

General Specifications

Model CM and CH Thermocouple

GS 06B01B01-00E

■ GENERAL

Model CM and CH Thermocouples consist of a thermocouple element (type K, F, J, or T), with glass insulation, in a metallic protection tube or a thermowell which is joined to a terminal box.

The Model CM uses a drawn protection tube. Versions are available for pipe threads mounting or mounting by a fixed or movable flange. The Model CM is most widely used for general processes.

Model CH uses a drilled thermowell - straight or tapered tubes are available - and fixed flange or pipe threads mounting. Since the Model CH thermocouple is much stronger than the Model CM, it is suitable for use in high-pressure processes.

The operating temperature range depends on type of thermocouple, diameter of wire element and material of protection tube or thermowell, but thermocouples are available to cover the range 0 to 1000 °C or -200 °C to 0 °C for example.

Model CM-00 is the glass-insulated thermocouple element alone.

These thermocouples conform to JIS and IEC standards. Thermocouples conforming to DIN standards are also available to order.

■ STANDARD SPECIFICATIONS

Construction:

Thermocouple with drawn protection tube. for model CM
Thermocouple With drilled thermowell for model CH

Mounting Style:

CM-0. . . Element only
CM-1. . . Plain insertion type
CM-2. . . Flange mount type
CH-2. . . Flange mount type
CM-3. . . Pipe threads mount type
CH-3. . . Pipe threads mount type

Terminal Box:

Refer to Figure 1.

Thermocouple:

Type K, F, J, T (refer to Table 1)

Class:

IEC, JIS Class 1, 2 or 3

Limits of Normal Operating Temperature:

Refer to Table 2.

Limits of Elevated Operating Temperature:

Refer to Table 2.



Tolerance on Temperature:

Refer to Table 3.

Number of Element:

Single or double.

Protection Tube Outside Dia.:

φ10, 12, 15 or 21.7 mm

Thermowell Outside Dia.:

φ15, 22 or 26 mm

Protection Tube and Thermocouple Combinations:

Refer to Table 4.

Thermowell and Thermocouple Combinations:

Refer to Table 4.

Material:

Protection Tube:

Stainless steel, Sandvik P4 or Kanthal AF.

Thermowell:

Stainless steel (JIS SUS 304 or SUS316)

Flange and Pipe Threads:

Same as that of the protection tube (or thermowell), if the protection tube is Sandvik P4, however, the flange material is JIS SUS 304.

Note: ⚠ Users must consider the characteristics of selected wetted parts material and the influence of process fluids. The use of inappropriate materials can result in the leakage of corrosive process fluids and cause injury to personnel and/or damage to plant facilities. It is also possible that the instrument itself can be damaged and that fragments from the instrument can contaminate the user's process fluids.

Be very careful with highly corrosive process fluids such as hydrochloric acid, sulfuric acid, hydrogen sulfide, sodium hypochlorite, and high-temperature steam (150 °C [302 °F] or above). Contact Yokogawa for detailed information of the wetted parts material.

Mounting Flange;

Rating:

JIS 5K , 10K or 20K.

ANSI Class 150 or Class 300.

Facing:

Raised face or Flat face.

Nominal Size:

15 mm (1/2 in.), 20 mm (3/4 in.),

25 mm (1 in.), 40 mm (1-1/2 in.) or

50 mm (2 in.).

Mounting Pipe Threads;

Style:

JIS Straight or Tapered type.

ANSI Tapered type.

Nominal Size:

1/2 in., 3/4 in. or 1 in.

Protection Tube and Mounting Flange or Pipe Thread**Combination:**

Refer to Table 5.

Thermowell and Mounting Flange or Pipe Threads**Combinations:**

Refer to Table 5.

Table 1. Thermocouple Composing Materials

Thermocouple type	Composing materials	
	+leg *1	-leg *1
K	Nickel-Chromium	Nickel-Aluminium
E	Nickel-Chromium	Copper-Nickel
J	Iron	Copper-Nickel
T	Copper	Copper-Nickel

*1: The +leg means a leg to be connected to +terminal of an instrument to measure thermoelectromotive force, and -leg means opposite side one.

Table 2. Limits of Normal Operating Temperature and Elevated Operating Temperature.

Thermocouple type	Diameter of element wire mm	Normal operating temperature limit *1 °C	Elevated operating temperature limit *2 °C	Thermocouple type	Diameter of element wire mm	Normal operating temperature limit *1 °C	Elevated operating temperature limit *2 °C
K	0.65	650	850	J	0.65	400	500
	1.00	750	950		1.00	450	550
	1.60	850	1050		1.60	500	650
	2.30	900	1100		2.30	550	750
	3.20	1000	1200		3.20	600	750
E	0.65	450	500	T	0.32	200	250
	1.00	500	550		0.65	200	250
	1.60	550	650		1.00	250	300
	2.30	600	750		1.60	300	350
	3.20	700	800				

*1: Normal operating temperature limit means the limit of temperature within which thermocouples can be continuously used in the air.

*2: Elevated operating temperature limit means the limit of temperature at which thermocouples can be used for a short time in the case of unavoidable needs.

Table 3. Tolerance on Temperature (IEC 584-2, JIS C 1602)

Types	Tolerance class 1	Tolerance class 2	Tolerance class 3 *1
Type T Temperature range Tolerance value Temperature range Tolerance value	-40 °C to +125 °C ±0.5 °C 125 °C to 350 °C ±0.004 • t	-40 °C to +133 °C ±1 °C 133 °C to 350 °C ±0.0075 • t	-67 °C to +40 °C ±1 °C -200 °C to -67 °C ±0.015 • t
Type E Temperature range Tolerance value Temperature range Tolerance value	-40 °C to +375 °C ±1.5 °C 375 °C to 800 °C ±0.004 • t	-40 °C to +333 °C ±2.5 °C 333 °C to 900 °C ±0.0075 • t	-167 °C to +40 °C ±2.5 °C -200 °C to -167 °C ±0.015 • t
Type J Temperature range Tolerance value Temperature range Tolerance value	-40 °C to 375 °C ±1.5 °C 375 °C to 750 °C ±0.004 • t	-40 °C to +333 °C ±2.5 °C 333 °C to 750 °C ±0.0075 • t	- - - -
Type K, type N Temperature range Tolerance value Temperature range Tolerance value	-40 °C to 375 °C ±1.5 °C 375 °C to 1000 °C ±0.004 • t	-40 °C to +333 °C ±2.5 °C 333 °C to 1200 °C ±0.0075 • t	-167 °C to +40 °C ±2.5 °C -200 °C to -167 °C ±0.015 • t

T03E.EPS

*1: Thermocouple materials are normally supplied to meet the manufacturing tolerances specified in the table for temperatures above -40 °C. These materials, however, may not fall within the manufacturing tolerances for low temperatures given under class 3 for types T, E, K and N. If thermocouples are required to meet limits of class 3, as well as those of class 1 or 2 the purchaser shall state this, as selection of materials is usually required.

Table 4. Protection Tube or Thermowell and Thermocouple Combinations

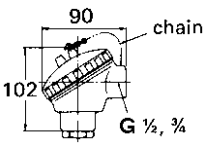
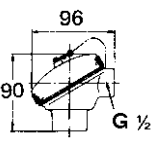
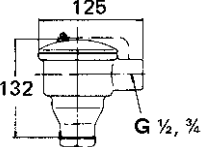
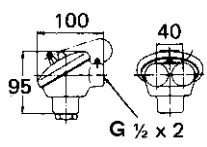
Model	Protection tube/Thermowell				Thermocouple			
	Material	Operating temp.		O. D. (mm)	I. D. (mm)	Classification of thermocouple	Dia. of element wire	
		Normal	Elevated				Single	Double
CM	Stainless steel	850 °C	950 °C	10	7	Type K, E, J or T	1.0	1.0
				12	9	Type K, E, J or T	1.6	1.6
				15	11	Type K, E, J or T	1.6	1.6
				22	16	Type K, E, or J	3.2	3.2
	Sandvik P4	1050 °C	1200 °C	21.3	16	Type K or E	3.2	3.2
	Kanthal A1	1200 °C	1350 °C	22	19	Type K or E	3.2	3.2
CH	Stainless steel	850 °C	950 °C	15 22 26	9 9 9	Type K, E, J, or T	1.6	1.6

T04E.EPS

Table 6. Protection Tube or Thermowell and Mounting Flange or Pipe Threads Combinations.

Protection tube/thermowell o. d.	Flange nominal size	Pipe threads nominal size
φ10, 12 mm	15 mm, 20 mm, 25 mm, 40 mm, 50 mm	1/2 in., 3/4 in., 1 in.
φ15 mm	15 mm, 20 mm, 25 mm, 40 mm, 50 mm	3/4 in., 1 in.
φ21.3, 22, 26 mm	25 mm, 40 mm, 50 mm	1 in.

T05E.EPS

Suffix code	1	3	4	5
Type	General type	Phenol resin type	Flameproof type	Double element type
Terminal box material	Cast aluminum alloy	Phenolic resin	Cast aluminum alloy	Cast aluminum alloy
Electrical connections	JIS G 1/2 or G 3/4 female	JIS G 1/2 female	JIS G 1/2 or G 3/4 female	JIS G 1/2 female
Number of terminals	2 or 4	2 or 4	2 or 4	4
Terminal material	Ceramic	Ceramic	Epoxy resin	Ceramic
Finished	Polyurethane paint	None	Polyurethane paint	Polyurethane paint
Color	Jade green	Black	Jade green	Jade green
External Dimension (unit: mm)				

T06E.EPS

Figure 1. List of Terminal Box

■ OPTIONS (Category I)

● With Movable Collar (Option code suffix: /MC)

Applied only to model CM-1 for $\phi 10$, 12 and 15.

Material: iron.

● With Waterproof Cap

Option code	Terminal box elec. connection	I. D. of packing	Applied to terminal box
/WP	-15A -15B -15C	JIS G1/2 Female	$\phi 9$ mm $\phi 10$ mm $\phi 11$ mm
	-20A -20B -20C	JIS G3/4 Female	$\phi 12$ mm $\phi 13$ mm $\phi 15$ mm

T07E.EPS

● With Flameproof Packing Adapter (Option code suffix: /PG)

Electrical connection :

JIS G1/2 Female. for single element

JIS G3/4 Female. for double element

Cable O.D.:

$\phi 8.8$ to 10.7 mm. for JIS G1/2 female

$\phi 10$ to 12 mm. for JIS G3/4 female

● With Allen Wrench (Option code suffix: /AW)

For flameproof type terminal box.

● Special Color Finish

Option code	Color	Finished
/CFP	-G1	Black
	-G7	Metallic silver
/CFE	-G1	Black
	-G2	Jade green
	-G7	Metallic silver

T08E.EPS

● Tetrafluoroethylene-hexafluoropropylene copolymer cover (code: FE□□□□)

This cover - used to protect the metallic protection tube or thermowell from corrosion - can be used with the fixed flange mounting type of insertion length 100 to 2000 mm and flange nominal size 15 to 40 A. Thickness of the cover is approximately 1.5 mm. This tetrafluoroethylene-hexafluoropropylene copolymer can withstand almost all corrosive conditions and can be used in the temperature range -200 to +150 °C. (Specify insertion length (mm) as four characters in □□□□ of the option code suffix.)

● With Movable Flange

Applied only to model CM-1.

Option code	Flange rating, nominal size	Material
/MF	-J05 -15A	JIS 5K, 15 mm
	-15A	JIS 10K, 15 mm
	-J10 -20A	JIS 10K, 20 mm
	-25A	JIS 10K, 25 mm

T09E.EPS

MODEL AND SUFFIX CODES

Model	Suffix Code	Description
CM		Termocouple (with Drawn Protection Tube)
CH		Termocouple (with Drilled Thermowell and Nipple)
(1) Construction	-0 -1 -2 -3	Element only (Applied to Model CM) Plain Insertion Type (Applied to Model CM) Flange-mount Type (Flange Facing: Raised Face) Pipe threads-mount Type
(2) Terminal Box	0 1 3 4 5	None (Element only) General Type Phenol Resin Type Flameproof Type (Applied to Model CM-1, CM-2 and CM-3) Double Element Type
(3) Potation Tube Outside Diameter (Applied to Model CM)	-1 -2 -3 -4	φ10 (Inside Diameter φ7) φ12 (Inside Diameter φ9) φ15 (Inside Diameter φ11) φ21.7 (Inside Diameter φ16)
(3) Thermowell Outside Diameter (Applied to Model CH)	-A -B -C -D -E -F	φ15 (Straight Tube) φ22 (Straight Tube) φ26 (Straight Tube) φ22×φ15 (Tapered Tube) φ22×φ18 (Tapered Tube) φ26×φ22 (Tapered Tube)
(4) Protection Tube or Thermowell Material	N 1 3 4 5	None (Applied to Model CM-00) Stainless Steel (JIS SUS 304) Stainless Steel (JIS SUS 316) Sandvik P4 (Applied to Model CM) (φ21.3) Kanthal AF (Applied to Model CM-1) (φ22)
(5) Mounting (Rating)	NN JH J1 J2 A1 A3 JT JF AT	Without Mounting (Applied to Model CM-0 and CM-1) JIS 5K Flange JIS 10K Flange JIS 20K Flange ANSI Class 150 Flange ANSI Class 300 Flange JIS Taper Pipe Threads JIS Straight Pipe Threads ANSI Taper Pipe Threads
(6) Mounting (Nominal Size)	N 1 2 3 4 5 C D E	Without Mounting (Applied to Model CM-0 and CM-1) 15 mm (1/2 in.) Flange (Applied to φ10, 12 and 15) 20 mm (3/4 in.) Flange (Applied to φ10, 12 and 15) 25 mm (1 in.) Flange 40 mm (1-1/2 in.) Flange 50 mm (2 in.) Flange (Applied to JIS 10 K Flange) 1/2 in. Pipe Threads (Applied to ≤ φ12 and Model CM-3) 3/4 in. Pipe Threads (Applied to ≤ φ15) 1 in. Pipe Threads
(7) Classification of Element	-K -E -J -T -W -X -Y -D	Single Element, Type K Single Element, Type E Single Element, Type J Single Element, Type T Double Element, Type K Double Element, Type E Double Element, Type J Double Element, Type T
(8) Class	1 2	JIS IEC Class 2 JIS IEC Class 1
(9) Protection Tube or Thermowell Length	-□□□□□ ...	Expressed in 4-Digit Numbers (in mm)

Note1: Model CM-2 with the length of L-A < 50 mm and Model CM-3 with the length of L-A < 60 mm are not available.

T10E.EPS

Note2: Maximum length for Flameproof type : 2000 mm

Note3: First digit of Protection Tube or Thermowell Length will be selected from L, P, K, D, E or F.

- □□□□□

↑ L, P, K, D, E, or F

Code	Protection Tube or Thermowell Material	Number of Elements	Code	Protection Tube or Thermowell Material	Number of Elements
L	Stainless Steel	Single	D	Stainless Steel	Double
P	Sandvik P4	Single	E	Sandvik P4	Double
K	Kanthal AF	Single	F	Kanthal AF	Double

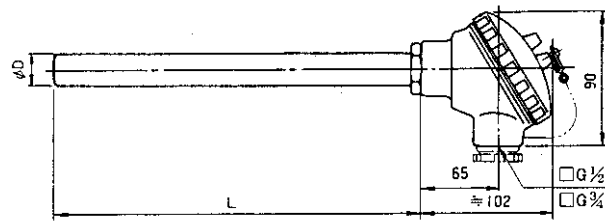
■ OPTION CODES

Option code		Description
/FF		Flat Face (Standard Flange Facing; Raised Face)
/WP	-15A	Waterproof Cap (G1/2 φ9)
	-15B	Waterproof Cap (G1/2 φ10)
	-15C	Waterproof Cap (G1/2 φ11)
	-20A	Waterproof Cap (G3/4 φ12)
	-20B	Waterproof Cap (G3/4 φ13)
	-20C	Waterproof Cap (G3/4 φ15)
/PG		Flameproof Packing Adaptor G1/2 φ8.8 to φ10.7 or G3/4 φ10 to φ12
/AW		Allen Wrench for Flameproof Type Terminal Box
/CFP	-G1	Special Color Finish for Terminal Box Baked Polyurethane Resin Finish Color: Black
	-G7	Special Color Finish for Terminal Box Baked Polyurethane Resin Finish Color: Metallic Silver
/CFE	-G1	Special Color Finish for Terminal Box Baked Epoxy Resin Finish Color: Black
	-G2	Special Color Finish for Terminal Box Baked Epoxy Resin Finish Color: Jade Green
	-G7	Special Color Finish for Terminal Box Baked Epoxy Resin Finish Color: Metallic Silver
/CFU		Special Color Finish for Terminal Box Customer Specification with Color Sample
/FE□□□□ (□□□□: Insertion Length in mm)		FEP Cover for φ10, φ12 or φ15
/MF	-J05-15A	Movable Flange (Raised Face; FC20; JIS 5K 15A)
	-J10-15A	Movable Flange (Raised Face; SUS304; JIS 10K 15A)
	-J10-20A	Movable Flange (Raised Face; SUS304; JIS 10K 20A)
	-J10-25A	Movable Flange (Raised Face; SUS304; JIS 10K 25A)
	-J10-40A	Movable Flange (Raised Face; SUS304; JIS 10K 40A)
	-J10-50A	Movable Flange (Raised Face; SUS304; JIS 10K 50A)

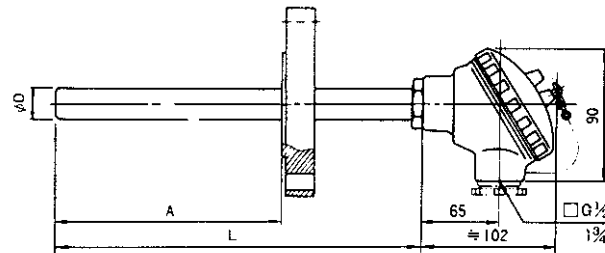
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DIMENSIONS

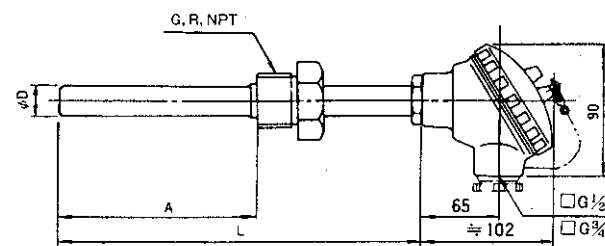
CM-11



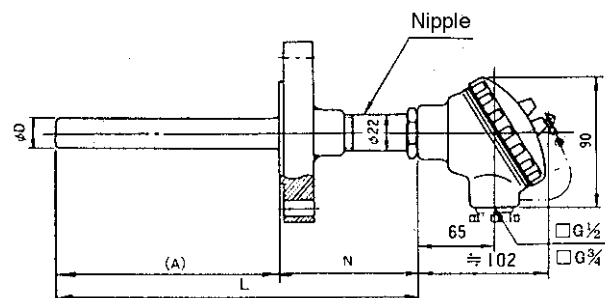
CM-21



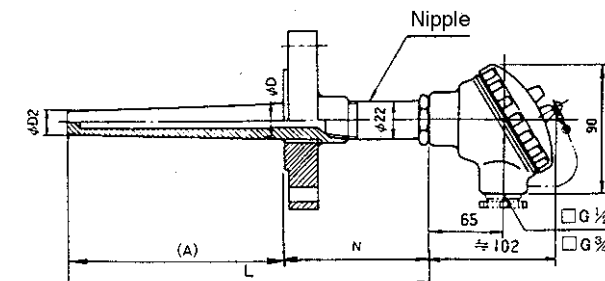
CM-31



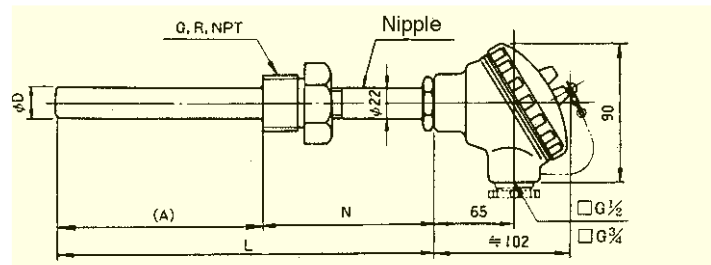
CH-21 (Straight tube)



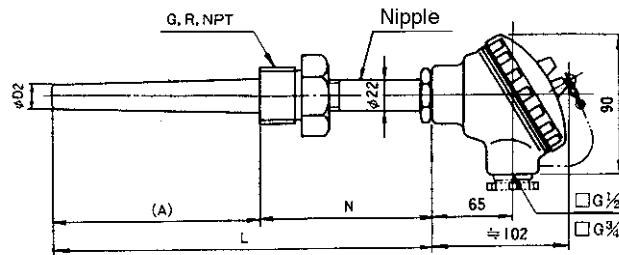
CH-21 (Tapered tube)



□CH-31 (Straight tube)



□CH-31 (Tapered tube)



(Note) Model CM-2 with the length of L-A <50 mm is not available
Model CM-3 with the length of L-A <60 mm it not available

< ORDERING INFORMATIONS >

1. Model and Suffix Codes
2. Insertion Length (Applied to model CM-2 and CM-3)
3. Option Desired