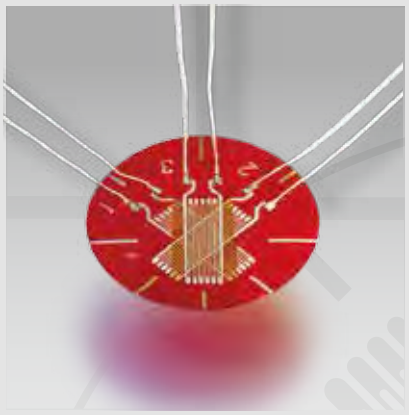
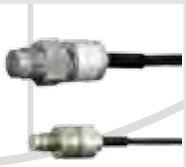
TML Pam E-8501D

TML

PRODUCT GUIDE 2017





- STRAIN GAUGES
- STRAIN GAUGE TRANSDUCERS
- MEASURING INSTRUMENTS
- AUTOMOTIVE MEASURING SYSTEM
  Vehicle powertrain/Driving stability
- SPECIAL PURPOSE MEASUREMENTS
- MEASUREMENT SOFTWARE *Visual LOG*®

TML Tokyo Sokki Kenkyujo Co., Ltd.

TML Strain Gauges with a Proven Perfomance Record

Advances in technology have led to construction of new buildings that are more sophisticated and complex than any that have come before.
This trend has made strain measurement an even more critical part of ensuring structural integrity and safety.
TML is an industry leader in strain gauges. Our products enjoy an outstanding reputation both in Japan and abroad, where they meet the high-level needs of customers ranging from research facilities to civil engineering and construction companies.
We have also developed a wide variety of strain measurement accessory products to complement our strain gauges.
At TML you can count on field-proven products that meet the industry's highest standards for quality, accuracy and performance.

TML is accredited in FORCE field.

JCSS 0090

Tokyo Sokki Kenkyujo Co., Ltd. (TML) is accredited by Japan Calibration Service System (JCSS), conformed to international standards JIS Q 17025 (ISO/IEC 17025) under the laboratory accreditation body ISO/IEC 17011. International Accreditation Japan (IA Japan) plays as the accreditation body of JCSS and is a signatory to MRA of Asia Pacific Laboratory Accreditation Cooperation (APLAC) as well as International Laboratory Accreditation Cooperation (ILAC). Our Kiryu factory is certified as a JCSS-accredited laboratory working in compliance with an international Mutual Recognition Arrangement (MRA). The accreditation number of the Kiryu Factory is 0090.

TML Calibration Service

Offers calibration service and support for your measuring instruments

Maintaining strict calibration for various measuring instruments to be used is essential. We offer calibration service to certify that the instruments are traceable to National standards.

- Issue of calibration certificate with logo of MRA/JCSS for force transducers
  There are JCSS calibration and general calibration according to TML in-house regulations for force transducers (load cells). The JCSS calibration for universal load cells is only for either tension or compression. In the general calibration, both tension and compression are calibrated. The JCSS calibration is only for combination of a load cell and a measuring instrument.
- TML 10MN force calibration machine calibrated directly by National Institute of Advanced Industrial Science and Technology (AIST).
- Combined calibration with other maker's products
  Calibration or traceability certificates for combined devices.
  N.B. Calibration for other maker's products only is out of service.
- A certificate for calibration of up to 10 force transducers with the same indicator can be issued.
- Measurement management in accordance with ISO9001
- EMC (Electromagnetic Compatibility) calibration for TML instruments
- For the calibrated instruments, the following certificates are issued on request:
  [JCSS Calibration Certificate/TML General Calibration Certificate] or [Short-form Certificate] to certify calibration and traceability for individual products
- [Detailed Calibration Certificate] including calibration data for all devices used for calibration
- [Certificate of Traceability] showing that the devices used for calibration are traceable to National Standards or public calibration laboratories.
- [Certificate of Combined Calibraiton] for combination with our product or other maker's products

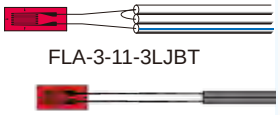
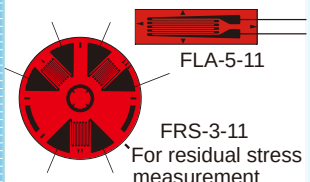
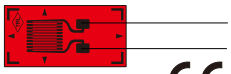
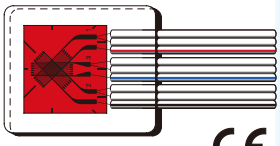
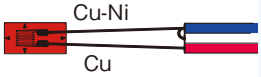
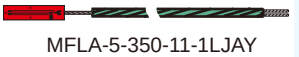
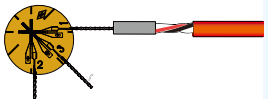
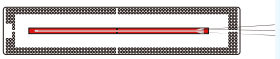
JCSS Calibration Certificate
for combined Load Cell and instrument

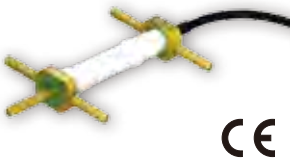
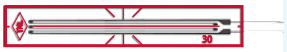
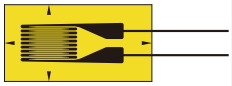
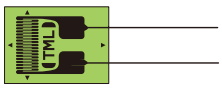
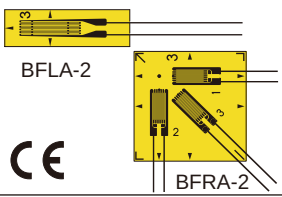
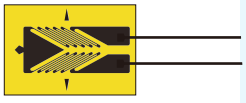
TML General Certificate of Calibration

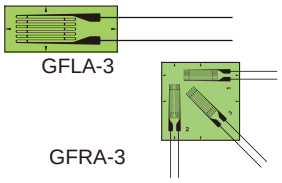
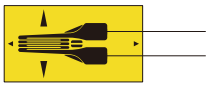
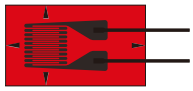
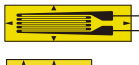
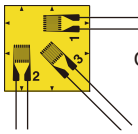
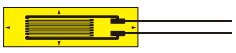
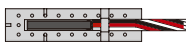
TML Short-form Certificate of Calibration

TML Combined Certificate of Calibration

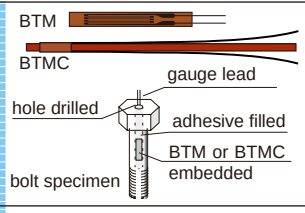
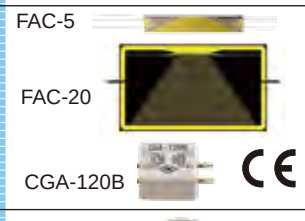
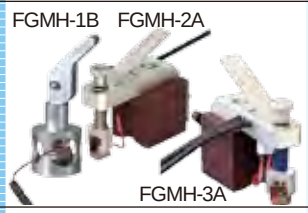
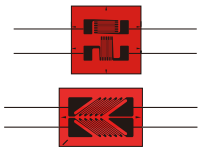
TML Certificate of Traceability

Gauge Series	Gauge Pattern (example)	Description	Gauge Length (mm)	Operating Temperature Range (°C)	Remarks
Integral leadwire Strain Gauge	 FLA-3-11-3LJBT FLA-1-11-1LJC	Most of TML strain gauges are available with extension leadwires pre-attached at our factory. Those leadwire-integrated strain gauges greatly save the time and labor for the leadwire connection works during the strain gauge installation. The F, PF and P series strain gauges are available with 2-wire (1, 3 or 5 meter) or 3-wire (3 or 5 meter) paralleled vinyl leadwire as standard specifications. In addition, various kinds of leadwires are available for use in high/low temperature and/or in many other conditions with many other series of strain gauges. Most of our leadwires are optionally available with CE marking by applying "F-option". Please contact TML or your local representative for the details.			
Foil Strain Gauge F	 FLA-5-11 FRS-3-11 For residual stress measurement	These gauges employ Cu-Ni alloy foil for the grid and special plastics for the backing. The backing exhibits excellent electrical insulation performance and is color coded to identify the material for self-temperature-compensation. A strain gauge with small gauge length as 0.2mm and a stress concentration measurement gauge are also available in this series. The operating temperature range is -196 to +150°C.	0.2~30	−196~+150	Single/ 2-/ 3-element
Foil Strain Gauge F GOBLET	GOBLET  FLAB-1-11	Strain gauges compliant with RoHS2 Directive 2011/65/EU are added to the lineup in F series with our loge GOBLET. In addition to the use of a special plastics backing, these gauges have a unique gauge pattern. Owing to these, the GOBLET gauges show excellent fatigue life and wide operating temperature range of -196 to +150°C which are the same as the ordinary F series strain gauges	0.2~30	−196~+150	Single/ 2-/ 3-element
Foil Strain Gauge WF	 WFRA-3-11-3LDBTB-F	This gauge is designed to eliminate the need for moisture-proofing-coating, which sometimes makes troublesome in field test. The gauge has vinyl lead wire and whole area of the gauge and junction of lead wire are fully overcoated with transparent flexible epoxy resin.	3, 6	0~+80	Single/ 2-/ 3-element
Temperature-integrated Strain Gauge FLA-T/QFLA-T	Cu-Ni  Cu FLA-2T-11-3TLJBT	This is TML's original strain gauge including T-thermocouple. One core of three-core parallel lead wire of the strain gauge is made of Cu-Ni wire, while other two cores are made of ordinary Cu wire. A T-thermocouple is composed of the Cu-Ni wire and one of the Cu wire. Strain measurement with quarter bridge 3-wire method and accurate temperature measurement are available using TML's Data Logger.	1~5	FLA-T: −20~+80 QFLA-T: −20~+200	Single element
Magnetic field Strain Gauge MF	 MFLA-5-350-11-1LJAY  MFRAL-2-350-6FD1LTS	This gauge is intended for strain measurement in the magnetic field. Sensing material and grid configuration make the gauge less sensitive to the influence of alternating field. This gauge is supplied with integral twisted lead wires. 2- and 3-element gauges are usable in high temperature up to +200°C.	Single element 2, 5, 60 2-/3-element : 2	Single element −20~+80 2-/3-element : −20~+200	Single/ 2-/ 3-element
Concrete surface Foil Strain Gauge PF	PFLR-30-11 	This is a foil strain gauge having the same transparent plastic backing as that of P series gauge. Electrical insulatioin is excellent, and installation is very easy. It is especially recommendable for the measurement on mortar. Extenstion leadwire pre-attached is only for single element PFL available, but not for 2-element PFLC, 3-element PFLR.	10~30	−20~+80	Single/ 2-/ 3-element
Concrete surface Polyester Strain Gauge P	 PL-60-11	This gauge is a standard wire strain gauge utilizing a transparent plastic backing impregnated with a polyester resin. Gauge length is available in 3 steps from 60~120mm, so it is suited for measurement of concrete strain. Extenstion leadwire pre-attached is only for single element PL available, but not for 2-element PLC, 3-element PLR.	60~120	−20~+80	Single/ 2-/ 3-element
Concrete surface Metal-backing Strain Gauge FLM/WFLM	 FLM-60-11	This gauge is designed for successful strain measurement on the concrete surface. It has a thin stainless steel backing which prevents penetration of moisture from the reverse side. It retains good electrical insulatioin to the concrete surface.	30, 60	−20~+80	Single/ 2-/ 3-element
Concrete embed-ment Mold Strain Gauge PM	 PML-60-2LJD	This gauge is designed for the measurement of interior strain in concrete under loading test by simply embedding the gauge.	60, 120	−20~+60	Single element

Gauge Series	Gauge Pattern (example)	Description	Gauge Length (mm)	Operating Temperature Range (°C)	Remarks
Concrete embedment Mold Strain Gauge PMF	 PMFL-50-2LJRTA PMFL-50T-3TLJBT	This gauge has been exclusively designed for measuring interior strain in concrete or mortar under loading test. It employs super engineering plastics capable of superior water proofing characteristics. Temperature sensor integrated model PMFL-T is available for measurement of both strain and temperature.	50, 60	−20~+60	Single element
Asphalt embedment Strain Gauge PMFLS	 PMFLS-60-50-2LTSC	This gauge is embedded in asphalts and used for testing in loading application such as rolling compaction. The material of the backing is a super engineering plastics with water and heat resitance. The gauge withstand a high temperature up to 200°C in placement of asphalt.	60	−20~+60	Single element
Concrete surface and/or embedment Strain Transducer KM		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. A built-in thermocouple sensor models enable actual temperature measurement in addition to strain measurement. Adding to the above embedment use, surface strain measurement on concrete or H-beam steel is also available.	31~200	−20~+180	Strain : Full bridge Temperature : Quarter bridge 3-wire
Asphalt embedment Strain Transducer KM-100HAS		This strain transducer consists of flanges at which reinforcing bars are mounted for a good fixation in asphalt pavement materials, a thin spring element connected to the flanges, and metallic pipe and fluoroplastic tape to protect the spring element. This transducer has a heat-resistive and waterproof construction. The asphalt strains are converted into electrical signals and can be read out with a strainmeter.	100	−20~+180	Strain : Full bridge Temperature : Quarter bridge 3-wire
Wood Strain Gauge PFLW/PLW	 PFLW-30-11	This gauge has a thin metal backing for long term measurement on woods, not affected by moisture enclosed in wood. The gauge is bonded with PS adhesive.	30, 60	−20~+80	Single element
Post-Yield Strain Gauge YEF/YF	 YFLA-2	These gauges feature a special plastic carrier base capable of withstanding extreme elongation without creeping or cracking. The YEF series is for 10~15% elongation, and YF for 15~20% with high accuracy. These gauges must be bonded with CN or CN-Y adhesive. The YEF is also suited for measurement of repeatedly applied strain in elastic range.	2~20	−20~+80	Single/ 2-/ 3-element
Post-Yield Strain Gauge YHF	 YHFLA-5	These gauges are developed for the measurement of very large strain up to 30~40%. They are not applicable to the measurement of repeated strain in elastic modulus range as well as in large range.	2, 5	−30~+80	Single element
Composite Strain Gauge UBF	 UBFLA-03	This gauge is designed for measurement on composite materialls. It has a specially designed grid configuration to reduce the tightening effect of the gauge to the specimen. Developing soft carrier backing, this gauge features advanced characteristics of thermal cycle examination and gauge creep.	0.3, 1	Static use: −30~+120 Dynamic use: −30~+150	Single element
Composite Strain Gauge BF	 BFLA-2 BFRA-2	This is a foil strain gauge intended for the measurement of fibre reinforced plastics. It utilizes polyimide backing and special grid configuration, which allow a good performance in strain measurement up to +200°C.	2, 5	−20~+200	Single/ 2-/ 3-element
Stress Gauge SF	 SFA-285	This gauge is designed for measuring the stress in optional direction in a plane stress field. This gauge can detect the stress in gauge axial direction regardless of shearing strain. This gauge is available for mild steel, stainless steel SUS304 and aluminium.	4	−20~+200	–

Gauge Series	Gauge Pattern (example)	Description	Gauge Length (mm)	Operating Temperature Range (°C)	Remarks
Low Elastic Strain Gauge GF	 GFLA-3 GFRA-3	This gauge is a foil strain gauge which is desgined for materials with a low elastic modulus such as plastics. It has a special configuration to minimize the effect of gauge installation. Self temperature compensation for thermal expansion coefficient of 50 and 70x10^{-6}/°C is available.	3, 6	−20 ~ +80	Single/2-/3-element
High/Low temperature Strain Gauge CEF	 CE	This gauge has a polyimide-amide carrier backing for use in wide temperature range from cryogenic condition up to 200°C.	1, 3, 6	−269~+200	Single element
Cryogenic temperature Strain Gauge CF	 CE	This is an epoxy backing foil strain gauge designed for measurement under cryogenic conditions. The specially selected and heat-treated sensing foil of this gauge shows very small zero shift under cryogenic temperature compared with conventional strain gauge.	1~6	−269~ +80	Single/ 2-/ 3-element
High Temperature Strain Gauge QF	 QFLA-5-11  QFRA-1-11 CE	This is a foil strain gauge having polyimide backing which exhibits excellent performance at high temperature. Stress concentration measurement gauge or shear stress measurement gauge is also available in this series.	0.2~6	−20~+200	Single/ 2-/ 3-element
High Temperature Strain Gauge ZF	 ZFLA-1-11 CE	This is a foil strain gauge having polyimide backing and special grid configuration designed on the basis of many tests and calculations. The strain sensing element is a Nickel-Chrome foil, so this gauge is successfuly used for high temperature measurement	1~6	−20~+300	Single/ 2-/ 3-element
High Temperature Strain Gauge EF	 EFLK-02-11  EFRA-05-11 CE	This gauge has polyimide backing and is designed very small for use in measurement of printed circuit boards or surface mounted devices which are getting smaller and smaller. The maximum operational temperature range of single element gauge is 300°C, which is different from that of two or three element gauges.	Single element 0.2 2- /3- element 0.5	Single element −196~ +300 2- /3- element −196~ +200	Single/ 2-/ 3-element
High Endurance Strain Gauge DSF	 DSFLA-5-350 CE	This gauge is designed for fatigue test in high stress level such as composite materials. It satisfies the fatigue life over 10 million times at a strain level of ±3000x10^{-6}. It is suited to loading tests of materials under repeated strains.	2, 5	−60~+200	Single element
Weldable Strain Gauge AW	 AW-6-350-11-01LT	This gauge is made of 0.08mm thick stainless steel carrier base and a high temperature foil strain gauge usable up to 300°C. It is installed by spot welding.	6	−196~ +300	Single element
Weldable Strain Gauge AWC/AWCH	 AWC-8B-11-3LT  AWCH-2-11-MI-2L-05LQ	These gauges have hermetically sealed stainless steel strain tube and mounted by spot welding. Neither coating nor wiring is needed. Suitable for long term measurement in harsh environments. AWC-8B is of quarter bridge 3-wire system, while AWC-2B and AWCH-2 are applicable to our developed 1-gauge 4-wire strain measurement method.	2, 8	AWC-2B/-8B −20~+100 AWCH-2 −196~+200	Single element
Weldable Strain Gauge AWM/AWMD AWH/AWHU	 AWHU-5  AWHU-8 CE	These gauges have a metal carrier backing such as stainless steel and designed to be spot-welded to the test specimen.			

AWM-8	8	-196~+300	Static/Dynamic
AWMD-5/-8	5, 8	-196~+800	Dynamic
AWH-4/-8	4, 8	-196~+600	Static
		-196~+650	Dynamic
AWHU-5/-8	5, 8	-196~+800	Static/Dynamic

Gauge Series	Gauge Pattern (example)	Description	Gauge Length (mm)	Operating Temperature Range (°C)	Remarks
Bolt Strain Gauge BTM/BTMC CE		Bolt strain gauge is intended for measuring a tensile force of bolt tightening. After a hole is drilled at the center of a bolt, the BTM is embedded with heat-curing A-2 adhesive or the BTMC is easily embedded with fast-curing CN adhesive. This method has the advantage where an ordinary strain gauge cannot be mounted on the bolt surface.	BTM: 1, 6 BTMC: 0.5, 1, 3	−10~ +80	Single element
One-side Strain Gauge DD		This gauge is specially designed to separately measure bending and tensile stresses by bonding the gauge to one side of a plate or beam on the assumption that strain distribution in the section of the plate or beam subjected to both bending and tensile stress is linear.	3	−10~ +70	Single element
Crack Detection Gauge FAC	 CE	This gauge is designed to measure the progress of crack and the rate of growth in a test specimen for which metal fatigue should be monitored. Special adaptor CGA-120B is required between the gauge and strainmeter.	—	−30~ +80	Single element
Frictional type Axial force Strain Transducer FGAH		This is a transducer designed for measuring axial strain of a tie-rod (tension rod). It is suited to measurement of steering tie rod of a motor car. It is also applicable for tensile force measurement of tension rod in a seismic strengthened architecture or a steel frame structure.	—	−20~ +60	Single element Full bridge
Frictional type Torque Sensor System FGDH		This sensor system is developed with frictional strain gauge, not requring bonding ahdhesive, and telemetry transmitter is incorporated. By installing it on a car's driving shaft, torque can be easily measured. Two models of FGDH-2A and FGDH-3A are available for different telemetry receiver.	—	FGDH-2A −20~ +60 FGDH-3A −20~ +60	Special
Frictional type Strain Checker FGMH		The strain checker picks up strain through friction by pressing down the strain sensing element on the structures with the magnet. The checker can be easily fixed on the position of interest and immediately gets ready for strain measurement.	—	0~ +60	Single/ 3-element
Transducer specific Strain Gauges		TML strain gauges are used not only for the purpose of knowing strain/stress of the material but also as a sensor for strain gauge type transducers. A strain gauge type transducer converts physical quantity such as load, pressure or displacement into mechanical strain on an elastic body, and the mechanical strain is converted into electrical output using strain gauges mounted on the elastic body. These gauges are designed especially for use in transducers.	For details, contact TML or your local representative.		

SPOT WELDER W-50R

This is a capacitive discharge spot welder used for installing weldable strain gauges and fixing lead wires. The welding energy is controlled in 2 ranges of 1~10/5~50 watt second continuously,and a stabilizing circuit cancels the effect of changes in the power source voltage.

STRAIN GAUGE CLAMP

Gauge Mate GMA/GMR

GMA-S
for flat specimen of 1mm thick or more

GMR-S
for round specimen of 6~32mm-dia.

PRESSEE

with pressing area of 19mm-dia. for flat specimen

These are pressing jigs for strain gauge adhesion. They can be used with room-temperature curing type bonding adhesive. The pressing part of the Pressee is transparent, and the adhesion state can be confirmed.

Press & See

STRAIN GAUGE ADHESIVES

Type	Component	Operating Temperature	Applications
P-2	Polyester	− 30 ~ +180°C	Two component Room-temperature-curing (Mixing ratio: 2-6%)
RP-2	Polyester	− 30 ~ +180°C	Two component Room-temperature-curing (Mixing ratio: 2-4%)
NP-50B	Polyester	− 30 ~ +300°C	Two component Room-temperature-curing (Mixing ratio: 3-4%)
PS	Polyester	− 30 ~ +100°C	Two-component, Room-temperature-curing (mixing ratio: 2 ~ 4%), Concrete use
CN	Cyanoacrylate	− 196 ~ +120°C	Single component Room-temperature-curing, Metal, Plastics, Composite
CN-E	Cyanoacrylate	− 30 ~ +120°C	Single component Room-temperature-curing, Concrete, Mortar, Wood
CN-Y	Cyanoacrylate	− 30 ~ + 80°C	Single component, Room-temperature-curing, Metal, Plastics, Composite, Post-Yield gauge use
CN-R	Cyanoacrylate	− 30 ~ +120°C	Single component, Room-temperature-curing, For use in low temperature, Winter season's production
C-1	Phenol	−269 ~ +200°C	Single component, Heat-curing, Recommendable for use in long term of period and in high temperature, Metal
EA-2A	Epoxy	−269 ~ + 50°C	Two component, Room-temperature-curing (mixing ratio: 2:1), Cryogenic temperature use Metal, Concrete, Composite
EB-2	Epoxy	− 60 ~ +200°C	Two component, Room-temperature-curing (mixing ratio: 10:3), Long term measurement use Metal, Composite
A-2	Epoxy	− 30 ~ +100°C	Two component, Room-temperature-curing (mixing ratio: 10:1), BTM bolt strain gauge use, Bolt

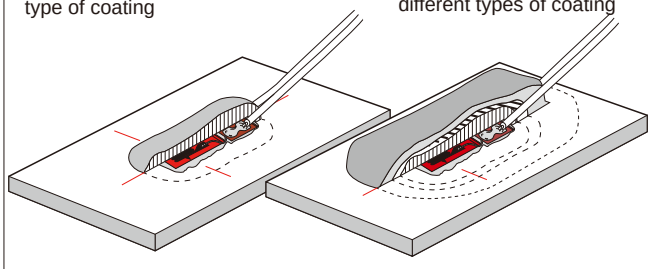
SDS : SAFETY DATA SHEET
TML supplies SDS for all strain gauge adhesives and coatings. Contact your TML supplier for more information.

STRAIN GAUGE COATING MATERIALS

Type	Operating Temperature	Application	Materials	Description
W-1	0 ~ +50°C	Hot-melting +100~+120°C Room-temperature curing	Microcrystalline wax solid	General purpose coating for laboratory and field requirements where mechanical protection is not needed, or as a prime-coat for duplex coating.
N-1	−30 ~ +80°C	Air-drying A half day in room temperature curing	Chloroprene rubber based solvent thinned	Moisture- and water-proofing coating for laboratory and less severe field requirements where mechanical protection is not needed.
K-1	−269 ~ +60°C	Air-drying A half day in room temperature curing	Special rubber based solvent thinned	Moisture-proofing coating from cryogenic to room temperature for laboratory requrements. Does not provide a high degree of mechanical protection.
UE-1	−40 ~ +150°C	Air-drying A half day in room temperature curing	Special rubber based solvent thinned	Oil-resistant coating for laboratory and field requirements. Does not provide a high degree of mechanical protection.
SB tape	−30 ~ +80°C	Pressure sensitive	Butyl rubber	Moisture- and water-proofing coating for laboratory and field requirements where mechanical protection is not needed, or used as a first coating for multi-layer coating. 10mm (wide) × 3mm (thick) 5m long/roll
VM tape	−20 ~ +80°C	Pressure sensitive	Butyl rubber	Used as a second coating or later for multi-layer coating. Offers excellent moisture and water resistant characteristics. Very convenient for use. 38mm (wide) × 1mm (thick), 6m long/roll
KE-348W/ KE -348T	−50 ~ +200°C	Air-drying solvent-thinned a half day in room temperature	Silicon rubber	Heat-resistive Two types: KE-348W of white color and KE-348T of transparent material.
TSE3976-B	−50 ~ +250°C	Air-drying solvent-thinned a half day in room temperature	Silicon rubber	Heat-resistive For short term use, approximately one day, higher termperature is available up to 300°C.

Single-layer coating with one type of coating

Multi-layer coating with different types of coating



SDS : SAFETY DATA SHEET
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Contact your TML supplier for more information.

CONNECTING TERMINALS

Connecting terminals provide convenient junction points to connect strain gauges to instrumentaion leads.

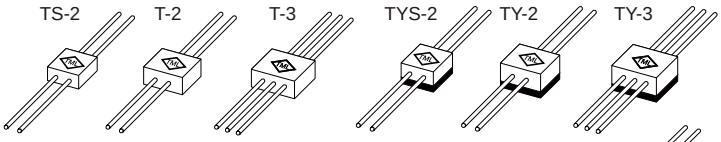
Cubic shape

for general purpose

TS-2 T-2 T-3

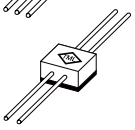
for large strain with rubber backing

TYS-2 TY-2 TY-3

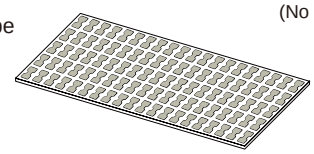


TP-2

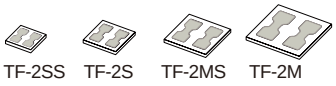
Self-bonding type
(No adhesive required)



Foil shape



for general purpose



TF-2SS TF-2S TF-2MS TF-2M

for large strain with rubber backing

TFY-2SS TFY-2S TFY-2MS TFY-2M

High temperature use with polyimide resin backing

TPF-2SS TPF-2S TPF-2MS TPF-2M
TPFH-2SS TPFH-2S TPFH-2MS —

NB:

TPFH series features heat-resistive connecting terminals with polyimide resin backing to TPF. It allows high temperature measurement using QF/ZF series gauges and bonding repetition on the terminals.

Cubic shape

Type	Dimension (mm)	Operating Temperature	Quantity per box
TS-2	7.5×7.5× 5	−20 ~ + 90°C	100
T-2	10 × 10× 5	−20 ~ + 90°C	100
T-3 (3-wire method)	10 × 10× 5	−20 ~ + 90°C	100
TYS-2	7.5×7.5× 7	−20 ~ + 90°C	100
TY-2	10 × 10× 7	−20 ~ + 90°C	80
TY-3(3-wire method)	10 × 10× 7	−20 ~ + 90°C	80
TP-2	10 × 10× 6	−20 ~ + 60°C	100

Foil shape

Type	Dimension (mm)	Operating Temperature	Quantity Pairs/sheet
TF-2SS	4.6×3.8×0.2	−196 ~ + 180°C	50
TF-2S	6 ×5.3×0.2	−196 ~ + 180°C	50
TF-2MS	8 ×7.2×0.2	−196 ~ + 180°C	50
TF-2M	10 ×9.2×0.2	−196 ~ + 180°C	50
TFY-2SS	4.6×3.8×0.8	−20 ~ + 120°C	50
TFY-2S	6×5.3×0.8	−20 ~ + 120°C	50
TFY-2MS	8×7.2×0.8	−20 ~ + 120°C	50
TFY-2M	10×9.2×0.8	−20 ~ + 120°C	50
TPF-2SS	4.6×3.8×0.2	−196 ~ + 200°C	50
TPF-2S	6×5.3×0.2	−196 ~ + 200°C	50
TPF-2MS	8×7.2×0.2	−196 ~ + 200°C	50
TPF-2M	10×9.2×0.2	−196 ~ + 200°C	50
TPFH-2SS	4.6×3.8×0.1	−269 ~ + 350°C	50
TPFH-2S	6×5.3×0.1	−269 ~ + 350°C	50
TPFH-2MS	8×7.2×0.1	−269 ~ + 350°C	50

1-GAUGE 4-WIRE STRAIN MEASUREMENT METHOD

For strain gauge measurement, various bridge configurations are employed accoring to the number of strain gauges to be used and measuring purpose. In quarter bridge configuration, three wire method is widely used to remove the effect of temperature to gauge leadwire resistance; however, some measurement error is caused by variation of contact resistance of connection parts and correction for gauge factor change due to lead wire resistance is required. Our patented 1-gauge 4-wire strain measurement method serves to eliminate such an error and make gauge factor correction unnecessary.

Leadwire resistance

In conventional method, it is recommended to use a leadwire as thick and short as possible to keep the resistance of the leadwire as low as possible. On the contrary, since the 1-gauge 4-wire measurement is not influenced at all by the leadwire resistance, it is possible to connect a thin and/or long leadwire to the strain gauge.

Contact resistance

In conventional method, leadwire extension and connection to a measuring instrument are done by soldering or the use of exclusive connector. As the 1-gauge 4-wire method is not affected at all by contact resistance, a modular plug can be used. Because the modular plug makes leadwire extension and connection to the instrument possible by merely plugging in, the efficiency of wiring work and prevention of wiring mistake are achieved and also RoHS-compliant lead free soldering is unnecessary.

Using commercial interconnection adapter, leadwire extension can be easily done.

Instruments applicable

With TML Data Logger, 1-gauge 4-wire method is completed by merely connecting the modular plug to its built-in switching box or Switching Box.

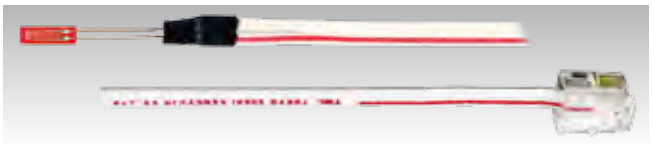
Data Loggers:
TDS-630, TDS-530, TDS-150, TC-32K

Switching Boxes:
IHW-50H, IHW-50G, ISW-50G
SSW-50D, FSW-10, CSW-5B

Strain gauges with leadwires and modular plug

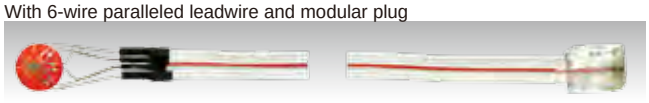
The strain gauges are used in our developed 1-gauge 4-wire strain measurement method. Most of our strain gauges can be supplied with pre-attached leadwires and modular plug (RJ12). As a modular plug is attached to the end of the leadwire, soldering or screwing connectioin to a measuring instrument is unnecessary, but the instrument must be of TML make. The 4-wire leadwires are covered with polypropylene resin which does not generate noxious gas even if incinerated.

Single element strain gauge with 4-wire paralleled leadwire

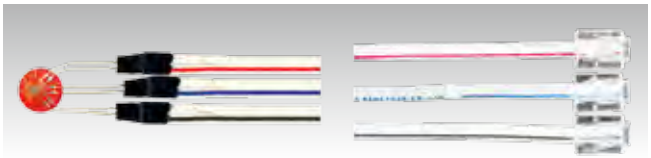


Rectangular 3-element, 0°/45°/90° stacked rosette strain gauge

With 6-wire paralleled leadwire and modular plug



With 4-wire paralleled leadwire and modular plug



LOAD CELLS Compression

CLS-NA/CLS-NB	CLB-NA	CLA-NA	CLG-NB
			
Compression, Miniature 2N~10kN	Low Range, Compression 50~200N	Compression 500N~20kN	Compression, Low Profile 10~200kN

LOAD CELLS Compression

CLP-NB	CLU-NA	CLM-NB	CLJ-NA
			
Compression 10kN~10MN Dual-output option is available.	Compression 10kN~1MN Dual-output option is available.	Compression, High Performance 10~500kN	Compression, High Performance Remote sensing 5~30kN

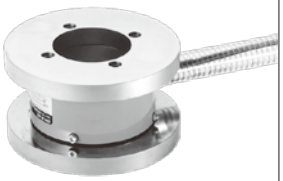
LOAD CELLS Compression

CLJ-NB	CLF-NA	CLL-NA/CLH-NA	CLR-NAH
			High temperature +160°C 
Compression, High Performance Remote sensing 50kN~10MN	Compression, Low Profile 500kN~10MN	Compression, Flat Face CLH-NA 1~2MN CLL-NA 500kN~1MN	500N~200kN

LOAD CELLS Compression

KCE-NA	KCM-NA	CLC-NA	KCG-NA
			
Compression, Center-hole 500kN ~ 2MN	Compression, Center-hole 10kN ~ 5MN	Compression, Center-hole 50kN ~ 5MN	Compression, Center-hole Strand force measurement 200kN

LOAD CELLS Compression

KCC-NA	KCK-NA
	
Compression, Center-hole 200kN ~ 1MN	Compression, Center-hole 500kN / 1MN

Tension/Compression universal

TCLB-NA	TCLA-NB
	
Tension/Compression 50~200N	Tension/Compression 500N~20kN

LOAD CELLS Tension/Compression universal

TCLK-NA	TCLZ-NA	TCLM-NB	TCLY-NA
			
Tension/Compression 5~50kN	Tension/Compression High Performance 10N~10kN	Tension/Compression High Performance 10~200kN	Tension/Compression High Performance 300kN~2MN

LOAD CELLS Tension/Compression universal

TCLP-NB

Tension/Compression 10kN~2MN
Dual-output option is available.

TCLU-NA

Tension/Compression 10~200kN
Dual-output option is available.

TCLN-NA

Miniature Tension/Compression
500N~5kN

Tension

TLJ-NA

Tension, High Performance
Remote sensing
10~100kN

LOAD CELLS Tension

TLP-NB

Tension 10kN~1MN
Dual-output option is available.

3-Component

SLP-NA-T

Fx, Fy, Fz : 100N~1kN

TORQUE TRANSDUCERS

LTA-NA

Socket Wrench Torque Transducer
50~500N·m

LTB-NA

Flange Type Torque Transducer
10N·m~1kN·m

DISPLACEMENT TRANSDUCERS

CDP/CDP-D

CE (CDP only)

High Sensitivity 5~100mm(CDP)
Spring Loading, Dual-output
50/100mm (CDP-D)

CDP-B

Drip-proofing, High Sensitivity
Spring Loading 5~25mm

CDP-M/CDP-MT

Miniature, High Sensitivity
5~100mm

DDP-A

Dial Gauge Type
10~50mm

DISPLACEMENT TRANSDUCERS

SDP-C/SDP-D

Spring Loading 50/100mm(SDP-C)
Spring Loading 200/300mm(SDP-D)

SDP-CT

Spring Loading, Tension Type
50/100mm

DP-E

Tape Measure Type, Long Span
500 ~ 5000mm

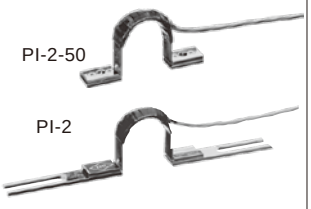
FDP-A

Protection ratings: IP-68

Waterproof, LVDT Type
10 ~ 100mm

DISPLACEMENT TRANSDUCERS

PI

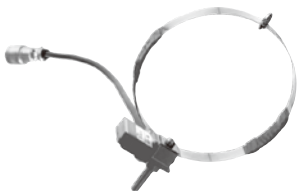


Large Span ±2 / ±5mm
Gauge Length 50~300mm

CE

Cantilever Type 2~10mm

OU



Ring Type 10 ~ 30mm

RA/RA-L

COD Measurement

RA / RA-L 2/5mm
RA-L for Cryogenic temperature -196°C

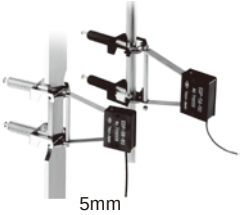
DISPLACEMENT TRANSDUCERS EXTENSOMETER

UB/UB-A

COD Measurement

UB 2/5mm
UB-A 5mm (ASTM compatible)

EDP-A/EDP-B



5mm
For Round Specimen : EDP-A
For Flat Plate Specimen : EDP-B

PRESSURE TRANSDUCERS

PW-PA/PWH-PA

Cavity Type

PW-PA 100kPa~50MPa

PWH-PA 70~200MPa

PWF-PB/PWFC-PB

Flush Diaphragm Type

PWF-PB 1~50MPa

PWFC-PB (Small) 2~50MPa

PRESSURE TRANSDUCERS

PW-PAH

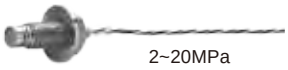
High Temperature +170°C

Small, 2~50MPa

PWFD-PB/PWFE-PA

High Temperature +150°C

Bolt Mount type



2~20MPa

PWFD-PB (M8 size)

PWFE-PA (M6 size)

2~20MPa

PWFA-PA

High Temperature +120°C

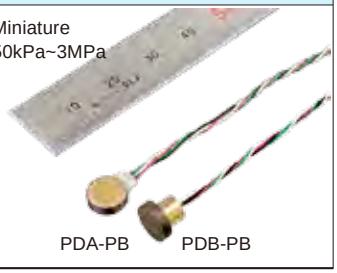
Amplifier-integrated

2~20MPa

Small and lightweight

PDA-PB/PDB-PB

Miniature
50kPa~3MPa



PDA-PB PDB-PB

ACCELERATION TRANSDUCERS

ARS-A

High Sensitivity
10m/s^2

ARM-A-T

Small, Tri-Axial
X, Y: 100m/s^2 , Z: 400m/s^2

ARF-A/ARF-A-T

Small, Low Range
Uni-axial : 10~500m/s^2, ARF-A
Tri-axial : 20~500m/s^2, ARF-A-T

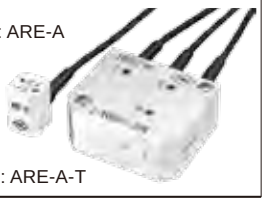
Uni-axial
ARF-A

Tri-axial
ARF-A-T

ARE-A/ARE-A-T

Uni-axial ARE-A 1000～10000m/s^2
Tri-axial ARE-A-T 1000～ 5000m/s^2

Uni-axial: ARE-A



Tri-axial: ARE-A-T

ACCELERATION TRANSDUCERS

ARH-A

Protection ratings: IP-67

Waterproof, Low Range 10 ~ 500m/s^2

ARJ-A/ARJ-A-D/ARJ-A-T

Small, High Frequency Response
50 ~ 2000m/s^2

Uni-axial
ARJ-A

Bi-axial
ARJ-A-D

Tri-axial: ARJ-A-T

ARK-A

Small, High Frequency Response
1000/2000m/s^2

Accessory Mounting Plates

ARJF-11 ARFF-11 ARHF-11

ARJF-12 ARSF-11

STRAIN TRANSDUCERS

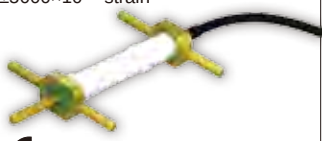
KM/KM-AT/KM-BT

±5000×10^{-6} strain

NB: KM-30 and KM-50F not compliant to CE marking.
For concrete materials
Thermocouple-integrated : KM-AT/-BT

KM-100HAS

±5000×10^{-6} strain



For asphalt pavement materials

REINFORCING-BAR METER

KSA-A/KSAT-A

300N/mm^2
KSAT-A Thermocouple-integrated

JOINT METER

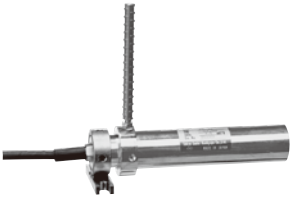
KJA-A/KJB-A

5~50mm

KJA-A for embedment in concrete
KJB-A for concrete surface

SHEAR-DISPLACEMENT TRANSDUCER

KU-A



For Concrete Structures : ±2.5mm

CRACK DISPLACEMENT TRANSDUCERS

KG-A

For Concrete Crack : ±2/±5mm

KG-B

For Concrete Crack in 2-directions
X: +4mm/−2mm, Y: ±3mm

COMPRESSOMETER

CM/CM-H

Gauge length:
CM : 100/125/150mm
CM-H for destructive test : 100mm

PORE PRESSURE GAUGES

KPA-PA/KPB-PA

KPA-PA

KPB-PA

ϕ40mm 200kPa~2MPa

KPC-PA/KPD-PA

KPC-PA

KPD-PA

ϕ30mm 200kPa~2MPa

KPE-PB

Small, For model testing
200kPa~2MPa

SOIL PRESSURE GAUGES

KDA-PA/KDB-PA

ϕ200mm

KDB-PA

KDA-PA

200kPa~2MPa

SOIL PRESSURE GAUGES

KDC-PA/KDD-PA

ϕ100mm

200kPa~2MPa

KDE-PA/KDF-PA

ϕ50mm

200kPa~2MPa

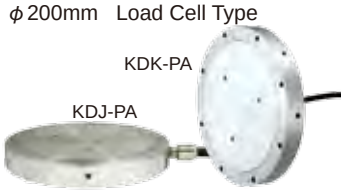
KDG-PA/KDH-PA

ϕ100mm Load Cell Type

200kPa~2MPa

KDJ-PA/KDK-PA

ϕ200mm Load Cell Type



200kPa~2MPa

SOIL PRESSURE GAUGES INCLINOMETERS

KDL-PA

ϕ180mm Small Aspect Ratio

200kPa

KB-AB/KB-AC

Surface Type

±1~5°

KB-AB : 1-directional
KB-AC : 2-directional

KB-DB/KB-EB

Small Type

±5/±10°

KB-DB : 1-directional
KB-EB : 2-directional

KB-JG/KB-KG

Multi-layer use

±5/±10°

Max 15 layers

KB-JG : 1-directional
KB-KG : 2-directional

INCLINOMETERS

KB-JH/KB-KH

Multi-layer use

±5/±10°

Max 31 layers

KB-JH : 1-directional
KB-KH : 2-directional

KB-KD

Multi-layer use

±5/±10°

Max 15 layers

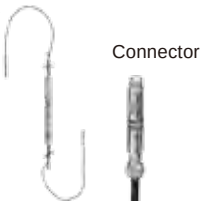
2-directional High Outputs

NKB-LE/NKB-ME

Multi-layer use for TML-NET

Connector

±5/±10°



NKB-LE : 1-directional
NKB-ME : 2-directional

KB-P

Built-in Arrestor

Embedment Type

±5/±10°

INCLINOMETERS

KB-GC/KB-HC

Insertion Type

±5/±10°

KB-GC : 1-directional
KB-HC : 2-directional

MICRO-CREEP METER

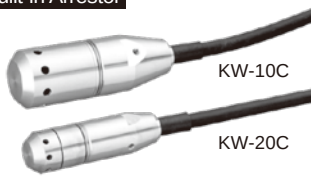
KH-A

5mm

WATER LEVEL METERS

KW-C

Built-in Arrestor



10, 20, 30, 50m

WATER-TUBE DISPLACEMENT TRANSDUCERS

KWL-E

Built-in Arrestor

KWL-E

Water Level Type 100, 200mm

GROUND EXTENSION GAUGES

KLG-A/NKLG-AB

Built-in Arrestor

Land Slide Measurement

KLG-A : 200mm

NKLG-AB: TML-NET compatible 200mm

KLG-B/NKLG-BB

Built-in Arrestor

Land Slide Measurement

KLG-B : 50, 100mm

NKLG-BB: TML-NET compatible 50, 100mm

SETTLEMENT TRANSDUCERS

KLA-A/NKLA-B

Max 6 layers

KLA-A : 100, 200mm

NKLA-B : TML-NET compatible 100,200mm

SETTLEMENT TRANSDUCERS

KLC-50A

Max 8 layers

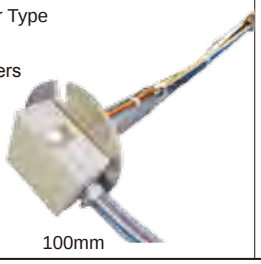
50mm(−20~ +30mm)

ROCK DISPLACEMENT TRANSDUCERS

KLB-B

Multi-layer Type

Max 8 layers



100mm

CAISSON SKIN-FRICTION METER

KKA-PB

200, 300kPa

CAISSON CUTTING-EDGE REACTION METER

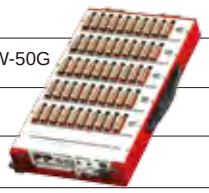
KKB-PB

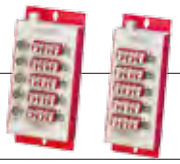
5, 10, 15MPa

STRAIN MEASURING INSTRUMENTS Static Measurements

Strain which is considered not to change with time during the measurement is called static strain. The static strain meter/data logger employs highly accurate and stable amplifier and A/D converter of high resolution, and offers excellent measurement accuracy and stability. The strain can be measured by scanning the input channels. Fundamentally, one strain meter has one amplifier and A/D converter for all input channels. Some models are equipped with an amplifier and A/D converter for every 10 channels to obtain higher measurement speed. Measurement of 1000 channels in 0.1 seconds is possible at the fastest with excellent accuracy. Input of strain gauge with quarter/half/full bridge, strain gauge based transducer, thermocouple of 8 types or Pt-RTD with 3-wire connection is possible for each channel. For TDS-630 and TDS-540, the distance between each two switching boxes can be extended up to 800 meters by using RS-422 or optical fiber cable for the connection.

Data Logger	Switching Box	Channels at max.	Fastest measuring time
High Performance Data Logger TDS-630  Interface : LAN/USB/RS-232C * : For combination use with PCU-4A	IHW-50H	1000	0.1 sec.
	IHW-50G-01*	1000	0.1 sec.
	IHW-50G	1000	0.4 sec.
	ISW-50G	1000	2 sec.
	ASW-50C SSW-50D	1000	60 sec.
	Built-in (High Speed)	30	0.1 sec.
Data Logger TDS-540  Interface: LAN/USB/RS-232C CE	IHW-50G	1000	0.4 sec.
	ISW-50G	1000	2 sec.
	ASW-50C SSW-50D	1000	60 sec.
	Built-in (High Speed)	30	0.4 sec.
	Built-in (Standard)	30	1.2 sec.
Portable Data Logger TDS-150 Interface: USB/RS-232C LAN (option) CE 	FSW-10 FSW-10L	50	3.4 sec.
Handheld Data Logger TC-32K Interface: USB/RS-232C CE 	CSW-5B	5	0.4 sec.
	Main body only	1	0.06 sec.





TML Data Loggers are designed for multi-input measurements of strain, strain-gauge based transducer, DC voltage and temperature.

High Performance DATA LOGGER TDS-630

- High speed 1000 channels in 0.1 sec.
- Color LCD monitor with touch panel
- Display toggle between Japanese and English
- Onboard analog output upto 20 channels (Option)
- 3-Interface LAN, USB2.0 and RS232C
- High resolution mode with 0.1x10^{-6} strain
- Built-in 30-ch switching box at max. with semicondutor relay(10-ch as standard)
- Direct reading in physical quanity
- 1-Gauge 4-Wire strain measurement with modular plug connection
- Complete compensation method for strain with Wheatstone Bridge COMET

DATA LOGGER TDS-540

- High speed 1000 channels in 0.4 sec.
- Color LCD monitor with touch panel
- Display toggle between Japanese and English
- 3-Interface LAN, USB2.0 and RS232C
- High resolution mode with 0.1x10^{-6} strain
- Built-in 30-ch switching box at max. with semicondutor relay(10-ch as standard)
- Direct reading in physical quanity
- Reliable data storage by internal secure memory device and uninterruptible power supply
- Complete compensation method for strain with Wheatstone Bridge COMET
- Remote operation using a tablet terminal possible through an internet browser

High Speed SWITCHING BOX IHW-50H

- Exclusive switcing box for Data Logger TDS-630 with the fastest measurement of 1000 channels in 0.1 sec.
- Simultaneous measurement of strain and temperature with one channel
- High resolution mode with 0.1x10^{-6} strain
- Compatible with high speed communication method TML-LINK
- Onboard lightning surge arrester on each channel
- 1-Gauge 4-Wire strain measurement with modular plug connection
- Complete compensation method for strain with Wheatstone Bridge COMET

High Speed SWITCHING BOX IHW-50G

- Electricaly insulated with Data Logger
- Multi-measurement of strain, DC voltage temperature with PtRTD and thermo-couple
- Connectable Data Logger TDS-540, TDS-630
- 1-Gauge 4-Wire strain measurement with modular plug connection
- Simultaneous measurement of strain and temperature with one channel
- High resolution mode with 0.1x10^{-6} strain
- Onboard lightning surge arrester
- Complete compensation method for strain with Wheatstone Bridge COMET

STRAIN MEASURING INSTRUMENTS Static Measurements

SWITCHING BOX ISW-50G

- Electricaly insulated from Data Logger.
- Multi-measurement of strain, DC voltage temperature with PtRTD and thermo-couple
- Connectable Data Logger TDS-540, TDS-630
- 1-Gauge 4-Wire strain measurement with modular plug connection
- Simultaneous measurement of strain and temperature with one channel
- High resolution mode with 0.1x10^{-6} strain
- Onboard lightning surge arrester
- Complete compensation method for strain with Wheatstone Bridge COMET

SWITCHING BOX SSW-50D

- 1-Gauge 4-Wire strain measurement with modular plug connection
- Available for strain, DC voltage and thermocouple measurements
- Can be used with conventional models SSW/ASW-50C.
- Complete compensation method for strain with Wheatstone Bridge COMET
- Cascade connection by one cable of 9mm-dia. with data logger
- Applicable Data Logger: TDS-540, TDS-630

PORTABLE DATA LOGGER TDS-150

- Connectable Five decade channel units (FSW-10/FSL-10L) for 50 channels max.
- Possible long-term automatic measure-ment using sleep interval timer
- AC, alkaline D-cells or battery driving
- Multi-measurement of strain, DC voltage, temperature with PtRTD and thermo-couple
- 1-Gauge 4-Wire strain measurement with modular plug connection
- Complete compensation method for strain with Wheatstone Bridge COMET
- Connectable TML-NET network modules (Factory installed option)

FSW-10

FSW-10L

CHANNEL UNIT FSW-10/FSW-10L

- Exclusive decade channel units for Data Logger TDS-150
- FSW-10L comes with compact size.
- Expandable up to 5 units (50 channels)
- Multi-measurement of strain, DC voltage, temperature with PtRTD and thermo-couple
- 1-Gauge 4-Wire strain measurement with modular plug connection [FSW-10]

HANDHELD DATA LOGGER TC-32K

- Measurement of strain, DC voltage, temperature with PtRTD and thermo-couple
- Insulation and resistance measurement function is provided to check sensors.
- 1-Gauge 4-Wire strain measurement
- One touch connector of sensor cable
- Multiple measurements with exclusive Switching Box CSW-5B
- Complete compensation method for strain with Wheatstone Bridge COMET
- Possible automatic measurement using sleep interval timer

CSW-5B-05 CSW-5B

SWITCHING BOX CSW-5B/CSW-5B-05

- Exclusive 5 channel units for Handheld Data Logger TC-32K
- CSW-5B comes with compact size
- Multi-measurement of strain, DC voltage temperature with PtRTD and thermo-couple
- 1-Gauge 4-Wire strain measurement

SWITCHING BOX EXTENSION CABLE

CR-800 Extension cable

NDIS(plug)-NDIS(receptacle) 7-core 5m

- Used for connecting switching box SSW or ASW to data logger, or for connecting between switching boxes SSW/ASW
- Other length is optionally available on request.
  CR-801 (10m), CR-802(20m)
  CR-803 (30m), CR-805(50m)
  CR-810 (100m), CR-812(200m)

CR-832M Extension cable

for ISW/IHW RS-422 2m

- Used for connecting switching box ISW or IHW to data logger TDS-540/TDS-630, or for connecting between switching boxes ISW/IHW

CR-842M Optical fiber extension cable for ISW/IHW 2m

- Used for connecting switching box ISW or IHW to data logger TDS-540/TDS-630, or for connecting between switching boxes ISW/IHW
- Other length is optionally available on request.
  CR-845M(5m), CR-8401(10m)
  CR-8402(20m), CR-8405(50m)
  CR-8410(100m)

CR-872M TML LINK extension cable 2m

- Used for connecting between data logger TDS-630 and switching box IHW-50H, or for connecting between each two parallel communication units PCU-4A
- Other length is optionally available on request.
  CR-875M(5m), CR-8701(10m)
  CR-8702(20m), CR-8705(50m)
  CR-8710(100m)

REMOTE POWER CONTROLLER RPC-05A

- Controls remotely power on/off.
- Applicable instruments
  Data Logger TDS-150,TC- 32K
  Network Handheld Strainmeter TC-35N
- An excessive power protection built in the power supply section (10~18V)
- Incorporates auxiliary recharge circuit to battery.
- ON-OFF power control by computer via RS232C

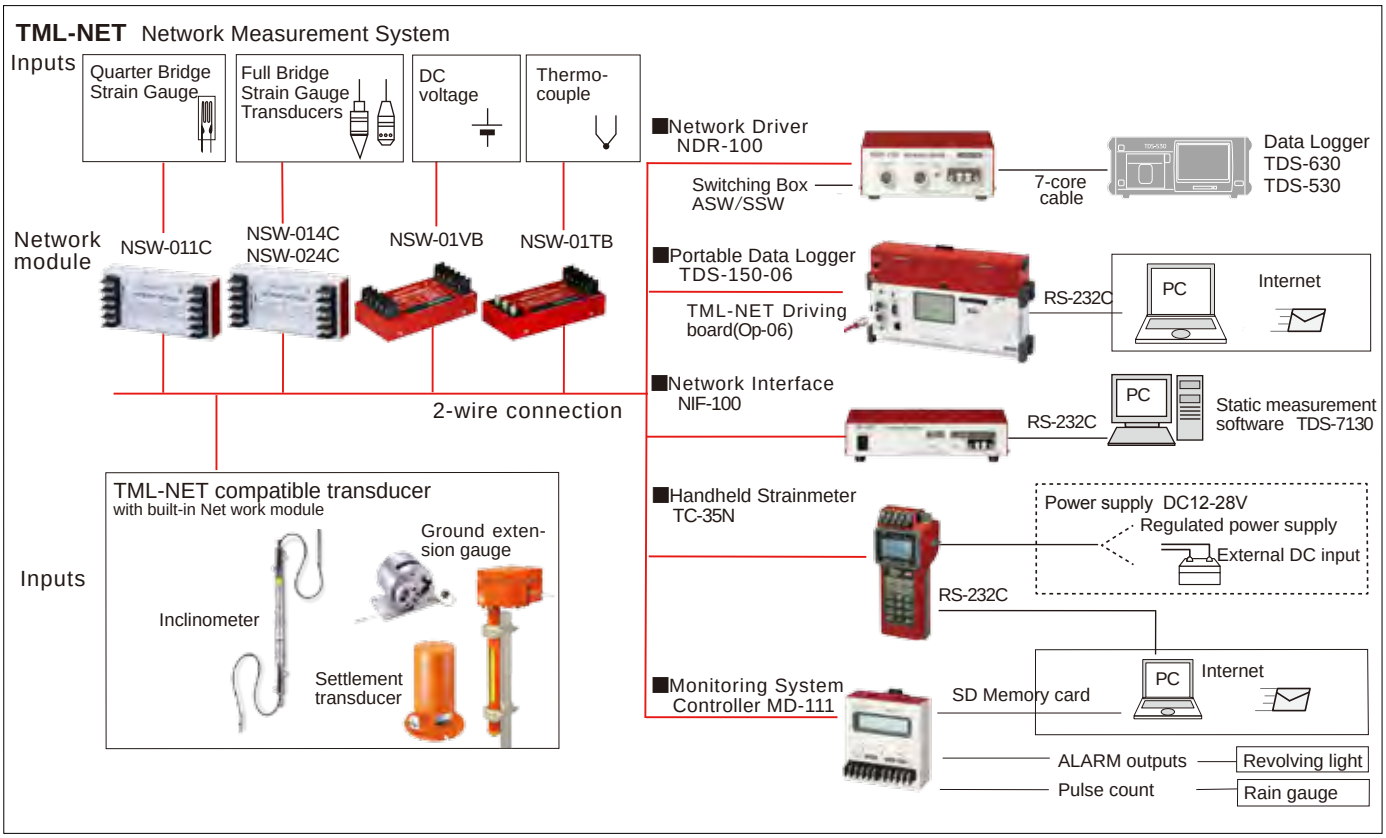
QUICK CONNECTING TERMINAL SB-OT1B

- This terminal is capable of connecting input lead wire by merely pressing down the knob and inserting the lead wire into the hole of the terminal. The lead wire is secured by the restoring spring force of the knob. This terminal is mounted on the input terminal of switching box. One terminal is used for one lead wire. One set contains five terminals.

TML-NET NETWORK MEASUREMENT SYSTEM Static Measurements

TML NET is a data acquisition network for strain measurement to perform measurement control and data transfer using two-wire cable. Unlike ordinary analog measurement system, there is no influence of sensitivity drop due to cable extension and cable insulation lowering, so long term and stable measurement is achieved. Connection between measurement modules can be made by star type or ring type, and the wirings can easily be done. The TML-NET is also compatible with 4-wire system wherein power supply is provided by another line for measurement channel and distance extension. Mixing with 2-wire system is possible. And this system is driven by Data Logger TDS-630, TDS-530, TDS-150, Network Handheld Strainmeter TC-35N, PC, or Monitoring System Controller MD-111.

- Easy connection and branching
- Small and lightweight network module - Easy installation
- No sensitivity drop due to cable extension
- Resistive to noise owing to digital processing near sensors
- No influence of insulation lowering
- Various Network Modules for strain gauge, strain gauge-type transducers, DC voltage, and thermocouple
- 2km total distance (between data logger and NDR-100)
- 2km total distance (between NDR-100 and network module)
- Possible mixing of 2-wire and 4-wire
- Available combination with external switching boxes-Isolated between instruments



NETWORK DRIVER NDR-100

- Connects network modules to Data Logger TDS-630/TDS-530.
- 100 channels per unit, maximum 10 units, total 1000 channels
- Possible parallel use with ordinary Switching Box SSW/ASW
- 2km total distance between Data Logger and NDR-100

NETWORK INTERFACE NIF-100

- Direct driving from a PC using the built-in RS-232C interface
- 100 channels per unit
- Compatible with Visual LOG TDS-7130v2 static measurement software

NETWORK HANDHELD STRAINMETER TC-35N

- AA(LR6) battery operation
- Available to build a small measuring system, or to check function on site
- RS-232C interface available
- 5 modules use with built-in battery AA (LR6) or AC adaptor, or 100 modules use with external DC input
- Built-in compact flash card
- Measurement with Sleep interval function

MONITORING SYSTEM CONTROLLER MD-111

- Output contact functions to build an alarm system
- Measurement with Sleep interval function
- RS-232C interface available
- 5 modules use with built-in battery D (LR20) or 100 modules use with external DC input
- Data recording on SD card

NETWORK MODULES NSW-C TYPE with low power consumption

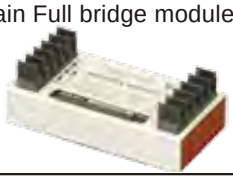
Full bridge 2-channel module NSW-024C

- Strain full bridge method
- 2 measuring channels per unit
- Expandable up to 100 units (200 channels)
- Low power consumption
  During standby 1mA MAX
  During measurement 36mA MAX
- 120 ~ 1000Ω
- $\pm 30000 \times 10^{-6}$ strain

Strain Quarter bridge module NSW-011C

- Strain Quarter bridge 3-wire method
- Low power consumption
  During standby 1mA MAX
  During measurement 36mA MAX
- Either 120Ω or 350Ω
- $\pm 30000 \times 10^{-6}$ strain

Strain Full bridge module NSW-014C



- Strain Full bridge method
- Low power consumption
  During standby 1mA MA
  During measurement 36mA MAX
- 120 ~ 1000Ω
- $\pm 30000 \times 10^{-6}$ strain

NETWORK MODULES NSW-B TYPE

Voltage module NSW-01VB

- DC Voltage
- Measuring range
  V1 ±2.5V V2 ±25V

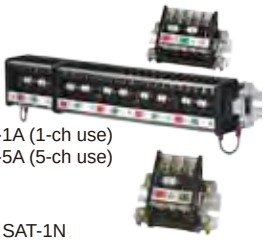
Thermocouple module NSW-01TB

- Thermocouple T applicable [JIS C1602(1995)]
- Measuring range -200~+400°C

Counter module NSW-01C

- For non-voltage contact or Open collector input to count rainfall, flow rate, pass number of transportation, working rate of machinery, etc.
- Input signals: Contact/Open collector/Square wave

With built-in gas-tube arrestor for Transducers and Instruments



SAT-1A (1-ch use)
SAT-5A (5-ch use)

SAT-1N
for TML-NET

SURGE ABSORBER SAT-A/SAT-N

- Surge absorber SAT-A and SAT-N are designed to protect transducer and instrument from lightning-induced currents.
- DC Breakdown in voltage(100V/s): 72~108V
- Impulse Breakdown in voltage (100V/μs): 450V at Max.
- Impulse Discharge current 8/20μs : 10kA
- AC Discharge current (50Hz) 9 cycles : 45A
- DC Holdover voltage : 50V
- Surge life (10/1000μs 500A): 100 shots
- Insulation Resistance : 10000 MΩ at Min.
- Electrostatic capacitance: 2.0pF at Max.

THUNDERPROOF FOR TML-NET NNZ-2A

- Shuts off network line automatically during measurement standby status to avoid induced current.
- Power is supplied from network line
- Monitors voltage of network line and current of network modules, and shuts off immediately if abnormal condition occurs.

TML-NET COMPATIBLE 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 when 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 detectors can also be connected to the TML-NET system via a switching box.

Inclinometer
NKB-LE
NKB-ME

Ground Extension Gauge
NKLG-BB

Settlement Transducer NKLA-B

Ground Extension Gauge NKLG-AB

Strain which changes with time is called dynamic strain. A dynamic strainmeter amplifies strain in analog form and outputs to an external recorder. Fundamentally, each one strainmeter and recorder is required for one measurement point. Multi-channel strainmeter having two or more channels is generally used.

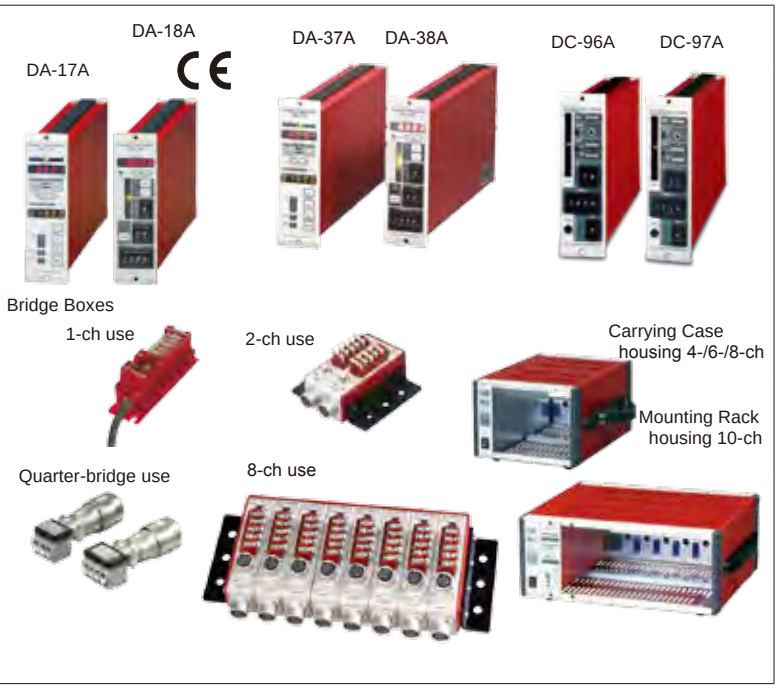
Nowadays, digital dynamic strainmeters are available in multi-channel configuration. Their function is to convert analog signal into digital values at high speed for storage in internal memory and transfer to a PC.

DIGITAL DYNAMIC STRAINMETER

Type	No. of channels	Bridge Voltage	Frequency Response	Interface
DRA-162B	16	0.5, 2Vrms 5kHz	DC ~ 2.5kHz	LAN
DC-204R CE DC-204Ra	4 4	DC0.5, 2V DC0.5, 2V	DC ~ 10kHz DC ~ 10kHz	USB
DC-004P	4	DC0.5, 2V	DC ~ 2kHz	USB
DH-14A	4	DC0.5, 2V	DC ~ 1kHz	_
DRA-30A	30	DC2V	DC ~ 3kHz	USB GP-IB
DS-50A	50	DC2V	DC ~ 100Hz	LAN

ANALOG DYNAMIC STRAINMETER

Type	No. of channels	Bridge Voltage	Frequency Response
DA-17A	1	0.5, 2Vrms 5kHz	DC ~ 2.5kHz
DA-18A CE	1	0.5, 2Vrms 5kHz	DC ~ 2.5kHz
DA-37A	1	0.5, 2Vrms 20kHz	DC ~ 10kHz
DA-38A	1	0.5, 2Vrms 20kHz	DC ~ 10kHz
DC-96A	1	DC0.5, 1, 2, 5, 10V	DC ~ 200kHz
DC-97A	1	DC0.5, 1, 2, 5, 10V	DC ~ 500kHz



MULTI-CHANNEL DYNAMIC STRAIN METER DS-50A

- 50-channel dynamic strainmeter expandable up to 1000 channels (20 sets)
- 1kHz sampling at the fastest (when using one set)
- Connection cable can be extended up to 100 meters between each two sets
- Bridge box integrated for each channel for connection of strain gauge in quarter bridge 3-wire (120Ω, 350 Ω), half or full bridge
- Combination of strain/voltage unit and thermocouple unit possible
- Standard supply of Control software DS-750

DIGITAL DYNAMIC STRAINMETER DRA-162B

- 16-chanel carrier wave type
- 16-bit A/D converter is builtin for each channel, recording waveform in digital data
- Data memory of 256k words per channel
- TEDS compatible
- Binary high-speed transfer by LAN
- Expandable 16 units(256 channels) max. synchronous measurement available.
- Data read-in software supplied

STRAIN MEASURING INSTRUMENTS Dynamic Measurements

Static strain mode

Dynamic strain mode

MULTI-CHANNEL DIGITAL STRAIN METER DRA-30A

- Either dynamic or static strain measurement available by switching
- Possible quarter (in 3-wire system), half and full bridge and voltage measurements
- Each channel incorporates A/D converter for simultaneous measurement and record in digital values for all channels
- On-line measurement with built-in GP-IB and USB interface
- Control software DRA-730A supplied as an accessory

SMART DYNAMIC STRAIN RECORDER DC-204R/DC-204Ra

- 4-channel configuration with miniature size like postcard
- Sampling speed of max. 5μ-sec./channel
- Data recording on compact flash card of 2G-byte capacity
- Parallel connection up to 8 units (32 channels)
- Upgraded model DC-204Ra with analog output of ±5V
- Data format conforms to commercial analysis software DADiSP/2000

HANDHELD DYNAMIC STRAINMETER DH-14A

- 4-channel handheld use
- Simultaneous sampling for 4 channels
- Fastest 20kHz sampling for one channel
- AA-battery driving for 6 hours at max.
- Fine colour monitoring for numerical data and waveform data
- Shoulder case suitable for handheld use is supplied.

PC-CONTROLLED DYNAMIC STRAIN-METER DC-004P

- Directly saved in PC storage, making a long term measurement possible
- Simultaneous manual, data trigger and interval measurements.
- Fastest 50kHz sampling for one channel
- Simultaneous sampling of 12.5kHz for all 4 channels
- Large strain measurement up to 80,000x10^{-6} strain with 0.5V bridge excitation
- TEDS compatible
- Control software supplied

DA-17A DA-18A

DYNAMIC STRAINMETER DA-17A/DA-18A Carrier type

- Frequency response of 2.5kHz
- Digital sensitivity setting method
- Upgraded electronic automatic balancing
- Isolation of input and output
- Digital monitor incorporated
- Dual outputs
- Built-in low-pass filter
- DA-17A with built-in Insulation resistance check of strain bridge
- DA-18A compatible with TEDS
- DA-17A available for computer control with LAN compatible carrying case

DA-37A DA-38A

DYNAMIC STRAINMETER DA-37A/DA-38A Carrier type

- High frequency response of 10kHz
- Digital sensitivity setting method
- Upgraded electronic automatic balancing
- Isolation of input and output
- Digital monitor incorporated
- Dual outputs
- Built-in low-pass filter
- DA-37A with built-in Insulation resistance check of strain bridge
- DA-38A compatible with TEDS
- DA-37A available for computer use with LAN interface carrying case

DC-96A DC-97A

DYNAMIC STRAINMETER DC-96A/DC-97A DC type

- 1-channel dynamic strainmeter of DC bridge excitation
- Wide frequency response range (DC-96A: DC~200kHz, DC-97A: DC~500kHz)
- Sensitivity is less dependent on gauge resistance
- Improved electronic auto-balancing performance
- Built-in low-pass and high-pass filter
- External control of balancing and calibration output possible
- Operation on AC or DC power source
- Small and light

THERMOCOUPLE ADAPTOR TA-01KT

- For temperature measurement with DC exciting strainmeter
- External power source is not required.
- Built-in reference juncion compensation
- Isolated input and output
- Built-in digital linearizer provides better linearity than analog linearizer
- Burnout detection function provided
- Calibration output function for setting strainmeter sensitivity
- Applicable: DC-204R/Ra, DC-96A/-97A,DC-004P, DH-14A, TMR-200/-300 DRA-30A (dynamic mode)

ATTENUATOR CABLE

CR-4010 Attenuator cable

- Attenuation factor 1/1000
  For DC-204R, TMR-221

CR-4110 Attenuator cable

- Attenuation factor 1/1000
  For DC-004P, DH-14A

CR-4020 Attenuator cable

- Attenuation factor 1/100
  For DC-204R, TMR-221

CR-4120 Attenuator cable

- Attenuation factor 1/100
  For DC-004P, DH-14A

BRIDGE BOX SB-121A/SB-351A

1 channel bridge box for strain measurement
- Quarter Bridge 2-wire (with short-circuit bar)
- Quarter Bridge 3-wire
  SB-121A: 120 Ω SB-351A : 350Ω
- Half Bridge, Full Bridge : 60~1000Ω
- Connecting terminal: Screwing/Soldering

BRIDGE BOX SB-120B/SB-350B

1 channel bridge box for strain measurement
- Quarter Bridge 2-wire
- Quarter Bridge 3-wire
- Opposite Half Bridge
- Opposite Half Bridge 3-wire
  SB-120B : 120Ω SB-350B : 350Ω
- Half Bridge, Full Bridge : 60~1000Ω
- Connecting terminal: Screwing/Soldering

SB-122A-2

BRIDGE BOX SB-122A

- Configuration in 2,4,6,8 or 10 channels
  SB-122A-2 : 2-ch., SB-122A-4 : 4-ch.
  SB-122A-6 : 6-ch., SB-122A-8 : 8-ch.
  SB-122A-10 : 10-ch.
- Quarter Bridge 2-wire :120 Ω
  Quarter Bridge 3-wire : 120 Ω
- Half Bridge, Full Bridge : 60~1000Ω
- Connecting terminal: Screwing/Soldering/

SB-120PY-2

BRIDGE BOX SB-120PY for post-yield measurement

- Sensitivity of the measurement is reduced to 1/10
- Configured in 2,4,6,8 or 10 channels
  SB-120PY-2 : 2-ch., SB-120PY-4 : 4-ch.
  SB-120PY-6 : 6-ch., SB-120PY-8 : 8-ch.
  SB-120PY-10 : 10-ch.
- Quarter Bridge 2-wire : 120Ω (with short-circuit bar)
  Quarter Bridge 3-wire: 120Ω
- Half Bridge, Full Bridge : 60~1000Ω
- Connecting terminal: Screwing/Soldering/

SB-120SB-8

BRIDGE BOX SB-120SB

- Configured in 2, 4, 6, 8 or 10 channels
  SB-120SB-2: 2 ch. SB-120SB-4: 4 ch.
  SB-120SB-6: 6 ch. SB-120SB-8: 8 ch.
  SB-120SB-10: 10 ch.
- Quarter Bridge 2-wire: 120 Ω (with short-circuit bar)
  Quarter Bridge 3-wire: 120 Ω
- Half Bridge, Full Bridge: 60~1000 Ω
- Connecting terminal: Screwing/Soldering/ NDIS connector

SB-128A

BRIDGE BOX SB-128A/SB-358A/SB-128A-10

- Configured in 8 or 10 channels
  SB-128A/SB-358A: 8 ch.
  SB-128A-10: 10 ch.
- Quarter Bridge 2-wire,Quarter Bridge 3-wire,
  Opposite Half Bridge,Opposite Half Bridge 3-wire
  SB-128A/SB-128A-10: 120 Ω
  SB-358A: 350Ω
- Half Bridge, Full Bridge: 60~1000 Ω
- Connecting terminal: Screwing/Soldering

SB-120DG-1R2

SB-120DG-1R3

BRIDGE BOX SB-120DG-1R2/SB-120DG-1R3

- 1-ch bridge box for strain measurement
- Connected directly to the input connector of strainmeter
- SB-120DG-1R2: Quarter Bridge 2-wire 120 Ω
- SB-350DG-1R2: Quarter Bridge 2-wire 350 Ω
- SB-120DG-1R3: Quarter Bridge 3-wire 120 Ω
- SB-350DG-1R3: Quarter Bridge 3-wire 350 Ω
- Connecting terminal: Clamping type easy connection

BRIDGE BOX SB-123A

- 1 channel bridge box for strain measurement
- Quarter Bridge 2-wire : 120Ω
  Quarter Bridge 3-wire : 120Ω
  Opposite Half Bridge 2-wire : 120Ω
  Opposite Half Bridge 3-wire : 120Ω
- Half Bridge, Full bridge : 60~1000Ω
- Bridge mode is set by three slide switches
- Connecting terminal: Clamping type easy connection

QUICK CONNECTING TERMINAL SB-OT1B

- This terminal is capable of connecting input lead wire by merely pressing down the knob and inserting the lead wire into the hole of the terminal. The lead wire is secured by the spring force of the knob. This terminal is mounted on the input terminal of switching box or bridge box(SB-120SB, SB-121A, SB-122A). One terminal is used for one lead wire. (One set contains five terminals).

CARRYING CASE P-B

- These carrying cases are used to configure multi-channel system with DA series or DC series dynamic strain meters. Each case is equipped with a power switch, calibration switch and balancing button for simultaneous control of all channels.
  P-4B: 4-ch. P-8B: 8-ch.
  P-6B: 6-ch. P-10B; 10-ch.

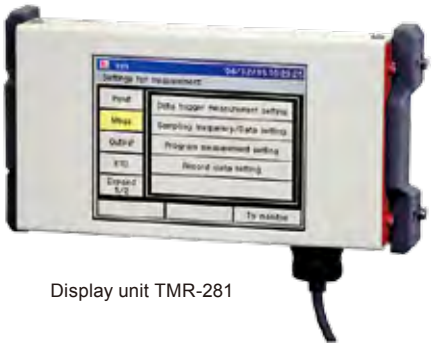
Computer control CARRYING CASE LAN compatible P-AL

- Applicable strainmeter DA-37A/DA-17A
  Controls each setting of sensitivity, low-pass filter, balancing and calibration and acquires each set value and monitor values through LAN.
  P-4AL: 4-ch. P-8AL: 8-ch
  P-6AL: 6-ch. P-10AL: 10-ch.

MULTI-RECORDER TMR-200 SERIES Small Multi-channel Data Acquisition System

The multi-recorder TMR-200 series is a small multi-channel data acquisition system enabling combination of various measuring units according to measurement purposes. The testing objects are analog input such as stress, load, pressure, acceleration, etc. using strain gauges and strain gauge based transducers and digital input/output such as CAN, etc. in vehicle onboard measurement.

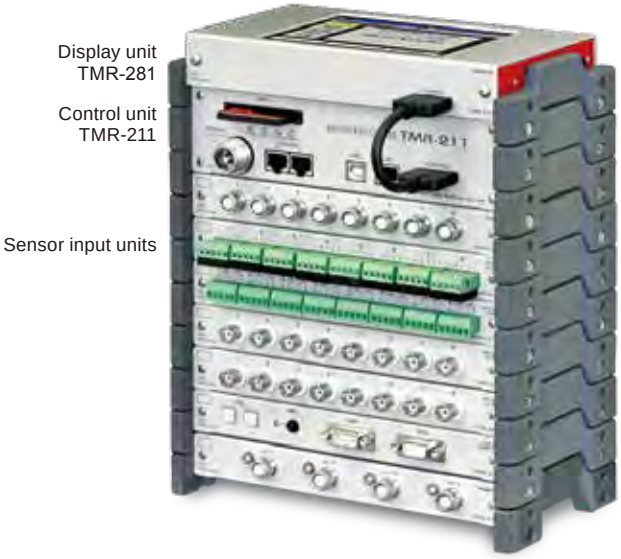
- Combination of a plentiful and various sensor input/output units for strain, temperature, voltage, CAN, etc.
- The maximum measurement of 80 channels
- 100kHz high speed sampling
- USB and LAN interfaces
- Vibration tolerance and small size suitable for vehicle onboard
- Battery operation
- Data recovery at power interruption and measurement restart at power recovery
- Various settings, monitoring and measurement result display with the display unit



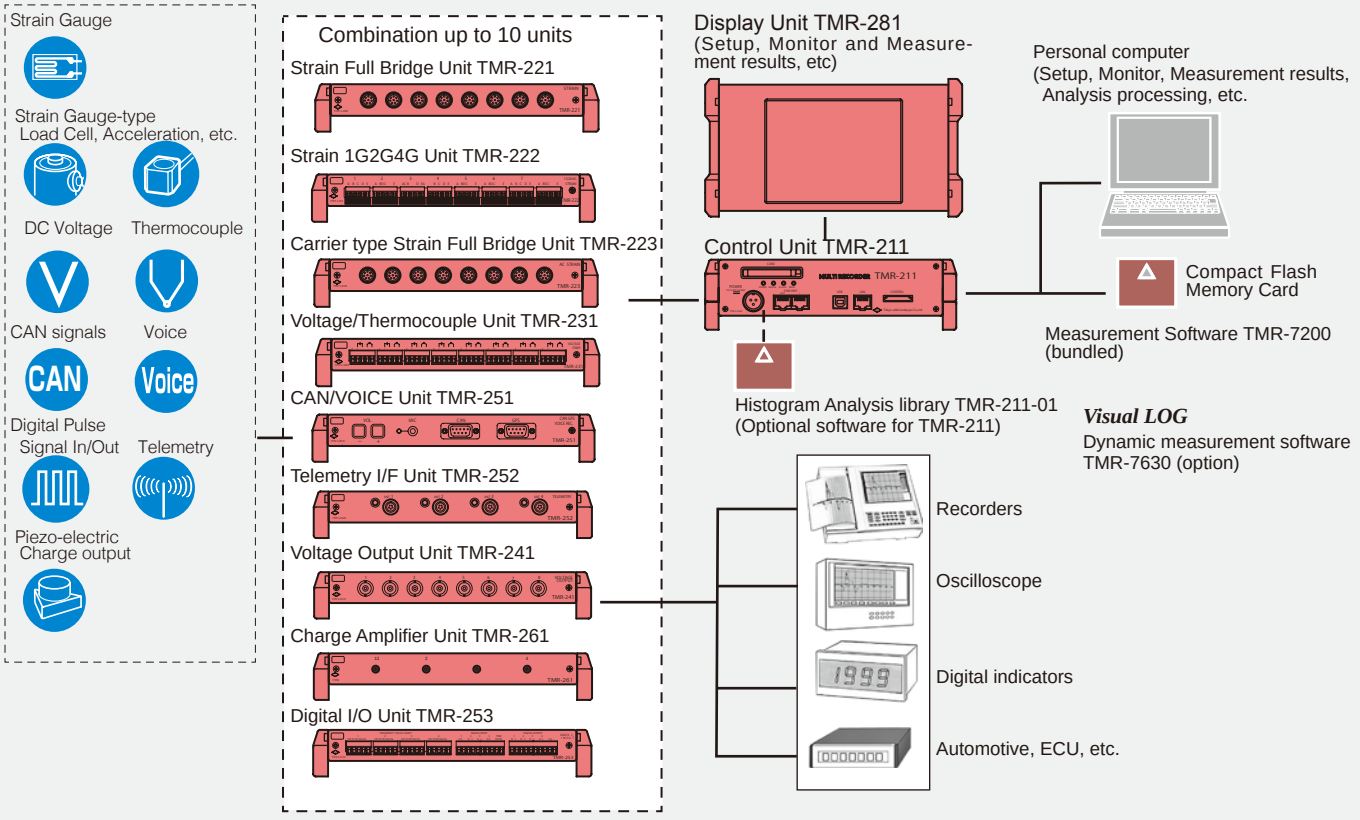
Display unit TMR-281

Voluntary combination of various sensor input units according to purposes

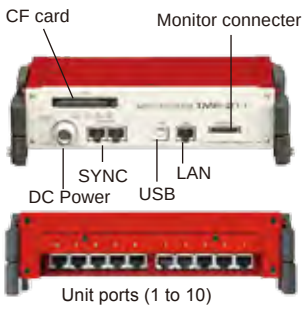
Unit ports (back)



Systematic diagram



MULTI-RECORDER TMR-200 SERIES Small Multi-channel Data Acquisition System



Control Unit TMR-211

- Possible combination of various sensor input/output units such as strain, temperature, voltage, CAN, etc.
- Maximum 80-channel measurements
- High speed sampling of 100kHz
- Anti-vibration and small size to suit vehicle onboard
- Data recovery during power failure and measurement restart functions after power recovery
- Display of monitor and measuring results from various settings with a display unit

Display Unit TMR-281

- 5.7-in. color TFT LCD touch panel display
- Display of various analysis results such as numerical monitor, wave monitor, frequency analysis, etc.
- Possible measurement start/stop, balance control, setting to various measurement units, etc.

Strain Full Bridge Unit TMR-221

- Full bridge strain measurement
- 8 measuring channels
- Input : Strain (120~1000Ω)
- Available for voltage measurement with attenuation cable CR-4010
- Measuring range
  ±20000x10^{-6} strain (at 2V excitation)
  ±80000x10^{-6} strain (at 0.5V excitation)

Strain 1G2G4G Unit TMR-222

- Quarter, Half and Full bridge measurement using an exclusive small bridge box
- 8 measuring channels
- Input : strain (120~1000Ω)
- Supplied with 8 pieces of exclusive bridge box SB-120T or SB-350T to be selected when ordering
- Measuring range
  ±20000x10^{-6} strain (at 2V excitation)
  ±80000x10^{-6} strain (at 0.5V excitation)

Carrier type Strain Full Bridge Unit TMR-223

- Carrier wave type bridge excitation resistive to noise
- 8 measuring channels
- Carrier wave frequncy : 5kHz
- Input : Strain (Full bridge 120~350Ω)
- Measuring range
  ±20000x10^{-6} strain (at 2V excitation)
  ±80000x10^{-6} strain (at 0.5V excitation)

Voltage/Thermocouple Unit TMR-231

- Voltage/Thermocouple measurement
- 8 measuring channels
- Input : Voltage, Thermocouple (T,K,J)
- Isolated between channels

Voltage Output Unit TMR-241

- Voltage output of measured data using other measurement units
- 8 analog output channels(BNC connector)
- Optionally settable measuring channels
- Possible output of addition and subtraction operation results up to 4 channels

CAN/VOICE Unit TMR-251

- [CAN] Protocol: Conforms to CAN spec. V2.0B active
  Transfer speed : 10k~1Mbps
  Number of messages: 64
- [Speed measurement] 100Hz interval
- [VOICE memo] Number of inputs: 1

Telemetry I/F Unit TMR-252

- Connecting Digital telemetry receiver DT-24R for wheel torque measuring system
- Connectable 4 units of receiver
- Compatible sensor: Wheel torque transducer LTW-ND

Digital I/O unit TMR-253

- [Frequency measurement and Pulse counter]
  Number of inputs : 4
  Maximum input voltage: ±15V
  Frequency response : 1Hz~100kHz
  Power source : 5V/50mA or 12V/25mA
  Count range : 0~29999 counts
- [Digital inputs] Number of inputs : 4
- [Digital outputs]
  Trigger signal, Upper and Lower alarm, Sampling signal (each 1 point)

Charge Amplifier Unit TMR-261

- Measurement of charge output type piezoelectric accelerometer
- 4 measuring channels
- Charge sensitivity
  0.1pC/(m/s^2)~10pC/(m/s^2)
- Allowable input charge : 10,000pC

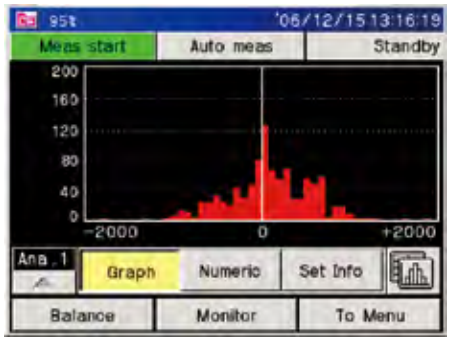
Multi-Recorder Software Option
Histogram Analysis Library TMR-211-01

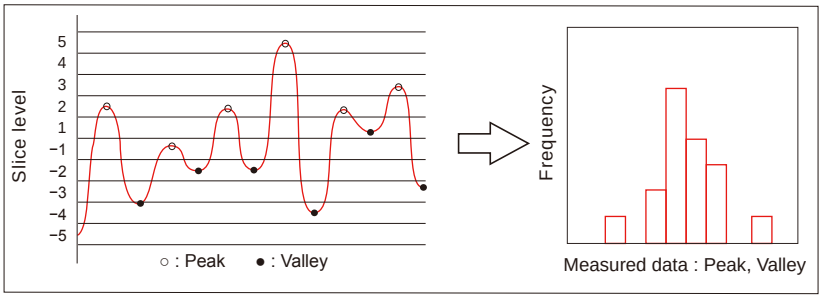
By installing the TMR-211-01 software in the control unit TMR-211, the function of a histogram recorder can be added to the TMR-200 system.

• Analysis method	1-dimentional histogram analysis: Peak-Valley, Maximum-Minimum, Time-frequency, Amplitude, Level-crossing, Rainflow
• Number of analyses	80 (in 1msec. sampling for any channel)
• Number of slices	Max. ±50 (100) optional setting
• Full scale	200~20,000x10^{-6} strain
• Count capacity	About 4.2 billion counts/slice
• Ineffective amplitude	4~5,000x10^{-6} strain(effective other methods than Time-frequency)
• Filing function	Recording in files of histogram data (Possible filing of histogram data at an interval and accumulated histogram data)

Histogram Recording System using MULTI-RECORDER TMR-200 SERIES

For precise understanding of various phenomena that change with time, it is important to know not only waveforms of each phenomenon but their frequency distribution and correlation. The Multi-Recorder TMR-200 Series is also available for measuring the frequency distribution of phenomena with optional software Histogram Analysis Library TMR-211-01, i.e. histogram, by digitally processing analog data sent from strain gauges and transducers. The digital processing is carried out simultaneously with input of data, in accordance with a pre-set program, and measurement data are recorded in the form of frequency. For example, as shown in the following chart, in a peak/valley program, the peak and valley values of input waveforms are detected and counted in their corresponding slice levels. There are slice levels, and the physical quantity corresponding to their width can be set optionally. Accordingly, a histogram of measurement results obtained for a long period of time can be produced quickly enough.

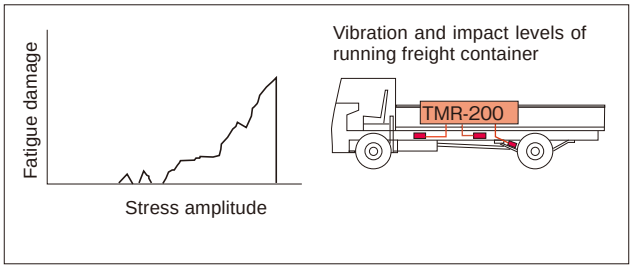




■Histogram recording in applications

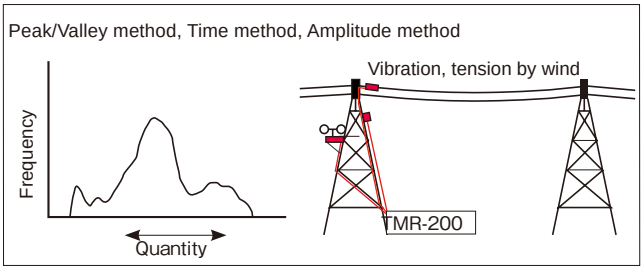
●Fatigue life prediction

It is well known that the majority of structures involve parts subjected to cyclic loads, resulting in structrural failure, and such failure includes a correlation between stress and cycles. A random stresses usually take place in structural parts of vehicles, machinary and architecture. Understanding of failure mechanism due to such stresses as above is very important. For cyclic stresses in random, fatigue failure is typically characterized with the processed stress amplitude and its cycles by the Rain-flow counting method.



●Measurement of behavior of structures

Outdoor structures such as steel towers are under various influences caused by weather conditions. By using appropriate sensors and the multi recorder TMR-200, histogram data can be obtained not only for stress of structural members and tensional force and vibration of wires but also for direction and velocity of wind, temperature, etc. Data arranged in a form of histogram are obtained for microtremors under normal condition, maximum tensile stress and vibration under strong wind, etc. It is effective in finding behavior of structures in their actual working conditions.



■FREQUENCY ANALYSIS

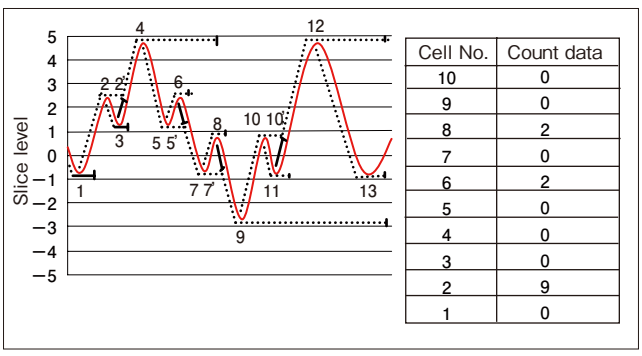
Frequency analyses of the TMR-200 series are ready for the followings.
Peak/Valley method, Maximum/Minimum value method, Amplitude method, Time method, Level crossing method, Rain-flow counting method

●RAIN-FLOW COUNTING method

In analysing signal wave by Rainflow method, take the vertical axis for time axis and the horizontal axis for strain signal. Connect the point of peak and valley of signal wave continuously, and consider the lines between each adjacent peak and valley and also between each adjacent valley and peak as multiple roofs and imagine that rain drop flows from each peak or valley to lower direction along the roof. Assume that the flow of rain drop will be stopped when one of three conditions described below is applicable, and measure the horizontal distance of the flow till stop and calculate the strain amplitude to be counted.

Three conditions of stop of flow

1. Rain drop which flows to the right stops when peak or valley appears left than the strating point.
   (1–2–2'–4、5–6、7–8、9–10–10'–12)
2. Rain drop which flows to the left stops when peak or valley appears right than the starting point.
   (0–1、2–3、4–5–5'–7–7'–9、10–11、12–13)
3. Two drops do not flow along one roof at the same time, and the first starting drop has a preference. When a following drop meets the flow of the first drop, the following drop stops.
   (3–2'、6–5'、8–7'、11–10')



Cell No.	Count data
10	0
9	0
8	2
7	0
6	2
5	0
4	0
3	0
2	9
1	0

INDICATOR/STRAIN CALIBRATORS

DIGITAL INDICATOR TC-31M

- Designed for strain gauge based transducers
- Compatible with flash memory card of 128MB
- A sleep interval function to make unattended operation possible
- Battery drive available in field site
- Drip-proof construction (IP54)
- Lightweight of 800 gr. and easy field use

DIGITAL LOAD METER TC-31L

- Small and easy to carry
- Drip-proof construction (IP54)
- Peak-hold function provided
- Simultaneous display of monitor and peak value
- Data memory for maximum 4000 counts
- One-touch connection of transducer cable
- Compatible with flash memory card of 128MB
- Control and data transfer via RS-232C

DIGITAL INDICATOR TD-23L

- Excellent accuracy and stability
- The least resolution of 0.01×10^{-6}strain
- Possible remote sensing method
- Possible Pt RTD measurement (Option)
- High bright color LCD (5.7 inches 320 × 240 dots) available in both Japanese and English
- Interface: RS-232C and LAN

DIGITAL INDICATOR TD-30L

- Excellent accuracy and stability
- The least resolution of $0.01X10^{-6}$ strain
- Information on eight sensors are registered
- Possible remote sensing
- Automatic condition setting by TEDS
- Interface: RS-232C and LAN

DIGITAL INDICATOR TD-98A

- Processing of 2000 times/second
- D/A output of voltage or current
- Large-size color graphic LCD with excellent visibilly
- Graphic display possible
- High/Low limit setting possible
- Various hold functions
- Analog/digital filter provide

DIGITAL INDICATOR TD-96A

- Processing of 4000 times/second
- D/A output of voltage or current
- Color graphic display with excellent visibilly
- Graphic display possible
- High/Low, High/High, Low/Low limit setting possible
- Various hold functions
- DIN conforming design suitable for mounting on testing machine

DIGITAL INDICATOR TD-91B

- Small and lightweight
- Direct reading in physical quantity by calibration with equivalent input value
- Analog peak hold and upper/lower limit functions
- Easy-to-see monitor display with wide viewing angle
- Voltage/current outputs

STRAIN CALIBRATOR CBA-131A

- Full bridge strain calibrator for static and dynamic strainmeters
- Input bridge resistance 120Ω and 350Ω
- Bridge excitation available in both constant voltage and constant current.
- Possible computer control (via RS-232C)
- High resolution (max. 1/100000, max. 0.1×10^{-6} strain)

AUTOMATIC CALIBRATOR CBA-2310A

Caibration of 10 channels simultaneously for static and dynamic strainmeters, and switching boxes

- Computer control available
- Generation of dynamic phenomena in full bridge method, and DC voltage mode
- High resolution
- Excellent stability

STRAIN CALIBRATOR CBM-122A/CBM-352A

Operation check and sensitivity calibration of strainmeters

- Bridge resistance
  CBM-122A : 120Ω
  CBM-352A : 350Ω
- Applicable Bridge configuration
  Full bridge

STRAIN CALIBRATOR CBM-123A/CBM-353A

Operation check and sensitivity calibration of staitic strainmeters and switching boxes

- Bridge resistance
  CBM-123A : 120Ω
  CBM-353A : 350Ω
- Applicalbe to DC bridge excitation
- Applicable Bridge configuration
  Quarter, Quarter 3-wire, Half, Full bridge

STRAIN CALIBRATOR CB-2R

- Sensitivity calibration and zero shift monitoring of strainmeters
- Bridge resistance : Either 120Ω or 350Ω
- Two calibration values generated
- Applicable Bridge configuration
  Quarter, Quarter 3-wire, Half, Full bridge
- Applicable to DC bridge excitation

MATING CONNECTORS

NDIS Push-Pull Circular Connector Plug and Jack

Plug
PRC03-12A10-7M

Jack
PRC03-32A10-7F

- Universal coaxial connectors 7-pin plug and jack with a single pull or push motion
- Applied to strain gauge transducers, switching boxes, extension cables of transducers, instruments, etc.

NDIS Connector Flange Mount Receptacle

Receptacle
PRC03-21A10-7F

- Flange mount receptacle for combination use with NDIS Push-Pull circular connector plug that allows input of transducer's signals.
- Applied to dynamic strainmeter series DRA, DA and DC.

NDIS Connector Bulkhead Mount Receptacle

Receptacle
PRC03-23A10-7F

- Bulkhead mount receptacle for combination use with NDIS Push-Pull circular connector plug that allows input of transducer's signals
- Applied to Switching Boxes.

Waterproof Circular Connector Plug and Jack

Plug
TC1108-12A10-7M

Jack
TC1108-32A10-7F

- Universal coaxial connectors 7-pin plug and jack with built-in compact and tight waterproofing mechanism of screw coupling
- Applied to Input/Output cable and supplied cables of transducers.

Waterproof Connector Bulkhead Mount Receptacle

Receptacle
TC1108-23A10-7F

- Bulkhead mount receptacle for combination use with Waterproof circular connector plug that allows input of transducer's signals
- Applied to body of load cells and pressure transducers.

BNC Adapter JJ

Adapter for interconnection of two BNC connector plugs with easy-to-use bayonet lock system

BNC T-Type Adapter JPJ

T-Type adapter JPJ to branch signals of BNC outputs from dynamic strainmeter

BNC T-Type Adapter JJJ

T-Type adapter JJJ to branch BNC connector plug in two outputs

Miniature Connector plug for DC-204R and TMR-221

Plug
PRC07-P8M

Miniature connector plug applied to Smart dynamic strain recorder DC-204R and Multi-Recorder Strain Full Bridge unit TMR-221 and Carrier type Full Bridge unit TMR-223.

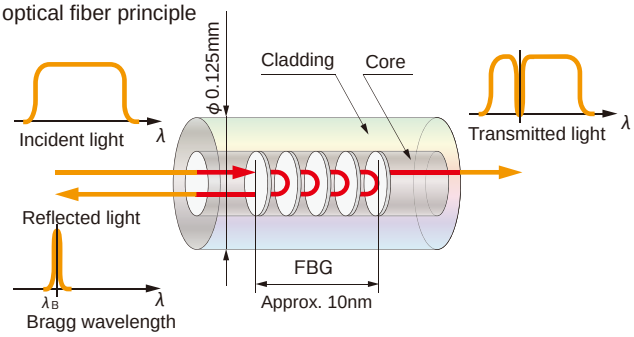
SPECIAL PURPOSE MEASUREMENTS

FBG Optical fiber sensing system

Our sensing system utilizing FBG (Fiber Bragg Grating) has advantages as in the right.

1) Not influenced by electromagnetic noise
2) Free from electrical problem caused by insulation deterioration
3) Two or more sensors can be connected in series

FBG optical fiber principle



●FBG (Fiber Bragg Grating)

Fiber Bragg Grating is a type of reflective structure constructed in a part of an optical fiber with a periodic variation in the refractive index of the fiber core along the longitudinal direction (approx. 10 nm) of the fiber. When light passes through the FBG, only the light of a particular wavelength is reflected (refer to the left figure). Spectrum center wavelength of the reflected light is called Bragg wavelength.

●FBG sensing

The change in the mechanical strain or tensile force applied to the FBG optical fiber makes a change in the wavelength of the reflected light. The mechanical strain or tensile force is known by measuring the change in the wavelength.

FBG Optical Fiber Strain Gauge OFSG-10A/-10B

OFSG-10B Both-end connector type

OFSG-10A One-end connector type

These are strain gauges utilizing FBG optical fiber sensor. They are suited to strain measurement where conventional strain gauges are not applicable, such as in the vicinity of a motor or transformer which may cause electrical noise. They are also suited to use in petrochemical, natural gas or chemical plant or in hydrogen environment where explosion protection is required.

- Temperature compensation function provided
- Less influenced by electrical noise or insulation deterioration
- Connection of two or more gauges possible for both-end connector type
- Direct reading in strain by combined use with fiber optical strain meter TFM-104
- Operated in similar way as conventional strain gauge - No special technique required
- Measurement objects are concrete, steel and composite material like FRP.

FBG Fiber Optical Strain Meter TFM-104

This is a measurement device for optical fiber strain gauge. It uses WDM (wavelength division multiplexing) and has four ports for connection of FBG strain gauge. The use of wideband light source offers excellent vibration tolerance and durability. This strain meter has functions of converting FBG sensor output into strain and also compensating the temperature dependence of the sensor. These functions allow highly accurate strain measurement when combined with our FBG sensors. In addition, by connecting the clock input and trigger input with our multi-recorders, synchronized measurement becomes possible with various sensors such as strain gauges, voltage signals and thermocouples.

- Less influenced by vibration and secular change because it uses durable optical parts
- Two or more sensors can be measured simultaneously using one optical fiber port
- Four optical signal ports are provided
- Temperature compensation is possible when combined with our FBG sensor
- Measured values can be monitored and recorded in strain or other physical quantities
- WDM (wavelength division multiplexing) is adopted which enables optical fiber branching
- After sales service is assured because this product is developed by ourselves.

TML Small Falling Weight Deflectometer System FWD-Light ®

TML small FWD - Falling Weight Deflectometer - FWD-Light® is used for estimating construction of pavement or rigidity of subgrade.

- Excellent portability and enables simple and quick measurement of coefficient of subgrade reaction.
- Two measurement method are offered with our original 2-wire digital line measurement system.

FWD-Light is a registered trademark of Tokyo Sokki Kenkyujo Co., Ltd.

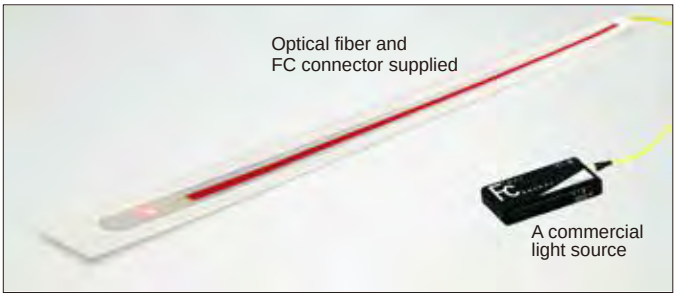
2-wire digital line measurement system

Concrete Crack Detection Sensor

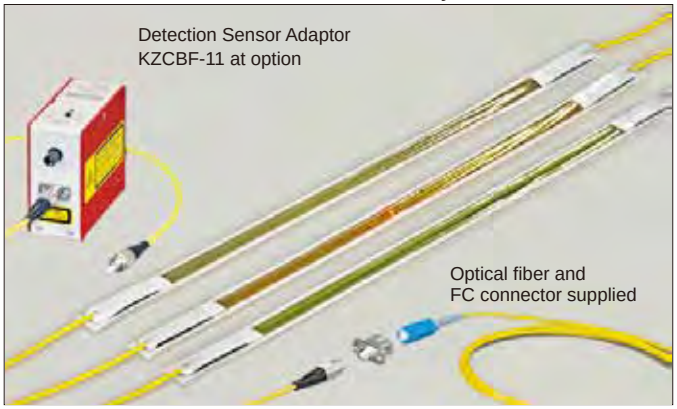
A crack generated on the surface of the concrete structure by degradation or damage can be detected easily and accurately even in a high and/or dark place. The sensor is previously bonded on a concrete structure and placement of the optical fiber cable is finished. When checking, a light source is connected to the optical fiber cable via the connector. If crack is generated, optical fiber is disconnected at the position of crack and the light is emitted from the disconnected part, thus making it possible to easily know the occurrence and the position of the crack.

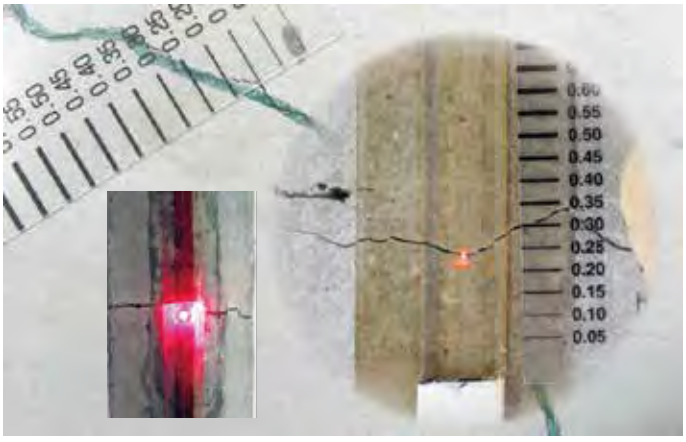
- Easy to find out cracks – No special knowledge about management and control of structures is required for the checker
- The light emission from the sensor shows the generation of crack
- The light source is small, light and easy to operate – No external power source is required for the checking
- Detection accuracy of crack width is selected among from 0.05, 0.1, 0.2 and 0.3 mm
- Crack detection length is selected between 300 and 500 mm

KZCA-A



KZCB-A for Automatic Crack Detection System





A detection point lighten where crack generates.

AUTOMOTIVE MEASURING SYSTEM

Among the mechanisms in an automobile, there are many items to be measured such as the maintenance of the engine and the electrical components, the effectiveness of power transfer to the drive wheels, the driving stability that determines the riding comfort, and the braking performance that controls the driving of a car. Our automotive measuring products allow you to build an all-in-one system for in-vehicle measurement, incorporating even a recorder and a PC.

Powertrain (Power transfer)
- Wheel Torque Transducer LTW Series
- 6-Component Wheel Force Transducer SLW Series

Suspension (Driving stability)
- 6-Component Wheel Force Transducer SLW Series
- Wheel Alignment Measuring System WAD/WAM

Braking
- Wheel Torque Transducer LTW Series
- 6-Component Wheel Force Transducer SLW Series
- Braking Pedal Force Transducer MLA-NA

Braking Pedal Force Transducer MLA-NA

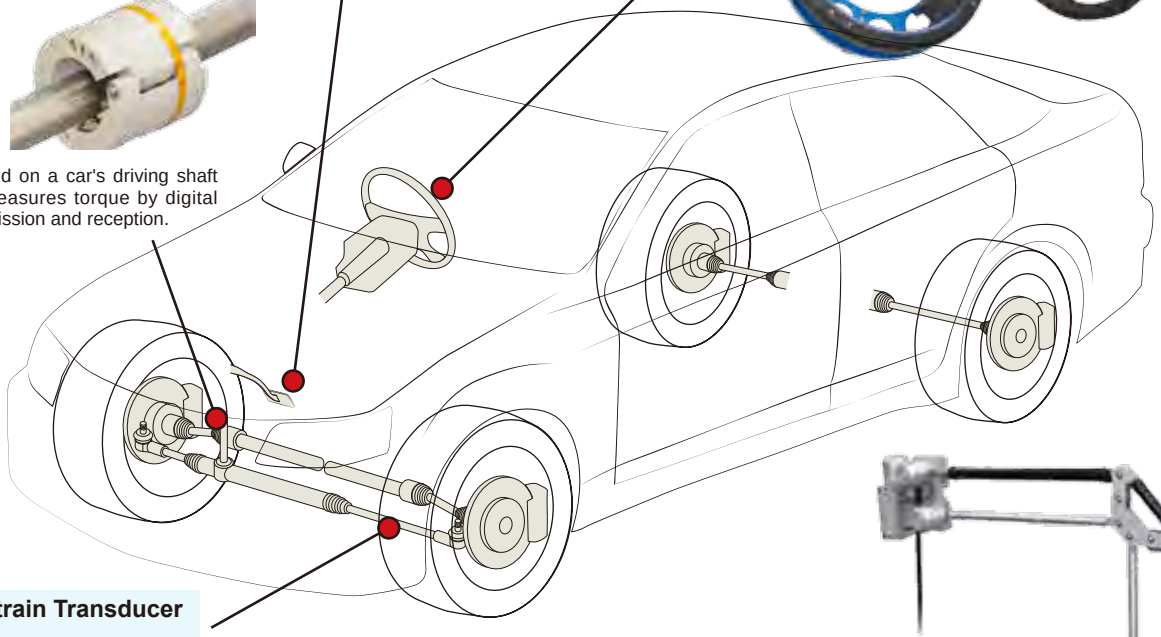
This is a load cell to measure the brake pedal force. It can easily be attached without modifying the pedal.

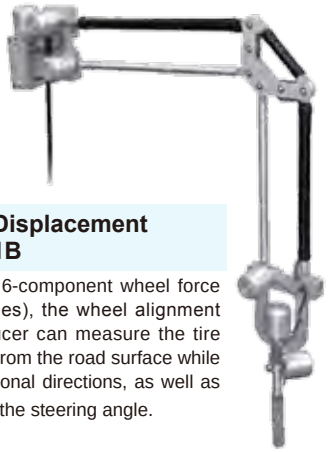
Frictional Torque Sensor System FGDH-2A/-3A

Installed on a car's driving shaft and measures torque by digital transmission and reception.

Steering Torque/Angle Transducer HLA-50A HLB-50A

By attaching the transducer to steering column of a passenger car, steering torque and steering angle are measured.





Axial Force Strain Transducer FGAH-1B

Measures tensile force and compressive force on steering tie-rod

Wheel Alignment Displacement Transducer WAD-1B

By installing with the 6-component wheel force transducer (SLW series), the wheel alignment displacement transducer can measure the tire displacement passed from the road surface while driving in three orthogonal directions, as well as the camber angle and the steering angle.

6-Component Wheel Force Transducer

- SLW-NC Slip-ring type
- SLW-NE Digital telemetry type

The signals sent from the 6-Component Wheel Force Transducer (SLW series) attached to the axle shaft are amplified by the exclusive force analyzer (MFT series) to be converted into digital values. The digitalized measurements are used to perform real-time computational correction for the crosstalk correction between component forces, the rotation correction to cancel the rotational influence on the transducer, and the moment position correction. After the correction, forces of forth/back (Fx), right/left(Fy), and vertical (Fz), and moment (Mx, My, Mz) around each force axis are output in analog form or recorded in a CF card. The digital telemetry model has been upgraded to a high accuracy model, and you can build a wireless all-in-one system when used with the exclusive receiver.

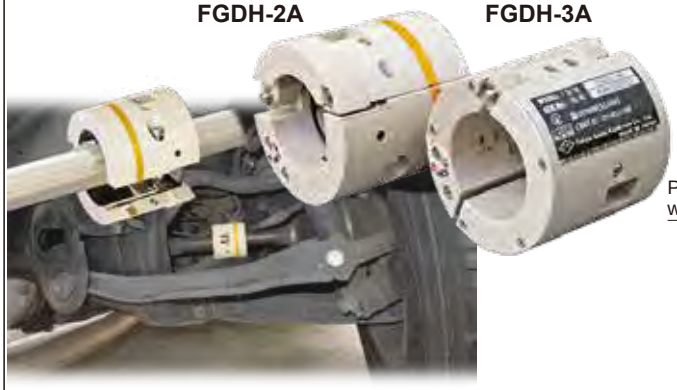
Wheel Torque Transducer

LTW-ND Digital telemetry type
LTW-NA Slip-ring type

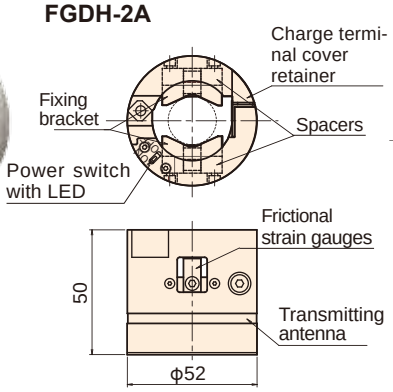
The wheel torque measuring system can measure the driving torque and braking torque while driving, in analog output form. The slip-ring built-in model, which incorporates an encoder, can also measure the rotation speed. The model incorporating a miniature transmitter is lightweight and has almost no projections, and so it can take measurements without disturbing the driving conditions.

Frictional Torque Sensor System FGDH

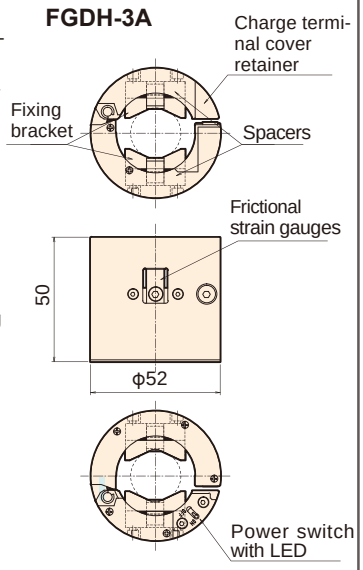
FGDH-2A **FGDH-3A**



FGDH-2A



FGDH-3A



Unit : mm

FGDH-2A

- No bonding is required because frictional strain gauges are used
- Less sensitive to noise and no wiring required due to the use of digital transmission and reception
- Applicable to drive shafts of different diameters (ϕ20~30mm)
- Easy-to-use rechargeable power supply

FGDH-3A

- Globally standardized 2.4GHz band data communication system is used
- No bonding is required because frictional strain gauges are used
- Spacers are compatible with those for FGDH-2A (ϕ20~30mm)
- Less sensitive to noise and no wiring required due to the use of digital transmission and reception
- Easy-to-use rechargeable power supply
- Sleep function provided

Steering Torque/Angle Transducer

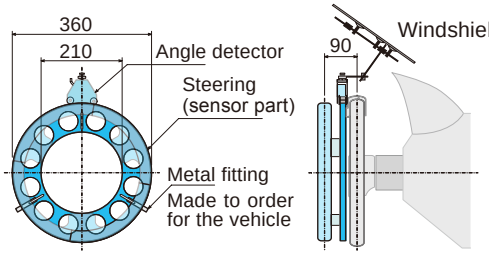
HLA-50A

- Installation possible on cars of various types (applicable to outer diameter of 350-380mm
- Easy installation and removal
- Excellent operability
- Steering torque is detected by strain gauges and output by digital telemetry

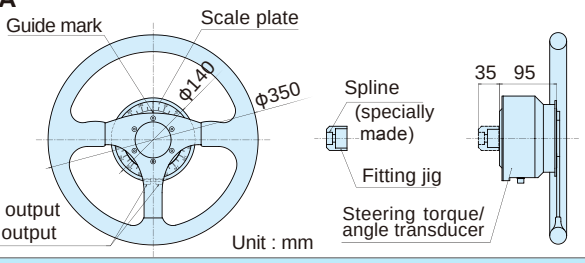
HLB-50A

- Made to order for optional steering wheel diameter
- Excellent operability

HLA-50A



HLB-50A



Output connector
Steering force : Strain output
Steering angle: Pulse output

Unit : mm

Wheel Torque Measuring System

DIGITAL TELEMETRY TYPE

Telemetry Receiver DT-24R

Multi-Recorder TMR-200 series

- Display unit TMR-281
- Control unit TMR-211
- Telemetery I/F unit TMR-252

Digital Telemetry type
Wheel Torque Transducer LTW-ND

SLIP-RING/ENCODER INTEGRATED TYPE

Multi-Recorder TMR-200 series

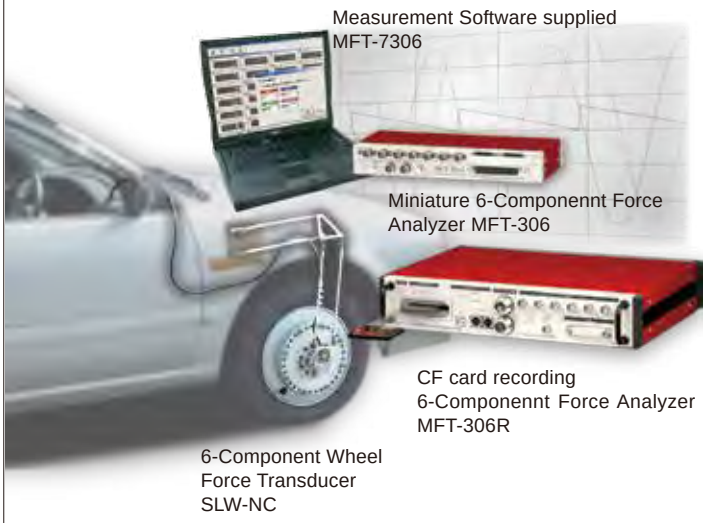
- Display unit TMR-281
- Control unit TMR-211
- Strain Full Bridge unit TMR-221
- Digital I/O unit TMR-253

Slip-ring/Encoder Integrated type
Wheel Torque Transducer LTW-NA

6-Component Wheel Force Measuring System

The 6-Component Wheel Force Measuring System is comprised of the 6-Component Wheel Force Transducer and the exclusive 6-component force analyzer. Depending on how the 6-component force is detected, there are two types available, slipring type and digital telemetry type. The slip-ring 6-Component Wheel Force Measuring System is the combination of the 6-Component Wheel Force Transducer SLW-NC and the 6-Component Force Analyzer MFT-306 or MFT-306R.

SLIP-RING TYPE



6-Component Wheel Force Transducer SLW-NC
Fx, Fy, Fz: 20kN/30kN Mx, My, Mz: 3kN-m/6kN-m

- High stability
- Light weight
- Possible installation to various vehicles using exclusive rim and hub adaptor
- Easy fixture to a real car
- Waterproof construction making driving in the rain possible

Miniature 6-Component Force Analyzer MFT-306

- Small and lightweight - Reduction of installation area
- High-speed operation of crosstalk, rotation correction, etc.
- 6-component force data and tire rotation count signal output in voltage form
- Forward and backward measurement possible with the encoder
- 6-Component Wheel Force Transducer characteristics data set by PC
- Up to 4 units controllable

CF card recording 6-Component Force Analyzer MFT-306R

- High-speed operation of crosstalk, rotation correction, etc.
- 6-component force data, tire rotation count signal output in voltage form
- Forward and backward measurement possible with the encoder
- 6-Component Wheel Force Transducer characteristics data set by PC
- Up to 4 units controllable
- Data from start-to-stop are recorded in a CF card
- Synchronous recording of up to 4 units. When combined with a DC-204R synchronous measuring of up to 8 units

DIGITAL TELEMETRY TYPE

SLW-20KNE-A/-B High-accuracy type
Fx, Fy, Fz: 20kN Mx, My, Mz: 3kN-m

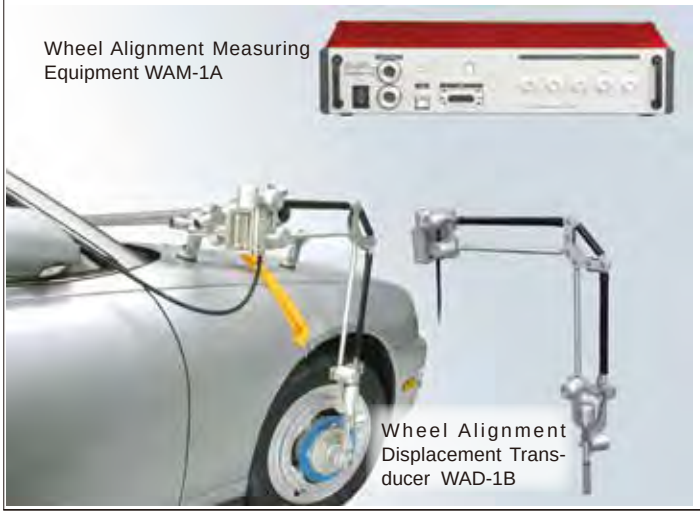
- No supporters and cables outside the passenger car - Safe car driving
- Signals from the 6-Component Wheel Force Transducer received wirelessly in the car, requiring no cables routed inside and outside the car
- Wheel alignment displacement transducer WAD-1B can be used with SLW-NC or SLW-NE (having rotary encorder for angle detection).
- Installable into every passenger car type using the exclusive rim and hub adapter
- AA batteries used. Use of secondary batteries also possible

Digital-telemetry type 6-Component Force Analyzer MFT-306T and Telemetry receiver DT-24R

- Small and lightweight - Reduction of installation area
- High-speed operation of crosstalk, rotation correction, etc.
- 6-component force data and tire rotation count signal output in voltage form
- Measurement data are transferred wirelessly by built-in telemetry
- Up to 4 units controllable
- Telemetry Receiver applicable inside, easy to secure cables
- Control software MFT-7306T supplied

Wheel Alignment Measuring System

The Wheel Alignment Measuring System is composed of WAD-1B Displacement Transducer and its exclusive Measuring Equipment WAM-1A. By installing to the 6-componennt Wheel Force Transducer it can measure 3 orthogonal force components applied on a tire during running and surrounding 3 moments. Not only 3-directional displacements of wheel center but steering angle and camber angle can be measured at the same time. Measurement results are output in voltage in real time by vehicle onboard measuring equipment.

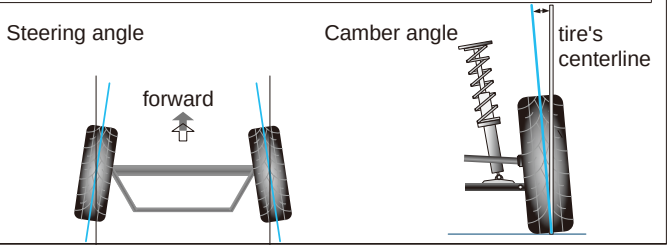


Wheel Alignment Measuring Equipment WAM-1A

- Small and lightweight - Reduction of installation area
- Possible setting of alignment transducer data and measuring equipment by computer.
- Bundled control software WAM-701A
- Simultaneous control of maximum 4 units

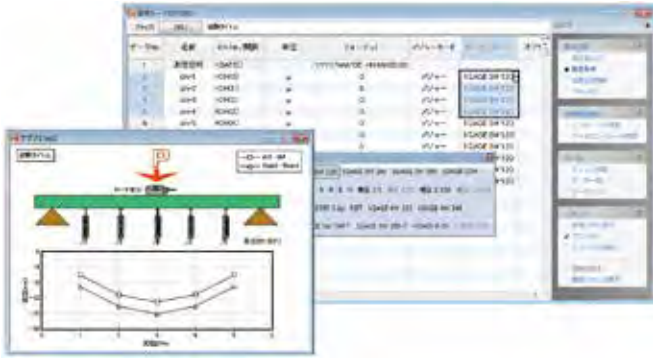
Wheel Alignment Displacement Transducer WAD-1B

- Measures displacements of wheel center in orthogonal 3 directions
- Steering angle
- Camber angle



MEASUREMENT SOFTWARE *Visual LOG*®

Data Logger use Static Measurement Software TDS-7130v2

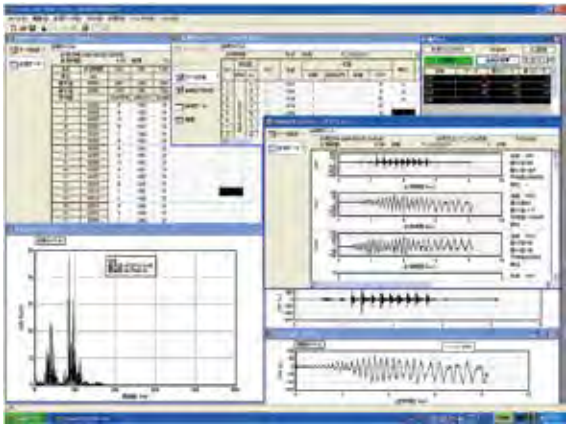


The TDS-7130v2 is general purpose static measurement software for controlling TML data loggers. It is a powerful tool for creating a report with data and graphs because it is capable of pasting multiple graphs, value monitors, labels and images on one graph sheet.

-- Windows Vista(SP2), 7(SP1), 8, 8.1, 10

- Number of measuring times is 20 million at the maximum; applicable to long-term continuous measurement.
- Maximum number of data item is 4000 items (including calculation results).
- Rectangular rosette analysis and various numerical operations are possible.
- For interval timer and data comparator, 8 tables can be created and executed respectively.
- Continuous measurement by every 0.1 seconds is possible corresponding to high speed mode of TDS-630.
- Two or more graphs are indicated on one graph sheet.
- Vector monitor and arrow monitor are indicated on graph sheet.
- Storage and reproduction of screen layout.
- Applicable instruments
  Data Logger TDS-630/TDS-540/TDS-530/TDS-150
  Multi-channel Digital Strainmeter DRA-30A (on static mode)
  TML-NET Interface NIF-100
  TML-NET Use Handheld Strainmeter TC-35N

DRA model use Dynamic Measurement Software DRA-7630

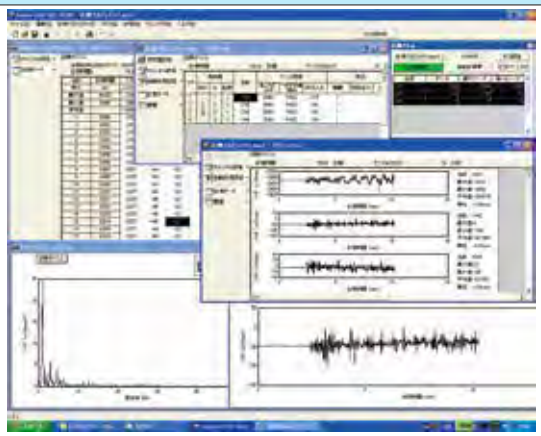


The DRA-7630 is software for processing data and measuring dynamic phenomenon using up to 10 sets (300 channels) of DRA-30A Multi-channel Digital Strainmeter.

-- Windows Vista(SP2), 7(SP1), 8, 8.1, 10

- Data monitorings with various styles are possible.
- Graphics in versatile formats including spectrum graphs are possible.
- Text file conversion of data is compatible with CSV or DADiSP format
- Rectangular rosette analysis and various numerical operations are possible using expanded channel.
- Number of expanded channel is up to 1000 points.
- Performs a unified control of condition settings and data
- Applicable instruments
  Digital Dynamic Strainmeter DRA-101C/DRA-107A (Up to 10 sets, 100 channels)
  Multi-channel Digital Strainmeter DRA-30A (Up to 10 sets, 300 channels)

DC-204R model use Dynamic Strain Recorder Measurement Software DC-7630

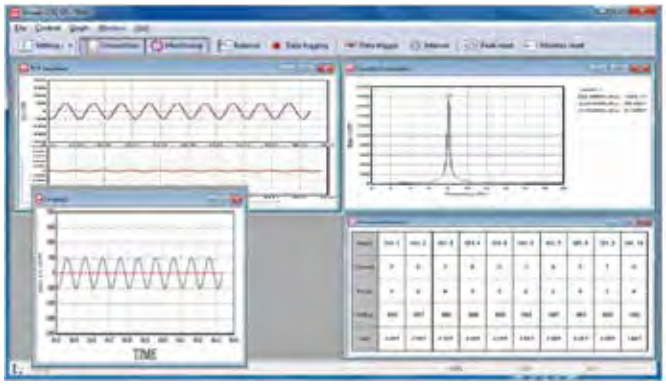


The DC-7630 is specially designed for Smart Dynamic Strain Recorder DC-204R and DC-204Ra, processing data and measuring dynamic phenomenon using upto 8 units (32 channels). Also, it features simultaneous measurement and realtime wave monitoring during sampling. The data is compatible with CSV and DADiSP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

-- Windows Vista(SP2), 7(SP1), 8, 8.1, 10

- Data monitorings with various styles are possible.
- Graphics in versatile formats including spectrum graphs are possible.
- Text file conversion of data is compatible with CSV or DADiSP format
- Rectangular rosette analysis and various numerical operations are possible using expanded channel.
- Number of expanded channel is up to 100 points.
- Performs a unified control of condition settings and data
- Applicable instruments
  Smart Dynamic Strain Recorder DC-204R/-204Ra (Up to 8 units, 32 channels)
- Option
  DC-7630-M (Synchronous retrieval of motion images and data)
  Measurement and storage of motion images with DirectX compatible are made together, and the recorded measurement data and images can be synchronously retrieved.

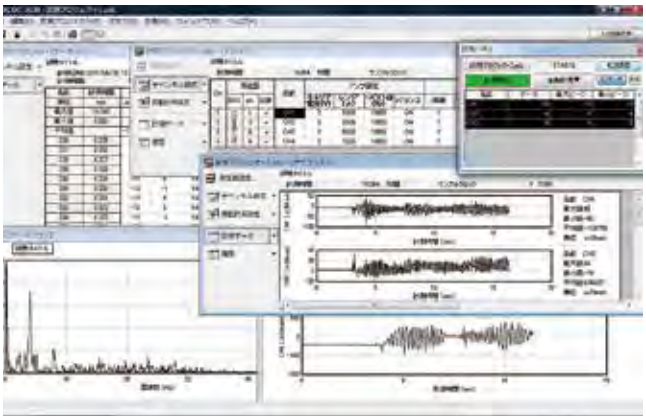
DS-50A model use Dynamic Measurement Software DS-7640



- This software enables simultaneous sampling of up to 1000 points by connecting 20 sets of DS-50A at the maximum. It performs numerical operation and rectangular rosette analysis among measurement channels, and shows the results along with measurement data.
- --Windows Vista (SP2), 7(SP1), 8, 8.1, 10
- Graphics in versatile formats including spectrum graphs are possible.
- Rectangular rosette analysis and various numerical operations are possible using expanded channel.
- Number of expanded channel is up to 1000 points.
- Measurement of manual, data trigger and interval can be logged simultaneously.
- Recorded data are processed by our software WF-7630.

MEASUREMENT SOFTWARE *Visual LOG*®

Multi-Recorder Measurement Software TMR-7630



The TMR-7630 is software for processing data and measuring dynamic phenomenon using up to 320 channels of TMR-200 series.

-- Windows Vista(SP2), 7(SP1), 8, 8.1, 10

- Data monitorings with various styles are possible.
- Graphics in versatile formats including spectrum graphs are possible.
- Text file conversion of data is compatible with CSV or DADiSP format
- Rectangular rosette analysis and various numerical operations are possible using expanded channel.
- Number of expanded channel is up to 1000 points.
- Performs a unified control of condition settings and data
- Applicable instruments Multi Recorder Control unit TMR-211 4 units at maximum
- Option

TMR-7630H (Frequency analysis)

Frequency analysis and S-N analysis of the measured dynamic waveform are possible by post processing.

TMR-7630-M (Synchronous retrieval of motion images and data)

Measurement and storage of motion images with DirectX compatible are made together, and the recorded measurement data and images can be synchronously retrieved.

Dynamic Strain Measurement Waveform Display Software WF-7630

This software is for management, merging, cutting out and thinning of data files created during the measurement using our dynamic measurement software and dynamic strainmeters.

-- Windows Vista(SP2), 7(SP1), 8, 8.1, 10

Maximum Calculation items (Expanded channel) are up to 1000.
Functions for rectangular rosette analysis, numerical operation, trigonometric calculation, etc. are included.

- Separated files created by free run measurement are merged into one file.
- Cutting out and thinning are possible during CSV conversion of data files.
- Several graphs and objects are arranged in a graph window.
- Image storage of graph data and CSV file storage of graph values are possible

Monitoring Measurement Software *Visual LOG Light* TDS-700L

The Visual Log Light is control software for monitoring measurement using our static strainmeters.

-- Windows Vista(SP2), 7(SP1), 8, 8.1, 10

- For interval timer, 3 tables can be created and executed respectively.
- Direct writing to a worksheet of Excel is possible.
- Data file format is CSV.
- Maximum measurement channels are 200 points.
- Applicable interface includes LAN, USB, RS-232C and GP-IB.
- Applicable instruments
  Data Logger TDS-540/TDS-530/TDS-150
  Handheld Data Logger TC-32K
  Network(TML-NET) use Handheld Strainmeter TC-35N

JCSS 0090

Tokyo Sokki Kenkyujo Co., Ltd. (TML) is accredited by Japan Calibration Service System (JCSS), conformed to international standards JIS Q 17025 (ISO/IEC 17025) under the laboratory accreditation body ISO/IEC 17011. International Accreditation Japan (IA Japan) plays as the accreditation body of JCSS and is a signatory to MRA of Asia Pacific Laboratory Accreditation Cooperation (APLAC) as well as International Laboratory Accreditation Cooperation (ILAC). Our Kiryu factory is certified as a JCSS-accredited laboratory working in compliance with an international Mutual Recognition Arrangement (MRA). The accreditation number of the Kiryu Factory is 0090.

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

Tokyo Sokki Kenkyujo Co., Ltd.

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email address: **sales@tml.jp**