



# STRAIN GAUGE EXTENSION LEADWIRES

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

## Standard leadwire length for leadwire-integrated strain gauges

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

·OPTION -F Leadwire with CE marking

Leadwire with CE marking (compliant to RoHS2 Directive)

Identification code "-F" is appended to the type number of the leadwire.

## Leadwire selection

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

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

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

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

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

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

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

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



# STRAIN GAUGE EXTENSION LEADWIRES

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

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

### •Polyurethane leadwires




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

### •Polyester leadwires

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

### •Polyimide leadwires

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

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

N.B.: \*1: Two types with different core diameters, which are 0.14 mm and 0.18 mm, are available for each enamel wire.




\*2: Attachment of lead wire cannot be performed on stacked-type two-element or three-element gauges.

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

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



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

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

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

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





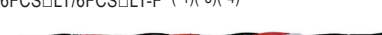
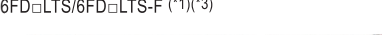
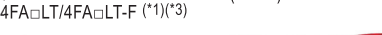
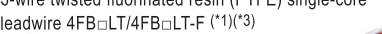
Special leadwire for temperature-integrated gauge consists of 2-core copper and 1-core constantan. To extend this wire, the exclusive leadwire should be applied properly.

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 leadwire TLJBT/TLJBT-F 	7/0.12 (0.08mm <sup>2</sup> )	-20~+80°C	0.44Ω/m <sup>(*)1</sup>	1.2×3.6mm	—	Red-White-Blue
Temperature-integrated 3-wire twisted fluorinated resin (FEP) leadwire 6FB□TLT <sup>(*)2</sup> 	1/0.2	-269~+200°C	1.2Ω/m <sup>(*)1</sup>	Φ1.1mm	—	Red-White-Blue

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

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

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

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

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



# HOW ARE INTEGRAL LEADWIRES JOINED

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

### Heat-shrinkable tubing

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

### Connecting terminals joint type

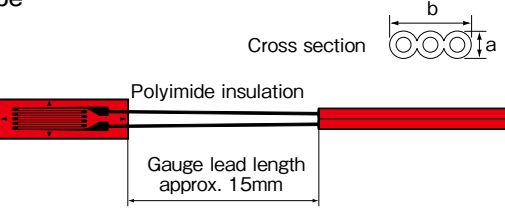
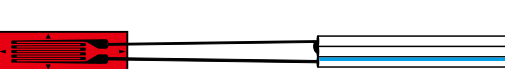
Gauge leads and leadwires are joined using foil shape connecting terminals. Measurement in high temperature is possible by using a high temperature solder with melting point of 300°C or more for the joint.

### Insulation film type

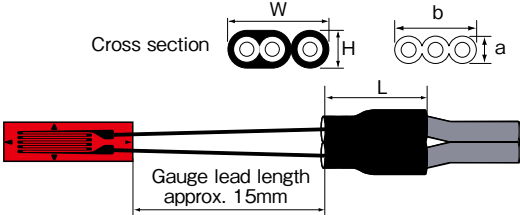
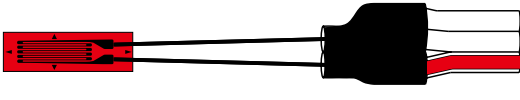


A soldered joint between gauge leads and leadwires is covered with an insulation film of glass cloth base. The film is resistive to heat up to 300°C, so this method is suited to measurement in high temperature.

### Direct type

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

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

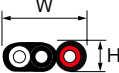
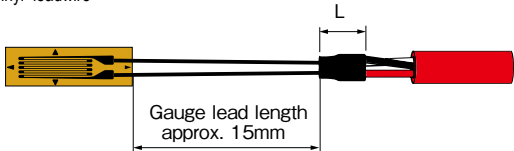
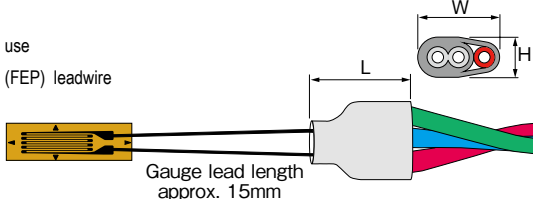
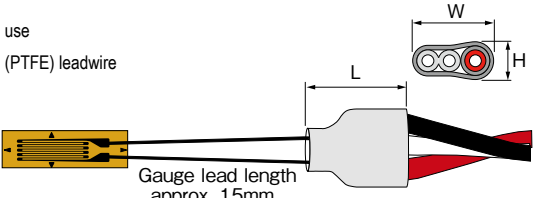
The option code "-F" appended to the leadwire code indicates that lead-free solder is used for the leadwire.

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

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

**Heat-shrinkable tubing**

Gauge lead length approx. 15mm

Gauge lead length approx. 15mm		Construction		Dimension			order		
				L	H	W			
3-core shielded Vinyl leadwire		Cross section							
3-wire			3-wire twisted	7/0.12	Φ3	10	2	4	-LTSA -LTSA-F
				7/0.26	Φ5	12.5	3	6	-LTSB
High temperature use									
Fluorinated resin (FEP) leadwire									
3-wire			FEP (Fluorinated-ethylenepropylene) 3-wire twisted	1/0.2	Φ1.1	11	2	2	-6FB <sub>o</sub> LT -6FB <sub>o</sub> LT-F
				7/0.18	Φ2	11	3	4	-6FAS <sub>o</sub> LT -6FAS <sub>o</sub> LT-F
High temperature use									
Fluorinated resin (PTFE) leadwire									
3-wire			PTFE (Polytetrafluoroethylene) 3-wire twisted	1/0.2	Φ1.1	11	2	2	-4FB <sub>o</sub> LT -4FB <sub>o</sub> LT-F
				7/0.16	Φ1.9	11	2.5	4	-4FA <sub>o</sub> LT -4FA <sub>o</sub> LT-F

**Connecting terminals joint type**

Fluorinated resin (PTFE) leadwire


Special construction

3-wire		PTFE (Polytetrafluoroethylene) 3-wire twisted	1/0.2	Φ1.1	-4FB○LT(CT) -4FB○LT-F(CT)
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**Insulation film type**

Fluorinated resin (PTFE) leadwire

Special construction

3-wire		PTFE(Polytetrafluoroethylene) 3-wire twisted	7/0.16	Φ1.9	13	1.5	4	-4FA <sub>o</sub> LT(TA) -4FA <sub>o</sub> LT-F(TA)
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N.B.:

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

"o" in the "Code to order" is filled with the leadwire length in meter.