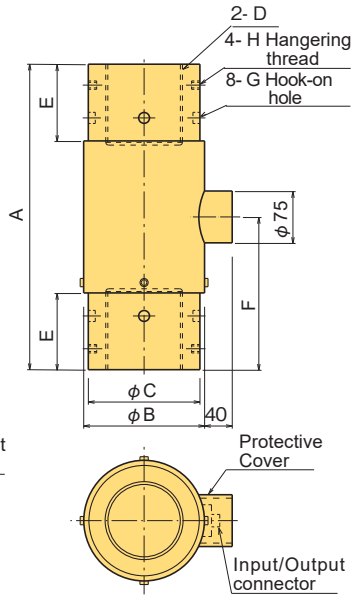
TCLP-10 ~ 200KNB



TCLP-300/-500KNB



TCLP-1 ~ 2MNB



■ DIMENSIONS

TYPE	A	ϕB	ϕC	D	E	F	G	H
TCLP-10KNB	100	55	45	M12 x 1.75 DP15	15	53	36	-
TCLP-20KNB	110	60	50	M18 x 1.5 DP20	20	58	46	-
TCLP-30KNB	125	60	50	M24 x 2 DP30	20	63	46	-
TCLP-50KNB	125	60	50	M24 x 2 DP30	20	63	46	-
TCLP-100KNB	175	65	55	M39 x 2 DP45	37.5	87.5	50	-
TCLP-200KNB	255	80	70	M50 x 2 DP65	65	127.5	65	-
TCLP-300KNB	255	100	90	M65 x 3 DP65	60	127.5	ϕ13 DP8	-
TCLP-500KNB	330	130	120	M85 x 3 DP85	80	165	ϕ15 DP10	-
TCLP-1MNB	440	175	160	M110 x 3 DP110	108	220	ϕ15 DP10	M12 DP12
TCLP-1.5MNB	530	215	200	M140 x 4 DP140	155	265	ϕ20 DP10	M16 DP20
TCLP-2MNB	605	245	230	M160 x 4 DP160	194	302.5	ϕ20 DP10	M20 DP25

■ FITTING ACCESSORY

TYPE	Spherical Cap FA	Rotary attach-ment FD	Rod End FE	Eye Bolt FF	Load Button FG	Shackle FH
TCLP-10KNB	FA-60	FD-1A	FE-1A	FF-1	FG-1	FH-1B
TCLP-20KNB	FA-80	FD-2A	FE-2A	FF-2	FG-2	FH-2B
TCLP-30/-50KNB	FA-100	FD-5	FE-5A	FF-5	FG-5	FH-5B
TCLP-100KNB	FA-140	FD-10	FE-10A	FF-10	FG-10	FH-10B
TCLP-200KNB	FA-140	FD-20	FE-20A	FF-20B	FG-20	FH-20B

Refer to pages 131~134 for load cell fitting accessories.

■ SPECIFICATIONS

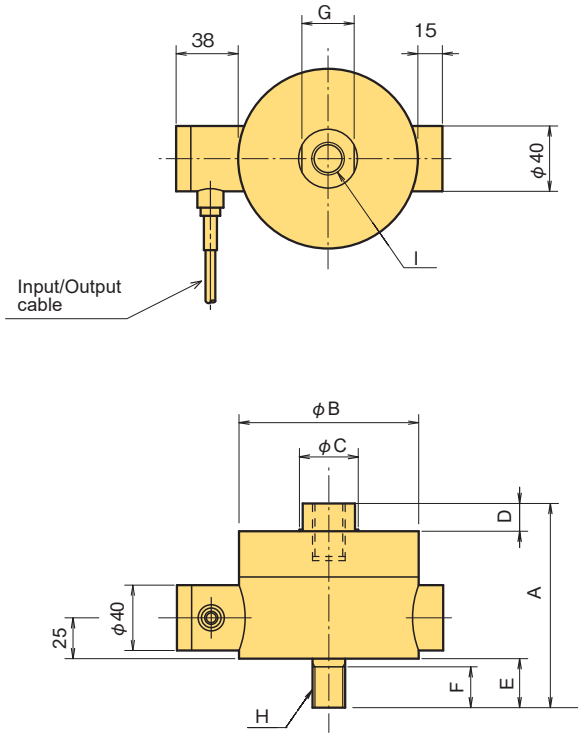
TYPE	TCLP-10KNB	TCLP-20KNB	TCLP-30KNB	TCLP-50KNB	TCLP-100KNB	TCLP-200KNB	TCLP-300KNB	TCLP-500KNB	TCLP-1MNB	TCLP-1.5MNB*	TCLP-2MNB*
Capacity	10kN	20kN	30kN	50kN	100kN	200kN	300kN	500kN	1MN	1.5MN	2MN
Rated Output	1mV/V(2000×10^{-6} strain) ±0.5%										
Non-linearity	0.1%RO									0.3%RO	
Hysteresis	0.1%RO									0.3%RO	
Natural frequency	6.8kHz	7.9kHz	8.3kHz	10kHz	10kHz	7.7kHz	6.7kHz	5.3kHz	4kHz	3.1kHz	2.6kHz
Temperature effect on zero	0.01%RO/°C										
Temperature effect on span	0.005%/°C										
Compensated temperature range	-10 ~ +60°C										
Allowable temperature range	-20 ~ +70°C										
Over load	200%										
Input/Output resistance	350Ω±1%										
Recommended exciting voltage	10V or less										
Allowable exciting voltage	20V										
Zero balance	5%RO										
Weight	1.5kg	1.5kg	2kg	2kg	2.5kg	5kg	8kg	15kg	50kg	85kg	110kg

Supplied cable : CT9-4N10/WP-STB (ϕ 9mm 0.5mm^2 4-core shielded chloroprene cable 10m) *Made-to-order

TLJ-NA Tension Load Cell 10~100kN

Made-to-order





The TLJ-NA Tension Load Cell is designed considering JIS B7721 "Tension/compression testing machines - Verification and calibration of the force-measuring system" and JIS B 7728 "Calibration of force-proving instruments used for the verification of uniaxial testing machine" and is the most suitable for verification of single axis tension testing machine. Calibration in accordance with JIS B 7721 and JIS B 7728 is available at extra cost.

Protection ratings: IP65 equivalent

High stability
Remote sensing compatible

■ DIMENSIONS

TYPE	A	ϕB	ϕC	D	E	F	G	H	I
TLJ-10KNA	125	110	36	17	30	25	32	M20 x 1.5	M20 x 1.5 DP35
TLJ-20KNA	125	110	36	17	30	25	32	M20 x 1.5	M20 x 1.5 DP35
TLJ-50KNA	132	125	36	17	35	30	32	M20 x 1.5	M20 x 1.5 DP35
TLJ-100KNA	142	145	42	17	40	34	36	M24 x 2	M24 x 2 DP35

■ FITTING ACCESSORY

TYPE	Rod End FE
TLJ-10KNA ~ 50KNA	FE-5C/FE-5D
TLJ-100KNA	FE-5A/FE-5B

Refer to pages 131~134 for load cell fitting accessories.

■ SPECIFICATIONS

TYPE	TLJ-10KNA	TLJ-20KNA	TLJ-50KNA	TLJ-100KNA
Capacity	10kN	20kN	50kN	100kN
Rated Output	2mV/V(4000×10^{-6} strain) or more			
Non-linearity	0.03%RO			
Hysteresis	0.03%RO			
Natural frequency	3.5kHz	4.4kHz	4.5kHz	4.7kHz
Temperature effect on zero	0.005%RO/°C			
Temperature effect on span	0.005%/°C			
Compensated temperature range	-10 ~ +60°C			
Allowable temperature range	-30 ~ +80°C			
Over load	120%			
Ultimate overload rating	200%			
Input/Output resistance	350Ω±2%			
Recommended exciting voltage	6V or less			
Allowable exciting voltage	15V			
Zero balance	5%RO			
Weight	5.3kg	5.3kg	6.9kg	10kg

Input/Output cable : ϕ6mm 0.08mm^2 6-core shielded polyurethane cable 5m (Remote sensing compatible)

TLP-NB Tension Load Cell 10kN~1MN

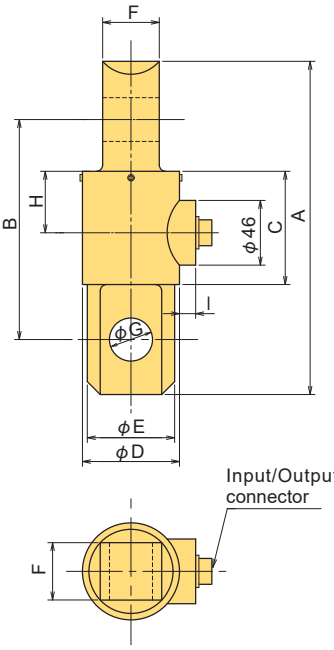


The TLP-NB Tension Load Cell is a tension-only load cell that is used primarily in applications such as measuring tension on wire rope or loads suspended from cranes. Eyebolts integrated into the main unit facilitate mounting simply by attaching shackles.

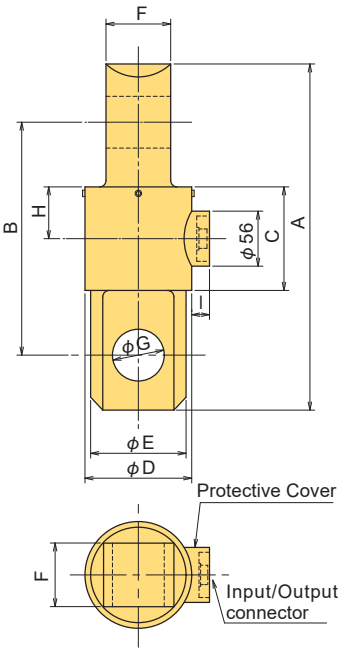
Protection ratings: IP65 equivalent

Eyebolts integrated type

TLP-10 ~ 50KNB



TLP-100KNB ~ 1MNB



■ DIMENSIONS

TYPE	A	B	C	ϕD	ϕE	F	ϕG	H	I
TLP-10KNB	140	110	69	50	32	20	18	39	10
TLP-20KNB	164	122	71	50	40	25	22	40	10
TLP-30KNB	179	127	63	60	50	30	27	34	10
TLP-50KNB	234	168	80	70	60	40	37	44	10
TLP-100KNB	292	200	86	95	85	56	49	47	35
TLP-200KNB	358	244	108	112	100	68	54	56	35
TLP-300KNB	428	288	128	135	120	75	64	64	35
TLP-500KNB	508	342	148	160	145	98	75	74	35
TLP-1MNB	690	450	210	210	195	130	102	105	35

■ FITTING ACCESSORY

TYPE	Shackle FH
TLP-10KNB	FH-1B
TLP-20KNB	FH-2B
TLP-30KNB	FH-3B
TLP-50KNB	FH-5B
TLP-100KNB	FH-10B
TLP-200KNB	FH-20B
TLP-300KNB	FH-30B
TLP-500KNB	FH-50B
TLP-1MNB	FH-100B

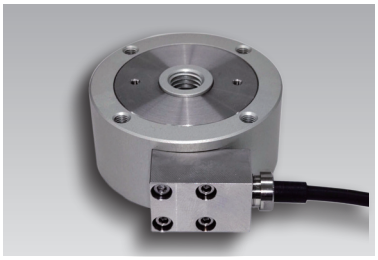
Refer to pages 131~134 for load cell fitting accessories.

■ SPECIFICATIONS

TYPE	TLP-10KNB	TLP-20KNB	TLP-30KNB	TLP-50KNB	TLP-100KNB	TLP-200KNB	TLP-300KNB*	TLP-500KNB*	TLP-1MNB*
Capacity	10kN	20kN	30kN	50kN	100kN	200kN	300kN	500kN	1MN
Rated Output	1mV/V(2000×10^{-6} strain) ±0.5%								
Non-linearity	0.1%RO								
Hysteresis	0.1%RO								
Natural frequency	11kHz	9.5kHz	6.0kHz	4.8kHz	4.0kHz	3.7kHz	3.2kHz	2.7kHz	2.0kHz
Temperature effect on zero	0.01%RO/°C								
Temperature effect on span	0.005%/°C								
Compensated temperature range	-10 ~ +60°C								
Allowable temperature range	-20 ~ +70°C								
Over load	200%								
Input/Output resistance	350Ω±1%								
Recommended exciting voltage	10V or less								
Allowable exciting voltage	20V								
Zero balance	5%RO								
Weight	1kg	1.5kg	2kg	4kg	8kg	14kg	24kg	38kg	110kg

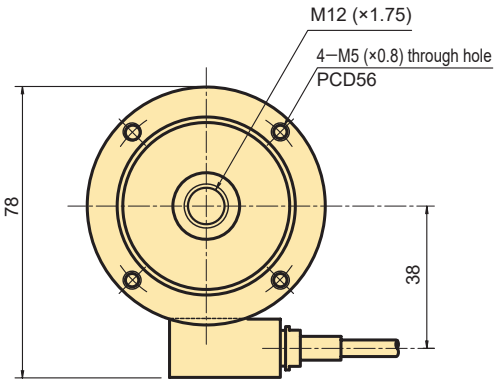
Supplied cable : CT9-4N10/WP-STB (ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 10m) *Made-to-order

WTCLP-NA Waterproof load cell 500N~10kN



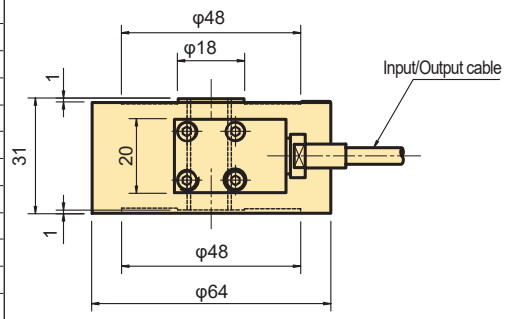
This low-capacity, waterproof load cell is optimized for integration into soil testing systems and offers reliable performance under water pressures up to 1.5 MPa.
Protection ratings : IP 68 equivalent

Outer diameter: φ64 mm; height: 31 mm
Rated output: approx. 2mV/V
Designed to be unaffected by pressure fluctuations
Pressure resistance: up to 1.5MPa (waterproof)
Optional relay fitting available



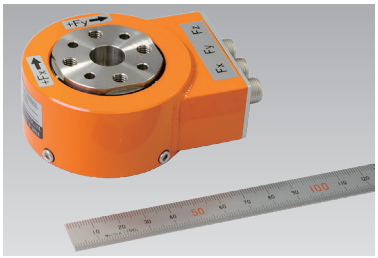
SPECIFICATIONS

Type	WTCLP-500NA	WTCLP-1KNA	WTCLP-2KNA	WTCLP-5KNA	WTCLP-10KNA
Capacity	500N	1kN	2kN	5kN	10kN
Rated output	Approx. 2mV/V Approx. 4000x10^{-6} strain)				
Non-linearity	0.5%RO				
Hysteresis	0.5%RO				
Temperature effect on zero	0.05%RO/°C				
Temperature effect on span	0.01%/°C				
Compensated temperature range	0 to +40°C				
Allowable temperature range	0 to +60°C				
Over load	120%				
Input/Output resistance	175Ω				
Recommended exciting voltage	2V or less				
Allowable exciting voltage	10V				
Zero balance	5000x10^{-6} or less				
Pressure resistance	1.5MPa				
Input/Output cable	φ4.6mm 0.14mm^2 4-conductor shielded vinyl cable 2m free end				



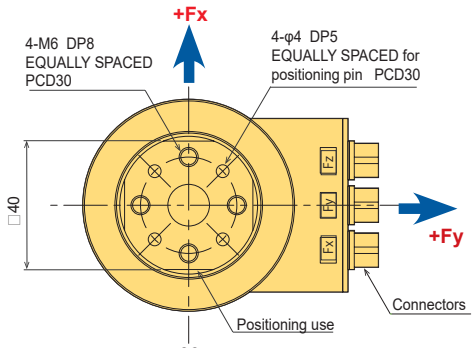
SLP-NA-T 3-component load cell 100N~1kN

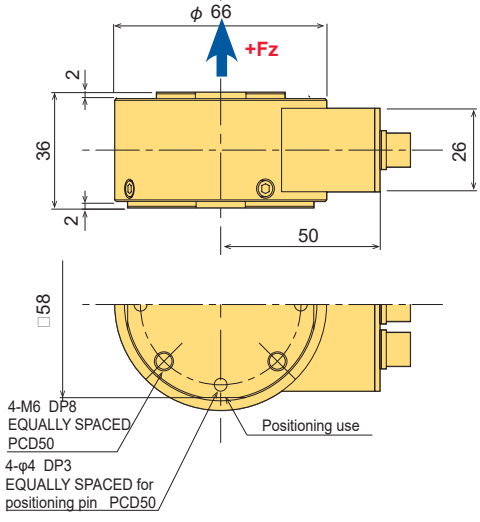
Made-to-order



The SLP-NA-T is a strain gauge based load cell for simultaneous measurement of forces in three mutually perpendicular axes. Since the load cell is constructed small and light, it is well suited to use in model testing.
Protection ratings: IP65 equivalent

Small and light
High frequency response
Easy handling
Applicable to wind tunnel testing and vibra-tion testing of models





SPECIFICATIONS

TYPE	SLP-100NA-T	SLP-200NA-T	SLP-500NA-T	SLP-1KNA-T
Capacity Fx, Fy, Fz	100N	200N	500N	1kN
Rated Output	Approx. 0.5mV/V(Approx. 1000×10^{-6} strain)			
Non-linearity	0.5%RO			
Hysteresis	0.5%RO			
Cross sensitivity	2%RO			
Temperature effect on zero	0.05%RO/°C			
Temperature effect on span	0.05%/°C			
Compensated temperature range	-10 ~ +60°C (No icing)			
Allowable temperature range	-20 ~ +80°C (No icing)			
Over Load	150%			
Ultimate overload rating	200%			
Input/Output resistance	350Ω			
Recommended exciting voltage	2V or less			
Allowable exciting voltage	15V			
Zero balance	20%RO			
Weight	Approx. 300g		Approx. 800g	

Supplied cable : φ4mm 0.09mm^2 4-core shielded vinyl cable 5m, 3 pcs.

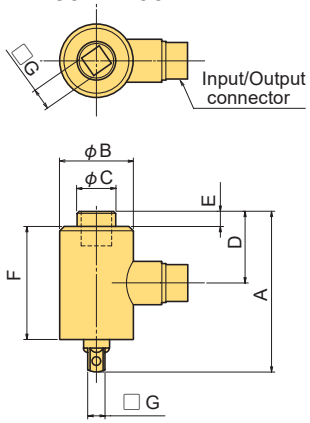
LTA-NA Torque Transducer 50~500N·m



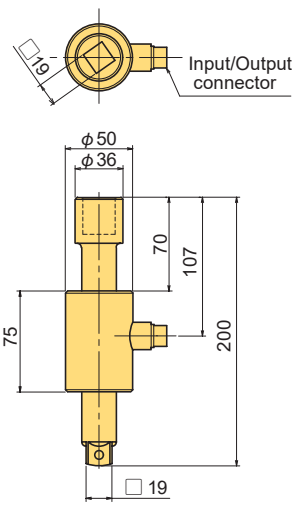
Fastening torque measurement for bolts and nuts

The LTA-NA Torque Transducer is a high precision transducer that is used to measure tightening force on nuts and bolts. Compact and light weight, it is mounted between the socket and the socket wrench handle. Although the transducer uses a strainmeter to take readings, it can be used to take peak readings simply by connecting it to a peak hold measuring instrument.

LTA-50 ~ -200NA



LTA-500NA



■ SPECIFICATIONS

TYPE	LTA-50NA	LTA-100NA	LTA-200NA	LTA-500NA
Capacity	50N·m	100N·m	200N·m	500N·m
Rated Output	2mV/V(4000×10^{-6} strain) ±2%		3mV/V (6000×10^{-6} strain) ±2%	2mV/V(4000×10^{-6} strain) ±2%
Non-linearity	0.3%RO			
Temperature effect on zero	0.1%RO/°C			
Temperature effect on span	0.05%/°C			
Compensated temperature range	-10 ~ +60°C			
Allowable temperature range	-10 ~ +60°C			
Input/Output resistance	350Ω±1%			
Recommended exciting voltage	3V or less			
Allowable exciting voltage	10V			
Zero balance	10%RO			
Over Load	120%			
Weight	0.25kg	0.3kg	0.3kg	1.5kg

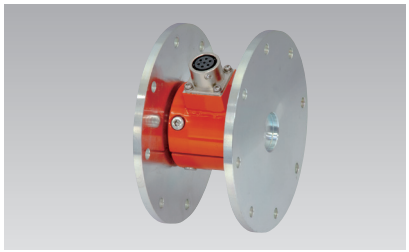
■ DIMENSIONS

TYPE	A	φB	φC	D	E	F	□G
LTA-50NA	75	34	18	35	7	52	9.5
LTA-100NA	75	34	23.5	38	9	48	12.7
LTA-200NA	75	34	23.5	38	9	48	12.7
LTA-500NA	As per the figure						

Protection ratings: IP40 equivalent

Supplied cable :
CT6-4V5/NP-STB (φ6mm 0.3mm^2 4-core shielded vinyl cable 5m)

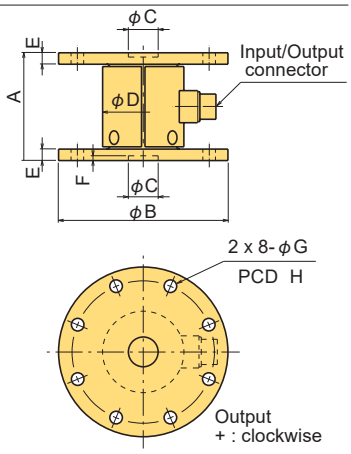
LTB-NA Torque Transducer 10N·m~1kN·m



Flange mounting type

The LTB-NA Torque Transducer is a flange-mounted transducer that is installed between non-rotating measuring items in order to detect torque in the items.

Protection ratings: IP30 equivalent



■ DIMENSIONS

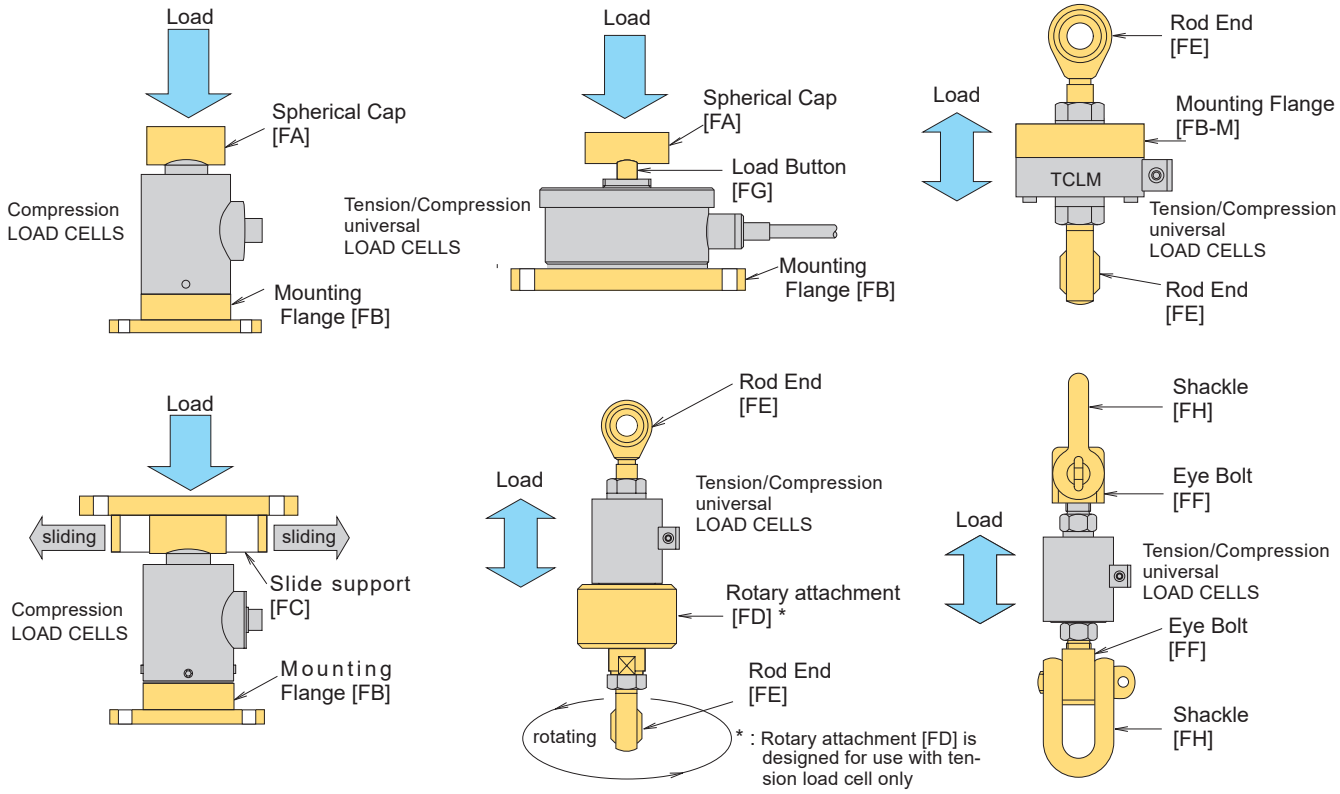
TYPE	A	φB	φC	φD	E	F	φG	H
LTB-10NA	55	105	20 H8	45	5	3	5.5	90
LTB-20NA	55	105	20 H8	45	5	3	5.5	90
LTB-30NA	55	105	20 H8	45	5	3	5.5	90
LTB-50NA	55	105	20 H8	45	5	3	5.5	90
LTB-100NA	75	115	20 H8	55	8	3	8.5	95
LTB-200NA	75	115	20 H8	55	8	3	8.5	95
LTB-300NA	75	115	20 H8	55	8	3	8.5	95
LTB-500NA	90	130	30 H8	60	10	3	10.5	110
LTB-1KNA	105	140	30 H8	70	12	3	12.5	115

■ SPECIFICATIONS

TYPE	LTB-10NA	LTB-20NA	LTB-30NA	LTB-50NA	LTB-100NA	LTB-200NA*	LTB-300NA*	LTB-500NA*	LTB-1KNA*
Capacity	10N·m	20N·m	30N·m	50N·m	100N·m	200N·m	300N·m	500N·m	1kN·m
Rated Output	1mV/V(2000×10^{-6} strain) ±2%								
Non-linearity	0.3%RO								
Hysteresis	0.3%RO								
Temperature effect on zero	0.01%RO/°C								
Temperature effect on span	0.005%/°C								
Compensated temperature range	0 ~ +40°C								
Allowable temperature range	-10 ~ +60°C								
Over load	150%								
Input/Output resistance	350Ω±1%								
Recommended exciting voltage	6V or less								
Allowable exciting voltage	10V								
Zero balance	5%RO								
Weight	1kg	1kg	1kg	1kg	2kg	2kg	2kg	3kg	5kg

Supplied cable :CT6-4V5/NP-STB (φ6mm 0.3mm^2 4-core shielded vinyl cable 5m) *Made-to-order

Load Cell Fitting Accessory CE



Compression Load Cells	Fitting accessory		
	Spherical Cap FA	Mounting Flange FB	Slide Support FC
CLA-500NA ~ 20KNA	FA-20	FB-2-44	FC-2-20
CLP-10, -20KNB	FA-60	FB-10-30	FC-5-60
-30, -50KNB (-D) **	FA-60	FB-10-30	FC-5-60
-100KNB (-D)**	FA-80	FB-10-30	FC-20-80
-200KNB (-D)**	FA-100	FB-20-40	FC-20-100
-300, -500KNB (-D)**	FA-140	FB-50-60	FC-50-140
-1MNB (-D)**	FA-160	FB-100-80	–
-2MNB (-D)**	FA-250	FB-200-100	–
-3MNB (-D)**	FA-360	FB-300-120	–
-5MNB (-D)**	FA-360B	FB-500-140	–
-10MNB	FA-720	FB-1000-200	–
CLG-10, -20KNB	FA-60	FB-2-70	FC-5-60
-50KNB	FA-60	FB-5-82	FC-5-60
-100KNB	FA-80	FB-10-90	FC-20-80
-200KNB	FA-100	FB-20-100	FC-20-100
CLM-10KNB ~ 50KNB	FA-60	FB-5-80	FC-5-60
-100KNB	FA-80	FB-10-90	FC-20-80
-200KNB	FA-100	FB-20-120	FC-20-100
-500KNB	FA-140	FB-50-150	FC-50-140
CLU-10KNA ~ 50KNA	FA-60	FB-5-54	FC-5-60
-100KNA (-D)**	FA-80	FB-10-60	FC-20-80
-200KNA (-D)**	FA-100	FB-20-70	FC-20-100
-500KNA (-D)**	FA-140	FB-50-100	FC-50-140
-1MNA (-D)**	FA-160	FB-100-104	–
CLR-500NAH ~ -200KNAH	FA-20	FB-2-44	FC-2-20
-50KNAH	FA-60	FB-5-82	FC-5-60
-100KNAH	FA-80	FB-10-90	FC-20-80
-200KNAH	FA-100	FB-20-100	FC-20-100

** : -D in the parenthesis is a suffix code for two isolated I/O ports type load cell at option

Load Cell Fitting Accessory

CE

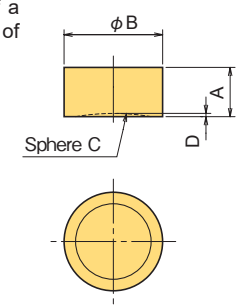
Tension/Compression Universal Load Cells	Fitting accessory							
	Spherical Cap FA	Mounting Flange FB	Slide Support FC	Rotary Attach-ment FD	Rod End FE	Eye Bolt FF	Load Button FG	Shackle FH
TCLN-500NA ~ 2KNA	–	–	–	–	FE-002C/002D	–	–	–
-5KNA	–	–	–	–	FE-05C/-05D	–	–	–
TCLB-50NA ~ 200NA	FA-20	FB-002-65	–	FD-002	FE-002A		FG-002	
TCLA-500NB ~ 5KNB	–	–	–	FD-05B	FE-05A/-05B	–	–	–
TCLA-10KNB	–	–	–	FD-1B	FE-1A/-1B	–	–	–
TCLA-20KNB	–	–	–	FD-2B	FE-2A/-2B	–	–	–
TCLP-10KNB	FA-60	–	–	FD-1A	FE-1A	FF-1	FG-1	FH-1B
-20KNB (-D)**	FA-80	–	–	FD-2A	FE-2A	FF-2	FG-2	FH-2B
-30, -50KNB (-D)**	FA-100	–	–	FD-5	FE-5A	FF-5	FG-5	FH-5B
-100KNB (-D)**	FA-140	–	–	FD-10	FE-10A	FF-10	FG-10	FH-10B
-200KNB (-D)**	FA-140	–	–	FD-20	FE-20A	FF-20B	FG-20	FH-20B
TCLK-5KNA	FA-20	–	–	–	FE-05C	–	FG-05B	–
-10KNA	FA-60	–	–	–	FE-1A	–	FG-1	–
-20KNA	FA-80	–	–	–	FE-2A	–	FG-2	–
-50KNA	FA-100	–	–	–	FE-5A	–	FG-5	–
TCLZ-10NB ~ 200NB	FA-20	–	–	FD-002	FE-002A	–	FG-002	–
-500NA ~ 5KNA	FA-20	–	–	FD-05A	FE-05A	FF-1	FG-05	FH-1B
-10KNA	FA-20	–	–	FD-1A	FE-1A	FF-1	FG-05	FH-1B
TCLU-10KNA	FA-60	–	–	FD-1A	FE-1A	FF-1	FG-1	FH-1B
-20KNA	FA-80	–	–	FD-2A	FF-2A	FF-2	FG-2	FH-2B
-50KNA	FA-100	–	–	FD-5	FE-5A	FF-5	FG-5	FH-5B
-100KNA	FA-140	–	–	FD-10	FE-10A	FF-10	FG-10	FH-10B
-200KNA	FA-140	–	–	FD-20	FE-20A	FF-20B	FG-20	FH-20B
TCLM-10KNB	FA-60	FB-1M	–	FD-1A	FE-1A	FF-1	FG-1	FH-1B
-20KNB	FA-80	FB-2M	–	FD-2A	FE-2A	FF-2	FG-2	FH-2B
-50KNB	FA-100	FB-5M	–	FD-5	FE-5A	FF-5	FG-5	FH-5B
-100KNB	FA-140	FB-10M	–	FD-10	FE-10A	FF-10	FG-10	FH-10B
-200KNB	FA-140	FB-20M	–	FD-20	FE-20A	FF-20B	FG-20	FH-20B
Tension Load Cell	Spherical Cap FA	Mounting Flange FB	Slide Support FC	Rotary Attach-ment FD	Rod End FE	Eye Bolt FF	Load Button FG	Shackle FH
TLP-10KNB	–	–	–	–	–	–	–	FH-1B
-20KNB	–	–	–	–	–	–	–	FH-2B
-30KNB	–	–	–	–	–	–	–	FH-3B
-50KNB	–	–	–	–	–	–	–	FH-5B
-100KNB	–	–	–	–	–	–	–	FH-10B
-200KNB	–	–	–	–	–	–	–	FH-20B
-300KNB	–	–	–	–	–	–	–	FH-30B
-500KNB	–	–	–	–	–	–	–	FH-50B
-1MNB	–	–	–	–	–	–	–	FH-100B
TLJ-10KNA ~ 50KNA	–	–	–	–	FE-5C/-5D	–	–	–
-100KNA	–	–	–	–	FE-5A/-5B	–	–	–

** : -D in the parenthesis is a suffix code for two I/O ports type load cell at option

FA SPHERICAL CAP

The FA Spherical Cap is mounted to the top of a compression load cell for accurate transmission of compression loads.



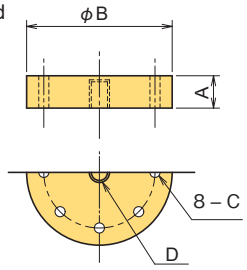


TYPE	A	ϕB	C	D	Weight
FA-20	15	38	20	2	0.15kg
FA-60	25	58	60	1	0.5kg
FA-80	25	58	80	1	0.5kg
FA-100	30	58	100	1.5	0.6kg
FA-140	40	78	140	3.5	1.5kg
FA-160	40	98	160	4	2.5kg
FA-250	45	128	250	5	4kg
FA-360	50	148	360	6	6kg
FA-360B	60	196	360	10	13kg
FA-720	110	280	720	10	54kg

FB-M MOUNTING FLANGE

The FB-M Mounting Flange is used to mount Rod End and Eye Bolt to TCLM-NB type load cell.



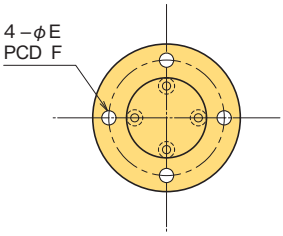


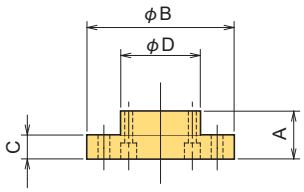
TYPE	A	ϕB	C	D	Weight
FB-1M	20	118	M8 PCD90	M12 x 1.75 DP15	1.5kg
FB-2M	25	118	M8 PCD90	M18 x 1.5 DP20	2kg
FB-5M	35	127	M8 PCD100	M24 x 2 DP30	3kg
FB-10M	50	187	M12 DP15 PCD150	M39 x 2 DP45	10kg
FB-20M	70	226	M16 DP25 PCD185	M50 x 2 DP60	21kg

FB MOUNTING FLANGE

The FB Mounting Flange is used when mounting area for a compression load cell is unstable or when load cell can not be secured from the bottom.





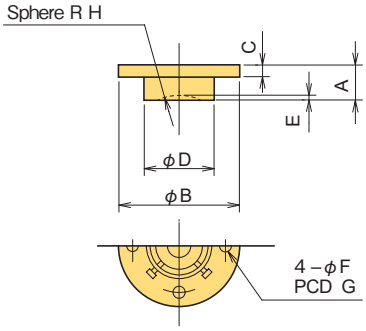


TYPE	A	ϕB	C	ϕD	ϕE	F	Weight
FB-2-44	20	98	10	54	9	76	0.7kg
FB-2-70	12	124	9	84	9	108	0.95kg
FB-5-54	25	138	10	92	11	114	2kg
FB-5-80	25	148	13	98	11	124	2.5kg
FB-5-82	20	150	14	102	11	130	2kg
FB-10-30	25	108	10	60	11	84	0.9kg
FB-10-60	30	158	10	108	11	134	3kg
FB-10-90	25	168	13	118	11	144	3kg
FB-20-40	30	118	10	70	11	94	1.5kg
FB-20-70	30	168	10	118	11	142	3kg
FB-20-100	30	178	15	127	11	158	4kg
FB-20-120	35	208	13	158	11	184	7kg
FB-50-60	40	138	15	90	11	114	3kg
FB-50-100	40	218	15	160	14	190	8kg
FB-50-150	40	248	15	187	14	220	11kg
FB-100-80	50	158	20	110	14	134	5kg
FB-100-104	50	228	20	170	14	200	11kg
FB-200-100	60	208	25	140	18	172	10kg
FB-300-120	60	228	25	160	18	192	13kg
FB-500-140	70	277	30	200	22	236	22kg
FB-1000-200	100	400	40	295	26	350	73kg

FC SLIDE SUPPORT

The FC Slide Support can be used to eliminate lateral load from compression load cell for high precision measurements.



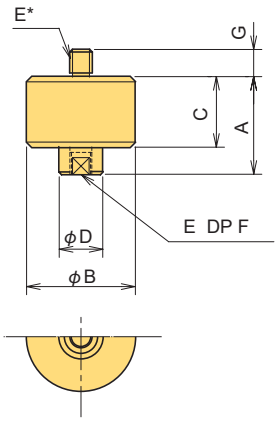


TYPE	A	ϕB	C	ϕD	E	ϕF	G	H	Sliding area	Weight
FC-2-20	27	98	10	56	2	9	76	20	±6mm	0.75kg
FC-5-60	40	128	13	84	1	11	106	60	±8mm	2kg
FC-20-80	45	168	13	118	1	11	140	80	±10mm	4kg
FC-20-100	45	168	13	118	1.5	11	140	100	±10mm	4kg
FC-50-140	55	218	18	164	3.5	13	190	140	±15mm	10kg

FD ROTARY ATTACHMENT

The FD Rotary Attachment ensures smooth load transmission by eliminating torsion during tension load measurements.





TYPE	A	ϕB	C	ϕD	E *	F	G	Weight
FD-002	54	58	39	20	M 6x1	12	7	0.8kg
FD-05A	54	58	39	20	M12x1.75	15	13	0.8kg
FD-05B	54	58	39	20	M12x1.75	15	15	0.8kg
FD-1A	54	88	39	20	M12x1.75	15	13	2kg
FD-1B	54	88	39	20	M12x1.75	15	15	2kg
FD-2A	67	100	50	26	M18x1.5	20	18	3kg
FD-2B	67	100	50	26	M18x1.5	20	20	3kg
FD-5	87	100	71	32	M24x2	30	28	4kg
FD-10	112	138	93	50	M39x2	45	43	11kg
FD-20	150	176	122	65	M50x2	65	60	23kg

E * :FD-05B M12xP1.75 DP15 internal thread
FD-1B M12xP1.75 DP15 internal thread
FD-2B M18xP1.5 DP20 internal thread

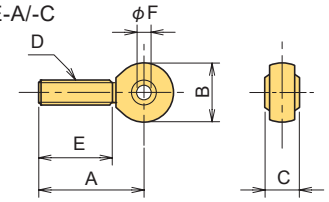
Load Cell Fitting Accessory CE

FE ROD END

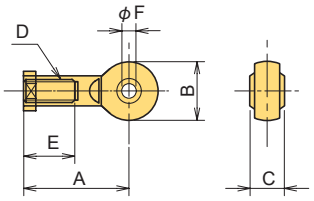
The FE Rod End is ideal when a tension/compression universal load cell is used to measure tension loads on machinery and structures.



FE-A/-C



FE-B/-D



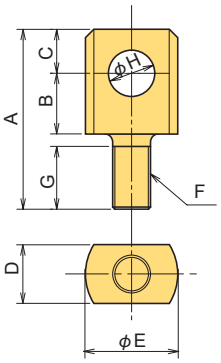
Please note that a combination use is not available with the FH Shackle below.

TYPE	A	B	C	D	E	ϕF	Weight
FE-002A	36	18	9	M 6x1	22	6	0.02kg
FE-002C	39.5	20.5	11	M 5x0.8	22	5	0.035kg
FE-002D	35	20.5	11	M 5x0.8	19	5	0.04kg
FE-05A	54	30	16	M12x1.75	33	12	0.1kg
FE-05B	50	30	16	M12x1.75	24	12	0.1kg
FE-05C	46	23	11	M 8x1.25	29	8	0.04kg
FE-05D	41	23	11	M 8x1.25	22	8	0.05kg
FE-1A	62	34	16	M12x1.75	37	12	0.15kg
FE-1B	57	34	16	M12x1.75	32	12	0.15kg
FE-2A	79.5	43	20	M18x1.5	46	18	0.3kg
FE-2B	74	43	20	M18x1.5	40	18	0.3kg
FE-5A	105	70	35	M24x2	59	25	1kg
FE-5B	105	70	35	M24x2	54	25	1.2kg
FE-5C	83	45	22	M20x1.5	50	20	0.3kg
FE-5D	76	45	22	M20x1.5	41	20	0.33kg
FE-10A	173	100	43	M39x2	80	40	4kg
FE-20A	231	120	53	M50x2	105	50	7kg

FF EYE BOLT

The FF Eye Bolt is used when a tension/compression universal load cell is used to measure tension. It can be used with FH Shackle.



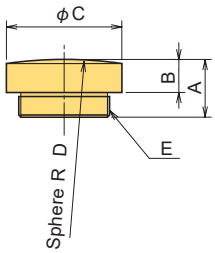


TYPE	A	B	C	D	ϕE	F	G	ϕH	Weight
FF-1	65	25	15	22	35	M12x1.75	21	18	0.2kg
FF-2	86	30	21	27	45	M18x1.5	30	22	0.5kg
FF-5	128	45	33	43	70	M24x2	44	37	1.5kg
FF-10	166	55	46	58	95	M39x2	57	49	4kg
FF-20B	207	53	57	68	100	M50x2	85	54	6kg

FG LOAD BUTTON

The FG Load Button is used when a tension/compression universal load cell is used to measure compression.



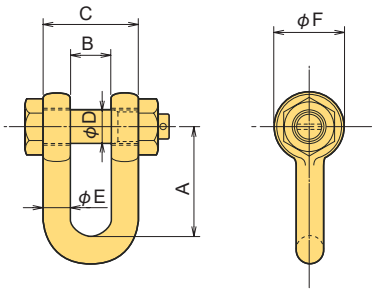


TYPE	A	B	ϕC	D	E	Weight
FG-002	10	6	9	20	M 6x1	4g
FG-05B	15	8	14	20	M 8x1.25	12g
FG-05	18	10	16	20	M12x1.75	20g
FG-1	20	10	20	60	M12x1.75	30g
FG-2	20	10	26	80	M18x1.5	55g
FG-5	22	12	32	100	M24x2	100g
FG-10	25	15	50	140	M39x2	300g
FG-20	30	20	64	140	M50x2	600g

FH SHACKLE

The FH Shackle is used with a tension load cell in instances such as measuring wire tension.



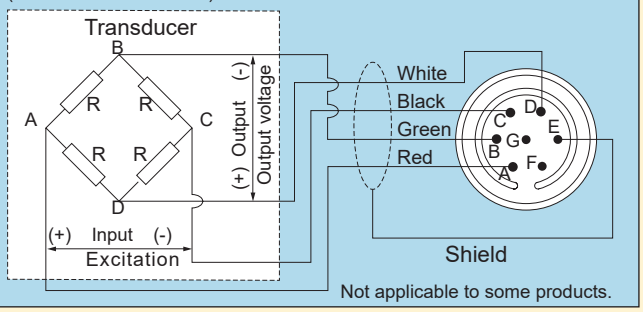


TYPE	A	B	C	ϕD	ϕE	ϕF	Weight
FH-1B	56	24	52	17	14	36	0.4kg
FH-2B	72	29	65	21	18	45	0.85kg
FH-3B	88	34	78	26	22	55	1.5kg
FH-5B	120	45	105	36	20	75	5kg
FH-10B	160	60	140	48	40	100	11kg
FH-20B	171	73	165	50	46	110	13kg
FH-30B	201	83	183	58	50	127	20kg
FH-50B	239	105	236	70	65	153	40kg
FH-100B	314	134	314	96	90	203	100kg

TML displacement transducers are used to measure various types of displacement such as displacement in structures and machinery as well as elongation and cracks in materials testing. They are widely used in applications ranging from testing and research to control. We offer a wide spectrum of displacement transducers to fit any type of measuring item, mounting location or displacement, and our products can easily be combined with Data Loggers or other equipment for automatic measurement of multiple points.

OUTPUT POLARITY WITH A LOAD

The measured value changes in positive (+) direction when the distance between the displacement transducer and the contact point increases or when the distance between two contact points incrases (for crack measurement).



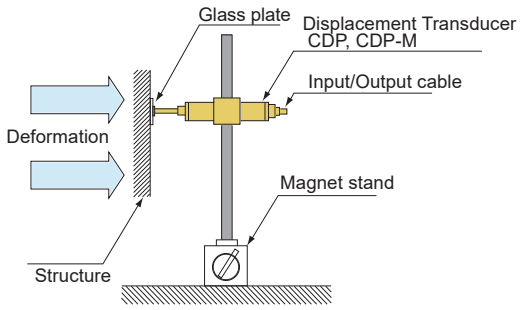
Not applicable to some products.

Displacement transducer selection

Application	TYPE	Capacity (mm)														
		2	5	10	20	25	30	50	100	200	250	300	500	1000	2000	5000
High sensitivity	CDP		●	●		●		●	●							
	CDP-M/-MT		●	●		●		●	●							
Drip-proof structure	CDP-B		●	●		●										
High sensitivity, Two-isolated I/O ports type	CDP-D							●	●							
High sensitivity, Tension use	CDP-T					●										
General, Ruler built-in	SDP-E							●	●	●		●				
Tension use, Ruler built-in	SDP-ET							●	●							
Dial gauge type	DDP-A			●	●		●	●								
Tape measure type	DP-E/-G												●	●	●	●
Wire type	WD-A										●		●	●		
Waterproofing structure	FDP-A			●		●		●	●							
Large span	PI	●	●													
Ring type	OU			●	●		●									
Simplest construction	CE	●	●	●												
Simple design, COD (Crack opening displacement) measurement	RA	●	●													
	RA-L	●	●													
	UB	●	●													
	UB-A		●													
Displacement transducers accessory		Contact tips, Hook bolt, Holder, Magnet stand, Fixing jigs, etc.														
Extensometer	EDP-A/-B		●													

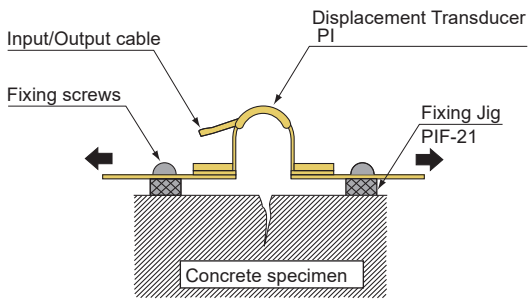
EXAMPLE OF DISPLACEMENT TRANSDUCER USE

General displacement measurements



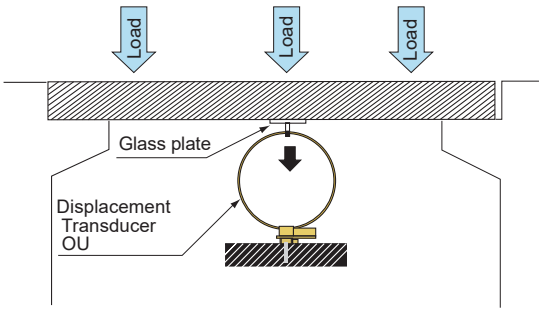
This configuration is used to measure structural deformation and movement.

Measuring cracks in concrete



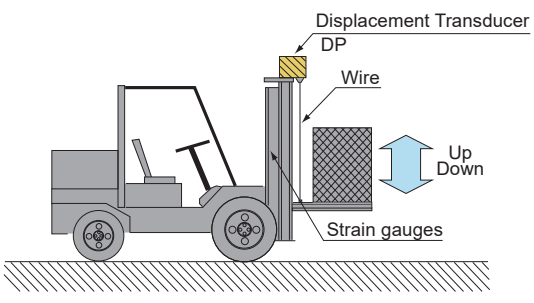
This configuration is used to measure opening displacement due to cracks propagating in concrete.

Measuring girder bend



This configuration is used to measure bend with a load applied to a bridge girder.

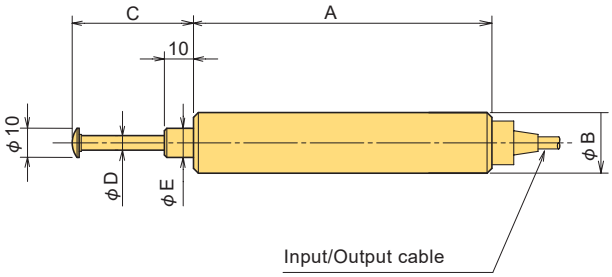
Measuring displacement and bending strains



This configuration is used to measure displacement and bending strains in fork-lift truck onboard measurement.

CDP Displacement Transducer 5~100mm





The CDP displacement transducer is a compact, easy-to-operate strain gauge type transducer. Because it is designed to produce a large output and to deliver stable performance, highly accurate measurements can be made. It is suitable for both static and dynamic measurements.

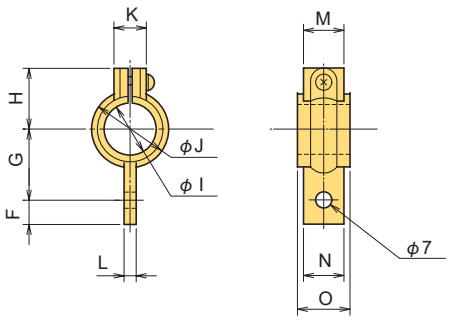
Protection ratings: IP40 equivalent

High precision

■ DIMENSIONS

TYPE	A	ϕB	C	ϕD	ϕE
CDP-5	99	20.5	20	5	10
CDP-10	99	20.5	24	5	10
CDP-25	114	20.5	40	5	10
CDP-50	154	33.5	65	5	10
CDP-100	274	41	118	6	12

HOLDER CDPF-11



■ DIMENSIONS HOLDER

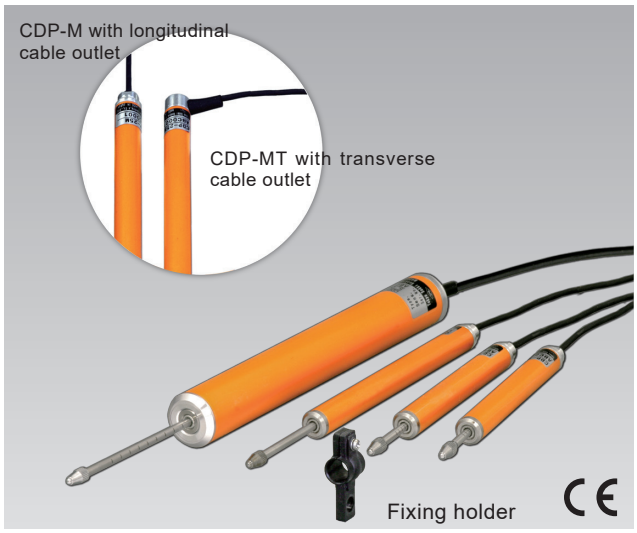
TYPE	Applicable CDP	F	G	H	ϕI	ϕJ	K	L	M	N	O
CDPF-11-25	CDP-5~25	10	28	25	20.5	30	13	5	15	15	20
CDPF-11-50	CDP-50	10	35	32	33.5	43	13	5	15	15	20
CDPF-11-100	CDP-100	11	36	40	41	50	17.5	8	14	16	25

■ SPECIFICATIONS

TYPE	CDP-5	CDP-10	CDP-25	CDP-50	CDP-100
Capacity	5mm	10mm	25mm	50mm	100mm
Rated Output	5mV/V(10000×10^{-6} strain) ±0.15%	5mV/V(10000×10^{-6} strain) ±0.1%	6.25mV/V(12500×10^{-6} strain) ±0.1%	5mV/V (10000×10^{-6} strain) ±0.1%	
Sensitivity(x10^{-6} strain)/mm	2000	1000	500	200	100
Non-linearity	0.15%RO	0.1%RO			
Spring force	6.4N	3.4N			4.9N
Frequency response	40Hz	12Hz	8Hz	6Hz	3Hz
Temperature effect on zero	0.01%RO/ºC		0.008%RO/ºC	0.01%RO/ºC	
Compensated temperature range	0 ~ +40°C (no condensation)				
Allowable temperature range	-10 ~ +60°C (no condensation)				
Input/Output resistance	350Ω				
Recommended exciting voltage	2V or less				
Allowable exciting voltage	10V				
Holders supplied	CDPF-11-25 1 piece			CDPF-11-50 2 pieces	CDPF-11-100 2 pieces
Weight	90g	90g	100g	270g	580g

Supplied cable : CT6-4V10/NJ-STB (ϕ6mm 0.3mm^2 4-core shielded vinyl cable 10m)

CDP-M Small Displacement Transducer 5~100mm

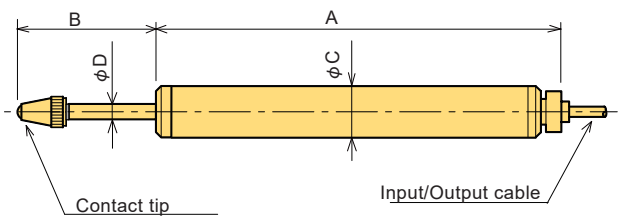


The CDP-M series is a small and high sensitivity displacement transducer. Compared with conventional CDP series, its output is the same but the CDP-M is smaller by 50~80% in diameter and its temperature range extended up to +80°C. This series is available with CDP-M with cable output along the measurement axis and CDP-MT with cable output vertical to the axis. The transducer can be used for not only static measurements but quasi-dynamic measurements. A fixing holder is supplied as a standard accessory. Options include ordinary magnet stand MB-B and small MB-PSL specified for the CDP-M series.

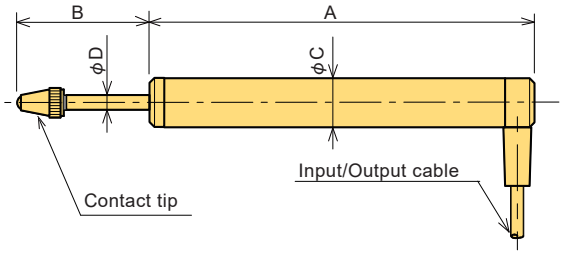
Protection ratings: IP40 equivalent

Small size

CDP-M



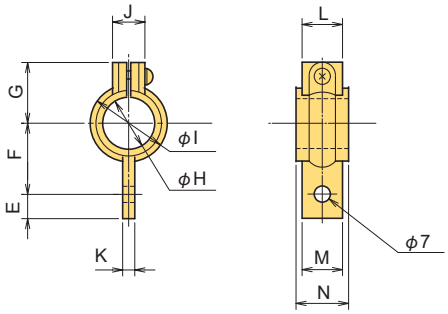
CDP-MT



■ DIMENSIONS

TYPE	A	B	ϕC	ϕD	Holder
CDP-5M /-5MT	79	21.5	10	3	CDPF-12-25
CDP-10M /-10MT	79	27			
CDP-25M /-25MT	114.5	41.5			
CDP-50M /-50MT	158	68	20		CDPF-11-25
CDP-100M /-100MT	268	115	33	5	CDPF-11-50

HOLDER



■ DIMENSIONS HOLDER

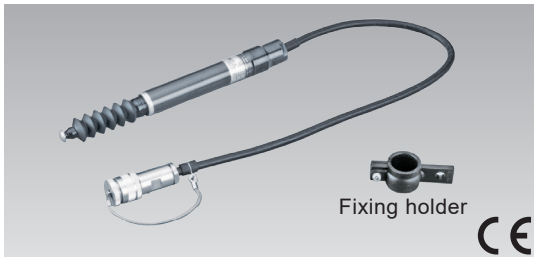
TYPE	E	F	G	ϕH	ϕI	J	K	L	M	N
CDPF-12-25	7	17.5	16.5	10.4	15	9	5	10	10	15
CDPF-11-25	10	28	25	20.5	30	13	5	15	15	20
CDPF-11-50	10	35	32	33.5	43	13	5	15	15	20

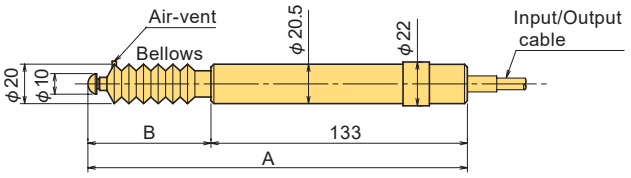
■ SPECIFICATIONS

TYPE	CDP-5M CDP-5MT	CDP-10M CDP-10MT	CDP-25M CDP-25MT	CDP-50M CDP-50MT	CDP-100M CDP-100MT
Capacity	5mm	10mm	25mm	50mm	100mm
Rated Output	5mV/V(10000×10^{-6} strain) ±0.3%		6.25mV/V(12500×10^{-6} strain) ±0.3%	5mV/V (10000×10^{-6} strain) ±0.3%	
Sensitivity(x10^{-6} strain)/mm	2000	1000	500	200	100
Non-linearity	0.3%RO				
Spring force	2N	1.3N	1.5N	1.2N	5N
Frequency response	13Hz	6.5Hz	7Hz	10Hz	9.5Hz
Temperature effect on zero	0.05%RO/°C				
Compensated temperature range	0 ~ +40°C (no condensation)				
Allowable temperature range	-10 ~ +80°C (no condensation)				
Input/Output resistance	350Ω				
Recommended exciting voltage	2V or less				
Allowable exciting voltage	10V				
Holders supplied	CDPF-12-25 1 piece			CDPF-11-25 2 pieces	CDPF-11-50 2 pieces
Weight	29g		46g	120g	350g

Supplied cable : CT6-4V10/NJ-STB (ϕ6mm 0.3mm^2 4-core shielded vinyl cable 10m)

CDP-B Displacement Transducer 5~25mm





The CDP-B displacement transducer is the CDP displacement transducer with a bellows attached to the measuring rod. It is used if measurement must be made in an adverse on-site environment.

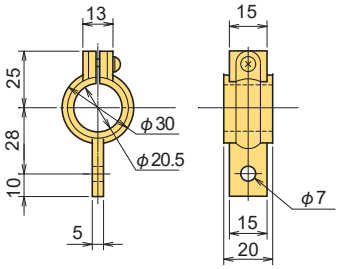
Protection ratings: IP42 equivalent

On-site application

■ DIMENSIONS

TYPE	A	B
CDP-5B	197	64
CDP-10B	198	65
CDP-25B	208	75

HOLDER CDPF-11-25



■ SPECIFICATIONS

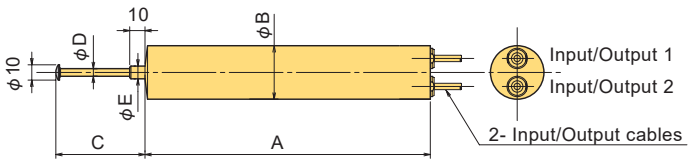
TYPE	CDP-5B	CDP-10B	CDP-25B
Capacity	5mm	10mm	25mm
Rated Output	5mV/V(10000×10^{-6} strain) ±0.1%		6.25mV/V(12500×10^{-6} strain) ±0.1%
Sensitivity(x10^{-6} strain)/mm	2000	1000	500
Non-linearity	0.15%RO	0.1%RO	
Spring force	6.4N	3.4N	
Frequency response	40Hz	12Hz	5Hz
Temperature effect on zero	0.01%RO/°C		0.008%RO/°C
Compensated temperature range	0 ~ +40°C (no condensation)		
Allowable temperature range	-10 ~ +60°C (no condensation)		
Input/Output resistance	350Ω		
Recommended exciting voltage	2V or less		
Allowable exciting voltage	10V		
Holders supplied	CDPF-11-25 1 piece		
Weight	130g	130g	140g

Supplied cable :CT6-4N10/WJ-STB (ϕ6mm 0.35mm^2 4- core shielded chloro-prene cable 10m)

CDP-D Displacement Transducer 50/100mm

Made-to-order





The CDP-D displacement transducer is the CDP displacement transducer with dual isolated I/O ports. For example, one set of input and output cables can be connected to an analog measuring instrument and the other set to a digital measuring instrument. With two different types of measuring equipment connected to this transducer, simultaneous measurements can be made without interference.

■ DIMENSIONS

TYPE	A	ϕB	C	ϕD	ϕE
CDP-50-D	165	33.5	65	5	10
CDP-100-D	274	41	118	6	12

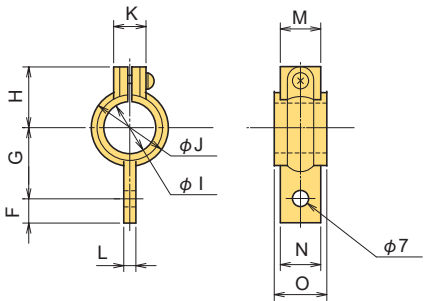
Protection ratings: IP40 equivalent

■ SPECIFICATIONS

TYPE	CDP-50-D	CDP-100-D
Capacity	50mm	100mm
Rated Output	5mV/V(10000×10^{-6} strain) ±0.1%	
Sensitivity(x10^{-6} strain)/mm	200	100
Non-linearity	0.1%RO	
Cross sensitivity	0.2%RO	
Spring force	3.4N	4.9N
Frequency response	6Hz	3Hz
Temperature effect on zero	0.01%RO/°C	
Compensated temperature range	0 ~ +40°C (no condensation)	
Allowable temperature range	-10 ~ +60°C (no condensation)	
Input/Output resistance	350Ω	
Recommended exciting voltage	2V or less	
Allowable exciting voltage	10V	
Holders supplied	CDPF-11-50 2 pcs.	CDPF-11-100 2 pcs.
Weight	300g	600g

Supplied cable : CT6-4V10/NJ-STB (ϕ6mm 0.3mm^2 4-core shielded vinyl cable 10m)

HOLDER CDPF-11



■ DIMENSIONS HOLDER

TYPE	Applicable CDP	F	G	H	ϕI	ϕJ	K	L	M	N	O
CDPF-11-50	CDP-50-D	10	35	32	33.5	43	13	5	15	15	20
CDPF-11-100	CDP-100-D	11	36	40	41	50	17.5	8	14	16	25

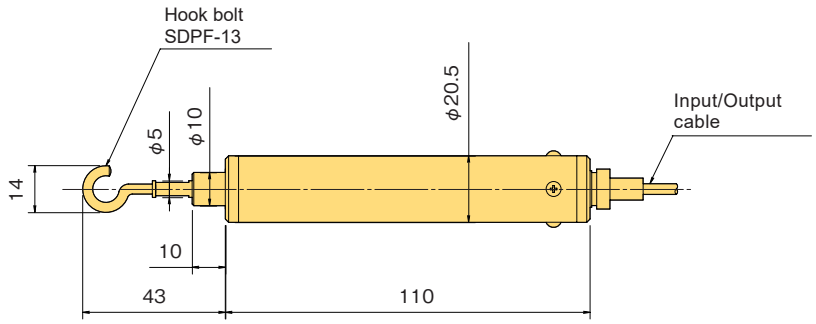
CDP-T Displacement Transducer 25mm



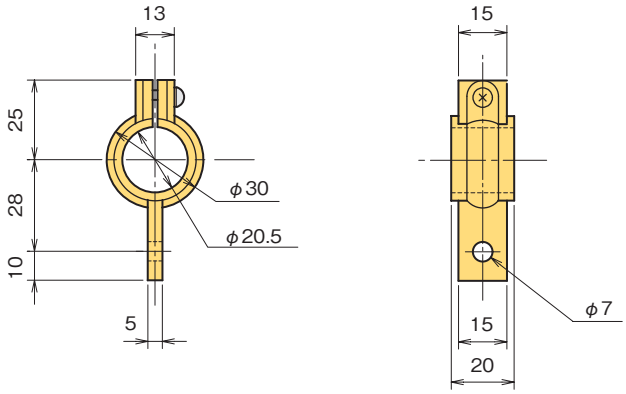
Wire tension
High precision

The CDP-T displacement transducer is the Tensile-type CDP displacement transducer. Use the hook on the measuring axis of the main unit to measure the displacement via a wire or other means.
Because it is designed to produce a large output and to deliver stable performance, highly accurate measurements can be made. (Please take into account the loss of sensitivity due to stretching of wires, etc. before use.)

Protection ratings: IP40 equivalent



HOLDER CDPF-11-25

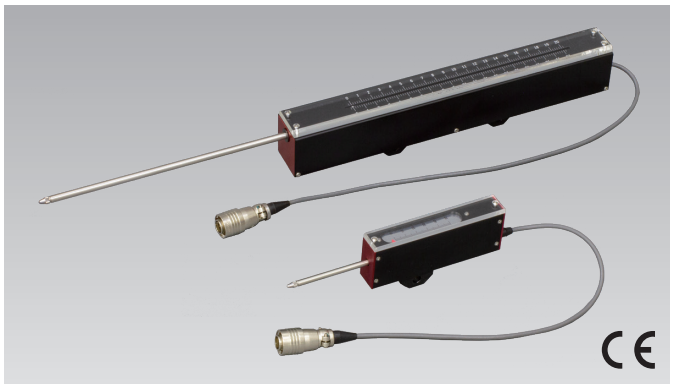


■ SPECIFICATIONS

TYPE	CDP-25T
Capacity	25mm
Rated Output	6.25mV/V(12500×10^{-6} strain) ±0.15%
Sensitivity(x10^{-6} strain)/mm	500
Non-linearity	0.15%RO
Spring force	3.4N
Frequency response	8Hz
Temperature effect on zero	0.015%RO/°C
Compensated temperature range	0 ~ +40°C (no condensation)
Allowable temperature range	-10 ~ +60°C (no condensation)
Input/Output resistance	350Ω
Recommended exciting voltage	2V or less
Allowable exciting voltage	10V
Holders supplied	CDPF-11-25 1 pcs.
Weight	115g

Supplied cable : CT6-4V10/NJ-STB (ϕ6mm 0.3mm^2 4-core shielded vinyl cable 10m)

SDP-E Displacement Transducer 50/100/200/300mm

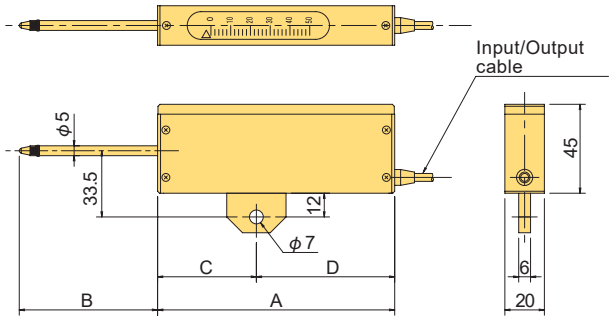


General purpose

This is a strain gauge type displacement transducer for general purpose. This transducer has a small cantilever inside, and displacement is mechanically converted into deflection of the cantilever. Strain, which is proportional to the deflection, is generated on the cantilever and is measured by strain gauges.
Stable measurement is possible even for a small displacement. The scale and pointer on the main body enables easy positioning of the transducer.
For SDP-200E and SDP-300E, a dual-output type with two independent input/output ports is optionally available.

Protection ratings: IP40 equivalent

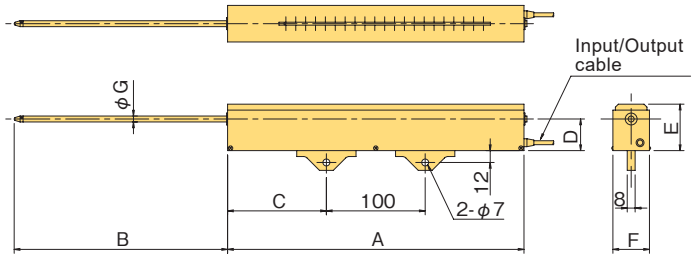
SDP-50E/SDP-100E



■ DIMENSIONS

TYPE	A	B	C	D
SDP-50E	120	70	50	70
SDP-100E	210	120	90	120

SDP-200E/SDP-300E



■ DIMENSIONS

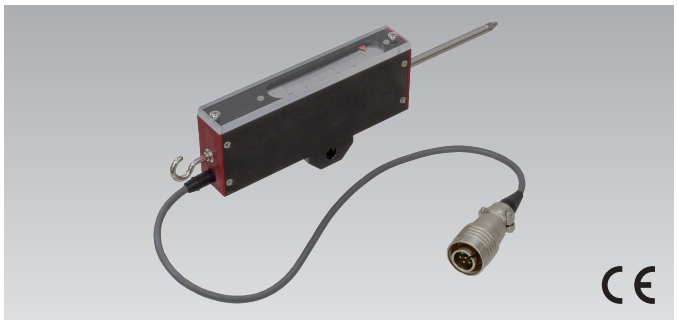
TYPE	A	B	C	D	E	F	G
SDP-200E	300	216	100	32	47	37	6
SDP-300E	400	317	150	35	51	42	8

■ SPECIFICATIONS

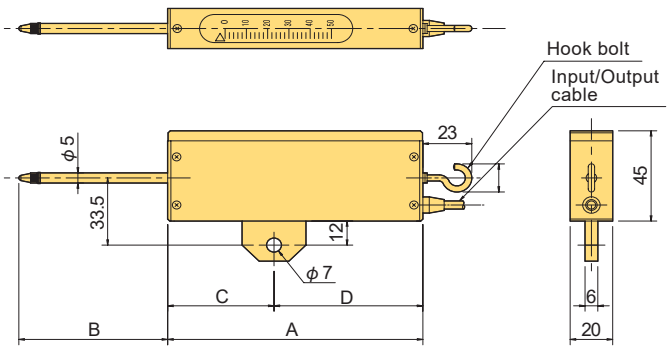
TYPE	SDP-50E	SDP-100E	SDP-200E	SDP-300E
Capacity	50mm	100mm	200mm	300mm
Rated Output	2.5mV/V(5000×10^{-6} strain) ±0.2%		5mV/V(10000×10^{-6} strain) ±0.3%	
Sensitivity(x10^{-6} strain)/mm	100	50	50	33
Non-linearity	0.2%RO		0.3%RO	
Spring force	6N			7.4N
Frequency response	1Hz		2Hz	1.5Hz
Allowable temperature range	-10 ~ +60°C (no condensation)			
Input/Output resistance	350Ω			
Recommended exciting voltage	2V or less			
Allowable exciting voltage	5V		10V	
Weight	220g	320g	900g	1200g

Supplied cable : CT6-4V10/NJ-STB (ϕ6mm 0.3mm^2 4-core shielded vinyl cable 10m)

SDP-ET Displacement Transducer 50/100mm



Wire tension
General purpose



The SDP-ET displacement transducer is a general-purpose, strain gauge type transducer, and features measurement of tension displacement using hook bolt. Designed with a strain-generating cantilever, it is able to make stable measurement while maintaining the high sensitivity to minuscule displacements.

Protection ratings: IP40 equivalent

■ SPECIFICATIONS

TYPE	SDP-50ET	SDP-100ET
Capacity	50mm	100mm
Rated Output	2.5mV/V(5000×10^{-6} strain) ±0.2%	
Sensitivity(x10^{-6} strain)/mm	100	50
Non-linearity	0.2%RO	
Spring force	6N	
Frequency response	1Hz	
Allowable temperature range	-10 ~ +60°C (no condensation)	
Input/Output resistance	350Ω	
Recommended exciting voltage	2V or less	
Allowable exciting voltage	5V	
Weight	220g	320g

Supplied cable : CT6-4V10/NJ-STB (ϕ6mm 0.3mm^2 4-core shielded vinyl cable 10m)

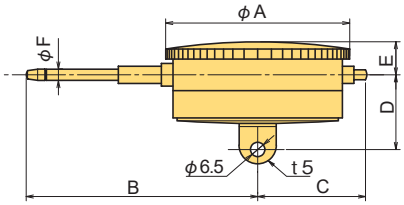
■ DIMENSIONS

TYPE	A	B	C	D
SDP-50ET	120	70	50	70
SDP-100ET	210	120	90	130

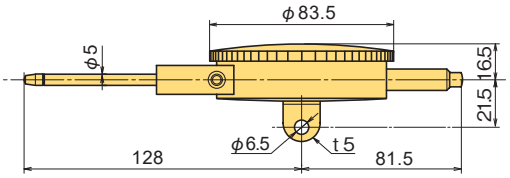
DDP-A Displacement Transducer 10~50mm



DDP-10~-30A



DDP-50A



The DDP-A displacement transducer is a dial gauge with a strain sensing element and a bridge circuit integrated. The amount of displacement can be checked by viewing the pointer while the output from the sensing element can be used to control a recorder or a machine.

Protection ratings: IP40 equivalent

■ DIMENSIONS

TYPE	ϕA	B	C	D	E	ϕF
DDP-10A	53	65	40.5	33	14.5	4
DDP-20A	66.5	90	41	33	14.5	5
DDP-30A	76	102	46	33	15	5
DDP-50A	As per the figure					

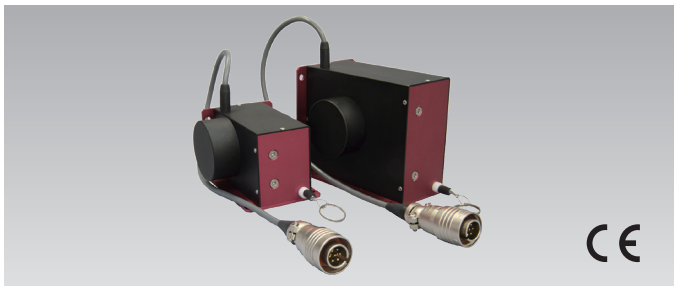
Dial gauge Integrated

■ SPECIFICATIONS

TYPE	DDP-10A	DDP-20A	DDP-30A	DDP-50A
Capacity	10mm	20mm	30mm	50mm
Rated Output	1.5mV/V(3000×10^{-6} strain) ±0.3%			2.5mV/V(5000×10^{-6} strain) ±0.3%
Sensitivity(x10^{-6} strain)/mm	300	150	100	
Non-linearity	0.3%RO			
Spring force	2.9N	3.9N		5.4N
Frequency response	2Hz		1Hz	
Allowable temperature range	-10 ~ +60°C (no condensation)			
Input/Output resistance	350Ω			
Recommended exciting voltage	2V or less			
Allowable exciting voltage	5V			
Weight	190g	340g	400g	500g

Supplied cable : CT6-4V10/NJ-STB (ϕ6mm 0.3mm^2 4-core shielded vinyl cable 10m)

DP-G / E Displacement Transducer 500~5000mm



Wire tension type

The DP-G / E displacement transducer is used to measure a large amount of displacement. A stainless steel wire is drawn to measure displacement. The wire tension is constant in the same direction regardless of the amount of displacement. This is a small, lightweight, and high-accuracy transducer.

Protection ratings: IP 40 equivalent

■ SPECIFICATIONS

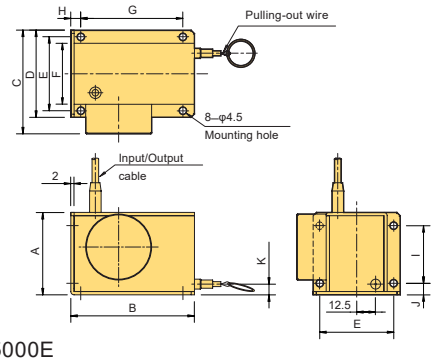
TYPE	DP-500G	DP-1000G	DP-2000G	DP-5000E
Capacity	500mm	1000mm	2000mm	5000mm
Rated Output	5mV/V(10000×10^{-6} strain) ±0.3%			
Sensitivity(x10^{-6} strain)/mm	20	10	5	2
Non-linearity	0.3%RO			
Spring force	1.5N		1.7N	2N
Allowable temperature range	-10 ~ +80°C (no condensation)			
Input/Output resistance	Input 260Ω Output 350Ω			Input 200Ω Output 350Ω
Recommended exciting voltage	2V or less			
Allowable exciting voltage	10V			
Weight	230g	230g	400g	1400g

Supplied cable : CT6-4V10/NJ-STB (ϕ 6mm 0.3mm^2 4-coreshielded vinyl cable 10m)
* Spike noise may be generated when measuring at lower displacement speeds than 10 mm/s.

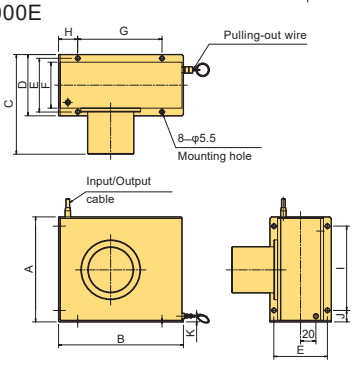
■ DIMENSIONS

TYPE	A	B	C	D	E	F	G	H	I	J	K
DP-500G	50	75	63	53	45	37	62	6	35	7	6.5
DP-1000G	50	75	63	53	45	37	62	6	35	7	6.5
DP-2000G	80	98	67	57	49	41	74	16	53	19	6.5
DP-5000E	137	163	130	80	70	60	110	25	110	15	7.5

DP-500G/-1000G/-2000G



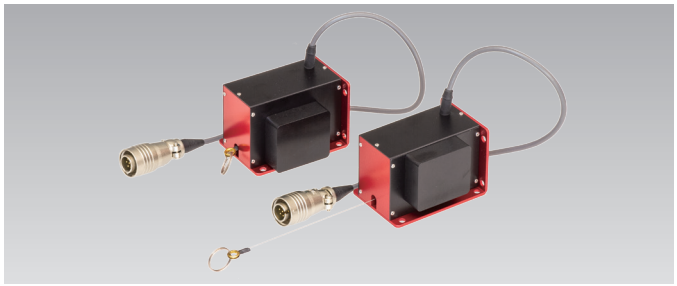
DP-5000E



DPEF-11:
Mounting Base for DP-500 and DP-1000E

DPEF-12:
Mounting Base for DP-2000E

WD-A Displacement Transducer 250/500/1000mm



Wire type

Displacement transducer for measuring large displacement. Measurement by pulling out a stainless wire. A compact, lightweight, and highly precise displacement transducer.

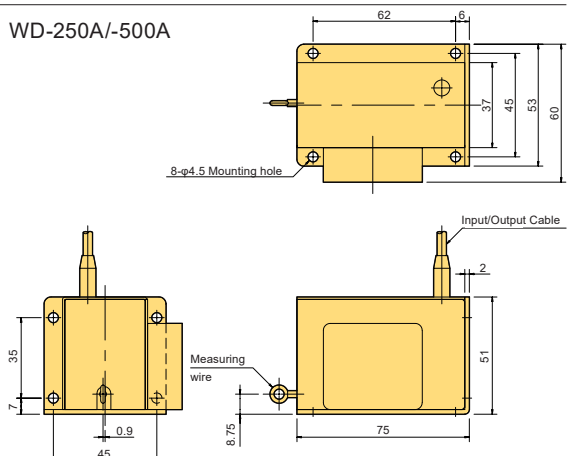
Protection ratings : IP 20 equivalent

■ SPECIFICATIONS

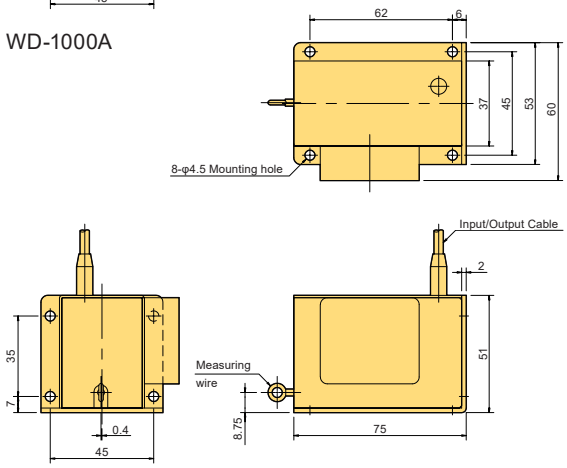
TYPE	WD-250A	WD-500A	WD-1000A
Capacity(mm)	250	500	1000
Rated output	5mV/V(10000×10^{-6} strain)±0.3%		
Sensitivity	40×10^{-6}strain/mm	20×10^{-6}strain/mm	10×10^{-6}strain/mm
Nonlinearity	0.3%RO		
Spring Force	Approx. 2.5N		Approx.1.6N
Temperature range	-10 to +80 °C (no condensation)		
Input/Output Resistance	Input Approx. 350Ω Output Approx. 500Ω		
Recommended Exciting Voltage	2V or less		
Allowable Exciting Voltage	10V		
Weight	Approx. 250g		
Supplied Cable	CT6-4V10/NJ-STB (Φ6mm 0.3mm^2 4-core shielded vinyl cable 10m)		

* Spike noise may be generated when measuring at lower displacement speeds than 0.1 mm/s.

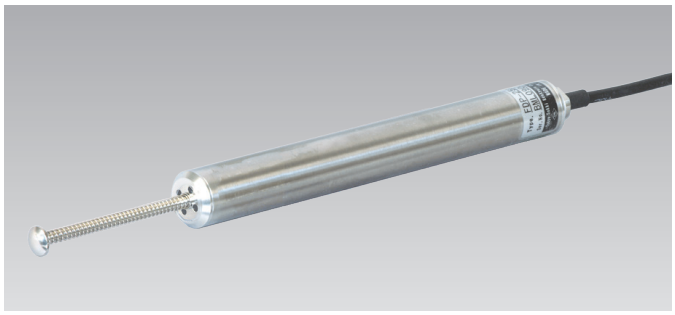
WD-250A/-500A

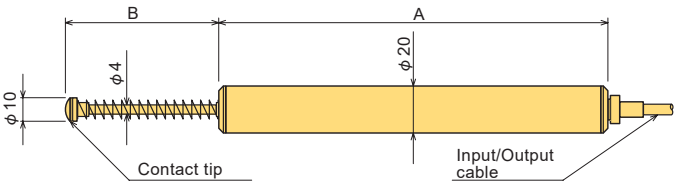


WD-1000A



FDP-A Wataerproof Displacement Transducer 10~100mm





■ DIMENSIONS

TYPE	A	B
FDP-10A	170	69
FDP-25A	170	69
FDP-50A	230	89
FDP-100A	347	181

FDP-A series is a DC operated LVDT which can be measured with not only our TDS series data loggers but DC excitation type dynamic strainmeters and handheld strainmeters. In addition to high output and high response, waterproof structure and all stainless steel made external parts make underwater measurement possible.

Protection ratings: IP68 equivalent

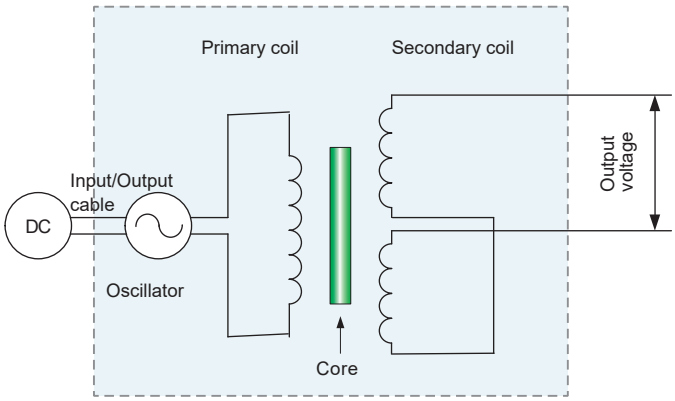
Waterproof type

■Instruments

Data Logger



■Sensor mode ap-plicalbe:Full bridge 0-2V



Handheld Data Logger



Dynamic strain recorder

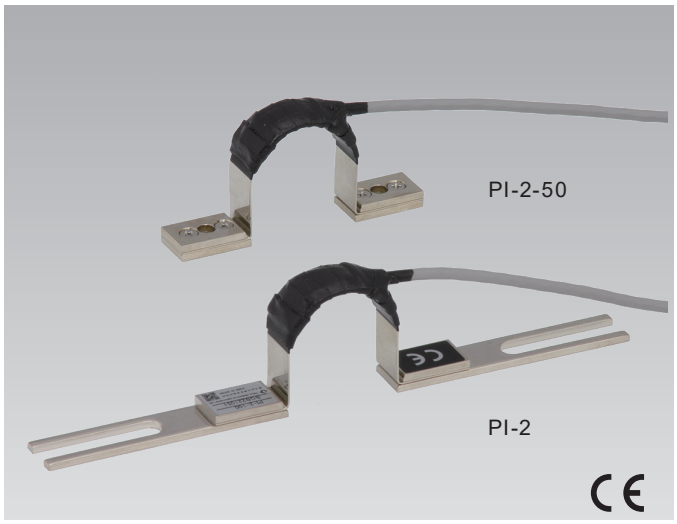


■ SPECIFICATIONS

TYPE	FDP-10A	FDP-25A	FDP-50A	FDP-100A
Capacity	10mm	25mm	50mm	100mm
Rated Output	10000×10^{-6} strain	15000×10^{-6} strain		
Sensitivity(x10^{-6} strain)/mm	1000	600	300	150
Non-linearity	0.5%RO			
Spring force	3N	3.5N		
Frequency response	16Hz	10Hz	8Hz	5Hz
Temperature effect on zero	0.05%RO/°C			
Compensated temperature range	-10 ~ +60°C (no icing)			
Allowable temperature range	-10 ~ +80°C (no icing)			
Recommended exciting voltage	2V or less			
Allowable exciting voltage	5V			
Water pressure resistance	1MPa			
Holders supplied	CDPF-11-25 1 pc.		CDPF-11-25 2 pcs.	
Weight	250g	250g	350g	650g

Input/Output cable : ϕ4.6mm 0.14mm^2 4-core shielded vinyl cable 10m

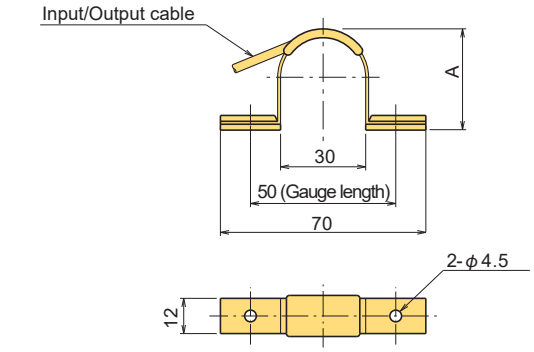
PI Displacement Transducer ±2/±5mm



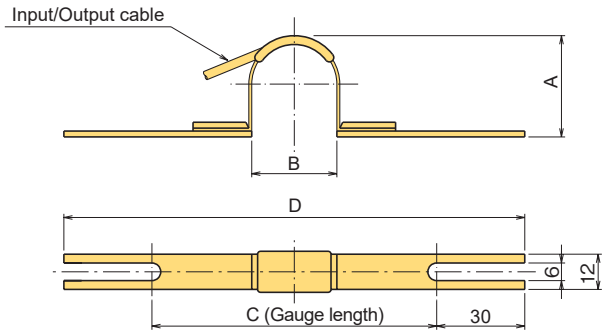
The PI displacement transducer has a simple structure: a combination of strain gauges and an arch-shaped spring plate, the former attached to the latter. Six models designed for gauge lengths of 50 mm to 300 mm are available. This transducer is used to measure the crack opening displacement occurring within each gauge length on the surface of concrete or to measure the displacement of various structures.

Pi-shape type
Surface measurement use

PI-2-50/PI-5-50



PI-2/PI-5



■ DIMENSIONS

TYPE	A	B	C	D	Weight
PI-2-50	35	As per the figure			40
PI-2-100	35	30	100	160	50
PI-2-150	35	30	150	210	60
PI-2-200	35	30	200	260	70
PI-2-250	35	30	250	310	80
PI-2-300	35	30	300	360	90
PI-5-50	50	As per the figure			40
PI-5-100	45	40	100	160	50
PI-5-150	45	40	150	210	60
PI-5-200	45	40	200	260	70
PI-5-250	45	40	250	310	80
PI-5-300	45	40	300	360	90

■ ACCESSORY

TYPE	Dummy plate	Fixing jig
PI-2-50 / PI-5-50	PIF-11-50	PIF-21-50
PI-2-100 / PI-5-100	PIF-11-100	PIF-21-100
PI-2-150 / PI-5-150	PIF-11-150	PIF-21-100
PI-2-200 / PI-5-200	PIF-11-200	PIF-21-100
PI-2-250 / PI-5-250	PIF-11-250	PIF-21-100
PI-2-300 / PI-5-300	PIF-11-300	PIF-21-100

Dummy plate PIF-11

This plate is used to maintain the proper gauge length when mounting the PIF-21 jig to test specimen.

Fixing Jig PIF-21

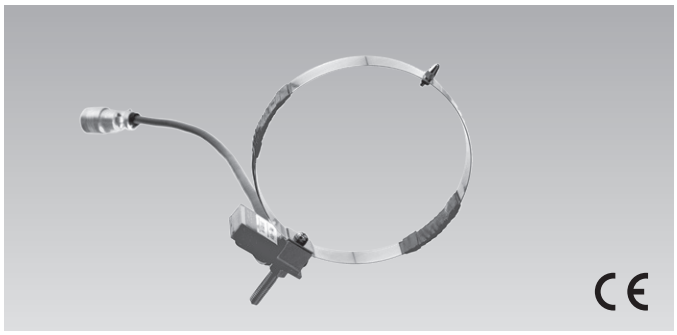
This Jig is pre-mounted to concrete and other test specimen in order to screw-mount PI displacement transducer.

■ SPECIFICATIONS

TYPE	PI-2	PI-5
Gauge length	50、100、150、200、250、300 mm	
Capacity	±2mm	±5mm
Rated Output	2mV/V(4000×10^{-6} strain)	2.5mV/V(5000×10^{-6} strain)
Sensitivity(x10^{-6} strain)/mm	2000	1000
Non-linearity	0.5%RO	
Allowable temperature range	0 ~ +40°C	
Input/Output resistance	350Ω	
Recommended exciting voltage	2V or less	
Allowable exciting voltage	10V	

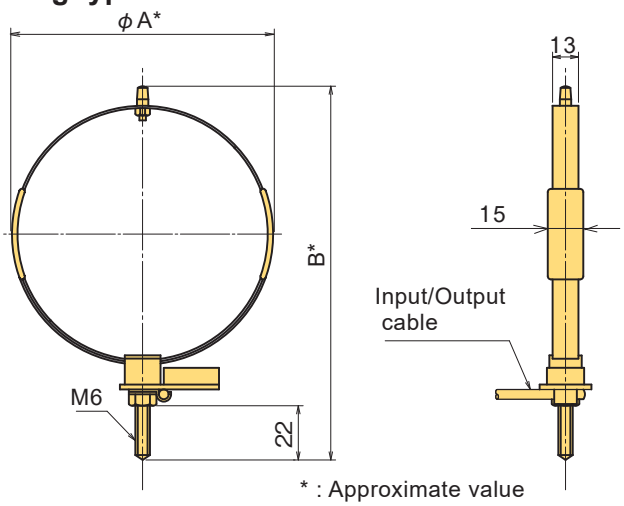
Input/Output cable : φ3mm 0.09mm^2 4-core vinyl cable 2m

OU Ring type Displacement Transducer 10~30mm



The OU displacement transducer is a combination of a round plate spring and strain gauges. It is mounted with its contact tip pressed against a structure. When displacement occurs in the structure, the plate spring is deformed and the amount of output proportional to the amount of displacement can be output.

Ring type



* : Approximate value

■ SPECIFICATIONS

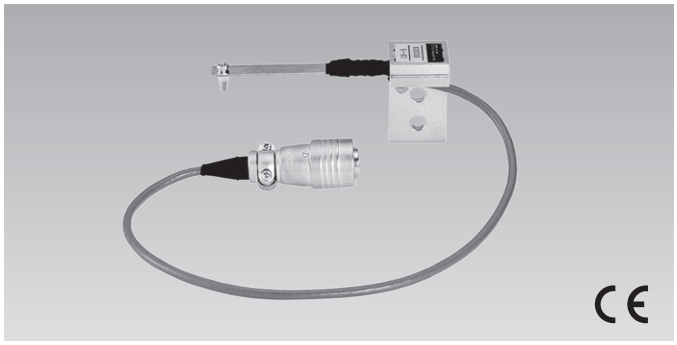
TYPE	OU-10	OU-20	OU-30
Capacity	10mm	20mm	30mm
Rated Output	5mV/V(10000×10^{-6} strain)		
Sensitivity(x10^{-6} strain)/mm	1000	500	300
Non-linearity	1%RO		
Spring force	31N	25N	17N
Frequency response	55Hz	30Hz	20Hz
Allowable temperature range	0 ~ +40°C		
Input/Output resistance	350Ω		
Recommended exciting voltage	2V or less		
Allowable exciting voltage	10V		
Weight	60g	70g	75g

Supplied cable : CT6-4V5/NJ-STB (ϕ6mm 0.3mm^2 4-core shielded vinyl cable 5m)

■ DIMENSIONS

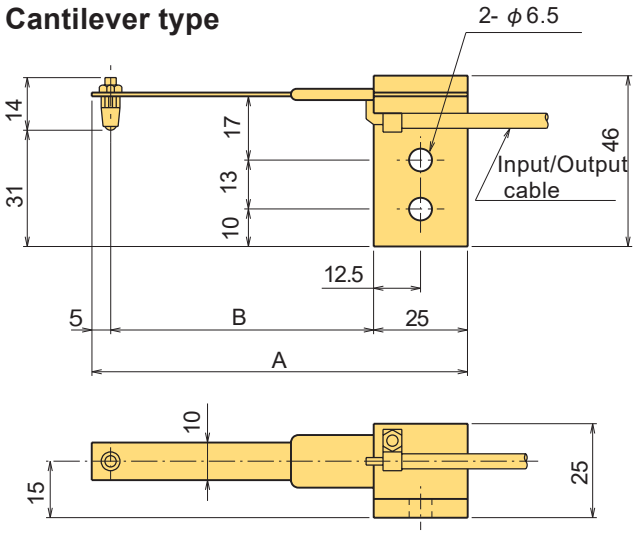
TYPE	ϕA	B
OU-10	85	130
OU-20	115	160
OU-30	155	200

CE Cantilever type Displacement Transducer 2~10mm



The CE displacement transducer has the structure of strain gage mounted on a cantilever. The high responsiveness to displacement and the simple structure allows this transducer to make accurate and stable measurement and to be installed in a confined space.

Cantilever type



■ SPECIFICATIONS

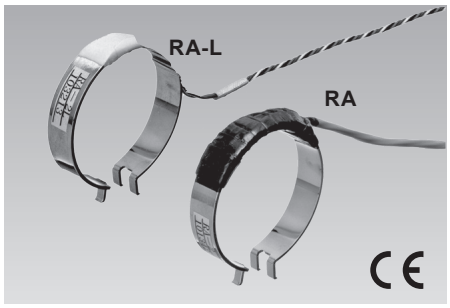
TYPE	CE-2	CE-5	CE-10
Capacity	2mm	5mm	10mm
Rated Output	2.5mV/V(5000×10^{-6} strain)		
Sensitivity(x10^{-6} strain)/mm	2500	1000	500
Non-linearity	1%RO		
Spring force	7.1N	4.7N	3.2N
Frequency response	110Hz	45Hz	25Hz
Allowable temperature range	0 ~ +40°C		
Input/Output resistance	350Ω		
Recommended exciting voltage	2V or less		
Allowable exciting voltage	10V		
Weight	90g	90g	95g

Supplied cable : CT6-4V5/NJ-STB (ϕ6mm 0.3mm^2 4-core shielded vinyl cable 5m)

■ DIMENSIONS

TYPE	A	B
CE-2	75	45
CE-5	100	70
CE-10	130	100

RA / RA-L Clip-shape Displacement Transducer 2 / 5mm



Clip-on type

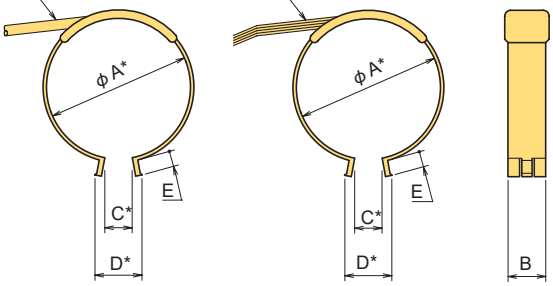
The RA Clip-shape Displacement Transducer is designed to measure crack opening displacement(COD) in metal.
The RA-L Cryogenic Clip-shape Displacement Transducer is designed to measure crack opening displacement(COD) in metal under low-temperature conditions.

RA

Input/Output cable
4-core vinyl

RA-L

Input/Output cable 4-core
Fluoride plastic insulated



* : Approximate value

■ SPECIFICATIONS

TYPE	RA-2 / RA-2L	RA-5 / RA-5L
Capacity	2 (2~4) mm	5 (2~7) mm
Rated Output	1mV/V(2000×10^{-6} strain)	1.5mV/V(3000×10^{-6} strain)
Sensitivity(x10^{-6} strain)/mm	1000	600
Non-linearity	1%RO	
Allowable temperature range	RA-2/RA-5 : 0 ~ +40°C RA-2L/RA-5L : -196 ~ +40°C	
Input/Output resistance	350Ω	
Recommended exciting voltage	2V or less	
Allowable exciting voltage	10V	
Weight	RA-2 : 31g RA-2L : 22g	RA-5 : 35g RA-2L : 28g

Input/Output cable : RA-2/RA-5 : ϕ3mm 0.09mm^2 4-core vinyl cable 2m
: RA-2L/RA-5L :0.08mm^2 4-core Fluoride plastic insulated cable 2m

■ DIMENSIONS

TYPE	ϕA	B	C	D	E
RA-2 / RA-2L	40	10	8	12	5
RA-5 / RA-5L	50	12	14	16	10

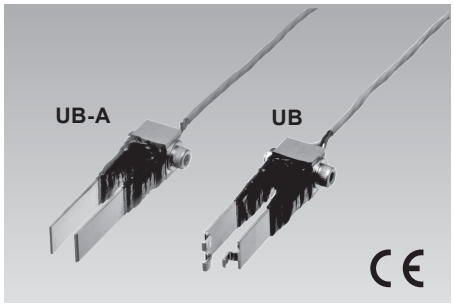
NB: Calibration of RA-L for cryogenic use is available only at room temperature

■ ACCESSORY

Fixing Jig RAF-11

The RAF-11 is pre-mounted on test specimen in order to clasp-mount the RA and RA-L.

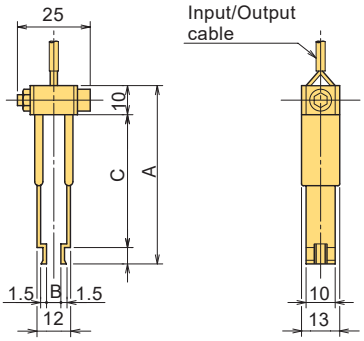
UB / UB-A Clip-shape Displacement Transducer 2 / 5mm



Clip-on type

The UB and UB-5A Clip-shape Displacement Transducers are designed to measure crack opening displacement(COD) in metal. The UB-5A has a shape of the tip conforms to ASTM specifications.

UB



■ DIMENSIONS

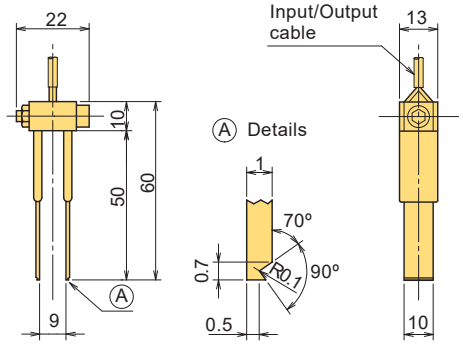
TYPE	A	B	C
UB-2	40	2	26
UB-5	60	5	46

■ ACCESSORY

Fixing Jig RAF-11

The RAF-11 is pre-mounted on test specimen in order to clasp-mount the UB.

UB-5A



■ SPECIFICATIONS

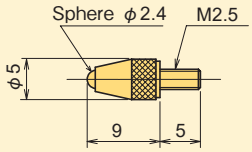
TYPE	UB-2	UB-5	UB-5A
Capacity	2 (2~4) mm	5 (2~7) mm	5 (3~8) mm
Rated Output	2.5mV/V(5000×10^{-6} strain)		2.5mV/V(5000×10^{-6} strain)
Sensitivity(x10^{-6} strain)/mm	2500	1000	1000
Non-linearity	1%RO		1%RO
Allowable temperature range	0 ~ +40°C		0 ~ +40°C
Input/Output resistance	350Ω		350Ω
Recommended exciting voltage	2V or less		2V or less
Allowable exciting voltage	10V		10V
Weight	39g	42g	42g

Input/Output cable : ϕ3mm 0.09mm^2 4-core vinyl cable 2m

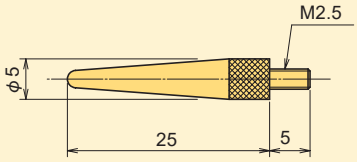
Displacement Transducers Accessories CE

Contact Tip DF-11

The DF-11 is used with CDP-M/CDP-MT/ DDP-A/SDP-50E/SDP-100E/SDP-ET/CE/OU type displacement transducer.

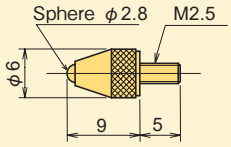


Contact Tip DF-15

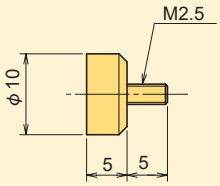


Contact Tip DF-12

The DF-12 is used with SDP-D type displacement transducer.

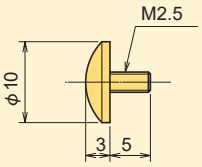


Contact Tip DF-16

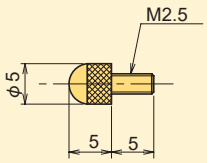


Contact Tip DF-13

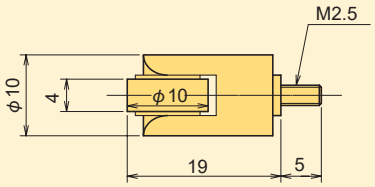
The DF-13 is used with CDP type displacement transducer.



Contact Tip DF-17

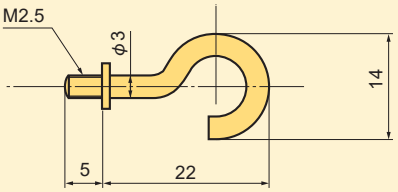


Contact Tip DF-14 with roller



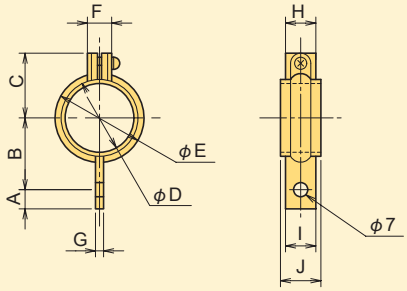
Hook Bolt SDPF-13

The SDPF-13 is used with CDP-T/SDP-ET displace-ment transducer. Also available with SDP-200E/-300E for tension displacement use.



Holder CDPF-11/-12

The CDPF-11 is used to mount CDP displacement transducer, and the CDPF-12 to mount CDP-M/-MT.



Type	Applicable transducers
CDPF-11-25	CDP-5~25,-5~25B,CDP-50M/-MT, CDP-25T, FDP-10A~-100A
CDPF-11-50	CDP-50,-50-D, CDP-100M/-MT
CDPF-11-100	CDP-100,-100-D
CDPF-12-25	CDP-5M~25M, CDP-5MT~25MT

Type	A	B	C	ϕ D	ϕ E	F	G	H	I	J
CDPF-11-25	10	28	25	20.5	30	13	5	15	15	20
CDPF-11-50	10	35	32	33.5	43	13	5	15	15	20
CDPF-11-100	11	36	40	41	50	17.5	8	14	16	25
CDPF-12-25	7	17.5	16.5	10.4	15	9	5	10	10	15

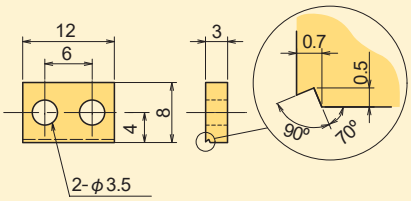
Magnet Stand MB

The MB is used to mount displacement transducers.



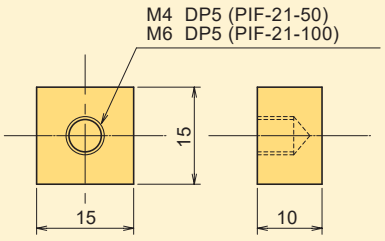
Fixing Jig RAF-11

The RAF-11 is pre-mounted on test specimen in order to clasp-mount RA or UB type displacement transducer.



Fixing Jig PIF-21

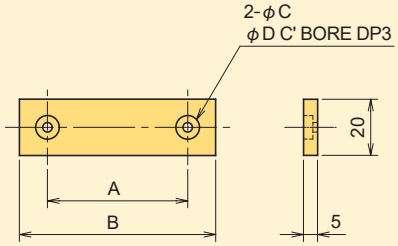
The PIF-21 is pre-mounted on concrete and other test speci-men in order to screw-mount PI type displacement transducer.



Type	Applicable transducer
PIF-21-50	PI-2-50 / PI-5-50
PIF-21-100	PI-2-100 / PI-5-100
	PI-2-150 / PI-5-150
	PI-2-200 / PI-5-200
	PI-2-250 / PI-5-250
	PI-2-300 / PI-5-300

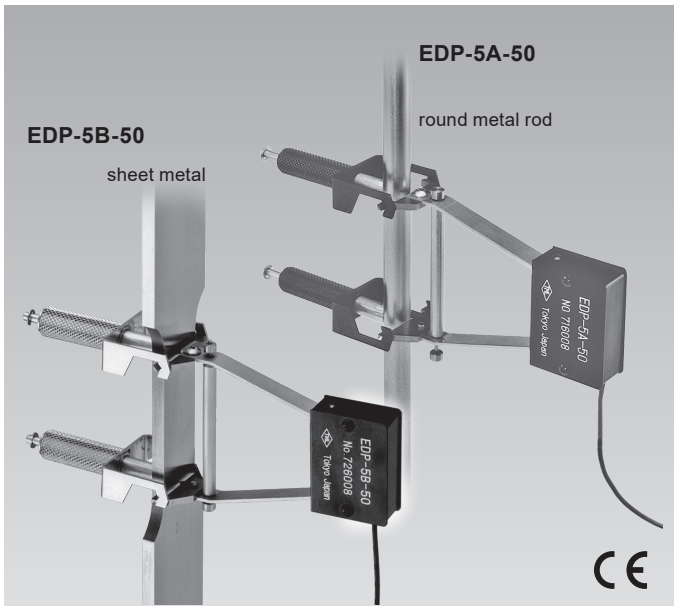
Dummy Plate PIF-11

The PIF-11 is used to maintain the proper gauge length when mounting the PIF-21 Fixing Jig on test specimen.



Type	Applicable transducer	A	B	ϕ C	ϕ D
PIF-11-50	PI-2-50 / PI-5-50	50	70	4.1	8
PIF-11-100	PI-2-100 / PI-5-100	100	120	6.1	12
PIF-11-150	PI-2-150 / PI-5-150	150	170	6.1	12
PIF-11-200	PI-2-200 / PI-5-200	200	220	6.1	12
PIF-11-250	PI-2-250 / PI-5-250	250	270	6.1	12
PIF-11-300	PI-2-300 / PI-5-300	300	320	6.1	12

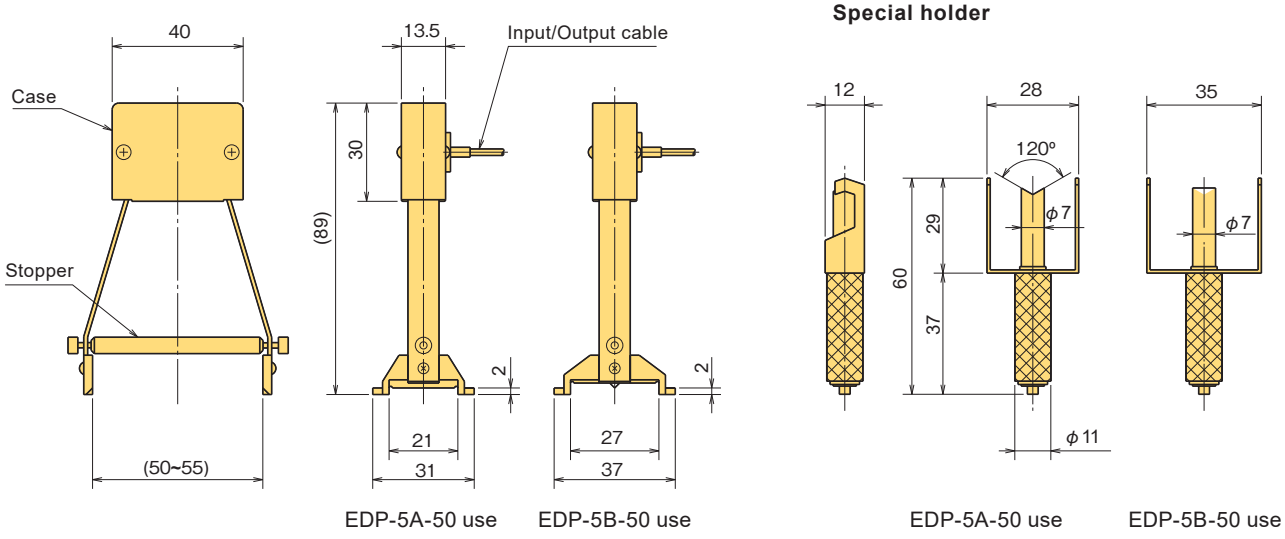
EDP-A / EDP-B Extensometer 5mm



The EDP series extensometer is designed to measure elongation in round metal rod or sheet metal test specimen. It has a special holder that simply and securely holds it in place, and it detects elongation in test specimen based on displacement between two knife edges. This series uses a strain gauge for the sensing element and can be connected to an ordinary strainmeter for high precision measurements.

Protection ratings: IP20 equivalent

For materials tension test



EDP-5A-50 use EDP-5B-50 use EDP-5A-50 use EDP-5B-50 use

■ SPECIFICATIONS

TYPE	EDP-5A-50	EDP-5B-50
Gauge length	50mm	
Capacity	5mm	
Applicable test specimen	Round bar ϕ8~20mm	Plate 5~17mm thickness 10~25mm width
Rated Output	3mV/V(6000×10^{-6} strain)	
Sensitivity	1200×10^{-6} strain/mm	
Non-linearity	0.3%RO	
Allowable temperature range	0 ~ +40°C (No condensation)	
Input/Output resistance	350Ω	
Recommended exciting voltage	2V or less	
Allowable exciting voltage	10V	
Weight	Extensometer: 30g Holder (a pair) : 40g	

Input/Output cable : ϕ2.2mm 0.05mm^2 4-core shielded vinyl cable 2m

KJA-A/KJB-A Joint-meter

Civil engineering design

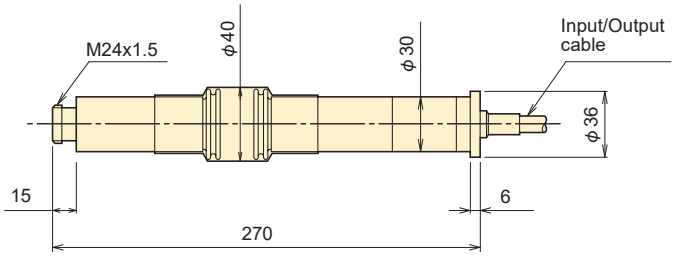


Excellent waterproofness
Long term stable measurement
Easy Installation

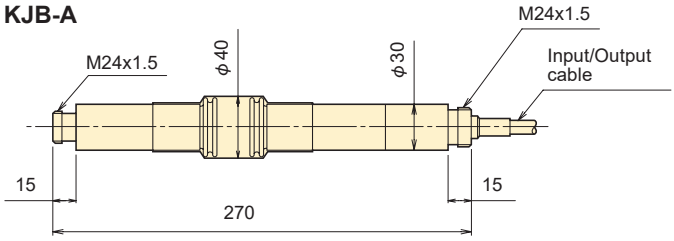
These models are used to measure joint opening displacement of mass concrete. Two models are ready for different applications. The KJA-A Joint-Meter is embedded in an exclusive socket mounted to concrete blocks made of mass concrete or other materials, and is used to measure joint opening displacement. The KJB-A is used to measure displacement on concrete surfaces or underwater simply by manufacturing appropriate fittings. Moreover, these models are available for waterproof type displacement transducer. Optional model with built-in thermocouple unit can be supplied.

Protection ratings : IP 68 equivalent

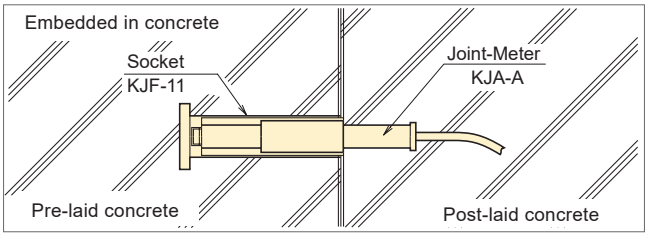
KJA-A

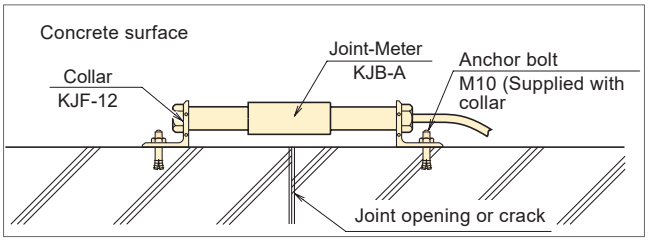


KJB-A



■ INSTALLATION EXAMPLE





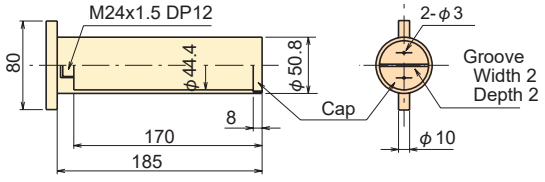
■ SPECIFICATIONS

TYPE	KJA-5A KJB-5A	KJA-10A KJB-10A	KJA-20A KJB-20A	KJA-50A KJB-50A
Capacity	5mm	10mm	20mm	50mm
Rated Output	1mV/V (2000×10^{-6} strain)			
Non-linearity	1%RO			
Allowable temperature range	-20 ~ +80°C			
Input/Output resistance	350Ω			
Recommended exciting voltage	2V or less			
Allowable exciting voltage	10V			
Weight	700g			

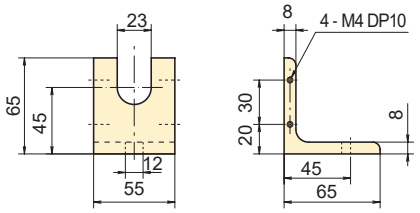
Input/Output cable : ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 2m

■ ACCESSSORY

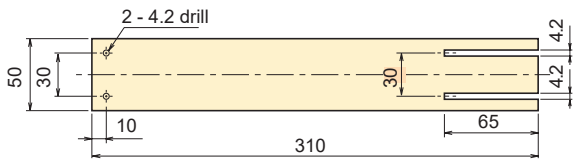
Socket KJF-11 KJA-A use



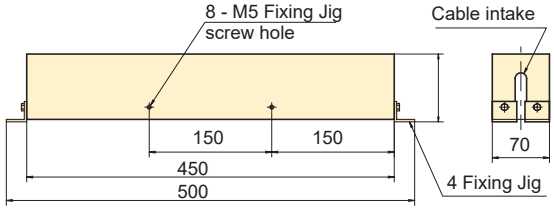
Collar KJF-12 KJB-A use



Dummy plate KJF-13 KJB-A use

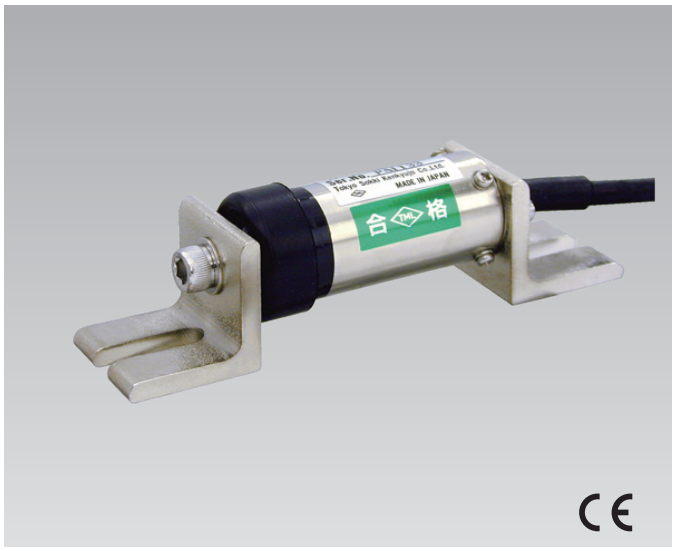


Protective cover KJF-14 KJB-A use

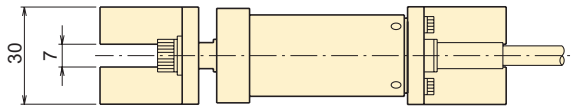


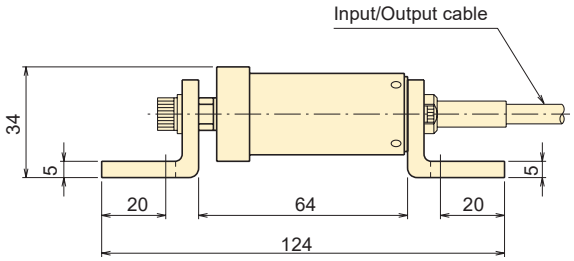
KG-A Crack Displacement Transducer

Civil engineering design



Drip-proof structure
Excellent stability over a long period of time
High sensitivity,High accuracy
Compact, Easy to handle





The KG-A crack displacement transducer is set across a crack on the surface of concrete or across a joint between two concrete layers to measure the displacement of openings. The waterproof feature allows this transducer to make accurate and stable measurement outdoors over a long period of time. It is mounted using an anchor bolt (KGF-11) or a mounting metal piece (KGF-31).

Protection ratings : IP 65 equivalent

■ SPECIFICATIONS

TYPE	KG-2A	KG-5A
Capacity	±2mm	±5mm
Rated Output	1.5mV/V (3000×10^{-6} strain)	2mV/V (4000×10^{-6} strain)
Sensitivity	1500×10^{-6} strain/mm	800×10^{-6} strain/mm
Non-linearity	0.5%RO	1%RO
Spring force	15N (1.5kgf)	
Allowable temperature range	-20 ~ +60°C	
Input/Output resistance	350Ω	
Recommended exciting voltage	2V or less	
Allowable exciting voltage	5V	
Weight	180g	

Input/Output cable : ϕ6mm 0.35mm^2 4-core shielded chloroprene cable 2m

■ ACCESSSORY

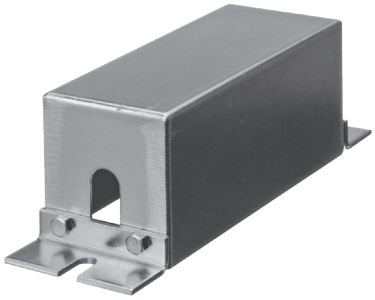
Anchor Bolt KGF-11
This bolt is used to mount the KG-A transducer. After the bolt is placed on to concrete surface the KG-A is mounted. (2 pcs/set)
Thread M6



Fixing Jig KGF-31
This jig is screw-mounted to the collar of the transducer, and bonded on to concrete surface. (2 pcs/set)

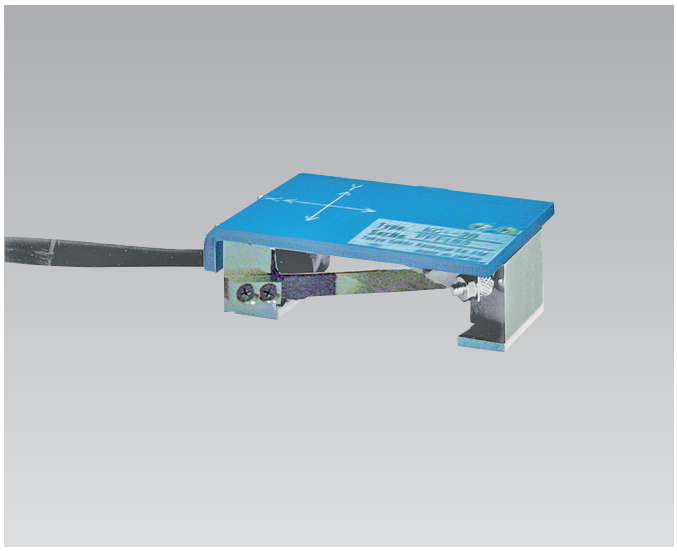


Protective Cover KGF-21
This cover protects the transducer installed on to concrete surface from mechanical damage.

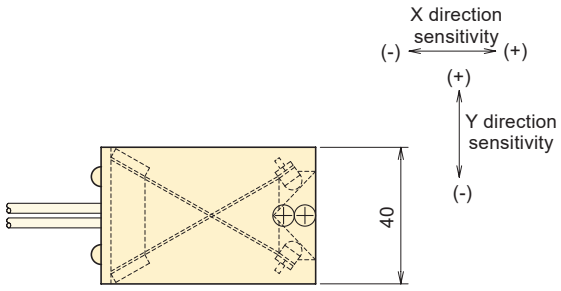


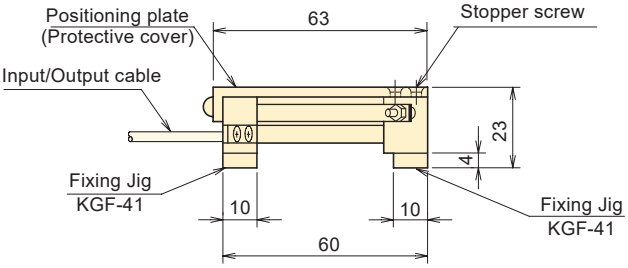
KG-B Crack Displacement Transducer

Civil engineering design



Compact, Light-weight
Easy to handle
Repeated use





The KG-B crack displacement transducer is used to measure the displacement in two directions simultaneously: the displacement of openings, such as concrete cracks or joints, and the horizontal shear displacement. It is mounted on a structure by bonding with adhesive. Because the fixing jigs are detachable, the transducer can be demounted and set on a different structure. This allows this transducer to be used repeatedly on different structures. In addition, the small-size feature makes this transducer suitable for indoor measurement.

■ SPECIFICATIONS

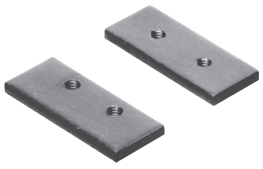
TYPE	KG-3B
Capacity	X-direction : -2mm~+4mm Y-direction : ±3mm
Rated Output	X-direction: Approx. -1~+2mV/V(-2000~+4000×10^{-6} strain) Y-direction : Approx. ±1.5mV/V (±3000×10^{-6} strain)
Sensitivity	Approx. 1000×10^{-6} strain/mm
Non-linearity	1%RO
Cross sensitivity	X-direction : 1.5%RO Y-direction : 2.0%RO
Allowable temperature range	0 ~ +40°C
Input/Output resistance	350Ω
Recommended exciting voltage	2V or less
Allowable exciting voltage	5V
Fixing Jig	1 pc.
Weight	180g

Input/Output cable : ϕ3mm 0.05mm^2 4-core shielded chloroprene cable 2m, 2 pcs.

■ ACCESSSORY

Fixing Jig KGF-41

This jig is bonded onto concrete surface to mount the transducer. (2 pcs/set)



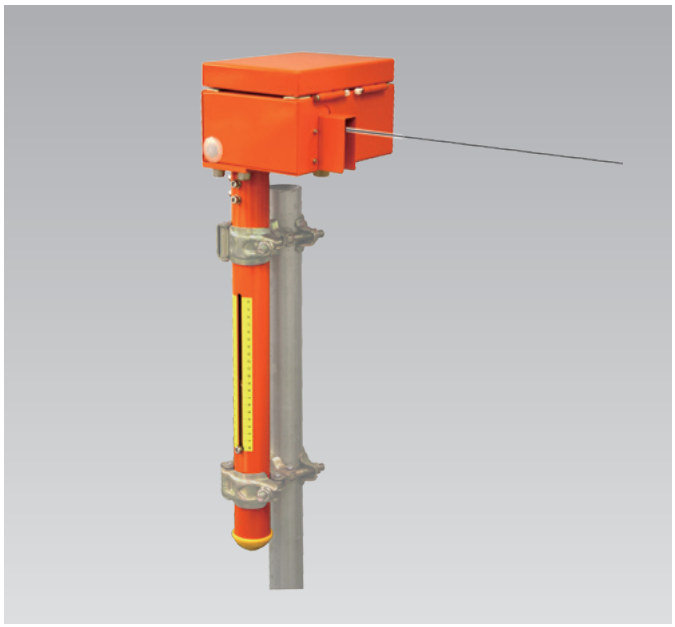
Dummy plate KGF-61

This plate is temporarily mounted to maintain proper gauge length for installation of the transducer with KGF-41 jig.



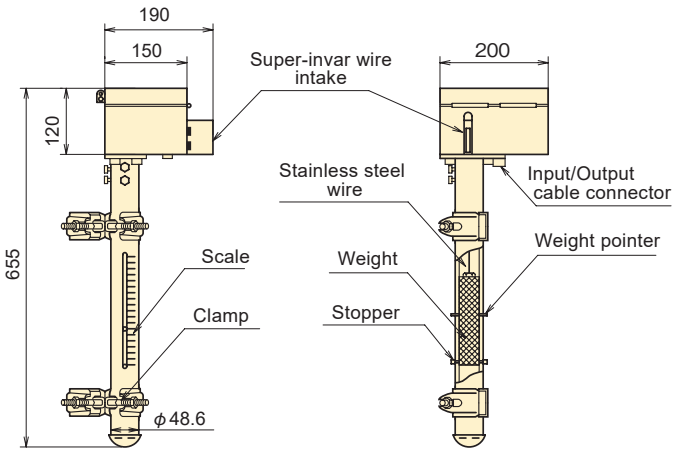
KLG-A/NKLG-AB Ground Extension Gauge

Civil engineering design



Remote measurement
Excellent stability
Easy to handle
Electrical insulation function

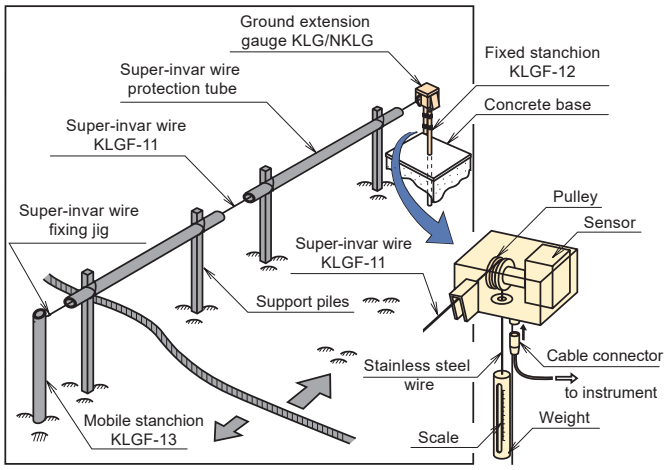
BUILT-IN ARRESTOR



The KLG-A ground extension gauge is used to measure the displacement of a ground surface. A super-invar wire is set between a stanchion at a reference point (fixed stanchion) and a stanchion at a measurement position (mobile stanchion) and this gauge is mounted on the stanchion at the reference point. The waterproof and environmental resistance features make this gauge suitable for on-site measurement work. The NKLG-AB model is designed specifically for use with the network measurement system TML-NET.

Protection ratings : IP 25 equivalent

■ PRINCIPLE AND APPLICATION



■ KLG-A SPECIFICATIONS

TYPE	KLG-200A
Capacity	200mm
Rated Output	2.5mV/V (5000×10^{-6} strain)
Non-linearity	1%RO
Allowable temperature range	-20 ~ +60°C (No icing)
Input/Output resistance	350Ω
Recommended exciting voltage	2V or less
Allowable exciting voltage	5V
Weight	10 kg

Input/Output cable :
CT9-4N2/WP-STB (ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 2m)

■ NKLG-AB SPECIFICATIONS

TYPE	NKLG-200AB
Capacity	200mm
Rated indication	Approx. 5000 digits
Non-linearity	1%RO
Allowable temperature range	-20 ~ +60°C (No icing)
Channel set	Factory default (000~ 999)
Weight	10 kg

Supplied cable :
CT6-2R2/WP-STB (ϕ6mm 0.5mm^2 2-core shielded vinyl cable 2m)

To activate electrical insulation function it requires the dedicated instrument as below.

TDS-540-03 and ND-100, TS-360 or TDS-150-06 including an option for Switching box/TML-NET driving board

■ COMPATIBLE ACCESSORY

With KLG-A/NKLG-AB/KLG-B/NKLG-BB



KLGF-11



KLGF-14

Super-Invar wire KLGF-11
The KLGF-11 Super-Invar Wire is a wire used to connect an extension gauge to a mobile stanchion in order to to transmit displacement.
0.5mm-dia. × 30m (Thermal expansion 1ppm or less)

Fixed Stanchion KLGF-12
The KLGF-12 Fixed Stanchion is installed at a reference point and is used to mount an extension gauge.
48.6mm-dia. × 1.5m

Mobile Stancion KLGF-13
The KLGF-13 mobile Stanchion is installed at a measurement point and is used for fixing the other end of the Super-Invar Wire drawn from the extension gauge.
48.6mm-dia. × 1.5m

Crimp Pliers KLGF-14
The KLGF-14 Crimp Pliers are used to crimp the wire locks supplied with the Super-Invar Wire.

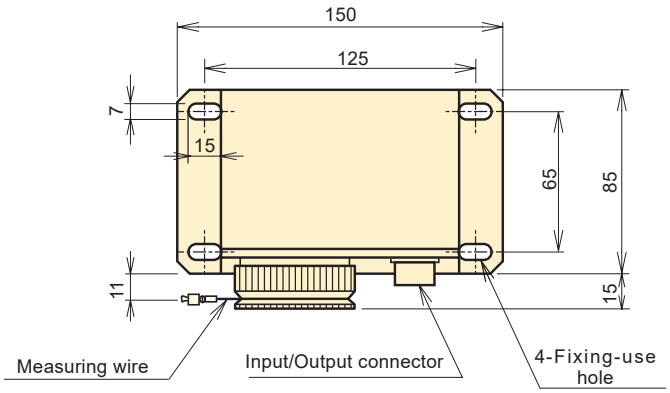
KLG-B/NKLG-BB Ground Extension Gauge

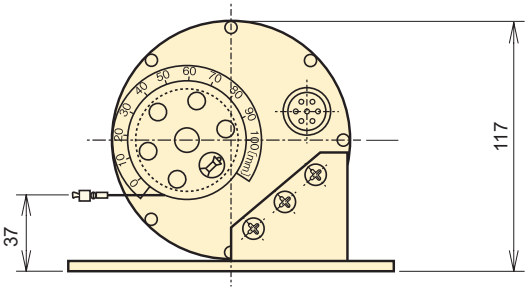
Civil engineering design



Remote measurement
Excellent stability
Easy to handle
Electrical insulation function

BUILT-IN ARRESTOR





The KLG-B ground extension gauge is placed near the ground surface to measure the displacement of a ground slide. A super-Invar wire is set between a stanchion at a reference point (fixed stanchion) and a stanchion at a measurement position (mobile stanchion) and this gauge is mounted on the stanchion at the reference point. The waterproof and environmental resistance features make this gauge suitable for on-site measurement work. The NKLG-BB model is designed specifically for use with the network measurement system TML-NET.

Protection ratings : IP 55 equivalent

■ KLG-B SPECIFICATIONS

TYPE	KLG-100B
Capacity	100mm
Rated Output	Approx. 2.5mV/V (5000×10^{-6} strain)
Non-linearity	1%RO
Allowable temperature range	-20 ~ +60°C (No icing)
Input/Output resistance	350Ω
Recommended exciting voltage	2V or less
Allowable exciting voltage	5V
Weight	1.2 kg

Input/Output cable :
CT9-4N2/WP-STB (ϕ 9mm 0.5mm^2 4-core shielded chloroprene cable 2m)

■ NKLG-BB SPECIFICATIONS

TYPE	NKLG-100BB
Capacity	100mm
Rated indication	Approx. 5000 digits
Non-linearity	1%RO
Allowable temperature range	-20 ~ +60°C (No icing)
Channel set	Factory default (000~ 999)
Weight	1.2 kg

Input/Output cable :
CT6-2R2/WP-STB (ϕ 6mm 0.5mm^2 2-core shielded vinyl cable 2m)

To activate electrical insulation function it requires the dedicated instrument as below.

TDS-540-03 and ND-100, TS-360 or TDS-150-06 including an option for Switching box/TML-NET driving board

■ KLG-B/NKLG-BB DEDICATED ACCESSORY

Mounting plate KLGF-15
This dedicated plate is usable to mount the extension gauge KLG-B/NKLG-BB.



Protective cover KLGF-16
This dedicated cover is usable to protect the extension gauge KLG-B/NKLG-BB mounted on plate KLGF-15

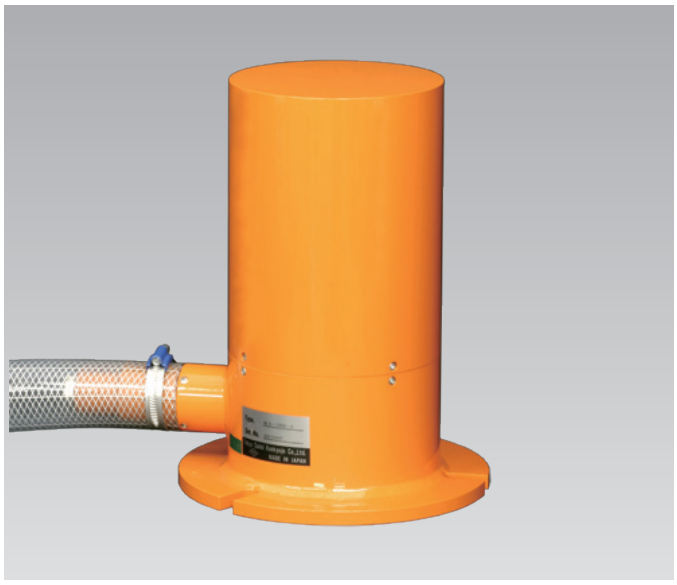


Stanchion mount adapter KLGF-17
This dedicated adapter is usable to fix the extension gauge KLG-B/NKLG-BB mounted on the plate KLGF-15 to the stanchion accessory KLGF-12.



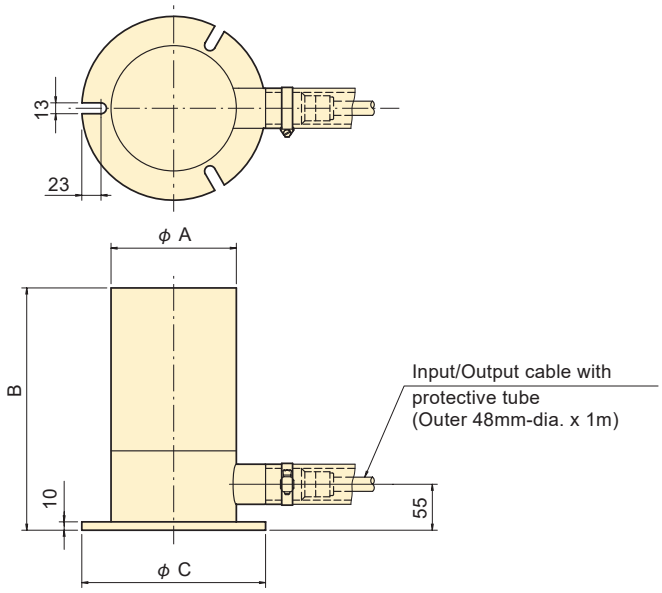
KLA-A/NKLA-B Settlement Transducer

Civil engineering design



Remote measurement

Measures the amount of settlement of ground layers at the maximum 6 positions.

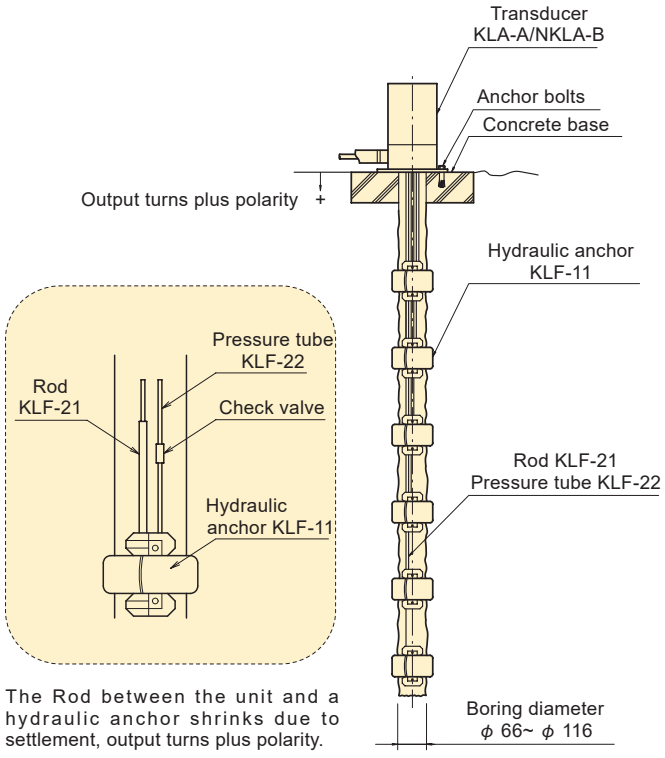


The KLA-A Settlement Transducers is set on a ground surface to measure the settlement of each ground layer. The NKLA-A is also for the same measurement while it can be used with the network measurement system TML-NET. Special anchors are mounted at specified positions inside a borehole and the amount of positional displacement between each anchor and the ground surface level is measured. Anchors can be mounted at the maximum of six levels inside one borehole..

Protection ratings : IP 45 equivalent

TYPE	ϕ A	B	ϕ C	D
KLA-100A/NKLA-100B	150	290	220	23
KLA-200A/NKLA-200B	200	360	260	15

■ PRINCIPLE AND APPLICATION



The Rod between the unit and a hydraulic anchor shrinks due to settlement, output turns plus polarity.

■ KLA-A SPECIFICATIONS

TYPE	KLA-100A-X	KLA-200A-X
Measuring point	1~6 points (-X filled with the specified points)	
Capacity	100mm	200mm
Rated Output	Approx. 2.5mV/V (5000×10^{-6} strain)	
Non-linearity	1%RO	
Allowable temperature range	-20 ~ +60°C (No icing)	
Input/Output resistance	350Ω	
Recommended exciting voltage	2V or less	
Allowable exciting voltage	5V	
Weight	5 kg	4.5~6 kg

Input/Output cable
for 1~3 points: ϕ11.5mm 0.3mm² 12-core shielded vinyl cable 2m
for 4~6 points: ϕ16.5mm 0.3mm² 24-core shielded vinyl cable 2m

■ NKLA-B SPECIFICATIONS

TYPE	NKLA-100B-X	NKLA-200B-X
Measuring point	1~6 points (-X filled with the specified points)	
Capacity	100mm	200mm
Rated indication	Approx. 5000 digits	
Non-linearity	1%RO	
Allowable temperature range	-20 ~ +60°C (No icing)	
Channel set	Factory default (000~ 999)	
Weight	5 kg	5~7 kg

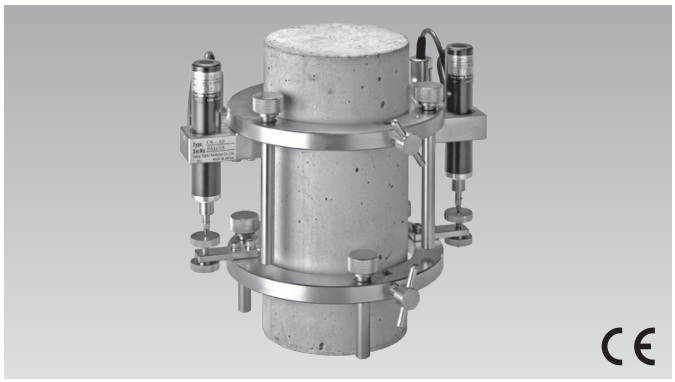
Supplied cable
CT6-2R2/WP-STB ϕ6mm 0.5mm² 2-core shielded vinyl cable 2m

To activate electrical insulation function it requires the dedicated instrument as below.

TDS-540-03 and ND-100, TS-360 or TDS-150-06 including an option for Switching box/TML-NET driving board

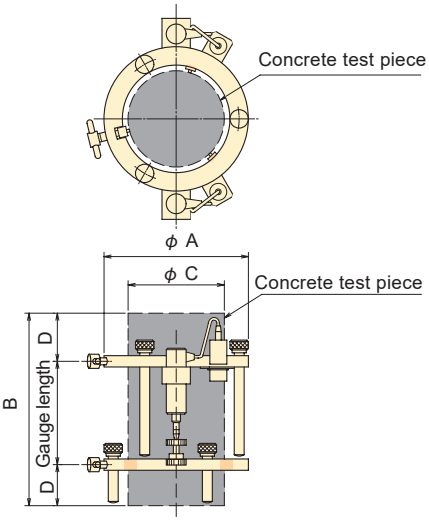
CM Compressometer

Civil engineering design



Easy to install
Repeated use
Easy drawing of stress- strain curve

The CM compressometer is designed to conduct a strength test. It measures the axial strain on a cylindrical concrete specimen placed in and secured by screws to the inner chamber of this compressometer. It uses a high-sensitivity displacement transducer to measure the amount of strain. By multiplying a measurement by a certain factor, the amount of strain can be calculated as a numerical value. Unlike the case of ordinary strain gauges, this compressometer is simple and easy to operate and can be used repeatedly. However, it cannot be used to conduct breaking tests.



■ SPECIFICATIONS

TYPE	CM-10	CM-12	CM-15
Applicable specimen	ϕ 10x20 cm	ϕ 12.5x25 cm	ϕ 15x30 cm
Gauge length	100mm	125mm	150mm
Capacity	50000×10^{-6} strain	40000×10^{-6} strain	33000×10^{-6} strain
Input/Output resistance	350Ω		
Recommended exciting voltage	2V or less		
Allowable exciting voltage	10V		
Weight	2.5 kg	3.1 kg	3.7 kg

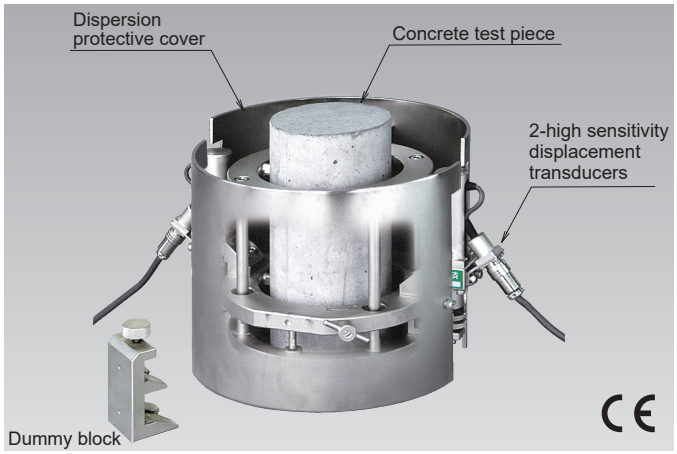
Supplied cable : CT6-4V10/NP-STB (ϕ6mm 0.3mm^2 4-core shielded vinyl cable 10m)

■ DIMENSIONS

TYPE	ϕ A	B	ϕ C	D
CM-10	150	200	100	50
CM-12	185	250	125	62.5
CM-15	210	300	150	75

CM-H Compressometer (Destructive)

Civil engineering design



The CM-10H compressometer is designed to measure compressive strain of cylindrical specimen made of ordinary concrete or high-strength concrete under loading test. It uses high sensitive displacement transducers for measurement of strain, and is constructed not to apply excessive displacement to the transducers even after the sepcimen is broken. In addition, it is equipped with protective covers intended to prevent dispersion of fragments of broken specimen. The displacement transducers are also protected with covers. It is very easy to set a specimen to the compressometer . A wet concrete specimen, which is just after taken out from underwater curing, can aloso be measured. When used together with load cell CLL-NA or CLH-NA, it is possible to measure the modulus of static erlasticity.

Usable till destruction of a specimen
Easy to install
Possible strain measurement of wet specimen
Repeated use

■ SPECIFICATIONS

TYPE	CM-10H
Applicable specimen	ϕ 10x20 cm
Gauge length	100mm
Capacity	20000×10^{-6} strain
Input/Output resistance	350Ω
Weight	4.5 kg

Supplied cable :
CT6-4V3/SNP-STB (ϕ6mm 0.3mm^2 4-core shielded vinyl cable 3m)

■ OPTION

Mounting jigs to position concrete test specimen are replaceable with option as damaged.

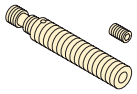
CMF-11H Fixed edge

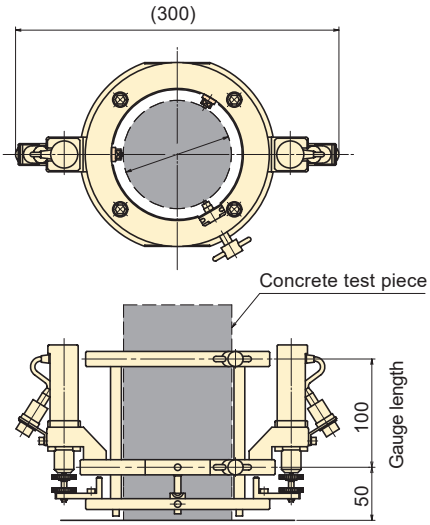


CMF-12H Movable edge



CMF-13H Handle screw

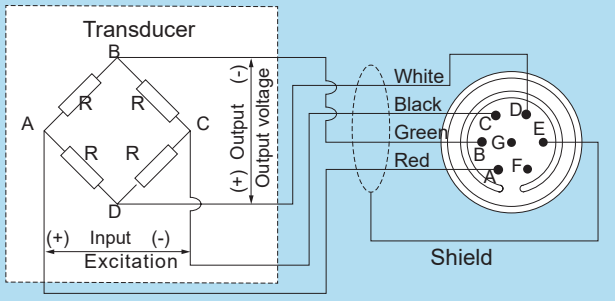




TML Pressure Transducers electrically detect the gauge pressure of fluids like oil and water or gases like air. Our pressure transducers have sensing elements that use TML strain gauges made exclusively for transducers, and they can be used for consistent, highly reliable measurements over long periods of time. Our PW-PA, PWH and PW-PAH models are cavity type pressure transducers ideal for high precision static measurements, and PWF, PWFA, PWFC, PWFD and PWFE models have flush diaphragm structures best suited for dynamic measurements. PWFA model is with built-in amplifier, capable of high temperature use up to 120 deg. C. and the output voltage is 0.5~5V. PW-PAH model is designed for high temperature use up to 170 deg. C with smaller size. And PDA/PDB models are Miniature Pressure gauges. Their sensing part is 7.6mm-dia. and 2mm-thick.

OUTPUT POLARITY WITH A LOAD

The measured value changes in positive(+) direction with increase of pressure..



Not applicable to some products.

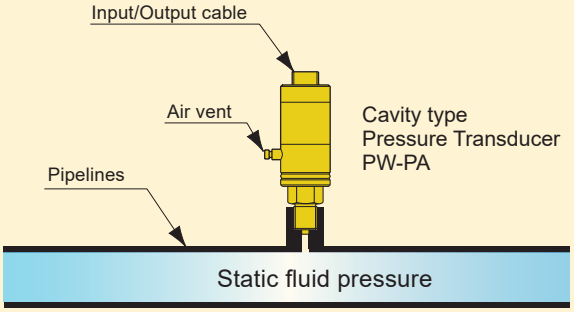
Pressure transducer selection

Utility	Type	Capacity (kPa)					Capacity (MPa)											
		50	100	200	300	500	1	2	3	5	10	20	30	50	70	100	150	200
High precision	**PW-PA**		●	●	●	●	●	●		●	●	●	●	●				
High capacity, High sensitivity	**PWH-PA**														●	●	●	●
High temperature use upto 170 deg C	**PW-PAH**							●		●	●	●		●				
Built-in amplifier, High temperature use	**PWFA-PA**							●		●	●	●						
Flush diaphragm	**PWF-PB**						●	●		●	●	●		●				
Flush diaphragm, Small G1/8 screw	**PWFC-PB**							●		●	●	●		●				
Flush diaphragm, M8 bolt shape	**PWFD-PB**							●		●	●	●						
Flush diaphragm, M6 bolt shape	**PWFE-PA**							●		●	●	●						
Miniature, 7.6mm-dia. 2mm-thick	**PDA-PB**	●	●	●		●	●	●	●									
Miniature, 7.6mm-dia. 2mm-thick	**PDB-PB**	●	●	●		●	●	●	●									
Miniature,5.8mm-dia. 2.5mm-thick	**PDC-PA**		●	●	●													
Miniature,5.8mm-dia. 2.5mm-thick	**PDD-PA**		●	●	●													

EXAMPLE OF PRESSURE TRANSDUCER USE

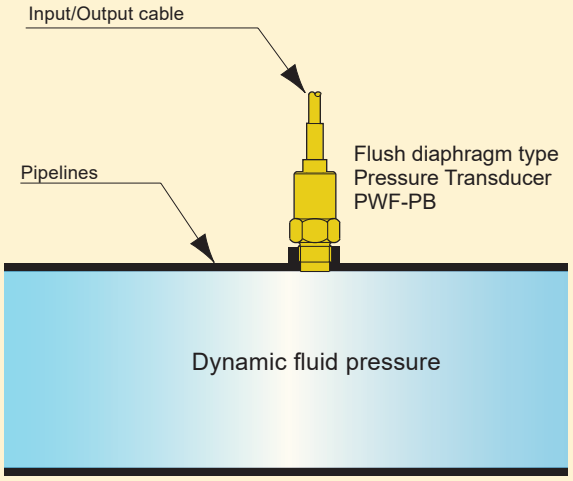
Static measurement

Measuring static water (oil) pressure in pressure vessels

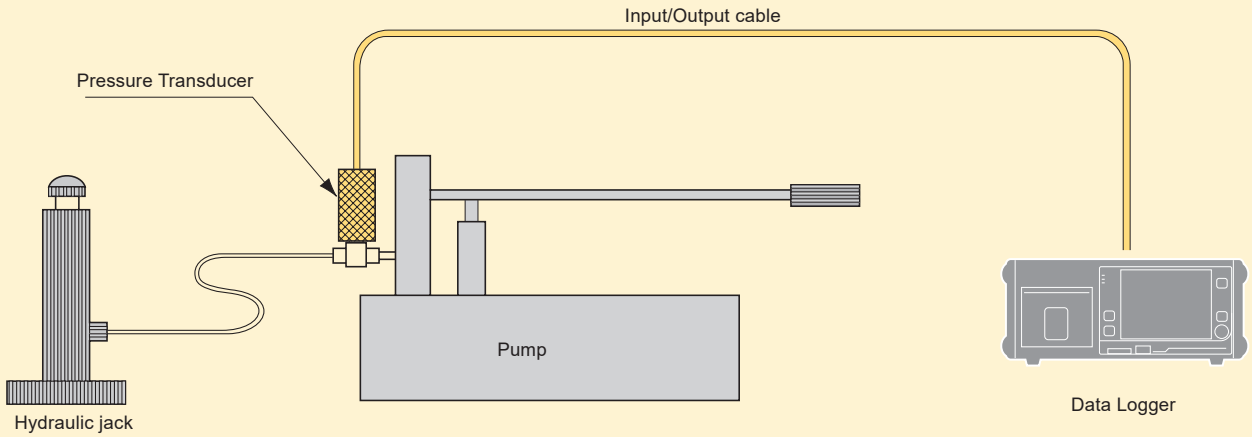


Dynamic measurement

Measuring pressure variation in pipe lines



Measuring hydraulic jack loads



Method used to calculate the conversion coefficient when measuring hydraulic jack load (kN or MN) with a pressure transducer

Correction coefficient (K) = C × A

K: Correction coefficient
C: Calibration coefficient for the transducer
A: Jack cylinder surface area exposed to pressure
F: Maximum jack load
P: Maximum jack pressure

Example

Determine the correction coefficient when a pressure transducer is mounted to a jack with a maximum load of 3MN and a cylinder surface area exposed to pressure of 500cm^2.

$$\text{Maxium jack pressure } P = \frac{F}{A} = \frac{3 \times 10^{6}}{5 \times 10^{-2}} = 60\text{MPa}$$

Select a pressure transducer with a capacity higher than 60MPa because maximum jack pressure here is 60MPa. In this case, use the PWH-70MPA because it has a capacity of 70MPa.

If the calibration coefficient for the PWH-70MPA is
C= 0.035MPa/1 × 10^{-6} strain,

then the correction coefficient (K) is
C × A = 0.035 × 10^{6} × 5 × 10^{-2}
and equals 1.75 × 10^{3}N.

Converted to MN, we get the following:

$$K = \frac{1.75 \times 10^{3}\ \text{N}}{1 \times 10^{-6}\ \text{strain}} = 0.00175\text{MN}/1 \times 10^{-6}\ \text{strain}$$

Therefore Data Logger TDS-540 settings are as follows:

Sensor Mode : 4 GAGE
Coefficient : +0.00175 E+0
Unit : MN
Point : ###.###

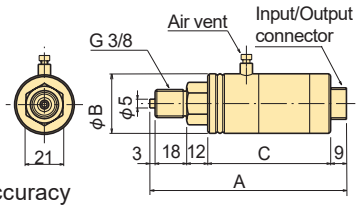
Settings are entered, screen displays the reflected functions.

Coefficient : 1.75000 E-3
Unit : MN
Point : ###.###

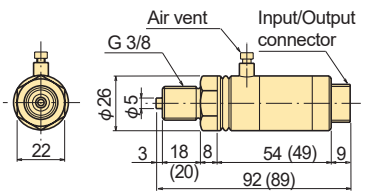
PW-PA Pressure Transducer 100kPa~50MPa



PW-100KPA ~ 5MPA



PW-10 ~ 50MPA



Figures in parentheses are of PW-50MPA.

The PW-PA pressure transducer can make stable high-accuracy measurement over a long period of time. It is widely used in production lines and plants and to measure liquid pressure, air pressure, and so forth in laboratories.
Protection ratings: IP42 equivalent PW-100KPA, 200KPA / IP65 equivalent PW-500KPA~50MPA

■ Dimensions

TYPE	A	φB	C
PW-100~ 500KPA	105	42	63
PW-1~ 5MPA	112	34	70
PW-10~ 50MPA	As per the figure		

■ SPECIFICATIONS

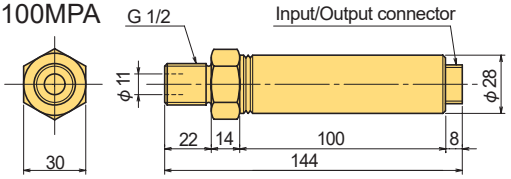
TYPE	PW-100KPA	PW-200KPA	PW-500KPA	PW-1MPA	PW-2MPA	PW-5MPA	PW-10MPA	PW-20MPA	PW-30MPA	PW-50MPA
Capacity	100kPa	200kPa	500kPa	1MPa	2MPa	5MPa	10MPa	20MPa	30MPa	50MPa
Rated Output	1mV/V(2000×10^{-6} strain) ±1%	1.5mV/V(3000×10^{-6} strain) ±1%			2mV/V(4000×10^{-6} strain) ±1%					
Non-linearity	0.3%RO		0.2%RO							
Hysteresis	0.3%RO		0.2%RO							
Repeatability	0.3%RO				0.2%RO					
Temperature effect on zero	0.02%RO/°C									
Temperature effect on span	0.02%/°C									
Compensated temperature range	-10 ~ +60°C									
Allowable temperature range	-20 ~ +70°C									
Over load	150%									
Ultimate overload rating	300%									
Input/Output resistance	350Ω±1%									
Recommended exciting voltage	3V or less				6V or less					
Allowable exciting voltage	10V				15V					
Mounting thread	G3/8 (PF3/8)									
Materials of pressure media	SUS630									
Weight	530g			400g			200g			

Supplied cable : CT9-4N2/WP-STB (φ9mm 0.5mm² 4-core shielded chloroprene cable 2m) For measurement of negative pressure, please consult us.

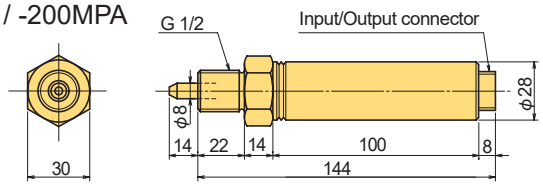
PWH-PA High capacity Pressure Transducer 70~200MPa



PWH-70 / -100MPA



PWH-150 / -200MPA



The PWH-PA high-capacity pressure transducer has a sealed structure made with high-strength stainless steel. Using this highly sensitive transducer, stable high-accuracy measurement can be made over a long period of time. It is used to control plant or production lines, to measure jack pressure, and for various other applications.
Protection ratings: IP65 equivalent

■ SPECIFICATIONS

TYPE	PWH-70MPA	PWH-100MPA	PWH-150MPA	PWH-200MPA
Capacity	70MPa	100MPa	150MPa	200MPa
Rated Output	1mV/V(2000× 10^{-6} strain) ±1%			
Non-linearity	0.2%RO			
Hysteresis	0.2%RO			
Repeatability	0.3%RO			
Temperature effect on zero	0.02%RO/°C			
Temperature effect on span	0.02%/°C			
Compensated temperature range	-10 ~ +60°C			
Allowable temperature range	-20 ~ +70°C			
Over load	150%			
Ultimate overload rating	300%			
Input/Output resistance	350Ω±1%			
Recommended exciting voltage	6V or less			
Allowable exciting voltage	15V			
Mounting thread	G1/2 (PF1/2)			
Materials of pressure media	SUS630			
Weight	400g		410g	

Supplied cable : CT9-4N2/WP-STB (φ9mm 0.5mm² 4-core shielded chloroprene cable 2m)

High capacity
Available for many fields of industrial application such as plant, production line, jack pressure, etc.

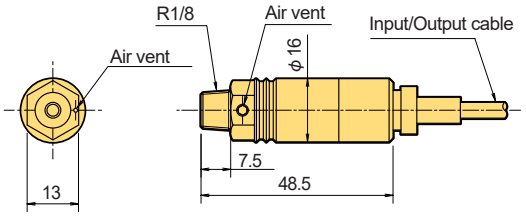
PW-PAH High temperature Pressure Transducer 2~50MPa



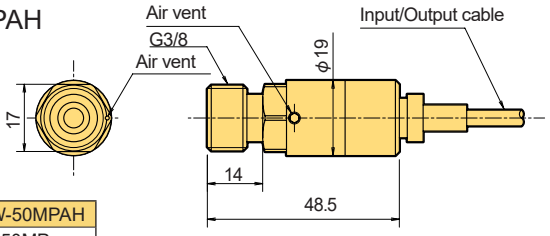
The PW-PAH pressure transducer is designed to measure pressure in a high temperature with compact size. As the model equipped with a fluoroplastic Input/Output cable, a high temperature pressure measurement is available up to 170°C. These models line up five ranges of 2, 5, 10, 20 and 50MPa.

Protection ratings: IP65 equivalent

PW-2MPAH~ 20MPAH



PW-50MPAH



■ SPECIFICATIONS

TYPE	PW-2MPAH	PW-5MPAH	PW-10MPAH	PW-20MPAH	PW-50MPAH
Capacity	2MPa	5MPa	10MPa	20MPa	50MPa
Rated Output	2mV/V(4000× 10^{-6} strain) ±25%				
Non-linearity	0.3%RO				
Hysteresis	0.2%RO				
Repeatability	0.2%RO				
Temperature effect on zero	0.008%RO/°C				
Temperature effect on span	0.01%/°C				
Compensated temperature range	-40 ~ +150°C				
Allowable temperature range	-40 ~ +170°C				
Over load	150%				
Input/Output resistance	350Ω				
Recommended exciting voltage	5V or less				
Allowable exciting voltage	10V				
Mounting thread	R1/8 (Male)				G3/8 (Male)
Materials of pressure media	SUS630				
Weight	50g				70g

Gases and liquids pressure measurement in high temperature +170ºC at max.
Smallest size with 16mm-dia. 48.5mm long

Supplied cable :
CT4-4F5/SNP-STB (ϕ 4mm 0.08mm² 4-core shielded fluoroplastic resin cable 5m)

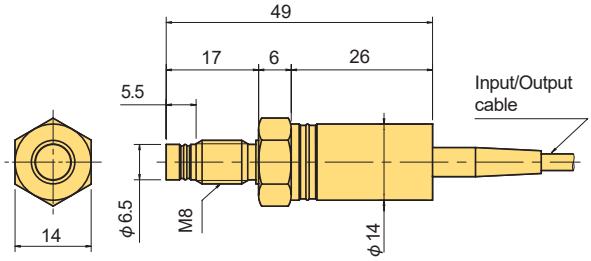
PWFA-PA Small High-Temperature Pressure Transducer with built-in amplifier 2~20MPa



The PWFA-PA is a M8 bolt-shaped flush diaphragm pressure transducer with a built-in strain amplifier. Since the PWFA-PA is small sized and can be used for dynamic measurement in high temperature ranges, it is most suited to in-vehicle measurement of hydraulic oil pressure of engine, motor, transmission, oil pump and so on.

Protection ratings: IP65 equivalent

Excellent anti-vibration characteristics
Measurement possible in high temperature up to 120°C
Light weight of 45 g, which is less than half of conventional products.
Overall length after installation is 32 mm, which is less than one third of conventional products



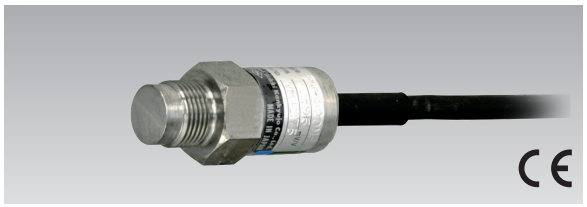
■ SPECIFICATIONS

TYPE	PWFA-2MPA	PWFA-5MPA	PWFA-10MPA	PWFA-20MPA
Capacity	2MPa	5MPa	10MPa	20MPa
Output voltage	0.5 ~ 5V			
Non-linearity	0.5%RO			
Hysteresis	0.3%RO			
Temperature effect on zero	0.1%RO/°C			
Temperature effect on span	0.03%/°C			
Compensated temperature range	-20 ~ +120°C			
Allowable temperature range	-20 ~ +120°C			
SN ratio	50dB or more			
Load resistance	5kΩ or more			
Frequency response of amplifier	DC ~ 1kHz			
Over load	150%			
Mounting thread	M8			
Materials of pressure media	SUS630			
Weight	45g			

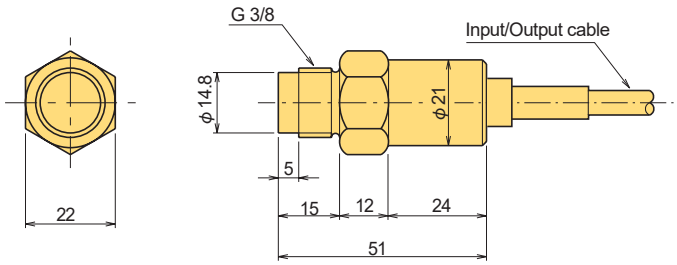
Input/Output cable :
ϕ 3mm 0.08mm² 4-core shielded fluoroplastic cable 5m)

NB: A zero point may drift for a long term con-tinuous use in high temperature.

PWF-PB Flush Diaphragm type Pressure Transducer 1~50MPa



G3/8 size
High response



Because this transducer has its pressure-receiving surface at the top of mounting screws, it is suitable for use in a situation where pressure changes dynamically. It is widely used to measure the pressure in pipelines, cylinder pressure, and so forth
Protection ratings: IP67 equivalent

■ SPECIFICATIONS

TYPE	PWF-1MPB	PWF-2MPB	PWF-5MPB	PWF-10MPB	PWF-20MPB	PWF-50MPB
Capacity	1MPa	2MPa	5MPa	10MPa	20MPa	50MPa
Rated Output	1.75mV/V(3500× 10^{-6} strain) ±25%					
Non-linearity	0.5%RO					
Hysteresis	0.5%RO					
Repeatability	0.5%RO					
Temperature effect on zero	0.06%RO/°C					
Temperature effect on span	0.03%/°C					
Compensated temperature range	-10 ~ +60°C					
Allowable temperature range	-20 ~ +70°C					
Over load	150%					
Ultimate overload rating	300%					
Input/Output resistance	350Ω					
Recommended exciting voltage	6V or less					
Allowable exciting voltage	10V					
Natural frequency	30kHz	40kHz	60kHz	80kHz	110kHz	170kHz
Mounting thread	G3/8 (PF3/8)					
Materials of pressure media	SUS630					
Weight	100g					

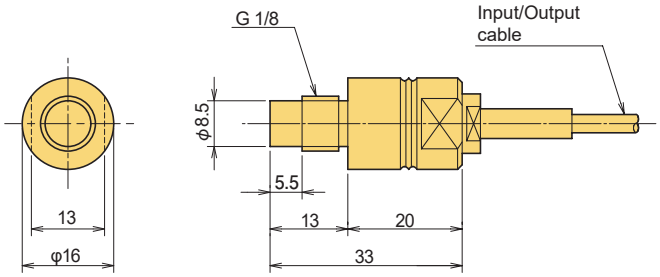
Input/Output cable :
φ6mm 0.35mm² 4-core shielded chloroprene cable 2m

Applicable fitting torque: 10~20N·m

PWFC-PB Flush Diaphragm type Pressure Transducer 2~50MPa



G1/8 size
High response



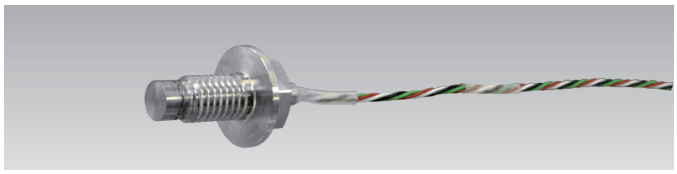
The PWFC-PB flush diaphragm pressure transducer is small in size and the screw used to mount it is also small G1/8 (PF1/8). The high responsiveness to changes in pressure makes this transducer most suitable for pressure control systems or pressure measurement in a confined space. It is widely used to control pressure in production lines, to measure cylinder pressure, and for many other applications.
Protection ratings: IP67 equivalent

■ SPECIFICATIONS

TYPE	PWFC-2MPB	PWFC-5MPB	PWFC-10MPB	PWFC-20MPB	PWFC-50MPB
Capacity	2MPa	5MPa	10MPa	20MPa	50MPa
Rated Output	1.5mV/V(3000×10^{-6} strain) ±25%	2mV/V(4000×10^{-6} strain) ±25%			
Non-linearity	0.5%RO				
Hysteresis	0.5%RO				
Repeatability	0.5%RO				
Temperature effect on zero	0.03%RO/°C				
Temperature effect on span	0.03%/°C				
Compensated temperature range	-10 ~ +60°C				
Allowable temperature range	-20 ~ +70°C				
Over load	150%				
Ultimate overload rating	300%				
Input/Output resistance	350Ω				
Recommended exciting voltage	3V or less				
Allowable exciting voltage	6V				
Natural frequency	70kHz	90kHz	130kHz	180kHz	290kHz
Mounting thread	G1/8 (PF1/8)				
Materials of pressure media	SUS630				
Weight	25g				

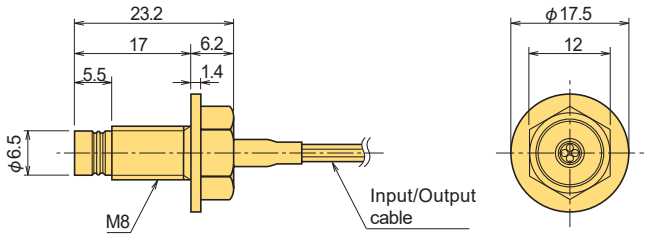
Input/Output cable :
φ3mm 0.05mm² 4-core shielded chloroprene cable 2m
Applicable fitting torque: 10~15N·m

PWFD-PB Flush Diaphragm Pressure Transducer 2~20MPa



The PWFD-PB is a bolt-shaped flush diaphragm pressure transducer. As it is small and can be used for dynamic measurement in high temperature region, it suits various pressure measurements around engine. The shape of hexagonal bolt (M8 size) with flange makes installation to a screw hole easy.
Protection ratings: IP67 equivalent

M8 size
High temperature



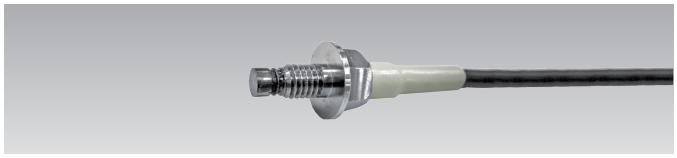
■ SPECIFICATIONS

TYPE	PWFD-2MPB	PWFD-5MPB	PWFD-10MPB	PWFD-20MPB
Capacity	2MPa	5MPa	10MPa	20MPa
Rated Output	1.5mV/V(3000×10^{-6} strain) ±25%	2mV/V(4000×10^{-6} strain) ±25%		
Non-linearity	0.5%RO			
Hysteresis	0.5%RO			
Repeatability	0.5%RO			
Temperature effect on zero	0.03%RO/°C			
Temperature effect on span	0.03%/°C			
Compensated temperature range	0 ~ +150°C			
Allowable temperature range	-20 ~ +150°C			
Over load	150%			
Ultimate overload rating	300%			
Input/Output resistance	350Ω			
Recommended exciting voltage	2V or less			
Allowable exciting voltage	5V			
Natural frequency	70kHz	90kHz	130kHz	180kHz
Mounting thread	M8			
Materials of pressure media	SUS630			
Weight	7g			

Input/Output cable :
0.08mm^2 4-core fluoroplastic insulated cable 2m
Applicable fitting torque : 10~15N·m

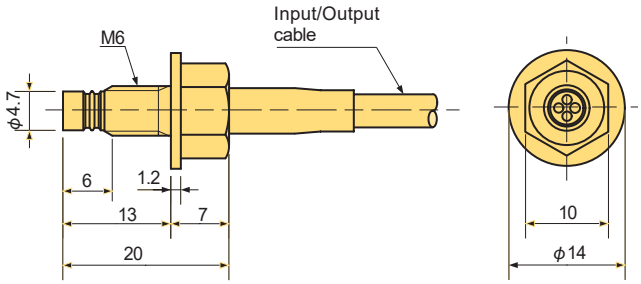
NB: A zero point may drift for a long term continuous use in high temperature.

PWFE-PA Flush Diaphragm Pressure Transducer 2~20MPa



The PWFE-PA is a bolt-shaped flush diaphragm pressure transducer. As it is small and can be used for dynamic measurement in high temperature region, it suits various pressure measurements around engine. The shape of hexagonal bolt (M6 size) with flange makes installation to a screw hole easy.
Protection ratings: IP67 equivalent

M6 size
High temperature



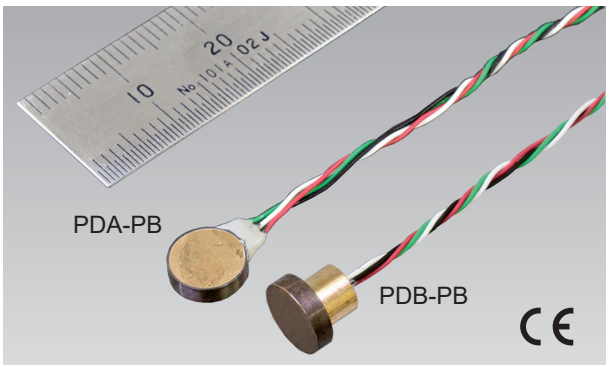
■ SPECIFICATIONS

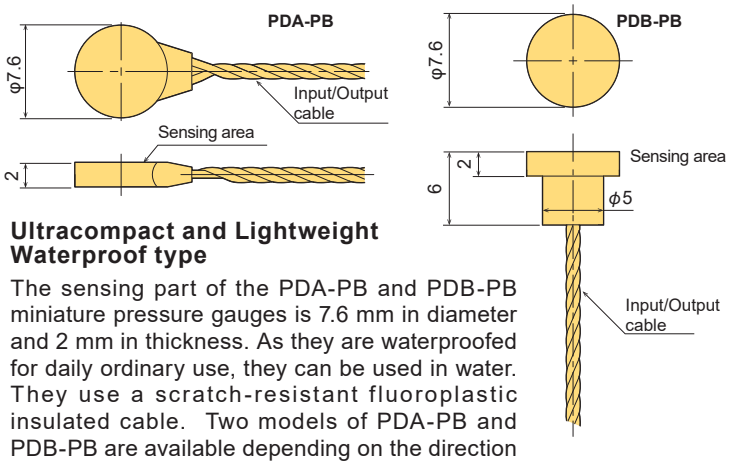
TYPE	PWFE-2MPA	PWFE-5MPA	PWFE-10MPA	PWFE-20MPA
Capacity	2MPa	5MPa	10MPa	20MPa
Rated Output	1.5mV/V(3000×10^{-6} strain) ±25%		1.75mV/V(3500×10^{-6} strain) ±25%	
Non-linearity	1%RO		0.5%RO	
Hysteresis	1%RO		0.5%RO	
Repeatability	0.5%RO			
Temperature effect on zero	0.1%RO/°C			
Temperature effect on span	0.03%/°C			
Compensated temperature range	-20 ~ +150°C			
Allowable temperature range	-20 ~ +150°C			
Over load	120%			
Input/Output resistance	120Ω			
Recommended exciting voltage	2V or less			
Allowable exciting voltage	5V			
Natural frequency	110kHz	160kHz	200kHz	270kHz
Mounting thread	M6			
Materials of pressure media	SUS630			
Weight	5g			

Input/Output cable :
ϕ4mm 0.08mm^2 4-core fluoroplastic insulated cable 2m
Applicable fitting torque : 4~5N·m

NB: A zero point may drift for a long term continuous use in high temperature.

PDA-PB / PDB-PB Miniature Pressure Transducer 50kPa~3MPa





Protection ratings: IP67 equivalent

Ultra-miniature, Easy handling
Optimum for model testing
Capable of underwater use for a short term

Ultracompact and Lightweight Waterproof type

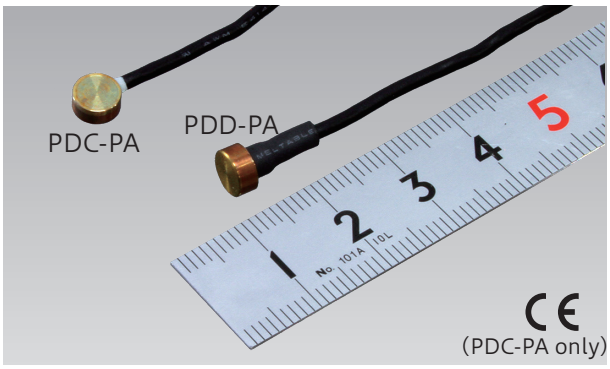
The sensing part of the PDA-PB and PDB-PB miniature pressure gauges is 7.6 mm in diameter and 2 mm in thickness. As they are waterproofed for daily ordinary use, they can be used in water. They use a scratch-resistant fluoroplastic insulated cable. Two models of PDA-PB and PDB-PB are available depending on the direction of cable outlet.

■ SPECIFICATIONS

TYPE	PDA-50KPB PDB-50KPB	PDA-100KPB PDB-100KPB	PDA-200KPB PDB-200KPB	PDA-500KPB PDB-500KPB	PDA-1MPB PDB-1MPB	PDA-2MPB PDB-2MPB	PDA-3MPB PDB-3MPB
Capacity	50kPa	100kPa	200kPa	500kPa	1MPa	2MPa	3MPa
Rated Output	0.5mV/V (1000×10^{-6} strain)	0.75mV/V (1500×10^{-6} strain)	1mV/V(2000×10^{-6} strain)				
Non-linearity	1%RO						
Hysteresis	1%RO						
Temperature effect on zero	1%RO/°C						
Temperature effect on span	1%/°C						
Compensated temperature range	-10 ~ +60°C (no icing)						
Allowable temperature range	-20 ~ +70°C (no icing)						
Input/Output resistance	350Ω						
Recommended exciting voltage	2V or less						
Allowable exciting voltage	5V						
Weight	PDA-PB: 0.4g PDB-PB: 0.7g						

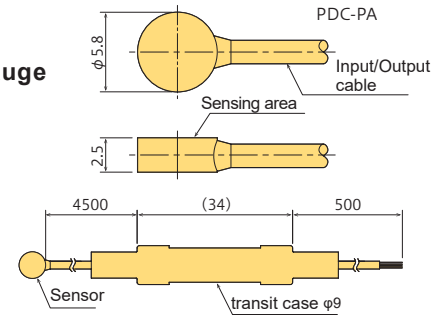
Input/Output cable : 0.014mm^2 4-core cross-linked polyethylene insulated cable 1m
Note: If used in water for a prolonged period, the waterproof performance may deteriorate.

PDC-PA/PDD-PA Miniature Pressure Transducer 100~300kPa



High output with low capacitance
Ultra-compact pressure gauge with a pressure-sensitive surface of 5.8 mm dia.

High resolution(High resolution (approx. 5 times higher than ours at 200 kPa)
Ultra-compact and easy to handle
Outer diameter φ7.6 → φ5.8
Compared to our conventional model, about -24% smaller
Optimal for model experiments

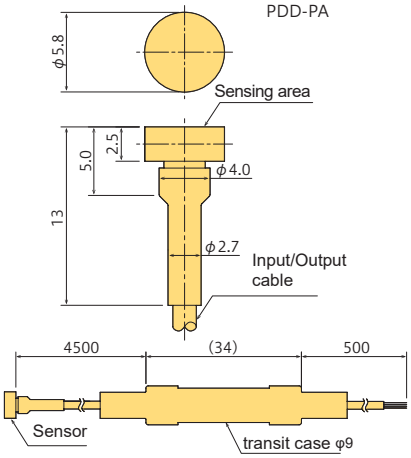


Protection ratings: IP68 equivalent

■ SPECIFICATIONS

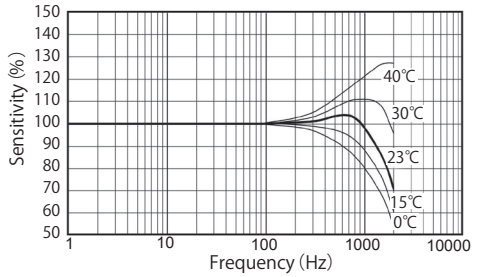
TYPE	PDC-100KPA PDD-100KPA	PDC-200KPA PDD-200KPA	PDC-300KPA PDD-300KPA
Capacity	100kPa	200kPa	300kPa
Rated Output	approx.4.0mV/V (8000×10^{-6} strain)	approx.5.0mV/V (10000×10^{-6} strain)	approx.4.0mV/V (8000×10^{-6} strain)
Non-linearity	1.0%RO		
Temperature effect on zero	1%RO/°C		
Temperature effect on span	0.5%/°C		
Compensated temperature range	0 ~ +60°C (no icing)		
Allowable temperature range	-10 ~ +70°C (no icing)		
Input/Output resistance	Input resistance 450Ω / Output resistance 640Ω		
Recommended exciting voltage	2V or less		
Allowable exciting voltage	5V		
Weight	approx. 0.3g		

Input/Output cable : φ1.7 0.035mm^2 4-conductor shielded vinyl cable 5m
Note: If used in water for a prolonged period, the waterproof performance may deteriorate.



TML Acceleration Transducers electrically detect acceleration in all types of structures, including automobiles and machinery. Our acceleration transducers have sensing elements that use TML strain gauges made exclusively for transducers, and they can be used to take measurements based on DC levels.

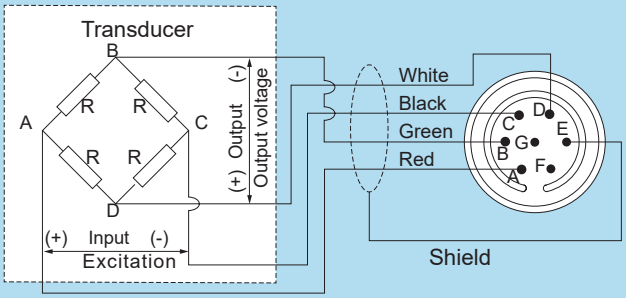
Example of Frequency characteristics



Acceleration transducer presents different frequency characteristics, output sensitivity vs. frequency, depending on temperature.

OUTPUT POLARITY WITH A LOAD

The measured value changes in positive (+) direction when acceleration is applied to the transducer in + direction marked on the transducer.



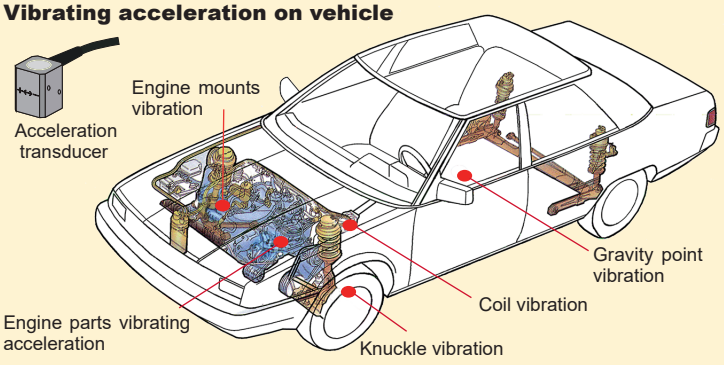
Not applicable to some products.

Acceleration transducer selection

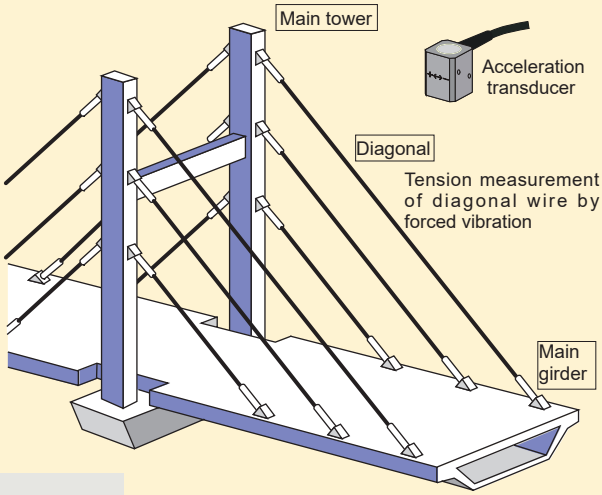
Utility		Type	Capacity (m/s²)										
			10	20	40	50	100	200	500	1000	2000	5000	10000
Micromechanical Vibration	Uni-axial model	**ARS-A**	●										
Smallest and lightest	Tri-axial model	**ARM-A-T**	100m/s² is for X- and Y-directions, 400m/s² is for Z-direction.										
Compact size	Uni-axial model	**ARF-A**	●	●		●	●	●	●				
	Tri-axial model	**ARF-A-T**		●		●	●	●	●				
Small size and high responsive in the range of high frequencies	Uni-axial model	**ARE-A**								●	●	●	●
	Tri-axial model	**ARE-A-T**								●	●	●	
Waterproof structure	Uni-axial model	**ARH-A**	●	●		●	●	●	●				
Small size and high responsive characteristics	Uni-axial model	**ARJ-A**				●	●	●	●	●	●		
	Bi-axial model	**ARJ-A-D**				●	●	●	●	●	●		
	Tri-axial model	**ARJ-A-T**				●	●	●	●	●	●		
Small High response High capacity	Uni-axial model	**ARGH-A**							●	●	●		
Small High response Low capacity	Uni-axial model	**ARGL-A**		●	●		●	●					
Small High response High capacity	Tri-axial model	**ARGH-A-T**							●	●			
Small High response Low capacity	Tri-axial model	**ARGL-A-T**		●	●		●	●					

HOW TO USE

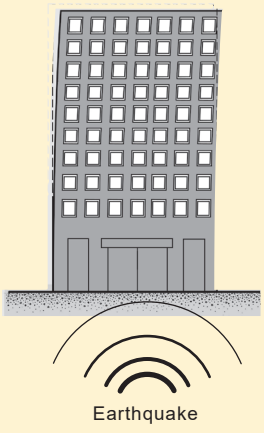
Vibrating acceleration on vehicle

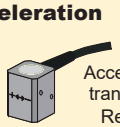


Cable force of cable-stayed bridge

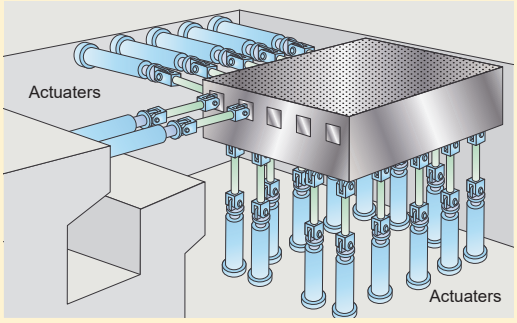


Structure vibrating acceleration





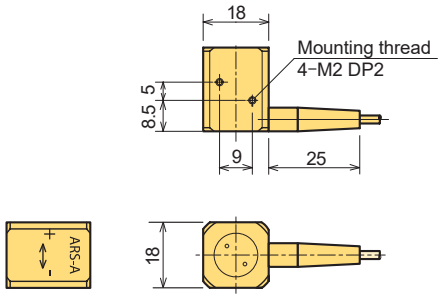
Acceleration transducer
Real size 3D shaking structure



ARS-A High sensitive Acceleration Transducer 10m/s²

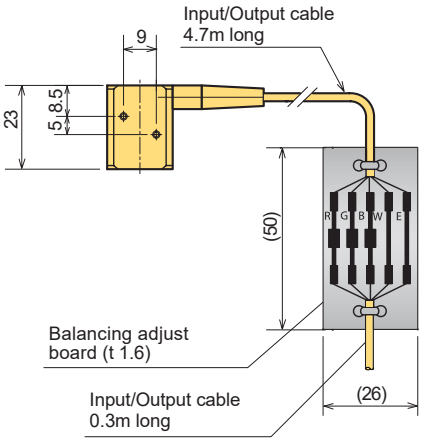


High sensitivity



Small accelerometer suitable for measurement of vibration mode of machines and structures including cable tension of bridges. High sensitivity of 30000×10⁻⁶ strain for 10m/s² makes minute vibration measurement possible.

Protection ratings: IP61 equivalent

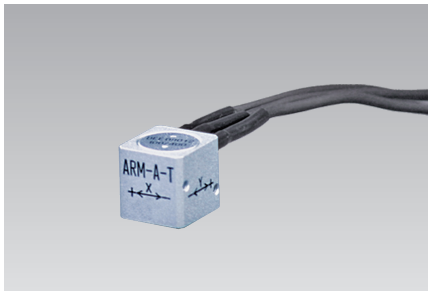


■ SPECIFICATIONS

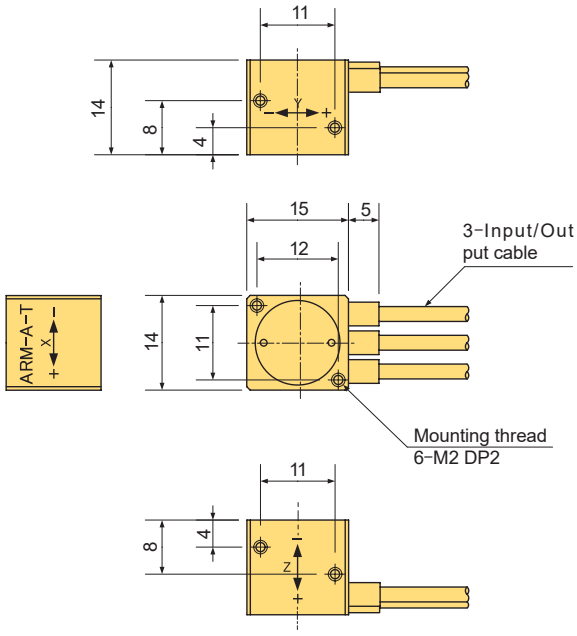
TYPE	ARS-10A
Capacity	10m/s²
Rated Output	15mV/V(30000×10⁻⁶ strain)
Non-linearity	1%RO
Frequency response range	DC~30Hz (Sensitivity deviation ±5%)
Natural frequency	55Hz
Allowable temperature range	-10 ~ +50°C
Over load	500%
Input/Output resistance	120Ω
Recommended exciting voltage	2V or less
Allowable exciting voltage	5V
Zero balance	±5000×10⁻⁶ strain or less
Weight	23g

Input/Output cable : φ3.2mm 0.08mm² 4-core shielded vinyl cable 5m

ARM-A-T Small Tri-axial model Acceleration Transducer 100m/s2 / 400m/s²



Identical gravity position for 3 axes
Easy handling



Tir-axial acceleration transducers for the fields of machines, vehicles, shipping, civil works and structures.

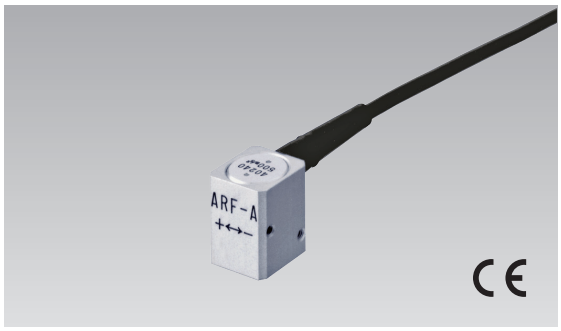
Protection ratings: IP61 equivalent

■ SPECIFICATIONS

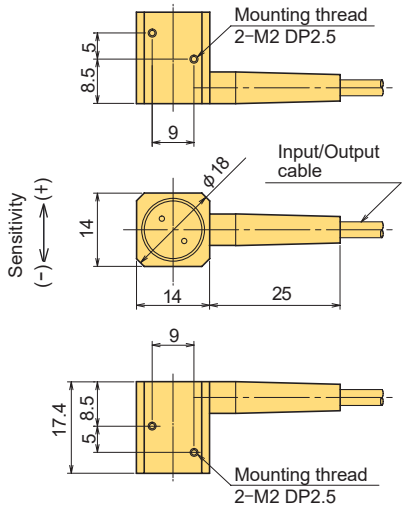
TYPE	ARM-A-T
Numbers of measurement	3 directions
Capacity	X- and Y-directions 100m/s² Z-direction 400m/s²
Rated output	0.5mV/V(1000×10⁻⁶ strain)
Non-linearity	1%RO
Frequency response range	DC~200Hz (Sensitivity deviation ±10%)
Natural frequency	X- and Y-directions 500Hz Z-direction 1400Hz
Cross sentivity	3%RO (at 100m/s² load)
Allowable temperature range	-10 ~ +60°C
Over load	300%
Input/Output resistance	X- and Y-directions 1000Ω Z-direction 200Ω
Recommended exciting voltage	2V or less
Allowable exciting voltage	5V
Weight	13g

Input/Output cable : φ2.2mm 0.05mm² 4-core shielded vinyl cable 5m

ARF-A Low capacity Acceleration Transducer 10~500m/s²



General purpose
Low capacity



The ARF-A acceleration transducer is used to measure the acceleration of structures subject to vibration such as machinery, vehicles, ships, civil engineering structures, buildings, and so forth. It is small and lightweight and can make measurement on the DC level.

Protection ratings: IP61 equivalent

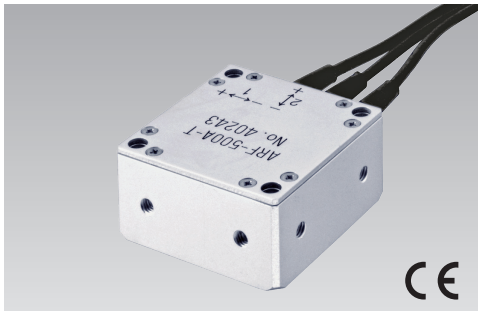
■ SPECIFICATIONS

TYPE	ARF-10A	ARF-20A	ARF-50A	ARF-100A	ARF-200A	ARF-500A
Capacity	10m/s²	20m/s²	50m/s²	100m/s²	200m/s²	500m/s²
Rated Output	0.5mV/V(1000×10⁻⁶ strain)					
Non-linearity	1%RO					
Frequency response range (※)	DC~50Hz	DC~80Hz	DC~130Hz	DC~180Hz	DC~310Hz	DC~520Hz
Natural frequency	100Hz	150Hz	240Hz	300Hz	520Hz	870Hz
Allowable temperature range	-10 ~ +50°C					
Over load	300%					
Input/Output resistance	120Ω					
Recommended exciting voltage	2V or less					
Allowable exciting voltage	5V					
Weight	13g					

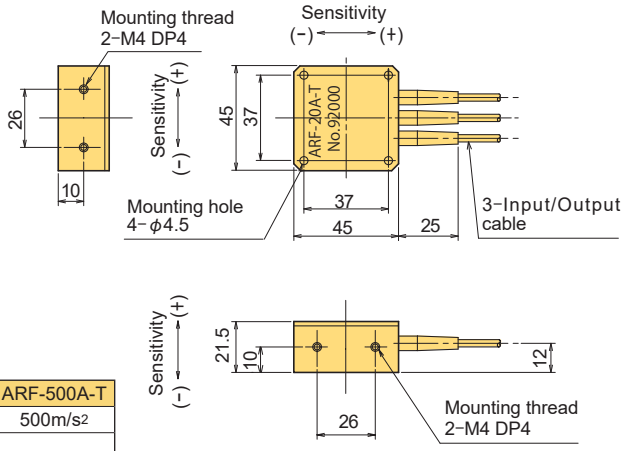
※Sensitivity deviation ±5%

Input/Output cable : φ3.2mm 0.08mm² 4-core shielded vinyl cable 5m Shield of Input/Output cable is grounded to the body.

ARF-A-T Low capacity Tri-axial Acceleration Transducer 20~500m/s²



General-purpose
Low capacity
Three directional measurement



The ARF-A-T acceleration transducer measures accelera-tion in three directions (X, Y and Z) simultaneously. It is small and lightweight and can make high-accuracy measurement with the least interference.

Protection ratings: IP61 equivalent

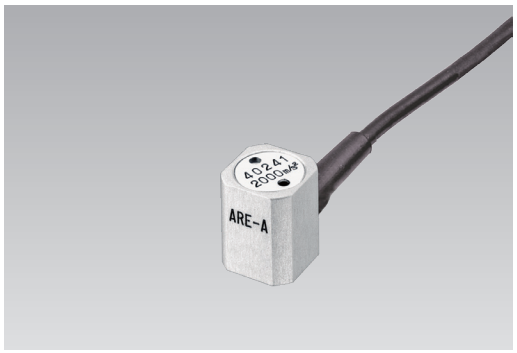
■ SPECIFICATIONS

TYPE	ARF-20A-T	ARF-50A-T	ARF-100A-T	ARF-200A-T	ARF-500A-T
Capacity	20m/s²	50m/s²	100m/s²	200m/s²	500m/s²
Rated Output	0.5mV/V(1000×10⁻⁶ strain)				
Non-linearity	1%RO				
Frequency response range (※)	DC~80Hz	DC~130Hz	DC~180Hz	DC~310Hz	DC~520Hz
Natural frequency	150Hz	240Hz	300Hz	520Hz	870Hz
Cross sensitivity	3%RO				
Allowable temperature range	-10 ~ +50°C				
Over load	300%				
Input/Output resistance	120Ω				
Recommended exciting voltage	2V or less				
Allowable exciting voltage	5V				
Weight	85g				

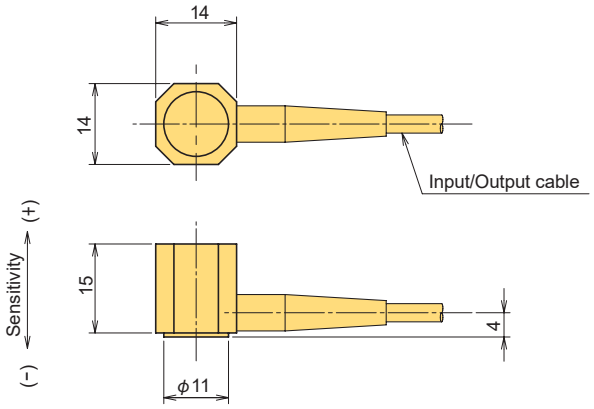
※Sensitivity deviation ±10%

Input/Output cable : φ3.2mm 0.08mm² 4-core shielded vinyl cable 5m Shield of Input/Output cable is grounded to the body.

ARE-A High capacity Acceleration Transducer 1000~10000m/s²



General purpose
High capacity



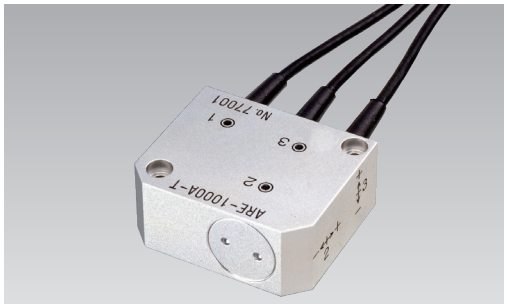
The ARE-A acceleration transducer is used to measure the acceleration of structures subject to relatively strong vibration. It is small, lightweight and easy to operate.
Protection ratings: IP61 equivalent

■ SPECIFICATIONS

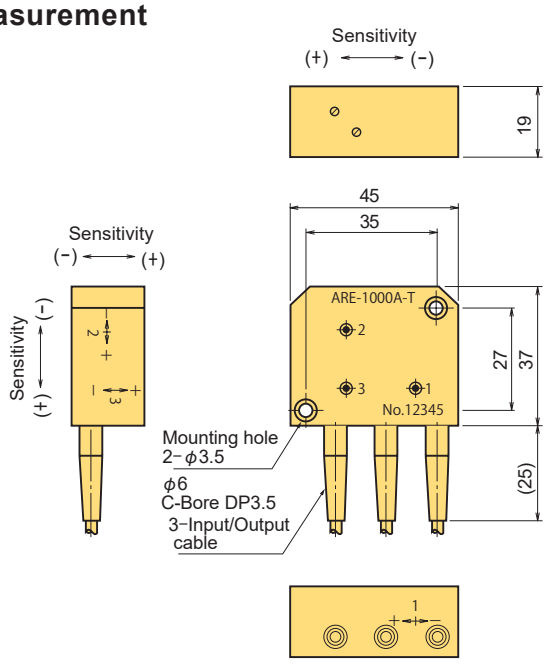
TYPE	ARE-1000A	ARE-2000A	ARE-5000A	ARE-10000A
Capacity	1000m/s²	2000m/s²	5000m/s²	10000m/s²
Rated Output	0.5mV/V(1000×10⁻⁶ strain)			
Non-linearity	1%RO			
Frequency response range	DC~1.3kHz※1	DC~2.1kHz※1	DC~2.1kHz※1	DC~5kHz※2
Natural frequency	2.2kHz	3.5kHz	4.5kHz	7.5kHz
Allowable temperature range	-10 ~ +50°C		-10 ~ +60°C	
Over load	300%			
Input/Output resistance	120Ω			
Recommended exciting voltage	2V or less			
Allowable exciting voltage	5V			
Weight	8g			

※ 1 : Sensitivity deviation ±5%　※ 2 : Sensitivity deviation ±10%
Input/Output cable : φ3.2mm 0.08mm² 4-core shielded vinylcable 5m
Shield of Input/Output cable is grounded to the body.

ARE-A-T High capacity Tri-axial Acceleration Transducer 1000~5000m/s²



General purpose
High capacity
Three directional measurement



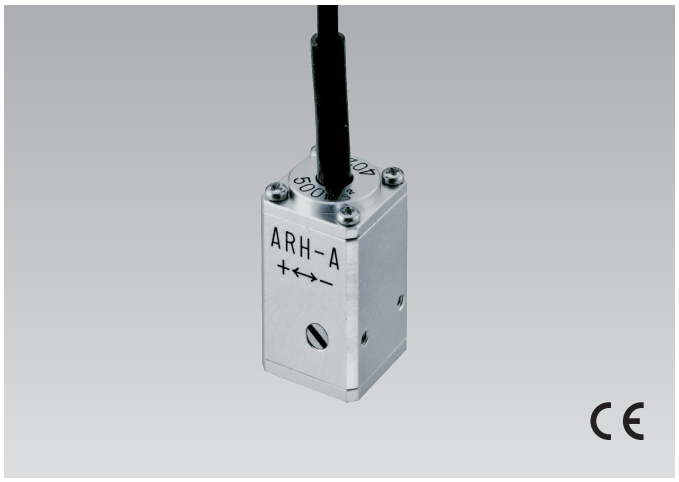
The ARE-A-T acceleration transducer measures accelera-tion in three directions (X, Y and Z) simultaneously. It is small and lightweight and can make high-accuracy measurement with the least interference.
Protection ratings: IP61 equivalent

■ SPECIFICATIONS

TYPE	ARE-1000A-T	ARE-2000A-T	ARE-5000A-T
Capacity	1000m/s²	2000m/s²	5000m/s²
Rated Output	0.5mV/V(1000×10⁻⁶ strain)		
Non-linearity	1%RO		
Frequency response range (※)	DC~1.3kHz	DC~2.1kHz	DC~2.1kHz
Natural frequency	2.2kHz	3.5kHz	4.5kHz
Cross sensitivity	3%RO		
Allowable temperature range	-10 ~ +50°C		-10 ~ +60°C
Over load	300%		
Input/Output resistance	120Ω		
Recommended exciting voltage	2V or less		
Allowable exciting voltage	5V		
Weight	77g	77g	75g

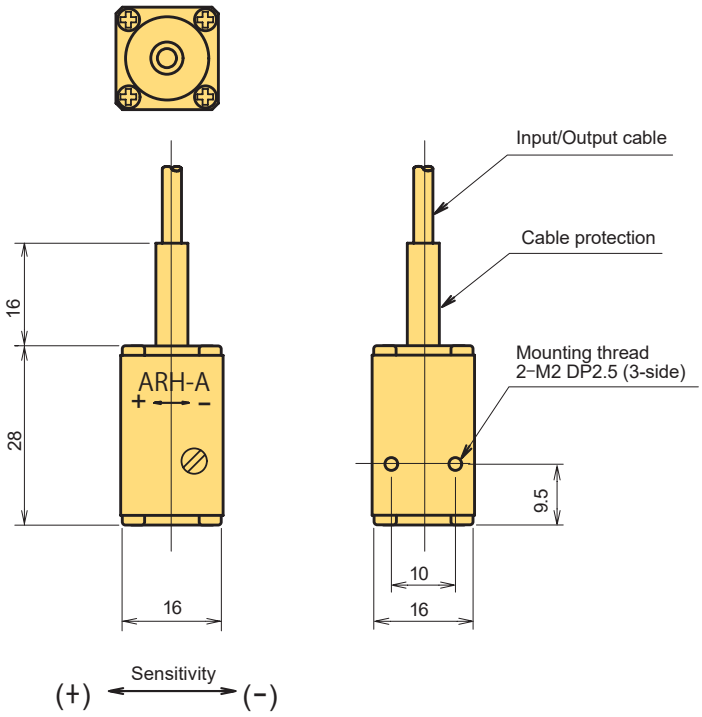
※ Sensitivity deviation ±5%
Input/Output cable : φ3.2mm 0.08mm² 4-core shielded vinyl cable 5m
Shield of Input/Output cable is grounded to the body.

ARH-A Waterproof, Low capacity Acceleration Transducer 10~500m/s²



Waterproof type
Low capacity

The ARH-A acceleration transducer has a waterproof structure. It is installed in water or ground or embedded in concrete. The rigid waterproof structure makes this transducer suitable for use in an adverse environment or for outdoor use.
Protection ratings: IP67 equivalent

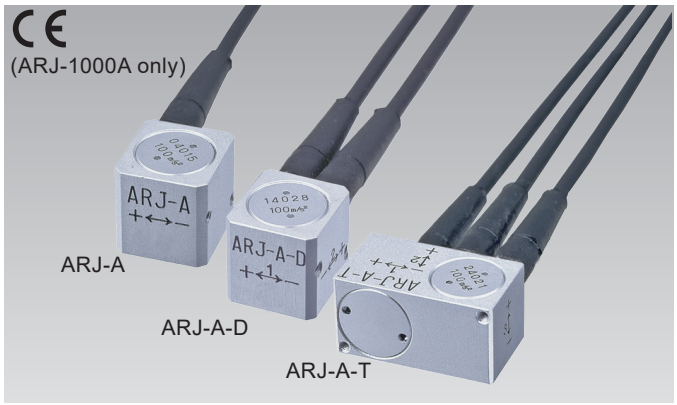


■ SPECIFICATIONS

TYPE	ARH-10A	ARH-20A	ARH-50A	ARH-100A	ARH-200A	ARH-500A
Capacity	10m/s²	20m/s²	50m/s²	100m/s²	200m/s²	500m/s²
Rated Output	0.5mV/V(1000×10⁻⁶ strain)					
Non-linearity	1%RO					
Frequency response range (※)	DC~50Hz	DC~80Hz	DC~130Hz	DC~180Hz	DC~310Hz	DC~520Hz
Natural frequency	100Hz	150Hz	240Hz	300Hz	520Hz	870Hz
Allowable temperature range	-10 ~ +50°C					
Over load	300%					
Input/Output resistance	120Ω					
Recommended exciting voltage	2V or less					
Allowable exciting voltage	5V					
Water pressure resistive	500kPa					
Weight	18g					

※ Sensitivity deviation ±5%
Input/Output cable : φ3.2mm 0.08mm² 4-core shielded vinyl cable 5m Shield of Input/Output cable is grounded to the body.

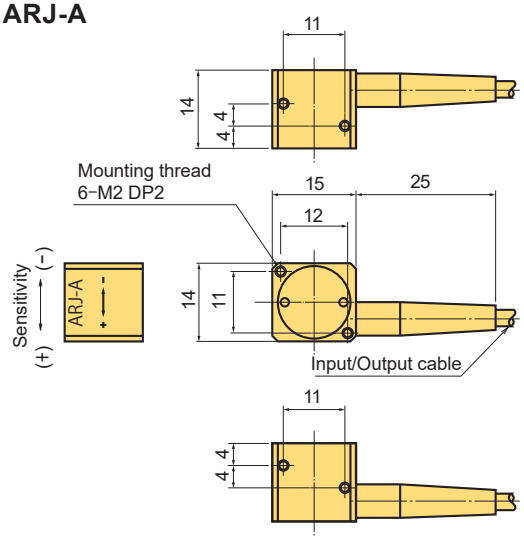
ARJ series Acceleration Transducer 50~2000m/s²



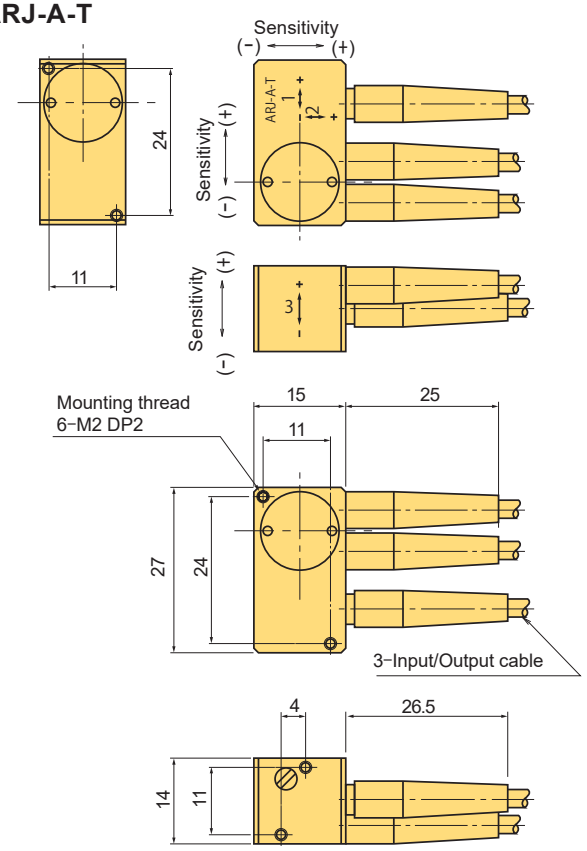
The ARJ series acceleration transducer is small in size and has highly responsive characteristics. This series is developed to measure the acceleration of machinery, vehicles, ships, civil engineering structures, buildings, and so forth. And the series consists of uni-axial model ARJ-A, bi-axial model ARJ-A-D with the same size and weight as the uni-axial model, and tri-axial model ARJ-A-T with the same height as the uni-, bi-axial models and weighs times double of the bi-axial model.

Protection ratings: IP61 equivalent

ARJ-A

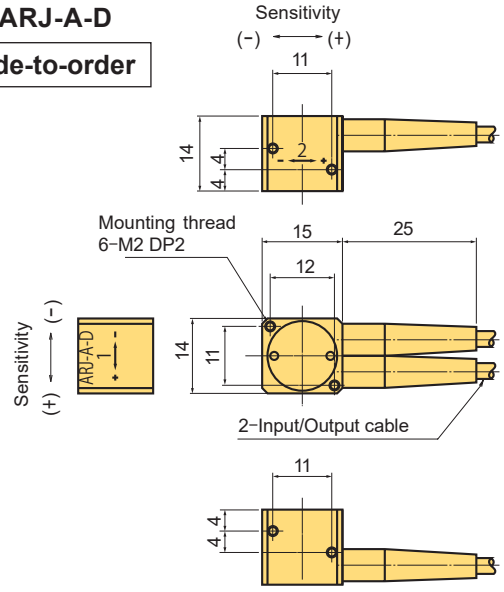


ARJ-A-T



ARJ-A-D

Made-to-order



■ SPECIFICATIONS

TYPE	Uni-axial Bi-axial Tri-axial	ARJ-50A ARJ-50A-D ARJ-50A-T	ARJ-100A ARJ-100A-D ARJ-100A-T	ARJ-200A ARJ-200A-D ARJ-200A-T	ARJ-500A ARJ-500A-D ARJ-500A-T	ARJ-1000A ARJ-1000A-D ARJ-1000A-T	ARJ-2000A ARJ-2000A-D ARJ-2000A-T
Capacity		50m/s²	100m/s²	200m/s²	500m/s²	1000m/s²	2000m/s²
Rated Output		0.5mV/V(1000×10⁻⁶ strain)					
Non-linearity		1%RO					
Frequency response range (※)		DC~150Hz	DC~300Hz	DC~500Hz	DC~780Hz	DC~1kHz	DC~2kHz
Natural frequency		280Hz	500Hz	830Hz	1kHz	2kHz	3kHz
Cross sensitivity		3%RO (except uni-axial model ARJ-A)					
Allowable temperature range		-10 ~ +50°C					
Over load		300%					
Input/Output resistance		Approx. 1kΩ					
Recommended exciting voltage		5V or less					
Allowable exciting voltage		15V					
Weight	Uni-axial	13g	12g	12g	10g	11g	11g
	Bi-axial	14g	13g	13g	11g	12g	12g
	Tri-axial	27g	25g	24g	20g	22g	22g

※ Sensitivity deviation ±5%

Input/Output cable : φ3.2mm 0.08mm² 4-core shielded vinyl cable 5m Shield of Input/Output cable is grounded to the body.

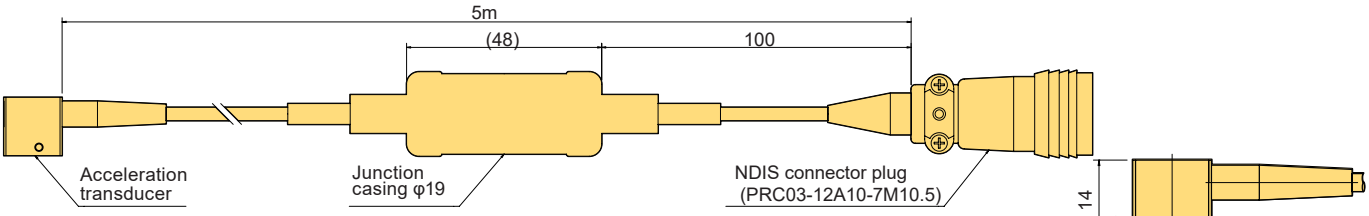
ARGH-A Small, High response, High capacity Acceleration Transducer 500~2000m/s²



MEMS-based acceleration transducer compatible with DC-exciting dynamic strain meter

The ARGH-A is a small and high-response acceleration transducer incorporating a MEMS-based acceleration sensor. Its small, light-weight and robust structure allows the use of this transducer for the measurement in various fields such as machines, vehicles, ships, civil engineering and construction. This transducer can easily be used by merely connecting it to our dc-exciting dynamic strain meter without using an external power supply.

Protection ratings: IP61 equivalent

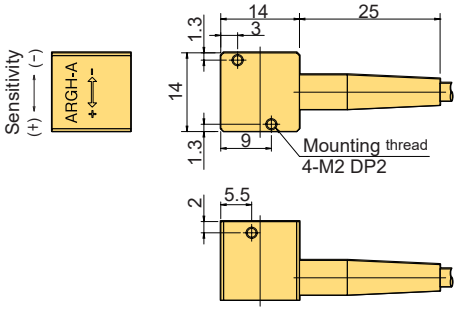


■ SPECIFICATIONS

TYPE	ARGH-500A	ARGH-1000A	ARGH-2000A
Capacity	500m/s² (51G)	1000m/s² (102G)	2000m/s² (204G)
Rated output	Equivalent to 1800×10⁻⁶ strain±10%		
Non-linearity	2%RO		
Frequency response range	DC ~ 2kHz (sensitivity deviation ±5%)		
Zero balance	Equivalent to 2250×10⁻⁶ strain±15%		
Allowable temperature range	-10 ~ +60°C		
Allowable overload	20000m/s² 4000%	20000m/s² 2000%	20000m/s² 1000%
Allowable exciting voltage	DC2.0 ~ 3.6V		
Current consumption	20mA MAX (DC2V)		
Weight	Approx. 10g		

Input/Output cable : φ3.2mm 0.08mm² 4-core shielded vinyl cable 5m, NDIS plug attached on the end

Sensor part



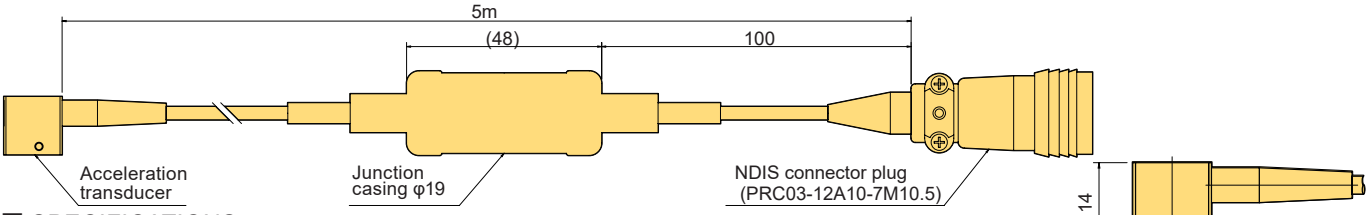
ARGL-A Small, High response, Low capacity Acceleration Transducer 20~200m/s²



MEMS-based acceleration transducer compatible with DC-exciting dynamic strain meter

The ARGL-A is a small and high-response acceleration transducer incorporating a MEMS-based acceleration sensor. Its small, light-weight and robust structure allows the use of this transducer for the measurement in various fields such as machines, vehicles, ships, civil engineering and construction. This transducer can easily be used by merely connecting it to our dc-exciting dynamic strain meter without using an external power supply.

Protection ratings: IP61 equivalent

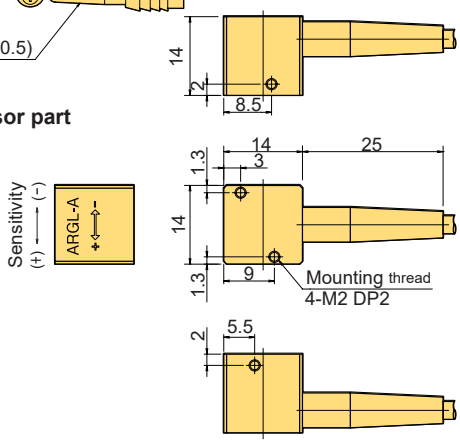


■ SPECIFICATIONS

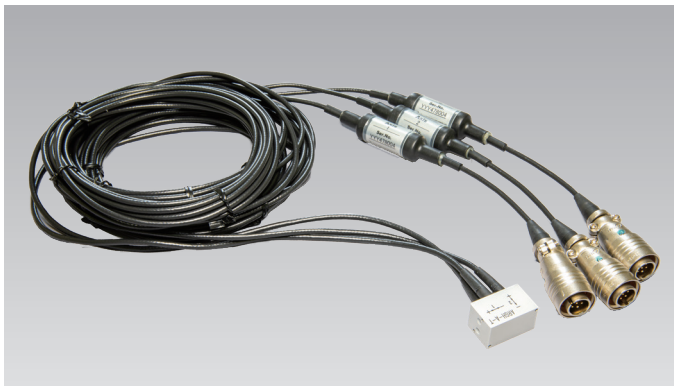
TYPE	ARGL-20A	ARGL-40A	ARGL-100A	ARGL-200A
Capacity	20m/s² (2.04G)	40m/s² (4.08G)	100m/s² (10.2G)	200m/s² (20.4G)
Rated output	Equivalent to 800×10⁻⁶ strain±15%			
Non-linearity	2%RO			
Frequency response range	DC ~ 200 Hz (sensitivity deviation ±5%)			
Zero balance	Equivalent to 900×10⁻⁶ strain±10%			
Allowable temperature range	-10 ~ +60°C			
Allowable overload	20000m/s² 100000%	20000m/s² 50000%	20000m/s² 20000%	20000m/s² 10000%
Allowable exciting voltage	DC2.0 ~ 3.6V			
Current consumption	15mA MAX (DC2V)			
Weight	Approx. 10g			

Input/Output cable : φ3.2mm 0.08mm² 4-core shielded vinyl cable 5m, NDIS plug attached on the end

Sensor part



ARGH-A-T Small, High response, High capacity, Tri-axial Acceleration Transducer 500/1000m/s^2

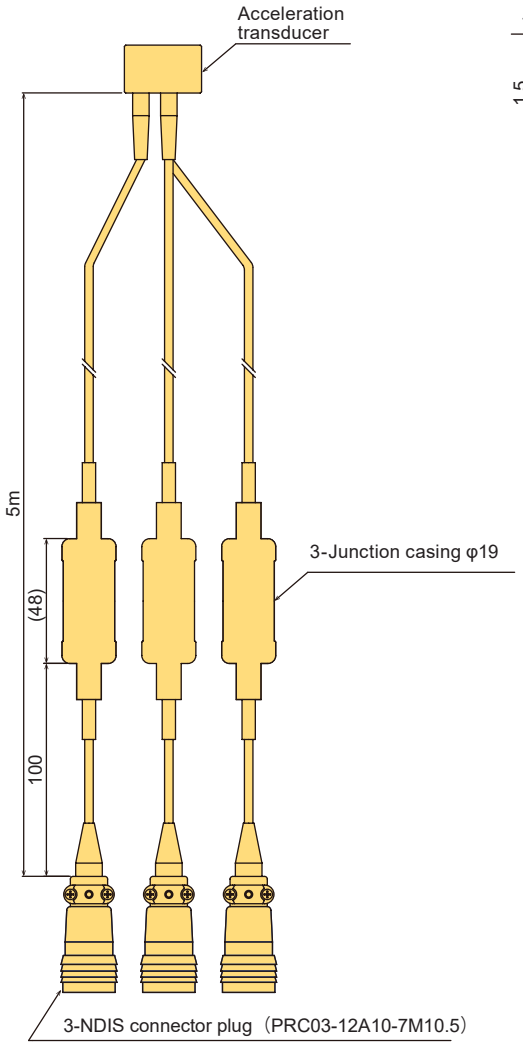


MEMS-based tri-axial acceleration transducer compatible with DC-exciting dynamic strain meter

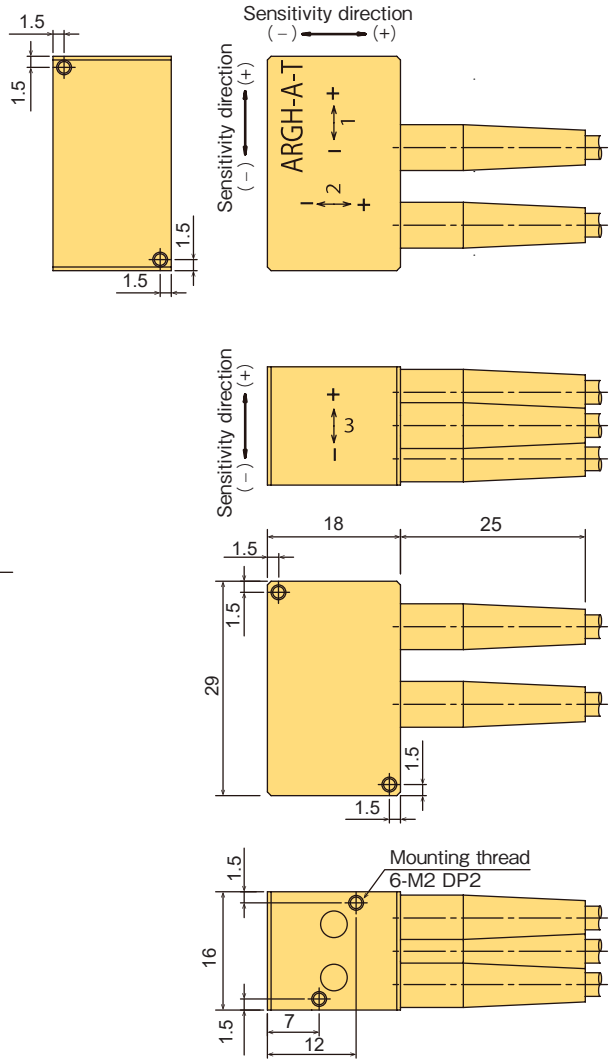
The ARGH-A-T is a small and high-response acceleration transducer incorporating a MEMS-based acceleration sensor. Its small, light-weight and robust structure allows the use of this transducer for the measurement in various fields such as machines, vehicles, ships, civil engineering and construction. This transducer can easily be used by merely connecting it to our dc-exciting dynamic strain meter without using an external power supply.

Protection ratings: IP61 equivalent

Overall view



Acceleration transducer



UNIT : mm

■ SPECIFICATIONS

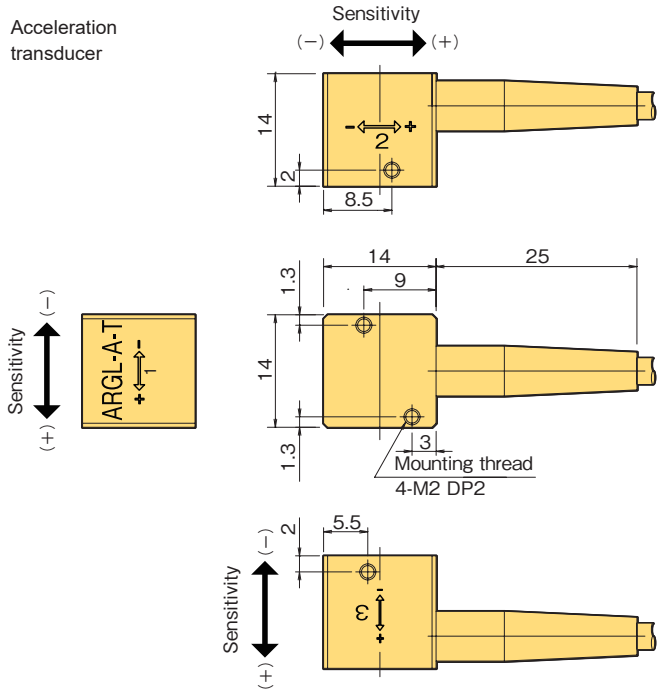
TYPE	ARGH-500A-T	ARGH-1000A-T
Number of measurement axis	3-axis	
Capacity	500m/s^2 (51G)	1000m/s^2 (102 G)
Rated output	Equivalent to 1800×10^{-6} strain ±10%	
Non-linearity	2%RO	
Frequency response range	DC ~ 2kHz (sensitivity deviation ±10%)	
Cross sensitivity	5%RO	
Zero balance	Equivalent to 2250×10^{-6} strain ±15%	
Allowable temperature range	-10 ~ +60°C	
Allowable overload	20000 m/s^2 4000%	20000 m/s^2 2000%
Allowable exciting voltage	DC 2.0 ~ 3.6 V	
Current consumption	20mA MAX. (DC 2 V)	
Weight	Approx. 25g	

Input/Output cable :φ3.2mm 0.08mm^2 4-core shielded vinyl cable 5m, NDIS plug attached on the end.
The zero balance is the output at no load and depends on the condition of the measuring instrument.
TMR-321, DC-204R and DC-204Ra accept the use of a remote sensing cable (CR-6184).

ARGL-A-T Small, High response, Low capacity, Tri-axial Acceleration Transducer 20~200m/s^2

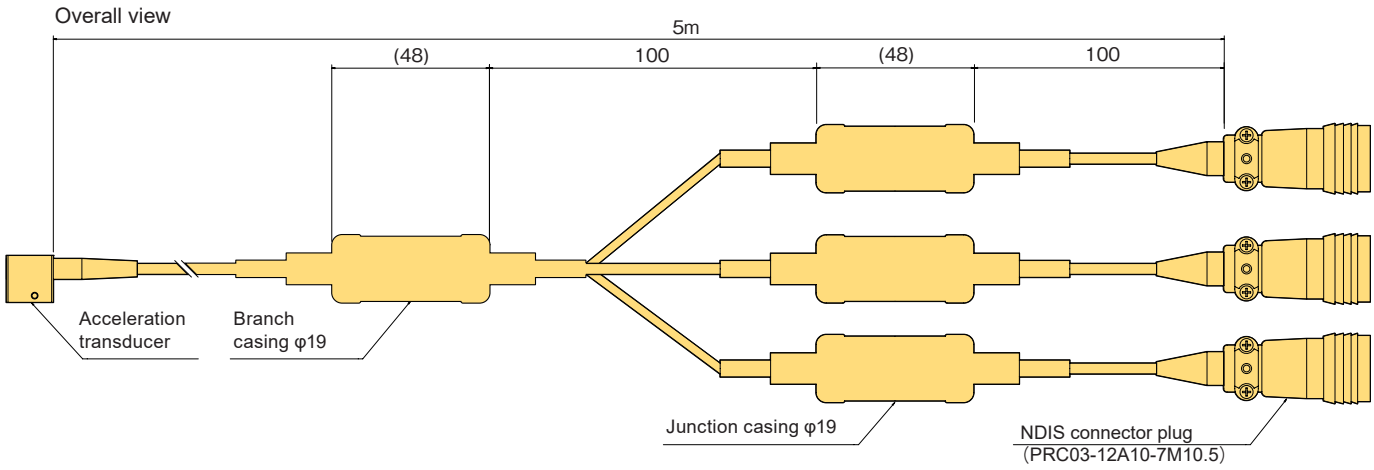


Same shape as single-axis type
Capable of measuring in three directions



The ARGL-A-T is a small and high-response acceleration transducer incorporating a MEMS-based acceleration sensor. Its small, light-weight and robust structure allows the use of this transducer for the measurement in various fields such as machines, vehicles, ships, civil engineering and construction. This transducer can be just connected to our dc-exciting dynamic strain meter and measured without the need of an external power supply.

Protection ratings: IP61 equivalent



■ SPECIFICATIONS

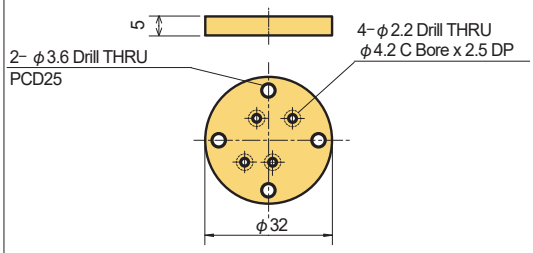
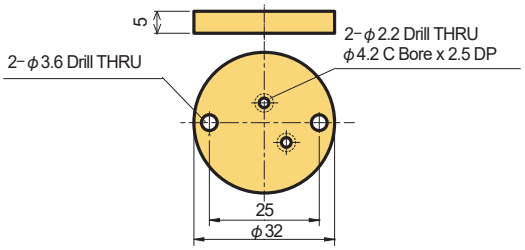
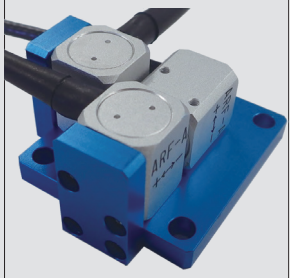
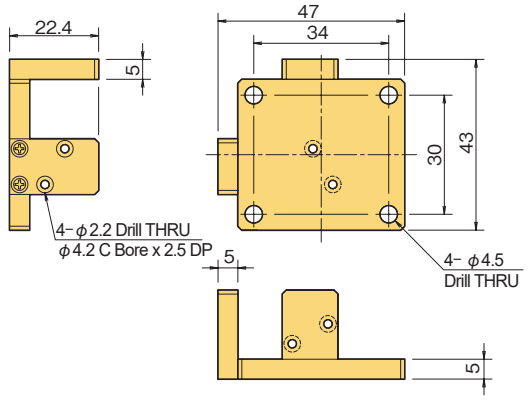
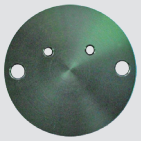
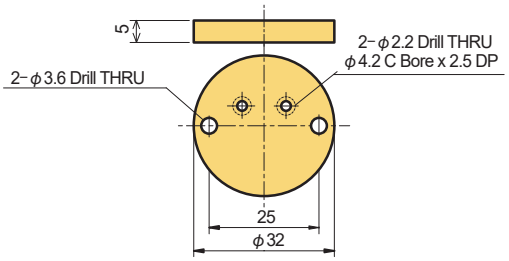
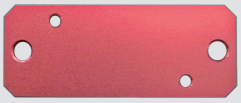
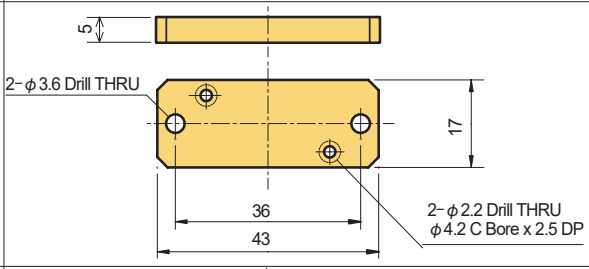
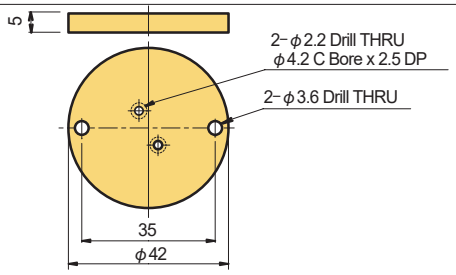
TYPE	ARGL-20A-T	ARGL-40A-T	ARGL-100A-T	ARGL-200A-T
Number of measurement axis	3-axis			
Capacity	20 m/s^2 (2.04 G)	40 m/s^2 (4.08 G)	100m/s^2 (10.2 G)	20 m/s^2 (20.4 G)
Rated output	Equivalent to 800×10^{-6} strain ±15%			
Non-linearity	2%RO			
Frequency response range	DC ~ 200 Hz (sensitivity deviation ±5%)			
Cross sensitivity	5%RO			
Zero balance	Equivalent to 900×10^{-6} strain ±10%			
Allowable temperature range	-10 ~ +60°C			
Allowable overload	20000 m/s^2 100000%	20000 m/s^2 50000%	20000 m/s^2 20000%	20000 m/s^2 10000%
Allowable exciting voltage	DC 2.0 ~ 3.6 V			
Current consumption	15 mA MAX. (DC 2 V)			
Weight	Approx. 10 g			

Input/Output cable :φ3.2mm 0.08mm^2 4-core shielded vinyl cable 5m, NDIS plug attached on the end.
The zero balance is the output at no load and depends on the condition of the measuring instrument.
TMR-321, DC-204R and DC-204Ra accept the use of a remote sensing cable (CR-6184).

Acceleration transducers accessories

Mounting plate

There are 5 kinds of mounting plates to suit the following acceleration transducers.
Six pieces of the fixing bolt M2x5mm are supplied for each mounting plate.

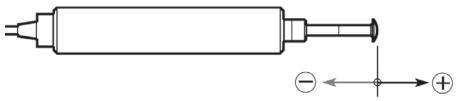
Mounting plate		Applicable transducers	Mount faces	Dimension
ARJF-11		●ARJ-A ●ARJ-A-D ●ARJ-A-T ●ARM-A-T	Side/Bottom Side/Bottom Side Side/Bottom Side/Bottom	
ARFF-11		●ARF-A	Side	
ARFF-12		●ARF-A x 3	Tri-axial mounting	
ARHF-11		●ARH-A	Side	
ARJF-12		●ARJ-A-T	Bottom	
ARSF-11		●ARS-A	Side	

Transducer Output Polarity

Our standard transducers are designed with the following output polarity for measurement.

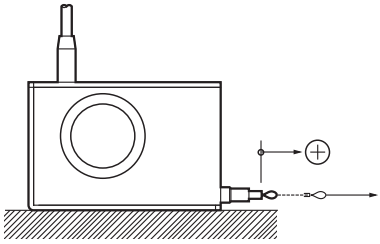
Displacement Transducer CDP, SDP

Measuring rod is depressed on measurement, ouput turns minus polarity.



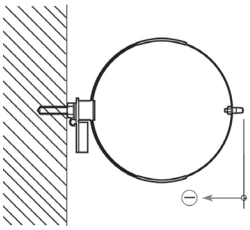
Displacement Transducer DP

Measuring wire is taken out on measurement, ouput turns plus polarity.



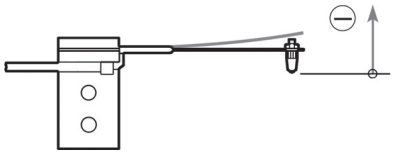
Displacement Transducer OU

Measuring contact tip is depressed on measurement, ouput turns minus polarity.



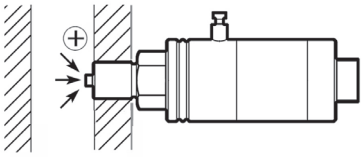
Displacement Transducer CE

Measuring contact tip is depressed on measurement, ouput turns minus polarity.



Pressure Transducer PW

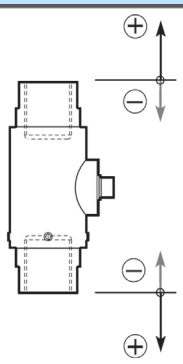
Pressure is loaded, output turns plus polarity.



Load Cells

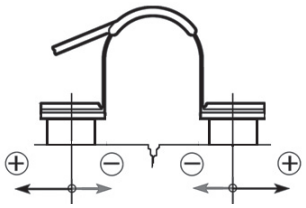
Compressive force is loaded, output turns minus polarity, while tensile force is loaded, output turns plus polarity.

N.B.:
The measured value of the KCK-NA and KCH-NA load cell shows "+" polarity with increase in compression load.



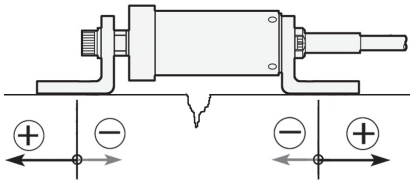
Displacement Transducer PI

Crack opening develops, ouput turns plus polarity.



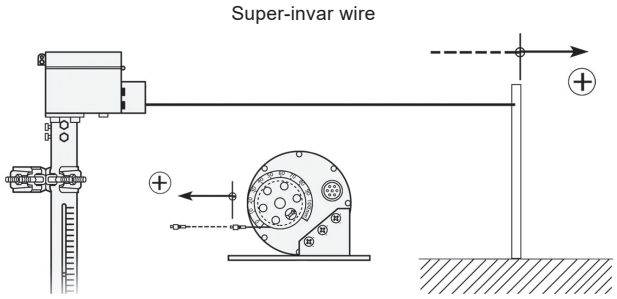
Crack Displacement Gauge KG

Crack opening develops, ouput turns plus polarity.



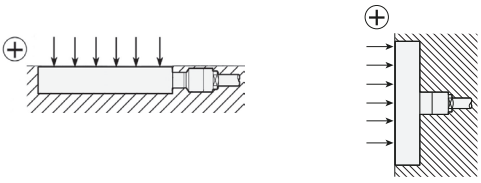
Ground Extension Gauge KLG/NKLG

Super-invar wire is extended on measurement, ouput turns plus polarity.



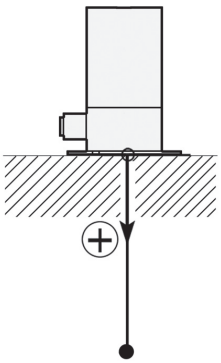
Soil Pressure Gauge KDA - KDL

Pressure is loaded, ouput turns plus polarity.



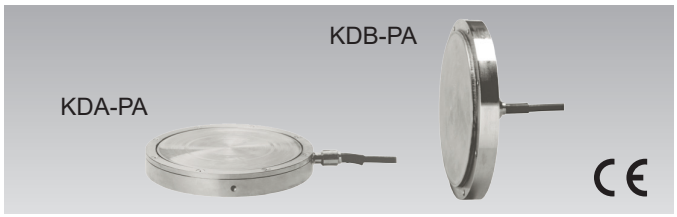
Settlement Transducer KLA/NKLA

Rod (KLF-21) between the transducer KLA/NKLA and a hydraulic anchor shrinks due to settlement, output turns plus polarity.



KDA-PA/KDB-PA Soil Pressure Gauge

Civil engineering design



The KDA-PA and KDB-PA are soil pressure gauges each 200 mm in outside diameter. They are widely used at construction sites. They are designed with a dual-diaphragm structure that can minimize the displacement of a sensing area and thereby can keep the stress distribution in soil undisturbed under pressure. The KDA-PA is used to measure the pressure in soil and to monitor the behavior of embankments. The KDB-PA is used to measure the pressure in earth retaining walls or the pressure on wall surfaces of structures.

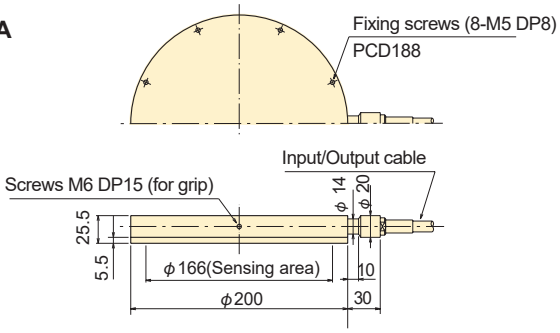
Protection ratings: IP68 equivalent

Minute displacement of pressure-sensitive area due to dual-diaphragm structure
Can measure dynamic earth pressure, too

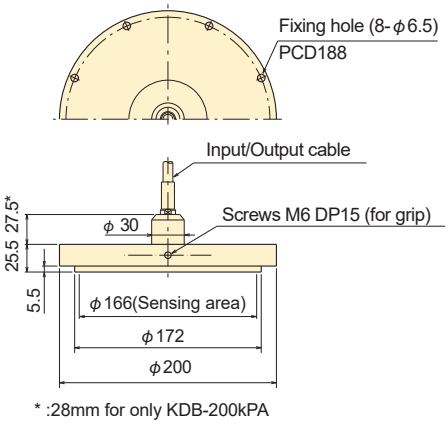
■ SPECIFICATIONS

TYPE	KDA-200KPA KDB-200KPA	KDA-500KPA KDB-500KPA	KDA-1MPA KDB-1MPA	KDA-2MPA KDB-2MPA
Capacity	200kPa	500kPa	1MPa	2MPa
Rated Output	1mV/V(2000×10^{-6} strain)			
Non-linearity	2%RO	1%RO		
Allowable temperature range	-20 ~ +60°C			
Input/Output resistance	350Ω			
Recommended exciting voltage	3V or less			
Allowable exciting voltage	10V			
Cable drawing direction	KDA-PA: from side of body KDB-PA: from back of body			
Weight	6 kg			

KDA-PA



KDB-PA



* :28mm for only KDB-200kPA

Input/Output cable :
ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 2m

KDC-PA/KDD-PA Soil Pressure Gauge

Civil engineering design



The KDC-PA and KDD-PA are anticorrosion stainless-steel soil pressure gauges each 100 mm in outside diameter. They are used to measure the pressure in soil in ocean or coastal civil engineering structures and to measure the dynamic pressure of waves. The difference between these two models is the way the cable is attached to the gauge body.

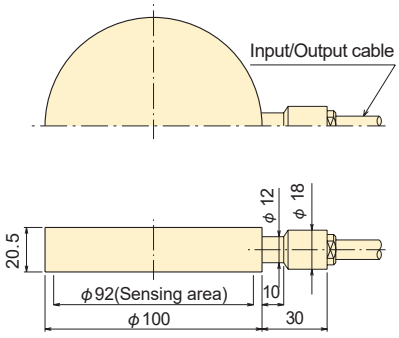
Protection ratings: IP68 equivalent

Made of all stainless steel with excellent corrosion resistance
Minute displacement of pressure-sensitive area due to dual-diaphragm structure
Can measure dynamic earth pressure, too

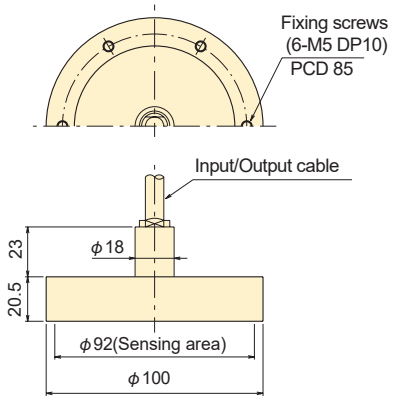
■ SPECIFICATIONS

TYPE	KDC-200KPA KDD-200KPA	KDC-500KPA KDD-500KPA	KDC-1MPA KDD-1MPA	KDC-2MPA KDD-2MPA
Capacity	200kPa	500kPa	1MPa	2MPa
Rated Output	1mV/V(2000×10^{-6} strain)			
Non-linearity	2%RO	1%RO		
Allowable temperature range	-20 ~ +60°C			
Input/Output resistance	350Ω			
Recommended exciting voltage	3V or less			
Allowable exciting voltage	10V			
Cable drawing direction	KDC-PA: from side of body KDD-PA: from back of body			
Weight	1.2 kg			

KDC-PA



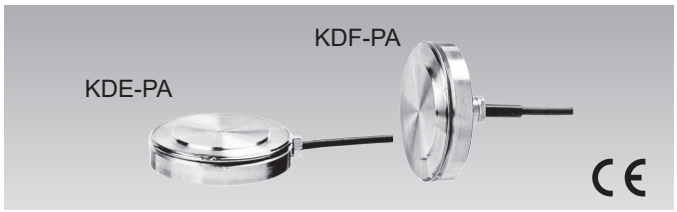
KDD-PA



Input/Output cable :
ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 2m

KDE-PA/KDF-PA Soil Pressure Gauge

Civil engineering design

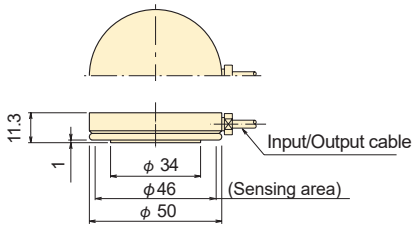


The KDE-PA and KDF-PA are soil pressure gauges each 50 mm in outside diameter. They are small in size and have a dual diaphragm structure, so they are widely used to conduct model experiments. The difference between these two models is the way the cable is attached to the gauge body.

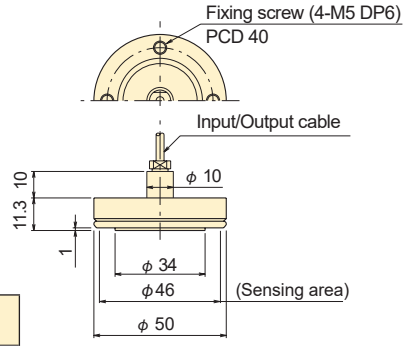
Protection ratings: IP68 equivalent

Made of all stainless steel with excellent corrosion resistance
Minute displacement of pressure-sensitive area due to dual-diaphragm structure
Can measure dynamic earth pressure, too

KDE-PA



KDF-PA



■ SPECIFICATIONS

TYPE	KDE-200KPA KDF-200KPA	KDE-500KPA KDF-500KPA	KDE-1MPA KDF-1MPA	KDE-2MPA KDF-2MPA
Capacity	200kPa	500kPa	1MPa	2MPa
Rated Output	0.3mV/V (600×10^{-6} strain)	0.5mV/V(1000×10^{-6} strain)		
Non-linearity	2%RO			
Allowable temperature range	-20 ~ +60°C			
Input/Output resistance	350Ω			
Recommended exciting voltage	3V or less			
Allowable exciting voltage	10V			
Cable drawing direction	KDE-PA: from side of body KDF-PA: from back of body			
Weight	160 g			

Input/Output cable :
ϕ3mm 0.05mm² 4-core shielded chloroprene cable 2m

KDG-PA/KDH-PA Load Cell type Soil Pressure Gauge

Civil engineering design

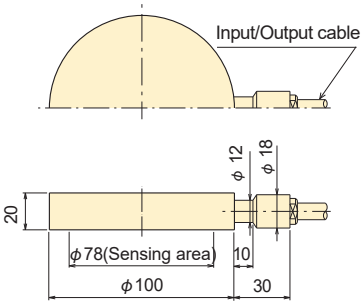


The KDG-PA and KDH-PA are stainless-steel soil pressure gauges each 100 mm in outside diameter. They are load-cell-type soil pressure gauges and designed with a high level of resistance to lateral pressure. The difference between these two models is the way the cable is attached to the gauge body.

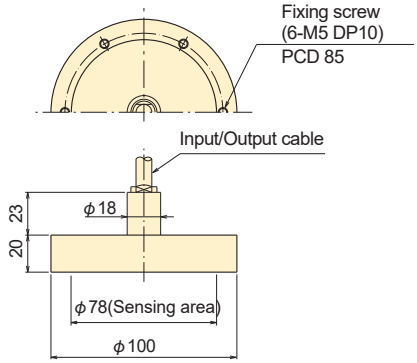
Protection ratings: IP68 equivalent

Made of all stainless steel with excellent corrosion resistance
Robuster than the diaphragm type

KDG-PA



KDH-PA



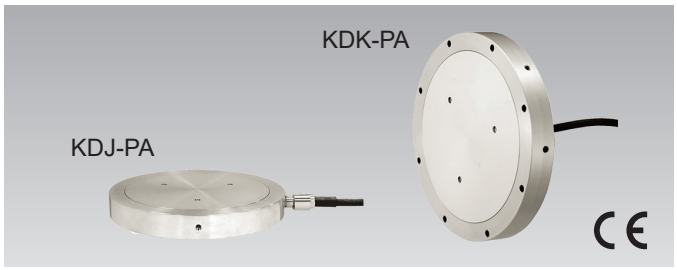
■ SPECIFICATIONS

TYPE	KDG-200KPA KDH-200KPA	KDG-500KPA KDH-500KPA	KDG-1MPA KDH-1MPA	KDG-2MPA KDH-2MPA
Capacity	200kPa	500kPa	1MPa	2MPa
Rated Output	1mV/V(2000×10^{-6} strain)			
Non-linearity	1%RO			
Allowable temperature range	-20 ~ +60°C			
Input/Output resistance	350Ω			
Recommended exciting voltage	3V or less			
Allowable exciting voltage	10V			
Cable drawing direction	KDG-PA: from side of body KDH-PA: from back of body			
Weight	1.2 kg			

Input/Output cable :
ϕ9mm 0.5mm² 4-core shielded chloroprene cable 2m

KDJ-PA/KDK-PA Load Cell type Soil Pressure Gauge

Civil engineering design



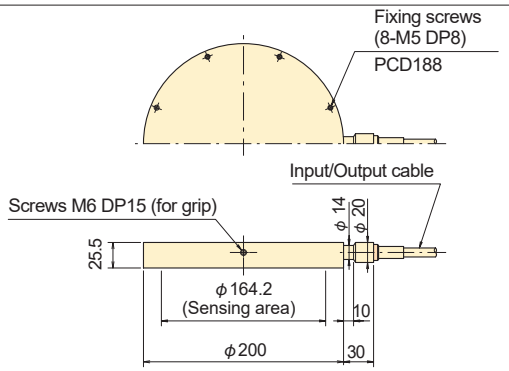
The KDJ-PA and KDK-PA are stainless-steel soil pressure gauges each 200 mm in outside diameter. They are load-cell-type soil pressure gauges and designed with a high level of resistance to lateral pressure. The difference between these two models is the way the cable is attached to the gauge body.

Protection ratings: IP68 equivalent

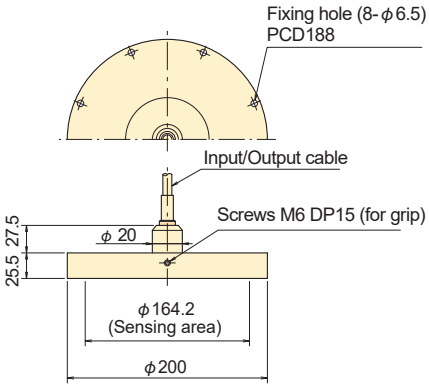
Made of all stainless steel with excellent corrosion resistance

Robuster than the diaphragm type

KDJ-PA



KDK-PA



■ SPECIFICATIONS

TYPE	KDJ-200KPA KDK-200KPA	KDJ-500KPA KDK-500KPA	KDJ-1MPA KDK-1MPA	KDJ-2MPA KDK-2MPA
Capacity	200kPa	500kPa	1MPa	2MPa
Rated Output	1mV/V(2000×10^{-6} strain)			
Non-linearity	1%RO			
Allowable temperature range	-20 ~ +60°C			
Input/Output resistance	350Ω			
Recommended exciting voltage	3V or less			
Allowable exciting voltage	10V			
Cable drawing direction	KDJ-PA: from side of body KDK-PA: from back of body			
Weight	5.2 kg			

Input/Output cable :
φ9mm 0.5mm^2 4-core shielded chloroprene cable 2m

Pore water pressure in ground

KPC-PA/KPD-PA Pore Pressure Gauge

Civil engineering design



These pressure gauges, which are one size smaller than the KPA-PA and KPB-PA, are used to measure pore water pressure in soil, sheet piles, piles and boreholes. The KPC-PA is attached to a pile, a diaphragm wall, a sheet pile, etc., and buried in ground to measure pore water pressure. The KPD-PA is buried in a borehole to measure pore water pressure in bedrock.

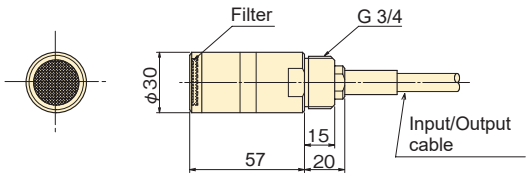
Protection ratings: IP68 equivalent

Dual structure not affected by the outer lateral pressure

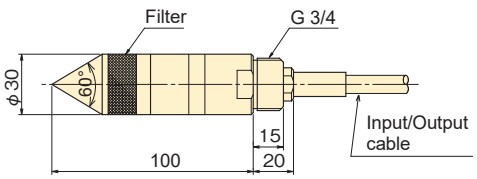
Made of all stainless steel with excellent corrosion resistance

Small, easy handling

KPC-PA



KPD-PA



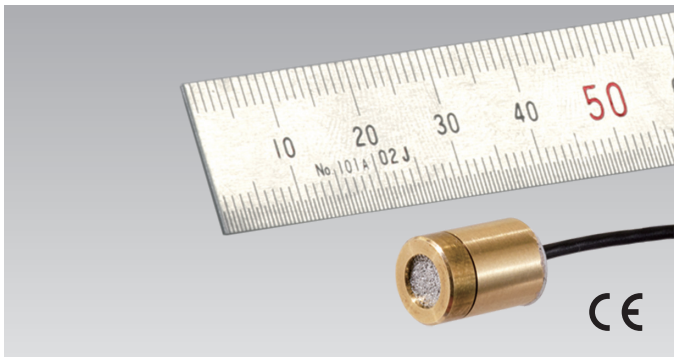
■ SPECIFICATIONS

TYPE	KPC-200KPA KPD-200KPA	KPC-500KPA KPD-500KPA	KPC-1MPA KPD-1MPA	KPC-2MPA KPD-2MPA
Capacity	200kPa	500kPa	1MPa	2MPa
Rated output	0.8mV/V (1600x10^{-6} strain)	1mV/V (2000x10^{-6} strain)		
Non-linearity	1.5%RO	1%RO		
Outer diameter	φ 30mm			
Filter mesh	40μm(*)			
Allowable temperature range	0 ~ +60°C (No icing)			
Input/Output resistance	350Ω			
Recommended exciting voltage	3V or less			
Allowable exciting voltage	10V			
Weight	KPC-200KPA ~ KPC-2MPA 250 g		KPD-200KPA ~ KPD-2MPA 350 g	

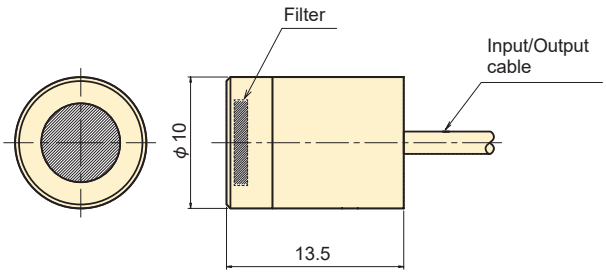
Input/Output cable :
φ 9mm 0.5mm^2 4-core shielded chloroprene cable 2m
* : Filter mesh with 70μm available on request

KPE-PB Small Pore Pressure Gauge

Civil engineering design



Small, lightweight
Easy handling
Dual structure not affected by the outer lateral pressure
Replaceable filter



A small pore pressure gauge to measure pore water pressure in model testing. The dual construction not affected by lateral pressure offers accurate measurement.
Protection ratings: IP68 equivalent

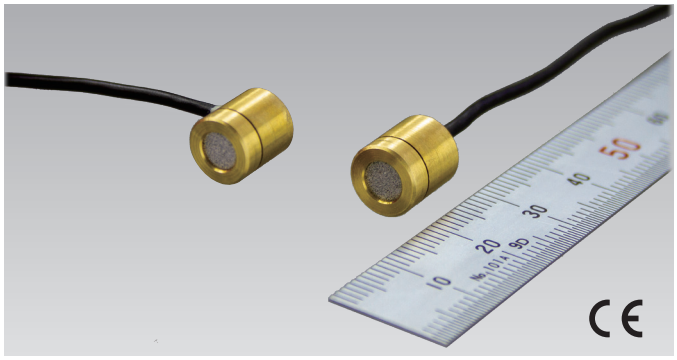
■ SPECIFICATIONS

TYPE	KPE-200KPB	KPE-500KPB	KPE-1MPB	KPE-2MPB
Capacity	200kPa	500kPa	1MPa	2MPa
Rated output	Approx.1mV/V (2000x10^{-6} strain)			
Non-linearity	1%RO			
Filter mesh	40μm(*)			
Allowable temperature range	0 ~ +60°C (No icing)			
Input/Output resistance	350Ω			
Recommended exciting voltage	2V or less			
Allowable exciting voltage	5V			
Weight	Approx. 4.5 g			

Input/Output cable : ϕ 1.7mm 0.035mm^2 4-core shielded vinyl cable 2m
* : Filter mesh with 70μm available on request

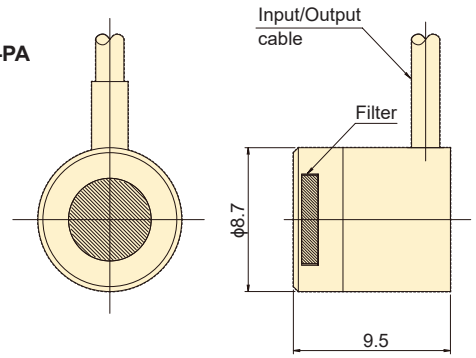
KPG-PA/KPH-PA Ultracompact Pore Pressure Gauge

Civil engineering design

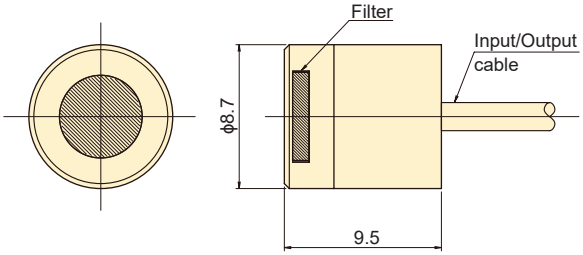


Small, lightweight
Easy handling
Dual structure not affected by the outer lateral pressure
Replaceable filter

KPG-PA



KPH-PA



This is a miniature pore pressure gauge for measurement of pore water pressure in soil. It is designed for use in model testing, and is applicable to measurement for about one week under conditions within the specifications.
Protection ratings: IP68 equivalent

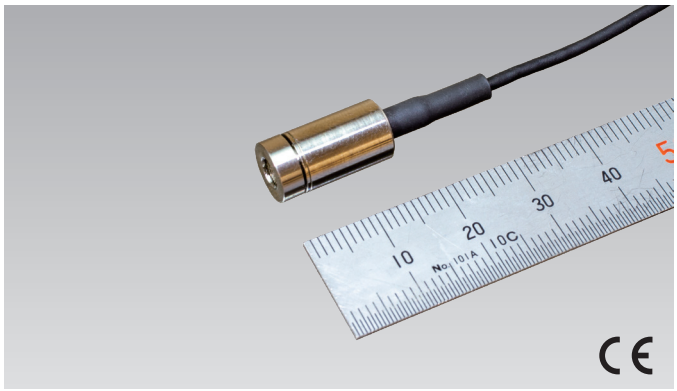
■ SPECIFICATIONS

TYPE	KPG-50KPA KPH-50KPA	KPG-100KPA KPH-100KPA	KPG-200KPA KPH-200KPA
Capacity	50kPa	100kPa	200kPa
Rated output	Approx. 0.5mV/V (1000x10^{-6} strain)	Approx. 0.75mV/V (1500x10^{-6} strain)	Approx. 1.6mV/V (3200x10^{-6} strain)
Non-linearity	1%RO		2%RO
Filter mesh	40μm		
Allowable temperature range	0 ~ +60°C (No icing)		
Input/Output resistance	350Ω		
Recommended exciting voltage	2V or less		
Allowable exciting voltage	5V		
Weight	Approx. 2.3 g		

Input/Output cable : ϕ 1.7mm 0.035mm^2 4-core shielded vinyl cable 2m

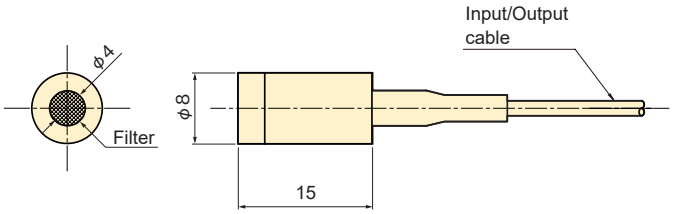
PP-200KPA High-sensitivity compact pore water pressure Transducer

Civil engineering design



Compact pore water pressure transducer to measure pore water pressure in soil in model tests.
It is possible to measure for about one week under the environment within the specification range.
Protection ratings: IP68 equivalent

Compact and lightweight
High sensitive
(Approx. 3 times that of KPH-200KPA)
Made of all stainless steel with excellent corrosion resistance



■ SPECIFICATIONS

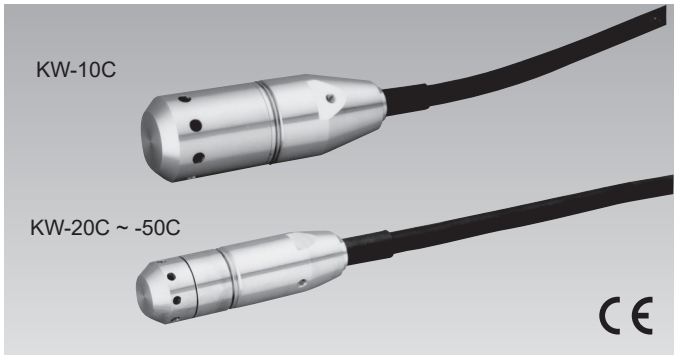
TYPE	PP-200KPA-8V/-8H
Capacity	200kPa
Rated Output	approx.5.0mV/V(10000x10^{-6}strain)
Non-linearity	0.3%RO
Filter Mesh	♯100
Allowable temperature range	0 ~ +60°C (No icing)
Input/Output resistance	approx. 5000Ω
Recommended exciting voltage	approx. 2V or less
Allowable exciting voltage	15V
Weight	approx. 5g
Applicable measuring instrument	TMR-321 / TMR-322 / TDS-540*
Related products	Filter Mesh ♯200, ♯400

Input/Output cable : φ1.7mm 0.035mm^2 4-core shielded vinyl cable 2m free end
*It is possible to use TDS-540 (built-in switch box with serial number COW0220540 or later)

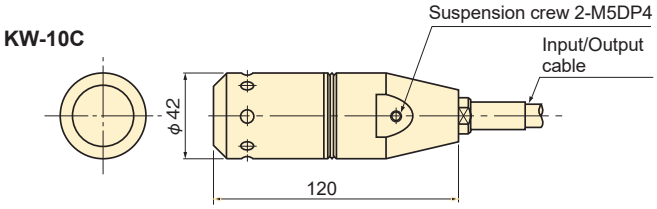
Level of water in dam, river and under-ground water

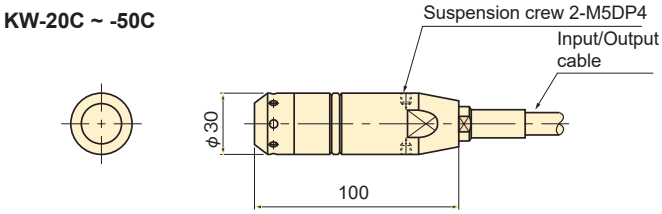
KW-C Water Level Transducer

Civil engineering design



Not affected by the change of atmospheric pressure
Made of stainless steel with excellent corrosion resistance
Easy handling and stable measurement





The KW-C is a hydraulic water level transducer that measures the level of water in dams and rivers and the level of under-ground water in ground in landslide areas. Effects of changes in atmospheric pressure do not need to be compensated, so high-accuracy measurement can be made.
Protection ratings: IP68 equivalent

■ SPECIFICATIONS

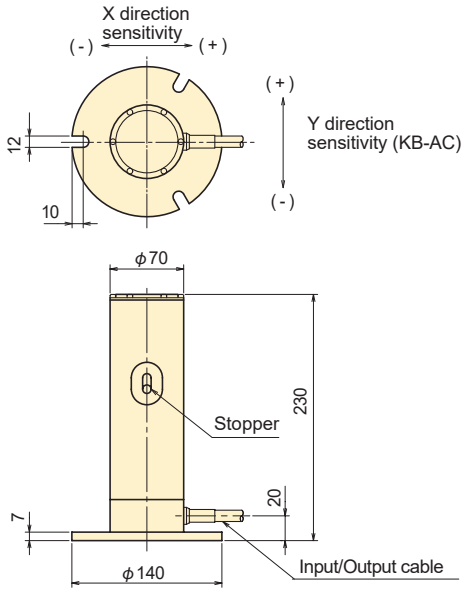
TYPE	KW-10C	KW-20C	KW-30C	KW-50C
Capacity	10m	20m	30m	50m
Rated output	1mV/V (2000x10^{-6} strain)			
Non-linearity	0.2%RO		0.3%RO	
Temperature effect on zero	0.03%RO/°C			
Compensated temperature range	0 ~ +50°C (No icing)			
Allowable temperature range	-20 ~ +60°C (No icing)			
Input/Output resistance	350Ω			
Recommended exciting voltage	3V or less			
Allowable exciting voltage	10V			
Weight	700 g	200g		

Input/Output cable :
KW-10C φ11.5mm 0.5mm^2 4-core shielded vinyl cable with air-vent tube 13m
KW-20C φ11.5mm 0.5mm^2 4-core shielded vinyl cable with air-vent tube 23m
KW-30C φ11.5mm 0.5mm^2 4-core shielded vinyl cable with air-vent tube 33m
KW-50C φ11.5mm 0.5mm^2 4-core shielded vinyl cable with air-vent tube 53m

KB-AB/KB-AC Inclinometer

Civil engineering design





The KB-AB and KB-AC are low-capacity inclinometers. They are used to monitor the conditions of inclination of neighboring structures built by urban civil engineering works. The KB-AB measures inclination in one direction, while the KB-AC measures inclination in both X and Y directions.

Protection ratings: IP67 equivalent

Made of all stainless steel with excellent corrosion resistance

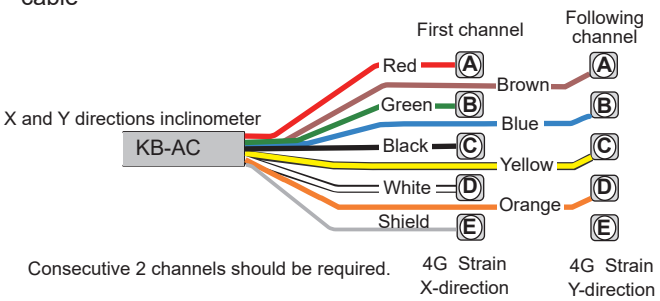
Easy carriage and installtion with external stopper

Two (X and Y) directional measurement with KB-AC

Excellent stability

■CONNECTION TO DATA LOGGER

X and Y directions Inclinometer KB-AC with 8-core integral cable



■ SPECIFICATIONS

TYPE	KB-1AB	KB-2AB	KB-5AB	KB-1AC	KB-2AC	KB-5AC
No. of measuring direction	1			2		
Capacity	±1°	±2°	±5°	±1°	±2°	±5°
Rated output	1mV/V (2000x10^{-6} strain)					
Non-linearity	0.5%RO					
Cross sensitivity	-			3%RO or less		
Allowable temperature range	-20 ~ +60°C					
Input/Output resistance	350Ω					
Recommended exciting voltage	2V or less					
Allowable exciting voltage	5V					
Weight	5 kg					

Input/Output cable :
KB-AB ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 2m
KB-AC ϕ9mm 0.3mm^2 8-core shielded vinyl cable 2m

■ ACCESSORY

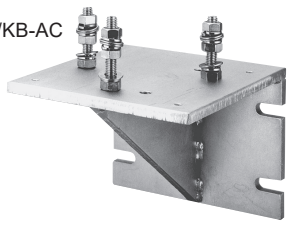
■Protective cover KBF-13

This cover protects the KB-AB//KB-AC inclinometer installed to structure from mechanical damage.



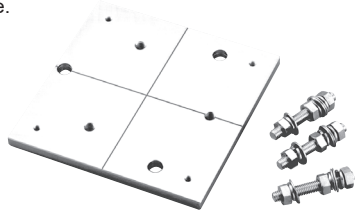
■Wall mount fitting KBF-14

This fitting is used to mount the KB-AB/KB-AC inclinomter to wall of structure.



■Flat mounting fitting KBF-15

This fitting is used to mount the KB-AB/ KB-AC inclinomter to flat surface.



■Level KBF-16

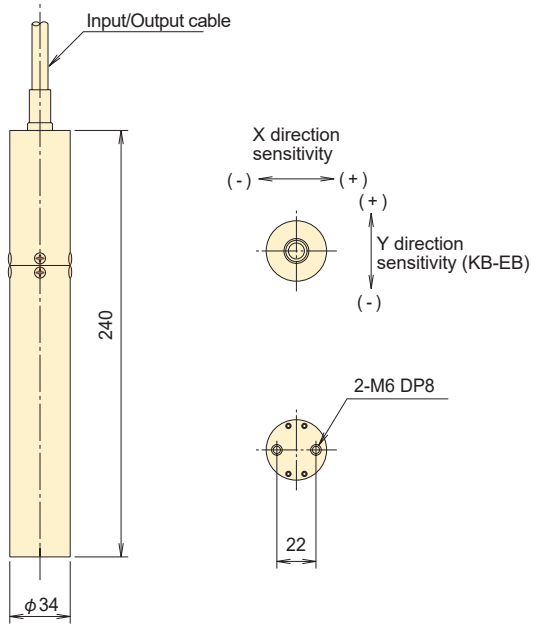
This level is standardly supplied to the KB-AB/KB-AC inclinomter.



KB-DB/KB-EB Inclinometer

Civil engineering design





The KB-DB and KB-EB inclinometers are suitable for monitoring the conditions of structures being constructed or measuring the behavior of structures for a long period. The KB-DB is for measurement in one direction, while the KB-EB is for simultaneous measurement in both X and Y directions.

Protection ratings: IP67 equivalent

Made of all stainless steel with excellent corrosion resistance

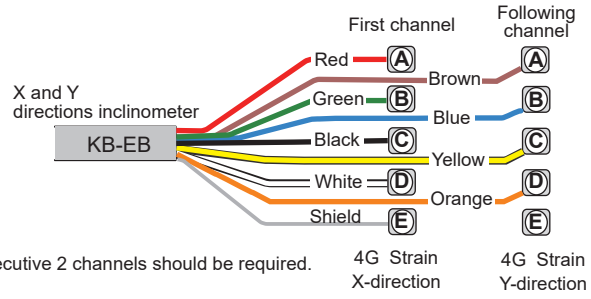
Wall mounting and vertical installation

Waterproofness and excellent stability

Two (X and Y) directional measurement with KB-EB

■CONNECTION TO DATA LOGGER

X and Y directions Inclinometer KB-EB with 8-core integral cable



Consecutive 2 channels should be required.

■ SPECIFICATIONS

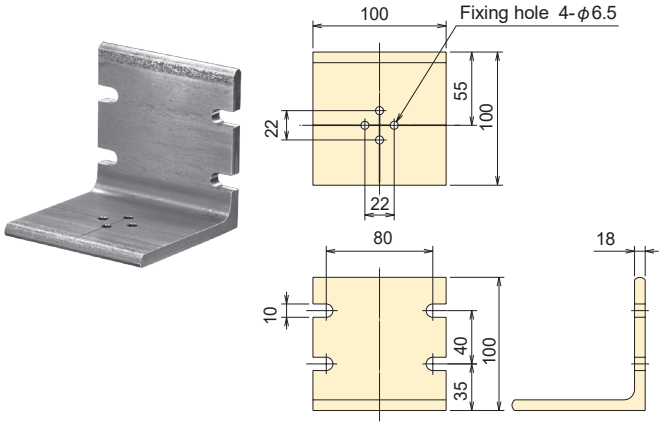
TYPE	KB-5DB	KB-10DB	KB-5EB	KB-10EB
No. of measuring direction	1		2	
Capacity	±5°	±10°	±5°	±10°
Rated output	1mV/V (2000x10^{-6} strain)			
Non-linearity	0.5%RO			
Cross sensitivity	-		3%RO or less	
Allowable temperature range	-20 ~ +60°C			
Input/Output resistance	350Ω			
Recommended exciting voltage	2V or less			
Allowable exciting voltage	5V			
Weight	1.3 kg			

Input/Output cable :
KB-5DB/-10DB
ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 2m
KB-5EB/-10EB
ϕ9mm 0.3mm^2 8-core shielded vinyl cable 2m

■ ACCESSORY

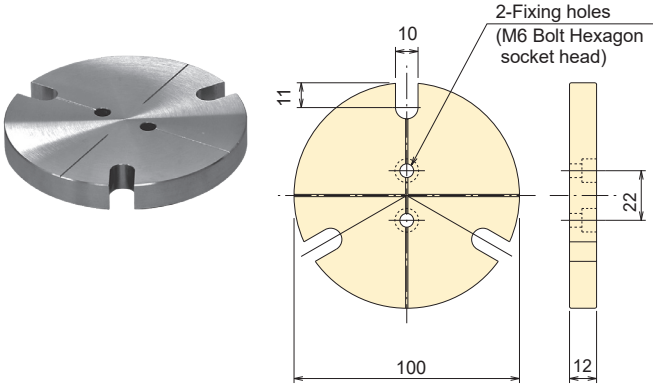
■Wall mount fitting KBF-17

This fitting is used to mount the KB-DB/KB-EB inclinomter to wall of structure.



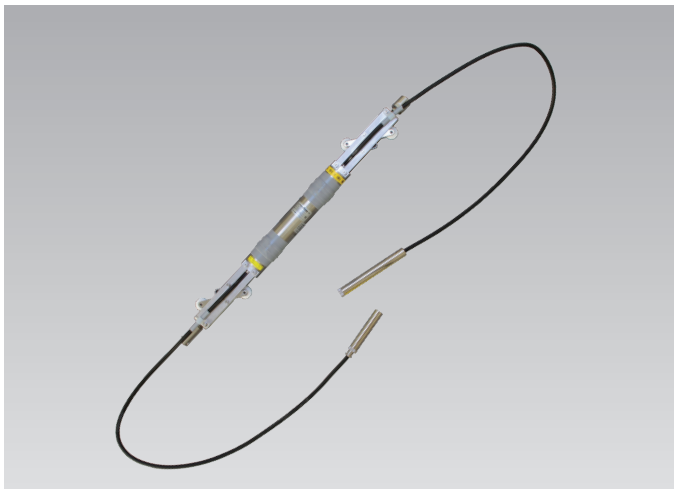
■Flat mount fitting KBF-18

This fitting is used to mount the KB-DB/KB-EB inclinometer to flat surface.

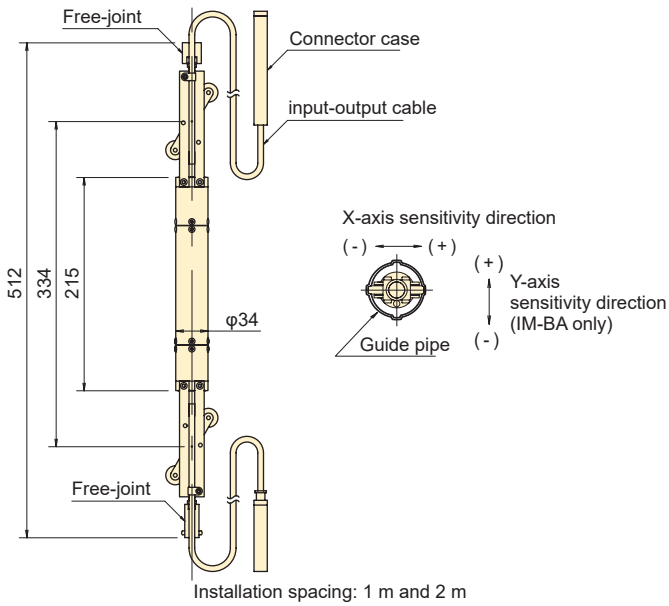


IM-10UA/BA Network CompatibleMulti-layer inclinometer

Civil engineering design



IM-10UA (1-axis) / IM-10BA (2-axis)



Installation spacing: 1 m and 2 m

An inclinometer developed to automatically measure the displacement of ground and structures.
The dedicated guide pipes are installed vertically in the ground or structure in advance, and multiple inclinometers are connected to the guide pipes via relay rods (KBF-33JG) and fixed to the measurement positions. The built-in network module in the inclinometer provides the connection of inclinometers with a single cable in succession. It is used for measuring underground displacement of landslides and deformation state of earth retaining walls. The IM-10UA can measure only in one direction, and the IM-10BA can measure in both the X- and Y-directions simultaneously with a single unit.

Protection rating: IP68 equivalent

Eliminated transportation constraints (horizontal transportation supported)
Connection using only single cable
All stainless-steel structure that provides excellent anti-corrosion resistance
Adoption of new small diameter guide pipe (IM-GP: φ50.5)
Also compatible with conventional guide pipes (φ56) (optional)
High resolution, compared to conventional NKB-10 (Cap.10° : Res. 0.005° → 0.001°)
Compact overall length (identical with KB-JG)
Built-in temperature sensor allows temperature measurement per depth (optional)
Can be mixed with older model NKBs

■ SPECIFICATIONS

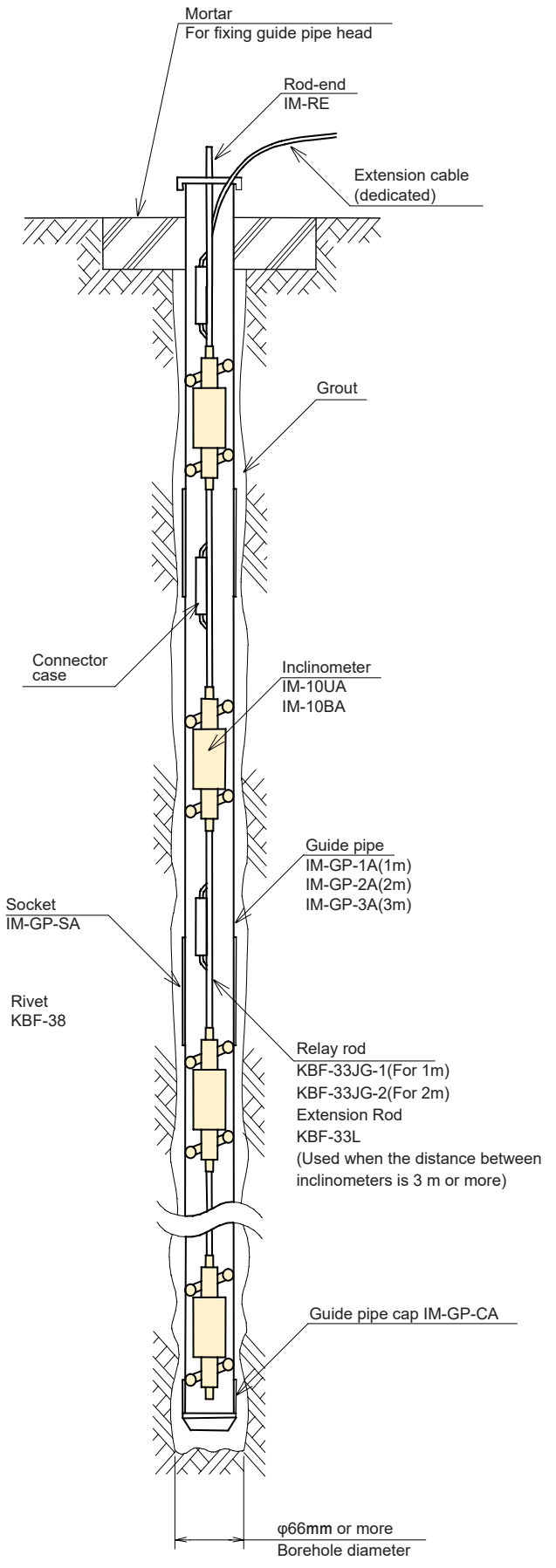
TYPE	IM-10UA	IM-10BA
No. of measuring axis	1	2
Capacity	±10°	
Rated indication	±10000 digit	
Non-Linearity	0.5%RO	
Cross sensitivity	-	3%RO
Temperature range	-20 to +60°C	
Channel set	000 to 999	
input-output cable	φ6mm 0.5mm^2 2-conductor shielded vinyl cable Special waterproof connector at the end	
weight	Approx. 1.7kg	
Standard installation interval	1m or 2m	
Total Extension Distance / Maximum Number of Units Connected	Within 2000m per system / Maximum of 100 units can be connected. (within 1 km when TS-360, TDS-150-06 or MD-111 is used)	
	Within 100m depth per hole / Max. 50 units (within 100 channels when TS-360, TDS-150-06, TC-35N, MD-111 are used)	

IM-10UA/BA Network CompatibleMulti-layer inclinometer

Civil engineering design

■ RELATED PRODUCTS

Example of installation with inclinometer IM and related products

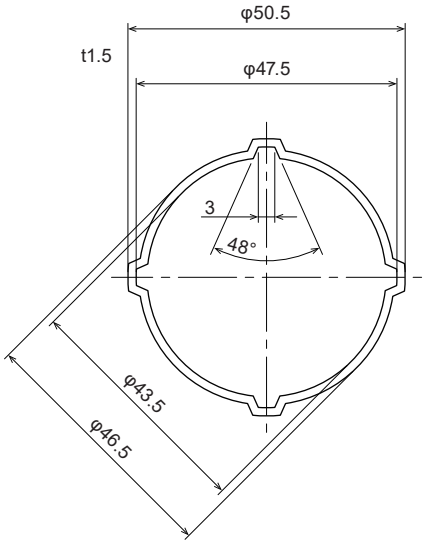


Guide pipe	IM-GP-1A(1m)/ IM-GP-2A(2m)/ IM-GP-3A(3m)
Guide pipe socket	IM-GP-SA
Guide pipe cap	IM-GP-CA
Rod end	IM-RE
Relay rod	KBF-33JG-1(1m)/ KBF-33JG-2(2m)
Relay rod	IM-RR-1A-LF(1m)/ IM-RR-2A-LF(2m)
for mixed use	IM-RR-1A-MF(1m)/ IM-RR-2A-MF(2m)
Extension rod	KBF-33L-1/ KBF-33L-2
Rivet	KBF-38 (IM-GP/ Rivets for KBF-31 (80 pcs.))
SB Tape	— (IM-GP/ SB tape for KBF-31 (10 pcs.))

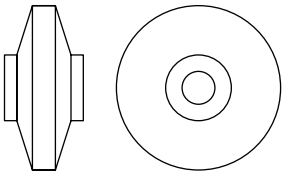
We also offer extension rods, head caps, rivets, riveters, and demountable pliers. Please contact us for details.

■Guide pipes for IM-UA/BA

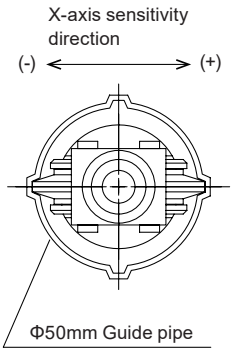
Compatible with small diameters
Aluminum Guide Pipe Φ50mm IM-GP



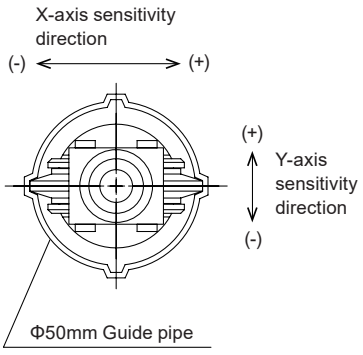
Φ50mm Roller for Guide Pipes



IM-10UA



IM-10BA

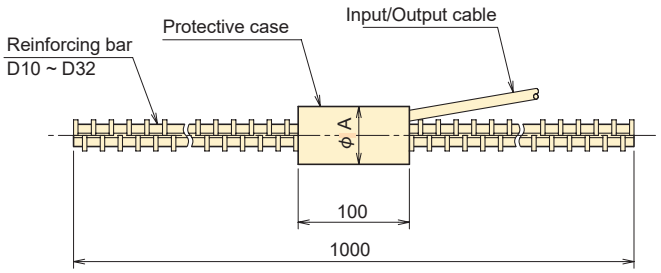


Transducers

KSAT-A Reinforcing Bar Meter

Civil engineering design





The KSAT-A are used to measure stress applied to structural reinforcing bars, and are normally welded at both ends to form part of the reinforcement arrangement. And the meters are with built-in temperature sensor, making possible simultaneous measurement of stress and temperature. The KSAT-A has a thermocouple that can be used to measure actual temperature.

Protection ratings: IP68 equivalent

Temperature measuring function to measure real temperature

Long-term stable measurement

Capable of measuring thermal stress

■ SPECIFICATIONS

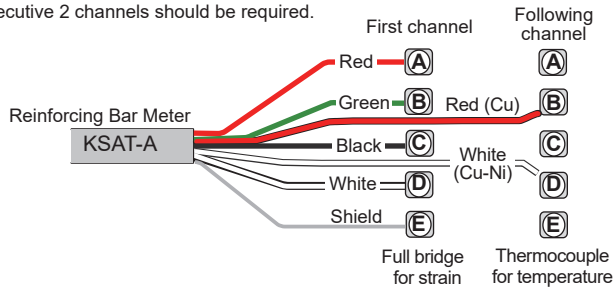
TYPE	ϕ A	Applical bar		Yield point
		Name	Class	
KSAT-10A	33	D10	SD345	345~440N/mm^2
KSAT-13A	36	D13		
KSAT-16A	42	D16		
KSAT-19A	47	D19		
KSAT-22A	47	D22		
KSAT-25A	53	D25		
KSAT-29A	53	D29		
KSAT-32A	62	D32		

Other bar with different size is avilable. Consult TML.

■CONNECTION TO DATA LOGGER

KSAT-A with built-in thermocouple

Consecutive 2 channels should be required.



Stranded cables of Red, Green, Black and White to the first channel for strain measurement. Thermocouple of single core Red (Cu) and White (Cu-Ni) should be connected directly to the following channel for temperature measurement.

■ SPECIFICATIONS

TYPE	KSAT-10A	KSAT-13A	KSAT-16A	KSAT-19A	KSAT-22A	KSAT-25A	KSAT-29A	KSAT-32A
Capacity	300 N/mm^2							
Rated output	2.2mV/V (4400x10^{-6} strain)							
Non-linearity	1%RO							
Temperature sensor	KSA-A : Strain gauge 350Ω Quarter bridge with 3-wire (Approx. 50x10^{-6} strain/°C) in relative temperature KSAT-A : Thermocouple T in real temperature							
Allowable temperature range	-20 ~ +80°C							
Input/Output resistance	350Ω							
Recommended exciting voltage	6V or less							
Allowable exciting voltage	10V							
Weight	0.9 kg	1.3 kg	1.9 kg	2.6 kg	3.4 kg	4.3 kg	5.4 kg	6.6 kg

Input/Output cable :
KSAT-10A ~ 16A ϕ9mm 0.3mm^2 4-core shielded T-thermocouple compound cable 2m
KSAT-19A ~ 32A ϕ11.5mm 0.5mm^2 4-core shielded T-thermocouple compound cable 2m

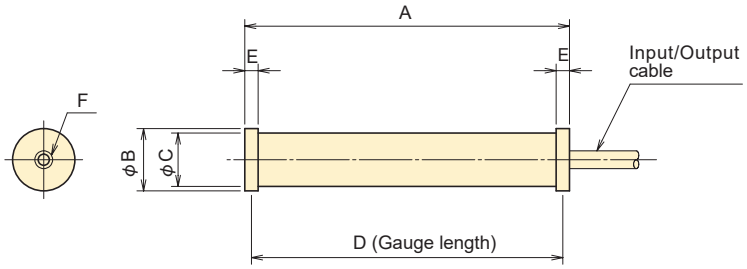
KM Strain Transducers

Civil engineering design



The KM series strain transducers are designed to measure strain in materials such as concrete, synthetic resin which undergo a transition from a compliant state to a hardened state. Their extremely low modulus (40N/mm^2 approx.) and waterproof construction are ideally suited for internal strain measurement during the very early stages of curing. They are totally impervious to moisture absorption, producing excellent stability for long-term strain measurement. Relative temperature measurement is also possible with the KM-B. The built-in thermocouple sensor of the KM-BT enable actual temperature measurement in addition to strain measurement. Adding to the above embedment use, surface strain measurement onto concrete, H-beam steel is also available with various optional fittings.
The KM series is compliant to CE marking except for KM-30.

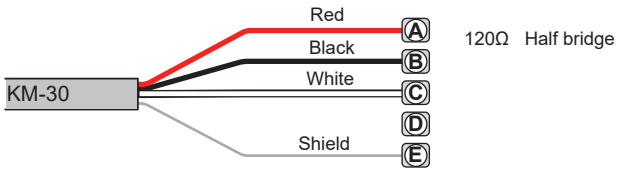
Protection ratings: IP67 equivalent for KM-30
IP68 equivalent for KM-100B ~ KM-100BT

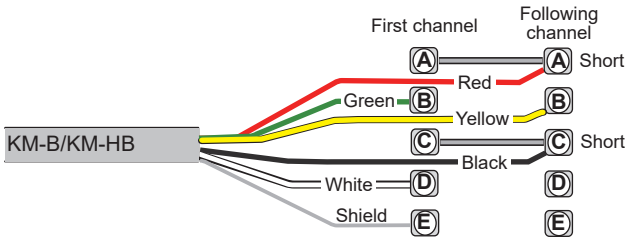


■DIMENSION

TYPE	Dimension					
	A	ϕ B	ϕ C	D	E	F
KM-30	34	12	10	31	3	M3 DP4
KM-100B	104	20	17	100	4	M3 DP6
KM-100HB	104	20	17	100	4	M3 DP6
KM-100BT	104	20	17	100	4	M3 DP6

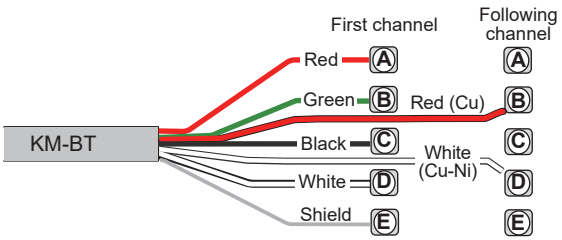
■CONNECTION TO DATA LOGGER





Consecutive 2 channels should be required for simultaneous measurement of strain and temperauture.

Straded cables of Green, White and shield are connected to the first channel. Remaining cables of Red, Yellow and Black should be connected directly to the following channel for temperature measurement, making short-circuit between A-A and C-C with copper wire for strain measurement.



Consecutive 2 channels should be required for simultaneous measurement of strain and temperauture.

Stranded cables of Red, Green, Black, White and shield to the first channel for strain measurement. Thermocouple of single core Red and White should be connected directly to the following channel for temperature measurement.

■ SPECIFICATIONS

TYPE	KM-30	KM-100B	KM-100HB	KM-100BT
Capacity	±5000x10^{-6} strain			
Gauge length	31mm	100mm		
Rated output (Approximately)	2.5mV/V 5000x10^{-6} strain	2.5mV/V 5000x10^{-6} strain		
Non-linearity	1%RO			
Apparent elastic modulus	40N/mm^2			
Strain measurement	120Ω Half bridge	350Ω Full bridge		
Temperature measurement	-	*1Strain gauge (350Ω Quarter bridge 3-wire method :50x 10^{-6} strain/°C)		*2 Thermocouple T
Allowable temperature range	-20 ~ +60°C	-20 ~ +80°C	-20 ~+180°C	-20 ~ +80°C
Input/Output resistance	120Ω (Half bridge)	350Ω Full bridge		
Weight	12 g	75 g	80 g	75 g

Input/Output cable :
KM-30 ϕ2.4mm 0.04mm^2 3-core shielded vinyl cable 2m
KM-100B ϕ9mm 0.3mm^2 5-core shielded chloroprene cable 2m
KM-100HB ϕ6mm 0.3mm^2 5-core shielded fluoroplastic cable 2m
KM-100BT ϕ9mm 0.3mm^2 4-core shielded T-thermocouple compound cable 2m

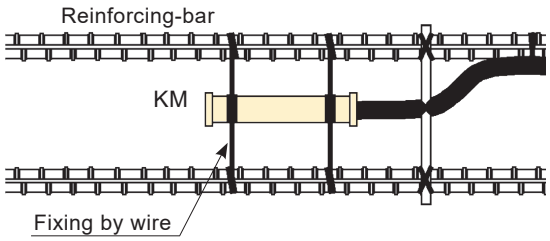
*1 Relative temperature measurement possible
*2 Real temperature measurement possible

KM Strain Transducers

Civil engineering design

For use of internal strain measurement

The KM Strain Transducers make possible strain measurement in materials such as concrete which undergo transition from a compliant state to a hardened state. The KM is designed to measure various strains produced by external force, ambient temperature, drying shrinkage, materials creep, etc. Applicable gauge length should be three times as large as the diameter of the aggregate so as to give an averaged evaluation of the concrete.
As illustrated right, the KM end is wired between reinforcing bars, then position the KM to marked points of reinforcing bar in advance.



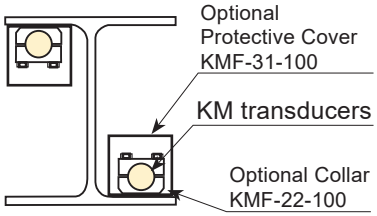
For surface strain measurement

Surface strain measurement onto steel and concrete structures is available with KM-100B or KM-100BT. (Optional fittings such as Spacer and Collar are available for fixing the model and positioning gauge length.

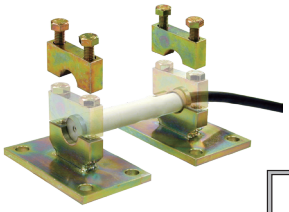
An installation onto the surface of steel structure



The KM model is combined with optional Collar KMF-22-100 to install onto the surface of steel by welding.

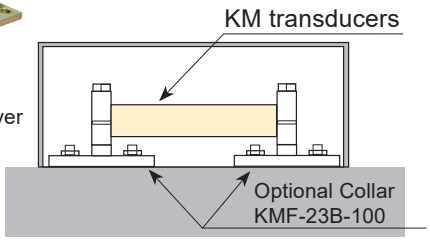


An installation onto the surface of concrete structure



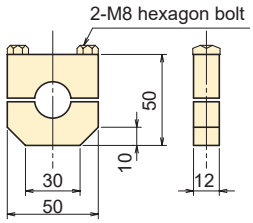
Optional Protective Cover
KMF-32B-100

The KM model is combined with optional Collar KMF-23B-100 to install onto the surface of concrete structure with anchor bolts.

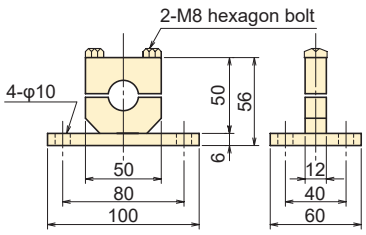


■ RELATED PRODUCTS

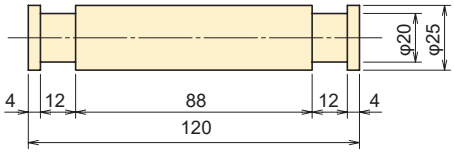
For steel surfaces
Optional Collar
KMF-22-100



For concrete surfaces
Optional Collar KMF-23B-100

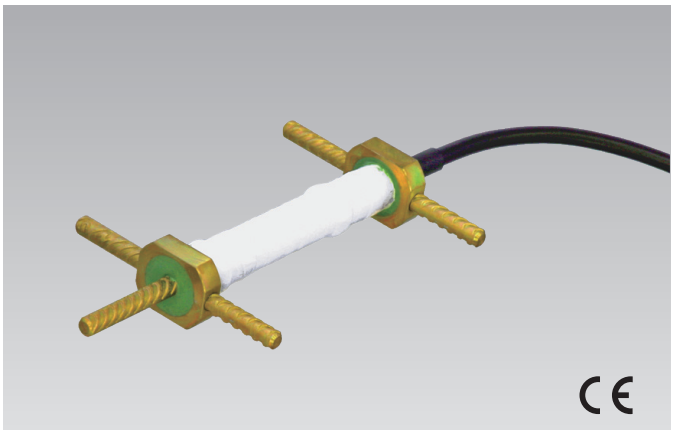


Simulated strainmeter
KMF-12-100
(Except for KM-30)

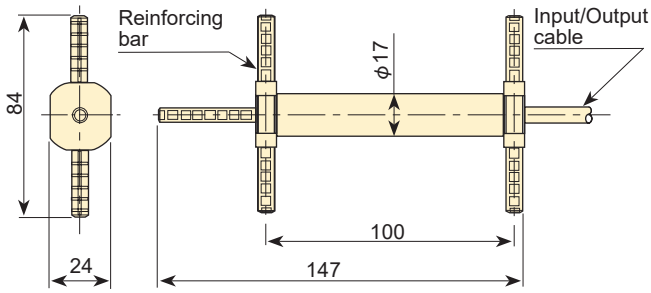


KM-HAS Strain Transducers

Civil engineering design



The KM-HAS transducers are embedded into asphalt for measurement of internal strain. The transducers have reinforcing bar flanges at its both ends for good fixation to asphalt pavement materials, and provide for fully waterproof construction. The operating temperature range is -20 to +180°C.

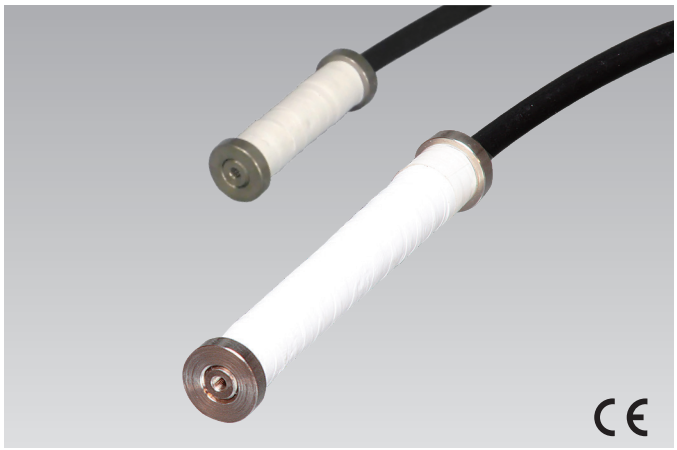


■ SPECIFICATIONS

TYPE	KM-100HAS
Capacity	±5000x10^{-6} strain
Gauge length	100mm
Rated output (Approximately)	2.5mV/V (5000x10^{-6} strain)
Non-linearity	1%RO
Apparent elastic modulus	Approx. 40N/mm^2
Strain measurement	350Ω Full bridge
Temperature measurement	350Ω Quarter bridge 3-wire
Allowable temperature range	-20 ~ +180°C
Bridge excitation	Recommended 1~2V, Allowable 10V

KM-M Compact Size Strain Transducer

Civil engineering design



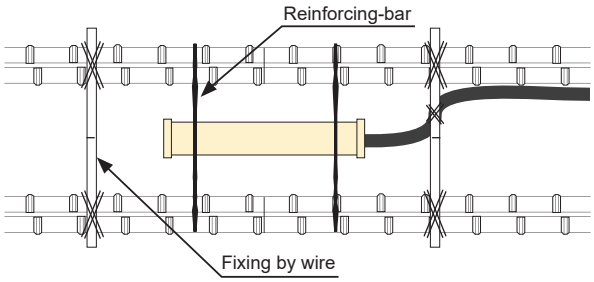
Smaller diameter enables strain measurement during the curing process of concrete, mortar, asphalt, synthetic resin, etc. with thin cover thicknesses!

"KM-M Strain Transducer" have extremely high insulation properties and can measure strain with high accuracy. The "Strain Transducer with built-in temperature measuring function" can measure strain and temperature at the same time, which greatly simplifies wiring work. In addition, a wide variety of related products enable measurement of not only internal strain of concrete but also surface strain of steel materials such as "concrete surface" and "H-shaped steel".

Protection ratings :IP 68 equivalent

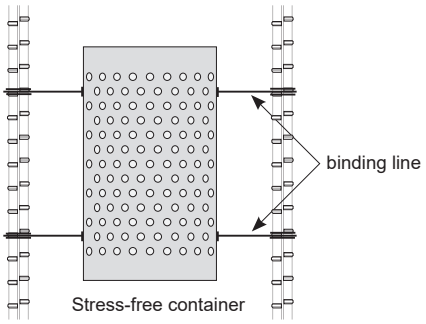
Example of installation on reinforced concrete structur

To install the Strain Transducer, bind wires are tied to two locations on the body of the main unit as shown in the figure, and the strain transducer is installed in accordance with the markings on the rebar near the installation location in advance.



Example of installation on stress-free container

A strain transducer (KM-M) is attached to the stress-free container (KMF-51) and installed in the concrete structure. The linear expansion coefficient and shrinkage strain of the concrete are obtained from the strain value and the temperature measured by the built-in temperature measuring function. The stress-free container (KMF-51) to which the strain transducer (KM-M) is attached should be secured to a reinforcing bar or the like in the vicinity of the installation location with a binding wire or the like to prevent it from being washed away during concrete placement.
(If there is no reinforcing bar in the vicinity of the mass concrete, etc., please reinforce and fix the reinforcing bar for installation so that there are no structural problems.)



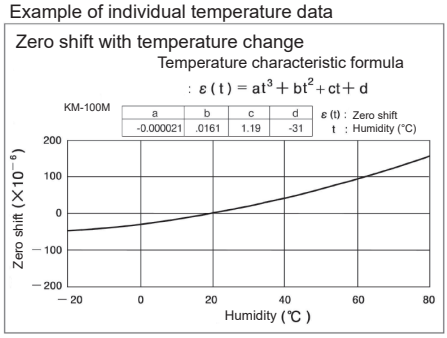
If a stress-free container cannot be installed, a specimen is prepared under the same conditions as the frame, and this strain transducer is installed under the same conditions of moisture movement without external force to determine the linear expansion coefficient and drying shrinkage strain of the concrete.vidu

Strain transducer temperature measuring function

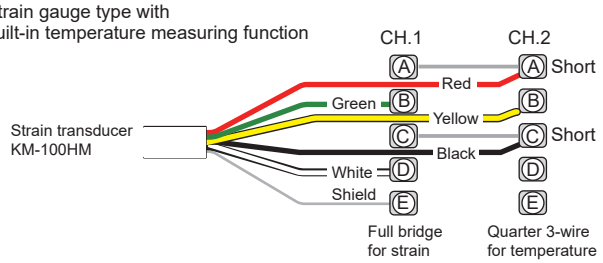
Strain transducer with built-in temperature measuring function are available in two types: strain gauge type and thermocouple type. The former is the Quarter bridge with 3-wire method (350Ω) and measures relative temperature, while the latter is a thermocouple type and measures actual temperature. Both types of gauges enable accurate measurement and greatly simplify installation and wiring work compared to the use of separate thermometers.

Strain gauge type with built-in temperature measuring function **KM-100HM**
Built-in thermocouple temperature measuring function **KM-100MT**

Example of individual temperature data

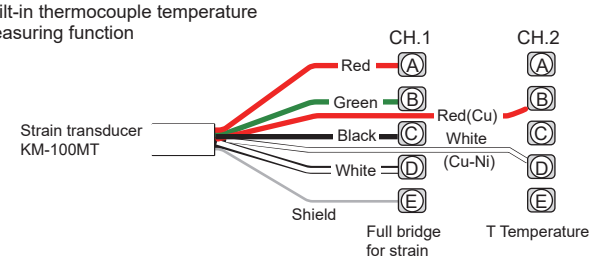


Strain gauge type with built-in temperature measuring function



Connect to any two consecutive channels on the instrument. Be sure to connect the red, yellow, and black cores of the strain transducer cable to the CH.2 side of the temperature measurement channel, and short A-A and C-C with copper wire.

Built-in thermocouple temperature measuring function



Connect to any two consecutive channels on the instrument.

KM-M Compact Size Strain Transducer

Civil engineering design

■ SPECIFICATIONS

Type	KM-50M	KM-100M	KM-100HM	KM-100MT
Capacity	±5000×10^{-6} strain			
Gauge length	50mm	100mm		
Rated output (Approx.)	approx. 3mV/V(6000×10^{-6} strain)	approx. 2.5mV/V(5000×10^{-6} strain)		
Non-linearity	2%RO			
Apparent elastic modulus	approx. 25N/mm^2			
Temperature measurement	-		Strain gauge 350Ω Quarter bridge 3-wire method (approx. 50×10^{-6} strain/°C)	Thermocouple T
Allowable temperature range	-20 ~ 80°C		-20 ~ 180°C	-20 ~ 80°C
Input/output resistance	350Ω Full bridge			

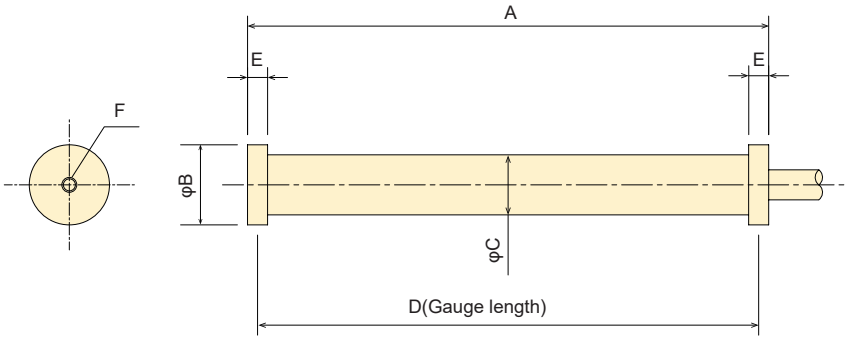
Input/Output cable :

KM-50M/KM-100M	φ6mm 0.35mm^2	4-core shielded chloroprene cable 2, free end
KM-100HM	φ6mm 0.3mm^2	5-core shielded fluoroplastic cable 2m free end
KM-100MT	φ6mm 0.18mm^2	4-core shielded T-thermocouple compound cable, free end

■ DIMENSION

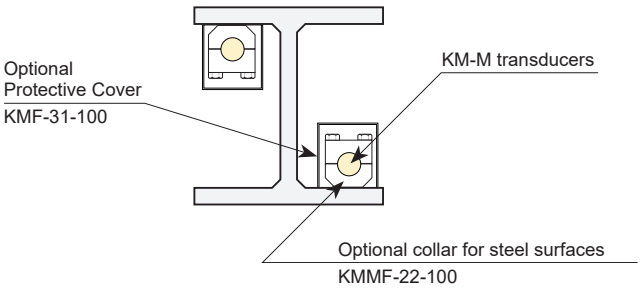
Common to all KM-M/KM-HM/KM-MT models

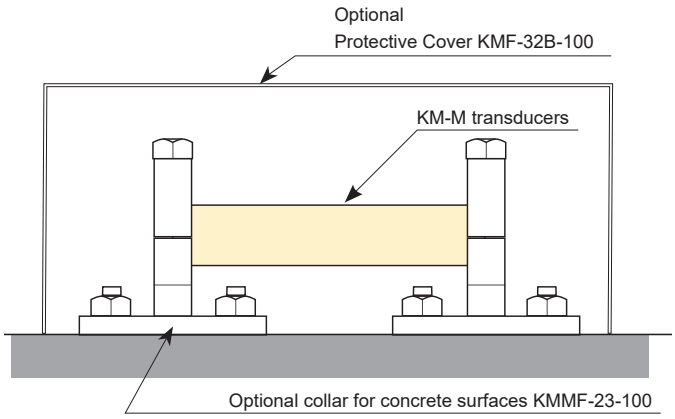
TYPE	Dimension					
	A	φ B	φ C	D	E	F
KM-50M	54	16	12	50	4	M3 DP6
KM-100M	104	16	12	100	4	M3 DP6
KM-100HM	104	16	12	100	4	M3 DP6
KM-100MT	104	16	12	100	4	M3 DP6



■ EXAMPLE OF INSTALLATION ON STEEL SURFACE/CONCRETE SURFACE

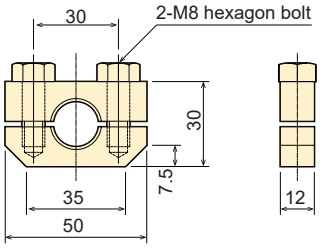
Optional collar for steel and concrete surfaces/Optional Protective Cover /Simulated Strainmeter



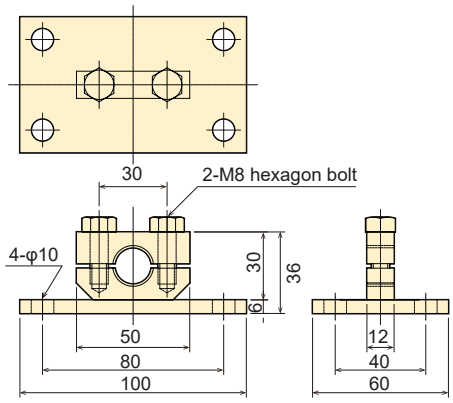


■ RELATED PRODUCTS

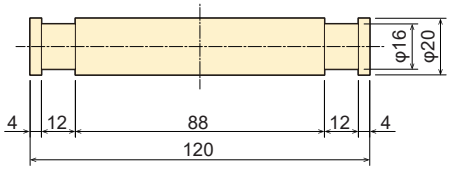
For steel surfaces
Optional Collar
KMMF-22-100



For concrete surfaces
Optional Collar KMMF-23-100



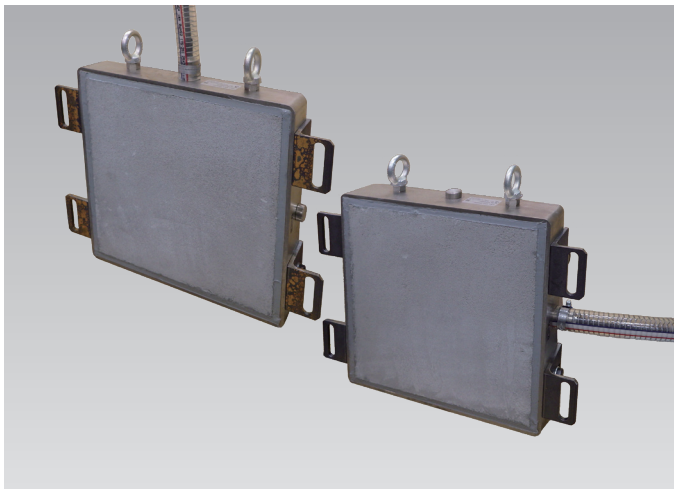
Simulated strainmeter
KMMF-12-100
(Except for KM-50M)



Transducers

KKA-PC Caisson skin-friction meter

Civil engineering design



The KKA-PC is a transducer to measure the skin-friction bearing force of a caisson, which is acting on the wall of a concrete caisson generated by the friction between the ground and the concrete surface. The transducer is installed so that the sensing surface of the transducer is positioned in the same surface with the caisson wall. The skin-friction bearing force by the ground is measured during the immersion and settlement of the caisson.

Protection ratings : IP 67 equivalent

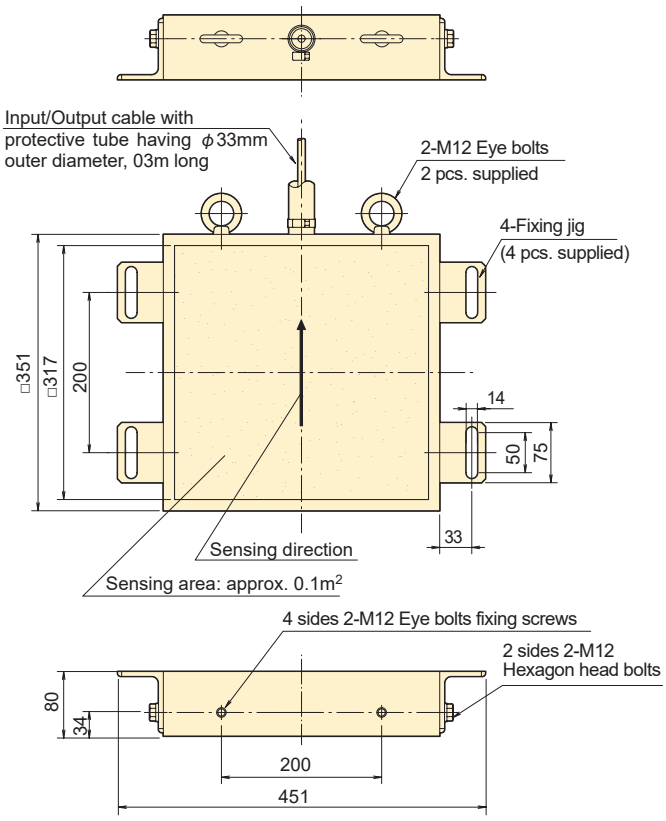
For skin-friction meter for steel caisson, please contact us.

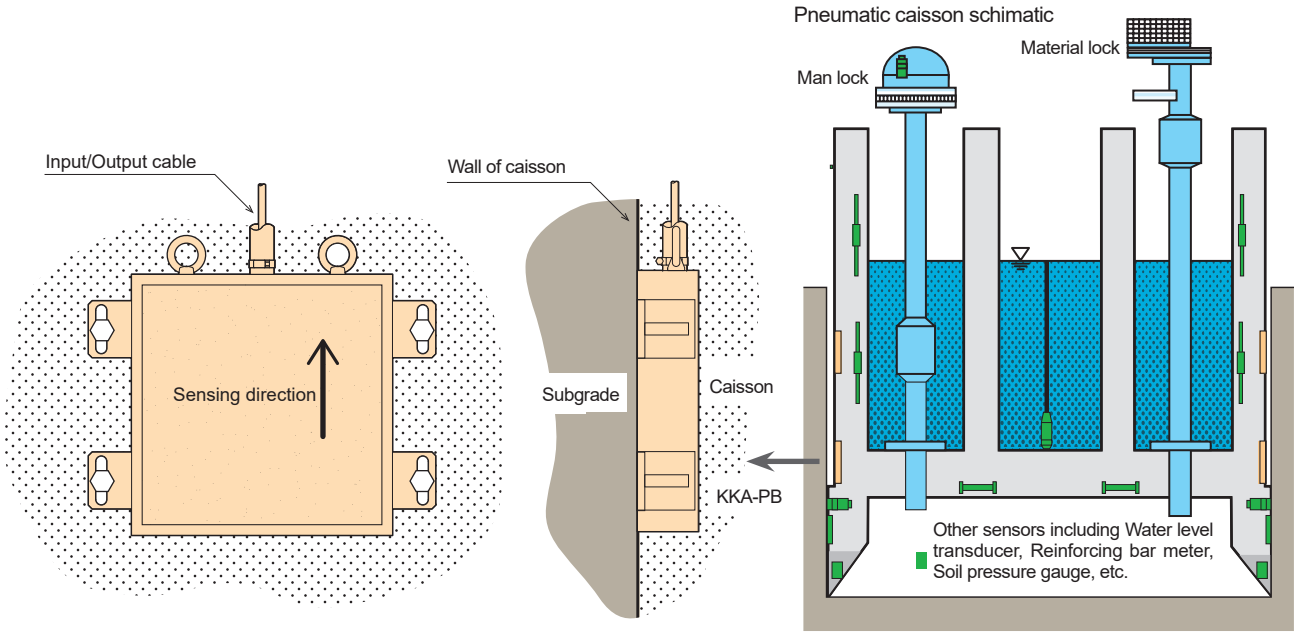
■ SPECIFICATIONS

TYPE	KKA-200KPC-U KKA-200KPC-R	KKA-300KPC-U KKA-300KPC-R
Capacity	200kPa	300kPa
Rated output	1.5mV/V (3000x10^{-6} strain)	
Non-linearity	1%RO	
Allowable temperature range	-30 ~ +70°C (No freezing)	
Input/Output resistance	350Ω	
Recommended exciting voltage	2V	
Allowable exciting voltage	10V	
Zero balance	±1500x10^{-6} strain or less	
Weight	33 kg	

Input/Output cable : ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 2m

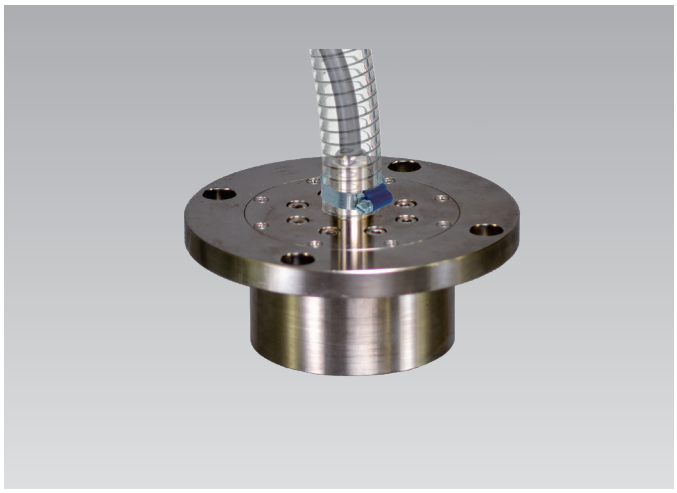
Observation and control of caisson driving process

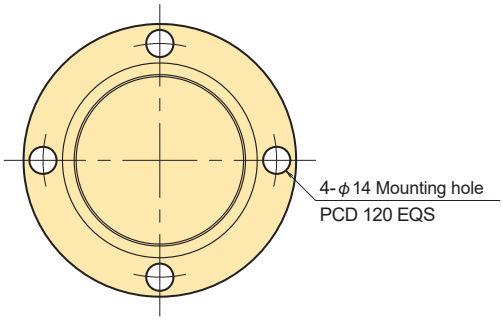


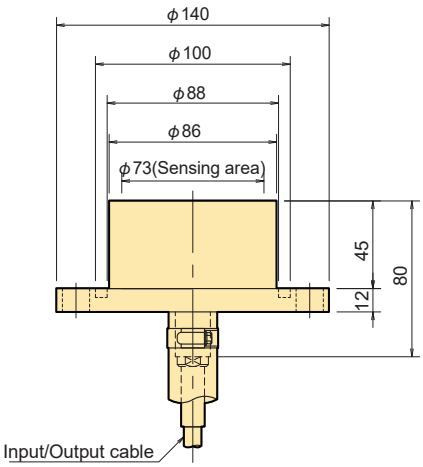


KKB-PC Caisson cutting-edge reaction meter

Civil engineering design







The KKB-PC is a transducer to measure the subgrade reaction force (bearing force) acting on the caisson cutting edge. The transducer is installed so that the sensing surface of the transducer is positioned in the same surface with the bottom surface of the caisson cutting edge. The subgrade reaction force is measured during the immersion and settlement of the caisson.

Protection ratings: IP 68 equivalent

When ordering, please clarify the shape of the cutting edge.

Measurement of subgrade reaction force on caisson cutting edge

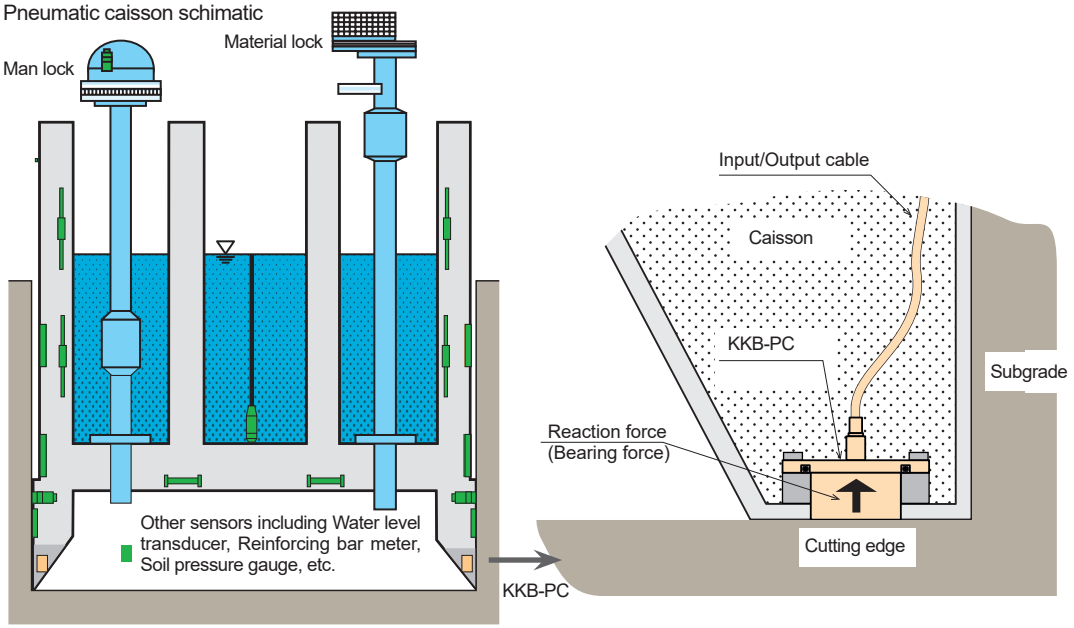
Supplied with 1 m protective tube (outer diameter: Ø26 mm)

■ SPECIFICATIONS

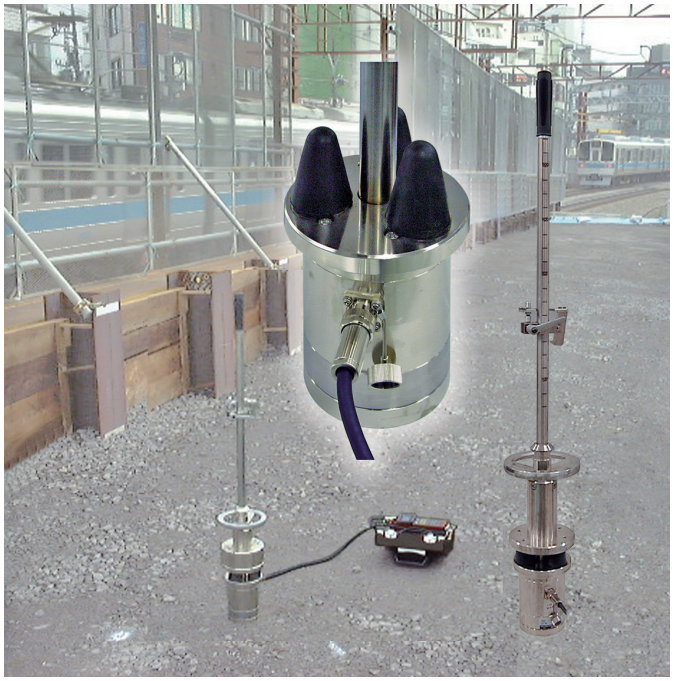
TYPE	KKB-5MPC	KKB-10MPC	KKB-15MPC
Capacity	5MPa	10MPa	15MPa
Rated output	1.0mV/V (2000x10^{-6} strain)		
Non-linearity	1%RO		
Hysteresis	1%RO		
Allowable temperature range	-30 ~ +70°C (No freezing)		
Allowable overload	150%		
Input/Output resistance	350Ω		
Recommended exciting voltage	3V or less		
Allowable exciting voltage	10V		
Weight	3.2 kg		

Input/Output cable : ϕ9mm 0.5mm^2 4-core shielded chloroprene cable 7m

Pneumatic caisson schimatic



FWD-Light TML Small Falling Weight Deflectometer

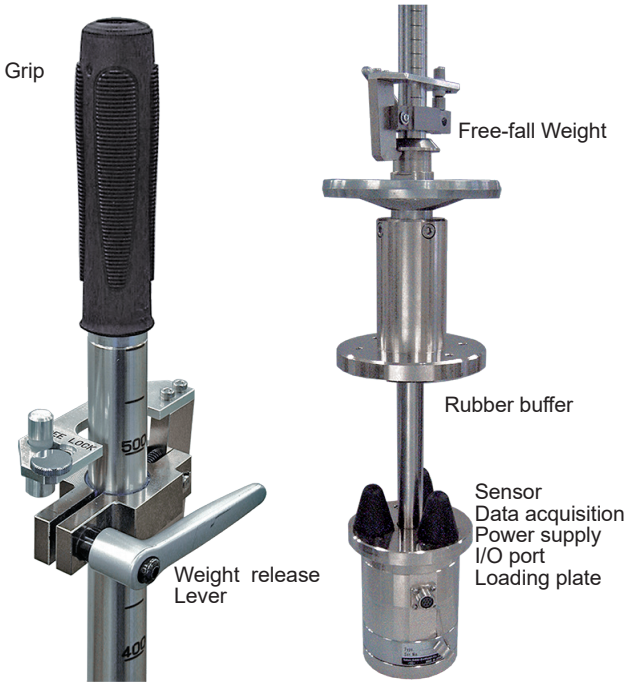


Simple and quick measurement of coefficient of subgrade reaction and modulus of subgrade elasticity
2-wire digital network lines
Battery driven

FWD (Falling Weight Deflectometer) is used for estimating construction of pavement or rigidity of subgrade. Also, plate loading test is used for estimating characteristics of subgrade. However, these methods require much time and works for their preparation, data acquisition and analysis. TML small FWD System "FWD-Light" features excellent portability and enables simple and quick measurement of coefficient of subgrade reaction which is called K value and modulus of sbugrade elasticity which is called E value. FWD-Light consists of main body KFD-100A and indicator TC-351F. The main body includes load cell and acceleration transducer whose measuring ranges are 20kN of load and 2.5mm of displacement at maximum. Values of maximum load and displacement, and analysis results of K value and E value are indicated on the indicator. Each analysis result can be stored in memory card and printed by exclusive printer. Data stored in memory card can be transferred to a personal computer by directly connecting the card or via the indicator. Measurement and processing software TC-7100 is available as an optional item for indicating waveforms of load, acceleration, velocity and displacement, O-P time and time product using personal computer.

Protection ratings : IP 42 equivalent

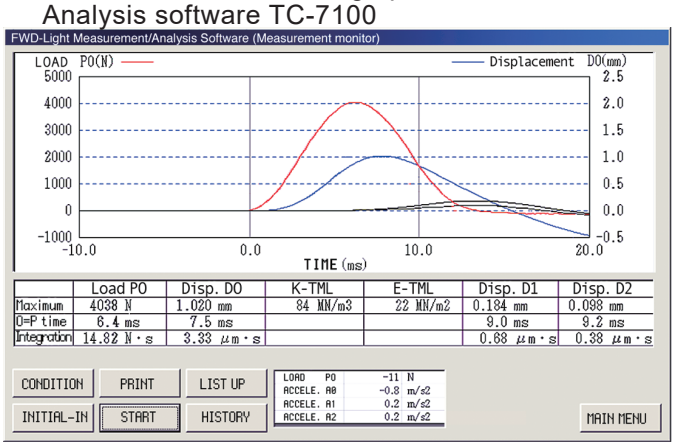
Main unit KFD-100A



■ SPECIFICATIONS

Type		KFD-100A
Dimensions of loading plate		ϕ 100 x 15 (thick) mm (KFDF-31-100)
Mass of weight		5 kg
Falling height		50~530mm
Falling method of weight		Lever with stopper
Sensor	Load Cell	Rated capacity : 20kN
		Maximum load : 20kN
	Acceleration transducer	Rated capacity : 500m/s^2
		Maximum displacement : 2.500 mm
Data acquisition		
	No. of measuring points	2 points (load and acceleration)
	Measuring accuracy	±(0.1% rdg.+2 digits) at 23±5°C
Sampling speed		800 data/point, 50 µsec.
Trigger function		By data (Load Cell) Pre-trigger saving
Interface		Exclusive 2-wire serial transfer
No. of external displacement transducer		4 points at maximum
Power source		Supplied by TC-351F
Environment		-20~+60°C 85%RH or less (No condensation)
Protection ratigs		IP 42 equivalent
Height		Approx. 1,100 mm
Weight		15 kg including 5 kg weight

■ Waveform indication using optional Measurement/ Analysis software TC-7100



Load and displacement measurements of four channels at maximum are possible.

Civil engineering design

Exclusive indicator TC-351F



Designed for field measurement
Measured data saved in CF card
Acquires a lot of data in a short period of time
Battery driven

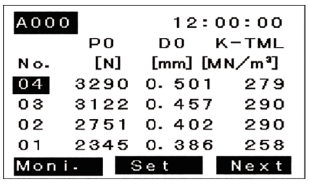
The indicator indicates results of analyses and also saves them into CF card. Measurement/Analysis software (TC-7100) is required for measurement system with personal computer. In this system, data indicated on the indicator are transferred to the computer through the indicator without modification. Personal computer displays waveforms of load and displacement and also processes each analysis.

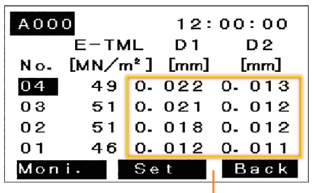
Protection ratings : IP 54 equivalent

■ SPECIFICATIONS

Type	TC-351F
Display	Liquid crystal display 128x64 dots
Monitor	Load, Acceleration, Acceleration of external displacement sensor, Time
Analysis results	Maximum load, Maximum displacement, Maximum displacement of external sensor Coefficient of subgrade reaction (K_{TML}) Modulus of subgrade elasticity (E_{TML}) Indicates results of last four measurements
Data memory	7500 measurements at maximum
Memory card	CF card with adaptor, Capacity 8~128MBytes
Recording format	CSV
Interface	RS-232C
Power supply	Nickel-Hydride (Ni-MH) battery pack
Continuous operation	Approx. 32 hours or 1000 times measurements at 23°C±5°C when measured 30 times/1 hour by standard configuration with fully charged battery
Vibration tolerance	30m/s^2 at 50Hz 0.6mm$_{p-p}$
Environment	-10~+50°C 85%RH or less (No condensation)
Dimensions	Approx. 150(W) x 120(H) x 265(D) mm
Weight	3 kg

Display exampled





Monitoring external displacement sensor optional

OPTION

External Displacement Sensor KFDS-1B

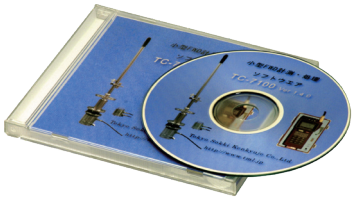
Measurement of external displacement of four points at maximum is available by combining External Displacement Sensor KFDS-1B.



Maximum displacement:
1.000mm
Dimensions φ79 x 125(H) mm
Weight 1.5 kg

Measurement/Analysis software TC-7100

Measurement and processing software for controlling TML Small FWD and analyzing measured data using personal computer which runs on Windows OS. It is available as an optional item for indicating waveforms of load, acceleration, velocity and displacement, O-P time and time product using the PC.



Loading plate KFDF-31

Different size of loading plates are available depending on pavement or rigidity of subgrade.



KFDF-31-90	90mm-dia.
KFDF-31-150	150mm-dia.
KFDF-31-200	200mm-dia.
KFDF-31-300	300mm-dia.

Additional weight KFDF-11

Different loading weights are available to adjust the specified displacement denpending on size of loading plate.



KFDF-11-10 10 kg with KFDF-11-05
KFDF-11-15 15 kg with KFDF-11-10

Measuring Instruments

INTRODUCTION

Since the change in the resistance of a strain gauge is so small, electrical means are required to measure it. A strainmeter is prepared for this purpose, converts the change in the resistance of the strain gauge into a change in voltage, and the change is amplified to extract it as digital or analog data.

In addition, transducers that use strain gauges inside, such as load cells and displacement meters, are also connected to a strainmeter to perform measurements. Many models of strainmeters can also perform voltage measurements and temperature measurements using thermocouples and platinum resistance temperature detectors.

STATIC AND DYNAMIC STRAIN

Strain that is considered not to change over time is called static strain, while strain that changes over time is called dynamic strain. There are two types of strainmeters: static strainmeters intended to measure static strain and dynamic strainmeters intended to measure dynamic strain.

Refer to page 194 for detail.

CHANGES TO THE CATALOG

Changes to this catalog due to product improvements may occur without prior notice.

DIMENSIONS

All dimensions are given in millimeters unless otherwise stated.

PRICES

This catalog does not list product prices. Customers must request a price list separately.

TABLE OF CONTENTS

Instrument Overview 194

Data Loggers

Static Strainmeters 198

TS-963/TS-960 (High-speed, High-accuracy, High-functionality) 202
T-ZACCS UNIT EU-10VO 212
T-ZACCS UNIT EU-10DO 213
T-ZACCS BOX EX-50H 214
T-ZACCS UNIT EU-10H 217
T-ZACCS UNIT EU-10D 220
T-ZACCS + EI-01P (switch box protocol converter) 221
T-ZACCS + EE-00R repeater 222
TS-560 223
TS-360 (Portable data logger) 227
T-ZACCS BOX AU-50 233
TDS-540 (General-purpose type) 235
IHW-50G (High-speed) 241
ISW-50G 244
SSW-50D 247
TDS-150 (Portable) 248
TC-37K (Handheld) 253
TC-32K (Handheld) 259
RPC-05A (Remote power controller) 264

Networked Measurement System

TML-NET 265
ND-100 (Network driver) 266
NIF-100 (network interface) 266
TC-35N (Handheld) 267
MD-111 (monitoring system controller) 268
NSW Series (Network Modules) 270
TML-NET Compatible Transducers 272
NNZ-2A (Lightning arrester for the TML-NET) 273

Data Loggers

Dynamic Strainmeters 274

DS-50A (Multichannel) 276
DRA-162B (Digital dynamic strainmeter) 279
DC-204R / DC-204Ra (Ultraminiature) 283
DC-004P (PC control type) 288
DH-14A (Handheld) 291
DA-17A (Carrier type) 294
DA-18A (Carrier type) 295
DA-37A (Carrier type) 296
DA-38A (Carrier type) 297
DC-96A / DC-97A (DC type) 298
TA-01KT 300

Bridge Box

SB-122A 301
SB-123A/SB-353A 301
SB-120SB 302
SB-120PY 302
SB-120B/SB-350B 302
SB-128A/SB-128A-10/SB-358A 302
SB-120DD-1R/4R/SB-350DD-1R 303
SB-120DG-1R2/1R3/4R/SB-350DG-1R2/1R3 303
Related Products (for dynamic strainmeters) 304

Telemetry System

DT-221T/DT-281R 305

Multi-Recorder TMR-300 series

TMR-311 (control unit) 308
TMR-381 (Display unit) 309
TMR-321 (Strain 4G unit) 310
TMR-322 (Strain 1G2G4G unit) 310
TMR-323 (Carrier type strain unit) 311
TMR-331 (Voltage input unit) 311
TMR-332 (Thermocouple voltage unit) 312
TMR-341 (Voltage output unit) 312
TMR-351 (CAN unit) 313
TMR-353 (Digital I/O unit) 313
TMR-354 (GPS unit) 314
TMR-361 (Charge amplifier unit) 314
TMR-362 (IEPE unit) 315
TMR-371 (Distribution unit) 316
TMR-371-1 (Distribution adapter) 316
TMR-372 (Synchronization unit) 317
TMR-311-01 frequency analysis library (Software option of the TMR-311) 317
Related Products, Attached Software 318

Stress Frequency Analysis 319

Indicators 322

TD-98A 323
TD-96A 324

USB Strain Converter

DSCUSB 325

Pocket Road Meter / Pocket Data Logger

MM-014L 326
MM-014 327
MM-01V 328
MM-01T 329

Digital Indicator

TD-30L (High-precision) 330
TD-91B (for instrumentation) /TD-91BB (desktop type) 331

Related Products

CB-2R (Strain checker) 332
JB-2/JB-4 (Averaging junction box) 333

Cable / Connector

Power Cable 334
Ground Wire / Output Cable / Attenuator 335
Data Cable 336
Data Cable 338
Switch Box Extension Cable / AC Adapter 339
Printer Paper / Precision Fixed Resistor, Connector 340

Instrument

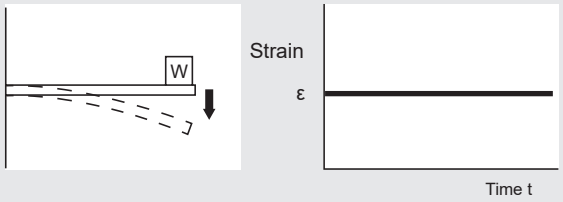
Static Strain and Dynamic Strain

Strain that is considered not to change over time is called static strain, while strain that changes over time is called dynamic strain. There are two types of strainmeters: static strainmeters intended to measure static strain and dynamic strainmeters intended to measure dynamic strain.

The data loggers introduced in this catalog are representative of static strainmeters. Dynamic strainmeters are digital-type instruments in addition to standard analog-type instruments. There are also measuring instruments such as histogram recorders that measure histograms, or frequency distributions, of dynamic phenomena.

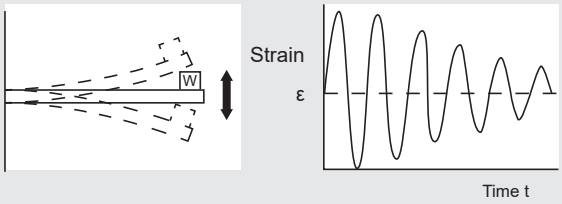
Static strain

When the amount of strain measured does not change with time or changes slowly.



Dynamic strain

When the amount of strain measured changes quickly with time.
This also includes vibration phenomena that vary sinusoidally at a certain frequency.



Classification of Strainmeters

In this catalog, strainmeters are divided into the following product groups according to their intended uses and functions.

- **Data Loggers / Static Strainmeters**

  Since static strain can be considered not to change during measurement, it is possible to measure a large number of measuring points using a single measuring instrument by switching the points sequentially. The strain is obtained as a digital value. By combining the unit with a switch box, multi-point automatic switching measurements can be performed. Recently, performance has been further improved, such as faster measuring speed and fulfilling processing functions in particular.

- **Dynamic Strainmeters**

  Since dynamic strain changes over time, it is amplified and output as an analog signal, and the signal is recorded on a separately provided recorder for measurement. Basically, one measuring instrument and one recorder are required for each measuring point. Recently, there are digital dynamic strainmeters that can digitize analog signals at high speed, record them in internal memory, and then transfer them to a PC.

- **Multi-recorders**

  This equipment is a compact multichannel data recording system that can be freely combined with a variety of measuring units according to the purpose. In addition to analog input units for temperature using strain gauges, strain gauge type transducers, DC voltage, or thermocouples, distribution units that enable widespread distributed allocation of voltage output units and measurement units are also available.

- **Histogram Analysis**

  The histogram (frequency) of the forces generated in a member is obtained by frequency analysis of dynamic waveform data recorded by dynamic strainmeters, such as a multi-recorder system. It is effective to understand the magnitude and trend of dynamic phenomena occurring in vehicles, bridges, and other facilities or structures.

- **Indicators**

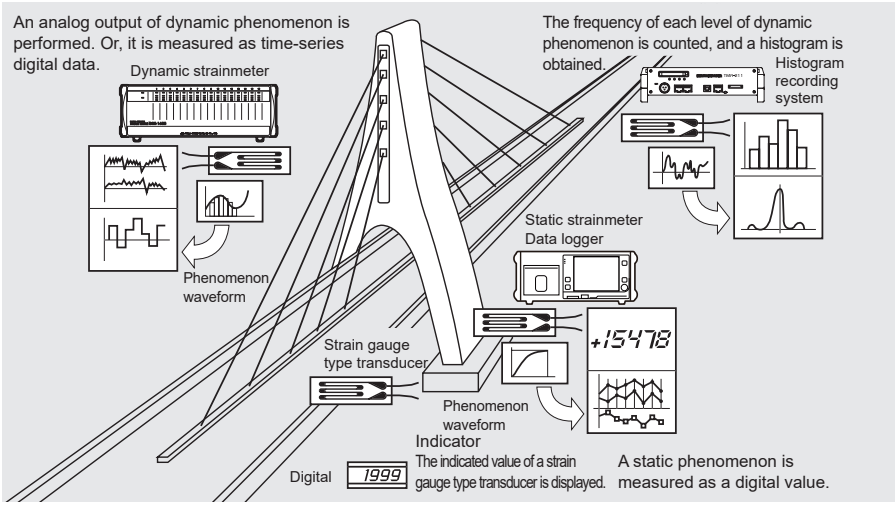
  Indicators are available as measuring instruments dedicated for strain gauge type transducers, such as load cells, displacement meters, and pressure meters. For industrial use, panel mountable models and models with upper and lower limit setting functions are available.

- **Strain Checker**

  A strain checker is also available for operation checks and sensitivity calibrations of measuring instruments.

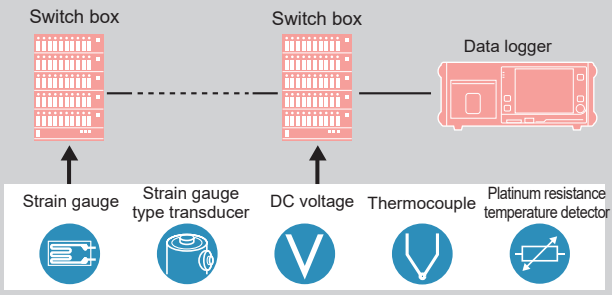
- **Other**

  Connection cables between devices, power cables, printer paper, and various connectors are also available.

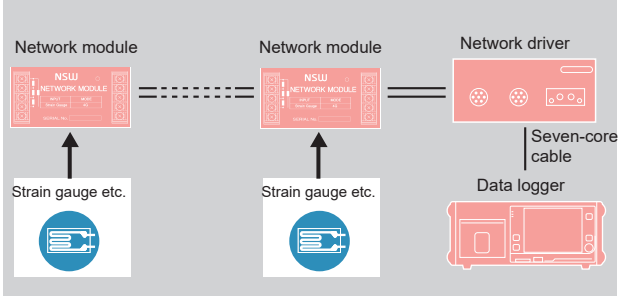


Data Logger and Network Measuring System

The combination of a data logger and a switch box is a widely used system for static measurements. Sensors, such as strain gauges and transducers, are connected to the switch box via sensor cables. The switch box and the data logger are connected via a switch box extension cable. When there are two or more switch boxes, it is possible to connect them sequentially via a single cable (cascade connection), such as between the data logger and the first switch box, between the first and second switch boxes, and so on. Even if the cable between the data logger and the switch box is extended, there will be no influence on the characteristics as long as the cable length is within the specifications.



On the other hand, the network measuring system is a completely new method of automatic measurement for multiple points. A network module is installed near each of the sensors such as strain gauges and transducers. The network modules are connected sequentially (cascade connection) via 2-core cables. Each network module is a so-called small digital strainmeter equipped with such functions as amplification and A/D (analog-digital) conversion to transmit measurement data via a cable according to a command from the network controller. Therefore, data from the sensors connected to the network can be freely obtained on the controller. By connecting a network driver to the data logger, it can be used as a controller.



Explanation of function identification marks for measuring instruments

The functions of the same measuring instrument may differ depending on the version. In such cases, the applicable functions are displayed using the following function identification marks.



This mark is attached to a measuring instrument with the default setting of the complete compensation method of strain.

This mark indicates a measuring instrument that supports the complete compensation method of strain.

This mark indicates a measuring instrument equipped with wireless LAN.

Instrument

Main Terms of Measuring Instruments

The main terms used in this chapter of this catalog are shown below. For the terms of data loggers and dynamic strainmeters, also refer to pages 199 and 275.

- **Number of Measuring Points**

  The number of points that can be measured using a measuring instrument. For a static strainmeter, such as a data logger or switch box, the number of points that can be switched for measurement is indicated. For a dynamic strainmeter, the number of points (channels) that can be measured at the same time is indicated.

- **Applicable Gauge Resistance**

  This is the measurable resistance value of a strain gauge (or strain gauge type transducer).

- **Bridge Excitation**

  For a power supply applied to a bridge circuit in strain measurement, distinctions between voltage and current and between DC and AC are indicated. For a measuring instrument that applies bridge excitation in pulsed form, the pulse width is indicated. In addition, when the bridge excitation is AC, the frequency is also indicated.

- **Switching Speed**

  The time required to measure 1 point using a data logger is indicated.

- **Scanning Speed**

  The time required to perform one measurement using a data logger is indicated.

- **Measuring Speed**

  The time to complete one measurement using a data logger is indicated. (This includes the time required for calculation and recording processing.)

- **Sampling Speed**

  The speed at which a phenomenon is continuously digitized using a dynamic digital measuring instrument is indicated.

- **Balancing Range**

  The range of initial unbalance value that can be adjusted by a measuring instrument.

  For a carrier type measuring instrument using AC for the bridge excitation, the capacity value is also indicated in addition to the resistance value.

- **Balancing Accuracy**

  The accuracy of the balancing operation. The value converted into an input strain value or the like is indicated.

- **Measuring Range**

  The range in which measurements can be performed while meeting the specifications.

- **Storage range of Initial value**

  The range of initial value that can be stored.

- **Sensor Mode**

  The distinction and setting of a measuring object, such as the measuring method (one-gauge method, four-gauge method, etc.) when measuring strain or the type of thermocouple when measuring temperature, is indicated.

- **Response Frequency Range**

  The frequency range in which the output can respond to a sinusoidally changing input while meeting the specifications. The frequency where the output becomes -3 dB (approximately 70% of the output) is indicated.

- **Measuring Mode**

  The processing method of measurement value in a data logger is indicated. The measuring modes include initial measurement, direct measurement, and measure measurement.

  Initial measurement:
  In strain measurement, there is an initial unbalance value (also called initial value) even in an unloaded state. This value is measured and stored.

  Direct measurement:
  A measured value (which includes the initial unbalance value and is called direct value) is measured as is.

  Measure measurement:
  The stored initial value is subtracted from the direct value and the resulting value is output. Therefore, the change from the initial value is measured.

- **Accuracy**

  The limit value of error under specified conditions.
  It is expressed as a percentage (% rdg or %FS) of the indicated value or measuring range. Here, rdg = reading (indicated value) and FS = full scale (measuring range).

- **Resolution**

  The smallest amount of change that can be measured.

- **Non-linearity**

  The maximum deviation of a measurement curve from a straight line connecting the base point and the maximum value of output, such as in the output of an amplifier or the indicated value of an indicator. It is expressed as a percentage of the maximum measurement value.

- **Stability**

  The change in zero point or sensitivity due to a change in temperature, time, etc.

- **Signal to Noise Ratio**

  The ratio of specified output to noise at a set sensitivity. It is expressed in decibels (dB).

$$\text{Decibel} = 20 \log_{10} \frac{2\times\text{Output voltage}}{\text{Noise voltage}}$$

- **Sensitivity**

  The output (voltage, current, indicated value, etc.) for an input under specified conditions.

- **Operating Temperature and Humidity Range**

  The temperature and humidity ranges in which the measuring instrument can be used while meeting the specifications.

Data Loggers / Static Strainmeters

A data logger can be configured as a system according to the number of measuring points and has such functions as calculation, recording, and processing of measurement values.

The measuring objects are not limited to strain because the voltage and temperature can also be measured. Please select the most suitable model based on the number of measuring points, switching speed, processing functions, and other factors.

Data Loggers: Measuring time at maximum number of measuring points

Data logger	Measurement box	Number of Measuring Points	Measuring speed [Measuring interval]
T-ZACCS9 TS-963/-960 data logger	T-ZACCS BOX EX-50H	1000	Data update rate: Display and record measurement value updating cycle: 0.1 sec
	TS-963 built-in unit	30	
	TS-960 built-in unit	10	
Data logger	**Switch box**	**Number of Measuring Points**	**Scanning speed [Measuring time]**
T-ZACCS5 TS-560 data logger	IHW-50G	1000	0.4 sec/1000 points (0.04 sec/point) (1 sec)
	ISW-50G	1000	2 sec/1000 points (0.04 sec/point) (3 sec)
T-ZACCS3 TS-360 portable data logger	AU-10 AU-10-05	1000	80 sec/1000 points (0.08 sec/point) (80 sec)
	SSW-50D	1000	80 sec/1000 points (0.08 sec/point) (80 sec)
TDS-540 data logger	IHW-50G	1000	0.4 sec/1000 points (0.04 sec/point) (1 sec)
	ISW-50G	1000	2 sec/1000 points (0.04 sec/point) (3 sec)
	SSW-50D	1000	80 sec/1000 points (0.08 sec/point) (80 sec)
	Built-in (High-speed type)	30	0.4 sec/30 points (0.04 sec/point) (1 sec)
	Built-in (Standard type)	30	1.2 sec/30 points (0.04 sec/point) (2 sec)
TDS-150 portable data logger	FSW-10	50	4 sec/50 points (0.08 sec/point) (4 sec)
	FSW-10L	50	4 sec/50 points (0.08 sec/point) (4 sec)
TC-37K handheld data logger	CSW-5B	5	0.4 sec/5 points (0.08 sec/point) (1 sec)
	Main body itself	1	0.08 sec/1 point (0.08 sec/point) (0.1 sec)
TC-32K handheld data logger	CSW-5B	5	0.4 sec/5 points (0.08 sec/point) (1 sec)
	Main body itself	1	0.08 sec/1 point (0.08 sec/point) (1 sec)

Model List

Model name Measurement item	TS-963/-960	TS-560	TS-360	TDS-540	TDS-150	TC-37K	TC-32K
Strain	◎	◎	◎	◎	◎	◎	◎
DC voltage	◎	◎	◎	◎	◎	◎	◎
Thermocouple	◎	◎	◎	◎	◎	◎	◎
Platinum resistance temperature detector	◎	◎	—	◎	◎	◎	◎
Max. number of measuring points	1000	1000	1000	1000	100	5	5
Max. number of built-in boxes	TS-963 : 30 TS-960 : 10	—	50	30	50	1	1
Display	9-inch TFT LCD 800 x 480 dots Touch panel Japanese / English switchable	Color LCD 320 x 240 dots Touch panel Japanese / English switchable	Monochrome LCD 255 x 160 dots Japanese / English switchable	Color LCD 320 x 240 dots Touch panel Japanese / English switchable	Monochrome LCD 255 x 160 dots Japanese / English switchable	Monochrome LCD 255 x 160 dots Japanese / English switchable	Monochrome LCD 255 x 160 dots Japanese / English switchable
Interface	LAN、USB、RS-232C	LAN、USB、RS-232C	LAN、USB、RS-232C	LAN、USB、RS-232C Wireless LAN (Options)	USB、RS-232C、 LAN (Options)	USB、RS-232C	USB、RS-232C
Data recording	Built-in memory, SD card	Built-in memory, SD card USB memory	Built-in memory, SD card	Built-in memory, SD card USB memory, built-in printer	Built-in memory CF card	Built-in memory, SD card	Built-in memory, CF card
Data processing	Coefficient calculation Function calculation Rosette analysis, etc.	Coefficient calculation	Coefficient calculation	Coefficient calculation	Coefficient calculation	Coefficient calculation	Coefficient calculation
Other functions	High-speed mode, high-accuracy mode, interval measurement, comparator measurement, alarm, sampling measurement, sequence control, high-resolution mode, strain and temperature simultaneous measurement, graphic monitor, 1000-point 0.1 second high-speed measurement, sensor ID, analog output (optional), external printer (optional)	Interval timer, quick interval, monitor comparator, high-resolution mode, strain and temperature simultaneous measurement, remote data logger, sensor ID, TEDS compatible	Interval timer, monitor comparator, battery powered, long-term unmanned measurement, TML-NET compatible, external printer (optional), alarm unit	Interval timer, quick interval, monitor comparator, high-resolution mode, strain and temperature simultaneous measurement, remote data logger, sensor ID, TEDS compatible	Interval timer, monitor comparator, battery powered, long-term unmanned measurement, switch box TML-NET Drive board (optional), alarm unit (optional), wireless module (optional), external printer (optional), concrete sensor mode, TEDS compatible	Interval timer, battery powered, long-term unmanned measurement, handheld, TEDS compatible	Interval timer, battery powered, long-term unmanned measurement, handheld, TEDS compatible
Page	202	223	227	235	252	253	259

Main Features of Data loggers

● Coefficient calculation

This function multiplies the measurement value by a coefficient when compensating the gauge factor of a strain gauge or converting the output of a strain gauge type transducer into a physical quantity. For data loggers, a gauge factor of 2.00 is the standard, and the value measured under this condition is multiplied by a coefficient. Therefore, a coefficient of 1 corresponds to a gauge factor of 2. For gauge factor compensation, set 2 / (gauge factor of the strain gauge used). In the case of a direct reading measurement of a transducer, the calibration coefficient is set, in principle. (Details vary depending on the data logger.) The voltage is measured by direct reading when the coefficient is 1. In the data logger specifications, the measuring range, resolution, and other elements are shown with a coefficient of 1. Since the coefficient is multiplied by a digitized value, it is not possible to change the substantial resolution and measuring range by the coefficient setting.

● Function calculation

The TS-963/-960 has a function for calculation processing of measurement values of 2 or more points. It is possible to perform calculations using four arithmetic operations and specified functions, and arithmetic expressions can be set arbitrarily. In addition, since they have programs for rosette analysis and horizontal displacement measurements using a multistage inclinometer, calculation results can be obtained simultaneously with the measurement by setting the channel number and other conditions.

● Interface

The RS-232C, LAN, and USB interfaces for controlling the data logger and transferring measurement data using a PC are provided. (Details vary depending on the model). Everything from the settings to data processing can be performed from a PC.

● Interval timer

This function performs an automatic measurement at regular time intervals. The time interval and number of auto starts can be set for each step with 10 to 100 steps depending on the model. In addition, the TS-963/-960 is equipped with timer tables of 10 systems, each of which can be used as an independent interval timer.

● Monitor comparator (Data comparator)

This function performs automatic measurements based on changes in the monitor value. As an example, it is possible to perform automatic measurements by monitoring the load value in a static load test.

● Alarm measurement

The TS-963/TS-960/TS-360/TDS-150/MD-111 models are equipped with a function that performs automatic measurements of all points when either the monitor value or measurement value exceeds a set value. In addition, the TDS-150 and MD-111 can output an external contact signal when an alarm occurs (optional for the TDS-150).

TS-360 can also output external contact signals when connected to the AL-360.

● Application method of bridge excitation

There are two methods of applying bridge excitation during strain measurements. The constant voltage method, which keeps the voltage constant, and the constant current method, which keeps the current constant. The constant voltage method is characterized by the wide range of bridge resistance values that can be connected, and is the method used in strain measurement mode unless otherwise specified. However, with this method, a reduction in sensitivity occurs because of the resistance of the extension cable beyond the switch box, so compensation by calculation may be required. With the constant current method, the loss of sensitivity due to cable resistance is extremely small, but the bridge resistance value that can be connected is limited.

● Remote measuring system

This is a system that performs data collection by connecting a measuring instrument installed in a remote location using a wired or wireless modem. To perform long-term measurements using batteries, the main power supply for the measuring instrument can be controlled by a dedicated remote power controller. Therefore, in addition to automatic measurements at regular time intervals, data can be obtained at any time.

● Sensor ID

This indicates the sensor related setting items (sensor mode, coefficient, unit and display digits) and can be managed by an arbitrary sensor ID number. By calling a saved sensor ID from the recording media, the setting for the sensor to be used can be easily reflected in the channel setting.

The function related to sensor ID can be used with the TS-963/TS-960/TS-560/TDS-540/MM-014 models.

● Network measuring system

A network module is installed near each sensor, such as a strain gauge or transducer, and the modules are connected sequentially with a two-core cable to form a network. The module digitizes the measurement data and sends it over the network, where it is collected by a network controller. This is a completely new measuring system that differs from ordinary data loggers. By connecting a network driver to the data logger, it can be used as a controller.

● Complete compensation method of strain

Our data loggers are equipped with a complete compensation method of strain using a Wheatstone bridge. This is a strain measuring method that eliminates the influence of the initial unbalance value and the bridge nonlinearity error.

For details on the complete compensation method of strain, refer to page 201.

● Reading of TEDS sensor

The Transducer Electronic Data Sheet (TEDS) has sensor information stored on an IC chip inside the sensor. This function allows a TEDS-compatible measuring instrument to automatically recognize a sensor by reading the parameters from this information.

Compatible measuring instruments

TS-560, TDS-540, TDS-150, TC-37K, TC-32K, TD-30L, MM-014, MM-014L,TD-96A

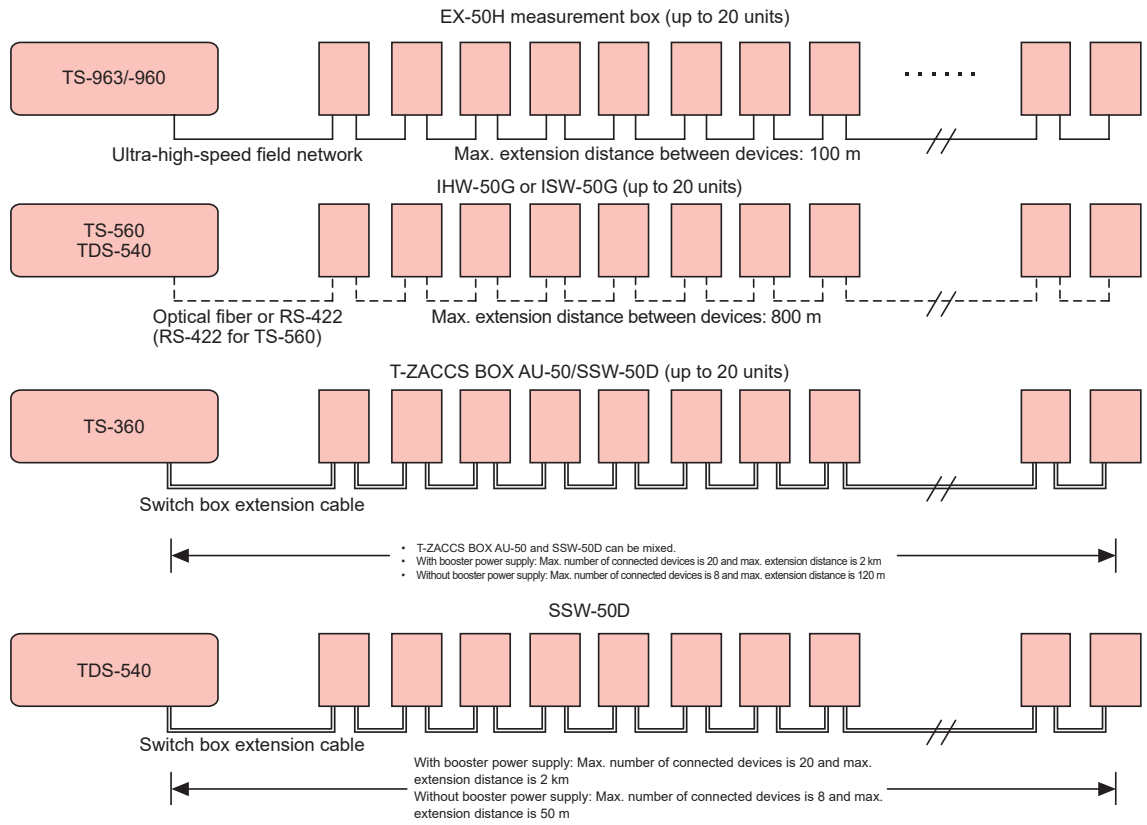
Data Loggers / Static Strainmeters

Operational Functions by Combination of Data Logger and Switch Box

Data logger	Switch box	Number of points/unit	one-gauge method four-wire type	Strain	Strain constant current	High-resolution mode	DC voltage	Thermocouple	Platinum resistance temperature detector	Strain and temperature simultaneous	Connector combined use	Connection
T-ZACCS9 TS-963/-960	T-ZACCS BOX EX-50H*5	50	—	○	○	○*2	○	○	○	○	○	Ultra-high-speed field network
	T-ZACCS+EI-01P, IHW-50G	50	○	○	○	○	○	○	○	○	○*3	Ultra-high-speed field network, RS-422
	TS-963 built-in unit	30	—	○	○	○*2	○	○	○	○	○	—
	TS-960 built-in unit	10	—	○	○	○*2	○	○	○	○	○	
T-ZACCS5 TS-560	IHW-50G	50	○	○	○	○	○	○	○	○	○*3	RS-422 (Optical fiber can be used between switch boxes)
	ISW-50G	50	○	○	○	○	○	○	○	○	○*3	
T-ZACCS3 TS-360	AU-10	10	—	○	○	—	○	○	—	—	—	Connector connection
	AU-10-05	10	—	○	○	—	○	○	—	—	○	
	SSW-50D	50	○	○	○	—	○	○	—	—	○*3	Switch box extension cable
TDS-540	IHW-50G	50	○	○	○	○	○	○	○	○	○*3	Optical fiber or RS-422
	ISW-50G	50	○	○	○	○	○	○	○	○	○*3	
	SSW-50D	50	○	○	○	○	○	○	—	—	○*3	Switch box extension cable
	Built-in	30	○*4	○	○	○	○	○	○	○	○	—
TDS-150	FSW-10	10	○	○	○	—	○	○	○	—	○	Connector connection
	FSW-10L	10	○*1	○	○	—	○	○	○	—	—	
T-ZACCS3 TC-37K	CSW-5B	5	○*1	○	○	—	○	○	○	—	○*3	Dedicated cable
	Main body only	1	○	○	○	—	○	○	○	—	○	—
TC-32K	CSW-5B	5	○*1	○	○	—	○	○	○	—	○*3	Dedicated cable
	Main body only	1	○	○	○	—	○	○	○	—	○	—

*1: A sensor cable can only be connected with loose tip wires.
*2: Strain high-resolution mode cannot be used in high-speed mode.
*3: Connector combined use is only compatible with the “-05”.
*4: This requires a one-gauge, four-wire unit (optional).
*5: Measurement box

Switch Box Connection Examples and Extension Distances



Complete Compensation Method of Strain Using Wheatstone Bridge

In strain measurements, an initial unbalance value almost always occurs. Conventionally, this initial unbalance value was considered an initial strain and was subtracted from the measurement value when strain occurred to obtain the strain. In addition, since the relationship between the bridge output voltage and strain was not proportional, compensation of the nonlinearity was required for any large strain value. Recent technological advances have been rapid, and high-speed, high-accuracy, and high-resolution measurement instruments with a wide measurement range have been developed for strain measurements. As a result, it is now possible to perform severe analysis and processing of measurement data as well, making it possible to see unnatural points that would previously not have been issues or could not be seen. These include measured strain that differed depending on the magnitude of the initial unbalance value, that although compensation of apparent strain was performed, there was somehow a lack of continuity in the strain data, and when measuring large strain, the strain gauge was replaced midway through, but continuity was still questionable. In addition, in multipoint measurements using the one-gauge method, three-wire type, the lead wires at all measuring points are made the same length in order to simplify compensation for decreased sensitivity due to the lead wires. For this reason, the lengths of the lead wires should be adjusted to match that of the measuring point with the longest length, and the space to store the excess lead wires is enormous. In addition, this also increases the cost.

Our complete compensation method of strain is a revolutionary strain measuring method that eliminates the influence of the initial unbalance value and reduces the bridge nonlinearity error to zero, thereby resolving all of the above-mentioned questions. Its features are as follows.

(1) The measurement error due to initial unbalance value is zero. (One-gauge method, one-gauge method, three-wire type, two-gauge common dummy method)
It is not influenced by the resistance values of the strain gauge and lead wires that cause the occurrence of the initial unbalance. In addition, the resistance values can be any values as long as they are within the initial unbalance value range of the measuring instrument.

(2) The bridge nonlinearity error is zero. (One-gauge method, one-gauge method, three-wire type, two-gauge common dummy method)
Conventional nonlinearity compensation is subject to a condition where the initial imbalance value is zero. For the complete compensation method of strain, there is no such condition.

(3) In the one-gauge method, three-wire type, reduced sensitivity due to the lead wires is compensated automatically.
The lead wire at each measuring point may only be of the minimum necessary length, and this results in a significant cost reduction.

(4) Complete compensation of apparent strain by the temperature of the strain gauge (one-gauge method, one-gauge method, three-wire type, two-gauge common dummy method)
Apparent strain is data in a strain-free state, not data when strain occurs. Compensation according to the strain is required. This is particularly effective in cases of large apparent strain.

(5) Compensation of error occurring when replacing the strain gauge (one-gauge method, one-gauge method, three-wire type, two-gauge common dummy method)
For large strain measurements, the strain gauge is replaced to measure further strain. In that case, accurate strain cannot be calculated unless the amount of strain at the time of replacement is used, and then the measured strain is compensated.

As an example, the graphs show the measurement results when a constant strain is generated using strain gauges with different resistance values. Figure 1 shows the conventional measurement results, and Figure 2 shows the measurement results using the complete compensation method of strain. The difference is clearly visible. (Features (1) and (2): [Comet-A])
Additionally, in the past, for decreased sensitivity due to lead wire resistances, the compensation calculation was performed on the measurement results (Figure 3). In contrast, for a data logger that adopts the complete compensation method of strain, automatic compensation is performed, and the influence of decreased sensitivity due to the lead wire resistances is eliminated as shown in Figure 4. (Features (1), (2) and (3): [Comet-B])

●Influence of Difference in Resistance Values of Strain Gauges on Sensitivity

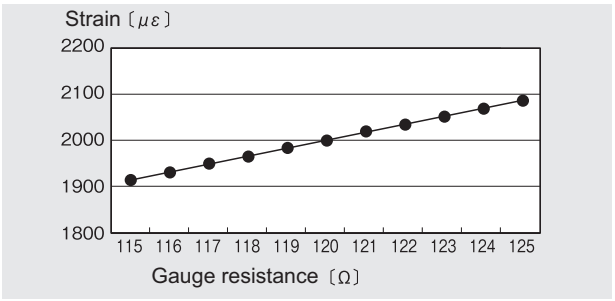


Figure 1. Conventional Measurement Results

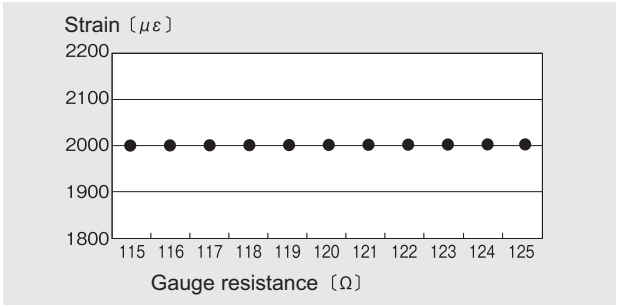


Figure 2. Measurement Results by Complete Compensation Method of Strain

●Influence of Lead Wire Resistances on Sensitivity

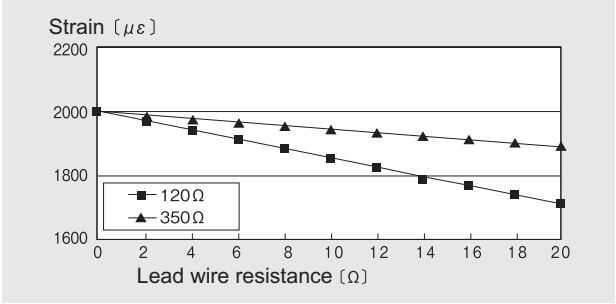


Figure 3. Conventional Measurement Results

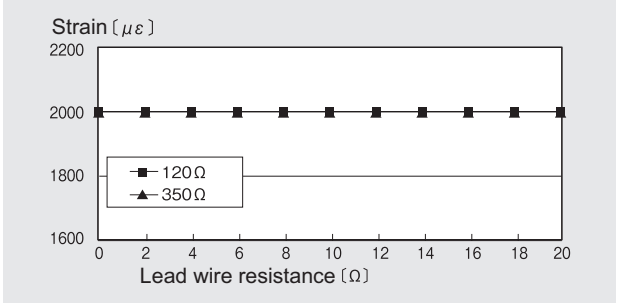


Figure 4. Measurement Results by Complete Compensation Method of Strain

TS-963/TS-960 (High-speed, High-accuracy, High-functionality) T-ZACCS 9

- Up to 1000 points (+ 1000 channels of strain gauge with temperature measurement function + 100 channels of expansion CH)
- Our unique next-generation A/D method that achieves both high accuracy and high stability and high-speed measurement realizes high-precision, high-stability and high-speed measurement.
- High-speed measurement with a maximum interval of 0.1 seconds
- Secure data retention by robust built-in data memory and UPS circuit
- Realization of stable interval measurement with a clock accuracy of ±1 second per day
- Collective setting of coefficient, unit, decimal point and sensor type by Sensor ID
- Equipped with high-resolution (0.1 x 10^{-6} strain) mode
- Equipped with Complete Compensation Method of Strain (Comet)
- Various check functions can be performed automatically by a timer.
- Equipped with a 9-inch-wide LCD touch panel, the wide screen and easy-to-use screen configuration allow for comfortable operation.
- Supports Japanese and English displays
- Fulfilling monitor functions that can display various numerical values and graphs in five tables and four frames.
- Equipped with DVI output for display on an external display (our recommended product)
- Automatic measurement (interval measurement, comparator measurement, alarm, sequence measurement, and sampling measurement)
- Equipped with an expansion channel function that performs calculations in real time based on the calculation formula set by the user.
- By using the expansion channel function, various calculations including inter-channel calculations, logical calculations, and rosette analysis can be performed.
- Equipped with a remote data logger function, the data logger can be operated from a Web browser.



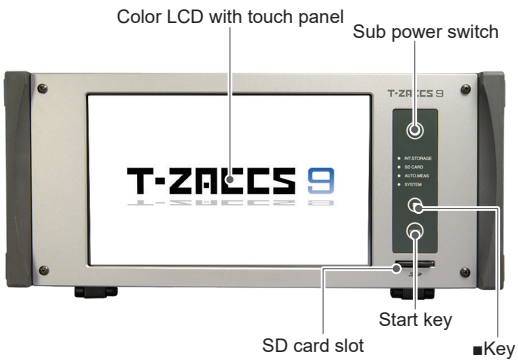
T-ZACCS9 TS-960 high-speed, high-accuracy, high-functionality data logger



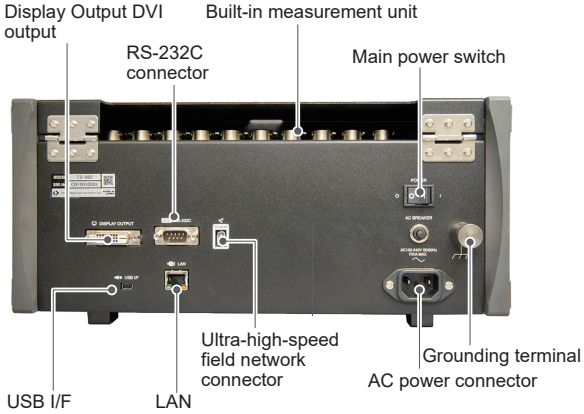
T-ZACCS9 TS-963 high-speed, high-accuracy, high-functionality data logger

This equipment is a data logger of the T-ZACCS9 series that combines high speed, high accuracy, and high functionality. This equipment allows you to measure strain gauges, strain gauge type converters, thermocouples, platinum resistance temperature detectors, DC voltages, and other equipment. The number of measuring points of the TS-963 is 30 points for its built-in measurement unit and that of the TS-960 is 10 points for its built-in measurement unit. By using external measurement boxes, it is possible to measure up to 1000 points, making it possible to measure measurements of any scale. By adopting our unique next-generation A/D method that achieves both high accuracy and high stability and high-speed measurement, and an ultra-high-speed field network based on Ethernet, various thermo-electromotive forces, zero movement of the amplifier, and commercial power supply noise are eliminated, and high-precision and high-stability measurements are realized. At the same time, regardless of the number of measurement points, the high-speed mode measures at 0.1-second intervals and the high-precision mode measures at 0.4-second (50 Hz) intervals, achieving stress-free operability, and a wide range of phenomena from static phenomena to quasi-dynamic phenomena can be measured. Various monitors, various automatic measurements, and various calculations are possible without using a PC. Using an external analog output unit, voltage output can be linked to the measurement value and/or the calculation result of an expansion channel.

Front Panel (TS-960)



Back Panel (TS-960)



Equipped with built-in measurement unit

TS-960 data logger comes standard with 10 built-in measurement units, while the TS-963 comes standard with 30 built-in measurement units.

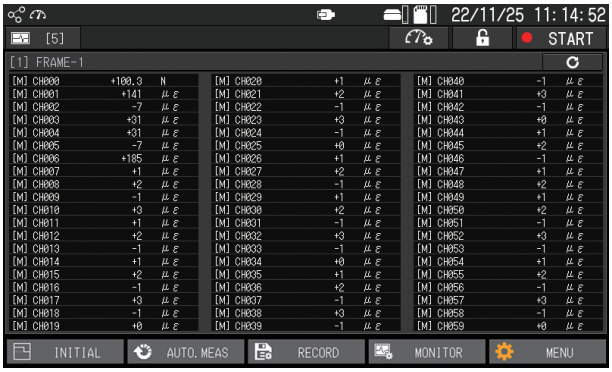


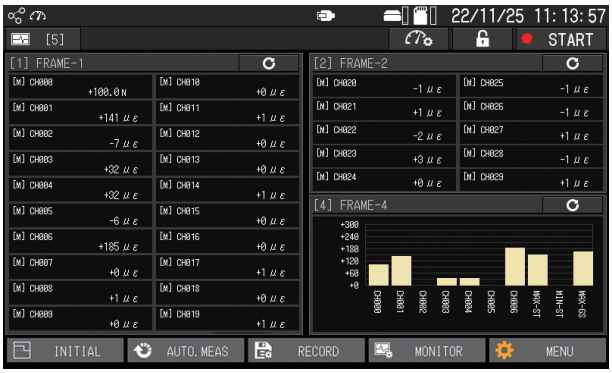
No delay in measuring intervals due to an increase in the number of measuring points

The built-in measurement unit of the TS-963/-960 and the EX-50H measurement box and the EU-10H measurement unit can measure every 0.1 sec in high-speed mode. The TS-963/-960 is capable of recording the measurement values and displaying the monitor in a manner that completely tracks the measurement. There is no delay in measuring intervals due to an increase in the number of measuring points. It is now possible to monitor and record the measurement value closer to real time.

Fulfilling monitor display functions

On the monitor display screen, the measurement data can be checked in real time with the measurement value updated every 0.1 sec.
Taking advantage of the 9-inch-wide screen, up to 60 points of the measurement data can be displayed at the same time.

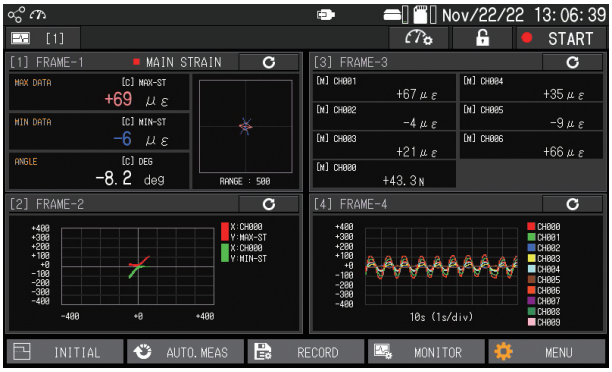




The TS-963 can monitor 30 channels of the built-in measurement unit.
The display format can be selected according to your purpose from the numeric monitor, max / min display, and graph display (Y-T graph, X-Y graph, bar graph, vector graph).

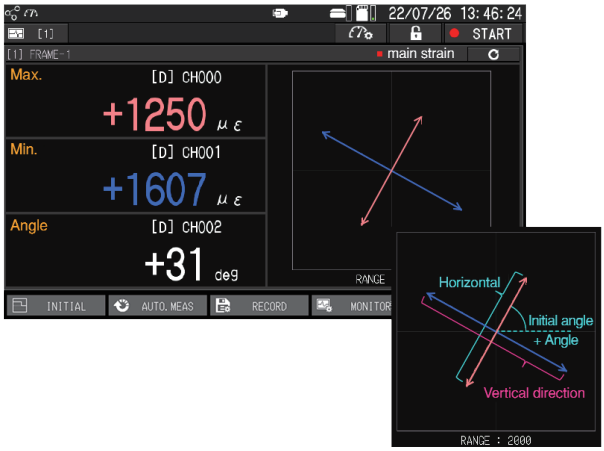
Switching of monitor display settings

It is possible to have up to five tables of display settings for the monitor, and the settings can be switched seamlessly.



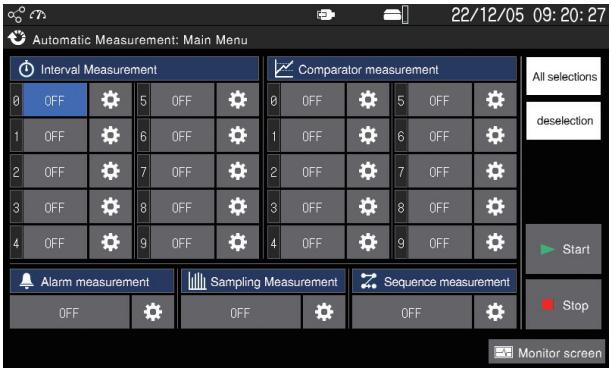
Vector display function

Up to three channels are assigned to the horizontal component, vertical component, and angle to display as a vector. Combined with the rosette analysis using extended channel calculations, multi-axis phenomena can be grasped intuitively.



Automatic measurement

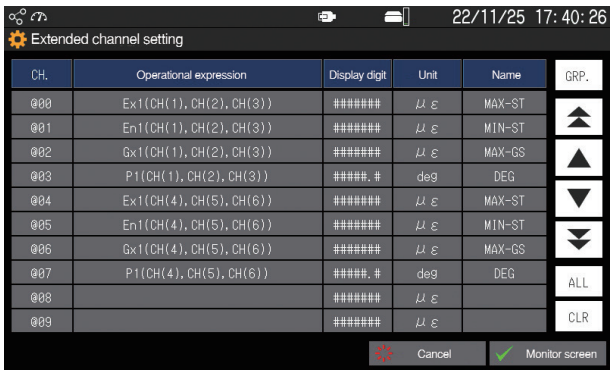
Equipped with interval measurements of 10 systems x 100 steps, comparator measurements of 10 systems x 100 steps, alarms, and sampling measurements, it is possible to execute multiple automatic measurements at the same time.
In addition, it is also equipped with sequence measurements that control and execute a series of measurements by combining the various functions and conditions in sequence.

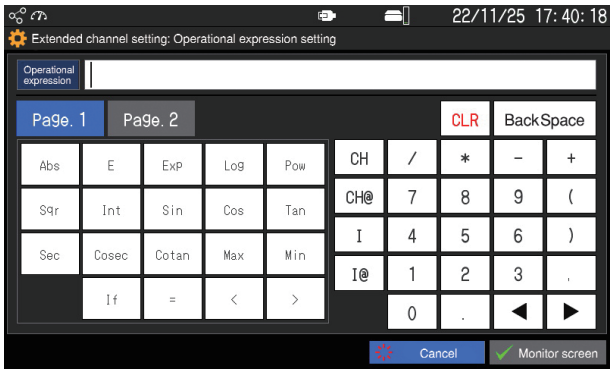


TS-963/TS-960 (High-speed, High-accuracy, High-functionality)

Expansion channel function

The expansion channel function performs a calculation in real time based on the calculation formula set by the user. The calculation result can be displayed, recorded, and output to an interface as with normal measurement values. In addition, the function also supports the judgment condition of automatic measurement and analog output.
For the calculation formula, it is possible to combine constants, measurement values, four arithmetic operations, and functions with various calculation functions. Since logical operations (IF statement, max, min) can be used as functions, it is possible to obtain calculation results according to the conditions, which allow for highly flexible settings compatible with various measurement systems.





Recording

The TS-963/-960 has a built-in memory with a storage capacity of 4 GB, allowing recording of even multi-point, long-term, and high-frequency measurement. It is also possible to perform recording corresponding to measurements at 100 ms intervals and multipoint high-speed recording is possible in CSV format (with header information). In addition, a standard SD card is adopted as external memory, so the data can be checked easily.

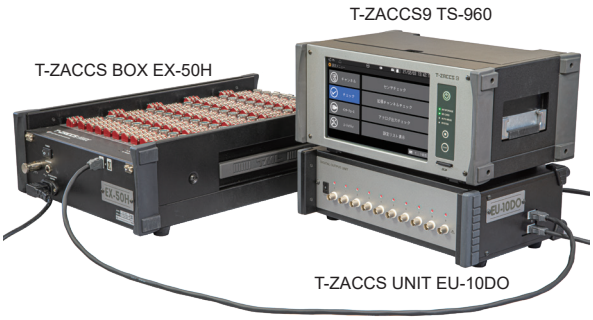
Analog output

By connecting the EU-10VO analog output unit, the TS-963/-960 can perform analog output of the value of any measuring point and expansion channel with high resolution.

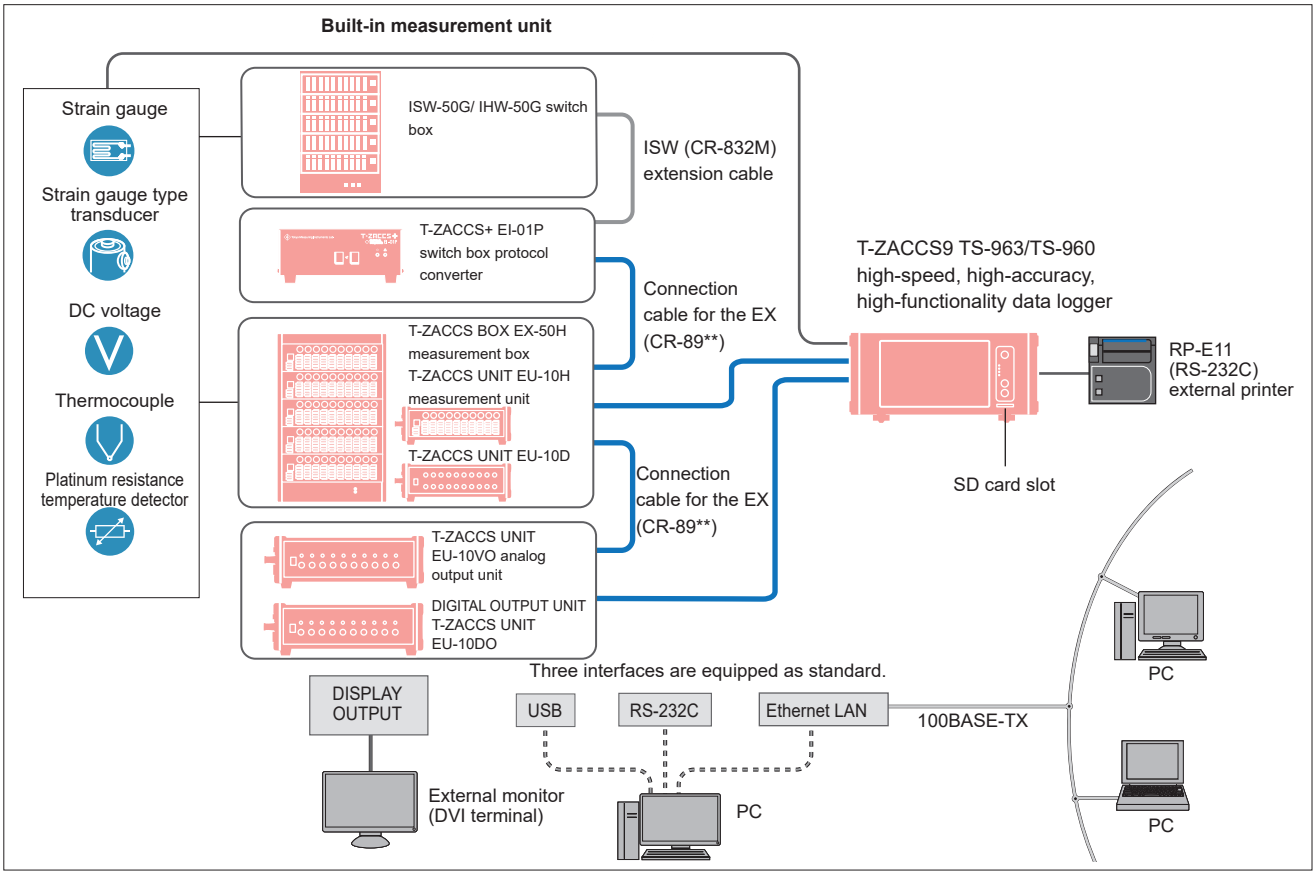


Digital output

By connecting the dedicated EU-10DO digital output unit, it is possible to output up to 10 points of the TTL/LVTTL level digital signals at the same time based on the trigger and alarm conditions set on the TS-960/TS-963.

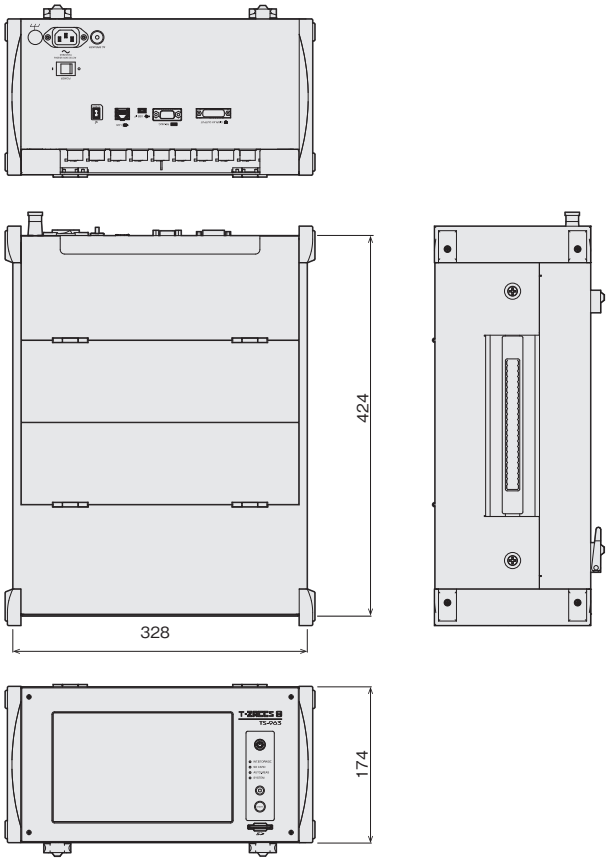


System Block Diagram

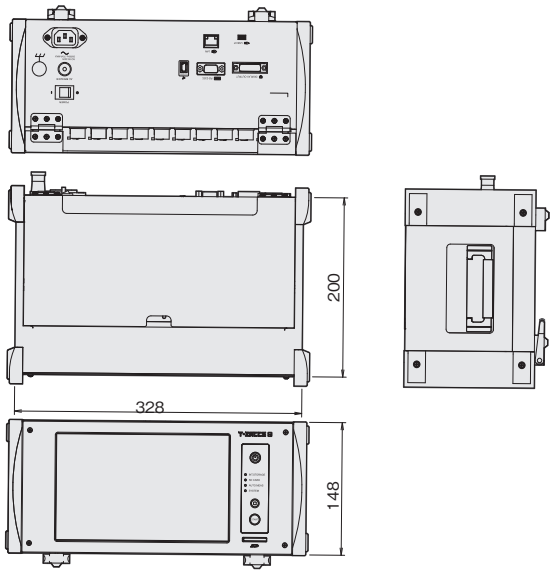


External Dimensions

TS-963



TS-960



TS-963/TS-960 (High-speed, High-accuracy, High-functionality)

Specifications

Measurement capabilities		
Number of measuring points	When using a box connection	Up to 1000 points (Up to 2000 points when using gauge with temperature measurement function)
	When using a box connection built-in measurement unit in combination	
	Built-in measurement unit	TS-963: 30 points (Up to 60 points when using gauge with temperature measurement function)
		TS-960: 10 points (Up to 20 points when using gauge with temperature measurement function)
Measuring speed	Data update rate	Display / record measurement value updating cycle: 0.1 sec
Measuring mode		Initial, direct, measure (For temperature measurement, direct only)
Simple measure		Coefficient 1 Unit Interlocked with sensor mode Decimal point Interlocked with sensor mode
Compensation mode		Comet NON、Comet A、Comet B
Monitor	Number of setting tables	5
	Number of display frames	0-4
	Display mode	Numerical, max / min, graph (Y-T), graph (X-Y), graph (BAR), vector displays
	Display channel	Numerical value display 0-60 points Max / min display 0-40 points Graph display (Y-T) 0-10 points Graph display (X-Y) 0-5 sets Graph display (BAR) 0-20 points Vector display 0-3 points
Measurement	Manual measurement	START key (Touch panel: START button)
	Automatic measurement	Interval measurement, comparator measurement, alarm measurement, sampling measurement and sequence measurement
	Interface	LAN、USB、RS-232C

Channel setting	Coefficient	± (0.00000-200000)	
	Unit	με, mV, °C, kgf, mm, etc.	
	Decimal point	Display after the decimal point can be set arbitrarily with 0 to 5 digits	
	Offset	To be written by arbitrarily measurement channel	
	Sensor mode	The type of sensor to be connected is set.	
		Strain	One-gauge method, three-wire type 120 / 240 / 350 Ω, One-gauge method, four-wire type 120 / 240 / 350 Ω, Two-gauge common dummy method, two-gauge method, Four-gauge method, four-gauge method constant current 350 Ω, Four-gauge method high-resolution mode, Four-gauge method constant current 350 Ω high-resolution mode Four-gauge method 0-2 V mode Gauge with temperature measurement 120 / 240 / 350 Ω
		Voltage	640 mV, 64 V
		Temperature	Thermocouple T, K, J, B, S, R, E, N, Pt 100 3 W
	Channel name	To be set arbitrarily with eight or fewer uppercase English letters, numbers, and symbols	
Sensor ID	Function	Reading and setting of sensor ID, writing of sensor ID	
Expansion channel setting	Function	Function calculations and inter-channel calculations	
	Number of channels	100 channels	
	Characters that can be used	Channel, expansion channel, constant	
	Calculation	Four arithmetic operations	4 types
		General functions	7 types
		Trigonometrical functions	15 types
		Rosette functions	7 types
		Multistage inclinometer functions	3 types
		Logical functions	8 types
		Other functions	1 type
Check function	At the time of measurement	Open check	
	Sensor	Insulation check, sensitivity check, variation check, thermocouple disconnection check, lead wire resistance check, and bridge output check	
	Expansion Channel	Processing time check	
	Analog output	Calibration output Arbitrary output at zero and within the output level range	
	Display setting list	Measurement channel setting, channel setting, reference junction setting, expansion channel setting, analog output setting, interval setting, comparator setting, alarm setting, sampling setting, sequence setting, initial value, lead wire resistance, bridge output, etc.	

*This is effective when using a switch box protocol converter.

Interval measurement	
Function	Recording of measurement values at the set time interval and time
Time interval	Hour / minute / second can be set for each step up to 99 hours, 59 minutes and 59 seconds.
Real time start	Start time (hour / minute / second) can be set for each step
Number of starts	Up to 99 times per step or infinite
Number of steps	Programmable up to 100 steps
GOTO step	Program loop possible to one of the previous steps
Execution processing	Measurement, initial-in, insulation check, variation check, sensitivity check, and thermocouple disconnection check
Number of systems	10 systems Recording channel, file name, recording medium and output interface can be set for each system.

Comparator measurement	
Function	Recording of measurement values based on the set amount of change of arbitrary channel
Comparison amount	Can be set for each step: Up to ±999999
Comparison method	Amount of change or upper / lower limit
Number of starts	Up to 99 times per step or infinite
Number of steps	Programmable up to 100 steps
GOTO step	Program loop possible to one of the previous steps
Number of systems	10 systems Recording channel, file name, recording medium and output interface can be set for each system.

Alarm	
Function	Alarm output when arbitrary channel exceeds the upper and lower limit
Comparison amount	Up to ±999999
Comparison method	Upper and lower limit value
Output	Speaker output, measurement value recording, screen display

Sampling measurement	
Function	Recording at set time intervals
Number of measurements	Specify from 1 to 1000000
Time interval	Select from 0.1, 0.2, 0.5, and 1 seconds Only 1 second can be selected when high accuracy mode is selected
Trigger	Select ON / OFF for each channel
Trigger level	Up to ±999999
Comparison method	OR of amount of change and each channel
Trigger action	Measurement based on the number of measurements or time interval

Sequence control	
Function	Automatic measurement by combining manual measurement, sampling measurement, alarm, interval measurement and comparator measurement
Number of steps	Programmable up to 100 steps
GOTO step	Program loop possible to one of the previous steps
Event step	Interval, comparator, alarm, wait, etc.

Time	
Setting	Year, month, day, hour, minute, second
Accuracy	Daily error: ±1 sec (at 23°C ± 5°C)
Retention	About 30 days (with a full charge)

Display / operation			
Display	Display unit	**LCD panel**	9-inch TFT LCD (with touch panel)
		Resolution	800 x 480 dots
		Point defect	10 dots or less (excluding aging deterioration)
	External output		DVI
Operation			Touch panel, POWER key, FUNCTION key, START key, remote data logger function

Recording		
Built-in	**Function**	Recording / reproduction of measurement data, saving of setting file
	Recording format	CSV format (with header information)
	Capacity	4 GB
SD card	**Function**	Recording / reproduction / copying of measurement data, saving / copying of setting file Writing / reading of sensor ID
	Physical format	FAT 16/32
	Recording format	CSV format (with header information)
	Capacity	4 GB (Designated by us)

Interface	
LAN	10BASE-T/100BASE-TX General-purpose command port server function (various settings, measurement, and data collection)
USB	USB 2.0 protocol compatible mini-B General-purpose command compatible (various settings, measurement, and data collection)
RS-232C	RS-232C compliant Baud rate: 9600, 19200, 115200, 230400, 460800, and 921600 bps General-purpose command compatible (various settings, measurement, and data collection)

TS-963/TS-960 (High-speed, High-accuracy, High-functionality)

Analog output	
Function	Voltage output of measurement value of arbitrary channel
Number of output points	20 points (The EU-10VO analog output unit is required for every 10 points.)
Output range	±10 V, ±5 V, 0-5 V
Capacity (Full scale)	Up to ±999999
Output accuracy	The specifications related to the output conform to the specifications of each unit.
Data update time	Interlocked with measurement cycle, the fastest is 0.1 seconds

Power supply	
Power supply voltage	AC 100-240 V 50/60 Hz
Maximum power consumption	TS-963 : 152 VA max/ TS-960 : 70 VA max

Environment	
Operating temperature / humidity range	0 to +50°C 85% RH or less (No condensation)

Others	
Outside dimension (Excluding rubber protectors and protrusions)	TS-963: 328 (W) × 174 (H) × 424 (D) mm TS-960: 328 (W) × 148 (H) × 200 (D) mm
Mass	TS-963: Approx. 10 kg / TS-960: Approx. 5 kg

Built-in measurement unit (common to all modes)

Common to all modes	
Number of measuring points	TS-963: 30 points / TS -960: 10 points
Input terminal	Dual-purpose type for screw fixing and soldering
One-touch connector	NDIS one-touch connector

High-speed mode

Measuring speed	0.1 sec (0.2 seconds when using gauge with temperature measurement)	
Strain measurement		
Applicable wiring method, gauge resistance	One-gauge method, three-wire type	120, 240, 350 Ω
	Two-gauge method	60-1000 Ω
	Two-gauge common dummy method	60-1000 Ω
	Four-gauge method	60-1000 Ω
	Four-gauge method constant current	350 Ω
	Four-gauge method 0-2 V mode	60-1000 Ω
	Mode for gauge with temperature measurement function (one-gauge method, three-wire type)	120,240,350Ω T（JIS C1602:2015、IEC 60584-1:2013）
Sensor cable extension range	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1% to -0.5% / Cable round-trip resistance: 100 Ω
Lead wire resistance compensation range Comet B (1G3W)	Gauge resistance 120 Ω: About 100 Ω or less	
	Gauge resistance 240 Ω: About 200 Ω or less	
	Gauge resistance 350 Ω: About 300 Ω or less	
Zero stability	±1.0 × 10^{-6} strain/°C or less (one-gauge method) ±0.5 × 10^{-6} strain/°C or less (two-gauge method)	
Initial unbalance	±750 × 10^{-6} strain/°C or less (one-gauge method) ±500 × 10^{-6} strain/°C or less (two-gauge method)	
DC voltage measurement		
V1/1	DC ± 640 mV	
V1/100	DC ± 64 V	
Input impedance	1 MΩ or more	
Allowable input voltage between B and D	DC ± 70 V max	
Thermocouple temperature measurement		
Applicable thermocouple	T,K,J,B,S,R,E,N JIS C1602:2015、IEC 60584-1:2013	
Platinum resistance temperature detector measurement		
Applicable platinum resistance temperature detector	Pt100 (500 μA constant current 3-wire type) JIS C 1604:2013, IEC 60751: 2008	

Strain measurement (High-speed mode)		
Bridge excitation	DC2V 4ms (50 Hz)	
Initial value storage range	±160000 × 10^{-6} strain	
Temperature coefficient of accuracy	±0.002% rdg/°C	
Aging change of accuracy	±0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000 × 10^{-6} strain	1 × 10^{-6} strain
	± 80000 × 10^{-6} strain	2 × 10^{-6} strain
	± 160000 × 10^{-6} strain	4 × 10^{-6} strain
	± 320000 × 10^{-6} strain	8 × 10^{-6} strain
	± 640000 × 10^{-6} strain	16 × 10^{-6} strain
Accuracy (at 23°C ± 5°C)	± (0.08% rdg + 3 digits) (one-gauge method, two-gauge method, four-gauge method) ± (0.08% + 6 digits) (four-gauge method 0-2 V mode)	

Constant current strain measurement (four-gauge method only) (high-speed mode)		
Bridge excitation	DC 6mA 4ms (50 Hz)	
Bridge resistance	350 Ω	
Initial value storage range	± 160000 × 10^{-6} strain	
Temperature coefficient of accuracy	±0.002% rdg/°C	
Aging change of accuracy	±0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000 × 10^{-6} strain	1 × 10^{-6} strain
	± 80000 × 10^{-6} strain	2 × 10^{-6} strain
	± 160000 × 10^{-6} strain	4 × 10^{-6} strain
	± 320000 × 10^{-6} strain	8 × 10^{-6} strain
	± 640000 × 10^{-6} strain	16 × 10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.08%rdg+3digit)	

DC voltage measurement (high-speed mode)			
Initial value storage range			
V1/1		±160.000mV	
V1/100		±16.0000V	
Temperature coefficient of accuracy		±0.0024%rdg/°C	
Aging change of accuracy		±0.024% rdg/year	
Measurement range and resolution		Measurement range	Resolution
	V1/1	± 40.000mV ± 80.000mV ±160.000mV ±320.000mV ±640.000mV	0.001mV 0.002mV 0.004mV 0.008mV 0.016mV
	V1/100	± 4.0000V ± 8.0000V ±16.0000V ±32.0000V ±64.0000V	0.0001V 0.0002V 0.0004V 0.0008V 0.0016V
Accuracy (at 23°C ± 5°C) With moving averaging	**V1/1**	±(0.08%rdg+6digit)	
	V1/100	±(0.08%rdg+6digit)	
Accuracy (at 23°C ± 5°C) Without moving averaging	**V1/1**	±(0.08%rdg+50digit)	
	V1/100	±(0.08%rdg+50digit)	

Platinum resistance temperature detector temperature measurement (JIS C 1604:2013, IEC 60751:2008) (high-speed mode)	
Applicable resistance temperature detector	Pt100
Measurement Method	Three-wire type (Pt3W)
Linearization	Digital calculation
Temperature coefficient of accuracy	±0.0020% rdg/°C
Aging change of accuracy	±0.05% rdg/year
Measurement range	-200 to +850°C
Resolution	0.1° C
Accuracy (at 23°C ± 5°C)	± (0.1% rdg + 0.3°C)

TS-963/TS-960 (High-speed, High-accuracy, High-functionality)

Thermocouple temperature measurement (JIS C 1602:2015, IEC 60584-1:2013) (high-speed mode)				
Applicable thermocouple	T, K, J, B, S, R, E, N			
Linearization	Digital calculation			
Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C) (External reference junction)	Accuracy (at 23°C ± 5°C) (Internal reference junction)
T	-250 to -200°C	0.1°C	±(0.31%rdg+1.9°C)	±(0.31%rdg+5.2°C)
	-200 to -100°C	0.1°C	±(0.14%rdg+0.8°C)	±(0.14%rdg+2.1°C)
	-100 to 0°C	0.1°C	±(0.11%rdg+0.5°C)	±(0.11%rdg+1.2°C)
	0 to +400°C	0.1°C	±(0.08%rdg+0.4°C)	±(0.08%rdg+0.9°C)
K	-210 to -160°C	0.1°C	±(0.17%rdg+0.9°C)	±(0.17%rdg+2.5°C)
	-160 to 0°C	0.1°C	±(0.12%rdg+0.6°C)	±(0.12%rdg+1.5°C)
	0 to +960°C	0.1°C	±(0.09%rdg+0.4°C)	±(0.09%rdg+0.9°C)
	+960 to +1370°C	0.1°C	±(0.10%rdg+0.9°C)	±(0.10%rdg+1.5°C)
J	-200 to -160°C	0.1°C	±(0.15%rdg+0.6°C)	±(0.15%rdg+1.8°C)
	-160° to 0°C	0.1°C	±(0.11%rdg+0.4°C)	±(0.11%rdg+1.3°C)
	0 to +700°C	0.1°C	±(0.09%rdg+0.3°C)	±(0.09%rdg+0.8°C)
	+700 to +1200°C	0.1°C	±(0.09%rdg+0.6°C)	±(0.09%rdg+1.0°C)
B	+200 to +280°C	0.5 to 0.4°C	±(0.03%rdg+6.0°C)	±(0.03%rdg+6.0°C)
	+280 to +800°C	0.3 to 0.1°C	±(0.03%rdg+2.4°C)	±(0.03%rdg+2.4°C)
	+800 to +1760°C	0.1°C	±(0.04%rdg+2.6°C)	±(0.04%rdg+2.6°C)
S	-10 to +200°C	0.1°C	±(0.06%rdg+2.4°C)	±(0.06%rdg+3.1°C)
	+200 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+2.0°C)
R	-10 to +150°C	0.1°C	±(0.06%rdg+2.4°C)	±(0.06%rdg+3.1°C)
	+150 to +1760°C	0.1°C	±(0.05%rdg+1.5°C)	±(0.05%rdg+1.8°C)
E	- 210 to + 550°C	0.1°C	±(0.16%rdg+0.6°C)	±(0.16%rdg+2.0°C)
	+ 550 to +1000°C	0.1°C	±(0.09%rdg+0.4°C)	±(0.09%rdg+0.9°C)
N	- 200 to 0°C	0.1°C	±(0.11%rdg+1.3°C)	±(0.11%rdg+2.7°C)
	0 to +1090°C	0.1°C	±(0.09%rdg+0.5°C)	±(0.09%rdg+1.0°C)
	+1090 to +1300°C	0.1°C	±(0.06%rdg+0.9°C)	±(0.06%rdg+1.3°C)

*The accuracy of sensor is not included, and thermocouple B does not use the reference junction.

High-precision mode

Measuring speed	0.4 sec (50 Hz) / 0.34 sec (60 Hz) (0.8 sec when using gauge with temperature measurement) (50 Hz) / 0.67 sec (60 Hz)	
Strain measurement		
Applicable wiring method, gauge resistance	One-gauge method, three-wire type	120, 240, 350 Ω
	Two-gauge method	60-1000 Ω
	Two-gauge common dummy method	60-1000 Ω
	Four-gauge method	60-1000 Ω
	Four-gauge method constant current	350 Ω
	Four-gauge method high-resolution mode	120-1000 Ω
	Four-gauge method constant current high-resolution mode	350 Ω
	Four-gauge method 0-2 V mode	60-1000 Ω
	Mode for gauge with temperature measurement function (one-gauge method, three-wire type)	120, 240, 350 Ω T(JIS C 1602:2015, IEC 60584-1:2013)
Sensor cable extension range	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
	Four-gauge method constant current high-resolution: 350 Ω	Cable round-trip resistance: 160 Ω or less
Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1% to -0.5% / Cable round-trip resistance: 100 Ω
	Four-gauge method constant current high-resolution: 350 Ω	
Lead wire resistance compensation range Comet B (1G3W)	Gauge resistance 120 Ω: About 100 Ω or less	
	Gauge resistance 240 Ω: About 200 Ω or less	
	Gauge resistance 350 Ω: About 300 Ω or less	
Zero stability	±1.0 × 10^{-6} strain/°C or less (one-gauge method) ±0.5 × 10^{-6} strain/°C or less (two-gauge method)	
Initial unbalance	±750 × 10^{-6} strain or less (one-gauge method) ±500 × 10^{-6} strain or less (two-gauge method)	
DC voltage measurement		
V1/1	DC±640mV	
V1/100	DC±64V	
Input impedance	1MΩ or more	
Allowable input voltage between B and D	DC±70V MAX	

Thermocouple temperature measurement		
Applicable thermocouple	T,K,J,B,S,R,E,N JIS C1602:2015、IEC 60584-1:2013	
Platinum resistance temperature detector measurement		
Applicable platinum resistance temperature detector	Pt100 (500 μA constant current 3-wire type) JIS C 1604:2013, IEC 60751: 2008	
Strain measurement (high-precision mode)		
Bridge excitation	DC2V 24ms(50Hz)	
Initial value storage range	±160000×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000 × 10^{-6} strain	1 × 10^{-6} strain
	± 80000 × 10^{-6} strain	2 × 10^{-6} strain
	± 160000 × 10^{-6} strain	4 × 10^{-6} strain
	± 320000 × 10^{-6} strain	8 × 10^{-6} strain
	± 640000 × 10^{-6} strain	16 × 10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+1digit)	
Constant current strain measurement (four-gauge method only) (high-precision mode)		
Bridge excitation	DC6mA 24ms(50Hz)	
Bridge resistance	350Ω	
Initial value storage range	±160000×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000 × 10^{-6} strain	1 × 10^{-6} strain
	± 80000 × 10^{-6} strain	2 × 10^{-6} strain
	± 160000 × 10^{-6} strain	4 × 10^{-6} strain
	± 320000 × 10^{-6} strain	8 × 10^{-6} strain
	± 640000 × 10^{-6} strain	16 × 10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+1digit)	
High-resolution strain measurement (four-gauge method only) (high-precision mode)		
Bridge excitation	DC5V 24ms(50Hz)	
Initial value storage range	±16000.0×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 4000.0 × 10^{-6} strain	0.1 × 10^{-6} strain
	± 8000.0 × 10^{-6} strain	0.2 × 10^{-6} strain
	± 16000.0 × 10^{-6} strain	0.4 × 10^{-6} strain
	± 32000.0 × 10^{-6} strain	0.8 × 10^{-6} strain
	± 64000.0 × 10^{-6} strain	1.6 × 10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+3digit)	
High-resolution strain measurement (four-gauge method only) (high-precision mode)		
Bridge excitation	DC 14 mA 24 ms (50 Hz)	
Bridge resistance	350 Ω	
Initial value storage range	± 16000.0 × 10^{-6} strain	
Temperature coefficient of accuracy	±0.002% rdg/°C	
Aging change of accuracy	±0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 4000.0 × 10^{-6} strain	0.1 × 10^{-6} strain
	± 8000.0 × 10^{-6} strain	0.2 × 10^{-6} strain
	± 16000.0 × 10^{-6} strain	0.4 × 10^{-6} strain
	± 32000.0 × 10^{-6} strain	0.8 × 10^{-6} strain
	± 64000.0 × 10^{-6} strain	1.6 × 10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+3digit)	

DC voltage measurement (high-precision mode)			
Initial value storage range			
V1/1		±160.000mV	
V1/100		±16.0000V	
Temperature coefficient of accuracy		±0.0024%rdg/°C	
Aging change of accuracy		±0.024% rdg/year	
Measurement range and resolution		Measurement range	Resolution
	V1/1	± 40.000mV ± 80.000mV ±160.000mV ±320.000mV ±640.000mV	0.001mV 0.002mV 0.004mV 0.008mV 0.016mV
	V1/100	± 4.0000V ± 8.0000V ±16.0000V ±32.0000V ±64.0000V	0.0001V 0.0002V 0.0004V 0.0008V 0.0016V
V1/1 accuracy (at 23°C ± 5°C)		±(0.05%rdg+3digit)	
V1/100 accuracy (at 23°C ± 5°C)		±(0.05%rdg+2digit)	

Platinum resistance temperature detector temperature measurement (JIS C 1604:2013, IEC 60751:2008 Pt100) (high-precision mode)	
Applicable resistance temperature detector	Pt100
Measurement Method	Three-wire type (Pt3W)
Linearization	Digital calculation
Temperature coefficient of accuracy	±0.0020% rdg/°C
Aging change of accuracy	±0.05% rdg/year
Measurement range	-200 to +850°C
Resolution	0.1°C
Accuracy (at 23°C ± 5°C)	± (0.05% rdg + 0.3°C)

Thermocouple temperature measurement (JIS C 1602:2015, IEC 60584-1:2013) (high-precision mode)				
Applicable thermocouple		T, K, J, B, S, R, E, N		
Linearization		Digital calculation		
Type	**Measurement range**	**Resolution**	**Accuracy (at 23°C ± 5°C)**	
			(External reference junction)	**(Internal reference junction)**
T	-250 to -200°C	0.1°C	±(0.19%rdg+0.5°C)	±(0.19%rdg+3.8°C)
	-200 to -100°C	0.1°C	±(0.09%rdg+0.2°C)	±(0.09%rdg+1.6°C)
	-100 to +400°C	0.1°C	±(0.06%rdg+0.2°C)	±(0.06%rdg+0.9°C)
K	-210 to -160°C	0.1°C	±(0.11%rdg+0.3°C)	±(0.11%rdg+1.8°C)
	-160 to 0°C	0.1°C	±(0.08%rdg+0.2°C)	±(0.08%rdg+1.1°C)
	0 to +960°C	0.1°C	±(0.06%rdg+0.1°C)	±(0.06%rdg+0.7°C)
	+960 to +1370°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.2°C)
J	-200 to -160°C	0.1°C	±(0.09%rdg+0.2°C)	±(0.09%rdg+1.4°C)
	-160 to 0°C	0.1°C	±(0.07%rdg+0.1°C)	±(0.07%rdg+1.0°C)
	0 to +700°C	0.1°C	±(0.05%rdg+0.1°C)	±(0.05%rdg+0.6°C)
	+700 to +1200°C	0.1°C	±(0.06%rdg+0.4°C)	±(0.06%rdg+0.8°C)
B	+200 to +280°C	0.5 to 0.4°C	±(0.03%rdg+1.5°C)	±(0.03%rdg+1.5°C)
	+280 to +800°C	0.3 to 0.1°C	±(0.03%rdg+0.6°C)	±(0.03%rdg+0.6°C)
	+800 to +1760°C	0.1°C	±(0.04%rdg+0.4°C)	±(0.04%rdg+0.4°C)
S	-10 to +200°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.3°C)
	+200 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+0.8°C)
R	-10 to +150°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.3°C)
	+150 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+0.8°C)
E	-210 to +550°C	0.1°C	±(0.10%rdg+0.2°C)	±(0.10%rdg+1.6°C)
	+550 to +1000°C	0.1°C	±(0.06%rdg+0.3°C)	±(0.06%rdg+0.7°C)
N	- 200 to 0°C	0.1°C	±(0.11%rdg+0.4°C)	±(0.11%rdg+1.8°C)
	0 to +1090°C	0.1°C	±(0.05%rdg+0.2°C)	±(0.05%rdg+0.7°C)
	+1090 to +1300°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+0.9°C)

* The accuracy of sensor is not included, and thermocouple B does not use the reference junction.

Box / unit connection

Target model	**Measurement box Measurement unit**	EX-50H、 EU-10H、EU-10D、EI-01P
	Output unit	EU-10VO
Number of connectable units	**Measurement box Measurement unit**	Up to 100 units
	Output unit	Up to 2 units
Extension distance		100 m (between devices)
Connection cable		Connection cable for the EX CR-892M (2 m), CR-895M (5 m), CR-8901 (10 m), CR-8902 (20 m), CR-8905 (50 m), CR-8910 (100 m)

* Regarding the number of measurement boxes connected, one EX-50H is counted as five units.

Standard accessories

- Instruction Manual (CD) 1
- AC power cable (CR-03) 1
- Ground wire (CR-20) 1
- SD card 1
- Vinyl cover 1
- Warranty certificate 1
- Phillips screwdriver 1

Related Products

SD card

Supported card capacity: 4 GB (Designated by us)

RP-E11 external printer

The measurement data of the TS-963/-960 data logger is printed out.
RP-E11-K3FJ1-S
(RS-232C connection)



Dedicated printer paper P-80

5 rolls/box Paper size: 80 mm width, 25 m/7200 lines/roll

Measurement software Visual LOG

Visual LOG TDS-7130v2 static measurement software

SB-OT1B one-touch terminal

This terminal block allows one-touch connection of input lead wires. It is used by attaching to the input terminal of the switch box. (One set of five terminals)

T-ZACCS UNIT EU-10VO

- Up to two units or 20 points of analog outputs are possible for one TS-963/-960 unit.
- This unit can be installed anywhere on the line between the data logger and the measurement box and unit.



T-ZACCS UNIT EU-10 VO
analog output unit

This equipment is an analog output unit for the T-ZACCS9 TS-963/-960. Analog data according to inputs, such as strain and voltage can be output. Since this equipment is an independent unit, it can be installed anywhere on the line between the data logger and the measurement box and unit.

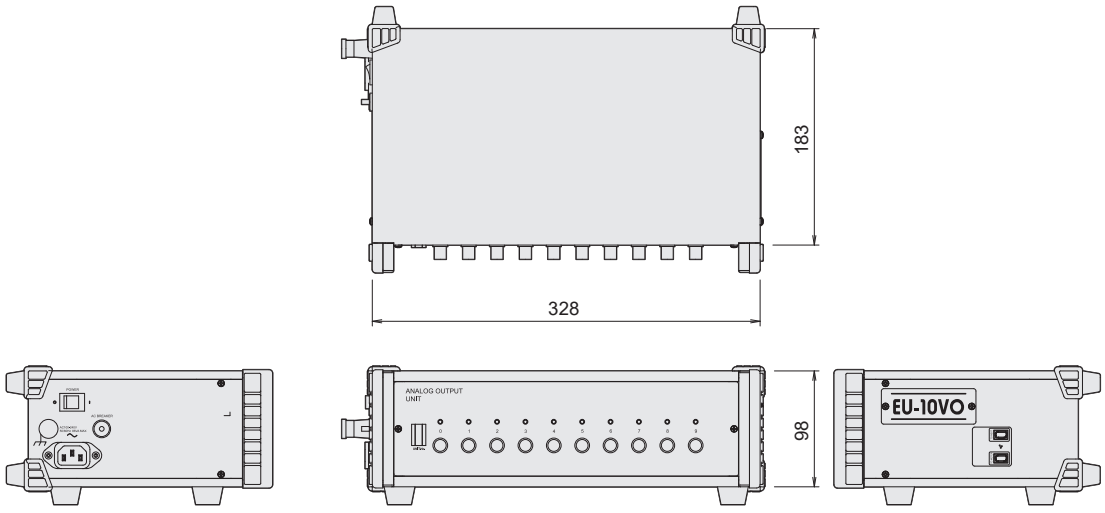
Specifications

Function	
Function	Voltage output of measurement value of arbitrary channel
Number of output points	10 points
Output	BNC connector
Output range	±10 V, ±5 V, 0 to +5 V
Calibration output	Arbitrary output at zero and within the output level range
Accuracy	
Output accuracy	± (0.1% + 5 mV)
Connection with data logger	
Number of connectable units	Up to 2 units
Extension distance	100 m (between devices)
Connection cable	Connection cable for the EX (CR-89**)
Power supply	
Power supply voltage	AC 100-240 V 50/60 Hz
Maximum power consumption	86 VA max
Environment	
Operating temperature / humidity range	0 to +50°C 85% RH or less (No condensation)
Others	
Outside dimension	328 (W) × 98 (H) ×183 (D) mm (Excluding rubber protectors and protrusions)
Mass	About 3 kg

Standard accessories

AC power cable (CR-03) 1
Ground wire (CR-20) 1
Vinyl cover 1
Connection cable for the EX (CR-892M) 1
Warranty certificate 1

External Dimensions



T-ZACCS UNIT EU-10DO

NEW

- Up to 10 points of non-isolated TTL or LVTTL level digital signals can be output.
- Easy connection with BNC cables



T-ZACCS UNIT EU-10DO
digital output unit

This equipment is an analog output unit dedicated for the T-ZACCS9 TS-960/-963. It is possible to output up to 10 points of TTL/LVTTL level digital signals at the same time based on the trigger and alarm conditions set on the TS-960/TS-963. Since wiring using BNC cables is possible, it is easy to build a system that uses measuring instruments and test equipment tailored to the TS-960/TS-963 measurements, synchronization with the PLC, and trigger control.

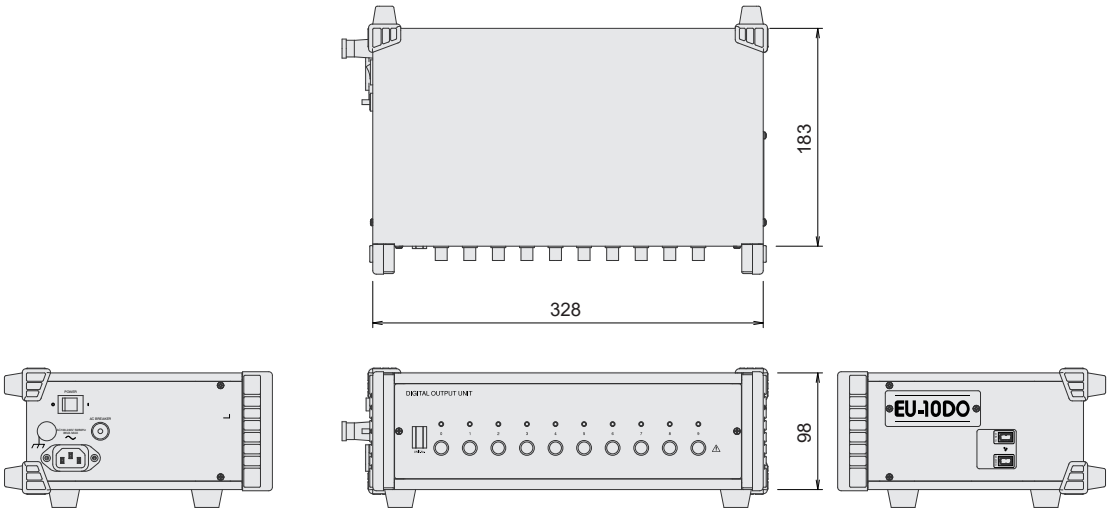
Specifications

Function	
Function	Trigger and alarm signal output or inter-unit synchronization signal output according to TS-960/963 setting
Number of output points	10 points
Output connector	BNC connector
Output format	Non-isolated TTL output DC 5 V (TTL trigger level) HI (ON) level output voltage: 2.0 V or more LO (OFF) level output voltage: 0.8 V or less Non-isolated LVTTL output DC 3.3 V (LVTTL trigger level) HI (ON) level output voltage: 2.0 V or more LO (OFF) level output voltage: 0.8 V or less
Maximum output current	3 mA max
Unit synchronization signal output	Output signal frequency: 10 Hz
Connection with data logger	
Number of connectable units	Up to 1 unit
Extension distance	100 m (between devices)
Connection cable	Connection cable for the EX (CR- 89xx)
Power supply	
Power supply voltage	AC 100-240 V 50/60Hz
Maximum power consumption	86 VA max
Environment	
Operating temperature / humidity range	0 to +50°C 85% RH or less (No condensation)
Others	
Outside dimension	328 (W) × 183 (D) × 98 (H) mm
Mass	3 kg

Standard accessories

AC power cable (CR-03) 1
Ground wire (CR-20) 1
Connection cable for the EX (CR-892M) 1
Vinyl cover 1
Warranty certificate 1

External Dimensions



T-ZACCS BOX EX-50H

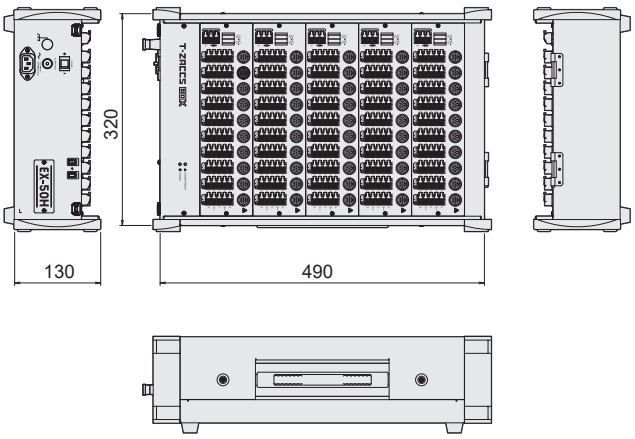
- 1000 points per 0.1 seconds at the fastest due to adoption of an ultra-high-speed field network
- Our unique next-generation A/D method that achieves both high precision and high stability and high-speed measurement eliminates various thermo-electromotive forces, zero movement of the amplifier, and commercial power supply noise and realizes high-precision and high-stability measurement.
- The high-precision mode can measure 1000 points in 0.4 seconds (50 Hz) even when using the thermocouple measurement or high-resolution mode.
- A strain gauge with temperature measurement function can be measured with one channel.
- Equipped with Complete Compensation Method of Strain (Comet)
- Various check functions (insulation check, sensitivity check, variation check, and thermocouple disconnection check)



T-ZACCS BOX EX-50H

This equipment is a measurement box for expanding the number of measuring points in combination with the T-ZACCS9 TS-963/-960. With 50 measurement points, this equipment allows you to measure strain gauges, strain gauge type converters, thermocouples, platinum resistance temperature detectors, DC voltages, and other equipment. By adopting our unique next-generation A/D method that achieves both high precision and high stability and high-speed measurement, and an ultra-high-speed field network based on the Ethernet, various thermo-electromotive forces, zero movement of the amplifier, and commercial power supply noise are eliminated, and high-precision and high-stability measurement is realized. At the same time, regardless of the number of measuring points, the high-speed mode can measure in 0.1 seconds and the high-precision mode can measure in 0.4 seconds (50 Hz).

External Dimensions



Specifications

Measurement capabilities

Common to all modes		
Number of measuring points	50 points	
Input terminal	Dual-purpose type for screw fixing and soldering	
One-touch connector	NDIS one-touch connector	
Compensation mode	Comet NON, Comet A, Comet B	
Check function	At the time of measurement	Open check
	Sensor	Insulation check, sensitivity check, variation check, and thermocouple disconnection check Lead wire resistance check and bridge output check

High-speed mode

V1/1	DC ± 640 mV	
V1/100	DC ± 64 V	
Input impedance	1 MΩ or more	
Measuring speed	0.1 seconds (0.2 seconds when using a gauge with the temperature measurement)	
Strain measurement		
Applicable wiring method, gauge resistance	One-gauge method, three-wire type	120, 240, 350 Ω
	Two-gauge method	60-1000 Ω
	Two-gauge common dummy method	60-1000 Ω
	Four-gauge method	60-1000 Ω
	Four-gauge method constant current	350 Ω
	Four-gauge method 0-2 V mode	60-1000 Ω
	Mode for gauge with temperature measurement function (one-gauge method, three-wire type)	120,240,350Ω T (JIS C1602:2015、IEC 60584-1:2013)
Sensor cable extension range	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1% to -0.5% / Cable round-trip resistance: 100 Ω
Lead wire resistance compensation range Comet B (1G3W)	Gauge resistance 120 Ω: About 100 Ω or less	
	Gauge resistance 240 Ω: About 200 Ω or less	
	Gauge resistance 350 Ω: About 300 Ω or less	
Zero stability	± 1.0 × 10^{-6} strain/°C or less (one-gauge method) ± 0.5 × 10^{-6} strain/°C or less (two-gauge method)	
Initial unbalance	± 750 × 10^{-6} strain or less (one-gauge method) ± 500 × 10^{-6} strain or less (two-gauge method)	
DC voltage measurement		
Allowable input voltage between B and D	DC ± 70 V max	
Thermocouple temperature measurement		
Applicable thermocouple	T,K,J,B,S,R,E,N JIS C1602:2015、IEC 60584-1:2013	
Platinum resistance temperature detector measurement		
Applicable platinum resistance temperature detector	Pt100 (500 μA constant current three-wire type) JIS C 1604:2013, IEC 60751: 2008	

Strain measurement (high-speed mode)		
Bridge excitation	DC2V 4ms(50Hz)	
Initial value storage range	±160000×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000 × 10^{-6} strain	1 × 10^{-6} strain
	± 80000 × 10^{-6} strain	2 × 10^{-6} strain
	± 160000 × 10^{-6} strain	4 × 10^{-6} strain
	± 320000 × 10^{-6} strain	8 × 10^{-6} strain
	± 640000 × 10^{-6} strain	16 × 10^{-6} strain
Accuracy (at 23°C ± 5°C)	± (0.08% rdg + 3 digits) (one-gauge method, two-gauge method, four-gauge method) ± (0.08%+ 6 digits) (four-gauge method 0-2 V mode)	

Constant current strain measurement (four-gauge method only) (high-speed mode)		
Bridge excitation	DC6mA 4ms(50Hz)	
Bridge resistance	350Ω	
Initial value storage range	±160000×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000 × 10^{-6} strain	1 × 10^{-6} strain
	± 80000 × 10^{-6} strain	2 × 10^{-6} strain
	± 160000 × 10^{-6} strain	4 × 10^{-6} strain
	± 320000 × 10^{-6} strain	8 × 10^{-6} strain
	± 640000 × 10^{-6} strain	16 × 10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.08%rdg+3digit)	

DC voltage measurement (high-speed mode)			
Initial value storage range			
V1/1	±160.000mV		
V1/100	±16.0000V		
Temperature coefficient of accuracy	±0.0024%rdg/°C		
Aging change of accuracy	± 0.024% rdg/year		
Measurement range and resolution		Measurement range	Resolution
	V1/1	± 40.000mV	0.001mV
		± 80.000mV	0.002mV
		±160.000mV	0.004mV
		±320.000mV	0.008mV
		±640.000mV	0.016mV
	V1/100	± 4.0000V	0.0001V
		± 8.0000V	0.0002V
		±16.0000V	0.0004V
		±32.0000V	0.0008V
		±64.0000V	0.0016V
Accuracy (at 23°C ± 5°C) With moving averaging	**V1/1**	±(0.08%rdg+6digit)	
	V1/100	±(0.08%rdg+6digit)	
Accuracy (at 23°C ± 5°C) Without moving averaging	**V1/1**	±(0.08%rdg+50digit)	
	V1/100	±(0.08%rdg+50digit)	

Platinum resistance temperature detector temperature measurement (JIS C 1604:2013, IEC 60751:2008 Pt100) (high-speed mode)	
Applicable resistance temperature detector	Pt100
Measurement Method	Three-wire type (Pt3W)
Linearization	Digital calculation
Temperature coefficient of accuracy	±0.0020% rdg/°C
Aging change of accuracy	±0.05% rdg/year
Measurement range	-200 to +850°C
Resolution	0.1°C
Accuracy (at 23°C ± 5°C)	± (0.1% rdg + 0.3°C)

Thermocouple temperature measurement (JIS C 1602:2015, IEC 60584-1:2013) (high-speed mode)

Applicable thermocouple	T, K, J, B, S, R, E, N			
Linearization	Digital calculation			
Type	**Measurement range**	**Resolution**	**Accuracy (at 23°C ± 5°C)**	
			(External reference junction)	**(Internal reference junction)**
T	-250 to -200°C	0.1°C	±(0.31%rdg+1.9°C)	±(0.31%rdg+5.2°C)
	-200 to -100°C	0.1°C	±(0.14%rdg+0.8°C)	±(0.14%rdg+2.1°C)
	-100 to 0°C	0.1°C	±(0.11%rdg+0.5°C)	±(0.11%rdg+1.2°C)
	0 to +400°C	0.1°C	±(0.08%rdg+0.4°C)	±(0.08%rdg+0.9°C)
K	-210 to -160°C	0.1°C	±(0.17%rdg+0.9°C)	±(0.17%rdg+2.5°C)
	-160 to 0°C	0.1°C	±(0.12%rdg+0.6°C)	±(0.12%rdg+1.5°C)
	0 to +960°C	0.1°C	±(0.09%rdg+0.4°C)	±(0.09%rdg+0.9°C)
	+960 to +1370°C	0.1°C	±(0.10%rdg+0.9°C)	±(0.10%rdg+1.5°C)
J	-200 to -160°C	0.1°C	±(0.15%rdg+0.6°C)	±(0.15%rdg+1.8°C)
	-160 to 0°C	0.1°C	±(0.11%rdg+0.4°C)	±(0.11%rdg+1.3°C)
	0 to +700°C	0.1°C	±(0.09%rdg+0.3°C)	±(0.09%rdg+0.8°C)
	+700 to +1200°C	0.1°C	±(0.09%rdg+0.6°C)	±(0.09%rdg+1.0°C)
B	+ 200 to + 280°C	0.5 to 0.4°C	±(0.03%rdg+6.0°C)	±(0.03%rdg+6.0°C)
	+ 280 to + 800°C	0.3 to 0.1°C	±(0.03%rdg+2.4°C)	±(0.03%rdg+2.4°C)
	+ 800 to +1760°C	0.1°C	±(0.04%rdg+2.6°C)	±(0.04%rdg+2.6°C)
S	- 10 to + 200°C	0.1°C	±(0.06%rdg+2.4°C)	±(0.06%rdg+3.1°C)
	+ 200 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+2.0°C)
R	- 10 to + 150°C	0.1°C	±(0.06%rdg+2.4°C)	±(0.06%rdg+3.1°C)
	+ 150 to +1760°C	0.1°C	±(0.05%rdg+1.5°C)	±(0.05%rdg+1.8°C)
E	- 210 to + 550°C	0.1°C	±(0.16%rdg+0.6°C)	±(0.16%rdg+2.0°C)
	+ 550 to +1000°C	0.1°C	±(0.09%rdg+0.4°C)	±(0.09%rdg+0.9°C)
N	- 200 to 0°C	0.1°C	±(0.11%rdg+1.3°C)	±(0.11%rdg+2.7°C)
	0 to +1090°C	0.1°C	±(0.09%rdg+0.5°C)	±(0.09%rdg+1.0°C)
	+1090 to +1300°C	0.1°C	±(0.06%rdg+0.9°C)	±(0.06%rdg+1.3°C)

* The accuracy of sensor is not included and thermocouple B does not use the reference junction.

High-precision mode

Measuring speed	0.4 sec (50 Hz) / 0.34 sec (60 Hz) (0.8 sec when using gauge with temperature measurement) (50 Hz) / 0.67 sec (60 Hz)	
Strain measurement		
Applicable wiring method, gauge resistance	One-gauge method, three-wire type	120, 240, 350 Ω
	Two-gauge method	60-1000 Ω
	Two-gauge common dummy method	60-1000 Ω
	Four-gauge method	60-1000 Ω
	Four-gauge method constant current	350 Ω
	Four-gauge method high-resolution mode	120-1000 Ω
	Four-gauge method constant current high-resolution mode	350 Ω
	Four-gauge method 0-2 V mode	60-1000 Ω
	Mode for gauge with temperature measurement function (One-gauge method, three-wire type)	120, 240, 350 Ω T (JIS C 1602:2015, IEC 60584-1:2013)
Sensor cable extension range	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
	Four-gauge method constant current high-resolution: 350 Ω	Cable round-trip resistance: 160 Ω or less
Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1 to -0.5% / Cable round-trip resistance: 100 Ω
	Four-gauge method constant current high-resolution: 350 Ω	
Lead wire resistance compensation range Comet B (1G3W)	Gauge resistance 120 Ω: About 100 Ω or less	
	Gauge resistance 240 Ω: About 200 Ω or less	
	Gauge resistance 350 Ω: About 300 Ω or less	
Zero stability	± 1.0 × 10^{-6} strain/°C or less (one-gauge method) ± 0.5 × 10^{-6} strain/°C or less (two-gauge method)	
Initial unbalance	± 750 × 10^{-6} strain or less (one-gauge method) ± 500 × 10^{-6} strain or less (two-gauge method)	
DC voltage measurement		
V1/1	DC±640mV	
V1/100	DC±64V	
Input impedance	1 MΩ or more	
Allowable input voltage between B and D	DC±70V MAX	
Thermocouple temperature measurement		
Applicable thermocouple	T,K,J,B,S,R,E,N JIS C1602:2015、IEC 60584-1:2013	
Platinum resistance temperature detector measurement		
Applicable platinum resistance temperature detector	Pt100 (500 μA constant current 3-wire type) JIS C 1604:2013, IEC 60751: 2008	

Strain measurement (high-precision mode)		
Bridge excitation	DC2V 24ms(50Hz)	
Initial value storage range	±160000×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000×10^{-6} strain	1×10^{-6} strain
	± 80000×10^{-6} strain	2×10^{-6} strain
	±160000×10^{-6} strain	4×10^{-6} strain
	±320000×10^{-6} strain	8×10^{-6} strain
	±640000×10^{-6} strain	16×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+1digit)	

Constant current strain measurement (four-gauge method only) (high-precision mode)		
Bridge excitation	DC6mA 24ms(50Hz)	
Bridge resistance	350Ω	
Initial value storage range	±160000×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000×10^{-6} strain	1×10^{-6} strain
	± 80000×10^{-6} strain	2×10^{-6} strain
	±160000×10^{-6} strain	4×10^{-6} strain
	±320000×10^{-6} strain	8×10^{-6} strain
	±640000×10^{-6} strain	16×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+1digit)	

T-ZACCS BOX EX-50H

High-resolution strain measurement (four-gauge method only) (high-precision mode)		
Bridge excitation	DC5V 24ms(50Hz)	
Initial value storage range	±16000.0×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 4000.0×10^{-6} strain ± 8000.0×10^{-6} strain ±16000.0×10^{-6} strain ±32000.0×10^{-6} strain ±64000.0×10^{-6} strain	0.1×10^{-6} strain 0.2×10^{-6} strain 0.4×10^{-6} strain 0.8×10^{-6} strain 1.6×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+3digit)	

High-resolution strain measurement (four-gauge method only) (high-precision mode)		
Bridge excitation	DC14mA 24ms(50Hz)	
Bridge resistance	350Ω	
Initial value storage range	±16000.0×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 4000.0×10^{-6} strain ± 8000.0×10^{-6} strain ±16000.0×10^{-6} strain ±32000.0×10^{-6} strain ±64000.0×10^{-6} strain	0.1×10^{-6} strain 0.2×10^{-6} strain 0.4×10^{-6} strain 0.8×10^{-6} strain 1.6×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+3digit)	

DC voltage measurement (high-precision mode)			
Initial value storage range			
V1/1		±160.000mV	
V1/100		±16.0000V	
Temperature coefficient of accuracy		±0.0024%rdg/°C	
Aging change of accuracy		±0.024%rdg/year	
Measurement range and resolution		Measurement range	Resolution
	V1/1	± 40.000mV ± 80.000mV ±160.000mV ±320.000mV ±640.000mV	0.001mV 0.002mV 0.004mV 0.008mV 0.016mV
	V1/100	± 4.0000V ± 8.0000V ±16.0000V ±32.0000V ±64.0000V	0.0001V 0.0002V 0.0004V 0.0008V 0.0016V
V1/1 accuracy (at 23°C ± 5°C)		±(0.05%rdg+3digit)	
V1/100 accuracy (at 23°C ± 5°C)		±(0.05%rdg+2digit)	

Platinum resistance temperature detector temperature measurement (JIS C 1604:2013, IEC 60751:2008 Pt100) (high-precision mode)	
Applicable resistance temperature detector	Pt100
Measurement Method	Three-wire type (Pt3W)
Linearization	Digital calculation
Temperature coefficient of accuracy	± 0.0020% rdg/°C
Aging change of accuracy	± 0.05% rdg/year
Measurement range	-200 to +850°C
Resolution	0.1° C
Accuracy (at 23°C ± 5°C)	± (0.05% rdg + 0.3°C)

Thermocouple temperature measurement (JIS C 1602:2015, IEC 60584-1:2013) (high-precision mode)				
Applicable thermocouple	T, K, J, B, S, R, E, N			
Linearization	Digital calculation			
Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C)	
			External reference junction)	(Internal reference junction)
T	- 250 to - 200°C - 200 to - 100°C - 100 to + 400°C	0.1°C 0.1°C 0.1°C	±(0.19%rdg+0.5°C) ±(0.09%rdg+0.2°C) ±(0.06%rdg+0.2°C)	±(0.19%rdg+3.8°C) ±(0.09%rdg+1.6°C) ±(0.06%rdg+0.9°C)
K	- 210 to - 160°C - 160 to 0°C 0 to + 960°C + 960 to +1370°C	0.1°C 0.1°C 0.1°C 0.1°C	±(0.11%rdg+0.3°C) ±(0.08%rdg+0.2°C) ±(0.06%rdg+0.1°C) ±(0.06%rdg+0.6°C)	±(0.11%rdg+1.8°C) ±(0.08%rdg+1.1°C) ±(0.06%rdg+0.7°C) ±(0.06%rdg+1.2°C)
J	- 200 to - 160°C - 160 to 0°C 0 to + 700°C + 700 to +1200°C	0.1°C 0.1°C 0.1°C 0.1°C	±(0.09%rdg+0.2°C) ±(0.07%rdg+0.1°C) ±(0.05%rdg+0.1°C) ±(0.06%rdg+0.4°C)	±(0.09%rdg+1.4°C) ±(0.07%rdg+1.0°C) ±(0.05%rdg+0.6°C) ±(0.06%rdg+0.8°C)
B	+ 200 to + 280°C + 280 to + 800°C + 800 to +1760°C	0.5 to 0.4°C 0.3 to 0.1°C 0.1°C	±(0.03%rdg+1.5°C) ±(0.03%rdg+0.6°C) ±(0.04%rdg+0.4°C)	±(0.03%rdg+1.5°C) ±(0.03%rdg+0.6°C) ±(0.04%rdg+0.4°C)
S	- 10 to + 200°C + 200 to +1760°C	0.1°C 0.1°C	±(0.06%rdg+0.6°C) ±(0.05%rdg+0.4°C)	±(0.06%rdg+1.3°C) ±(0.05%rdg+0.8°C)
R	- 10 to + 150°C + 150 to +1760°C	0.1°C 0.1°C	±(0.06%rdg+0.6°C) ±(0.05%rdg+0.4°C)	±(0.06%rdg+1.3°C) ±(0.05%rdg+0.8°C)
E	- 210 to + 550°C + 550 to +1000°C	0.1°C 0.1°C	±(0.10%rdg+0.2°C) ±(0.06%rdg+0.3°C)	±(0.10%rdg+1.6°C) ±(0.06%rdg+0.7°C)
N	- 200 to 0°C 0 to +1090°C +1090 to +1300°C	0.1°C 0.1°C 0.1°C	±(0.11%rdg+0.4°C) ±(0.05%rdg+0.2°C) ±(0.06%rdg+0.6°C)	±(0.11%rdg+1.8°C) ±(0.05%rdg+0.7°C) ±(0.06%rdg+0.9°C)

* The accuracy of sensor is not included and thermocouple B does not use the reference junction.

Connection with data logger

Number of connectable units	Up to 20 units
Extension distance	100 m (between devices)
Connection cable	Connection cable for the EX (CR-89**)

Power supply

Power supply voltage	AC 100 to 240 V 50/60 Hz
Maximum power consumption	EX-50H: 104 VA max

Environment

Operating temperature / humidity range	0 to +50°C 85% RH or less (No condensation)

Others

Outside dimension	320 (W) × 130 (D) × 490 (H) mm (Excluding rubber protectors and protrusions)
Mass	Approx. 10 kg

Standard accessories

- AC power cable (CR-03) 1
- Ground wire (CR-20) 1
- Vinyl cover 1
- Connection cable for the EX (CR-892M) 1
- Phillips screwdriver 1
- Warranty certificate 1

Related Products

SB-OT1B one-touch terminal

This terminal block allows one-touch connection of input lead wires. It is used by attaching to the input terminal of the switch box. (One set of five terminals)

Connection cable for the EX CR-89XX

This is a cable for connecting the TS-963/-960 data logger to the T-ZACCS BOX/T-ZACCS UNIT and for connecting each BOX and UNIT to each other.

CR-892M (2 m), CR-895M (5 m), CR-8901 (10 m),
CR-8902 (20 m), CR-8905 (50 m), CR-8910 (100 m)

T-ZACCS UNIT EU-10H

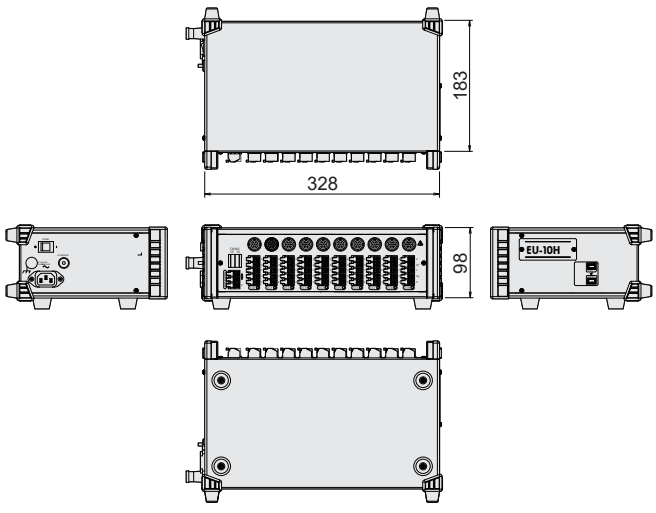
- 1000 points per 0.1 sec at the fastest due to adoption of an ultra-high-speed field network.
- Our unique next-generation A/D method that achieves both high precision and high stability, and high-speed measurement eliminates the various thermo-electromotive forces, zero movement of the amplifier, and commercial power supply noise and realizes high-precision and high-stability measurement.
- The high-precision mode can measure 1000 points in 0.4 seconds (50 Hz) even when using the thermocouple measurement or high-resolution mode.
- A strain gauge with temperature measurement function can be measured with one channel.
- Equipped with the Complete Compensation Method of Strain (Comet).
- Various check functions (insulation check, sensitivity check, variation check, and thermocouple disconnection check).
- 10 ch space saving.
- Can be distributed to scattered measurement locations.



T-ZACCS UNIT EU-10H

This equipment is a measurement unit for expanding the number of measuring points in combination with the T-ZACCS9 TS-963/-960. With 10 measurement points, this equipment allows you to measure strain gauges, strain gauge type converters, thermocouples, platinum resistance temperature detectors, DC voltages, and other equipment. By adopting our unique next-generation A/D method that achieves both high precision and high stability and high-speed measurement, and an ultra-high-speed field network based on Ethernet, various thermo-electromotive forces, zero movement of the amplifier, and commercial power supply noise are eliminated, and high-precision and high-stability measurement are realized. At the same time, regardless of the number of measuring points, the high-speed mode can measure in 0.1 seconds, and the high-precision mode can measure in 0.4 seconds (50 Hz).

External Dimensions



Specifications

Measurement capabilities

Common to all modes		
Number of measuring points	10 points	
Input terminal	Dual-purpose type for screw fixing and soldering	
One-touch connector	NDIS one-touch connector	
Compensation mode	Comet NON, Comet A, Comet B	
Check function	At the time of measurement	Open check
	Sensor	Insulation check, sensitivity check, variation check, and thermocouple disconnection check Lead wire resistance check and bridge output check

High-speed mode

Measuring speed	0.1 seconds (0.2 seconds when using the gauge with temperature measurement)	
Strain measurement		
Applicable wiring method, gauge resistance	One-gauge method, three-wire type	120, 240, 350 Ω
	Two-gauge method	60-1000 Ω
	Two-gauge common dummy method	60-1000 Ω
	Four-gauge method	60-1000 Ω
	Four-gauge method constant current	350 Ω
	Four-gauge method 0-2 V mode	60-1000 Ω
	Mode for gauge with temperature measurement function (One-gauge method, three-wire type)	120,240,350 Ω T (JIS C 1602:2015, IEC 60584-1:2013)
Sensor cable extension range	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1 to -0.5%/ Cable round-trip resistance: 100 Ω
Lead wire resistance compensation range Comet B (1G3W)	Gauge resistance 120 Ω: About 100 Ω or less	
	Gauge resistance 240 Ω: About 200 Ω or less	
	Gauge resistance 350 Ω: About 300 Ω or less	
Zero stability	± 1.0 × 10^{-6} strain/°C or less (one-gauge method) ± 0.5 × 10^{-6} strain/°C or less (two-gauge method)	
Initial unbalance	± 750 × 10^{-6} strain or less (one-gauge method) ± 500 × 10^{-6} strain or less (two-gauge method)	
DC voltage measurement		
V1/1	DC±640mV	
V1/100	DC±64V	
Input impedance	1 MΩ or more	
Allowable input voltage between B and D	DC±70V MAX	
Thermocouple temperature measurement		
Applicable thermocouple	T,K,J,B,S,R,E,N JIS C1602:2015、IEC 60584-1:2013	
Platinum resistance temperature detector measurement		
Applicable platinum resistance temperature detector	Pt100 (500 μA constant current three-wire type) JIS C 1604:2013, IEC 60751: 2008	

Strain measurement (high-speed mode)		
Bridge excitation	DC2V 4ms(50Hz)	
Initial value storage range	±160000×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 80000 × 10^{-6} strain ± 160000 × 10^{-6} strain ± 320000 × 10^{-6} strain ± 640000 × 10^{-6} strain	1×10^{-6} strain 2×10^{-6} strain 4×10^{-6} strain 8×10^{-6} strain 16×10^{-6} strain
Accuracy (at 23°C ± 5°C)	± (0.08% rdg + 3 digits) (one-gauge method, two-gauge method, four-gauge method) ± (0.08%+ 6 digits) (four-gauge method 0-2 V mode)	

Constant current strain measurement (four-gauge method only) (high-speed mode)		
Bridge excitation	DC 6mA 4ms (50 Hz)	
Bridge resistance	350 Ω	
Initial value storage range	± 160000 × 10^{-6} strain	
Temperature coefficient of accuracy	± 0.002% rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000×10^{-6} strain ± 80000×10^{-6} strain ±160000×10^{-6} strain ±320000×10^{-6} strain ±640000×10^{-6} strain	1×10^{-6} strain 2×10^{-6} strain 4×10^{-6} strain 8×10^{-6} strain 16×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.08%rdg+3digit)	

T-ZACCS UNIT EU-10H

DC voltage measurement (high-speed mode)			
Initial value storage range			
V1/1		±160.000mV	
V1/100		±16.0000V	
Temperature coefficient of accuracy		±0.0024%rdg/°C	
Aging change of accuracy		±0.024%rdg/year	
Measurement range and resolution	**V1/1**	Measurement range	Resolution
		± 40.000mV ± 80.000mV ±160.000mV ±320.000mV ±640.000mV	0.001mV 0.002mV 0.004mV 0.008mV 0.016mV
	V1/100	± 4.0000V ± 8.0000V ±16.0000V ±32.0000V ±64.0000V	0.0001V 0.0002V 0.0004V 0.0008V 0.0016V
Accuracy (at 23°C ± 5°C) With moving averaging	**V1/1**	±(0.08%rdg+6digit)	
	V1/100	±(0.08%rdg+6digit)	
Accuracy (at 23°C ± 5°C) Without moving averaging	**V1/1**	±(0.08%rdg+50digit)	
	V1/100	±(0.08%rdg+50digit)	

Platinum resistance temperature detector temperature measurement (JIS C 1604:2013, IEC 60751:2008 Pt100) (high-speed mode)	
Applicable resistance temperature detector	Pt100
Measurement Method	Three-wire type (Pt3W)
Linearization	Digital calculation
Temperature coefficient of accuracy	± 0.0020% rdg/°C
Aging change of accuracy	± 0.05% rdg/year
Measurement range	-200 to +850°C
Resolution	0.1°C
Accuracy (at 23°C ± 5°C)	± (0.1% rdg + 0.3°C)

Thermocouple temperature measurement (JIS C 1602:2015, IEC 60584-1:2013) (high-speed mode)

Applicable thermocouple	T, K, J, B, S, R, E, N
Linearization	Digital calculation

Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C) (External reference junction)	Accuracy (at 23°C ± 5°C) (Internal reference junction)
T	- 250 to - 200°C	0.1°C	±(0.31%rdg+1.9°C)	±(0.31%rdg+5.2°C)
	- 200 to - 100°C	0.1°C	±(0.14%rdg+0.8°C)	±(0.14%rdg+2.1°C)
	- 100 to 0°C	0.1°C	±(0.11%rdg+0.5°C)	±(0.11%rdg+1.2°C)
	0 to + 400°C	0.1°C	±(0.08%rdg+0.4°C)	±(0.08%rdg+0.9°C)
K	- 210 to - 160°C	0.1°C	±(0.17%rdg+0.9°C)	±(0.17%rdg+2.5°C)
	- 160 to 0°C	0.1°C	±(0.12%rdg+0.6°C)	±(0.12%rdg+1.5°C)
	0 to + 960°C	0.1°C	±(0.09%rdg+0.4°C)	±(0.09%rdg+0.9°C)
	+ 960 to +1370°C	0.1°C	±(0.10%rdg+0.9°C)	±(0.10%rdg+1.5°C)
J	- 200 to - 160°C	0.1°C	±(0.15%rdg+0.6°C)	±(0.15%rdg+1.8°C)
	- 160 to 0°C	0.1°C	±(0.11%rdg+0.4°C)	±(0.11%rdg+1.3°C)
	0 to + 700°C	0.1°C	±(0.09%rdg+0.3°C)	±(0.09%rdg+0.8°C)
	+ 700 to +1200°C	0.1°C	±(0.09%rdg+0.6°C)	±(0.09%rdg+1.0°C)
B	+ 200 to + 280°C	0.5 to 0.4°C	±(0.03%rdg+6.0°C)	±(0.03%rdg+6.0°C)
	+ 280 to + 800°C	0.3 to 0.1°C	±(0.03%rdg+2.4°C)	±(0.03%rdg+2.4°C)
	+ 800 to +1760°C	0.1°C	±(0.04%rdg+2.6°C)	±(0.04%rdg+2.6°C)
S	- 10 to + 200°C	0.1°C	±(0.06%rdg+2.4°C)	±(0.06%rdg+3.1°C)
	+ 200 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+2.0°C)
R	- 10 to + 150°C	0.1°C	±(0.06%rdg+2.4°C)	±(0.06%rdg+3.1°C)
	+ 150 to +1760°C	0.1°C	±(0.05%rdg+1.5°C)	±(0.05%rdg+1.8°C)
E	- 210 to + 550°C	0.1°C	±(0.16%rdg+0.6°C)	±(0.16%rdg+2.0°C)
	+ 550 to +1000°C	0.1°C	±(0.09%rdg+0.4°C)	±(0.09%rdg+0.9°C)
N	- 200 to 0°C	0.1°C	±(0.11%rdg+1.3°C)	±(0.11%rdg+2.7°C)
	0 to +1090°C	0.1°C	±(0.09%rdg+0.5°C)	±(0.09%rdg+1.0°C)
	+1090 to +1300°C	0.1°C	±(0.06%rdg+0.9°C)	±(0.06%rdg+1.3°C)

* The accuracy of sensor is not included, and thermocouple B does not use the reference junction.

High-precision mode

Measuring speed	0.4 sec (50 Hz) / 0.34 sec (60 Hz) (0.8 sec when using gauge with temperature measurement) (50 Hz) / 0.67 sec (60 Hz)	
Strain measurement		
Applicable wiring method, gauge resistance	One-gauge method, three-wire type	120, 240, 350 Ω
	Two-gauge method	60-1000 Ω
	Two-gauge common dummy method	60-1000 Ω
	Four-gauge method	60-1000 Ω
	Four-gauge method constant current	350 Ω
	Four-gauge method high-resolution mode	120-1000 Ω
	Four-gauge method constant current high-resolution mode	350 Ω
	Four-gauge method 0-2 V mode	60～1000 Ω
	Mode for gauge with temperature measurement function (One-gauge method, three-wire type)	120,240,350Ω T（JIS C1602:2015、IEC 60584-1:2013）
Sensor cable extension range	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
	Four-gauge method constant current high-resolution: 350 Ω	Cable round-trip resistance: 160 Ω or less
Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1 to -0.5% / Cable round-trip resistance: 100 Ω
	Four-gauge method constant current high-resolution: 350 Ω	
Lead wire resistance compensation range Comet B (1G3W)	Gauge resistance 120 Ω: About 100 Ω or less	
	Gauge resistance 240 Ω: About 200 Ω or less	
	Gauge resistance 350 Ω: About 300 Ω or less	
Zero stability	±1.0 × 10^{-6} strain/°C or less (one-gauge method) ± 0.5 × 10^{-6} strain/°C or less (two-gauge method)	
Initial unbalance	± 750 × 10^{-6} strain or less (one-gauge method) ± 500 × 10^{-6} strain or less (two-gauge method)	
DC voltage measurement		
V1/1	DC±640mV	
V1/100	DC±64V	
Input impedance	1MΩ以上	
Allowable input voltage between B and D	DC±70V MAX	
Thermocouple temperature measurement		
Applicable thermocouple	T,K,J,B,S,R,E,N JIS C1602:2015、IEC 60584-1:2013	
Platinum resistance temperature detector measurement		
Applicable platinum resistance temperature detector	Pt100 (500 μA constant current 3-wire type) JIS C 1604:2013, IEC 60751: 2008	
Strain measurement (high-precision mode)		
Bridge excitation	DC2V 24ms(50Hz)	
Initial value storage range	±160000×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000×10^{-6} strain ± 80000×10^{-6} strain ±160000×10^{-6} strain ±320000×10^{-6} strain ±640000×10^{-6} strain	1×10^{-6} strain 2×10^{-6} strain 4×10^{-6} strain 8×10^{-6} strain 16×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+1digit)	
Constant current strain measurement (four-gauge method only) (high-precision mode)		
Bridge excitation	DC 6 mA 24 ms (50 Hz)	
Bridge resistance	350 Ω	
Initial value storage range	± 160000 × 10^{-6} strain	
Temperature coefficient of accuracy	± 0.002% rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000×10^{-6} strain ± 80000×10^{-6} strain ±160000×10^{-6} strain ±320000×10^{-6} strain ±640000×10^{-6} strain	1×10^{-6} strain 2×10^{-6} strain 4×10^{-6} strain 8×10^{-6} strain 16×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+1digit)	

High-resolution strain measurement (four-gauge method only) (high-precision mode)		
Bridge excitation	DC5V 24ms(50Hz)	
Initial value storage range	±16000.0×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 4000.0×10^{-6} strain	0.1×10^{-6} strain
	± 8000.0×10^{-6} strain	0.2×10^{-6} strain
	±16000.0×10^{-6} strain	0.4×10^{-6} strain
	±32000.0×10^{-6} strain	0.8×10^{-6} strain
	±64000.0×10^{-6} strain	1.6×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+3digit)	

High-resolution strain measurement (four-gauge method only) (high-precision mode)		
Bridge excitation	DC14mA 24ms(50Hz)	
Bridge resistance	350Ω	
Initial value storage range	±16000.0×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 4000.0×10^{-6} strain	0.1×10^{-6} strain
	± 8000.0×10^{-6} strain	0.2×10^{-6} strain
	±16000.0×10^{-6} strain	0.4×10^{-6} strain
	±32000.0×10^{-6} strain	0.8×10^{-6} strain
	±64000.0×10^{-6} strain	1.6×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+3digit)	

DC voltage measurement (high-precision mode)			
Initial value storage range			
V1/1		±160.000mV	
V1/100		±16.0000V	
Temperature coefficient of accuracy		±0.0024%rdg/°C	
Aging change of accuracy		±0.024%rdg/year	
Measurement range and resolution		Measurement range	Resolution
	V1/1	± 40.000mV	0.001mV
		± 80.000mV	0.002mV
		±160.000mV	0.004mV
		±320.000mV	0.008mV
		±640.000mV	0.016mV
	V1/100	± 4.0000V	0.0001V
		± 8.0000V	0.0002V
		±16.0000V	0.0004V
		±32.0000V	0.0008V
		±64.0000V	0.0016V
V1/1 accuracy (at 23°C ± 5°C)		± (0.05% rdg + 3 digits)	
V1/100 accuracy (at 23°C ± 5°C)		± (0.05% rdg + 2 digits)	

Platinum resistance temperature detector temperature measurement (JIS C 1604:2013, IEC 60751:2008 Pt100) (high-precision mode)	
Applicable resistance temperature detector	Pt100
Measurement Method	Three-wire type (Pt3W)
Linearization	Digital calculation
Temperature coefficient of accuracy	± 0.0020% rdg/°C
Aging change of accuracy	± 0.05% rdg/year
Measurement range	-200 to +850°C
Resolution	0.1°C
Accuracy (at 23°C ± 5°C)	± (0.05% rdg + 0.3°C)

Thermocouple temperature measurement (JIS C 1602:2015, IEC 60584-1:2013) (high-precision mode)				
Applicable thermocouple	T, K, J, B, S, R, E, N			
Linearization	Digital calculation			
Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C) (External reference junction)	Accuracy (at 23°C ± 5°C) (Internal reference junction)
T	- 250 to - 200°C	0.1°C	±(0.19%rdg+0.5°C)	±(0.19%rdg+3.8°C)
	- 200 to - 100°C	0.1°C	±(0.09%rdg+0.2°C)	±(0.09%rdg+1.6°C)
	- 100 to + 400°C	0.1°C	±(0.06%rdg+0.2°C)	±(0.06%rdg+0.9°C)
K	- 210 to - 160°C	0.1°C	±(0.11%rdg+0.3°C)	±(0.11%rdg+1.8°C)
	- 160 to 0°C	0.1°C	±(0.08%rdg+0.2°C)	±(0.08%rdg+1.1°C)
	0 to + 960°C	0.1°C	±(0.06%rdg+0.1°C)	±(0.06%rdg+0.7°C)
	+ 960 to +1370°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.2°C)
J	- 200 to - 160°C	0.1°C	±(0.09%rdg+0.2°C)	±(0.09%rdg+1.4°C)
	- 160 to 0°C	0.1°C	±(0.07%rdg+0.1°C)	±(0.07%rdg+1.0°C)
	0 to + 700°C	0.1°C	±(0.05%rdg+0.1°C)	±(0.05%rdg+0.6°C)
	+ 700 to +1200°C	0.1°C	±(0.06%rdg+0.4°C)	±(0.06%rdg+0.8°C)
B	+ 200 to + 280°C	0.5 to 0.4°C	±(0.03%rdg+1.5°C)	±(0.03%rdg+1.5°C)
	+ 280 to + 800°C	0.3 to 0.1°C	±(0.03%rdg+0.6°C)	±(0.03%rdg+0.6°C)
	+ 800 to +1760°C	0.1°C	±(0.04%rdg+0.4°C)	±(0.04%rdg+0.4°C)
S	- 10 to + 200°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.3°C)
	+ 200 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+0.8°C)
R	- 10 to + 150°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.3°C)
	+ 150 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+0.8°C)
E	- 210 to + 550°C	0.1°C	±(0.10%rdg+0.2°C)	±(0.10%rdg+1.6°C)
	+ 550 to +1000°C	0.1°C	±(0.06%rdg+0.3°C)	±(0.06%rdg+0.7°C)
N	- 200 to 0°C	0.1°C	±(0.11%rdg+0.4°C)	±(0.11%rdg+1.8°C)
	0 to +1090°C	0.1°C	±(0.05%rdg+0.2°C)	±(0.05%rdg+0.7°C)
	+1090 to +1300°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+0.9°C)

* The accuracy of sensor is not included, and thermocouple B does not use the reference junction.

Connection with data logger

Number of connectable units	Up to 100 units can be connected (Including those built into TS-960/-963)
Extension distance	100 m (between devices)
Connection cable	Connection cable for the EX (CR-89**)

Power supply

Power supply voltage	AC 100 to 240 V 50/60Hz
Maximum power consumption	86 VA max

Environment

Operating temperature / humidity range	0 to +50°C 85% RH or less (No condensation)

Standard accessories

AC power cable (CR-03) 1
Ground wire (CR-20) 1
Vinyl cover 1
Connection cable for the EX (CR-892M) 1
Warranty certificate 1

Related Products

SB-OT1B one-touch terminal

This terminal block allows one-touch connection of input lead wires. It is used by attaching to the input terminal of the switch box. (One set of five terminals)

Connection cable for the EX CR-89XX

This is a cable for connecting the TS-963/-960 data logger to the T-ZACCS BOX/T-ZACCS UNIT and for connecting each BOX and UNIT to each other.
CR-892M (2 m), CR-895M (5 m), CR-8901 (10 m),
CR-8902 (20 m), CR-8905 (50 m), CR-8910 (100 m)

T-ZACCS UNIT EU-10D

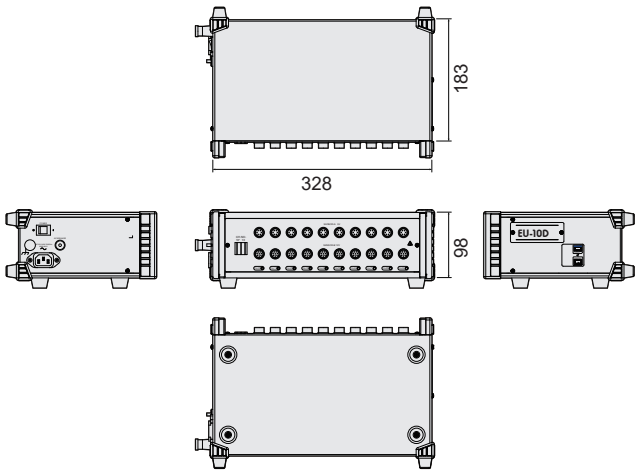
- Digital displacement sensors can be measured in combination with the T-ZACCS9 TS-963/-960.
- Two types of digital displacement sensors are supported.
- There is no signal degradation since this equipment handles digital signals.
- This equipment can be used in combination with other T-ZACCS BOX and/or T-ZACCS UNIT devices.



T-ZACCS UNIT EU-10D

This equipment is a digital displacement sensor measurement unit in combination with the T-ZACCS9 TS-963/-960. The measurement of the digital displacement sensor can be performed with 10 measurement points.
This equipment can perform high-speed measurement regardless of the number of measurement points by performing our original high-precision and high-stable measurement and by adopting an ultra-high-speed field network based on the Ethernet.

External Dimensions



Specifications

Function

Number of measuring points	10 points		
Supported digital displacement sensors		Sensor A (5V)	Sensor B (12V)
	Compatible connector	R03-PB6M (Manufactured by Tajimi)	R03-PB8M (Manufactured by Tajimi)
	Sensor power supply	4.5-5.5V (100mA)	11.4-12.6V (50mA)
	Pin assignment	A: Phase A B: Phase B C: +5V D: NC E: GND F: GND	A: GND B: Phase A C: +12V D: Phase B E: NC F: Shield G: NC H: NC
Input signal	Rectangular wave voltage input		
Counting method	Up/down counting by phase difference of phase A + phase B		
Measurement range	± 640000 integrated counting		
Measuring speed	0.1 seconds		
Measurement accuracy	Depending on the digital displacement sensor used		
Measurement resolution	Depending on the digital displacement sensor used		
Quantization error	±1 count		
Counter reset	When the power is turned ON／ Full count		

Connection with data logger

Number of connectable units	Up to 100 units can be connected (Including those built into data logger)
Extension distance	100 m (between devices)
Connection cable	Connection cable for the EX (CR-89**)

Power supply

Power supply voltage	AC 100 to 240 V 50/60 Hz
Maximum power consumption	86 VA max

Environment

Operating temperature / humidity range	0 to +50°C 85% RH or less (No condensation)

Others

Outside dimension	3328 (W) × 98 (H) × 183 (D) mm (Excluding rubber protectors and protrusions)
Mass	Approx. 3 kg

Standard accessories

- AC power cable (CR-03) 1
- Ground wire (CR-20) 1
- Vinyl cover 1
- Connection cable for the EX (CR-892M) 1
- Warranty certificate 1

T-ZACCS + EI-01P (switch box protocol converter)

- Measurement with the ISW-50G/IHW-50G switch box is possible.
- No special settings are required for ease of use.



T-ZACCS + EI-01P

This equipment is a protocol converter connected to the T-ZACCS9 TS-963/-960 to operate the ISW-50G/IHW-50G switch box. This equipment can operate one switch box.

Specifications

Connection with data logger

Target model	TS-960/-963
Number of connectable units	Up to 20 units (in total including EX-50H)
Extension distance	100 m (between devices)
Connection cable	Connection cable for the EX (CR-89**)

Connection with switch box

Target model		IHW-50G、ISW-50G
ELECTRICAL (RS-422)	**Number of connectable units**	1 unit, 50 points
	Extension distance	2 m
	Connection cable	Extension cable for the ISW/IHW (CR-832M)

Display / operation

POWER LED	Lights up with the power is ON
SYSTEM LED	LED indicating system errors (Normal state: Lights off ISW-50G/IHW-50G connected state: Blinking in red Error state: Lighting in red)

Power supply

Power supply voltage	AC 100 to 240 V 50/60 Hz
Maximum power consumption	12 VA max

Environment

Operating temperature / humidity range	0 to +50°C 85% RH or less (No condensation)

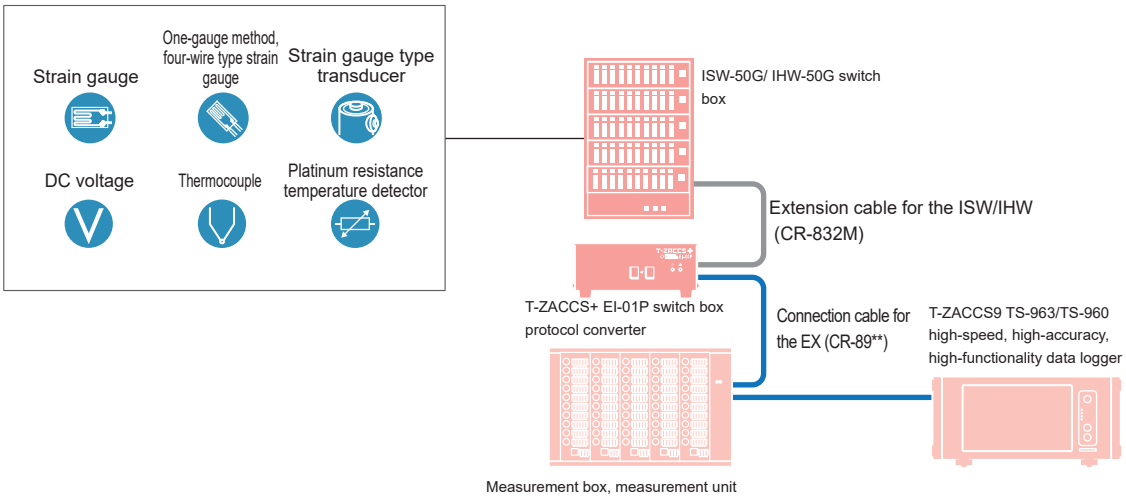
Others

Outside dimension	160 (W) × 60 (H) × 171.5 (D) mm (Excluding protrusions)
Mass	Approx. 1 kg

Standard accessories

AC power cable (CR-03) 1
Ground wire (CR-20) 1
Connection cable for the EX (CR-892M) 1
Warranty certificate 1

System Block Diagram



T-ZACCS + EE-00R repeater

NEW

- The communication distance between devices of 100 m can be further extended by 100 m.
- No special settings are required and easy to use.



T-ZACCS + EE-00R repeater

This equipment is a repeater that is connected between the T-ZACCS 9 and T-ZACCS BOX/T-ZACCS UNIT or between the T-ZACCS BOX/T-ZACCS UNIT and T-ZACCS BOX/T-ZACCS UNIT to extend the communication distance. By using this equipment, the communication distance between devices of 100 m can be further extended by 100 m.

Specifications

Connection with data logger

Target model	T-ZACCS9 T-ZACCS BOX/T-ZACCS UNIT
Number of connectable units	Up to 100 units * Each additional unit disables the use of 10 channels.
Extension distance	100 m (between devices)
Connection cable	Connection cable for the EX (CR-89**)

Display

Power LED	Lights up with the power is ON
Error LED	Shows error indication.

Power supply

Rated power supply voltage	AC 100 to 240 V 50/60Hz
Maximum power consumption	12 VA max

Environment

Operating temperature / humidity range	0 to +50°C 85% RH or less (No condensation)

Others

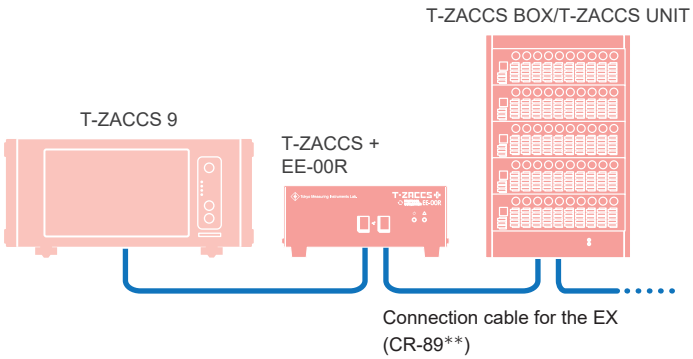
Outside dimension	160 (W) × 60 (H) × 171.5 (D) mm (Excluding protrusions)
Mass	Approx. 1kg

Standard accessories

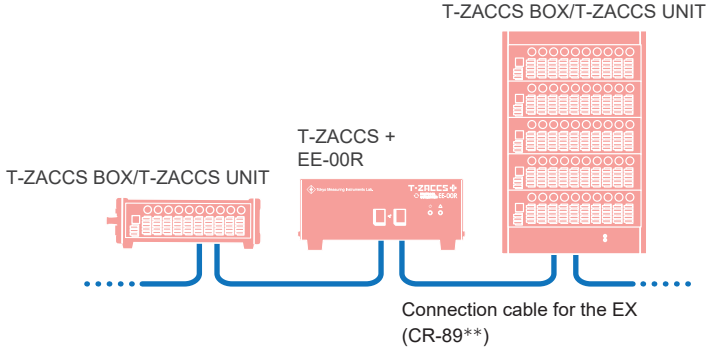
C power cable (CR-03) 1
Ground wire (CR-20) 1
Connection cable for the EX (CR-892M) 1
Warranty certificate 1

System Block Diagram

■ When connected between the T-ZACCS 9 and T-ZACCS BOX/T-ZACCS UNIT



■ When connected between the T-ZACCS BOX/T-ZACCS UNIT



TS-560

T-ZACCS 5

- Secure data retention by robust built-in data memory
- Realization of stable interval measurement with a clock accuracy of ±1 second per day
- Collective setting of coefficient, unit, decimal point and sensor type by “Sensor ID”
- Equipped with interval measurement “Quick Interval” that requires no settings
- Equipped with “Remote Data Logger” that enables remote operation from an Internet browser
- The maximum number of measurement points is 1000 (using external switch boxes)
- Equipped with the Complete Compensation Method of Strain
- Various check functions (Automatic check by a timer is possible)
- Color LCD monitor with touch panel
- Equipped with automatic measurement function using interval timer and monitor comparator
- Supports SD card and USB memory as recording media
- Equipped with LAN, USB, and RS-232C as standard
- Can be used with built-in battery even when external power supply is cut off

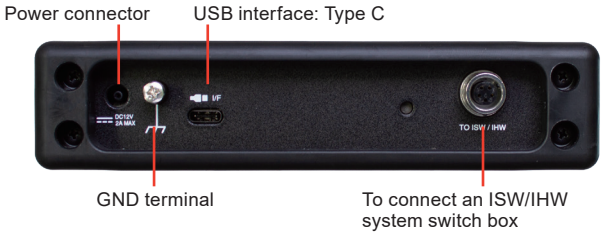


TS-560 data logger

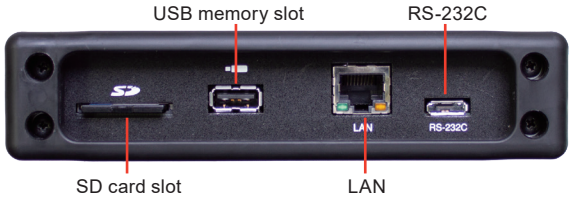
This equipment is a data logger that can easily perform multi-point measurements when combined with the high-speed IHW-50G switch box or the ISW-50G switch box. It is possible to measure up to 1000 points depending on the user application, including strain gauges, strain gauge type transducers, DC voltages, thermocouples, platinum resistance temperature detectors, and other equipment. Since this data logger is smaller and lighter than conventional ones, it can be used in a variety of measurement situations. It employs a color LCD monitor with touch panel and provides clear monitor display and comfortable, intuitive operability to enable monitoring of measurement data and quick checking and verification after measurement.

Side interface

● Right side



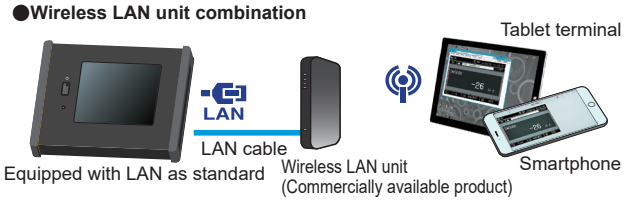
● Left side



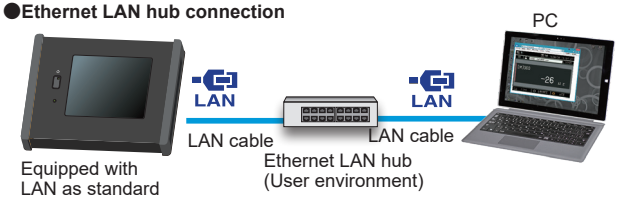
Remote data logger function

Remote operation according to the user communication mode
Equipped with Web server function (remote data logger function). Measurement and monitoring with the TS-560 can be performed from an Internet browser. No special software is required.

●Wireless LAN unit combination



●Ethernet LAN hub connection



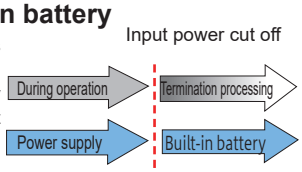
File download using remote data logger function
During remote operation, measurement data files recorded by the equipment in a data memory or SD card can be downloaded (transferred) to a PC or tablet. It is also possible to select multiple files.
*Files saved on a USB memory device cannot be downloaded.

TS-560

Data protection

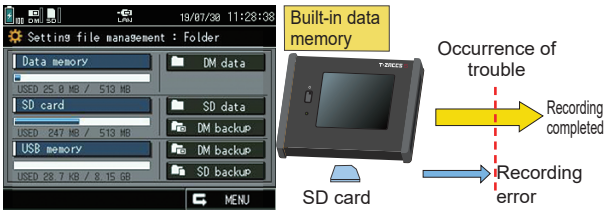
● Equipped with a built-in battery

Even if the external input power is suddenly cut off while accessing a file, file corruption can be prevented by continuing to supply power without power interruptions.



● Data backup function

Although an SD card is used to record measurement data, the highly durable and reliable built-in data memory ensures data backup even when the SD card fails.



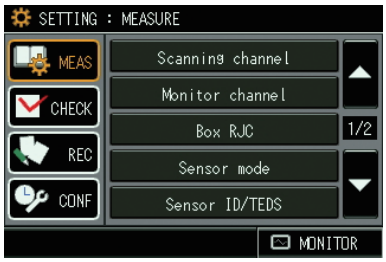
The SD cards designated by us have a long data retention period (about 10 years) and are dedicated for industrial applications suitable for measurements with frequent writing.
USB memory devices are used for data copying and reproduction.

Touch panel display

The display is a color LCD display with a touch panel that is easy to see and intuitive to use. It also supports display in Japanese and English.

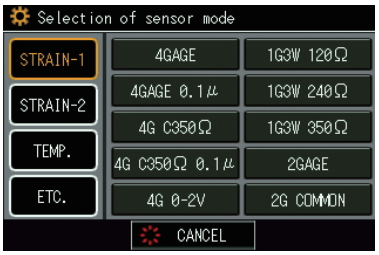
● Setting Menu

Measurement:
Sensor mode, scan channel, sensor ID, etc.
Check:
Check, output of setting list, list output of automatic measurement setting, etc.
Recording:
File management, file output, interface selection, etc.
Configuration:
Date/time, measurement environment, version upgrade, factory setting, etc.



● Sensor mode selection

Strain-1:
4 GAGE/4 GAGE 0.1 μ/1G3W/
4 G C350 Ω / 4G C350 Ω 0.1 μ / other
Strain-2:
1G4W 120 Ω, 240 Ω, 350 Ω
1G3W 120 Ω -T, 240 Ω -T, 350 Ω -T
Temperature:
T (CC)/K (CA)/J (IC)/B/S/R/N/E (CRC)/Pt100 3W
Other:
DC 640 mV/DC 64 V/JUMP



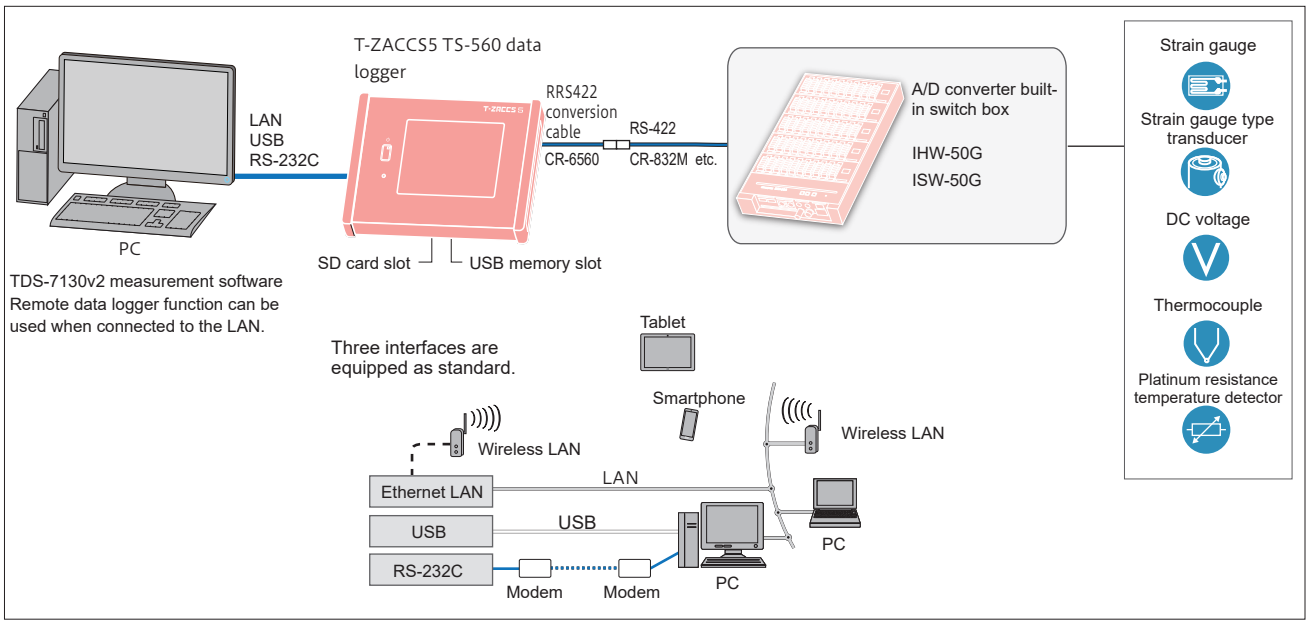
● Sensor ID setting

The sensor ID (parameter) can be saved. Parameters of coefficient, unit, display digit, and sensor type can be set collectively. For example, when replacing some of the connected sensors, the setting of new measurement is completed by simply reading out the saved sensor IDs and updating only the relevant parameters.

Specifications

Measurement capabilities		
Number of measuring points		Up to 1000 points (Up to 2000 points when using strain gauge with temperature measurement function)
Measuring speed	IHW-50G	0.4 sec / 1000 points (1 sec/1000 points)
	ISW-50G	2 sec / 1000 points (3 sec/1000 points)
Measuring mode		Initial, direct, measure (For temperature measurement, direct only)
Simple measure		Coefficient 1.000 Unit Interlocked with sensor mode Decimal point Interlocked with sensor mode
Compensation mode		Comet NON, Comet A, Comet B
Measuring point switching method	Scanning	Automatic switching measurement from the first channel to the last channel (jump possible)
	Monitor	Repeated measurement of monitor channels (up to 10 points)
Scanning measurement start	Manual	START button (Monitor screen)
	Automatic	Interval timer, monitor comparator
	Interface	LAN, USB, RS-232C
Channel setting	Coefficient	± (0.0001-99999)
	Unit	40 types including με, mV, °C, kgf, mm
	Decimal point	Display after the decimal point can be set arbitrarily with 0 to 5 digits
	Offset	To be written by arbitrarily measurement channel
	Sensor mode	Jump

System Block Diagram



Measurement capabilities				
Channel setting	Sensor mode		Strain	One-gauge method three-wire type, 120 / 240 / 350 Ω
				One-ga8uge method four-wire type, 120 / 240 / 350 Ω
				Two-gauge common dummy method, two-gauge method
				Four-gauge method, four-gauge method constant current 350 Ω
				Four-gauge method high-resolution mode
				Four-gauge method constant current 350 Ω high-resolution mode
				Four-gauge method 0-2 V mode
				Gauge with temperature measurement 120 / 240 / 350 Ω
			DC voltage 640 mV, 64 V	
			Temperature	Thermocouple T/K/J/B/S/R/E/N
				Platinum resistance temperature detector Pt100 3W
Sensor ID TEDS function	Sensor ID	Function	Reading and setting of sensor ID Writing of sensor ID	
	TEDS	Standard	IEEE 1451.4 Class 2 compatible (Template No. 33)	
		Function	Sensor information reading and setting	
Check function	At the time of measurement		Open check	
	Sensor		Insulation check, sensitivity check, variation check, thermocouple disconnection check, lead wire resistance check, bridge output check	

Interval timer		
Function		Scanning measurement at the set time interval and time
Quick setting	Time interval	1 min / 10 min / 1 hr (measured on the minute or hour)
Table setting	Time interval	Hour / minute / second can be set for each step up to 99 hours, 59 minutes, and 59 seconds.
	Real time start	Start time (day / hour / minute / second) can be set for each step.
	Number of starts	Up to 99 times per step or infinite
	Number of steps	Programmable up to 50 steps
	GOTO step	Program loop possible to one of the previous steps
	GOTO comparator	Go to Step 1 of the monitor comparator.
	Execution processing	Scanning, insulation check, sensitivity check, variation check, thermocouple disconnection check
Sleep function		When the interval between the end of scanning and the start of scanning is 1 min or longer, the power is turned on/OFF automatically.

Monitor comparator		
Function		Automatic measurement based on the amount of change in the setting of monitor channel (1 point)
Table setting	Comparison amount	Can be set for each step: Up to ±999999
	Comparison method	Amount of change or upper / lower limit
	Number of starts	Up to 99 times per step or infinite
	Number of steps	Programmable up to 50 steps
	GOTO step	Program loop possible to one of the previous steps
	GOTO Interval	Go to Step 1 of the interval.

Remote data logger function	
Function	Remote operation of data logger, remote monitoring, and data download function by the Web server function
Connection	LAN
File download	Download (transfer) of the measurement data files (multiple files can be selected) in the data memory or SD card to a PC or tablet in the ZIP format

Time	
Setting	Year, month, day, hour, minute, second
Accuracy	Daily error: ±1 sec (at 23°C ± 5°C)

Display / operation	
Display unit	Color TFT LCD display (with a touch panel), 320 x 240 dots
	Point defect: 10 dots or less (excluding aging deterioration)
Operation	Touch panel, POWER key
Automatic backlight OFF	When no command is received from the operation / interface for an arbitrary set time, the LCD backlight is turned OFF automatically. Automatic backlight OFF function can be set to ON/OFF

Recording		
Built-in	Function	Recording / reproduction of measurement data, saving of setting file
	Recording format	TDS format, CSV format 540 CSV format
	Capacity	512 MB
SD card	Function	Recording / reproduction / copying of measurement data, Saving / copying of setting file Writing / reading of sensor ID
	Physical format	FAT16/32
	Recording format	TDS format, CSV format 540 CSV format
	Capacity	512 MB (Designated by us)
USB memory	Function	Reproduction / copying of measurement data, Saving / copying of setting file Writing / reading of sensor ID
	Physical format	FAT16/32

Interface	
LAN	10BASE-T/100BASE-TX General-purpose command port server function (various settings, measurement, data collection) Web server function (remote data logger function)
USB	USB 2.0 protocol compatible (Connection terminal: USB Type-C) General-purpose command compatible (various settings, measurement, data collection)
RS-232C	USB 2.0 protocol compatible (Connection terminal: USB Type-C) General-purpose command compatible (various settings, measurement, data collection)

ISW/IHW switch box	
Measurement accuracy	Depends on switch box specifications
Target model	IHW-50G/ISW-50G
Number of connectable units	20 units connected（1000 points）
Extension distance	800 m (between devices)
Connection cable	CR-832M (when using CR-6560)

* The first switch box connection interface supports only ELECTRICAL (RS-422).

Internal power supply	
Internal battery	Lithium-ion battery
Battery capacity	2450 mAh
Continuous use time	About 1 hr (Temperature: 23°C ± 5°C, when the IHW-50G is connected)
Charging time	About 3 hr (standby) (when using CR-1867)

Power supply	
Rated power supply voltage	AC adapter (CR-1867) AC 100 to 240 V 50/6 0 Hz
Maximum power consumption	2A MAX（DC12V）

Environment		
Operating temperature / humidity range	0 to +50°C	85% RH or less (No condensation)
Charging temperature / humidity range	0 to +40°C	85% RH or less (No condensation)

Other	
Outside dimension	200 (W) × 30 (H) × 150 (D) mm (Excluding protrusions)
Mass	Approx. 1 kg

Standard accessories

Instruction Manual (CD) 1
AC adapter (CR-1869)..... 1
RS422 conversion cable (CR-6560) 1
Ground wire (CR-2020) 1
Warranty certificate 1

Options

DC Power Cable (CR-062)

TS-560

Related Products

SD card 512 MB

Be sure to use highly durable industrial SD cards designated by us.

RS-232C cable CR-5532

This is a D-sub 9P 10P (small) cross 1.5 m cable to be used to connect to a PC.



Measurement software Visual LOG

Visual LOG TDS-7130v2 static measurement software
Visual LOG Light TDS-700L interval measurement software
Visual LOG Light TDS-Mail data mail management software

IHW-50G high-speed switch box

This equipment is a switch box with built-in A/D converter (parallel operation compatible) that enables high-speed and high-accuracy measurements. High-speed measurement of 50 points in 0.4 sec is possible. In a system using multiple units of this equipment, even strain measurements of 1000 points can be performed in 0.4 sec. An insulated RS-422 is used to connect to the TS-560 main unit.



ISW-50G switch box

This equipment is a switch box with a built-in A/D converter that enables high-speed and high-accuracy measurements. Measurement of 50 points in 2 sec is possible. In a system using multiple units of this equipment, even strain measurements of 1000 points can be performed in 2 sec. An insulated RS-422 is used to connect to the TS-560 main unit.



Comparison of functions of major compatible switch boxes

Switch box model	Number of measuring points	Connector combined use	Strain	Constant current mode	High-resolution mode	DC voltage	Thermocouple	Platinum resistance temperature detector	Built-in lightning arrester	Scanning speed (measurement time*1)	one-gauge method four-wire type*2	Switching method	Application
IHW-50G	50	-	●	●	●	●	●	●	●	0.4 sec / 1000 points (0.04 sec/point) (1 sec)	●	Semiconductor relay	Strain / temperature of gage with temperature measurement function, 1 ch
IHW-50G-05		●											
ISW-50G	50	-	●	●	●	●	●	●	●	2 sec / 1000 points (0.04 sec/point) (3 sec)	●	Semiconductor relay	Strain / temperature of gage with temperature measurement function, 1 ch measurement function compatible
ISW-50G-05		●											

*1: The scanning time includes the time for data logger recording, interface output, etc.
*2: One-gauge method four-wire type: In addition to the one-gauge method four-wire type unit option (code: HF) built into the main unit, a switch box equipped with the same function can also be used.

TS-360 (Portable data logger)

NEW T-ZACCS 3

- The number of measurement points is up to 50 when the main unit and channel unit are combined, and up to 1000 points by connecting external switch boxes.
- Can be powered by 4D size batteries, the dedicated AC adapter (optional), an external battery (12 VDC), etc.
- LAN, USB and RS-232C interfaces are equipped as standard.
- A remote measurement assistance function for LAN communication is available.
- The channel unit can also be utilized as an external switch box when combined with AU-50M master unit sold separately.
- SSW-50D can also be connected.
- Recording is performed using the built-in data memory (16 GB) and/or an external SD card (16 GB).
- Network modules can be connected.

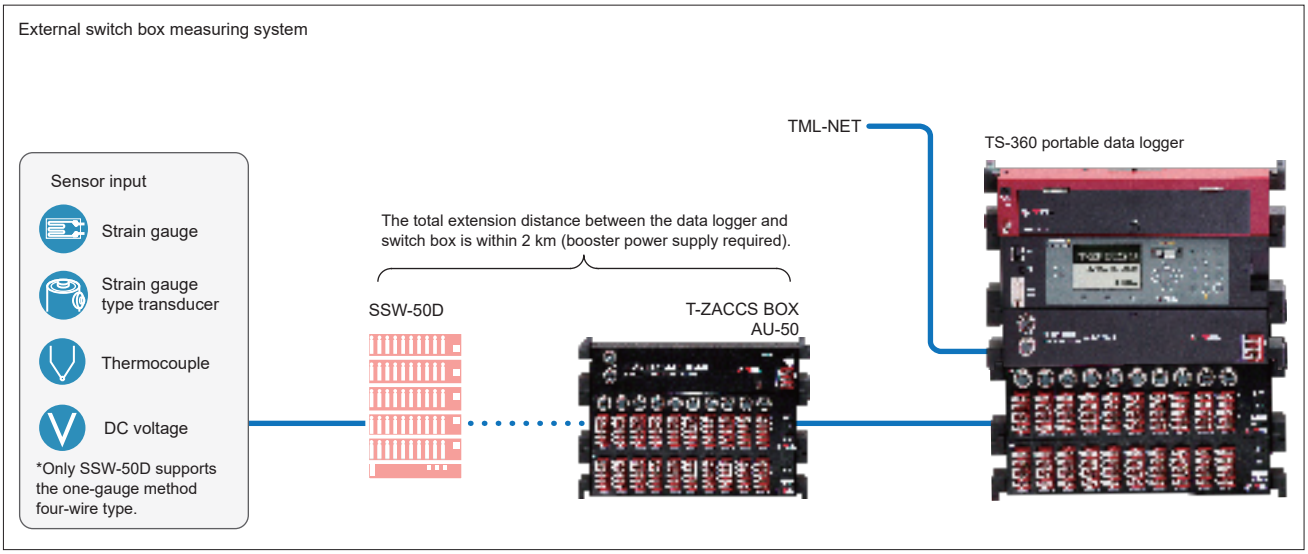


TS-360 portable data logger

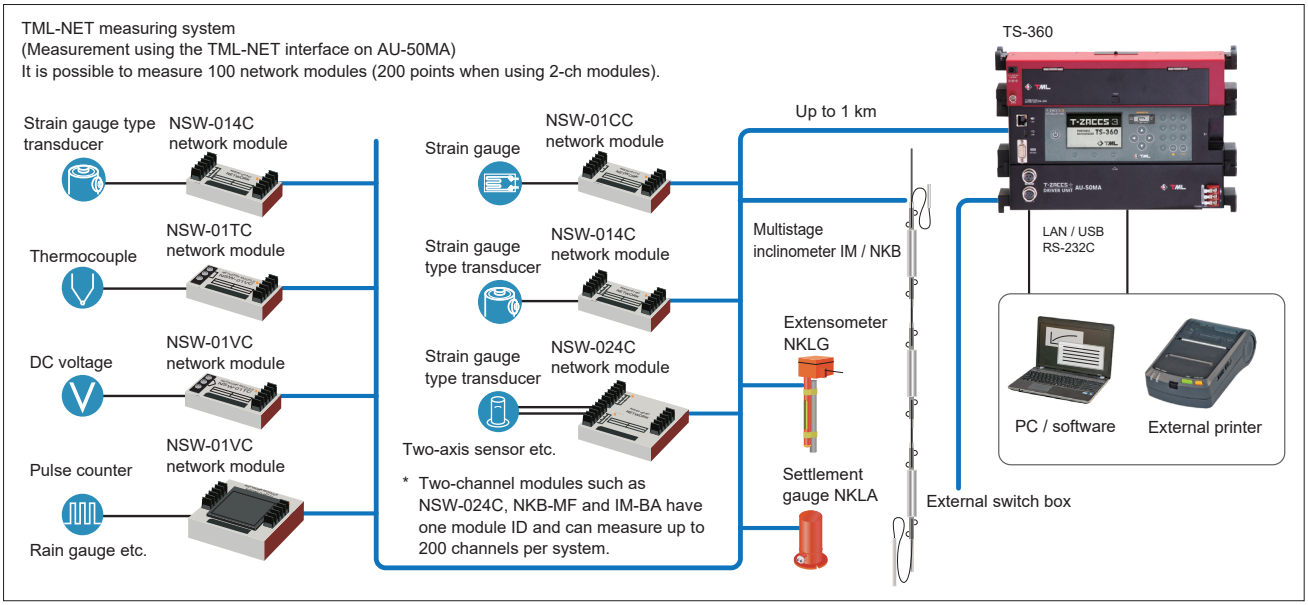
This product is a portable data logger that can measure a strain gauge, strain gauge converter, DC voltage and thermocouple by combining a control unit, battery unit, driver unit, and channel unit.
Each channel unit can connect 10 measurement points and up to five units (50 measurement points) can be connected. In addition, by connecting external switch boxes, it is possible to measure up to 1000 points.
This product can be operated using commercially available D size batteries or a battery even in places where AC power is unavailable.

It is equipped with a large capacity built-in data memory and sleep interval timer function that enable automatic measurement over a long period of time. It is also possible to record and save the measurement data and setting files on an SD card. LAN, USB and RS-232C are equipped as standard for communication interfaces to allow various settings and data to be imported from a PC. As for LAN communication, a remote measurement assistance function is available, and the risk of communication error is reduced when building a remote communication system with this product.

System Block Diagram

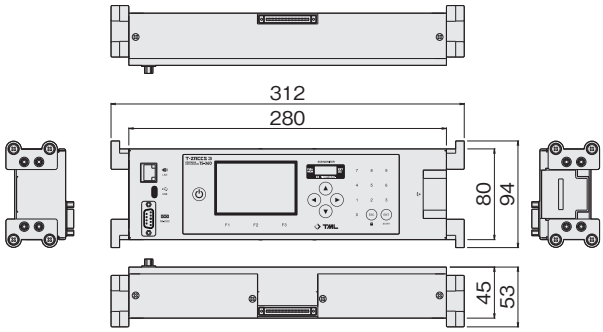


TS-360 (Portable data logger)

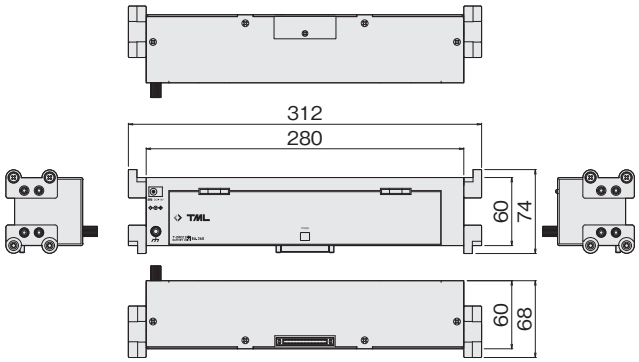


External Dimensions

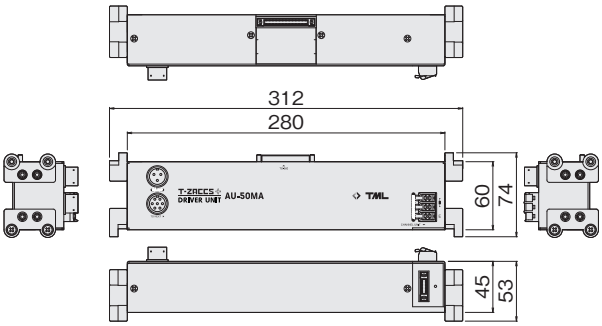
T-ZACCS3 TS-360 control unit



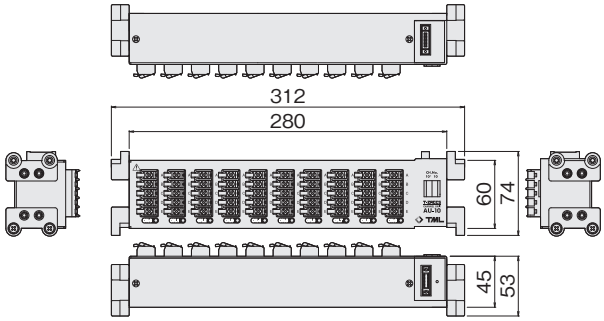
T-ZACCS+ BA-360 battery unit



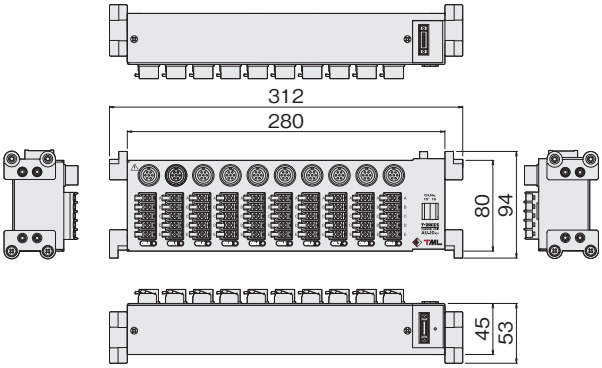
T-ZACCS+ AU-50MA driver unit



T-ZACCS UNIT AU-10 channel unit



T-ZACCS UNIT AU-10-05 channel unit



Specifications
T-ZACCS3 TS-360 control unit

Measurement capabilities			
Number of measuring points		Up to 1000 points	
Measuring speed	Scan measurement	0.080 sec/point (50 Hz) 0.067 sec/point (60 Hz)	
	Monitor measurement	0.5 sec/point	
Measuring mode		Initial, direct, measure (For temperature measurement, direct only)	
Simple measure		Coefficient	1
		Unit	Interlocked with sensor mode
		Decimal point	Interlocked with sensor mode
Compensation mode		Comet NON, Comet A, Comet B	
Monitor	Display mode	OFF, value, scan	
	Number of display channels	Numerical value display	1 - 8 points
		Scan display	1 - 1000 points
Measurement	Manual measurement	START key	
	Automatic measurement	Interval measurement, comparator measurement	
	Interface	LAN, USB, RS-232C	
Channel setting	Coefficient	± (0.00000-200000)	
	Unit	με, mV, °C, kgf, mm, etc.	
	Decimal point	Display after the decimal point can be set arbitrarily with 0 to 5 digits	
	Offset	To be written by arbitrarily measurement channel	
	Sensor mode	The type of sensor to be connected is set.	
		Strain	One-gauge method three-wire type 120 / 240 / 350 Ω,
			One-gauge method four-wire type*120 / 240 / 350 Ω,
			Two-gauge common dummy method, two-gauge method,
			Four-gauge method, four-gauge method constant current 350 Ω
		Voltage	Voltage [300 mV]
			Voltage [30 V]
		Temperature	Thermocouple T, K, J, B, S, R, E, N
Check function	At the time of measurement	Open check	
	Sensor	Insulation check, sensitivity check, variation check, thermocouple disconnection check lead wire resistance check, bridge output check Coefficient check	
	Display setting list	Initial value, lead wire resistance	

* The one-gauge method four-wire type is only supported by the SSW-50D. (As of June 2024)

Interval measurement	
Function	Recording of measurement values at the set time interval and time
Time interval	Hour / minute / second can be set for each step up to 99 hours, 59 minutes, and 59 seconds.
Real time start	Start time (hour / minute / second) can be set for each step
Number of starts	Up to 9999 times per step or infinite
Number of steps	Programmable up to 10 steps
GOTO step	Program loop possible to one of the previous steps
GOTO comparator	Go to Step 1 of the comparator.
Sleep function	Turns the power ON/OFF automatically when the interval 1 minute or longer from the end of the scan to the start of the next scan.

Comparator measurement	
Function	Recording of measurement values based on the set amount of change of arbitrary channel (1 point)
Comparison amount	Can be set for each step: Up to ±999999
Comparison method	Upper / lower limit values, relative value
Number of starts	Up to 9999 times per step or infinite
Number of steps	Programmable up to 10 steps
GOTO step	Program loop possible to one of the previous steps
GOTO Interval	Go to Step 1 of the interval.

Time		
Setting		Year, month, day, hour, minute, second
Accuracy		Daily error: ±1 sec (at 23°C ± 5°C)
Retention		About 30 days (with full charge)
Display / operation		
Display	Display unit	LCD panel: 3.0-inch semi-transparent monochrome STN LED backlight
		Resolution: 255 x 160 dots
		Point defect: 10 dots or less (excluding aging deterioration)
Operation		POWER, Cross key, ESC, ENT 0-9, F1, F2, F3
Recording		
Built-in	Function	Recording / reproduction of measurement data Saving of setting file
	Recording format	CSV format, TDS format
	Capacity	16 GB
SD card	Function	Recording / reproduction / copying of measurement data Saving / copying of setting file
	Physical format	FAT32
	Recording format	CSV format, TDS format
	Capacity	16 GB (Designated by us)
Interface		
LAN		10BASE-T/100BASE-TX General-purpose command port server function (various settings, measurement, data collection)
USB		USB 2.0 protocol compatible USB Type-C receptacle Various settings, measurement, data collection
RS-232C		RS-232C compliant Baud rate 9600, 19200, 38400, 57600, 115200 bps Various settings, measurement, data collection
Power supply		
Power supply voltage		Supplied by BA-360
Environment		
Operating temperature / humidity range		10 to +50°C 85% RH or less (No condensation)
Other		
Outside dimension		280 (W) × 45 (H) × 80 (D) mm (Excluding rubber protectors and protrusions)
Mass		Approx. 800 g

Standard accessories

Instruction Manual (CD) 1
D size alkaline dry-cell battery 4
SD card 1
Phillips screwdriver 1
Warranty certificate 1

Options

SD card (16 GB (Designated by us))
AC adapter (CR-1869)
AC Adapter [For China] (CR-1869-C)
DC Power Cable (CR-062)
RS-232C cable (CR-5360)
USB cable for (CR-6189)
External printer (RS-232C connection) (DPU-S245 (RS-232C connection))
Shoulder belt (TSB-360)
For belt bracket 60 mm (BA-360, AU-50MA, AU-10) (TSB-366)
For belt bracket 80 mm (TS-360, AU-10-05) (TSB-368)

TS-360 (Portable data logger)

T-ZACCS+ AU-50MA driver unit

Measurement capabilities			
Number of measuring points (AU-50MA)	When the switch boxes are connected	Up to 1000 points	
	When the switch boxes and channel units are connected in combination		
	When the channel units are connected	Up to 50 points	
Measuring speed		0.080 sec/point (50 Hz) 0.067 sec/point (60 Hz)	
Measuring mode		Direct	
Strain measurement	Applicable wiring method, gauge resistance	One-gauge method three-wire type	120/240/350 Ω
		One-gauge method four-wire type*	120/240/350 Ω
		Two-gauge method	120-1000 Ω
		Two-gauge common dummy method	120-1000 Ω
		Four-gauge method	120-1000 Ω
		Four-gauge method constant current	350 Ω
	Sensor cable extension range	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
		One-gauge method four-wire type*	Cable round-trip resistance: 200 Ω or less
	Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1 to -0.5%/Cable round-trip resistance of 100 Ω
	Lead wire resistance compensation range CometB (1G3W)	Gauge resistance 120 Ω: About 100 Ω or less	
		Gauge resistance 240 Ω: About 200 Ω or less	
		Gauge resistance 350 Ω: About 300 Ω or less	
	Zero stability	± 1.0 × 10^{-6} strain/°C or less (one-gauge method) ± 0.5 × 10^{-6} strain/°C or less (two-gauge method)	
	Initial unbalance	± 750 × 10^{-6} strain or less (one-gauge method three-wire type) ± 500 × 10^{-6} strain or less (one-gauge method four-wire type*) ±500 × 10^{-6} strain or less (two-gauge method)	
DC voltage measurement	Input impedance	1 MΩ or more	
	Allowable input voltage between B and D	DC±50V MAX	
Thermocouple temperature measurement		T, K, J, B, S, R, E, N JIS C1602:2015 IEC60584-1:2013	
Check function	At the time of measurement	Open check	
	Sensor	Insulation check, sensitivity check, variation check, thermocouple disconnection check lead wire resistance check, bridge output check	

* The one-gauge method four-wire type is only supported by the SSW-50D. (As of June 2024)

Strain measurement		
Bridge excitation	DC 2 V 24 ms (50 Hz)	
Initial value storage range	± 160000 × 10^{-6} strain	
Temperature coefficient of accuracy	± 0.002% rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 30000×10^{-6} strain ±300000×10^{-6} strain	1×10^{-6} strain 10×10^{-6} strain
Accuracy (at 23°C ± 5°C) (Excluding the one-gauge method four-wire type)	±(0.08%rdg+1digit)	
Accuracy (at 23°C ± 5°C) One-gauge method four-wire type*	±(0.28%rdg+1digit)	

Constant current strain measurement (four-gauge method only)		
Bridge excitation	DC 6 mA 24 ms (50 Hz)	
Bridge resistance	350 Ω	
Initial value storage range	± 160000 × 10^{-6} strain	
Temperature coefficient of accuracy	± 0.002% rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 30000×10^{-6} strain ±300000×10^{-6} strain	1×10^{-6} strain 10×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.08%rdg+1digit)	

DC voltage measurement		
Initial value storage range	V1/1	±160.000mV
	V1/100	±16.0000V
Temperature coefficient of accuracy	±0.0024%rdg/°C	
Aging change of accuracy	±0.024%rdg/year	
Measurement range and resolution		Measurement range / Resolution
	V1/1	± 30.000mV / 0.001mV ±300.000mV / 0.010mV
	V1/100	± 3.0000V / 0.0001V ±30.0000V / 0.0010V
Accuracy (at 23°C ± 5°C)	V1/1	±(0.08%rdg+3digit)
	V1/100	±(0.08%rdg+2digit)

Thermocouple temperature measurement (JIS C 1602:2015, IEC 60584-1:2013)

Applicable thermocouple	T, K, J, B, S, R, E, N
Linearization	Digital calculation

Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C) (External reference junction)	Accuracy (at 23°C ± 5°C) (Internal reference junction)
T	-250 to -200°C	0.1°C	0.38%rdg+0.6°C	0.38%rdg+3.9°C
	-200 to -100°C	0.1°C	0.15%rdg+0.2°C	0.15%rdg+1.4°C
	-100 to +400°C	0.1°C	0.10%rdg+0.2°C	0.10%rdg+1.0°C
K	-210 to -160°C	0.1°C	0.19%rdg+0.3°C	0.19%rdg+1.6°C
	-160 to 0°C	0.1°C	0.12%rdg+0.2°C	0.12%rdg+1.0°C
	0 to +960°C	0.1°C	0.08%rdg+0.1°C	0.08%rdg+0.5°C
	+960 to +1370°C	0.1°C	0.10%rdg+0.9°C	0.10%rdg+1.4°C
J	-200 to -160°C	0.1°C	0.16%rdg+0.2°C	0.16%rdg+1.2°C
	-160 to 0°C	0.1°C	0.12%rdg+0.1°C	0.12%rdg+0.8°C
	0 to +700°C	0.1°C	0.08%rdg+0.1°C	0.08%rdg+0.5°C
	+700 to +1200°C	0.1°C	0.08%rdg+0.6°C	0.08%rdg+0.9°C
B	+200 to +280°C	0.5 to 0.4°C	0.04%rdg+4.0°C	0.04%rdg+4.0°C
	+280 to +800°C	0.3 to 0.1°C	0.04%rdg+1.2°C	0.04%rdg+1.2°C
	+800 to +1760°C	0.1°C	0.05%rdg+0.4°C	0.05%rdg+0.4°C
S	-10 to +200°C	0.1°C	0.09%rdg+0.6°C	0.09%rdg+1.2°C
	+200 to +1760°C	0.1°C	0.07%rdg+0.4°C	0.07%rdg+0.7°C
R	-10 to +150°C	0.1°C	0.09%rdg+0.7°C	0.09%rdg+1.2°C
	+150 to +1760°C	0.1°C	0.07%rdg+0.4°C	0.07%rdg+0.7°C
E	-210 to +550°C	0.1°C	0.17%rdg+0.2°C	0.17%rdg+1.4°C
	+550 to +1000°C	0.1°C	0.09%rdg+0.4°C	0.09%rdg+0.8°C
N	-200 to 0°C	0.1°C	0.18%rdg+0.4°C	0.18%rdg+1.6°C
	0 to +1090°C	0.1°C	0.08%rdg+0.2°C	0.08%rdg+0.6°C
	+1090 to +1300°C	0.1°C	0.08%rdg+0.9°C	0.08%rdg+1.2°C

* The accuracy of sensor is not included, and thermocouple B does not use the reference junction.

Switch box drive unit		
Target model		SSW-50D、ASW-50C
		AU-50M
Number of connectable units	Without booster power supply	8 units connected, 400 points
	With booster power supply	20 units connected, 1000 points
Extension distance	Without booster power supply	120m
	With booster power supply	2km
Connection cable		Switch box connection cable (CR-65)

TML-NET drive unit		
Target model		NSW series / TML-NET compatible transducer
Number of connectable units	Low power consumption type	Up to 100 units
	Conventional type	Up to 20 units (150 m or less)
Extension distance	Low power consumption type	1km
	Conventional type	1 km or less (up to 10 units)
Connection cable		Dedicated TML-NET cable (CR-6930)

When the channel units are connected	
Target model	AU-10, AU-10-05
Number of connectable units	Up to 5 units
Connection connector	Dedicated connector for unit connection

Power supply	
Power supply voltage	Supplied by TS-360

Environment	
Operating temperature / humidity range	-10 to +50°C 85% RH or less (No condensation)

Other		
Outside dimension	280 (W) × 45 (H) × 60 (D) mm (Excluding rubber protectors and protrusions)	
Mass	Approx. 800 g	

T-ZACCS+ BA-360 battery unit

Function		
Function	Supply power to TS-360	
Battery used	D size alkaline dry-cell battery x 4	
Environment		
Operating temperature / humidity range	-10 to +50°C 85% RH or less (No condensation)	
Power supply		
Power supply	D size dry-cell battery x 4	
	Dedicated AC adapter (CR-1867)	AC 100 to 240 V 50/60 Hz
	External DC power input	DC 9 to 18 V
Other		
Outside dimension	280 (W) × 60 (H) × 60 (D) mm (Excluding rubber protectors and protrusions)	
Mass	Approx. 1.2 kg (including D size dry-cell battery x 4)	

T-ZACCS UNIT AU-10/AU-10-05 channel unit

Function		
Number of measuring points	10 points	
Input terminal	Dual-purpose type for screw fixing and soldering	
One-touch connector	NDIS one-touch connector (AU-10-05 only)	
Measurement capabilities	Equivalent to AU-50MA / AU-50M	
Power supply		
Power supply voltage	Supplied by AU-50MA / AU-50M	
Environment		
Operating temperature / humidity range	-10 to +50°C 85% RH or less (No condensation)	
Other		
Outside dimension	AU-10 280 (W) ×45 (H) ×60 (D) mm AU-10-05 280 (W) ×45 (H) ×80 (D) mm (Excluding rubber protectors and protrusions)	
Mass	AU-10 Approx. 900 g AU-10-05 Approx. 1.2 kg	
Standard accessories	Warranty certificate	1
Options		
Protective cover (60 mm type) (AU-10)	TS-360-F60	
Protective cover (80 mm type) (AU-10-05)	TS-360-F80	
Handle for AU-50 (AU-10, AU-10-05)	-	

Related Products

T-ZACCS + Alarm unit AL-360

The AL-360 is a dedicated alarm unit that connects to the TS-360. The alarm output is a function that monitors a specified channel and closes a specified contact when the measurement value changes by a certain amount (relative value setting) or exceeds a threshold value (upper and lower limit setting).
This monitoring compares and switches the contact when monitoring or scanning is performed. There are four contacts to be output and the contacts of comparison channel, comparison condition and output destination can be set. In addition, if one contact is set for multiple channels, it is also possible to close the contact when any one of the channels exceeds the set range.





Specifications

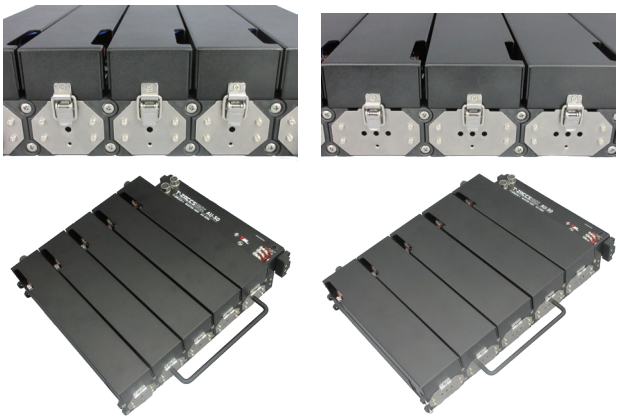
Target model	TS-360
Number of contacts	4 points
Contact	Semiconductor relay (a-contact: Normally open) Contact capacity AC 140 V / DC 200 V max Rated current: 0.6 A max Inrush current: 1.8 A max ON resistance: 2 Ω max
Display	Status LED Lights up when each contact is closed
Comparison method	Relative value / upper and lower limits
Number of setting tables	1000 table
Other functions	Alarm test
Power supply	Supplied via TS-360
Operating temperature / humidity range	-10 to +50°C 85% RH or less (No condensation)
Outside dimension	280 (W) × 45 (H) × 60 (D) mm (Excluding rubber protectors and protrusions)
Mass	Approx. 600 g

TS-360 (Portable data logger)

Related Products

Protective cover TS-360 top cover

A protective cover that is easy to attach and remove.
Model name: TS-360-F60 (for AU-10)
TS-360-F80 (for AU-10-05)
TS-360 main unit and AU-10/-10-05 channel unit



DPU-S245 (External printer)

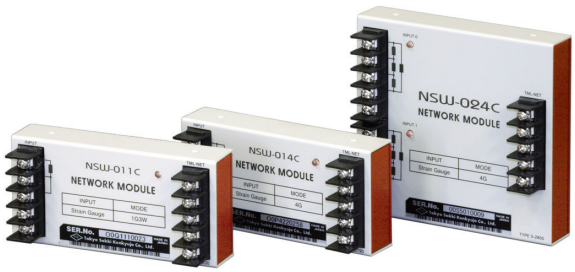
The measurement data of the TS-360 is printed out. The TP-S245L-1 recording paper (optional) is used.

CR-4530 printer cable



NSW network module

This equipment enables measurement control and data transfer via a two-wire type network line. A measurement circuit is configured near a strain gauge, DC voltage signal, thermocouples, etc. and the measurement data is digitized. This allows for stable measurements over a long period of time without influences by decreased sensitivity and cable insulation degradation due to cable extension.



CR-1867 AC adapter

This equipment is connected to AC 100 V to supply the power.

Measurement software Visual LOG

Visual LOG TDS-7130v2 static measurement software
Visual LOG Light TDS-700L interval measurement software
Visual LOG Light TDS-Mail data mail management software

SD card

Supported card capacity: 16 GB (Designated by us)

Cable

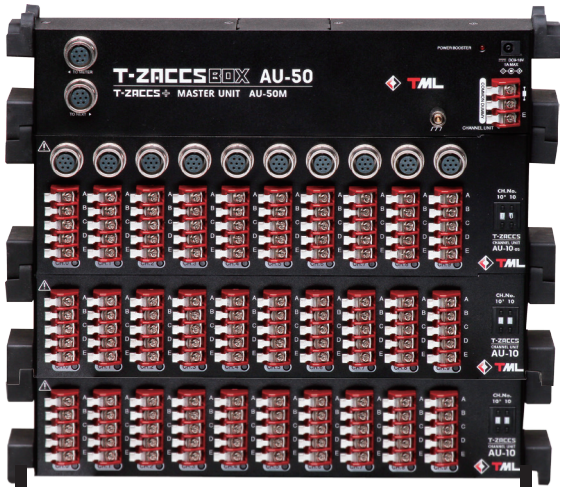
CR-5360 RS-232C cable
D-sub 9P-D-sub 9 P cross 1.5 m
This cable is used to connect to a PC.

CR-6189 USB cable
USB(C)-USB(A) 1.5 m
This cable is used to connect to a PC.

T-ZACCS BOX AU-50

NEW

- This equipment is used with the master unit and channel unit in combination.
- Measurements of strain, DC voltage and thermocouple are possible.
- The number of measuring points is up to 50 per 1 set.
- The number of measuring points can be selected according to the number of channel units connected.
- A power booster for multipoint long-distance extension is built in.
- The complete compensation method of strain (Comet) is supported.
- Can be used with the T-ZACCS 3 TS-360 portable data logger and the TDS-540 data logger.



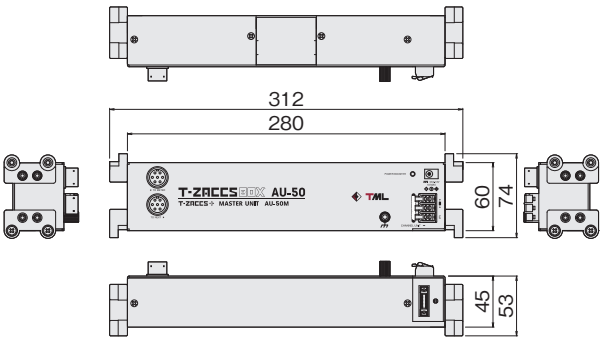
AU-50 switch box

This product is a switch box that combines the master unit and channel unit.
In addition to expanding and extending the number of measuring points of the T-ZACCS 3 TS-360 portable data logger, it can also be used with the TDS-540 data logger.

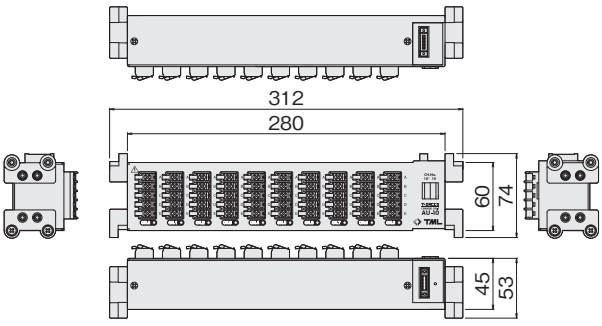
Up to five channel units can be connected to one master unit, allowing for strain measurement, DC voltage measurement, and temperature measurement using thermocouple. Since any number of channel units can be connected, measurements can be performed at the necessary and sufficient number of measuring points.

External Dimensions

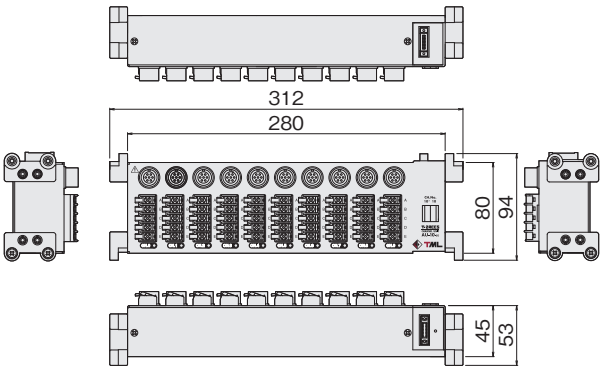
T-ZACCS + AU-50M master unit



T-ZACCS UNIT AU-10 channel unit



T-ZACCS UNIT AU-10-05 channel unit



T-ZACCS BOX AU-50

Specifications

T-ZACCS + AU-50M master unit

Measurement capabilities			
Number of measuring points	**Number of measuring points When the channel units are connected**	Up to 50 points (A total of 5 units of AU-10 or AU-10-05)	
Strain measurement	**Applicable wiring method, gauge resistance**	One-gauge method three-wire type	120/240/350 Ω
		Two-gauge method	120-1000 Ω
		Two-gauge common dummy method	120-1000 Ω
		Four-gauge method	120-1000 Ω
		Four-gauge method constant current	350 Ω
	Measurement range	Depends on the data logger combined	
	Sensor cable extension range	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
	Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1 to -0.5%/ Cable round-trip resistance of 100 Ω
	Zero stability	± 1.0 × 10^{-6} strain/°C or less (one-gauge method) ± 0.5 × 10^{-6} strain/°C or less (two-gauge method)	
	Other specifications	Depends on the data logger combined	
DC voltage measurement	**Measurement range**	Depends on the data logger combined	
	Accuracy	Depends on the data logger combined	
	Input impedance	1 MΩ or more	
Thermocouple temperature measurement	**Thermocouple type**	Depends on the data logger combined	
	Measurement range	Depends on the data logger combined	
	Accuracy	Depends on the data logger combined	
Display/operation			
Sensor mode		Set each point by the data logger.	
Measuring point number		Set the top 2 digits arbitrarily for every 10 points.	
Measuring point display		Three-color LED at each point	
When the channel units are connected			
Target model		AU-10 or AU-10-05	
Number of connectable units		Up to 5 units	
Data logger connection			
Target model		TDS-540, TS-360 (AU-50MA)	
Extension distance		According to the data logger to be connected	
Connection cable		Switch box connection cable (CR-65)	
Power supply			
Power supply	**Usually, supplied by a data logger**		
	When a booster is used	Dedicated AC power adapter (optional) or external DC power input	
		Power supply voltage: AC power adapter	AC 100 to 240 V 50/60 Hz
		Power supply voltage: DC power supply	DC 9 to 18 V
Environment			
Operating temperature / humidity range		-10 to +50°C 85% RH or less (No condensation)	
Other			
Outside dimension		280 (W) × 45 (H) × 60 (D) mm (Excluding rubber protectors and protrusions)	
Mass		Approx. 800 g	
Standard accessories		Instruction Manual (CD)	1
		Connection cable CR-65	1
		Phillips screwdriver	1
		Warranty certificate	1
Options		AC power adapter	CR-1869
		AC Adapter [For China]	CR-1869-C
		DC Power Cable	CR-062
		For belt bracket 60 mm (AU-50M, AU-10)	TSB-366
		For belt bracket 80 mm (AU-10-05)	TSB-368

T-ZACCS UNIT AU-10/AU-10-05 channel unit

Measurement capabilities		
Number of measuring points	10 points	
Input terminal	Dual-purpose type for screw fixing and soldering	
One-touch connector	NDIS one-touch connector (AU-10-05 only)	
Measurement capabilities	Equivalent to AU-50MA / AU-50M	
Power supply		
Power supply voltage	Supplied by AU-50MA / AU-50M	
Environment		
Operating temperature / humidity range	-10 to +50°C 85% RH or less (No condensation)	
Other		
Outside dimension	AU-10 280 (W) × 45 (H) × 60 (D) mm AU-10-05 280 (W) × 45 (H) × 80 (D) mm (Excluding rubber protectors and protrusions)	
Mass	AU-10 Approx. 900 g AU-10-05 Approx. 1.2 kg	
Standard accessories	Warranty certificate	1
Options		
Protective cover (60 mm type) (AU-10)	TS-360-F60	
Protective cover (80 mm type) (AU-10-05)	TS-360-F80	
Handle for AU-50 (AU-10, AU-10-05)	-	



When protective cover (60 mm type) is attached



When protective cover (80 mm type) is attached

* Use the protective cover (60 mm type) for the AU-10 and the protective cover (80 mm type) for the AU-10-05.
* The protective cover is attached to each channel unit.
* To install the handle for AU-50, four or more AU-10 units with the protective cover attached are required, and three or more AU-10-05 units are required.

TDS-540 (General-purpose type)

- Secure data retention by robust built-in data memory and UPS circuit
- Realization of stable interval measurement with a clock accuracy of ±1 second per day
- Fast start-up within 4 seconds at the fastest
- Collective setting of coefficient, unit, decimal point, and sensor type by “Sensor ID”
- Equipped with interval measurement “Quick Interval” that requires no settings
- Equipped with remote operation “Remote Data Logger” from an Internet browser
- The number of measuring points is 1000 (using external switch boxes)
- High-speed measurement of 0.04 sec per point
- Equipped with high-resolution (0.1 x 10^{-6} strain) mode
- A strain gauge with temperature measurement function can be measured with one channel.
- Equipped with Complete Compensation Method of Strain
- Various check functions (Automatic check by a timer is possible)
- Color LCD monitor with a touch panel
- Built-in high-speed printer (0.04 sec per line per channel)
- Supports SD card and USB memory as recording media
- Equipped with LAN, USB and RS-232C as standard
- Wireless LAN unit can be equipped (factory option)
- A semiconductor relay switch box with up to 30 points can be built in
- The built-in switch box is available with a surge absorber for lightning protection as standard.
- TML-NET compatible (in combination with the ASW/SSW unit and ND-100)

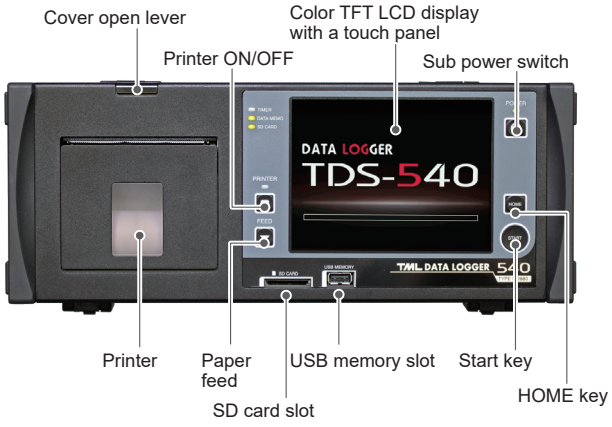


TDS-540 data logger

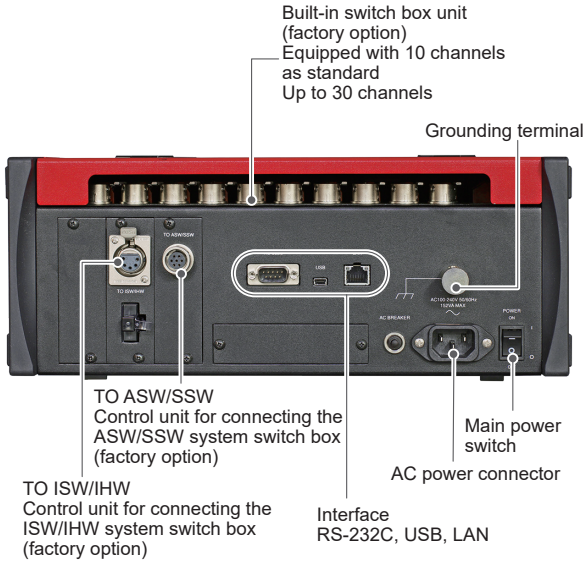
CE

This equipment is a data logger for multipoint automatic switching measurements of strain gauges, temperature, DC voltage, thermocouples, platinum resistance temperature detectors, etc. Our unique measurement method eliminates various thermo-electromotive forces, amplifier zero shifts, and commercial power noise, achieving highly accurate and stable measurements. The number of measuring points is up to 30 using the main unit only, and up to 1000 points can be measured when using external switch boxes in combination. In addition, when combined with the IHW-50G high-speed switch box, up to 1000 points of strain measurements can be performed in 0.4 sec. Newly equipped with a remote data logger function, this enables remote operation from an Internet browser. Equipped with wireless LAN (optional), this enables measurement and monitoring of the data logger from a tablet or smartphone. The interface supports Ethernet LAN, USB, RS-232C, and optionally wireless LAN.

Front panel



Back panel

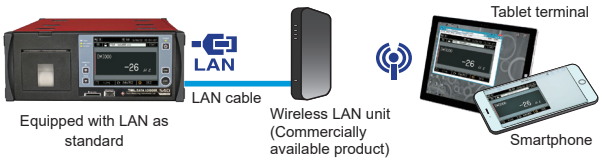


TDS-540 (General-purpose type)

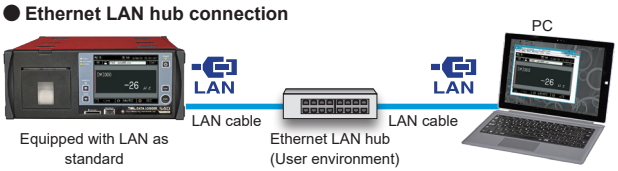
Remote data logger function

Remote operation according to the user communication mode
Equipped with a Web server function (remote data logger function).
Measurement and monitoring with the TDS-540 can be performed from an Internet browser.
No special software is required.

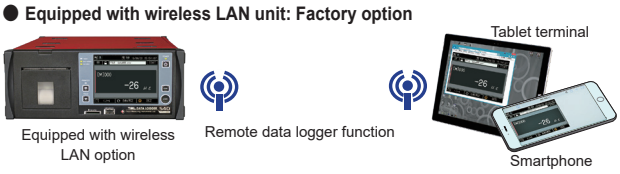
● **Wireless LAN unit combination**



● **Ethernet LAN hub connection**



● **Equipped with wireless LAN unit: Factory option**



The built-in wireless LAN unit is only certified in Japan. It does not support overseas use.
Connect a commercially available wireless LAN router to use this unit.

File download using remote data logger function
During remote operation, measurement data files recorded by the equipment in a data memory or SD card can be downloaded (transferred) to a PC or tablet. It is also possible to select multiple files.

* Files saved on a USB memory device cannot be downloaded.

One-gauge method four-wire type measurement method [Patented]

Strain measurement is possible with one-touch connection using a modular plug.
The one-gauge method four-wire type strain measurement method developed by us connects four-wire type lead wires to a strain gauge and enables connection using a modular plug. One-touch connection using a modular connector significantly improves the prolonged connection work for multipoint measurements. The four-wire type achieves the following functions.

- No decreased sensitivity due to lead wire resistance
- No influence due to thermal output of lead wires
- No influence of contact resistance
- Lead-free, environmentally friendly strain measurement with plug-in connection

1-CH strain / temperature simultaneous measurement

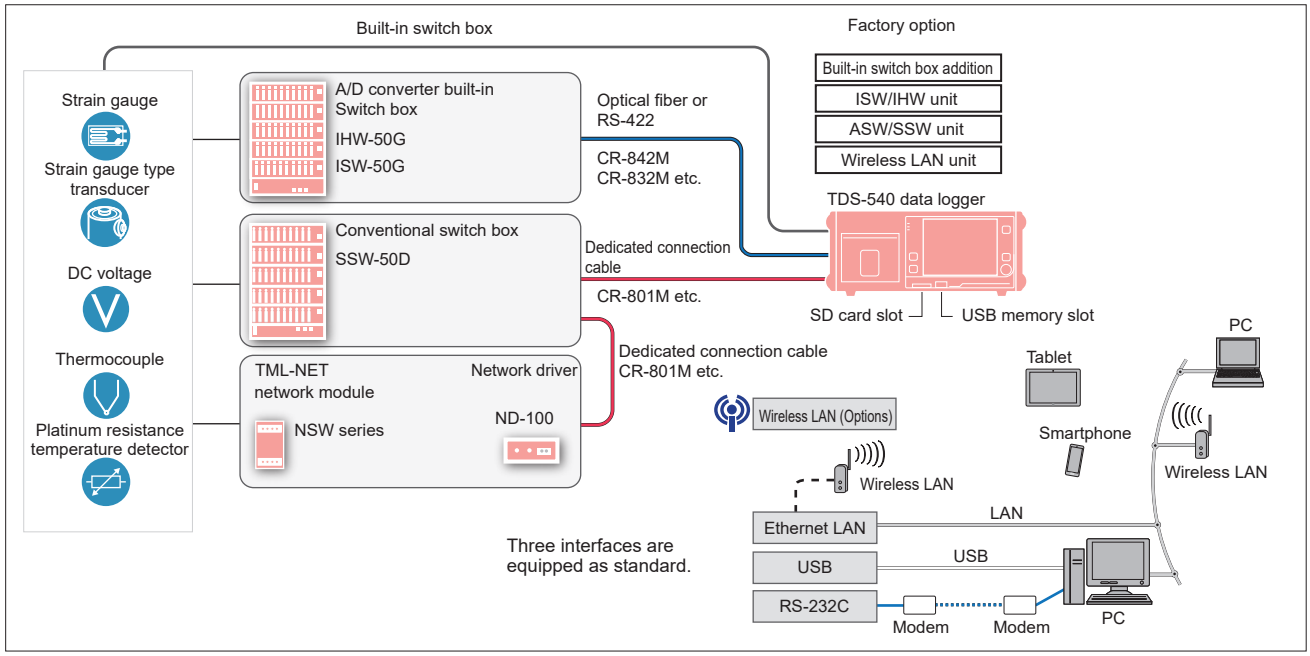
Strain gauge with temperature measurement function: FLAB-2T, QFLAB-2T, etc.



Our unique strain gauge with temperature measurement function previously required two channels for strain measurement and temperature measurement. However, the TDS-540 can simultaneously measure strain and T-type thermocouples with only one channel using the one-gauge method three-wire type connection.

* 1-CH measurement of strain gauge with temperature measurement function can be used with the built-in switch box, as well as the ISW-50G and IHW-50G.

System Block Diagram



Specifications

Measurement capabilities			
Number of measuring points	When the switch boxes are connected		Up to 1000 points (Up to 2000 points when using strain gauge with temperature measurement function)
	When the switch boxes and built-in switch box units are connected in combination		
	Built-in switch box unit		Up to 30 points (Up to 60 points when using strain gauge with temperature measurement function)
Scanning speed (Measuring speed)	IHW-50G		0.4 sec/1000 points (1 sec/1000 points)
	ISW-50G		2 sec/1000 points (3 sec/1000 points)
	ISW-50C		3 sec/1000 points (5 sec/1000 points)
	ASW/SSW		0.08 sec/points (80 sec/1000 points)
	TML-NET		0.20 sec/points (200 sec/1000 points)
	Built-in switch box unit		0.04 sec/point, 0.08 sec/point
Measuring mode			Initial, direct, measure (For temperature measurement, direct only)
Compensation mode			Coefficient 1.000 Unit Interlocked with sensor mode Decimal point Interlocked with sensor mode
Compensation mode			Comet NON, Comet A, Comet B
Measuring point switching method	Scanning		Automatic switching measurement from the first channel to the last channel (jump possible)
	Monitor		Repeated measurement of monitor channels (up to 10 points)
Scanning measurement start	Manual		Start key switch
	Automatic		Interval timer, monitor comparator
	Interface		LAN, USB, RS-232C, wireless LAN (optional)
Channel setting	Coefficient		± (0.0001-99999)
	Unit		40 types including με, mV, °C, kgf, mm
	Decimal point		Display after the decimal point can be set arbitrarily with 0 to 5 digits
	Offset		To be written by arbitrarily measurement channel
	Sensor mode		The type of sensor to be connected is set.
			Strain: One-gauge method three-wire type, 120 / 240 / 350 Ω Two-gauge common dummy method, two-gauge method Four-gauge method, four-gauge method constant current 350 Ω Four-gauge method high-resolution mode Four-gauge method constant current 350 Ω high-resolution mode Four-gauge method 0-2 V mode Gauge with temperature measurement 120 / 240 / 350 Ω
			DC voltage 640 mV, 64 V
			Temperature: Thermocouple T/K/J/B/S/R/E/N/Pt100 3W
			TML-NET: Various network modules
Sensor ID TEDS function	Sensor ID	Function	Reading and setting of sensor ID Writing of sensor ID
	TEDS	Standard	IEEE 1451.4 Class 2 compatible (Template No. 33)
		Function	Sensor information reading and setting
Check function	At the time of measurement		Open check, thermocouple disconnection check
	Sensor		Insulation check, sensitivity check, variation check, thermocouple disconnection check, lead wire resistance check, bridge output check
TML-NET	When the ASW/SSW system control unit is available		ID check, sensitivity check, check module, channel setting

Interval timer		
Function		Scanning measurement at the set time interval and time
Quick setting	Time interval	1 min / 10 min / 1 hr (measured on the minute or hour)
Table setting	Time interval	Hour / minute / second can be set for each step up to 99 hours, 59 minutes, and 59 seconds.
	Real time start	Start time (day / hour / minute / second) can be set for each step.
	Number of starts	Up to 99 times per step or infinite
	Number of steps	Programmable up to 50 steps
	GOTO step	Program loop possible to one of the previous steps
	GOTO comparator	Go to Step 1 of the monitor comparator.
	Execution processing	Scanning, insulation check, sensitivity check, variation check, thermocouple disconnection check
Sleep function		When the interval between the end of scanning and the start of scanning is 1 min or longer, the power is turned on/OFF automatically.

Monitor comparator		
Function		Automatic measurement based on the amount of change in the setting of monitor channel (1 point)
Table setting	Comparison amount	Can be set for each step: Up to ±999999
	Comparison method	Amount of change or upper / lower limit
	Number of starts	Up to 99 times per step or infinite
	Number of steps	Programmable up to 50 steps
	GOTO step	Program loop possible to one of the previous steps
	GOTO Interval	Go to Step 1 of the interval.

Remote data logger function	
Function	Remote operation of data logger, remote monitoring, and data download function by the Web server function
Connection	LAN, Wireless LAN (Options)
File download	Download (transfer) of the measurement data files (multiple files can be selected) in the data memory or SD card to a PC or tablet in the ZIP format

Time	
Setting	Year, month, day, hour, minute, second
Accuracy	Daily error: ±1 sec (at 23°C ± 5°C)
Retention	About 60 days (with full charge)

Display/operation	
Display unit	Color TFT LCD display (with a touch panel), 320 x 240 dots
Operation	Touch panel, POWER key, HOME key START key, PRINTER key, FEED key

Recording		
Built-in	Function	Recording / reproduction of measurement data, saving of setting file
	Recording format	TDS format, CSV format 540 CSV format
	Capacity	512 MB
SD card	Function	Recording / reproduction / copying of measurement data, saving / copying of setting file Writing / reading of sensor ID
	Physical format	FAT16/32
	Recording format	TDS format, CSV format 540 CSV format
	Capacity	512 MB (Designated by us)
USB memory	Function	Reproduction / copying of measurement data, saving / copying of setting file Writing / reading of sensor ID
	Physical format	FAT16/32

Printer	
Printing content	Measurement data, setting values, check results, etc.
Printing method	Thermal
Printing speed	1 channel, 1 line/0.04 sec
Suitable paper	P-80 (Paper width: 80 mm)

Interface	
Wireless LAN (Options) * This is only available in Japan.	IEEE 802.11b/g/n compliant General-purpose command port server function (various settings, measurement, data collection) Web server function (remote data logger function) DHCP server function
LAN	10BASE-T/100BASE-TX General-purpose command port server function (various settings, measurement, data collection) Web server function (remote data logger function)
USB	USB 2.0 protocol compatible General-purpose command compatible (various settings, measurement, data collection)
RS-232C	RS-232C compliant Baud rate 9600/19200/115200 bps General-purpose command compatible (various settings, measurement, data collection)

Power supply	
Rated power supply voltage	AC 100 to 240 V 50/60 Hz
Maximum power consumption	152 VA max

Environment	
Operating temperature / humidity range	0 to +50°C 85% RH or less (No condensation)

Other	
Outside dimension	320 (W) × 130 (H) × 440 (D) mm (Excluding rubber protectors and protrusions)
Mass	About 8 kg (when equipped with a built-in switch box unit (10 channels))

TDS-540 (General-purpose type)

Built-in switch box unit (factory option)

Number of measuring points	Up to 30 points (equipped with 10 points as standard)
Switch	Semiconductor relay
Lightning arrester	Each channel is equipped with a surge absorber for lightning protection as standard.
Input terminal	Dual-purpose type for screw fixing and soldering
One-touch connector	NDIS one-touch connector

Strain measurement

Applicable wiring method, gauge resistance	One-gauge method three-wire type	120/240/350 Ω
	Two-gauge method	60-1000 Ω
	Two-gauge common dummy method	60-1000 Ω
	Four-gauge method	60-1000 Ω
	Four-gauge method constant current	350 Ω
	Four-gauge method high-resolution mode	120-1000 Ω
	Four-gauge method constant current high-resolution mode	350 Ω
	Four-gauge method 0-2 V mode	60-1000 Ω
	Mode for gauge with temperature measurement function (One-gauge method three-wire type)	120/240/350Ω T(JIS C1602-1995、IEC 60584)
Sensor cable extension range	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
	Four-gauge method constant current high-resolution: 350 Ω	Cable round-trip resistance: 160 Ω or less
Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1 to -0.5%/ Cable round-trip resistance: 100 Ω
	Four-gauge method constant current high-resolution: 350 Ω	
Lead wire resistance compensation range Comet B (1G3W)	Gauge resistance 120 Ω: About 100 Ω or less	
	Gauge resistance 240 Ω: About 200 Ω or less	
	Gauge resistance 350 Ω: About 300 Ω or less	
Zero stability	± 1.0 × 10^{-6} strain/°C or less (one-gauge method) ± 0.5 × 10^{-6} strain/°C or less (two-gauge method)	
Initial unbalance	± +750 × 10^{-6} strain or less (one-gauge method) ± +500 × 10^{-6} strain or less (two-gauge method)	

DC voltage measurement

V 1/1	DC±640mV
V 1/100	DC±64V
Input impedance	1 MΩ or more
Allowable input voltage between B and D	DC±70V MAX

Thermocouple temperature measurement

Applicable thermocouple	T/K/J/B/S/R/E/N JIS C 1602-1995, IEC 60584

Platinum resistance temperature detector measurement

Applicable platinum resistance temperature detector	Pt100 (500 μA constant current 3-wire type) JIS C 1604-1997, IEC 60751

Strain measurement

Bridge excitation	DC 2 V 24 ms (50 Hz)	
Initial value storage range	± 160000 × 10^{-6} strain	
Temperature coefficient of accuracy	± 0.002% rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
	Measurement range	Resolution
Measurement range and resolution	± 40000×10^{-6} strain	1×10^{-6} strain
	± 80000×10^{-6} strain	2×10^{-6} strain
	±160000×10^{-6} strain	4×10^{-6} strain
	±320000×10^{-6} strain	8×10^{-6} strain
	±640000×10^{-6} strain	16×10^{-6} strain
Accuracy (at 23°C ± 5°C) (Excluding the one-gauge method four-wire type)	±(0.05%rdg+1digit)	

Constant current strain measurement (four-gauge method only)

Bridge excitation	DC6mA 24ms (50Hz)	
Bridge resistance	350Ω	
Initial value storage range	±160000×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
	Measurement range	Resolution
Measurement range and resolution	± 40000×10^{-6} strain	1×10^{-6} strain
	± 80000×10^{-6} strain	2×10^{-6} strain
	±160000×10^{-6} strain	4×10^{-6} strain
	±320000×10^{-6} strain	8×10^{-6} strain
	±640000×10^{-6} strain	16×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+1digit)	

High-resolution strain measurement (four-gauge method only)

Bridge excitation	DC 5V 48ms (50Hz)	
Initial value storage range	±16000.0×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
	Measurement range	Resolution
Measurement range and resolution	± 4000.0×10^{-6} strain	0.1×10^{-6} strain
	± 8000.0×10^{-6} strain	0.2×10^{-6} strain
	±16000.0×10^{-6} strain	0.4×10^{-6} strain
	±32000.0×10^{-6} strain	0.8×10^{-6} strain
	±64000.0×10^{-6} strain	1.6×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+3 digits)	

High-resolution constant current strain measurement (four-gauge method only)

Bridge excitation	DC14mA 48ms (50Hz)	
Bridge resistance	350Ω	
Initial value storage range	±16000.0×10^{-6} strain	
Temperature coefficient of accuracy	±0.002%rdg/°C	
Aging change of accuracy	±0.02%rdg/year	
	Measurement range	Resolution
Measurement range and resolution	± 4000.0×10^{-6} strain	0.1×10^{-6} strain
	± 8000.0×10^{-6} strain	0.2×10^{-6} strain
	±16000.0×10^{-6} strain	0.4×10^{-6} strain
	±32000.0×10^{-6} strain	0.8×10^{-6} strain
	±64000.0×10^{-6} strain	1.6×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.05%rdg+3 digits)	

DC voltage measurement

Initial value storage range	V1/1 :±160.000mV V1/100 :±16.0000V		
Temperature coefficient of accuracy	±0.0024%rdg/°C		
Aging change of accuracy	±0.024%rdg/year		
		Measurement range	Resolution
Measurement range and resolution	**V1/1**	± 40.000mV	0.001mV
		± 80.000mV	0.002mV
		±160.000mV	0.004mV
		±320.000mV	0.008mV
		±640.000mV	0.016mV
	V1/100	± 4.0000V	0.0001V
		± 8.0000V	0.0002V
		±16.0000V	0.0004V
		±32.0000V	0.0008V
		±64.0000V	0.0016V
V1/1 accuracy (at 23°C ± 5°C)	±(0.05%rdg+3 digits)		
V1/100 accuracy (at 23°C ± 5°C)	±(0.05%rdg+2 digits)		

Thermocouple temperature measurement (JIS C 1602-1995, IEC 60584)				
Applicable thermocouple		T, K, J, B, S, R, E, N		
Linearization		Digital calculation		
Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C) (External reference junction)	Accuracy (at 23°C ± 5°C) (Internal reference junction)
T	- 250 to - 200°C	0.1°C	±(0.19%rdg+0.5°C)	±(0.19%rdg+3.8°C)
	- 200 to - 100°C	0.1°C	±(0.09%rdg+0.2°C)	±(0.09%rdg+1.6°C)
	- 100 ~ + 400°C	0.1°C	±(0.06%rdg+0.2°C)	±(0.06%rdg+0.9°C)
K	- 210 to - 160°C	0.1°C	±(0.11%rdg+0.3°C)	±(0.11%rdg+1.8°C)
	- 160 to 0°C	0.1°C	±(0.08%rdg+0.2°C)	±(0.08%rdg+1.1°C)
	0 ~ + 960°C	0.1°C	±(0.06%rdg+0.1°C)	±(0.06%rdg+0.7°C)
	+ 960 to +1370°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.2°C)
J	- 200 to - 160°C	0.1°C	±(0.09%rdg+0.2°C)	±(0.09%rdg+1.4°C)
	- 160 to 0°C	0.1°C	±(0.07%rdg+0.1°C)	±(0.07%rdg+1.0°C)
	0 to + 700°C	0.1°C	±(0.05%rdg+0.1°C)	±(0.05%rdg+0.6°C)
	+ 700 to +1200°C	0.1°C	±(0.06%rdg+0.4°C)	±(0.06%rdg+0.8°C)
B	+ 200 ~ + 280°C	0.5 to 0.4°C	±(0.03%rdg+1.5°C)	±(0.03%rdg+1.5°C)
	+ 280 to + 800°C	0.3 to 0.1°C	±(0.03%rdg+0.6°C)	±(0.03%rdg+0.6°C)
	+ 800 to +1760°C	0.1°C	±(0.04%rdg+0.4°C)	±(0.04%rdg+0.4°C)
S	- 10 to + 200°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.3°C)
	+ 200 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+0.8°C)
R	- 10 to + 150°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.3°C)
	+ 150 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+0.8°C)

Thermocouple temperature measurement (JIS C 1602-1995, IEC 60584)				
Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C) (External reference junction)	Accuracy (at 23°C ± 5°C) (Internal reference junction)
E	- 210 to + 550°C	0.1°C	±(0.10%rdg+0.2°C)	±(0.10%rdg+1.6°C)
	+ 550 to +1000°C	0.1°C	±(0.06%rdg+0.3°C)	±(0.06%rdg+0.7°C)
N	- 200 to 0°C	0.1°C	±(0.11%rdg+0.4°C)	±(0.11%rdg+1.8°C)
	0 to +1090°C	0.1°C	±(0.05%rdg+0.2°C)	±(0.05%rdg+0.7°C)
	+1090 to +1300°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+0.9°C)

* The accuracy of sensor is not included, and thermocouple B does not use the reference junction.

Platinum resistance temperature detector temperature measurement (JIS C 1604-1997, IEC 60751 Pt100)	
Applicable resistance temperature detector	Pt100
Measurement Method	3-wire type (Pt3W)
Linearization	Digital calculation
Temperature coefficient of accuracy	± 0.0020% rdg/°C
Aging change of accuracy	± 0.05% rdg/year
Measurement range	-200 to +850°C
Resolution	0.1°C
Accuracy (at 23°C ± 5°C)	± (0.05% rdg + 0.3°C)

Built-in one-gauge method four-wire type unit (factory option)

Number of measuring points	Up to 30 points can be equipped for every 10 points	
Switch	Semiconductor relay	
Modular connector	6-Pin modular jack	
Applicable gauge resistance	120/240/350 Ω	
Sensor cable extension range	Cable round-trip resistance: 200 Ω or less	
Zero stability	±1.0 × 10^{-6} strain/°C or less	
Initial unbalance	± 500 × 10^{-6} strain or less	
Initial value storage range	± 100000 × 10^{-6} strain	
Temperature coefficient of accuracy	± 0.002% rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 40000×10^{-6} strain	1×10^{-6} strain
	± 80000×10^{-6} strain	2×10^{-6} strain
	±100000×10^{-6} strain	4×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.25%rdg+1digit)	

ISW/IHW unit (factory option)

The specifications related to measurement conform to those of the switch box.

Connection

Target model		IHW-50G/ISW-50G
ELECTRICAL (RS-422)	Number of connected units / extension distance	20 units connected, 1000 points, distance between devices 800 m
	Connection cable	CR-832M extension cable for ISW/IHW
OPTICAL (Optical fiber)	Number of connected units / extension distance	20 units connected, 1000 points, distance between devices 800 m
	Connection cable	Extension optical cable for ISW/IHW: CR-842M

ASW/SSW unit (factory option)

The specifications related to measurement conform to those of the built-in switch box.

Target model		SSW-50D/ASW-50C/ND-100
Network module target model		All models (One ND-100 is required for every 100 points)
Number of connected units / extension distance	Without booster power supply	8 units connected, 400 points, extension distance 120 m
	With booster power supply	20 units connected, 1000 points, extension distance 2 km
Connection cable		Switch box connection cable CR-65 or switch box extension cable CR-800

* The number of network modules connected and the extension distance conform to the specifications of ND-100.

Standard accessories

- Quick Reference 1
- Instruction Manual (CD) 1
- AC power cable (CR-03) 1
- Ground wire (CR-20) 1
- Printer paper (P-80) ..... 2 rolls
- Phillips screwdriver 1
- Warranty certificate 1

TDS-540 (General-purpose type)

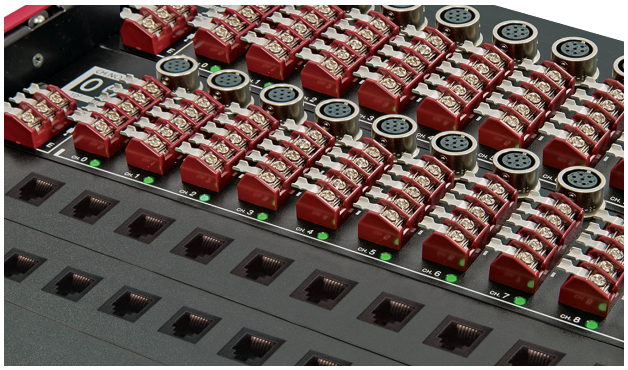
Factory option

Built-in switch box addition
The built-in switch box is equipped with the normal unit 10 channels as standard. The expansion units can be selected from the high-speed units equipped with ADC and the normal units without ADC (mixing is not possible), and up to 30 channels can be equipped in units of 10 channels.

Normal unit: Each unit operates sequentially
TDS-540-20 (built-in 20 channels)
TDS-540-30 (built-in 30 channels)

High-speed unit: Each unit operates in parallel
TDS-540-20H (built-in 20 channels)
TDS-540-30H (built-in 30 channels)

Built-in one-gauge method four-wire type unit
This is an option for the normal unit 10 channels and when adding the high-speed unit.



Equipped with 10 CH (channels) as standard, expanded in units of 10 CH, up to 30 CH
* The photo may vary from the actual product.

ISW/IHW unit
Control unit for connecting the ISW/IHW system switch box

ASW/SSW unit
Control unit for connecting the ASW/SSW system switch box

Wireless LAN unit
This unit enables easy remote operation from a tablet, etc.
* This is only available in Japan.



Option code

TDS-540 (-30HF - 02A)

Built-in unit option	
None	10CH (as standard)
-20	20CH
-30	30CH
-20H	High-speed 20CH
-30H	High-speed 30CH
-10HF	(High-speed + 1G4W)-10CH
-20HF	(High-speed + 1G4W)-20CH
-30HF	(High-speed + 1G4W)-30CH

Other options	
None	None
-01	ASW/SSW
-02A	ISW/IHW (With Optical Fiber Option)
-02N	ISW/IHW (Without Optical Fiber Option)
-03A	ASW/SSW+ISW/IHW (With Optical Fiber Option)
-03N	ASW/SSW+ISW/IHW (Without Optical Fiber Option)
-04	Wireless LAN
-05	Wireless + ASW/SSW
-06A	Wireless +ISW/IHW (With Optical Fiber Option)
-06N	Wireless + ISW/IHW (Without Optical Fiber Option)
-07A	Wireless +ASW/SSW+ISW/IHW (With Optical Fiber Option)
-07N	Wireless + ASW/SSW + ISW/IHW (Without Optical Fiber Option)

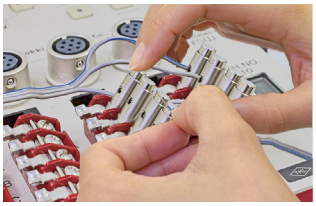
Related Products

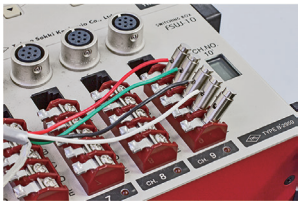
SD card 512 MB
Be sure to use highly durable industrial SD cards designated by us.

Dedicated printer paper P-80
Five rolls/box
Paper size: 80 mm width, 25 m/7200 lines/roll



SB-OT1B one-touch terminal
This terminal block allows one-touch connection of input lead wires. It is used by attaching it to the input terminal of the switch box. (One set of five terminals)





CR-5811 one-gauge method four-wire type modular conversion cable
Use this cable when connecting one-gauge method four-wire type loose wires with the built-in switch box HF.

ND-100 TML-NET network driver
This is a driver interface that drives a TML-NET compatible converter or network module from a data logger. A distributed data recording system is built.



Measurement software Visual LOG
Visual LOG TDS-7130v2 static measurement software
Visual LOG Light TDS-700L interval measurement software
Visual LOG Light TDS-Mail data mail management software

Comparison of functions of major compatible switch boxes

Switch box model name	Number of measuring points	Connector combined use	Strain	Constant current mode	High-resolution mode	DC Voltage	Thermocouple	Platinum resistance temperature detector	Built-in lightning arrester	Scanning speed [Measurement time*3]	one-gauge method four-wire type*1	Switching method	Application
IHW-50G	50	-	●	●	●	●	●	●	●	0.4 sec / 1000 points (0.04 sec/point) [1 sec]	●	Semiconductor relay	Strain / temperature of gage with temperature measurement function, 1 ch measurement function compatible
IHW-50G-05		●											
ISW-50G	50	-	●	●	●	●	●	●	●	2 sec / 1000 points (0.04 sec/point) [3 sec]	●	Semiconductor relay	Strain / temperature of gage with temperature measurement function, 1 ch measurement function compatible
ISW-50G-05		●											
SSW-50D	50	-	●	●	●	●	●	-	●*2	80 sec / 1000 points (0.08 sec/point) [80 sec]	●	Semiconductor relay	
SSW-50D-05		●											

*1: One-gauge method four-wire type: In addition to the one-gauge method four-wire type unit option (code: HF) built into the main unit, a switch box equipped with the same function can also be used.
*2: Factory option
*3: The scanning time includes the time for data logger recording, interface output, etc.

IHW-50G (High-speed)

- Electrically isolated from the data logger main unit
- Measurements of strain, DC voltage, thermocouple, and platinum resistance temperature detector
- Equipped with high-resolution (0.1 x 10^{-6} strain) mode*
- Sampling speed is 0.04 sec for 1 point and 0.4 sec for 50 points. In a system using multiple units of this equipment, 1000 points can be measured in 0.4 sec.
- One-gauge method four-wire type measurement via modular plug connection
- Equipped with gauge mode with temperature measurement function that can measure strain and temperature using 1 channel
- Each channel is equipped with a surge absorber for lightning protection as standard.
- Equipped with Complete Compensation Method of Strain

* The high-resolution mode supports the four-gauge method and the four-gauge constant current method.



IHW-50G-05 high-speed switch box

This equipment is a switch box with a built-in A/D converter that enables high-speed and high-accuracy measurements and was developed to be used in combination with the TS-560/TDS-540 data logger to expand the number of measuring points. High-speed measurement of 50 points in 0.4 sec is possible. Thanks to parallel operation of the built-in A/D converter in a system using multiple units of this equipment, even strain measurements of 1000 points can be performed in 0.4 sec. High-speed digital communication via RS-422 or optical fiber isolated from the measuring instrument main unit makes this equipment extremely resistant to noise.

IHW-50G-05

In addition to the standard terminals, all points are equipped with NDIS one-touch connectors (receptacles). This equipment is convenient for connecting strain gauge type transducers with tip NDIS plug. For this type, its depth becomes large because of the additional space for the connectors.

Option code

ISW/IHW -50G (- A)

Other options	
-A	With Optical Fiber Option
-N	Without Optical Fiber Option



With Optical Fiber Option



Without Optical Fiber Option

Specifications

Standard specifications IHW-50G (Standard mode)

Strain measurement

Sensor mode	(One-gauge method three-wire type, two-gauge method, four-gauge method) Four-gauge method 0-2 V, four-gauge method constant current, One-gauge method four-wire type, mode for gauge with temperature measurement function * The two-gauge common dummy method cannot be used.	
Bridge excitation	Constant voltage: DC 2 V 24 ms (50 Hz) Constant current (four-gauge method only): DC 6 mA 24 ms (50 Hz)	
Initial value storage range	Conform to that of the data logger	
Measurement range and resolution	Measurement range	Resolution
	± 40000×10^{-6} strain	1×10^{-6} strain
	± 80000×10^{-6} strain	2×10^{-6} strain
	±160000×10^{-6} strain	4×10^{-6} strain
	±320000×10^{-6} strain	8×10^{-6} strain
	±640000×10^{-6} strain	16×10^{-6} strain
Accuracy (at 23°C ± 5°C) *Excluding the one-gauge method four-wire type	±(0.05%rdg+1 digit)	
Accuracy (at 23°C ± 5°C) *One-gauge method four-wire type	±(0.25%rdg+1 digit)	
Temperature coefficient of accuracy	± 0.002% rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Bridge resistance (constant current method)	350 Ω	
Extension range (constant current method)	Equivalent to cable round-trip resistance of 400 Ω	
Sensitivity change (constant current method)	+0.1 to -0.5%/Cable round-trip resistance of 100 Ω	

High-resolution strain measurement

Sensor mode	Four-gauge method, four-gauge method constant current	
Bridge excitation	Constant voltage DC5V 48ms(50Hz) Constant current DC14mA 48ms(50Hz)	
Initial value storage range	Conform to that of the data logger	
Measurement range and resolution	Measurement range	Resolution
	± 4000.0×10^{-6} strain	0.1×10^{-6} strain
	± 8000.0×10^{-6} strain	0.2×10^{-6} strain
	±16000.0×10^{-6} strain	0.4×10^{-6} strain
	±32000.0×10^{-6} strain	0.8×10^{-6} strain
	±64000.0×10^{-6} strain	1.6×10^{-6} strain
Accuracy (at 23°C ± 5°C)	± (0.05% rdg + 3 digits)	
Temperature coefficient of accuracy	± 0.002% rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Bridge resistance (constant current method)	350 Ω	
Extension range (constant current method)	Equivalent to cable round-trip resistance of 160 Ω	
Sensitivity change (constant current method)	+0.1% to -0.5%/Cable round-trip resistance of 100 Ω	

DC voltage measurement

Initial value storage range		Conform to that of the data logger	
Measurement range and resolution		Measurement range	Resolution
	V1/1	± 40.000mV	0.001mV
		± 80.000mV	0.002mV
		±160.000mV	0.004mV
		±320.000mV	0.008mV
		±640.000mV	0.016mV
	V1/100	± 4.0000V	0.0001V
		± 8.0000V	0.0002V
		±16.0000V	0.0004V
		±32.0000V	0.0008V
		±64.0000V	0.0016V
Accuracy (23°C ±5°C)	**V1/1**	±(0.05%rdg+3 digit)	
	V1/100	±(0.05%rdg+2 digit)	
Temperature coefficient of accuracy		±0.0024%rdg/°C	
Aging change of accuracy		±0.024%rdg/year	

IHW-50G (High-speed)

Thermocouple temperature measurement (JIS C 1602-1995, IEC 60584)

Applicable thermocouple		T, K, J, B, S, R, E, N		
Linearization		Digital calculation		
Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C) (External reference junction)	Accuracy (at 23°C ± 5°C) (Internal reference junction)
T	-250 to -200°C	0.1°C	±(0.19%rdg+0.5°C)	±(0.19%rdg+3.8°C)
	-200 to -100°C	0.1°C	±(0.09%rdg+0.2°C)	±(0.09%rdg+1.6°C)
	-100 to + 400°C	0.1°C	±(0.06%rdg+0.2°C)	±(0.06%rdg+0.9°C)
K	-210 to -160°C	0.1°C	±(0.11%rdg+0.3°C)	±(0.11%rdg+1.8°C)
	-160 to 0°C	0.1°C	±(0.08%rdg+0.2°C)	±(0.08%rdg+1.1°C)
	0 to +960°C	0.1°C	±(0.06%rdg+0.1°C)	±(0.06%rdg+0.7°C)
	+960 to +1370°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.2°C)
J	-200 to -160°C	0.1°C	±(0.09%rdg+0.2°C)	±(0.09%rdg+1.4°C)
	-160 to 0°C	0.1°C	±(0.07%rdg+0.1°C)	±(0.07%rdg+1.0°C)
	0 to +700°C	0.1°C	±(0.05%rdg+0.1°C)	±(0.05%rdg+0.6°C)
	+700 to +1200°C	0.1°C	±(0.06%rdg+0.4°C)	±(0.06%rdg+0.8°C)
B	+200 to +280°C	0.5 to 0.4°C	±(0.03%rdg+1.5°C)	±(0.03%rdg+1.5°C)
	+280 to +800°C	0.3 to 0.1°C	±(0.03%rdg+0.6°C)	±(0.03%rdg+0.6°C)
	+800 to +1760°C	0.1°C	±(0.04%rdg+0.4°C)	±(0.04%rdg+0.4°C)
S	-10 to +200°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.3°C)
	+200 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+0.8°C)
R	-10 to +150°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.3°C)
	+150 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+0.8°C)
E	-210 to +550°C	0.1°C	±(0.10%rdg+0.2°C)	±(0.10%rdg+1.6°C)
	+550 to +1000°C	0.1°C	±(0.06%rdg+0.3°C)	±(0.06%rdg+0.7°C)
N	-200 to 0°C	0.1°C	±(0.11%rdg+0.4°C)	±(0.11%rdg+1.8°C)
	0 to +1090°C	0.1°C	±(0.05%rdg+0.2°C)	±(0.05%rdg+0.7°C)
	+1090 to +1300°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+0.9°C)

* The accuracy of sensor is not included, and thermocouple B does not use the reference junction.

Platinum resistance temperature detector temperature measurement (JIS C 1604-1997, IEC 60751 Pt100)

Applicable resistance temperature detector	Pt100
Measurement Method	Three-wire type (Pt3W)
Linearization	Digital calculation
Temperature coefficient of accuracy	± 0.002% rdg/°C
Aging change of accuracy	± 0.05% rdg/year
Measurement range	-200 to +850°C
Resolution	0.1°C
Accuracy (at 23°C ± 5°C)	± (0.05% rdg + 0.3°C)

High-speed mode (HSP) compatible specifications IHW-50G-01 (factory option)

Measurements with the high-speed mode (HSP) of the TDS-630 data logger. The strain high-resolution mode cannot be used.

Strain measurement

Sensor mode	(One-gauge method three-wire type, two-gauge method, four-gauge method) Four-gauge method 0-2 V, four-gauge method constant current, One-gauge method four-wire type, mode for gauge with temperature measurement function * The two-gauge common dummy method cannot be used.	
Bridge excitation	Constant voltage DC2V 4ms (50 Hz) Constant current (four-gauge method only) DC 6mA 4ms (50 Hz)	
Initial value storage range	Conform to that of the data logger	
Measurement range and resolution	Measurement range	Resolution
	± 40000×10^{-6} strain	1×10^{-6} strain
	± 80000×10^{-6} strain	2×10^{-6} strain
	±160000×10^{-6} strain	4×10^{-6} strain
	±320000×10^{-6} strain	8×10^{-6} strain
	±640000×10^{-6} strain	16×10^{-6} strain
Accuracy (at 23°C ± 5°C) *** Excluding the one-gauge method four-wire type**	±(0.08%rdg+3 digit)	
Accuracy (at 23°C ± 5°C) *** One-gauge method four-wire type**	±(0.28%rdg+3 digit)	
Temperature coefficient of accuracy	± 0.002% rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Bridge resistance (constant current method)	350 Ω	
Extension range (constant current method)	Equivalent to cable round-trip resistance of 400 Ω	
Sensitivity change (constant current method)	+0.1% to -0.5%/Cable round-trip resistance of 100 Ω	

DC voltage measurement

Initial value storage range		Conform to that of the data logger	
		Measurement range	Resolution
Measurement range and resolution	V1/1	± 40.000mV	0.001mV
		± 80.000mV	0.002mV
		±160.000mV	0.004mV
		±320.000mV	0.008mV
		±640.000mV	0.016mV
	V1/100	± 4.0000V	0.0001V
		± 8.0000V	0.0002V
		±16.0000V	0.0004V
		±32.0000V	0.0008V
		±64.0000V	0.0016V
Moving averaging process		**Enabled**	**Disabled**
V1/1 accuracy (at 23°C ± 5°C)		±(0.08%rdg+6 digit)	±(0.08%rdg+50 digit)
V1/100 accuracy (at 23°C ± 5°C)		±(0.08%rdg+6 digit)	±(0.08%rdg+50 digit)
Temperature coefficient of accuracy		±0.0024%rdg/°C	
Aging change of accuracy		±0.024%rdg/year	

* The moving average of the last five A/D conversion values is calculated. DC voltage measurement can be set to disabled.

Thermocouple temperature measurement (JIS C 1602-1995, IEC 60584)

Applicable thermocouple		T, K, J, B, S, R, E, N		
Linearization		Digital calculation		
Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C) (External reference junction)	Accuracy (at 23°C ± 5°C) (Internal reference junction)
T	-250 to -200°C	0.1°C	±(0.31%rdg+1.9°C)	±(0.31%rdg+5.2°C)
	-200 to -100°C	0.1°C	±(0.14%rdg+0.8°C)	±(0.14%rdg+2.1°C)
	-100 to +0°C	0.1°C	±(0.11%rdg+0.5°C)	±(0.11%rdg+1.2°C)
	0 to + 400°C	0.1°C	±(0.08%rdg+0.4°C)	±(0.08%rdg+0.9°C)
K	-210 to -160°C	0.1°C	±(0.17%rdg+0.9°C)	±(0.17%rdg+2.5°C)
	-160 to 0°C	0.1°C	±(0.12%rdg+0.6°C)	±(0.12%rdg+1.5°C)
	0 to +960°C	0.1°C	±(0.09%rdg+0.4°C)	±(0.09%rdg+0.9°C)
	+960 to +1370°C	0.1°C	±(0.10%rdg+0.9°C)	±(0.10%rdg+1.5°C)
J	-200 to -160°C	0.1°C	±(0.15%rdg+0.6°C)	±(0.15%rdg+1.8°C)
	-160 to 0°C	0.1°C	±(0.11%rdg+0.4°C)	±(0.11%rdg+1.3°C)
	0 to + 700°C	0.1°C	±(0.09%rdg+0.3°C)	±(0.09%rdg+0.8°C)
	+700 to +1200°C	0.1°C	±(0.09%rdg+0.6°C)	±(0.09%rdg+1.0°C)
B	+200 to +280°C	0.5 to 0.4°C	±(0.03%rdg+6.0°C)	±(0.03%rdg+6.0°C)
	+280 to +800°C	0.3 to 0.1°C	±(0.03%rdg+2.4°C)	±(0.03%rdg+2.4°C)
	+800 to +1760°C	0.1°C	±(0.04%rdg+2.6°C)	±(0.04%rdg+2.6°C)
S	-10 to +200°C	0.1°C	±(0.06%rdg+2.4°C)	±(0.06%rdg+3.1°C)
	+200 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+2.0°C)
R	-10 to 150°C	0.1°C	±(0.06%rdg+2.4°C)	±(0.06%rdg+3.1°C)
	+150 to +1760°C	0.1°C	±(0.05%rdg+1.5°C)	±(0.05%rdg+1.8°C)
E	-210 to +550°C	0.1°C	±(0.16%rdg+0.6°C)	±(0.16%rdg+2.0°C)
	+550 to +1000°C	0.1°C	±(0.09%rdg+0.4°C)	±(0.09%rdg+0.9°C)
N	-200 to 0° C	0.1°C	±(0.11%rdg+1.3°C)	±(0.11%rdg+2.7°C)
	0 to +1090°C	0.1°C	±(0.09%rdg+0.5°C)	±(0.09%rdg+1.0°C)
	+1090 to +1300°C	0.1°C	±(0.06%rdg+0.9°C)	±(0.06%rdg+1.3°C)

* The moving average of the last five A/D conversion valuesis calculated.
* The accuracy of sensor is not included, and thermocouple B does not use the reference junction.

Platinum resistance temperature detector temperature measurement (JIS C 1604-1997, IEC 60751 Pt100)

Applicable resistance temperature detector	Pt100
Measurement Method	Three-wire type (Pt3W)
Linearization	Digital calculation
Temperature coefficient of accuracy	± 0.002% rdg/°C
Aging change of accuracy	± 0.05% rdg/year
Measurement range of accuracy	-200 to +850°C
Resolution	0.1°C
Accuracy (at 23°C ± 5°C)	± (0.05% rdg + 0.3°C)

Measurement capabilities

Number of measuring points	Up to 50 points * When the mode for strain gauge with temperature measurement function is used, more than 50 points can be measured.

Measuring point switching method

High-speed scanning measurement	Parallel switching measurement from the first channel to the last channel of each unit in the box (jump possible)
Monitor measurement (during standard mode)	Measurement of specified channel

Measuring point switching speed

mode	IHW-50G (Standard model)	
	50Hz area	60Hz area
Strain	40ms/ch	34ms/ch
Strain high-resolution	120ms/ch	100ms/ch
Voltage	40ms/ch	34ms/ch
Thermocouple temperature	40ms/ch*	34ms/ch*
Platinum resistance temperature detector temperature	40ms/ch	34ms/ch

* When using the thermocouple mode, add the measurement time of 1 point for every 10 points.
* If even a gauge with temperature measurement function is used even at 1 point, the measurement time is twice as long as that in the table above.

Compensation mode

Compensation mode (Processing of measurement value)	Comet None: Supported
	Comet A: Supported
	Comet B: Supported

TEDS (Transducer Electronic Data Sheet)

Function	Depends on the data logger combined
Connection	Six-pin modular jack, NDIS one-touch connector (-05 type only)

Check function

Stabilized insulation	Supported	**Direct**	Supported
Sensitivity	Supported	**Lead wire**	Supported
Variation	Supported	**Hum**	Supported
Thermocouple disconnection	Supported		

Operation

[SET]	Start changing the measuring point position, determine the measuring point allocation.
[+] [-]	Change the measuring point allocation for every 10 points.

Display

Measuring point number	For every 10 points, the upper two digits are displayed on a seven-segment, two-digit LCD.
Measuring point display	Red LED at each point

Setting

Measuring point allocation	Set by key operation, retain in an EEPROM.
Sensor mode	Set each point from the data logger.
Settable sensor mode	
Jump	Jump
Strain	One-gauge method three-wire type, 120 / 240 / 350 Ω, One-gauge method four-wire type, 120 / 240 / 350 Ω, two-gauge method, four-gauge method, Four-gauge method constant current 350 Ω, four-gauge method, high-resolution mode, Four-gauge method constant current 350 Ω high-resolution mode Four-gauge method 0-2 V mode *The two-gauge common dummy method cannot be used.
Strain gauge with temperature measurement function	Strain gauge with temperature measurement function, 120 / 240 / 350 Ω * Supported by the TS-560 and TDS-540 only
Voltage	Voltage [640 mV]/[64 V]
Temperature	T, K, J, B, S, R, E, N, Pt100 3W

Connection with data logger (Communication with data logger)

ELECTRICAL (RS-422)	Extension distance Connection cable	Distance between devices: 800 m RS422 cable CR-832M
OPTICAL (Optical fiber)	Extension distance Connection cable	Distance between devices: 800 m Optical fiber cable CR-842M
TO METER	Connect to the data logger side * Either RS-422 or optical fiber	
TO NEXT	Connect to the next ISW/IHW system switch boxes. * Either RS-422 or optical fiber	

Channel unit

Number of measuring points	Up to 50 points
Switch	Semiconductor relay
Lightning arrester	Each channel is equipped with a surge absorber for lightning protection as standard.
Input terminal	Dual-purpose type for screw fixing and soldering
Connector	Six-pin modular jack NDIS one-touch connector (-05 type only)
TEDS readout	Readout of TEDS (Transducer Electronic Data Sheet) compatible sensor information

Strain measurement		
Applicable wiring method, gauge resistance	One-gauge method three-wire type : 120, 240, 350Ω	
	One-gauge method four-wire type : 120, 240, 350Ω	
	Two-gauge method : 60 to 1000Ω	
	Four-gauge method : 60 to 1000Ω	
	Four-gauge method constant current: 350Ω	
	Four-gauge method high-resolution mode : 120 to 1000Ω	
	Four-gauge method constant current high-resolution : 350Ω	
	Four-gauge method 0-2 V mode : 60~1000Ω	
	Mode for strain gauge with temperature measurement function : 120, 240, 350Ω (One-gauge method three-wire type, thermocouple T) T JIS C 1602-1995, IEC 60584 * Supported by the TS-560 and TDS-540 only	
Sensor cable extension range	Four-gauge method constant current high-resolution	Cable round-trip resistance: 140 Ω or less
	Four-gauge method constant current high-resolution 350 Ω	Cable round-trip resistance: 140 Ω or less
	One-gauge method four-wire type	Cable round-trip resistance: 200 Ω or less
Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1 to -0.5% per cable round-trip resistance of 100 Ω
	Four-gauge method constant current high-resolution 350 Ω	
Lead wire resistance compensation range Comet B (1G3W)	Gauge resistance 120 Ω	About 100 Ω or less
	Gauge resistance 240 Ω	About 200 Ω or less
	Gauge resistance 350 Ω	About 300 Ω or less
Zero stability	±1.0 με/°C or less (one-gauge method) ± 0.5 με/°C or less (two-gauge method)	
DC voltage measurement	V 1/1 : DC ± 640 mV V 1/100: DC ± 64 V Input impedance: 1 MΩ or more Allowable input voltage between B and D: DC ± 70 V max	
Thermocouple temperature measurement		
Applicable thermocouple	T, K, J, B, S, R, E, N JIS C 1602-1995, IEC 60584	
Platinum resistance temperature detector measurement		
Applicable platinum resistance temperature detector	Pt100 (500 μA constant current 3-wire type) JIS C 1604-1997, IEC 60751 Pt100	

Environment

Operating temperature / humidity range	0 to +50°C 85% RH or less (No condensation)

Power supply (AC power supply)

AC power supply	**Rated voltage**	AC 100 to 240 V 50/60 Hz
	Allowable voltage	AC 85 to 250 V 50/60 Hz
	Maximum power consumption	104 VA max
DC power supply	**Rated voltage**	DC 12 V
	Allowable voltage	DC 10 to 16 V

Outside dimension / mass

Normal type	298 (W) x 100 (H) x 500 (D) mm (excluding protrusions) Approx. 8 kg
-05 type	298 (W) x 100 (H) x 600 (D) mm (excluding protrusions) Approx. 8 kg

Standard accessories

Instruction Manual.....1
AC power cable (CR-03).....1
Ground wire (CR-20).....1
Connection cable.....1
(RS-422 cable CR-832M)
Phillips screwdriver.....1
Warranty certificate.....1

Related Products

SB-OT1B one-touch terminal

This terminal block allows one-touch connection of input lead wires. It is used by attaching it to the input terminal of the switch box. (One set of five terminals)

ISW-50G

- Electrically isolated from the data logger main unit
- Measurements of strain, DC voltage, thermocouple, and platinum resistance temperature detector
- Equipped with high-resolution (0.1 x 10^{-6} strain) mode*
- Sampling speed is 0.04 sec for 1 point and 2 sec for 50 points. In a system using multiple units of this equipment, 1000 points can be measured in 2 sec.
- One-gauge method four-wire type measurement via modular plug connection
- Equipped with gauge mode with temperature measurement function that can measure strain and temperature using 1 channel
- Each channel is equipped with a surge absorber for lightning protection as standard.
- Equipped with Complete Compensation Method of Strain

* The high-resolution mode supports the standard mode, four-gauge method, and the four-gauge constant current method.



ISW-50G switch box

This equipment is a switch box with a built-in A/D converter that enables high-speed and high-accuracy measurements and was developed to be used in combination with the TS-560/TDS-540 data logger to expand the number of measuring points. High-speed digital communication via RS-422 or optical fiber isolated from the measuring instrument main unit makes this equipment extremely resistant to noise.

ISW-50G-05

In addition to the standard terminals, all points are equipped with NDIS one-touch connectors (receptacles). This equipment is convenient for connecting strain gauge type transducers with tip NDIS plugs. For this type, its depth becomes large because of the additional space for the connectors.

Option code

ISW/IHW -50G (- A)

Other options	
-N	Without Optical Fiber Option
-A	With Optical Fiber Option



With Optical Fiber Option



Without Optical Fiber Option

Specifications

Strain measurement

Sensor mode	(One-gauge method three-wire type, two-gauge method, four-gauge method) Four-gauge method 0-2 V, four-gauge method constant current, one-gauge method four-wire type, mode for gauge with temperature measurement function	
Bridge excitation	Constant voltage DC 2 V 24 ms (50 Hz) Constant current (four-gauge method only) DC 6 mA 24 ms (50 Hz)	
Initial value storage range	Conform to that of the data logger	
Measurement range and resolution	Measurement range	Resolution
	± 40000×10^{-6} strain	1×10^{-6} strain
	± 80000×10^{-6} strain	2×10^{-6} strain
	±160000×10^{-6} strain	4×10^{-6} strain
	±320000×10^{-6} strain	8×10^{-6} strain
	±640000×10^{-6} strain	16×10^{-6} strain
Accuracy (at 23°C ± 5°C) * Excluding the one-gauge method four-wire type	±(0.05%rdg+1 digit)	
Accuracy (at 23°C ± 5°C) * One-gauge method four-wire type	±(0.25%rdg+1 digit)	
Temperature coefficient of accuracy	± 0.002% rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Bridge resistance (constant current method)	350 Ω	
Extension range (constant current method)	Equivalent to cable round-trip resistance of 400 Ω	
Sensitivity change (constant current method)	+ 0.1 to -0.5%/Cable round-trip resistance of 100 Ω	

High-resolution strain measurement

Sensor mode	Four-gauge method, four-gauge method constant current	
Bridge excitation	Constant voltage DC 5 V 48 ms (50 Hz) Constant current DC 14 mA 48 ms (50 Hz)	
Initial value storage range	Conform to that of the data logger	
Measurement range and resolution	Measurement range	Resolution
	± 4000.0×10^{-6} strain	0.1×10^{-6} strain
	± 8000.0×10^{-6} strain	0.2×10^{-6} strain
	±16000.0×10^{-6} strain	0.4×10^{-6} strain
	±32000.0×10^{-6} strain	0.8×10^{-6} strain
	±64000.0×10^{-6} strain	1.6×10^{-6} strain
Accuracy (at 23°C ± 5°C)	± (0.05% rdg + 3 digits)	
Temperature coefficient of accuracy	± 0.002% rdg/°C	
Aging change of accuracy	± 0.02% rdg/year	
Bridge resistance (constant current method)	350 Ω	
Extension range (constant current method)	Equivalent to cable round-trip resistance of 160 Ω	
Sensitivity change (constant current method)	+ 0.1 to -0.5%/Cable round-trip resistance of 100 Ω	

DC voltage measurement

Initial value storage range		**Conform to that of the data logger**	
Measurement range and resolution	**V1/1**	Measurement range	Resolution
		± 40.000mV	0.001mV
		± 80.000mV	0.002mV
		±160.000mV	0.004mV
		±320.000mV	0.008mV
		±640.000mV	0.016mV
	V1/100	± 4.0000V	0.0001V
		± 8.0000V	0.0002V
		±16.0000V	0.0004V
		±32.0000V	0.0008V
		±64.0000V	0.0016V
Accuracy (23°C ± 5°C)	**V1/1**	±(0.05%rdg+3 digit)	
	V1/100	±(0.05%rdg+2 digit)	
Temperature coefficient of accuracy		± 0.0024% rdg/°C	
Aging change of accuracy		± 0.024% rdg/year	

Thermocouple temperature measurement (JIS C 1602-1995, IEC 60584)

Applicable thermocouple	T, K, J, B, S, R, E, N
Linearization	Digital calculation

Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C) (External reference junction)	Accuracy (at 23°C ± 5°C) (Internal reference junction)
T	-250 to -200°C	0.1°C	±(0.19%rdg+0.5°C)	±(0.19%rdg+3.8°C)
	-200 to -100°C	0.1°C	±(0.09%rdg+0.2°C)	±(0.09%rdg+1.6°C)
	-100 to +400°C	0.1°C	±(0.06%rdg+0.2°C)	±(0.06%rdg+0.9°C)
K	-210 to -160°C	0.1°C	±(0.11%rdg+0.3°C)	±(0.11%rdg+1.8°C)
	-160 to 0°C	0.1°C	±(0.08%rdg+0.2°C)	±(0.08%rdg+1.1°C)
	0 to +960°C	0.1°C	±(0.06%rdg+0.1°C)	±(0.06%rdg+0.7°C)
	+960 to +1370°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.2°C)
J	-200 to -160°C	0.1°C	±(0.09%rdg+0.2°C)	±(0.09%rdg+1.4°C)
	-160 to 0°C	0.1°C	±(0.07%rdg+0.1°C)	±(0.07%rdg+1.0°C)
	0 to +700°C	0.1°C	±(0.05%rdg+0.1°C)	±(0.05%rdg+0.6°C)
	+700 to +1200°C	0.1°C	±(0.06%rdg+0.4°C)	±(0.06%rdg+0.8°C)
B	+200 to +280°C	0.5 to 0.4°C	±(0.03%rdg+1.5°C)	±(0.03%rdg+1.5°C)
	+280 to +800°C	0.3 to 0.1°C	±(0.03%rdg+0.6°C)	±(0.03%rdg+0.6°C)
	+800 to +1760°C	0.1°C	±(0.04%rdg+0.4°C)	±(0.04%rdg+0.4°C)
S	-10 to +200°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.3°C)
	+200 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+0.8°C)
R	-10 to +150°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+1.3°C)
	+150 to +1760°C	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+0.8°C)
E	-210 to +550°C	0.1°C	±(0.10%rdg+0.2°C)	±(0.10%rdg+1.6°C)
	+550 to +1000°C	0.1°C	±(0.06%rdg+0.3°C)	±(0.06%rdg+0.7°C)
N	-200 to 0°C	0.1°C	±(0.11%rdg+0.4°C)	±(0.11%rdg+1.8°C)
	0 to +1090°C	0.1°C	±(0.05%rdg+0.2°C)	±(0.05%rdg+0.7°C)
	+1090 to +1300°C	0.1°C	±(0.06%rdg+0.6°C)	±(0.06%rdg+0.9°C)

* The accuracy of sensor is not included, and thermocouple B does not use the reference junction.

Platinum resistance temperature detector temperature measurement (JIS C 1604-1997, IEC 60751 Pt100)

Applicable resistance temperature detector	Pt100
Measurement Method	Three-wire type (Pt3W)
Linearization	Digital calculation
Temperature coefficient of accuracy	± 0.0020% rdg/°C
Aging change of accuracy	± 0.05% rdg/year
Measurement range	-200 to +850C°
Resolution	0.1C°
Accuracy (at 23°C ± 5°C)	± (0.05% rdg + 0.3C°)

Measuring point switching speed

Sensor mode	Switching speed 50 Hz area	Switching speed 60 Hz area
Strain	40 ms	34 ms
Strain high-resolution	120 ms	100 ms
Voltage	40 ms	34 ms
Thermocouple temperature (Data for 1 CH is added for every 10 points.)	40ms	34ms
Platinum temperature	40 ms	34 ms

* Excluding transfer time

Measurement capabilities

Number of measuring points	Up to 50 points * When the mode for strain gauge with temperature measurement function is used, more than 50 points can be measured.

Measuring point switching method

Scan measurement	Switching measurement from the first channel to the last channel in the box (jump possible)
Monitor measurement	Measurement of specified channel

Measurement time

When measuring strain of all points		50 Hz area	60 Hz area
Scanning measurement time	10 points	0.4 sec	0.34 sec
	20 points	0.8 sec	0.67 sec
	30 points	1.2 sec	1.00 sec
	40 points	1.6 sec	1.34 sec
	50 points	2.0 sec	1.67 sec

* Excluding transfer time
* When using the thermocouple mode, add the measurement time of 1 point for every 10 points.
* Add the measurement time separately to the above-mentioned measurement time obtained by using a strain gauge with temperature measurement function.
* When the high-resolution mode is used, the measurement time per point is three times longer.

Compensation mode

Compensation mode (Processing of measurement value)	Comet None	: Supported
	Comet A	: Supported
	Comet B	: Supported

Check function

Stabilized insulation	Supported	**Direct**	Supported
Sensitivity	Supported	**Lead wire**	Supported
Variation	Supported	**Hum**	Supported
Thermocouple disconnection	Supported		

Operation

[SET]	Start changing the measuring point position, determine the measuring point allocation.
[+] [-]	Change the measuring point allocation for every 10 points.

Display

Measuring point number	For every 10 points, the upper two digits are displayed on a seven-segment, two-digit LCD.
Status display	Red LED at each point

Setting

Measuring point allocation	Set by key operation, retain in an EEPROM.
Sensor mode	Set each point from the data logger.

Settable sensor mode

Jump	Jump
Strain	One-gauge method three-wire type, 120 / 240 / 350 Ω, one-gauge method four-wire type, 120 / 240 / 350 Ω, two-gauge method, two-gauge common dummy method, four-gauge method, four-gauge method constant current 350 Ω, four-gauge method, high-resolution mode, four-gauge method constant current 350 Ω high-resolution mode, four-gauge method 0-2 V mode
Strain gauge with temperature measurement function	Strain gauge with temperature measurement function, 120 / 240 / 350 Ω * Supported by the TS-560 and TDS-540 only
Voltage	Voltage [640 mV]/[64 V]
Temperature	T, K, J, B, S, R, E, N, Pt100 3W

Connection with data logger (Communication with data logger)

ELECTRICAL (RS-422)	Extension distance	Distance between devices: 800 m
	Connection cable	RS422 cable CR-832M
OPTICAL (Optical fiber)	Extension distance	Distance between devices: 800 m
	Connection cable	Optical fiber cable CR-842M
TO METER	Connect to the data logger side * Either RS-422 or optical fiber	
TO NEXT	Connect to the next ISW/IHW system switch boxes. * Either RS-422 or optical fiber	

Channel unit

Number of measuring points	Up to 50 points
Switch	Semiconductor relay
Lightning arrester	Each channel is equipped with a surge absorber for lightning protection as standard.
Input terminal	Dual-purpose type for screw fixing and soldering
Connector	Six-pin modular jack NDIS one-touch connector (-05 type only)
TEDS readout	Readout of TEDS (Transducer Electronic Data Sheet) compatible sensor information * Supported by the TS-560 and TDS-540 only

ISW-50G

Strain measurement		
Applicable wiring method, gauge resistance	One-gauge method three-wire type :120, 240, 350 Ω	
	One-gauge method four-wire type : 120, 240, 350 Ω	
	Two-gauge method : 60–1000 Ω	
	Two-gauge common dummy method : 60–1000 Ω	
	Four-gauge method : 60–1000 Ω	
	Four-gauge method constant current : 350 Ω	
	Four-gauge method high-resolution mode : 120–1000 Ω	
	Four-gauge method constant current high-resolution : 350 Ω	
	Four-gauge method 0-2 V mode : 60–1000 Ω	
	Mode for strain gauge with temperature measurement function 120, 240, 350 Ω (One-gauge method three-wire type, thermocouple T) T JIS C 1602-1995, IEC 60584 * Supported by the TS-560 and TDS-540 only	
Sensor cable extension range	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
	Four-gauge method constant current high-resolution 350 Ω	Cable round-trip resistance: 140 Ω or less
	One-gauge method four-wire type	Cable round-trip resistance: 200 Ω or less
Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1 to -0.5% per cable round-trip resistance of 100 Ω
	Four-gauge method constant current high-resolution 350 Ω	
Lead wire resistance compensation range Comet B (1G3W)	Gauge resistance 120 Ω	About 100 Ω or less
	Gauge resistance 240 Ω	About 200 Ω or less
	Gauge resistance 350 Ω	About 300 Ω or less
Zero stability	±1.0 με/C° or less (one-gauge method) ± 0.5 με/C° or less (two-gauge method)	
DC voltage measurement	V 1/1 : DC ± 640 mV V 1/100: DC ± 64 V Input impedance: 1 MΩ or more Allowable input voltage between B and D: DC ± 70 V max	
Thermocouple temperature measurement		
Applicable thermocouple	T, K, J, B, S, R, E, N JIS C 1602-1995, IEC 60584	
Platinum resistance temperature detector measurement		
Applicable platinum resistance temperature detector	Pt100 (500 μA constant current three-wire type) JIS C 1604-1997, IEC 60751 Pt100	

Environment

Operating temperature / humidity range	0C° to +50C° 85% RH or less (No condensation)

Power supply (AC power supply)

AC power supply	**Rated voltage**	AC 100 to 240 V 50/60 Hz
	Allowable voltage	AC 85 to 250 V 50/60 Hz
	Maximum power consumption	37 VA max
DC power supply	**Rated voltage**	DC 12 V
	Allowable voltagevoltage	DC 10 to 16 V
	Maximum consumption current	0.8 A max

Outside dimension / mass

Normal type	298 (W) x 100 (H) x 500 (D) mm (excluding protrusions) Approx. 8 kg
-05 type	298 (W) x 100 (H) x 600 (D) mm (excluding protrusions) Approx. 8 kg

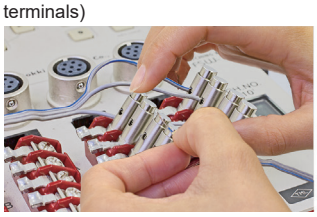
Standard accessories

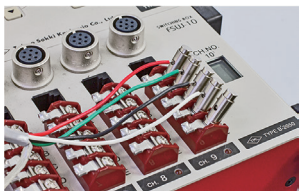
Instruction Manual..... 1
AC power cable (CR-03) 1
Ground wire (CR-20) 1
Connection cable 1
(CR- 842M Optical fiber cable or CR-832M RS-422 cable)
Phillips screwdriver 1
Warranty certificate 1

Related Products

SB-OT1B one-touch terminal

This terminal block allows one-touch connection of input lead wires. It is used by attaching it to the input terminal of the switch box. (One set of five terminals)





SSW-50D

- Measurements of strain, DC voltage and thermocouple are possible.
- Strain measurement using the new one-gauge method four-wire type is possible.
- Modular plug connection allows for significant reduction in wiring time. (Modular connectors can only be used for the new one-gauge method four-wire type measurement.)
- A power booster for multipoint long distance extension is built in.
- Cascade connection with SSW / ASW-50C is possible.
- A heater for moisture prevention can be built in optionally.
- Equipped with Complete Compensation Method of Strain

This equipment is a switch box for expanding the number of measuring points in combination with the TDS-540 data logger. The number of measuring points is 50 points per unit and, in addition to measurements of strain, DC voltage and thermocouple temperature, it is also possible to perform the one-gauge method four-wire type strain measurement, which is a new measurement method. A modular connector is provided for the one-gauge method four-wire type strain measurement to facilitate speedy wiring work when performing multipoint measurements.

Specifications

Number of measuring points	50 points	
Strain measurement		
Applicable wiring method, gauge resistance	One-gauge method three-wire type	: 120, 240, 350 Ω
	One-gauge method four-wire type	: 120, 240, 350 Ω
	Two-gauge method	: 60–1000 Ω
	Two-gauge common dummy method	: 60–1000 Ω
	Four-gauge method (standard resolution mode)	: 60–1000 Ω
	Four-gauge method (high-resolution mode)	: 120–1000 Ω
	Four-gauge method constant current	: 350 Ω
Measurement range	Depends on the data logger combined	
Sensor cable extension range	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
	Four-gauge method constant current high-resolution: 350 Ω	Cable round-trip resistance: 80 Ω or less
	One-gauge method four-wire type	Cable round-trip resistance: 200 Ω or less
Zero stability	One-gauge method three-wire type (±1.0 × 10^{-6} strain/°C or less) One-gauge method four-wire type (±1.0 × 10^{-6} strain/°C or less) Two-gauge method (± 0.5 × 10^{-6} strain/°C or less)	
Voltage measurement		
Measurement range	Depends on the data logger combined	
Input impedance	1 MΩ or more	
Thermocouple temperature measurement		
Measurement range	Depends on the data logger combined	
Sensor mode		
REMOTE	Set each point from the data logger.	
Measuring point number	Set the top two digits arbitrarily for every 10 points.	
Measuring point display	Red LED at each point	
Switch	Semiconductor relay	
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)	
Power supply	Usually, supplied by a data logger	
AC power supply	Only when booster / heater are used	
Rated voltage	AC 100 to 240 V 50/60 Hz	
Allowable voltage	AC 85 to 250 V 50/60 Hz	
Maximum power consumption	17 VA max (AC 121 to 250 V) 10 VA max (AC 85 to 120 V)	
Outside dimension	SSW-50D : 298 (W) × 100 (H) × 500 (D) mm (Excluding protrusions) SSW-50D-05 : 298 (W) × 100 (H) × 600 (D) mm (Excluding protrusions)	
Mass	SSW-50D: Approx. 7 kg SSW-50D-05: Approx. 8 kg	

Standard accessories

Instruction Manual..... 1
AC power cable (CR-03) 1
Connection cable (CR-65) 1
Phillips screwdriver 1
Warranty certificate 1



SSW-50D switch box

SSW-50D-05



In addition to the standard terminals, all points are equipped with NDIS one-touch connectors (receptacles). This equipment is convenient for connecting strain gauge type transducers with tip NDIS plug. For this type, its depth becomes large because of the additional space for the connectors.

Factory option

Heater for moisture prevention
Power consumption

AC100V	50/60 Hz	26 VA max
AC 240 V	50/60 Hz	110 VA max

Gas tube arrester for lightning protection

Protection voltage	170 V to 290 V
Protection current	10 kA

Related Products

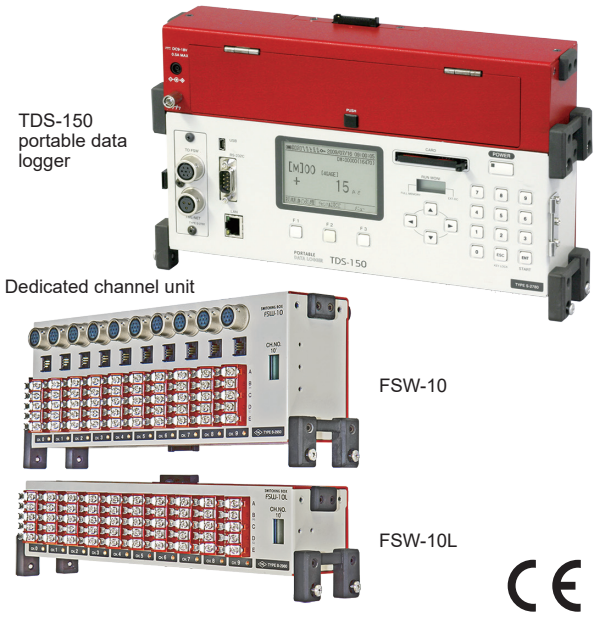
SB-OT1B one-touch terminal

This terminal block allows the one-touch connection of input lead wires. It is used by attaching it to the input terminal of the switch box. (One set of five terminals)

TDS-150 (Portable)

- Up to five channel units (FSW-10/FSW-10L) (50 ch) can be connected (both are optional).
- Long-term automatic measurement is possible using the sleep interval timer.
- Low power consumption
- Measurements of strain, DC voltage, thermocouple / platinum resistance temperature detector are possible.
- Equipped with large capacity data memory
- The one-gauge method four-wire type measurement is possible.
- Equipped with TEDS reading function
- Equipped with Complete Compensation Method of Strain
- Network modules can be connected (optional)
- Measurement via wireless communication using the ZT-150 wireless controller and ZT-014 wireless module (optional) is possible.
- Equipped with concrete sensor mode

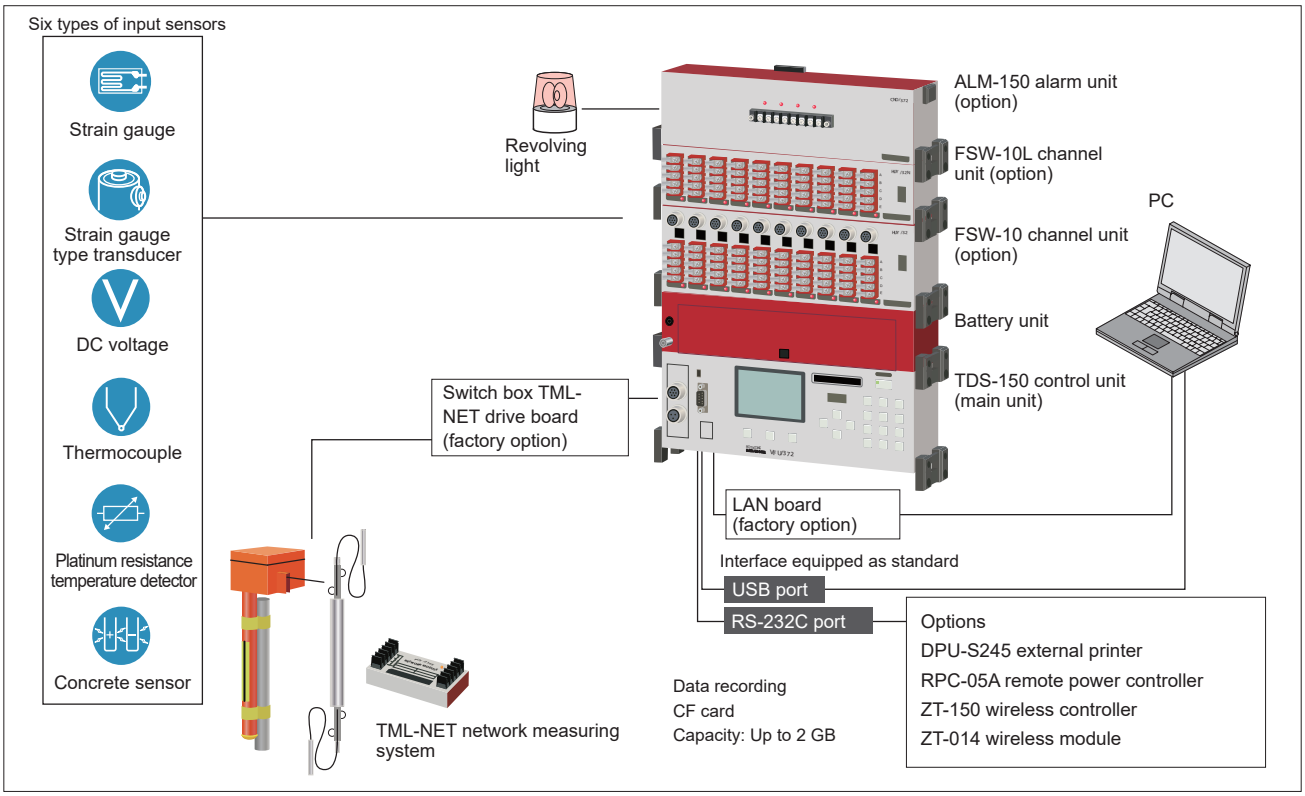
*The TDS-150 and the FSW-10/-10L channel unit are CE mark compliant.



This equipment is a portable data logger that can measure strain gauges, strain gauge type transducers, DC voltages, thermocouples, and platinum resistance temperature detectors in combination with the dedicated channel units (FSW-10/FSW-10L). Up to five units of the 10-channel unit (FSW-10/FSW-10L) (50 channels) can be connected. In addition, up to 100 channels can be connected using the switch box TML-NET drive board (optional). This product can be operated using commercially available D size alkaline dry-cell batteries or batteries even in places where AC power is unavailable.

It is equipped with data memory and sleep interval timer function that enable automatic measurement over a long period of time. It is possible to record the data and settings to a CF card. USB and RS-232C are equipped as interfaces to allow various settings and data to be imported from a PC. Wireless measurement is possible using the ZT-150 wireless controller and ZT-014 wireless module (optional). In addition, the CONCRETE mode is newly installed, and this allows the concrete filling detection sensor KZA and concrete moisture sensor KZW, which previously required two channels, to be measured with one channel.

System Block Diagram



Specifications

Number of measuring points

Up to 100 points	When using the switch box TML-NET drive board (factory option) or when using the ZT-150 wireless controller in combination
50 points	Dedicated channel unit FSW-10/FSW-10L When 5 units are connected

Applicable sensor

Strain measurement	One-gauge method four-wire type 120Ω One-gauge method four-wire type 240Ω One-gauge method four-wire type 350Ω	Bridge voltage DC 1 V 48 ms (50 Hz)
	One-gauge method three-wire type 120Ω One-gauge method three-wire type 240Ω One-gauge method three-wire type 350Ω	
	Two-gauge method 120–1000Ω Four-gauge method 120–1000Ω Four-gauge method constant current 350Ω	
	Four-gauge method 120~1000Ω	Bridge voltage DC 2 V 24 ms (50 Hz)
Thermocouple measurement	Thermocouple T Thermocouple K Thermocouple J Thermocouple B Thermocouple S Thermocouple R Thermocouple E Thermocouple N	Linearization digital calculation JIS C 1602-1995
Voltage measurement	DC 300 mV ± 300 mV DC 30 V ± 30 V	Input impedance V 1/1 500 MΩ or more V 1/100 1 MΩ or more
Platinum resistance temperature detector measurement	Platinum temperature measurement 3-wire type	Linearization digital calculation JIS C 1604-1997 Pt100
Concrete sensor measurement	CONCRETE (Concrete filling detection sensor, etc.)	Applied voltage: DC 2 V DC voltage measurement of sensor residual charge: Measured at ± 30 V
Wireless measurement	Four-gauge method connection to the ZT-014 wireless module (optional) 350-1000 Ω	Received by the ZT-150 wireless controller (optional)
TML-NET	Operates the NSW series (optional)	Data reading from the network module

Measurement range

Measurement item	Range	Measurement range	Measuring mode	Initial value storage range
Strain measurement	×1 ×10	±30000×10^{-6} strain ±300000×10^{-6} strain	Initial, direct, measure	±160000×10^{-6} strain
DC voltage measurement	×1 ×10	V 1/1 ± 30.000mV ±300.000mV	Initial, direct, measure	V1/1 ±160.000mV V1/100 ± 16.0000V
	×1 ×10	V 1/100 ± 3.0000 V ±30.0000 V		
Thermocouple temperature measurement	-	T: -250 to + 400C° K: -210 to +1370C° J: -200 to +1200C° B: +200 to +1760C° S: -10 to +1760C° R: -10 to +1760C° E: -210 to +1000C° N: -200 to +1300C°	Direct	-
Platinum resistance temperature detector	-	–200 to +850C°	Direct	-

The measurement range of the four-gauge method 0-2 V mode (supporting our differential transformer displacement meter, etc.) is as follows.
x1 : ±15000×10^{-6} strain, x10 : ±150000×10^{-6} strain

Measurement accuracy

Sensor mode	Range	Resolution	Accuracy (at 23°C ± 5°C)	Temperature coefficient of accuracy (% rdg/°C)	Aging change of accuracy (% rdg/year)
Strain (Excluding the One-gauge method four-wire type)	×1	1×10^{-6} strain	±(0.08%rdg+1digit)	±0.002	±0.02
	×10	10×10^{-6} strain	±(0.08%rdg+1digit)	±0.002	±0.02
Strain (One-gauge method four-wire type)	×1	1×10^{-6} strain	±(0.28%rdg+1digit)	±0.002	±0.02
	×10	10×10^{-6} strain	±(0.28%rdg+1digit)	±0.002	±0.02
Voltage V1/1	×1	0.001mV	±(0.08%rdg+3digit)	±0.0024	±0.02
	×10	0.010mV	±(0.08%rdg+3digit)	±0.0024	±0.02
Voltage V1/100	×1	0.0001V	±(0.08%rdg+2digit)	±0.002	±0.02
	×10	0.0010V	±(0.08%rdg+2digit)	±0.002	±0.02
Platinum resistance temperature detector Pt100 3W	-	0.1°C	±(0.08%rdg+0.3°C)	±0.002	±0.05
Strain measurement with wireless module	-	1×10^{-6} strain	±(0.10%rdg+3digit)	±0.01	-

* The range is automatically switched.

Lead wire resistance compensation Comet B (One-gauge method three-wire type)	Gauge resistance	Lead wire resistance value compensation range
	120Ω	About 100 Ω or less
	240Ω	About 200 Ω or less
	350Ω	About 300 Ω or less

Thermocouple measurement accuracy

Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C) External reference junction	Accuracy (at 23°C ± 5°C) Internal reference junction
T	-250 to -200°C	0.1°C	±(0.38%rdg+0.6°C)	±(0.38%rdg+3.9°C)
	-200 to -100C°	0.1°C	±(0.15%rdg+0.2°C)	±(0.15%rdg+1.4°C)
	-100 to +400C°	0.1°C	±(0.10%rdg+0.2°C)	±(0.10%rdg+0.8°C)
K	-210 to -160C°	0.1°C	±(0.19%rdg+0.3°C)	±(0.19%rdg+1.6°C)
	-160 to 0C°	0.1°C	±(0.12%rdg+0.2°C)	±(0.12%rdg+1.0°C)
	0 to +960C°	0.1°C	±(0.08%rdg+0.1°C)	±(0.08%rdg+0.5°C)
	+960 to +1370C°	0.1°C	±(0.10%rdg+0.9°C)	±(0.10%rdg+1.4°C)
J	-200 to -160C°	0.1°C	±(0.16%rdg+0.2°C)	±(0.16%rdg+1.2°C)
	-160 to 0C°	0.1°C	±(0.12%rdg+0.1°C)	±(0.12%rdg+0.8°C)
	0 to +700C°	0.1°C	±(0.08%rdg+0.1°C)	±(0.08%rdg+0.5°C)
	+700 to +1200C°	0.1°C	±(0.08%rdg+0.6°C)	±(0.08%rdg+0.9°C)
B	+200 to +280C°	0.5 to 0.4°C	±(0.04%rdg+4.0°C)	±(0.04%rdg+4.0°C)
	+280 to +800C°	0.3 to 0.1°C	±(0.04%rdg+1.2°C)	±(0.04%rdg+1.2°C)
	+800 to +1760C°	0.1°C	±(0.05%rdg+0.4°C)	±(0.05%rdg+0.4°C)
S	-10 to +200C°	0.1°C	±(0.09%rdg+0.6°C)	±(0.09%rdg+1.2°C)
	+200 to +1760C°	0.1°C	±(0.07%rdg+0.4°C)	±(0.07%rdg+0.7°C)
R	-10 to +150C°	0.1°C	±(0.09%rdg+0.7°C)	±(0.09%rdg+1.2°C)
	+150 to +1760C°	0.1°C	±(0.07%rdg+0.4°C)	±(0.07%rdg+0.7°C)
E	-210 to +550C°	0.1°C	±(0.17%rdg+0.2°C)	±(0.17%rdg+1.4°C)
	+550 to +1000C°	0.1°C	±(0.09%rdg+0.4°C)	±(0.09%rdg+0.8°C)
N	-200 to 0C°	0.1°C	±(0.18%rdg+0.4°C)	±(0.18%rdg+1.6°C)
	0 to +1090C°	0.1°C	±(0.08%rdg+0.2°C)	±(0.08%rdg+0.6°C)
	+1090 to +1300C°	0.1°C	±(0.08%rdg+0.9°C)	±(0.08%rdg+1.2°C)

The accuracy of sensor is not included, and thermocouple B does not use the reference junction.

Measurement switching speed

Switch box	Sensor mode	Switching speed 50 Hz area	Switching speed 60 Hz area
FSW-10/-10L	Strain measurement	80 ms	67 ms
	DC voltage measurement	80 ms	67 ms
	Concrete sensor measurement	160 ms	134 ms
	Thermocouple measurement * Time for 1 ch is added for every 10 points.	80 ms	67 ms
	Platinum resistance temperature detector measurement	80 ms	67 ms
TML-NET	Each module	200 ms	200 ms

Display / function

Display	Display unit	LCD with backlight
	Resolution	255 x 160 dots
	Display content	Measurement data, setting list, Y-T monitor
Time	Setting	Year, month, day, hour, minute, second
	Accuracy	Daily error: ±1 sec (at 23°C ± 5°C)
Interface	USB, RS-232C, LAN (Options)	
	Function	Receiving of commands, sending of measurement data, etc.
Measuring mode	Initial, direct or measure can be set for each point. (For temperature measurement, direct only)	
Measuring point switching method	Scanning	Automatic switching measurement from the first channel to the last channel (jump possible)
	Monitor	Repeated measurement of monitor channels Graphic monitor for time change
Measurement start	Start key switch, interval timer, RS-232C, USB, LAN (optional)	
Program setting	Can be set for each point	
	Coefficient	± (0.0001-99999)
	Unit	40 types including με, mV, °C, kN, mm
	Decimal point	Display after the decimal point can be set arbitrarily with 0 to 6 digits
	Initial value	Can be written to each arbitrarily measurement channel
	Sensor mode	The type of sensor to be connected can be set.
Simple measure	Coefficient	1.0000
	Unit	Interlocked with sensor mode
	Decimal point	Interlocked with sensor mode
Self-diagnosis function	Insulation, variation, thermocouple disconnection, lead wire resistance, bridge output, coefficient setting	

TDS-150 (Portable)

TEDS function	Standard	IEEE 1451.4 Class 2
	Function	Reading of TEDS sensor information
Interval timer	Function	Automatic start at the set time interval and time
	Interval	Hour / minute / second can be set for each step up to 99 hours, 59 minutes, and 59 seconds.
	Number of starts	Up to 99 times per step or infinite
	Number of steps	Programmable up to 10 steps
	Real time start	Start time (day / hour / minute / second) can be set for each step
	GOTO step	Program loop possible to one of the previous steps
	Sleep function	The power is turned on 5 sec before the measurement time and automatically turned OFF after the measurement is completed. Sleep function can be set to ON/OFF.
Monitor comparator	Function	Automatic measurement based on the set amount of change of monitor channel (1 point)
	Comparison amount	Can be set for each step: Up to ±999999
	Comparison method	Select either amount of change or absolute value.
	Number of starts	Up to 99 times per step or infinite
	Number of steps	Programmable up to 10 steps
	GOTO step	Program loop possible to one of the previous steps
	GOTO Interval	Go to Step 1 of the interval.
Data memory	Function	Recording / reproduction of measurement data
	Recording content	Measuring mode, channel number, measurement data, time data, data number
	Data capacity	Up to about 80000 units About 16000 scans with 10 channels
	Data retention period	About 20 days (with full charge)
Memory card	Card standard	CF card
	Card capacity	Up to 2 GB (Designated by us)
Auto power OFF	When no command is received from the key operation / each interface for an arbitrary time, the power is turned OFF automatically. Auto power OFF function can be set to ON/OFF.	

Switch box TML-NET drive board (Options)	TML-NET drive unit Cable used Dedicated 2-core shielded cable (2-12.5L1) When using a low-power consumption network module Number of connectable units: Up to 100 units NSW-011C/-014C/-024C/-01 VC/-01TC Total extension distance 1 km or less When using a conventional network module Number of connected units Up to 20 units (NSW-014B etc., 150 m or less) Total extension distance 1 km or less (NSW-014B etc., 10 units or less)
Continuous use time	Using D size alkaline dry-cell batteries, LCD backlight (at 23°C ± 5°C) No option About 40 hr When using LAN board About 9.5 hr Switch box TML-NET drive board NSW-014C When using 100 units About 1 hr NSW-014B When using 20 units About 1 hr
Use time during sleep interval (1 hour interval)	Using D size alkaline dry-cell batteries, LCD backlight (at 23°C ± 5°C) No option About 8 months When using LAN board About 2 months Switch box TML-NET drive board NSW-014C When using 100 units About 10 days NSW-014B When using 20 units About 10 days
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation) When using LAN board (optional), 0 to +50°C, 85% RH or less (No condensation)
Storage temperature range	-20 to +60C°
Power supply	D size alkaline dry-cell battery x 4, dedicated AC adapter CR-1867 or external power input DC 9-18 V
Outside dimension	DS-150 280 (W) × 60 (H) × 162 (D) mm (Excluding protrusions) FSW-10 280 (W) × 60 (H) × 100 (D) mm (Excluding protrusions) FSW-10L 280 (W) × 60 (H) × 60 (D) mm (Excluding protrusions)
Mass	TDS-150 : Approx. 2.1 kg (Including battery unit and dry cell batteries) FSW-10 : Approx. 1.5 kgg FSW-10L : Approx. 1 kg

Standard accessories

Instruction Manual..... 1
D size alkaline dry-cell battery 4
Phillips screwdriver 1
Shoulder belt 1
Warranty certificate 1

Options

AC Adapter (CR-1869)
AC Adapter [For China] (CR-1869-C)
DC Power Cable (CR-062)

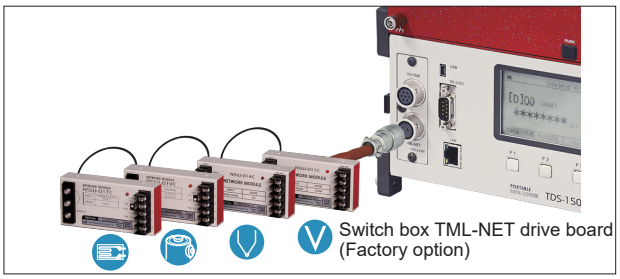
Related Products

LAN board (factory option)

This board adds LAN (Ethernet) interface to the TDS-150.

TDS-150-06 (Switch box TML-NET drive board) (Factory option)

By installing the TML-NET drive board, the transducer and network module NSW compatible with the TML-NET network measuring system can be used.



Switch box TML-NET drive board (Factory option)

See pages 265 - 273 for details.

FSW-10 / FSW-10L (Dedicated channel unit)

This is a 10-ch switch box that connects to the TDS-150. Measurements of strain gauges, strain gauge type transducers, DC voltages, thermocouples, platinum resistance temperature detectors can be performed.

ALM-150 (Dedicated alarm unit)

This equipment is a dedicated alarm unit that connects to the TDS-150. The alarm output is a function that monitors a specified channel and closes a specified contact when the measurement value changes by a certain amount (relative value setting) or exceeds a threshold value (upper and lower limit setting).



Specifications

Number of contact outputs	4 points
Contact capacity	AC 140 V / DC 200 V max
	Rated current: 0.5 A max
	Inrush current: 1.5 A max
	ON resistance: 3.2 Ω max
Display	Status LED: Lights up when each contact is closed
Comparison method	Relative value / upper and lower limits
Number of setting tables	100 table
Other functions	Alarm test
Power supply	Supplied via TDS-150
Outside dimension	280 (W) × 60 (H) × 80 (D) mm (Excluding protrusions)
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)
Mass	About 600 g

Standard accessories

Instruction Manual..... 1
Warranty certificate 1

Protective cover TDS-150 top cover

A protective cover that is easy to attach and remove.
Model name: TDS-150-F01
Compatible with the TDS-150 main unit and FSW-10 channel unit



DPU-S245 (External printer)

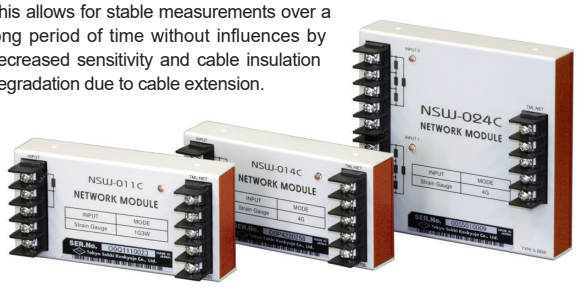
The measurement data of the TDS-150 is printed out. The TP-S245L-1 recording paper (optional) is used.

CR-4530 printer cable



NSW network module

This equipment enables measurement control and data transfer via a two-wire type network line. A measurement circuit is configured near a strain gauge, DC voltage signal, thermocouples, etc. and the measurement data is digitized. This allows for stable measurements over a long period of time without influences by decreased sensitivity and cable insulation degradation due to cable extension.



CR-1867 AC adapter

This equipment is connected to AC 100 V to supply the power.

Measurement software Visual LOG

Visual LOG TDS-7130v2 static measurement software
Visual LOG Light TDS-700L interval measurement software
Visual LOG Light TDS-Mail data mail management software

CF card

Supported card capacity: 128 MB to 2 GB (Designated by us)

RPC-05A (Remote power controller)

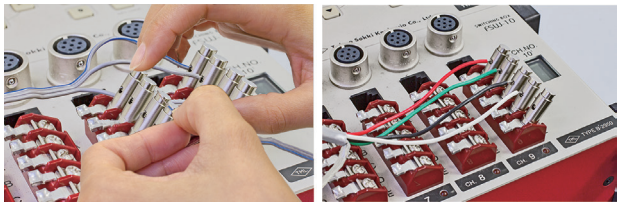
By combining with this remote power controller, the sleep function of the TDS-150 is utilized to enable long-term measurement powered by an external battery.



Dedicated cable CR-5354
A cable for connecting to the TDS-150 is required.

SB-OT1B one-touch terminal

This terminal block allows one-touch connection of input lead wires. It is used by attaching it to the input terminal of the switch box. (One set of five terminals)



Cable

CR-5360 RS-232C cable
D-sub 9P-D-sub 9 P cross 1.5 m
This cable is used to connect to a PC.

CR-6187 USB cable
miniB-A (with ferrite Core) 1.8 m
This cable is used to connect to a PC.

TDS-150 (Portable)

External Dimensions

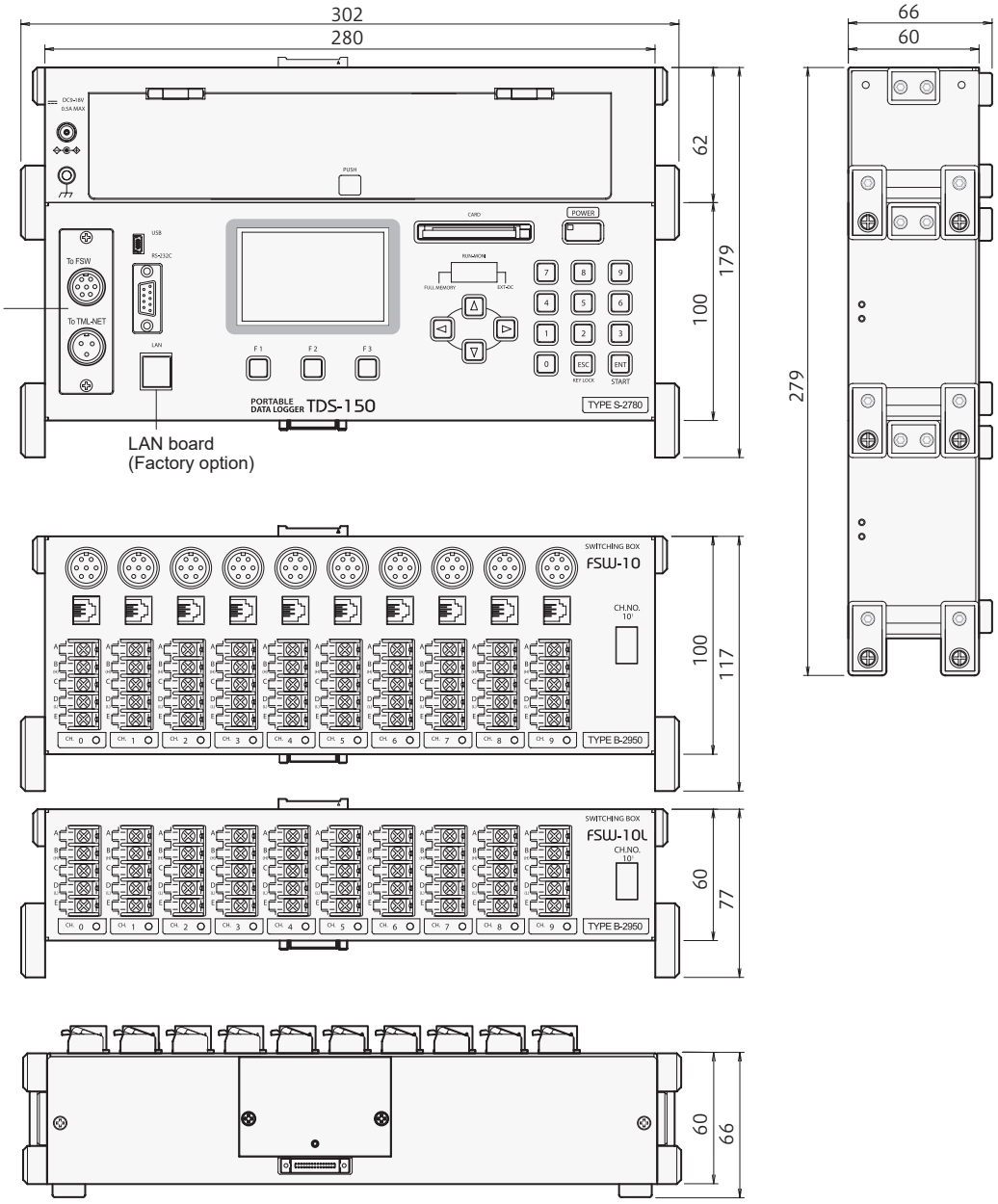
TDS-150 control unit
(Main unit)

Switch box TML-NET
drive board
(Factory option)

LAN board
(Factory option)

FSW-10 channel unit
(Options)

FSW-10L channel unit
(Options)



TC-37K (Handheld)

NEW T-ZACCS 3

- Scanning as fast as 0.1 seconds (in single-channel mode)
- Monitor that displays maximum (MAX) and minimum (MIN) values
- Measurements of strain, DC voltage, thermocouple, platinum resistance temperature detector, resistance, and insulation resistance are possible.
- Since this equipment can also measure insulation resistance, it can check sensors.
- Now supports the “1-gage 2-wire” sensor mode (quarter -bridge, 2-wire)
- 1G4W compatible (one-gauge method four-wire type strain measurement method)
- TEDS compatible
- One-touch connection of loose wires
- Quickly operate key functions via shortcut keys
- Automatic measurement using interval timer
- Compatible with the measurement software “TDS-7130v2”
- Equipped with an SD card slot
- Low power consumption
- Powered by 4 AA size dry-cell batteries, easy to replace in the field
- Multipoint measurement in combination with the CSW-5B switch box
- Can be combined with the two-axis inclinometer adapter

Strain gauge	DC voltage	Thermocouples	Platinum resistance temperature detector

Strain gauge type transducer
Load cells, displacement meters, pressure meters, inclinometers, etc.

TEDS compatible
This equipment instantly and automatically recognizes the information of a transducer having a built-in IC chip in which individual parameters of measurement capacity and rated output are recorded.



TC-37K handheld data logger

TC-37K is a compact handheld measuring instrument that fits neatly in one hand. It has a splashproof structure and can be used safely outdoors. The terminal section for connecting a sensor is a one-touch type that allows easy connection of both lead wires and banana plugs, allowing for speedy measurements. It is possible to set the sensor modes, coefficients, and initial values of up to 20 channels and record the measurement data. This makes it easy to organize data even when collecting data while moving around multiple sites. In addition, by using the dedicated CSW-5B switch box, automatic measurement of five points is possible. It is possible to record using an interval timer, data memory, and SD card, and it can also be connected to a PC for control and data transfer. The check functions for resistance and insulation resistance allow it to be used to check strain gauges, transducers, and other devices.

High-brightness LCD, easy operation



LCD with backlight
Resolution: 255 x 160 dots
Main display content
Measurement data, setting list, graphic display of time series data, etc.

SD card



Measurement data and configuration settings can be stored on an SD card.
Firmware can also be upgraded via the card.
Supported card capacity: up to 16 GB.

Interface: RS-232C and USB

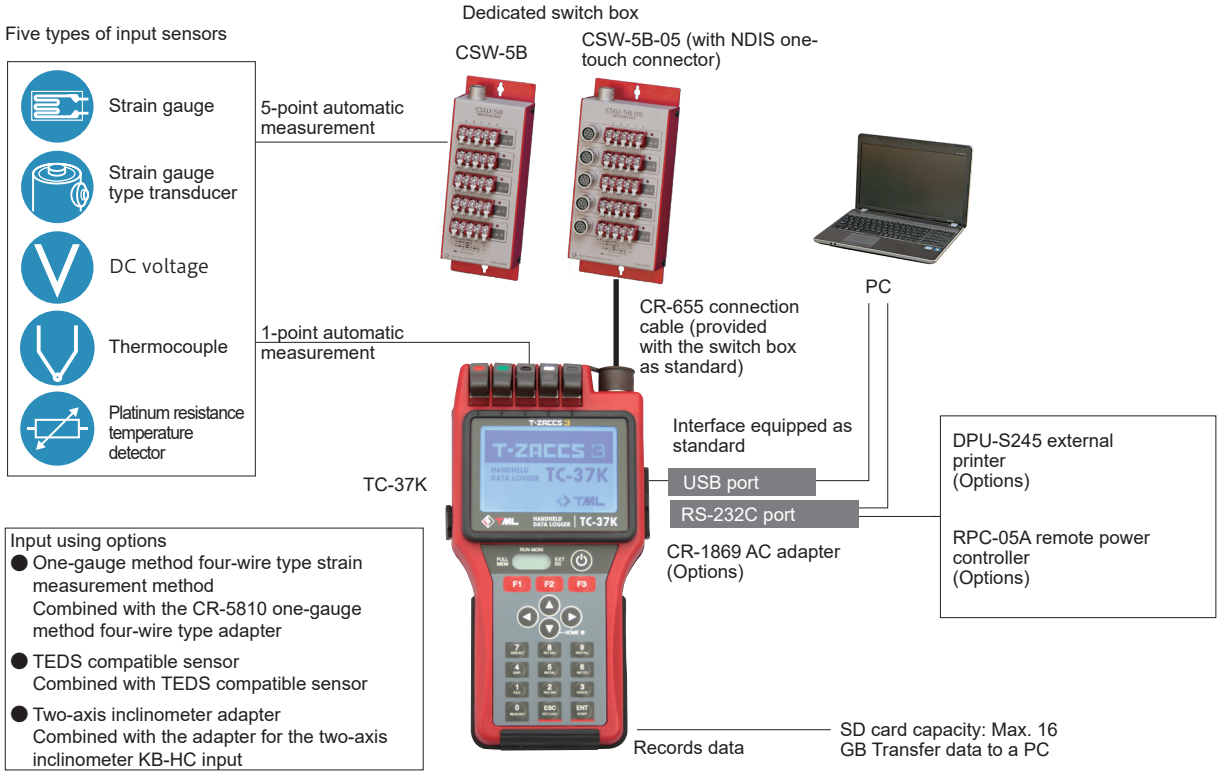


Interface
Control and data transfer via RS-232C and USB
The USB driver is included in the separately sold Instruction Manual: Interface Edition or the monitoring measurement software Visual LOG Light.

AC adapter (optional) compatible

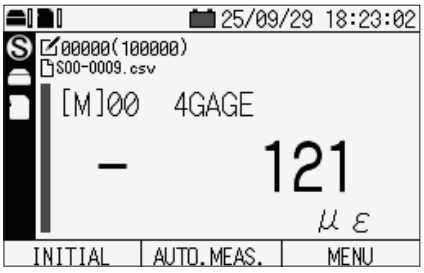
TC-37K (Handheld)

System Block Diagram

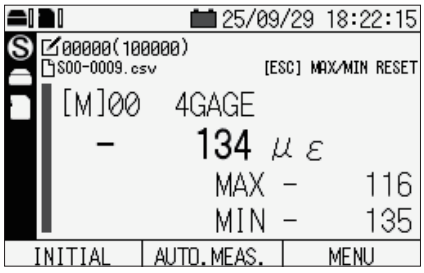


Operation screen examples

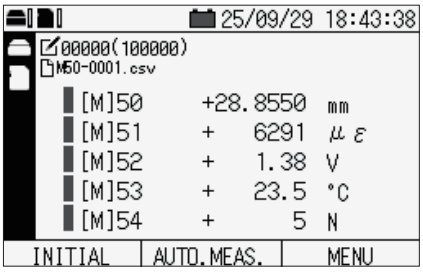
[Monitor screen, single]



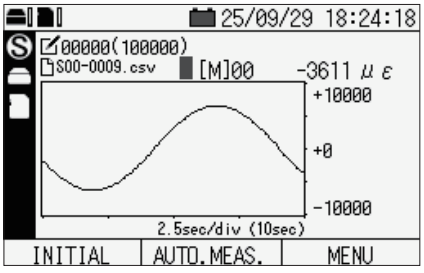
[Monitor screen, single MAX/MIN]



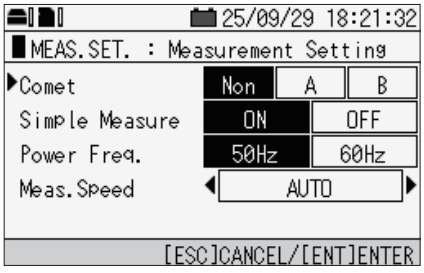
[Monitor screen, multi]



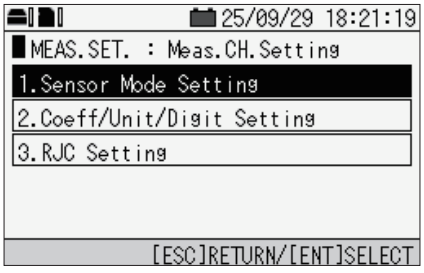
[Waveform monitor]



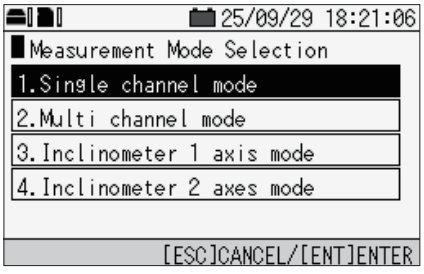
[Measurement Setting]



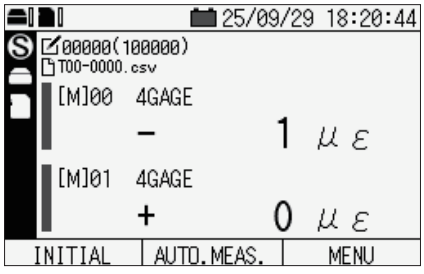
[Meas.CH.Setting]



[Measurement CH.Mode Selection]



[Inclinometer, two-axis mode]



Specifications
Measurement capabilities

Number of measuring points	**Single channel mode / inclinometer, one-axis mode**	1 point	
		Sensor input	One-touch terminal
			NDIS one-touch connector
	Multichannel mode (When combined with the dedicated switch box)	5 points	
		Target switch box	CSW-5B, CSW-5B-05
	Inclinometer, two-axis mode (When combined with the two-axis insertion type inclinometer adapter)	2 points	
		Target adapter	IA-33, IA-32
Measuring speed	**Normal mode**	500 ms/point (Monitor), 500 ms/point (Scanning)	
	High-speed mode	100 ms/point (Monitor), 100 ms/point (Scanning)	
Measuring point switching method	**Single channel mode**	Repeated measurement of 1 channel	
	Multichannel mode	Automatic switching measurement of 5 channels from *0 to *4	
Measuring mode		Initial, direct, measure (For temperature measurement, direct only)	
Simple measure		Coefficient: 1 Unit: Interlocked with sensor mode Decimal point: Interlocked with sensor mode	
Compensation mode		Comet NON, Comet A, Comet B	
Monitor	**Display mode**	OFF, numerical value, waveform (Y-T), numerical value / maximum value / minimum value	
	Number of display channels	Numerical value display	1, 2, 5 points
		Waveform (Y-T) display	1 point
		Numerical value / maximum value / minimum value display	1, 2, 5 points
Measurement	**Manual**	Start key switch	
	Automatic	Interval timer	
	Interface	USB, RS-232C	
Channel setting	**Coefficient**	± (0.00001 to 200000)	
	Unit	48 types including με, mV, °C, kgf, mm	
	Decimal point	Display after the decimal point can be set arbitrarily with 0 to 5 digits	
	Offset	To be written by arbitrarily measurement channel	
	Sensor mode	The type of sensor to be connected is set.	
		Strain	One-gauge method two-wire type, 120 / 240 / 350 Ω, One-gauge method three-wire type, 120 / 240 / 350 Ω, One-gauge method four-wire type, 120 / 240 / 350 Ω, Two-gauge method, Four-gauge method, Four-gauge method constant current, 350 Ω, Four-gauge method, 0-2 V mode
		Voltage	DC 300 mV (V1/1) DC 30 V (V1/100) DC Auto
		Temperature	Thermocouple T, K, J, B, S, R, E, N, Pt100 3 W

* DC Auto can only be used in the single channel mode.
* DC Auto automatically switches between V1/1 and V1/100 depending on the input voltage.

Strain measurement		
Applicable wiring method, gauge resistance	One-gauge method two-wire type	120, 240, 350Ω
	One-gauge method three-wire type	120, 240, 350Ω
	One-gauge method four-wire type	120, 240, 350Ω
	Two-gauge method	120 to 1000Ω
	Four-gauge method	120 to 1000Ω
	Four-gauge method constant current	350Ω
	Four-gauge method, 0-2 V mode	120 to 1000Ω
Sensor cable extension range	One-gauge method four-wire type	Cable round-trip resistance: 200 Ω or less
	Four-gauge method constant current, 350 Ω	Cable round-trip resistance: 400 Ω or less
Sensitivity change	Four-gauge method constant current, 350 Ω	+0.1 to -0.5% / Cable round-trip resistance: 100 Ω
Lead wire resistance compensation range Comet B (1G3W)	Gauge resistance 120 Ω: About 100 Ω or less	
	Gauge resistance 240 Ω: About 200 Ω or less	
	Gauge resistance 350 Ω: About 300 Ω or less	
Zero stability	± 1.0 × 10^{-6} strain/°C or less (one-gauge method) ± 0.5 × 10^{-6} strain/°C or less (two-gauge method)	
Initial unbalance	± 750 × 10^{-6} strain or less (one-gauge method) ± 500 × 10^{-6} strain or less (one-gauge method four-wire type) ± 500 × 10^{-6} strain or less (two-gauge method)	
DC voltage measurement		
Input impedance	1MΩ or higher	
Allowable input voltage between B and D	DC±50V MAX	
Thermocouple temperature measurement		
Applicable thermocouple	T, K, J ,B, S, R, E, N JIS C1602:2015, IEC 60584-1:2013	
Platinum resistance temperature detector measurement		
Applicable platinum resistance temperature detector	Pt100 (500 μA constant current three-wire type) JIS C 1604 : 2013, IEC 60751:2008	

TEDS function	**TEDS**	**Standard**	IEEE 1451.4 Class 2 compatible (Template No. 33)
		Function	Reading and setting of sensor information
Auto power OFF function			When no command is received from the operation or interface for an arbitrary set time, the power is turned OFF automatically. (The auto power off function can be set to ON / OFF.)

* The TEDS function can only be used in the single channel mode.

TC-37K (Handheld)

Check function

Insulation check	**Function**	Checks the insulation resistance between the connected sensor and the test specimen. Applied voltage 2.5 V
	Range	0 to 500MΩ
	Accuracy	± 20% rdg * When powered by batteries
	Resolution	0.1MΩ
	Measuring speed	About 1 s
Resistance check	**Function**	Checks the resistance between the input terminals A and B. 10 µA constant current method
	Range	0 to 30kΩ
	Accuracy	0 to 3kΩ ±(0.5% rdg + 0.2Ω) 3k to 30kΩ ±(0.5% rdg + 2Ω)
	Resolution	0.1Ω(0 to 3kΩ) 1Ω(3k to 30kΩ)
	Measuring speed	About 0.5 s
Variation check		Checks the variation of measurement values.
Lead wire resistance check		Check of the lead wire resistance divided voltage of the one-gauge method three-wire type
Bridge output check		Compensation of the one-gauge method two-wire type and one-gauge method three-wire type. Check of the bridge output voltage without calculation
Check during measurement		Open check
		Thermocouple disconnection check
Display setting list		Initial-in value
		Lead wire resistance divided voltage

Strain measurement		
Bridge power supply	DC1V 46ms (50 Hz) * DC 2 V 24 ms (50 Hz) for the four-gauge method 0-2 V mode	
Initial value storage range	±160000×10^{-6} strain	
Temperature coefficient of accuracy	±0.002% rdg/°C	
Aging change of accuracy	±0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 30000 × 10^{-6} strain * ± 15000 × 10^{-6} strain for the four-gauge method 0-2 V mode	1 × 10^{-6} strain
	± 300000 × 10^{-6} strain * ± 150000 × 10^{-6} strain for the four-gauge method 0-2 V mode	10 × 10^{-6} strain
Accuracy (at 23°C ± 5°C) (Excluding the one-gauge method four-wire type)	±(0.08% rdg+1digit)	
Accuracy (at 23°C ± 5°C) (One-gauge method four-wire type)	±(0.28% rdg+1digit)	

Constant current strain measurement (four-gauge method only)		
Bridge power supply	DC2.86mA 46ms(50Hz)	
Bridge resistance	350Ω	
Initial value storage range	±160000×10^{-6} strain	
Temperature coefficient of accuracy	±0.002% rdg/°C	
Aging change of accuracy	±0.02% rdg/year	
Measurement range and resolution	Measurement range	Resolution
	± 30000×10^{-6} strain	1×10^{-6} strain
	±300000×10^{-6} strain	10×10^{-6} strain
Accuracy (at 23°C ± 5°C)	±(0.08% rdg+1digit)	

DC voltage measurement			
Initial value storage range			
V1/1		±160.000mV	
V1/100		±16.0000V	
Temperature coefficient of accuracy		±0.0024% rdg/°C	
Aging change of accuracy		±0.024% rdg/year	
Measurement range and resolution	**V1/1**	Measurement range	Resolution
		± 30.000mV	0.001mV
		±300.000mV	0.010mV
	V1/100	± 3.0000V	0.0001V
		±30.0000V	0.0010V
Accuracy (at 23°C ± 5°C)	**V1/1**	±(0.08% rdg+3digit)	
	V1/100	±(0.08% rdg+2digit)	

* DC Auto can only be used in the single channel mode.
* DC Auto automatically switches between V1/1 and V1/100 depending on the input voltage.

Thermocouple temperature measurement (JIS C 1602:2015, IEC 60584-1:2013)

Applicable thermocouple	**T, K, J, B, S, R, E, N**			
Linearization	**Digital calculation**			
Type	**Measurement range**	**Resolution**	**Accuracy (at 23°C ± 5°C)** (External reference junction)	**Accuracy (at 23°C ± 5°C)** (Internal reference junction)
T	- 250 to - 200C° - 200 to - 100C° - 100 to+ 400C°	0.1C° 0.1C° 0.1C°	±(0.38%rdg+0.6C°) ±(0.15%rdg+0.2C°) ±(0.10%rdg+0.2C°)	±(0.38%rdg+3.9C°) ±(0.15%rdg+1.4C°) ±(0.10%rdg+0.8C°)
K	- 210 to - 160C° - 160 to 0C° 0 to+ 960C° + 960 to+ 1370C°	0.1C° 0.1C° 0.1C° 0.1C°	±(0.19%rdg+0.3C°) ±(0.12%rdg+0.2C°) ±(0.08%rdg+0.1C°) ±(0.10%rdg+0.9C°)	±(0.19%rdg+1.6C°) ±(0.12%rdg+1.0C°) ±(0.08%rdg+0.5C°) ±(0.10%rdg+1.4C°)
J	- 200 to - 160C° - 160 to 0C° 0 to+ 700C° + 700 to+ 1200C°	0.1C° 0.1C° 0.1C° 0.1C°	±(0.16%rdg+0.2C°) ±(0.12%rdg+0.1C°) ±(0.08%rdg+0.1C°) ±(0.08%rdg+0.6C°)	±(0.16%rdg+1.2C°) ±(0.12%rdg+0.8C°) ±(0.08%rdg+0.5C°) ±(0.08%rdg+0.9C°)
B	+ 200 to+ 280C° + 280 to+ 800C° + 800 to+ 1760C°	0.5 to 0.4C° 0.3 to 0.1C° 0.1C°	±(0.04%rdg+4.0C°) ±(0.04%rdg+1.2C°) ±(0.05%rdg+0.4C°)	±(0.04%rdg+4.0C°) ±(0.04%rdg+1.2C°) ±(0.05%rdg+0.4C°)
S	- 10 to + 200C° + 200 to+ 1760C°	0.1C° 0.1C°	±(0.09%rdg+0.6C°) ±(0.07%rdg+0.4C°)	±(0.09%rdg+1.2C°) ±(0.07%rdg+0.7C°)
R	- 10 to+ 150C° + 150 to+ 1760C°	0.1C° 0.1C°	±(0.09%rdg+0.7C°) ±(0.07%rdg+0.4C°)	±(0.09%rdg+1.2C°) ±(0.07%rdg+0.7C°)
E	- 210 to+ 550C° + 550 to+ 1000C°	0.1C° 0.1C°	±(0.17%rdg+0.2C°) ±(0.09%rdg+0.4C°)	±(0.17%rdg+1.4C°) ±(0.09%rdg+0.8C°)
N	- 200 to 0C° 0 to + 1090C° +1090 to + 1300C°	0.1C° 0.1C° 0.1C°	±(0.18%rdg+0.4C°) ±(0.08%rdg+0.2C°) ±(0.08%rdg+0.9C°)	±(0.18%rdg+1.6C°) ±(0.08%rdg+0.6C°) ±(0.08%rdg+1.2C°)

* The accuracy of the sensor is not included, and thermocouple B does not use the reference junction.

Platinum resistance temperature detector temperature measurement (JIS C 1604:2013, IEC 60751:2008 Pt100)	
Applicable resistance temperature detector	Pt100
Measurement Method	3-wire type (Pt3W)
Linearization	Digital calculation
Temperature coefficient of accuracy	± 0.0020% rdg/°C
Aging change of accuracy	± 0.05% rdg/year
Measurement range	-200 to +850°C
Resolution	0.1°C
Accuracy (at 23°C ± 5°C)	± (0.08% rdg + 0.3°C)

Interval timer

Function		Measurement at the set time interval and time
Table setting	Time interval	Hour / minute / second can be set for each step up to 99 hours, 59 minutes and 59 seconds. Or 0.5-, 0.2-, or 0.1-second interval
	Real time start	Start time (day / hour / minute / second) can be set for each step.
	Number of starts	Up to 99 times per step or infinite
	Number of steps	Programmable up to 10 steps
	GOTO step	Program loop possible to one of the previous steps
Sleep function		Turns the power ON/OFF automatically when the interval is 1 minute or longer.

Time

Setting	Year, month, day, hour, minute, second
Accuracy	Daily error: ±1 sec (at 23°C ± 5°C)
Retention	About 20 days (with a full charge)

Display / operation

Display unit	LCD panel	3.0-inch semi-transparent monochrome STN LED backlight
	Resolution	255 x 160 dots
	Point defect	10 dots or less (excluding aging deterioration)
Operation		POWER key, Cross key, ESC, ENT 0-9, F1, F2, F3

Recording media

Internal memory	Function	Recording / reproduction of measurement data Saving of setting file
	Recording format	CSV format TDS format Data memory function (up to 100,000 data)
	Capacity	512 MB
SD card	Function	Recording / reproduction / copying of measurement data Saving / copying of setting file
	Physical format	FAT32
	Recording format	CSV format TDS format
	Capacity	512 MB to 16 GB (Designated by us)

Interface

USB	USB 2.0 protocol compatible USB Type-C receptacle General-purpose command compatible (various settings, measurement, data collection)
RS-232C	RS-232C compliant Baud rate 9600, 19200, 115200 bps General-purpose command compatible (various settings, measurement, data collection)

Power supply

Power supply	AA size alkaline dry-cell battery x 4 Dedicated AC adapter (CR-1869) or external power input DC 9-18 V Can be powered from USB bus power
Continuous use time	When using alkaline dry-cell batteries: About 10 hrs (When a 350 Ω bridge is connected for strain measurement)

Environment

Operating temperature / humidity range	-10ºC to +50°C 85% RH or less (No condensation)

Others

Outside dimension	102 (W) ×49 (H) ×202 (D) mm (Excluding protrusions)
Mass	About 750 g
Vibration tolerance	29.4 m/s^2 (50 Hz 0.6 mmp-p)
Shock resistance	49 m/s^2
Splash proofness	IP-54 (with connector cap attached)

Standard accessories

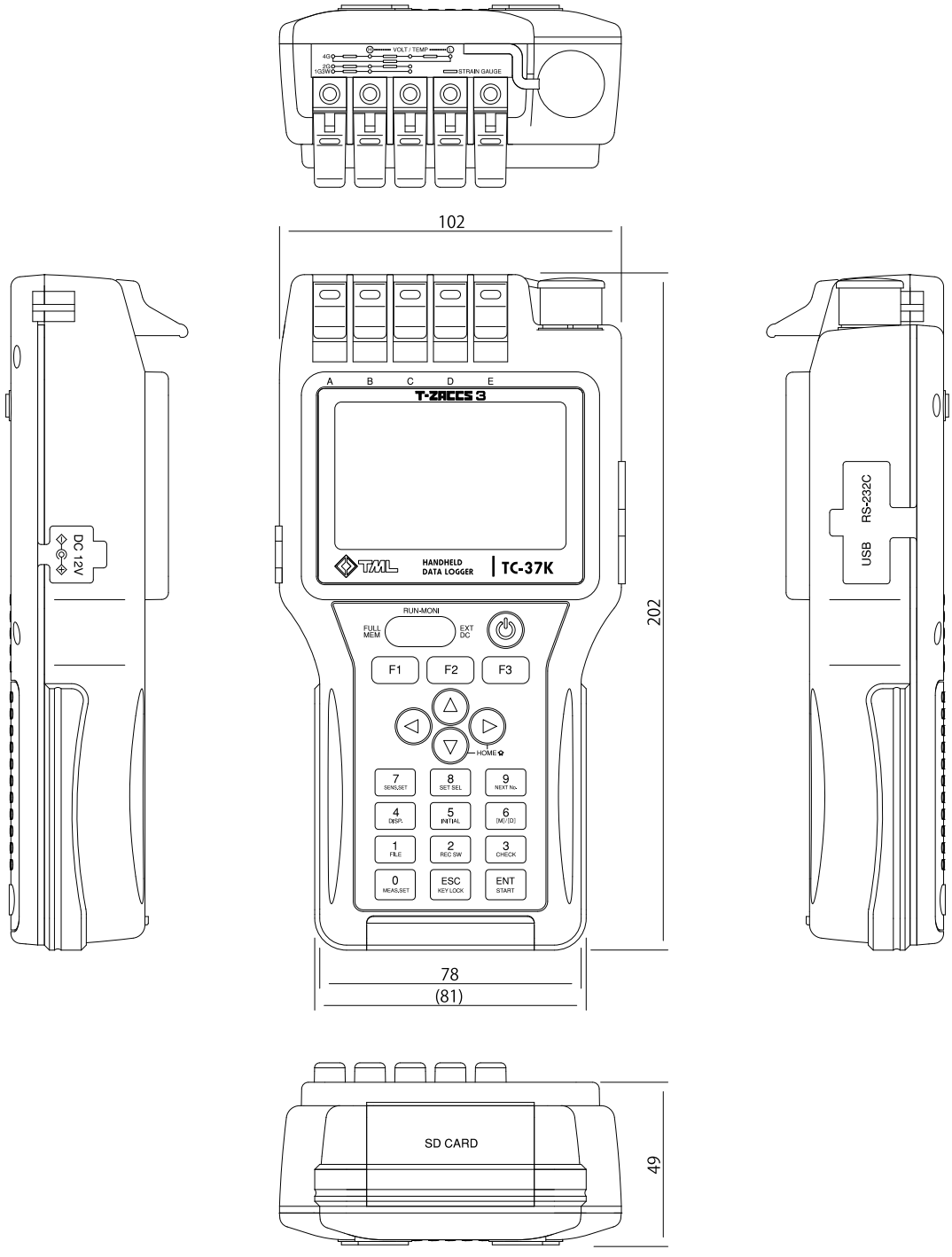
Instruction Manual (CD) 1
AA size alkaline dry-cell battery 4
Shoulder belt 1
Accessory box 1
Warranty certificate 1

Options (Related Products)

SD card (512MB, 4GB, 16GB)
AC Adapter (CR-1869, [For China] (CR-1869-C))
RS-232C cable (CR-5532 / D-sub 9P–10P (Compact Type, Crossed) Cable – 1.5 m)
USB cable (CR-6189 / Type C-A)
External printer (DPU-S245 (RS-232C Interface))
Printer cable (CR-4511 / HRS 8P–10P (Compact Type, Straight) Cable – 0.5 m)
Remote power controller (RPC-05A)
Dedicated switch box (CSW-5B, CSW-5B-05)
Switch box connection cable (CR-655)
Two-axis insertion type inclinometer adapter (IA-33, IA-32)
DC Power Cable (CR-062)

TC-37K (Handheld)

External Dimensions



Unit: mm

TC-32K (Handheld)

- Measurements of strain, DC voltage, thermocouple, and platinum resistance temperature detector
- Since this equipment can also measure insulation resistance, it can be used to check sensors.
- One-gauge method four-wire type measurement method compatible
- Equipped with Complete Compensation Method of Strain
- TEDS compatible
- One-touch connection of loose wires
- Automatic measurement using interval timer
- Low power consumption
- Powered by four AA size batteries, easy to replace in the field
- Multipoint measurement in combination with the CSW-5B switch box
- Can be combined with the IA-33/IA-32 two-axis insertion type inclinometer adapter

Strain gauge	DC voltage	Thermocouples	Platinum resistance temperature detector

Strain gauge type transducer
Load cells, displacement meters, pressure meters, inclinometers, etc.

TEDS compatible
This equipment instantly and automatically recognizes the information of a transducer having a built-in IC chip in which individual parameters of measurement capacity and rated output are recorded.



TC-32K handheld data logger

CE

The TC-32K is a compact handheld measuring instrument that fits neatly in one hand. It has a splash-proof structure and can be used safely outdoors. The terminal section for connecting a sensor is a one-touch type (patented) that allows easy connection of both lead wires and banana plugs, allowing for speedy measurements. It is possible to set the sensor modes, coefficients, and initial values of up to 20 channels and record measurement data. This makes it easy to organize data even when collecting data while moving around multiple sites. In addition, by using the dedicated switch box CSW-5B, automatic measurement of 5 points is possible. It is possible to record using an interval timer, data memory and CF card, and it can also be connected to a PC for control and data transfer. The check functions for resistance and insulation resistance allow it to be used to check strain gauges, transducers, etc.

High-brightness LCD, easy operation with Japanese display



LCD with backlight
Resolution: 255 x 160 dots
Main display content
Measurement data, setting list, graphic display of time series data, etc.

CF card



It is possible to record the measurement data and setting content on a CF card. It is also possible to upgrade the firmware version from the card.
Supported card capacity: Max. 2 GB

Interface: RS-232C and USB

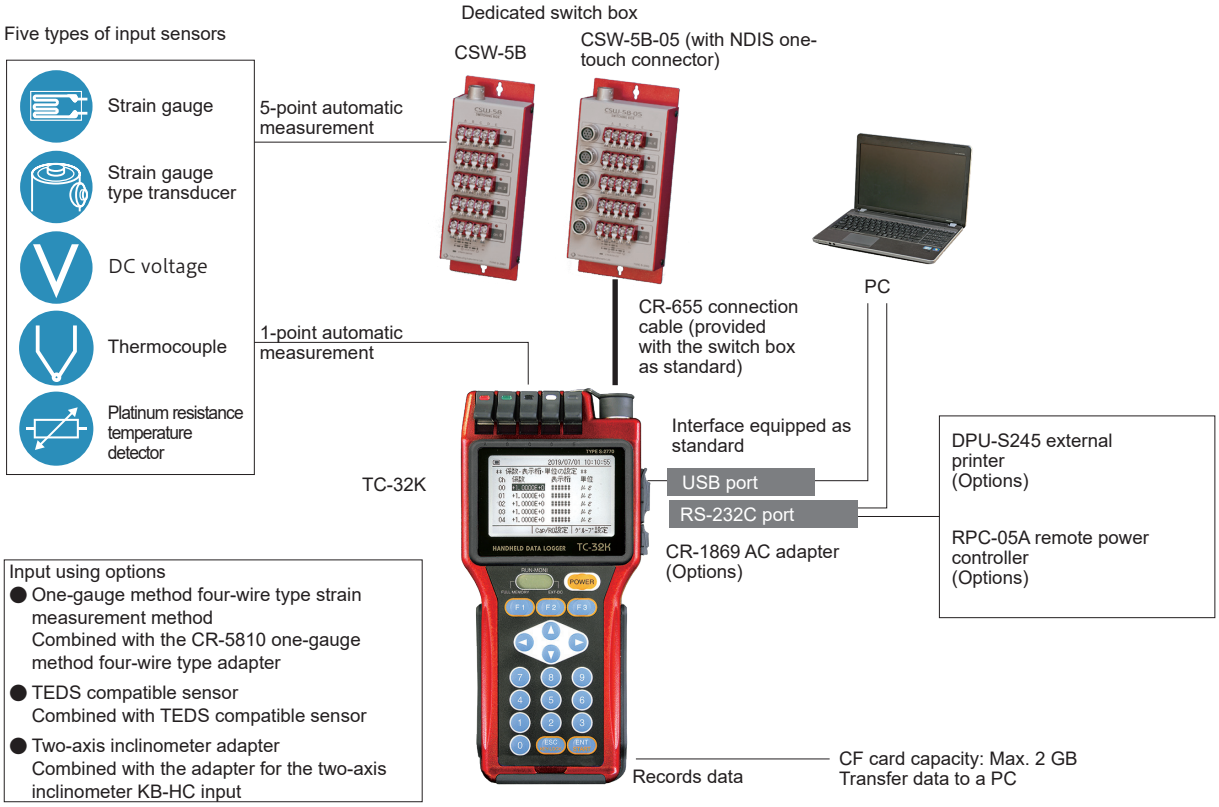


Interface
Control and data transfer via RS-232C and USB
The USB driver is included in the separately sold Instruction Manual: Interface Edition or the monitoring measurement software Visual LOG Light.

AC adapter (optional) compatible

TC-32K (Handheld)

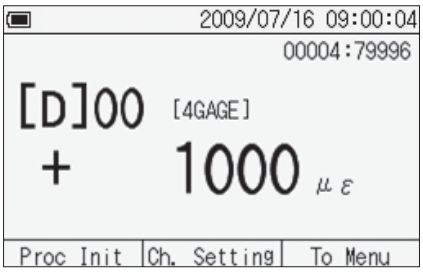
System Block Diagram



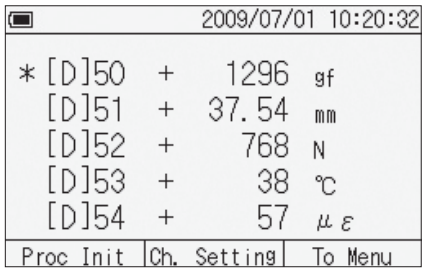
Easy operation with Japanese display

Operation screen examples

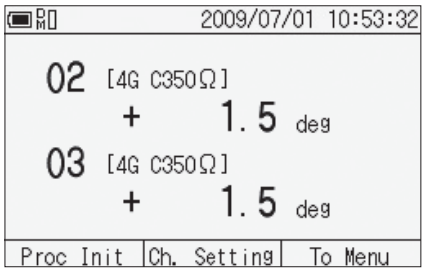
[Monitor screen, single]



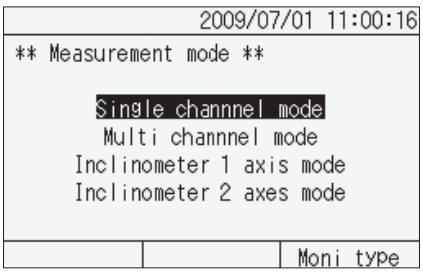
[Monitor screen, multi]



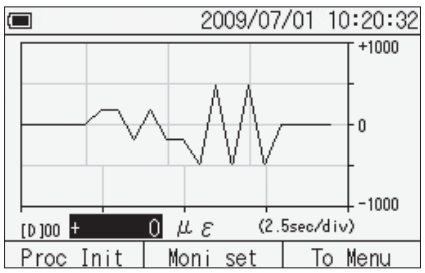
[Inclinometer, two-axis mode]



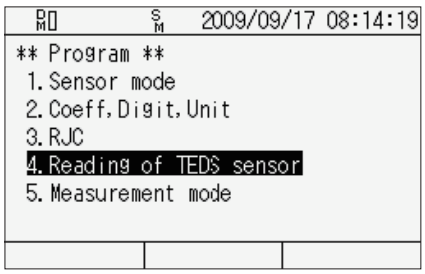
[Measuring mode switching]



[Waveform monitor]



[Program menu]



Specifications

Number of measuring points

1 point	Stand-alone	Sensor input from NDIS or one-touch terminal
5 points	When combined with CSW-5B	CSW-5B, CSW-5B-05

Applicable sensor

Strain measurement	One-gauge method four-wire type 120Ω One-gauge method four-wire type 240Ω One-gauge method four-wire type 350Ω	* 1: The one-gauge method four-wire type uses the optional adapter. Bridge voltage DC 1 V 44 ms (50 Hz)
	One-gauge method three-wire type 120Ω One-gauge method three-wire type 240Ω One-gauge method three-wire type 350Ω	
	Two-gauge method 120 - 1000Ω Four-gauge method 120 - 1000Ω Four-gauge method constant current 350Ω	
	Four-gauge method 0-2 V 120 - 1000Ω	*1: The one-gauge method four-wire type uses the optional adapter. Bridge voltage DC 1 V 44 ms (50 Hz)
Thermocouple measurement	T, K, J, B, S, R, E, N	Linearization digital calculation JIS C 1602-1995
Voltage measurement	DC 300 mV ± 300 mV DC 30 V ± 30 V DC Auto ± 30 V ＊1	Input impedance V 1/1 500MΩ or more V 1/100 1MΩ or more
Platinum resistance temperature detector	Platinum temperature measurement 3-wire type	Linearization digital calculation JIS C 1604-1997 Pt100

* 1: Only 1CH measurement from the main unit

Measurement range

Measurement item	Range	Measurement range	Initial value storage range	Sampling speed
Strain measurement	×1 ×10	±30000×10^{-6} strain ±300000×10^{-6} strain	±160000 ×10^{-6} strain	80 ms (50 Hz area) 67 ms (60 Hz area)
DC voltage measurement	×1 ×10	V 1/1 ± 30.000mV ±300.000mV	V 1/1 ±160.000mV	
	×1 ×10	V 1/100 ± 3.0000 V ±30.0000 V	V 1/100 ± 16.0000 V	
Thermocouple temperature measurement	-	T: -250 to +400C° K: -210 to +1370C° J: -200 to +1200C° B: +200 to +1760C° S: -10 to +1760C° R: -10 to +1760C° E: -210 to +1000C° N: -200 to +1300C°	-	
Platinum resistance temperature detector	-	- 200 to +850C°	-	

The measurement range of the four-gauge method 0-2 V mode (supporting our differential transformer displacement meter, etc.) is as follows.
x1 : ±15000×10^{-6} strain, x10 : ±150000×10^{-6} strain

Thermocouple measurement accuracy

Type	Measurement range	Resolution	Accuracy (at 23°C ± 5°C) (External reference junction)	Accuracy (at 23°C ± 5°C) (Internal reference junction)
T	- 250 to - 200C° - 200 to - 100C° - 100 to+ 400C°	0.1C° 0.1C° 0.1C°	±(0.38%rdg+0.6C°) ±(0.15%rdg+0.2C°) ±(0.10%rdg+0.2C°)	±(0.38%rdg+3.9C°) ±(0.15%rdg+1.4C°) ±(0.10%rdg+0.8C°)
K	- 210 to - 160C° - 160 to 0C° 0 to+ 960C° + 960 to+ 1370C°	0.1C° 0.1C° 0.1C° 0.1C°	±(0.19%rdg+0.3C°) ±(0.12%rdg+0.2C°) ±(0.08%rdg+0.1C°) ±(0.10%rdg+0.9C°)	±(0.19%rdg+1.6C°) ±(0.12%rdg+1.0C°) ±(0.08%rdg+0.5C°) ±(0.10%rdg+1.4C°)
J	- 200 to - 160C° - 160 to 0C° 0 to+ 700C° + 700 to+ 1200C°	0.1C° 0.1C° 0.1C° 0.1C°	±(0.16%rdg+0.2C°) ±(0.12%rdg+0.1C°) ±(0.08%rdg+0.1C°) ±(0.08%rdg+0.6C°)	±(0.16%rdg+1.2C°) ±(0.12%rdg+0.8C°) ±(0.08%rdg+0.5C°) ±(0.08%rdg+0.9C°)
B	+ 200 to+ 280C° + 280 to+ 800C° + 800 to+ 1760C°	0.5 to 0.4C° 0.3 to 0.1C° 0.1C°	±(0.04%rdg+4.0C°) ±(0.04%rdg+1.2C°) ±(0.05%rdg+0.4C°)	±(0.04%rdg+4.0C°) ±(0.04%rdg+1.2C°) ±(0.05%rdg+0.4C°)
S	- 10 to + 200C° + 200 to+ 1760C°	0.1C° 0.1C°	±(0.09%rdg+0.6C°) ±(0.07%rdg+0.4C°)	±(0.09%rdg+1.2C°) ±(0.07%rdg+0.7C°)
R	- 10 to+ 150C° + 150 to+ 1760C°	0.1C° 0.1C°	±(0.09%rdg+0.7C°) ±(0.07%rdg+0.4C°)	±(0.09%rdg+1.2C°) ±(0.07%rdg+0.7C°)
E	- 210 to+ 550C° + 550 to+ 1000C°	0.1C° 0.1C°	±(0.17%rdg+0.2C°) ±(0.09%rdg+0.4C°)	±(0.17%rdg+1.4C°) ±(0.09%rdg+0.8C°)
N	- 200 to 0C° 0 to + 1090C° +1090 to + 1300C°	0.1C° 0.1C° 0.1C°	±(0.18%rdg+0.4C°) ±(0.08%rdg+0.2C°) ±(0.08%rdg+0.9C°)	±(0.18%rdg+1.6C°) ±(0.08%rdg+0.6C°) ±(0.08%rdg+1.2C°)

* The accuracy of sensor is not included, and thermocouple B does not use the reference junction.

Measurement accuracy

Sensor mode	Range	Resolution	Accuracy (23°C ± 5°C)	Temperature coefficient of accuracy (% rdg/C°)	Aging change of accuracy (% rdg/year)
Strain (Excluding the One-gauge method four-wire type)	×1 ×10	1×10^{-6} strain 10×10^{-6} strain	± (0.08%rdg+1digit) ± (0.08%rdg+1digit)	±0.002 ±0.002	±0.02 ±0.02
Strain (One-gauge method four-wire type)	×1 ×10	1×10^{-6} strain 10×10^{-6} strain	± (0.28%rdg+1digit) ± (0.28%rdg+1digit)	±0.002 ±0.002	±0.02 ±0.02
Voltage V1/1	×1 ×10	0.001mV 0.010mV	± (0.08%rdg+3digit) ± (0.08%rdg+3digit)	±0.0024 ±0.0024	±0.02 ±0.02
Voltage V1/100	×1 ×10	0.0001V 0.0010V	± (0.08%rdg+2digit) ± (0.08%rdg+2digit)	±0.002 ±0.002	±0.02 ±0.02
latinum resistance temperature detector Pt100 3W	-	0.1C°	± (0.08%rdg+0.3C°)	±0.0020	±0.05

The range is automatically switched. For the resistance measurement 2-wire type, lead wire resistances are not included.

Lead wire resistance compensation Comet B (One-gauge method three-wire type)	Gauge resistance	Lead wire resistance value compensation range
	120Ω 240Ω 350Ω	About 100 Ω or less About 200 Ω or less About 300 Ω or less

Check function

Insulation check	Checks the insulation resistance between the connected sensor and the test specimen.
Resistance check	Checks the resistance between the input terminals A and B.
Variation check	Checks the variation of measurement values.
Coefficient setting check	Checks the coefficient calculation results when there are inputs equivalent to 100, 1000 and 10000 μV.

Item	Insulation resistance	Resistance measurement
Range	0–500 MΩ	0–30 kΩ
Accuracy	±20% rdg *When powered by batteries	0–3 kΩ ± (0.5% rdg + 0.2 Ω) 3 k–30 kΩ ± (0.5% rdg + 2 Ω)
Resolution	0.1 MΩ	0–3 kΩ 0.1 Ω 3 k to 30 kΩ 1 Ω
Sampling speed	About 1s	About 0.5 s
Remarks	Applied voltage 2.5 V	10 μA constant current method

Display / function

Display	Display unit	LCD with backlight
	Resolution	255 x 160 dots
	Display content	Measurement data, setting list, Y-T monitor
Time	Setting	Year, month, day, hour, minute, second
	Accuracy	Daily error: ±1 sec (at 23°C ± 5°C)
Interface	USB, RS-232C	
	Function	Receiving of commands, sending of measurement data, etc.
Measuring mode	Initial, direct or measure can be set for each point. (For temperature measurement, direct only)	
Measuring point switching method	Scanning	Automatic switching measurement from the first channel*0 to the last channel*4 (Jump possible only when CSW-5B is connected)
	Monitor	Repeated measurement of monitor channels Graphic monitor for time change
Measurement start	Start key switch, interval timer, RS-232C	
Program setting	Can be set for each point	
	Coefficient	± (0.0001-99999)
	Unit	40 types including με, mV, °C, kN, mm
	Decimal point	Display after the decimal point is set arbitrarily with 0 to 6 digits
	Initial value	To be written by arbitrarily measurement channel
	Sensor mode	The type of sensor to be connected is set.
Simple measure	Coefficient	1.0000
	Unit	Interlocked with sensor mode
	Decimal point	Interlocked with sensor mode
Self-diagnosis function	Version display, battery, variation, burnout	
TEDS function	Standard: IEEE 1451.4, Class 2 Function: Reading of TEDS sensor information	
Interval timer	Function	Automatic start at the set time interval and time
	Interval	Hour / minute / second can be set for each step up to 99 hours, 59 minutes, and 59 seconds.
	Number of starts	Up to 99 times per step or infinite
	Number of steps	Programmable up to 5 steps
	Real time start	Start time (hour / minute / second) is set for each step
	GOTO step	Program loop possible to one of the previous steps
	Sleep function	The power is turned on 5 sec before the measurement time and automatically turned OFF after the measurement is completed. Sleep function can be set to ON/OFF.
Data memory	Function	Recording / reproduction of measurement data
	Recording content	Measuring mode, channel number, measurement data, time data, data number
	Data capacity	Up to about 80000 units
	Data retention period	About 20 days (with full charge)

TC-32K (Handheld)

Memory card	Card standard	CF card
	Card capacity	Up to 2 GB
Auto power OFF	When no command is received from the key operation / each interface for 10 minutes, the power is turned OFF automatically. Auto power OFF function can be set to ON/OFF.	

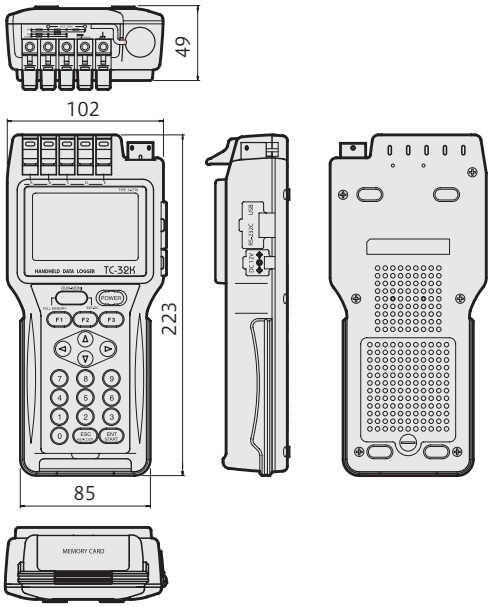
General specifications

Vibration tolerance	29.4 m/s^2 (50 Hz 0.6 mmp-p)
Shock resistance	49 m/s^2
Splash proofness	IP-54 (with connector cap attached)
Continuous use time	When using alkaline dry-cell batteries About 10 hrs (When a 350 Ω bridge is connected for strain measurement)
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)
Storage temperature range	-20 to +60C°
Power supply	AA size alkaline dry-cell battery x 4, dedicated AC adapter CR-1867 or external power input DC 9-18 V
Outside dimension	102 (W) × 49 (H) × 223 (D) mm
Mass	Approx. 800 g

Standard accessories

AA size alkaline dry-cell battery 4
Shoulder belt 1
Accessory box 1
Instruction Manual..... 1
Warranty certificate 1

External Dimensions



Options

AC Adapter (CR-1869)
AC Adapter [For China] (CR-1869-C)
DC Power Cable (CR-062)

TC-37K / TC-32K Related Products

DPU-S245 external printer

The measurement data of the TC-37K / -32K is printed out. The TP-S245L-1 recording paper (optional) is used.



CR-4511 printer cable
Dsub9P- 10P (small)
Straight 0.5 m
(Dedicated for the TC-37K / -32K)

RPC-05A remote power controller



CR-152M battery connection cable
External battery
CR-5353 RS-232C cable

By combining with this remote power controller, the sleep function of the TC-37K / -32K is utilized to enable long-term measurement powered by an external battery.

CR-5532 RS-232C cable

This is a D-sub 9P-10P (small) cross 1.5 m cable (dedicated for the TC-37K / -32K) to be used to connect to a PC.

CR-6187 USB cable (TC-32K)

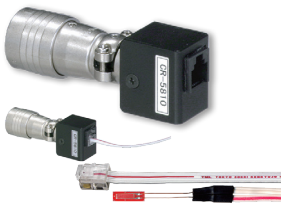
miniB-A (with ferrite core) 1.5 m (dedicated for the TC-32K)
This cable is used to connect to a PC.

CR-6189 USB cable (TC-37K)

Type C-A

CR-5810 one-gauge method four-wire type dedicated adapter

With One-gauge method four-wire type strain gauge modular plug
(One-touch connection type)



TEDS compatible sensor

The TC-37K/-32K can use TEDS compatible sensors. Connect a transducer, such as a TEDS compatible load cell or displacement meter. These transducers have a built-in IC chip in which individual parameters of measurement capacity and rated output are recorded.

IC chip built-in load cell
TCLZ



CR-1869 AC adapter

This equipment is connected to AC 100 V to supply the power.

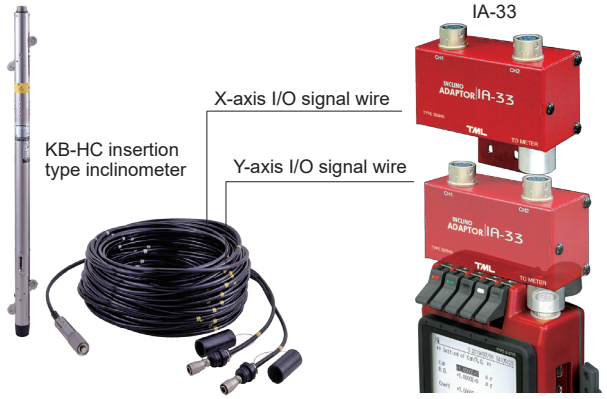
CF card (TC-32K)

Supported card capacity: 128 MB, 512 MB, 1 GB, 2 GB (designated by us)

SD card (TC-37K)

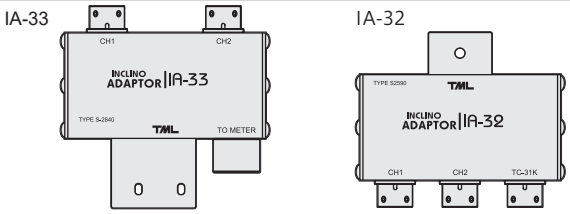
Supported card capacity: 512 MB, 4 GB, 16 GB (designated by us)

IA-33 / IA-32 two-axis insertion type inclinometer adapter



The IA-33 is a measurement adapter for a two-axis insertion type inclinometer that can be easily attached to the NDIS connector part of the TC-37K / -32K and can be mounted with two screws.
The IA-32 is a measurement adapter for a stationary two-axis insertion type inclinometer that connects to the TC-37K / -32K with a dedicated cable.
When the measurement mode of the TC-37K / -32K is set to a two-axis insertion type inclinometer, the X- and Y-axes can be monitored at the same time.
By using the separately sold IMP-7210 insertion type inclinometer management software, it is possible to obtain the section displacement and cumulative displacement at each depth from the accumulated measurement data to output graphs of comparison chart / distribution chart and data list.

External Dimensions



Specifications

Applicable measuring instrument	TC-37K / -32K
Number of measuring points	2 points
Measurement accuracy	Equivalent to TC-37K / -32K
Power supply	Supply from TC-37K / -32K, DC 5 V, 100 mA or less
Operating temperature / humidity range	-10 to +50C° 85% or less (No condensation)
Outside dimension	IA-33: 95 (W) × 41 (H) × 50 (D) mm IA-32: 95 (W) × 42 (H) × 50 (D) mm (Excluding protrusions)
Mass	Approx. 300 g

CSW-5B/CSW-5B-05 switch box

- Measurements of strain, voltage, thermocouple, and platinum resistance temperature detector are possible.
- The sensor mode is set with the TC-37K / -32K.
- Terminals can be screwed or soldered.
- Compact and lightweight

Combination with the TC-37K / -32K





CSW-5B CSW-5B-05

This equipment is a switch box for expanding the number of measuring points in combination with the TC-37K / -32K handheld data logger. The number of measuring points is 5, and measurements of strain, DC voltage, thermocouple and platinum resistance temperature detector are possible.
* The CSW-5B-05 is a connector combination type equipped with NDIS one-touch connector receptacles on all points.

Specifications

Applicable measuring instrument	TC-37K / -32K
Number of measuring points	5 points
Strain measurement	
Applicable wiring method, gauge resistance	One-gauge method three-wire type: 120, 240, 350 Ω
	One-gauge method four-wire type: 120, 240, 350 Ω
	Two-gauge method: 120–1000 Ω
	Four-gauge method: 120–1000 Ω
	Four-gauge method constant current: 350 Ω (Cable round-trip resistance: 200 Ω or less)
	Four-gauge method 0-2 V: 120–1000 Ω
Measurement range	Depends on the data logger combined
Decrease in sensitivity	×1 ± (0.08% rdg + 1 digit) - 0.33% rdg or less
	×10 ± (0.08% rdg + 2 digit) - 0.33% rdg or less
DC voltage measurement	
Measurement range	Equivalent to the TC-37K / -32K
Voltage measurement	±300mV ±30V
Allowable input voltage	300 mV range ±5V 30 V range ±35V
Thermocouple temperature measurement	T, K, J, B, S, R, E, N
Measurement range	Equivalent to the TC-37K / -32K
Platinum resistance temperature detector temperature measurement	
Measurement range	Equivalent to the TC-37K / -32K
Measurement Method	Three-wire type
Measuring point number	Fixed (CH0 - CH4)
Measuring point display	Red LED at each point
Switch	Semiconductor relay
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)
Power supply	Supplied by the TC-37K / -32K
Outside dimension	CSW-5B: 75 (W) × 35 (H) × 204 (D) mm (Excluding protrusions) CSW-5B-05: 95 (W) × 35(H) × 204 (D) mm (Excluding protrusions)
Mass	CSW-5B: Approx. 500 g CSW-5B-05: Approx. 650 g

Standard accessories

Instruction Manual..... 1
CR-655 connection cable 1
Accessory box 1
Warranty certificate 1

RPC-05A (Remote power controller)

This equipment is a power controller that enables battery operation of our data loggers, digital strainmeters (TDS-150, TC-37K / -32K), and network handheld measuring instruments (TC-35N) in locations where AC power is unavailable. It is equipped with a battery charger function and unmanned measurement over a long period of time can be easily performed by simply connecting a solar cell. In addition, it is equipped with a function for turning on/off the power of measuring instruments, and the power of the measuring instruments can be controlled on the PC side by connecting it to a PC via an RS-232C interface. Therefore, even when the sleep interval (automatic measurement function that reduces power consumption by going into a standby state when not measuring) is set, the power of the measuring instruments can be turned on to perform data collection, etc. Furthermore, by using a wireless telephone line system (such as mobile phone + modem) for the connection part to a PC (RS-232C interface), various controls (measurement, turning on/off of the power of measuring instrument, data collection, etc.) can be performed from a location far away from the measuring instruments.

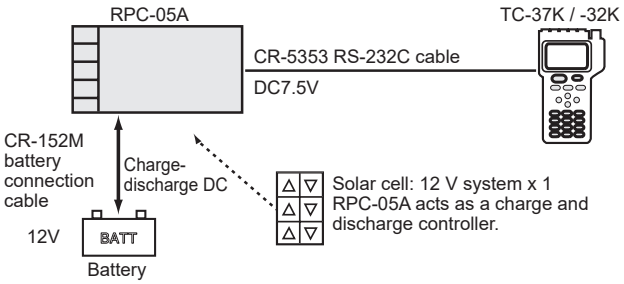
Data loggers and digital strainmeters supported by RPC-05A
TC-37K / -32K, TC-35N, TDS-150



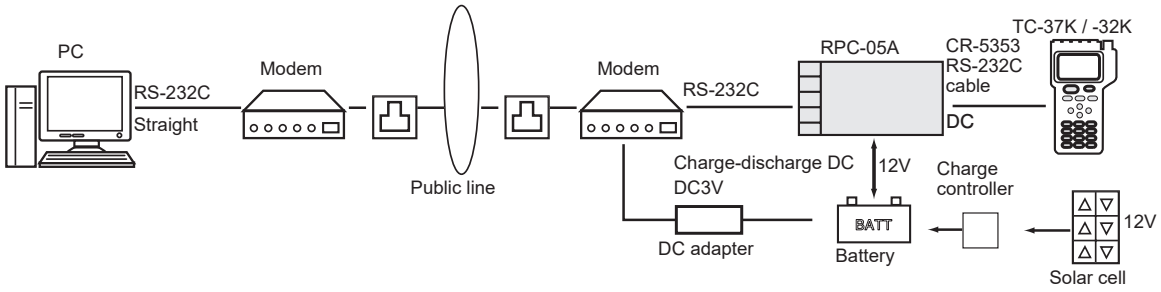
PC-05A remote power controller

System Block Diagram

In the case of offline measurement



When using a general telephone line



Specifications

Connectable instrument to this software	TC-37K / -32K, TC-35N, TDS-150
12 V BATT. IN	
Battery input voltage	DC 10 to 18 V
Charging voltage	13.65 V ± 1%
Charging current limit value	About 350 mA
CHARGE IN	
Input voltage	18 V max
Power output for measuring instrument	
Output voltage	DC 7.5 V ± 1 V
Output current (Minimum guaranteed value)	350 mA
ON pulse output	33 ms ±10% positive pulse When ESC + 0 + N is received from RS-232C IN, the above-mentioned pulse is generated on the ON pulse output line of RS-232C OUT.

Control signal	RS-232C
Baud rate	1200, 2400, 4800, 9600 dps
Bit length	8-bit
Parity	None
Self-consumption current	5 mA or less
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Outside dimension	80 (W) × 35 (H) × 169 (D) mm
Mass	Approx. 320 g

Standard accessories

Instruction Manual..... 1
Battery connection cable (CR-152M)..... 1
Connection cable
(CR-5353 for the TC-37K / -32K or CR-5351 for the TC-31K/TC-35N) 1
Battery connection fitting: for + leg, for - leg..... 1
Warranty certificate 1

TML-NET

- Easy connection and branching
- Easy installation due to compact and lightweight module part
- No decrease in sensitivity due to cable extension
- Highly resistant to noise due to digital processing near a sensor
- No influence due to decrease in insulation resistance
- Total extension distance of network module: 2 km or less (When using ND-100, NIF-100, TC-35N)
- Total extension distance between a data logger and ND-100: 2 km or less
- Can also be used in combination with a switch box. Each measuring instrument is insulated from the others.
- Conventional type and low power consumption type can be mixed.

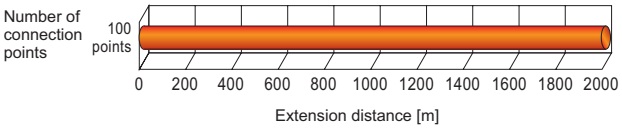
The TML-NET is our unique network that enables measurement control and data transfer via a two-wire type network line and supplies the power. It is also our unique network in which commands and data are transferred on the network along with a clock to enable two-way communication. The network module configures a measurement circuit near a strain gauge, DC voltage signal, and T-type thermocouple, and digitizes the measurement data. The digitized data is transferred to a data logger by a network driver connected to the network. (The network interface allows direct connection to a PC.) This is a low-power consumption network module that consumes 1/10 the power of the conventional type and allows for more connections and longer extension distance than the conventional network module. The data is transferred via digitized signals, allowing for stable measurements over a long period of time without influences by decreased sensitivity and cable insulation degradation due to cable extension. In addition, there is an advantage that, with simple wiring, correlations between strain, strain gauge type transducer, voltage, temperature, etc. can be measured, processed, and recorded in a lump sum for the required number of channels.

TML-NET (Network part) Specifications

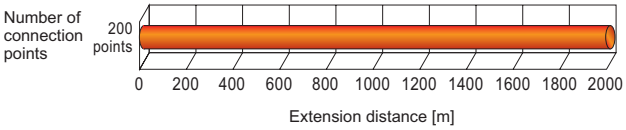
Communication part specifications (2-wire type)

Transmission method	Two-wire type, bidirectional serial transfer
Number of connection points	Max. 100 points per system, max. 1000 points can be connected
Standard cable used	Dedicated 2-core shielded cable (2-1.25L1)
Total extension distance	2 km or less per system (Refer to the figure below.)
Measurement time	200 ms/point (including transfer time)
Loop connection	Possible
Terminator	Not required

Network module Two-wire type Extension distance:
NSW-011C, NSW-014C, NSW-01 VC, NSW-01TC, NSW-01CC

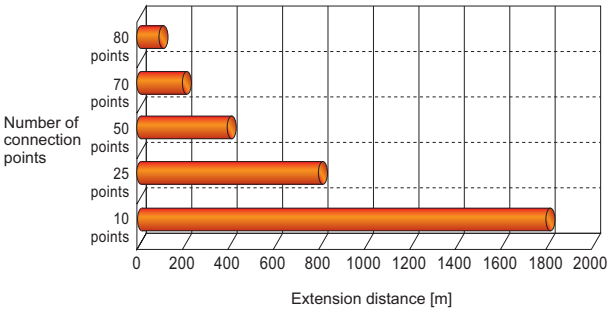


Network module Two-wire type Extension distance:
NSW-024C (2CH type)



Dedicated shielded cable used, 2-wire type: 1

Network module Two-wire type Extension distance:
Conventional type module



ND-100 (Network driver)

NEW



ND-100 network driver

This equipment is a driver interface that drives each module from the system of the switch box extension cable of the TDS series measuring instrument.

Specifications

Number of connectable units		Up to 100 units * 1
Extension distance		2 km*1
Connectable data logger		TDS-540
TML-NET connection		Terminal block: PRC03-23A10-3AF connector for dedicated two-core shielded cable connection
Function		Conversion of three-wire signals to two-wire signals Power supply to network modules
Power supply		Supplied by data logger * Booster power supplies are required when extending multiple systems.
Booster Power supply	AC power supply	Rated voltage: AC 100 to 240 V, 50/60 Hz Maximum power consumption: 80 VA max
	DC power supply	Rated voltage: DC 9 to 18 V Maximum power consumption 2.0 A max
Operating temperature / humidity range		0 to +50C° 85% RH or less (No condensation)
Outside dimension		150 (W) × 45 (H) × 100 (D) mm(Excluding protrusions)
Mass		Approx. 500 g

*1. When using a low-power consumption type network module

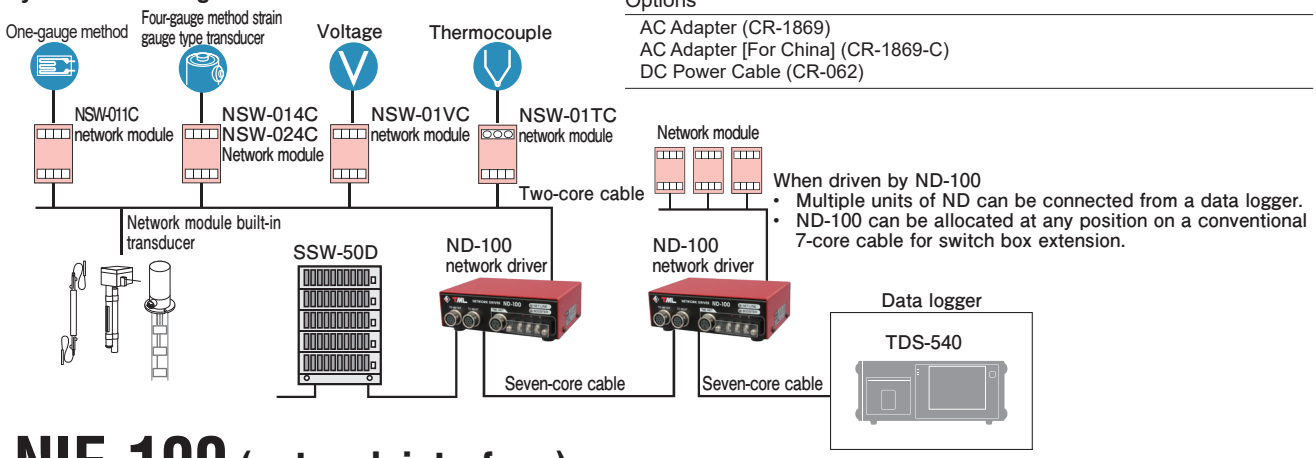
Standard accessories

Instruction Manual..... 1
Warranty certificate 1
AC power cable (CR-03) 1
Connection cable 1.5 m (CR-65) 1

Options

AC Adapter (CR-1869)
AC Adapter [For China] (CR-1869-C)
DC Power Cable (CR-062)

System Block Diagram



NIF-100 (network interface)



NIF-100 network interface

Driver interface for directly driving each module from a PC

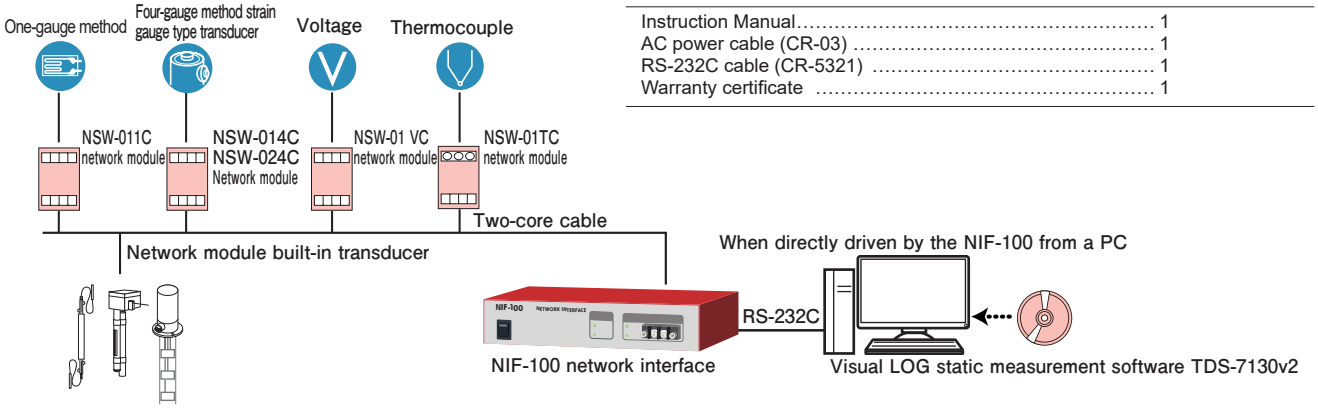
Specifications

Number of connectable units	When using a low-power consumption network module 100 units When using a conventional network module 80 units
Extension distance	When using a low-power consumption network module 2 km When using a conventional network module 1.8 km (with a limit on the number of units used)
Interface	RS-232C compliant, baud rate: 300, 600, 1200, 2400, 9600, 19200 bps
TML-NET connection	Terminal block
Function	Scanning measurement, monitor measurement, module check, ID check, channel setting of network module, power supply to network module
Power supply	AC power supply Rated voltage: AC 100 to 240 V, 50/60 Hz Allowable voltage: AC 85 to 250 V, 50/60 Hz Maximum power consumption: 90 VA max
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Outside dimension	235 (W) ×50 (H) ×160 (D) mm (Excluding protrusions)
Mass	Approx. 1.2 kg

Standard accessories

Instruction Manual..... 1
AC power cable (CR-03) 1
RS-232C cable (CR-5321) 1
Warranty certificate 1

System Block Diagram



TC-35N (Handheld)



TC-35N network handheld measuring instrument

The TC-35N network handheld measuring instrument receives and processes digitized strain data from a network module. It is small and lightweight, has a splashproof structure, and operates on AA size alkaline batteries. Therefore, it can be used for on-site checks and measurements as a small-scale measuring system. In addition, long-term automatic measurement is possible using the sleep interval. Measured data can be transferred to a PC via the RS-232C interface or recorded in data memory or on a CF card.

Related Products

CR-183B AC adapter
This equipment is connected to AC 100 V to supply the power.
RS-232C cable CR-553B (25P), CR-5531 (9P)
This cable is used to connect to a PC.
DPU-S245 external printer
The measurement data of the TC-35N is printed.
CR-4512 printer cable
This is a dedicated cable for connecting to the TC-35N printer.
RPC-05A remote power controller
This enables long-term measurements powered by an external battery.

Specifications

Number of connectable units	When using a low-power consumption network module 50 units When internal AA size batteries or AC adapter is used 100 units When external DC input 24 V is supplied When using a conventional network module 5 units When internal AA size batteries or AC adapter is used 100 units When external DC input 24 V is supplied (200 m or less)
Extension distance	When using a low-power consumption network module 50 m or less When internal AA size batteries or AC adapter is used 2 km or less When external DC input 24 V is supplied When using a conventional network module 50 m or less When internal AA size batteries or AC adapter is used 2 km or less When external DC input 24 V is supplied (15 units or less)
Cable used	Dedicated two-core shielded cable
Applicable transducer	Equivalent to a network module
Measurement range, resolution, accuracy	Equivalent to a network module
Data acquisition speed	About 0.2 s/CH
External DC input	DC 12 to 28 V, 1 A max. External input of DC power supplied to TML-NET
Data memory	About 23000 data (at the time of 1 ch measurement)
Memory card	CF card (PC card adapter required) 128 MB
Number of transducer setting points	1000 points Setting record contents: Coefficient, unit, decimal point, initial value
Function	Scanning measurement, monitor measurement, module check function, ID check function, channel setting function of network module
Interval timer function	Function : Automatic start at the set time interval and time Time : Year, month, day, hour, minute, second Time accuracy : Daily error: ±2 sec (at 25°C ± 5°C) Interval : Hour / minute / second can be set for each step up to 99 hours, 59 minutes, and 59 seconds. Number of starts : Up to 99 times per step or infinite Number of steps : Programmable up to 10 steps Real time start : Start time (hour / minute / second) can be set for each step. GOTO step : Program loop possible to one of the previous steps. Sleep function : The power is turned on 10 sec before the measurement time and turned OFF after the measurement is completed. (Sleep can be set to ON/OFF.)
Auto power OFF function	The power is turned OFF about 10 min after the last key operation.
Interface function	RS-232C Function: Receiving of control, measurement data, etc. Baud rate: 4800, 9600, 19200, 38400 bps
Display	128 x 64 dot LCD with backlight
Vibration tolerance	30 m/s^2 Shock resistance: 50 m/s^2
Splash proofness	IP-54 (with connector cap attached)
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)
Power supply	AA size alkaline dry-cell battery (LR-6) x 4 or AC adapter (CR-183B, optional)
Outside dimension	102 (W) × 55 (H) × 223 (D) mm
Mass	Approx. 850 g

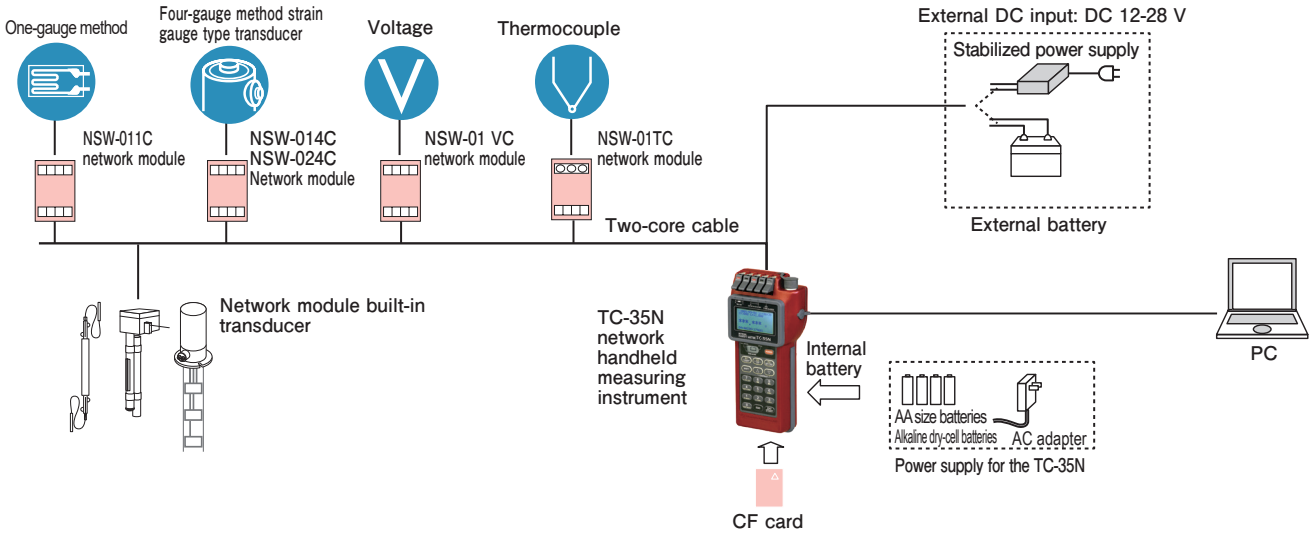
Standard accessories

Instruction Manual..... 1
Shoulder belt 1
AA size alkaline dry-cell battery 4
Accessory box 1
Warranty certificate 1

Options

AC Adapter (CR-185B)
AC Adapter [For China] (CR-185B-C)

System Block Diagram



MD-111 (monitoring system controller)

Disaster prevention systems can be constructed by alarm output with contact output.

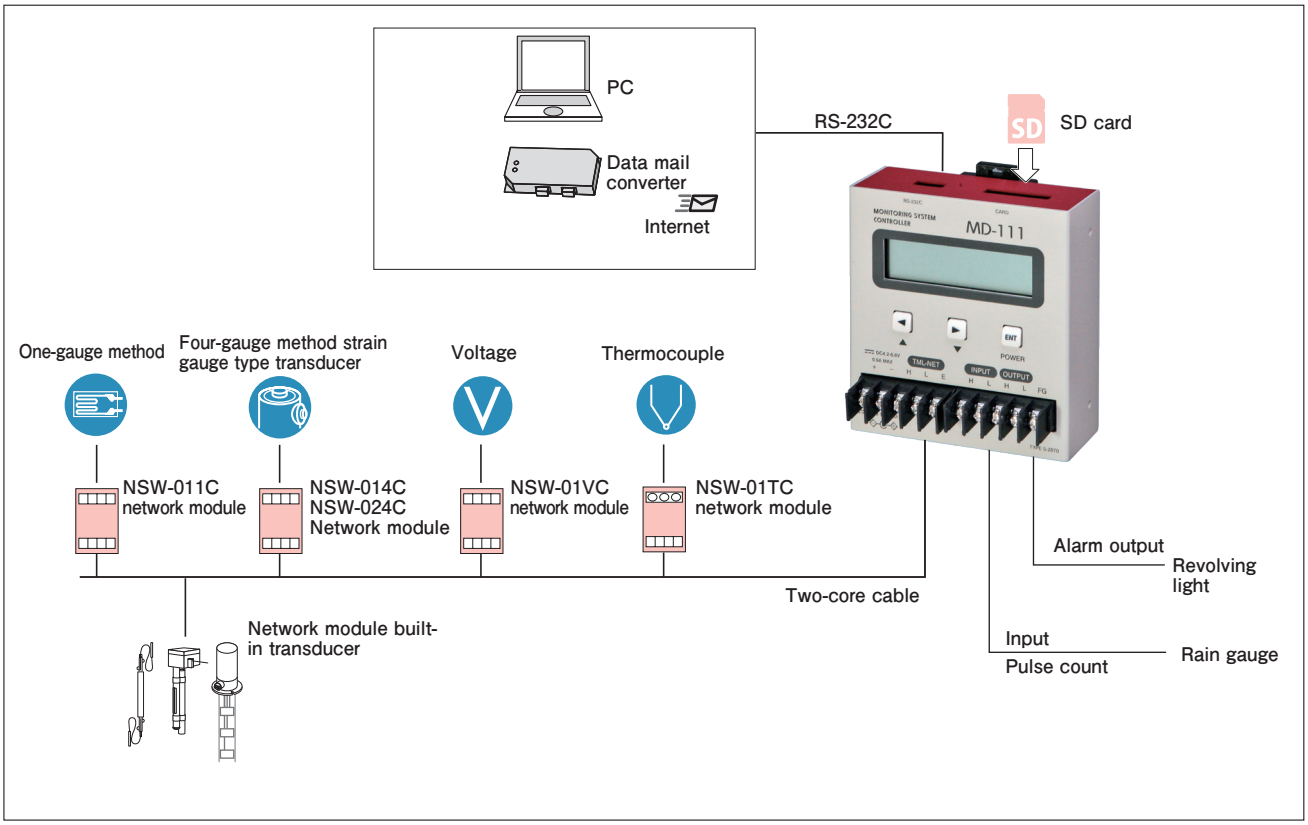
- Automatic measurement with sleep interval, battery powered
- Distributed measuring system
- Easily expansion of the number of measuring points using TML-NET
- Recording of measurement data using an SD card
- Counting and recording the pulses of rain gauge pulses with contact input
- Alarm transmission with contact output
- Easy installation on DIN rails due to compact and lightweight design
- By connecting to a data mail converter, data management from a remote location is easy.



MD-111 monitoring system controller

This monitoring system is a disaster prevention system that utilizes the TML-NET network measuring system. It consists of a controller, network modules, and TML-NET compatible transducers. The controller controls the network modules and TML-NET compatible transducers at a specified measurement interval and records the measurement data on an SD card. Its shape is suitable for stationary application, and it is equipped with interfaces for contact input/output and data mail converter and allows the building of a relatively small-scale disaster prevention system at low cost.

System Block Diagram



Specifications

TML-NET drive unit

Target model	NSW series
Number of connectable units	When using a low-power consumption network module 100 units
	When using a conventional network module Up to 20 units (Connection distance: 150 m or less)
Total extension distance	When using a low-power consumption network module 1 km or less
	When using a conventional network module 1 km or less (up to 10 units)
Connection cable	Dedicated two-core shielded cable

Function

Number of measuring points	100 points
Function	Interval measurement, monitor
Setting	First channel, last channel
Measuring mode	Simple measure mode
TML-NET setting function	Channel number setting of network module (Only when 1 unit is connected)

Interval timer

Function	Measurement at the set time interval
Time interval	1, 2, 5, 10, 15, 20, 30 min. 1, 2, 3, 4, 6, 12, 24 hrs (Measurement start time can be specified)
Sleep function	When the sleep function is enabled, the power is automatically turned on/OFF during interval measurement.

Clock

Function	Year, month, day, hour, minute, second
Accuracy	Daily error: ± 3 sec (at 23°C ± 5°C)
Retention	About 1 hr (with full charge)

Display / operation

Display unit	Seven-segment LCD
Operation key	Operated by the key switch

Memory

Function	Recording of measurement data, recording of setting file Readout
Applicable card	SD card (Designated by us)
Applicable physical format	FAT16
Recording format	CSV format
Card capacity	512 MB

Contact input

Number of contacts	1
Input signal	Non-voltage contact, open collector signal
Response pulse width	0.01 s or more
Measurement range	0 to 31,999 count
Accuracy	±1 digit or less
Recording content	Records a pulse integration value at each recording interval
Measurement data	Integrated count

Contact output

Number of contacts	1
Contact	Semiconductor relay
Contact capacity	AC 140 V / DC 200 V max Rated current: 0.5 A max. Inrush current: 1.5 A max
Output format	a-contact
Comparison format	Relative value, upper / lower limits

Battery power supply

Rated power supply voltage	DC 4.2 to 6.8 V
Battery life	About 3 months Conditions Battery : D size alkaline dry-cell battery x 4 Atmospheric temperature : 23°C ± 5°C Measurement : 1-hour interval Number of connectable units : 10 units
Consumption current	Sleep current: 1 mA max Operating current 300 mA max (when driving 1 unit) 360 mA max (When driving 10 units) 900 mA max (When driving 100 units)

External DC power supply

Rated power supply voltage	DC 9 to 18 V
Consumption current	Sleep current 1 mA max Operating current 500 mA max (when driving 100 unit)

Interface

RS-232C	RS-232C compliant Baud rate: 9600, 19200, 38400 bps For various settings, measurement, data collection

Environment

Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)
Outside dimension	95 (W) × 30 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 200 g

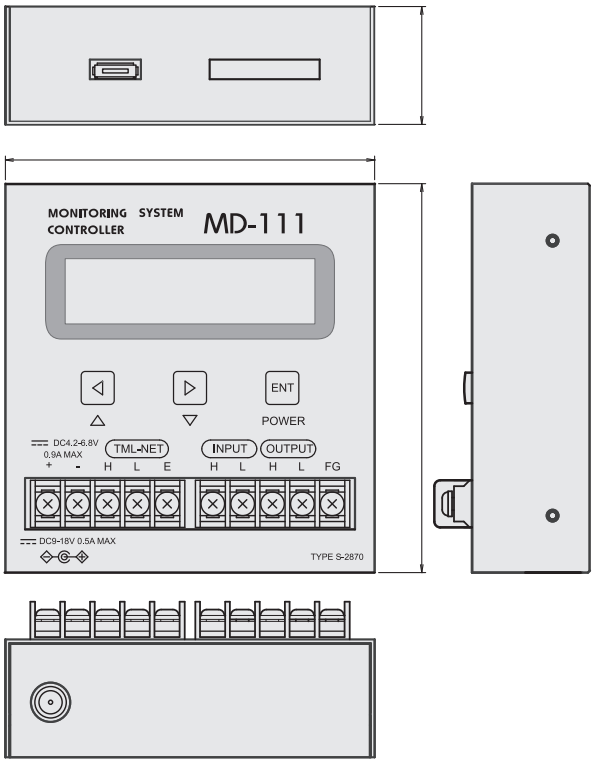
Standard accessories

Instruction Manual..... 1
SD card (512 MB)..... 1
Warranty certificate 1

Options

AC Adapter (CR-1869)
AC Adapter [For China] (CR-1869-C)
DC Power Cable (CR-062)

External Dimensions



NSW Series (Network Modules)

NSW-011C and NSW-014C common specifications (low-power consumption type)

Number of measuring points	1 point
Measurement time	200 ms/point (including transfer time)
Program setting	Channel number: 000-999
Power supply voltage	DC 10 to 28 V
Consumption current	During standby 1 mA max During measurement 36 mA max
Operating temperature / humidity range	-20 to +60C° 85% RH or less (No condensation)
Outside dimension	50 (W) × 20 (H) × 100 (D) mm
Mass	Approx. 250 g

Standard accessories

Instruction Manual..... 1
Warranty certificate 1

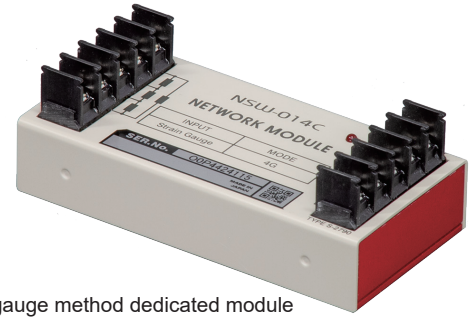
NSW-011C one-gauge method dedicated strain module



One-gauge method dedicated module

Measuring mode	One-gauge method three-wire type
Applicable gauge resistance	120 Ω/350 Ω (fixed at the time of shipment)
Bridge excitation	DC 1 V 60 ms (50 Hz)
Measurement range	± 30000 × 10^{-6} strain
Resolution	1 × 10^{-6} strain
Accuracy	± (0.05% rdg + 2 digits) (23C° ± 5C°) * Decrease in sensitivity due to lead wire is not included.
Temperature coefficient	0.005% rdg/°C
Aging change	0.05% rdg/year
Check function	Over check, sensitivity check, open check

NSW-014C four-gauge method dedicated strain module



Four-gauge method dedicated module
Strain gauge type transducers, etc. are connected.

Measuring mode	Four-gauge method
Applicable gauge resistance	120–1000 Ω
Bridge excitation	DC 1 V 60 ms (50 Hz)
Measurement range	± 30000 × 10^{-6} strain
Resolution	1 × 10^{-6} strain
Accuracy	± (0.05% rdg + 2 digits) (23C°±5C°) * Decrease in sensitivity due to lead wire is not included.
Temperature coefficient	0.002% rdg/°C
Aging change	0.05% rdg/year
Check function	Over check, sensitivity check, open check

2-ch network module NSW-024C



Number of measuring points	2 points
Measurement time	200 ms/point (including transfer time)
Program setting	Channel number: INPUT 0 000-998 INPUT 1 INPUT 0 +1
Measuring mode	Four-gauge method
Applicable gauge resistance	120–1000 Ω
Bridge excitation	DC 1 V 60 ms (50 Hz)
Measurement range	± 30000 × 10^{-6} strain
Resolution	1 × 10^{-6} strain
Accuracy	± (0.05% rdg + 2 digits) (23C° ± 5C°) * Decrease in sensitivity due to lead wire is not included.
Temperature coefficient	0.002% rdg/°C
Aging change	0.05% rdg/year
Check function	Over check, sensitivity check, open check
Power supply voltage	DC 10 to 28 V
Consumption current	During standby 1 mA max During measurement 36 mA max
Operating temperature / humidity range	-20 to +60C° 85% RH or less (No condensation)
Outside dimension	95 (W) × 20 (H) × 100 (D) mm
Mass	Approx. 300 g

Standard accessories

Instruction Manual..... 1
Warranty certificate 1

NSW-01 VC voltage module



DC voltage measurement module

Measuring mode	DC voltage

Input terminal	Measurement range	Resolution	Input resistance
V1	±2.5000 V	0.1 mV	About 2 MΩ
V2	±25.000 V	1 mV	

Accuracy	± (0.08% rdg + 3 digits)
Zero stability	± 0.1 mV/°C (V1 mode) ±1 mV/°C (V2 mode)
Sensitivity stability	0.01% rdg/C°
Aging change	0.1% rdg/year
Check function	Over check, sensitivity check

NSW-01TC thermocouple module



T-type thermocouple temperature measurement module

Applicable thermocouple	T [JIS C 1602-2015]
Reference junction	Internal temperature compensation method
Linearization	Digital calculation
Measurement range	−100 to +200°C
Resolution	0.1°C
Accuracy (at 23°C ± 5°C)	External reference junction: ± (0.11% rdg + 0.2°C) Internal reference junction ± (0.11% rdg + 0.9°C)
Temperature coefficient of accuracy	0.01%rdg/°C
Aging change of accuracy	0.1% rdg/year
Zero-point temperature coefficient	0.03C°/C°
Check function	Sensitivity check

NSW-01CC counter module NEW



This equipment is a module that counts rainfall, flow rate, quantity, number of passing vehicles, number of machine operations, etc. using non-voltage contact or open collector input.
The built-in backup batteries allow continuous counting even when the power is not supplied.

Number of measuring points	1 point	
Measurement time	200 ms/point (including transfer time)	
Program setting	Channel number: 000-999	
Power supply voltage	DC 10 to 28 V	
Consumption current	During standby	12mA MAX.
	During measurement	12mA MAX.
Maximum number of connectable units	Up to 10 units of NSW-01CC can be connected out of 100 units with an extension of 2 km.	
Input signal	Non-voltage contact/open collector signal, rectangular wave	
Input waveform	Counted by the edge at the time of close	
Input pulse width	0.01 s or more	
Input contact current	About 120 μA	
Count direction	Up count	
Measurement data	Integrated count	
Measurement range	0 to 31,999 count	
Resolution	±1 count	
Measurement accuracy	±1 digit or less	
Overflow processing	0 reset	
Check function	Sensitivity check (10000 fixed value return)	
Reset function	Full count/external reset	
Backup power supply	AA size alkaline dry-cell battery x 3 About 3 months	
Operating temperature / humidity range	-20 to +60°C 85% RH or less (No condensation)	
Outside dimension	95 (W) × 35 (H) × 100 (D) mm (Excluding protrusions)	
Mass	About 250 g (Excluding 3 AA size alkaline dry-cell batteries: 70 g)	

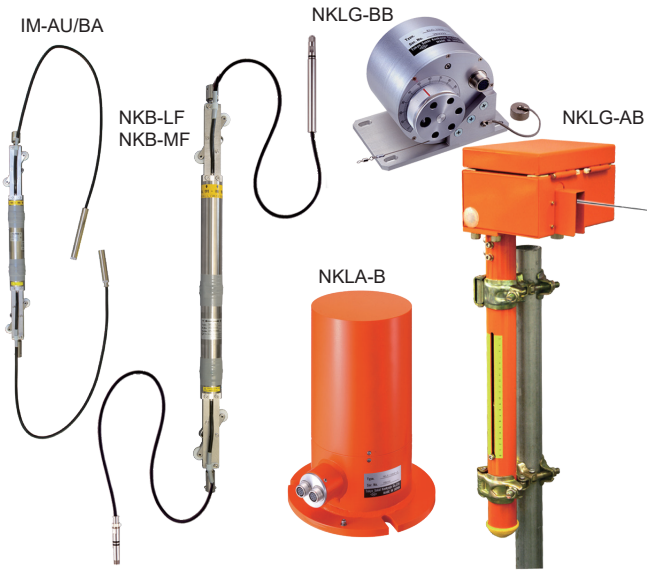
Standard accessories

Instruction Manual 1
Warranty certificate 1
AA size alkaline dry-cell battery 4

*** Connect H of the TML-NET connection terminal to H (hot side) of the network driver and connect L to L (cold side) of the network driver. When connected in reverse, the module will not operate.**
*** Up to 10 units of NSW-01CC can be connected out of 100 units with an extension distance of 2000 m.**

TML-NET Compatible Transducers

- Built-in digital conversion module for the TML-NET
  A low power consumption type network module is adopted to support multipoint / wide-range measurements. The ND-100 network driver is required separately to connect to a data logger. Refer to page 266 for details on ND-100. In addition, contact us for compatible data loggers and measuring instruments.
- No influence of reduced sensitivity or insulation
  Since data is transferred using digital signals, there is no influence of reduced sensitivity or insulation due to cable extension.
- Easy wire connection
  Data can be transferred simply by using a two-wire cable instead of the conventional seven-core cable. In addition, temperature measurements using conventional strain gauge type transducers, thermocouples and platinum resistance temperature detectors can be used together via a switch box.
- Equipped with insulation check function
  A measurement function for insulation resistance values is available as an indicator of the soundness in the state of transducer installation. In addition, contact us for compatible data loggers and measuring instruments.

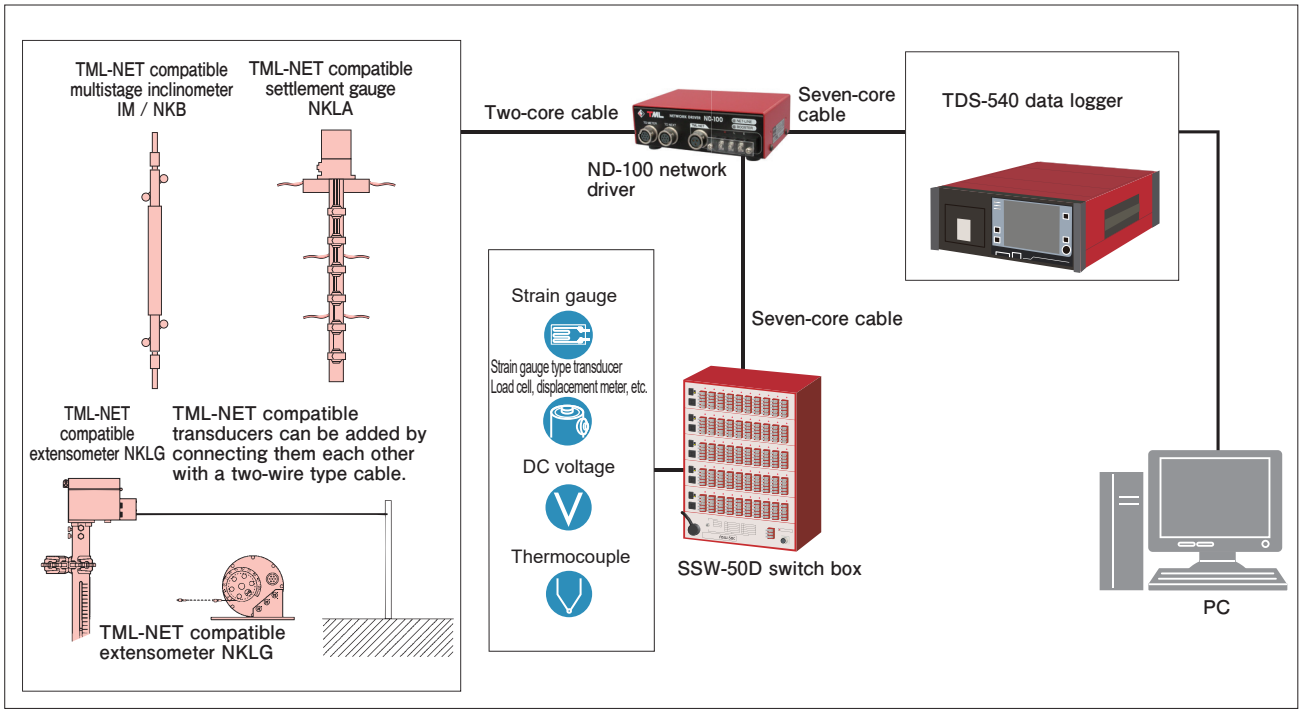


This equipment is a strain gauge-type-based transducer with a built-in digital conversion module designed for network measurement. Data can be transferred by connecting to a network driver or a measuring instrument that supports the TML-NET. Using a two-wire type cable, it is possible to easily add TML-NET compatible transducers or a network module to build a measuring system. In addition, conventional strain gauges, transducers, thermocouples, and platinum resistance temperature detectors can also be used by incorporating them into the network system using a switch box.

Supported transducers	Multistage inclinometer	NKB-LF/-MF, IM-AU/BA
	Settlement gauge	NKLA-B
	Extensometer	NKLG-AB/-BB (with built-in arrester)

System Block Diagram

● TML-NET digital network system examples



NNZ-2A (Lightning arrester for the TML-NET)

Prevents breakdown of measuring system due to induced lightning.

- When waiting for measurement, the relay is disconnected automatically to prevent induced current.
- Power supply from the network line
- The voltage of network line and the current of network modules are monitored to immediately shut off them in the event of an abnormality.

Specifications

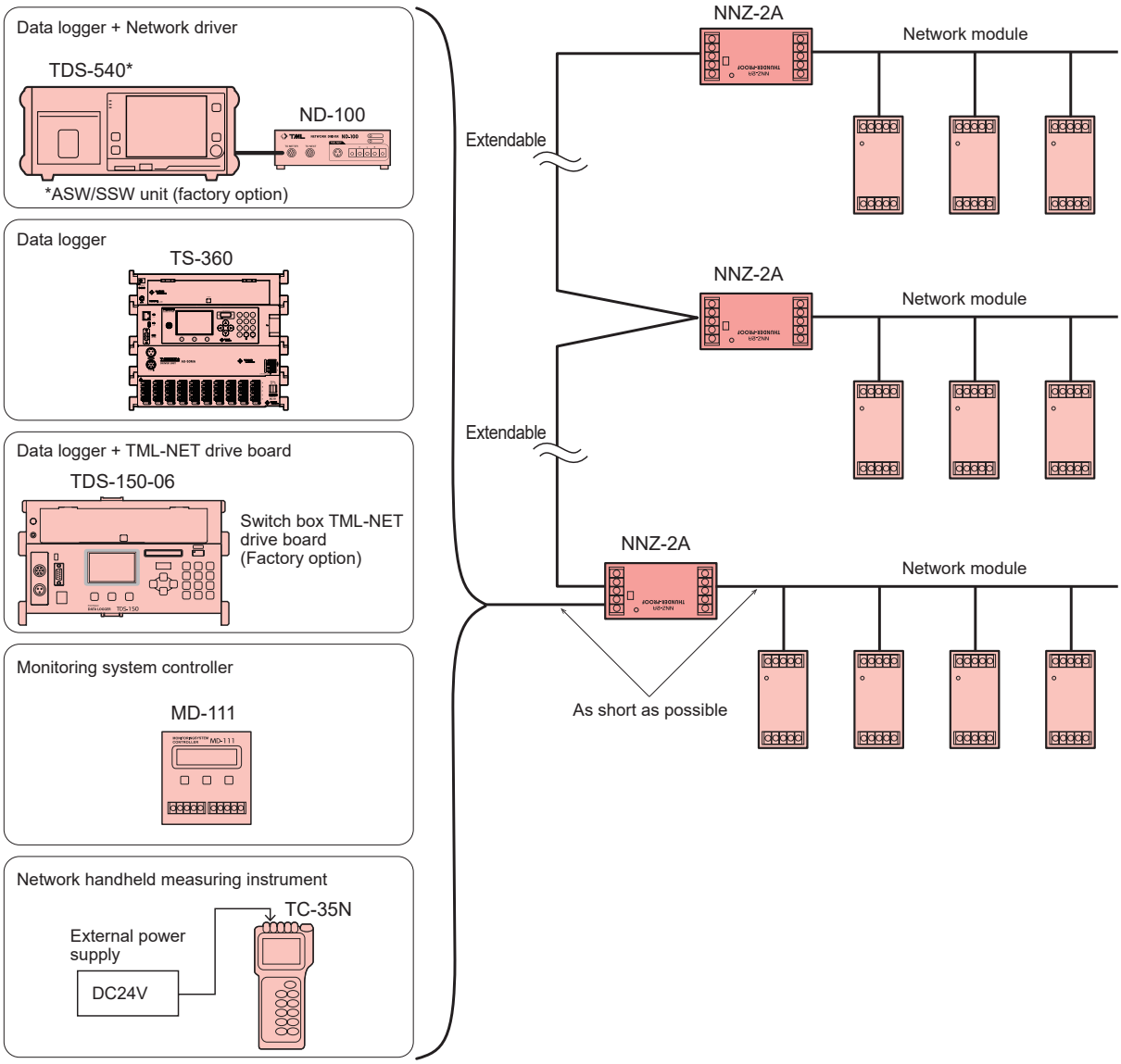
Surge withstand	100 A (8/20 μs impulse)
Number of usable units	NNZ-2A: 10 units Low-power consumption network module: 100 units
Rated power supply voltage	DC 18 to 24 V
Standard cable used	Dedicated two-core shielded cable Total extension distance: 2 km or less (When power supply voltage of DC 24 V is used) 1 km or less (When power supply voltage of DC 18 V is used)
Display function	Voltage drop on network line Overcurrent of the network module (overcurrent causes the network module to be isolated)
Operating temperature / humidity range	-20 to +60C° 85% RH or less (No condensation)
Outside dimension	50 (W) × 28 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 120 g



NNZ-2A Lightning arrester for the TML-NET

This equipment protects the TML-NET network measuring system from induced lightning. In areas prone to lightning, when cables for measuring instruments, network modules etc. are subjected to induced lightning, the induced current can cause failures in the network drivers and network modules connected to the network line. When this equipment is connected to both ends of the network line to be extended and when this equipment is on standby for measurement, the network line is disconnected automatically to prevent induced current when the network line is struck by inductive lightning to protect the network driver and network module.

System Block Diagram



* TDS-150 and MD-111 use AC power adapters.

Dynamic Strainmeters

We offer a wide range of dynamic strainmeters, from basic types for 1 point to multifunction types capable of various digital processing. Please select the model based on the scale of measurement, measurement frequency, data processing method, etc.

Model List

Digital type

Model name	Number of measuring points	Bridge excitation	Response frequency	Output	Records data	Interface	Other functions	Page
DS-50A	50	2 V DC	DC to 100 Hz * Variable depending on the number of connected units	-	PC storage Direct	LAN	Up to 20 units synchronized (1000 ch) Built-in bridge box Voltage measurement unit Thermocouple unit	276
DRA-162B	16	0.5, 2 Vrms 5 kHz	DC to 2.5 kHz	±10 V (5 kΩ load)	PC storage Direct	LAN	Data processing TEDS compatible	279
DC-204R	4	0.5, 2 V DC	DC to 10 kHz	-	CF card	USB	Up to 8 units synchronized (Up to 32 ch)	283
DC-204Ra				±5 V (5 kΩ load)				
DC-004P	4	0.5, 2 V DC	DC to 2 kHz	-	PC storage Direct	USB	PC control TEDS compatible	288
DH-14A	4	0.5, 2 V DC	DC to 1 kHz	-	CF card	-	AA size dry-cell battery powered Handheld use TEDS compatible	291
TMR-300	8-80	Depends on the unit	DC to 10kHz	±10 V, ±5 V alarm	SD card	LAN USB Wireless LAN	Various sensor input units such as strain, temperature, voltage, and pulse can be combined, and the units can be arranged in a distributed manner.	307

Analog type

Model name	Number of measuring points	Bridge excitation	Response frequency	Output	Other functions	Page
DA-17A	1	0.5, 2 Vrms 5kHz	DC to 2.5kHz	±10V ±20mA	Digital monitor Level meter Digital sensitivity setting PC control (when stored in the dedicated case)	294
DA-18A	1	0.5, 2 Vrms 5kHz	DC to 2.5kHz	±10V ±10V	Digital monitor Level meter Digital sensitivity setting TEDS compatible	295
DA-37A	1	0.5, 2 Vrms 20 kHz	DC to 10kHz	±10V ±50mA	High response frequency of 10 kHz Digital monitor Level meter Digital sensitivity setting PC control (when stored in the dedicated case)	296
DA-38A	1	0.5, 2 Vrms 20 kHz	DC to 10kHz	±10V ±10V	High response frequency of 10 kHz Digital monitor Level meter Digital sensitivity setting TEDS compatible	297
DC-96A	1	0.5, 1, 2, 5, 10 V DC	DC to 200kHz	±10V ±50mA	Broadband response frequency 200 kHz Digital sensitivity setting	298
DC-97A	1	0.5, 1, 2, 5, 10 V DC	DC to 500kHz	±10V ±50mA	Broadband response frequency 500 kHz Digital sensitivity setting	298

Major Functions

●Number of measuring points

The number of points (channels) that can be measured with 1 measuring instrument is indicated.

Although DA-17A/-18A/-37A/-38A and DC-96A/-97A are designed for one channel use when used alone, they can be configured for multichannel use by incorporating them into a case or rack.

●Bridge excitation and response frequency range

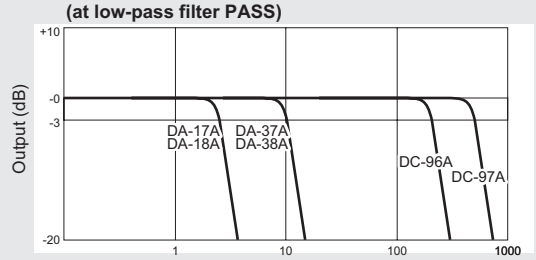
There are two types: the carrier type which uses AC as the bridge excitation and the DC type that uses DC.

The carrier type is characterized by a high signal-to-noise ratio and excellent stability and is the most widely used method for dynamic strainmeters. The response frequency is up to about half the carrier frequency and there are two types: 2.5 kHz type and 10 kHz type.

The DC type is characterized by a high response frequency and has excellent linearity as well. DC-96A provides a response frequency of 200 kHz and DC-97A provides a response frequency of 500 kHz.

The voltage of bridge excitation can be switched between two to five levels depending on the model. The magnitude of the output relative to the input strain, in other words, the sensitivity, is proportional to the bridge excitation, so it is advantageous to increase the bridge voltage in that respect. However, the current flowing through the strain gauge will be larger and the influence of the resulting heat generation will also be greater. Therefore, 2 V shall be the standard for normal measurements, and a lower voltage of 0.5 V shall be chosen when measuring materials with poor heat dissipation, such as plastic, or when measuring strain gauges with very small gauge lengths. For DC-96A/-97A, 5 V or 10 V can be set to obtain higher sensitivity.

Frequency characteristics of dynamic strainmeters (at low-pass filter PASS)



●Constant current bridge excitation method

Most dynamic strainmeters use the constant voltage method in which the bridge excitation voltage is kept constant, but DC-96A/-97A can be used by switching between the constant voltage method and the constant current method.

The constant current method keeps the current of the bridge excitation constant and has an advantage that there is almost no apparent decrease in sensitivity due to the resistance of the cable connecting the bridge circuit (bridge box, transducer, etc.) and the measuring instrument. However, with the constant current method, the bridge resistance value that can be connected is limited.

●Output

There are various types of recorders, including data recorders, which record the output signals of dynamic strainmeters.

Analog type dynamic strainmeters have two voltage output terminals and two recorders can be connected at the same time.

●Records data

This function not only outputs measurement data as an analog signal but also digitizes and records it. This makes it possible to capture dynamic phenomena without using an analog recorder. The DC-204R, DH-14A, and TMR-300 series record data on a memory card and transfer it to a PC after measurement is completed. The DRA-162B, DS-50A, DC-004P, and TMR-300 series record data on a PC in real time. Data analysis can be easily performed on a PC.

●Interface

This is an interface for communicating with a PC.

The TMR-311, DRA-162B, DS-50A, DC-004P, and DC-204 are set and operated from a PC via the built-in interface. In addition, it is also possible to transfer the setting status to a PC.

●Automatic balancing

Dynamic strainmeters require balancing of the bridge resistance (resistance balancing). In addition, carrier type dynamic strainmeters also require balancing of the capacity (capacity balancing). Both measuring instruments are equipped with a function to perform these balancing operations automatically.

Resistance balancing is a method in which the input during balancing operation is digitized and recorded, then converted back to an analog quantity again and subtracted from subsequent inputs. Since the balancing operation can be performed almost instantly, and simultaneous operations of multiple points are also possible, this is particularly useful when there are many measuring points. Capacity balancing is performed to cancel the output generated by imbalance in the capacitance of the lead wires connecting a strain gauge etc. to a measuring instrument. It detects the output due to capacity imbalance contained in the strain input and feeds it back to the input to balance it. This operation is performed automatically throughout the measurement, not only eliminating the need for balance adjustment operation but also enabling extremely stable measurements without influence of capacity change during the measurement.

●Low-pass filter

This filter is effective in removing high frequency components unnecessary for the measurement, such as electrical noise and mechanical micro vibrations, and is available on all models of dynamic strainmeters. The cutoff frequency can be selected from four to eight levels.

●High-pass filter

This filter removes frequency components lower than the cutoff frequency from the measurement signal. It is used in dynamic strainmeters to remove slow unnecessary components such as thermal output and drift of strain gauges. It is possible to set this filter to ON/OFF for each channel.

●Reading of TEDS sensor

The TEDS (Transducer Electronic Data Sheet) has a sensor information stored on an IC chip inside the sensor. This function allows a TEDS compatible measuring instrument to automatically recognize a sensor by reading the parameters from this information.

Compatible measuring instruments
DRA-162B, DC-004P, DH-14A, DA-18A, DA-38A, MM-014L

DS-50A (Multichannel)

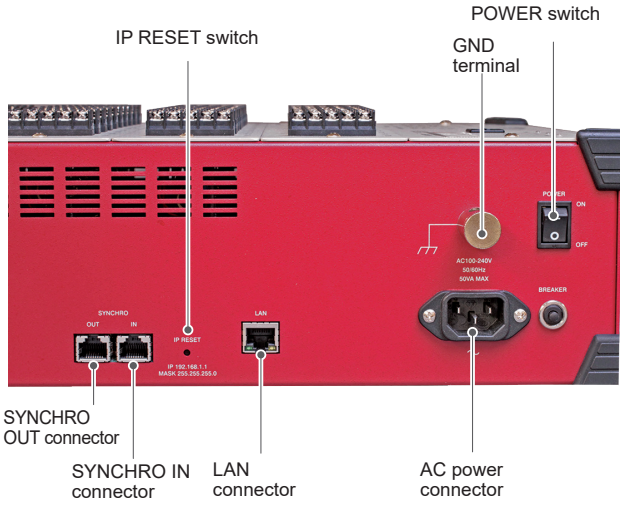
- Synchronized measurement of up to 20 units (1000 channels) is possible.
- Maximum sampling rate of 1 kHz
- Equipped with bridge box
- Strain, voltage and thermocouple units can be mixed
- Measurement software (DS-750) included as standard



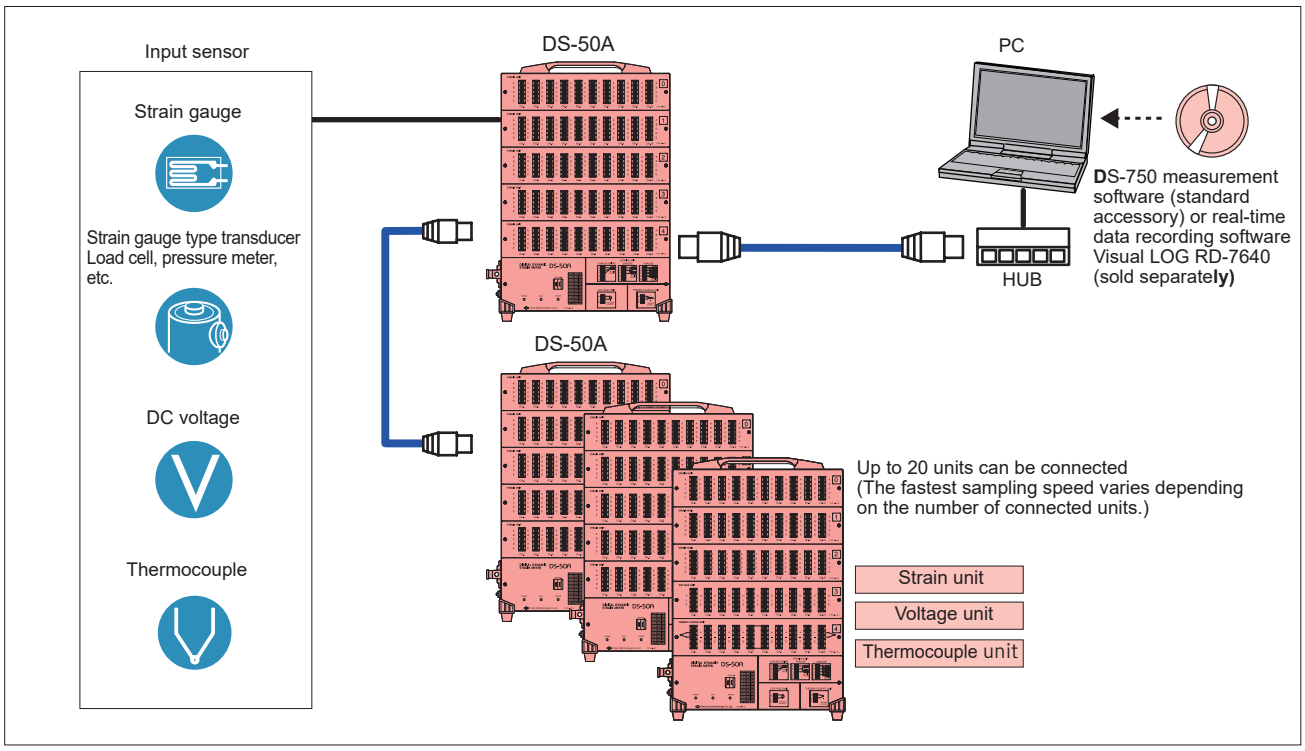
DS-50A multichannel digital dynamic strainmeter

The DS-50A is a multichannel digital dynamic strainmeter for online measurement with a PC. Each unit can measure 50 points and, by connecting up to 20 units with cables, it is possible to perform simultaneous sampling measurements of up to 1000 points. With a maximum sampling rate of 1 kHz, it supports measurement of phenomena of around 100 Hz. In addition, the devices can be separated by up to 100 m with connecting cables, and it is possible to measure multipoint dynamic strain distributed over a wide area, which was difficult with conventional dynamic strainmeters.

Side control panel



System Block Diagram



Specifications

DS-50A (Main unit)	
Number of measuring points	Up to 50 points Strain, voltage and thermocouple units can be mixed. 1 unit: 10 points
Synchronization	Up to 20 units (1000 points)
Sampling	1–10000 ms*1
Interface	LAN (100BASE-TX)
Operating temperature / humidity range	0C° to +50C° 5% RH or less (No condensation)
AC power supply	Rated voltage: 100 to 240 V, 50/60 Hz Allowable voltage: 90 to 264 V, 50/60 Hz Maximum power consumption 50 VA max
Outside dimension	420 (W) × 110 (H) × 298 (D) mm (Excluding protrusions)
Mass	Approx. 5 kg

Standard accessories

- Instruction Manual 1
- AC power cable (CR-03) 1
- LAN power cable, 3 m (CR-6462) 1
- DS-750 measurement software (CD- ROM) 1
- Phillips screwdriver 1
- Warranty certificate 1

*1: The fastest sampling speed is increased by 1 ms for each 1 connected unit.

Strain unit	
Number of measuring points	10 points
Applicable gauge resistance	One-gauge method three-wire type: 120 Ω, 350 Ω Two-gauge method: 120-1000 Ω Four-gauge method: 120-1000 Ω
Bridge excitation	DC 2 V
Measurement accuracy	± 0.05% FS (23C°±5C°)
Measurement range	± 25000 × 10^{-6} strain
Resolution	1 × 10^{-6} strain
Balancing method	Electronic automatic
Balancing accuracy	± 3 × 10^{-6} strain or less
Balancing range	± 10000 × 10^{-6} strain
Response frequency	DC to 100 Hz
Low-pass filter	
Cutoff frequency	Digital filter 1 Hz to 100 Hz (Can be set in 1 Hz increments) -3 dB ± 1 dB
Cutoff property	-48 dB ± 1 dB/oct, Butterworth property
High-pass filter	
Cutoff frequency	Digital filter 0.2 Hz, 1 Hz or OFF

Voltage unit	
Number of measuring points	10 points
Input format	Single end (unbalanced)
Input impedance	About 100 kΩ
Measurement range	±20 V
Measurement accuracy	± 0.05% FS (23C°±5C°)
Resolution	1 mV
Response frequency	DC to 100 Hz
Low-pass filter	
Cutoff frequency	Digital filter 1 Hz to 100 Hz (Can be set in 1 Hz increments) -3 dB ± 1 dB
Cutoff property	-48 dB ± 1 dB/oct, Butterworth property
High-pass filter	
Cutoff frequency	Digital filter 0.2 Hz, 1 Hz or OFF

Thermocouple unit			
Number of measuring points			10 points
Measurement range			T: -250 to +400C° K: -210 to +1370C° J: -200 to +1200C°
Measurement accuracy	Internal reference junction	T	-250 to -200C°± (0.5% rdg + 6C°) -200 to -100C°± (0.5% rdg + 3C°) -100 to +400C°± (0.5% rdg + 2C°)
		K	-210 to 0C°± (0.5% rdg + 3C°) 0C° to +1370C°± (0.5% rdg + 2C°)
		J	-200 to 0C°± (0.5% rdg + 3C°) 0C° to +1200C°± (0.5% rdg + 2C°)
	External reference junction		± (0.5%rdg + 1C°)
Resolution			0.1C°
Response frequency			DC to 10 Hz

DS-750 measurement software (attached software)	
System	
OS	Windows 7(SP1)/8.1/10/11
Computer	The above-mentioned OS environment is recommended and a PC equipped with dual-core or higher CPU is recommended.
Interface	LAN (100BASE-TX)
Basic specifications	
Compatible measuring instruments	DS-50A *Number of connectable units: 2
Measurement	Balance measurement, monitor measurement, manual measurement
Display	Numerical monitor, T-Y monitor, T-Y graph
Data format	DADiSP format *Can be converted to text file (CSV) format.
Data processing	T-Y graph display and print, numerical value list display

Related Products

Measurement software Visual LOG

●Real-time data recording software Visual LOG RD-7640

This measurement software controls up to 20 DS-50A units and performs the monitor, manual, data trigger, and interval measurements of 1 to 1000 measurement channels and up to 1000 expansion channels. It also supports our measuring instrument TMR-311. A version that supports video capture, RD-7640-M, is also available.

●Real-time data recording software Visual LOG RD-7640WF

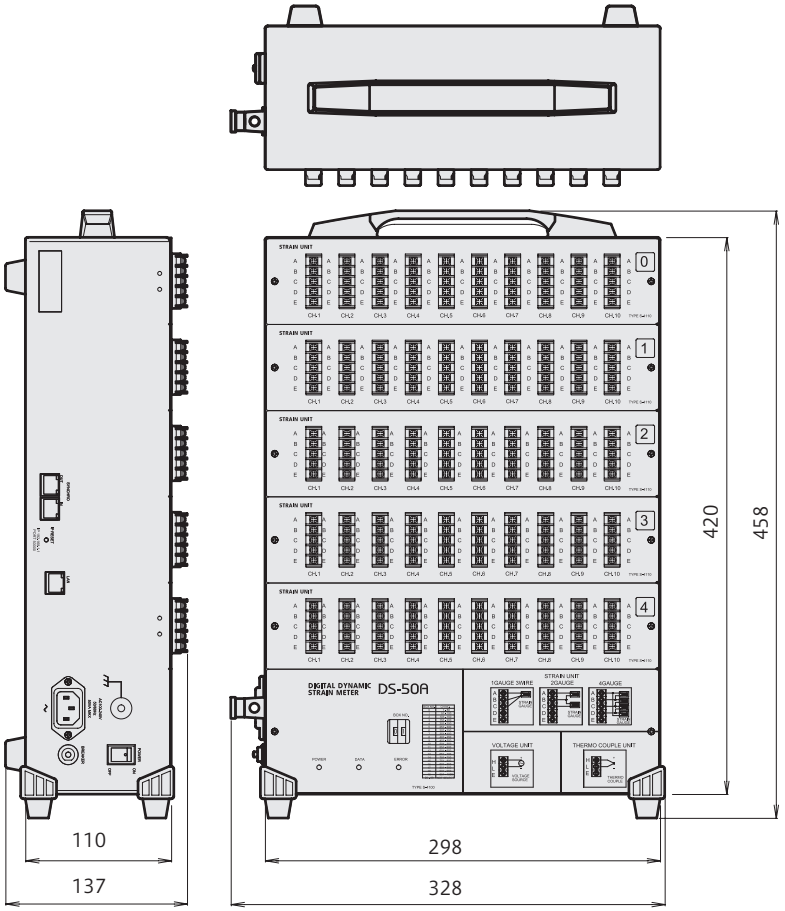
This is a great value package that bundles the WF-7630 waveform display software for data processing of the RD-7640.

●Waveform display software Visual LOG WF-7630

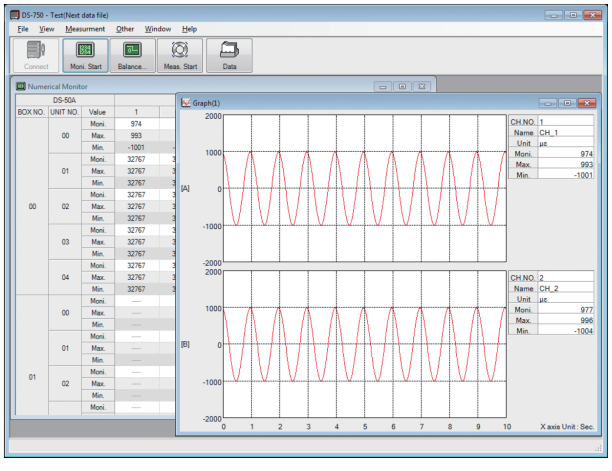
This software is used for post-processing the data file recorded with the RD-7640. With the frequency processing compatible version of the WF-7630-H, it is possible to set frequency analysis conditions and perform frequency analysis of waveform data.

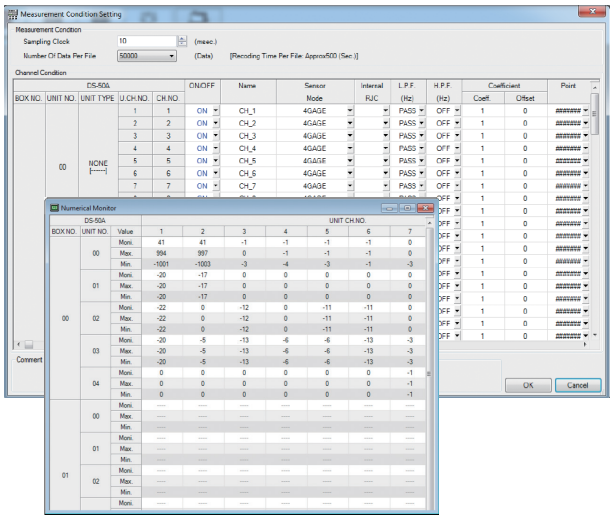
DS-50A (Multichannel)

External Dimensions



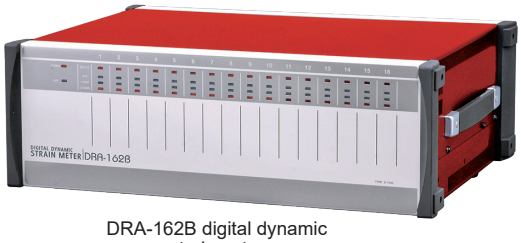
DS-750 measurement software display examples



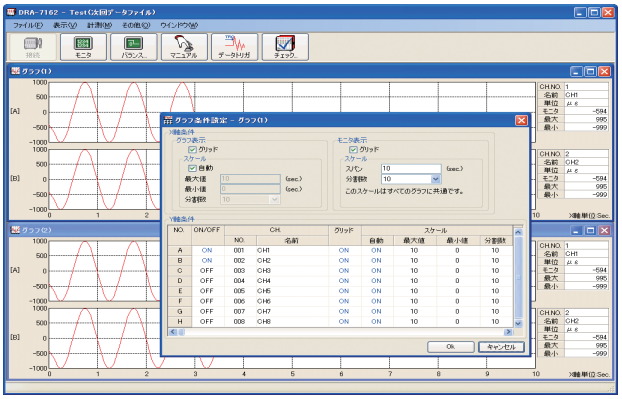


DRA-162B (Digital dynamic strainmeter)

- Built-in 16-bit A/D converter for each channel and waveform recording by digital values.
- Equipped with 256 k word/channel memory.
- No decrease in sensitivity when the cable is extended (up to 100 m) because of remote sensing of the bridge voltage.
- Each setting can be computer controlled.
- Bridge excitation switching (AC 0.5, 2 V) can be set independently for each channel.
- TEDS standard compliant, easy setting of supported transducers (dedicated software required).
- High-speed transfer of about 500 K word/second when transferring recorded binary data via LAN.
- Internal structure is card-type to support improvement of serviceability.
- Synchronized measurement of up to 16 units (256 channels) connected is possible.
- DRA-7162 measurement software included as standard (only one unit is supported).

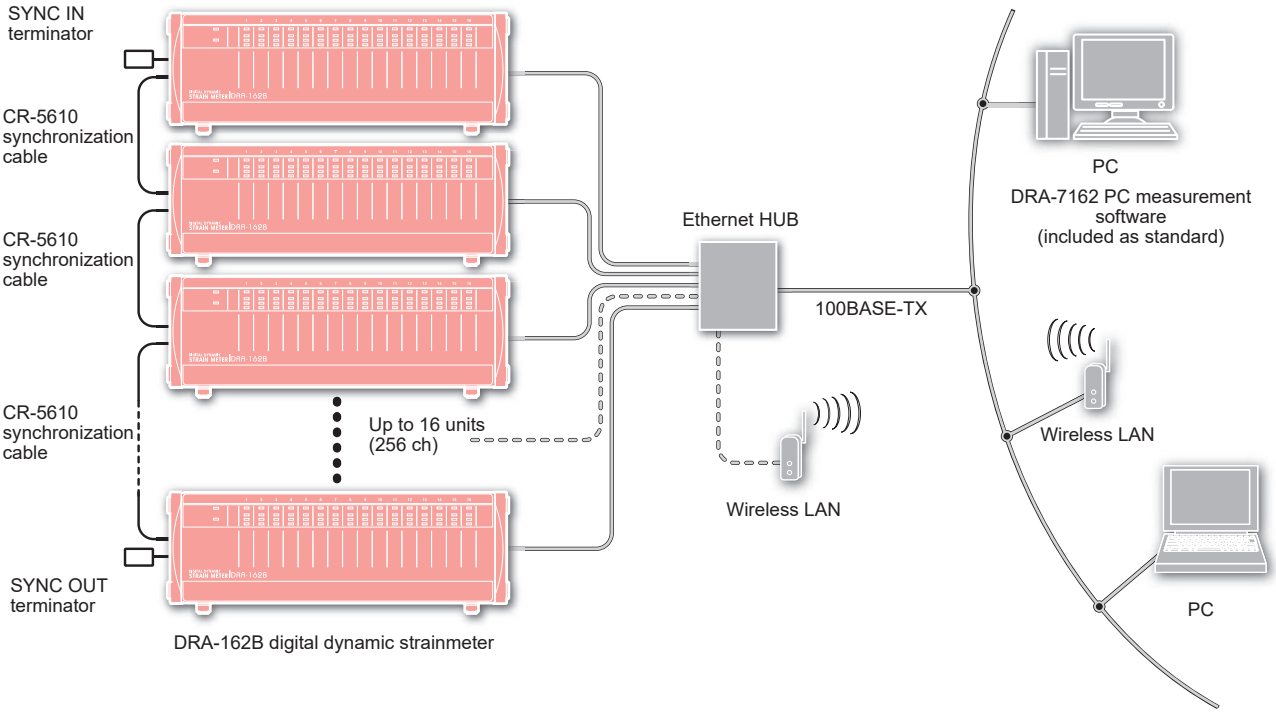


DRA-162B digital dynamic strainmeter



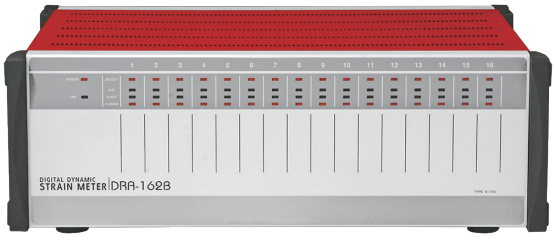
The DRA-162B is a highly reliable 16-channel carrier type dynamic strainmeter. Each channel has 256 k words of memory, and the data is always backed up. The sensor signal input to this equipment is internally amplified and filtered, then A/D converted, and sent to a PC. In addition, an analog voltage can be output at the same time for external devices. All operations of this equipment, such as amplification degree, filter frequency, and balance, can be performed from a PC.

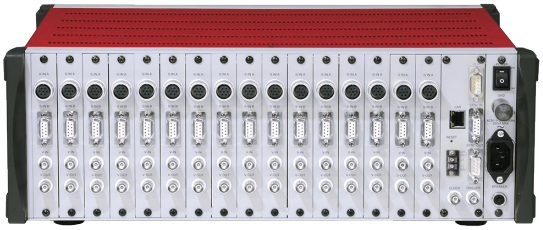
Synchronized measurement of up to 16 units (256 channels) connected is possible.



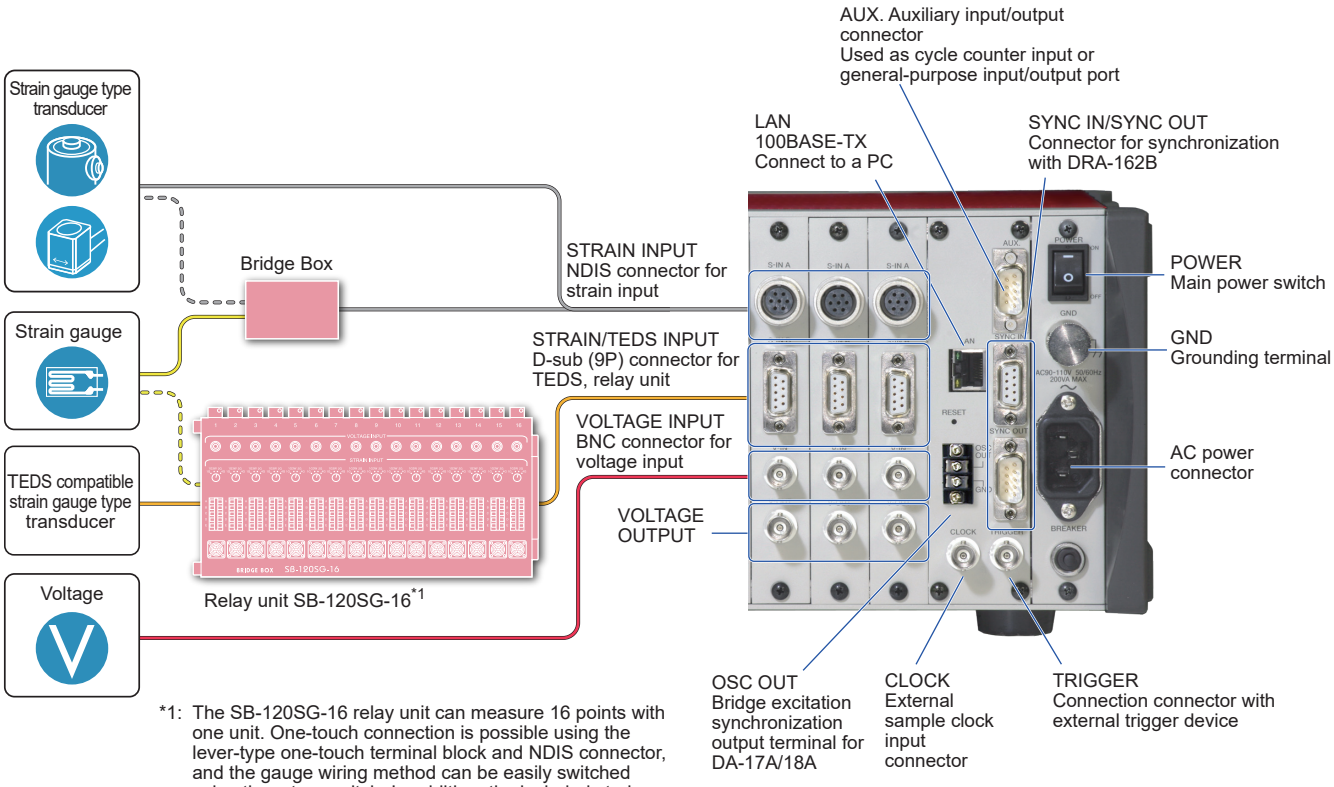
DRA-162B digital dynamic strainmeter

DRA-162B





System Block Diagram



*1: The SB-120SG-16 relay unit can measure 16 points with one unit. One-touch connection is possible using the lever-type one-touch terminal block and NDIS connector, and the gauge wiring method can be easily switched using the rotary switch. In addition, the included strain relay cable has remote sensing and TEDS sensor compatibility functions (made-to-order product).

Specifications

Number of measuring points	16 points (1 to 16 points can be selected at the time of order)
Input connector	NDIS, Dsub (9P) * NDIS does not support TEDS; only remote sensing is supported.
Applicable sensor	Strain gauge (120 to 350 Ω), strain gauge type transducer
Strain measurement	
Measurement range	± 32000 × 10^{-6} strain
Bridge excitation	0.5, 2 Vrms (5 kHz)
Balancing range	Resistance : ±10000 × 10^{-6} strain Capacity : 5000 pF
Balancing method	Pure electronic automatic
Balancing accuracy	± 2 × 10^{-6} strain
Stability	Zero point: ± 0.1×10^{-6} strain/°C ± 0.5×10^{-6} strain/8 H Sensitivity: ± 0.05%/°C ± 0.2% /8 H
Remote sense	Sensitivity decrease 0.5% or less (gauge resistance: 120 Ω) 1.0% or less (gauge resistance: 350 Ω) When extended to 100 m (when using 0.5 mm2 extension cable)
Response frequency range	DC to 2.5 kHz (−3 dB ± 1 dB)
Voltage measurement	
Input format	Single end type (unbalanced)
Input impedance	100 kΩ
Measurement range	±32 V
Stability	Zero point: ± 0.1 mV/°C 0.5 mV/8 H Sensitivity: ± 0.05%/°C ± 0.2%/8 H
Response frequency range	DC to 5 kHz (-3 dB ± 1 dB)
Low-pass filter	
Cutoff frequency	10, 30, 100, 300, 1 kHz (-3 dB ± 1 dB)
Cutoff property	Butterworth type
Slope	-12 dB ± 1 dB/oct
TEDS function	IEEE 1451.4 Class 2 Multiwire interface
A/D converter	
A/D conversion method	Successive approximation
Resolution	16-bit
Measurement accuracy	± (0.5% rdg + 3 digits)
Sampling format	All points simultaneous sample hold
Sampling clock	Internal Low speed--- 1 to 32,767 ms (can be set in 1 ms increments) High speed---------- 0.1 to 0.9 ms (can be set in 0.1 ms increments) External Low speed--- 1 ms or more High speed -- 0.1 ms or more
Trigger function	Data trigger, command trigger, external contact trigger
Analog output	
Output connector	BNC
Maximum output	±10 V FS (5 kΩ load)
Sensitivity regulator **At the time of strain input** **At the time of voltage input**	100, 200, 500, 1000, 2000, 5000 × 10^{-6} strain/V 0.1, 0.2, 0.5, 1.0, 2.0, 5.0 V/V
Calibration output	
Strain	Range: ± (100 to 10000 × 10^{-6} strain) Accuracy: ± (0.5% +1 × 10^{-6} strain)
Voltage	Range: ± (100 to 10000 mV) Accuracy: ± (0.5% + 1 mV)
Nonlinearity	± 0.1% FS or less
S/N ratio	56 dBp-p or more (Range: 200 x 10^{-6} strain/V)
Stability	Zero point: ± 0.5 mV/°C ± 4 mV/8 H Sensitivity: ± 0.05%/°C ± 0.2%/8 H
Check function	ROM, RAM, insulation, direct value, initial-in value, amplifier sensitivity, input open, input over
Data processing function	Averaging Maximum, minimum, and average values (processing after recording, at output)
Data memory	The number of memory words per channel varies depending on the number of implemented channels.

Number of implemented channels	Number of memory words
1	4,194,304
2	2,097,152
3, 4	1,048,576
5, 6, 7, 8	524,288
9, 10	419,430
11, 12, 13, 14, 15, 16	262,144

The number of pre-trigger data can be set arbitrarily.
Retention time when power is OFF: 72 hours (when fully charged)

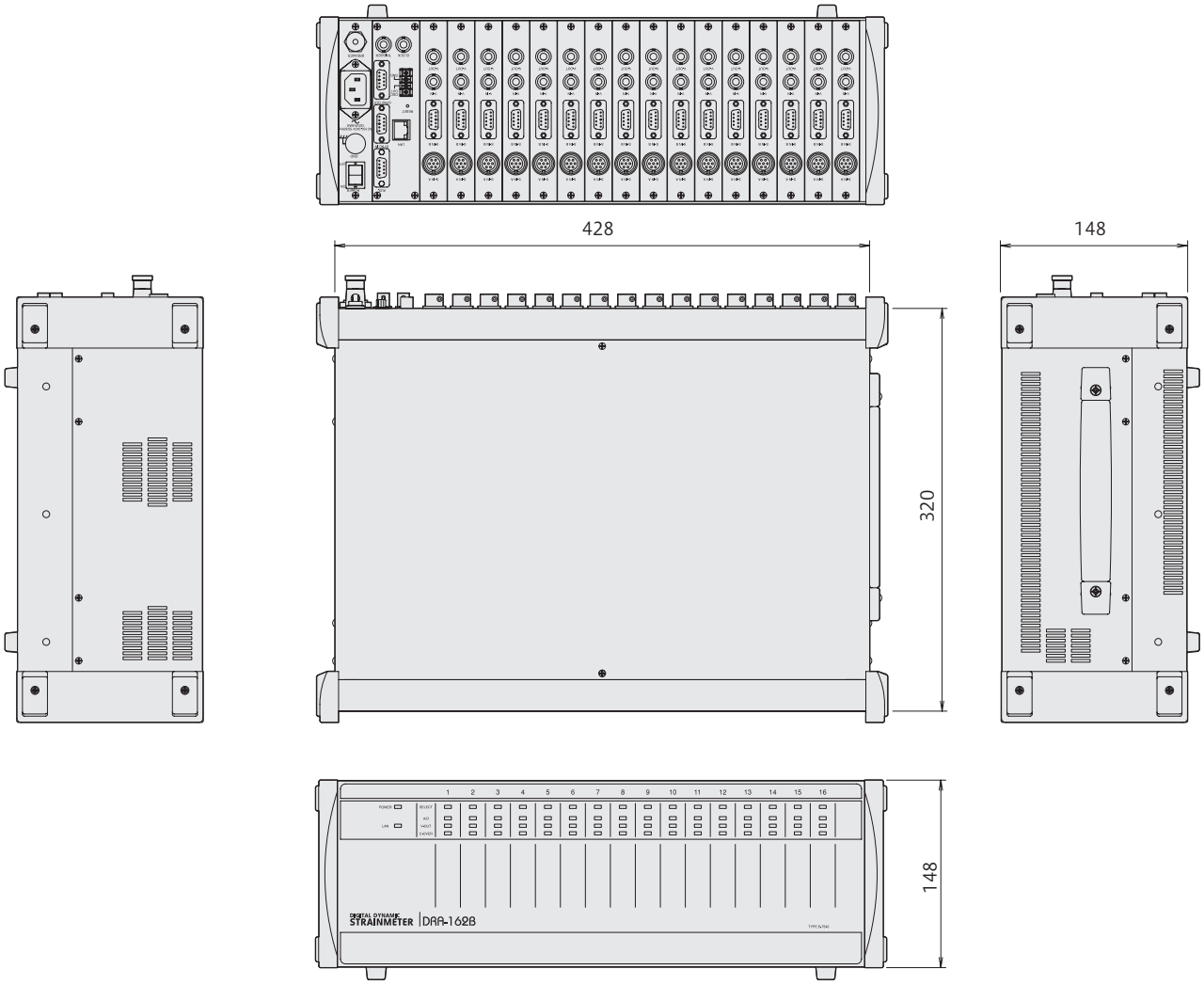
Interface	LAN (100BASE−TX) Recorded binary data transfer speed: About 500 k word/second
Trigger input	Negative logic Contact input possible
External sampling clock input	
Input	Negative logic (edge detection) Input frequency: 10 kHz or less
Sampling error	10 µs or less
Alarm output	Upper limit, lower limit (Negative logic)
Auxiliary input/output (compatible with cycle counter)	
Input part	Number of input points Two points Count Max. measurement frequency -- 1 kHz Max. number of counts ---------- 4,294,967,295
Output part	Number of output points Four points
Synchronization input/output	Number of connectable units: Up to 16 units
External synchronization output	100 units of DA-16A/17A/18A can be connected
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
AC power supply	
Rated voltage **Allowable voltage** **Maximum power consumption**	AC 100 to 240 V 50/60 Hz AC 90 to 264 V 50/60 Hz 130 VA max
Outside dimension	About 428 (W) x 148 (H) x 320 (D) mm (Excluding protrusions)
Mass	Approx. 11 kg

Standard accessories

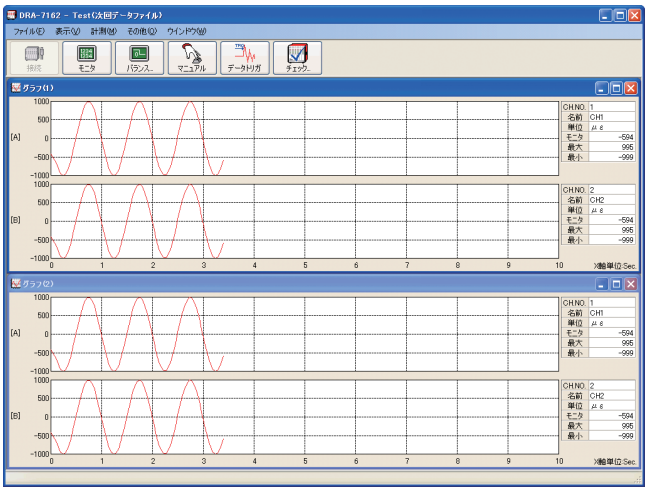
- Instruction Manual (CD-ROM) 1
- AC power cable (CR-03) 1
- SYNC IN terminator 1
- SYNC OUT terminator 1
- DRA-7162 measurement software (CD-ROM) 1
- Vinyl cover 1
- Warranty certificate 1

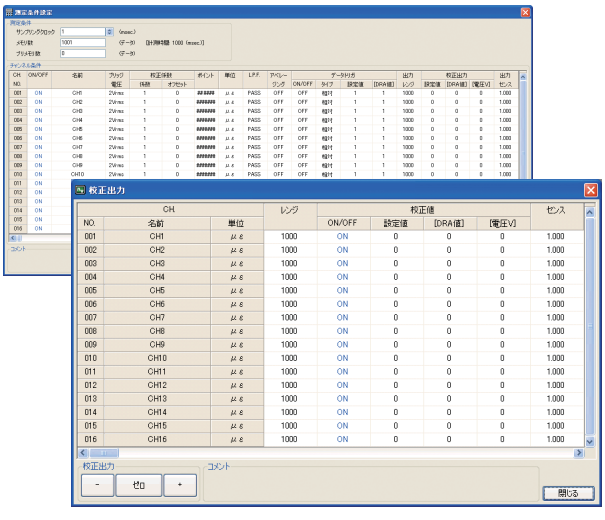
DRA-162B

External Dimensions



DRA-7162 measurement software display examples





DC-204R / DC-204Ra (Ultraminiature)

- Miniature size of 84 (W) x 42 (H) x 157 (D) for four channels.
- 200 kHz sampling (at the fastest in the one channel mode).
- Four-channel simultaneous sampling at 50 kHz.
- Large strain measurement up to ±80000 μ strain is possible (when using a 0.5 V carrier).
- Synchronized connection of eight units is possible with simultaneous sampling of up to 32 channels.
- Supports CF card with up to 2 GB and can store a large amount of data.
- Measurement data is compatible with the DADiSP format.
- External start/stop and external triggers are available.
- Equipped with a sensor open check function.
- Equipped with a USB interface and control software included as standard.

DC-204R smart dynamic strain recorder

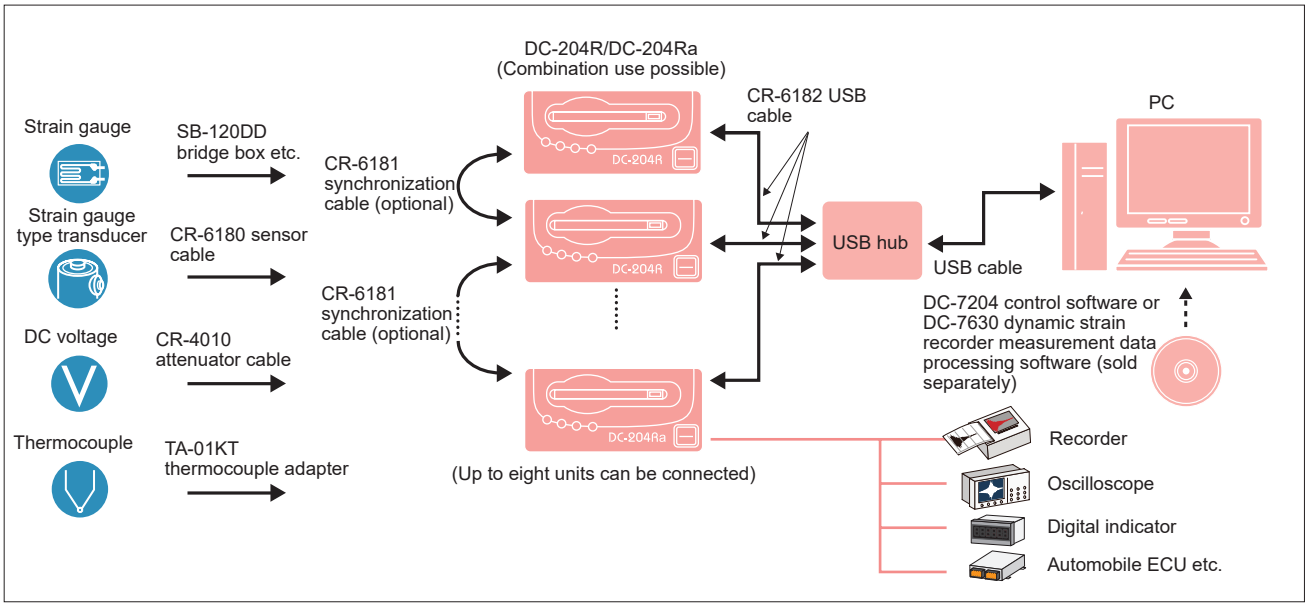


DC-204Ra smart dynamic strain recorder (with analog output)



This equipment is a high-speed, compact, four-channel dynamic strain recorder of a CF card recording type. High-speed sampling of 200 kHz is possible in the one-channel mode, and by synchronously connecting eight units, simultaneous sampling of up to 32 channels is possible.
This equipment is connected to a PC via a USB interface and controlled using the standard included software.
Measurements can be performed using the START/STOP button on the front panel. It is also possible to start measurements by trigger setting and to control using an external trigger and external start/stop signals.
Measurement data is saved in DADiSP format on a CF card. This data can be processed using DADiSP compatible software or the standard included software. In addition, by performing the CSV conversion using the standard included software, the data can be processed using spreadsheet software, such as Excel.

System Block Diagram



DC-204R / DC-204Ra (Ultraminiature)

Specifications

Measurement part	
Number of measuring points	4 points
Input	Strain, voltage (using option CR-4010)
Strain measurement	
Applicable gauge resistance	120 to 1000 Ω (4 G bridge)
Bridge excitation	DC 2 V, DC 0.5 V, ON/OFF control
Measurement range	Five ranges of 1000, 2000, 5000, 10000, 20000 x 10^{-6} strain (when using 2 V bridge excitation)
Measurement range	± 20000 × 10^{-6} strain (when using 2 V bridge excitation) ± 80000 × 10^{-6} strain equivalent (when using 0.5V bridge excitation)
Measurement accuracy	± 0.2% FS
Voltage measurement (when using option CR-4010)	
Measurement range	Five ranges of 1 V, 2 V, 5 V, 10 V, and 20 V
Measurement range	± 20 V
Measurement accuracy	± 0.3% FS (when using CR-4010)
Low-pass filter	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz (Bessel filter)
Response frequency range	DC to 10 kHz (−3 dB ± 1 dB)
Temperature coefficient	Zero stability: ±1 x 10^{-6} strain/°C (at max. sensitivity) Sensitivity stability: ± 0.01%/°C (at max. sensitivity)
Balancing method	Electronic
Balancing range	± 10000 × 10^{-6} strain
Balancing accuracy	± 0.06% FS
Balancing time	About 1 sec/CH
A/D conversion	16-Bit (Successive approximation type)
Resolution	1000 x 10^{-6} strain range 1 or 0.1 x 10^{-6} strain 2000 x 10^{-6} strain range 1 or 0.1 x 10^{-6} strain 5000 x 10^{-6} strain range 1 x 10^{-6} strain 10000 x 10^{-6} strain range 1 x 10^{-6} strain 20000 x 1^{-6} strain range 1 x 10^{-6} strain
Sampling method	Simultaneous sampling
Sampling speed	One-channel mode fastest 5 µs (200 kHz) Two-channel mode fastest 10 µs (100 kHz) Four-channel mode fastest 20 µs (50 kHz)
Measurement function	
Start	Possible from front panel key, external signal, and PC
Stop	Possible from front panel key, external signal, and PC
Manual trigger	Possible from front external signal and PC
Balance/open check	Possible from front panel key and PC
Synchronized measurement	Simultaneous sampling of up to eight units or 32 channels * By matching the settings, synchronized measurements with the DC-104R/-104Ra are possible.
Display function	
LED	Power status, synchronization status, USB communication status, and measurement status are indicated.
Setting part	
Setting method	Setting via USB communication (dedicated software)
Channel setting	One-, two- and four-channel mode
Trigger setting	
Trigger mode	SINGLE, CONTINUE, and FREE RUN
Trigger level	± (0% to 100%) of full scale in 0.1% increments
Slope	UP, DOWN

Recording part	
Recording media	CF card Up to 2 GB (Designated by us)
Recording format	DADiSP compliant
Recording speed (Sampling interval)	5 µs*1, 10 µs*2, 20 µs, 50 µs, 100 µs, 200 µs, 500 µs, 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1s *1 When one channel is used only. *2 When one or two channels are used only. Other speed can be used up to four channels.
Recording size	1 k, 2 k, 4 k, 8 k, 16 k, 32 k, 64 k, 128 k, 256 k, 512 k, 1 M, 2 M, 3 M, 4 M, 6 M, 8 M, 12 M, 16 M, 24 M, 32 M, 48 M, 60 M, 120 M*1, 240 M*2 data *1 When one or two channels are used only. *2 When one channel is used only. Other speeds can be used for up to four channels. * When sampling at high speed, the recording size is 64 K or more.
Pre-area	Can be set from 0% to 100% in 10% increments (up to 256 k [one channel])
Number of files created	Up to 255 files
Analog output part [DC-204Ra only]	
Output level	± 5 V (5 kΩ load) ±1 mA
Voltage output accuracy	± 0.3% FS
Voltage output balancing accuracy	Within ± 5 mV (at 5000 × 10^{-6} strain range)
Zero stability	± 2 mV/°C (at max. sensitivity)
Calibration output	±1 V (superimposed on input value)
Low-pass filter	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz (Bessel filter)
S/N ratio	DC - 100 Hz 53 dB or more DC - 1 kHz 46 dB or more DC - 10 kHz 38 dB or more (All in the ±1000 × 10^{-6} strain range)
Basic part	
Power supply Rated voltage Maximum consumption current	DC10 to DC16V DC-204R MAX0.4A DC-204Ra MAX0.4A
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Vibration tolerance	49 m/s^2 (5-55 Hz, three directions)
Outside dimension	84 (W) × 42 (H) × 157 (D) mm (Excluding protrusions)
Mass	500g

Standard accessories

Instruction manual (included in CD-ROM)	1
Warranty certificate	1
Power cable (CR-1310)	1
Sensor input cable CR-6180	4
USB power cable CR-6182	1
CF card (high-speed type) 512 MB	1
Control software CD-ROM DC-7204v2	1
CR-3610 output cable *[DC-204Ra only]	1

Options

AC Adapter (CR-1868)
AC Adapter [For China] (CR-1868-C)

CF card
Use one of the card products designated by us.
Up to 2 GB capacity is supported.

Status LED
Indicates each operating status.
MES / During measurement
USB / Communication status via USB cable
SYNC / Synchronized status with two or more recorders connected
PWR / Powered ON status
In the balance mode, each LED flashes.



START/STOP
Start and stop of measurement

Balanced state
Press and hold the above button for 3 seconds or longer to put the recorder into the balance mode.

DC-204R

USB interface
Connect the USB cable (CR-6182). The measurement setup and data are transferred to a PC.

Control part

Power supply part
This equipment is powered by DC power supply. Connect the battery and this equipment with the power cable (CR-1310). An AC power supply can also be used with the separately sold AC adapter set CR-1866.



Input channels
Connect strain gauges / various strain gauge type transducers with a sensor input conversion cable (CR-6180). The voltage input attenuator cable (CR-4010, optional) and TA-01KT thermocouple adapter (optional) can also be connected.

DC-204Ra

Control part
Synchronization is performed when two or more units are connected. The synchronization cable (CR-6181) is required separately.

USB interface



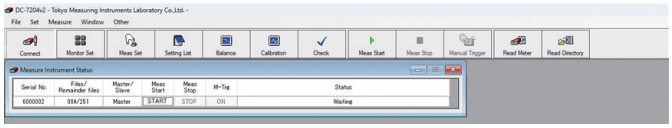
Power supply part

Analog output [DC-204Ra only]
This is the analog output installed on DC-204Ra. By connecting the included analog output cable (CR-3610), raw waveforms can be output to an external recorder.

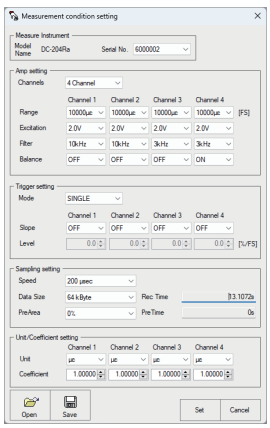
Measurement software

DC-7204v2 controller (included as standard)

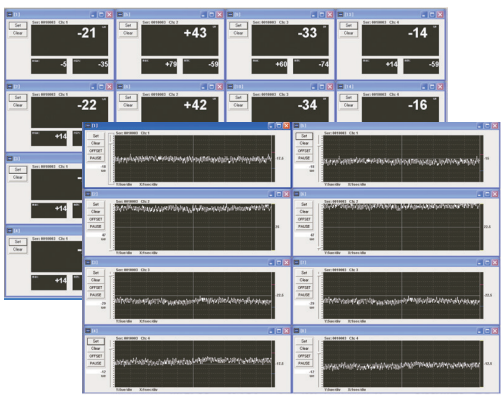
Tool bar



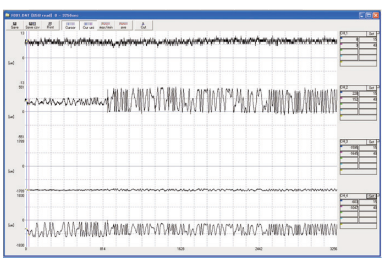
Setting up of measurement conditions



Monitoring

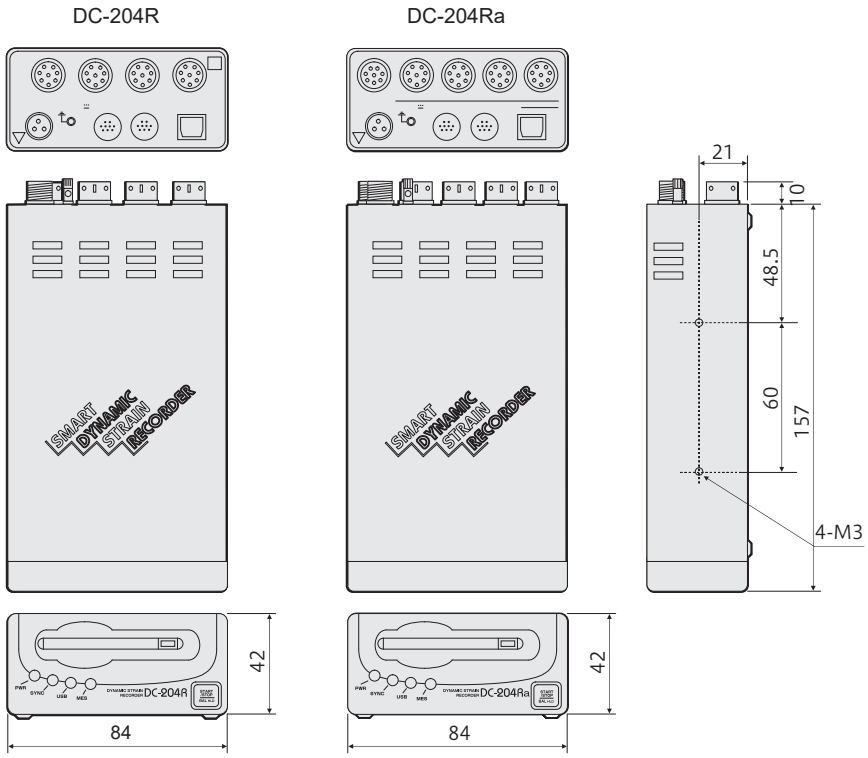


Data processing



DC-204R/DC-204Ra (Ultraminiature)

External Dimensions



Back Port Functions

Control part

Connection of up to 32 CH/ 8 units

When connecting two or more units of the DC-204R/DC-204Ra, simultaneous sampling is possible using the CR-6181 synchronization cable (optional). At this time, power must be supplied to all recorders.

CR-6181 synchronization cable



External start/stop, external trigger

Connect the inputs, such as the external start/external stop of an external control signal and external trigger to CONTROL IN. Configure a switch using the CR-6183 external control cable (optional).

Power supply part

DC power supply

DC power DC 10 to 16 V

Use the included CR-1310 cable.



Battery powered

This recorder can be powered by battery when combined with the BA-104 battery pack (optional).

AC power supply

Power can also be supplied from an AC power source using the CR-1866 AC adapter set (optional).

USB interface part

The DC-204R/DC-204Ra is connected to a PC using the CR-6182 USB cable included with the recorder main unit.



Analog output part [DC-204Ra only]



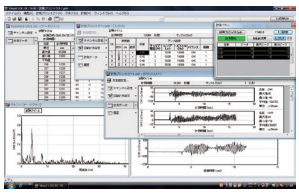
The DC-204Ra has an analog output part and a voltage output of 0 to ± 5 V can be obtained by connecting the included CR-3610 output cable. The output connector is a four-channel centralized connector and can output voltages for four channels from one output cable to an external recorder.

Related Products

Measurement software Visual LOG

●DC-7630 dynamic strain recorder measurement / data processing software

This software performs online/offline automatic measurements in addition to calculation expansion channels. It is equipped with a measurement data extraction function and thinning function. It is also possible to display a real-time graph during sampling.



●WF-7630 waveform display software

This is software to display measurement data in the DADiSP format as a list or waveform. This software can combine, cutout, thin, and conversion of data files to CSV, as well as perform calculations of maximum / minimum values, FFT analysis and expansion channels, and draw graphs (X-Y, T-Y, spectrum). With the frequency processing compatible version WF-7630-H, it is possible to set frequency analysis conditions and perform frequency analysis of waveform data.

●DFA-7610 FFT analysis processing software

In addition to the standard included software DC-7204 v2, the separately sold software DC-7630 performs FFT analysis and frequency analysis of recorded data files.

CF card

High-speed sampling compatible CF cards 128 MB to 2 GB (sold by us)

CA-10A carrying case

This is an aluminum carrying case that enhances mobility and portability.
It is used to store the recorder, bridge boxes, cables, etc.
Size: 390 (W) X 310 (D) X 110 (H) mm



CR-1866 AC adapter set

This equipment is connected to AC 100 V to supply the power.

BA-104 battery pack

It is possible to power by battery in combination with the BA-104 battery pack.

10 AA size dry-cell batteries are used
About 5 hours of measurement possible with nickel-metal hydride batteries (20°C)
About 3 hours of measurement possible with alkaline dry-cell batteries (20°C)

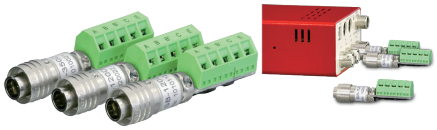


SB-120DD/-350DD bridge box

These are bridge boxes (optional) dedicated for the DC-204R/DC-204Ra recorder.

SB-120DD-1R	One-gauge method three-wire type	: 120 Ω
	Two-gauge method	: 120 Ω/350 Ω
SB-350DD-1R	One-gauge method three-wire type	: 350 Ω
	Two-gauge method	: 120 Ω/350 Ω
SB-120DD-4R	Four-gauge method	: 120-1000 Ω

In addition, the CR-6185 remote sense cable (optional) is also available to compensate for the sensitivity decrease because of the connection of an extension cable.



TA-01KT thermocouple adapter

This is an adapter that enables temperature measurement using the type T/type K thermocouples. No external power supply is required, and the connection is made via the CR-6180 sensor input conversion cable included with this equipment.



CR-4010 attenuator cable

This cable is used to perform voltage measurements. The measurement range of voltage signal is ± 20 V. The voltage signal is attenuated to 1/1000 and input to this equipment.



CR-6180 sensor input conversion cable

This cable is used when connecting a strain gauge transducer with NDIS connector (load cell, displacement meter, pressure meter, accelerometer, etc.). (Included as standard)



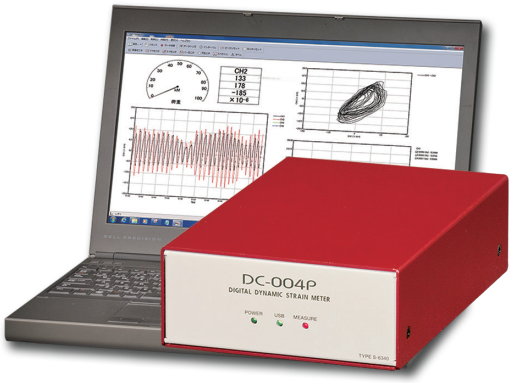
CR-6181 synchronization cable

This cable enables simultaneous sampling by connecting two or more units of DC-204/DC-104 series.

DC-004P (PC control type)

Direct writing of data to a PC's storage
Easy-to-use control software

- Manual, data trigger, and interval measurements can be performed simultaneously.
- 50 kHz sampling (at the fastest in the one channel mode).
- Four-channel simultaneous sampling (12.5 kHz).
- Capable of measuring large strain equivalent to ±80000 × 10^{-6} (when using 0.5 V bridge excitation).
- Long time recording by direct writing to the PC side.
- Powered by USB bus power.
- Available in four-channel type and two-channel type.
- Measurement data is compatible with the DADiSP format.
- TEDS compatible.
- Control software is included as standard (DC-7004P).

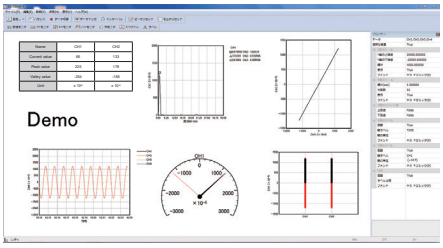


DC-004P PC control type dynamic strainmeter

This is a dynamic strainmeter that does not have recording media and records measurement data sequentially to a PC via USB connection. Since continuous recording is possible, it is ideal for measurements such as material testing.
It supports high-speed sampling and consists of two software programs to perform simple measurement operations.

DC-7004P-T measurement software

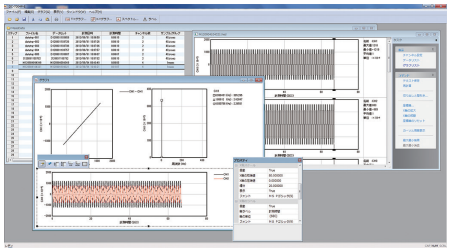
DC-7004P-T is software dedicated for measurements that controls the DC-004P PC control type dynamic strainmeter to monitor and record the measurement values.



- Manual, data trigger, and interval measurements can be performed simultaneously.
- Calculations using the four arithmetic operations, trigonometric functions and special calculation functions are possible.
- Numerical monitor, T-Y monitor, X-Y monitor, bar monitor, spectrum, circle monitor, label, OLE object

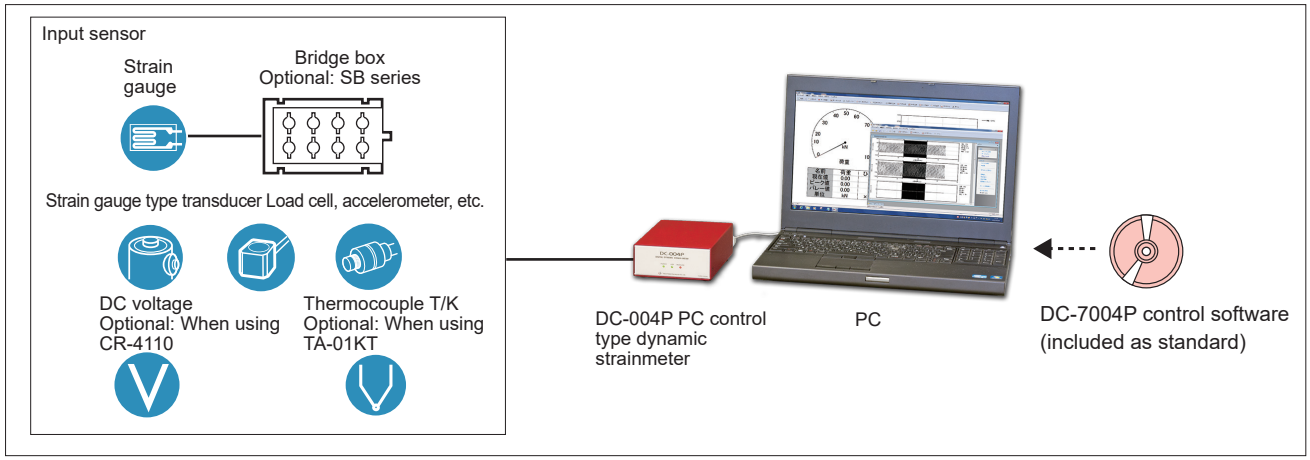
DC-7004P-E data editing software

DC-7004P-E checks the measurement data recorded by DC-7004P-T and performs data processing, such as text conversion.



- Data file management
- Data file editing
- Graph display function

System Block Diagram

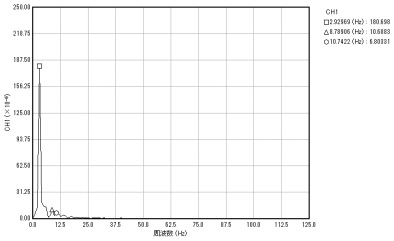


Screen display examples

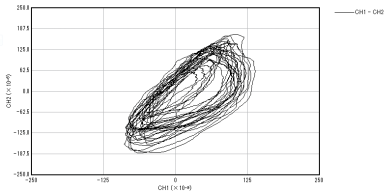
Numerical monitor

Name	CH1	CH2
Current value	66	133
Peak value	225	178
Valley value	-254	-185
Unit	x 10^{-6}	x 10^{-6}

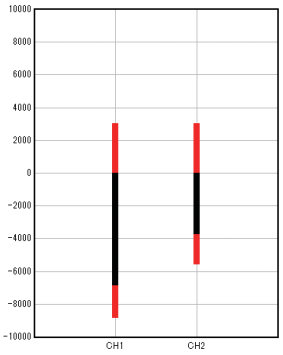
Spectrum



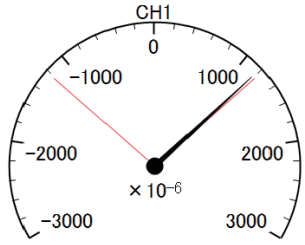
X-Y monitor



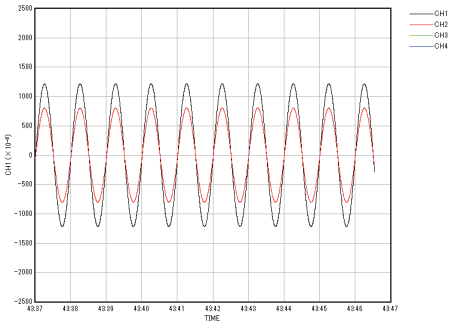
BAR monitor



Circle monitor



T-Y monitor

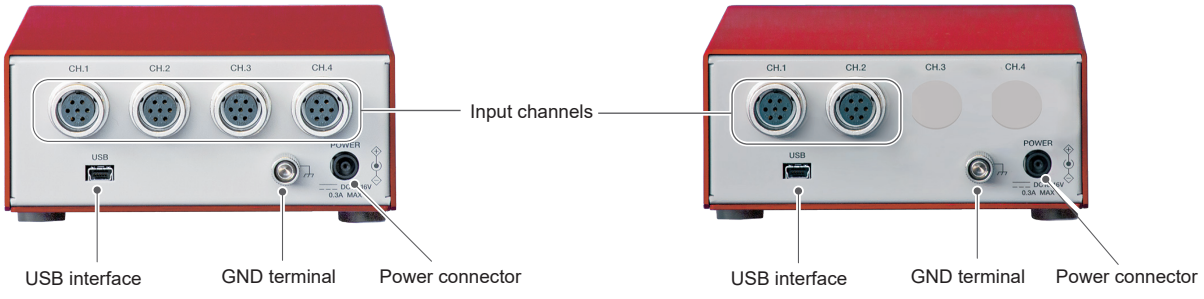


Function



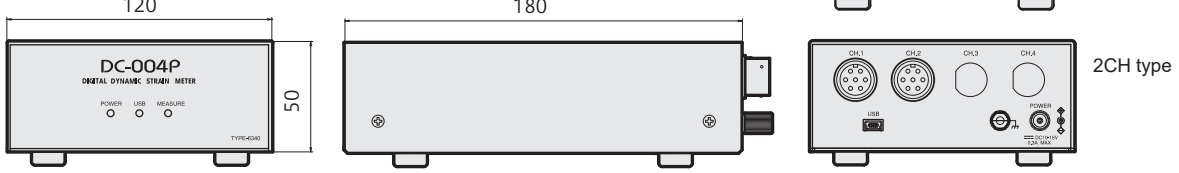
Four-channel type DC-004P

Status LED	Each operating state is displayed by the LEDs.
POWER	Lights up in green when the powered is turned ON.
USB	When the USB cable is connected: Lights up in green During USB communication: Blinking in green
MEASURE	During measurement: Lights up in red



Input channel	Connection of various sensors (four-channel type and two-channel type)
USB interface	Connection to a PC using the included USB cable
GND terminal	Frame grounding terminal
Power connector	Connection of the AC adapter (optional)

External Dimensions



DC-004P (PC control type)

Specifications / DC-004P PC control type dynamic strainmeter

Number of measuring points	4 points (4-channel type), 2 points (2-channel type)
Input	Strain Voltage *Optional CR-4110 (1/1000 attenuator cable) required
Strain measurement	
Applicable gauge resistance	120 Ω, 350 Ω (4 G bridge)
Bridge excitation	DC 2 V, DC 0.5V
Measurement range	± 20000 × 10^{-6} strain (1 range) (When using 2 V bridge excitation)
Measurement range	± 20000 × 10^{-6} strain (when using 2 V bridge excitation) ± 80000 × 10^{-6} strain (when using 0.5 V bridge excitation)
Measurement accuracy	± 0.3% FS
Voltage measurement	*Optional: When CR-4110 (1/1000 attenuator cable) is used
Measurement range	± 20 V (1 range)
Measurement range	± 20 V
Measurement accuracy	± 0.3% FS
Response frequency	DC to 2 kHz
Temperature coefficient	Zero point: ± 0.5 × 10^{-6} strain/°C Sensitivity: ± 0.05% FS/°C
Balancing method	Digital calculation method
Balancing range	± 10000 × 10^{-6} strain (at bridge excitation DC 2 V)
Low-pass filter	Analog filter: 2 kHz, -3 dB ± 1 dB Digital filter: 1 Hz to 1 kHz (Can be set in 1 Hz increments)
High-pass filter	Cutoff frequency 0.6 Hz
A/D conversion	24-bit
Sampling method	Simultaneous sampling
Display function	LED power status, communication status
Interface	USB 2.0
Function	TEDS compatible
Setting function (Setting via USB communication)	Channel mode: One, two, and four channels LPF setting: 0 to 1 kHz (0 is Pass) HPF setting: ON/OFF Bridge power setting: 0.5/2.0 V Balance setting: ON/OFF
Recording speed (Sampling interval)	20 µs*1, 40 µs*2, 50 µs*2, 80 µs, 100 µs, 200 µs, 500 µs, 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1s *1 Only for one-channel measurement *2 Only for one- or two- channel measurement Other speeds can be used up to four channels.
Power supply Rated voltage Maximum consumption current	DC 10 to 16 V 0.3 A max (when powered from the DC jack) * Can be powered from USB bus power
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Outside dimension	120 (W) × 50 (H) × 180 (D) mm (Excluding protrusions)
Mass	Four-channel type: About 600 g Two-channel type: About 500 g

Standard accessories

DC-7004P Control software CD-ROM 1
CR-6187 USB cable (miniB-A) 1
Warranty certificate 1

Specifications/ DC-7004P-T measurement software/ DC-7004P-E data editing software

System	
Compatible measuring instruments	DC-004P PC control type dynamic strainmeter x 1
OS	Windows 7/8/8.1/10/11
Computer	CA model with 2 or more CPUs (Core Duo equivalent or better Clock speed: 600 MHz or more)
Disk capacity	5 GB or more of free space * A warning is displayed when the free space falls below 5 GB.
Monitor resolution	1,024 x 768 pixels or more
Interface	USB 2.0
DC-7004P-T measurement software	
Measurement conditions	
Number of measuring points	1 to 4 points (When measuring 3 points, measure 4 points and record 3 points.)
Sampling	According to the measuring instrument
Recording time	Select with or without recording time specifications. For measurement time specification, specify the number of data sets per channel in the range from 1 to 1 G (1,073,741,824). When not specified, it depends on the capacity of the recording media (hard disk).
Channel conditions	Name, bridge voltage, low-pass filter, high-pass filter, balance coefficient, rated output, capacity, offset, unit, format, upper limit, lower limit
Data reading from sensor	Settings of TEDS information reading from sensor, coefficient, and unit
Expansion Channel	Number of points (up to 10 points), name, function, unit, format, upper limit, lower limit
Version upgrade of measuring instrument	Upgrade the firmware version of measuring instrument
Measurement method	al measurement, data trigger measurement and interval measurement These three types of measurements can be performed simultaneously.
Data file	DADiSP format
Monitor	The measurement value is always displayed while the measuring instrument is connected. * When sampling is slower than 1 ms, the value measured at 1 ms sampling is displayed.
Monitor display items	Numerical monitor, T-Y monitor, X-Y monitor, bar monitor, spectrum, circle monitor, label, OLE object
DC-7004P-E data editing software	
Data file management	List display of all data files in the folder in which the data files are recorded
Management items	Display of files, change of file names, move of files, combining of files, text conversion (save format, splitting, thinning)
Data file processing	Channel setting, expansion channel: up to 10 points (name, function, unit, format), data list, graph list, max/min search, cutout (thinning), text conversion (save format, splitting, thinning, range specification, cursor display), print
Graph display	Displays a graph of any channel selected from the data file in a window. Multiple graphs can be added in one window.
Graph display items	T-Y graph, X-Y graph, spectrum, label, OLE object
Edit items	Save, save text, graph copy, image save (bitmap, enhanced metafile, PNG), print

Related Products

CR-1869 AC adapter	Power supply to DC jack
CR-4110 attenuator cable	Used for voltage measurement
TA-01KT thermocouple adapter	Temperature measurement adapter for type T/ type K thermocouples
Bridge box SB series	For the one-gauge method connection of strain gauge
DC-7972 concrete static elastic modulus test software	Static elastic modulus test for concrete

Options

AC Adapter (CR-1869)
AC Adapter [For China] (CR-1869-C)
DC Power Cable (CR-062)

DH-14A (Handheld)

Mobile dynamic measurements

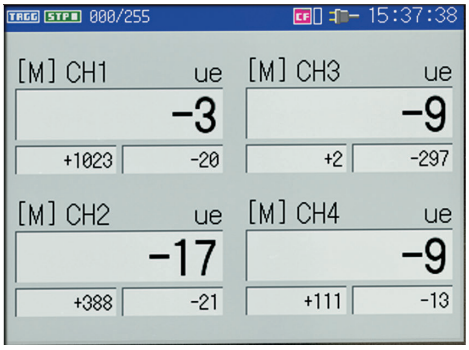
- Four-channel handheld dynamic strainmeter
- four-channel simultaneous sampling
- Sampling speed: up to 50 µsec (20 kHz)
- (One-channel mode)
- Measurements of strains, strain gauge type converters, DC voltages, thermocouples
- Continuous use time up to 6 hours with 4 AA size dry-cell batteries
- Clear numerical and waveform monitor (color LCD display)
- Shoulder bag suitable for handheld use is included as standard.

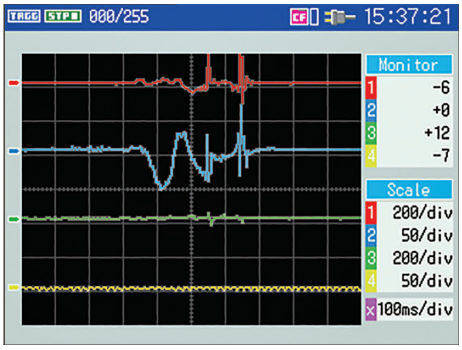


DH-14A handheld dynamic strainmeter

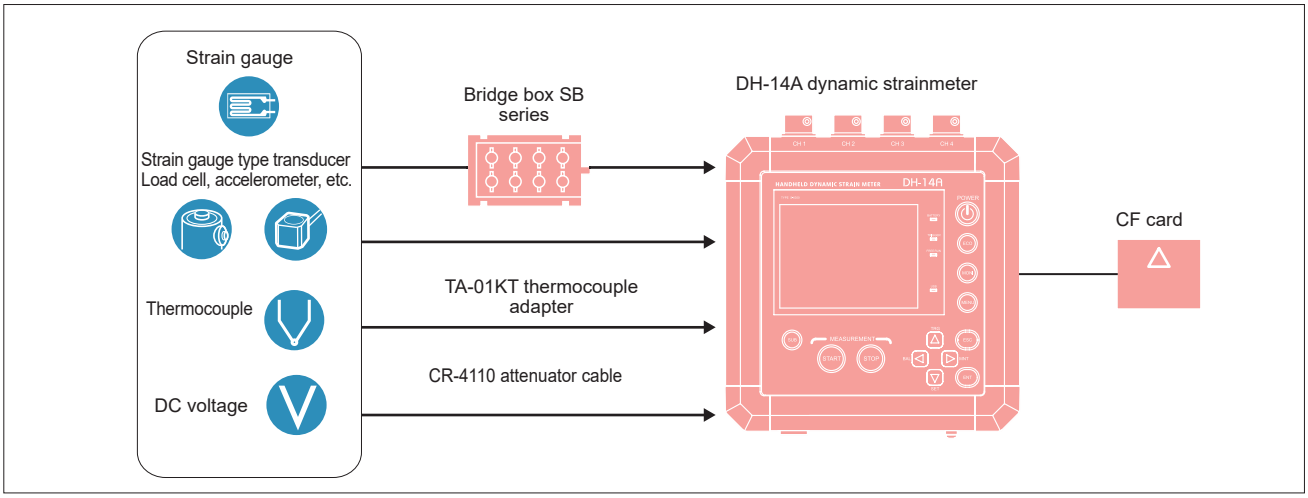


DH-14A is a battery powered handheld dynamic strainmeter. This equipment has four measurement channels and measurement modes, such as trigger measurement and free-run measurement, and is capable of easy dynamic strain measurements while monitoring the numerical value and waveform. It can be utilized in various measurement scenes, such as fieldwork, measurement of moving objects, and as a checker to check the sensors and noise. Four AA size dry-cell batteries allow for continuous measurement for 4 hours (up to 6 hours in power saving mode).





System Block Diagram



DH-14A (Handheld)

Applications

Measurements in combination with the strain checker FGMH series

By combining the DH-14A handheld dynamic strainmeter with the strain checker FGMH series, dynamic strains occurring in steel materials, such as bridges, can be easily measured while moving. The strain checker FGMH series measures a strain by the friction generated at the boundary surface by pressing the sensing part against a structure using the attractive force of a magnet.







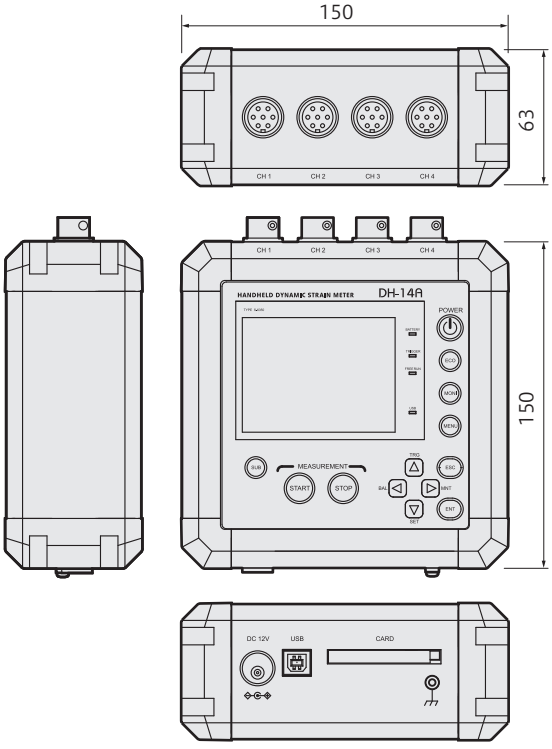
Dynamic strain measurements in various scenes
This equipment can be utilized to measure hydraulic pressure, vibration, and load of moving objects.

Sensor operation check
It is also effective for checking the operation and noise of sensors, such as accelerometers and pressure meters, before testing.

External Dimensions

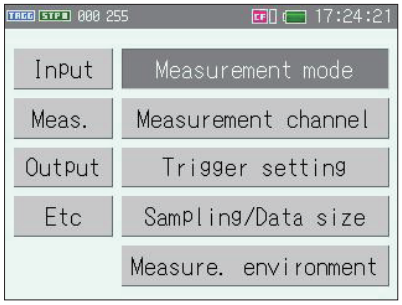




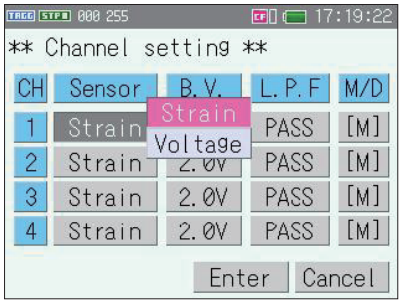


Screen display examples

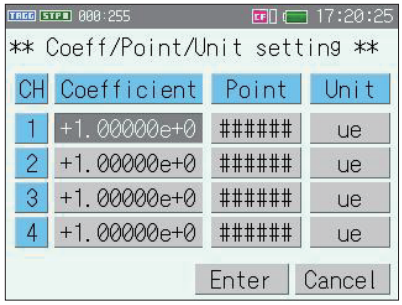
Menu display



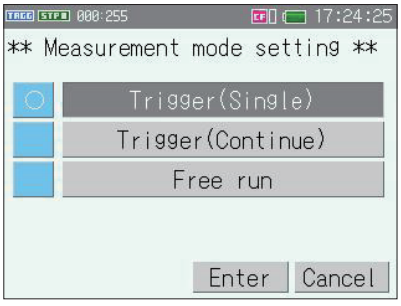
Channel setting



Coefficient decimal point setting



Measuring mode selection



Related Products

CR-1869 AC adapter	Power supply to DC jack
CR-4110 attenuator cable	Used for voltage measurement
TA-01KT thermocouple adapter	Temperature measurement adapter for type T/type K thermocouples
Bridge box SB series	For one-gauge method connection of strain gauge
WF-7630 waveform display software	Measurement data edit

Options

AC Adapter (CR-1869)
AC Adapter [For China] (CR-1869-C)
DC Power Cable (CR-062)

Specifications

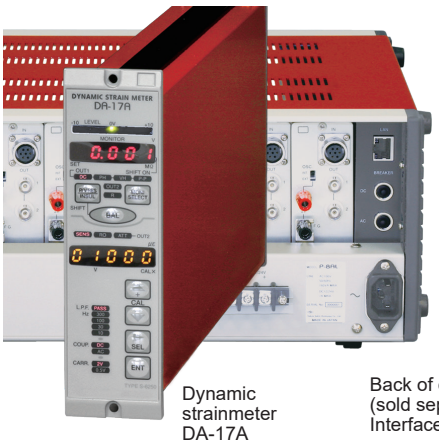
Measurement part	
Number of measuring points	4 points
Input	Strain Voltage (when using the CR-4110 optional attenuator cable)
Strain measurement	
Applicable gauge resistance	120-350 Ω
Bridge excitation	DC 2 V, DC 0.5V
Measurement range	± 20000 × 10^{-6} strain (Bridge excitation DC 2 V) ±80000 × 10^{-6} strain (Bridge excitation DC 0.5 V)
Measurement accuracy	± 0.2% FS
Voltage measurement	(when using the CR-4110 optional attenuator cable, including the error of CR-4110)
Measurement range	± 20 V
Measurement accuracy	± 0.3% FS
Low-pass filter	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz (Bessel filter)
Response frequency	DC to 1 kHz (−3 dB ± 1 dB)
Temperature coefficient	
Zero stability	± 1 × 10^{-6} strain/C°
Sensitivity stability	± 0.01% rdg/C°
Balancing range	± 10000 × 10^{-6} strain
Balancing accuracy	± 3 × 10^{-6} strain or less
Balancing time	About 1 sec
Resolution	Strain: 1 × 10^{-6} strain Voltage: 1 mV
Sampling method	Simultaneous sampling
Sampling speed	One-channel mode fastest 50 µsec (20 kHz) Two-channel mode fastest 100 µsec (10 kHz) Four-channel mode fastest 200 µsec (5 kHz) Maximum 1 sec (Trigger measurement, free-run measurement)
Measurement function	Trigger measurement, free-run measurement, open check
Display function	
Display unit	3.5-inch color LCD display
Resolution	320 x 240 dots
Menu	Various settings, file management, etc.
Value monitor	Display of set channel, monitor value, peak value
Waveform monitor	Display of set channel
Data file	Numerical display, waveform display
LED	Battery level, trigger measurement status, free-run measurement status
Setting part	
Channel setting	Coefficient, decimal point, unit, measure/direct Reading of TEDS sensor
Trigger setting	
Trigger mode	SINGLE, CONTINUE
Trigger level	-full scale to +full scale
Trigger slope	UP, DOWN
Pre-area	Can be set from 0% to 100% in 10% increments (Up to 256 k data [one channel])
Energy-saving setting	ECO mode: 5 levels
Recording part	
Recording media	CF card, 512 MB to 2 GB (Designated by us)
Recording format	DADiSP compliant
Number of files created	Up to 255 files
Basic part	
Power supply	AA size dry-cell battery x 4 AC adapter (optional)
Vibration tolerance	29.4 m/s^2 (50 Hz, 0.6 mmp-p) three directions
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation * When using dry batteries, the operating temperature range of the dry batteries shall not be exceeded.
Outside dimension	150 (W) × 63 (H) × 150 (D) mm (Excluding protrusions)
Mass	Approx. 1 kg

Standard accessories

Instruction Manual..... 1
DH-714 v2 (CSV conversion software) CD-ROM 1
AA size alkaline dry-cell battery 4
Shoulder bag 1
Warranty certificate 1

DA-17A (Carrier type)

- Digital sensitivity setting method
- Electronic automatic balancing
- Input/output isolation
- Automatic tracking type capacity balancing
- Equipped with digital monitor function
- Dual output method
- Built-in low-pass filter
- Equipped with strain bridge insulation check function
- Capable of external control of balance and calibration output
- Dual power supply method of AC and DC



Dynamic strainmeter DA-17A

Back of dedicated case (sold separately) Interface part

This is a carrier type dynamic strainmeter that can be externally controlled via a PC. A digital sensitivity setting method is adopted for sensitivity adjustment to easily perform accurate sensitivity adjustments. In addition, such functions as automatic tracking capacity balancing and digital monitoring of measurement values enable highly reliable dynamic strain measurements. Although this equipment is designed for one channel use when used alone, it can be configured for multichannel use by incorporating it into the dedicated case or rack.

Specifications

Number of measuring points	1 point
Applicable gauge resistance	60–1000 Ω
Gauge factor	2.00
Bridge excitation	2 or 0.5 Vrms (5 kHz)
Balancing method	
Resistance	Electronic automatic (remote control possible) Adjustment time: About 2 seconds Using nonvolatile memory
Capacity	Electronic automatic tracking
Balancing range	
Resistance	± 10000 × 10^{-6} strain
Capacity	5000 pF
Balancing accuracy	± 1 × 10^{-6} strain or less (Bridge excitation 2 Vrms, SENS of 200 x 10^{-6} strain or less)
Rated output (RO)	1 to 10 V can be set in 1 V steps
Sensitivity adjustment (SENS)	For rated output of 1 V, 50 to 5000 × 10^{-6} strain For rated output of 10 V, 500 to 10000 × 10^{-6} strain Both can be set in 1 x 10^{-6} strain steps (Bridge excitation 2 Vrms)
Fine adjustment (ATT)	0 to 1 times (OUT 2 only)
Sensitivity	50 × 10^{-6} strain, at bridge excitation of 2 Vrms
OUT V	1 V (5 kΩ load)
OUT I	12 mA or more (30 Ω load)
Measurement range	± 50000 × 10^{-6} strain (bridge excitation 2 Vrms)
Nonlinearity	± 0.1% FS
Maximum output	
OUT V	±10 V (5 kΩ load)
OUT I	± 20 mA (30 Ω load) or ±10 V (100 kΩ load)
Output shift	-10 to +10 V or OFF (can be set in 1 mV steps)
Calibration output	
Voltage	± (RO, RO/2)
Accuracy	± 0.5% RO
Response frequency range	DC to 2.5 kHz (−3 dB ± 1 dB) (Low pass filter: PASS, with coupling DC)
Low-pass filter	
Cutoff frequency	10, 30, 100, 300 Hz (-3 dB ± 1 dB) and PASS
Cutoff property	Butterworth property −12 dB ± 1 dB/oct (10 Hz to 300 Hz)
High-pass filter	Coupling AC mode
Cutoff frequency	About 0.3 Hz
S/N ratio	For bridge excitation 2 Vrms, maximum output 10 V 60 dBp-p or more (SENS = 100 x 10^{-6} strain or more, RO = 1 V, LPF = PASS) 64 dBp-p or more (SENS = 200 x 10^{-6} strain or more, RO = 1 V, LPF = PASS)
Stability	
Zero point	0.1 × 10^{-6} strain/°C (at max. sensitivity) ± 0.5 × 10^{-6} strain/24 h (at max. sensitivity) (Bridge excitation 2 Vrms)
Sensitivity	± 0.05% FS/C° ± 0.2% FS/24h
Output monitor	Four-digit 1/2 digital display (Maximum/minimum values and over display function available) 21-point LED level meter
Vibration tolerance	29.4 m/s^2 (50 Hz, 0.6 mmp-p) three directions
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)
Power supply	
AC power supply	(1) Rated voltage: AC 100 V, 50/60 Hz Allowable voltage: AC 90 to 132 V, 50/60 Hz (2) Rated voltage: AC 200 V to 240 V, 50/60 Hz Allowable voltage: AC 180 to 250 V, 50/60 Hz (Either (1) or (2) as specified by the customer) Maximum power consumption: 7.5 VA max. (AC 100 V)
DC power supply	Rated voltage: DC 12 to 24 V Allowable voltage: DC 10 to 30 V Maximum power consumption: 0.25 A max. (DC 12 V)
Outside dimension	40 (W) × 140 (H) × 266 (D) mm (Excluding protrusions)
Mass	Approx. 870 g

Standard accessories

Instruction Manual	1
AC power cable (CR-04)*	1
Output cable (CR-31)	2
Accessory box	1
Dedicated mounting screw (M3 bind screw)	2
Vinyl washer	2
Warranty certificate	1

* CR-061 included with DC power supply specification

DA-18A (Carrier type)

Pursuing ease of use
Resistant to noise
Carrier type

- Carrier type bridge excitation system that is resistant to noise
- Equipped with two types of display units: level meter and digital value
- Low power consumption, 20% less than conventional products
- Automatic tracking type capacity balancing
- Reading of TEDS sensor information and automatic setting function
- Dual output method
- Built-in low-pass filter
- External control of balance and calibration output



Dynamic strainmeter DA-18A

This is a carrier type dynamic strainmeter that is designed for ease of use and resistance to noise. A digital setting method is adopted for sensitivity adjustment to easily perform accurate sensitivity adjustments. In addition, highly reliable dynamic strain measurement is possible with such functions as digital monitoring of measurement values. It can be configured for multichannel use by incorporating it into the case or rack.

Specifications

Number of measuring points	1 point
Applicable gauge resistance	60–1000 Ω
Gauge factor	2.00
Bridge excitation	2 or 0.5 Vrms (5 kHz)
Balancing method	
Resistance	Electronic automatic (remote control possible) Adjustment time: About 2 seconds Using nonvolatile memory
Capacity	Electronic automatic tracking
Balancing range	
Resistance	± 10000 × 10^{-6} strain
Capacity	3000 pF
Balancing accuracy	± 1 × 10^{-6} strain or less (Bridge excitation 2 Vrms, SENS of 200 x 10^{-6} strain or less)
Rated output (RO)	1 to 10 V can be set in 1 V steps
Sensitivity adjustment (SENS)	For rated output of 1 V, 50 to 5000 × 10^{-6} strain For rated output of 10 V, 500 to 10000 × 10^{-6} strain Both can be set in 1 x 10^{-6} strain steps (Bridge excitation 2 Vrms)
Sensitivity	50 × 10^{-6} strain, at bridge excitation of 2 Vrms
OUT 1	1 V (5 kΩ load)
OUT 2	1 V (5 kΩ load)
Measurement range	± 50000 × 10^{-6} strain (bridge excitation 2 Vrms)
Nonlinearity	± 0.1% FS
Maximum output	
OUT 1	±10 V (5 kΩ load)
OUT 2	±10 V (5 kΩ load)
Calibration output	
Voltage	±RO
Accuracy	± 0.5% RO
Response frequency	DC to 2.5 kHz (−3 dB ± 1 dB) (Low pass filter: PASS, with coupling DC)
Low-pass filter	
Cutoff frequency	10, 30, 100, 300 Hz (-3 dB ± 1 dB) and PASS
Cutoff property	Butterworth property −12 dB ± 1 dB/oct (10 to 300 Hz)
High-pass filter	Coupling AC mode
Cutoff frequency	About 0.3 Hz
S/N ratio	For bridge excitation 2 Vrms, maximum output 10 V 60 dBp-p or more (SENS = 100 x 10^{-6} strain or more, RO = 1 V, LPF = PASS) 64 dBp-p or more (SENS = 200 x 10^{-6} strain or more, RO = 1 V, LPF = PASS)
Stability	
Zero point	± 0.1 × 10^{-6-6} strain/°C (at max. sensitivity) ± 0.5 × 10^{-6} strain/24 h (at max. sensitivity)
Sensitivity	± 0.05% FS/C° ± 0.2%/FS/24h
TEDS	Reading of TEDS sensor information, automatic setting of coefficients, display of physical quantities
Output monitor	Four-digit 1/2 digital display (Voltage output, physical quantity, TEDS information display and over display function available) 21-point LED level meter
Vibration tolerance	29.4 m/s^2 (50 Hz, 0.6 mmp-p) three directions
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)
Power supply	
AC power supply	(1) Rated voltage AC 100 V, 50/60 Hz Allowable voltage: AC 90 to 110 V, 50/60 Hz (2) Rated voltage AC 220 V, 50/60 Hz Allowable voltage: AC 198 to 242 V, 50/60 Hz (Either (1) or (2) as specified by the customer) Maximum power consumption 6 VA max. (AC 100 V)
DC power supply	Rated voltage DC 12 to 24 V Allowable voltage DC 10 to 30 V Maximum power consumption 0.25 A max. (DC 12 V)
Outside dimension	40 (W) × 140 (H) × 266 (D) mm (Excluding protrusions)
Mass	Approx. 870 g

Standard accessories

Instruction Manual	1
AC power cable (CR-04)*	1
Output cable (CR-31)	2
Accessory box	1
Dedicated mounting screw (M3 bind screw)	2
Vinyl washer	2
Warranty certificate	1

* CR-061 included with DC power supply specification

DA-37A (Carrier type)

- High response frequency of 10 kHz
- Digital sensitivity setting method
- Electronic automatic balancing
- Input/output isolation
- Automatic tracking type capacity balancing
- Equipped with digital monitor function
- Dual output method
- Built-in low-pass filter
- Equipped with strain bridge insulation check function
- Capable of external control of balance and calibration output
- Dual power supply method of AC and DC

This is a carrier type dynamic strainmeter that can be externally controlled via a PC. A digital sensitivity setting method is adopted for sensitivity adjustment to easily perform accurate sensitivity adjustments. It is a high-response type with a response frequency of 10 kHz. In addition, such functions as automatic tracking capacity balancing and digital monitoring of measurement values enable highly reliable dynamic strain measurements. Although this equipment is designed for one channel use when used alone, it can be configured for multichannel use by incorporating it into the dedicated case or rack.



Dynamic strainmeter DA-37A

Specifications

Number of measuring points	1 point
Applicable gauge resistance	60–1000 Ω
Gauge factor	2.00
Bridge excitation	2 or 0.5 Vrms (20 kHz)
Balancing method	
Resistance	Electronic automatic (remote control possible) Adjustment time: About 2 seconds Using nonvolatile memory
Capacity	Electronic automatic tracking
Balancing range	
Resistance	± 10000 × 10^{-6} strain
Capacity	5000 pF
Balancing accuracy	± 1 × 10^{-6} strain or less (Bridge excitation 2 Vrms, SENS of 200 x 10^{-6} strain or less)
Rated output (RO)	1 to 10 V can be set in 1 V steps
Sensitivity adjustment (SENS)	For rated output of 1 V, 50 to 5000 × 10^{-6} strain For rated output of 10 V, 500 to 10000 × 10^{-6} strain Both can be set in 1 x 10^{-6} strain steps (Bridge excitation 2 Vrms)
Fine adjustment (ATT)	0 to 1 times (OUT 2 only)
Sensitivity	50 × 10^{-6} strain, at bridge excitation of 2 Vrms
OUT 1	1 V (5 kΩ load)
OUT 2	12 mA or more (30 Ω load)
Measurement range	± 50000 × 10^{-6} strain (bridge excitation 2 Vrms)
Nonlinearity	± 0.2% FS
Maximum output	
OUT 1	±10 V (5 kΩ load)
OUT 2	± 20 mA (30 Ω load) or ±10 V (100 kΩ load)
Output shift	
Shift range	-10 to +10 V or OFF (can be set in 1 mV steps)
Calibration output	
Voltage	± (RO、RO/2)
Accuracy	±0.5%RO
Response frequency	DC to 10 kHz (−3 dB ± 1 dB) (Low pass filter: PASS, with coupling DC)
Low-pass filter	
Cutoff frequency	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz (-3 dB ± 1 dB) and PASS
Cutoff property	Butterworth property −12 dB ± 1 dB/oct (10 to 1 kHz)
High-pass filter	Coupling AC mode
Cutoff frequency	About 0.3 Hz
S/N ratio	For bridge excitation 2 Vrms, maximum output 10 V 56 dBp-p or more (SENS = 100 x 10^{-6} strain or more, RO = 1 V, LPF = PASS) 62 dBp-p or more (SENS = 200 x 10^{-6} strain or more, RO = 1 V, LPF = PASS)
Stability	
Zero point	± 0.1 × 10^{-6} strain/°C (at max. sensitivity) ± 0.5 × 10^{-6} strain/24 h (at max. sensitivity) (Bridge excitation 2 Vrms)
Sensitivity	± 0.05% FS/C° ± 0.2%/FS/24 h
Output monitor	Four-digit 1/2 digital display (Maximum/minimum values, open and over display function available) 21-point LED level meter
Vibration tolerance	29.4 m/s^2 (50 Hz, 0.6 mmp-p) three directions
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)
Power supply	
AC power supply	(1) Rated voltage AC 100 V, 50/60 Hz Allowable voltage: AC 90 to 110 V, 50/60 Hz Power consumption 9.2 VA max. (AC 100 V) (2) Rated voltage AC 110 to 120 V, 50/60 Hz Allowable voltage AC 99 to 132 V, 50/60 Hz Power consumption 9.8 VA max. (AC 120 V) (3) Rated voltage AC 200 to 240 V, 50/60 Hz Allowable voltage AC 180 to 264 V, 50/60 Hz Power consumption 14 VA max. (AC 240 V) (Either (1) or (3) as specified by the customer)
DC power supply	Rated voltage DC 12 to 24 V Allowable voltage DC 10 to 30 V Maximum power consumption 0.35 A max. (DC 12 V)
Outside dimension	40 (W) × 140 (H) × 266 (D) mm (Excluding protrusions)
Mass	Approx. 750 g

Standard accessories

Instruction Manual	1
AC power cable (CR-04)*	1
Output cable (CR-30)	2
Accessory box	1
Dedicated mounting screw (M3 bind screw)	2
Vinyl washer	2
Warranty certificate	1

* CR-061 included with DC power supply specification

Digital monitor

Monitor selection

DC	OUT1 average voltage value
PH	+ peak value of OUT1 from balancing or P/V reset
VH	- peak value of OUT1 from balancing or P/V reset
P-P	- Difference between PH and VH from balancing or P/V reset
OUT2	OUT2 average voltage value
R	Bridge insulation resistance



DA-38A (Carrier type)

- High response frequency of 10 kHz
- Carrier type bridge excitation system that is resistant to noise
- Equipped with two types of display units: level meter and digital value
- Low power consumption, 20% less than conventional products
- Automatic tracking type capacity balancing
- Reading of TEDS sensor information and automatic setting function
- Dual output method
- Built-in low-pass filter
- External control of balance and calibration output



Dynamic strainmeter DA-38A

This is a carrier type dynamic strainmeter that is compact and designed for ease of use. A digital sensitivity setting method is adopted for sensitivity adjustment to easily perform accurate sensitivity adjustments. It is a high-response type with a response frequency of 10 kHz. In addition, highly reliable dynamic strain measurement is possible with such functions as digital monitoring of measurement values. It can be configured for multichannel use by incorporating it into the case or rack.

Specifications

Number of measuring points	1 point
Applicable gauge resistance	60–1000 Ω
Gauge factor	2.00
Bridge excitation	2 or 0.5 Vrms (20 kHz)
Balancing method	
Resistance	Electronic automatic (remote control possible) Adjustment time: About 2 seconds Using nonvolatile memory
Capacity	Electronic automatic tracking
Balancing range	
Resistance	± 10000 × 10^{-6} strain
Capacity	3000 pF
Balancing accuracy	± 1 × 10^{-6} strain or less (Bridge excitation 2 Vrms, SENS of 200 x 10^{-6} strain or less)
Rated output (RO)	1 to 10 V can be set in 1 V steps
Sensitivity adjustment (SENS)	For rated output of 1 V, 50 to 5000 × 10^{-6} strain For rated output of 10 V, 500 to 10000 × 10^{-6} strain Both can be set in 1 x 10^{-6} strain steps (Bridge excitation 2 Vrms)
Sensitivity	50 × 10^{-6} strain, at bridge excitation of 2 Vrms
OUT 1	1 V (5 kΩ load)
OUT 2	1 V (5 kΩ load)
Measurement range	± 50000 × 10^{-6} strain (bridge excitation 2 Vrms)
Nonlinearity	± 0.2% FS
Maximum output	
OUT 1	±10 V (5 kΩ load)
OUT 2	±10 V (5 kΩ load)
Output shift	
Shift range	-10 to +10 V or OFF (can be set in 1 mV steps)
Calibration output	
Voltage	±RO
Accuracy	± 0.5% RO
Response frequency	DC to 10 kHz (−3 dB ± 1 dB) (Low pass filter: PASS, with coupling DC)
Low-pass filter	
Cutoff frequency	30 Hz, 100 Hz, 300 Hz, 1 kHz (-3 dB ± 1 dB) and PASS
Cutoff property	Butterworth property −12 dB ± 1 dB/oct (30 Hz to 1 kHz)
High-pass filter	Coupling AC mode
Cutoff frequency	About 0.3 Hz
S/N ratio	For bridge excitation 2 Vrms, maximum output 10 V 56 dBp-p or more (SENS = 100 x 10^{-6} strain or more, RO = 1 V, LPF = PASS) 62 dBp-p or more (SENS = 200 x 10^{-6} strain or more, RO = 1 V, LPF = PASS)
Stability	
Zero point	± 0.1 × 10^{-6} strain/°C (at max. sensitivity) ± 0.5 × 10^{-6} strain/24 h (at max. sensitivity)
Sensitivity	± 0.05% FS/C° ± 0.2%/FS/24 h
TEDS	Reading of TEDS sensor information, automatic setting of coefficients, display of physical quantities
Output monitor	Four-digit 1/2 digital display (Voltage output, physical quantity, TEDS information display and over display function available) 21-point LED level meter
Vibration tolerance	29.4 m/s^2 (50 Hz, 0.6 mmp-p) three directions
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)
Power supply	
AC power supply	Rated voltage AC 100 to 240 V, 50/60 Hz Allowable voltage AC 90 to 264 V, 50/60 Hz Maximum power consumption 8.5 VA max (AC 100 V) 13 VA max (AC 240 V)
DC power supply	Rated voltage DC 12 to 24 V Allowable voltage DC 10 to 30 V Maximum power consumption 0.27 A max. (DC 12 V)
Outside dimension	40 (W) × 140 (H) × 266 (D) mm (Excluding protrusions)
Mass	Approx. 750 g

Standard accessories

Instruction Manual	1
AC Power Cable(CR-04)*	1
DC Power Cable(CR-061)*	1
Output cable (CR-31)	1
Accessory box	1
Dedicated mounting screw (M3 bind screw)	2
Vinyl washer	2
Warranty certificate	1

* Specify CR-041 or CR-061 when ordering

DC-96A / DC-97A (DC type)

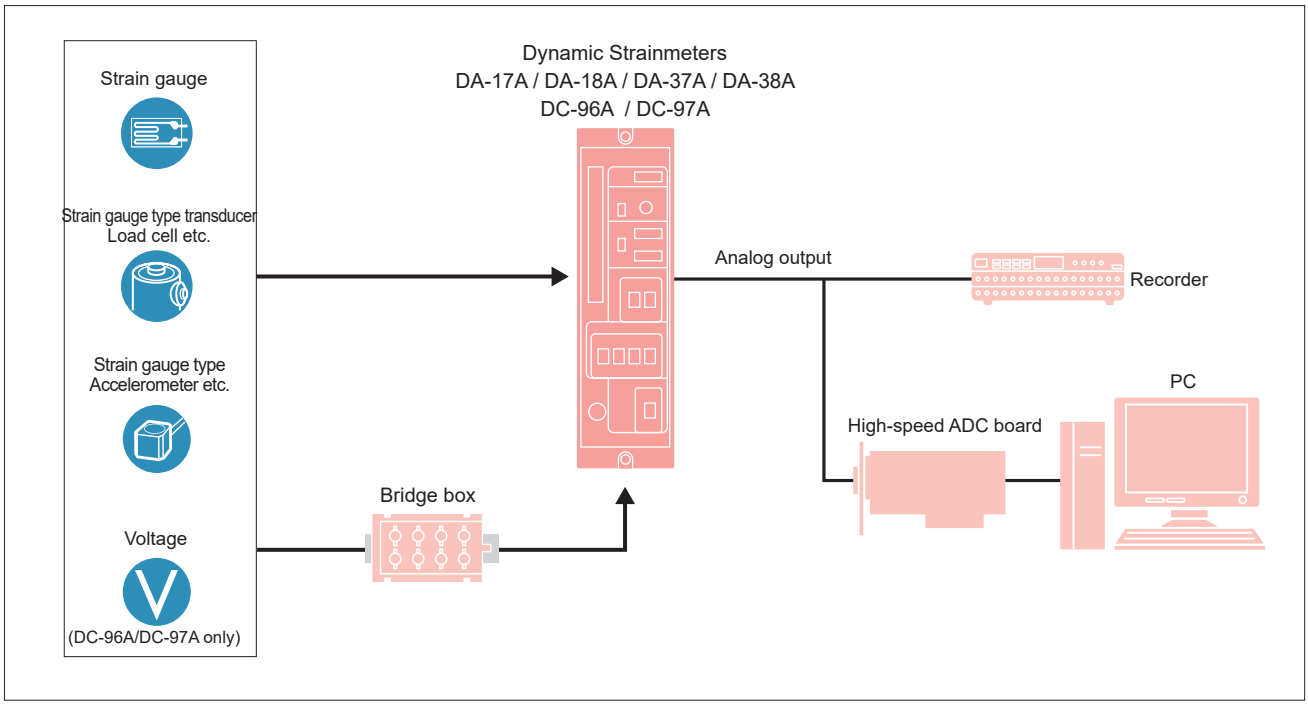
- Broadband response frequency
  DC-96A: DC to 200 kHz
  DC-97A: DC to 500 kHz
- Digital sensitivity setting. (The amplifier sensitivity is set by selecting the amplifier's rated output (RO) in the range from 1 to 10 V and then setting the corresponding strain on the four-digit digital setting unit.)
- Improved performance of electronic automatic balancing. (The balancing range is 10000 x 10^{-6} strain and the balancing accuracy is 5 x 10^{-6} strain.)
- As for the temperature stability of zero-point, high accuracy of 0.5 x 10^{-6} strain/°C is achieved.
- Can be used as a DC amplifier.
- Bridge excitation can be switched between constant voltage and constant current.
- Dual output system equipped with conventional output terminals of two systems, voltage and current.
- Built-in low-pass filter and high-pass filter.
- Capable of external control of balance and calibration output.
- Dual power supply method of AC and DC.



Dynamic strainmeter DC-96A

This is a broadband DC type dynamic strainmeter that is compact and designed for ease of use. A digital sensitivity setting method is adopted for sensitivity adjustment to perform accurate sensitivity adjustments. The range and accuracy of electronic automatic balancing are improved compared to the conventional ones, allowing it to be used for a wide range of measurements. In addition, capacity balancing is not required because this is a DC type. Furthermore, the bridge excitation can be selected from either the constant voltage type or the constant current type. When the constant current method is used for the bridge excitation, there is no sensitivity decrease because of the resistance of the connection cable to the strain gauge type transducer, and bridge box. Although this equipment is designed for one channel use when used alone it can be configured for multichannel use by incorporating it into the dedicated case or rack.

System Block Diagram



Specifications

Number of measuring points	1 point
Applicable gauge resistance	
Constant voltage	60 to 1000 Ω (Bridge excitation 2 V)
Constant current	120, 350 Ω
Gauge factor	2.00
Bridge excitation	
Constant voltage	DC 0.5, 1, 2, 5, 10 V
Constant current	DC about 4.2, 8.3, 17, 42 mA (Bridge resistance 120 Ω) DC about 1.4, 2.9, 5.7, 14, 29 mA (Bridge resistance 350 Ω)
Input resistance	10 MΩ + 10 MΩ (Balanced differential input)
Balancing method	Electronic automatic (remote control possible) Adjustment time: About 2 seconds Using nonvolatile memory
Balancing range	± 10000 × 10^{-6} strain
Balancing accuracy	± 5 × 10^{-6} strain or less
Rated output (RO)	1 to 10 V is set in 1 V steps (Bridge excitation 2 V, SENS of 500 x 10^{-6} strain or more)
Sensitivity adjustment (SENS)	For rated output of 1 V, 50 to 10000 × 10^{-6} strain For rated output of 10 V, 500 to 10000 × 10^{-6} strain Both can be set in 1 x 10^{-6} strain steps (Bridge excitation 2 V)
As DC amplifier	For rated output of 1 V, 0.050 to 10.000 mV For rated output of 10 V, 0.500 to 10.000 mV Both can be set in 0.001 mV steps
Fine adjustment (I.SENS)	1/10 to 1 (OUT I only)
Sensitivity	50 × 10^{-6} strain, at bridge excitation of 2 V
OUT V	1 V (5 kΩ load)
OUT I	12 mA or more (30 Ω load)
As DC amplifier	At 0.05 mV
OUT V	1 V (5 kΩ load)
OUT I	12 mA or more (30 Ω load)
Measurement range	±100000 × 10^{-6} strain (Bridge excitation 2 V)
As DC amplifier	±100 mV
Nonlinearity	OUT V ± 0.02% FS or less OUT I ± 0.2% FS or less
Maximum output	
OUT V	±10 V (5 kΩ load)
OUT I	± 50 mA (30 Ω load, when using 120 Ω bridge) or ±10 V (5 kΩ load)
Output shift	
Function	Shifts the output with a multi-turn potentiometer.
Shift range	-10 to 10 V or OFF
Calibration output	
Voltage	± (RO, RO/2)
Accuracy	± 0.5% RO
Response frequency range	DC-96A: DC to 200 kHz (-3 dB± 1 dB) DC-97A: DC to 500 kHz (-3 dB± 1 dB) (Low pass filter: PASS, with coupling DC)
Low-pass filter	
Cutoff frequency	10, 30, 100, 300 Hz, 1 k, 3 k, 10 k, 30 kHz (-3 dB ± 1 dB) and PASS
Cutoff property	Bessel property −12 dB ± 1 dB/oct

High-pass filter	Coupling AC mode		
Cutoff frequency	0.05 Hz ± 0.015 Hz (−3 dB)		
Cutoff property	−6 dB ± 1 dB/oct		
S/N ratio	For bridge excitation 2, maximum output 10 V		
		DC-96A	DC-97A
	PASS	28 dBp-p or more	30 dBp-p or more
	DC to 10 kHz	40 dBp-p or more	46 dBp-p or more
	DC to 1 kHz	44 dBp-p or more	50 dBp-p or more
	DC to 100 Hz	50 dBp-p or more	56 dBp-p or more
	(SENS = 100 × 10^{-6} strain, RO = 1 V)		
Stability			
Zero point	± 0.5 × 10^{-6} strain/°C (at max. sensitivity) ± 5 × 10^{-6} strain/24 h (at max. sensitivity) (Bridge excitation 2 V)		
Sensitivity	± 0.01%/C° ± 0.05%/24 h		
As DC amplifier			
Zero point	± 0.5 μV/°C (at max. sensitivity) ± 5 μV/24 h (at max. sensitivity)		
Sensitivity	± 0.01%/C° ± 0.05%/24 h		
Output monitor	41-point LED level meter (with over display function)		
Self-diagnosis function	Amplifier sensitivity Bridge excitation Open over		
Common mode rejection ratio	60 dB or more		
Vibration tolerance	29.4 m/s^2 (50 Hz, 0.6 mmp-p) three directions		
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)		
Power supply			
AC power supply	(Either (1) or (2) as specified by the customer)		
(1) Rated voltage	AC 100 V 50/60 Hz		
Allowable voltage	AC 90 to 132 V 50/60 Hz		
(2) Rated voltage	AC 200 to 240 V 50/60 Hz		
Allowable voltage	AC 180 to 250 V 50/60 Hz		
Maximum power consumption	16 VA max		
DC power supply			
Rated voltage	DC 12 to 24 V		
Allowable voltage	DC 10 to 30 V		
Maximum consumption current	0.7 A max		
Outside dimension	40 (W) × 140 (H) × 266 (D) mm (Excluding protrusions)		
Mass	Approx. 1.2 kg		

Standard accessories

Instruction Manual 1
AC power cable (CR-04)* 1
Output cable (CR-30)..... 2
Flathead screwdriver 1
Accessory box 1
Warranty certificate 1

* CR-061 is included when the DC power option is specified.

TA-01KT

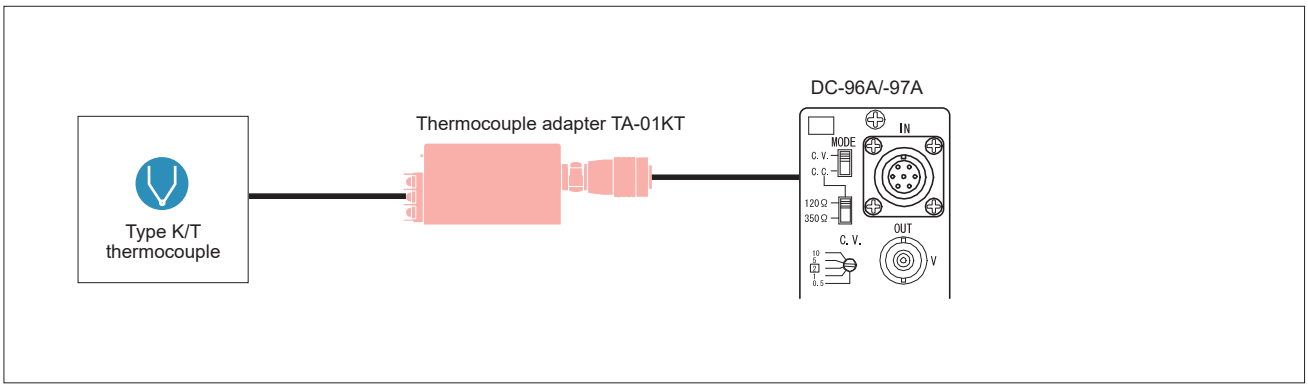
- Compact and lightweight
- No external power supply required
- Built-in reference junction
- Isolated Input and output
- Digital linearization provides better linearity than analog linearization
- Built-in burnout function
- Calibration output function enables setting check of strainmeters



TA-01KT thermocouple adapter

The TA-01KT is a K/T thermocouple adapter to perform temperature measurement with a DC bridge excitation type strainmeter.
Since a power supply from the main unit of the measuring instrument is used, no external power supply is required, and K/T thermocouple temperature measurement is possible with most strainmeters of the DC bridge excitation method. It has a thin shape and can be directly connected to the connector of strainmeter, so it does not take up much space.

System Block Diagram



Specifications

Number of measuring points	1 point
Applicable thermocouple	K, T
Measurement temperature range	K: -50C° to +1000C°, T: -50C° to +300C°
Response time	20 ms or less (0 → 90%)
Burnout	Upper scale out (Output of +1050°C or mode)
Sensitivity	10 μV/°C (When bridge excitation is 2 V, 10 x 10^{-6} strain/°C)
Accuracy	± (0.2% + 1.0°C) (Ambient temperature: +20 to +30°C) ± (0.4% + +1.5°C) (Ambient temperature: 0 to +50°C)
Internal reference junction accuracy	± 0.7°C (Ambient temperature: +20 to +30°C) ± 1.0°C (Ambient temperature: 0 to +50°C)
Allowable conductor resistance	500 Ω or less
Allowable input voltage	±30 V
Input/output insulation resistance	100 Ω or more (at DC 500 V)
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Power supply (Bridge excitation)	DC 1.95 to 5.3 V (Constant voltage method)
Consumption current	16 mA max
Outside dimension	22 (W) × 41 (H) × 70 (D) mm (Excluding protrusions)
Mass	Approx. 100 g

Compatible measuring instruments

DC type dynamic strainmeters
DC-204R ／ -204Ra、DC-004P
DH-14A
DC-96A ／ -97A
DS-50A
TMR-321



Bridge Box

The bridge box is used when connecting a strain gauge using the one-gauge method, two-gauge method to a measuring instrument that supports the four-gauge method, such as a dynamic strainmeter.
Resistors for bridge configuration are provided inside. In addition, even in the case of a four-gauge method transducer, a bridge box is used to connect it to the terminal when the tip is a loose wire. Depending on the connection method to a terminal, various bridges can be configured.
(Refer to page 14 of “Strain Gauge Bridge Circuit”)

Model name	Number of measuring points	Applicable gauge resistance value*1	Bridge configuration						Other functions
			four-gauge method	one-gauge method three-wire type	one-gauge method two-wire type	two-gauge method	Opposite side two-gauge method	Opposite side two-gauge method three-wire type	
SB-122A	2,4,6,8,10	120Ω	●	●	●	●			One-gauge method two-wire type compatible
SB-123A	1	120Ω	●	●	●	●	●	●	General-purpose compact one-touch terminal
SB-353A	1	350Ω	●	●	●	●	●	●	
SB-120SB	2,4,6,8,10	120Ω	●	●	●*3	●			Connector connection compatible
SB-120PY	2,4,6,8,10	120Ω	●	●	●*3	●			Plastic region measurement compatible
SB-120B	1	120Ω	●	●	●	●	●	●	
SB-350B	1	350Ω	●	●	●	●	●	●	
SB-128A	8	120Ω	●	●	●	●	●	●	
SB-128A-10	10	120Ω	●	●	●	●	●	●	
SB-358A	8	350Ω	●	●	●	●	●	●	
SB-120DD-1R	1	120Ω		●		●			Connector direct connection for DC-204R/ TMR*4
SB-120DD-4R	1	-	●						
SB-350DD-1R	1	350Ω		●		●			
SB-120DG-1R2	1	120Ω			●				NDIS connector direct connection one-touch terminal
SB-120DG-1R3	1	120Ω		●					
SB-120DG-4R	1	-	●						
SB-350DG-1R2	1	350Ω			●				
SB-350DG-1R3	1	350Ω		●					

*1: The values apply to the one-gauge method or opposite side two-gauge method. The values for the two-gauge method and four-gauge method depend on the measuring instrument.
*2: This is supported by the included short bar.
*3: This is supported by shorting B-C.
*4: When using DC-204R/-204Ra, remote sensing is supported by the dedicated extension cable.

Precautions when using the one-gauge method two-wire type

In the one-gauge method, the increase in resistance due to the length of the lead wire of the two-wire type reduces the sensitivity and increases the initial imbalance. Furthermore, fluctuations in the cable resistance due to temperature changes are a major unstable factor in measurements. To reduce the effect, make lead wires as thick and short as possible and use the product in a place where temperature changes do not occur.
For cases where temperature changes or the lead wires are long, we recommend the one-gauge method three-wire type. The three-wire type has half the sensitivity decrease because of the lead wire length as the two-wire type and offsets the effect on the initial unbalance and fluctuations in the lead resistance due to temperature. Therefore, it is an excellent wiring method for stable measurements.

SB-122A

One-gauge method two-wire type compatible



SB-122A-2

- one-gauge method two-wire type compatible
- Easy to switch the gauge method by using switch

The gauge method can be easily switched using a changeover switch and four types of methods, or one-gauge method two-wire type, one-gauge method three-wire type, two-gauge method and four-gauge method, are supported.
As for the number of input points per unit, there are five types from 2 to 10 points.

Specifications

Number of measuring points	2 points: SB-122A-2 4 points: SB-122A-4 6 points: SB-122A-6 8 points: SB-122A-8 10 points: SB-122A-10
Input terminal	M3 x 3P, terminal bind screw x 2
Input	One-gauge method two-wire type: 120 Ω One-gauge method three-wire type: 120 Ω
	Two-gauge method: 60-1000 Ω Four-gauge method: 60-1000 Ω
Switch	Compact toggle switch
Connection terminal	Soldering, screw attachment
Operating temperature / humidity range	-20 to +60C° 85% RH or less (No condensation)

Outside dimension and mass

SB-122A-2	About 55 (W) ×35 (H) ×100 (D) mm	Approx. 0.4 kg
SB-122A-4	About 105 (W) ×35 (H) ×100 (D) mm	Approx. 0.6 kg
SB-122A-6	About 155 (W) ×35 (H) ×100 (D) mm	Approx. 0.8 kg
SB-122A-8	About 205 (W) ×35 (H) ×100 (D) mm	Approx. 1.0 kg
SB-122A-10	About 255 (W) ×35 (H) ×100 (D) mm	Approx. 1.2 kg

Standard accessories

- Mounting bracket ..... 1 set
- Instruction Manual 1
- Warranty certificate 1

* The connection cable CR-612 is available as an option.

SB-123A/SB-353A



- Compact and lightweight
- One-touch terminal
- Supports all wiring methods
- Easy to switch the gauge method by using a switch
- Easy to multi-channelize

This is a compact general-purpose bridge box that adopts one-touch terminals. All strain gauge wiring methods, or the one-gauge method, opposite side two-gauge method, two-gauge method, and four-gauge method, can be supported.

Specifications

Number of measuring points	1 point
Input	One-gauge method two-wire type, one-gauge method three-wire type, two-gauge method, opposite side two-gauge method, opposite side two-gauge method three-wire type SB-123A 120 Ω SB-353A 350 Ω
	two-gauge method, four-gauge method 60 to 1000 Ω
Switch	Compact slide switch
Connection terminal	Clamp type one-touch terminal
Operating temperature / humidity range	-20 to +60C° 85% RH or less (No condensation)
Outside dimension	30 (W) × 30 (H) × 90 (D) mm (Excluding protrusions)
Mass	Approx. 100 g

Standard accessories

- DIN rail mounting part 1
- M3 x 6 panhead screw 4
- Instruction Manual 1

* The connection cable CR-612 is available as an option.

Bridge Box

SB-120SB



- Equipped with NIDS connector
- Easy to switch the gauge method by a slide switch

The SB-120SB is a bridge box that can also relay a strain gauge type transducer using the NDIS connector with one unit. Easy to switch the gauge method with a slide switch. The lead wires can be connected either by soldering or screw attachment.
As for the number of input points per unit, there are five types from 2 to 10 points.

Specifications

Number of measuring points	2 points: SB-120SB-2 4 points: SB-120SB-4 6 points: SB-120SB-6 8 points: SB-120SB-8 10 points: SB-120SB-10
Input connector	Terminal : M3 x 5P terminal bind screw Connector : NDIS 7P connector
Input	One-gauge method (B-C shorted), one-gauge method three-wire type: 120 Ω Two-gauge method, four-gauge method: 60 to 1000 Ω
Switch	Compact slide switch
Connection terminal	Screw attachment, soldering, NDIS connector
Operating temperature / humidity range	-20 to +60C° 85% RH or less (No condensation)

Outside dimension and mass

SB-120SB-2	About 55 (W) ×35 (H) ×100 (D) mm	Approx. 0.6 kg
SB-120SB-4	About 105 (W) ×35 (H) ×100 (D) mm	Approx. 0.8 kg
SB-120SB-6	About 155 (W) ×35 (H) ×100 (D) mm	Approx. 1.0 kg
SB-120SB-8	About 205 (W) ×35 (H) ×100 (D) mm	Approx. 1.2 kg
SB-120SB-10	About 255 (W) ×35 (H) ×100 (D) mm	Approx. 1.4 kg

Standard accessories

- Mounting bracket ..... 1 set
- Instruction Manual..... 1
- Warranty certificate 1

* The connection cable CR-612 is available as an option.

SB-120PY

Plastic region measurement compatible



SB-120PY-2

- Plastic region measurement compatible
- Easy to switch the gauge method by using a switch

This is a bridge box that can measure plastic region strain using the one-gauge method. The switch enables to switch among the one-gauge method three-wire type, two-gauge method and four-gauge methods, as well as between normal measurement and plastic region measurement. In plastic region measurement, the sensitivity becomes 1/10 and up to 200000×10^{-6} strain can be measured using a dynamic strainmeter with a measurement range of 20000×10^{-6} strain.
As for the number of input points per unit, there are five types from 2 to 10 points.

Specifications

Number of measuring points	2 points: SB-120PY-2 4 points: SB-120PY-4 6 points: SB-120PY-6 8 points: SB-120PY-8 10 points: SB-120PY-10
Input terminal	M3 x 5P terminal bind screw
Input Normal measurement	One-gauge method two-wire type: 120 Ω (by shorting B-C) One-gauge method three-wire type: 120 Ω
	Two-gauge method, four-gauge method 60 to 1000 Ω
Input Plastic region measurement	One-gauge method two-wire type: 120 Ω (by shorting B-C) One-gauge method three-wire type: 120 Ω
Switch	Slide switch × 2, toggle switch
Connection terminal	Soldering, screw attachment
Operating temperature / humidity range	-20 to +60C° 85% RH or less (No condensation)

Outside dimension and mass

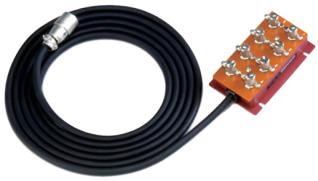
SB-120PY-2	About 55 (W) ×35 (H) ×100 (D) mm	Approx. 0.4 kg
SB-120PY-4	About 105 (W) ×35 (H) ×100 (D) mm	Approx. 0.6 kg
SB-120PY-6	About 155 (W) ×35 (H) ×100 (D) mm	Approx. 0.8 kg
SB-120PY-8	About 205 (W) ×35 (H) ×100 (D) mm	Approx. 1.0 kg
SB-120PY-10	About 255 (W) ×35 (H) ×100 (D) mm	Approx. 1.2 kg

Standard accessories

- Mounting bracket ..... 1 set
- Instruction Manual..... 1
- Warranty certificate 1

* The connection cable CR-612 is available as an option.

SB-120B/SB-350B



- Supports all wiring methods
- No mechanical parts and high durability

This is a 1-point type bridge box. Depending on the connection method to the terminals, various types of bridges, or the one-gauge method, opposite side two-gauge method, two-gauge method and four-gauge method, can be configured using strain gauges. The lead wires can be connected either by soldering or screw attachment.

Specifications

Number of measuring points	1 point
Input	One-gauge method, one-gauge method three-wire type, opposite side two-gauge method, opposite side two-gauge method three-wire type 120 Ω (SB-120B), 350 Ω (SB-350B)
	Two-gauge method, four-gauge method: 60 to 1000 Ω
Connection terminal	Dual-purpose for screw attachment and soldering
Operating temperature / humidity range	-10 to +50C° 85% RH or less (No condensation)
Input/output cable	φ9 mm, 4-core shielded cable, 3 m, tip NDIS plug
Outside dimension	65 (W) × 40 (H) × 110 (D) mm (Excluding protrusions)
Mass	Approx. 0.7 kg

SB-128A/SB-128A-10/SB-358A



- Supports all wiring methods

Specifications

Number of measuring points	8 points (SB-128A/SB-358A), 10 points (SB-128A-10)
Input	One-gauge method, one-gauge method three-wire type, opposite side two-gauge method, opposite side two-gauge method three-wire type 120 Ω (SB-128A/SB-128A-10) 350 Ω (SB-358A)
	Two-gauge method, four-gauge method 60 to 1000 Ω
Connection terminal	Dual-purpose for screw attachment and soldering
Operating temperature / humidity range	-20 to +60C° 85% RH or less (No condensation)
Outside dimension	SB-128A/SB-358A: 240 (W) × 33 (H) × 150 (D) mm SB-128A-10: 300 (W) × 33 (H) × 150 (D) mm (Excluding protrusions)
Mass	Approx. 2 kg

Standard accessories

- Instruction Manual..... 1
- Warranty certificate 1

* The connection cable CR-612 is available as an option.

SB-120DD-1R/4R/ SB-350DD-1R



- One-touch connection to measuring instruments with mini plug connector
- Compact space-saving and lightweight
- Easy connection o loose wire transducers (SB-120DD-4R)

This is a bridge box for the measuring instruments, DC-204R smart dynamic strain recorder and TMR-321/-323/-221/-223 multi-recorders that adopt mini plugs (PRC07-P8M). Since no cables are required to the measuring instrument, the area around the measuring instrument can be set up compactly. The SB-120DD-1R and SB-350DD-1R are compatible with the one-gauge method three-wire type (the one-gauge method two-wire type is supported by shorting B-B') and the two-gauge method, and the SB-120DD-4R is compatible with the four-gauge method.

In addition, when using the DC-204R/-204Ra, the remote sensing function between the measuring instrument and bridge box is enabled by using the CR-6185 sensor cable. This eliminates error factors due to cable conductor resistance and ambient temperature changes to achieving highly accurate measurements.

Specifications

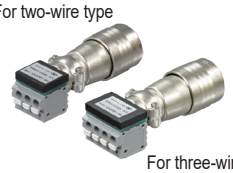
Number of measuring points	1 point	
Measurement method		
one-gauge method three-wire type*	SB-120DD-1R SB-350DD-1R	120Ω 350Ω
two-gauge method	SB-120DD-1R SB-350DD-1R	120、350Ω 120、350Ω
four-gauge method	SB-120DD-4R	120 ～ 1000Ω
Connection terminal	Screw attachment	
Operating temperature / humidity range	0 to +50C°	85% RH or less (No condensation)
Outside dimension	14 (W) ×19 (H) ×59 (D) mm (Excluding protrusions)	
Mass	Approx. 22 g	

Standard accessories

Instruction Manual..... 1

SB-120DG-1R2/1R3/4R SB-350DG-1R2/1R3

For two-wire type



For three-wire type

- One-touch connection to measuring instruments with NDIS connector plug
- One-touch terminals allow easy connection of lead wires
- Compact and lightweight

This is a bridge box that can be connected to a measuring instrument with one touch. Since no cables are required to the measuring instrument, the area around the measuring instrument can be set up compactly. The SB120DG-1R2 and SB-350DG-1R2 are compatible with the one-gauge method two-wire type, and the SB120DG-1R3 and SB-350DG-1R3 are compatible with the one-gauge method three-wire type.

Specifications

Number of measuring points	1 point
Input	SB-120DG-1R2/SB-350DG-1R2 One-gauge method two-wire type SB-120DG-1R3/SB-350DG-1R3 One-gauge method three-wire type SB-120DG-4R Four-gauge method
Applicable gauge resistance	SB-120DG-1R2/-1R3 120 Ω SB-350DG-1R2/-1R3 350 Ω
Connection terminal	touch
Operating temperature / humidity range	-20 to +60C° 85% RH or less (No condensation)
Outside dimension SB-120DG-1R2 / SB-350DG-1R 17 (W) × 18 (H) × 63 (D) mm (Excluding protrusions) SB-120DG-1R3 / SB-120DG-4R / SB-350DG-1R3 22 (W) × 18 (H) × 63 (D) mm (Excluding protrusions)	
Mass	Approx. 50 g

Standard accessories

Instruction Manual..... 1

Related Products (for dynamic strainmeters)

Carrying case



P-4B P-6B P-8B

This case is used to configure the DA series and DC series as multichannel type. It is equipped with a power switch, calibration strain generation switch, and balance button that allow simultaneous operation of all channels.



Model name	Number of channels	Outside dimension (W x H x D mm)
P-4B	4	208×148×308
P-6B	6	288×148×308
P-8B	8	368×148×308
P-10B	10	448×148×308

(Excluding protrusions)

LAN compatible carrying case for DA-37A/DA-17A



P-8AL with 1 unit of dynamic strainmeter incorporated



Back of case
LAN interface
DC and AC power switches

This case is used to configure the DA-37A and DA-17A as multichannel types. Various settings of the gain, low-pass filter, etc., operations of balance and calibration strain generation, each setting value, and monitor values can be obtained via the LAN interface from a PC. It is equipped with a power switch, calibration strain generation switch, and balance button that allow simultaneous operation of all channels.

Specifications

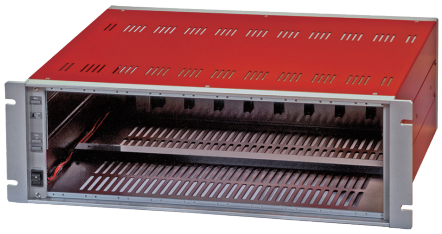
Number of measuring points	4 units: P-4AL 8 units: P-8AL	6 units: P-6AL 10 units: P-10AL
Interface	Ethernet IEEE 802.3, RJ-45 connector 10BASE-T/100BASE-TX	
Operation switch	Balance, calibration strain generation, power supply * Simultaneous operation of all channels	
External control	Balance, calibration strain generation, power supply * Simultaneous operation of all channels	
Rated voltage	AC 100 V 50/60 Hz 8 VA max DC 12/24 V 0.25 A max. (DC 12 V) * Power consumption is rack only.	
Allowable voltage	AC 90 to 132 V 50/60 Hz DC 10 to 30 V	
Operating temperature / humidity range	-10 to +50C°	85% RH or less (No condensation)

Outside dimension and mass

P-4AL	208 (W) × 148 (H) × 308 (D) mm	Approx. 2.3 kg
P-6AL	288 (W) × 148 (H) × 308 (D) mm	Approx. 2.7 kg
P-8AL	368 (W) × 148 (H) × 308 (D) mm	Approx. 3.1 kg
P-10AL	448 (W) × 148 (H) × 308 (D) mm	Approx. 3.5 kg

* Excluding protrusions. Mass is case only.

Rack



R-10B

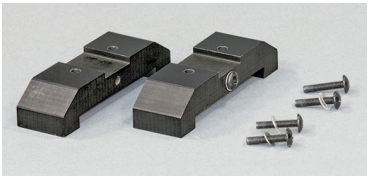
This is a JIS standard rack that stores the DA series, DC series, and other series in a 10-channel configuration. It is equipped with a power switch, calibration strain generation switch, and balance button that allow simultaneous operation of all channels.

Model name	Number of channels	Outside dimension (W x H x D mm)
R-10B	10	480×149×311

(Excluding protrusions)

Dynamic strainmeter fixing base

This is a base when using the DA series, DC series, and other series for one channel alone. It is used by attaching it to the bottom of the measuring instrument.



Applicable measuring instrument

Dynamic strainmeter DA series DC type dynamic strainmeter DC series

SB-OT1B one-touch terminal

This terminal block allows one-touch connection of input lead wires. It is used by attaching to the input terminal of the switch box and bridge box (SB-120SB / SB-120PY / SB-122A). One is used per lead wire (sold in units of five).



DT-221T/DT-281R (Telemetry system)

2.4 GHz advanced low-power data communication

System as a whole

- Using the 2.4 GHz band for the wireless band
- High-speed sampling of 10 kHz (100 µs)

DT-221T (Transmitter)

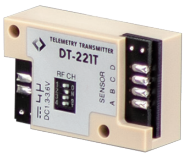
- Transmitting strain values as digital values
- No calibration is required since the strain value is pre-calibrated.
- Robust due to the use of materials with high mechanical strength
- Easy wiring due to unique terminal block
- Built-in transmitting antenna
- Compact: 36 (W) ×12.5 (H) ×22.5 (D) mm

DT-281R (Receiver)

- Outputs a voltage equivalent to the strain value.
- No calibration is required since the voltage output is pre-calibrated.
- The voltage output range can be switched among three types: ± 5000, ±10000 and ± 25000 x 10^{-6} strains.
- Model DT-281R (-04) that supports the voltage output ranges of ± 500, ±1000 and ± 2500 x 10^{-6} is available.



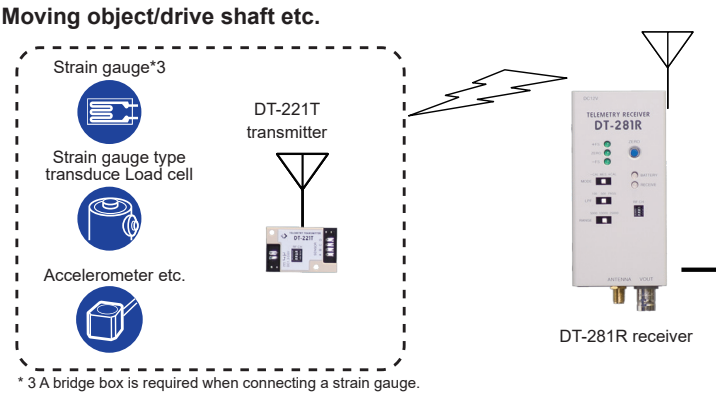
DT-281R receiver



DT-221T transmitter

This system is a telemetry system developed to perform strain measurements of rotating object, moving object, etc., which are difficult to measure with wires. It is effective for measurements when the target object is large, such as a large machine tool and when the range of movement is large, resulting in a large distance between the transmitter and receiver.

System Block Diagram

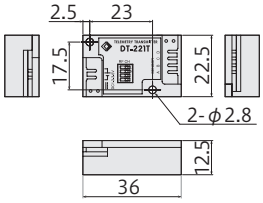


* 3 A bridge box is required when connecting a strain gauge.

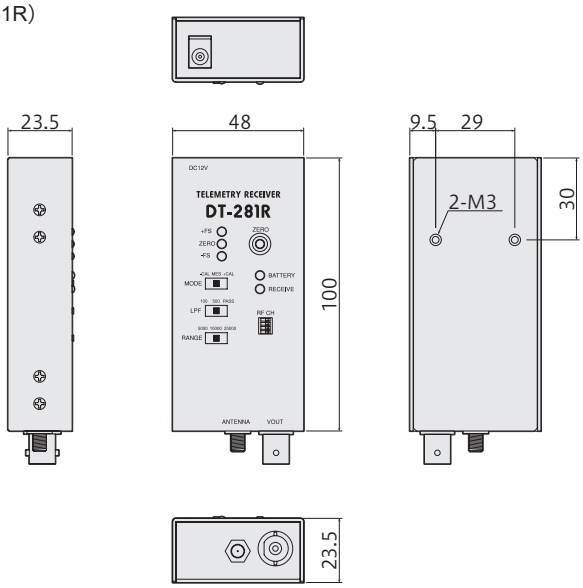
DT-221T/DT-281R

External Dimensions

Transmitter
(DT-221T)



Receiver
(DT-281R)



Specifications
Transmitter (DT-221T)

Strain measurement part	
Number of measuring points	1 point
Applicable gauge resistance	120 to 1000 Ω (4 G bridge)
Bridge excitation	2.0 V ± 8%
Measurement range	± 25000 × 10^{-6} strain (including initial imbalance)
Measurement accuracy	± 0.2% FS
Sampling frequency	10 kHz (100 µs)
Response frequency	DC to 1 kHz (−3 dB ± 1 dB)
Resolution	1 × 10^{-6} strain
Stability Zero point	± 0.8 × 10^{-6} strain/C°
Stability Sensitivity	± 0.01% FS/C°
Power supply voltage measurement part	
Number of measuring points	1 point
Measurement range	DC 1.3 to 3.6 V
Wireless part	
Wireless specifications	2.4 GHz advanced low-power data communication system
Number of channels	16 channels
Antenna	Built-in
Display/operation	Wireless channel changeover switch
General	
Power supply voltage	DC 1.3 to 3.6 V
Consumption current	75 mA max (DC 3 V supplied, 120 Ω gauge, +23°C ± 5°C)
Operating temperature / humidity range	-30 to +80C°, 85% RH or less (No condensation, excluding batteries)
Vibration tolerance	100 m/s^2, three directions
Centrifugal acceleration resistance	10000 m/s^2, height direction
Outside dimension	36 (W) x 12.5 (H) x 22.5 (D) mm (Excluding protrusions)
Chassis material	Resin
Mass	Approx. 17 g

Standard accessories

Instruction Manual..... 1
Warranty certificate 1

Receiver (DT-281R)

Wireless part	
Wireless specifications	2.4 GHz advanced low-power data communication system
Number of channels	16 channels
Antenna connection terminal	SMA connector
Display/operation	Receiving signal strength LED / transmitter battery voltage LED / wireless channel changeover switch
Voltage output part	
Voltage output connector	BNC connector
Voltage output	± 5 V Select with the strain output range changeover switch ± 25000 × 10^{-6} strain ± 10000 × 10^{-6} strain ± 5000 × 1^{-6}strain
Voltage output accuracy	± 0.5% FS (System as a whole)
Stability Zero point	± 0.55 mV/C°
Stability Sensitivity	± 0.05% FS/C°
S/N ratio	47 dB (System as a whole)
Calibration output	± 5 V
Low-pass filter	100 Hz, 500 Hz, PASS (1 kHz) (–3 dB ± 1 dB)
Balancing range	6000 × 10^{-6} strain
Balancing accuracy	± 5 mV
Display/operation	Strain output range changeover switch LPF changeover switch / calibration outputchangeover switch Balancing switch / output level LED
General	
Power supply voltage	DC 9 to 16 V
Consumption current	80 mA max (DC 12 V supplied, +23°C ± 5°C)
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Outside dimension	48 (W) x 23.5 (H) x 100 (D) mm (Excluding protrusions)
Mass	Approx. 140 g

Standard accessories

Instruction Manual..... 1
Warranty certificate 1
BNC coaxial cable (CR-31) 1
DC power cable (CR-062) 1
Receiving antenna 1

Options

2.4 GHz telemeter antenna cable, 1 m (CR-4701)
2.4 GHz telemeter antenna cable, 3 m (CR-4703)
2.4 GHz telemeter antenna cable, 5 m (CR-4705)
AC Adapter (CR-1869)
AC Adapter [For China] (CR-1869-C)

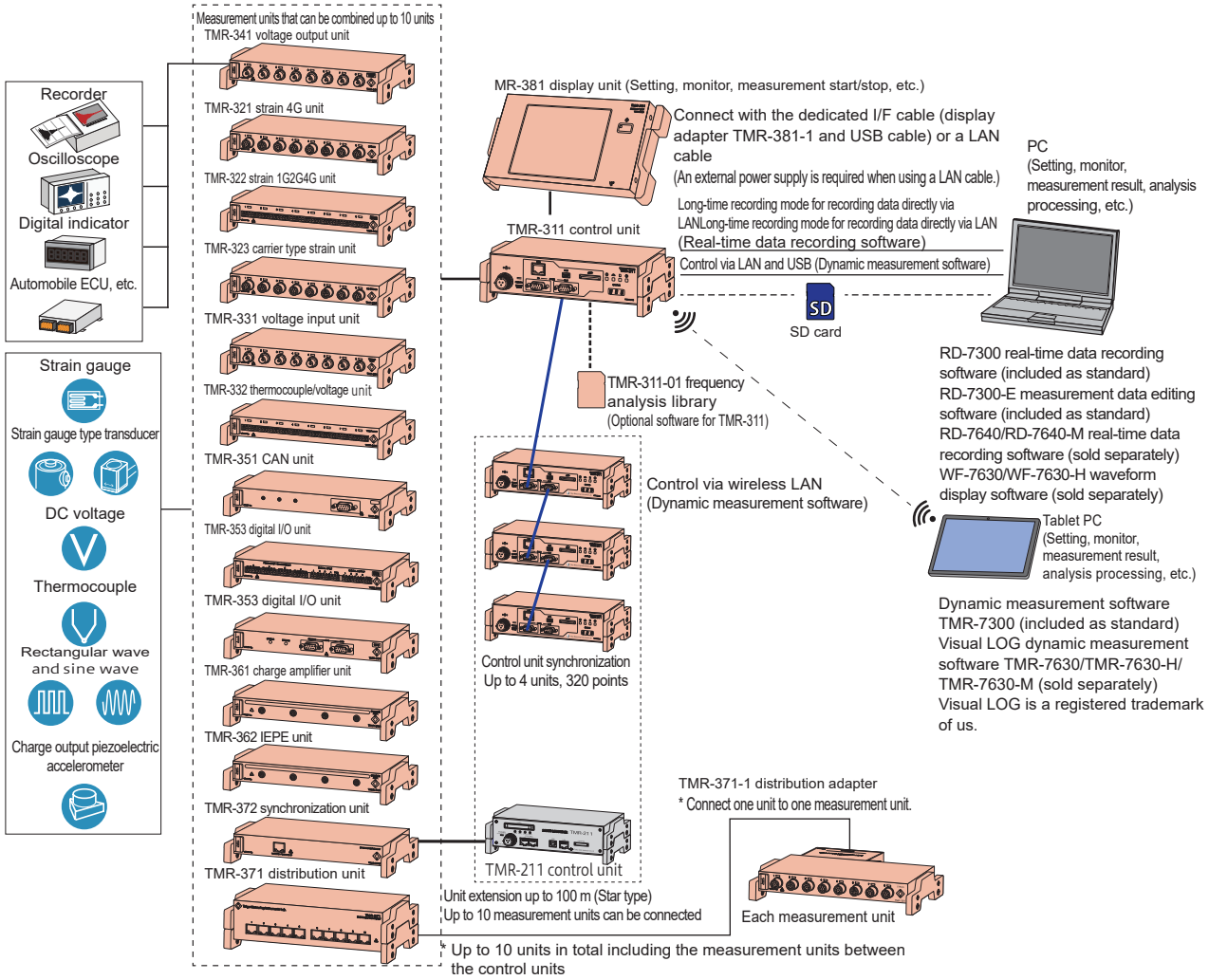
TMR-300 series

- A wide variety of sensor input/output units can be combined.
- Equipped with high-resolution range (strain 4G unit, strain 1G2G4G unit).
- High-speed sampling of 100 kHz.
- Up to 80 measuring points, up to 320 points with four units connected synchronously.
- Supports distributed connection of up to 100 m between the control unit and measurement unit.
- Vibration tolerance and compact size suitable for vehicle installation.
- Suitable for vehicle installation due to DC power operated.
- Data recovery during power outages and measurement resumption function when power is restored.
- Supports data storage on SD card (up to 32 GB).
- Built-in wireless LAN (Only in Japan).
- Real-time frequency analysis processing (optional) possible.
- Equipped with long-time recording mode that records data directly to a PC via LAN.
- TMR-321 supports remote sense and cancels a conductor resistance change in the sensor input conversion cable.



The multi-recorder TMR-300 series is a compact multichannel data recording system that can easily combine measurement units for various sensor inputs according to the purpose. Since it is compact and lightweight, it can be easily installed and used for measurements not only on existing structures (equipment machinery, bridges, etc.) with limited installation space but also on such moving objects as automobiles, aircraft, and ships. The measurement unit, which serves as the input for various sensors, supports strain gauges, DC voltages, thermocouples, etc., and can measure up to 80 points. In addition to waveform recording, real-time frequency analysis processing (optional) is possible. The control unit and up to 10 measurement units can be connected to be installed in a space-saving manner. In addition, the units can also be distributed and installed close to the sensors. The control unit is equipped with various interfaces, and various settings and measurement start are operated from a PC or the display unit. Using the built-in wireless LAN, operation and monitor display are possible using a tablet PC. In addition, by connecting the display unit, it is possible to control the multi-recorder in a stand-alone manner, including the setting of various units, measurement control, monitor, and setting file management.

System Block Diagram



TMR-311 (control unit)

Controls up to 80 input points (10 various measurement units), equipped with USB, LAN, and wireless LAN interfaces

This is a central unit of the multi-recorder compact multichannel data recording system. It controls various input/output units, supplies the power, and collects data. One unit of this equipment can perform measurement of up to 10 various input/output units, up to 80 points. Equipped with wireless LAN*1, its operation and monitoring are possible using a tablet PC.
*1: Wireless LAN is only available in Japan.

Supports SD cards of up to 32 GB capacity

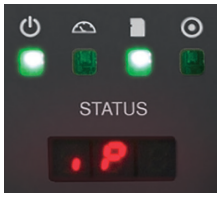
Measurement data is saved on an SD card. It supports SD cards of up to 32 GB capacity that enables long-time continuous data recording and supports recording in the high-speed mode of 0.01 ms.

Recording time of 16 GB SD card (included as standard)
Automatic measurement mode Free run
Sampling 1 ms

Number of CHs	Recording time
8 (1 unit)	Approx. 277 hours
80 (10 unit)	Approx. 27 hours

Three-digit, seven-segment LED to display the status of measuring instrument

The three-digit, seven-segment LED on the front of the TMR-311 displays the settings of IP address and errors, so the status of this unit can be checked easily.



Display contents of the seven-segment LED display
IP address
UPS charging rate
WLAN status
Serial number
SD card information
Power reduction
Error

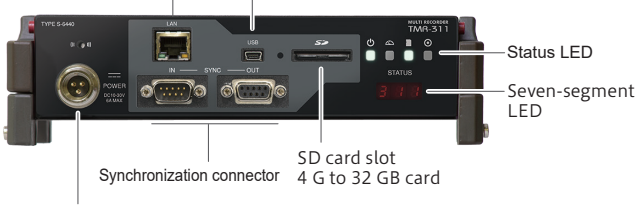
Histogram recording system

By adding the TMR-311-01 frequency analysis library (software option) to the control unit TMR-311, the multi-recorder system becomes a histogram recording system that digitally processes the measurement data according to a preset program and records it as a frequency count.
The frequency analysis result is recorded in real time, so the results can be checked immediately.

Front

LAN port
Connect to a PC using a LAN cable with RJ-45 connector. (For direct connection, a cross cable is used.)

USB port
Connect the CR-6187 USB cable included with this unit. Install the USB driver in the software included.



DC power connector
Connect the CR-10 DC power cable included with this unit. No power ON/OFF switch is provided. The unit operates at the same time when the power is connected.



TMR-311 control unit

Specifications (TMR-311)

Number of measuring points	Up to 80 points
Sampling	0.01 to 0.09 ms (0.01 ms increments) 0.1 to 0.9 ms (0.1 ms increments) 1 to 1000 ms (1 ms increments) 512 Hz, 1024 Hz, 2048 Hz, 4096 Hz, 8192 Hz
Data memory	128 M words (when used in the high-speed mode and no SD card inserted) The data is divided by the recording points in eight-point increments. When recorded eight points or less: 16 M data/point, when recorded 16 points or less: 8 M data/point When recorded 32 points or less: 4 M data/point, when recorded 64 points or less: 2 M data/point When recorded 80 points or less: 1.6 M data/point
Trigger function	
Data trigger	Data of arbitrary channel (Arbitrary input level, relative level from the start)
Command trigger	Command from interface
Timer trigger	Actual time, interval
External trigger	External trigger input from TMR-353
Synchronization of multiple units	Sampling and trigger synchronization up to TMR-311 x 4 sets (up to 320 points) Up to 100 m between control units
Recording media	SD card, 4 GB to 32 GB (SDHC high-speed mode, class 10)
Interface	LAN, USB, wireless LAN (AP mode, fixed IP)*1
Display	Status LED (Status display, IP address, etc.)
Power supply	DC 10 to 30 V, 0.6 A max (when 12 V is supplied, stand-alone) AC 100 to 240 V, 50/60 Hz, 100 VA max (when using the optional AC adapter CR-1895)
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Vibration tolerance	29.4 m/s² (10-55 Hz) three directions
Outside dimension	200 (W) × 50 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 900 g (Including rubber protectors)

Standard accessories

Instruction Manual..... 1
Warranty certificate 1
Power cable (CR-10)* 1
Ground wire (CR-2020) 1
CR-6187 USB cable 1
SD card (16 GB) 1
TMR-7300 dynamic measurement software
RD-7300 real-time data recording software
RD-7300-E measurement data editing software (CD-ROM) ... 1
Software instruction manual (included in CD-ROM) 1

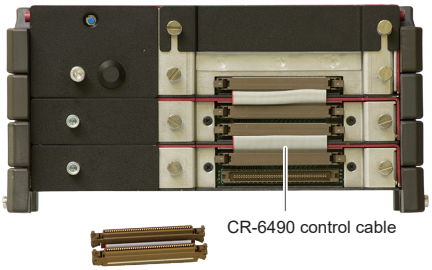
*CR-1011 is included for CE-compliant countries

Options

AC Adapter (CR-1897)
AC Adapter [For China] (CR-1897-C)

Back

The back of this unit is equipped with a flat cable connector for cascade connection of up to 10 measurement units. Connect using the CR-6490 control cable provided with the measurement unit.



TMR-381 (Display unit)

Stand-alone control of the TMR-311

Specifications for the TMR-381

Display unit	Color TFT LCD display, 320 x 240 dots (with touch panel)
Function	Various settings Control of measurement start / stop / balance Numerical monitor / waveform monitor Frequency monitor Measurement data display / frequency analysis result display
Interface	Dedicated I/F, LAN
Power supply	Supplied from TMR-311 using the dedicated I/F Or USB power feeding (Micro USB B connector)
Power supply voltage	DC 5 V
Consumption current	0.6 A max
Operating temperature / humidity range	0 to +50C° 5% RH or less (No condensation)
Outside dimension	200 (W) × 30 (H) × 110 (D) mm (Excluding protrusions)
Mass	Approx. 750 g (Including rubber protectors)

Standard accessories

Instruction Manual..... 1
Warranty certificate 1
CR-6188 dedicated I/F cable 1
TMR-381-1 display adapter 1

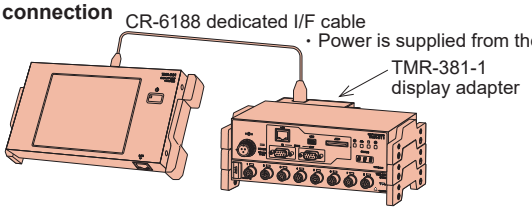
TMR-381 display unit



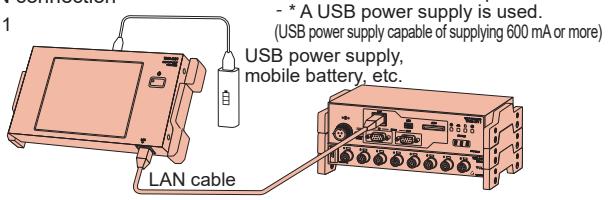
By connecting the TMR-381 display unit, it is possible to control the multi-recorder in a stand-alone manner, including the setting of various units, measurement control (balance / measurement start and stop / automatic measurement setting), monitor (T-Y Sweep / Y-T Cont. / X-Y / numerical / frequency) and setting file management. When using the dedicated I/F cable, no external power supply is required, and this unit is powered by the power supplied from the TMR-311 control unit. In addition, it also supports connection via a LAN cable, allowing for extension up to 100 m. As for power supply, it can be powered by a USB mobile battery. Additionally, the display unit is powered independently of the TMR-311 control unit. Even if the power supply of the display unit is turned OFF after automatic measurement was started, the measurement is continued. It is possible to connect when stopping the measurement or checking the data. Graph display of the measurement data recorded on an SD card and display of the frequency analysis result are possible.

Connection examples of the TMR-381 display unit

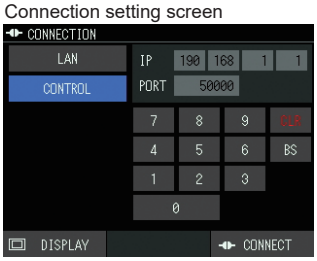
Control connection



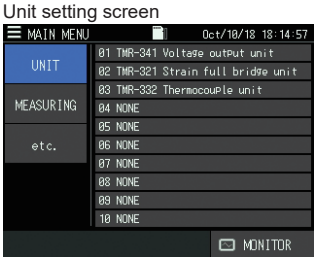
LAN connection



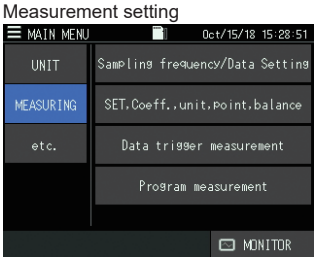
Connection setting screen



Unit setting screen



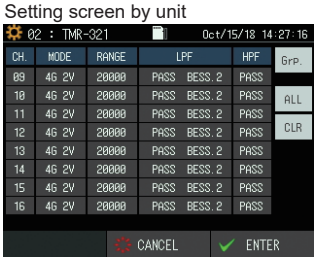
Measurement setting



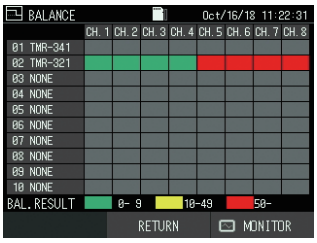
Others



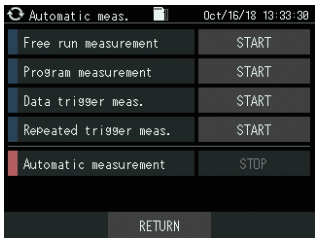
Setting screen by unit



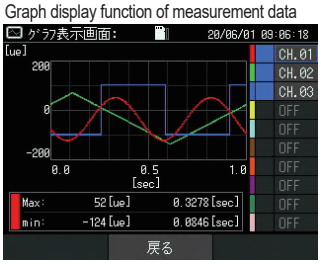
Balance result screen



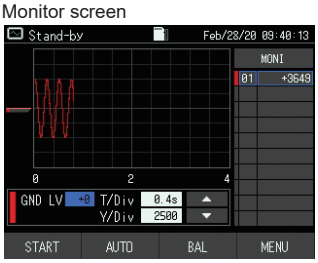
Automatic measurement menu



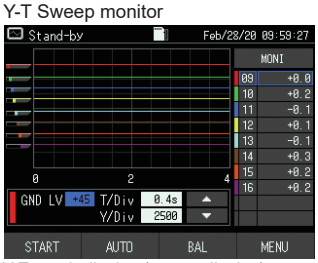
Graph display function of measurement data



Monitor screen

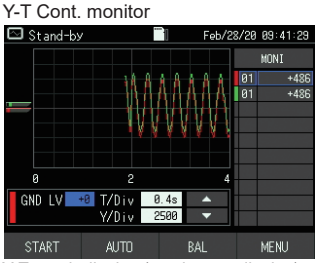


Y-T Sweep monitor



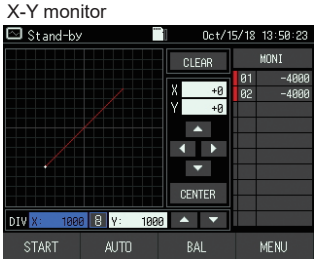
Y-T graph display (sweep display)

Y-T Cont. monitor



Y-T graph display (continuous display)

X-Y monitor



TMR-300 series (Various units)

TMR-321 strain 4G unit

Input unit for strain gauge type transducers and DC voltage
8 points/unit



TMR-321

Specifications for the TMR-321

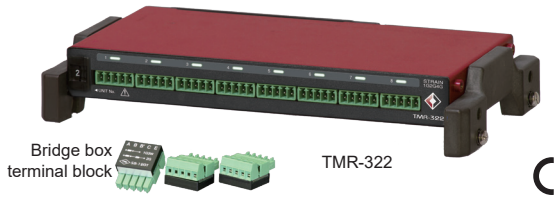
Number of measuring points	8 points
Input	Strain, voltage (when using option “CR-4010”)
Strain measurement	
Applicable gauge resistance	120 to 1000 Ω
Bridge excitation	DC 0.5 V, 2 V
Measurement range	± 20000 × 10^{-6} strain (Bridge excitation DC 2 V) ±80000 × 10^{-6} strain (Bridge excitation DC 0.5 V)
Measurement accuracy	± 20000/10000/5000 × 10^{-6} strain range ± 0.1% FS (at 23ºC ± 5C°) ± 2000 × 10^{-6} strain range ± 0.2% FS (at 23ºC ± 5C°)
Measurement range	± 20000/10000/5000/2000 × 10^{-6} strain range
Resolution	± 20000/10000/5000 × 10^{-6} strain range 1 × 10^{-6} strain (Bridge excitation 2 V) 4 × 10^{-6} strain (Bridge excitation 0.5 V) ± 2000 × 10^{-6} strain range 0.1 × 10^{-6} strain (Bridge excitation 2 V) 0.4 × 10^{-6} strain (Bridge excitation 0.5 V)
Balancing method	Electronic automatic
Balancing range	± 10000 × 10^{-6} strain
Balancing accuracy	± 3 × 10^{-6} strain or less
Zero stability	±1 × 10^{-6} strain/°C (at max. sensitivity)
Sensitivity stability	± 0.05%/°C (at max. sensitivity)
Voltage measurement	(When using the option CR-4010)
Measurement range	±20V
Measurement accuracy	± 20/10/5 V range ± 0.2% FS (at 23ºC ± 5°C) ± 2 V range ± 0.3% FS (at 23ºC ± 5°C)
Measurement range	± 20/10/5 V range (1 mV resolution) ± 2 V range (0.1 mV resolution)
Response frequency	DC to 10 kHz
Low-pass filter	
Cutoff frequency	Digital filter 1 Hz to 1 kHz (Can be set in 1 Hz increments) and PASS (Analog filter 10 kHz) -3 dB ± 1 dB
Cutoff property	1 Hz to 1 kHz: -12 dB/oct or -48 dB/oct Butterworth filter or Bessel filter PASS (10 kHz): -12 dB/oct Bessel filter
High-pass filter	
Cutoff frequency	Digital filter 0.2 Hz, 1 Hz and PASS
A/D converter	24bit
Display	Channel LED (Open, over, etc.) Unit number setting switch
Power supply	DC 10 V to 30 V, 0.2 A max (12 V) (Supplied from TMR-311)
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Vibration tolerance	29.4 m/s^2 (10-55 Hz) three directions
Outside dimension	200 (W) × 25 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 550 g (Including rubber protectors)

Standard accessories

Operation manual (A3 folded in one-eighth)..... 1
Warranty certificate 1
CR-6490 control cable 1
CR-6186 sensor input conversion cable 8

TMR-322 strain 1G2G4G unit

Various strain measurement bridge circuit compatible one-gauge method, two-gauge method and four-gauge method



Bridge box terminal block

TMR-322

Specifications for the TMR-322

Number of measuring points	8 points
Input	Strain
Strain measurement	
Applicable gauge resistance	120 to 1000 Ω
Bridge excitation	DC 0.5 V, 2 V
Measurement range	± 20000 × 10^{-6} strain (Bridge excitation DC 2 V) ±80000 × 10^{-6} strain (Bridge excitation DC 0.5 V)
Measurement accuracy	± 20000/10000/5000 × 10^{-6} strain range ± 0.1% FS (at 23ºC ± 5C°) ± 2000 × 10^{-6} strain range ± 0.2% FS (at 23ºC ± 5C°)
Measurement range	± 20000/10000/5000/2000 × 10^{-6} strain range
Resolution	± 20000/10000/5000 × 10^{-6} strain range 1 × 10^{-6} strain (Bridge excitation 2 V) 4 × 10^{-6} strain (Bridge excitation 0.5 V) ± 2000 × 10^{-6} strain range 0.1 × 10^{-6} strain (Bridge excitation 2 V) 0.4 × 10^{-6} strain (Bridge excitation 0.5 V)
Balancing method	Electronic automatic
Balancing range	± 10000 × 10^{-6} strain
Balancing accuracy	± 3 × 10^{-6} strain or less
Zero stability	±1 × 10^{-6} strain/°C (four-gauge method, at max. sensitivity)
Sensitivity stability	± 0.05%/°C (four-gauge method, at max. sensitivity)
Response frequency	DC to 10 kHz
Low-pass filter	
Cutoff frequency	Digital filter 1 Hz to 1 kHz (Can be set in 1 Hz increments) and PASS (Analog filter 10 kHz) -3 dB ± 1 dB
Cutoff property	1 Hz to 1 kHz: -12 dB/oct or -48 dB/oct Butterworth filter or Bessel filter PASS (10 kHz): -12 dB/oct Bessel filter
High-pass filter	
Cutoff frequency	Channel LED (Open, over, etc.) Unit number setting switch
A/D converter	24bit
Display	Channel LED (Open, over, etc.) Unit number setting switch
Power supply	DC 10 V to 30 V, 0.2 A max (12 V) (Supplied from TMR-311)
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Vibration tolerance	29.4 m/s^2 (10-55 Hz) three directions
Outside dimension	200 (W) × 25 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 550 g (Including rubber protectors)

Standard accessories

Operation manual (A3 folded in one-eighth)..... 1
Warranty certificate 1
CR-6490 control cable 1
Four-gauge terminal block 8
Small flathead screwdriver 1
SB-120T, SB-350T bridge box ..... 8 (factory selection)

TMR-323 carrier type strain unit

A carrier-type dynamic strain measurement unit ideal for measurement sites with a lot of induction noise, commercial power noise, etc.



TMR-323

CE

Specifications for the TMR-323

Number of measuring points		8 points
Input		Strain
Strain measurement		
Applicable gauge resistance		120 to 350 Ω
Bridge excitation		0.5 Vrms, 2 Vrms, 5 kHz
Measurement range		± 20000 × 10^{-6} strain (Bridge excitation 2 Vrms) ±80000 × 10^{-6} strain (Bridge excitation 0.5 Vrms)
Measurement accuracy		± 0.3% FS (at 23ºC ± 5C°)
Measurement resolution		1 x 10^{-6} strain (Bridge excitation 2 Vrms) 4 x 10^{-6} strain (Bridge excitation 0.5 Vrms)
Balancing range	Resistance	± 10000 × 10^{-6} strain
	Capacity	3000pF
Balancing method		Software type
Zero stability		± 0.1 × 10^{-6} strain/C° or less
Sensitivity stability		± 0.05% FS/ C° or less
Response frequency		DC to 2.5 kHz
Low-pass filter		
Cutoff frequency		Digital filter 5 Hz to 1 kHz (Can be set in 1 Hz increments) and PASS (Analog filter 2.5 kHz) -3 dB ± 1 dB
Cutoff property		5 Hz to 1 kHz: -48 dB ± 1 dB/oct Butterworth filter or Bessel filter PASS (2.5 kHz): Butterworth filter
High-pass filter		
High-pass filter		Digital filter 0.2 Hz, 1 Hz and PASS
A/D converter		18-bit
Display		Channel LED (Set, over, etc.) Unit number setting switch
Power supply		DC 10 V to 30 V, 0.3 A max (12 V) (Supplied from TMR-311)
Operating temperature / humidity range		0 to +50C° 85% RH or less (No condensation)
Vibration tolerance		29.4 m/s^2 (10-55Hz) three directions
Outside dimension		200 (W) × 25 (H) × 100 (D) mm (Excluding protrusions)
Mass		Approx. 660 g (Including rubber protectors)

Standard accessories

Operation manual (A3 folded in one-eighth)..... 1
Warranty certificate 1
CR-6490 control cable 1
CR-6186 sensor input conversion cable 8

TMR-331 voltage input unit

Measures DC voltage ± 52 V



TMR-331

CE

Specifications for the TMR-331

Number of measuring points	8 points (BNC connector)
Input	Voltage
Input method	Single end (unbalanced) Inter-channel insulation
Input impedance	About 100 kΩ
Measurement range	± 52 V
Measurement accuracy	± 0.2% FS (at 23ºC ± 5C°)
Measurement range	± 52 V range (5 mV resolution) ± 20 V range (2 mV resolution) ±10 V range (1 mV resolution) ± 5 V range (0.5 mV resolution) ±1 V range (0.1 mV resolution)
Zero stability	± 0.1 mV/°C (at max. sensitivity)
Sensitivity stability	± 0.05%/°C (at max. sensitivity)
Response frequency	DC to 10 kHz
Low-pass filter	
Cutoff frequency	Digital filter 1 Hz to 1 kHz (Can be set in 1 Hz increments) and PASS (Analog filter 10 kHz) -3 dB ± 1 dB
Cutoff property	1 Hz to 1 kHz: -12 dB/oct Butterworth filter or Bessel filter PASS (10 kHz): -12 dB/oct Bessel filter
A/D converter	24-bit
Display	Channel LED (Set, over, etc.) Unit number setting switch
Power supply	DC 10 V to 30 V, 0.25 A max (12 V) (Supplied from TMR-311)
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Vibration tolerance	29.4 m/s^2 (10-55 Hz) three directions
Outside dimension	200 (W) × 25 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 550 g (Including rubber protectors)

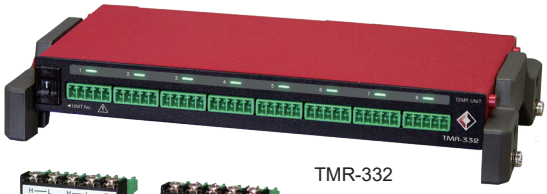
Standard accessories

Operation manual (A3 folded in one-eighth)..... 1
Warranty certificate 1
CR-6490 control cable 1

TMR-300 series (Various units)

TMR-332 thermocouple voltage unit

Temperature measurements with thermocouples T, K and J, and measurements of DC voltage ± 20 V



TMR-332



TA-02T thermocouple measurement terminal block



VA-02T voltage measurement terminal block

Specifications for the TMR-332

Thermocouple measurement		
Number of measuring points	8 points (when using the thermocouple measurement terminal block)	
Applicable thermocouple	T, K, J	
Measurement range	T	-200 to 400C°
	K	-200 to 1300C°
	J	-200 to 1200C°
Measurement range	T	-200 to 400°C 0.1°C resolution
	K, J	-200 to 600°C 0.1°C resolution
		-200 to 1300°C 0.2°C resolution
Measurement accuracy	External reference junction	± (0.5% rdg + 1C°) (23C°± 5C°) ± (0.5% rdg + 2C°)
	Internal reference junction	± (0.5% rdg + 1.5C°) (23C°± 5C°) ± (0.5% rdg + 2.5C°)
Response frequency	DC to 10 Hz	
Linearization	Digital calculation	
Voltage measurement		
Number of measuring points	8 points (when using the voltage measurement terminal block)	
Input method	Single end (unbalanced) Inter-channel insulation	
Input impedance	About 100 kΩ	
Measurement range	± 20 V	
Measurement range	± 20 V range, 2 mV resolution	
Measurement accuracy	± 0.5% FS	
Zero stability	± 2 mV/°C (at max. sensitivity)	
Sensitivity stability	± 0.05%/°C (at max. sensitivity)	
Response frequency	DC to 10 kHz	
Low-pass filter		
Cutoff frequency	Digital filter 1 Hz to 1 kHz (Can be set in 1 Hz increments) and PASS (Analog filter 10 kHz) -3 dB ± 1 dB	
Cutoff property	1 Hz to 1 kHz: -12 dB/oct Butterworth filter or Bessel filter PASS (10 kHz): -12 dB/oct Bessel filter	
A/D converter	24-bit	
Display	Channel LED (Set, over, etc.) Unit number setting switch	
Power supply	DC 10 V to 30 V, 0.25 A max (12 V) (Supplied from TMR-311)	
Operating temperature / humidity range	0 to +50C° 5% RH or less (No condensation)	
Vibration tolerance	29.4 m/s^2 (10-55 Hz) three directions	
Outside dimension	200 (W) × 25 (H) × 100 (D) mm (Excluding protrusions)	
Mass	Approx. 550 g (Including rubber protectors)	

Standard accessories

Operation manual (A3 folded in one-eighth)..... 1
Warranty certificate 1
CR-6490 control cable 1
TA-02T thermocouple measurement terminal block 4
VA-02T voltage measurement terminal block 4

Thermocouple measurement terminal block “TA-02T”

Number of measuring points	2 points
Applicable thermocouple	T, K, J
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Outside dimension	42 (W) × 14 (H) × 25 (D) mm (Excluding protrusions)
Mass	Approx. 20 g

Voltage measurement terminal block “VA-02T”

Number of measuring points	2 points
Input impedance	About 100 kΩ
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Outside dimension	42 (W) × 14 (H) × 25 (D) mm (Excluding protrusions)
Mass	Approx. 20 g

TMR-341 voltage output unit

Performs analog conversion of strain and temperature data measured by other measurement units to output as voltages.



TMR-341

* Connect the voltage output unit directly below the control unit.

Specifications for the TMR-341

Number of output points	8 points (BNC connector)
Output signal	Voltage output of the measurement data of another measurement unit (corresponding measuring points are set arbitrarily), output of addition/ subtraction results for up to 4 points
Output level	±10 V, ± 5 V, 0 to +5 V (5 kΩ load)
Output accuracy	± 0.5% FS
Calibration output	Arbitrary output at zero and within the output level range
Output accuracy	± 0.5% FS
S/N ratio	50 dBp-p or more (for maximum output 10 V)
Zero stability	± 0.5 mV/C°
Sensitivity stability	± 0.05%/°C
Display	Channel LED (Set, over, etc.) Unit number setting switch
Power supply	DC 10 V to 30 V, 0.3 A max (12 V) (Supplied from TMR-311)
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Vibration tolerance	29.4 m/s^2 (10-55 Hz) three directions
Outside dimension	200 (W) × 25 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 550 g (Including rubber protectors)

Standard accessories

Operation manual (A3 folded in one-eighth)..... 1
Warranty certificate 1
CR-6490 control cable 1

TMR-351 CAN unit

Built-in CAN interface allows data recording / output via CAN bus

Simultaneous measurements of vehicle integrated control signals and acceleration / torque / stress are possible, enabling analysis of control systems.



TMR-351

CAN signal
Data reception Number of recordable IDs: 0 to 64
Data transmission Number of signals: 0 to 8

Specifications for the TMR-351

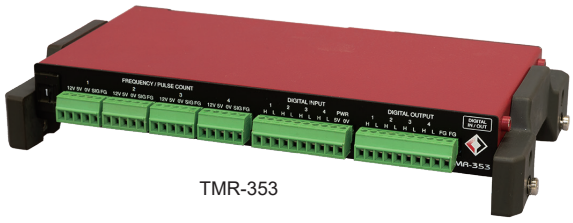
Supported protocol	CAN Specification V2.0B active compliant ISO 11898 (High Speed)
Communication speed	10 k to 1 Mbps
Number of messages	Up to 64 (Receiving: up to 64, sending: up to 62)
Number of signals	Up to 512
Data receiving	Records the message with the specified ID Number of recordable IDs: 0 to 64 Data length: 1 to 8 Byte When monitoring / recording with TMR-311, up to 80 signals (80 channels) (The maximum number of recordable signals depends on the unit configuration.)
Data sending	Data output of the specified channels Potential output of data 0 to 64 Data length: 16-bit (2 Byte)
Recording	Up to 32 Mbytes (Internal RAM) After recording data of other measurement units with TMR-311, all messages are recorded separately.
Function	Data bit specification, endianness setting For the sent message, data frame, remote frame, or return when receiving remote frame can be selected. The message sending cycle can be selected. The listen-only mode can be selected.
Display	Unit number setting switch CAN SIGNAL: CAN bus signal RECEIVE: Receiving SEND: Sending
Connector	D-Sub 9-pin connector (male) CAN input withstand voltage -27 V to 40 VDC (max)
Power supply	0.5 A max (12 V) (Supplied from TMR-311)
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Vibration tolerance	29.4 m/s² (10-55 Hz) three directions
Outside dimension	200 (W) × 25 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 530 g (Including rubber protectors)

Standard accessories

- Operation manual (A3 folded in one-eighth)..... 1
- Warranty certificate 1
- CR-6490 control cable 1
- CR-6480 CAN power cable 1

TMR-353 digital I/O unit

Equipped with functions for counting and frequency conversion of digital pulse signals of rotary encoders, speed sensors, etc. In addition, digital inputs and outputs required for various measurements, such as trigger (measurement start) signal input, sampling clock signal input/output and alarm (upper and lower limit setting) output, are possible.



TMR-353

Specifications for the TMR-353

Frequency measurement and pulse count part			
Number of input points	4 points		
Input signal waveform	Rectangular wave or sine wave		
Maximum input voltage	±15 V		
Measurement voltage range	Minimum input signal: 50 mVp-p	Maximum input signal: ±12 V	
Response frequency	1 Hz to 100 kHz		
Threshold level	Low	High level +15 mV	Low level -15 mV
	Middle	High level +100 mV	Low level -100 mV
	High	High level +1.0 V	Low level -1.0 V
	Digital	TTL, CMOS	
	Arbitrary	Setting range: ±10 V	Can be set in 0.1 V increments
Threshold level accuracy	±15 mV: ± (15 mV + 5 mV) Other than the above: ± (1% rdg + 50 mV)		
Frequency measurement accuracy	± 0.1% FS		
Frequency range	100 kHz range (10 Hz resolution), 50 kHz range (5 Hz resolution), 10 kHz range (1 Hz resolution), 5 kHz range (0.5 Hz resolution), 1 kHz range (0.1 Hz resolution), 500 Hz range (0.05 Hz resolution), 100 Hz range (0.01 Hz resolution)		
Power output	Output voltage: 5 V/12 V Output current: 5 V/50 mA, 12 V/25 mA (It is not possible to use 5 V and 12 V at the same time.)		
Count range	0 to 29,999 count 0 to 899,999,999 count (1CH + 2CH, 32-bit counter mode)		
Function	Frequency measurement, count measurement, rotary encoder calculation A-phase/B-phase count calculation, A-phase/B-phase/Z-phase angle calculation		
Digital input part			
Number of input points	4 points		
Insulation method	Photocoupler insulation		
Maximum applied voltage	15 V		
Operating current	4 mA to 25 mA		
Input pulse width	0.5 ms or more (Response frequency: 1 kHz or less), negative logic		
Power output	Output voltage: 5 V Output current: 50 mA		
Function	Trigger input, external sampling input, marker signal input, balance signal input, calibration output signal input (zero/+/-), measurement start (RUN), measurement stop (HALT), measurement pause (PAUSE) (Can be set arbitrarily for each input)		
Digital output part			
Number of output points	Trigger signal output: 1 point Alarm (upper limit): 1 point	Sampling signal output: 1 point Alarm (lower limit): 1 point	
Output format	Open collector output Maximum applied voltage: 15 V Maximum load current: 5 mA Maximum voltage when ON: 0.5 V or less		
Sampling output	Output signal frequency: 1 kHz or less		
Display	Unit number setting switch		
Power supply	0.5 A max (12 V) (Supplied from TMR-311)		
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)		
Vibration tolerance	29.4 m/s² (10-55 Hz) three directions		
Outside dimension	200 (W) × 25 (H) × 100 (D) mm (Excluding protrusions)		
Mass	Approx. 550 g (Including rubber protectors)		

Standard accessories

- Operation manual (A3 folded in one-eighth)..... 1
- Warranty certificate 1
- CR-6490 control cable 1
- Small flathead screwdriver 1
- Frequency/pulse count terminal block 4
- Digital input/output terminal block 2

TMR-300 series (Various units)

TMR-354 GPS unit

Records a satellite-based positioning system, such as the GPS, and time adjustment using the GPS is also possible.
Behavior understanding during long-distance transport using position information and timing synchronization with other equipment and images using accurate time data are possible.



TMR-354

Related Products

GPS receiver --- TMR-GPSC

* Contact us for compatible GPS receivers.

Specifications for the TMR-354

Maximum number of connectable units	1 unit for TMR-311
Supported GPS receiver	General-purpose RS-232C type Communication speed: 11520 bps NMEA protocol (without power supply) CAN type Communication speed: 250 kbps (with power supply)
Position measurement accuracy	GPS/Galileo/GLONASS/BeiDou Positioning accuracy: 2.5 m CEP Update cycle: 1 Hz * Depends on the GPS receiver used.
GPS data	Longitude in 0.0000001° units, latitude in 0.0000001° units Altitude in 1 m units, time in 0.1 sec units, speed in 0.1 km/h units, distance in 1 m units, azimuth direction in 0.1° units *Depends on the GPS receiver used.
GPS time adjustment	TMR-311 time adjustment with the GPS time data * The regional time is used.
Data receiving	Recording of the received GPS data When monitoring / recording with TMR-311, the GPS data is selected. (The maximum number of recordable data depends on the unit configuration.)
Recording	Up to 32 Mbytes (Internal RAM) After recording data of other measurement units with TMR-311, all GPS data are recorded separately.
Function	Setting of channels to be monitored / recorded Setting of recording format Setting of regional time Setting of the TMR-311 time adjustment
Display	Unit number setting switch STATUS: GPS receiver signal RECEIVE: Receiving
Connector	D-Sub 9-pin connector (male) RS-232C compliant x 1 CAN compliant x 1
Power supply	0.2 A max (12 V) (Supplied from TMR-311)
Operating temperature / humidity range	0 to +50C° 5% RH or less (No condensation)
Vibration tolerance	29.4 m/s² (10-55 Hz) three directions
Outside dimension	200 (W) × 25 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 530 g (including rubber protectors)

Standard accessories

Operation manual (A3 folded in one-eighth)..... 1
Warranty certificate 1
CR-6490 control cable 1
* GPS receiver and connection cable are sold separately.

TMR-361 charge amplifier unit

Compatible with piezoelectric accelerometers that are characterized by high frequency characteristics and a high operating temperature range.



TMR-361

Specifications for the TMR-361

Number of input points	4 points	
Compatible piezoelectric accelerometer	Charge output accelerometer, charge sensitivity 0.1 to 10 pC (m/s²)	
Input connector	10-32UNF miniature connector	
Allowable charge input	10000 pC	
Measurement accuracy	± 3% FS (100 Hz, at 23ºC ± 5C°)	
Measurement range	250 pC range	0.01 pC resolution Equivalent to 250 m/s² at charge sensitivity 1 pC/(m/s²)
	2500 pC range	0.1 pC resolution Equivalent to 2500 m/s² at charge sensitivity 1 pC/(m/s²)
	10000 pC range	0.4 pC resolution Equivalent to 10000 m/s² at charge sensitivity 1 pC/(m/s²)
Response frequency	1 Hz to 10 kHz	

Low-pass filter	
Cutoff frequency	Digital filter 1 Hz to 1 kHz (Can be set in 1 Hz increments) and PASS (Analog filter 10 kHz) -3 dB ± 1 dB
Cutoff property	1 to 1 kHz: -12dB ± 1 dB/oct Butterworth filter or Bessel filter PASS (10 kHz): Bessel filter
High-pass filter	
Cutoff frequency	Digital filter 1 Hz fixed
Display	Channel LED (Set, over, etc.) Unit number setting switch
Power supply	0.35 A max (12 V) (Supplied from TMR-311)
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Vibration tolerance	29.4 m/s² (10-55 Hz) three directions
Outside dimension	200 (W) × 25 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 550 g (including rubber protectors)

Standard accessories

Operation manual (A3 folded in one-eighth)..... 1
Warranty certificate 1
CR-6490 control cable 1

Connector shapes of compatible accelerometers
The input connector of the TMR-361 is a 10-32UNF miniature connector. It can be connected if the cable connector of the charge output accelerometer is the 10-32UNF (male type).

TMR-362 IEPE unit

This is an IEPE sensor unit designed for use with the TMR-300 Series Multi Recorder.
It is compatible with ICP® / IEPE Sensors.
***IEPE: Integrated Electronic Piezo-Electric.**



TMR-362

- Supports up to 4 measurement channels
- Two selectable measurement ranges: ±5000 mV and ±500 mV (for high-resolution measurements)
- High-speed mode with a maximum sampling rate of 1 MHz and frequency response up to 100 kHz

Specifications for the TMR-362

Number of measuring points		4
Applicable Sensors		Integrated Piezoelectric Sensors with Built-in Amplifier (IEPE)
Input Connector		BNC Connecto
Sensor Power Supply		Constant Current Supply (4 mA, DC 24 V)
Measuring range		±5000 mV
Measurement Accuracy		±3%FS (at 23±5C°)
Measurement Range		±5000 mV range ±500 mV range
Resolution		0.25 mV resolution (at ±5000 mV range) 0.025 mV resolution (at ±500 mV range)
Frequency Response		0.02Hz to 100kHz
Low-Pass Filter	**Cutoff Frequency**	Digital Filter 10 Hz to 10 kHz (adjustable in 10 Hz increments) and PASS (analog filter at 100 kHz) -3 dB ±1 dB
	Cutoff Characteristics	10 Hz to 10 kHz: -12 dB/oct or -48 dB/oct Butterworth or Bessel filters PASS (100 kHz): -12 dB/oct Bessel filter
A/D Converter		16bit
Sampling Rate		Low Speed 0.01msec to 0.09msec 0.1msec to 0.9msec 1msec to 1000msec High Speed 0.001 msec (1MHz) 0.002msec (0.5MHz) 0.005msec (0.2MHz)
Data Memory (Used when sampling interval is less than 0.01 ms)		16M Words (divided among channels) Recording 1 channel: 16M data points per channel Recording 2 channels: 8M data points per channel Recording 4 or fewer channels: 4M data points per channel
Display		Channel LEDs (e.g., Set, Overload indicators) Unit Number Setting Switch
Power Supply		0.4 A MAX (12 V) (Supplied from TMR-311)
Operating Temperature and Humidity Range		0 to +50C°, up to 85% RH (non-condensing)
Vibration Resistance		29.4 m/s^2 (10–55 Hz), 3 direction
Dimensions		200 (W) × 25 (H) × 100 (D) mm (excluding protrusions)
Weight		Approx. 550 g (including rubber protector)

Standard accessories

Operation manual (A3 folded in one-eighth) ····· 1
Warranty certificate ····· 1
CR-6490 control cable ····· 1

* After recording, data is transferred to the control unit, so continuous measurement is not possible.
When the maximum memory is full, each unit requires about 10 minutes before the next measurement.
Sampling below 0.01 ms prevents recording from other units.

Note: Synchronized measurement with multiple TMR-311 units is not supported.

TMR-300 series (Various units)

TMR-371 distribution unit

The measurement units are distributed to realize a wide range of dynamic measurements.



TMR-371

The TMR-371 distribution unit and the TMR-371-1 distribution adapter are units that enable distribution and extension of the measurement units of the TMR-300 series. By connecting the distribution unit to the control unit and connecting the distribution adapter to the measurement unit to be extended, the distance between the control unit (distribution unit) and the measurement unit (distribution adapter) can be extended up to 100 m.
Up to 10 measurement units can be connected to one distributed unit. With 10 measurement units distributed and extended, sampling of up to 100 kHz is possible, the same as when not extended. Since power supply to the measurement units is performed from the distribution unit via the connection cables, one connection cable enables communication, synchronization, and a power supply.

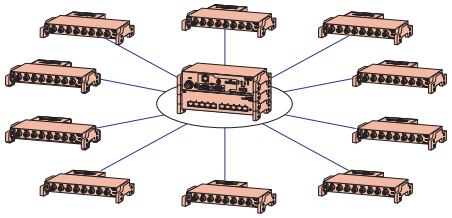
Specifications for the TMR-371

Number of distribution unit connections	1 unit (for 1 unit of the TMR-311)
Number of measurement unit connections	10 units (including the measurement unit that is connected directly to TMR-311)
Power supply	0.2 A max (12 V) (Supplied from TMR-311)
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Vibration tolerance	29.4 m/s^2 (10-55 Hz) three directions
Outside dimension	200 (W) × 50 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 800 g (including rubber protectors)

Standard accessories

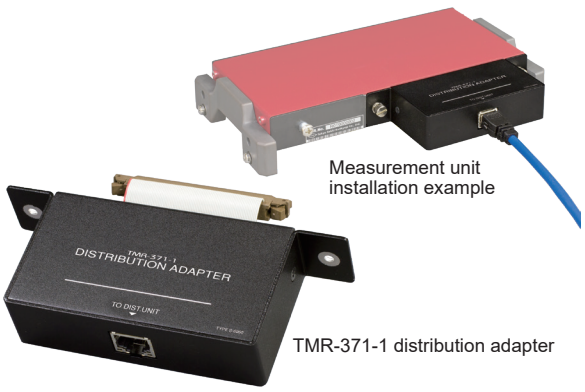
Operation manual (A3 folded in one-eighth)..... 1
Warranty certificate 1
CR-6490 control cable 1

- Measurement units can be distributed and arranged in a star configuration.
  The distance between the TMR-371 distribution unit and each measurement unit (TMR-371-1 distribution adapter) can be extended (up to 100 m) using the STP cable, and synchronized measurements of sensors scattered over a wide area is realized easily.
- Power supply from the distribution units
  Each distributed and allocated measurement unit is powered by the power supply from the TMR-371 distribution unit, so there is no need to install power supply equipment.
- Wiring saving
  Since the measurement unit can be allocated near the sensor, wiring saving of the sensor cables is possible and the digital signal from the measurement unit enables stable measurement.
- The number of measurement unit connections is up to 10 units.
  Up to 10 units in total including the measurement units between the control units can be connected. In addition, one distribution unit can be connected to one control unit.



TMR-371-1 distribution adapter

Extends the distance between the distribution unit and the measurement unit to up to 100 m.
Wiring saving is possible because the measurement unit can be installed near the sensors.



Measurement unit installation example

TMR-371-1 distribution adapter

Specifications for the TMR-371-1

Number of distribution adapter connections	10 units (for one unit of the TMR-371)
Number of measurement unit connections	1 unit
Extension distance	100 m
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Vibration tolerance	29.4 m/s^2 (10-55 Hz) three directions
Outside dimension	130 (W) × 25 (H) × 50 (D) mm (Excluding protrusions)
Mass	Approx. 150 g

Standard accessories

Warranty certificate 1

TMR-372 synchronization unit

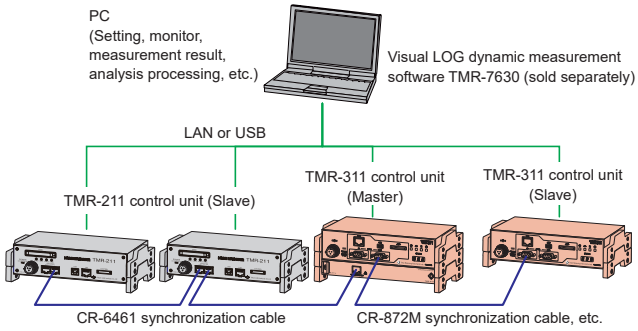
Realization of synchronized measurement with the TMR-211



TMR-372

Connection of synchronization unit

The TMR-372 synchronization unit is a unit that enables synchronized measurement of the TMR-300 series and the TMR-200 series. By combining the TMR-211 control units, sampling and trigger synchronized measurement of up to four units is possible.



Specifications for the TMR-372

Synchronizable unit	TMR-211
Number of the TMR-211 connections	Up to 3 units
Synchronization of multiple units	Up to 4 units (including master) • TMR-311 x 1 + TMR-211 x 3 • TMR-311 x 2 + TMR-211 x 2 • TMR-311 x 3 + TMR-211 x 1 * Only one TMR-372 can be used in one system. When there are multiple TMR-311s, connect them to the master side. * As for the TMR-311 to which TMR-372 is connected, the number of units that can be connected is limited to 9.
Delay time	When measurement is started from the TMR-311 with the fastest sampling rate of 100 kHz (10 µs), the TMR-311 data will be delayed by 390 µs relative to the TMR-211 data. When measurement is started from the TMR-211, the TMR-311 data will be delayed by 350 µs relative to the TMR-211 data.
Display	Unit number setting switch
Power supply	0.25 A max (12 V) (Supplied from TMR-311)
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Earthquake resistance	29.4 m/s² (10-55 Hz) three directions
Outside dimension	200 (W) × 25 (H) × 100 (D) mm (Excluding protrusions)
Mass	Approx. 500 g (Including rubber protectors)

Standard accessories

Operation manual (A3 folded in one-eighth)..... 1
Warranty certificate 1
CR-6490 control cable 1
CR-6461 synchronization cable 1

* When using the synchronization unit, use the TMR-7630 measurement software.

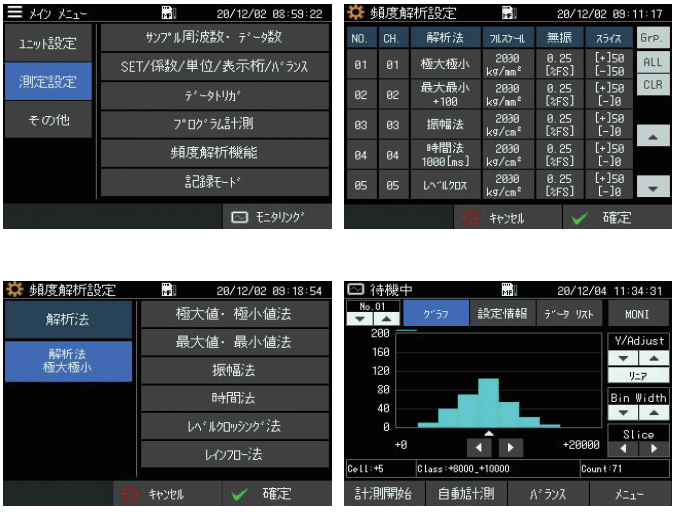
TMR-311-01 frequency analysis library (Software option of the TMR-311)

This is a software option to add the frequency analysis function to the TMR-300 multi-recorder system series. It realizes a histogram recording system that digitally processes measurement data according to a pre-set program and records it as a frequency count.
Before conducting measurements, it is necessary to see the frequency measurement. Specify the channel to perform frequency measurement and set the analysis method, slice level, full scale, etc. Frequency measurement can perform up to 80 analyses in low-speed mode with a sampling interval of 1 ms or more. In addition, it is also possible to set multiple analysis methods for the same channel.

Specifications for the TMR-311-01

Analysis method	Peak-valley method, max-min method, time method, amplitude method, level crossing method, rain flow method
Number of analyzes	80 analyses (arbitrary channel)
Number of slices	Up to 100 (Arbitrary setting for up to 100 slices within the range of ±100)
Full scale	200 to 20000 x 10^{-6} strain
Count capacity	About ± 4.2 billion count / slice
Invalid amplitude	4 to 5000 x 10^{-6} strain (Effective for analyses other than the time method)
File function	File recording frequency data (Frequency data files at regular intervals and cumulative frequency data files can be created)

*As analysis conditions, the sampling speed is slower than 1 ms and an SD card is inserted.



Frequency measurement setting screen and graph display screen using the TMR-381 display unit

TMR-300 series (Various units)

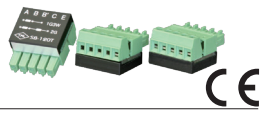
Related Products (For multi-recorders)

CR-1897 *AC Adapter for China (CR-1897-C)

This product connects the TMR-311 to AC 100 V to supply the power.

SB-120T / SB-350T bridge box

This is a bridge box for the TMR-322 strain 1G2G4G unit.



Number of measuring points	1 point
Applicable gauge resistance	120 Ω (SB-120T) 350 Ω (SB-350T)
Wiring method	one-gauge method three-wire type, two-gauge method
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Outside dimension	20 (W) × 14.5 (H) × 25 (D) mm (Excluding protrusions)
Mass	Approx. 10 g

Handle

This is a handle for transport and fixing.
(Dedicated screws included)



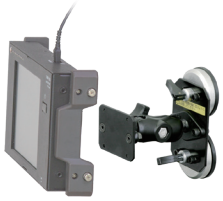
Bracket

This is an L bracket for installation.
(Dedicated screws included)



Display unit mounting stand

Attraction type stand
This is an attraction stand that fixes the display unit to the windshield, etc.
(Dedicated screws included)



Tilt type fixing stand
This stand is installed on the recorder main unit and the angle of the display unit can be adjusted freely. (Dedicated screws included)



CR-4010 attenuator cable

This cable is used when performing voltage measurements with the TMR-321.
Voltage measurement range: ± 20 V

BNC connector



Extension control cable

This cable is used to extend the connection between the control unit and the measurement unit. It can be used up to extension of 5 m in total.



CR-6491

Model name	Cable length
CR-6491	1 m
CR-6493	3 m
CR-6495	5 m

Distribution adapter extension cable (STP cable)

This is an STP (Shielded Twisted Pair) cable that connects the TMR-371 distribution unit and the TMR-371-1 distribution adapter. It can be extended up to 100 m.



CR-8899

Model name	Cable length
CR-8805	5 m
CR-8810	10 m
CR-8820	20 m
CR-8850	50 m
CR-8899	100m

Control unit synchronization cable

This is a synchronization cable that connects between the TMR-311 control units. It can be extended up to 100 m.



CR-8701

Model name	Cable length
CR-872M	2 m
CR-875M	5 m
CR-8701	10 m
CR-8702	20 m
CR-8705	50 m
CR-8710SYNC	100 m

Attached Software

TMR-7300 Dynamic measurement software

The TMR-7300 dynamic measurement software controls one TMR-311 and can perform online and offline measurements. It is possible to perform data monitoring, data collection, data editing (table creation, drawing), data processing, and calculations using expansion CHs. In offline measurement, it is possible to perform the free-run, data trigger and program measurements.

RD-7300 real-time data recording software

The RD-7300 real-time data recording software collects and records the data measured by the TMR-300 series directly to a PC. It can perform long-time and large-capacity measurements without depending on the data memory or SD card capacity of the TMR-311. In addition, the RD-7300-E measurement data editing software, which is also attached, is used for data processing.

RD-7300-E measurement data editing software

This software is used to perform data processing such as management of data files recorded by the RD-7300, batch processing of multiple data files and drawing

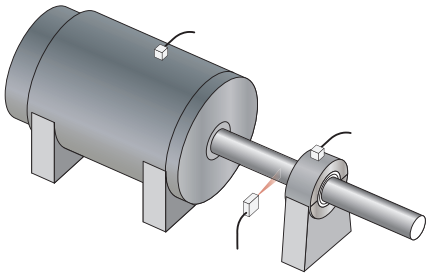
Compatible software	Standard attached software	Optional software
Dynamic measurement software	TMR-7300	MR-7630 TMR-7630-H (Frequency processing) TMR-7630-M (Video compatible)
Real-time data recording software	RD-7300	RD-7640
Measurement data editing software	RD-7300-E	WF-7630

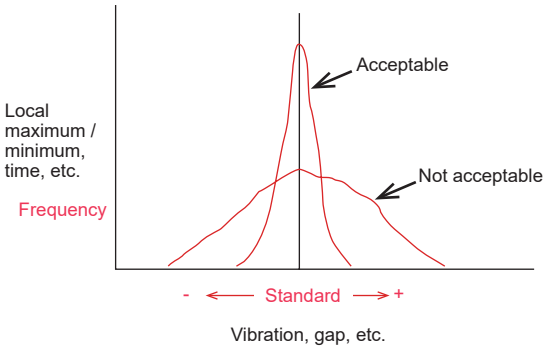
Stress Frequency Analysis

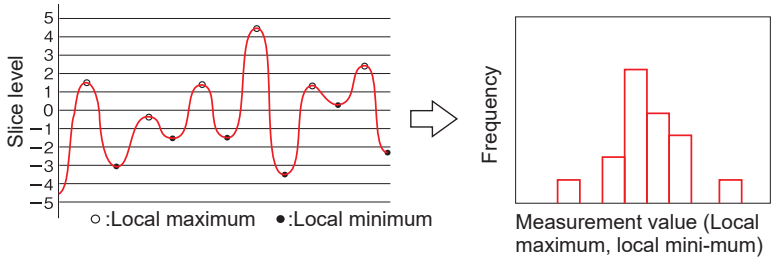
What is frequency analysis?

There are many phenomena around us that change over time. There are many cases where the physical quantities handled by measuring instruments change over long periods of time, such as the behavior of machine / structure, or changes in the surrounding environment, such as temperature and humidity. In order to accurately grasp the meanings of such quantities, it is necessary to know not only the change in waveform but also the frequency distribution and the correlation between two quantities. That is, what quantities and proportions occurred in changing phenomena over a long period of time, or how two phenomena occurred with what relationship.

For example, when the bearings of a rotating machine deteriorate, phenomena, such as greater variation in the gap between the rotor and stator and increased vibrations associated with rotation appear. Frequency analysis can be used to quantitatively grasp the phenomena to determine whether or not the parts need to be replaced or repaired. Accelerometers are used to measure vibrations and gaps, and the frequencies of local maximum / minimum valuesand time frequency are obtained. By reading out the frequencies at regular intervals, when the distribution exceeds a certain range, it can be determined that a repair is required. Therefore, the analysis is effective to optimize the replacement timing of machine parts.







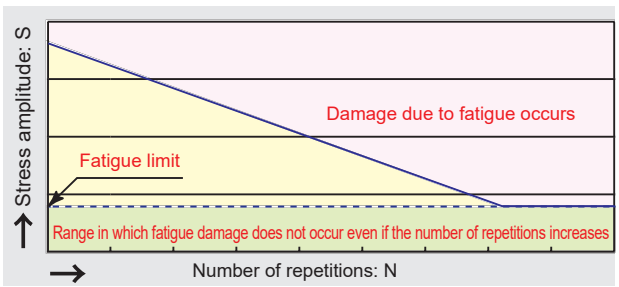
When considering commonly existing phenomena like this, a histogram, or frequency distribution, has very important implications.
In order to know the frequency distributions of various phenomena, physical quantities are continuously measured by suitable sensors and recorded on a recorder. Next, the required frequency distribution is calculated from the quantities, but this is usually a very complicated task. Typically, the longer the measurement time, the greater the amount of processing, and the analysis also takes a considerable amount of time.
Frequency analysis using spreadsheet software is a complicated and time-consuming task. We offer various measurement software programs equipped with frequency processing functions. By using the TMR-7630-H dynamic measurement software (frequency processing), the WF-7630-H waveform processing software (frequency processing), and the DFA-7610 FFT analysis processing software, frequency analysis can be performed in post-processing from the data recorded by dynamic strainmeters, such as a multi-recorder.

The histogram (frequency) of the stress generated in a member is obtained by frequency analysis of dynamic waveform data recorded by dynamic strainmeters.
The TMR-300 multi-recorder system series offers a Frequency Analysis Library (optional) that eliminates such time and labor and records the frequency analysis results in real time. The histogram recording system function with which a histogram can be obtained immediately after measurement with simple initial settings is added to the multi-recorder. Once measurement is started, data is collected continuously, and the specified analysis processing is performed at the same time. The processed data is recorded in the form of counts for each level of physical quantity. Long-term measurement exceeding a year is also possible.

Fatigue Life Estimation and Features

Stress frequency measurement reveals the frequency distribution of stress intensity occurring in a member.
It is possible to evaluate the presence or absence of damage to the member, the effectiveness of repair, and the degree of fatigue damage (estimation of fatigue life) using the cumulative fatigue damage law.
The fatigue life when subjected to an irregular fluctuating load can be estimated using the cumulative fatigue damage law from the frequency processing result of the actual operating waveform generated in the member and the and S-N diagram.

The S-N diagram is data that shows the number of times a material breaks because of repeated stress for each stress value. Various levels of stress are applied to actual structures, and the magnitude and number of times are quantified to give the stress frequency result. The degree of cumulative fatigue damage is the result of accumulating damage from each level of stress and the number of repetitions, and when the cumulative value reaches 1, the member will be destroyed. The presumption leading the destruction is made by stress frequency measurement.



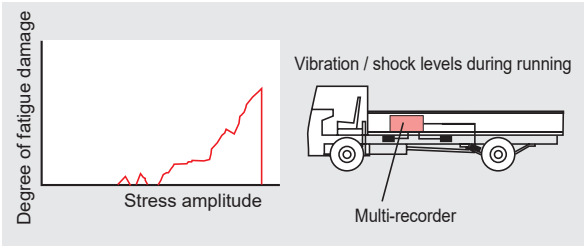
Fatigue S-N diagram

Stress Frequency Analysis

Application Examples of Histogram Recording

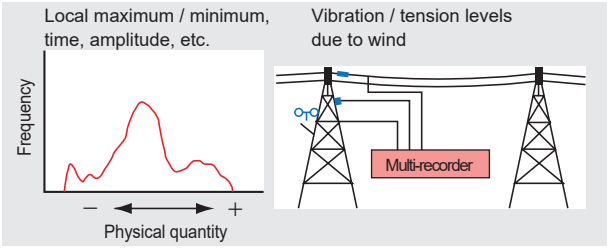
● Estimation of material fatigue life

It is well known that a material eventually breaks when repeatedly subjected to a load above a certain level, and that there is a certain relationship between the magnitude of the load that causes the destruction and the number of repetitions. Random loads are constantly acting on the members that make up vehicles, machines, building structures, etc. and it is important to know what sort of fatigue damage these loads cause to the members. By measuring the actual operating stress that a material is subjected to and performing frequency analysis, it is possible to evaluate the fatigue life from the S-N diagram of the material and the linear cumulative damage law.



● Behavioral measurement of structures

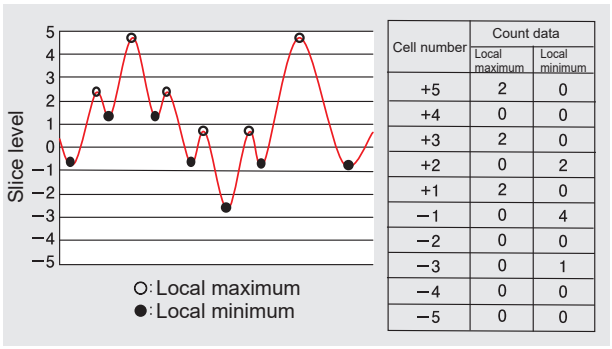
Outdoor structures, such as steel towers, are subject to various influences from weather conditions. By using appropriate sensors and multi-recorder system, frequency data on wind speed, direction and temperature can be obtained, along with the stress of structural member, wire tension, and vibration. Data on the micromotions that occur in normal times, maximum tension that occur during strong winds, and vibrations are obtained in the form of organized histograms. Therefore, it is useful for measuring the behavior of structure under actual operational conditions.



Main Frequency Analysis Methods

● Peak-valley method (PEAK-VALLEY)

This method is used to measure quantities that fluctuate in a short period, such as mechanical vibrations.



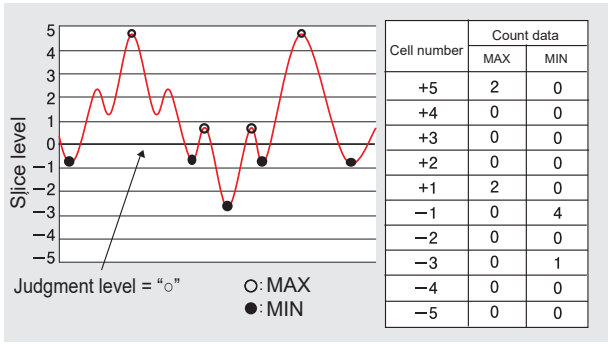
Cell number	Count data	
	Local maximum	Local minimum
+5	2	0
+4	0	0
+3	2	0
+2	0	2
+1	2	0
−1	0	4
−2	0	0
−3	0	1
−4	0	0
−5	0	0

Local maximum
When the signal wave changes from a positive slope to a negative slope, this is defined as a local maximum. When the local maximum is positive, the frequency of the local maximum between slice levels N-1 and N is accumulated in cell number N. When the local maximum is negative, the frequency of the local maximum between slice levels N+1 and N is accumulated in cell number N. In practice, by setting invalid amplitude X, the data is valid only when it reaches amplitude X+1 or more on a positive slope and then reaches amplitude of X+1 or more on the next negative slope.

Local minimum
When the signal wave changes from a negative slope to a positive slope, this is defined as a local minimum. When the local minimum is positive, the frequency of the local minimum between slice levels N-1 and N is accumulated in cell number N. When the local minimum is negative, the frequency of the local minimum between slice levels N+1 and N is accumulated in cell number N. As with the local maximum, the invalid amplitude becomes valid.

Overcount
When the local maximum / minimum exceeded the full scale, it is accumulated in the maximum cell number and the overcount data.

● Max-min method (max-min)



Cell number	Count data	
	MAX	MIN
+5	2	0
+4	0	0
+3	0	0
+2	0	0
+1	2	0
−1	0	4
−2	0	0
−3	0	1
−4	0	0
−5	0	0

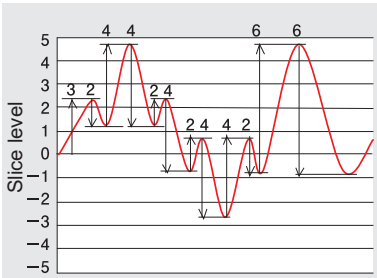
Max
The maximum value is defined as the highest level reached while the signal wave passes through the judgment level with a positive slope and then passes through the judgment level with a negative slope, and the frequency of the maximum value between slice levels N-1 and N is accumulated in cell number N. In practice, by setting invalid amplitude X, the data is valid only when it reaches amplitude X+1 or more on a positive slope and then reaches amplitude of X+1 or more on the next negative slope.

Min
The minimum value is defined as the lowest level reached while the signal wave passes through the judgment level with a negative slope and then passes through the judgment level with a positive slope, and the frequency of the minimum value between slice levels N +1 and N is accumulated in cell number N. As with the maximum value, the invalid amplitude becomes valid.

Overcount
When the maximum / minimum values exceeded the full scale, it is accumulated in the maximum cell number and the overcount data.

● Amplitude method (AMP)

The number of repetitions of phenomenon and fluctuation range can be known.



Cell number	Count data	
	Positive amplitude	Negative amplitude
10	0	0
9	0	0
8	0	0
7	0	0
6	1	1
5	0	0
4	2	3
3	1	0
2	2	2
1	0	0

Positive amplitude

When the signal wave changes from a positive slope to a negative slope, this is defined as a local maximum, and when it changes from a negative slope to a positive slope, this is defined as a local minimum. However, in practice, invalid amplitude X is set. As for a local maximum, the data is valid only when it first reaches amplitude X+1 or more with a positive slope and then reaches amplitude X+1 or more with a negative slope. As for a local minimum, the data is valid only when it first reaches amplitude X+1 or more with a negative slope and then reaches amplitude X+1 or more with a positive slope. Therefore, the amplitude difference between the local minimum and the next local maximum is defined as a positive amplitude, and when the absolute value of this amplitude difference corresponds to the slice level between N-1 and N, the frequency of this positive amplitude is accumulated in cell number N.

Negative amplitude

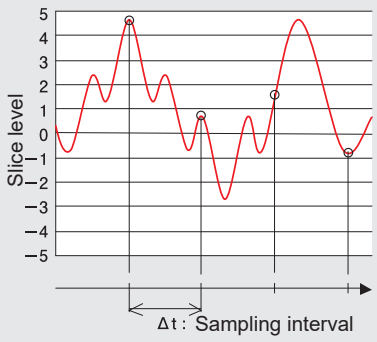
When the order of occurrence of the local minimum and local maximum in the above definition is reversed, that is, the amplitude difference between the local maximum and the next local minimum is defined as a negative amplitude, and when the absolute value of this amplitude difference corresponds to the slice level between N-1 and N, the frequency of this negative amplitude is accumulated in cell number N.

Overcount

When the local maximum / minimum exceeded the full scale, it is accumulated in the overcount data.

● Time method (TIME)

This method is useful to know within what range the phenomenon occurred.



Cell number	Count data
+5	1
+4	0
+3	0
+2	1
+1	1
−1	1
−2	0
−3	0
−4	0
−5	0

Time

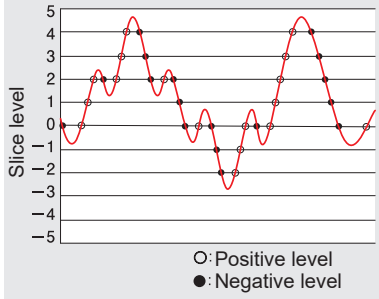
When the data during the sampling interval Δt is positive and is between slice levels N-1 and N, it is accumulated in cell number N. When it is positive and is between slice levels N+1 and N, it is accumulated in cell number N. Additionally, the setting of invalid amplitude X is ignored.

Overcount

When the sampling data exceeded the full scale, it is accumulated in the maximum cell number and the overcount data.

● Level crossing method (LEVEL)

Each time the input waveform passes through a slice level, the corresponding slice level is counted.



Cell number	Count data	
	Positive level	Negative level
+5	2	0
+4	2	2
+3	4	2
+2	2	4
+1	5	2
−1	1	5
−2	1	1
−3	0	1
−4	0	0
−5	0	0

Positive level crossing

When the signal wave passes through positive slice level N with a positive slope, it is accumulated into cell number N+1. (N ≧ 0)
When the signal wave passes through negative slice level N with a positive slope, it is accumulated into cell number N. (N < 0)

Negative level crossing

When the signal wave passes through positive slice level N with a negative slope, it is accumulated into cell number N. (N > 0)
When the signal wave passes through negative slice level N with a negative slope, it is accumulated into cell number N-1. (N ≦ 0)

Level crossing method

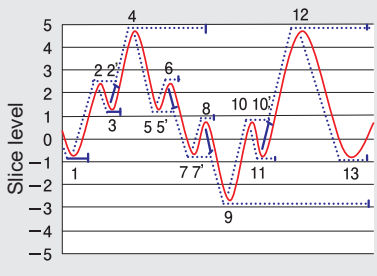
When the signal is positive, it is accumulated in the crossing frequency of positive level (N ≥ 0), and when the signal is negative, it is accumulated in the crossing frequency of negative level (N < 0).

Overcount

When the local maximum / minimum exceed the full scale, it is accumulated into the maximum cell number and the overcount data.

● Rain flow method (RAIN)

This method is a type of amplitude method and is used to estimate the degree of fatigue damage of a material subjected to repeated loads.



Cell number	Count data
10	0
9	0
8	2
7	0
6	2
5	0
4	0
3	0
2	9
1	0

The rain flow method is an analysis method that separates and accumulates small amplitude components and large amplitude components from the entire input waveform. In the waveform analysis using the rain flow method, the peaks and valleys of strain change are continuously connected with the passage of time on the vertical axis, and the straight lines between each peak and valley and between each valley and peak are regarded as multiple roofs; imagine a raindrop flowing off a peak (or valley) at a high position of one roof. The flow of raindrops is deemed to stop when any of the following three conditions are met. The horizontal axis of the path of the flow is measured to calculate amplitude.

"Three conditions for raindrops to stop flowing"

A raindrop flowing upward stops flowing when a peak (or valley) appears below the peak (or valley) where the flow began. (1-2-2'-4, 5-6, 7-8, 9-10-10'-12) A raindrop flowing downward stops flowing when a peak (or valley) appears above the peak (or valley) where the flow began. (0-1, 2-3, 4-5-5'-7-7'-9, 10-11, 12-13) No two raindrops flow off one roof. The raindrop that starts flowing first has priority, and when it meets the path of another raindrop, its flow stops. (3-2', 6-5', 8-7', 11-10') When the amplitude calculated as above is between slice levels N-1 and N, it is accumulated into the cell number. For the definition of amplitude, refer to the amplitude method.

Overcount

When the local maximum / minimum exceed the full scale, it is accumulated into the maximum cell number and the overcount data.

Indicators

Indicators are used to measure and display physical quantities in combination with strain gauge type transducers. These are equipped with analog outputs and upper / lower limit setting outputs. The panel mount type is used for instrumentation. Battery-powered handheld types, high-resolution, high-precision indicators, and strain converters (DSCUSB) that can be displayed on a PC are available.

There are four types of TEDS compatible models that automatically recognize converter information: TD-96A, MM-014L, MM-014, and TD-30L. The TD-30L is a high-precision indicator with a high resolution of 0.01 x 10^{-6} strain.

Model List

Model name	Shape	Display	Analog output	Digital output	Peak hold	Upper/lower limit setting	Others	Page
TD-98A	Panel mount	Digital ±99999	● ▲D/A converter	●RS-232C ▲B.C.D	●	●	Color TFT	323
TD-96A	Panel mount	Digital ±99999	●	▲RS-485	●	●	TEDS compatible Remote sensing	324
DSCUSB	Terminal type	Software	-	●USB			PC display CSV storage	325
MM-014L	Handheld	Digital ±9999999	-	●RS-232C ●SD card	●	-	Built-in battery TEDS compatible	326
MM-014	Handheld	Digital ±9999999	-	●RS-232C ●SD card	-	-	Sleep interval Built-in battery, TEDS compatible	327
MM-01V	Handheld	Digital ±9999999	-	●RS-232C ●SD card	-	-	Sleep interval Built-in battery	328
MM-01T	Handheld	Digital ±9999999	-	●RS-232C ●SD card	-	-	Sleep interval Built-in battery	329
TD-30L	Portable	Digital ±9999.99	-	●RS-232C ● LAN	-	-	TEDS compatible Remote sensing	330
TD-91B	Panel mount	Digital ±9999	●	-	●	●	-	331
TD-91BB	Desktop type	Digital ±9999	●	-	●	●	-	331

●:Standard specifications ▲: Factory option

Major Functions

● Shape

- Handheld: The shape fits neatly in one hand. This type can be easily operated while held in the hand.
- Portable: The shape enables easy carrying.
- Panel mount: This type is installed in an instrumentation panel and used for industrial measurements.
- Desktop type: This is a panel mount type housed in a dedicated case.
- Terminal type: This type uses the display of a PC as a display screen.

● Analog output

This function outputs an analog value corresponding to the measured value. There are voltage output and current output.
The types for instrumentation are available with 1 to 5 V output or 4 to 20 mA output.

● Digital output

This function is used for data transfer to a PC or connecting a printer.
In addition, DSCUSB can perform all operations and displays with the software and can save the data in the CSV format.

● Peak hold

This function detects and displays the extremum of measurement quantity that fluctuates during measurement . It is possible to know the maximum value even for high-speed phenomena that cannot be read on the display. The MM-014L, TD-98A and TD-96A can also detect local minimums.

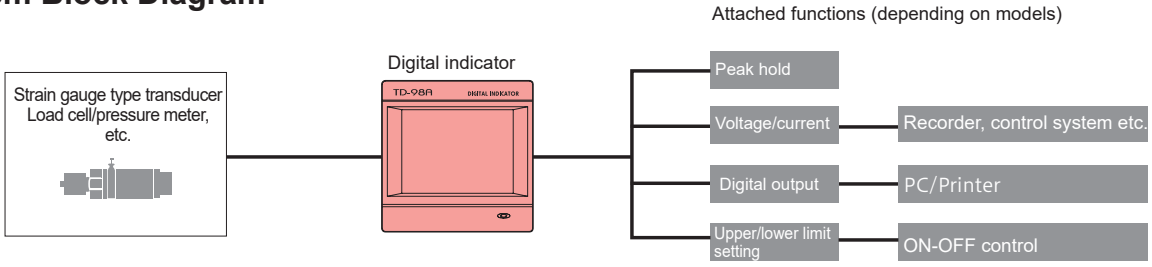
● Upper/lower limit setting

It is possible to extract a contact output by comparing the measurement value with a preset value. This function can be used to operate / stop a machine or to give an alarm based on the measurement value.

● Reading of TEDS sensor

The TEDS (Transducer Electronic Data Sheet) has the sensor information stored on an IC chip inside the sensor. This function allows a TEDS compatible measuring instrument to automatically recognize a sensor by reading the parameters from this information.

System Block Diagram



TD-98A

- High-speed processing of 2000 times/second
- Analog monitor output
- Eye-friendly large color display
- Graphic display possible
- Easy-to-operate touch panel
- Equipped with analog/digital filters
- Extensive hold functions
- Two types of holds possible at the same time



TD-98A

This is a digital indicator used for the measurement of strain gauge type transducers. It is equipped with an eye-friendly TFT color LCD and a touch panel that allows intuitive setting operations, achieving both visibility and operability. With a high-speed processing of 2000 times/second, waveform display function and upper/lower limit comparison function, it is ideal for automatic production equipment, sorting machines, testing devices, etc.

Specifications

Measurement point	1 point	
Bridge excitation	Select from DC 2.5 V, 10 V (Output current: 120 mA or less)	
Applicable gauge resistance	87.5 to 350 Ω	
Measurement range	±6.0 mV/V (at bridge excitation DC 2.5 V) ±3.0 mV/V (at bridge excitation DC 10 V) (Including initial imbalance)	
Balancing method	By digital calculation	
Nonlinearity	0.02% FS ± 1 digit or less (at 3.0 mV/V input)	
Zero stability	0.5 μV/°C RTI or less	
Sensitivity stability	0.01%/°C or less	
A/D converter	Speed Effective resolution	2000 times/second About 1/15000 for 6.0 mV/V input (At bridge excitation DC 2.5 V) About 1/30000 for 3.0 mV/V input (At bridge excitation DC 10 V)
Analog filter	Select from 30 Hz, 100 Hz, 300 Hz, 1 kHz	
Monitor output	About 0.5 V per 1 mV/V input (at bridge excitation DC 2.5 V) About 2 V per 1 mV/V input (at bridge excitation DC 10 V) (Load resistance 2 kΩ or more)	
Display unit	3.5-inch TFT color LCD module (Display area: 71 x 53 mm) 320 x 240 dots	
Display range	±99999 (5 digits)	
Calibration method	Equivalent input calibration, actual load calibration	
Equivalent input calibration	0.5mV/V to 6.0mV/V (at bridge excitation DC 2.5 V) 0.5mV/V to 3.0mV/V (at bridge excitation DC 10 V) Error range: ± 0.1% FS or less	
Hold function	1) Sample hold, 2) Peak hold, 3) Bottom hold, 4) Peak-to-peak hold, 5) Average hold, 6) Inflection point hold, 7) Local maximum hold, 8) Local minimum hold, 9) Extremum difference hold * There are a section setting for 2) to 5) (All section, external, external + time, level + time, level (peak hold/bottom hold only))	
Comparison function	A higher higher limit (HH), a lower lower limit (LL), OK, higher limit (HI), lower limit (LO)	
Calibration value selection	Four types of calibration values can be stored and switched.	
External output	Higher / lower limit comparison output (HH, HI, OK, LO, LL), normal operation output (RUN), hold end output (H/E), graph drawing end output (EVENT) Open collector output (30 Vmax, 30 mA max)	
External input	Work selection input (WORK0, WORK1, WORK2, WORK3), hold control input (T/H, SECTION), digital zero input (DZ), graph drawing control input (GRAPHTRIG), calibration value selection input (CAL0, CAL1)	
Interface	RS-232C Synchronous Baud rate: 9,600 bps to 57,600 bps	
Power supply voltage	DC 24 V (±15%) *** AC adapter set (CR-1812-C) required for use with AC 100V**	

Operating temperature / humidity range	-10C° to +40C°	85% RH or less (No condensation)
Storage temperature / humidity range	-20C° to +60C°	85% RH or less (No condensation)
Outside dimension	96 (W) x 96 (H) x 138 (D) mm (excluding protrusions)	
Panel cut dimensions	92 x 92^{+1}_{0}mm (Thickness: 1.6 to 3.2 mm)	
Mass	Approx. 1.0 kg	

Standard accessories

Instruction Manual..... 1
Warranty certificate 1
Connector for external input/output 1
Crimp terminal for power terminal block 2
Connector for BCD output (when the BCD option is equipped with) 1
Mini-driver (when DAV/DAI option is equipped with) 1

Options

NDIS relay connector (CR-616)
RS-232C cable (CR-5720)
AC adapter set (CR-1812-C)
One of the following 3 products can be selected.

● **TD-98A BCD (BCD data output)**
Open collector output (30 Vmax, 30 mAmax)
Select from output rates of 10, 20, 50, 100, 200, 500, 1000 and 2000 times/second

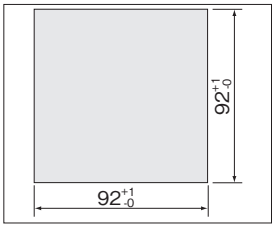
● **TD-98A DAV (D/A converter voltage output)**

Voltage output (DAV)	-10 V to +10 V (RL>2 kΩ)
Zero output and full scale can be digitally adjusted.	
Zero adjustment range	±10% FS
Gain adjustment range	±10% FS
Zero stability	0.6 mV/°C or less (Voltage output)
Sensitivity stability	50 ppm/°C or less
Nonlinearity	0.05% FS
Responsiveness	Depends on the A/D conversion speed of the main unit

● **TD-98A DAI (D/A converter current output)**

Current output (DAI)	4 to 20 mA (RL<350 Ω)
Zero output and full scale can be digitally adjusted.	
Zero adjustment range	About ±10% FS
Gain adjustment range	About ±10% FS
Zero stability	0.5 μA/°C or less (Current output)
Sensitivity stability	50 ppm/°C or less
Nonlinearity	0.05% FS
Responsiveness	Depends on the A/D conversion speed

Panel cut drawing



TD-96A

- High-speed processing of 4000 times/second
- Eye-friendly color graphic display
- Equipped with equivalent input function, easy sensitivity adjustment regardless of the actual
- Higher and lower limits, higher higher limit, and lower lower limit comparisons are possible
- Supports a variety of hold functions
- Easy setting with TEDS
- Remote sensing compatible
- Equipped with voltage / current outputs
- Ideal for incorporating into test machines due to DIN size

This is a digital indicator to measure loads, pressures, etc. using strain gauge type transducers. Since the indicated value judgment is displayed using an eye-friendly color graphic display, the operating status can be grasped intuitively. Equipped with a high-speed sampling, waveform display function and higher/lower limit comparison function, it is ideal for automatic production equipment, sorting machines, testing devices, etc.



TD-96A

Specifications

Number of measuring points	1 point
Applicable transducer	Strain gauge type transducer
Bridge excitation	DC 10 V, 2.5 V ± 10% (Current: Max. 30 mA, remote sense available)
Measurement range	±3.0mV/V
Balancing range	±2.0mV/V
Calibration	
Range	0.3 to 3.0 mV/V
Accuracy	0.1% FS However, when the sensor sensitivity is set to 0.5 mV/V or more
Method	Actual load calibration, equivalent input calibration, TEDS calibration
Accuracy	
Nonlinearity	0.01% FS + 1 digit or less (when the input is 1 mV/V or more)
Zero stability	0.5 μV/°C or less (input conversion value)
Sensitivity stability	± 0.005% FS/°C or less
A/D conversion speed	4000 times/second When using hold mode: 20000 times/second (24-bit A/D conversion)
D/A output	Insulation output Voltage output: 0±1 to ±10 V, in 1 V steps, or current output: 4 to 20 mA, 4000 times/second Depending on the setting, only one of two is output.*1
Comparison judgment output	
Number of terminals	5 points (HH, HI, OK, LO, LL)
Output format	Open collector output
Terminal capacity	Collector current: Max. 20 mA/30 V
Control signal input	
Number of terminals	6 points (hold, judgment, clear, digital zero, setting value memory selection 1, setting value memory selection 2)
Input format	Insulated from the main unit circuit by a photocoupler
Digital filter	Select from 3 Hz (-6 dB/oct), 10/30/100/300/1000 Hz (-12 dB/oct), none
TEDS function	IEEE 1451.4, class 2, mix mode interface
Hold function	Sample hold, peak hold, bottom hold, peak-to-peak hold, peak and bottom hold, average hold, section specified hold (excluding sample hold)
Comparison function	Higher higher limit (HH), lower lower limit (LL), higher limit (HI), lower limit (LO)
Display	
Display unit	320 x 240, color LCD display
Indication range	−99999 to 99999
Decimal point	Display position can be selected
Number of displays	Select from 4, 6, 10, and 20 times/second
Display mode	Standard display, bar meter display, indicated value magnified display, waveform display

Setting Item	
Calibration setting	Zero calibration/span calibration (TEDS calibration, actual load calibration, equivalent input calibration)
Function setting	Higher limit, lower limit, higher higher limit, lower lower limit, comparison mode, hysteresis, near zero, moving average processing, low-pass filter, motion detect, zero tracking, static strain, digital zero, digital taring, section specification, hold mode, key lock, minimum scale, display count, bridge voltage, digital zero limit, digital zero clear, comparison output pattern, comparison output control, data output selection, D/A converter, and remote sense
Power supply voltage	AC 100 to 240 V, 12 W (when using the included AC adapter) DC 12 to 24 V 9 W
Operating temperature / humidity range	0C° to +40C° 85% RH or less (No condensation)
Storage temperature / humidity range	-20C° to +60C° 85% RH or less (No condensation)
Outside dimension	About 96 (W) x 53 (H) x 132 (D) mm (Excluding protrusions)
Panel cut dimensions	92^{+1}_{0} (W)× 45^{+1}_{0} (H)mm (Thickness: 0.8 to 5 mm)
Mass	Approx. 300 g

Standard accessories

Instruction Manual..... 1
Warranty certificate 1
AC Adapter [Type A Plug] 1
Panel mounting bracket 2
DIN rail mounting bracket 1
Connector for external input/output 2
Micro flathead screwdriver 1

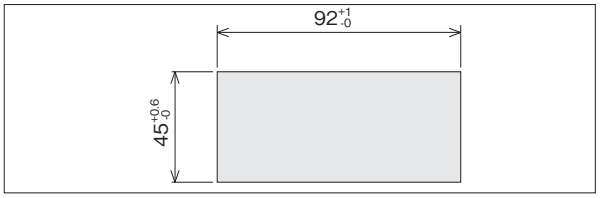
* When installed in the optional case, only voltage output can be used.

Options

AC Adapter	(CR-1869)
AC Adapter [For China]	(CR-1869-C)
DC Power Cable	(CR-062)
RS-485 output option	
TD-96A dedicated case	For 1 input

* When using the dedicated case, the RS-485 output option cannot be used.

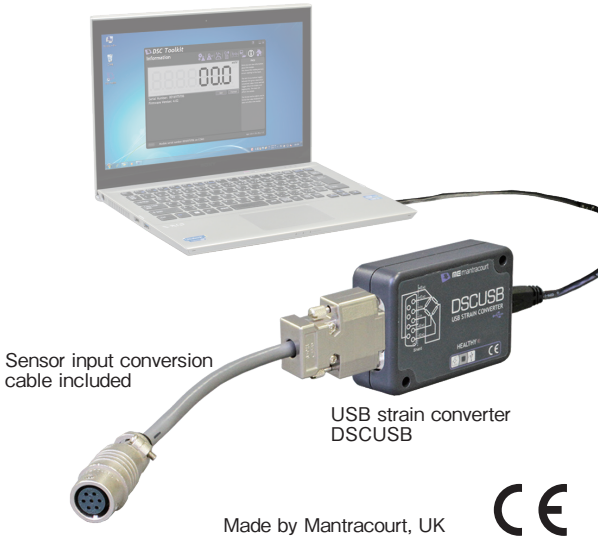
Panel cut drawing



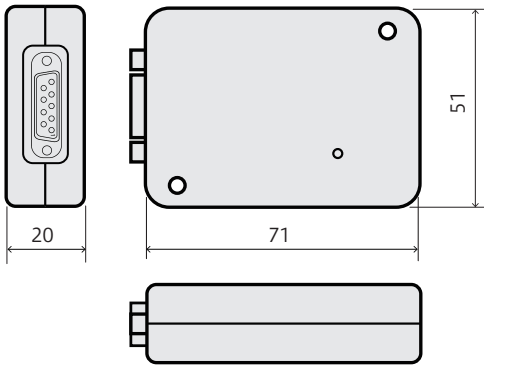
DSCUSB

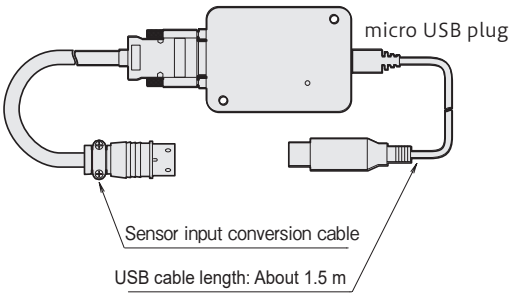
Displaying on a PC or display Data writing to a PC online

- Pocket-sized and weighs just 45 grams
- No power supply required (USB bus power used)
- Recording in the CSV format. Data reduction using spreadsheet software you are familiar with
- Measurements with multiple units also possible (using a USB hub)
- Conversion cable with NDIS connector included



External Dimensions





DSCUSB is an online type measuring instrument that connects to a PC via a USB interface. A sensor input conversion cable is included, allowing direct connection of a strain gauge type transducer. It is compact and no power supply required. Measurements can be performed easily, and a report can be created immediately.

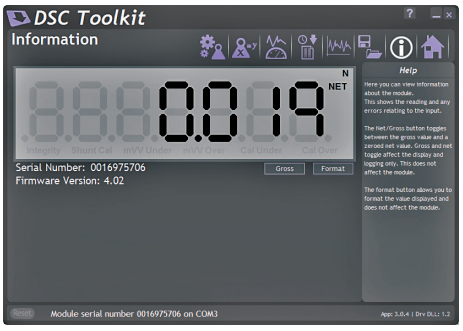
Specifications

Number of measuring points	1 point (Multiple units can be used)
Applicable transducer	Strain gauge type transducer (four-gauge method, 80 to 5000 Ω)
Bridge excitation	DC 5 V
Measurement range	± 3 mV/V (± 6000 × 10^{-6} strain)
A/D conversion	24-bit
Sampling frequency	1, 2, 5, 10, 20, 50, 60, 100, 200 Hz
Recording interval	Can be set to any value between 10 ms and 32 s.
Filter	Recursive filter (IIR) programming possible
Interface	USB
OS	Windows 7/8/8.1/10/11
Operating temperature / humidity range	-40C° to +85C° 95% RH or less (No condensation)
Outside dimension	71 (W) x 20 (H) x 51 (D) mm (Excluding the connector)
Mass	45 g (Main unit only)

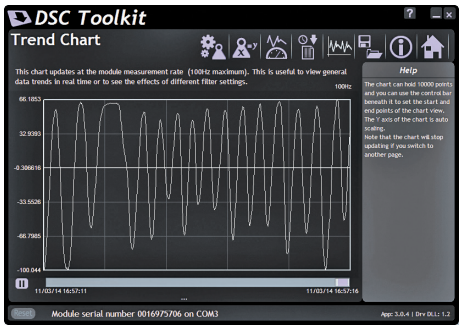
Standard accessories

Instruction Manual (Japanese simplified version) 1
Sensor input conversion cable 1
USB cable (microB-A 1.5 m) 1

Download the standard software DSCUSB Toolkit from the URL below.
URL: http://www.mantracourt.com/



Value monitor



Waveform

MM-014L

T-ZACCS 3

- Direct reading measurements of load, displacement, etc.
- Compact, lightweight, and easy to carry
- Peak hold function
- Simultaneous display of monitor value and peak value
- Retains settings for up to 20 transducers for easy setting
- Collective setting of coefficient, unit, display digit and offset value using the “sensor ID”
- TEDS sensor compatible
- Easy data collection using an SD card



T-ZACCS3
MM-014L pocket load meter

This is a compact, lightweight, and easy-to-carry handheld type measuring instrument that can directly read physical quantities by simply combining it with a strain gauge type transducer, such as a load cell or displacement meter, and setting the capacity and rated output. The peak hold function allows measurement values and peak values to be displayed and recorded. The measured data can be saved in the built-in data memory and on an SD card, allowing for easy and smooth data collection. A reflective color LCD is adopted for the display screen to provide excellent visibility even outdoors. Function switches linked to the icon displays in the screen are used for the operation, allowing intuitive operation.

Specifications

Strain measurement			
Number of measuring points	1 point		
Bridge excitation	Constant voltage method: DC 2 V Constant current method: 5.7 mA (2 V with 350 Ω bridge)		
Applicable transducer	Strain gauge type transducer (four-gauge method)		
Applicable gauge resistance	Constant voltage method: 120 to 1000 Ω Constant current method: 350 Ω		
Constant current mode extension Distance	Cable round-trip resistance: 45 Ω or less		
Measurement range	± 30000 × 10^{-6} strain		
Resolution	1 × 10^{-6} strain		
Sampling speed	0.2 seconds		
Balancing range	± 16000 × 10^{-6} strain		
Input	Terminal block/connector (EPRC07)		
Peak hold			
Peak hold contents	+peak value, -peak value		
Peak hold method	Analog detection, digital hold		
Peak hold accuracy	DC to 100 Hz ±1% FS 100 to 200 Hz ± 3% FS 200 to 300 Hz ± 5% FS (when the low-pass filter is set to PASS)		
Low-pass filter	30, 100, 300 Hz and PASS -3 dB ± 1 dB		
Function			
Measuring mode	Initial, direct, measure		
Program setting	Coefficient	± (0.00001 to 999999) (CAP, RO setting)	
	Unit	40 types including με, kgf, N, Pa, mm	
	Decimal point	Display after the decimal point can be set arbitrarily with 0 to 5 digits	
	Number of settings	20 points	
	Offset	To be written arbitrarily	
Sensor ID	Sensor ID	Function	Reading and setting of sensor ID Writing of sensor ID
	TEDS	Standard:	IEEE 1451.4, class 2 compatible (Template No. 33)
		Function	Reading and setting of sensor information
Interval function	Function	Measurement at the set time interval	
	Set time	1, 2, 3, 5, 10, 20, 30 sec 1, 2, 5, 10, 15, 20, 30 min	
Zero tracking function	When the value is equal to or less than the set value within the set time, it is regarded as zero sequentially. Set time 10 to 60 sec 10 sec intervals Set the value 1 to 10 digits 1-digit intervals		
Automatic power OFF	When no operation is received for an arbitrary set time, the power is turn off automatically (ON/OFF setting of the automatic power OFF function is possible)		
Display/operation			
Display unit	2.7-inch TFT LCD display		
Resolution	400 x 240 dots		
Point defect	10 dots or less (excluding aging deterioration)		
Operation	Function key: 1/2/3, UP/DOWN keys, ENTER key, power key		

Recording		
Built-in memory	Function	Recording of measurement data Saving and reading of the setting
	Capacity	Up to 6000 data
	Recording method	Interval timer, ENTER key (Manual)
SD card	Function	Recording of measurement data Recording and reading of setting file
	Physical format	FAT 16/32
	Recording format	CSV format
	Capacity	512 MB (Designated by us)
Interface		
RS-232C	RS-232C compliant (various settings, measurement, data collection)	
Built-in battery		
Built-in battery	Lithium-ion battery	
Battery capacity	1900mAh	
Continuous use time	About 6 hours * Conditions: Atmospheric temperature: 23°C ± 5°C Measurement: Monitor (350 Ω bridge)	
Charging time	Approx. 3 hours	
External power supply		
Power supply	Dedicated USB type AC adapter AC 100 to 240 V 50 Hz/60 Hz	
Connection terminal	USB Type-C (1.5A max @DC5V)	
Environment		
Operating temperature / humidity range	-10 to +50C°	85% RH or less (No condensation)
Charging temperature / humidity range	0 to +40C°	85% RH or less (No condensation)
Others		
Outside dimension	136 (W) × 32 (H) × 71 (D) mm (Excluding protrusions)	
Mass	Approx. 300 g	

Standard accessories

Instruction Manual..... 1
Warranty certificate 1
NDIS conversion cable (CR-8140)..... 1
4G Terminal block 1
AC Adapter (CR-1970) [Type A Plug]..... 1

Options

SD card (512 MB)
External printer (Applicable models: DPU-S245)
NDIS conversion cable (Remote sense) (CR-8141)
RS-232C cable (CR-5532)
Printer cable (CR-4511)

MM-014

T-ZACCS 3

- Adopted a reflective color LCD display that is clearly visible even outdoors on a sunny day (supports Japanese / English display)
- Long-time operation by battery (8 hours continuous operation)
- Equipped with automatic measurement function (equipped with sleep function, 2,800 hours of measurement possible with 1 hour interval measurement)
- Collective setting of coefficient, unit, decimal point, and sensor type by Sensor ID
- TEDS sensor compatible
- Secure data retention by recording to the built-in data memory
- Easy data collection using an SD card

This equipment is a compact and lightweight measuring instrument that can easily perform strain measurements. Our unique measurement method enables highly accurate and stable measurements. Adoption of a reflective color LCD screen provides excellent visibility and long-term operation with low power consumption. It is compact with low power consumption and is equipped with a highly accurate sleep function, enabling stable automatic measurement over a long period of time. Function switches linked to the icon displays in the screen allow intuitive operation. By connecting to a sensor, it is possible to check the numerical value of the signal being measured in real time. SD cards are adopted to record all measurement data, allowing for easy and smooth data collection.



T-ZACCS3
MM-014 strain measurement
pocket data logger

Specifications

Strain measurement			
Number of measuring points	1 point		
Bridge excitation	DC 1 V		
Applicable transducer	Strain gauge type transducer (four-gauge method)		
Applicable gauge resistance	120 to 1000 Ω		
Measurement range	± 30000 × 10^{-6} strain		
Resolution	1 × 10^{-6} strain		
Initial value storage range	± 16000 × 10^{-6} strain		
Input	Terminal block/connector (EPRC07)		
Function			
Measuring mode	Initial, direct, measure		
Program setting	Coefficient	± (0.00001-999999)	
	Unit	41 types including με, mm, N, Pa	
	Decimal point	Display after the decimal point can be set arbitrarily with 0 to 5 digits	
	Offset	To be written arbitrarily	
Simple measure	Coefficient: +1.00000 Unit: με Decimal point: 0		
GL input function	Water level measurement function GL - Offset of water surface depth		
Sensor ID	Sensor ID	Function	Reading and setting of sensor ID Writing of sensor ID
	TEDS	Standard:	IEEE 1451.4, class 2 compatible (Template No. 33)
		Function	Reading and setting of sensor information
Auto power	When no operation is received for an arbitrary set time, the power is turn off automatically (ON/OFF setting of the automatic power OFF function is possible)		
Interval timer			
Function	Measurement at the set time interval		
Time interval	1, 2, 5, 10, 15, 20, 30 min 1, 2, 3, 4, 6, 12, 24 hours (Measurement start time can be specified)		
Sleep function	Turns the power ON/OFF automatically from the end of scanning to the start of scanning		
Clock			
Setting	Year, month, day, hour, minute, second		
Display/operation			
Display unit	2.7-inch TFT LCD display		
Resolution	400 x 240 dots		
Point defect	10 dots or less (excluding aging deterioration)		
Operation	Function key: 1/2/3, UP/DOWN keys, ENTER key, power key		

Recording		
Built-in memory	Function	Recording of measurement data Recording and reading of setting file
	Capacity	Up to 10000 data
	Recording method	Interval timer, ENTER key (Manual)
SD card	Function	Recording of measurement data Recording and reading of setting file
	Physical format	FAT 16/32
	Recording format	CSV format
	Capacity	512 MB (Designated by us)
Interface		
RS-232C	RS-232C compliant (measurement data output)	
Battery		
Built-in battery	Lithium-ion battery	
Battery capacity	1900 mAh	
Continuous use time	About 8 hours (Conditions: Atmospheric temperature: 23°C ± 5°C Measurement: Monitor (350 Ω bridge))	
Charging time	About 3 hours (at standby)	
External power supply		
Power supply	Dedicated USB type AC adapter AC 100 to 240 V 50 Hz/60 Hz	
Connection terminal	USB Type-C (1.5A max @DC5V)	
Environment		
Operating temperature / humidity range	-10 to +50C°	85% RH or less (No condensation)
Charging temperature / humidity range	0 to +40C°	85% RH or less (No condensation)
Others		
Outside dimension	136 (W) × 32 (H) × 71 (D) mm (Excluding protrusions)	
Mass	Approx. 300 g	

Standard accessories

Instruction Manual..... 1
Warranty certificate 1
NDIS conversion cable (CR-8140)..... 1
4G Terminal block 1
AC Adapter (CR-1970) [Type A Plug]..... 1

Options

SD card (512 MB)
External printer (Applicable model: DPU-S245)
NDIS conversion cable (Remote sense) (CR-8141)
RS-232C cable (CR-5532)
Printer cable (CR-4511)

MM-01V

T-ZACCS 3

- Adopted a reflective color LCD display that is clearly visible even outdoors on a sunny day (supports Japanese / English display)
- Long-time operation by battery (8 hours continuous operation)
- Equipped with automatic measurement function (equipped with sleep function, 2,800 hours of measurement possible with 1 hour interval measurement)
- Secure data retention by recording to the built-in data memory
- Records up to 10000 measurement data in the built-in memory

This equipment is a compact, lightweight, and easy-to-carry handheld measuring instrument for measuring DC voltages.
The measured data can be saved in the built-in data memory and on an SD card, allowing for easy and smooth data collection. A reflective color LCD is adopted for the display screen to provide excellent visibility even outdoors.
Function switches linked to the icon displays in the screen are used for the operation, allowing intuitive operation.



T-ZACCS3
MM-01V voltage measurement pocket data logger

Specifications

DC voltage measurement		
Number of measuring points	1 point	
Measurement range	± 30.000 V	
Resolution	0.001 V	
Initial value storage range	±16.000 V	
Accuracy	± (0.08% rdg + 3 digits)	
Temperature coefficient of accuracy	± 0.002% rdg/C°	
Aging change of accuracy	± 0.05% rdg/year	
Input	Terminal block	
Function		
Measuring mode	Initial, direct, measure	
Program setting	Coefficient	± (0.00001 to 999999)
	Unit	40 types including με, °C, kgf, mm
	Decimal point	Display after the decimal point can be set arbitrarily with 0 to 5 digits
	Offset	To be written arbitrarily
Simple measure	Coefficient	+0.001
	Unit	V
	Decimal point	Three digits displayed after the decimal point
Auto power OFF	When no command is received from the operation or interface for an arbitrary set time, the power is turned OFF automatically (Auto power OFF function can be set to ON/OFF.)	
Others		

Standard accessories

Instruction Manual..... 1
Warranty certificate 1
AC Adapter (CR-1970) [Type A Plug]..... 1

Interval timer		
Function	Measurement at the set time interval	
Time interval	1, 2, 5, 10, 15, 20, 30 min 1, 2, 3, 4, 6, 12, 24 hours (Measurement start time can be specified)	
Sleep function	Turns the power ON/OFF automatically from the end of scanning to the start of scanning	
Clock		
Setting	Year, month, day, hour, minute, second	
Accuracy	Daily error: ±1 sec (at 23 ± 5°C)	
Display/operation		
Display unit	2.7-inch TFT LCD display	
Resolution	400 x 240 dots	
Point defect	10 dots or less (excluding aging deterioration)	
Operation	Function key: 1/2/3, UP/DOWN keys, ENTER key, power key	
Recording		
Built-in memory	Function	Recording of measurement data Recording and reading of setting file
	Capacity	Up to 10000 data
	Recording method	Interval timer, ENTER key (Manual)
SD card	Function	Recording of measurement data Recording and reading of setting file
	Physical format	FAT 16/32
	Recording format	CSV format
	Capacity	512 MB (Designated by us)
Interface		
RS-232C	RS-232C compliant (measurement data output)	
Battery		
Built-in battery	Lithium-ion battery	
Battery capacity	1900 mAh	
Continuous use time	Approx. 8 hours * Condition: Atmospheric temperature: 23°C ± 5°C Measurement: During monitor MM-01V (+10 V input)	
Charging time	About 3 hours (at standby)	
External power supply		
Power supply	Dedicated USB type AC adapter AC 100 to 240 V, 50 Hz/60 Hz	
Connection terminal	USB Type-C	
Consumption current	1.5 A max@DC5V	
Environment		
Operating temperature / humidity range	-10 to +50C°	85% RH or less (No condensation)
Charging temperature / humidity range	0 to +40C°	85% RH or less (No condensation)
Others		
Outside dimension	136 (W) × 32 (H) × 71 (D) mm (Excluding protrusions)	
Mass	Approx. 300 g	

Options

SD card (512 MB)
External printer (Applicable models: DPU-S245)
RS-232C cable (CR-5532)
Printer cable (CR-4511)

MM-01T

T-ZACCS 3

- Adopted a reflective color LCD display that is clearly visible even outdoors on a sunny day (supports Japanese / English display)
- Long-time operation by battery (8 hours continuous operation)
- Equipped with automatic measurement function (equipped with sleep function, 2,800 hours of measurement possible with 1 hour interval measurement)
- Secure data retention by recording to the built-in data memory
- Records up to 10000 measurement data in the built-in memory

This equipment is a compact, lightweight, and easy-to-carry handheld measuring instrument for measuring thermocouples.
The measured data can be saved in the built-in data memory and on an SD card, allowing for easy and smooth data collection.
A reflective color LCD is adopted for the display screen to provide excellent visibility even outdoors.
Function switches linked to the icon displays in the screen are used for the operation, allowing intuitive operation.



T-ZACCS3
MM-01T temperature measurement pocket data logger

Specifications

Thermocouple temperature measurement (JIS C 1602 - 1995)			
Number of measuring points	1 point		
Applicable thermocouple	T, K, J		
Measurement range	T: -130C° to +400C° K:-140C° to +1,370C° J:-180C° to +1,200C°		
Accuracy (at 23°C ± 5°C) (External reference junction)		Measurement range	Accuracy
	T	-130C° to +400C°	± (0.11% rdg + 0.2C°)
	K	-140C° to +1,370C°	± (0.11% rdg + 0.2C°)
	J	-180C° to +1,200C°	± (0.13% rdg + 0.2C°)
Accuracy (at 23°C ± 5°C) (Internal reference junction)		Measurement range	Accuracy
	T	-130C° to +400C°	± (0.11% rdg + 0.9C°)
	K	-140C° to +1,370C°	± (0.11% rdg + 0.9C°)
	J	-180C° to +1,200C°	± (0.13% rdg + 1.1C°)
Resolution	0.1C°		
Temperature coefficient of accuracy	± 0.002% rdg/C°		
Aging change of accuracy	± 0.05% rdg/year		
Input	Terminal block		

Function	
Sensor mode	T, K, J
Reference junction	Internal junction, external junction
Auto power OFF	When no command is received from the operation or interface for an arbitrary set time, the power is turned OFF automatically (Auto power OFF function can be set to ON/OFF.)

Others		
Interval timer		
Function	Measurement at the set time interval	
Time interval	1, 2, 5, 10, 15, 20, 30 min	1, 2, 3, 4, 6, 12, 24 hours (Measurement start time can be specified)
Sleep function	Turns the power ON/OFF automatically from the end of scanning to the start of scanning	
Clock		
Setting	Year, month, day, hour, minute, second	
Accuracy	Daily error: ±1 sec (at 23°C ± 5°C)	
Display/operation		
Display unit	2.7-inch TFT LCD display	
Resolution	400 x 240 dots	
Point defect	10 dots or less (excluding aging deterioration)	
Operation	Function key: 1/2/3, UP/DOWN keys, ENTER key, power key	
Recording		
Built-in memory	Function	Recording of measurement data Recording and reading of setting file
	Capacity	Up to 10000 data
	Recording method	Interval timer, ENTER key (Manual)
SD card	Function	Recording of measurement data Recording and reading of setting file
	Physical format	FAT 16/32
	Recording format	CSV format
	Capacity	512 MB (Designated by us)
Interface		
RS-232C	RS-232C compliant (measurement data output)	
Battery		
Built-in battery	Lithium-ion battery	
Battery capacity	1900 mAh	
Continuous use time	Approx. 8 hours *Condition: Measurement: During monitor	Atmospheric temperature: 23°C ± 5°C MM-01V (+10 V input)
Charging time	About 3 hours (at standby)	
External power supply		
Power supply	Dedicated USB type AC adapter	AC 100 to 240 V, 50 Hz/60 Hz
Connection terminal	USB Type-C	
Consumption current	1.5 A max@DC5V	
Environment		
Operating temperature / humidity range	-10 to +50C°	85% RH or less (No condensation)
Charging temperature / humidity range	0 to +40C°	85% RH or less (No condensation)
Others		
Outside dimension	136 (W) × 32 (H) × 71 (D) mm (Excluding protrusions)	
Mass	Approx. 300 g	

Standard accessories

Instruction Manual..... 1
Warranty certificate 1
AC Adapter (CR-1970) [Type A Plug]..... 1

Options

SD card (512 MB)
External printer (Applicable models: DPU-S245)
RS-232C cable (CR-5532)
Printer cable (CR-4511)

TD-30L (High-precision)



TD-30L high-precision digital indicator

The TD-30L is a digital indicator that supports measurements requiring particularly high precision, such as the calibration of force standard machine in combination with load cells and other strain gauge type transducers. It has a resolution of 0.01 x 10^{-6} strain and more stable measurements can be performed by switching the bridge excitation or combining moving average.



High-precision load cell (Remote sensing compatible)

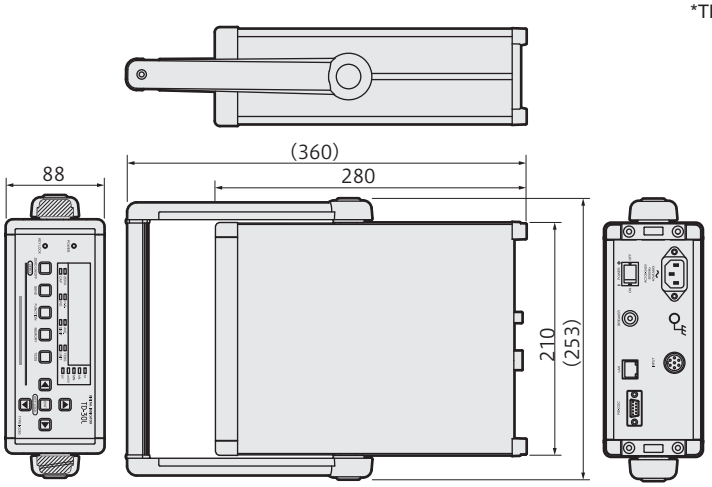


Our force standard machines (Max. 10 MN)

Information on calibration contract services

We provide calibration services for various measuring instruments.
In accordance with our calibration work standards, we perform highly reliable calibration using calibration equipment and methods that are traceable to the national measurement standards.
This indicator is ideal for JCSS calibration in combination with a load cell.

External Dimensions



Ideal for calibration work with high resolution and high stability

- Excellent accuracy and stability
- High resolution of 0.01 x 10^{-6} strain
- Information of up to 8 sensors can be registered and read out by switching them
- Remote sensing compatible*
- TEDS sensor compatible*
- LAN and RS-232C interfaces are equipped as standard

Specifications

Number of measuring points	1 point
Applicable gauge resistance	350 Ω
Bridge excitation	DC 5 V (Normal), DC 10 V (High stability)
Initial value storage range	± 600.00 × 10^{-6} strain
Measurement range	± 6000.00 × 10^{-6} strain
Resolution	0.01 × 10^{-6} strain
Measuring speed	500 ms
Accuracy	± (0.01% rdg + 2 digits) 23C°± 5C°
Sensitivity stability	± 0.0002%/C°
Moving averaging	ON/OFF
Remote sensing function*	Can be extended up to 10 m (using the dedicated cables)
Display	
Display unit	7-segment LED (Polarity + 6 digits)
Unit display	LED (N, kN, MN, mV/V, με, blank display)
Status display	LED (Power, Key lock, ZERO, H.S., AVE.)
Setting	
Capacity	± 0.00001 to 999999
Rated output	± 0.00001 to 9.99999 (mV/V)
Decimal point	Display after the decimal point can be set arbitrarily with 0 to 6 digits
Unit	N, kN, MN, mV/V, με, blank
Memory	Eight types of sensor settings can be registered and switched * Reading of initial value, capacity, rated output, decimal point, and unit settings
TEDS function*	Reading and setting of TEDS sensor information
Interface	LAN, RS-232C
Power supply	
Rated voltage	AC 100 V - 240 V 50/60 Hz
Allowable voltage	AC 90 - 264 V 50/60 Hz
Maximum power consumption	40 VA
Operating temperature range	0 to +50C° 85% RH or less (No condensation)
Outside dimension	210 (W) × 88 (H) × 280 (D) mm (Excluding protrusions)
Mass	Approx. 3 kg

Standard accessories

Instruction Manual..... 1
Warranty certificate 1
AC power cable (CR-03) 1
Ground wire (CR-20) 1

*TEDS and remote sensing cannot be used simultaneously.



TD-91B (for instrumentation) /TD-91BB (desktop type)

- Compact and lightweight
- Equipped with analog peak hold function and upper / lower limit setting function
- Wide balancing range
- Easy operation with jog dial
- Direct reading and display of physical quantities possible by equivalent input calibration
- Eye-friendly monitor with wide viewing angle
- Equipped with voltage / current outputs
- Panel mount (TD-91BB: Desktop type)

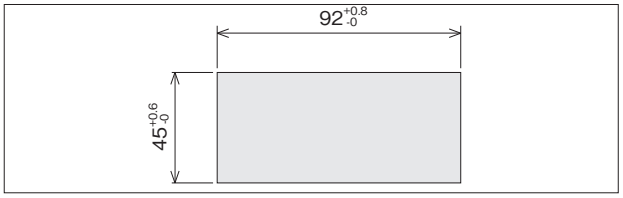


Instrumentation
TD-91B



Desktop type
TD-91BB

Panel cut drawing



This equipment is an instrumentation digital indicator to measure loads, displacements, and pressures using strain gauge type transducers. Equipped with an LED display with character height of about 20 mm and a jog dial, achieving an indicator with excellent operability. Equivalent input calibration and actual load calibration allow easy setting of input range and physical quantity display. In addition, the upper and lower limits and the measured value are compared to output the result as an open collector signal. The TD-91B is a panel mount type and the TD-91BB is a tabletop type.

Specifications

Measurement part	
Number of measuring points	1 point
Bridge excitation	DC 5 V± 5% 60 mA
Applicable sensor range	120 Ω, 350 Ω, 350 Ω sensor x 4
Zero adjustment range	-3 mV/V to +3 mV/V
Measurement range	-3 mV/V to +3 mV/V
Accuracy	SPAN/SPIN × 0.1% + 1 digit When directly reading strain ±3 digits
Sampling speed	About 2.5 times/second
Calibration value	0.5 mV/V 1.5 mV/V 2.0 mV/V
Stability	0.4 x 10^{-6} strain/C° in input conversion
Display	
Display	Red/green 7-segment LED (Character height: About 20 mm)
Display value	−9999 to +9999 (4 digits)
Decimal point	Arbitrary setting possible
Digital filter	400, 800, 1000, 2000, 5000 times moving average
Hold function	(1) Peak hold (2) Valley hold (3) Peak-valley hold (4) Start hold (5) Analog peak hold (6) Analog/digital peak hold
Comparison output part	
Comparison judgment value range	-9999 to +9999
Output circuit	Open collector output by photocoupler
Photocoupler output capacity	DC 30 V 20 mA
Comparison function	External output Upper limit setting: HI Upper limit or less, lower limit or more: GO Lower limit setting: LO *Comparison external output is only available for TD-91B.
Analog peak hold	
Response speed	Minimum input width: 2 ms
Droop speed	0.025% FS/s (1.5 x 10^{-6} strain/s)
Accuracy	± 0.5% FS

Reset control time	800 ms or more
Analog output part	
Response speed	Approx. 0.5 seconds
S/N ratio	26 dB or more (50 mVp-p)
Accuracy	± 0.5% FS
Output	Voltage output: 0 to 1 V (10 kΩ load or more) 0 to 10 V (10 kΩ load or more) 1 to 5 V (10 kΩ load or more)
External control part	Current output: 4 to 20 mA (550 Ω load or less) *The TD-91BB can only output voltage. Start hold terminal Analog peak hold terminal Digital peak hold terminal Digital zero terminal Relay reset terminal
	* The external control terminal is only available for TD-91B. * The TD-91BB has the analog peak hold control switch only.
General specifications	
Operating temperature / humidity range	-10C° to +50°C 35% to 85% RH or less (No condensation)
Power supply	
AC power supply Rated voltage Allowable voltage Maximum power consumption	AC 100 to 240 V 50/60 Hz AC 90 to 240 V 50/60 Hz 13 VA max
Warm-up time	30 minutes
Outside dimension	TD-91B 48: 48 (H) x 96 (W) x 99.5 (D) mm (Excluding protrusions) TD-91BB: 81 (H) x 170.5 (W) x 120 (D) mm (Excluding protrusions)
Mass	TD-91B: Approx. 450 g TD-91BB: Approx. 1.6 kg

Standard accessories

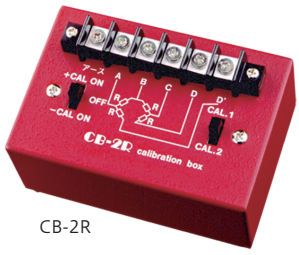
Instruction Manual..... 1
Warranty certificate 1
AC power cable (CR-05A) ..... 1 (TD-91B only)
Crimp terminal (TMEV1.25-3S) ..... 12 (TD-91B only)
Output cable (CR-30) ..... 1 (TD-91BB only)
Unit sticker 1

* Specify plug type when ordering TD-91BB

Strain checker

CB-2R

- The bridge resistance can be selected from 120 Ω or 350 Ω. (As specified at the time of order)
- The polarity of calibration strain and 2 types of calibration strain values can be selected.
- By switching the terminal connection, calibration is possible in the one-gauge method, one-gauge method three-wire type, two-gauge method, and four-gauge method.



CB-2R

This equipment is a highly stable checker used for sensitivity calibration, monitoring of zero-point movement, etc. of strainmeters. The bridge resistance is 120 Ω or 350 Ω. Two types of calibration values are generated by switching the switch.

Specifications

Bridge resistance	120 Ω or 350 Ω (As specified at the time of order)
Bridge configuration	One-gauge method, one-gauge method three-wire type, two-gauge method, four-gauge method (wire connection at the terminal)
Calibration value	Any 2 points in the 120 Ω bridge or any 2 points of the 350 Ω bridge

For 120 Ω bridge	For 350 Ω bridge
500 × 10^{-6} strain (0.25 mV/V)	-
1000 × 10^{-6} strain (0.5 mV/V)	1000 × 10^{-6} strain (0.5 mV/V)
2000 × 10^{-6} strain (1.0 mV/V)	2000 × 10^{-6} strain (1.0 mV/V)
3000 × 10^{-6} strain (1.5 mV/ V)	3000 × 10^{-6} strain (1.5 mV/V)
4000 × 10^{-6} strain (2.0 mV/V)	4000 × 10^{-6} strain (2.0 mV/V)
5000 × 10^{-6} strain (2.5 mV/V)	-
10000 × 10^{-6} strain (5.0 mV/V)	-
20000 × 10^{-6} strain (10.0 mV/V)	-

The calibration valuesfor the one-gauge method and the one-gauge method three-wire type are negative (compression) only.
The calibration valuesfor the two-gauge method and the four-gauge method are positive (tension) or negative (compression).

Accuracy	± 0.1%
Initial unbalance value	
one-gauge method	± 1000 × 10^{-6} strain or less
one-gauge method three-wire type	± 200 × 10^{-6} strain or less
two-gauge method	± 200 × 10^{-6} strain or less
four-gauge method	± 200 × 10^{-6} strain or less
Stability	
Zero point	± 1 × 10^{-6} strain/C°
Calibration value	± 0.001%/°C
Aging change	
Zero point	± 50 x 10^{-6} strain/year
Calibration value	± 0.02%/year
Operating temperature / humidity range	0 to +50C° 85% RH or less (No condensation)
Outside dimension	100 (W) × 45 (H) × 70 (D) mm (Excluding protrusions)
Mass	Approx. 500 g

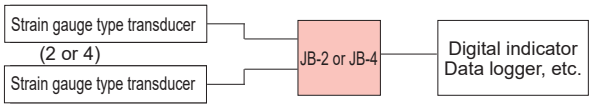
Standard accessories

Connection cable (CR-61A) 1
Instruction Manual..... 1
Warranty certificate 1

Averaging junction box

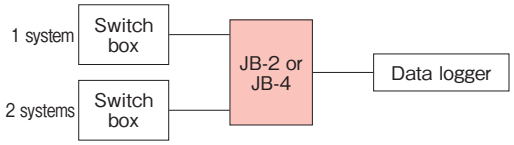
JB-2/JB-4

This equipment is used to connect two or four strain gauge type transducers to average their outputs. When combined with a digital indicator, an average value can be easily measured.



- The transducers that can be connected are limited to those with the same capacity, rated output and input/output resistance.
- The input/output resistance of transducer as seen from the measuring instrument is calculated as (Input/output resistance of transducer alone) / (Number of transducers connected). Use the equipment within the range where this value satisfies the specifications of the measuring instrument.

Example of use as branching box
Since 7 wires (A to G) are wired inside the junction box, it can also be used as a branching box when extending an ASW/SSW switch box.
(*A 7-core relay cable is required.)





Specifications

Number of input points	
JB-2	2 points
JB-4	4 points
Input connector	NDIS one-touch connector (receptacle) (Transducers with tip NDIS plug can be connected.)
Included cable	CR-611 (φ9 mm, 4-core shielded cable, 1.5 m, tip NDIS plug) (*)
Operating temperature / humidity range	0 to +50C° 5% RH or less (No condensation)
Outside dimension	80 (W) × 50 (H) × 120 (D) mm (Excluding protrusions)
Mass	Approx. 220 g

Standard accessories

Cable (CR-611 or CR-61) 1

* It can be changed to a tip loose wire when specified.

Cable/ Connector

Power Cable

Power Cable

CR-03 AC power cable Horizontal type 3P(P)-3P(J) 3 m



Data logger TS-963/-960, TDS-540
Switch box SSW, ISW, IHW, SHW
Indicator TD-30L
DS-50A dynamic strainmeter

CR-19 conversion adapter included

CR-04 AC power cable 3P(P)-12P(J) 3 m



DA/ DC series dynamic strainmeter
* When storing in a case or rack, the CR-01 is used.

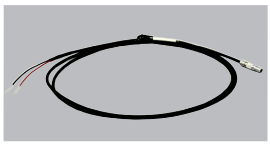
CR-19 conversion adapter included

CR-05A AC power cable 2P-Loose wire Crimp terminal) 2 m



TD-91B indicator

CR-1010 DC power cable 4P(J)-Loose wire 1.5 m



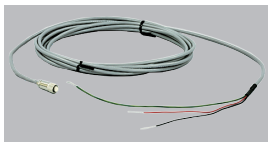
MF-660 six-component force analyzer

CR-12 DC power cable 3P(P)-3P(J) 1.5 m



Power supply relay

CR-1310 DC power cable 3P(J)-Loose wire 5 m



DC-204R smart dynamic strain recorder

CR-152M Battery connection cable Loose wire-Loose wire 1.5 m



For DC power wiring

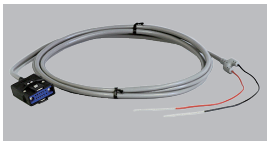
CR-02 AC power cable Vertical type 3P(P)-3P(J) 2 m



DRA-162B dynamic strainmeter
No straight type for overseas use

CR-19 conversion adapter included

CR-061 DC power cable 12P(J)-Loose wire 3 m



DA/ DC series dynamic strainmeter

CR-10 DC power cable 3P(J)-Loose wire 5 m



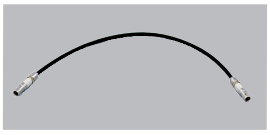
TMR-311 multi-recorder

CR-11 DC power cable 3P(J)-12 V cigarette 5 m



Supplies power from the cigarette lighter of automobile
TMR-311 multi-recorder

CR-1210 DC power cable 4P-4P 0.25 m



Supplies power to the second and subsequent MF-660 six-component force analyzer

CR-1320 DC power cable 3P(J)-12 V cigarette 5 m



Supplies power from the cigarette lighter of automobile to the DC-204R smart dynamic strain recorder

CR-17 DC power branch cable 3P(P)×2-3P(J) 0.2 m



Power branching

Ground Wire / Output Cable / Attenuator

Ground Wire

CR-20 Ground wire 5 m



Various data loggers

CR-2020 TMR ground wire 5 m



Various models of the TMR-300 series

Output Cable

CR-30 Output cable BNC-Banana tip 1.5 m



Dynamic strainmeter DRA, DA and DC series
TMR-331/-341 multi-recorder

CR-31 Output cable BNC-BNC 1.5 m



Dynamic strainmeter DRA, DA and DC series
TMR-331/-341 multi-recorder

CR-33 Output cable BNC-Alligator 1.5 m



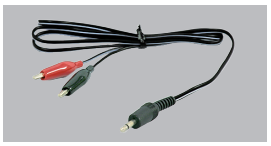
DRA, DA and DC series dynamic strainmeter
TMR-331/-341 multi-recorder

CR-3320 Output cable BNC-Loose wire 1.5 m



DRA, DA and DC series dynamic strainmeter

CR-32 Output cable Pin jack-Alligator 1 m



An analog output cable for connecting the voltage output terminal of the DC-96A / DC-97A dynamic strainmeter to an external recorder

CR-3610 Output cable 8P(P)-Loose wire 1.5 m



An analog output cable of the DC-204Ra smart dynamic strain recorder

CR-3620 Output cable 8P(P)-BNC x 4 1.5 m



Smart dynamic strain recorder
An analog output cable of DC-204Ra (four-channel)

CR-3630 Output cable 2P-Loose wire 1.5 m



An analog output cable for connecting the output terminal of the MF-660 six-component force analyzer to an external recorder

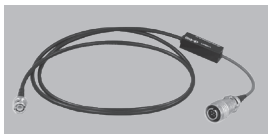
Attenuator Cable

CR-4010 Attenuator cable



CR-4010 Attenuator cable
Attenuation rate 1/1000
DC-204R smart dynamic strain recorder, TMR-321 mul-ti-recorder

CR-4110 Attenuator cable



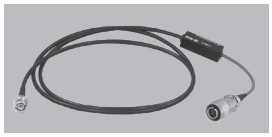
Attenuation rate 1/1000
Expands the measurement range when measuring voltage with the DC-004P / DH-14A dynamic strainmeter

CR-4020 Attenuator cable



Attenuation rate 1/100
DC-204R smart dynamic strain recorder, TMR-321 multi-recorder

CR-4120 Attenuator cable

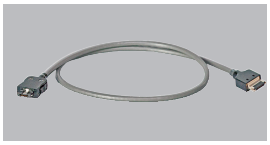


Attenuation rate 1/100
DC-004P PC control type dynamic strainmeter, DH-14A handheld dynamic strainmeter

Data Cable

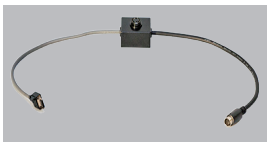
Data Cable

CR-4511 Printer cable



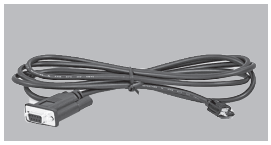
For connecting the TC-37K / -32K handheld data logger and the DPU-S245 printer

CR-4512 Printer cable



For connecting the TC-35N handheld measuring instrument and the DPU-S245 printer

CR-4530 Printer cable



For connecting the TDS-150 portable data logger or TC-351F FWD-light dedicated indicator and the DPU-S245 printer

CR-50 GP-IB cable 2 m



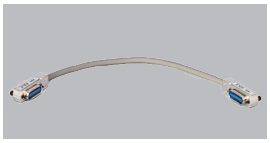
or connecting to equipment with the GP-IB interface

CR-501 GP-IB cable 4 m



For connecting to equipment with the GP-IB interface

CR-502 GP-IB cable 0.5 m



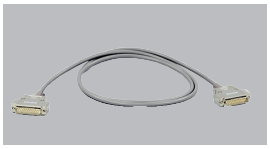
For connecting to equipment with the GP-IB interface

CR-531 RS-232C cable (A) 25P-25P 1.5 m Forward connection (Through)



For connecting to equipment with the RS-232C interface

CR-532 RS-232C cable (B) D-sub 25P-25P 1.5 m Reverse connection (Cross)



For connecting to equipment with the RS-232C interface

CR-533 RS-232C cable (C) D-sub 25P(P)×25P(J) 1.5 m



For connecting to equipment with the RS-232C interface Reverse connection (Cross)

CR-5353 RS-232C cable TC-37K / -32K-8P Forward connection (Through)



For connecting the RPC-05A remote power controller and the TC-37K / -32K handheld data logger

CR-5354 RS-232C cable D-sub 9P(J)-8P



For connecting the RPC-05A remote power controller and the TDS-150 portable data logger

CR-5360 RS-232C cable D-sub 9P(J)-D-sub 9P(J) Reverse connection 1.5 m



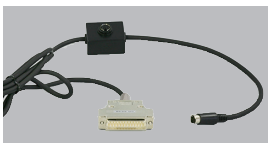
For connecting the TS-360 / TDS-540 data logger or TC-351F FWD-light dedicated indicator and the RS-232C PC interface

CR-5531 RS-232C cable 8P-D-sub 9P(J) 1.5 m



For connecting the TC-35N handheld measuring instrument and a PC

CR-553B RS-232C connection cable D-sub 25P(P)-8P 1.5 m



For connecting the TC-35N handheld measuring instrument and a PC

CR-5532 RS-232C cable For TC-37K / -32K



For connecting the TS-560 data logger, T-ZACCS3 MM-014/MM-014L or TC-37K / -32K handheld data logger and the RS-232C PC interface

CR-5533 RS-232C cable For MD-111



For connecting the MD-111 monitoring system controller or TC-37K / -32K handheld data logger and the RS-232C modem interface

Data Cable

CR-5720 RS-232C cable



For connecting the TD-98A digital indicator and a PC
mini DIN-D-Sub 9P, cross, 1.5 m

CR-5810 1G4W dedicated adapter



An adapter for connecting a strain gauge with 1G4W modular connector to the TC-37K / -32K handheld data logger

CR-61 Connection cable NDIS(P)-Loose wire, 4-core 1.5 m



For the CB-2R strain checker or TGA-1A/-1B temperature gauge adapter and a measuring instrument

CR-611 Connection cable NDIS(P)-NDIS(P), 4-core 1.5 m



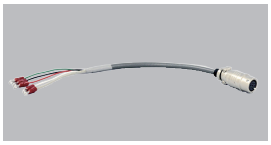
For connecting the JB-2/-4 averaging junction box and a measuring instrument

CR-612 Connection cable NDIS(P)-NDIS(P), 4-core 3 m



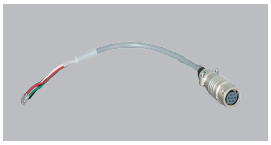
For connecting the SB-128A/-120SB bridge box and a measuring instrument

CR-615 Connection cable NDIS(J)-Loose wire, 4-core 0.2 m



A cable for connecting a transducer with tip NDIS plug to the TD-91B indicator

CR-616 NDIS relay cable NDIS(J)-Loose wire, 4-core



A cable for connecting a transducer with tip NDIS plug to the TD-96A/TD-98A indicator

CR-6160 Remote sense cable NDIS(P)-NDIS(J), 7-core 0.2 m



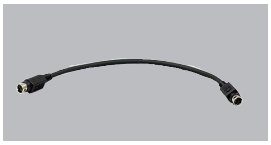
For the remote sense function of the DRA-162B dynamic strainmeter

CR-6180 Sensor cable PRC8P(P)-NDIS(J)



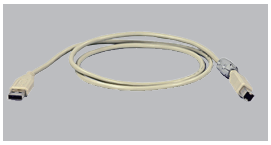
For connecting the DC-204R smart dynamic strain recorder and a transducer with the NDIS(P) connector or a bridge box

CR-6181 Sync cable



A synchronization cable for two or more DC-204R smart dynamic strain recorders

CR-6182 USB cable



For connecting the DC-204R smart dynamic strain recorder to a PC

CR-6183 External control cable



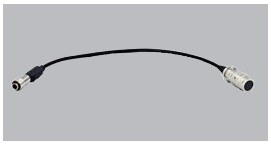
For inputting external control signals to the DC-204R smart dynamic strain recorder

CR-6184 DC-204R sensor cable



This is an extension sensor cable for the DC-204R smart dynamic strain recorder and the TMR-321 multi-recorder. A change in conductor resistance for the cable is eliminated.
(Remote sense compatible)

CR-6186 Sensor cable PRC8P(P)-NDIS(J)



For connecting the multi-recorder's TMR-321/-323 strain gauge unit to a transducer with the NDIS(P) connector

Data Cable

Data Cable

CR-6185 Bridge box SB-DD sensor cable



This is an extension sensor cable for the DC-204R smart dynamic strain recorder and the TMR-321 multi-recorder dedicated SB-120DD bridge box. A change in conductor resistance for the cable is eliminated.
(Remote sense compatible)

CR-6189 USB cable USB(C)-USB(A) 1.5 m



USB Type-C compatible
For connecting T-ZACCS3 TS-360 and a PC

CR-65 Switch box connection cable NDIS(P)-NDIS(P), 7-core 1.5 m



For connecting the SSW-50D switch boxes to each other, for connecting a data logger and the SSW-50D switch box

CR-670 Connection cable NDIS(P)-Loose wire, 7-core 1.5 m



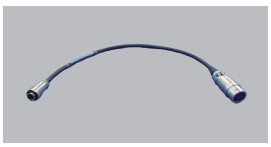
For connecting the NZ-7C and the SSW switch box

CR-872M Control unit synchronization cable 2 m



This is a synchronization cable that connects between the TMR-311 control units.
It can be extended up to 100 m.
CR-875 m (5 m), CR-8701 (10 m), CR-8702 (20 m), CR-8705 (50 m), CR-8710SYNC (100 m)

CR-8141 MM-014/MM-014L cable



For connecting the MM-014/MM-014L and a transducer with NDIS(P) connector
Remote sense compatible

CR-6187 USB cable mini B-A 1.8 m



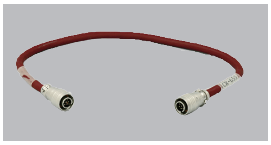
For connecting the TS-963/-960, TDS-540 data loggers, TC-37K / -32K handheld data logger, TDS-150 portable data logger or DC-004P PC control type dynamic strainmeter and a PC

CR-6462 LAN cable 3 m (Straight)



Used for an Ethernet Hub connection of a LAN compatible measuring instrument and as a synchronization cable of DS-50A

CR-655 Switch box connection cable NDIS(P)-NDIS(P), 7-core 0.5 m



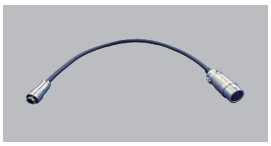
For connecting the TC-37K / -32K handheld data logger and the CSW-5B switch box

CR-671 Connection cable NDIS(J)-Loose wire, 7-core 1.5 m



For connecting the NZ-7C and the SSW switch box

CR-8140 MM-014/MM-014L cable



For connecting the MM-014/MM-014L and a transducer with NDIS(P) connector
TEDS compatible

CR-6930 Dedicated TML-NET cable 3P(P)-Loose wire, 2-core 1.5 m



For connecting the TS-360 or ND-100 and a network module

External Starter

CR-9180 External starter



A push-button switch for remote operation of measurement start of the DC-204R smart dynamic strain recorder

Switch Box Extension Cable / AC Adapter

Switch Box / Measurement Box Extension Cable

CR-892M Connection cable for EX 2 m



For connecting the EX-50 H measurement box and the TS-963/-960 data logger, and for connecting EX-50 Hs to each other
CR-895M (5 m), CR-8901 (10 m), CR-8902 (20 m), CR-8905 (50 m), CR-8910 (100 m)

CR-842M Extension optical fiber cable for ISW/IHW 2 m



For connecting the ISW/IHW switch box and the TDS-540/-630 data logger, and for connecting the ISWs/IHWs to each other
CR-845M (5 m), CR-8401 (10 m), CR-8402 (20 m), CR-8405 (50 m), CR-8410 (100 m)

CR-832M Extension cable for the ISW/IHW RS-422 2 m



For connecting the ISW/IHW switch box and the TS-560/TDS-540/-630 data logger, and for connecting ISWs/IHWs to each other

CR-872M TML-LINK connection cable 2 m



For connecting the TDS-630 data logger and the IHW-50 H switch box, and for synchronously connecting the TMR-311 multi-recorder control unit
CR-875M (5 m), CR-8701 (10 m), CR-8702 (20 m), CR-8705 (50 m), CR-8710 (100 m)

CR-800 Extension cable NDIS(P)-NDIS(J), 7-core 5 m



For connecting the switch box SSW series and a data logger
CR-801 (10 m), CR-802 (20 m), CR-803 (30 m), CR-805 (50 m), CR-810 (100 m), CR-812 (200 m)

AC adapter

CR-185B / CR-185-C AC power adapter (AC 100 to 240 V)



TC-35N handheld measuring instrument

CR-1868 / CR-1868-C AC power adapter set (AC 100 to 240 V)



DC-204R smart dynamic strain recorder

CR-1869 / CR-1869-C AC power adapter (AC 100 to 240 V)



TS-560 data logger
TS-360 T-ZACCS BOX AU-50M portable data logger
TC-37K / -32K handheld data logger
TDS-150, TS-360 portable data logger
Digital telemeter receiver
DT-281R, DT-281R-1, AU-50M, ND-100, DT-282R

CR-1870 AC power adapter (AC 100 to 240 V)



TC-351F FWD-light dedicated indicator

CR-1897 / CR-1897-C AC adapter



Output connector 3P(J)
TMR-311 multi-recorder control unit

CR-1812-C AC adapter set



For the TD-98A digital indicator

CR-1970 MM AC power adapter



MM-014/ MM-014L, MM-01T, MM-01V

Printer Paper / Precision Fixed Resistor, Connector

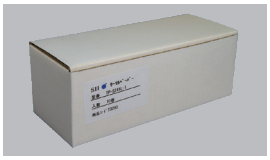
Printer Paper / Precision Fixed Resistor

P-80 80 mm (Width) x 25 m (Length), 5 rolls/box



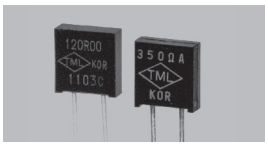
TDS-540 data logger

TP-S245L-1 58 mm (Width) x 19 m (Length), 10 rolls/box



DPU-S245 printer

KOR Precision fixed resistor



Fixed resistors 120 Ω and 350 Ω used for bridge configuration

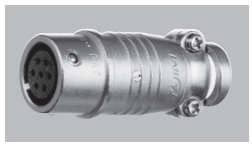
Connector

NDIS plug PRC03-12A10-7M



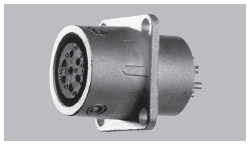
The seven-pin plug allows one-touch attachment / detachment. This connector is used at the tip of the included cable and extension cable for converters, switch boxes (ASW, SSW type) and bridge boxes.

NDIS jack PRC03-32A10-7F



This jack can be combined with the NDIS plug. It is used in combination with the NDIS plug at the tip of a converter extension cable, switch box extension cable, etc.

NDIS receptacle (Square flange) PRC03-21A10-7F



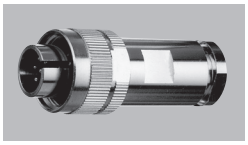
This receptacle can be combined with the NDIS plug. It is used for the input connector of dynamic strainmeters (DRA, DA and DC series).

NDIS receptacle (Round flange) PRC03-23A10-7F



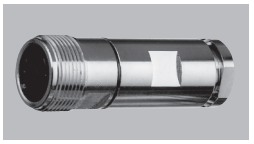
This receptacle can be combined with the NDIS plug. It is used for the input connector of switch boxes. (Optional for some models)

Waterproof plug TC1108-12A10-7M



This is a seven-pin plug. The inner circumference of the ring has a thread for mating with a jack or receptacle. It is used for the tip of a cable included with a transducer or an extension cable (on the transducer side).

Waterproof jack TC1108-32A10-7F



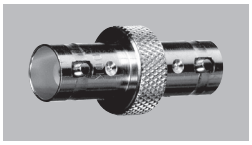
This is a jack that to be combined with a waterproof plug.

Waterproof receptacle TC1108-23A10-7F



This receptacle can be combined with a waterproof plug. It is used for the input/ output connector (on the transducer main unit side) of load cells and pressure meters.

BNC connector JJ



This connector is used to relay two BNC plugs.

BNC connector JPJ



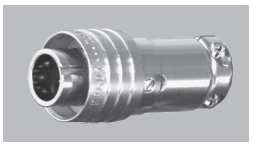
This connector is used to branch a BNC output terminal of a dynamic strainmeter, etc. into two.

BNC connector JJJ



This connector is used to branch a BNC plug into two.

Smart dynamic strain recorder / multi-recorder plug PRC07-P8M



This is a mini plug for the DC-204R smart dynamic strain recorder and the TMR-321 multi-recorder.

Head Office
Tokyo Measuring Instruments Laboratory Co., Ltd.
8-2, Minami-ohi 6-chome, Shinagawa-ku, Tokyo 140-8560, JAPAN
TEL: +81-3-3763-5614
LINE account: @tokyosokkikenkyujo

https://www.tml.jp/e

website LINE

Overseas Subsidiary(지사)
TML Korea Co., Ltd.
#901,Shinyoung Building,167, Sinheung-ro, Bucheon-si,
Gyeonggi-do,14580, Republic of Korea
TEL: +82-32-247-0602 PHONE: +82+10-3171-8539
FAX: +82-32-247-0604 E-mail: tmlkorea@tml.jp
BLOG URL: https://blog.naver.com/tmlkorea0602

https://www.tmlkorea.co.kr

website

Approval Certificate **ISO9001**
Design and manufacture of strain gauges, strain measuring equipment and transducers

Accredited Calibration

JCSS 0090

Tokyo Measuring Instruments Laboratory Co., Ltd. (TML) is accredited by Japan Calibration Service System (JCSS), conformed to international standards JIS Q 17025 (ISO/IEC 17025) under the laboratory accreditation body ISO/IEC 17011. International Accreditation Japan (IA Japan) plays as the accreditation body of JCSS and is a signatory to MRA of Asia Pacific Accreditation Cooperation (APAC) as well as International Laboratory Accreditation Cooperation (ILAC). Our Kiryu factory is certified as a JCSS-accredited laboratory working in compliance with an international Mutual Recognition Arrangement (MRA). The accreditation number of the Kiryu Factory is 0090.

The contents of this catalog are subject to change without prior notice.
The contents of this catalog are as of October 2025.