

INDUSTRIAL TEMPERATURE SENSOR



THERMOCOUPLE RESISTANCE THERMOMETER

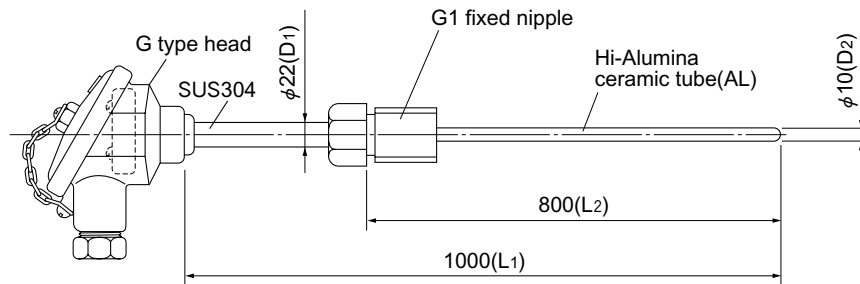
These sensors are for temperature measurements at industrial on-sites, and are available in two types, thermocouples and resistance thermometers. Each sensor consists of a terminal head, a protective tube, mounting fixture, an element, and an insulation tube. Depending on kinds of the protective tube and the mounting fixture, they are divided into straight types, flange types, nipple types, and L types.

FEATURES

- Various types of sensors available so broad temperature range measurements from low temperature range (-200°C) to high temperature range (over 1600°C) is possible.
- Various types of protection tube materials are available so measurement in corrosive atmosphere or other diverse conditions is possible.
- Elements are made of carefully selected materials with good craftsmanship so realize highly accurate temperature measurements.

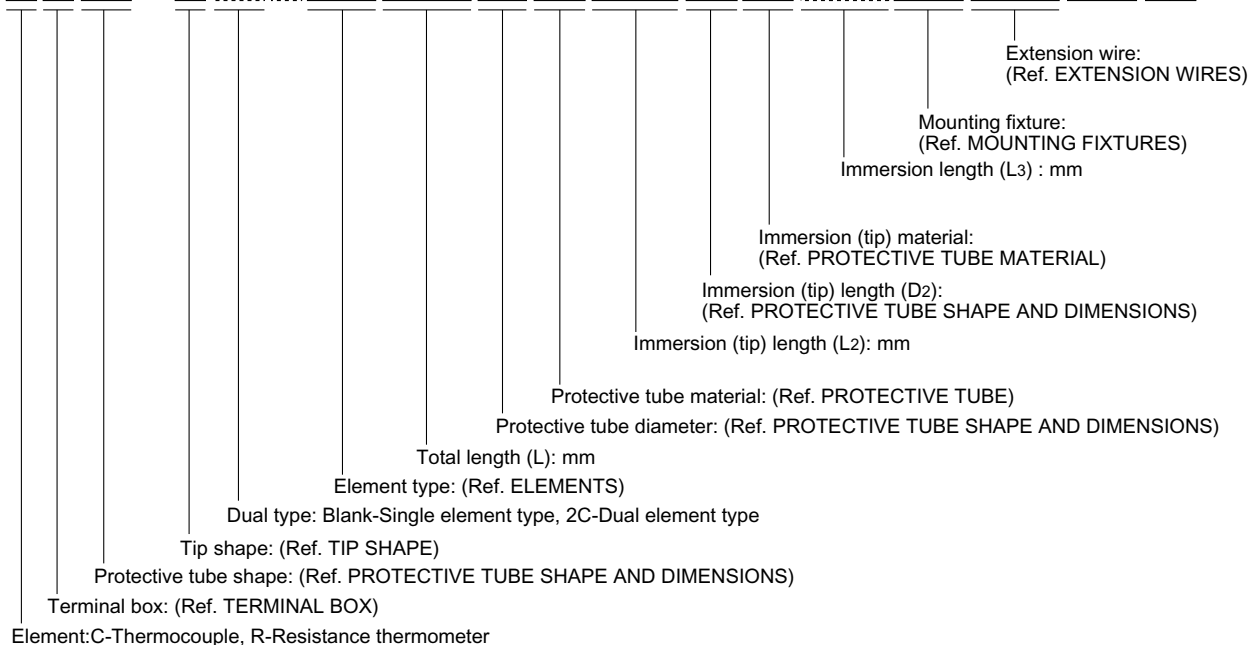
MODELS

(Example) Type K ($\phi 1.0\text{mm}$) with a fixed nipple and a stepped tube.



Extension wire length : m
Connection tip shape: (Ref. CONNECTION TIP)

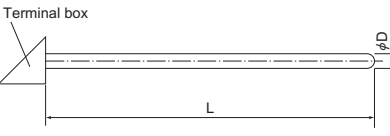
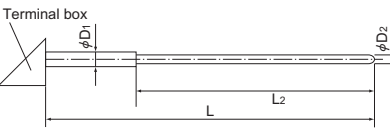
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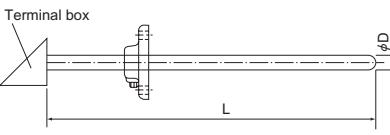
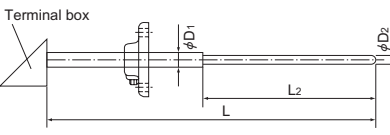
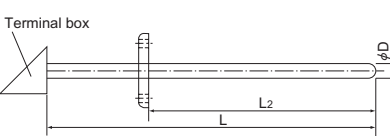
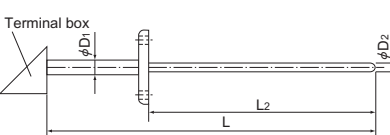
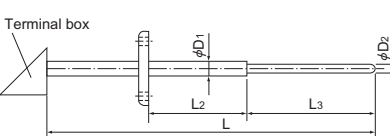


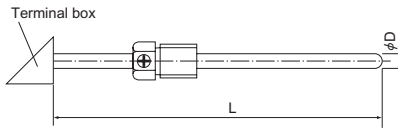
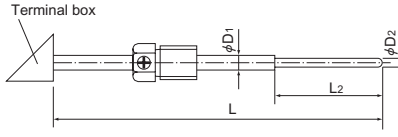
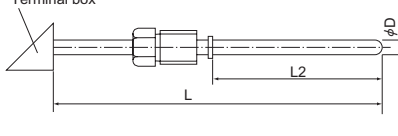
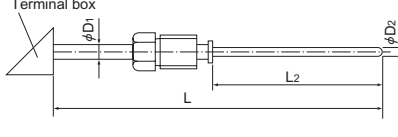
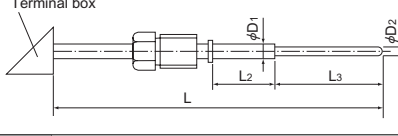
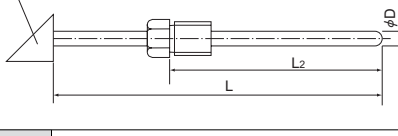
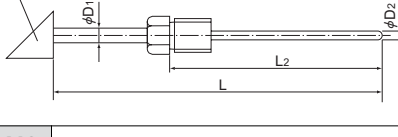
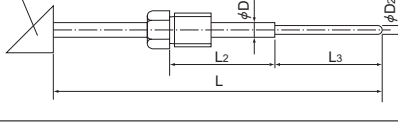
Element:C-Thermocouple, R-Resistance thermometer

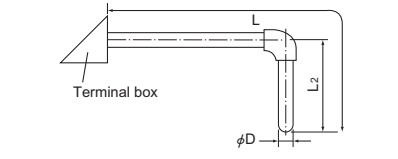
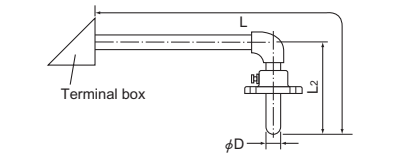
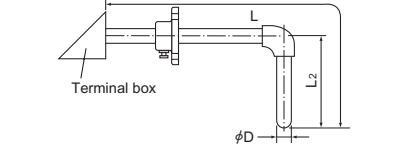
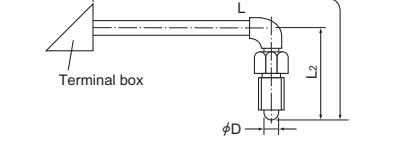
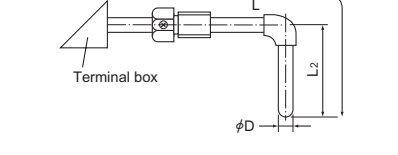
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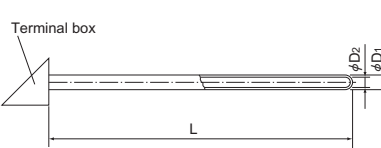
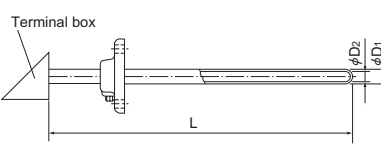
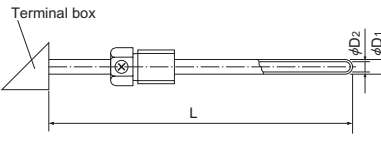
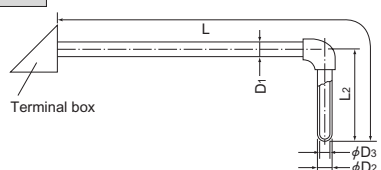
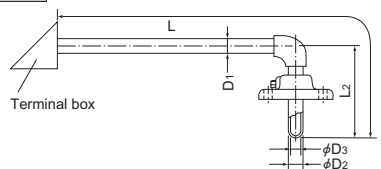
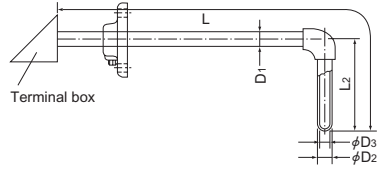
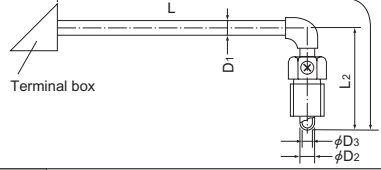
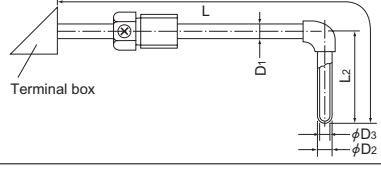
PROTECTIVE TUBE SHAPE AND DIMENSIONS

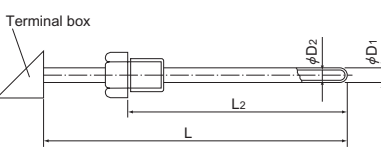
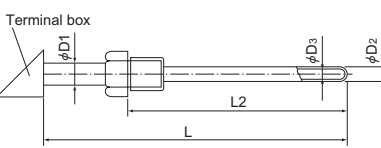
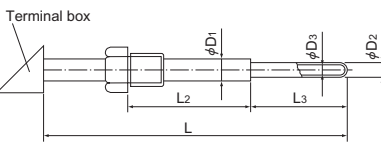
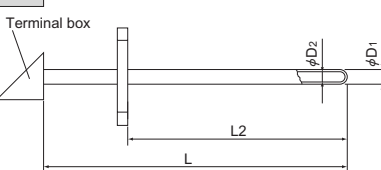
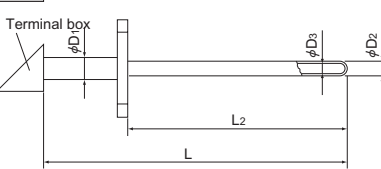
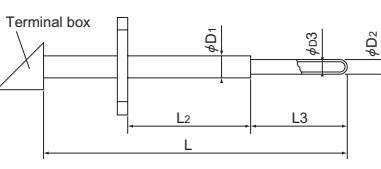
Code	Straight type
S1	Straight type
	
S5	With stepped tube
	

Code	Flange
S2	With sliding flange
	
S6	With sliding flange (stepped tube)
	
F1	With fixed flange
	
F2	With fixed flange (stepped tube)
	
F3	With fixed flange (stepped tube)
	

Code	Nipple
S3	With screw fixing nipple
	
S7	With screw fixing nipple (stepped tube)
	
N4	With sliding nipple
	
N5	With sliding nipple (stepped tube)
	
N6	With sliding nipple (stepped tube)
	
N1	With fixed nipple
	
N2	With fixed nipple (stepped tube)
	
N3	With fixed nipple (stepped tube)
	

Code	L type
L1	L type
	
L2	L type (with flange)
	
L3	L type (with flange)
	
L4	L type (with nipple)
	
L5	L type (with screw fixing nipple)
	

Code	Dual protective tube type
D1	Straight type
	
D2	With sliding flange
	
D3	With screw fixing nipple
	
D4	L type
	
D5	With fixed nipple
	
D6	L type (with sliding flange)
	
D7	L type (with screw fixing nipple)
	
D8	L type (with screw fixing nipple)
	

Code	Dual protective tube type with fixed accessory
W1	Straight type
	
W2	With sliding flange (stepped tube)
	
W3	With fixed nipple (stepped tube)
	
W4	With fixed flange
	
W5	With fixed flange (stepped tube)
	
W6	With fixed flange (stepped tube)
	

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TERMINAL BOX

Code	S	G	W	E	
External dimensions					
Material	Diecast aluminum	Diecast aluminum	Diecast aluminum	Phenol resin	
Construction	Closed waterproof	Closed waterproof	Closed waterproof	Closed waterproof	
Protective tube diameter (mm)	Metallic	$\phi 3.2, \phi 4.8, \phi 6, \phi 8, \phi 10, \phi 12$	$\phi 15, \phi 22, \phi 27$	$\phi 6, \phi 8, \phi 10, \phi 12, \phi 15, \phi 22, \phi 27$	$\phi 6, \phi 8, \phi 10, \phi 12$
	Non-metallic	$\phi 6, \phi 8$	$\phi 15, \phi 17, \phi 21$	$\phi 6, \phi 8, \phi 10, \phi 15, \phi 17, \phi 21$	

Code	F	B	T	P	M
External dimensions					
Material	Phenol resin	Diecast aluminum	Diecast aluminum	Diecast aluminum	Diecast aluminum
Construction	Closed waterproof	Terminal exposure	Terminal exposure	Closed waterproof	Terminal exposure
Protective tube diameter (mm)	Metallic	$\phi 15, \phi 22$	$\phi 3.2, \phi 4.8, \phi 6, \phi 8, \phi 10, \phi 12$	$\phi 3.2, \phi 4.8, \phi 6, \phi 8, \phi 10, \phi 12$	$\phi 3.2, \phi 4.8, \phi 6, \phi 8, \phi 10, \phi 12$
	Non-metallic		$\phi 10, \phi 15, \phi 17, \phi 21$	$\phi 6, \phi 8$	$\phi 6, \phi 8$

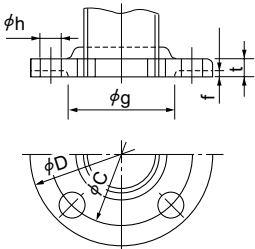
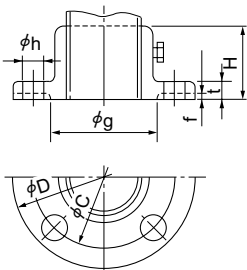
TIP SHAPE

Code	Shape	Code	Shape
0	Closed type	4	Net type
2	Open type	5	Ground type
3	Exposed type		

■ MOUNTING FIXTURES

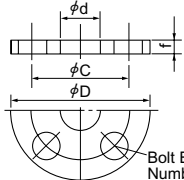
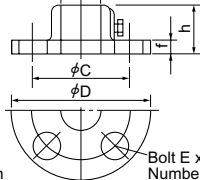
● Flange (JIS standard)

Unit : mm

Fixed flange 	Nominal size	Code		ϕD	Flange dimension				Bolt hole				
		A	B		SUS304	SUS316	t	f	ϕg	H	ϕC	ϕh	n
		Basic dimension of 5kg/cm ² flange											
	10	3/8	FC3	FM3	75	9	1	39	34	55	12	4	
	15	1/2	FC4	FM4	80	9	1	44	34	60	12	4	
	20	3/4	FC6	FM6	85	10	1	49	35	65	12	4	
	25	1	FC8	FM8	95	10	1	59	35	75	12	4	
	40	1-1/2	FCD	FMD	120	12	2	75	37	95	15	4	
	50	2	FCE	FME	130	14	2	85	39	105	15	4	
	65	2-1/2	FCF	FMF	155	14	2	110	39	130	15	4	
	80	3	FCG	FMG	180	14	2	121	39	145	19	4	
	100	4	FCH	FMH	200	16	2	141	41	165	19	8	
Sliding flange 	Basic dimension of 10kg/cm ² flange												
		10	3/8	JC3	JM3	90	12	1	46	37	65	15	4
		15	1/2	JC4	JM4	95	12	1	51	37	70	15	4
		20	3/4	JC6	JM6	100	14	1	56	39	75	15	4
		25	1	JC8	JM8	125	14	1	67	39	90	19	4
		40	1-1/2	JCD	JMD	140	16	2	81	41	105	19	4
		50	2	JCE	JME	155	16	2	96	41	120	19	4
		65	2-1/2	JCF	JMF	175	18	2	116	43	140	19	4
		82	3	JCG	JMG	185	18	2	126	43	150	19	8
		100	4	JCH	JMH	210	18	2	151	43	175	19	8
	Basic dimension of 20kg/cm ² flange												
		25	1	KC8	KM8	125	16	1	67	41	90	19	4
		40	1-1/2	KCD	KMD	140	18	2	81	43	105	19	4
		50	2	KCE	KME	155	18	2	96	43	120	19	8
	65	2-1/2	KCF	KMF	175	20	2	116	45	140	23	8	
	80	3	KCG	KMG	200	22	2	132	47	160	23	8	
	100	4	KCH	KMH	225	24	2	160	49	185	23	8	

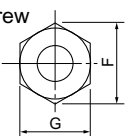
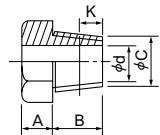
● CHINO standard flange

Unit : mm

Fixed flange 	Fixed flange 	Nominal size	Applicable protective tube diameter ϕd	Code			Flange diameter ϕD	Flange		Bolt hole			Mounting bolt
				Sliding flange	Fixed flange			t	h	Center hole diameter ϕC	Number n	Diameter ϕE	
					Aluminum	SUS304							
A	17 to 32	SAA	FCA	FMA	100	10	34	70	4	10	M8		
B	8 to 16	SAB	FCB	FMB	70	7.5	28	50	4	8	M6		
C	6.4 or less	SAC	FCC	FMC	50	3	13	35	4	4.5	M4		

● Nipple

Unit : mm

Parallel screw 	Tapered screw 	Nominal size (B)	Applicable protective tube diameter ϕd	Code				Screw dimension		Thread number per inch	Opposite side and opposite angle distance		A	B	K
				Parallel screw		Tapered screw		Outside diameter ϕC	Core diameter		G	F			
				SUS 304	SUS 316	SUS 304	SUS 316								
G-R1/8	6 or less	SC1	SM1	TC1	TM1	9.7	8.56	28	14	16.2	6	10	4.0		
G-R1/4	8 or less	SC2	SM2	TC2	TM2	13.1	11.4	19	17	19.6	8	12	6.0		
G-R3/8	10 or less	SC3	SM3	TC3	TM3	16.6	14.9	19	21	24.2	10	15	6.4		
G-R1/2	12 or less	SC4	SM4	TC4	TM4	20.9	18.6	14	26	30	12	20	8.2		
G-R3/4	16 or less	SC6	SM6	TC6	TM6	26.4	24.1	14	32	37	16	25	9.5		
G-R1	22 or less	SC8	SM8	TC8	TM8	33.2	30.2	11	41	47.3	20	30	10.4		

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● Compression fitting

Unit : mm

		Code						
		CF1	CF2	CF3	CF4	CF6	CF8	
<p>Type 1 Opposite side G2 hexagon type Opposite side G1 hexagon type Core Screw size B Abt.A</p> <p>Type 2 Opposite side G2 hexagon type Opposite side G3 hexagon type Opposite side G1 hexagon type Core Screw size B Abt.A</p> <p>CF6/CF8 For ϕ 1.0 to ϕ 8.0 CR6/CR8 For ϕ 1.0 to ϕ 8.0</p>	Copper core	CF1	CF2	CF3	CF4	CF6	CF8	Inner frame: Type2
	Teflon core	CR1	CR2	CR3	CR4	CR6	CR8	
	Screw size	R1/8	R1/4	R3/8	R1/2	R3/4	R1	
	For ϕ 1.0	A = 35	A = 31	A = 36	A = 43	A = 50	A = 52	
	For ϕ 1.6	B = 10	B = 12	B = 15	B = 20	B = 18	B = 20	
	For ϕ 2.0	G1=14	G1=17	G1=21	G1=26	G1=32	G1=38	
	For ϕ 3.2	G2=14	G2=14	G2=14	G2=14	G2=14	G2=14	
	For ϕ 4.8					G3=17	G3=17	
	For ϕ 6.0							
	For ϕ 6.4	A = 39			A = 43	A = 58	A = 60	
	For ϕ 8.0	G2=17		G2=17	G2=17	G2=17	G2=17	
	For ϕ 10			A = 41	A = 44	A = 53	A = 62	
				G2=21	G2=21	B = 25	B = 25	
					G2=21	G1=41		
For ϕ 12				A = 53	A = 55	A = 63		
For ϕ 15				G2=26	G2=26	G2=26		
For ϕ 16					A = 60	A = 65		
					G2=32	G2=32		
For ϕ 22						G2=41		

Note: Dimensions different from the dimensions shown in the upper column are shown in the lower column.

● Metal connector

Unit : mm

	Code	Dimensions				
		ϕ A	ϕ B	ϕ D	E	
	For thermocouple	12P-2	7	12	18	38
		16P-2	8.5	15.5	21.5	43
	For resistance thermometer	12P-3	7	12	18	38
		16P-3	8.5	15.5	21.5	43

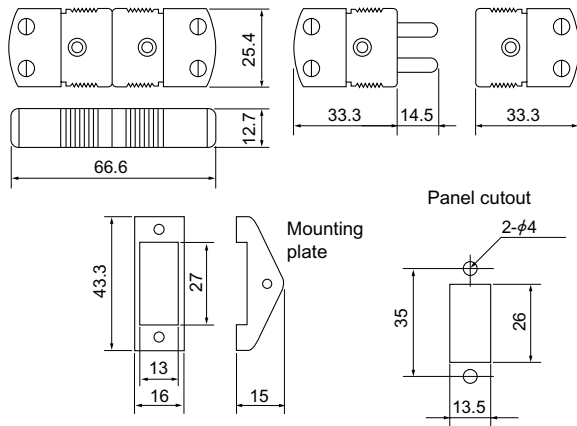
	Code	Dimensions				
		ϕ A	ϕ B	ϕ D	E	
	For thermocouple	12A-2	7	44.5	12.5	18
		16A-2	8.5	50	16.5	21.5
	For resistance thermometer	12A-3	7	44.5	12.5	18
		16A-3	8.5	50	16.5	21.5

	Code	Dimensions							
		ϕ A	ϕ B	ϕ C	ϕ D	E	G	ϕ H	
	For thermocouple	12R-2	15.5	12.5	23	19	16.5	3- ϕ 2.1	14
		16R-2	19	16.5	32	25.5	19	3- ϕ 3.2	19
	For resistance thermometer	12R-3	15.5	12.5	23	19	16.5	3- ϕ 2.1	14
		16R-3	19	16.5	32	25.5	19	3- ϕ 3.2	19

CONNECTORS

Unit : mm

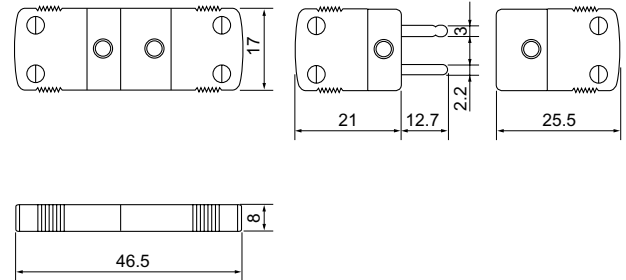
●CA connector



Pin materials

	(+) lead	(-) lead	color
For B, R, S	Copper	Copper alloy	Black
For K	Chromel	Alumel	Blue
For E	Chromel	Constantan	Violet
For J	Iron	Constantan	Yellow
For T	Copper	Constantan	Brown

●SM connector



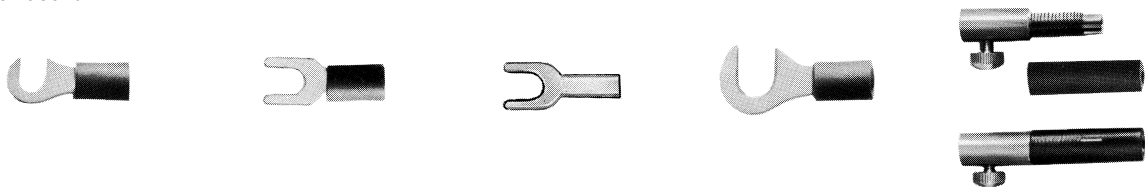
Pin materials

	(+) lead	(-) lead	color
For B, R, S	Copper	Copper alloy	Black
For K	Chromel	Alumel	Blue
For E	Chromel	Constantan	Violet
For J	Iron	Constantan	Yellow
For T	Copper	Constantan	Brown

CONNECTION TIPS

The connection tips can roughly be divided into the tips for termination and the tips for extension wires.

The tips for termination are used for terminating extension wires and are convenient for connections to terminals in a terminal board.



Classification	Terminals for connection				Terminals for relaying
Applications	For instrument terminals		For sensor terminals	For EB series recorder terminals	For connecting extension wires and thermocouple wires
Code	G	Y	U	F	B
Specifications	<p>Plastic cover</p>	<p>Plastic cover</p>		<p>Plastic cover</p>	<p>Clamping screw</p>
Covering color	+: Red, -: White		+: Red, -: White	+: Red, -: White	+: Red, -: Black

INDUSTRIAL TEMPERATURE SENSOR

PROTECTIVE TUBE

● Metallic tube

Material	Code	Ordinary temp. °C	Maximum working temp. °C	Features
SUS304	CN	900	1000	18% chrome, 8% nickel copper, Good corrosion resistance and heat resistance.
SUS316	32	900	1000	Include molybdenum effective in heat, acids and alkalis. Much better corrosive resistance than SUS304 .
SUS310S	42	1000	1200	Effective in heat.
NCF600 (Inconel 600)	IN	1050	1150	Same heat resistance as SUS310S. Excellent corrosive resistance.
SUS347	47	900	1000	Same corrosive resistance as SUS304. Resistant to embrittlement or grain boundary corrosion while continuous use at 400 to 850°C.
SUH446 (Sandvik P4)	P4	1000	1200	Strong resistance against heat, corrosion sulfurous gas and reducing gas.
Sandvik 253MA	MA	1000	1200	Good heat resistance and corrosion resistance.
Hastelloy B	HB	800	1100	Suitable to hydrochloric acids in all kind of density and with temperature up to boiling point.
Hastelloy C	HC	1000	1100	Good in ferric chloride, cupric chloride and wet chloride gas.
Kanthal A-1	KA	1100	1350	Excellent mechanical strength at high temperature (Cr 24%, Co 1 to 2.5%, Al 5.5%, balanced with iron).
Titanium	TI	250	500	Better chemical corrosion resistance than SUS304.
Cast iron	S5	700	800	Excellent mechanical strength. Used for melted aluminum.
SUS316L	6L	900	1000	Intergranular corrosive resistance material.
Teflon coating	TC	200	250	Teflon coating on SUS304. Strong resistance to chemicals on low temperature.
Glass coating	GC	350	400	Glass coating in steel. Good chemical resistance.

● Non-metallic tube

Material	Code	Ordinary temp. °C	Maximum working temp. °C	Features
Hard vinyl	VN	60	100	Suitable to corrosive fluids.
Hard glass	GS	500	600	Effective in acids and alkalis. Susceptible to heat and mechanical impact.
Quartz glass	QT	1000	1050	Small heat capacity. Quick response.
High aluminum ceramic tube (JIS PT1, PS1)	NC	1400	1450	Excellent air-tightness. Strong resistance to molten metals and combustion gas.
	AL	1500	1550	
Pure sintered aluminum (JIS PT, PS0)	DG	1700	1900	Strong resistance to neutral fire-proof materials, molten metals, glasses and lea-slugs.
	SL			
Zirconia	ZR	1800	2100	Strong resistance to bases, acids, basic slugs and special molten metals.
Silicone carbide	GK	1500	1700	Strong resistance to heat impact.
Silicone nitrite	SN	1200	1600	Strong resistance to acids, oxide salts, heat impact and molten non-ferrous metals.
Aluminum	HL	1600	1700	Strong resistance to acids and alkalis.
Teflon tube	TF	200	250	Strong resistance to chemicals in lower temperature.

ELEMENTS

● Thermocouple wire

Type	Code	Diameter (φmm)	Ordinary temp. °C	Maximum working temp. °C	JIS class	Minimum diameter of protective tube (φmm)			
						Metallic		Non-metallic	
						Single	Double	Single	Double
R	R05	0.5	1400	1600	2			6	8
B	B05	0.5	1500	1700	3			6	8
S	S05	0.5	1400	1600	2			6	8
K	K01	0.1			1* 2 3				
	K03	0.32				3.2	10	6	8
	K05	0.5							
	K06	0.65	650	850		4.8	10	8	13
	K10	1.0	750	950		10	12	10	15
	K16	1.6	850	1050		12	12	13	15
	K23	2.3	900	1100		22	22	17	21
T	T01	0.1	150	200	1* 2				
	T03	0.32	200	250		3.2	10	6	8
	T06	0.65	200	250		4.8	10	8	13
E	E03	0.32	400	450	1* 2 3	3.2	10	6	8
	E06	0.65	450	500		4.8	10	8	13
	E10	1.0	500	550		8	12	10	15
	E16	1.6	550	650		12	12	13	15
	E23	2.3	600	750		22	22	17	21
J	J06	0.65	400	500	1* 2	4.8	10	8	13
	J10	1.0	450	550		8	12	10	15
	J16	1.6	500	650		12	12	13	15
	J23	2.3	550	750		22	22	17	21
	J32	3.2	600	750		22	27	17	25
W95Re5-W74Re26	W05	0.5	2300						
*2 CR-AuFe	A02	0.2	Less than 300K	More than 4K					

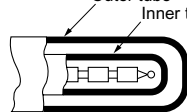
The ordinary temperature is the temperature that a thermocouple can be used in air continuously.

The maximum working temperature is the temperature that a thermocouple can be used in a short time for occasional uses.

*1 "H" is added for Class 1 like as "HK06".

*2 For CR-AuFe thermocouples, elements are covered by polyester.

● Double protective tube type

	Inner diameter (φmm)	Inner diameter (φmm)	
		Metallic	Non-metallic
	6	15	15
	10	22	17

● Resistance Thermometer

Type	Code	Resistance	Size (φmm)	Applicable protective tube diameter (φmm)	Temp. range (°C)	JIS class
Ceramic thin type	R61	JPt100Ω	φ1.5 x 15	φ3.2 or larger	-200 to 650	A, B
	R63	Pt100Ω				
Ceramic standard type	R81	JPt100Ω	φ4.0 x 35	φ6.0 or larger	-200 to 650	A, B
	R83	Pt100Ω				
Ceramic dual element type	RW1	JPt100Ω	φ1.5 x 15	φ9.0 or larger	-200 to 650	A, B
	RW3	Pt100Ω				

* Rated current: 1mA, 2mA

REFERENCE TYPES OF EXTENSION WIRES

Type	Uses	Code	Composition (mm)		Outer sheath		Resistance (Ω/m)	Working temperature (°C)	Error allowance (μV)	Outer diameter (mm)
			+ lead	- lead	Material	Color				
R	Heat resistance	RXH	Copper 0.65 x 7pcs	Copper alloy 0.65x7pcs	Glass wool braided	Black	0.03	0 to 150	± 60	4 x 6.5
	Waterproof	RXV			Vinyl			0 to 90	± 30	5 x 8
	Thin type heat resistance	RXJ	Copper 0.3 x 7pcs	Copper alloy 0.3x7pcs	Glass wool braided		0.13	0 to 150	± 60	2.4 x 4
	Thin type general	RXI			Vinyl			0 to 90	± 30	3 x 4.9
K	Precision class heat resistance	KXHS	Chromel 0.65 x 7pcs	Alumel 0.65x7pcs	Glass wool braided	Blue	0.43	0 to 150	±100	4 x 6.5
	Precision class waterproof	KXVS			Vinyl			(-)20 to 90		5 x 8
	Thin type precision class heat resistance	KXJS	Chromel 0.32 x 7pcs	Alumel 0.32x7pcs	Glass wool braided		1.94	0 to 150		3 x 4.9
	Thin type precision class heat general	KXIS			Vinyl			(-)20 to 90		2.4 x 4
	Heat resistance	WXH	Iron 0.65 x 7pcs	Constantan 0.65x7pcs	Glass wool braided		0.38	0 to 150	± 60	4 x 6.5
	Thin type heat resistance	WXJ			Iron 0.3 x 7pcs			Constantan 0.3x7pcs		Glass wool braided
	Thin type general	VXI	Copper 0.3 x 7pcs	Constantan 0.3x7pcs	Vinyl		1.25	(-)20 to 90		3 x 4.9
	Waterproof	VXV			Copper 0.65 x 7pcs			Constantan 0.65x7pcs		Vinyl
	With sheath shield	WXA	Iron 0.3 x 7pcs	Constantan 0.3x7pcs	Stainless braided		1.25	0 to 150	± 60	2.8 x 4.5
E	Heat resistance	EXH	Chromel 0.65 x 7pcs	Constantan 0.65x7pcs	Glass wool braided	Purple	0.51	0 to 150	±200	4 x 6.5
	Waterproof	EXV			Vinyl			(-)20 to 90		5 x 8
	Thin type heat resistance	EXJ	Chromel 0.3 x 7pcs	Constantan 0.3x7pcs	Glass wool braided		2.45	0 to 150		2.4 x 4
	Thin type general	EXI			Vinyl			(-)20 to 90		3 x 4.9
	With sheath shield	EXA			Stainless braided			0 to 150		2.8 x 4.5
J	Heat resistance	JXH	Iron 0.65 x 7pcs	Constantan 0.65x7pcs	Glass wool braided	Yellow	0.38	0 to 150	±140	3.4 x 6.2
	Waterproof	JXV			Vinyl			(-)20 to 90		5 x 8
	Thin type heat resistance	JXJ	Iron 0.3 x 7pcs	Constantan 0.3x7pcs	Glass wool braided		1.25	0 to 150		2.4 x 4
	Thin type general	JXI			Vinyl			(-)20 to 90		3 x 4.9
	With sheath shield	JXA			Stainless braided			0 to 150		2.8 x 4.5
T	Waterproof	TXV	Copper 0.65 x 7pcs	Constantan 0.65x7pcs	Vinyl	Brown	0.22	(-)20 to 90	± 60	5 x 8
	Thin type heat resistance	TXJ			Glass wool braided			0 to 150		2.4 x 4
	Thin type general	TXI	Copper 0.3 x 7pcs	Constantan 0.3x7pcs	Vinyl		1.05	(-)20 to 90		3 x 4.9
	With sheath shield	TXA			Stainless braided			0 to 150		2.8 x 4.5
W	Heat resistance	NXH	Copper alloy 0.5 single	Copper alloy 0.5 single	Glass wool braided	White	3.10	(-)20 to 150	-	2 x 3
B	Heat resistance	BXH	Copper 0.65 x 7pcs	Copper 0.65 x 7pcs	Glass wool braided	Gray	0.014	0 to 150	-	3.4 x 6.2
	Waterproof	BXV			Vinyl			0 to 90		5 x 8
	Thin type heat resistance	BXJ	Copper 0.3 x 7pcs	Copper 0.3 x 7pcs	Glass wool braided		0.068	0 to 150		2.4 x 4
	Thin type general	BXI			Vinyl			0 to 90		3 x 4.9
S	Heat resistance	SXH	Copper 0.65 x 7pcs	Copper alloy 0.65 x 7pcs	Glass wool braided	Black	0.045	0 to 150	± 60	4 x 6.5

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