STRAIN GAUGE EXTENSION LEADWIRES

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

Standard leadwire length for leadwire-integrated strain gauges

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

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

Leadwire selection

¶ Vinyl leadwires

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

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

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

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

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

Type number of leadwires (Option code -F for CE marking)	Core/Diameter (cross section)	Applicable temperature	Total resistance of lead wire	Outer insulated dimensions	Length per roll	Colors
0.08mm² paralleled vinyl lead wire LJB/LJB-F	7/0.12 (0.08mm²)	-20 ~+80°C	0.44Ω/m	1.1 x 2.2mm	200m	Red, White, Green, Black, Yellow Blue, Red-White
0.08mm² 3-wire paralleled vinyl leadwire LJBT/LJBT-F				1.1 x 3.3mm		White wire and whichever color Blue, Orange, Red, Green, Black or Yellow stripe is selectable.(*)
0.08mm² twisted vinyl leadwire LJA	7/0.12 (0.08mm²)	-20 ~+80°C	0.44Ω/m	ϕ 1.6mm	-	Red, Green, Yellow
0.08mm² 3-wire twisted vinyl leadwire LJAT				ϕ 1.9mm		Red-Green-Yellow, Red-Green-Blue, Red-Green-White
0.11mm² paralleled vinyl lead wire LJC/LJC-F	10/0.12 (0.11mm²)	-20 ~+80°C	0.32Ω/m	1.4 x 2.8mm	200m	Grey
0.11mm² 3-wire paralleled vinyl leadwire LJCT/LJCT-F				1.4 x 4.2mm	100m	Grey, One wire with Blue stripe (*)
0.3mm² paralleled vinyl leadwire LJD	12/0.8 (0.3mm²)	-20 ~+80°C	0.12Ω/m	1.9 x 3.8mm	200m	Grey
0.3mm² 3-wire paralleled vinyl leadwire LJDT				1.9 x 5.7mm	100m	White, One wire with Red stripe (*)
0.5mm² paralleled vinyl leadwire LJG	20/0.8 (0.5mm²)	-20 ~+80°C	0.07Ω/m	2.5 x 5.0mm	100m	Grey
0.5mm² 3-wire paralleled vinyl leadwire LJGT				2.1 x 6.3mm		White, One wire with Blue stripe (*)
0.02mm² twisted vinyl leadwire LH	5/0.07 (0.02mm²)	-20 ~+100°C	1.8 Ω/m	ϕ 0.8mm	-	Red, Green, White
0.02mm² 3-wire twisted vinyl leadwire LHT				ϕ 1.0mm		Red-Green-White
3.2mm-dia. 2-core shielded vinyl leadwire LS	7/0.12 (0.08mm²)	-20 ~+80°C	0.44Ω/m	ϕ 3.2mm	200m	Outer : Red, White or Green Core wire : Red-Black-White
3mm-dia. 3-core shielded vinyl leadwire LTSA	7/0.12 (0.08mm²)	-20 ~+80°C	0.1 Ω/m	ϕ 3mm	200m	Outer insulated: Black Core wire insulated: Red-Black-White
5mm-dia. 3-core shielded vinyl leadwire LTSB	7/0.26 (0.3mm²)	-20 ~+80°C	0.1Ω/m	ϕ 5mm	200m	White, One wire with Red, Blue or Black stripe (*)
0.08mm² polypropyrene 4-wire paralleled leadwire LQM/LQM-F	7/0.12 (0.08mm²)	-20 ~+100°C	0.44Ω/m	0.9 x 4.0mm	200m	White, One wire with Red stripe (*)

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

Type number of leadwires (Option code -F for CE marking)	Core/Diameter (cross section)	Applicable temperature	Total resist-ance of lead wire	Outer insulated dimensions	Length per roll	Colors
0.08mm^2 vinyl 4-wire paralleled leadwire LBQM/ LBQM-F 	7/0.12 (0.08mm^2)	-20 ~+80°C	0.44Ω/m	1.0 x 4.0mm	200m	
3-wire paralleled special vinyl leadwire LXT/ LXT-F 	7/0.12 (0.08mm^2)	-20 ~+150°C	0.44Ω/m	0.9 x 2.7mm	200m	Red-Black-White

¶ Enamel leadwires

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

·Polyurethane leadwires

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

·Polyester leadwires

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

·Polyimide leadwires

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

Leadwire type	Core/Diameter	Applicable temperature	Total resistance of leadwire	Outer insulated dimensions	Colors
0.14mm-dia. Polyurethane leadwire LP/LP-F	1/0.14	-10 ~+120°C	2.5Ω/m	ϕ 0.16mm	Red, Brown, Green
0.18mm-dia. Polyurethane leadwire LP/LP-F	1/0.18		1.5Ω/m	ϕ 0.20mm	
0.14mm-dia. Polyester leadwire LU/LU-F	1/0.14	-196 ~+200°C	2.5Ω/m	ϕ 0.16mm	Brown
0.18mm-dia. Polyester leadwire LU/LU-F	1/0.18		1.5Ω/m	ϕ 0.20mm	
0.14mm-dia. Polyimide leadwire LE/LE-F	1/0.14	-269 ~+300°C	2.5Ω/m	ϕ 0.16mm	Brown
0.18mm-dia. Polyimide leadwire LE/LE-F	1/0.18		1.5Ω/m	ϕ 0.20mm	

¶ Cross-linked Vinyl leadwires

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

¶ Cross-linked Polyethylene leadwires

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

Leadwire type	Core/Diameter (Cross section)	Applicable temperature	Total resistance of leadwire	Outer insulated dimensions	Length per roll	Colors
2-wire twisted cross-linked vinyl leadwire LJRA 	7/0.16 (0.14mm^2)	-20 ~+100°C	0.24Ω/m	ϕ 3.0mm		White
3-wire twisted cross-linked vinyl leadwire LJRTA 	7/0.127 (0.09mm^2)		0.4Ω/m	ϕ 2.0mm	200m	Red-Green-Black
3-wire twisted cross-linked polyethylene leadwire LJQTA 	7/0.127 (0.09mm^2)	-65 ~+125°C	0.4Ω/m	ϕ 2.0mm		Red-Yellow-Black Red-Yellow-Blue Red-Yellow-White

¶ Special leadwire for temperature-integrated gauge

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

Leadwire type	Core/Diameter (Cross section)	Applicable temperature	Total resistance of leadwire	Outer insulated dimensions	Length per roll	Colors
Temperature-integrated 3-wire paralleled vinyl lead iwre TLJBT/TLJBT-F 	7/0.12 (0.08mm2)	-20 ~+80°C	0.44Ω/m	1.2x3.6mm		Red-White-Blue
Temperature-integrated 4-wire paralleled vinyl leadwire TLQ 	7/0.12 (0.08mm2)	-20 ~+80°C	0.44Ω/m	1.2x4.8mm		Red-Green-White-Blue
Temperature-integrated 3-wire twisted fluorinated resin (FEP) leadwire 6FB_TLT 	1/0.2	-269 ~+200°C	1.05Ω/m	ϕ 1.1mm		Red-White-Blue

STRAIN GAUGE EXTENSION LEADWIRES

¶ Fluorinated resin leadwire

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

Leadwire type	Core/Diameter (Cross section)	Applicable temperature	Total resistance of leadwire	Outer insulated dimensions	Length per roll*1	Suffix code of leadwire	Colors
3-wire twisted fluorinated resin (FEP) insulated leadwire 6FA_LT/6FA_LT-F	7/0.18 (0.18mm²)	-269 ~+200°C	0.2Ω/m	φ 2.0mm	100m	-6FA_LT*2	Red-Green-Blue
3-wire twisted fluorinated resin (FEP) insulated leadwire 6FAS_LT/6FAS_LT-F	7/0.18 (0.18mm²)	-269 ~+200°C	0.2Ω/m	φ 2.0mm	100m	-6FAS_LT	Red-Green-Blue
3-wire twisted fluorinated resin (FEP) insulated leadwire 6FB_LT/6FB_LT-F	1/0.2 (0.09mm²)	-269 ~+200°C	1.2Ω/m	φ 1.1mm	-	-6FB_LT	Red-Green-Blue
3-wire twisted fluorinated resin (FEP) insulated leadwire 6FC_LT/6FC_LT-F	7/0.08 (0.04mm²)	-269 ~+200°C	1.1Ω/m	φ 1.1mm	-	-6FC_LT	Red-Black-White
3-wire twisted fluorinated resin (FEP) insulated leadwire 6FD_LTS/6FD_LTS-F	7/0.08 (0.04mm²)	-269 ~+200°C	1.1Ω/m	φ 1.1mm	-	-6FD_LTS	Red-Black-White
3-wire twisted fluorinated resin (PTFE) insulated leadwire 4FA_LT/4FA_LT-F	7/0.16 (0.14mm2)	-269 ~+260°C *3	0.24Ω/m	φ 1.9mm	100m	-4FA_LT*4	Red-Grey-White
3-wire twisted fluorinated resin (PTFE) insulated leadwire 4FB_LT/4FB_LT-F	1/0.2	-269 ~+260°C	1.05Ω/m	φ 1.1mm	-	-4FB_LT*4	Red-Black-White

N.B.: *1 : Leadwires are sold by one roll each *2 : _LT is filled with required length *3 : PTFE leadwire is available in 300ºC for short-term use. *4 : Suffix code LT (CT) is provided with connecting terminal joint, and another LT(TA) with insulation film

HOW ARE INTEGRAL LEADWIRES JOINTED

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

Different joints

·Integral type

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

·Heat-shrinkable tubing

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

·Connecting terminals joint type

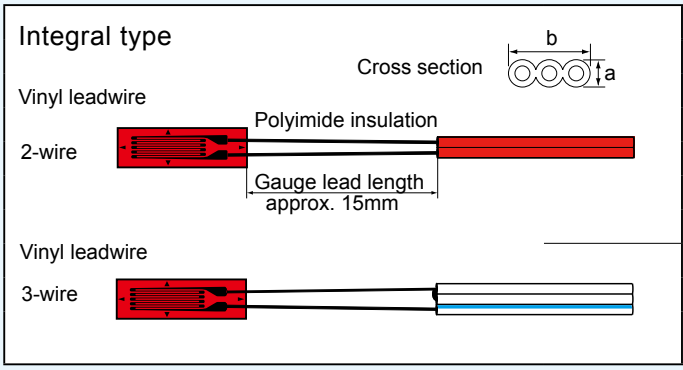
Gauge leads and leadwires are jointed using foil shape connecting terminals. Measurement in high temperature is possible by using a high temperature solder with melting point of 300°C or more for the joint.

·Insulation film type

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

·Direct type

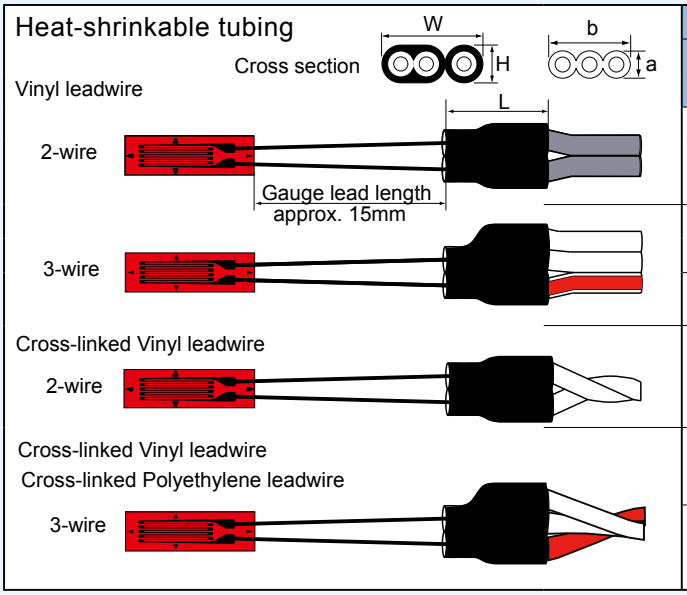
A vinyl leadwire is jointed directly to gauge leads, which are made of nickel plated copper. The solder joints are covered with vinyl insulation of a leadwire up to the end of the gauge base.



Leadwire				
Construction		Dimension a	Dimension b	Code to order
2-wire paralleled	7/0.12	1.1	2.2	-LJB/-LJB-F
	10/0.12	1.4	2.8	-LJC/-LJC-F
2-wire twisted	7/0.12	0.8	-	-LJA
	5/0.07	0.4	-	-LH
3-wire paralleled	7/0.12	1.1	3.3	-LJBT/-LJBT-F
	10/0.12	1.4	4.2	-LJCT/-LJCT-F
3-wire twisted	7/0.12	0.8		-LJAT

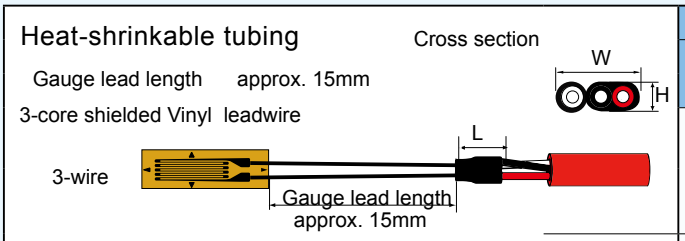
HOW ARE INTEGRAL LEADWIRES JOINTED

Heat-shrinkable tubing

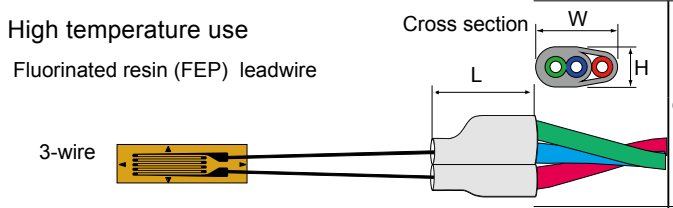


Leadwire Construction		Leadwire Dimension a	Leadwire Dimension b	Heat-shrinkable tube Dimension L	Heat-shrinkable tube Dimension H	Heat-shrinkable tube Dimension W	Code to order
2-wire paralleled	12/0.18	1.9	3.8	11	3	6	-LJD
	20/0.18	2.5	5.0	12	3.5	7	-LJG
3-wire paralleled	12/0.18	1.9	5.7	11	3	7	-LJDT
	20/0.18	2.1	6.3	11	3	7	-LJGT
3-wire twisted	5/0.07	0.4	-	5	0.8	1.6	-LHT
Cross-linked vinyl 2-wire twisted	7/0.16	0.9	-	11	2	4	-LJRA
Cross-linked vinyl 3-wire twisted	7/0.127	0.9	-	11	2	4	-LJRTA
Cross-linked polyethylene 3-wire twisted	7/0.127	1.0	-	11	2	4	-LJQTA

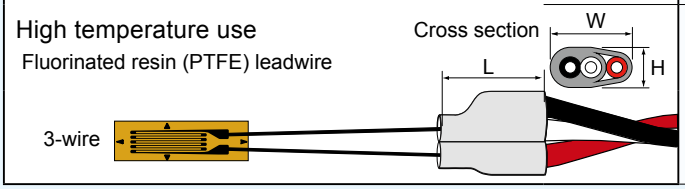
Heat-shrinkable tubing



High temperature use

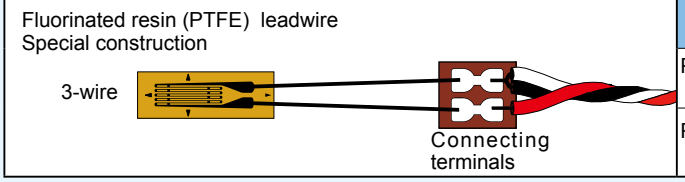


High temperature use



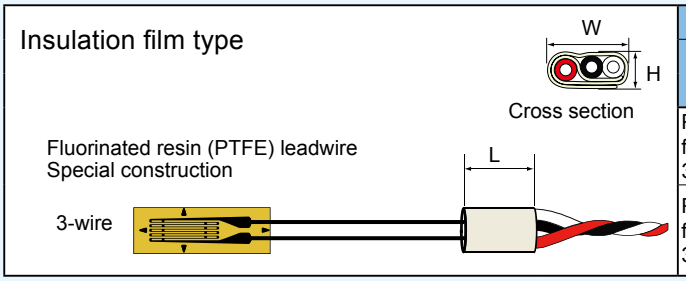
Leadwire Construction		Leadwire Dimension	Heat-shrinkable tube Dimension L	Heat-shrinkable tube Dimension H	Heat-shrinkable tube Dimension W	Code to order
3-wire twisted	7/0.12	ϕ 3.0	10	2	4	-LTSA
	7/0.26	ϕ 5.0	12.5	3	6	-LTSB
FEP (Fluorinated-ethylenepropylene) 3-wire twisted	1/0.2	ϕ 1.1	11	2	2	-6FB_LT
	7/0.18	ϕ 2.0	11	3	4	-6FA_LT
PTFE (Polytetra-fluoroethylene) 3-wire twisted	1/0.2	ϕ 1.1	11	2	2	-4FB_LT
	7/0.16	ϕ 1.9	11	2.5	4	-4FA_LT

Connecting terminals joint type



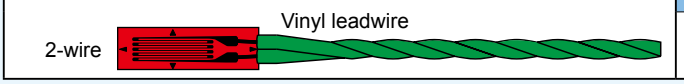
Leadwire Construction		Leadwire Dimension	Code to order
PTFE(Polytetrafluoro-ethylene) 3-wire twisted	7/0.16	ϕ 1.9	-4FA_LT (CT)
PTFE(Polytetrafluoro-ethylene) 3-wire twisted	1/0.2	ϕ 1.1	-4FB_LT (CT)

Insulation film type



Leadwire Construction		Leadwire Dimension	Film Dimension L	Film Dimension H	Film Dimension W	Code to order
PTFE(Polytetra-fluoroethylene) 3-wire twisted	7/0.16	ϕ 1.9	13	1.5	4	-4FA_LT (TA)
PTFE(Polytetra-fluoroethylene) 3-wire twisted	1/0.2	ϕ 1.1	13	1.5	4	-4FB_LT (TA)

Direct type



Leadwire Construction		Leadwire Dimension	Code to order
Vinyl leadwire 2-wire twisted	7/0.12	ϕ 1.6	-LDA

Figures in Leadwire construction column show "Number of cores/ Diameter of one conductor leadwire in mm". For example, "7/0.12" represents "7core / 0.12mm diameter for one conductor leadwire". All dimensions of the Leadwire Heat-shrinkable tube and Film are approximate values in mm.