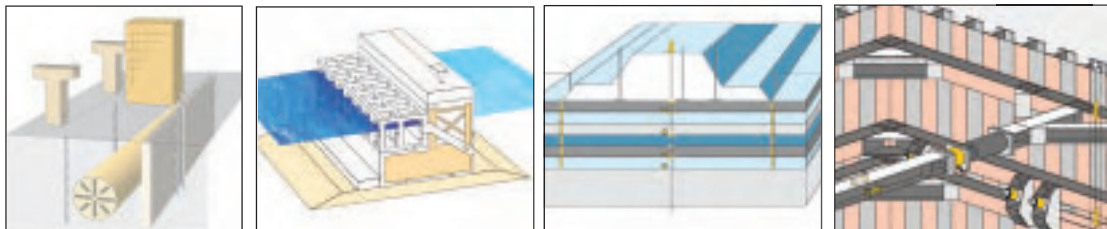


Strain Gauge-type

## Civil Engineering Transducers



# TML

## Strain Gauge-type

# Civil Engineering Transducers

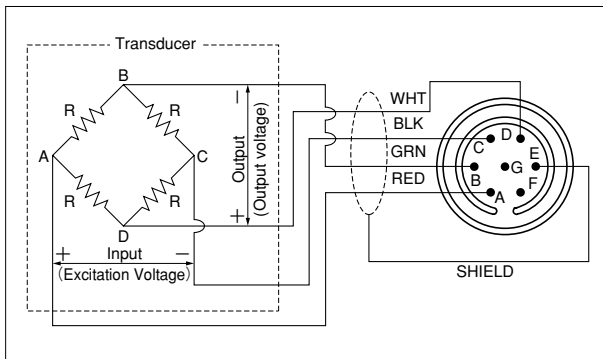
### INTRODUCTION

Strain gauge-type civil engineering transducers made by TML use strain gauges as detecting sensors. These transducers measure concrete strain, soil pressure, water pressure, stress, displacement, inclination, and other various physical quantities and convert them electrically. They are designed to deliver the best performance for many different applications and to maintain superb sensitivity, accuracy and durability over a long period of time. If they are used in combination with data loggers supplied by our company, it is possible to build an automated multi-point measurement system that operates

unattended to gather data for a long time. TML civil engineering transducers are now the indispensable components used to conduct experiments on or pursue research for general buildings, bridges, ground, tunnels, dams and other civil engineering structures. They also play an important role in predicting disasters, developing new construction techniques, and preparing safety designs for such mass-transport means as railways, vehicles, ships and airplanes.

### ■ Transducer bridge circuit and connector alignment

Bridge circuit inside and wiring system are given as follows, but not applicable to some products. Standard civil engineering transducers are usually supplied without connector plug. 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

\* Not applicable to some products

### ■ Rated output and strain value

The output (rated output) of a civil engineering transducer, one of capacity specifications, is expressed as mV/V. mV/V is the output voltage when a maximum load is applied to a civil engineering transducer. It shows the output voltage generated when 1V is applied.

Example:

1.5mV/V means that 1.5mV is output when a load below the transducer's full capacity is applied while 1V is applied to it at the same time. If 2V is applied to it (bridge power on a strain measuring instrument):

$$1.5\text{mV/V} \times 2\text{V} = 3\text{mV}$$

Therefore, if the gauge factor is 2.00 (coefficient set at 1.000) the output voltage of a civil engineering transducer is 3mV and the value to be shown on a strain measuring instrument can be calculated by the following expression, which is formulated based on the voltage-to-strain relational expression;

$$\Delta e = \frac{E}{4} K \epsilon$$

$$\epsilon = \frac{4 \Delta e}{KE}$$

where,

$\Delta e$ : Output voltage (V) of a civil engineering transducer

E: Excitation voltage (V)

K: Gauge factor of a strain measuring instrument

$\epsilon$ : Reading on a strain measuring instrument

With K, E and  $\Delta e$  defined as 2.00, 2V, and 3mV, respectively, 3mV is equal to 0.003V and therefore

$$\epsilon = 0.003 = 3000 \times 10^{-6} \text{ strain.}$$

By setting the gauge factor of a strain instrument at 2.00 and the output voltage of a transducer at 1V, we have the following:

$$2 \Delta e = \epsilon, \text{ then}$$

$$1\text{mV/V} = 2000 \times 10^{-6} \text{ strain.}$$

$$2\text{mV/V} = 4000 \times 10^{-6} \text{ strain.}$$

At Tokyo Sokki Kenkyujo Co., Ltd., we conduct quality assurance activities based on our company's quality policies to provide customers with the best products that can win their confidence. Products include our company's tangible products, sales activities, installation and measurement services, and all other servicing operations.

### ISO9001

In January 1997, we gained ISO 9001 accreditation (international quality assurance and management standard) for strain measuring equipment. In January 1999, we also gained ISO 9001 accreditation for transducer production. Our goal is to gain ISO 9001 accreditation for all company operations. We will further make efforts to achieve this goal and to maintain the system organized and streamlined according to the specifications of ISO9001.



Approval Certificate **ISO9001**  
Design and manufacture of  
strain gauges, strain measuring  
equipment and transducers

## ■ Civil Engineering Transducer with Temperature measuring functions

Temperature measurement is an essential part of strain and stress measurement in concrete structures. The strain transducers and reinforcing-bar meters in the line of strain gauge-type civil engineering transducers made by TML all have built-in temperature measuring capability that can be used to measure temperature without having to install a thermometer. As a result, measuring temperature with a Data Logger is quick and simple. A choice of available measuring methods between a special strain gauge and a thermocouple allows customers to choose the most appropriate method for the particular purpose and the type of Data Logger used.

## ■ Strain instruments with constant voltage and Constant current method

### Constant voltage type

The bridge power supply in our rated voltage-type strainmeter ensures a constant voltage regardless of the input resistance of any connected transducer. Even so, the sensitivity of the transducer will drop due to wire resistance in the connecting cable if the transducer cable is extended.

### Constant current type

Current from the bridge power supply to the transducer remains constant with our constant current-type strainmeters regardless of the input resistance of the transducer or the length of the cable (wire resistance). Therefore, the sensitivity of the transducer will not drop due to wire resistance in the cable if the transducer cable is extended. However, there is a limit on the input resistance of the transducer.

## ■ Optional data on temperature curve

When specified on order, temperature data on zero-shift of each civil engineering transducer is available for correction in long-term measurement at option.

## ■ Decreased sensitivity due to a long cable used to connect to a transducer

Constant-voltage and constant-current power systems are used to provide a strain measuring instrument with the bridge excitation (voltage to be applied to a transducer). If a strain measuring instrument designed for use with the constant-voltage system is used and if a cable (including the attached cable that comes with the transducer unit) must be further lengthened, the sensitivity or the rated output of a transducer deteriorates due to wire resistance. In this case, the rated output ( $\epsilon_m$ ) must be adjusted to obtain a new rated output ( $\epsilon_s$ ) based on the length and thickness of the longer new cable to be installed by using the following equation.

$$\epsilon_s = \epsilon_m \times \frac{R}{R+r \times L}$$

R : Input resistance ( $\Omega$ ) of a transducer

r : Total resistance ( $\Omega/m$ ) on the input side per meter of the longer cable

L : Length (m) of the longer cable

$\epsilon_m$  : Rated output given on the test sheet

## ■ Resistance per meter of a cable used to connect to a transducer

Cross section area (mm <sup>2</sup> )	Total resistance per meter ( $\Omega$ )
0.05	0.63
0.08	0.44
0.14	0.25
0.3	0.12
0.35	0.11
0.5	0.07
0.75	0.048





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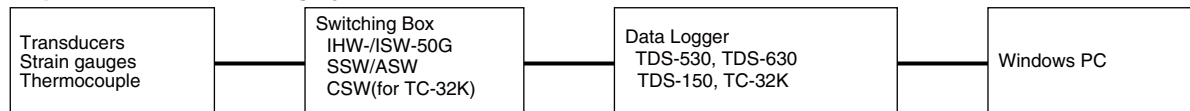
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## MEASURING SYSTEM

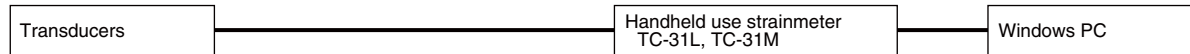
### STATIC MEASUREMENT

#### ● General system

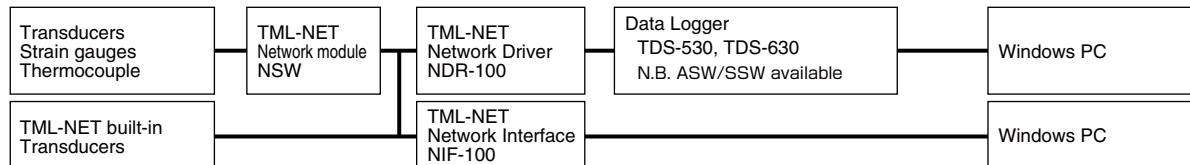
##### Multiple-channel measuring system



##### Spot measuring system

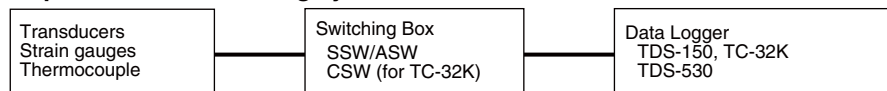


##### TML-NET Digital Network measuring system (Distribution Data acquisition system)



#### ● Battery drive system

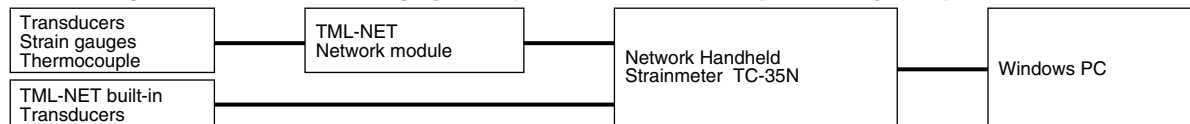
##### Multiple-channel measuring system



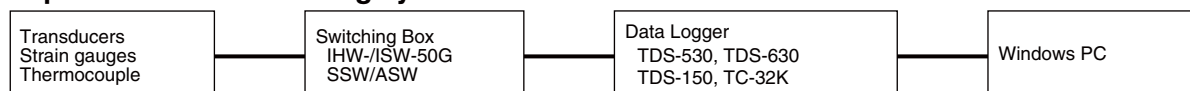
##### Spot measuring system



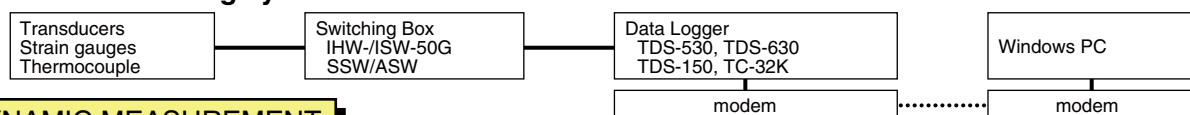
##### TML-NET Digital Network measuring system (Distribution Data acquisition system)



#### ● Telephone circuit measuring system

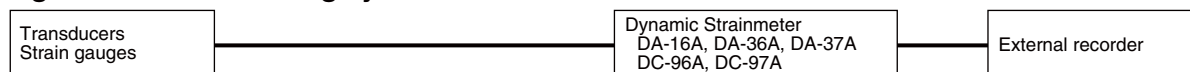


#### ● Modem measuring system

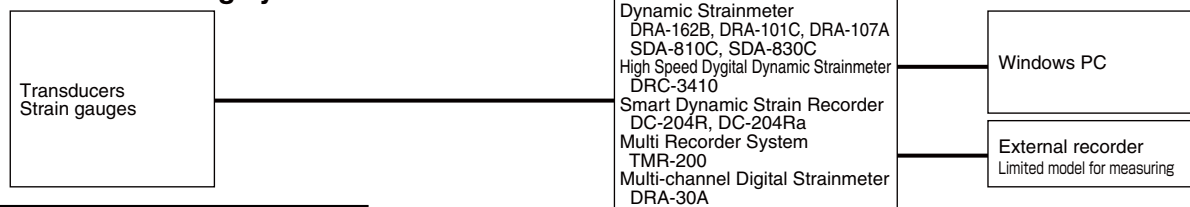


### DYNAMIC MEASUREMENT

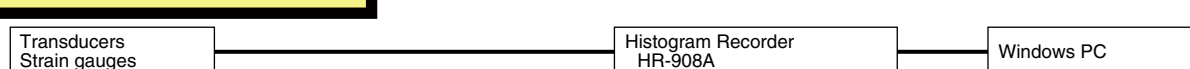
#### ● Single channel measuring system



#### ● On-line measuring system



### HISTOGRAM MEASUREMENT



# Transducer terminology

## Capacity

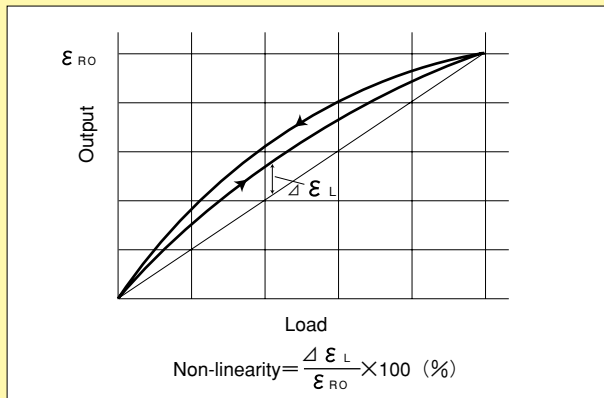
Maximum load that a transducer can measure and still maintain specifications.

## 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).

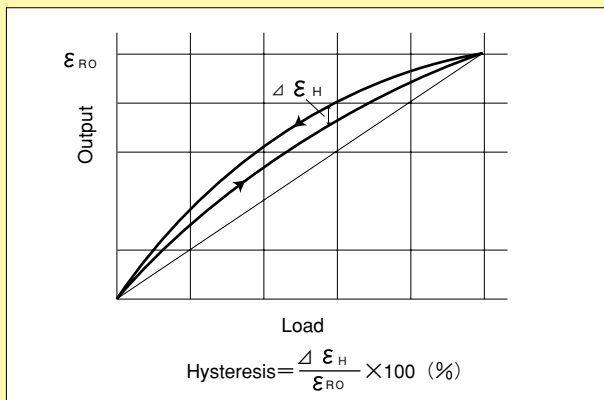
## Non-linearity

Maximum distance from a curve 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 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).

## 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 change exceeding specifications (%).

## Ultimate overload rating

Maximum load that can be applied continuously without causing permanent 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 ( $\times 10^{-6}$  strain)

## Frequency response

Maximum frequency at which the transducer can output within a specified range using a sine wave load (Hz).

## Natural frequency

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 ( $\times 10^{-9}$ /mm) when the strain meter 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 transducer (N).

## Input/output resistance

Resistance between input and output terminals measured under no-load conditions with input and output terminals disconnected ( $\Omega$ ).

## Input/output cable

Cable that cannot be disconnected from the transducer.

## Supplied cable

Standard cable accessory that can be disconnected from the transducer.

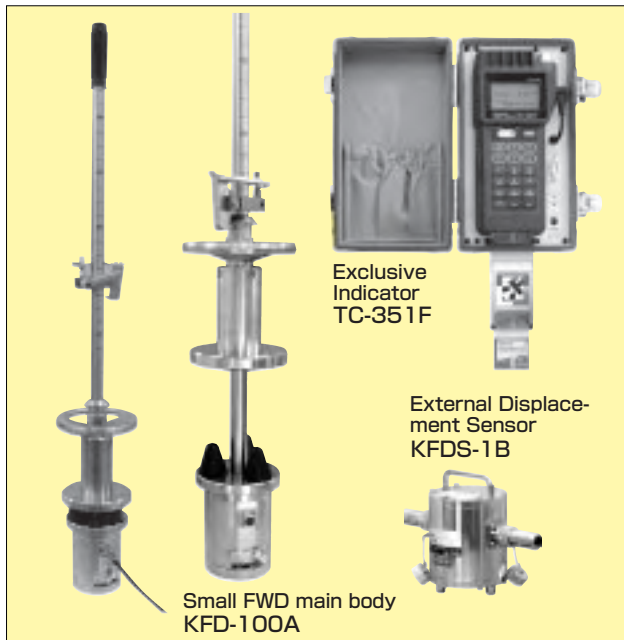
## Weight

Approximate weight of the main unit minus I/O cable and cable accessories.

## 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 C 0902, or IEC 60529, and entails various levels of ingress protection afforded against solid objects and water.

# Small Falling Weight Deflectometer FWD-Light



## FWD Specifications

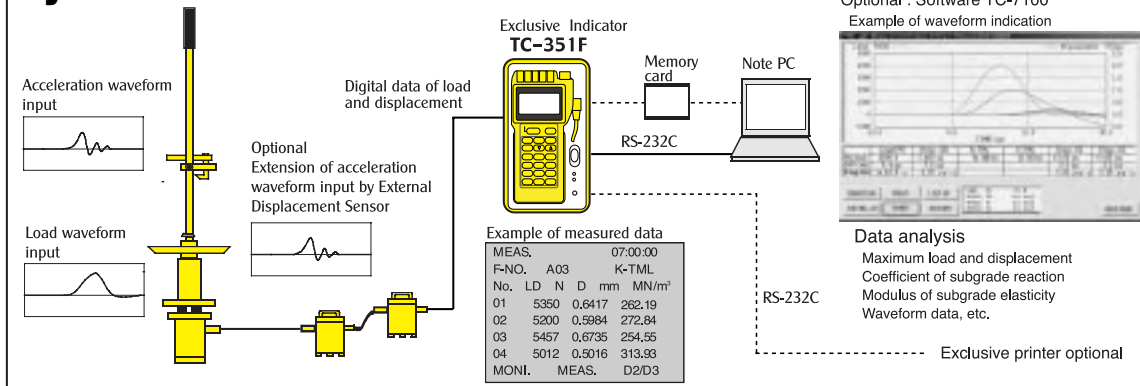
Type	KFD-100A
Dimensions of loading plate	$\phi 100 \times 15$ (thick) mm
Mass of weight	5 kg.
Falling height	50~530mm
Falling method of weight	Lever (with stopper)
Maximum load	20kN
Maximum displacement	2.500 mm
Strain gauge based sensor	
Load Cell	1 point, 20kN
Acceleration transducer	1 point, 500m/s <sup>2</sup>
Data acquisition	
No. of measuring points	2 points (load nad acceleration)
Measuring accuracy	$\pm(0.1\%rdg+2digits)$ at $23 \pm 5^\circ C$
Data memory	800 data/point
Sampling speed	50 $\mu s$
Trigger function	By data (load value)
Interface	Exclusive 2-wire serial transfer
No. of external displacement sensor	4 points at maximum
Power source	Supplied by TC-351F
Environment	-20~+60°C, less than 85%RH (no condensation)
Height	Approx. 1100mm
Weight	Approx. 15kg. (including 5kg weight)

The FWD-Light is a unique small-size FWD system that measures the rigidity of ground using the free fall of a plumb bob. It consists of a plumb bob of 5 kg and a loading platform of 100 mm in diameter. It is small in size, lightweight, transportable, and easy to operate. Using the FWD-Light, rigidity can be measured at any given point on the ground quickly. It measures load and flexure using the built-in strain gauge-type load cell and acceleration transducer and automatically analyzes the modulus of counterforce and elasticity of ground. It can measure rigidity at a maximum of three points on the ground. The indicator designed exclusively for the FWD-Light is battery-powered (NiMH battery) and can continuously operate for 32 hours.

## Exclusive Indicator Specifications

Type	TC-351F
Display	Liquid crystal display 128x64 dots
Monitor	Load, Acceleration, Acceleration of external sensor, Time
Analysis result	Maximum load, Maximum displacement, Maximum displacement of external sensor, Coefficient of subgrade reaction ( $K_{TML}$ ), Modulus of subgrade elasticity ( $E_{TML}$ )
File management	Deletion of stored data in specified file number formatting of memory card
Real time clock	
Setting	Year, Month, Day, Hour, Minute, Second
Accuracy	$\pm 2$ sec./day at $23 \pm 5^\circ C$
Memory card	Storing result of analysis
Card standard	Conforms to PC card standard Type II
Card type	Compact flash memory card (with card adaptor) or ATA flash memory card
Card capacity	8~128MByte
Data format	CSV
Interface	For using optional Measurement/ Analysis software TC-7100
Standard	RS-232C
Function	Receiving control command, Sending measured data, Output to exclusive printer
Power source	
Battery	Nickel-Hydrate (Ni-MH) battery pack
Continuous operation	Approx. 32 hours of 1000 times measurement at $23 \pm 5^\circ C$
Vibration tolerance	30m/s <sup>2</sup> (at 50Hz 0.5mm-p)
Drip-proof	IP-54 (with cover installed)
Environments	-10~+50°C, less than 85%RH (no condensation)
Dimensions	Approx. 150(W)×120(H)×265(D)mm
Weight	Approx. 3kg.

## System block



# KM Strain Transducer $\pm 5000 \times 10^{-6}$ strain

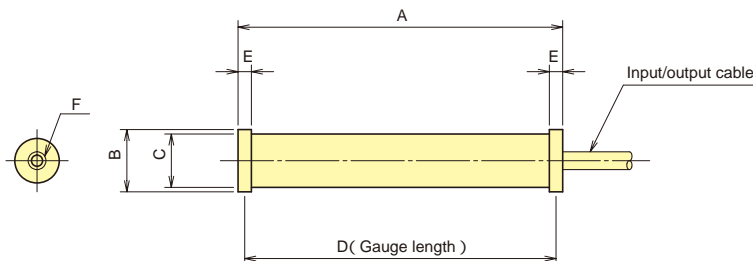


The KM series strain transducers are designed to measure strain in materials such as concrete, synthetic resin which undergo a transition from a compliant state to a hardened state. Their extremely low modulus (40N/mm<sup>2</sup> approx. except for KM-A) and waterproof construction are ideally suited 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-A and KM-B. The built-in thermocouple sensor of the KM-AT/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.

## FEATURES

- Self-temperature compensated transducer having a linear thermal expansion coefficient similar to concrete
- Low elastic modulus enables inner strain measurement during the very early stages of curing
- Simultaneous measurement of strain and temperature except for KM-30, KM-50F
- Surface strain measurement is also available onto retaining wall, strut, sheet pile, etc.

Protection ratings :  
IP 67 equivalent for KM-30  
IP 68 equivalent for KM-50F~ KM-200AT



Type	Dimensions (mm)						Weight (g)
	A	B	C	D	E	F	
KM-30	34	12	10	31	3	M3 Depth4	12
KM-50F	54	20	17	50	4	M3 Depth6	45
KM-100A	104	20	17	100	4	M3 Depth6	75
KM-100B	104	20	17	100	4	M3 Depth6	80
KM-100HB	104	20	17	100	4	M3 Depth6	80
KM-200A	205	28	23	200	5	M5 Depth8	220
KM-100AT	104	20	17	100	4	M3 Depth6	75
KM-100BT	104	20	17	100	4	M3 Depth6	75
KM-200AT	205	28	23	205	5	M5 Depth8	220

## SPECIFICATIONS

TYPE	KM-30	KM-50F	KM-100A	KM-100B	KM-100HB	KM-200A	KM-100AT	KM-100BT	KM-200AT
Capacity	± 5000× 10 <sup>-6</sup> strain								
Gauge length	31mm	50mm	100mm			200mm	100mm		200mm
Rated output (approxately)	2.5mV/V (5000× 10 <sup>-6</sup> )	4mV/V (8000× 10 <sup>-6</sup> )	2.5mV/V (5000× 10 <sup>-6</sup> )			5mV/V (10000×10 <sup>-6</sup> )	2.5mV/V (5000×10 <sup>-6</sup> )		5mV/V (10000× 10 <sup>-6</sup> )
Non-linearity	1%RO								
Apparent elastic modulus	40N/mm <sup>2</sup>		1000N/mm <sup>2</sup>	40N/mm <sup>2</sup>		1000N/mm <sup>2</sup>	1000N/mm <sup>2</sup>	40N/mm <sup>2</sup>	1000N/mm <sup>2</sup>
Integral temperature	—		*1Strain gauges (350Ω Quarter gauge with 3-wire 50x10 <sup>-6</sup> strain/°C approx.				*2Thermocouple T		
Temperature range	-20 ~ +60°C	- 20 ~ + 80°C			-20 ~+ 180 °C		-20 ~+ 80°C		
Input/Output	120Ω Half bridge	350Ω Full bridge							

\*1 Relative temperature measurement possible

\*2 Real temperature measurement possible

Input/output cable	KM-30	2.4mm	0.04mm <sup>2</sup>	3-core shielded	Vinyl cable	2m	cable-end free
	KM-50F	6mm	0.35mm <sup>2</sup>	4-core shielded	Chloroprene cable	2m	cable-end free
	KM-100A/-100B	9mm	0.3mm <sup>2</sup>	5-core shielded	Chloroprene cable	2m	cable-end free
	KM-100HB	6mm	0.3mm <sup>2</sup>	5-core shielded	Fluoroplastic cable	2m	cable-end free
	KM-200A	11.5mm	0.5mm <sup>2</sup>	5-core shielded	Chloroprene cable	2m	cable-end free
	KM-100AT/-100BT	9mm	0.3mm <sup>2</sup>	4-core shielded	T-thermocouple compound cable	2m	cable-end free
	KM-200AT	11.5mm	0.5mm <sup>2</sup>	4-core shielded	T-thermocouple compound cable	2m	cable-end free



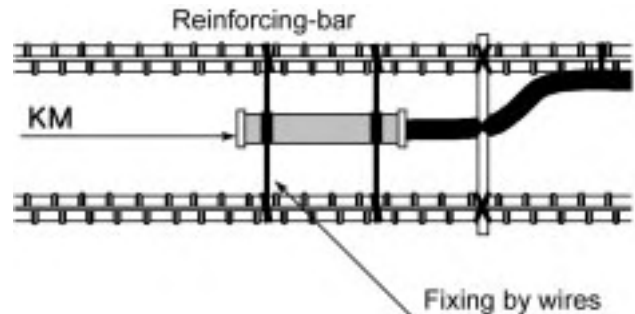
## For use of inner strain measurement

The KM Strain Transducers make possible strain measurement in materials such as concrete which undergo a transition from a compliant state to a hardened state. Various strains are produced by external force, ambient temperature, drying shrinkage, materials creep, etc., the KM is designed to measure such strains.

Applicable gauge length should require three times the diameter of the gravel pieces so as to give an averaged evaluation of the concrete.

### An installation to reinforcing concrete structures inside

As shown in figure right, attach wires to KM body at 2 points, then position the KM to marked points in advance of reinforcing bar to fix it.



### An installation with optional Non-stress meter KMF-51/KMF-52

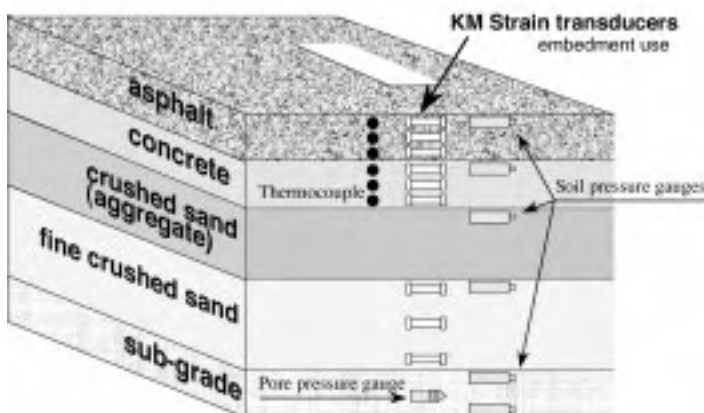
Optional Non-stress meter is available for measurement of the linear thermal expansion coefficient and dry shrinkage strain when a container with the transducer inside is embedded in concrete.

In case that the non-stress meter can not be applied, prepare the same model of concrete specimen to install the meter with the same condition of water inducement during unloaded. And linear thermal expansion coefficient and dry shrinkage strain of concrete can be measured.

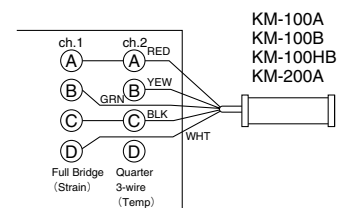
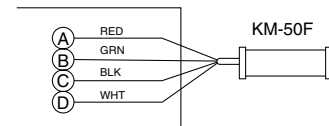
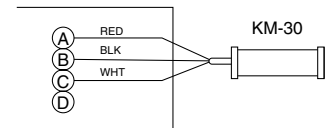
### An installation to pavement

During pavement construction, driving tests, loading test, and long-period deterioration tests are conducted using various types of sensors to check the degree of fatigue in relation to the load bearing capacity. The KM measures inner stress produced in each layers under road.

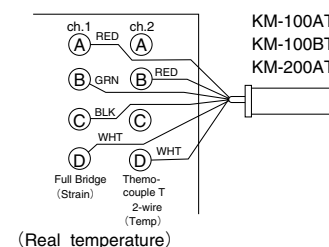
Measuring cables are separately positioned in advance. To protect sensors from mechanical damage, protective cover should be required, and such sensors are temporarily positioned. Then, they are fixed same time in each layer.



### ■ Wiring



(Relative temperature)



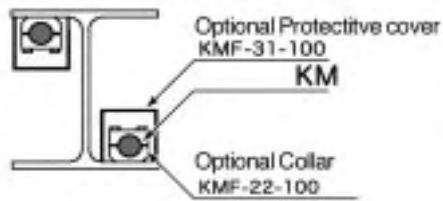
(Real temperature)

## For use of surface strain measurement

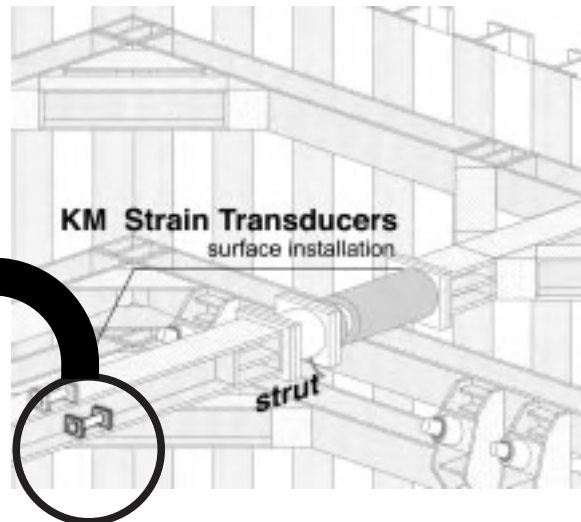
Surface strain measurement onto steel and concrete structures is available with KM-100B or KM-100BT. (Optional fittings such as Spacer and Collar are available for fixing the model and positioning gauge length.)

### An installation onto surface of steel structure

A strain transducer is installed onto surface of steel using optional Collar KMF-22-100 with welding works. Optional Protective Cover KMF-31-100 protects the transducer from physical damage.

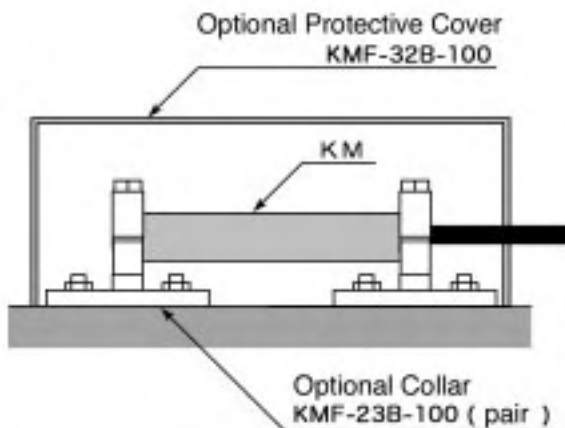


The KM model is combined with optional Collar KMF-22-100 to install onto surface of steel by welding.



### An installation onto surface of concrete structure

A strain transducer is installed onto surface of concrete using optional Collar KMF-23B-100 with anchoring works. Optional Protective Cover KMF-32B-100 protects the transducer from physical damage.



The KM model is combined with optional Collar KMF-23B-100 to install onto surface of concrete structure with anchor bolts.

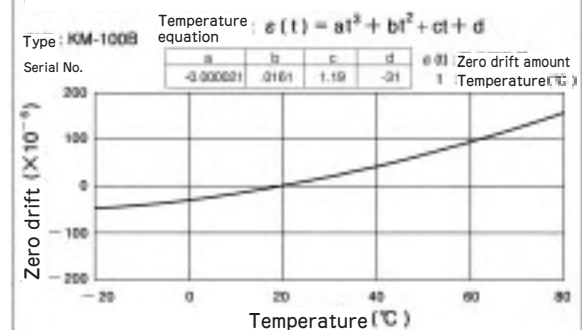
### Temperature measurement by Strain Transducer

Temperature sensor-integrated strain transducer have 2 types. One is for relative temperature measurement with strain gauge 350Ω quarter bridge with 3-wire system, another is for real temperature measurement with thermocouple sensor. Using Data Logger, it makes more precise measurement possible. Comparing to an external temperature probe use, this model can save considerable installation and wiring works.

Strain gauge temperature sensor integral type  
KM-100A/KM-100B/KM-100HB/KM-200A  
Thermocouple sensor integral type  
KM-100AT/KM-100BT/KM-200AT

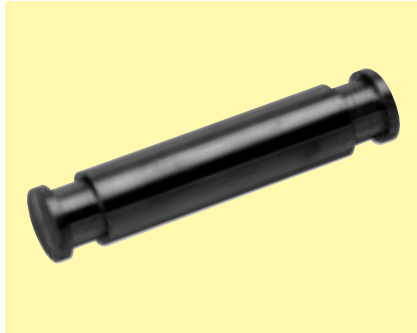
### Example of Temperature data (optional)

#### Zero shift due to temperature change



For more precise strain measurement with the transducer, correction of zero shift should be required. Optional temperature data on each supply is available on request.

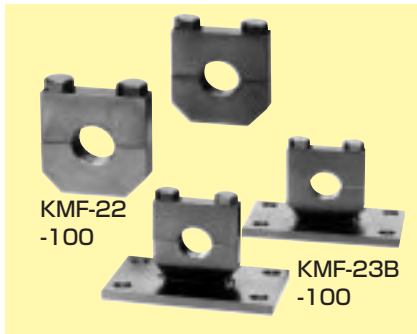
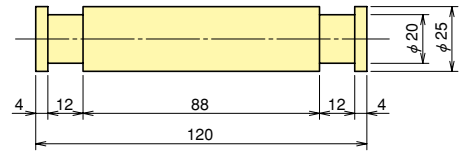
## KM Optional accessory



### Spacer KMF-12-100

A spacer is needed whenever strain transducer is installed to measure surface strain. The KMF-12-100 spacer is used to accurately locate the gauge length needed to attach KMF-22 and KMF-23B Collars to a structure.

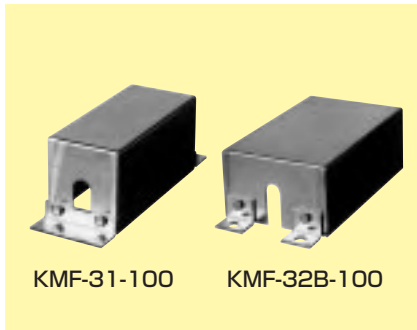
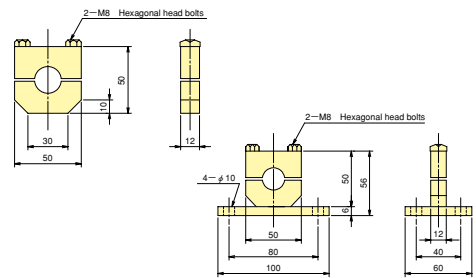
Applicable transducer : KM-100B  
KM-100BT



### Collar KMF-22-100/KMF-23B-100

The KMF-22-100 Collars are used to mount a strain transducer to steel surface (2 per set), and KMF-23-100 Collars are used to mount the transducer to the surface of concrete (2 per set).

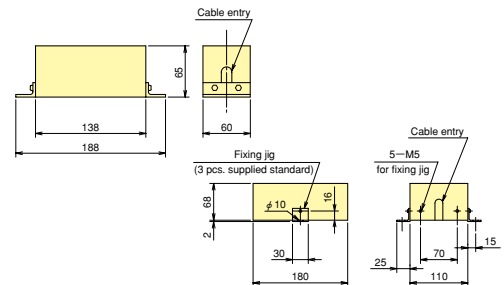
Applicable transducer : KM-100B  
KM-100BT



### Protective Cover KMF-31-100/KMF-32B-100

The KMF-31-100 protective Cover is used to protect the transducer attached onto steel surface with a KMF-22 Collar, and the KMF-32B-100 is the same onto concrete surface with a KMF-23B Collar.

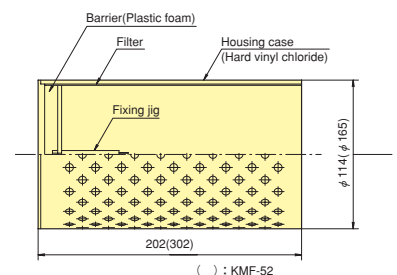
Applicable transducer : KM-100B  
KM-100BT



### Non-stress meter KMF-51/KMF-52

KMF-51 and KMF-52 are used to measure the linear thermal expansion coefficient and dry shrinkage strain when a container with the transducer inside is embedded in concrete.

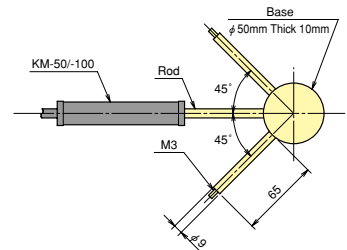
Type	Applicable transducer
KMF-51	KM-100A
	KM-100B
	KM-100AT
	KM-100BT
KMF-52	KM-200A
	KM-200AT



### Spiders KMF-41/KMF-42

KMF-41 and KMF-42 Spiders are used to properly embed the transducer in a predetermined direction for measuring plane and three-dimensional stress in structure.

Type		Axes	Applicable transducer
2-dimensional	KMF-41-2	2	KM-50F
	KMF-41-3	3	KM-100A
3-dimensional	KMF-42-3	3	KM-100AT
	KMF-42-4	4	KM-100B
	KMF-42-5	5	KM-100BT
	KMF-42-6	6	



# KSA-A/KSAT-A Reinforcing Bar Meter



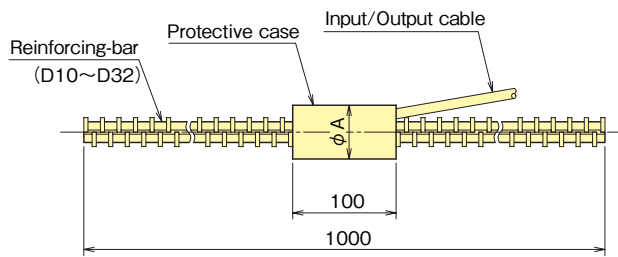
The KSA-A and KSAT-A are used to measure stress applied to structural reinforcing bars, and are normally welded at both ends to form part of the reinforcement arrangement. The KSAT-A has a thermocouple that can be used to measure actual temperature.

Protection ratings : IP 68 equivalent

## ■ Dimensions

Type	φ A	Applicable bar		Yield point or 0.2%
		Name	Class	
KSA-10A KSAT-10A	33	D10	SD295B	295~390N/mm <sup>2</sup>
KSA-13A KSAT-13A	36	D13	SD345	345~440N/mm <sup>2</sup>
KSA-16A KSAT-16A	42	D16		
KSA-19A KSAT-19A	47	D19		
KSA-22A KSAT-22A	47	D22		
KSA-25A KSAT-25A	53	D25		
KSA-29A KSAT-29A	53	D29		
KSA-32A KSAT-32A	62	D32		

Other bar with different size is available. Contact TML.



## ■ Specifications

Type	KSA-10A KSAT-10A	KSA-13A KSAT-13A	KSA-16A KSAT-16A	KSA-19A KSAT-19A	KSA-22A KSAT-22A	KSA-25A KSAT-25A	KSA-29A KSAT-29A	KSA-32A KSAT-32A
Capacity	300N/mm <sup>2</sup>							
Rated Output	Approx. 2.2mV/V (4400 × 10 <sup>-6</sup> strain)							
Non-linearity	1%RO							
Temperature measurement	KSA-A : *1 Strain Gauge (Quarter bridge 3-wire 350 Ω    Approx. 50 × 10 <sup>-6</sup> strain/°C) KSAT-A : *2 Thermocouple T							
Temperature range allowable	-20~+80°C							
Input/Output resistance	350 Ω							
Recommended exciting voltage	Less than 6V							
Allowable exciting voltage	10V							
Weight	0.9kg	1.3kg	1.9kg	2.6kg	3.4kg	4.3kg	5.4kg	6.6kg

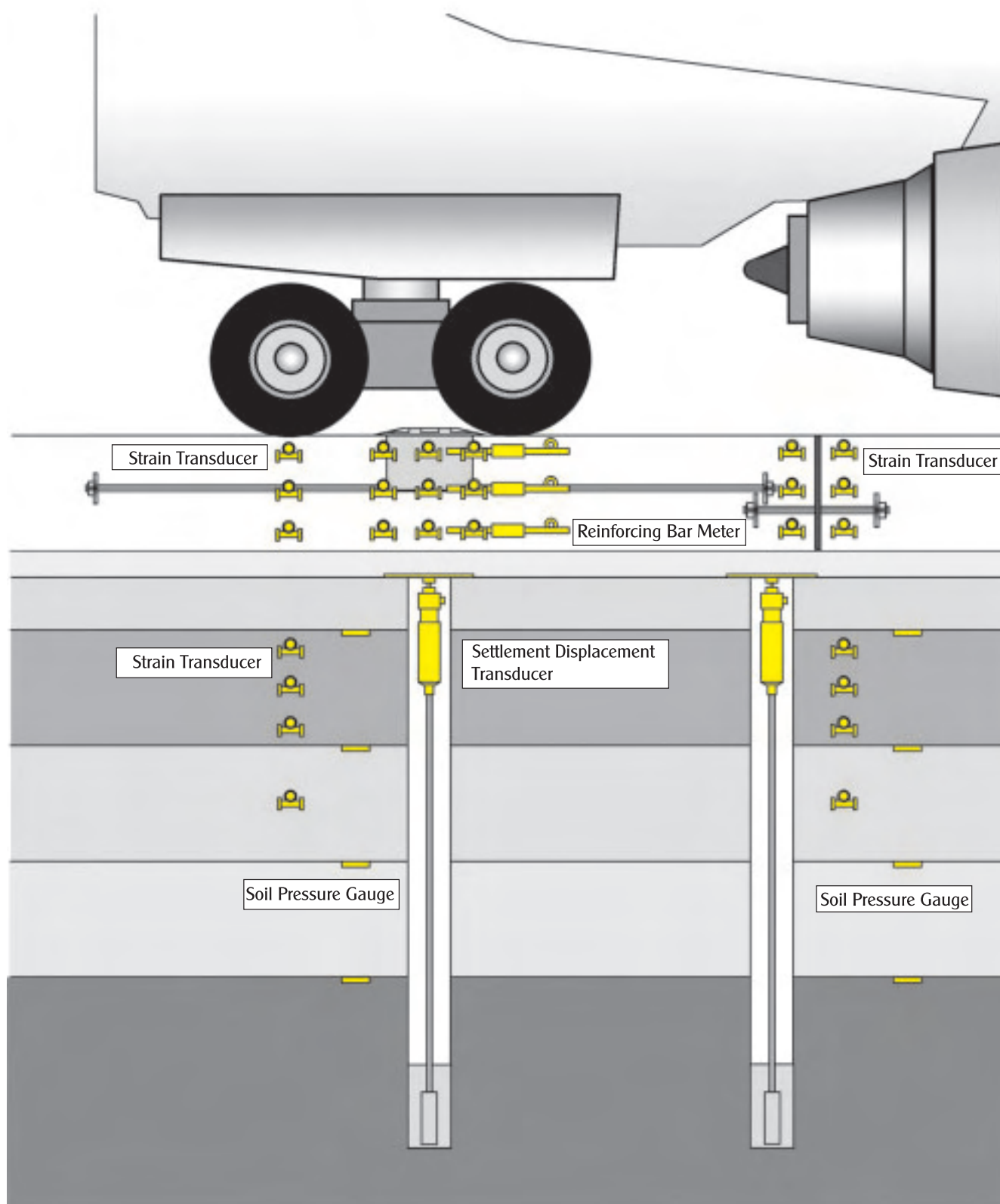
\* 1 Relative temperature available  
\* 2 Real temperature available

### Input/output cable

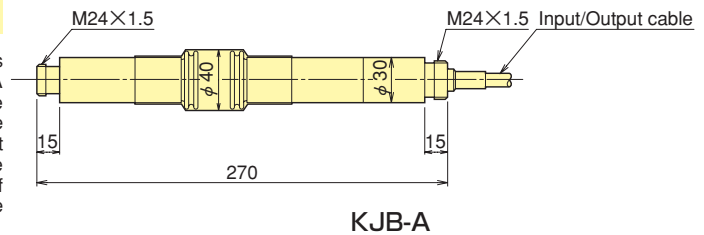
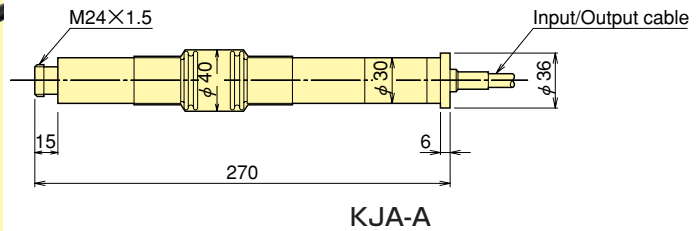
KSA-10A~16A	φ 9mm	0.3mm <sup>2</sup>	5-core shielded chloroprene cable	2m
KSAT-10A~16A	φ 9mm	0.35mm <sup>2</sup>	4-core shielded thermocouple-integrated cable	2m
KSA-19A~32A	φ 11.5mm	0.5mm <sup>2</sup>	5-core shielded chloroprene cable	2m
KSAT-19A~32A	φ 11.5mm	0.5mm <sup>2</sup>	4-core shielded thermocouple-integrated cable	2m



## ■Application to airport runway



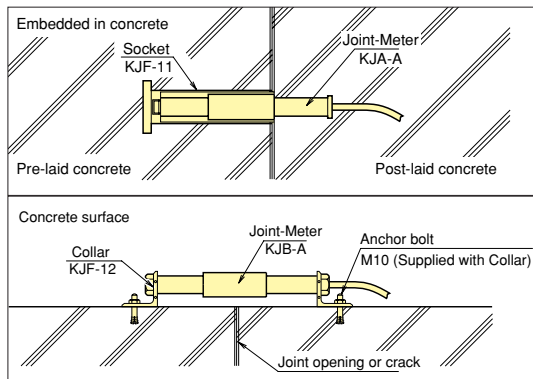
# KJA-A/KJB-A Joint-Meter



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 the 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

## Installation example



## Specifications

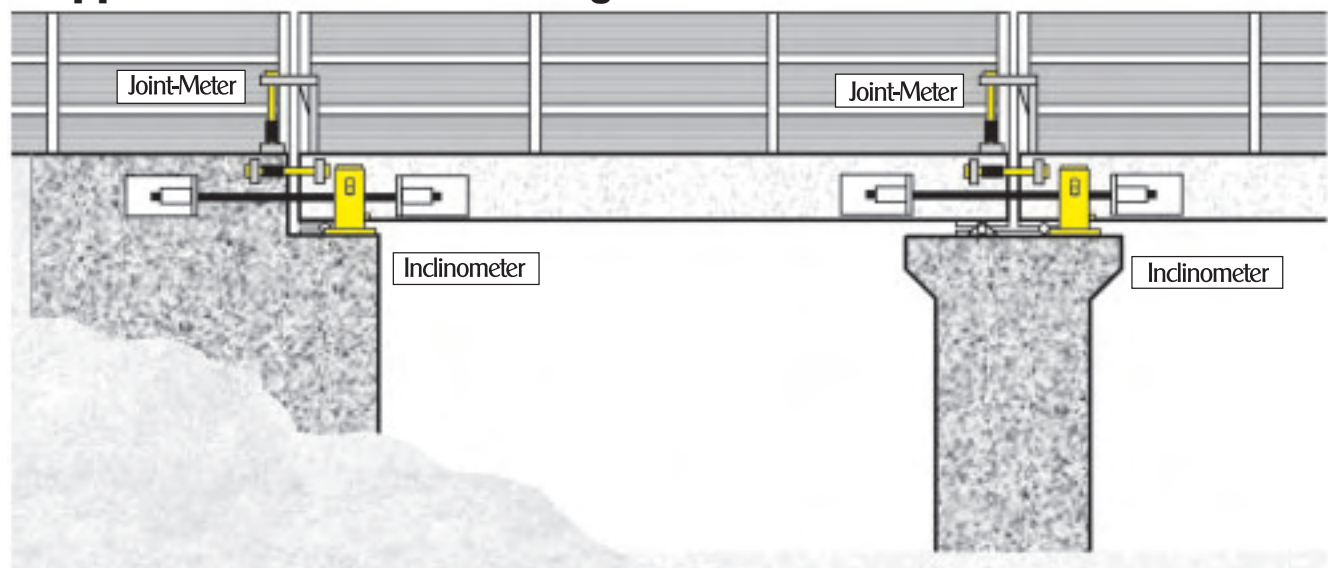
Type	KJA-5A KJB-5A	KJA-10A KJB-10A	KJA-20A KJB-20A	KJA-50A KJB-50A
Capacity	5mm	10mm	20mm	50mm
Rated Output	Approx. 1mV/V (2000×10 <sup>-6</sup> strain)			
Non-linearity	1 %RO			
Temperature range	-20~+80°C			
Input/Output resistance	350 Ω			
Recommended exciting voltage	Less than 2V			
Allowable exciting voltage	10V			
Weight	700 g			

Input/Output cable :  $\phi$  9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m

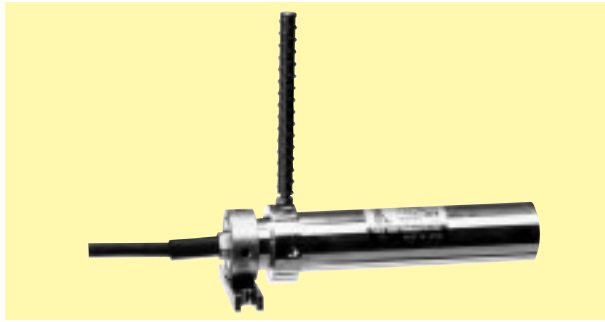
## Accessory

Socket KJF-11      Dummy plate KJF-13  
Collar KJF-12      Protective case KJF-14

## Application to elevated bridge



## KU-A Shear Displacement Transducer



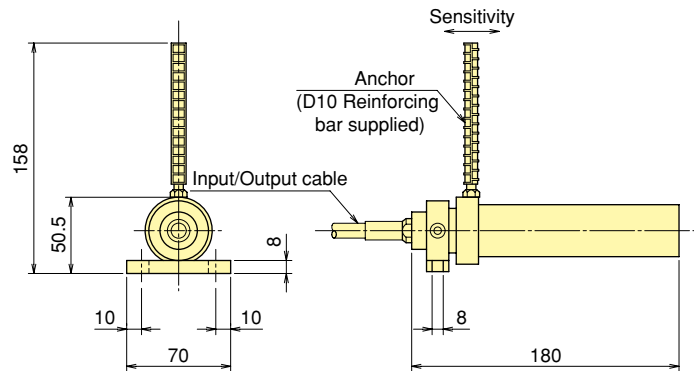
The KU-A shear displacement transducer is used to measure the shear displacement of a joint between tunnel bedrock and concrete lining or the shear displacement between two concrete layers of a concrete structure (concrete placed first and that placed next). This transducer is installed on the anchor bolt driven into tunnel bedrock or first-placed concrete, then concrete lining or another layer of concrete is laid to sandwich the transducer for shear displacement measurement.

Protection ratings : IP 68 equivalent

### Specifications

Type	KU-5A
Capacity	$\pm 2.5\text{mm}$
Rated output	$2.5\text{mV/V}$ ( $5000 \times 10^{-6}$ strain) $\pm 0.3\%$
Non-linearity	0.3%RO
Temperature range	$0 \sim +70^\circ\text{C}$
Input/output resistance	$350\ \Omega$
Recommended exciting voltage	Less than 2V
Allowable exciting voltage	10V
Weight	1.3kg

Input/output cable :  $\phi 9\text{mm}$   $0.5\text{mm}^2$  4-core shielded chloroprene cable 2m



### Accessory

#### Anchor Bolt KGF-11

This is used to mount the KU-A transducer.  
Thread M6

## KH-A Micro-Creep Meter



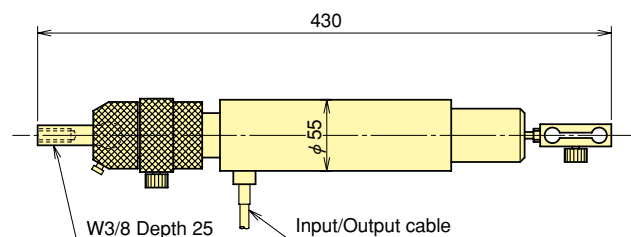
The KH-A micro-creep meter is used to measure the displacement in underground concrete tanks or tunnels. Specifically, it measures microscopic displacements by measuring the distance between two points set at an interval of 1 m to 10 m. The micro-creep meter is set at one point and an super-invar wire mounting hook is set at the other point, each secured using anchor bolts. An Invar wire is then set up between these two points to measure the distance. This meter is mainly used to control the conditions of work execution.

Protection ratings : IP 42 equivalent

### Specifications

Type	KH-5A
Capacity	5mm ( $\pm 2.5\text{mm}$ )
Rated Output	Approx. $3.8\text{mV/V}$ ( $7600 \times 10^{-6}$ strain)
Sensitivity	Approx. $1500 \times 10^{-6}$ strain/mm with 1m of super-invar wire
Non-linearity	0.3%RO
Spring force	30N (3kgf)
Temperature range	$-10 \sim +60^\circ\text{C}$ (no icing)
Input/output resistance	$350\ \Omega$
Recommended exciting voltage	Less than 2V
Allowable exciting voltage	10V
Weight	1.2kg

Supplied cable : CT9-4N30/WJ-STB ( $\phi 9\text{mm}$   $0.5\text{mm}^2$  4-core shielded chloroprene cable 30m)



### Accessory

#### Super-Invar wire KHF-11

This wire transmits displacement to the Microcreep meter.  
Outer diameter : 0.8mm

#### Super Invar wire Fixing Bracket KHF-12

This is used to mount the KHF-11 Super Invar wire to a wall surface.

#### Anchor Bolt KHF-13

This is used to mount the KH-A Microcreep meter and KHF-12 Fixing bracket to a wall surface.

#### Wire Lock KHF-14

This is used to lock the end of the KHF-11 Super Invar wire to the KHF-12 Fixing bracket.

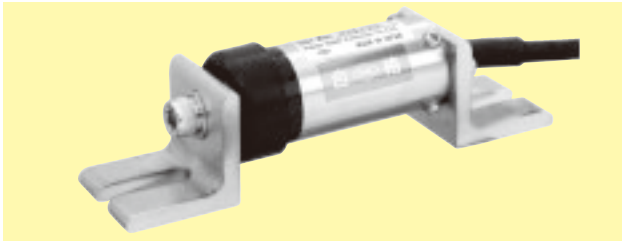
#### Crimping Pliers KHF-15

These are used to crimp the KHF-14 Wire Lock.

#### Supplied cable

CT9-4N30/WJ-STB : 9mm-dia.  $0.5\text{mm}^2$  4-core shielded chloroprene cable 30-meter.

## KG-A Crack Displacement Transducer



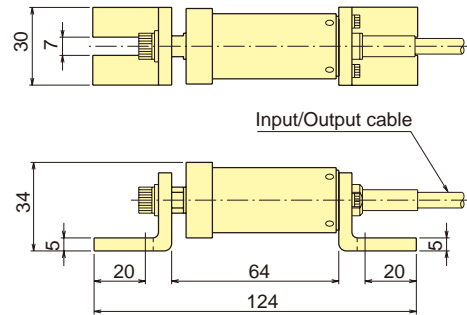
The KG-A crack displacement transducer is set across a crack on the surface of concrete or across a joint between two concrete layers to measure the displacement of openings. The waterproof feature allows this transducer to make accurate and stable measurement outdoors over a long period of time. It 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 <sup>-6</sup> strain)	2mV/V (4000 × 10 <sup>-6</sup> strain)
Sensitivity	Approx. 1500 × 10 <sup>-6</sup> strain/mm	Approx. 800 × 10 <sup>-6</sup> strain/mm
Non-linearity	0.5 %RO	
Spring force	15N	
Temperature range	- 20~ + 60 (no icing)	
Input/output resistance	350	
Recommended exciting voltage	Less than 2V	
Allowable exciting voltage	5V	
Weight	180g	

Input/output cable : 6mm 0.35mm<sup>2</sup> 4-core shielded chloroprene cable 2m



### Accessory

#### 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

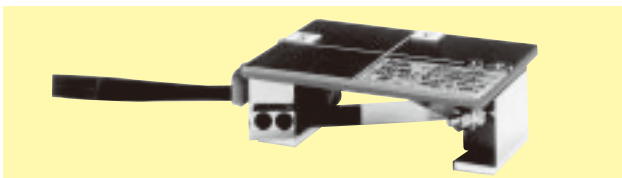
#### Fixing Jig KGF-31

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

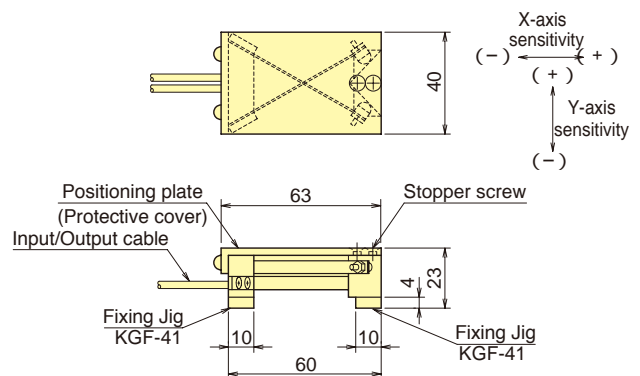


The KG-B crack displacement transducer is used to measure the displacement in two directions simultaneously: the displacement of openings, such as concrete cracks or joints, and the horizontal shear displacement. It is glued to a mounting plate, which is then mounted on a structure. Because the mounting plate is 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 + 4mm, - 2mm Y-direction ±3mm
Rated output	X-direction: Approx. +2mV/V, -1mV/V (+4000×10 <sup>-6</sup> strain, -2000×10 <sup>-6</sup> strain) Y-direction: Approx. 1.5mV/V (3000×10 <sup>-6</sup> strain)
Sensitivity	Approx. 1000× 10 <sup>-6</sup> strain/mm
Non-linearity	1%RO
Temperature range	0 ~ + 40
Input/output resistance	350Ω
Cross sensitivity	X-direction 1.5% Y-direction 2%
Recommended exciting voltage	Less than 2V
Allowable exciting voltage	5V
Weight	90g

Input/output cable : 3mm 0.05mm<sup>2</sup> 4-core shielded chloroprene cable 2m × 2pcs.



### Accessory

#### Fixing Jig KGF-41

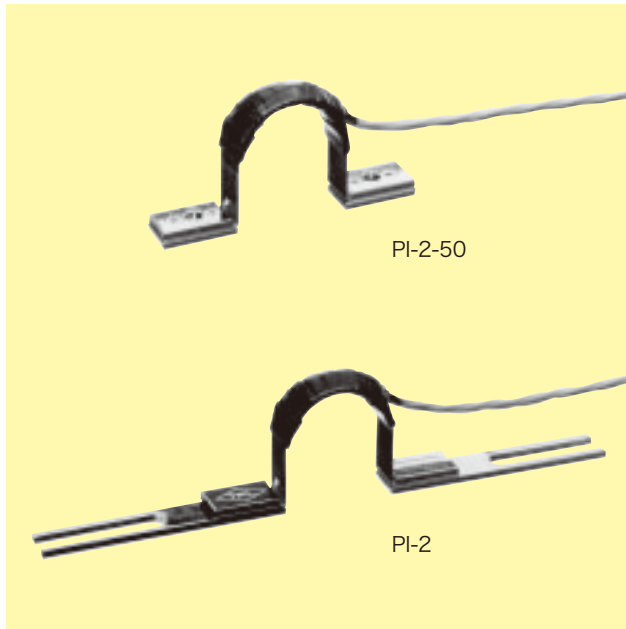
This jig is bonded onto concrete surface to mount the transducer. (2 pcs/set)

#### Dummy plate KGF-61

This plate is temporarily mounted to maintain proper gauge length for installation of the transducer with KGF-41 jig.



# PI Displacement Transducer



The PI displacement transducer has a simple structure: a combination of strain gauges and an arch-shaped spring plate, the former attached to ends of 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.

## Specifications

Type	PI-2	PI-5
Gauge length (Span)	50, 100, 150, 200, 250, 300mm	
Capacity	±2mm	±5mm
Rated output	2mV/V (4000×10 <sup>-6</sup> strain)	2.5mV/V (5000×10 <sup>-6</sup> strain)
Sensitivity	Approx. 2000×10 <sup>-6</sup> strain/mm	Approx. 1000×10 <sup>-6</sup> strain/mm
Non-linearity	0.5%RO	
Temperature range	0~+40°C	
Input/output resistance	350Ω	
Recommended exciting voltage	Less than 2V	
Allowable exciting voltage	10V	

Input/output cable : φ 3mm 0.09mm<sup>2</sup> 4-core vinyl cable 2m

## Dimensions

Type	A	B	C(Gauge length)	D	Weight (g)
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

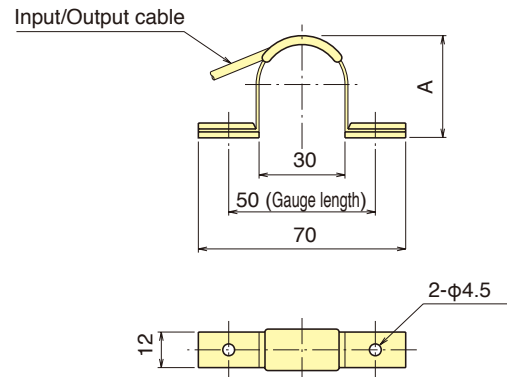
### Dummy plate PIF-11

This plate is used to maintain the proper gauge length when mounting the PIF-21 jig to test specimen.

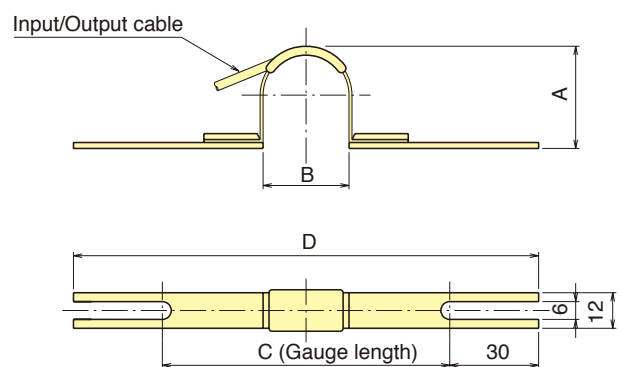
### Fixing Jig PIF-21

This Jig is pre-mounted to concrete and other test specimen in order to screw-mount PI displacement transducer.

### PI-2-50/PI-5-50

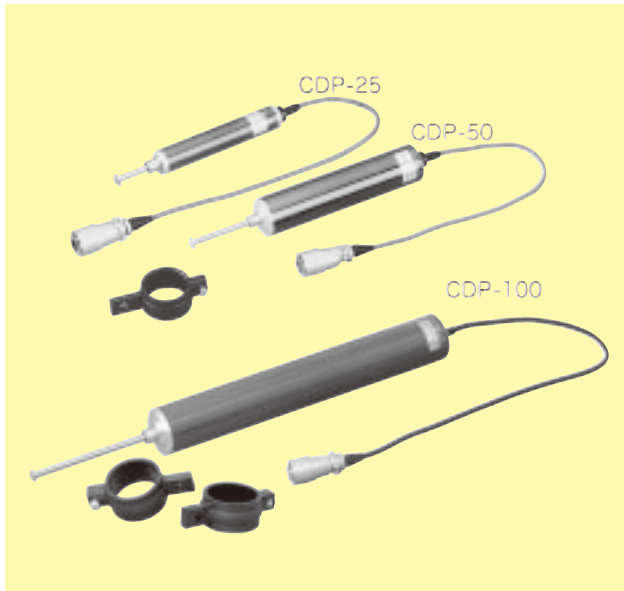


### PI-2/PI-5



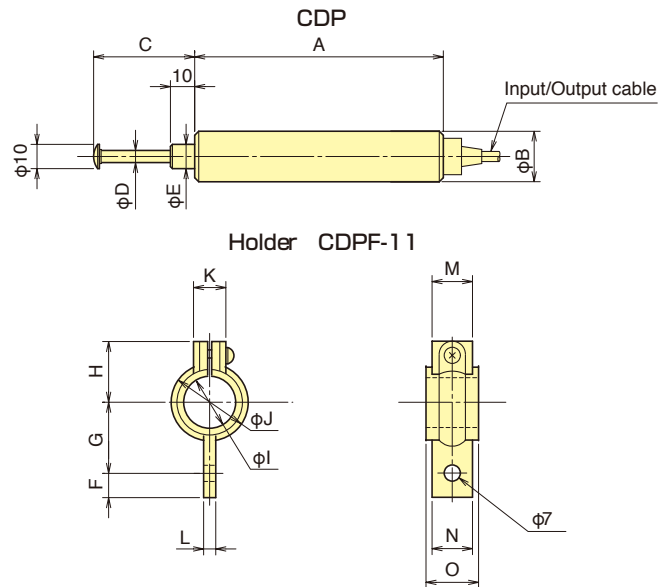
Type	Dummy plate	Fixing Jig
PI-2-50/PI-5-50	PIF-11-50	PIF-21-50
PI-2-100/PI-5-100	PIF-11-100	PIF-21-100
PI-2-150/PI-5-150	PIF-11-150	PIF-21-100
PI-2-200/PI-5-200	PIF-11-200	PIF-21-100
PI-2-250/PI-5-250	PIF-11-250	PIF-21-100
PI-2-300/PI-5-300	PIF-11-300	PIF-21-100

# CDP Displacement Transducer



The CDP displacement transducer is a compact, easy-to-operate strain 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 : IP 40 equivalent



## ■ Dimensions

Type	A	B	C	D	E
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

Type	Applicable transducer	F	G	H	I	J	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±0.15% (10000×10 <sup>-6</sup> strain) ±0.15%	5mV/V±0.1% (10000×10 <sup>-6</sup> strain) ±0.1%	6.25mV/V± 0.1% (12500×10 <sup>-6</sup> strain) ±0.1%	5mV/V± 0.1% (10000×10 <sup>-6</sup> strain) ±0.1%	
Sensitivity	2000×10 <sup>-6</sup> strain/mm	1000×10 <sup>-6</sup> strain/mm	500×10 <sup>-6</sup> strain/mm	200×10 <sup>-6</sup> strain/mm	100×10 <sup>-6</sup> strain/mm
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/ °C		0.008%RO/ °C	0.01%RO/ °C	
Compensated temperature range	0 ~ +40°C (no condensation)				
Temperature range	-10 ~ +60°C (no condensation)				
Input/output resistance	350Ω				
Recommended exciting voltage	Less than 2V				
Allowable exciting voltage	10V				
Holders supplied	1 pc.			2 pcs.	
Weight	90g		100g	270g	580g

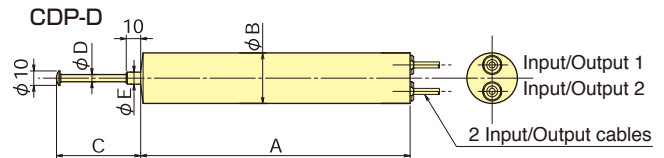
Supplied cable : CT6-4V10/NJ-STB (φ6mm 0.3mm<sup>2</sup> 4-core shielded vinyl cable 10m)

## CDP-D Displacement Transducer



The CDP-D displacement transducer is the CDP displacement transducer with dual independent inputs and outputs. 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.

Protection ratings : IP 40 equivalent



For detail, refer to page 22.

### Specifications

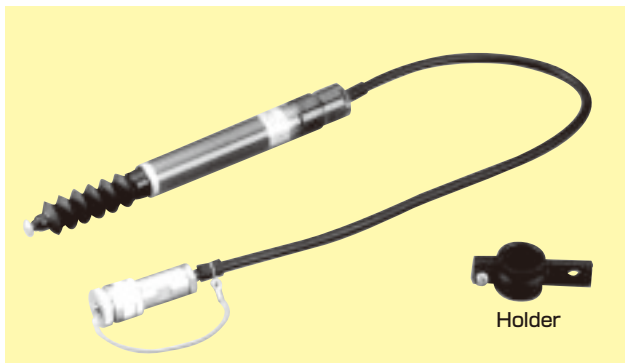
Type	CDP-50-D	CDP-100-D
Capacity	50mm	100mm
Rated Output	5mV/V (10000×10 <sup>-6</sup> strain) ±0.1%	
Sensitivity	200×10 <sup>-6</sup> strain/mm	100×10 <sup>-6</sup> strain/mm
Non-linearity	0.1%RO	
Cross sensitivity	0.2%RO	
Spring force	3.4N	4.9N
Frequency response	6Hz	3Hz
Temperature effect on zero	0.01%RO/ °C	
Compensated temperature range	0 ~ +40°C (no condensation)	
Temperature range	-10 ~ +60°C (no condensation)	
Input/output resistance	350Ω	
Recommended exciting voltage	Less than 2V	
Allowable exciting voltage	10V	
Weight	300g	600g

Supplied cable : CT6-4V10/NJ-STB (φ6mm 0.3mm<sup>2</sup> 4-core shielded vinyl cable 10m)

### Dimensions

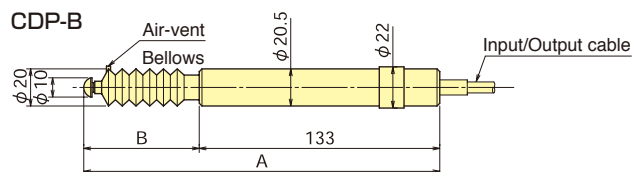
Type	A	B	C	D	E
CDP-50-D	165	33.5	65	5	10
CDP-100-D	274	41	118	6	12

## CDP-B Displacement Transducer



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 : IP 42 equivalent



For detail, refer to page 22.

### Specifications

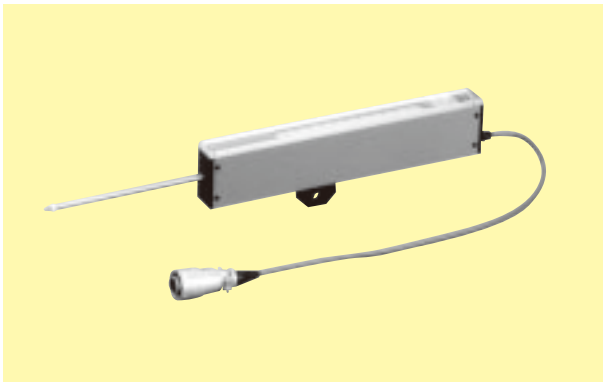
Type	CDP-5B	CDP-10B	CDP-25B
Capacity	5mm	10mm	25mm
Rated Output	5mV/V ±0.15% (10000 × 10 <sup>-6</sup> strain) ±0.15%	5mV/V ±0.1% (10000 × 10 <sup>-6</sup> strain) ±0.1%	6.25mV/V ±0.1% (12500 × 10 <sup>-6</sup> strain) ±0.1%
Sensitivity	2000 × 10 <sup>-6</sup> strain/mm	1000 × 10 <sup>-6</sup> strain/mm	500 × 10 <sup>-6</sup> strain/mm
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)		
Temperature range	-10 ~ +60°C (no condensation)		
Input/output resistance	350Ω		
Recommended exciting voltage	Less than 2V		
Allowable exciting voltage	10V		
Weight	130g		140g

Supplied cable : CT6-4N10/WJ-STB (φ6mm 0.35mm<sup>2</sup> 4-core shielded chloroprene cable 10m)

### Dimensions

Type	A	B
CDP-5B	197	64
CDP-10B	198	65
CDP-25B	208	75

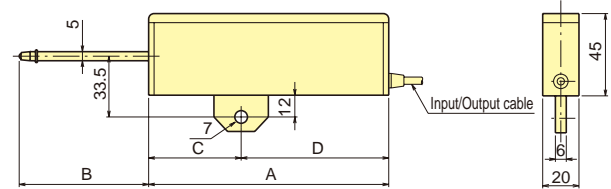
## SDP-C Displacement Transducer



The SDP-C displacement transducer is a general-purpose, strain gauge-type transducer. Designed with a strain-generating cantilever, it is able to make stable measurement while maintaining the high sensitivity to minuscule displacements.

Protection ratings : IP 40 equivalent

SDP-C



### Specifications

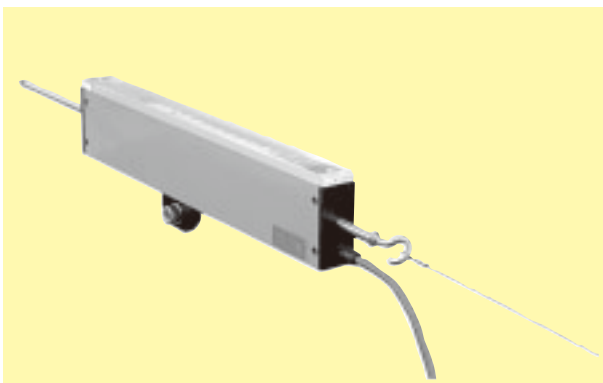
Type	SDP-50C	SDP-100C
Capacity	50mm	100mm
Rated Output	2.5mV/V (5000× 10 <sup>-6</sup> strain) ±0.2%	
Sensitivity	100× 10 <sup>-6</sup> strain/mm	50× 10 <sup>-6</sup> strain/mm
Non-linearity	0.2%RO	
Spring force	5.9N	
Frequency response	1 Hz	
Temperature range	0 ~ +60°C	
Input/output resistance	350Ω	
Recommended exciting voltage	Less than 2V	
Allowable exciting voltage	5V	
Weight	250g	350g

Supplied cable : CT6-4V10/NJ-STB ( 6mm 0.3mm<sup>2</sup> 4-core shielded vinyl cable 10m)

### Dimensions

Type	SDP-50C	SDP-100C
A	130	220
B	70	120
C	50	90
D	80	130

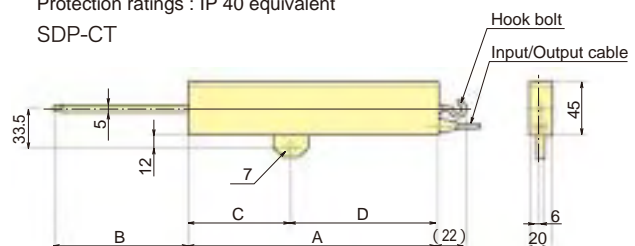
## SDP-CT Displacement Transducer



The SDP-CT 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 : IP 40 equivalent

SDP-CT



### Specifications

Type	SDP-50CT	SDP-100CT
Capacity	50mm	100mm
Rated Output	2.5mV/V (5000× 10 <sup>-6</sup> strain) ±0.2%	
Sensitivity	100× 10 <sup>-6</sup> strain/mm	50× 10 <sup>-6</sup> strain/mm
Non-linearity	0.2%RO	
Spring force	6N	
Frequency response	1 Hz	
Temperature range	0 ~ +60	
Input/output resistance	350	
Recommended exciting voltage	Less than 2V	
Allowable exciting voltage	5V	
Weight	250g	350g

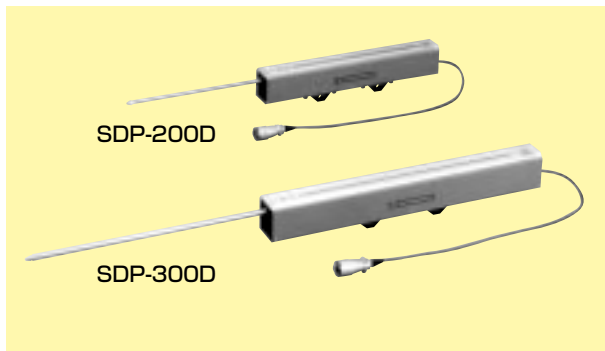
Supplied cable : CT6-4V10/NJ-STB ( 6mm 0.3mm<sup>2</sup> 4-core shielded vinyl cable 10m)

### Dimensions

Type	SDP-50CT	SDP-100CT
A	130	220
B	70	120
C	50	90
D	80	130

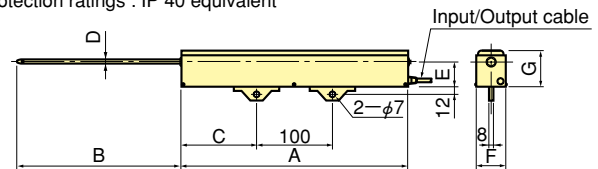


## SDP-D Displacement Transducer



The SDP-D displacement transducer is an axial-type transducer with a measuring range of 200 mm or 300 mm. The strain gauge-type design makes this transducer free of the noise generated by a strain gauge with sliding electrical contact points. Taking advantage of the stroke of the axial part, it can measure a large amount of displacement and make stable measurement over a long period of time. As it is provided with graduations, alignment work can be done easily.

Protection ratings : IP 40 equivalent



### Specifications

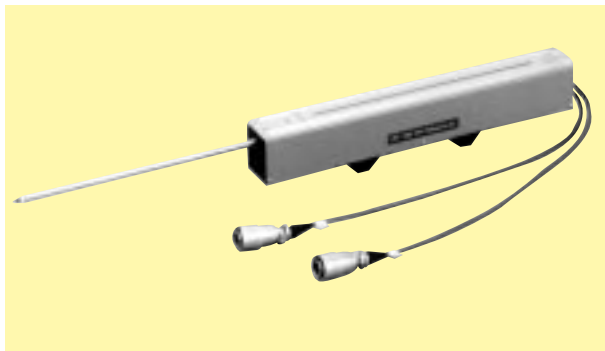
Type	SDP-200D	SDP-300D
Capacity	200mm	300mm
Rated Output	5mV/V (10000×10 <sup>-6</sup> strain) ±0.3%	
Sensitivity	50×10 <sup>-6</sup> strain/mm	33×10 <sup>-6</sup> strain/mm
Non-linearity	0.3%RO	
Spring force	5.9N	7.4N
Frequency response	2Hz	1.5Hz
Temperature range	0~+60℃	
Input/output resistance	350Ω	
Recommended exciting voltage	Less than 2V	
Allowable exciting voltage	10V	
Weight	900g	1200g

### Dimensions

Type	SDP-200D	SDP-300D
A	300	400
B	216	317
C	100	150
D	φ 6	φ 8
E	32	35
F	37	42
G	47	51

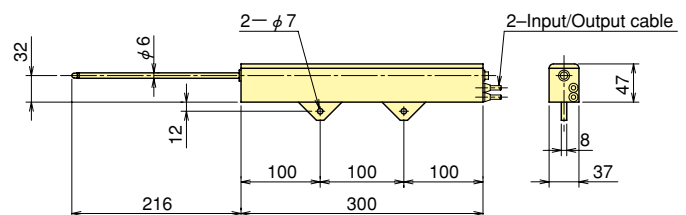
Supplied cable : CT6-4V10/NJ-STB (φ 6mm 0.3mm<sup>2</sup> 4-core shielded vinyl cable 10m)

## SDP-D-D Displacement Transducer



The SDP-D-D displacement transducer is the SDP-D displacement transducer with dual independent inputs and outputs. 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.

Protection ratings : IP 40 equivalent

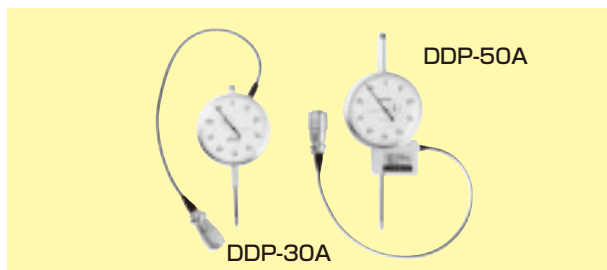


### Specifications

Type	SDP-200D-D
Capacity	200mm
Rated Output	5mV/V (10000×10 <sup>-6</sup> strain) ±0.3%
Sensitivity	50×10 <sup>-6</sup> strain/mm
Non-linearity	0.3%RO
Cross sensitivity	0.6%RO
Spring force	5.9N
Frequency response	2Hz
Temperature range	0~+60℃
Input/output resistance	350Ω
Recommended exciting voltage	Less than 2V
Allowable exciting voltage	10V
Weight	900g

Supplied cable : CT6-4V10/NJ-STB (φ 6mm 0.3mm<sup>2</sup> 4-core shielded vinyl cable 10m)

## DDP-A Displacement Transducer



The DDP-A displacement transducer is a dial gauge with a strain generating block and a bridge circuit integrated. The amount of displacement can be checked by viewing the pointer while the output from a strain generating block can be used to control a recorder or a piece of equipment.

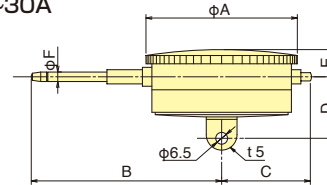
Protection ratings : IP 40 equivalent

### ■ Specifications

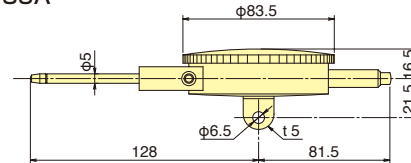
Type	DDP-10A	DDP-20A	DDP-30A	DDP-50A
Capacity	10mm	20mm	30mm	50mm
Rated Output	1.5mV/V± 0.3% (3000×10 <sup>-6</sup> strain) ±0.3%			2.5mV/V± 0.3% (5000×10 <sup>-6</sup> strain) ±0.3%
Sensitivity	300×10 <sup>-6</sup> strain/mm	150×10 <sup>-6</sup> strain/mm	100×10 <sup>-6</sup> strain/mm	
Non-linearity	0.3%RO			
Spring force	2.9N	3.9N		5.4N
Frequency response	2Hz		1Hz	
Temperature range	0~ + 60°C			
Input/output resistance	350Ω			
Recommended exciting voltage	Less than 2V			
Allowable exciting voltage	5V			
Weight	190g	340g	400g	500g

Supplied cable : CT6-4V10/NJ-STB (φ 6mm 0.3mm<sup>2</sup> 4-core shielded vinyl cable 10m)

DDP-10~30A



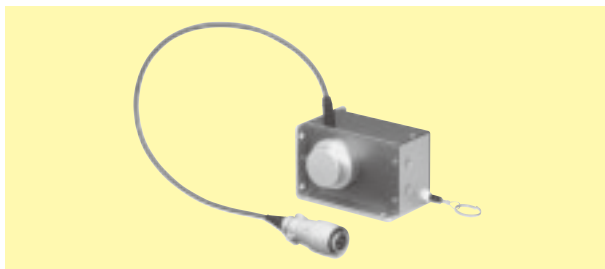
DDP-50A



### ■ Dimensions

Type	A	B	C	D	E	F
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	図面参照					

## DP-E Displacement Transducer



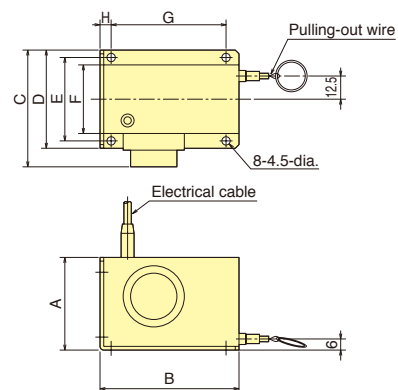
The DP-E displacement transducer is used to measure a large amount of displacement. A stainless steel wire is drawn to measure displacement. The wire tension is constant in the same direction regardless of the amount of displacement. This is a small, lightweight, and high-accuracy transducer.

Protection ratings : IP 40 equivalent

### ■ Specifications

Type	DP-500E	DP-1000E	DP-2000E
Capacity	500mm	1000mm	2000mm
Rated Output	5mV/V± 0.1% (10000×10 <sup>-6</sup> strain) ±0.3%		
Sensitivity	20×10 <sup>-6</sup> strain/mm	10×10 <sup>-6</sup> strain/mm	5×10 <sup>-6</sup> strain/mm
Non-linearity	0.3%RO		
Spring force	1.5N		1.7N
Temperature range	-10~+80°C (no condensation)		
Input/output resistance	Input 210Ω    Output 350Ω		
Recommended exciting voltage	Less than 2V		
Allowable exciting voltage	10V		
Weight	210g		400g

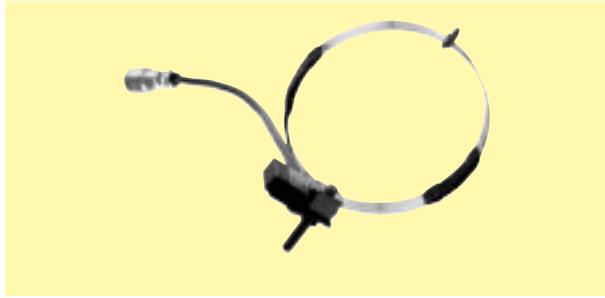
Supplied cable : CT6-4V10/NJ-STB (φ 6mm 0.3mm<sup>2</sup> 4-core shielded vinyl cable 10m)



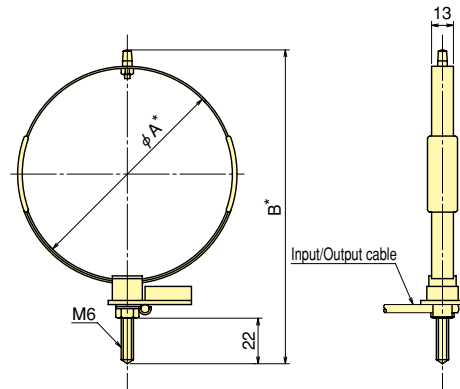
### ■ Dimensions

Type	A	B	C	D	E	F	G	H
DP-500E	50	75	63	53	45	37	62	6
DP-1000E	50	75	63	53	45	37	62	6
DP-2000E	80	98	67	57	49	41	74	16

## OU Displacement Transducer



The OU displacement transducer is a combination of a round plate spring and strain gauges. It is mounted with its probe 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.



\* : Approximate value

### Specifications

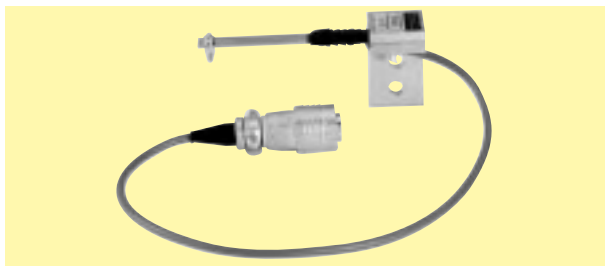
Type	OU-10	OU-20	OU-30
Capacity	10mm	20mm	30mm
Rated Output	5mV/V (10000×10 <sup>-6</sup> strain)		
Sensitivity	1000×10 <sup>-6</sup> strain/mm	500×10 <sup>-6</sup> strain/mm	300×10 <sup>-6</sup> strain/mm
Non-linearity	1%RO		
Spring force	31N	25N	17N
Frequency response	55Hz	30Hz	20Hz
Temperature range	0~+40°C		
Input/output resistance	350Ω		
Recommended exciting voltage	Less than 2V		
Allowable exciting voltage	10V		
Weight	60g	70g	75g

Supplied cable : CT6-4V5/NJ-STB (φ6mm 0.3mm<sup>2</sup> 4-core shielded vinyl cable 5m)

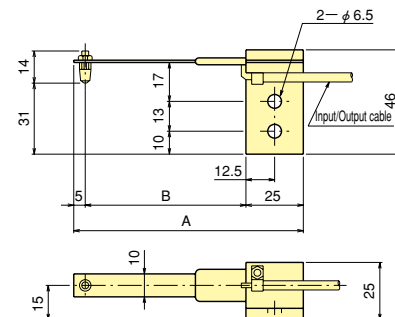
### Dimensions

Type	A	B
OU-10	80	130
OU-20	110	160
OU-30	150	200

## CE Displacement Transducer



The CE displacement transducer has the structure of a cantilever mounted on a strain gauge. 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.



### Specifications

Type	CE-2	CE-5	CE-10
Capacity	2mm	5mm	1mm
Rated Output	2.5mV/V (5000×10 <sup>-6</sup> strain)		
Sensitivity	2500×10 <sup>-6</sup> strain/mm	1000×10 <sup>-6</sup> strain/mm	500×10 <sup>-6</sup> strain/mm
Non-linearity	1%RO		
Spring force	7.1N	4.7N	3.2N
Frequency response	110Hz	45Hz	25Hz
Temperature range	0~+40°C		
Input/output resistance	350Ω		
Recommended exciting voltage	Less than 2V		
Allowable exciting voltage	10V		
Weight	90g		95g

Supplied cable : CT6-4V5/NJ-STB (φ6mm 0.3mm<sup>2</sup> 4-core shielded vinyl cable 5m)

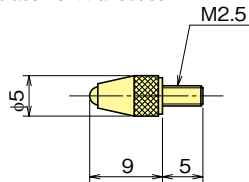
### Dimensions

Type	A	B
CE-2	75	45
CE-5	100	70
CE-10	130	100

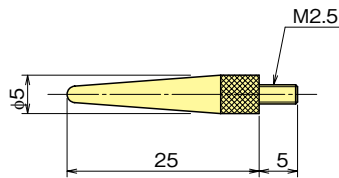
# Displacement Transducer Accessories

## Contact Tip DF-11

The DF-11 is used with OU/CE/SDP-C/SDP-CT type displacement transducer.

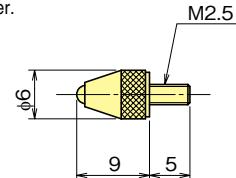


## Contact Tip DF-15

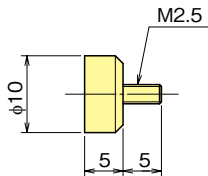


## Contact Tip DF-12

The DF-12 is used with SDP-D type displacement transducer.

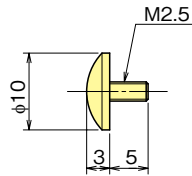


## Contact Tip DF-16

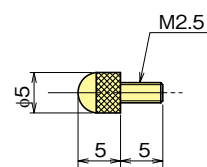


## Contact Tip DF-13

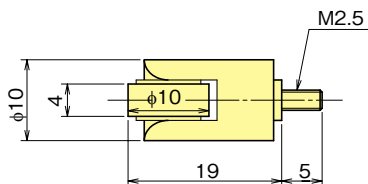
The DF-13 is used with CDP type displacement transducer.



## Contact Tip DF-17

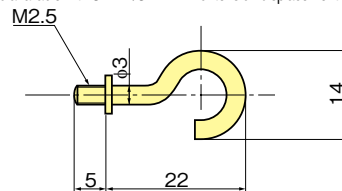


## Contact tip DF-14 (with roller)



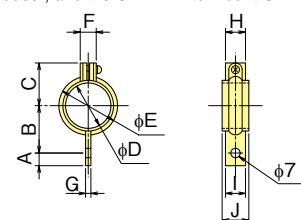
## Hook Bolt SDPF-13

The SDPF-13 is used with SDP-CT displacement transducer. Also available with SDP-D/SDP-D-D 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.



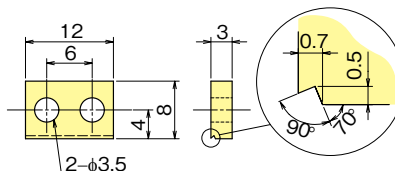
## Magnet Stand MB

The MB is used to mount displacement.



## Fixing Jig RAF-11

The RAF-11 is pre-mounted to test specimen in order to clasp-mount RA and UB type displacement transducer.

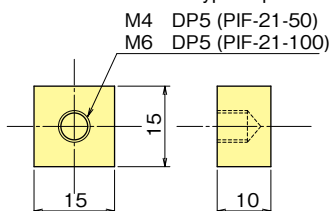


Type	Applicable transducer
CDPF-11-25	CDP-5~-25, -5B~-25B, -50M/-50MT
CDPF-11-50	CDP-50, 50-D
CDPF-11-100	CDP-100, 100-D
CDPF-12-25	CDP-5M~-25M, CDP-5MT~-25MT

Type	A	B	C	D	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

## Fixing Jig PIF-21

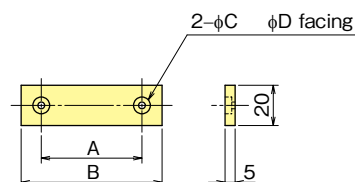
The PIF-21 is used to pre-mount to concrete and other test specimen in order to screw-mount PI type displacement transducer.



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

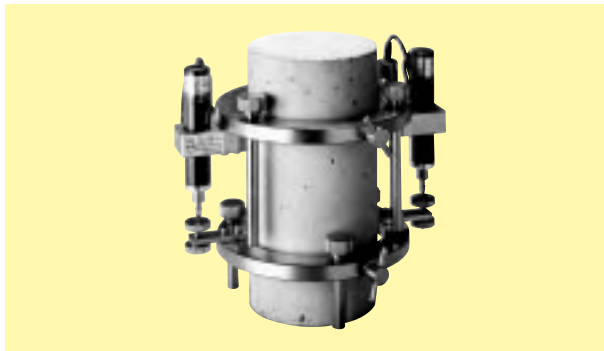
The PIF-11 is used to maintain the proper gauge length when mounting the PIF-21 Fixing Jig to test specimen.



Type	Applicable transducer	A	B	C	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



## CM Compressometer



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 strain gauge 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.

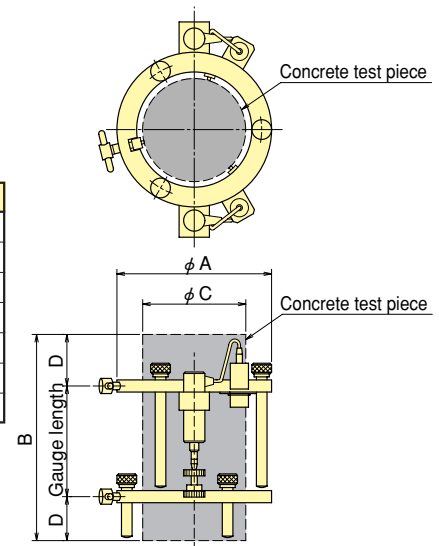
### Specifications

Type	CM-10	CM-12	CM-15
Applicable specimen	$\phi 10 \times 20\text{cm}$	$\phi 12.5 \times 25\text{cm}$	$\phi 15 \times 30\text{cm}$
Gauge length	100mm	120mm	150mm
Capacity	$50000 \times 10^{-6}$ strain	$40000 \times 10^{-6}$ strain	$33000 \times 10^{-6}$ strain
Input/output resistance	350 $\Omega$		
Recommended exciting voltage	Less than 2V		
Allowable exciting voltage	10V		
Weight	2.5kg	3.1kg	3.7kg

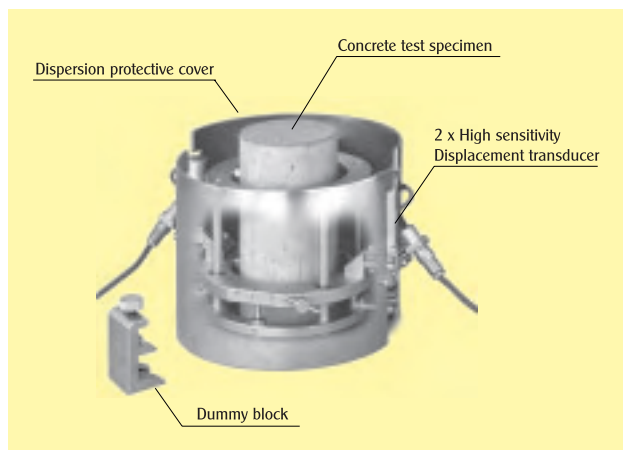
Supplied cable : CT6-4V10/NP-STB ( $\phi 6\text{mm}$  0.3mm<sup>2</sup> 4-core shielded vinyl cable 10m)

### Dimensions

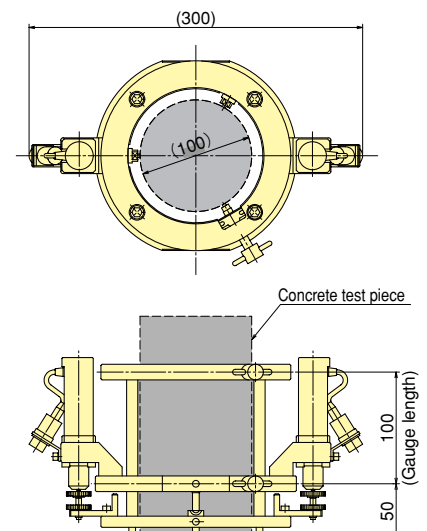
Type	A	B	C	D	Gauge length
CM-10	150	200	100	50	100
CM-12	185	250	125	62.5	125
CM-15	210	300	150	75	150



## CM-H Compressometer (Destructive)



The CM-10H compressometer is designed to conduct a breaking strength test. It measures the compression strain on a cylindrical concrete specimen (10 cm in diameter  $\times$  20 cm in length) made of generally used concrete or high-strength concrete. The high-sensitivity strain gauge is assembled into this compressometer to measure the amount of strain. Both the high-sensitivity strain gauge and a cylindrical concrete specimen are provided with coverings to protect them from damage. A cylindrical concrete specimen can be set in the compressometer quickly and easily. This compressometer allows the strain on a wet concrete specimen, taken out right after underwater curing, to be measured. With this compressometer linked with either the CLL-NA or CLH-MNA load meter, it is also possible to measure the modulus of static elasticity.



### Specifications

Type	CM-10H
Applicable specimen	$\phi 10 \times 20\text{cm}$
Gauge length	100mm
Capacity	$20000 \times 10^{-6}$ strain
Input/output resistance	350 $\Omega$
Recommended exciting voltage	Less than 2V
Allowable exciting voltage	10V
Weight	4.5

Supplied cable : CT6-4V3/SNP-STB ( $\phi 6\text{mm}$  0.3mm<sup>2</sup> 4-core shielded vinyl cable 3m)

# CLL-NA/CLH-NA Compression Load Cell



The CLL-NA and CLH-NA load cells with a flat loading platform are used to conduct loading tests on cylindrical concrete specimens. A cylindrical concrete specimen can be directly set on the surface of the loading platform. Guide markings are shown on the loading platform so that each specimen different in size can be placed in alignment with each appropriate guide marking.

The CLL-NA is designed to test a cylindrical test specimen made of generally used concrete, while 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. Although both have handles, other models, CLL-500KNA and CLH-1MNA, do not have handles.

Protection ratings : IP 65 equivalent

## CLL-NA Specifications

Type	CLL-500KNA	CLL-750KNA	CLL-1MNA
Applicable specimen	$\phi 10 \times 20\text{cm}$	$\phi 12.5 \times 25\text{cm}$	$\phi 15 \times 30\text{cm}$
Capacity	500kN	750kN	1MN
Rated Output	1.5mV/V ( $3000 \times 10^{-6}$ strain) $\pm 0.5\%$		
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		
Temperature range	-20~+70°C		
Over load	150%		
Input/output resistance	350 $\Omega \pm 5\%$		
Recommended exciting voltage	Less than 10V		
Zero balance	5%RO		
Allowable exciting voltage	20V		
Weight	9kg	12kg	22kg

Supplied cable : CT9-4N10/WP-STB ( $\phi 9\text{mm}$  0.5mm<sup>2</sup> 4-core shielded chloroprene cable 10m)

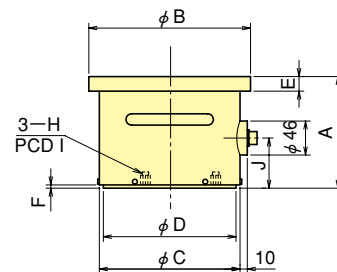
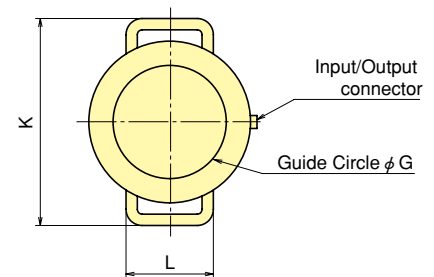
## CLH-NA Specifications

Type	CLH-1MNA	CLH-1.5MNA	CLH-2MNA
Applicable specimen	$\phi 10 \times 20\text{cm}$	$\phi 12.5 \times 25\text{cm}$	$\phi 15 \times 30\text{cm}$
Capacity	1MN	1.5MN	2MN
Rated Output	1.5mV/V ( $3000 \times 10^{-6}$ strain) $\pm 0.5\%$		
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		
Temperature range	-20~+70°C		
Over load	150%		
Input/output resistance	350 $\Omega \pm 5\%$		
Recommended exciting voltage	Less than 10V		
Zero balance	5%RO		
Allowable exciting voltage	20V		
Weight	10kg	14kg	26kg

Supplied cable : CT9-4N10/WP-STB ( $\phi 9\text{mm}$  0.5mm<sup>2</sup> 4-core shielded chloroprene cable 10m)

## Dimensions

Type	A	B	C	D	E	F	G	H	I	J	K	L
CLL-500KNA	115	160	140	130	25	1	102	M10DP10	80	45	—	—
CLH-1MNA												
CLL-750KNA	137	195	170	160	25	2	127	M10DP12	96	55	254	114
CLH-1.5MNA												
CLL-1MNA	155	220	190	180	25	2	153	M12DP15	124	65	280	120
CLH-2MNA												



## Combination with Compressometer

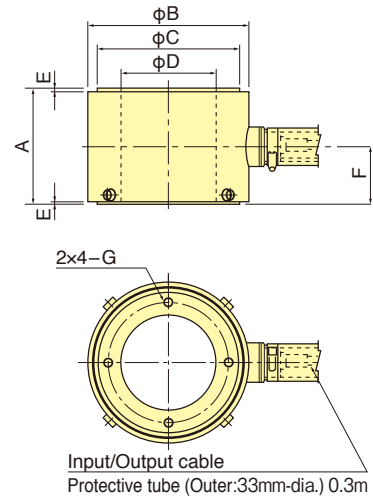


# KCE-NA Center-hole type Load Cell



The KCE-NA load cell 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.

Protection ratings : IP 67 equivalent



## ■ Dimensions

Type	A	B	C	D	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	M10 DP12 PCD112
KCE-1.5MNA	115	185	160	110	4	57.5	M12 DP15 PCD136
KCE-2MNA	155	215	188	140	5	77.5	M12 DP15 PCD164

## ■ Specifications

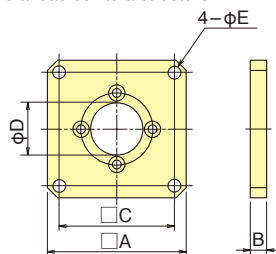
Type	KCE-500KNA	KCE-1MNA	KCE-1.5MNA	KCE-2MNA
Capacity	500kN	1MN	1.5MN	2MN
Rated Output	1.25mV/V (2500×10 <sup>-6</sup> strain) ±10%			
Non-linearity	0.5%RO			
Hysteresis	0.5%RO			
Temperature effect on zero	0.1%RO/°C			
Temperature effect on span	0.05%/°C			
Compensated temperature range	-10~+60°C			
Temperature range	-20~+70°C			
Over load	120%			
Input/output resistance	350Ω ± 1%			
Recommended exciting voltage	Less than 10V			
Allowable exciting voltage	20V			
Zero balance	5%RO			
Weight	4kg	8.5kg	12.2kg	21kg

Input/output cable : φ 9mm 0.5mm<sup>2</sup> 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.

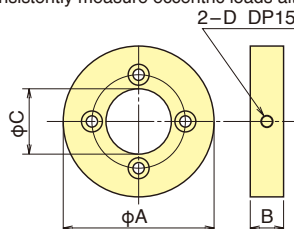
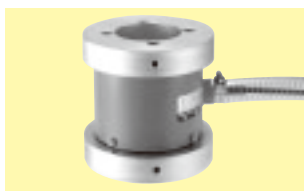


## ■ Dimensions

Type	Applicable Load Cell	A	B	C	D	E	Weight (kg)
KCEF-11-50	KCE-500KNA	180	20	150	82	12.5	4.1
KCEF-11-100	KCE-1MNA	200	20	170	90	12.5	5.1
KCEF-11-150	KCE-1.5MNA	220	35	190	110	12.5	10.4
KCEF-11-200	KCE-2MNA	250	35	220	140	12.5	13

### ● FLANGE KCEF-12

This flange is a pressure plate used to consistently measure eccentric loads although with limitations.



## ■ Dimensions

Type	Applicable Load Cell	A	B	C	D	Weight (kg)
KCEF-12-50	KCE-500KNA	156	26	82	M 8	2.8
KCEF-12-100	KCE-1MNA	176	35	90	M10	4.9
KCEF-12-150	KCE-1.5MNA	206	43	110	M10	7.9
KCEF-12-200	KCE-2MNA	236	47	140	M12	10

## KCM-NA Center-hole type Load Cell



The KCM-NA load cell is a center-hole-type load cell with a strain gauge mounted on a cylindrical strain-generating block. It is used to measure the load on earth anchors, lock anchors, PC anchors, and so forth.

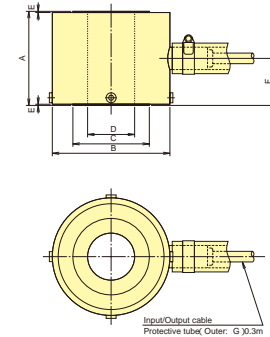
Protection ratings : IP 67 equivalent

### Specifications

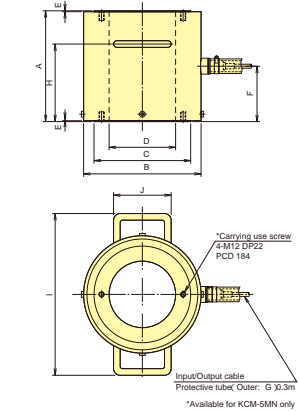
Type	KCM-50KNA	KCM-100KNA	KCM-200KNA	KCM-300KNA	KCM-500KNA	KCM-1MNA	KCM-2MNA	KCM-3MNA	KCM-5MNA
Capacity	50kN	100kN	200kN	300kN	500kN	1MN	2MN	3MN	5MN
Rated Output	1.5mV/V (3000× 10 <sup>-6</sup> strain) ±10%								
Non-linearity	0.5 %RO					1%RO			
Hysteresis	0.5 %RO					1%RO			
Temperature effect on zero	0.1%RO/°C								
Temperature effect on span	0.05%/°C								
Compensated temperature range	-10 ~ +60°C								
Temperature range	-20 ~ +70°C								
Over load	150%								
Input/output resistance	350Ω ± 1%								
Recommended exciting voltage	Less than 10V								
Allowable exciting voltage	20V								
Zero balance	5%RO								
Weight	0.8kg	1.1kg	1.4kg	2.0kg	2.8kg	6.2kg	16kg	29kg	55kg

Input/output cable : 9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 5m

KCM-50KNA~3MNA



KCM-5MNA



### Dimensions

Type	A	B	C	D	E	F	G	H	I	J
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	195	205	169	115	2	97.5	33	175	365	130

## CLC-NA Center-hole type Load Cell



The CLC-NA load cell is a center-hole-type load cell with a strain gauge mounted on a cylindrical strain-generating block. It is used to conduct pullout tests on anchors or laboratory experiments.

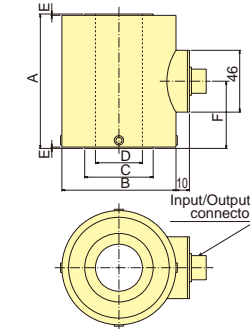
Protection ratings : IP 65 equivalent

### Specifications

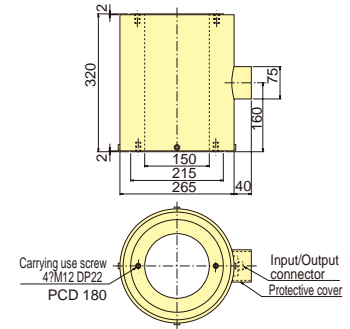
Type	CLC-50KNA	CLC-100KNA	CLC-200KNA	CLC-300KNA	CLC-500KNA	CLC-1MNA	CLC-2MNA	CLC-3MNA	CLC-5MNA
Capacity	50kN	100kN	200kN	300kN	500kN	1MN	2MN	3MN	5MN
Rated Output	1.5mV/V (3000×10 <sup>-6</sup> strain) ±0.5%								
Non-linearity	0.3%RO				0.5%RO				
Hysteresis	0.3%RO				0.5%RO				
Temperature effect on zero	0.01%RO/°C								
Temperature effect on span	0.005%/°C								
Compensated temperature range	-10 ~ + 60°C								
Temperature range	-20 ~ + 70°C								
Over load	150%								
Input/output resistance	350Ω ± 1%								
Recommended exciting voltage	Less than 10V								
Allowable exciting voltage	20V								
Zero balance	5%RO								
Weight	1kg	2kg	2kg	3kg	4kg	8kg	19kg	34kg	67kg

Supplied cable : CT9-4N10/WP-STB ( 9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 10m)

CLC-50KNA~3MNA



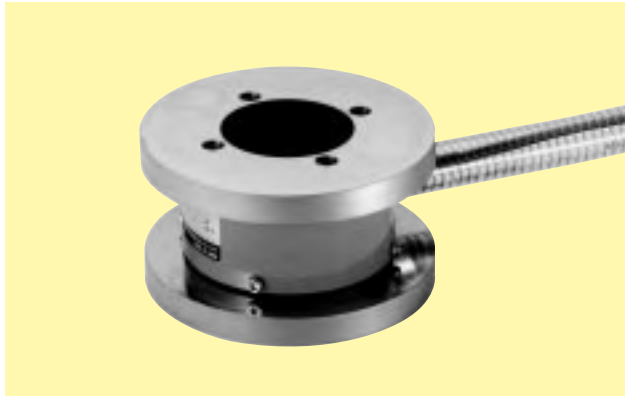
CLC-5MNA



### Dimensions

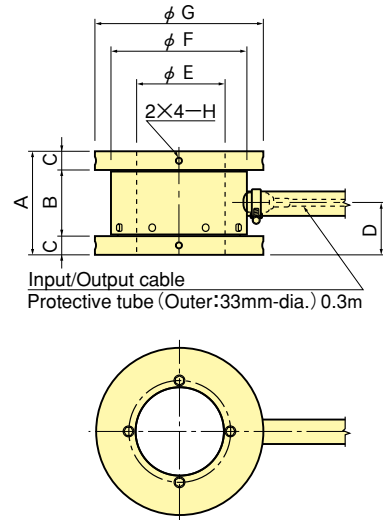
Type	A	B	C	D	E	F
CLC-50KNA	60	50	21	15	1	30
CLC-100KNA	70	60	29	20	1	35
CLC-200KNA	90	70	42	30	1	45
CLC-300KNA	100	85	51	35	1	50
CLC-500KNA	100	100	62	40	1	50
CLC-1MNA	150	130	90	60	2	75
CLC-2MNA	200	170	132	90	2	100
CLC-3MNA	250	205	164	115	2	125
CLC-5MNA	As per the figure					

# KCC-NA Center-hole type Load Cell



The KCC-NA load cell 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 : IP 67 equivalent



## ■ Dimensions

Type	A	B	C	D	E	F	G	H
KCC-200KNA	108	68	20	54	90	145	190	—
KCC-500KNA	140	90	25	70	120	185	230	M8 DP20
KCC-1MNA	183	123	30	92	140	220	250	M12 DP20

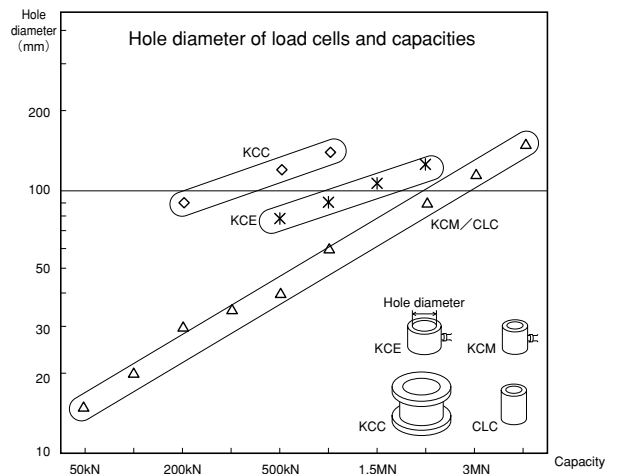
## ■ Specifications

Type	KCC-200KNA	KCC-500KNA	KCC-1MNA
Capacity	200kN	500kN	1MN
Rated Output	1mV/V (2000×10 <sup>-6</sup> 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		
Temperature range	-20~+70°C		
Over load	120%		
Input/output resistance	350Ω ±1%		
Recommended exciting voltage	Less than 10V		
Allowable exciting voltage	20V		
Zero balance	5%RO		
Weight	13kg	20kg	32kg

Input/output cable :  $\phi$  9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 5m

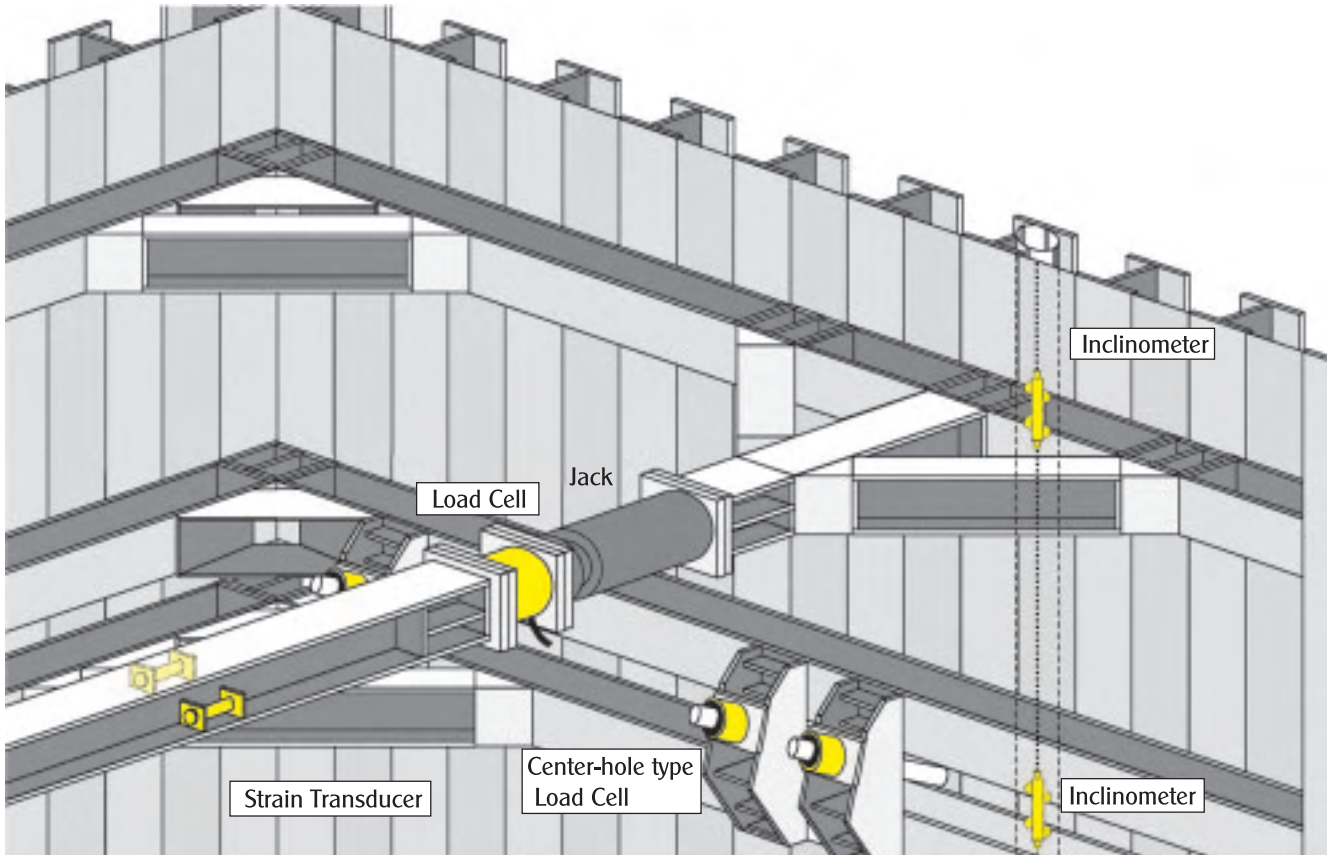
## Hole diameter vs. capacity and type

Capacity	50kN	100kN	200kN	300kN	500kN	1MN	1.5MN	2MN	3MN	5MN
Type										
KCC-NA			90		120	140				
KCE-NA					82	90	110	140		
KCM-NA	15	20	30	35	40	60		90	115	150
CLC-NA	15	20	30	35	40	60		90	115	150

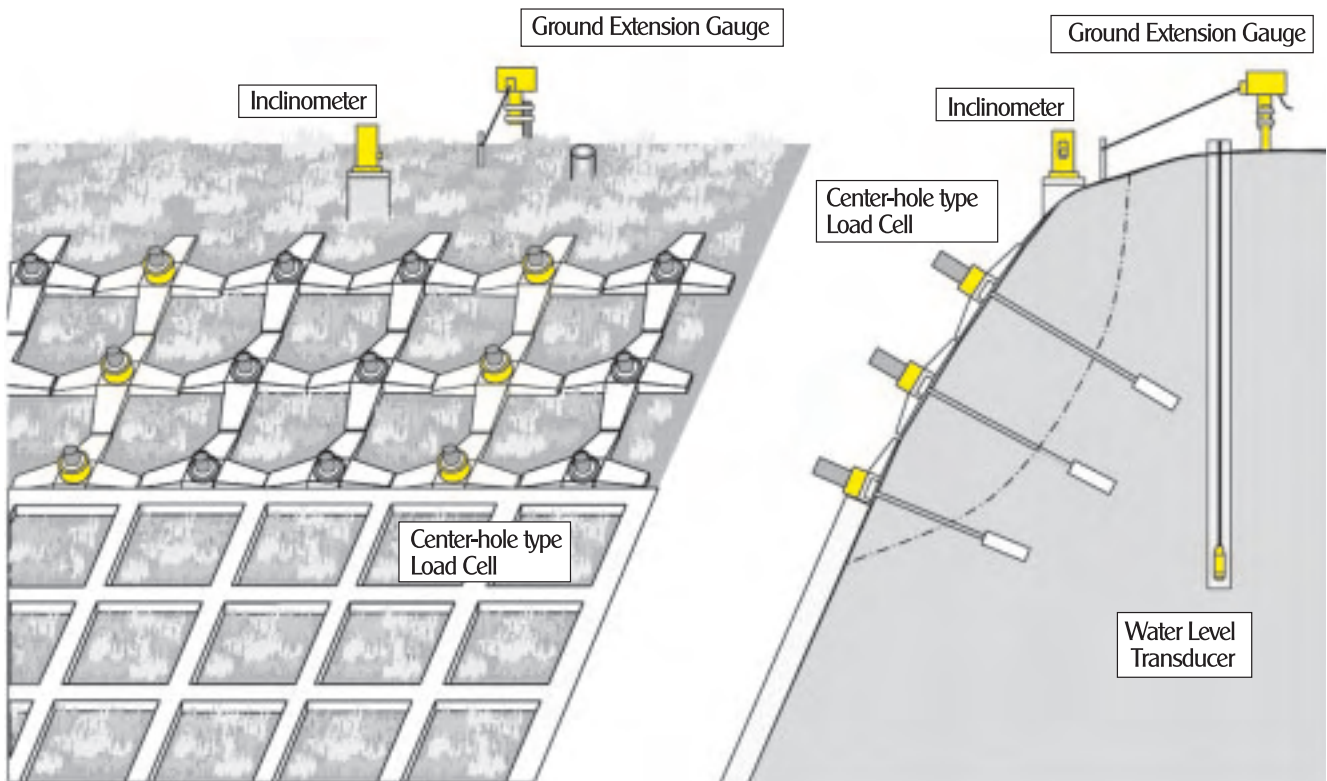




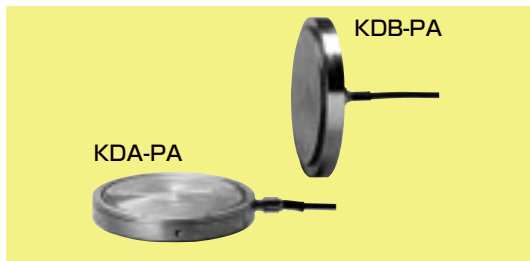
## ■Application to retaining wall measurement



## ■Application to cut slope



## KDA-PA/KDB-PA Soil Pressure Gauge



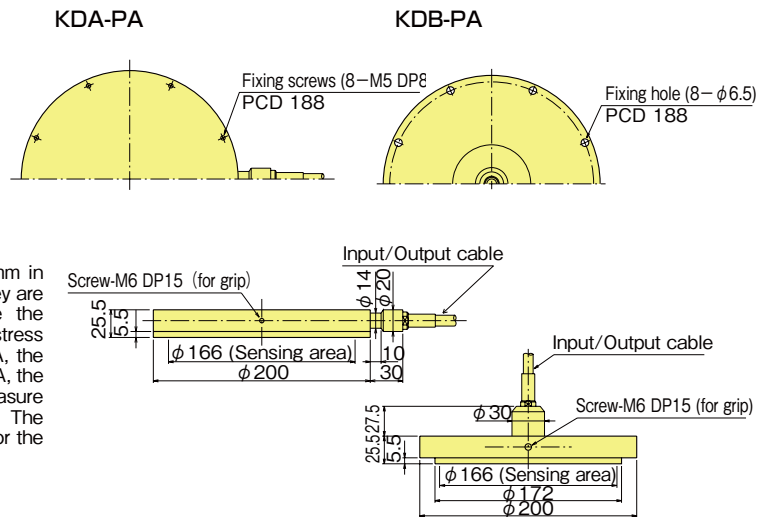
The KDA-PA and KDB-PA are soil pressure gauges each 200 mm in outside diameter. They are widely used at construction sites. They are designed with a dual-diaphragm structure that can minimize the displacement of a sensing area and thereby can keep the stress distribution in soil undisturbed under pressure. With the KDA-PA, the Input/Output cable comes from the side of body. With the KDB-PA, the cable comes from the back of body. 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 : IP 68 equivalent

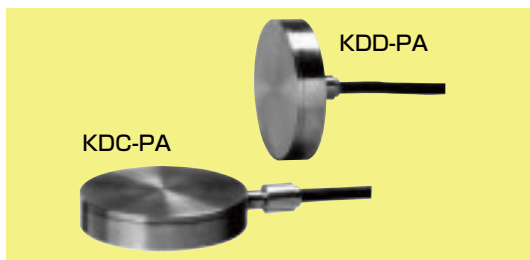
### Specifications

Type	KDA-200KPA	KDB-200KPA	KDA-500KPA	KDB-500KPA	KDA-1MPA	KDB-1MPA	KDA-2MPA	KDB-2MPA
Capacity	200kPa		500kPa		1MPa		2MPa	
Rated output	Approx. 1mV/V (2000×10 <sup>-6</sup> strain)							
Non-linearity	2%RO		1%RO					
Temperature range	-20~+60℃							
Input/output resistance	350Ω							
Recommended exciting voltage	Less than 3V							
Allowable exciting voltage	10V							
Cable drawing direction	KDA-PA : from side of body/KDB-PA : from back of body							
Weight	6kg							

Input/output cable :  $\phi$  9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m



## KDC-PA/KDD-PA Soil Pressure Gauge



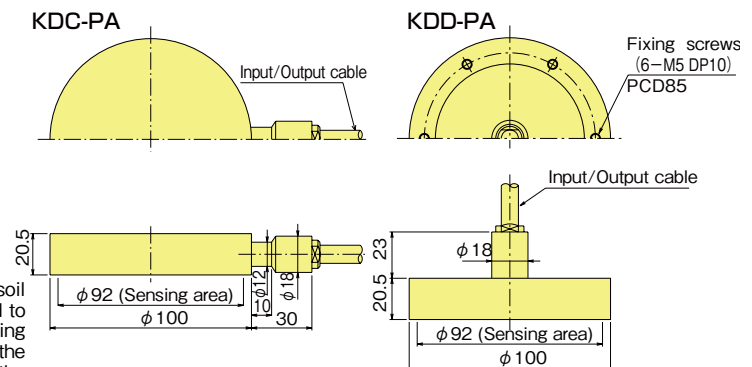
The KDC-PA and KDD-PA are anticorrosion stainless-steel soil pressure gauges each 100 mm in outside diameter. They are used to measure the pressure in soil in ocean or coastal civil engineering structures and to measure the dynamic pressure of waves. With the KDC-PA, the Input/Output cable comes from the side of body. With the KDD-PA, the cable comes from the back of body.

Protection ratings : IP 68 equivalent

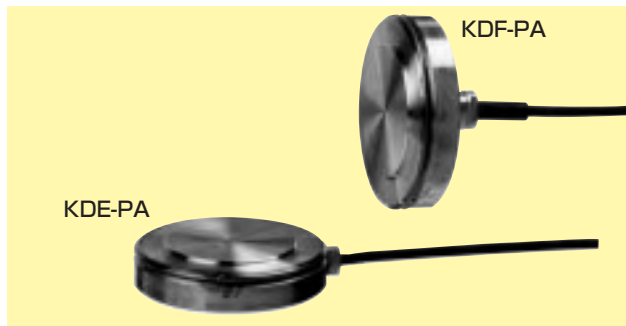
### Specifications

Type	KDC-200KPA	KDD-200KPA	KDC-500KPA	KDD-500KPA	KDC-1MPa	KDD-1MPa	KDC-2MPa	KDD-2MPa
Capacity	200kPa		500kPa		1MPa		2MPa	
Rated output	Approx. 1mV/V (2000×10 <sup>-6</sup> strain)							
Non-linearity	2%RO		1%RO					
Temperature range	-20~+60℃							
Input/output resistance	350Ω							
Recommended exciting voltage	Less than 3V							
Allowable exciting voltage	10V							
Cable drawing direction	KDC-PA : from side of body/KDD-PA : from back of body							
Weight	1.2kg							

Input/output cable :  $\phi$  9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m

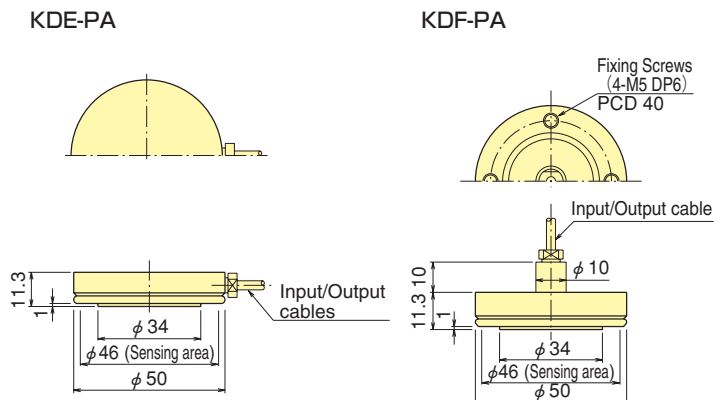


## KDE-PA/KDF-PA Soil Pressure Gauge



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. With the KDE-PA, the Input/Output cable comes from the side of body, while with the KDF-PA, it comes from the center of the back of body. This is the difference between these two models.

Protection ratings : IP 68 equivalent

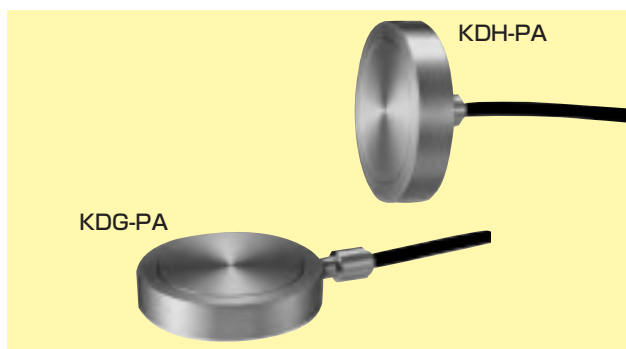


### Specifications

Type	KDE-200KPa	KDF-200KPa	KDE-500KPa	KDF-500KPa	KDE-1MPa	KDF-1MPa	KDE-2MPa	KDF-2MPa
Capacity	200kPa		500kPa		1MPa		2MPa	
Rated output	Approx. 0.3mV/V (600×10 <sup>-6</sup> strain)				Approx. 0.5mV/V (1000×10 <sup>-6</sup> strain)			
Non-linearity					2%RO			
Temperature range					-20~+60℃			
Input/output resistance					350 Ω			
Recommended exciting voltage					Less than 3V			
Allowable exciting voltage					10V			
Cable drawing direction					KDE-PA : from side of body/KDF-PA : from back of body			
Weight					160g			

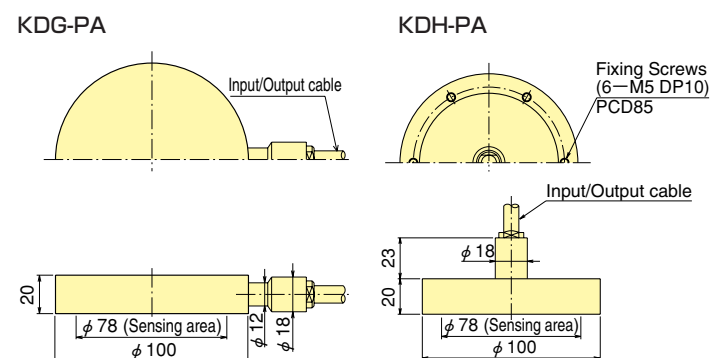
Input/output cable :  $\phi$  3mm 0.05mm<sup>2</sup> 4-core shielded chloroprene cable 2m

## KDG-PA/KDH-PA Load-Cell type Soil Pressure Gauge



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 : IP 68 equivalent



### 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					Approx. 1mV/V (2000×10 <sup>-6</sup> strain)			
Non-linearity					1%RO			
Temperature range					-20~+60℃			
Input/output resistance					350 Ω			
Recommended exciting voltage					Less than 3V			
Allowable exciting voltage					10V			
Cable drawing direction					KDG-PA : from side of body/KDH-PA : from back of body			
Weight					1.2kg			

Input/output cable :  $\phi$  9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m

## KDJ-PA/KDK-PA Load-Cell type Soil Pressure Gauge



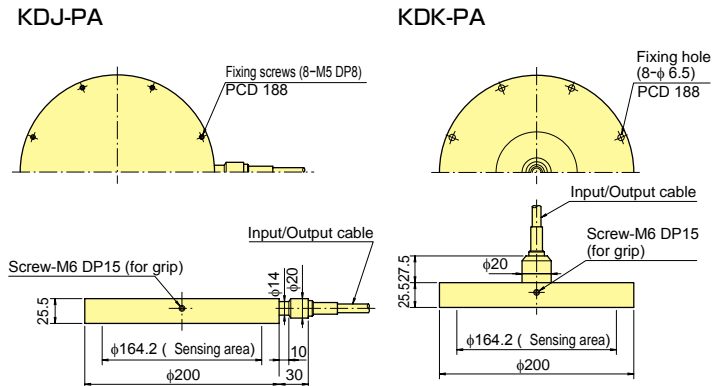
The KDJ-PA and KDK-PA are stainless-steel soil pressure gauges each 200 mm in outside diameter. They are load-cell-type soil pressure gauges and designed with a high level of resistance to lateral pressure. The difference between these two models is the way the cable is attached to the gauge body.

Protection ratings : IP 68 equivalent

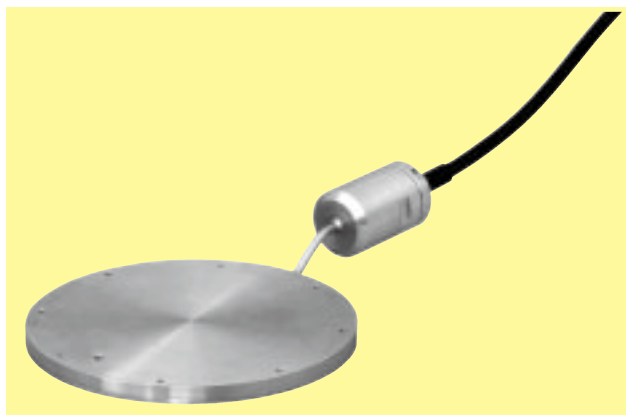
### Specifications

Type	KDJ-200KPA	KDK-200KPA	KDJ-500KPA	KDK-500KPA	KDJ-1MPA	KDK-1MPA	KDJ-2MPA	KDK-2MPA
Capacity	200kPa		500kPa		1MPa		2MPa	
Rated output	Approx. 1mV/V (2000×10 <sup>-6</sup> strain)							
Non-linearity	1%RO							
Temperature range	-20~+60℃							
Input/output resistance	120Ω							
Recommended exciting voltage	Less than 3V							
Allowable exciting voltage	10V							
Cable drawing direction	KDJ-PA: from side of body / KDK-PA: from back of body							
Weight	5.2kg							

Input/output cable : φ 9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m



## KDL-PA Soil Pressure Gauge



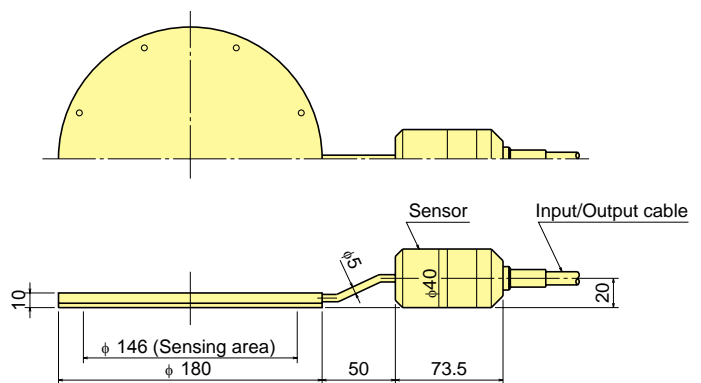
The KDL-PA is specially designed to keep the stress distribution in soil undisturbed under pressure.

Protection ratings : IP 68 equivalent

### Specifications

Type	KDL-200KPA
Capacity	200kPa
Rated output	Approx. 1mV/V (2000×10 <sup>-6</sup> strain)
Non-linearity	1%RO
Temperature range	-20~+60°C
Input/output resistance	350Ω
Recommended exciting voltage	Less than 3V
Allowable exciting voltage	10V
Weight	2.5kg

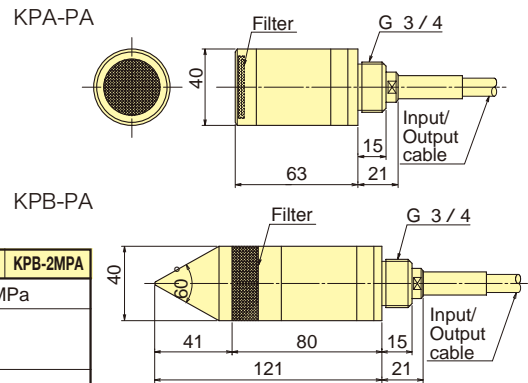
Input/output cable : φ 9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m



## KPA-PA/KPB-PA Pore Pressure Gauges



The KPA-PA and KPB-PA pore pressure gauges are used to measure pore water pressure in ground, sheet piles, piles, boreholes, etc. The KPA-PA is attached to a pile, a diaphragm wall, a sheet pile and so forth and buried in ground to measure pore water pressure. The KPB-PA is buried in a borehole to measure pore water pressure in bedrock. The feature of these gauges is the dual structure that makes them highly resistant to lateral pressure. Therefore, high-accuracy measurement can be made even if soil pressure changes markedly. Protection ratings : IP 68 equivalent



### Specifications

Type	KPA-200KPA	KPB-200KPA	KPA-500KPA	KPB-500KPA	KPA-1MPa	KPB-1MPa	KPA-2MPa	KPB-2MPa
Capacity	200kPa		500kPa		1MPa		2MPa	
Rated output	Approx. 0.8mV/V (1600×10 <sup>-6</sup> strain)		Approx. 1mV/V (2000×10 <sup>-6</sup> strain)					
Non-linearity	1%RO							
Filter mesh ( * )	40μm							
Temperature range	0 ~ +60°C(no icing)							
Input/output resistance	350Ω							
Recommended exciting voltage	Less than 3V							
Allowable exciting voltage	10V							
Weight	KPA-200KPA~KPA-2MPa				470g			
	KPB-200KPA~KPB-2MPa				650g			

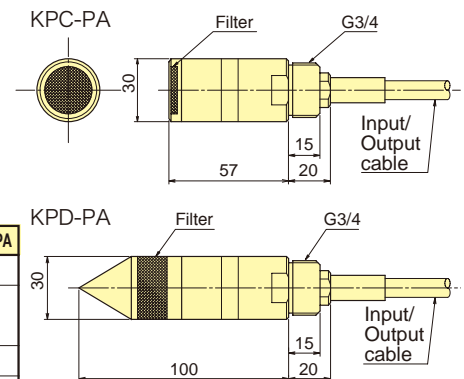
Input/output cable : 9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m

\* Filter mesh with 70 μm is available on request

## KPC-PA/KPD-PA Pore Pressure Gauges



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. It is also buried singly in ground to measure pore water pressure. The KPD-PA is put in a borehole to measure the pore water pressure in bedrock. The feature of these gauges is the dual structure that makes them highly resistant to lateral pressure. Therefore, high-accuracy measurement can be made even if soil pressure changes markedly. Protection ratings : IP 68 equivalent



### Specifications

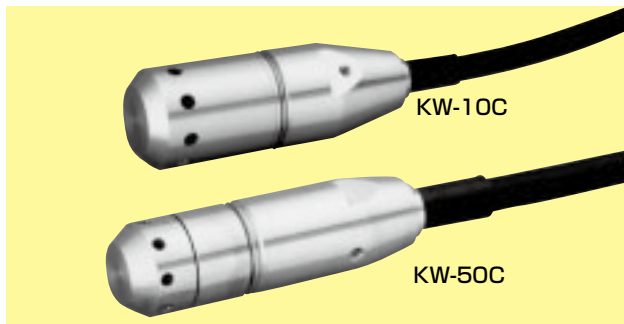
Type	KPC-200KPA	KPD-200KPA	KPC-500KPA	KPD-500KPA	KPC-1MPA	KPD-1MPA	KPC-2MPA	KPD-2MPA
Capacity	200kPa		500kPa		1MPa		2MPa	
Rated output	Approx. 0.8mV/V (1600×10 <sup>-6</sup> strain)		Approx. 1mV/V (2000×10 <sup>-6</sup> strain)					
Non-linearity	1.5%RO		1%RO					
Filter mesh ( * )	40μm							
Temperature range	0 ~ + 60°C (no icing)							
Input/output resistance	350Ω							
Recommended exciting voltage	Less than 3V							
Allowable exciting voltage	10V							
Weight	KPC-200KPA~KPC-2MPA				250g			
	KPD-200KPA~KPD-2MPA				350g			

Input/output cable : 9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m

\* Filter mesh with 70 μm is available on request



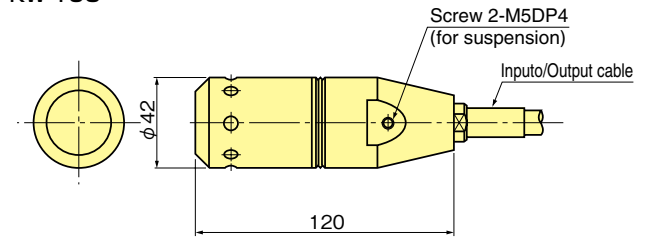
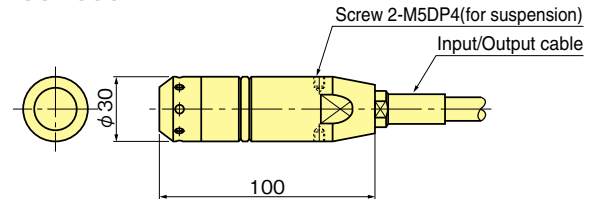
# KW-C Water Level Transducer

**Built-in Arrestor**


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.

Note: The KW-C hydraulic water level transducer made with titanium is also available. Contact TML for detailed information.

Protection ratings : IP 68 equivalent

**KW-10C**

**KW-20C~50C**


## Specifications

Type	KW-10C	KW-20C	KW-30C	KW-50C
Capacity	10m	20m	30m	50m
Rated output	Approx. 1mV/V (2000×10 <sup>-6</sup> 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)			
Temperature range	-20~+60°C (no icing)			
Input/output resistance	350 Ω			
Recommended exciting voltage	Less than 3V			
Allowable exciting voltage	10V			
Weight	700g	250g		

Input/output cable : KW-10C :  $\phi$  11.5mm 0.5mm<sup>2</sup> 4-core shielded vinyl cable with air-vent pipe, 13m  
 KW-20C :  $\phi$  11.5mm 0.5mm<sup>2</sup> 4-core shielded vinyl cable with air-vent pipe, 23m  
 KW-30C :  $\phi$  11.5mm 0.5mm<sup>2</sup> 4-core shielded vinyl cable with air-vent pipe, 33m  
 KW-50C :  $\phi$  11.5mm 0.5mm<sup>2</sup> 4-core shielded vinyl cable with air-vent pipe, 53m

# KB-B Inclinometer



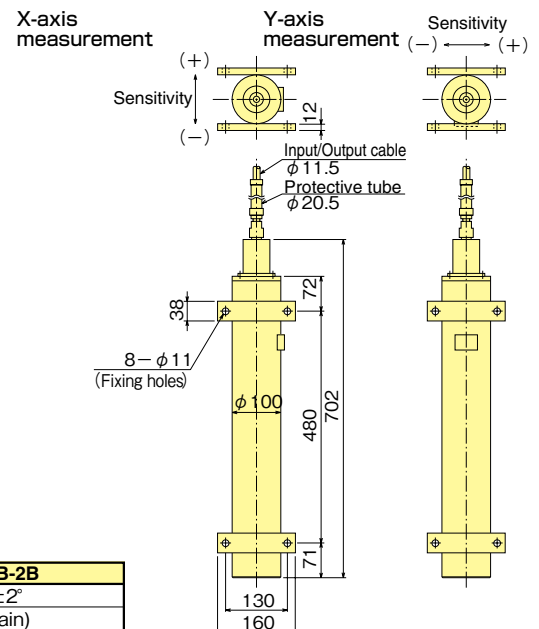
The KB-B inclinometer is used to measure the inclination of structures subject to strong impact or the inclination of piles when they are driven into the ground. It is set on an excavation bucket for the diaphragm wall construction method to monitor and control the conditions of vertical excavation work. Two models are available: one for X-axis measurement and the other for Y-axis measurement. The difference between these two models is the difference in the directions of measurement relative to the mounting surface.

Protection ratings : IP 68 equivalent

## Specifications

Type	KB-05B	KB-1B	KB-2B
Capacity	±0.5°	±1°	±2°
Rated Output	1mV/V (2000×10 <sup>-6</sup> strain)		
Non-linearity	2%RO		
Temperature range	-20~+60℃		
Input/output resistance	350Ω		
Recommended exciting voltage	Less than 6V		
Allowable exciting voltage	10V		
Weight	15kg	14kg	14kg

Input/output cable :  $\phi$  11.5mm 0.75mm<sup>2</sup> 4-core shock-resistive shielded chloroprene cable 3m

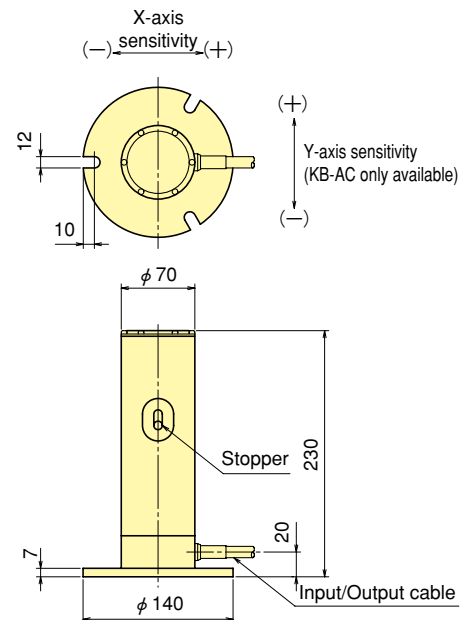


# KB-AB/KB-AC Inclinator



The KB-AB and KB-AC are low-capacity inclinometers. They are used to monitor the conditions of inclination of proximity 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 : IP 67 equivalent



## Specifications

Type	KB-1AB	KB-2AB	KB-5AB	KB-1AC	KB-2AC	KB-5AC
No. of measuring axis	1			2		
Capacity	±1°	±2°	±5°	±1°	±2°	±5°
Rated Output	1mV/V (2000×10 <sup>-6</sup> strain)					
Non-linearity	0.5%RO					
Cross sensitivity	—			3%RO		
Temperature range	-20~+60℃					
Input/output resistance	350Ω					
Recommended exciting voltage	Less than 2V					
Allowable exciting voltage	5V					
Weight	5kg					

Input/output cable : KB-AB :  $\phi 9\text{mm}$  0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m  
KB-AC :  $\phi 9\text{mm}$  0.3mm<sup>2</sup> 8-core shielded vinyl cable 2m

## Accessory

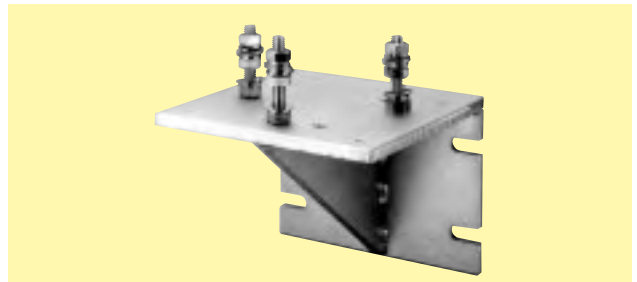
### Protective Cover KBF-13

This cover protects the KB-AB/KB-AC inclinometer installed to structure from mechanical damage.



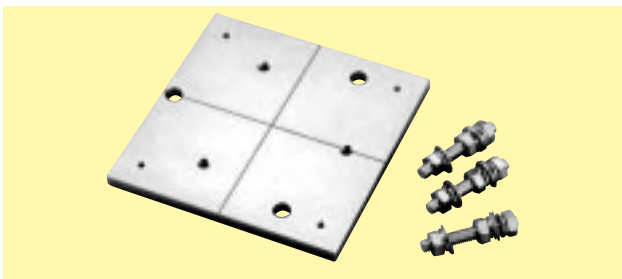
### Wall Mount Fitting KBF-14

This fitting is used to mount the KB-AB/KB-AC inclinometer to walls of structure.



### Flat Mount Fitting KBF-15

This fitting is used to mount the KB-AB/KB-AC inclinometer to flat surface.



### Level KBF-16

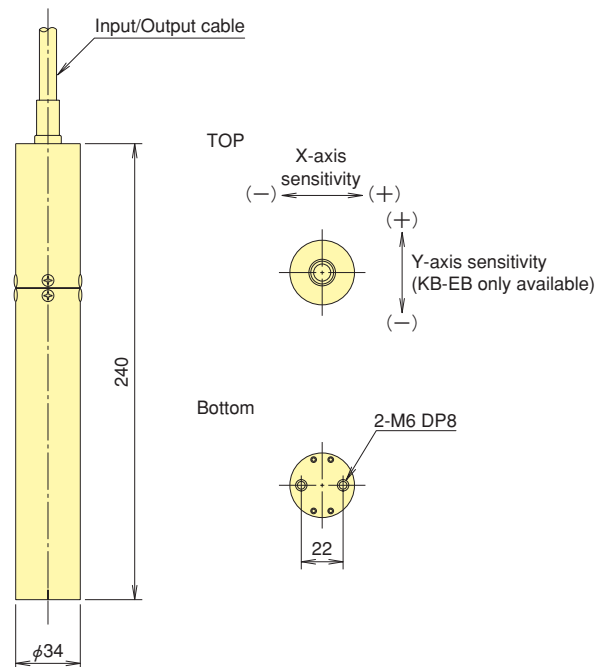
This level is standardly supplied to the KB-AB/KB-AC inclinometer.



# KB-DB/KB-EB Inclinometer



KB-DB (1-axis) / KB-EB (2-axis)



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 : IP 67 equivalent

## Specifications

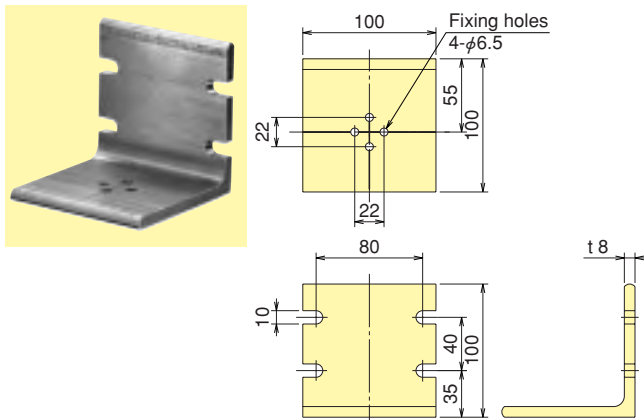
Type	KB-5DB	KB-10DB	KB-5EB	KB-10EB
No. of measuring axis	1		2	
Capacity	±5°	±10°	±5°	±10°
Rated Output	1mV/V (2000×10 <sup>-6</sup> strain)			
Non-linearity	0.5%RO			
Cross sensitivity	—		3%RO	
Temperature range	-20~+60℃			
Input/output resistance	350Ω			
Recommended exciting voltage	Less than 2V			
Allowable exciting voltage	5V			
Weight	1.3ka	1.3ka	1.3ka	1.3ka

Input/output cable : KB-DB :  $\phi 9\text{mm}$  0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m  
KB-EB :  $\phi 9\text{mm}$  0.3mm<sup>2</sup> 8-core shielded vinyl cable 2m

## Accessory

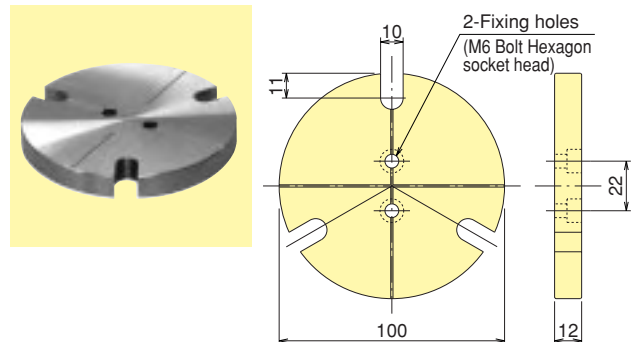
### Wall Mount Fitting KBF-17

This fitting is used to mount the KB-DB/KB-EB inclinometer to walls of structure.

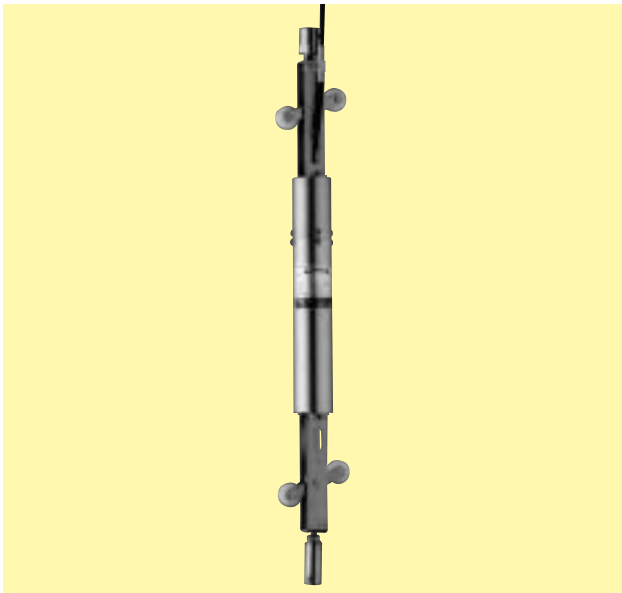


### Flat Mount Fitting KBF-18

This fitting is used to mount the KB-DB/KB-EB inclinometer to flat surface.

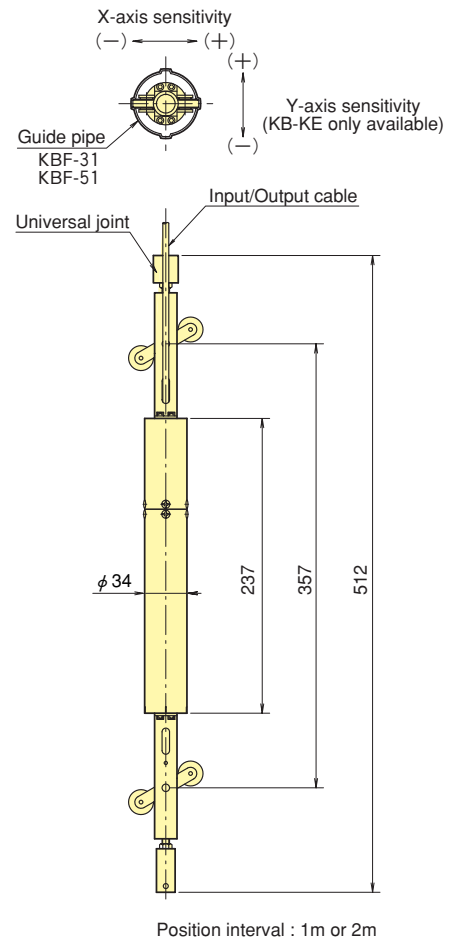


## KB-JE/KB-KE Inclinometer



KB-JE and KB-KE Inclinometer are multi-layer inclinometers to measure landslide and displacement of retaining wall. Special Guide pipe and Relay rod are pre-installed perpendicular to structures and the inclinometers are installed and connected on different levels at multiple measuring points up to 15 levels. Automatic measurement is available with our Data Logger. Graphical slope monitoring is also available with Data Logger TDS-602. The KB-KE is a bi-axial model. Arrester-integrated model is available.

Protection ratings : IP 68 equivalent



### Specifications

Type	KB-5JE	KB-10JE	KB-5KE	KB-10KE
No. of measuring axis	1		2	
Capacity	±5°	±10°	±5°	±10°
Rated Output	1mV/V (2000×10 <sup>-6</sup> strain)			
Non-linearity	0.5%RO			
Cross sensitivity	—		3%RO	
Temperature range	-20~-+60℃			
Input/output resistance	350 Ω		Input 175 Ω /Output 350 Ω	
Recommended exciting voltage	Less than 2V			
Allowable exciting voltage	5V			
Weight	1.5kg		1.5kg	

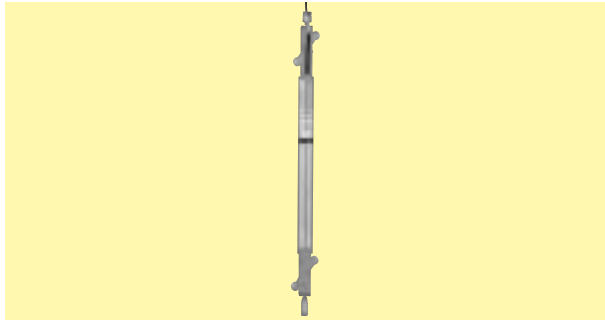
Input/output cable

KB-JE :  $\phi 4.6\text{mm}$  0.14mm<sup>2</sup> 4-core shielded vinyl cable 2m

KB-KE :  $\phi 4.6\text{mm}$  0.08mm<sup>2</sup> 6-core shielded vinyl cable 2m

(For details, refer to pages 41~44.)

## KB-KD Inclinometer



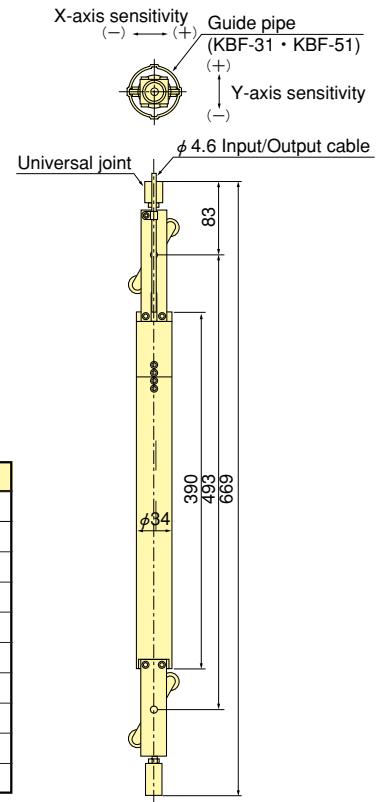
The KB-KD inclinometer is a high-output, multi-layer inclino-meter. It is used together with an aluminum guide pipe KBF-31 and an ABS guide pipe KBF-51-2.

Protection ratings : IP 68 equivalent

### Specifications

Type	KB-5KD	KB-10KD
No. of measuring axis	2	
Capacity	$\pm 5^\circ$	$\pm 10^\circ$
Rated Output	1.5mV/V (3000 $\times 10^{-6}$ strain)	
Non-linearity	0.5%RO	
Cross sensitivity	3%RO	
Temperature range	$-20 \sim +60^\circ\text{C}$	
Input/output resistance	Input 175 $\Omega$ / Output 350 $\Omega$	
Recommended exciting voltage	Less than 2V	
Allowable exciting voltage	5V	
Weight	2.2kg	

Input/output cable :  $\phi$  4.6mm 0.08mm<sup>2</sup> 6-core shielded vinyl cable 2m



## KB-P Inclinometer

**Built-in Arrestor**



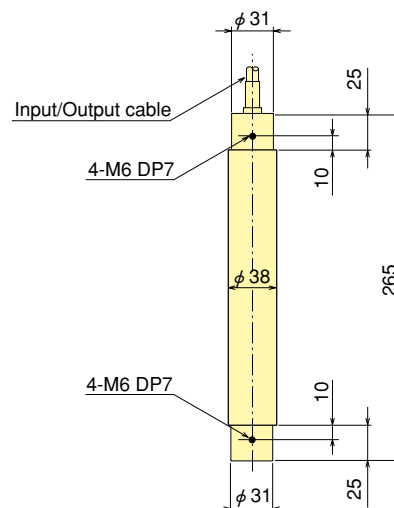
The KB-P inclinometer is used to measure the displacement of ground caused by landslides or the displacement of structures. Multiple KB-P inclinometers are attached to a special relay pipe, inserted into a borehole 66 mm or larger in diameter, and secured at multiple measurement positions. Grout is injected into the borehole to secure the inclinometers in position.

Protection ratings : IP 68 equivalent

### Specifications

Type	KB-5P	KB-10P
Capacity	$\pm 5^\circ$	$\pm 10^\circ$
Rated Output	1mV/V (2000 $\times 10^{-6}$ strain)	
Non-linearity	1%RO	
Temperature range	$-20 \sim +60^\circ\text{C}$	
Input/output resistance	350 $\Omega$	
Recommended exciting voltage	Less than 2V	
Allowable exciting voltage	5V	
Weight	1.5kg	

Input/output cable :  $\phi$  6mm 0.35mm<sup>2</sup> 4-core shielded chloroprene cable 2m



### Accessory

#### Relay Pipes

**KBF-41P-1 (1m)**

**KBF-41P-2 (2m)**

These Relay pipes are used to pre-connect the multiple layers of inclinometers.

#### Extension Pipes

**KBF-41L-1 (1m)**

**KBF-41L-2 (2m)**

These Extension pipes are used to extend pipes when the distance between inclinometers is longer than 2m.

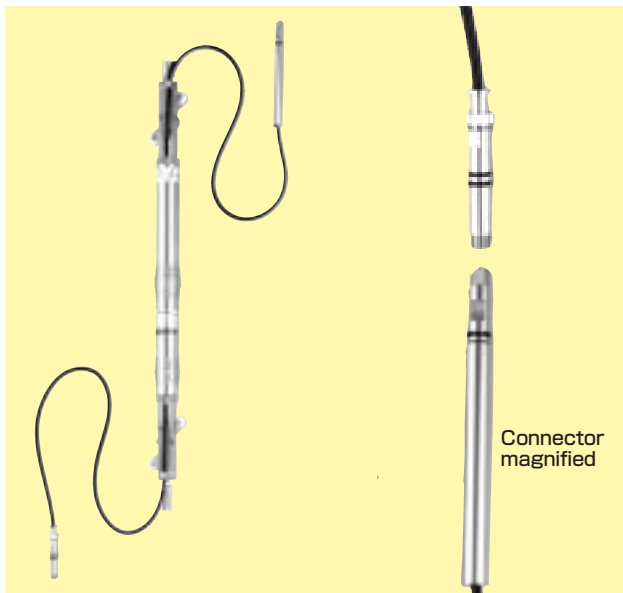
#### Positioning Pin

**KBF-42**

This pin is used to align the sensitivity direction of inclino-meters.

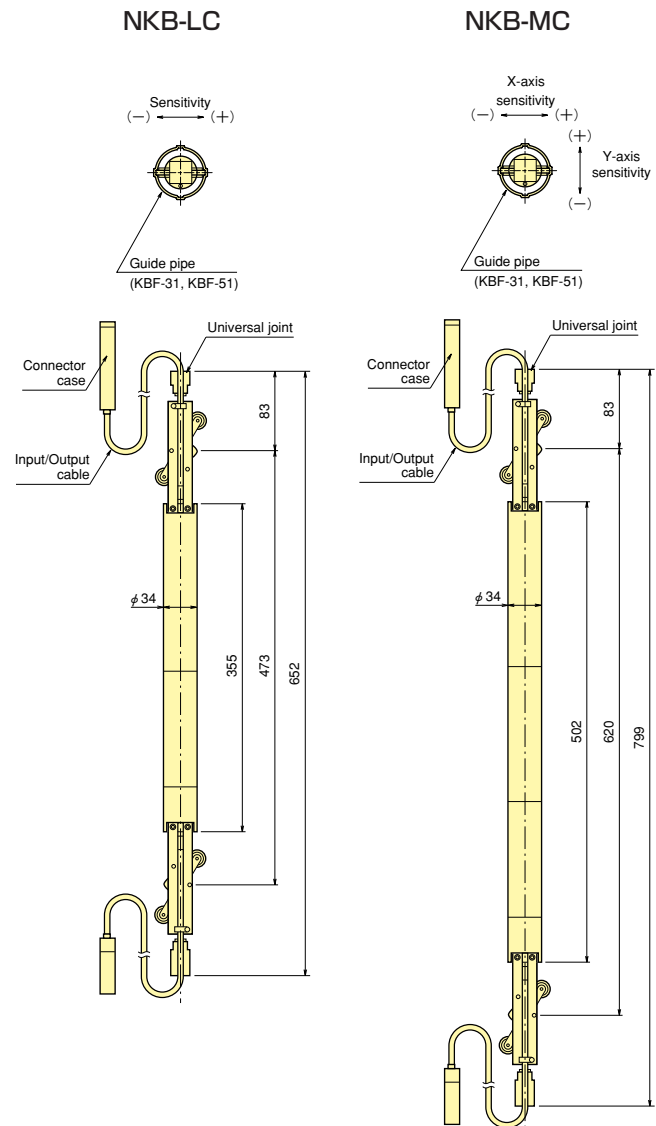


# NKB-LC/NKB-MC Inclinometer



The NKB-LC and NKB-MC inclinometers were developed to measure the displacement of ground or structures automatically. After a special guide pipe is set in the ground or a structure vertically, these inclinometers are attached to a relay rod (KBF-33), inserted into the special guide pipe, and secured at a specified measurement position. They have built-in network modules so that data on the angle of inclination is transmitted by each cable of network modules. They are used to measure the displacement caused by landslides or the displacement of earth retaining walls. The NKB-LC is for measurement in one direction, while the NKB-MC is for simultaneous measurement in both X and Y directions.

Protection ratings : IP 68 equivalent



Position interval : 1m or 2m

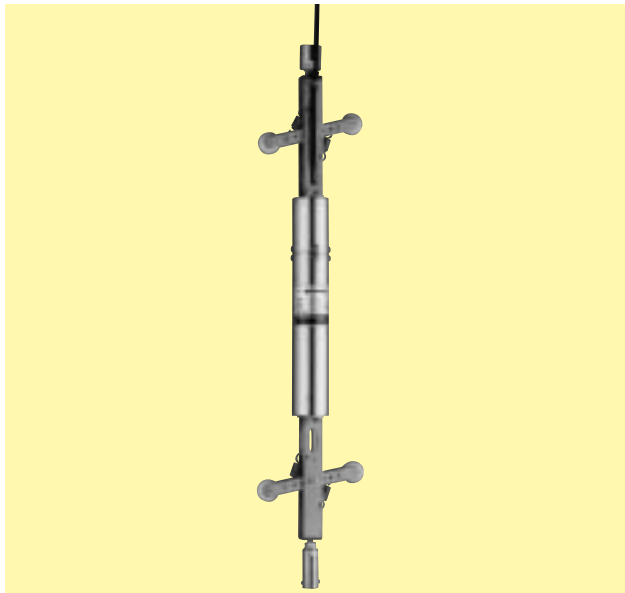
## Specifications

Type	NKB-5LC	NKB-10LC	NKB-5MC	NKB-10MC
No. of measuring axis	1		2	
Capacity	±5°	±10°	±5°	±10°
Rated indication	Approx. 2000 digit			
Non-linearity	0.5%RO			
Cross sensitivity	—		3%RO	
Temperature range	-20~+60℃			
Channel set	Factory default (000~999)			
Weight	2kg		3kg	

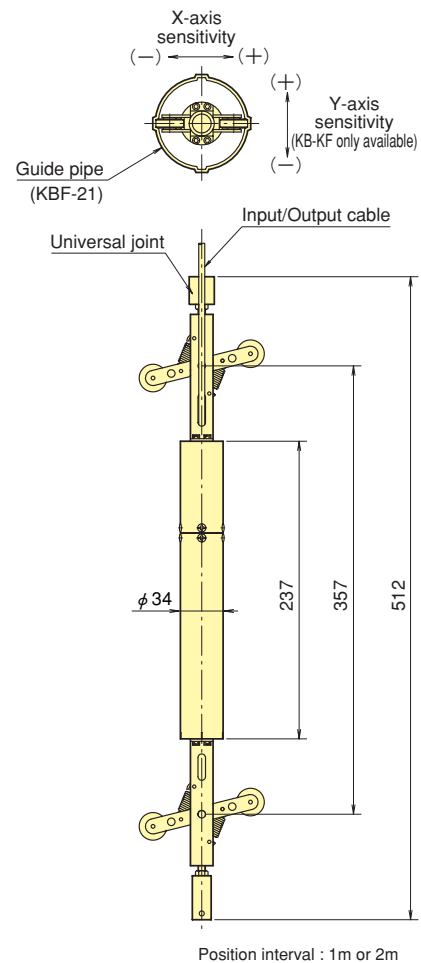
Input/output cable :  $\phi 6\text{mm}$   $0.5\text{mm}^2$  2-core shielded vinyl cable with special waterproofing connector, 2m  
Shield wire is connected to body.

(For combination use with instruments, refer to page 64.)

# KB-JF/KB-KF Inclinometer



KB-JF and KB-KF Inclinometer are multi-layer inclinometers similar to the KB-JE and KB-KE respectively. These models are used to measure landslide and displacement of retaining wall. The large inner diameter of the special guide pipe enable measurement up to 31 levels. Automatical measurement is available with our Data Logger. Graphical slope monitoring is also available with Data Logger TDS-602. The KB-KF is a bi-axial model. Arrester-integrated model is available. Protection ratings : IP 68 equivalent



## Specifications

Type	KB-5JF	KB-10JF	KB-5KF	KB-10KF
No. of measuring axis	1		2	
Capacity	±5°	±10°	±5°	±10°
Rated Output	1mV/V (2000×10 <sup>-6</sup> strain)			
Non-linearity	0.5%RO			
Cross sensitivity	—		3%RO	
Temperature range	-20~+60℃			
Input/output resistance	350 Ω		Input 175 Ω/Output 350 Ω	
Recommended exciting voltage	Less than 2V			
Allowable exciting voltage	5V			
Weight	1.5ka		1.5ka	

Input/output cable

KB-JF :  $\phi 4.6\text{mm}$  0.14mm<sup>2</sup> 4-core shielded vinyl cable 2m

KB-KF :  $\phi 4.6\text{mm}$  0.08mm<sup>2</sup> 6-core shielded vinyl cable 2m

(For details, refer to pages 41~44.)

## KB-GC/KB-HC Inclinator

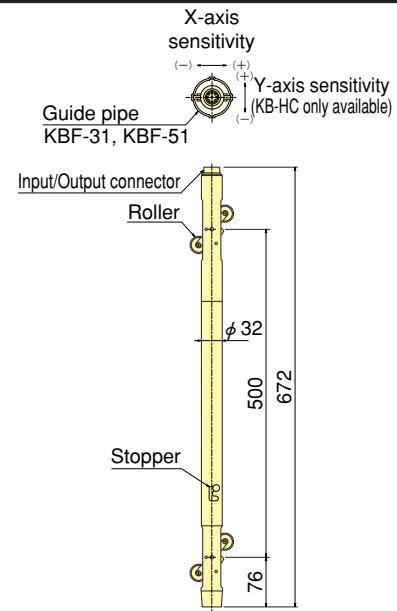


The KB-GC and KB-HC inclinometers are used to measure the inclination of ground or structures. Before installation, special guide pipes are first set in ground or structures vertically and then the inclinometers are inserted into these special guide pipes to measure inclination. The KB-HC can measure inclination in both X and Y directions simultaneously.

Protection ratings : IP 68 equivalent

### Specifications

Type	KB-5GC	KB-10GC	KB-5HC	KB-10HC
No. of measuring axis	1		2	
Capacity	±5°	±10°	±5°	±10°
Rated Output	1mV/V (2000×10 <sup>-6</sup> strain)			
Non-linearity	0.5%RO			
Cross sensitivity	—		3%RO	
Temperature range	-20~+60℃			
Input/output resistance	360Ω			
Recommended exciting voltage	Less than 2V			
Allowable exciting voltage	5V			
Unit weight	2.5kg			
Cable weight	5.5kg			



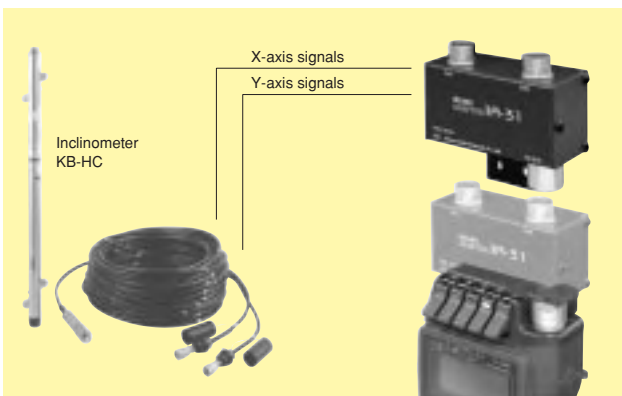
Supplied cable  
 KB-GC : CT9-4UM50/SWP-SNP  
 $\phi 9\text{mm}$  0.5mm<sup>2</sup>  
 4-core polyurethane cable with scale, 50m  
 KB-HC : CT9-8UM50/SWP-SNP  $\times 2$   
 $\phi 9\text{mm}$  0.3mm<sup>2</sup>  
 8-core polyurethane cable with scale, 50m

### Accessory

#### Carrying Case KBF-60

The Aluminium steel make Carrying Case contains main body of the inclinometer.  
 Size : 720(W)  $\times$  100(D)  $\times$  100(H)  
 Weight : 4.7 kg.

## IA-31 Inclinoadapter



The Inclinoadapter is designed to measure bi-axial inclination with our Handy Digital Strainmeter TC-31K. With setting of Inclino mode on the TC-31K, inclination in both X and Y directions can be measured simultaneously. Moreover, Data memory function of the TC-31K turns ON, separated data on X and Y is saved.

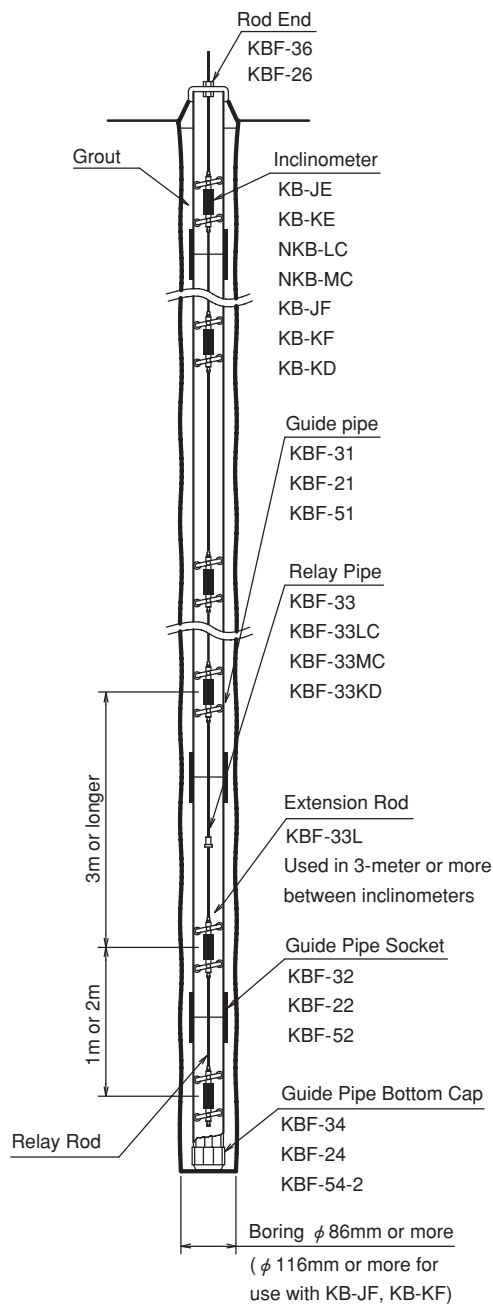
### Specifications

Applicable instruments	TC-31K <sup>(TYPE S330)</sup> (Ver.4.1A or later)
No. of measuring points	2
Carrier	350 $\Omega$ Constant current system 5.7mA DC drive
Extension of sensor cable	Maximum total cable resistance 150 $\Omega$
Accuracy	Subject to TC-31K
Power requirement	Powered by TC-31K 5Vdc 100mA or less
Environment	$-10 \sim +50^\circ\text{C}$ 80%RH or less (no condensation)
Dimensions	95(W) $\times$ 42(H) $\times$ 85(D)
Weight	300g.

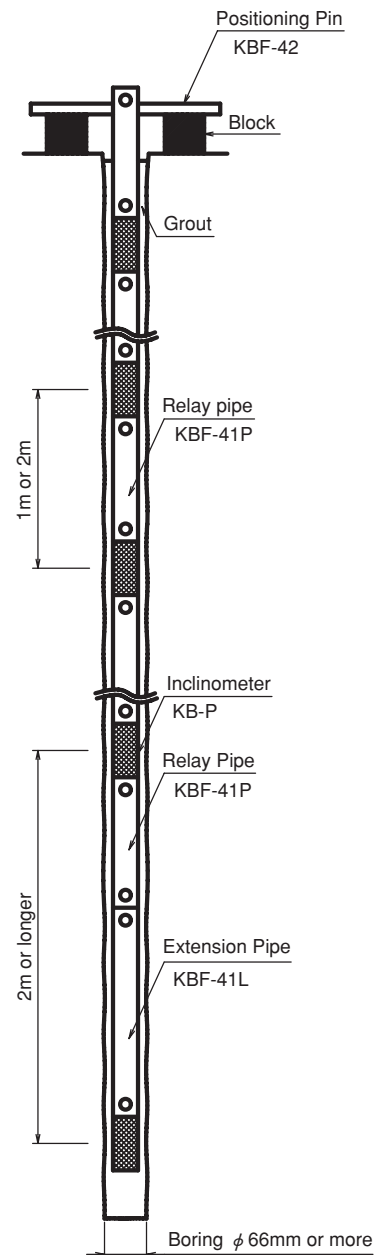
# Inclinometer accessories

## ■ Installation of Inclinometer and its accessories

Inclinometer KB-JE, KB-KE, KB-JF, KB-KF, KB-KD  
NKB-LC, NKB-MC



## ■ Installation of KB-P model and its accessories



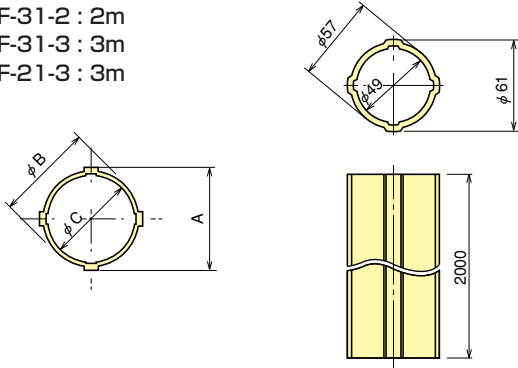
## Inclinometer accessories

### GUIDE PIPE KBF-31/KBF21/KBF-51

These pipes are used to hold inclinometers for insertion in the ground.

Aluminium Pipe  
KBF-31-1 : 1m  
KBF-31-2 : 2m  
KBF-31-3 : 3m  
KBF-21-3 : 3m

ABS Pipe  
KBF-51-2 : 2m



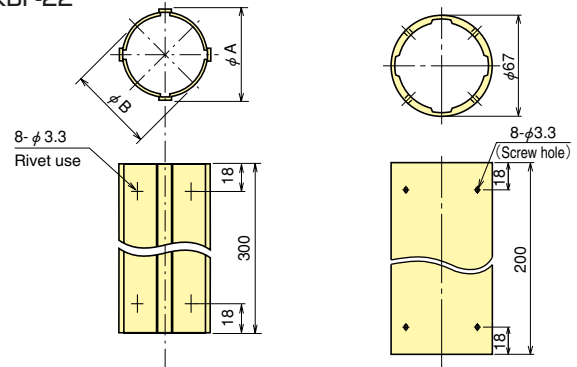
Type	A	B	C
KBF-31	56	52	49
KBF-21	78	74	69

### GUIDE PIPE SOCKET KBF-32/KBF-22/KBF-52

These Pipe.Sockets are used to connect guide pipes.

Aluminium Pipe  
KBF-32  
KBF-22

ABS Pipe  
KBF-52



Type	A	B
KBF-32	59.5	55.5
KBF-22	83.5	79.5

### ALUMINIUM GUIDE PIPE CAP

These caps are used to prevent muddy water from entering the Aluminium guide pipes. (Cap available for both top and bottom.)

KBF-34  
KBF-24



### ABS GUIDE PIPE CAP

These caps are used to prevent muddy water from entering the ABS guide pipes.

Top cap  
KBF-54-1

Bottom cap  
KBF-54-2



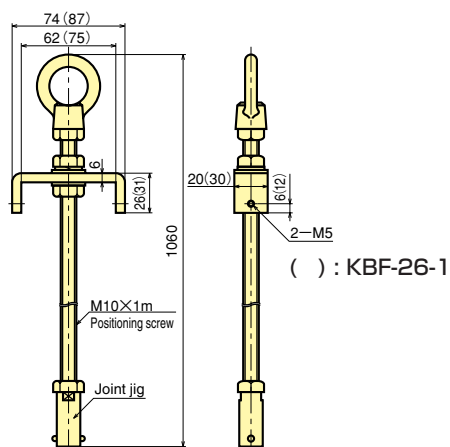
### ROD END

#### KBF-36-1

This End is used to secure the top of KB-JE, KB-KE and KB-KD Multi-layer inclinometers.

#### KBF-26-1

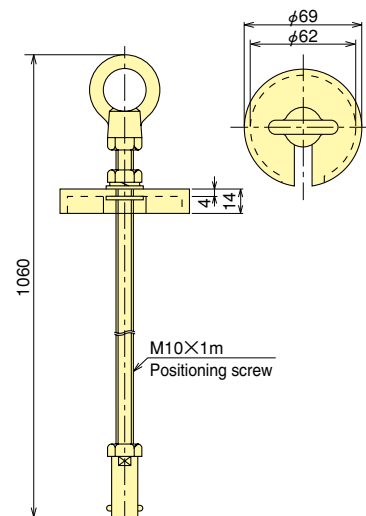
This End is used to secure the top of KB-JF and KB-KF Multi-layer inclinometers.



### ROD END

#### KBF-36-3

This End is used to secure the top of NKB-LC and NKB-MC Multi-layer inclinometers.





## Inclinometer accessories

### CABLE HOLDER KBF-37

This Holder is used to hold cables at the measuring point when taking measurements with KB-GC and KB-HC inclinometers.



### RIVET

#### KBF-38

This Rivet is used to secure the KBF-32 Guide Socket to the KBF-31 Guide Pipe.

#### KBF-28

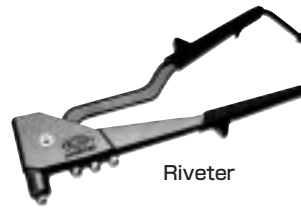
This Rivet is used to secure the KBF-22 Guide Socket to the KBF-21 Guide Pipe.

### RIVETER KBF-39

This Riveter is a pair of pliers used to mount KBF-38 and KBF-28 Rivets.

### SUSPENSION JIG KBF-39-2

This Jig is used to secure multi-layer inclinometers.



Riveter



Rivet

### CARRYING CASE KBF-60

This Case is for KB-GC or KB-HC inclinometer.



### REMOVAL PLIER KBF-39-1

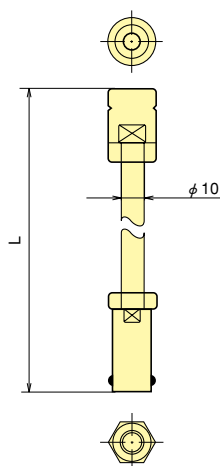
This Pliers are used to remove Relay Rods and Extension Rods from inclinometers.



### RELAY ROD

This rods are used to connect Multi-layer inclinometers on multiple levels.

	Type	L (mm)
1m use	KBF-33-1	512
	-33LC-1	372
	-33KD-1	355
2m use	KBF-33-2	1512
	-33LC-2	1372
	-33MC-2	1225
	-33KD-2	1355



### EXTENSION ROD KBF-33L

The KBF-33L Rods are used to extend Relay Rods.

Type	L
KBF-33L-1	1012
KBF-33L-2	2012

### TAPPING SCREWS KBF-58

This screw is used to secure ABS Guide Pipe KBF-51 to Guide Socket KBF-52.

## Inclinometer accessories

### Specifications

Name	Type	KB-GC	KB-HC	KB-JE	KB-KE	NKB-LC	NKB-MC	KB-JF	KB-KF	KB-KD
Guide pipe	KBF-31-1 (1m use)	●	●	●	●	●	●			●
	KBF-31-2 (2m use)	●	●	●	●	●	●			●
	KBF-31-3 (3m use)	●	●	●	●	●	●			●
	KBF-21-3 (3m use)							●	●	
	KBF-51-2 (2m use)	●	●	●	●	●	●			●
Guide pipe socket	KBF-32	●	●	●	●	●	●			●
	KBF-22							●	●	
	KBF-52	●	●	●	●	●	●			●
Relay rod	KBF-33-1 (1m use)			●	●			●	●	
	KBF-33-2 (2m use)									
	KBF-33LC-1 (1m use)					●				
	KBF-33LC-2 (2m use)									
	KBF-33MC-2 (2m use)						●			
	KBF-33KD-1 (1m use)									●
	KBF-33KD-2 (2m use)									
Extension rod	KBF-33L-1 (1m use)			▲	▲	▲	▲	▲	▲	▲
	KBF-33L-2 (2m use)									
Guide pipe cap	KBF-34	●	●	△	△	△	△			△
	KBF-24							△	△	
	KBF-54-1	●	●	△	△	△	△			△
Guide pipe cap	KBF-34	●	●	●	●	●	●			●
	KBF-24							●	●	
	KBF-54-2	●	●	●	●	●	●			●
Rod end	KBF-36-1			●	●					●
	KBF-36-3					●	●			
	KBF-26-1							●	●	
Rivet	KBF-38	●	●	●	●	●	●			●
	KBF-28							●	●	
Riveter	KBF-39	●	●	●	●	●	●	●	●	●
Guide pipe positioning jig	KBF-35	○	○	○	○	○	○			○
Cable holder	KBF-37	○	○							
Removal plier	KBF-39-1			●	●	●	●	●	●	●
Suspension jig	KBF-39-2			●	●	●	●	●	●	●
Tapping screws	KBF-58	●	●	●	●	●	●			●

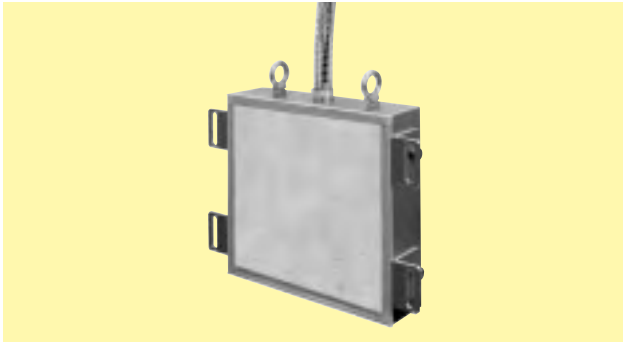
●Related products required for measurement

▲Used when the distance between inclinometers is longer than 3m

○Use improves workability

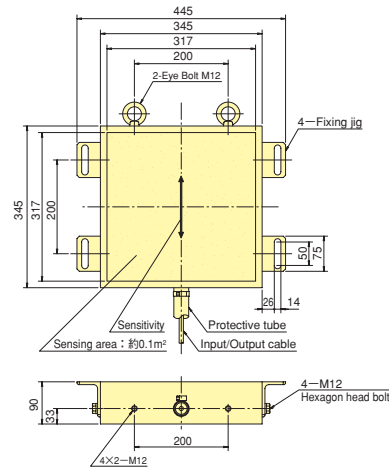
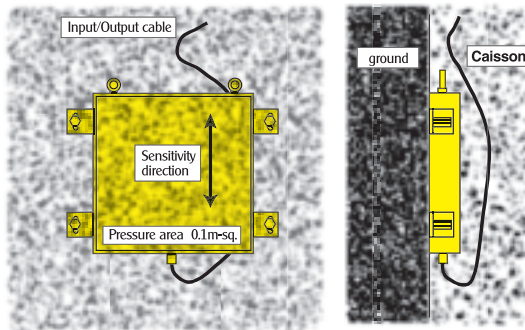
△Use according to environment

## KKK-PA Caisson Skin-friction meter



The KKA-PA is a transducer to measure skin friction bearing force with the ground acting on the wall of concrete caisson. The transducer is installed so that the sensing face of the transducer is facing position and measures skin friction bearing with the ground when settled and fixed. (For skin friction meter for steel caisson, you are requested to consult us.)

Protection ratings : IP 67 equivalent



### Specifications

Type	KKK-200KPA
Capacity	200kPa
Rated Output	Approx. 1.5mV/V (3000×10 <sup>-6</sup> strain)
Non-linearity	1%RO
Temperature range	-30~+70℃
Input/output resistance	350 Ω
Recommended exciting voltage	Less than 2V
Allowable exciting voltage	10V
Zero balance	±1500×10 <sup>-6</sup> strain or less
Weight	35kg

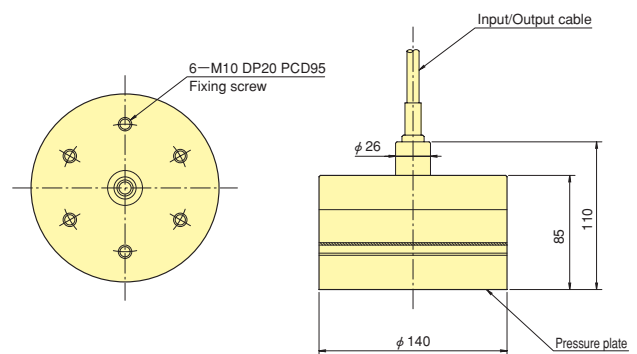
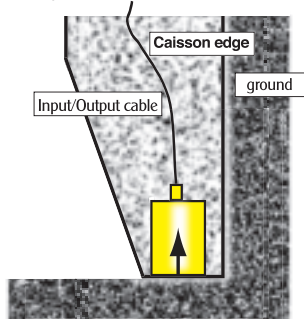
Input/output cable : φ 9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m

## KKK-PA Caisson Cutting-edge reaction meter



The KKB-PA is a transducer to measure subgrade reaction force (bearing force) acting on the Caisson cutting edge. The transducer is installed so that the sensing face of the transducer is facing position and measures subgrade reaction force. (When ordering, you are requested to let us know the configuration of cutting edge.)

Protection ratings : IP 67 equivalent

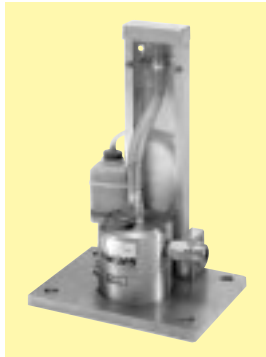


### Specifications

Type	KKK-2MPA
Capacity	2MPa
Rated Output	Approx. 1.5mV/V (3000×10 <sup>-6</sup> strain)
Non-linearity	1%RO
Hysteresis	1%RO
Temperature range	-30~+70℃
Over load	150%
Ultimate overload rating	300%
Input/output resistance	350 Ω
Recommended exciting voltage	Less than 6V
Allowable exciting voltage	15V
Zero balance	±1500×10 <sup>-6</sup> strain or less
Weight	8.5kg

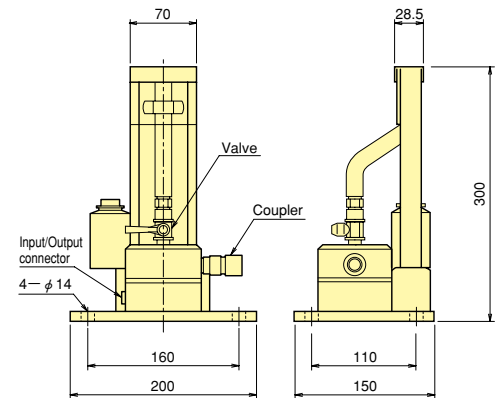
Input/output cable : φ 9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m

## KWL-B Water-tube Displacement Transducer



The KWL-B displacement transducer is used to measure the amount of deflection of bridges and other structures and the amount of subsidence of embankments. A pressure meter assembled into this transducer detects displacement by sensing the change in the pressure of water in a Standard Water Tank (optional) set at a fixed point and connected to this transducer via a Water tube (optional). If a Water tube (optional) with an indicator is attached to this Water tube (optional), it is possible to visually check the amount of change in the pressure of water.

Protection ratings : IP 64 equivalent



### Specifications

Type	KWL-1B	KWL-2B
Capacity	1m	2m
Rated Output	1.5mV/V (3000×10 <sup>-6</sup> strain)	2mV/V (4000×10 <sup>-6</sup> strain)
Non-linearity	0.3%RO	
Temperature effect on zero	Approx. 0.01%RO/°C	
Compensated temperature range	0~+40°C (no icing)	
Temperature range	-10~+60°C (no icing)	
Over load	150%	
Input/output resistance	350Ω	
Recommended exciting voltage	Less than 3V	
Allowable exciting voltage	10V	
Weight	6kg	

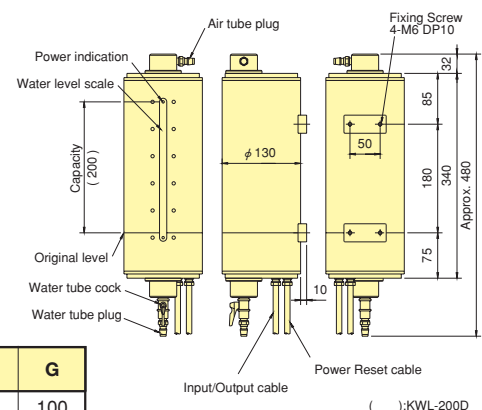
Supplied cable : CT9-4N3/WP-STB (φ9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 3m)

## KWL-D Water-tube Displacement Transducer Built-in Arrestor



These displacement transducers are used to measure the vertical displacement of bridges and other civil engineering structures. If vertical displacement occurs, the transducer measures the amount of displacement by sensing the change of a water level in a Standard Water Tank (optional) set at a fixed point and connected to it via a Water tube (optional). This transducer measures the displacement of a structure based on a difference between the Standard Water level before displacement occurs and the water level after displacement occurs in the water in a Standard Water Tank.

Protection ratings : IP 54 equivalent



Type	A	B	C	D	E	F	G
KWL-100D	340	200	51	100	49	120	100
KWL-200D	480	340	75	180	85	130	200

### Specifications

Type	KWL-100D	KWL-200D
Capacity	100mm	200mm
Rated Output	Approx. 1mV/V (2000×10 <sup>-6</sup> strain)	
Non-linearity	0.5%RO	
Resolution	Approx. 0.1mm	
Temperature range	0~+50°C (no icing)	
Input/output resistance	350Ω	
Recommended exciting voltage	Less than 2V	
Allowable exciting voltage	10V	
Power requirement	100Vac 50/60Hz 6VA MAX.	
Weight	4kg	5kg

Input/output cable : φ9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 3m  
Power cable : φ9mm 0.75mm<sup>2</sup> 4-core shielded vinyl cable 3m

# Water-tube Displacement Transducer accessories

## ■KWL-B/-D Common-use accessories

### ●KWL-STD STANDARD WATER TANK

The KWL-STD Standard Water Tank circulates water with a pump to maintain a constant water level.

Capacity : Approx. 6 ℓ

External dimensions : 280mm-dia. x 390mm

Weight : 12kg



### ●Water Tube KWLF-21-1

Vinyl tube with spring of 15mm-dia. x22

### ●Water Tube Tease KWLF-23-1

Branch to divide a Water tube KWLF-21-1

### ●Hose Band KWLF-24 for water tube (1 pc. supplied with the unit)

A band to tighten a Water tube at joint of Tease KWLF-23-1

### ●Water Tube Cock KWLF-25

(1 pc. supplied with Standard Water Tank)

Cock to release air inside Water Tank and Water Tube

### ●Heating materials KWLF-29 for Water Tube

Heat insulation materials for the Water Tube KWLF-21-1

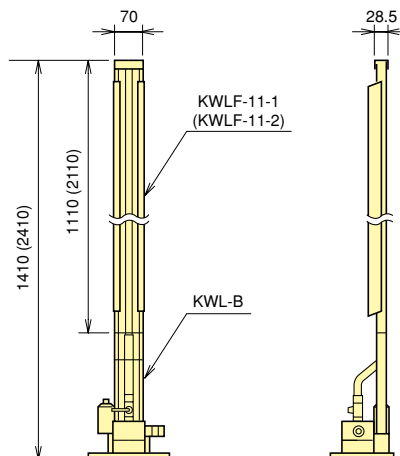
## ■KWL-B Exclusive accessories

### ●Water Tube KWLF-11 with scale

The KWLF-11 Water Tube with scale is easily bolt-mounted to the KWL-B model.

KWLF-11-1 : 1m use

KWLF-11-2 : 2m use



## ■KWL-D accessories

### ●Air Tube KWLF-21-2

Vinyl tube with a fiber-enforced of 9mm-dia. x22

### ●Water Tube Socket KWLF-22-1

A fixing jig to apply Water Tube KWLF-21-1 to the unit.

### ●Air Tube Socket KWLF-22-2 (1 pc. supplied to the unit)

A fixing jig to apply Air Tube KWLF-21-2 to the unit.

### ●Air Tube Tease KWLF-23-2

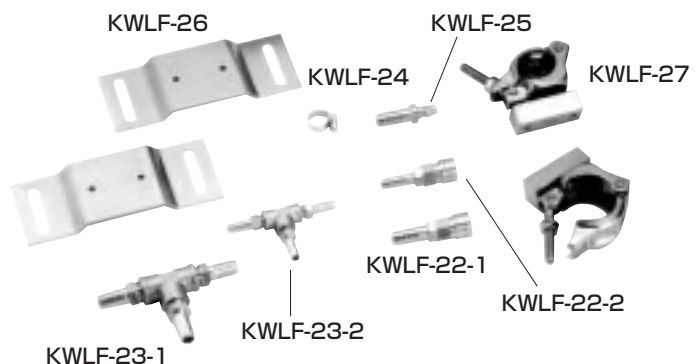
Branch to divide the Air tube KWLF-21-2

### ●Wall Fixing Jig KWLF-26

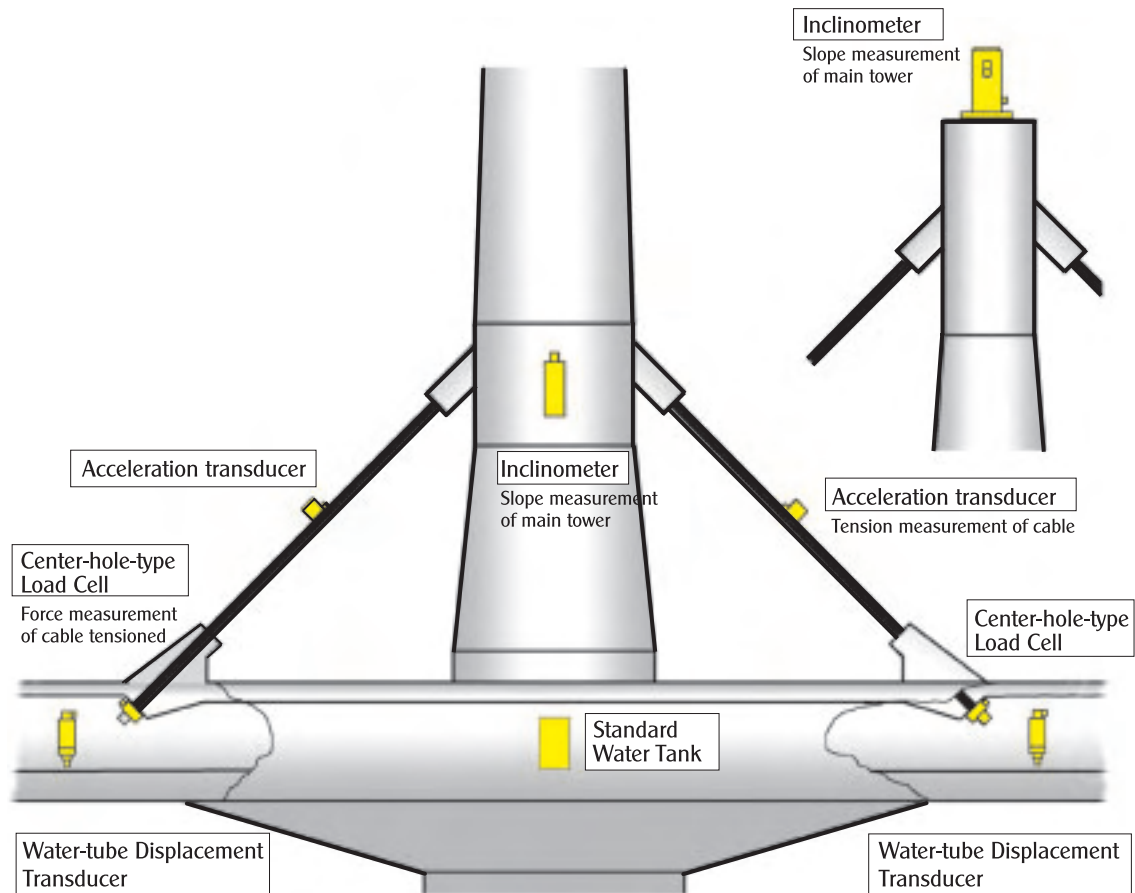
A Fixing Jig to apply the unit to vertical surface such as wall.

### ●Stanchion Fixing Jig KWLF-27

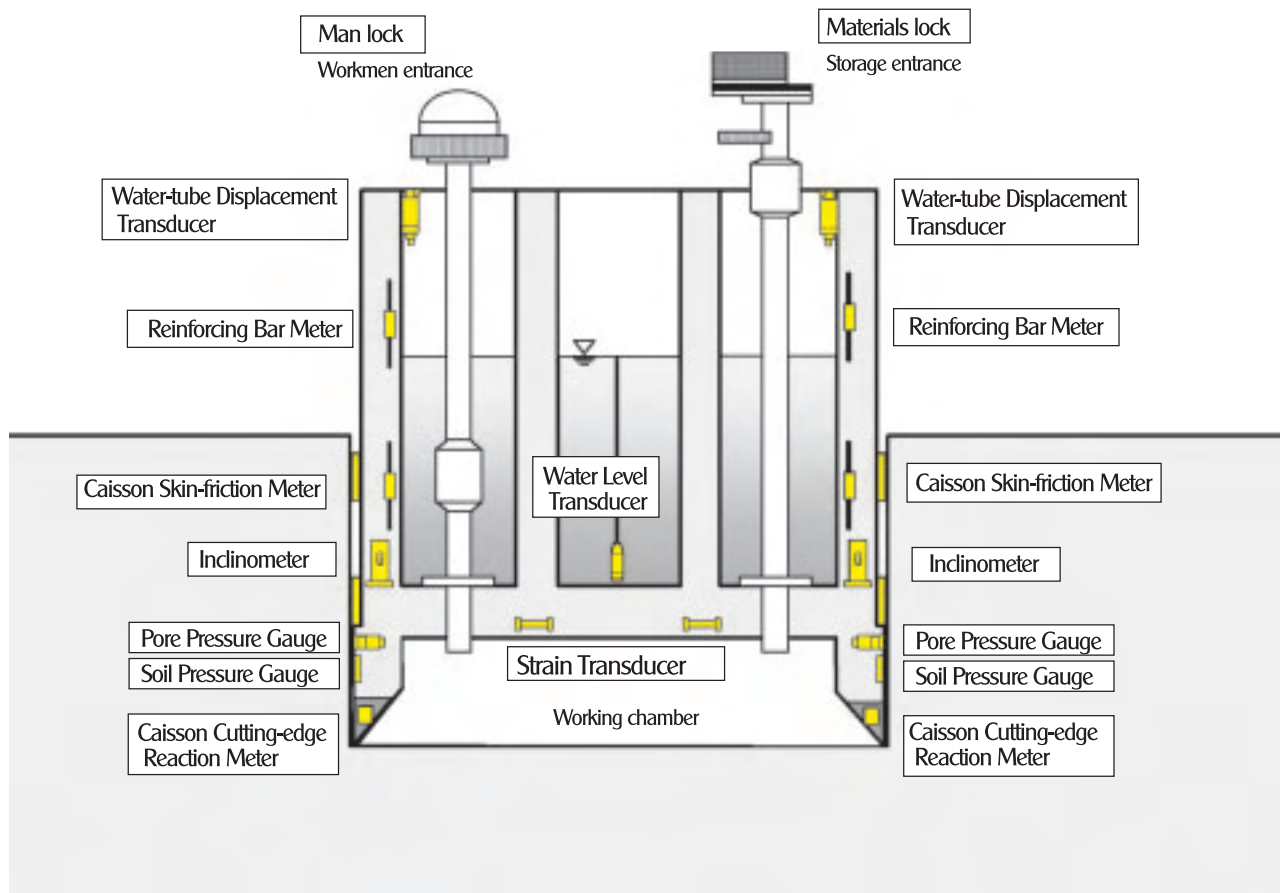
A Fixing Jig to apply the unit to a stanchion of 48.6mm-dia.



## ■Application to Cable-stayed bridge



## ■Application to Caisson



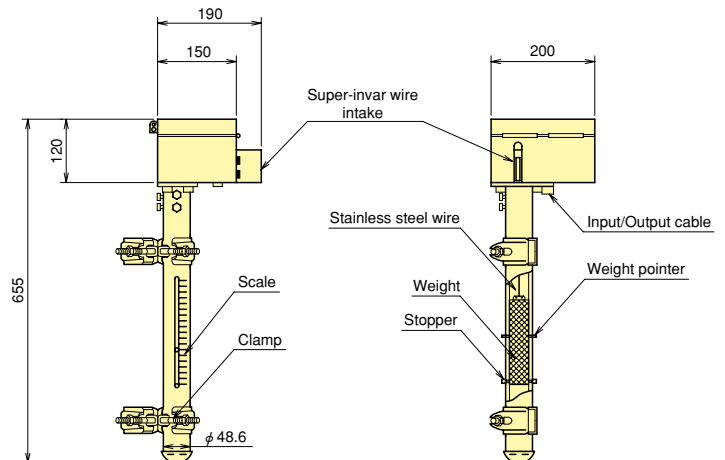


# KLG-A/NKLG-A Ground Extension Gauge

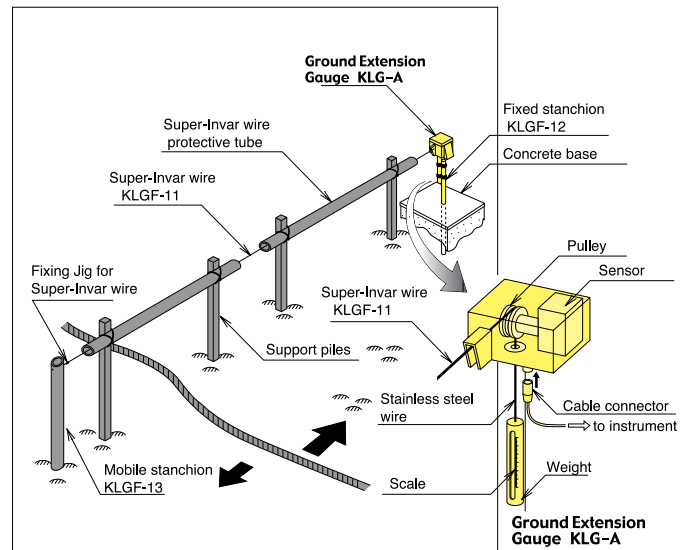
**Built-in Arrestor**


The KLG-A ground extension gauge is used to measure the amount of 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-A model is designed specifically for use with the TML-NET.

Protection ratings : IP 25 equivalent



## ■ Principle and Application



## ■ KLG-A Specifications

Type	KLG-200A
Capacity	200mm
Rated Output	Approx. 2.5mV/V (5000×10 <sup>-6</sup> strain)
Non-linearity	1%RO
Temperature range	-20~+60°C (no icing)
Input/Output resistance	350 Ω
Recommended exciting voltage	Less than 2V
Allowable exciting voltage	5V
Weight	10kg

Input/Output cable  
CT9-4N2/WP-STB (φ 9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m)

## ■ NKLG-A Specifications [TML-NET compatible]

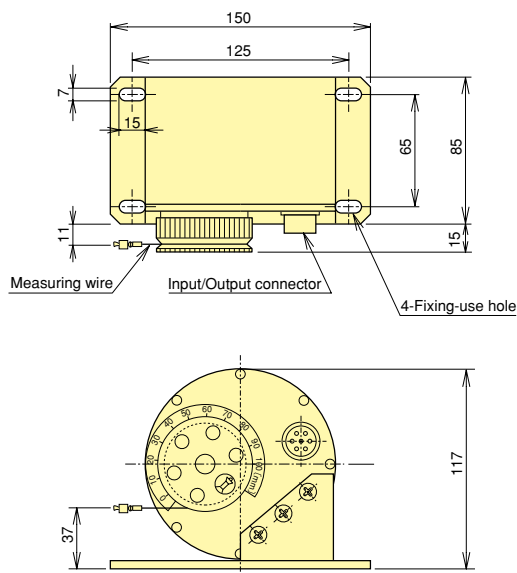
Type	NKLG-200A
Capacity	200mm
Rated indication	Approx. 5000 digit
Non-linearity	1%RO
Temperature range	-20~+60°C (no icing)
Channel set	Factory default (000~999)
Weight	10kg

# KLG-B/NKLG-B Ground Extension Gauge

**Built-in Arrestor**

The KLG-B ground extension gauge is placed near at ground surface to measure the amount of 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-B model is designed specifically for use with the TML-NET.

Protection ratings : IP 55 equivalent



## ■KLG-A Specifications

Type	KLG-50B	KLG-100B
Capacity	50mm	100mm
Rated Output	Approx. 2.5mV/V (5000×10 <sup>-6</sup> strain)	
Non-linearity	1%RO	
Temperature range	-20~+60°C (no icing)	
Input/Output resistance	350Ω	
Recommended exciting voltage	Less than 2V	
Allowable exciting voltage	5V	
Weight	1.2kg	

Supplied cable  
CT9-4N2/WP-STB (φ 9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m)

## ■NKLG-B Specifications [TML-NET compatible]

Type	NKLG-50B	NKLG-100B
Capacity	50mm	100mm
Rated indication	Approx. 5000 digit	
Non-linearity	1%RO	
Temperature range	-20~+60°C (no icing)	
Channel set	Factory default (000~999)	
Weight	1.2kg	

Supplied cable  
CT6-2R2/WP-STB (φ 6mm 0.5mm<sup>2</sup> 2-core shielded vinyl cable 2m)

## ■KLG-A and -B Compatible accessories



KLG-F-11



KLG-F-14

### Super-Invar wire KLG-F-11

The KLG-F-11 Super-Invar Wire is a wire used to connect an extension gauge to a mobile stanchion in order to transmit displacement.

0.5mm-dia. × 30m (Thermal expansion 1ppm or less)

### Fixed Stanchion KLG-F-12

The KLG-F-12 Fixed Stanchion is installed at a reference point and is used to mount an extension gauge.

48.6mm-dia. × 1.5m

### Mobile Stanchion KLG-F-13

The KLG-F-13 mobile Stanchion is installed at a measurement point and is used for the other end of the Super-Invar Wire drawn from the extension gauge.

48.6mm-dia. × 1.5m

### Crimp Pliers KLG-F-14

The KLG-F-14 Crimp Pliers are used to crimp the wire locks supplied with the Super-Invar Wire.

## ■KLG-B Exclusive accessory

### Mounting plate KLG-F-15

This exclusive plate is usable to mount the extension gauge KLG-B.



### Protective cover KLG-F-16

This exclusive cover is usable to protect the extension gauge KLG-B mounted on plate KLG-F-15.

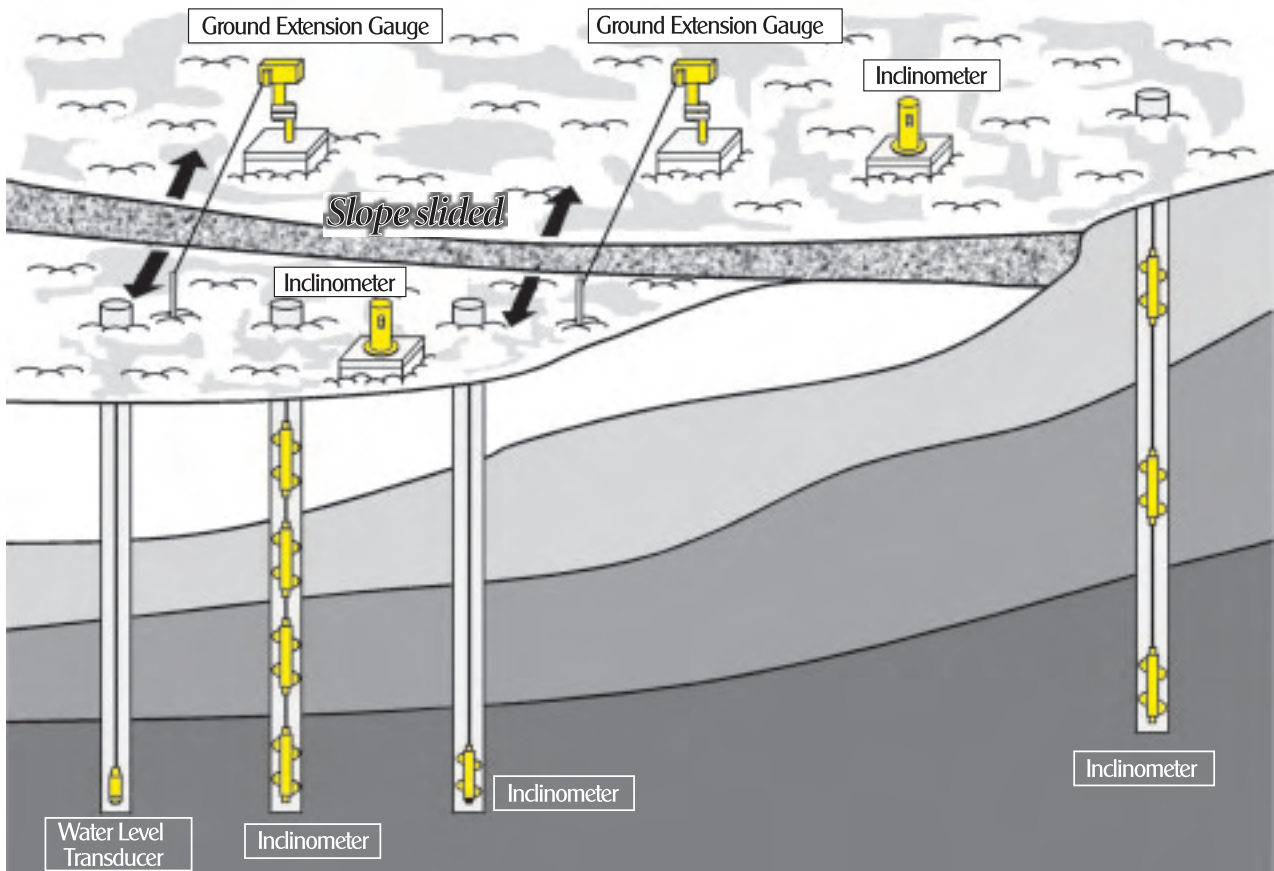


### Stanchion mount adapter KLG-F-17

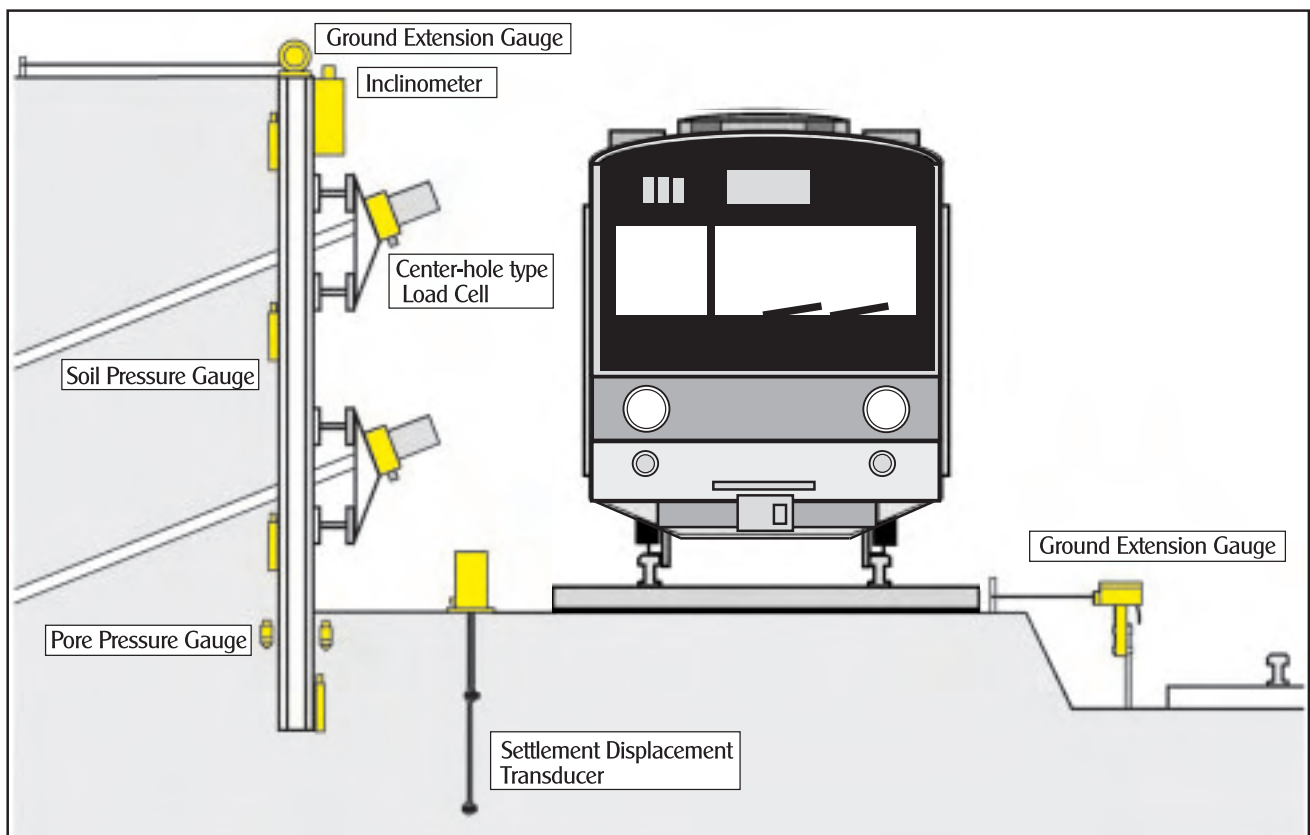
This exclusive adapter is usable to fix the extension gauge KLG-B onto the mounting plate KLG-F-15 to the stanchion accessory KLG-F-12.



## ■Application to land slide



## ■Application to railway cut-land



# KLA-A/NKLA-A Settlement Transducer



The KLA-A Settlement Transducers is set on a ground surface to measure the amount of settlement of each ground layer. The NKLA-A is also same measurement while it can be used with the TML-NET. Special anchors are mounted at specified positions inside a borehole and the amount of positional displacement between the anchors and the ground surface level is measured. Anchors can be mounted at a maximum of six levels inside one borehole.

Protection ratings : IP 45 equivalent

## KLA-A Specifications

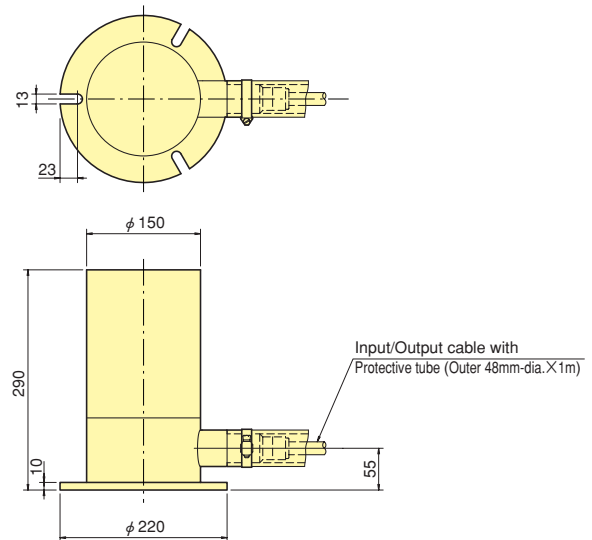
Type	KLA-100A
No. of measurement	1~6
Capacity	100mm
Rated Output	Approx. 2.5mV/V (5000×10 <sup>-6</sup> strain)
Non-linearity	1%RO
Temperature range	-10~+60°C (no icing)
Input/Output resistance	350 Ω
Recommended exciting voltage	Less than 2V
Allowable exciting voltage	5V
Weight	5kg

Input/Output cable

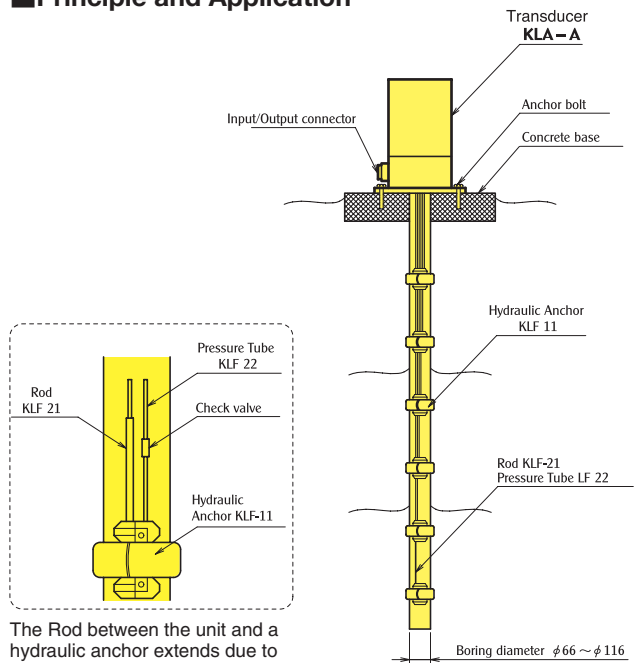
In case of 1~3 points :  $\phi$  11.5mm 0.3mm<sup>2</sup> 12-core shielded vinyl cable 2m)  
In case of 4~6 points :  $\phi$  16.5mm 0.3mm<sup>2</sup> 24-core shielded vinyl cable 2m)

## NKLA-A Specifications [TML-NET compatible]

Type	NKLA-100A
Capacity	100mm
Rated indication	Approx. 5000 digit
No. of measurement	1~6
Non-linearity	1%RO
Temperature range	-10~+60°C (no icing)
Channel set	Factory default (000~999)
Weight	5kg



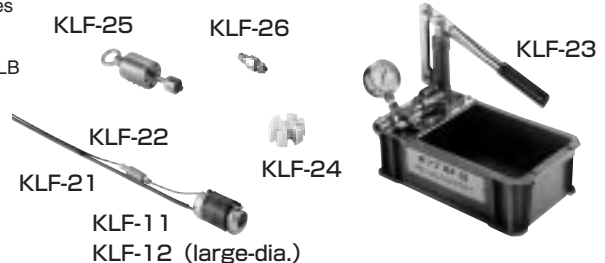
## Principle and Application



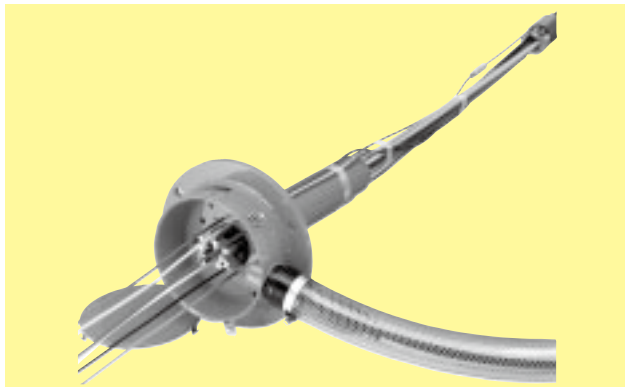
The Rod between the unit and a hydraulic anchor extends due to settlement, output turns minus polarity.

## KLA-A/NKLA-A/KLB-A Common-use accessories

Different accessories for KLA type Displacement Transducers and KLB type Rock Displacement Transducer

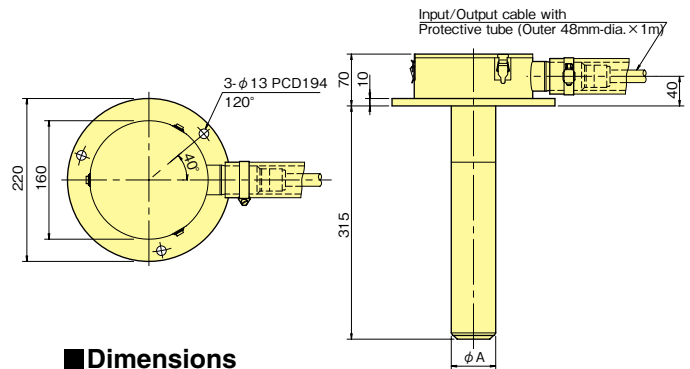


# KLB-A Rock Displacement Transducer



The KLB-A rock displacement transducer measures the amount of positional displacement between the plane on which it is mounted and a specified point in bedrock. The measurement setup consists of the KLB-A as a displacement sensor, the hydraulic anchor KLF-11, and the rod KLF-21 that connects the KLB-A to the hydraulic anchor. This transducer has a maximum of eight built-in displacement transducers, so it is able to make measurement using eight hydraulic anchors mounted inside one borehole (66 mm or larger in diameter). The displacement occurring between the transducer and anchors is detected via the rod and output as the amount of relative positional displacement. Anchors are secured to bedrock at specified measurement positions by hydraulic pressure generated by a pump on the ground.

Protection ratings : IP 45 equivalent



## ■ Dimensions

Type	A (mm)	* Weight (kg)
KLB-100A-1~6	60	4.5
KLB-100A-7, 8	70	5.2

\* Sensor unit only

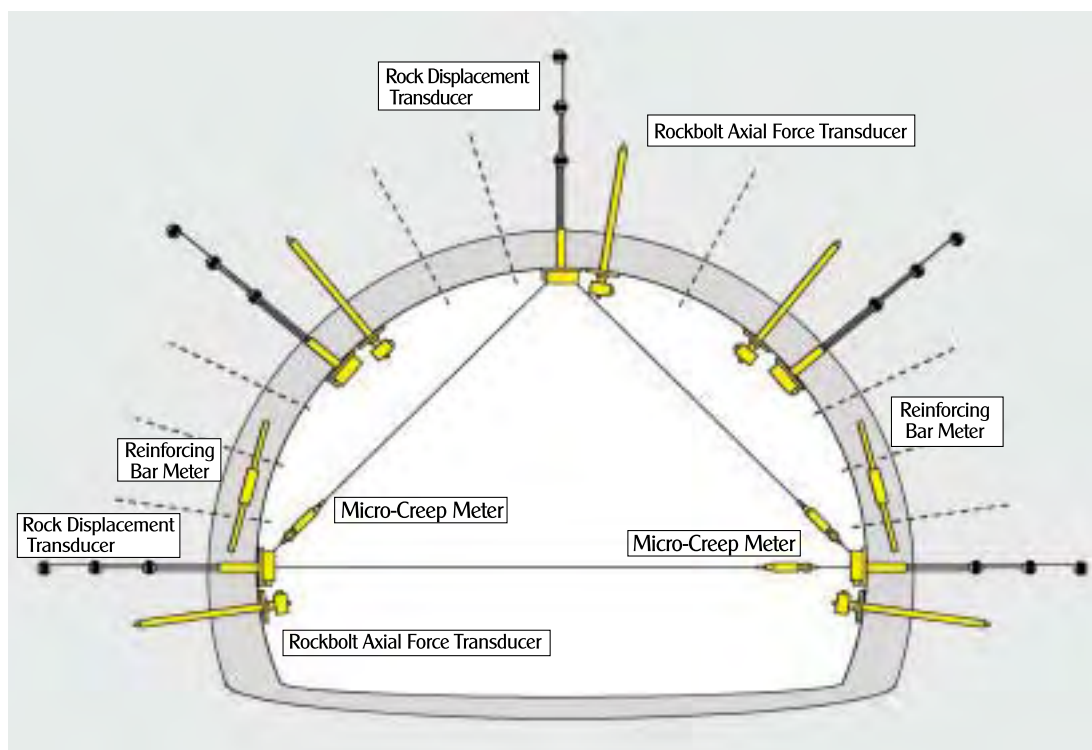
## ■ Specifications

Type	KLB-100A
No. of measurement	1~8
Capacity	100mm (-20~+80mm)
Rated Output	Approx. 2.5mV/V (5000×10 <sup>-6</sup> strain)
Non-linearity	0.5 %RO
Temperature range	0~+60°C (no icing)
Input/Output resistance	350 Ω
Recommended exciting voltage	Less than 2V
Allowable exciting voltage	5V
Weight	1~6 points model : 4.5kg 7, 8 points model : 5.2kg

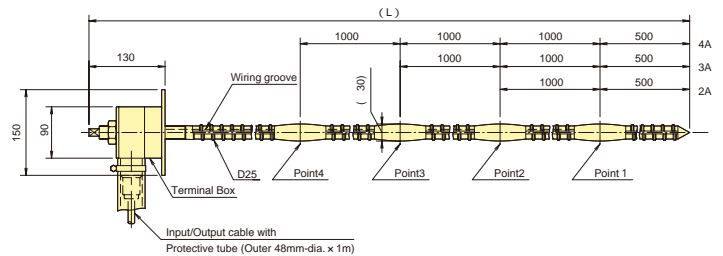
Input/Output cable

In case of 1~3 points :	φ 11.5mm	0.3mm <sup>2</sup>	12-core shielded vinyl cable	2m
In case of 4~6 points :	φ 16.5mm	0.3mm <sup>2</sup>	24-core shielded vinyl cable	2m
In case of 7, 8 points :	φ 18.5mm	0.3mm <sup>2</sup>	32-core shielded vinyl cable	2m

## ■ Application to NATM



# KRA-A Rock Bolt Axial Force Transducer



The KRA-A rock bolt axial force transducer is affixed to a rock bolt to measure axial force. The capacity is 100 kN and the number of measurement points is 2 to 4. It can make measurement with a high degree of accuracy with the least interference.

Protection ratings : IP 68 equivalent

## ■ Specifications

Type	KRA-2A	KRA-3A	KRA-4A
No. of measurement	2	3	4
Capacity	80kN		
Rated Output	Approx. 1.7mV/V (3400× 10 <sup>-6</sup> strain)		
Non-linearity	1%RO		
Temperature range	0 ~ + 60°C		
Input/output resistance	350Ω		
Recommended exciting voltage	Less than 6V		
Allowable exciting voltage	10V		
Zero balance	± 5000×10 <sup>-6</sup> strain or less		
Weight	9.5kg	13kg	16.5kg

## ■ Dimensions

T	L (mm)
KRA-2A	2000
KRA-3A	3000
KRA-4A	4000

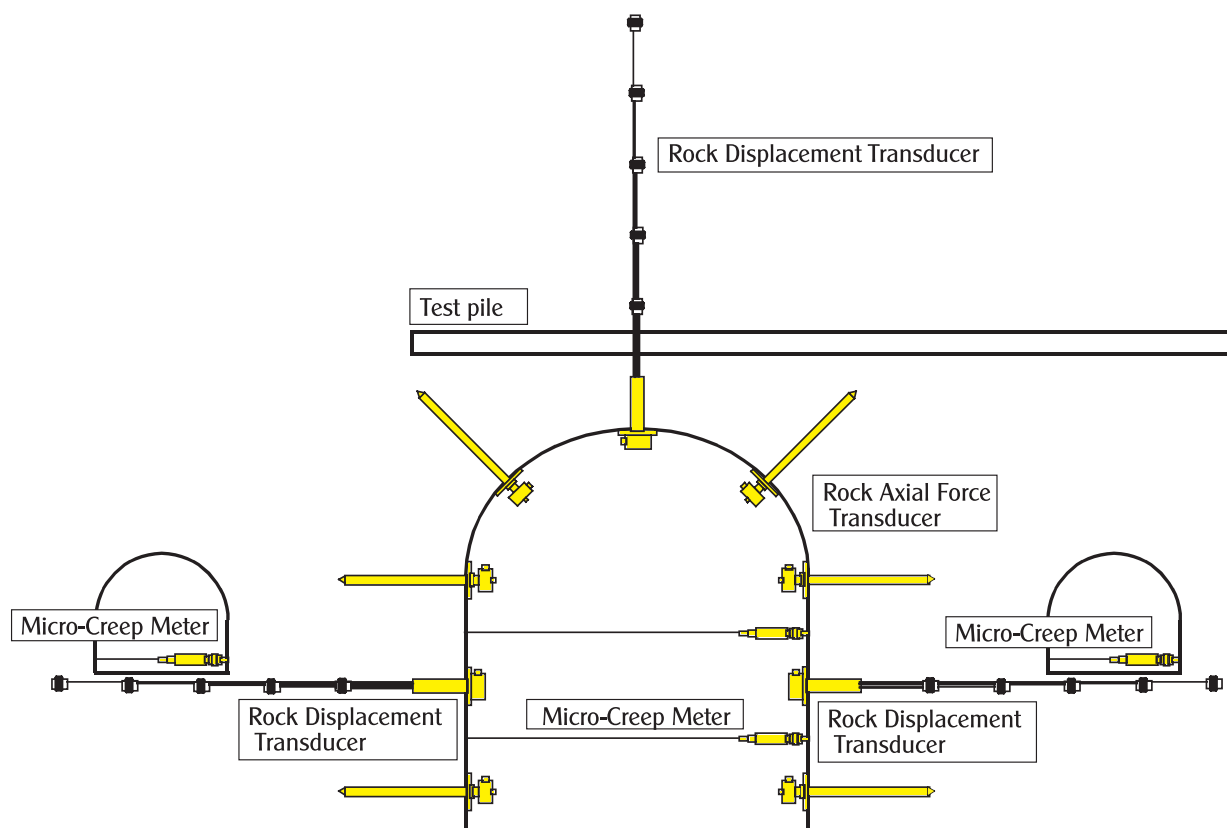
Input/output cable

KRA-2A/KRA-3A : 11.5mm 0.3mm<sup>2</sup>  
12-core shielded vinyl cable 2m

KRA-4A : 16.5mm 0.3mm<sup>2</sup>  
24-core shielded vinyl cable 2m



## ■Application to underground opening



## PW-PA Pressure Transducer



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.

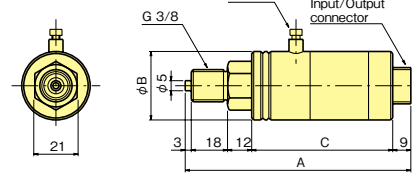
Protection ratings : IP 42 equivalent for PW-100KPA/PW-200KPA

: IP 65 equivalent for PW-500KPA-PW-50MPa

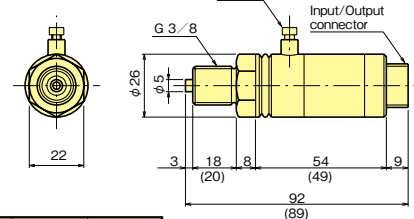
### Specifications

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 <sup>-6</sup> strain)±1%	1.5mV/V±0.1% (3000×10 <sup>-6</sup> strain)±1%	2mV/V±0.1% (4000×10 <sup>-6</sup> 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					0.02%RO/°C				
Temperature effect on span	0.02%/°C					0.02%/°C				
Compensated temperature range	-10~+60°C					-10~+60°C				
Temperature range	-20~+70°C					-20~+70°C				
Over load	150%					150%				
Input/output resistance	350Ω±1%					350Ω±1%				
Recommended exciting voltage	Less than 3V					Less than 6V				
Allowable exciting voltage	10V					15V				
Mounting screws	G3/8 (PF3/8)					G3/8 (PF3/8)				
Pressure media	SUS 630					SUS 630				
Weight	530g			400g			200g			

PW-100KPA~5MPa



PW-10~50MPa



( ) :PW-50MPa

### Dimensions

Type	A	B	C
PW-100~500KPA	105	42	63
PW-1~5MPa	112	34	70
PW-10~50MPa	As per the figure		

Supplied cable  
CT9-4N2/WP-STB (φ9mm 0.5mm<sup>2</sup>  
4-core shielded chloroprene cable 2m)

## PWH-PA Pressure Transducer



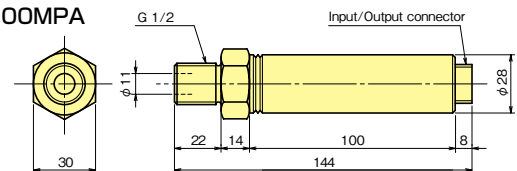
The PWH-PA high-capacity pressure transducer has a sealed structure made with high-strength stainless steel. Using this highly sensitive transducer, stable high-accuracy measurement can be made over a long period of time. It is used to control plant or production lines, to measure jack pressure, and for various other applications.

Protection ratings : IP 65 equivalent

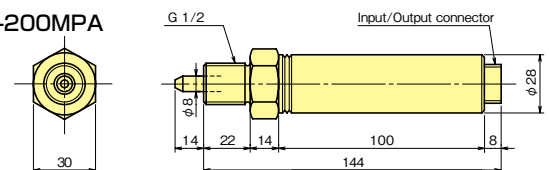
### Specifications

Type	PWH-70MPa	PWH-100MPa	PWH-150PA	PWH-200MPa
Capacity	70MPa	100MPa	150MPa	200MPa
Rated output	1mV/V (2000×10 <sup>-6</sup> 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			
Temperature range	-20~+70°C			
Over load	150%			
Input/output resistance	350Ω±1%			
Recommended exciting voltage	Less than 6V			
Allowable exciting voltage	15V			
Mounting screws	G1/2 (PF1/2)			
Pressure media	SUS 630			
Weight	400g		410g	

PWH-70/-100MPa

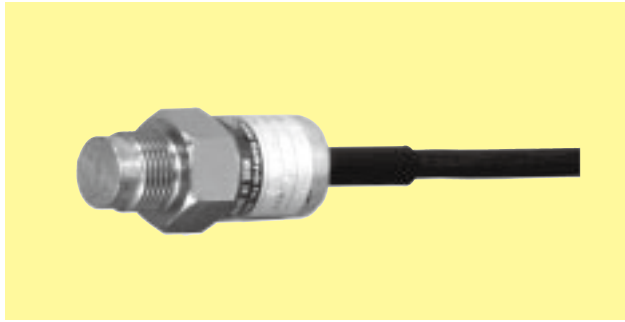


PWH-150/-200MPa



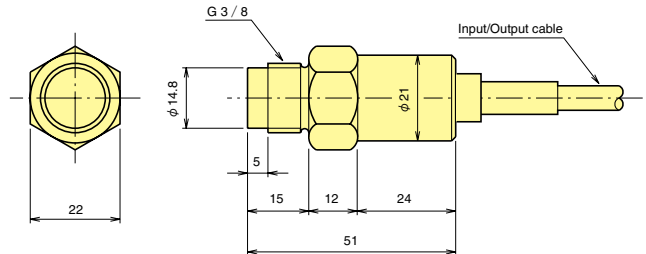
Supplied cable  
CT9-4N2/WP-STB (φ9mm 0.5mm<sup>2</sup>  
4-core shielded chloroprene cable 2m)

## PWF-PA Pressure Transducer



This transducer has its sensing area at the top of mounting screws, so 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 : IP 67 equivalent



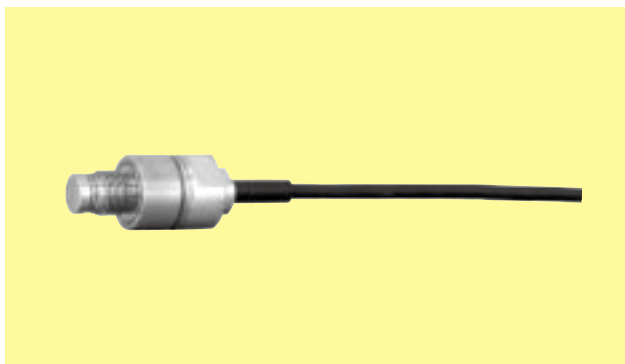
### Specifications

Type	PWF-1MPa	PWF-2MPa	PWF-5MPa	PWF-10MPa	PWF-20MPa	PWF-50MPa
Capacity	1MPa	2MPa	5MPa	10MPa	20MPa	50MPa
Rated output	1.5mV/V $\pm$ 25% (3000 $\times$ 10 $^{-6}$ strain) $\pm$ 25%					
Non-linearity	0.5%RO					
Hysteresis	0.5%RO					
Repeatability	0.5%RO					
Temperature effect on zero	0.06%RO/ $^{\circ}$ C					
Temperature effect on span	0.08%/ $^{\circ}$ C					
Compensated temperature range	-10 $\sim$ +60 $^{\circ}$ C					
Temperature range	-20 $\sim$ +70 $^{\circ}$ C					
Over load	150%					
Input/output resistance	350 $\Omega$					
Recommended exciting voltage	Less than 6V					
Allowable exciting voltage	10V					
Natural frequency	28kHz	38kHz	55kHz	76kHz	107kHz	166kHz
Mounting screws	G3/8 (PF3/8)					
Pressure media	SUS630					
Weight	100g					

N.B. : Applicable torque should be 10~ 20N $\cdot$ m.

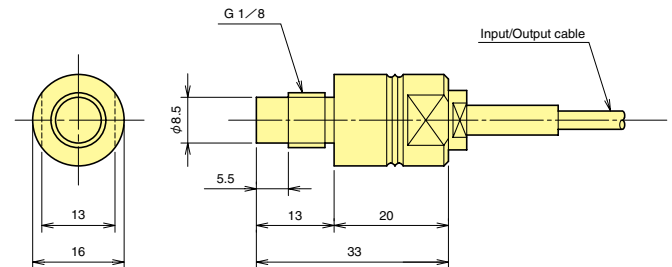
Input/output cable :  $\phi$  6mm 0.35mm $^2$  4-core shielded chloroprene cable 2m

## PWFC-PA Pressure Transducer



The PWFC-PA 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 : IP 67 equivalent



### Specifications

Type	PWFC-2MPa	PWFC-5MPa	PWFC-10MPa	PWFC-20MPa	PWFC-50MPa
Capacity	2MPa	5MPa	10MPa	20MPa	50MPa
Rated output	1.25mV/V (2500 ×10 <sup>-6</sup> strain)±25%	1.5mV/V±25% (3000×10 <sup>-6</sup> strain)±25%			
Non-linearity			0.5%RO		
Hysteresis			0.5%RO		
Repeatability			0.5%RO		
Temperature effect on zero			0.1%RO/°C		
Temperature effect on span			0.1%/°C		
Compensated temperature range	-10~+60°C				
Temperature range	-20~+70°C				
Over load	150%				
Input/output resistance	350Ω				
Recommended exciting voltage	Less than 3V				
Allowable exciting voltage	6V				
Natural frequency	70kHz	94kHz	130kHz	180kHz	290kHz
Mounting screws	G1/8 (PF1/8)				
Pressure media	SUS630				
Weight	25g				

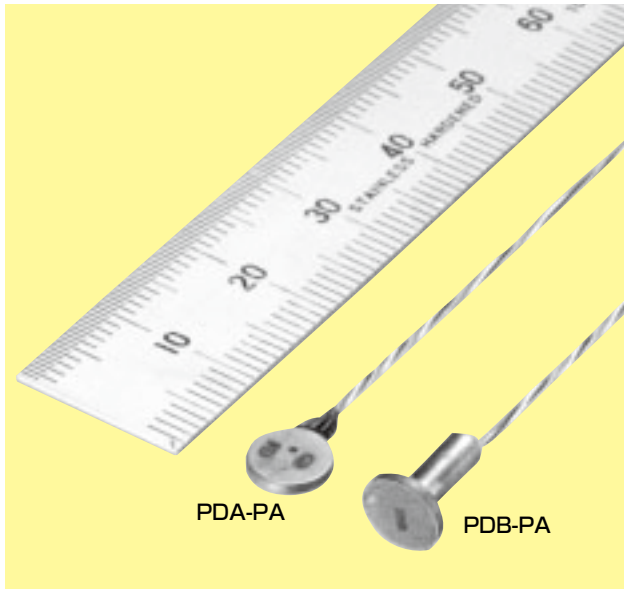
N.B. : Applicable torque should be 10~15N $\cdot$ m.

Input/output cable

$\phi$  3mm 0.05mm $^2$

4-core shielded chloroprene cable 2m

# PDA-PA/PDB-PA Miniature Pressure Gauge



The sensing part of the PDA-PA and PDB-PA miniature pressure gauges is 6.5 mm in diameter and 1 mm in thickness. As they are waterproofed for daily ordinary use, they can be used in water. They use a scratch-resistant Teflon-covered cable. Although the PDA-PA and PDB-PA are the same miniature pressure gauges, the Input/Output cable is attached to each gauge body differently.

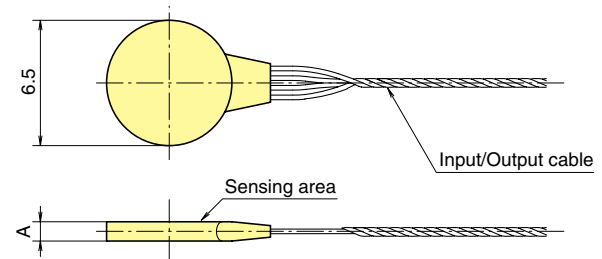
Note: If used in water for a prolonged period, the waterproof performance might deteriorate.

Protection ratings : IP 67 equivalent

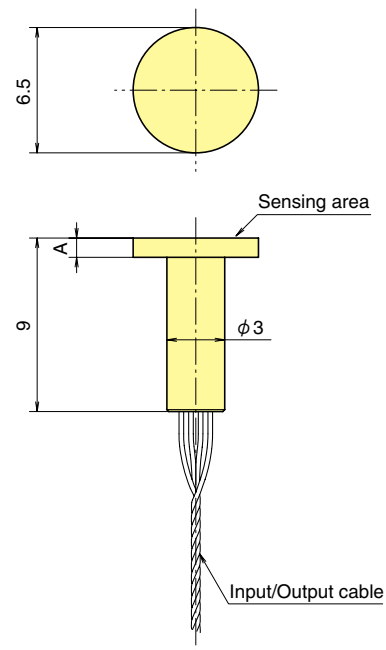
## ■ Dimensions

Type	A	Weight(g)
PDA-200KPA	1	0.1
PDA-500KPA	1	0.1
PDA-1MPa	1	0.1
PDA-2MPa	1.4	0.2
PDA-3MPa	1.4	0.2
PDB-200KPA	1	0.5
PDB-500KPA	1	0.5
PDB-1MPa	1	0.5
PDB-2MPa	1.4	0.6
PDB-3MPa	1.4	0.6

## PDA-PA



## PDB-PA



## ■ Specifications

Type	PDA-200KPA/PDB-200KPA	PDA-500KPA/PDB-500KPA	PDA-1MPa/PDB-1MPa	PDA-2MPa/PDB-2MPa	PDA-3MPa/PDB-3MPa
Capacity	200kPa	500kPa	1MPa	2MPa	3MPa
Rated output	0.8mV/V (1600×10 <sup>-6</sup> strain)	1mV/V (2000×10 <sup>-6</sup> 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)				
Temperature range	-20~+70°C (no icing)				
Input/output resistance	350Ω				
Recommended exciting voltage	Less than 2V				
Allowable exciting voltage	5V				

N.B.: Applicable torque should be 10~ 15N·m.

Input/output cable : 0.005mm<sup>2</sup> 4-core Fluoride plastic insulated cable 1m

## ARF-A Acceleration Transducer



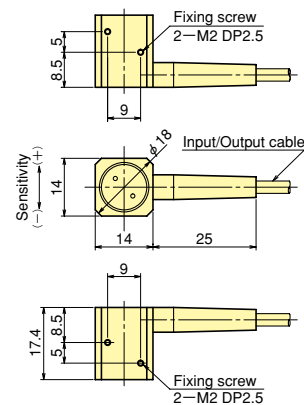
The ARF-A acceleration transducer is used to measure the acceleration of structures subject to vibration such as machinery, vehicles, ships, civil engineering structures, buildings, and so forth. It is small and lightweight and can make measurement on the DC level.

Protection ratings : IP 61 equivalent

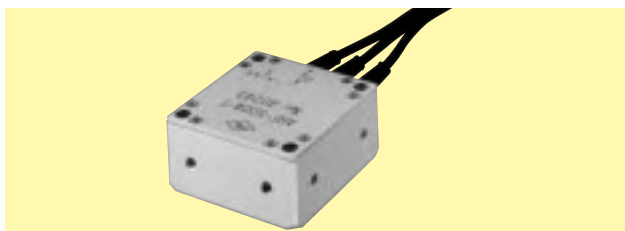
### Specifications

Type	ARF-10A	ARF-20A	ARF-50A	ARF-100A	ARF-200A	ARF-500A
Capacity	10m/s <sup>2</sup>	20m/s <sup>2</sup>	50m/s <sup>2</sup>	100m/s <sup>2</sup>	200m/s <sup>2</sup>	500m/s <sup>2</sup>
Rated Output	Approx. 0.5mV/V (1000×10 <sup>-6</sup> strain)					
Non-linearity	1%RO					
Frequency response	50Hz	80Hz	130Hz	180Hz	310Hz	520Hz
Natural frequency	100Hz	150Hz	240Hz	300Hz	520Hz	870Hz
Temperature range	-10~+50℃					
Over load	300%					
Input/Output resistance	120Ω					
Recommended exciting voltage	Less than 2V					
Allowable exciting voltage	5V					
Weight	13g					

Input/output cable :  $\phi$  3.2mm 0.08mm<sup>2</sup> 4-core shielded vinyl cable 5m  
Input/output cable is grounded to the body.



## ARF-A-T Acceleration Transducer



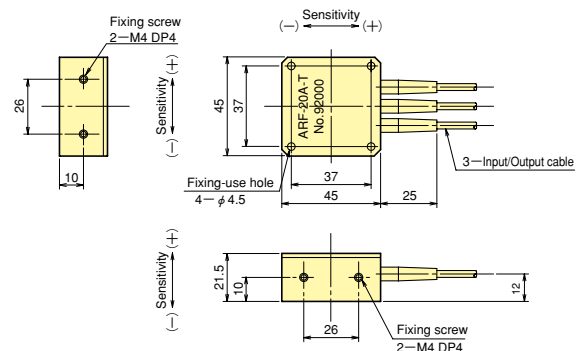
The ARF-A-T acceleration transducer measures acceleration in three directions (X, Y and Z) simultaneously. It is small and lightweight and can make high-accuracy measurement with the least interference.

Protection ratings : IP 61 equivalent

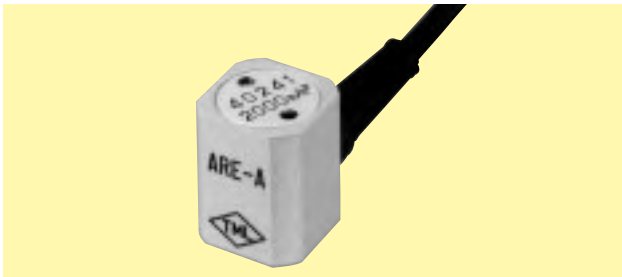
### Specifications

Type	ARF-20A-T	ARF-50A-T	ARF-100A-T	ARF-200A-T	ARF-500A-T
No. of measurement	3				
Capacity	20m/s <sup>2</sup>	50m/s <sup>2</sup>	100m/s <sup>2</sup>	200m/s <sup>2</sup>	500m/s <sup>2</sup>
Rated Output	Approx. 0.5mV/V (1000×10 <sup>-6</sup> strain)				
Non-linearity	1%RO				
Frequency response	80Hz	130Hz	180Hz	310Hz	520Hz
Natural frequency	150Hz	240Hz	300Hz	520Hz	870Hz
Cross sensitivity	3%RO				
Temperature range	-10~+50℃				
Over load	300%				
Input/Output resistance	120Ω				
Recommended exciting voltage	Less than 2V				
Allowable exciting voltage	5V				
Weight	85g				

Input/output cable :  $\phi$  3.2mm 0.08mm<sup>2</sup> 4-core shielded vinyl cable 5m, Input/output cable is grounded to the body.



## ARE-A Acceleration Transducer



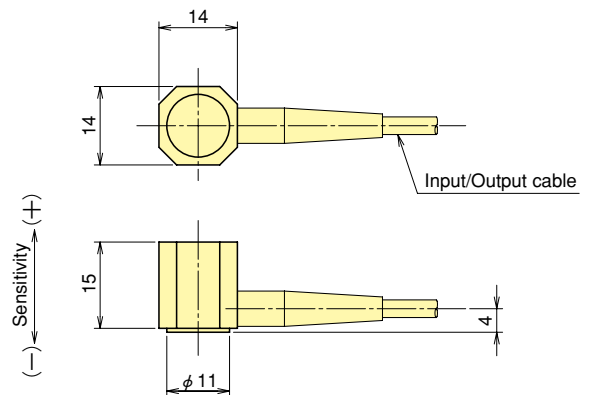
The ARE-A acceleration transducer is used to measure the acceleration of structures subject to relatively strong vibration. It is small, lightweight and easy to operate.

Protection ratings : IP 61 equivalent

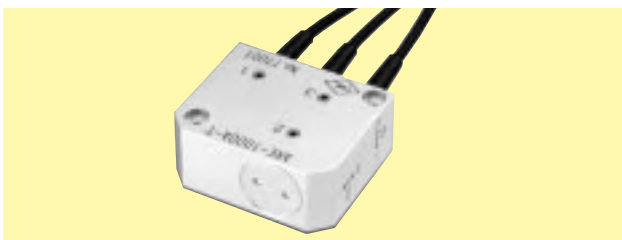
### Specifications

Type	ARE-1000A	ARE-2000A	ARE-5000A	ARE-10000A
Capacity	1000m/s²	2000m/s²	5000m/s²	10000m/s²
Rated Output	Approx. 0.5mV/V (1000×10 <sup>-6</sup> strain)			
Non-linearity	1%RO			
Frequency response	1300Hz	2100Hz	2100Hz	5000Hz
Natural frequency	2200Hz	3500Hz	4500Hz	7500Hz
Temperature range	-10~+50℃		-10~+60℃	
Over load	300%			
Input/Output resistance	120 Ω			
Recommended exciting voltage	Less than 2V			
Allowable exciting voltage	5V			
Weight	8g			

Input/output cable :  $\phi$  3.2mm 0.08mm<sup>2</sup> 4-core shielded vinyl cable 5m  
Input/output cable is grounded to the body.



## ARE-A-T Acceleration Transducer



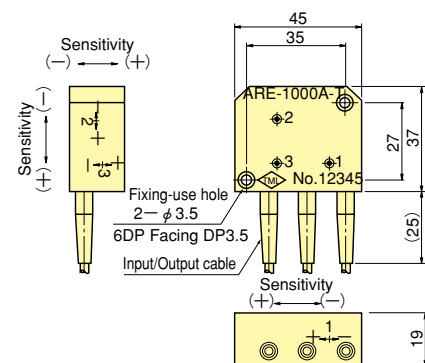
The ARE-A-T acceleration transducer measures acceleration in three directions (X, Y and Z) simultaneously. It is small and lightweight and can make high-accuracy measurement with the least interference.

Protection ratings : IP 61 equivalent

### Specifications

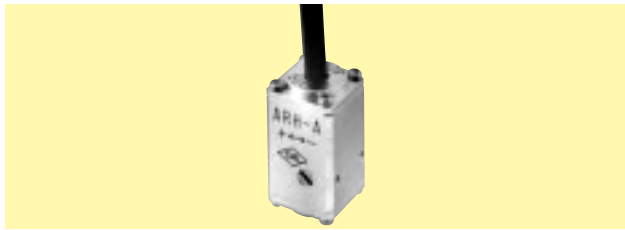
Type	ARE-1000A-T	ARE-2000A-T	ARE-5000A-T
No. of measurement	3		
Capacity	1000m/s <sup>2</sup>	2000m/s <sup>2</sup>	5000m/s <sup>2</sup>
Rated Output	Approx. 0.5mV/V (1000×10 <sup>-6</sup> strain)		
Non-linearity	1%RO		
Frequency response	1300Hz	2100Hz	2100Hz
Natural frequency	2200Hz	3500Hz	4500Hz
Cross sensitivity	3%RO		
Temperature range	-10~+50°C		-10~+60°C
Over load	300%		
Input/Output resistance	120 Ω		
Recommended exciting voltage	Less than 2V		
Allowable exciting voltage	5V		
Weight	77g	77g	75g

Input/output cable :  $\phi$  3.2mm 0.08mm<sup>2</sup> 4-core shielded vinyl cable 5m, Input/output cable is grounded to the body.





## ARH-A Acceleration Transducer



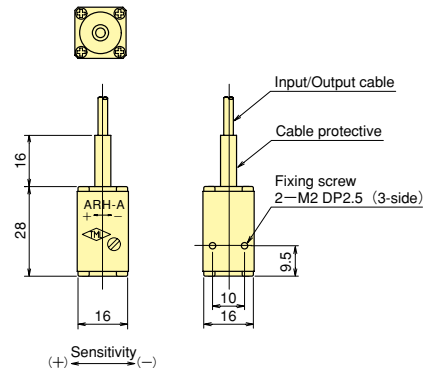
The ARH-A acceleration transducer has a waterproof structure. It is installed in water or ground or embedded in concrete. The rigid waterproof structure makes this transducer suitable for use in an adverse environment or for outdoor use.

Protection ratings : IP 67 equivalent

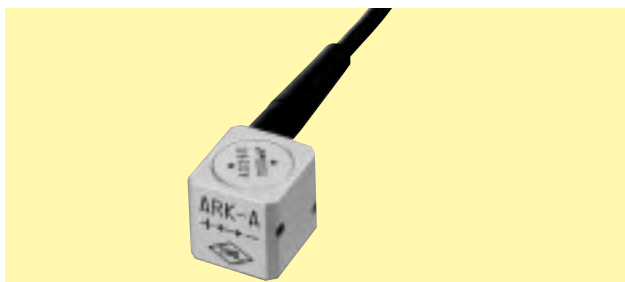
### Specifications

Type	ARH-10A	ARH-20A	ARH-50A	ARH-100A	ARH-200A	ARH-500A
Capacity	10m/s <sup>2</sup>	20m/s <sup>2</sup>	50m/s <sup>2</sup>	100m/s <sup>2</sup>	200m/s <sup>2</sup>	500m/s <sup>2</sup>
Rated Output	Approx. 0.5mV/V (1000×10 <sup>-6</sup> strain)					
Non-linearity	1%RO					
Frequency response	50Hz	80Hz	130Hz	180Hz	310Hz	520Hz
Natural frequency	100Hz	150Hz	240Hz	300Hz	520Hz	870Hz
Temperature range	-10~+50℃					
Over load	300%					
Input/Output resistance	120Ω					
Recommended exciting voltage	Less than 2V					
Allowable exciting voltage	5V					
Pressure allowable	500kPa					
Weight	18g					

Input/output cable :  $\phi$  3.2mm 0.08mm<sup>2</sup> 4-core shielded vinyl cable 5m  
Input/output cable is grounded to the body.



## ARK-A Acceleration Transducer



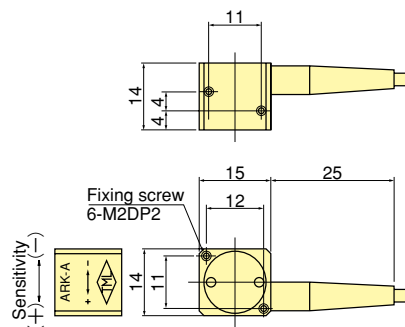
The ARK-A acceleration transducer is highly responsive in the range of high frequencies. It is suitable for impact acceleration measurement.

Protection ratings : IP 61 equivalent

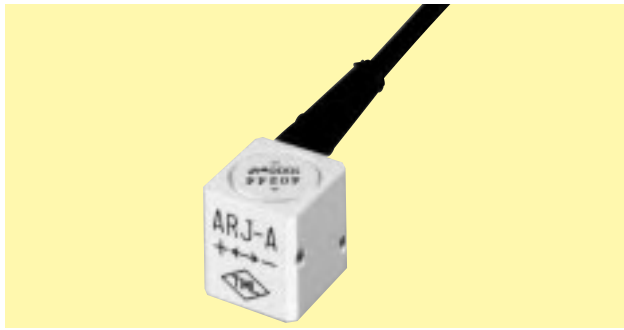
### Specifications

Type	ARK-1000A	ARK-2000A
Capacity	1000m/s <sup>2</sup>	2000m/s <sup>2</sup>
Rated Output	Approx. 0.5mV/V (1000×10 <sup>-6</sup> strain)	
Non-linearity	1%RO	
Frequency response	2000Hz	3000Hz
Natural frequency	3000Hz	4500Hz
Temperature range	-10~+50℃	
Over load	300%	
Input/Output resistance	120Ω	
Recommended exciting voltage	Less than 2V	
Allowable exciting voltage	5V	
Weight	10g	

Input/output cable :  $\phi$  3.2mm 0.08mm<sup>2</sup> 4-core shielded vinyl cable 5m  
Input/output cable is grounded to the body.



## ARJ-A Acceleration Transducer



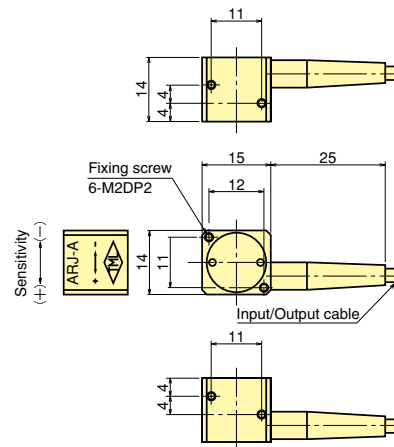
The ARJ-A acceleration transducer is small in size and has highly responsive characteristics. It was developed to measure the acceleration of machinery, vehicles, ships, civil engineering structures, buildings, and so forth.

Protection ratings : IP 61 equivalent

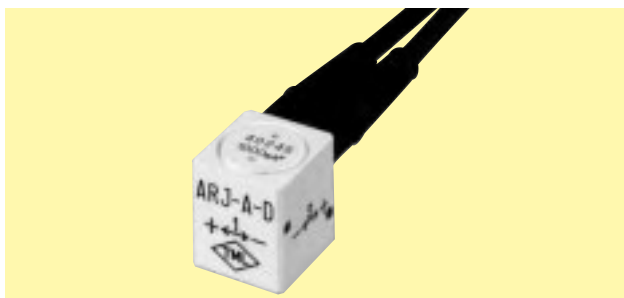
### Specifications

Type	ARJ-50A	ARJ-100A	ARJ-200A	ARJ-500A	ARJ-1000A	ARJ-2000A
No. of measurement	1					
Capacity	50m/s <sup>2</sup>	100m/s <sup>2</sup>	200m/s <sup>2</sup>	500m/s <sup>2</sup>	1000m/s <sup>2</sup>	2000m/s <sup>2</sup>
Rated Output	Approx. 0.5mV/V (1000×10 <sup>-6</sup> strain)					
Non-linearity	1%RO					
Frequency response	150Hz	300Hz	500Hz	780Hz	1kHz	2kHz
Natural frequency	280Hz	500Hz	830Hz	1kHz	2kHz	3kHz
Temperature range	-10~+60℃	-10~+50℃				
Over load	300%					
Input/output resistance	1kΩ					
Recommended exciting voltage	Less than 5V					
Allowable exciting voltage	15V					
Weight	13g	12g	12g	10g	11g	11g

Input/output cable :  $\phi$  3.2mm 0.08mm<sup>2</sup> 4-core shielded vinyl cable 5m  
Input/output cable is grounded to the body.



## ARJ-A-D Acceleration Transducer



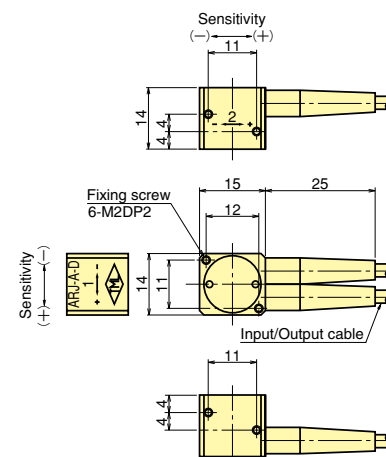
The ARJ-A-D acceleration transducer is small in size and has highly responsive characteristics. It was developed to measure the acceleration of machinery, vehicles, ships, civil engineering structures, buildings, and so forth.

Protection ratings : IP 61 equivalent

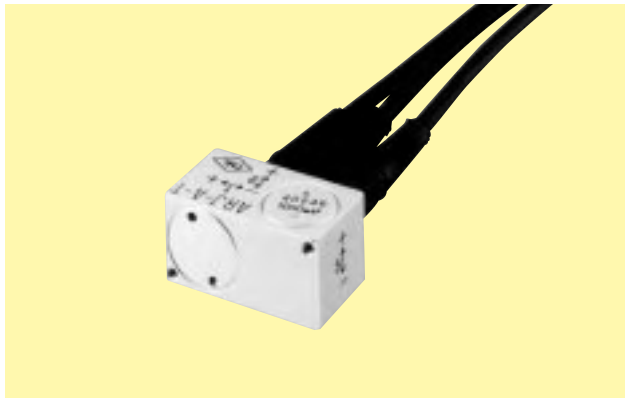
### Specifications

Type	ARJ-50A-D	ARJ-100A-D	ARJ-200A-D	ARJ-500A-D	ARJ-1000A-D	ARJ-2000A-D
No. of measurement	2					
Capacity	50m/s <sup>2</sup>	100m/s <sup>2</sup>	200m/s <sup>2</sup>	500m/s <sup>2</sup>	1000m/s <sup>2</sup>	2000m/s <sup>2</sup>
Rated Output	Approx. 0.5mV/V (1000×10 <sup>-6</sup> strain)					
Non-linearity	1%RO					
Frequency response	150Hz	300Hz	500Hz	780Hz	1kHz	2kHz
Natural frequency	280Hz	500Hz	830Hz	1kHz	2kHz	3kHz
Cross sensitivity	3%RO					
Temperature range	−10~+60℃	−10~+50℃				
Over load	300%					
Input/output resistance	1kΩ					
Recommended exciting voltage	Less than 5V					
Allowable exciting voltage	15V					
Weight	14g	13g	13g	11g	12g	12g

Input/output cable :  $\phi$  3.2mm 0.08mm<sup>2</sup> 4-core shielded vinyl cable 5m  
Input/output cable is grounded to the body.

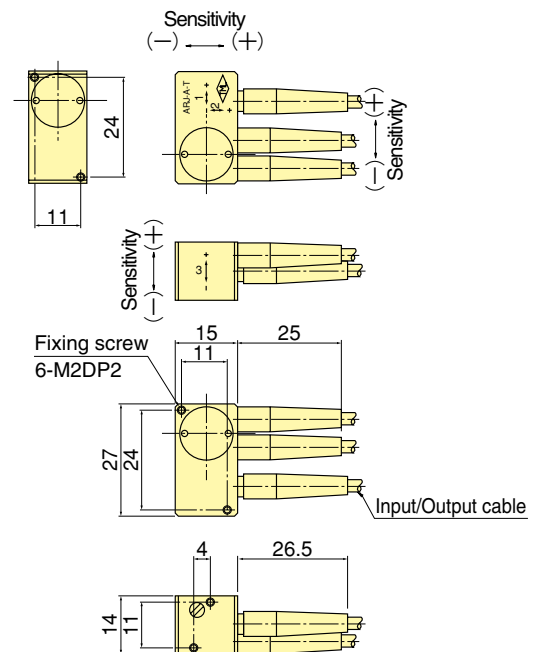


# ARJ-A-T Acceleration Transducer



The ARJ-A-T acceleration transducer was developed to measure the acceleration of machinery, vehicles, ships, civil engineering structures, buildings, and so forth. It is designed as a small, lightweight transducer so that it can be installed without disturbing the vibration mode of an object to be measured.

Protection ratings : IP 61 equivalent

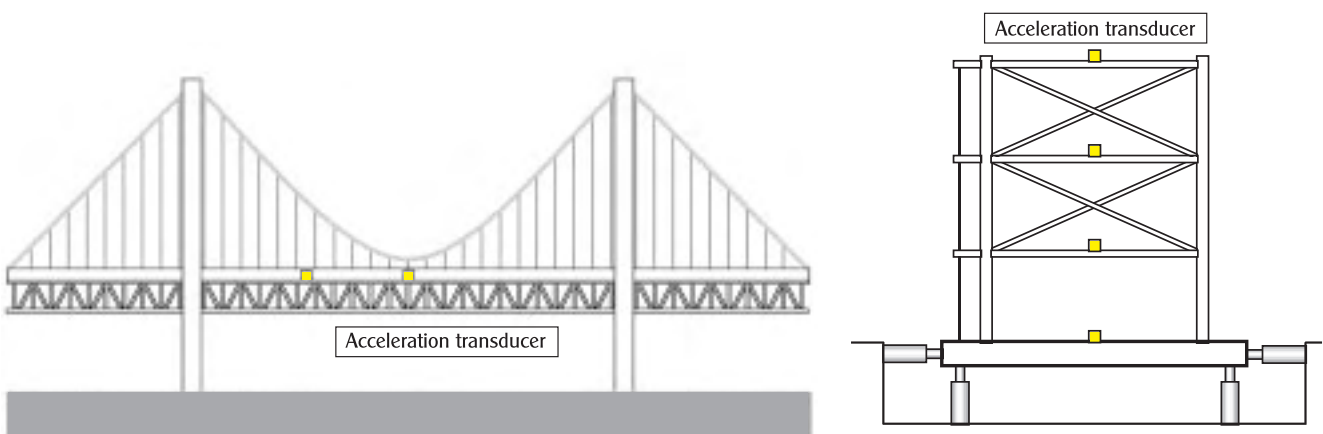


## Specifications

Type	ARJ-50A-T	ARJ-100A-T	ARJ-200A-T	ARJ-500A-T	ARJ-1000A-T	ARJ-2000A-T
No. of measurement	3					
Capacity	50m/s <sup>2</sup>	100m/s <sup>2</sup>	200m/s <sup>2</sup>	500m/s <sup>2</sup>	1000m/s <sup>2</sup>	2000m/s <sup>2</sup>
Rated Output	Approx. 0.5mV/V (1000×10 <sup>-6</sup> strain)					
Non-linearity	1%RO					
Frequency response	150Hz	300Hz	500Hz	780Hz	1kHz	2kHz
Natural frequency	280Hz	500Hz	830Hz	1kHz	2kHz	3kHz
Cross sensitivity	3%RO					
Temperature range	−10~+60℃	−10~+50℃				
Over load	300%					
Input/output resistance	1kΩ					
Recommended exciting voltage	Less than 5V					
Allowable exciting voltage	15V					
Weight	27g	25g	24g	20g	22g	22g

Input/output cable :  $\phi$  3.2mm 0.08mm<sup>2</sup> 4-core shielded vinyl cable 5m  
Input/output cable is grounded to the body.

## Application to structure



# TML-NET TRANSDUCERS

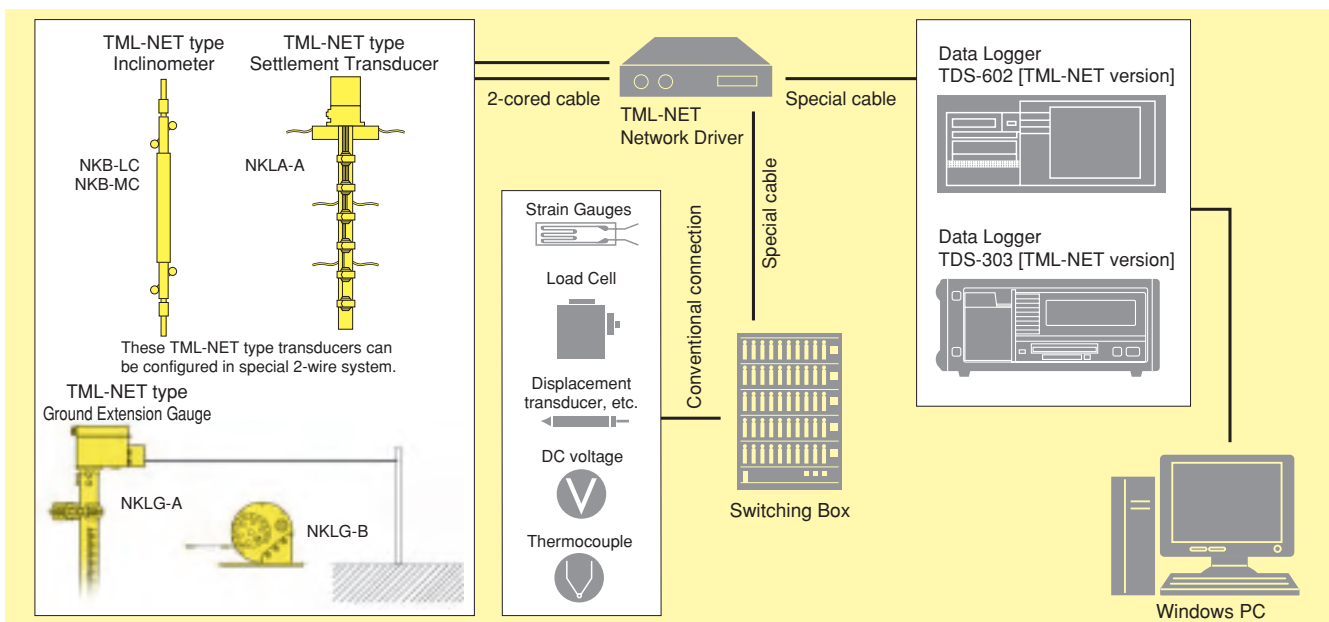


This transducer is a strain gauge-type transducer with a built-in digital conversion module. It is designed specifically for network measurement. Data can be transmitted if it is connected to the driver NDR-100 of the TML-NET that has a data recording function. Digital data transmission requires only a simple two-wire cable to connect this transducer to the driver. Additional TML-NET compatible transducers can also be connected to this transducer using two-wire cables. In addition, generally used strain gauges, transducers, thermocouples or resistance temperature sensors can also be connected to the TML-NET system via a switch box.

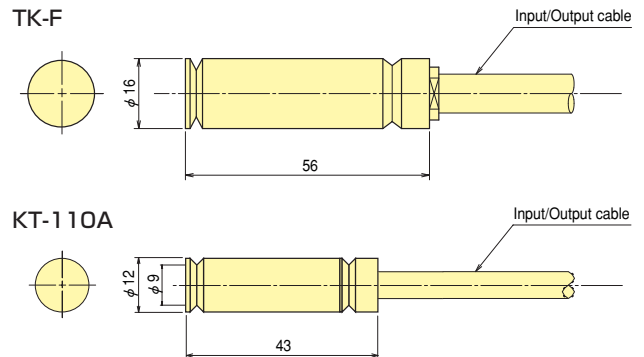
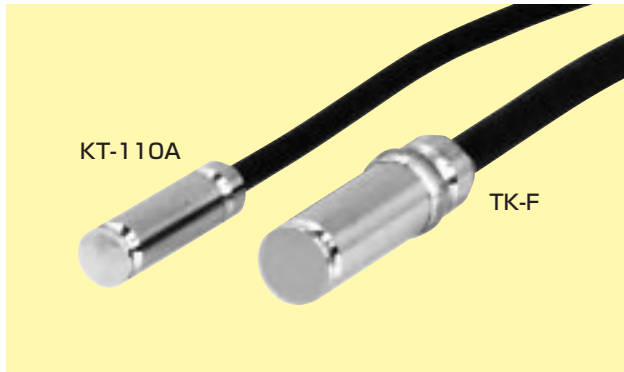
Compatible transducers:

- \* Multi-layer inclinometers - NKB-LC and -MC
- \* Settlement transducers - NKLA-A
- \* Ground Extension Gauge - NKLG-A and -B

## TML-NET Digital network measurement system



## TK-F/KT-A Temperature Gauge



The TK-F and KT-110A temperature gauges use a special temperature gauge as an internal sensor device. It has a waterproof structure and is suitable for being embedded in concrete or soil. Because it is designed with the 4-gauge bridge method, actual temperature can be measured using a measuring instrument that supports entry of initial values.

### Specifications

Type	TK-F	KT-110A
Capacity	-20~+80℃	-30~+80℃
Sensitivity	Approx. $140 \times 10^{-6}$ strain/℃	Approx. $130 \times 10^{-6}$ strain/℃
Measuring accuracy	±1℃	±0.3℃
Input/output resistance	350 Ω in full bridge	
Outer dimension	φ 16mm×56mm	φ 12mm×43mm
Weight	50g	20g

Input/output cable : TK-F φ 9mm 0.5mm<sup>2</sup> 4-core shielded chloroprene cable 2m  
 KT-110A φ 6mm 0.35mm<sup>2</sup> 4-core shielded chloroprene cable 2m

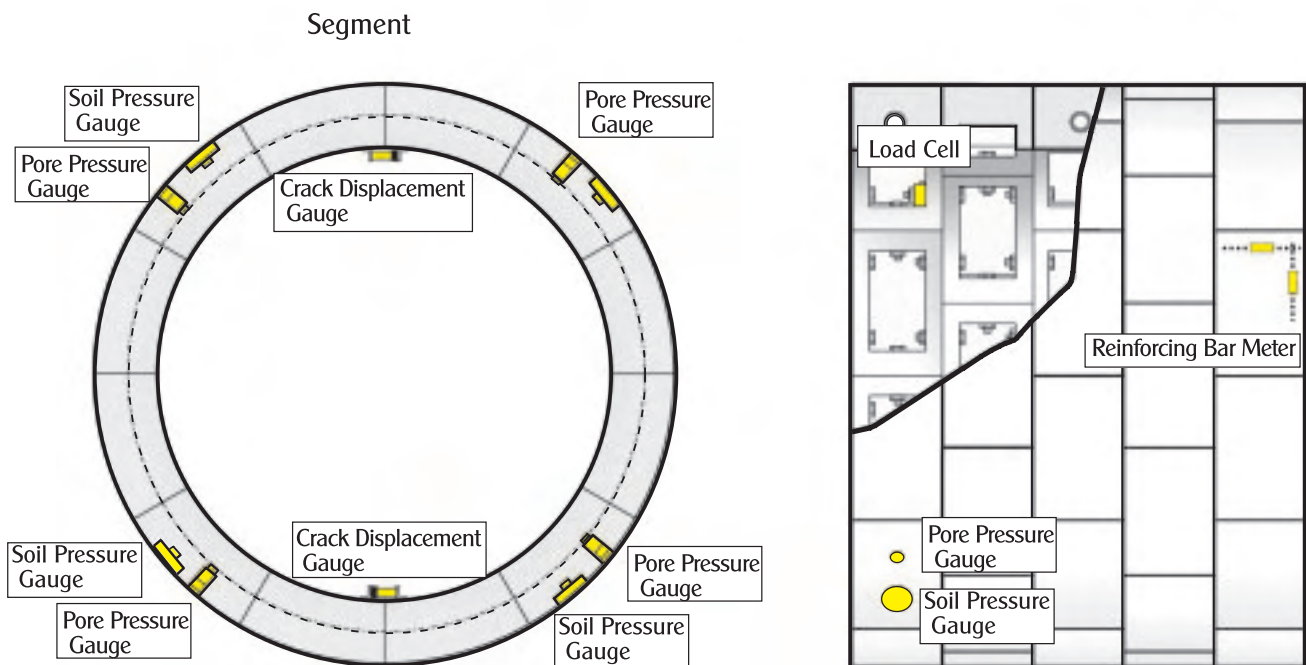
## Thermocouple

### Specifications

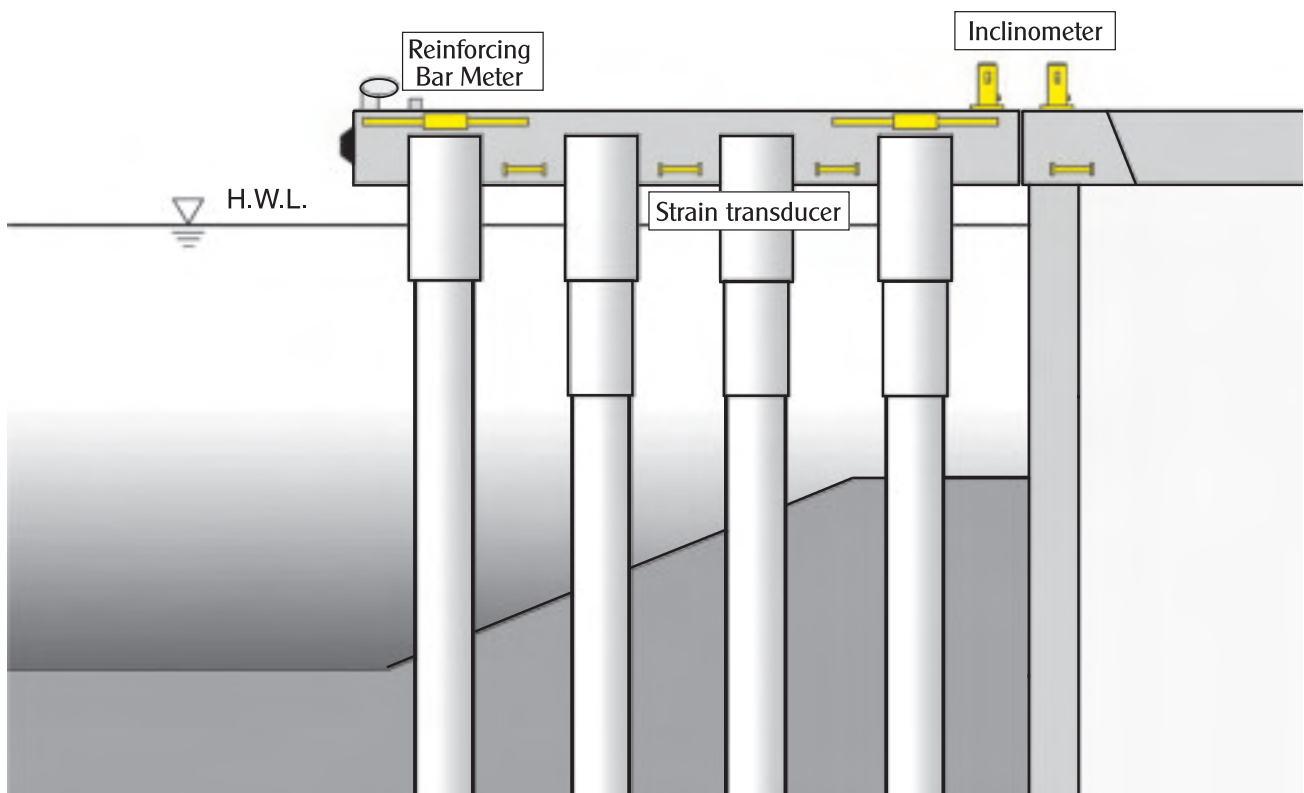
Type	Thermo-couple	Core diameter	Covering	Color of covering	Max. temperature of covering	Length per roll	Remarks
T-G-0.32	T	0.32	Heat resistant vinyl	Brown	100℃	100m	
T-G-0.65	T	0.65	Heat resistant vinyl	Brown	100℃	100m	
T-6F-0.32	T	0.32	Fuluroplastic	Brown	200℃	100m	
T-6F-0.65	T	0.65	Fuluroplastic	Brown	200℃	100m	
T-GS-0.65	T	0.65	Heat resistant vinyl	Brown	100℃	100m	Shielded
K-H-0.32	K	0.32	Glass	Blue	350℃	100m	
K-H-0.65	K	0.65	Glass	Blue	350℃	100m	

## OTHER APPLICATIONS

### ■Application to tunnel segment



### ■Application to driven piles of pier





# Arreste r-protected Measuring System



NZ-6B



NZ-7B



NZR-7A

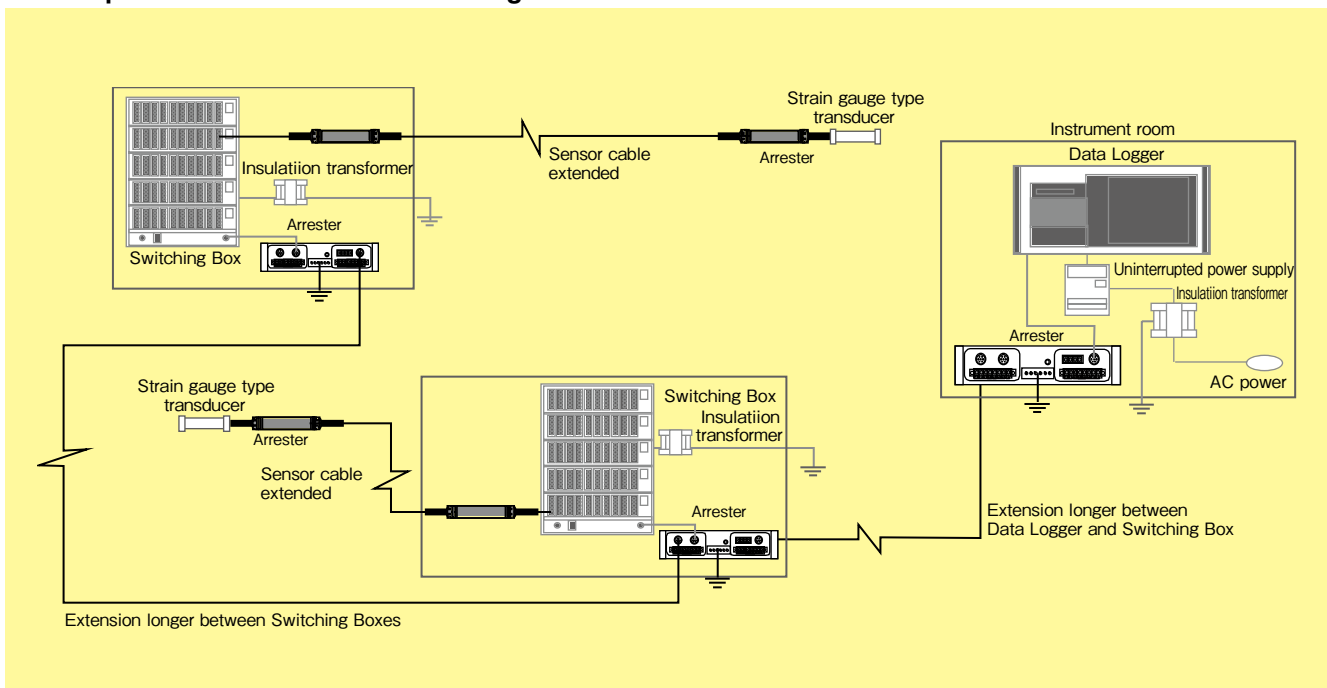
Strain gauges and a host of other transducers are used in structures for long-term maintenance control as well as for safety control during construction at civil engineering and other sites. These transducers need to be centrally controlled and are normally connected by cables running between the Instrument room and Data Loggers at a site office separated by anywhere from several tens of meters to hundreds of meters. The Data Logger and other connected transducers may be damaged by instantaneous high voltages in cables caused by lightning conduction even if lightning strikes near rather than directly on power or instrument cables laid outdoors.

Our arrester system attaches a special transducer cable arrester (NZ-6B) as well as an arrester unit (NZR-7A/NZ-7B) to the switching box and Data Logger cable to ground lightning strikes in order to minimize damage. An insulated transformer with a small static electricity capacity is used as a power supply cable measure to protect instruments from instantaneous high voltages. The system was developed based on many years of experience and field-proven performance in order to minimize instrument damage.

## Applicable instruments

Data Logger	TDS-303 TDS-602 TDS-530
Switching Box	ASW-30C, ASW-50C, SSW-50D, SSW-10MC

## Example of use at an actual measuring site



# Transducer output polarity

Our standard transducers are designed with the following output polarity for measurement.

## Displacement Transducer CDP

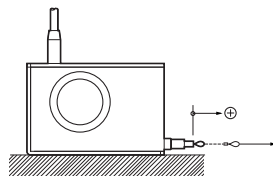
Measuring rod is depressed on measurement, output turns minus polarity.



Also, SDP and DDP models move same.

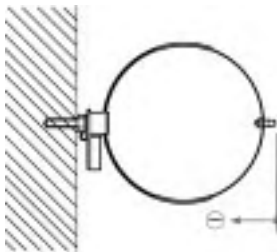
## Displacement Transducer DP-E

Measuring wire is taken out on measurement, output turns plus polarity.



## Displacement Transducer OU

Measuring contact tip is depressed on measurement, output turns minus polarity.



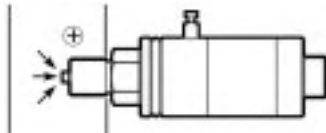
## Displacement Transducer CE

Measuring contact tip is depressed on measurement, output turns minus polarity.



## Pressure Transducer PW

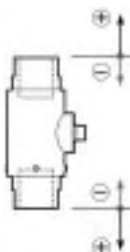
Pressure is loaded, output turns plus polarity.



Also, Water Level Meter KW-C and Pore Pressure Gauge KPA/KPB/KPC/KPD measure same.

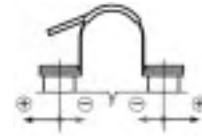
## Load Cells

Compressive force is loaded, output turns minus polarity, while tensile force is loaded, output turns plus polarity.



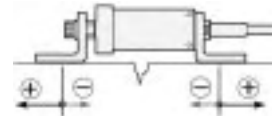
## Displacement Transducer PI

Crack opening develops, output turns plus polarity.



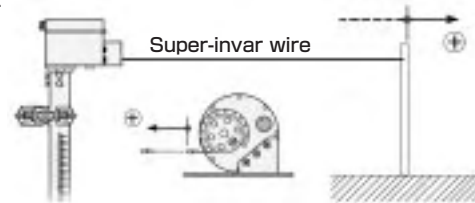
## Crack Displacement Gauge KG-A

Crack opening develops, output turns plus polarity.



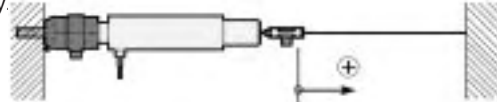
## Ground Extension Gauge KLG-A/KLG-B

Super-Invar wire is extended on measurement, output turns plus polarity.



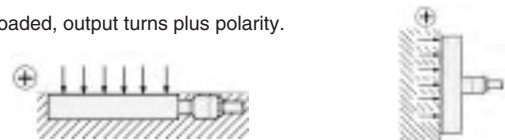
## Micro-Creep Meter KH-A

Super-Invar wire is extended on measurement, output turns plus polarity.



## Soil Pressure Gauge KDA/KDB/KDC/KDD/KDE/KDF

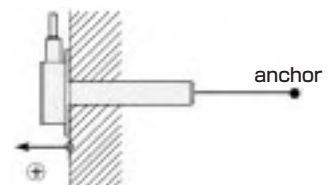
Pressure is loaded, output turns plus polarity.



Also, Load Cell type KDG/KDH/KDJ/KDK models measure same.

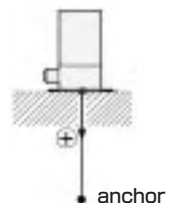
## Rock Displacement Transducer KLB-A

Rod (KLF-21) between the transducer KLB-A and a hydraulic anchor is extended due to ground movement, output turns plus polarity.



## Settlement Transducer KLA-A

Rod (KLF-21) between the transducer KLA-A and a hydraulic anchor is pressed due to settlement, output turns plus polarity.



## Handheld type static strainmeter

### Handy Digital Strainmeter TC-31K TYPE S238C



- Measures strain, DC voltage, thermocouple/Pt RTD temperature, gauge resistance, insulation resistance
- Available for direct reading in engineering unit
- Battery drive available in field site
- With built-in data memory (13,000 data max.), RS-232C interface
- Flash memory card available (Card adaptor/Memory card optionals)
- Autoswitching available with Switching box CSW-5A(optionals)
- Moisture-tight (IP-54 equivalent protection rating)
- Compact and lightweight of 800g
- Quick mount terminals (patent pending)

### Switching Box CSW-5A/CSW-5A-05



- 5-ch Switching Box specially designed for the TC-31K
- Can be used for strain gauge, transducer, DC voltage, thermocouple and platinum RTD
- Input connection by screw or soldering
- Compact and lightweight
- CSW-5A-05 provides both terminals and simple one-touch connectors

### Digital Load Meter TC-31L



- Direct measurement of load and displacement
- Setting of parameters for up to 20 transducers
- Peak-hold function
- Battery drive available in field site
- Simultaneous display of monitoring value and peak value
- Data memory function
- Flash memory card available (Card adaptor/Memory card 32/64/128MB optionals)
- Compatible Printer DPU-H245AS-A03A optional

### Digital Indicator TC-31M



- Designed for strain gauge based transducers
- Compatible with flash memory card of 32/64/128MB
- A sleep interval function to make unattended operation possible
- Battery drive available in field site
- Moisture-tight (IP-54 equivalent protection rating)
- Lightweight of 800 gr. and easy field use

## Data Logger/Static Strainmeters

### Data Logger TDS-602



- Color LCD touch panel offers true brilliance
- Measurement accuracy enhanced through original correction technique
- Measures strain, DC voltage, thermocouple/Pt RTD temperature
- Only 0.02 seconds per point for high-speed measurement
- Strain resolution extending to  $0.1 \times 10^{-6}$  strain
- Trigonometry functions, rectangular rosette analysis and much more
- Standardly equipped with 1.2GB hard disk storage
- Automatic starts with timers and monitor comparators
- With built-in computer interface GP-IB and RS-232C
- Available with 2-cable digital network system TML-NET

### TDS-530 Data Logger



- 1000 points/0.4sec.
- 1GB Compact Flash memory
- 3 Interfaces - LAN/USB/RS-232C
- High speed measurement of 1000 points at 0.4 sec.
- Color LCD with touch panel
- Strain, DC voltage, Thermocouple, Pt RTD
- High speed printing of 0.05 sec./line
- Standardly equipped with 10-ch. Switching Box
- 1-Gauge 4-Wire strain measurement

### Data Logger TDS-303 FLASH



- Measurement accuracy enhanced through original correction technique
- Measures strain, DC voltage, thermocouple/Pt RTD temperature
- A view-enhanced touch panel monitor display
- Quick sampling of 1000 channels in 4.9 seconds
- Strain resolution extending to  $0.1 \times 10^{-6}$  strain
- High speed print of 1 line of 18 digits in 0.06 seconds
- Incorporating flash memory card slot for 32/64/128MB
- System options - 1-Gauge 4-Wire measurement and Digital displacement measurement
- With built-in computer interface GP-IB, RS-232C and LAN

### Data Logger TDS-300



- RS-232C for PC connection allows configuration of a low-cost measuring system
- Maximum of 250 channels
- LCD monitor for indication of power ON and operating errors
- Selectable A/D converter sampling speed
- Measures strain, DC voltage, thermocouple/Pt RTD temperature
- Compact and lightweight unit for easy on-site measurement using a notebook PC
- Standardly equipped with primary software TDS-7300
- Cascade connection in any sequence regardless of channel number settings

## Data Logger/Static Strainmeters

### Data Logger TDS-102 FLASH



The above model with built-in Telemetry Modem optional is imaged.

- Maximum of 100 channels with 10 points provided in the TDS-102-10 and 20 points built into the TDS-102-20
- Battery operation and interval timer with sleep function for long-term automatic measurement
- Measures strain, DC voltage, thermocouple/Pt RTD temperature
- Large capacity data memory
- Data transfer by RS-232C interface or memory card
- Accommodates TRG-200L or TRG-700L telemetry modem (option) for telecommunication
- Compact and lightweight unit for easy on-site measurement
- Incorporating flash memory card slot for 32/64/128MB

### Multi-channel Digital Strainmeter DRA-30A



- Either dynamic or static strain measurement available by clicking icons
- Possible quarter (in 3-wire system), half and full bridge and voltage measurements
- One-touch connector receptacles and bridge box provided for each channel
- Each channel incorporates A/D converter for simultaneous measurements and saves in digital values for all channels
- Data memory of 112k words for each channel (30000 scans for static measurements)
- On-line measurement with a PC using built-in GP-IB or USB 1.1 interface
- Strain input has isolation and high impedance for each channel
- Operates on both AC90~250V (50/60Hz) and DC10~30V
- Control software both DRA-730AS and DRA-730AD supplied as standard accessory

### High Speed Data Logger THS-1100

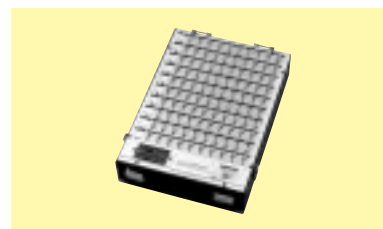


- Measures up to 1,000 channels per second
- High speed, high precision and high stability
- Strain, DC voltage and thermocouple temperature measurement using an external switching box
- Large capacity data memory
- Built-in graphic display
- Built-in coefficient calculation, interval timer and data comparator

#### High Speed Switching Box SHW-50D (Strain/Direct voltage)



#### High Speed Switching Box SHW-110T (Thermocouple temperature /Direct voltage)

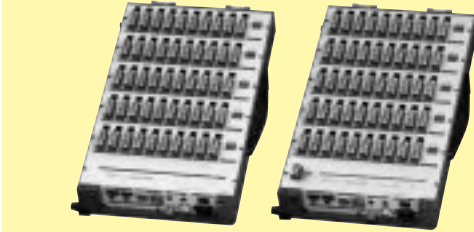


## Switching Boxes

### High Speed Switching Box IHW-50G Switching Box ISW-50G

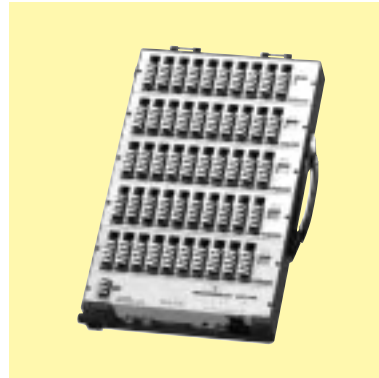
IHW-50G

ISW-50G



- IHW-50G 50 channels/0.4 sec. (with 1 unit)  
1000 channels/0.4 sec. (with 20 units)
- ISW-50G 50 channels/2 sec. (with 1 unit)  
1000 channels/2 sec. (with 20 units)
- One-touch connection by modular plug
- High resolution mode of  $0.1 \times 10^{-6}$  strain (standard)
- Multi-measurements for Strain, DC voltage, Temperature with Pt RTD & Thermocouples
- Simultaneous measurement of strain and temperature with the same channel
- Surge absorber for lightning with built-in each channel
- Both terminal and plug connection (Option -05)
- 1-Gauge 4-Wire measurement with one-touch connection by modular plug

### Switching Box SSW-50D



- Measures strain, DC voltage, Thermocouple temperature
- Patented 1-Gauge 4-Wire strain measuring system
- Combination use with SSW-C/ASW-C, ISW-50C switching boxes
- Great labour-saving with modular connector
- Built-in power-booster allows to extend channels and distance
- Heater to prevent moisture is available at option

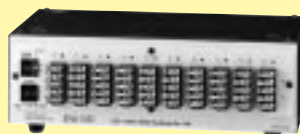
### Switching Box ASW-50C/ASW-30C



- Measures strain, DC voltage, Thermocouple temperature
- Sensor mode setting using the Data Logger program
- Cascade connection to Data Loggers using just one cable measuring 9mm in diameter
- Choice of screw or solder-type terminals
- Temperature measurement by platinum RTD enabled simply by replacing the Pt RTD unit (factory option)
- ASW-50C-05 equipped with standard terminal and one-touch all-channel connector

### Switching Box SSW-10MC/SSW-10SC

SSW-10MC



SSW-10SC

- SSW-10MC(master unit) with built-in control unit for measurement of up to 10 points
- Master unit can be connected with a maximum of four SSW-10SC satellite units
- The number of measuring points can be increased in units of 10 by adding the necessary number of satellite units
- Optional booster unit for master unit cable extension



## Dynamic Strainmeters

### High Speed Digital Dynamic Strainmeter DRC-3410



- Each channel incorporates A/D converter for simultaneous measurement for all 30 channels
- Waveform data stored in digital values
- Built-in large capacity memory
- High speed sampling at 1M samples/sec.
- High speed and large data transfer by LAN interface

### Dynamic Strainmeter DA-16A/DA-36A



- 1-channel dynamic strainmeter of carrier wave type
- Minimum sensitivity fluctuation due to gauge resistance
- Improved electronic auto-balancing performance
- Automatic tracking type capacity balance
- Built-in low-pass filter
- External control for balancing and calibration output
- Dual power supply of AC and DC

### Dynamic Strainmeter DC-96A/DC-97A



- 1-channel dynamic strainmeter of DC Exciting type
- High response frequency ranging from DC to 200kHz (DC-96A), while DC to 500kHz (DC-97A)
- Minimum sensitivity fluctuation due to gauge resistance
- Improved electronic auto-balancing performance
- Automatic tracking type capacity balance
- Built-in low-pass and high-pass filters
- External control for balancing and calibration output
- Dual power supply of AC and DC

### Digital Dynamic Strainmeter DRA-101C



CE

- Built-in 16-bit A/D converter at each channel for digital waveform recording
- Built-in large-capacity data memory (48k words/channel standard)
- Digital data eliminates range settings.
- Built-in GP-IB and RS-232C cable interface for on-line measuring
- Analog output from the D/A converter
- External sampling clock input capability
- Optional cycle counter interface measures cycles for fatigue test equipment based on voltage levels.

### Digital Dynamic Strainmeter DRA-107A



- Built-in 16-bit A/D converter at each channel for digital waveform recording
- Built-in large-capacity data memory (496k words/channel standard)
- Built-in GP-IB for on-line measurement
- Isolated strain input each channel, High input impedance
- Bridge excitation selectable either 0.5 or 2Vrms at each channel
- Remote sensing function to minimize sensitivity loss due to cable extension
- Primary measuring software DRA-7107 in CD media supplied

### Smart Dynamic Strain Recorder DC-204R/DC-204Ra

#### DC-204R



#### DC-204Ra

(ANALOG OUTPUT 5V)



CE

- Miniature model with a footprint size of 8.4x15.7 cm and extraordinarily lightweight of 500 gr.
- 4-channel configuration for strain and DC voltage measurement
- A maximum 32-channel sampling simultaneously
- High sampling rate of 5 microseconds per channel
- A compact flash memory card of 32MB~2GB available
- USB interface not required to restart computer or to set ID number
- On-vehicle measurement
- Frequency response of DC to 10kHz

# Histogram Recording System, Others

## Histogram Recorder HR-908A



- Simultaneous measurement and analysis as well as histogram recording
- Sets any slice count up to a maximum of  $\pm 50$
- Records multiple count data using a filing system
- Uses an internal timer for automatic measurement with real-time programs.
- Six control input and two output channels enable measurement by preset conditions as well as alarm output
- Response frequencies up to 2kHz with single-channel measurement
- Extremely stable long-term measurement automatically
- Input checks by real-time, multiple-channel and FFT monitoring using special software

## Histogram Recorder HR-916A



- Both measurements of histogram and waveform with histogram monitoring
- Simultaneous sampling up to 16 channels with 0.5msec. at maximum
- Available Flash memory card (32/64/128/512MB) for real-time recording of histogram and waveform data
- USB1.1/RS-232C interface available (USB can also transfer data to computer.)
- Sets any slice count up to a maximum of  $\pm 100$
- Response frequencies up to 2kHz with single-channel measurement

## Digital Indicator TD-97A



- Easy-to-see wide color display
- Graphical monitor
- Easy operation with touch panel
- High speed sampling of 2000 times/sec.
- Digital peak hold by high speed CPU
- Analog/Digital filter
- Different HOLD functions

## Digital Indicator TD-95A



- Automatically sets sensitivity by connecting TEDS (IEEE1451.4 class 2) compatible transducers
- Direct digital display ( $\pm 19999$ ) in any physical unit
- Possible high/low limit comparison
- Equivalent calibration signal input provided to make sensitivity adjustment easy without actual loading
- Analogue output with D/A conversion (Option)

## Digital 2-wire strain measurement TML-NET

### NDR-100 Network Driver



### NIF-100 Network Interface



### NSW Network Modules



- Easy connection and branching
- Compact module sections for easy installation
- Minimal sensitivity degradation by cable extension
- High resistance to noise because digital processing is conducted near strain gauges
- Unaffected by insulation resistance degradation
- Total distance : 2km with 2-wire system/2.5km with 4-wire system
- Combination use available with conventional switching boxes

## Strain Calibrator CBA-2310A



### CBA-131A



- Allows computer controlled operation (RS-232C)
- Wide calibration range ( $\pm 1,000,000 \times 10^{-6}$  strain)
- High resolution (max.  $1/100,000$ , max  $\pm 0.1 \times 10^{-6}$  strain)
- Excellent stability
- Capable of generating dynamic effects in a simulated manner
- Capable of being used as a standard voltage with  $\pm 20V$  output (0.1mV resolution)

# Measurement Software *Visual LOG*®



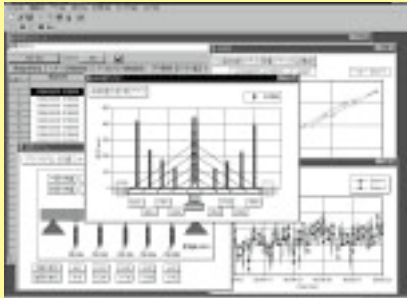
Visual Log is registered trademarks of Tokyo Sokki Kenkyujo Co., Ltd.

TML Measurement Software Visual LOG is designed for multiple channel measurements, and consists of different application software such as static, dynamic, histogram measurement and monitor-alarm measurement. Moreover, Visual LOG Light is lined up to expand field use with our Data Logger and

notebook computer, consisting of TDS-700L for GP-IB/RS-232C, TDS-701L for MODEM (telephone modem, TDS-702L for Modem-DM (Data Logger data memory) and TDS-703L for TRG (Telemetry modem).

## Static measurement

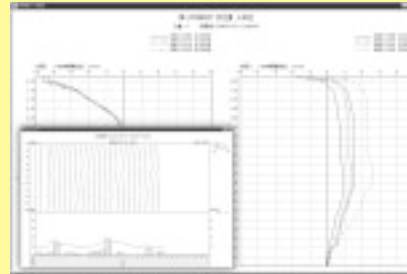
### Static measurement TDS-7130



Applicable system  
Data Logger :  
THS-1100/TDS-530/  
TDS-602/TDS-303/  
TDS-300/TDS-102/  
DRA-30A  
(switched on static mode)  
TML-NET Network  
interface NIF-100  
Interface :  
GP-IB(National  
Instruments make)/  
RS-232C/USB1.1

The TDS-7130 is a general purpose static measurement software for controlling our data loggers, data monitoring, data acquisition, and also offers powerful tool for presenting a report including data and graphics.

### Inclinometer control software IMP-7210

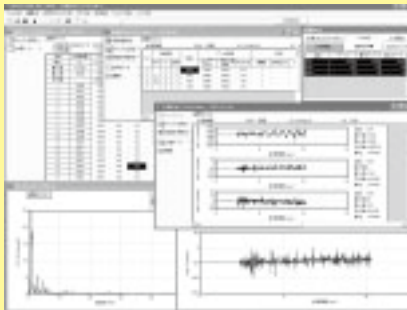


Applicable system  
Digital strainmeter :  
TC-31K TYPE S238C/  
Inclino adaptor  
IA-31 or IA-32  
  
Interface :  
RS-232C

The IMP-7210 is designed to process data measured by insertion type inclinometer KB-GC and KB-HC with digital strainmeter TC-31K TYPE S238C. Sectional displacement of ground, cumulative displacement are calculated from the data, then comparison chart and distribution graph, etc. are listed out. Moreover, the direct measured data can be manually input.

## Dynamic measurement

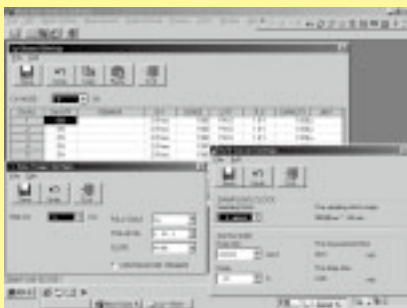
### DC-104R Dynamic measurement DC-7630



Applicable system  
DC-204R  
DC-204Ra  
  
Interface : USB

The DC-7630 is specially designed for Smart Dynamic Strain Recorder DC-204R and DC-204Ra, processing data and measuring dynamic phenomenon using upto 8 units (32 channels). Also, it features simultaneous measuring, realtime wave monitoring during sampling. The data is compatible with CSV and DADISP format.

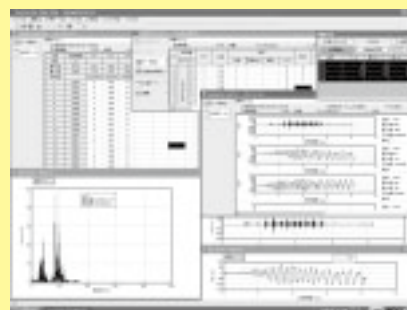
### Dynamic measurement SDA-7910



Applicable system  
Dynamic Strainmeter :  
SDA-810C, SDA-830C  
  
Interface :  
RS-232C

The SDA-7910 is automatical measurement software for processing data and measuring dynamic phenomenon using our SDA-810C or SDA-830C Dynamic Strainmeter. It is available for remote control of the instruments from Windows PC via RS-232C interface. The software conducts loading of wave data into the instruments, data transfer to such computer, and repeatedly starts measurements. It can also be used for various types of time series data processing.

### Dynamic measurement DRA-7630



Applicable system  
Digital Dynamic  
Strainmeter :  
DRA-101C/DRA-107A  
Multi-channel  
Digital Strainmeter :  
DRA-30A  
  
Interface :  
GP-IB(National  
Instruments make),  
RS-232C, USB1.1  
(only for DRA-30A)

The DRA-7630 is software for processing data and measuring dynamic phenomenon using up to 10 units (100 channels) DRA-101 and DRA-107A digital dynamic strainmeter. Multi-channel Digital Strainmeter DRA-30A is also available up to 10 units (300 channels). Maximum calculation items are 1000 points.

## Histogram measurement

### Histogram measurement HR-7610

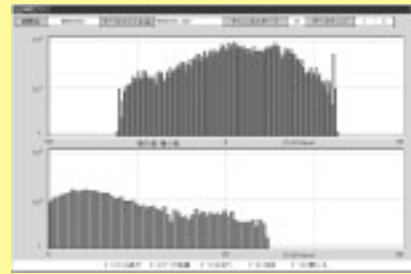


Applicable system  
Histogram Recorder :  
HR-908A

Interface :  
GP-IB  
(National Instruments  
make)/RS-232C

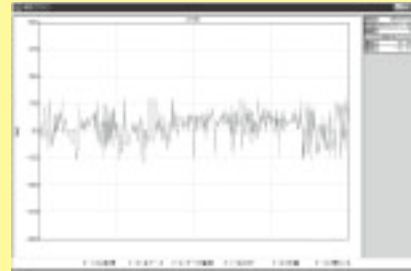
The HR-7610 measures cycle frequency by using the HR-908A histogram recorder as an input device. With computer control via GP-IB(RS-232C) interface, this easy-to-use software maximizes the performance of the measuring instrument for setting, measuring, data recording and data processing under the same environment.

### Histogram measurement HR-7916



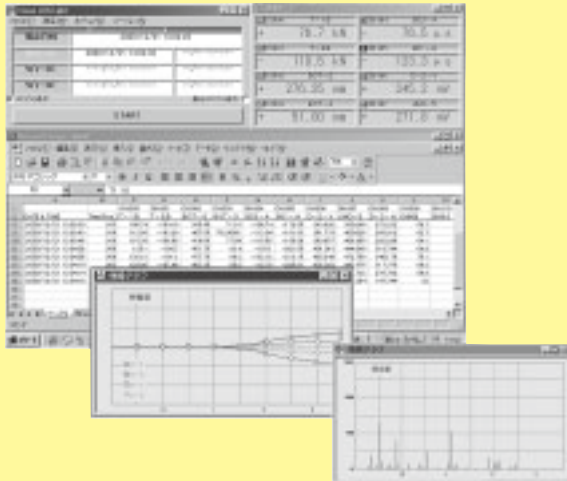
Applicable system  
Histogram Recorder :  
HR-916A

Interface :  
RS-232C, USB1.1



The HR-7916 measures and process cycle frequency data and record a long-period waveform by using the HR-916A histogram recorder. With computer control via RS-232C or USB1.1 interface, this easy-to-use software maximizes the performance of the measuring instrument for setting, measuring, data recording and data processing under the same environment.

## Visual LOG Light Monitor and Measurement



The Visual LOG Light is a control software of monitor-alarm with use of our static strainmeters. With different computer interface and such instruments, the software consists of 4 models, -1. TDS-700L for GP-IB/RS-232C, -2. TDS-701L for MODEM(Telephone modem), -3. TDS-702L for Modem-DM( Data Logger data memory) and -4. TDS-703L for TRG(Wireless Telemetry modem).

### ● Visual LOG® Light TDS-700L for RS/GP

Controls data logger remotely with personal computer via interface RS-232C or GP-IB.

Data Logger	TDS-530, TDS-303, TDS-300, TDS-102 TC-31K, TC-35N
Interface	GP-IB, RS-232C

### ● Visual LOG® Light TDS-703L for TRG

Enables wireless measurement with Telemetry modem TRG-200L and/or TRG-700L.

Data Logger	TDS-303, TDS-300, TDS-102, TC-31K
Telemetry modem	TRG-200L, TRG-700L
Interface	RS-232C

### ● Visual LOG® Light TDS-701L for Modem

Enables modem measurement with public line, mobile or satellite .

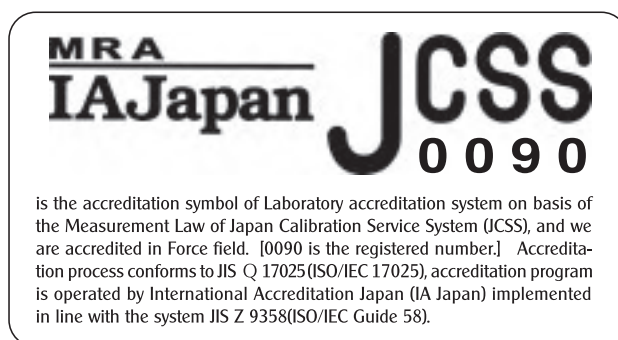
Data Logger	TDS-303, TDS-300, TDS-102, TC-31K
Modem	Conform to AT commands

### ● Visual LOG® Light TDS-702L for Modem-DM

Transfers measured data from built in data memory of data logger, saving it in personal computer.

Data Logger	TDS-303, TDS-102, TC-31K
Interface	RS-232C





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