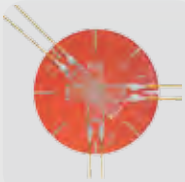
TML

PRODUCT GUIDE 2014

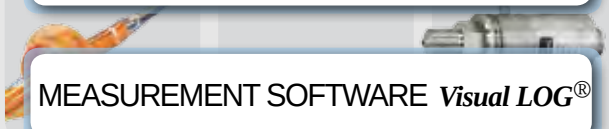

STRAIN GAUGES

STRAIN GAUGE TRANSDUCERS

MEASURING INSTRUMENTS


AUTOMOTIVE MEASURING SYSTEM
Vehicle powertrain/Driving stability

SPECIAL PURPOSE MEASUREMENTS

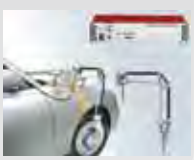
MEASUREMENT SOFTWARE *Visual LOG*®











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 sohphisticated 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 enginering 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 Mutural Recognition Arrangement (MRA). The accreditation number of the Kiryu Factory is 0090.

TML Calibration Service

Offers calibration service and support for your measuring instruments

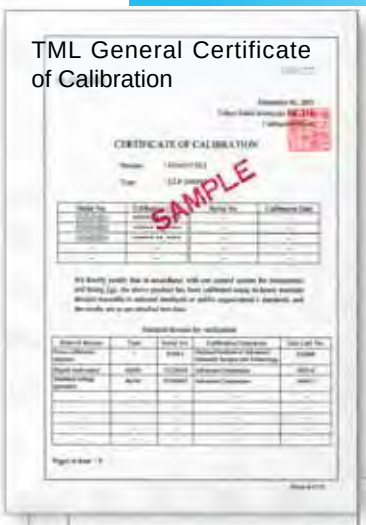
Maintaining strict calibration for various measuring instruments to be used is essential. We offer calibration service to certify that the instruments are traceable to National standards.

- 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 measuring instruments.
- 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 instruments

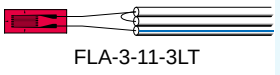
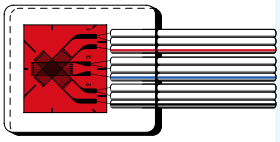
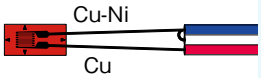
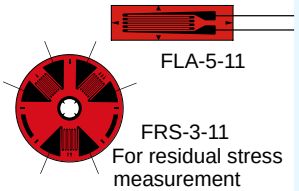
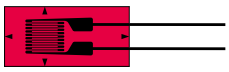
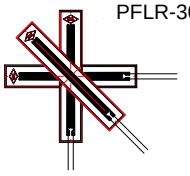
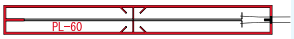
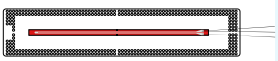
TML General Certificate of Calibration

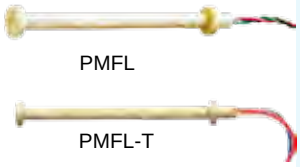
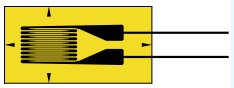
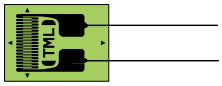
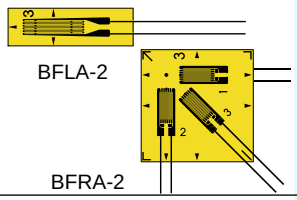
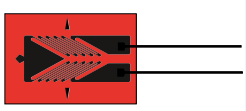
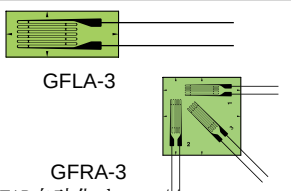


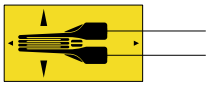
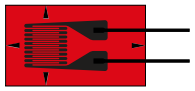
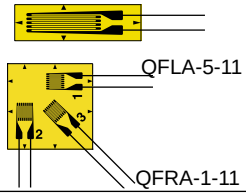
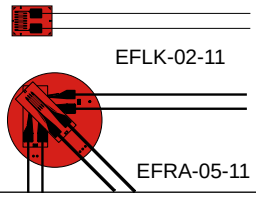
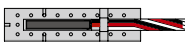
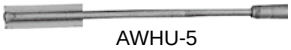
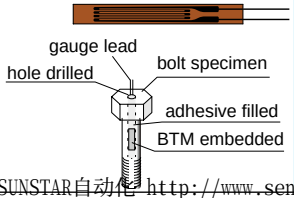
TML Short-form Certificate of Calibration

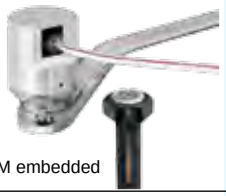
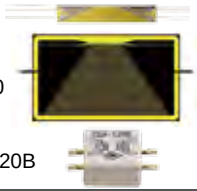
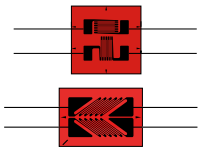
TML Combined Certificate of Calibration

TML Certificate of Traceability

Gauge Series	Gauge Pattern (example)	Description	Gauge Length (mm)	Operational Temperature Range (°C)	Remarks
Integral Lead Strain Gauge LW	 FLA-3-11-3LT  FLA-1-11-1L	This gauge is general purpose F, PF and P series gauge with pre-attached lead wires of 1, 3 or 5 meters in length for easy connection to a strainmeter. Pre-attachment among 2-wire parallel in 1-, 3-, and 5-meter long is available. Also, 3-wire parallel in 3- and 5-meter long are provided.	0.2~30	−20~+80	Single/ 2- / 3-element
Foil Strain Gauge WF	 WFRA-3-11-1L	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-11-3LT	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
Foil Strain Gauge F	 FLA-5-11 FRS-3-11 For residual stress measurement	This gauge is produced from specially controlled alloy foil. The grid is precision-etched and utilizes an extremely thin epoxy backing. Gauge length as short as 0.2mm or stress concentration measurement gauge is also available in this series.	0.2~30	−20~+80	Single/ 2-/ 3-element
Foil Strain Gauge UF	 UFLA-1-11	The operational temperature range of this gauge series extends to 150°C. The gauge is temperature-compensated for mild steel, stainless steel and aluminium. The gauge backing is color-coded according to the temperature compensated material type in the same method as for the F. The backing is thin and flexible, thus allowing easy adhesion on curved surfaces to provide superb performance in measuring resistance change and thermal output.	0.2~5	−20~+150	Single/ 2-/ 3-element
Magnetic field Strain Gauge MF	 MFLA-5-350-1LS	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 2, 5, 60 2-/3-element : 2	Single −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.	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.	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 element
Concrete embed-ment Polyester Mold Strain Gauge PM		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)	Operational Temperature Range (°C)	Remarks
Concrete embedment Mold Strain Gauge PMF	 PMFL PMFL-T	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		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		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
Composite Strain Gauge UBF		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		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	—
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

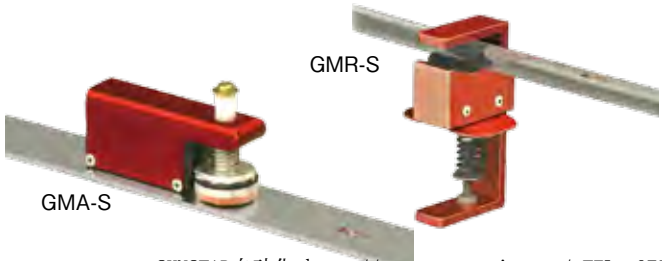
Gauge Series	Gauge Pattern (example)	Description	Gauge Length (mm)	Operational Temperature Range (°C)	Remarks
High/Low temperature Strain Gauge CEF		This gauge has a polyimide-amide carrier backing for wide use in temperature range from cryogenic condition up to 200°C.	1, 3, 6	−269~+200	Single element
Cryogenic temperature Strain Gauge CF		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	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	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	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	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 $\pm 3000 \times 10^{-6}$. 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 −30~+200	Single element
Weldable Strain Gauge AWM/AWMD AWH/AWHU	 AWHU-5  AWHU-8	These gauges have a metal carrier backing such as stainless steel and designed to be spot-welded to the test specimen.	AWM-8: 8 AWMD-5/-8: 5, 8 AWH-4/-8: 4, 8 AWHU-5/-8: 5, 8	AWM-8: -196~+300 Static/Dynamic AWMD-5/-8: -196~+800 Dynamic AWH-4/-8: -196~+600 Static; -196~+650 Dynamic AWHU-5/-8: -196~+800 Static/Dynamic	
Bolt Strain Gauge BTM		This gauge is intended for measuring a tensile force of bolt. A hole having 2mm diameter is drilled at the center of a bolt and the gauge is embedded to bond with A-2 adhesive. This method has the advantage where an ordinary strain gauge cannot be installed on the bolt surface.	1, 6	−10~+80	Single element

Gauge Series	Gauge Pattern (example)	Description	Gauge Length (mm)	Operational Temperature Range (°C)	Remarks
Bolt axial force measurement wrench BTMP	 BTM embedded	The bolt axial force can be easily measured by merely sticking the exclusive terminal on the head of a hexagonal bolt and setting the wrench on the bolt head. There is no need for attaching or detaching the leadwires when tightening the bolt.	For details, contact TML or your local representatives.		
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	FAC-5  FAC-20 CGA-120B	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.	—	−20~ +80	Single element
Frictional type Axial force Strain Transducer FGAH	FGAH-1A 	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 Transducer FGDH	FGDH-2A 	This transducer 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-1B and FGDH-2A are available for different telemetry receiver.	—	FGDH-1B −10~ +50 FGDH-2A −20~ +60	Special
Frictional type Strain Checker FGMH	FGMH-1B FGMH-2A  FGMH-3A	The strain checkers pick up strains 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 gauges are not only used for strain measurement, but also as sensors for strain gauge-type transducers including force transducer (load cell), pressure transducer, displacement transducer, acceleration transducer, and so on.	For details, contact TML or your local representatives.		

SPOT WELDER W-50R, W-50RB

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.
W-50RB carries CE marking.

STRAIN GAUGE CLAMP - Gauge Mate GMA and GMR



When bonding strain gagues, a constant pressure should be applied to the gauge until curing is completed. This can be easily done using the TML Gauge Mate, which is a gauge clamp device cosisting of a coil spring and a permanent magnet. For use on specimens of different shapes, two types are availablel. GMA-S is for flat specimens, and GMR for round specimens. Both can be used with room-temperature curing type bonding adhesive.

Type	Application
GMR-S	Round specimen use (6~32mm dia.)
GMA-S	Flat specimen use (1mm thick or more)

NB: Strain Gauge Clamp should be used at room temperature.

STRAIN GAUGE ADHESIVES

Type	Component	Operational Temperature (°C)	Applications
P-2	Polyester	− 30 ~ +180	Two-component, Room-temperature-curing (mixing ratio: 2 ~ 6%), General use
RP-2	Polyester	− 30 ~ +180	Two-component, Room-temperature-curing (mixing ratio: 2 ~ 4%), Concrete use
NP-50	Polyester	− 30 ~ +300	Two-component, Room-temperature-curing (mixing ratio: 6 ~ 8%), High temperature use
PS	Polyester	− 30 ~ +100	Two-component, Room-temperature-curing (mixing ratio: 2 ~ 4%), Concrete use
CN	Cyanoacrylate	− 196 ~ +120	Single component, Room-temperature-curing, General use
CN-E	Cyanoacrylate	− 30 ~ +120	Single component, Room-temperature-curing, Concrete, mortar or porous material use
CN-Y	Cyanoacrylate	− 30 ~ + 80	Single component, Room-temperature-curing, Post-Yield gauge use (large strain measurement)
CN-R	Cyanoacrylate	− 30 ~ +120	Single component, Room-temperature-curing, Recommendable for use in low temperature, dry condition
C-1	Phenol	−269 ~ +200	Single component, Heat-curing, Recommendable for use in long term of period and in high temperature
EA-2A	Epoxy	−269 ~ + 50	Two component, Room-temperature-curing (mixing ratio: 2:1), Cryogenic temperature use
EB-2	Epoxy	− 30 ~ +200	Two component, Room-temperature-curing (mixing ratio: 10:3), Long term measurement use
A-2	Epoxy	− 30 ~ +100	Two component, Room-temperature-curing (mixing ratio: 10:1), BTM bolt strain gauge use

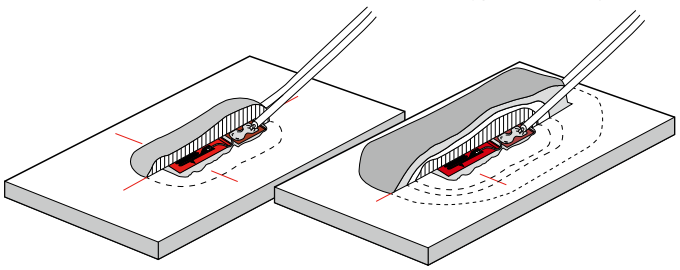
MSDS : Material Safety Data Sheet
TML supplies MSDS for all strain gauge adhesive and coatings. Contact your TML supplier for more information.

STRAIN GAUGE COATING MATERIALS

Type	Operational Temperature (°C)	Application	Materials	Description
W-1	0 ~ +50	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
SB tape	−30 ~ +80	Pressure sensitive	Buthyl	3-mm thin tape-form coating, Very convenient to use
VM tape	−20 ~ +80	Pressure sensitive	Buthyl	1-mm thin tape-form coating
Epoxy resin	−60 ~ +100	Two-component (Mixing ratio: 10:8) Room-temperature curing 24 hours	Epoxy	General purpose coating for mechanical protection
Epoxy resin AV138	−60 ~ +180	Two-component (Mixing ratio: 10:4) Room-temperature curing 24 hours	Epoxy	Mechanical protection use in high-temperature
KE-348	−50 ~ +200	Air-drying solvent Room-temperature curing 12 hours	Silicon rubber	Heat-resistive
TSE3976-B	−50 ~ +300 (short term)	Air-drying solvent Room-temperature curing 12 hours	Silicon rubber	Heat-resistive, For long term use, temperature is restricted up to +250°C

Single-layer coating with one type of coating

Multi-layer coating with different types of coating



MSDS : Material Safety Data Sheet
TML supplies MSDS for all strain gauge adhesive and coatings. Contact your TML supplier for more information.

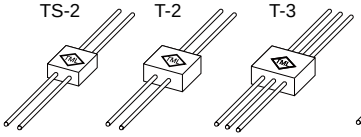
CONNECTING TERMINALS

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

Cubic shape

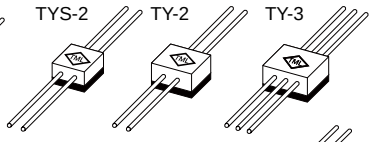
for general purpose

TS-2 T-2 T-3



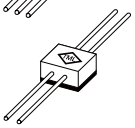
for large strain with rubber backing

TYS-2 TY-2 TY-3

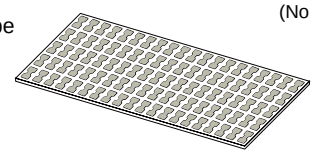


TP-2

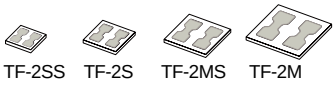
Self-bonding type
(No adhesive required)



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

Foil shape

Type	Dimension (mm)	Operational Temperature(°C)	Quantity Pairs/sheet
TF-2SS	5× 4 ×0.2	−196 ~ + 180	50
TF-2S	6× 5 ×0.2	−196 ~ + 180	50
TF-2MS	8×6.8×0.2	−196 ~ + 180	50
TF-2M	10× 9 ×0.2	−196 ~ + 180	50
TFY-2SS	5× 4 ×0.8	−20 ~ + 120	50
TFY-2S	6× 5 ×0.8	−20 ~ + 120	50
TFY-2MS	8×6.8×0.8	−20 ~ + 120	50
TFY-2M	10× 9 ×0.8	−20 ~ + 120	50
TPF-2SS	5× 4 ×0.2	−196 ~ + 200	50
TPF-2S	6× 5 ×0.2	−196 ~ + 200	50
TPF-2MS	8×6.8×0.2	−196 ~ + 200	50
TPF-2M	10× 9 ×0.2	−196 ~ + 200	50
TPFH-2SS	3.8×4.8×0.1	−269 ~ + 350	50
TPFH-2S	5.5× 6 ×0.1	−269 ~ + 350	50
TPFH-2MS	7.5× 8 ×0.1	−269 ~ + 350	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. (Japanese patent No.3546203)

Leadwire resistance

In conventional method, as bold and short leadwires as possible are recommended to keep the resistance of leadwires lower. On the contrary, as the 1-gauge 4-wire method is not influenced at all by the leadwire resistance, it is possible to connect a thin and long leadwires to strain gauges.

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

Dynamic Strainmeter DRC-3410

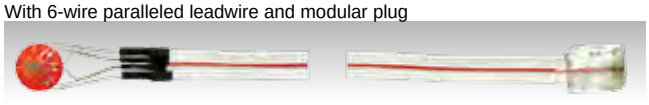
Strain gauges with leadwires and modular plug

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 leadwires, 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 disposed by fire.

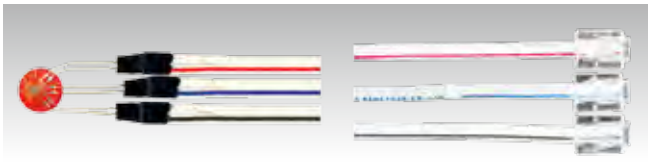
Single element strain gauge with 4-wire paralleled leadwire

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 10kN~2MN	Compression, High Performance Remote sensing 5~30kN

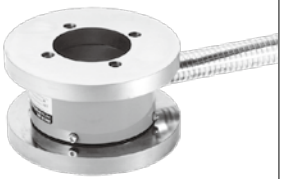
LOAD CELLS Compression

CLJ-NB	CLF-NA	CLL-NA/CLH-NA	CLR-NAH
			High temperature +160°C 
Compression, High Performance Remote sensing 10kN~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 Tension/Compression universal

KCC-NA	KCK-NA	TCLB-NA	TCLA-NB
			
Compression, Center-hole 200kN ~ 1MN	Compression, Center-hole 500kN / 1MN	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 model is available at option

TCLU-NA

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

TCLN-NA

Miniature Tension/Compression
500N~5kN

TLJ-NA

Tension, High Performance
Remote sensing
10~100kN

LOAD CELLS Tension

TLP-NB

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

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

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

DISPLACEMENT TRANSDUCERS

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

SDP-C/SDP-D

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

DISPLACEMENT TRANSDUCERS

SDP-CT

Spring Loading, Tension Type
50/100mm

DP-E

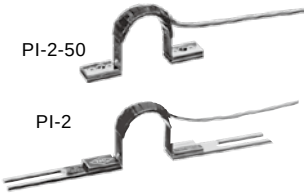
Tape Measure Type, Long Span
500 ~ 5000mm

FDP-A

Protection ratings: IP-68

Waterproof, LVDT Type
10 ~ 100mm

PI



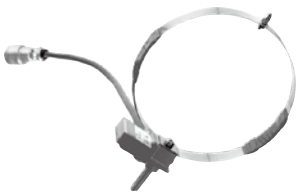
Large Span ±2 / ±5mm
Gauge Length 50~300mm

DISPLACEMENT TRANSDUCERS

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

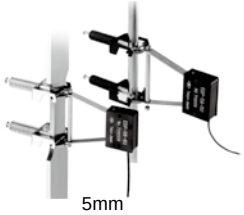
UB/UB-A

COD Measurement

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

EXTENSOMETER

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

PWA-PAH

High temperature +120°C

Amplifier-integrated

2 ~ 50MPa
Voltage Output : PWA-PAHV
Current Output : PWA-PAHA

PRESSURE TRANSDUCERS

PW-PAH

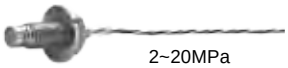
High Temperature +170°C

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

PDA-PA/PDB-PA

Miniature 200kPa~3MPa

PDA-PA PDB-PA

ACCELERATION TRANSDUCERS

ARS-A

High Sensitivity
10m/s²

ACCELERATION TRANSDUCERS

ARM-A-T

Small, Tri-Axial
X, Y: 100m/s² , Z: 400m/s²

ARF-A/ARF-A-T

Small, Low Range
Uni-axial : 10~500m/s², ARF-A
Tri-axial : 20~500m/s², ARF-A-T

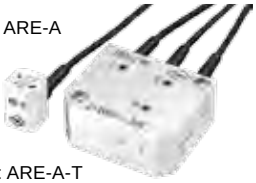
Uni-axial
ARF-A

Tri-axial
ARF-A-T

ARE-A/ARE-A-T

Uni-axial ARE-A 1000～10000m/s²
Tri-axial ARE-A-T 1000～ 5000m/s²

Uni-axial: ARE-A



Tri-axial: ARE-A-T

ARH-A

Protection ratings: IP-67

Waterproof, Low Range 10 ~ 500m/s²

ACCELERATION TRANSDUCERS

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

Small, High Frequency Response
50 ~ 2000m/s²

Uni-axial
ARJ-A

Bi-axial
ARJ-A-D

Tri-axial: ARJ-A-T

ARK-A

Small, High Frequency Response
1000/2000m/s²

Accessory Mounting Plates

ARJF-11 ARFF-11 ARHF-11

ARJF-12 ARSF-11

STRAIN TRANSDUCERS

KM/KM-AT/KM-BT

±5000×10⁻⁶ strain
For concrete materials
Thermocouple-integrated : KM-AT/-BT

STRAIN TRANSDUCERS

KM-100HAS

±5000×10⁻⁶ strain
For asphalt pavement materials

REINFORCING-BAR METER

KSA-A/KSAT-A

300N/mm²
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 : 50/100/125/150mm
CM-H with destructive proof : 100mm

PORE PRESSURE GAUGES

KPA-PA/KPB-PA

KPA-PA

KPB-PA

ϕ40mm 200kPa~2MPa

PORE PRESSURE GAUGES

KPC-PA/KPD-PA

KPC-PA

KPD-PA

ϕ30mm 200kPa~2MPa

SOIL PRESSURE GAUGES

KPE-PB

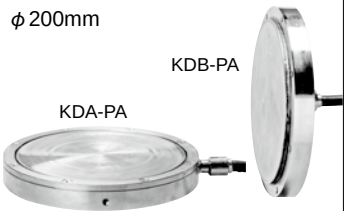
Small, Model-Kit Test
200kPa~2MPa

KDA-PA/KDB-PA

ϕ200mm

KDB-PA

KDA-PA



200kPa~2MPa

KDC-PA/KDD-PA

ϕ100mm

KDD-PA

KDC-PA

200kPa~2MPa

SOIL PRESSURE GAUGES

KDE-PA/KDF-PA

φ50mm

KDF-PA

KDE-PA

200kPa~2MPa

KDG-PA/KDH-PA

φ100mm Load Cell type

KDH-PA

KDG-PA

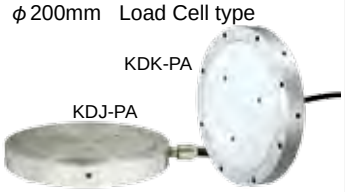
200kPa~2MPa

KDJ-PA/KDK-PA

φ200mm Load Cell type

KDK-PA

KDJ-PA



200kPa~2MPa

KDL-PA

φ180mm

200kPa

INCLINOMETERS

KB-AB/KB-AC

Surface Type

±1~5°

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

KB-B

Impactproof Type

±0.5~2°

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

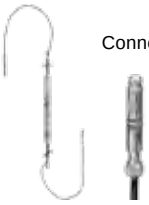
2-directional High Outputs

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

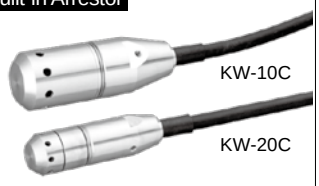
WATER LEVEL METERS

KW-C

Built-in Arrestor

KW-10C

KW-20C



10, 20, 30, 50m

WATER-TUBE DISPLACEMENT TRANSDUCERS

KWL-B/KWL-E

Built-in Arrestor

KWL-B

KWL-E

Water Pressure Type
1, 2m

Water Level Type
100, 200mm

GROUND EXTENSION GAUGES

KLG-A/NKLG-AB

Built-in Arrestor

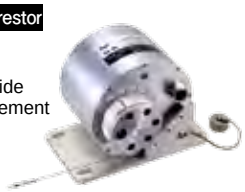
Land Slide Measurement

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

KLG-1000C

Mechanical Counter Type
No Power Required

1000mm

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

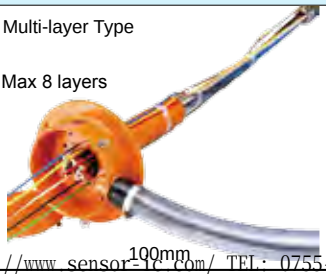
50mm(−20~ +30mm)

ROCK DISPLACEMENT TRANSDUCERS

KLB-A

Multi-layer Type

Max 8 layers



100mm

CAISSON SKIN-FRICTION METER

KKA-PB

200, 300kPa

CAISSON CUTTING-EDGE REACTION METER

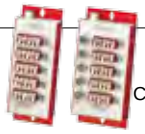
KKB-PA/KKB-PB

KKB-PA : 2MPa
KKB-PB : 5, 10, 15MPa

Strain which is regarded as no change with time is called static strain. The strain can be measured digitally by scanning the measurement channels of a static strainmeter or data logger.

Combination of a data logger and external switching boxes allows measurment of up to 1000 channels to be performed in the fastest 0.1 seconds.

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/-10MC	1000	60 sec.
	Built-in (High Speed)	30	0.1 sec.
Data Logger TDS-530  Interface : LAN/USB/RS-232C	IHW-50G	1000	0.4 sec.
	ISW-50G	1000	2 sec.
	ASW-50C SSW-50D/-10MC	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)	FSW-10	50	3.4 sec.
	FSW-21C	100	8.3 sec.
Handheld Data Logger TC-32K  Interface: USB/RS-232C	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
- New compensation methods of measuring strain provided

DATA LOGGER TDS-530

- 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
- 1-Gauge 4-Wire strain measurement with modular plug connection
- New compensation methods of measuring strain provided

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
- New compensation methods of measuring strain provided

High Speed SWITCHING BOX IHW-50G

- Electricaly insulated with Data Logger
- Multi-measurement of strain, DC voltage temperature with PtRTD and thermocouple
- Connectable Data Logger TDS-530, 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
- New compensation methods of measuring strain provided

SWITCHING BOX ISW-50G

- Electricaly insulated with Data Logger
- Multi-measurement of strain, DC voltage temperature with PtRTD and thermo-couple
- Connectable Data Logger TDS-530, 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
- New compensation methods of measuring strain provided

SWITCHING BOX SSW-50D

- Compatible with TML 1-Gauge 4-Wire strain measurement method
- Available for strain, DC voltage and thermocouple measurements
- Can be used with conventional models SSW/ASW-50C
- Complete strain correction method provided
- Cascade connection by one cable of 9mm-dia. with data logger
- Applicable Data Loggers: TDS-530

PORTABLE DATA LOGGER TDS-150

- Connectable Five decade channel units (FSW-10/FSL-10L) for 50 channels max.
- Possible long-term automatic measurement 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
- New compensation methods of measuring strain provided
- 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
- New compensation methods of measuring strain provided
- 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

REMOTE POWER CONTROLLER RPC-1A/RPC-05A

- Controls remotely power on/off
- Applicable instruments
  Data Logger TDS-530, TDS-150,TC- 32K
  Network Handheld Strainmeter TC-35N
- An excessive power protection built in the power supply section (12V/24V)
- Incorporates auxiliary recharge circuit to battery
- ON-OFF power control by computer via RS232C

EXTERNAL DISPLAY UNIT EDU-11

- Remote display with large, high-brightness LED for monitoring TDS-530, TDS-150 or TC-32K
- Any channel available for monitor
- By cascading connection, multi-channel monitoring is possible.

Controller ZT-211

Strain Module ZT-221

Voltage Module ZT-231

Thermocouple Module ZT-232

WIRELESS MESH TELEMETRY SYSTEM ZT-200 Series

- High reliable strain measuring system with wireless mesh networks
- Mesh connectivity establishes a wireless measuring system with sensor modules up to 20 units for strain, voltage, thermo-couple
- Mesh interface functions to avoid data damage, making spreads of measuring area possible.
- With the built-in LAN, remote measurement via router is available.
- Wireless telemetry system makes simple measuring system possible.

Wireless Module ZT-014

Wireless Controller ZT-120

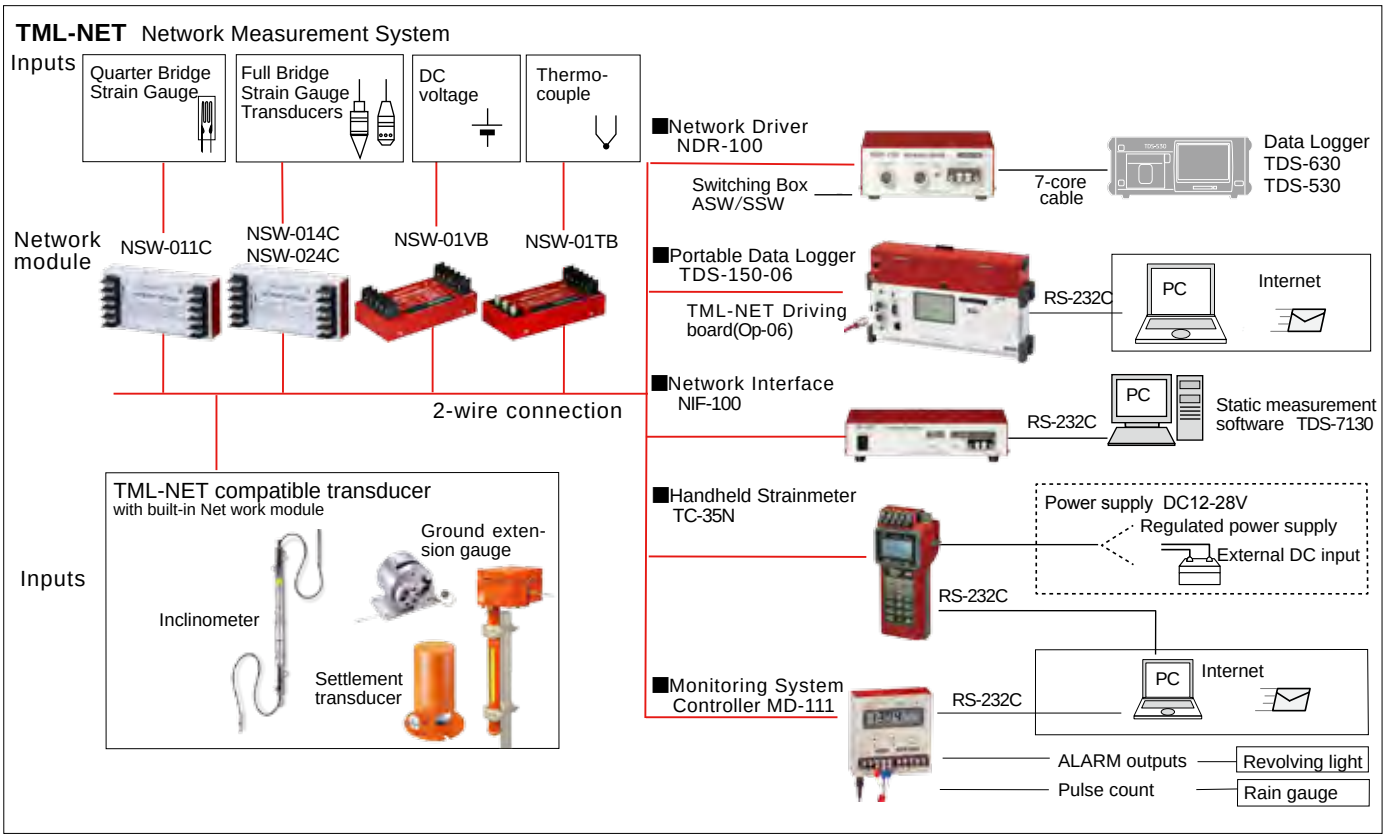
Wireless Controller ZT-150

WIRELESS DATA ACQUISITION SYSTEM ZT-014/ZT-120/ZT-150

- Wireless data acquisition from PCs or our Data Loggers
- Resistive to noise owing to digital processing near sensors
- Very low power consumption, possible one year or more measurement
- About 50m communication in an open view
- Small and lightweight wireless modules
- Two types of Wireless Controller
  ZT-120 is connected to PCs by USB
  ZT-150 is connected to TDS-150

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 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 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, or PC, Network Handheld Strainmeter TC-35N, Monitoring Sys-tem Controller MD-111.

- Easy connection and branch
- 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
- Possible parallel use with ordinary Switching Box SSW/ASW
- 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 100 modules use with external DC input
- Built-in compact flash card
- Measurement with Sleep interval func-tion

MONITORING SYSTEM CONTROLLER MD-111

- Output contact functions to build an alarm system
- Measurement with Sleep interval func-tion
- RS-232C interface available
- 5 modules use with built-in battery D (LR20) or 100 modules use with ex-ternal 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
- ±30000×10^{-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
- ±30000×10^{-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
- ±30000×10^{-6} strain

NETWORK MODULES NSW-B TYPE

Voltage module NSW-01VB

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

Thermocouple module NSW-01TB

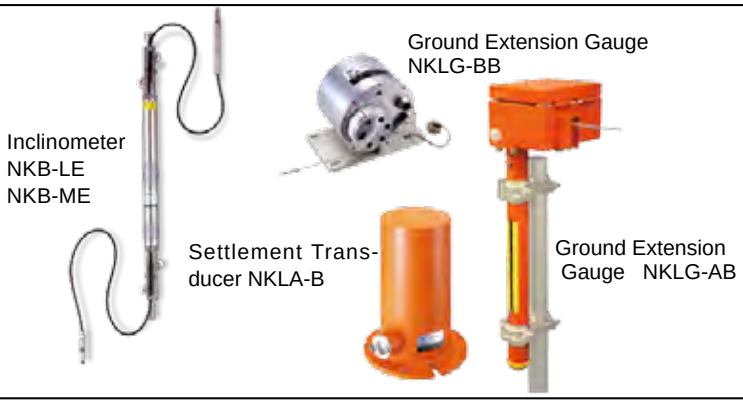
- Thermocouple T applicable [JIS C1602(1995)]
- Measuring range -200~+400°C

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

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.



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

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 volts(100V/s): 72~108V
- Impulse Breakdown in volts (100V/μs): 450V at Max.
- Impulse Discharge current 8/20μs : 10kA
- AC Discharge current (50Hz) 9 cycles : 65A
- DC Holdover voltage : 50V
- Surge life (10/1000μs 500A): 100 shots
- Insulation Resistance : 10000 MΩ at Min.
- Electrostatic capacitance: 2.0pF at Max.

NZ-6B

NZ-7C

NZR-7B

ARRESTER-PROTECTED MEASURING SYSTEM

- When using instruments and transducers in a field measurement for a long term, protection from surge voltages which may be caused by lightning is important.
- The NZ-7C/NZR-7B are designed for connection close to the data logger or switching box for protection of the instrument.
- The NZ-6B is designed for connection close to the transducer or switching box for protection of the transducer or instrument.

QUICK CONNECTING TERMINAL SB-OT1A

●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 temrinal is used for one lead wire. (One set contains five terminals).

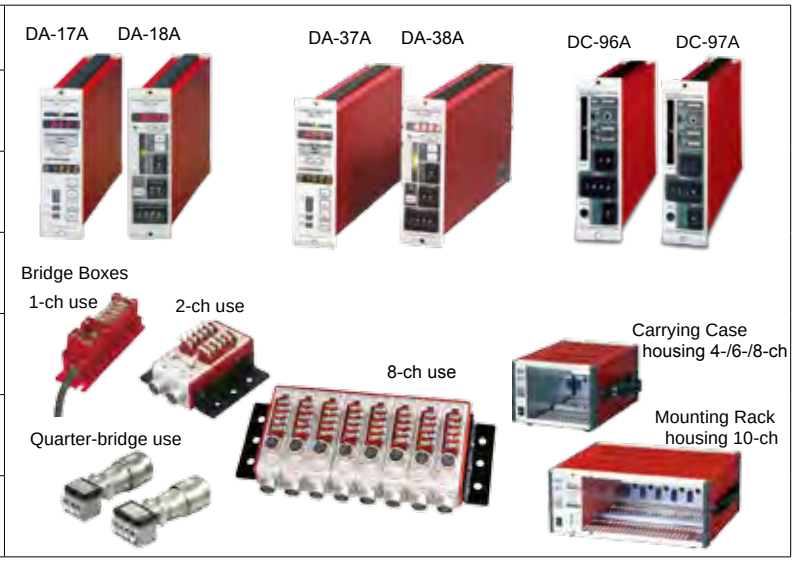
Strain which changes with time is called dynamic strain. The strain is amplified in analog and output by a dynamic strainmeter for data storage and analysis on external recording system. One dynamic strainmeter used to be needed for one measurement point, but nowadays digital single or multi-channel dynamic strainmeters which convert analog signal into digital value at high speed stores data in internal memory and transfer to a PC are available.

DIGITAL DYNAMIC STRAINMETER

Type	No. of channels	Bridge Voltage	Frequency Response	Interface
DRA-162B	16	0.5, 2Vrms 5kHz	DC ~ 2.5kHz	LAN
DRA-3410	30	DC0.5, 2, 5V	DC ~ 100kHz	LAN
DRA-101C	10	0.5, 2, 5Vrms 5kHz	DC ~ 2.5kHz	GP-IB RS-232C
DRA-107A	10	0.5, 2Vrms 5kHz	DC ~ 2.5kHz	GP-IB
DC-204R 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	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



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

DIGITAL DYNAMIC STRAINMETER DRC-3410

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

DIGITAL DYNAMIC STRAINMETER DRA-101C

- Built-in A/D converter for each channel for digital waveform recording
- Built-in data memory (standard 48k words /channel, expandable up to 496k words/channel at the maximum)
- Various functions of digital processing
- Analog output of calibration voltage and recorded waveform through D/A converter
- External sampling clock input capability
- High resolution mode ($0.1x10^{-6}$ strain)

DIGITAL DYNAMIC STRAINMETER DRA-107A

- Built-in A/D converter for each channel for digital waveform recording
- Built-in data memory of 496k words/channel
- Various functions of digital processing
- High resolution mode ($0.1x10^{-6}$ strain)
- Data read software DRA-7107 supplied as an accessory

MULTI-CHANNEL DIGITAL STRAIN METER DRA-30A

Static strain mode

Dynamic strain mode

- 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-channel
- 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

MULTI-CHANNEL DYNAMIC STRAIN METER DS-50A

- 50-channel dynamic strainmeter expandable to 1,000 channles (20 units)
- Fastest 1kHz sampling for the 1st unit.
- Enable to extend connection 100m long at max. between units
- Standard supply of software DS-750

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

DA-17A DA-18A

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

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

DA-37A DA-38A

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

DYNAMIC STRAINMETER DC-96A DC type

- Wide frequency response range DC~200kHz
- Digital sensitivity setting method
- Upgraded electronic automatic balancing
- Zero stability of 0.5×10^{-6} strain/°C
- Usable as DC amplifier
- Bridge excitation switchable in 5 steps
- Dual outputs
- Built-in low-pass and high-pass filters
- Possible external control for balancing and calibration signal output

DYNAMIC STRAINMETER DC-97A DC type

- Wide frequency response range DC~500kHz
- Digital sensitivity setting method
- Upgraded electronic automatic balancing
- Zero stability of 0.5×10^{-6} strain/°C
- Usable as DC amplifier
- Bridge excitation switchable in 5 steps
- Dual outputs
- Built-in low-pass and high-pass filters
- Possible external control for balancing and calibration signal output

THERMOCOUPLE ADAPTOR TA-01KT

- For temperature measurement with DC exciting strainmeter
- Small, light weight
- Unnecessary external power source
- Built-in reference contact
- Isolated input and output
- Built-in digital linearizer
- Onboard burn-out function
- Measuring range
  K: -50~+1000°C T: -50~+300°C
- Applicable instruments : TMR-221, DC-204R, DC-204Ra, 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

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

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

BRIDGE BOX SB-120PY

- Enables 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

BRIDGE BOX SB-120SB-8/SB-120SB-10

- 8 channels (SB-120SB-8) and 10 channels (SB-120SB-10) bridge box for strain measurement
- Quarter Bridge 2-wire : 120 Ω (with short-circuit bar)
  Quarter Bridge 3-wire : 120 Ω
- Half Bridge, Full Bridge: 60~1000Ω

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

- 8 channels (SB-128A) and 10 channels (SB-128A-10) bridge box for strain measurement
- Quarter Bridge 2-wire : 120Ω
  Quarter Bridge 3-wire : 120Ω
  Opposite Half Bridge : 120Ω
  Opposite Half Bridge 3-wire : 120 Ω
- Half Bridge, Full Bridge : 60~1000 Ω

SB-120DG-1R2

SB-120DG-1R3

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

- SB-120DG-1R2
  Quarter Bridge 2-wire : 120Ω
- SB-120DG-1R3
  Quarter Bridge 3-wire : 120 Ω

BRIDGE BOX SB-123A

- 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

QUICK CONNECTING TERMINAL SB-OT1A

- 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-A

- These carrying cases are used to configure multi-channel system with DA series, and DC series units. Each is equipped with a power switch for simultaneous ON/OFF of all channels, a calibration switch, and a balance button.

Computer control CARRYING CASE LAN interface P-AL

- This is a case for setting up multi-channel system wiith DA-17A/DA-37A series dynamic strainmeters. Setting of sensitivity and lowpass filter, initial-balancing, calibration and obtention of the set values and monitor values are possible through LAN interface from a computer.

MOUNTING RACK R-10A

- JIS rack to configure a system with up to 10 units DA or DC series This rack lets you configure a system with up to 10 channels using DA series, or DC series units. It is equipped with a power switch for simultaneous ON/OFF of all channels, a calibraiton switch and a balance button.

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

Voluntary combination of various sensor input units according to purposes

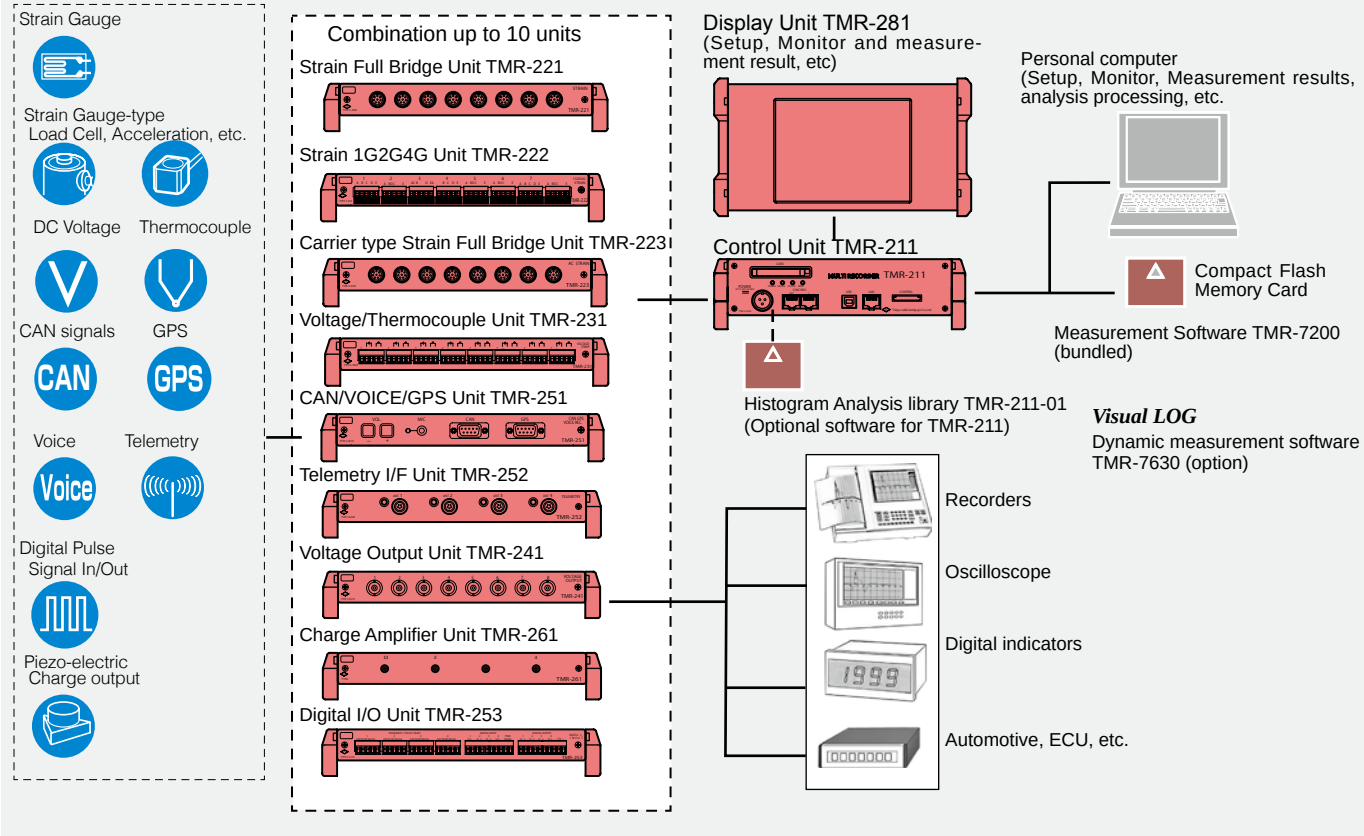
Unit ports (back)

Display unit TMR-281

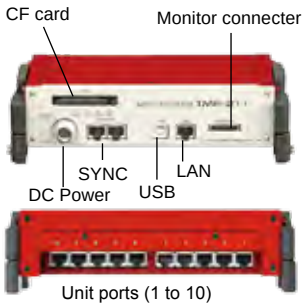
Control unit TMR-211

Sensor input units

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 suite 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/Thermocouples 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, subtraction and average operation results up to 4 channels

CAN/VOICE/GPS Unit TMR-251

- [CAN] Protocol: Conforms to CAN spec. V2.0B active
  Transfer speed : 10k~1Mbps
  Number of messages: 64
- [GPS] Applicable receiver : TMR-251-2
- [Speed measurement] 100Hz interval
- [VOICE memo] Number of inputs: 1
- GPS Receiver TMR-251-2
  Acquisition of information on position and time, automatic time adjustment for TMR-211, etc.

Telemetry I/F Unit TMR-252

- Connecting a Digital telemetry receiver DT-24R
- Connectable 4 units of receiver
- Compatible sensor: Wheel torque transducer LTW-ND
- Number of data: 8 points

Digital I/O unit TMR-253

- [Frequency measurement and Pulse counter]
  Number of inputs : 4
  Maximum input voltage: ±15V
  Frequency response : 1Hz~100kHz
  Output voltage : 5V/12V
  Output current : 5V/50mA, 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 accleratometer
- 4 measuring channels
- Charge sensitivity
  0.1pC/(m/s^2)~10pC/(m/s^2)
- Allowable input charge : 10,000pC

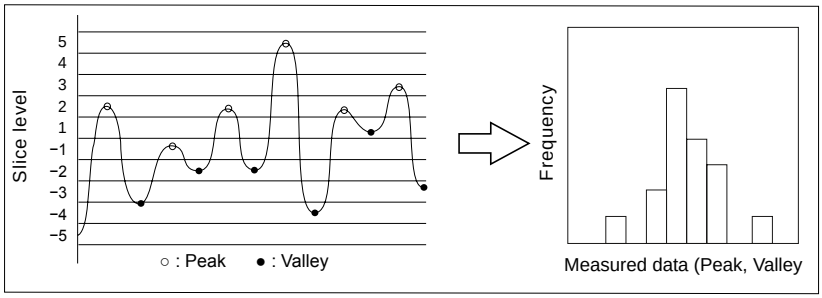
Multi-Recorder Software Option Histogram Analysis Library TMR-211-01

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 (effective other methods than Time-frequency)
• 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

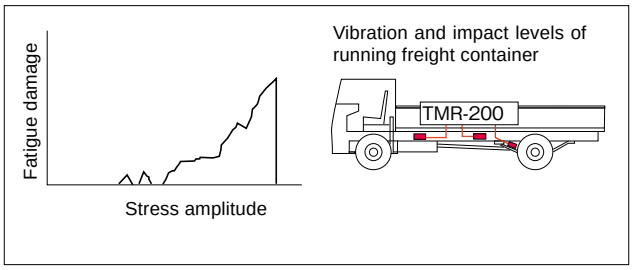
For precise understanding of various phenomena that change with time, it is important to know not only waveforms of each phenomenon but their frequency distribution and correlation. The Multi-Recorder TMR-200 Series is also available for measuring the frequency distribution of a phenomenon with optional software Histogram Analysis Library TMR-211-01, i.e. histogram, by digitally processing analog data sent from a strain gauge and transducer. 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 to be set 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

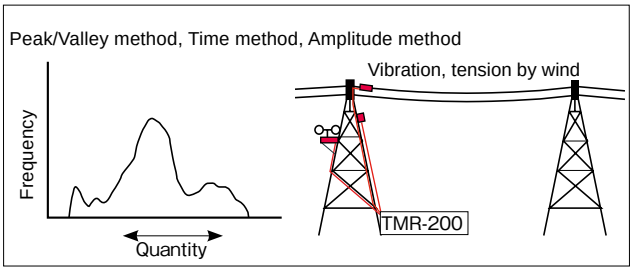
●Fatigue life prediction

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

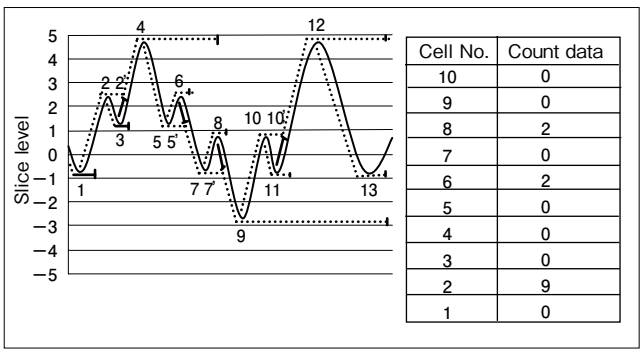
A frequency analysis of the TMR-200 series is ready for the followings.
Peak/Valley method, Maximum/Minimum value method, Amplitude method, Time method, Level crossing method, Rain-flow counting method

●RAIN-FLOW COUNTING method

In analyzing 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 peak and valley and 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 conditiions 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 of 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

TELEMETRY SYSTEM

DIGITAL TELEMERY SYSTEM DT-041T/DT-041R-1 315MHz

Radio frequency range of 315MHz (Extremely low power radio station)
Maximum 80-channel measurements

Digital Telemetry Transmitter DT-041T
- Transmission of strain data and the transmitter's supply voltage data
- Small and lightweight
- Driving by induced power supply (Option)

Digital Telemetry Receiver DT-041R-1 (Voltage output type)
- Outputs measurement data to recorder, etc.
- Small (48(W)×100(H)×21.5(D)mm)

DIGITAL TELEMERY SYSTEM DT-031T/DT-031R 315MHz

- Radio frequency range of 315MHz (Extremely low power radio station)
- Easy measurement data file in combination with TMR-200 series

Digital Telemetry Transmitter DT-031T
- Transmission of strain data and the transmitter's supply voltage data
- Small and lightweight
- Driving by induced power supply (Option)

Digital Telemetry Receiver DT-031R
- Onboard TMR interface for setting up a system with TMR
- Small (48(W)×100(H)×21.5(D) mm)

Digital Telemetry Receiver DT-031R-1 (Voltage output type)
- Outputs measurement data to recorder, etc.

DIGITAL TELEMERY SYSTEM DT-121T/DT-181R 2.4GHz

- 2.4GHz band low-power wireless data communication system.
- 5kHz sampling
- Wide measurement range of ±25000 x10^{-6} strain
- The voltage output of strain is fixed. No need of calibration.
- Long communication distance, and easy setting.

Transmitter DT-121T
- The antenna is built in the transmitter
- Power save function provided
- Small(45(W)×11(H)×31(D)mm)

Receiver DT-181R
- Voltage output type

TELEMETRY SYSTEM TT-91/TR-90/TR-87

TT-91 Transmitter
- Small and lightweight
- No user licence reuired due to the use of extremely low power radio wave
- Measurement with good S/N ratio due to the use of FM wave.

TR-90 Receiver
- 100V ac and 12V dc operation
- Easy channel distinction due to digital display of usage frequency
- Output voltage indicated by digital value and analog meter
- LED display of receiving signal level - Easy monitoring of receiving condition

TR-87 Receiver (Produced on order)
- Dimension of business card size

INDICATOR

DIGITAL INDICATOR TC-31M

- Designed for strain gauge based transducers
- Compatible with flash memory card of 32 64/128MB
- A sleep interval function to make unattended operation possible
- Battery drive available in field site
- 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 32 64/128MB
- Control and data transfer via RS-232C

DIGITAL INDICATOR TD-23L

- Excellent accuracy and stability
- A 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-97A

- Color liquid crystal display and touch panel operation provide clear indication and easy handling.
- One of three display of comparison, hold, and graphics is selectable
- Various options are available such as RS-232C communication interface, RS-485 communication interface, D/A converter.
- Equivalent Input calibration makes easy calibration by inputting the rated value of a sensors by touching the display.

DIGITAL INDICATOR TD-95A

- Direct digital display of physical quantity in ±19999
- High/low limit function
- Secure and easy setting with TEDS
- Equivalent signal input function provided - Easy sensitivity adjustment without real load
- DIN conforming design suitable for mounting on testing devices.
- BCD, RS-232C and D/A output (Factory installation option)

STRAIN CALIBRATORS

Automatic calibrator CBA-3308A

8-channel simultaneous calibration
- Isolated among channels
- Computer control available
- Wide calibration range
- High resolution
- Excellent stability
- Generation of dynamic phenomena in quarter bridge and full bridge method, DC voltage mode

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 straionmeters 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 CBM-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)

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
TC1108-23A-10-7F

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

BNC Adapter JJ

Adapter for interconnection of two BNC connectors 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, Multi-Recorder Control unit TMR-221

Steering Torque Transducer HLA-50A

By attaching the transducer to passenger car steering column, driving torque is measured. It equips with telemetry.

- Possible installation on various types of car (Steering outer-diameter: 330~380mm)
- Easy installation and removal
- Excellent operability
- Steering torgue detected by strain gauges and output by digital telemetry

Axial Force Strain Transducer FGAH-1A

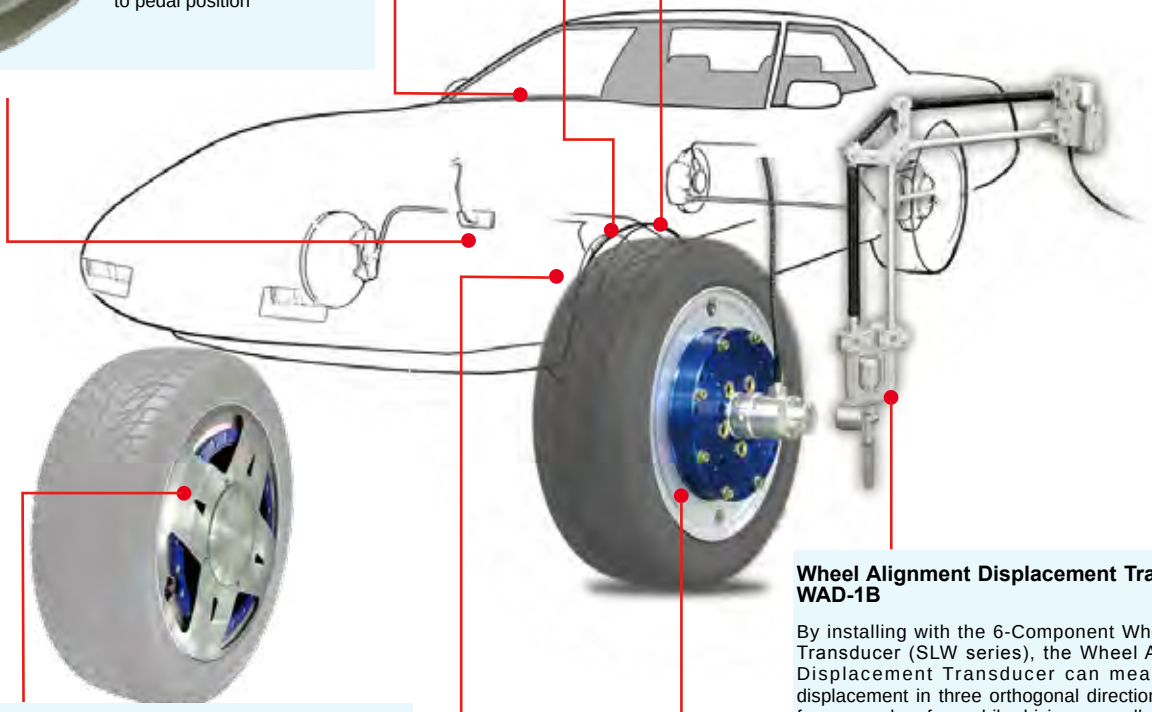
- Measures tensile force on steering tie-rod
- With built-in frictional strain gauge, no bonding is required.
- Easily mounted on an existing rod without detaching it
- Applicable rod : ϕ10~20mm
- Size : ϕ52mm x 35mm, Weight : 55g.

Frictional Torque Transducer (digital telemetry type) FGDH-1B/FGDH-2A

- With built-in frictional strain gauge, no bonding is required.
- Telemetry transmission incorporated.
- Not affected by noise due to the use of digital telemetry.
- Easily mounted on a drive shaft
- Applicable diameters of drive shaft ϕ20~30mm
- FGDH-2A is equipped with chargeable battery

Braking Pedal Force Transducer MLA-NA

- Measures brake pedal force
- Easily attached without modifying the pedal.
- Thin construction, Light weight
- Less measurement error due to pedal position



Wheel Alignment Displacement Transducer WAD-1B

By installing with the 6-Component Wheel Force Transducer (SLW series), the Wheel Alignment Displacement Transducer can measure tire displacement in three orthogonal directions passed from a road surface while driving, as well as camber angle and steering angle.

Wheel Torque Transducer (slip-ring type / digital telemetry type)

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

Driving torque and braking torque of a real car can be measured in analog.

6-Component Wheel Force Transducer (slip-ring type / digital telemetry type)

- SLW-NC Slip-ring type
- SLW-ND Digital telemetry type
- SLW-NE Digital telemetry and High accuracy type

The signals sent from the 6-Component Wheel Force Transducers (SLW series) attached to the axle shafts 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 influences on the sensor, and the moment position correction, which allow the front/back (Fx), right/left (Fy), and up/down (Fz) loads and each component force's torque (Mx, My, Mz) to be output in analog form or to be recorded in the CF card. The digital telemetry model has been newly added to the line up so you can build a wireless all-in-one system when used with the exclusive receiver.

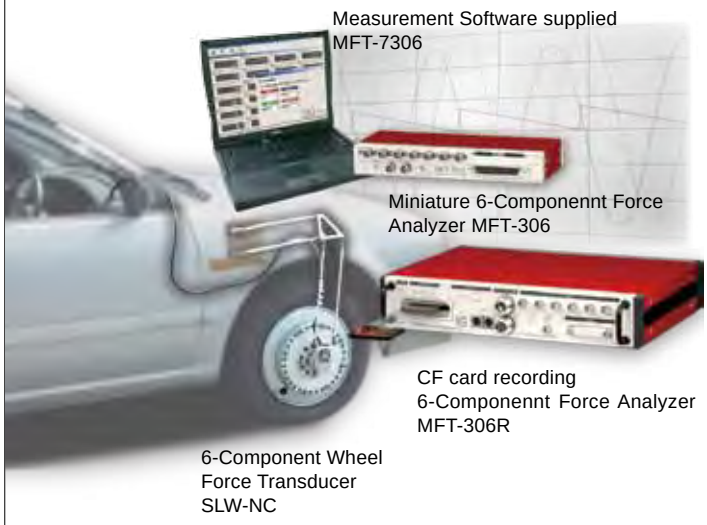
Tie-rod loadcell TCLT-NA

- Easy installation using connection thread between tie-rod and tie-rod end
- 3 types of thread making installation on various tie rods possible
- 6 kinds of combination of thread and capacity avaialble

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 and 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

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

- High-speed operation of crosstalk, rotation correction.
- 6-component force data, tire rotation count signal output in voltage form
- Forward and backward measurement possible with this 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

6-Component Wheel Force Transducer SLW-ND-A/-B
Fx, Fy, Fz: 20kN/40kN Mx, My, Mz: 4kN-m/8kN-m

High-accuracy type SLW-NE-A/-B
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-ND-A/-ND-B (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
Telemetry receiver DT-24R

- Small and lightweight - Reduction of installation area
- High-speed operation of crosstalk, rotation correction.
- 6-component force data, tire rotation count signal output in voltage form
- Measurement data 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 2 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

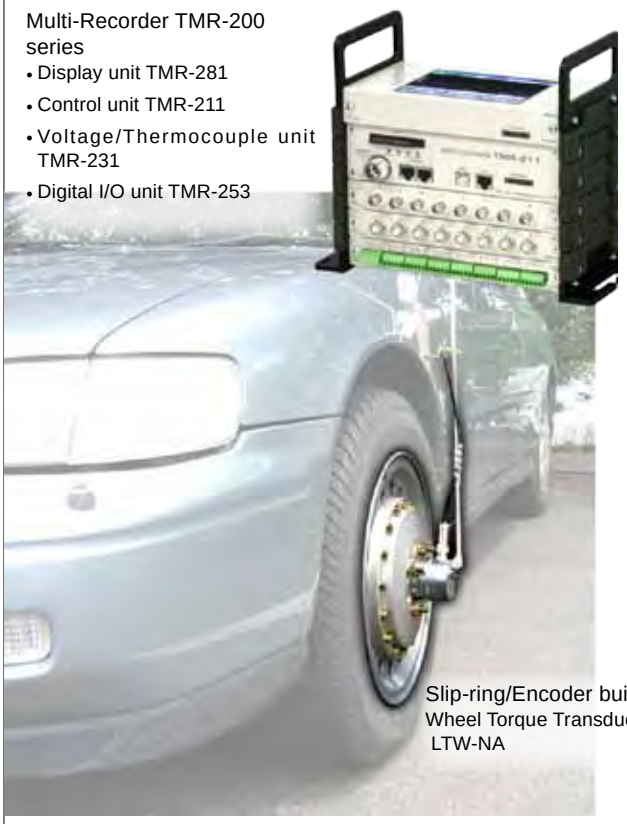
- Measures displacements of wheel center in orthogonal 3 directions
- Steering angle
- Camber angle

Wheel Torque Measuring System

The Wheel Torque Measuring System can measure the drive torque and braking torque while driving, in analog output form. The slip-ring/encoder built-in type, which incorporates an encoder, can also measure rotation speed. The model incorporating a miniature transmitter is lightweight and has almost no projections and so can take measurements without disturbing driving conditions. And the digital telemetry built-in type can measure drive torque and braking torque, and the output is taken out from the vehicle onboard telemetry receiver DT-24R, while passenger car driving.

SLIP-RING/ENCODER BUILT-IN TYPE

Multi-Recorder TMR-200 series
- Display unit TMR-281
- Control unit TMR-211
- Voltage/Thermocouple unit TMR-231
- Digital I/O unit TMR-253



Slip-ring/Encoder built-in type
Wheel Torque Transducer
LTW-NA

The Slip-ring/Encoder buit-in type Wheel Torque Measuring System, which is composed of the Wheel torque transducer LTW-NA to measure drive/braking torque, and Dynamic strainmeter, or Multi-Recorder, can measure torque with analog output by being connected to the included slipring and Dynamic Strainmeter. The slip-ring, which incorporates an encoder, allows rotation speed to be measured if connected to Digital I/O unit TMR-253 to count output pulses. The use of the exclusive rim and hub adapter allows installation into any type of passenger car.

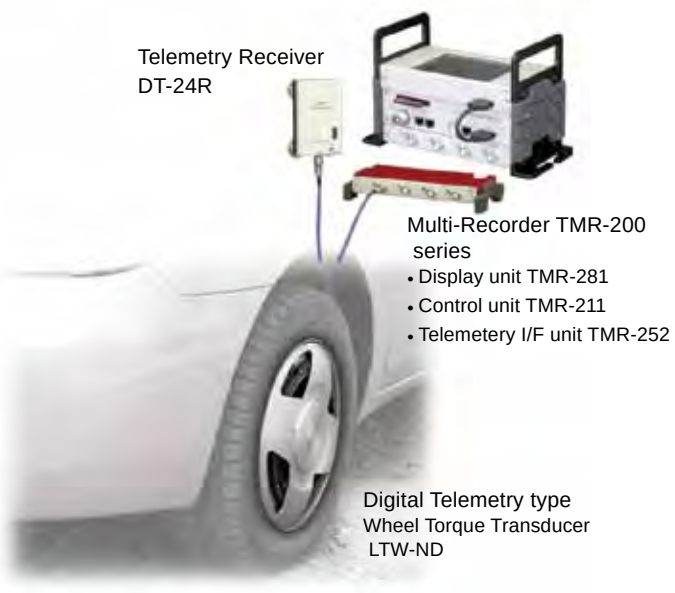
Wheel Torque Transducer LTW-NA **2.5kN-m**
- Lightweight, almost the same weight as ordinary passenger car wheel
- Watrproof construction making running in the rain possible
- Possible installation to various vehicles using exclusive rim and hub adaptor

Multi-Recorder TMR-200 series
Control Unit TMR-211
Display unit TMR-281
Voltage/Thermocouple unit TMR-231
Digital I/O unit TMR-253

- Torque measurement with analog output using combination of the built-in slip-ring and Voltage/Thermocouple unit TMR-231
- Rotation speed measurement using combination of the built-in encoder and Digital I/O unit TMR-253

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

The Digital Telemetry type Wheel Torque Measuring System is composed of a torque transducer LTW-ND to measure drive torque and braking torque, and onboard telemetry receiver DT-24R, during driving car. In torque transducer, a miniature telemetry transmitter is built in to transfer the digital data to the receiver installed in the passenger car. This system is small with very small projection and so can perform measurements without disturbing driving conditions; it is also cordless and so can be organized compactly. The use of the exclusive rim and hub adapter allows installation into any type of passenger car.

Wheel Torque Transducer LTW-ND **2.5kN-m/5kN-m**
- Small - Regular wheel size or equivalent
- Small projection
- Measurement in the rain is possible because of the waterproof structure
- Open structure helps release braking heat
- Easily make the change to slip-ring measurement as well
- Measurement with the standard offset possible for any car type using the special rim and hub adapter

Multi-Recorder TMR-200 series
Control Unit TMR-211
Display unit TMR-281
Telemetry I/F unit TMR-252

Telemetry Receiver DT-24R
- Wireless data reception possible in the car is possible, requiring no wiring from the outside to the inside of car.

TML Small Falling Weight Deflectometer System FWD-Light ®

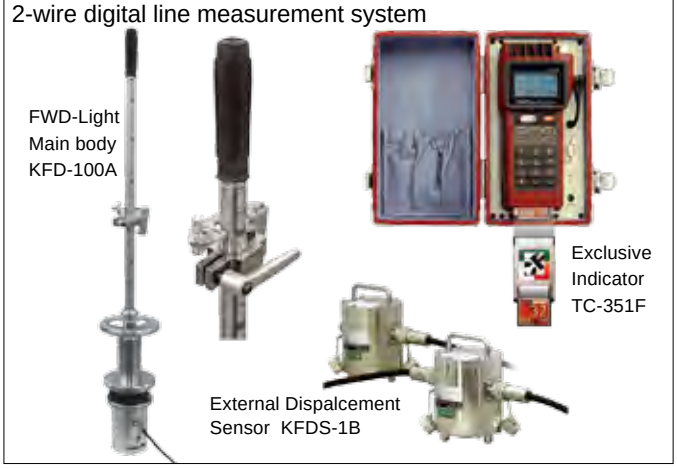
TML small FWD - Falling Weight Deflectometer - FWD-Light® is used for estimating construction of pavement or rigidity of subgrade.

- 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 and wireless measurement system.

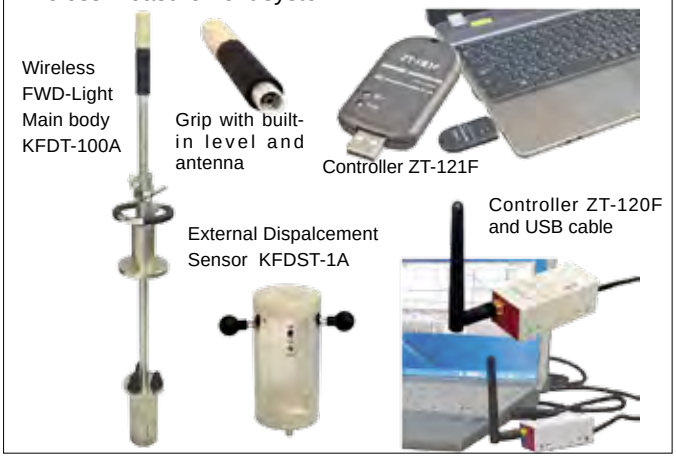
FWD-Light is a registered trademark of Tokyo Sokki Kenkyujo Co., Ltd.

Wireless measurement

2-wire digital line measurement system



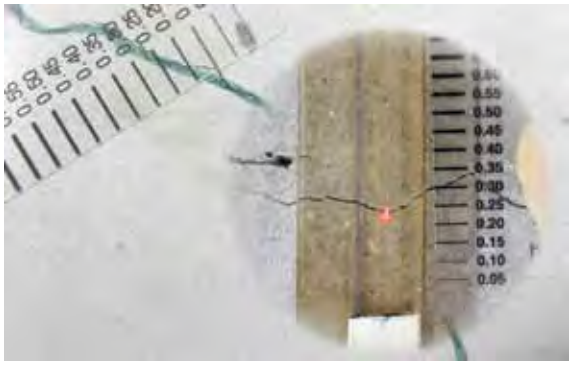
Wireless measurement system



Crack Detection Sensor

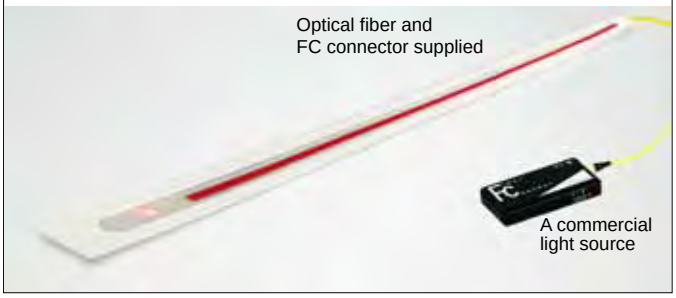
Cracks developed on the surface of concrete structures due to deterioration and damage can be easily and accurately found even in high or dark places. The sensor is bonded onto a concrete structure and the optical fiber cable set to a visible light source. When cracks occur, the optical fiber are disconnected, the light leaks and emits to enable you to recognize the occurrence and position of cracks.

- Easy to find out cracks - No exclusive knowledge about management and control of structures is required for a checker
- The luminescence of the sensor indicates the generation of cracks.
- Crack width detection accuracy : To be selected among
  0.05mm/0.1mm/0.2mm/0.3mm
- Crack detection length : 300mm or 500mm

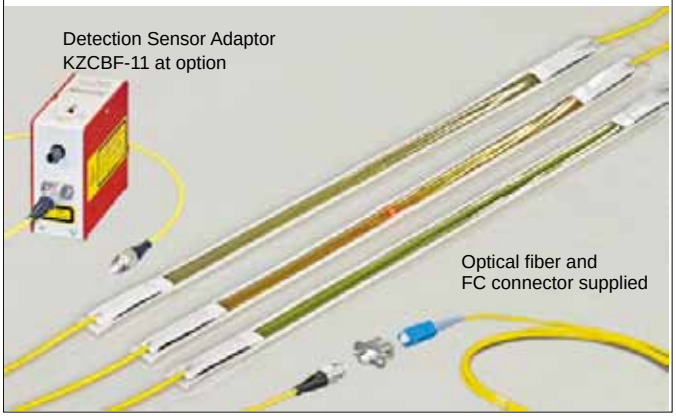


A detection point lighten where crack generates.

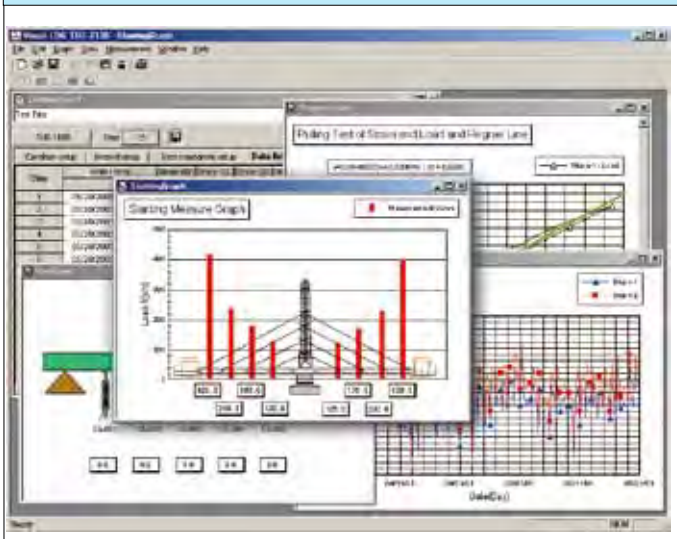
KZCA-A



KZCB-A for Automatic Crack Detection System



Data Logger use Static Measurement Software TDS-7130v2

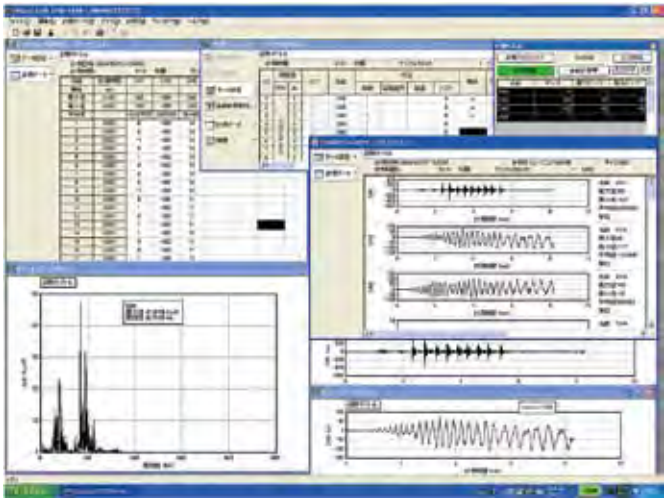


The TDS-7130v2 is general purpose static measurement software for controlling our data loggers, data monitoring and data acquisition, and it is also powerful tool for presenting a report including data and graphics.

-- Windows Vista(32),7(32/64), 8(32/64)

- Function : Rectangular rosette analysis, Numerical operation, Trigonometric, etc.
- Maximun number of Data Items : 4000items (including computation results)
- Total number of measurements 5000 measurements
- Various automatic measurements are possible
- Applicable instruments
  Data Logger TDS-630/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

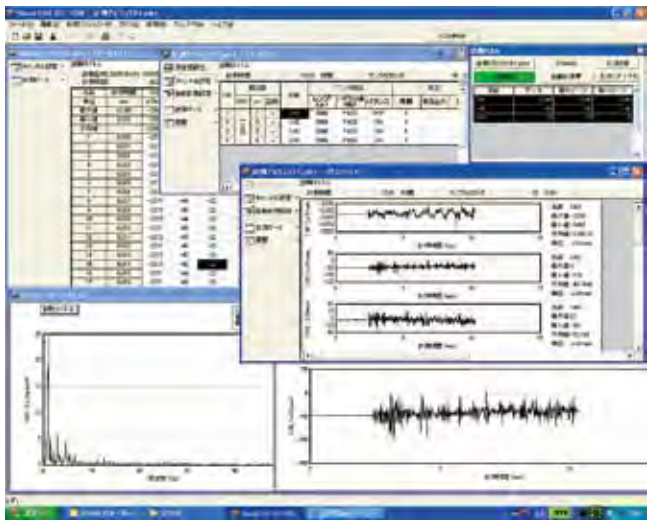


The DRA-7630 is software for processing data and measuring dynamic phenomenon using up to 10 units (100 channels) DRA-101C and DRA-107A digital dynamic strainmeter. Multi-channel Digitral Strainmeter DRA-30A is also available up to 10 units (300 channels). Maximum operation items are 1000 points.

-- Windows Vista(32),7(32/64), 8(32/64)

- 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
- Function : Rectangular rosette analysis, Numerical operation, Trigonometric, etc.
- Operation items are up to 1000
- Performs a unified control of condition settings and data
- Applicable instruments
  Digital Dynamic Strainmeter DRA-101C/DRA-107A (Up to 10 units, 100 channels)
  Multi-channel Digital Strainmeter DRA-30A (Up to 10 units, 300 channels)

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



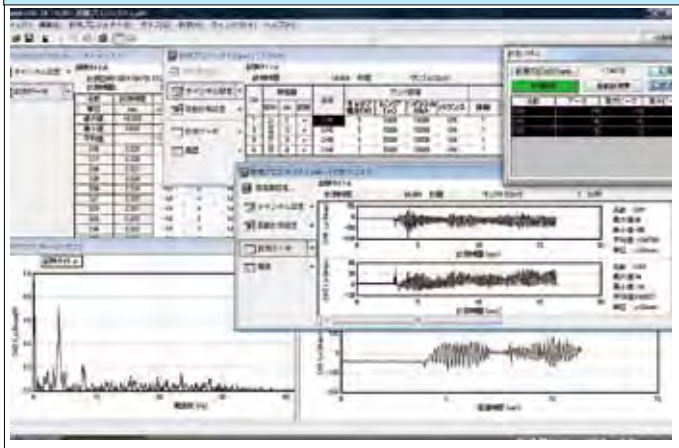
The DC-7630 is specially designed for Smart Dynamic Strain Recorder DC-204R and DC-204Ra, processing data and measuring dynamic phenomenon using upto 8 units (32 channels). Also, it features simultaneous measurement, realtime wave monitoring during sampling. The data is compatible with CSV and DADiSP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

-- Windows Vista(32),7(32/64), 8(32/64)

- 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
- Function : Rectangular rosette analysis, Numerical operation, Trigonometric, etc.
- Operation items are up to 1000
- Performs a unified control of condition settings and data
- Applicable instruments
  Smart Dynamic Strain Recorder DC-204R (Up to 8 units, 32 channels)
  Smart Dynamic Strain Recorder DC-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.

Multi-Recorder Measurement Software TMR-7630



The TMR-7630 is software for processing data and measuring dynamic phenomenon using up to 10 units (80 channels)

-- Windows Vista(32), 7(32/64), 8(32/64)

- 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
- Function : Rectangular rosette analysis, Numerical operation, Trigonometric, etc.
- Operation items are up to 1000
- Performs a unified control of condition settings and data

- Applicable instruments
  Multi Recorder Control unit TMR-211 (Up to 10 units, 80 channels)

- 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 synchronously be retrieved.

Dynamic Strain Measurement Waveform Display Software WF-7630

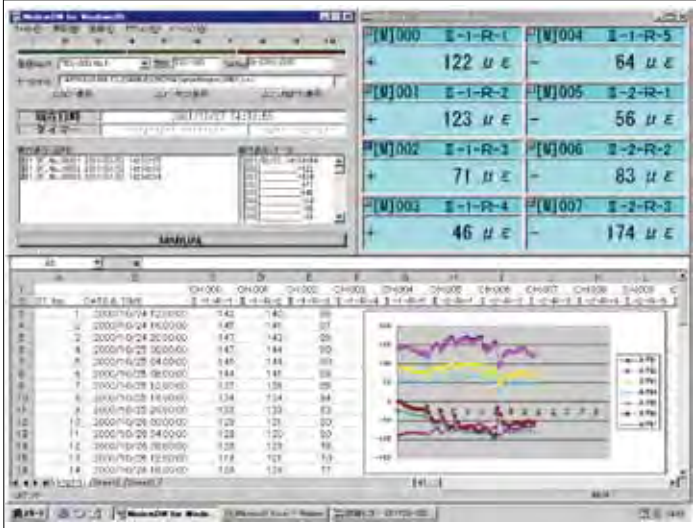
The WF-7630 is software for displaying measurement data of DADiSP, which are output by TML Dynamic strainmeters and dynamic strain measurement software. As the recorded data are raw data measured by such dynamic strainmeter, it is possible to change the coefficient by displaying the data or to carry out recalculation of measurement data such as resetting of expanded channel.

-- Windows Vista(32), 7(32/64), 8(32/64)

- Applicable instruments data
- Smart Dynamic Strain Recorder DC-204R/DC-204Ra,
  Handheld Dynamic Strainmeter DH-14A
  Multi-Recorder TMR-211

- Applicable data file
  DADiSP file of INTEGER and ASCII format output from dynamic measument software DC-7204/TMR-7200/DRA-730AD/DC-7630/DRA-7630/TMR-7630/DC-7004P

Monitoring Measurement Software *Visual LOG Light*



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

-- Windows Vista(32), 7(32/64), 8(32/64)

- Time Interval measurement is possible
- Direct writing to a worksheet of Excel is possible
- Interface : LAN/USB/RS-232C/GP-IB
- Applicable instruments
  Data Logger TDS-530/TDS-150
  Handheld Data Logger TC-32K
  Network(TML-NET) Use Handheld Strainmeter TC-35N

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

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