TE 65.01

Thermocouples

Measuring Insert

rigid • Model TC001
flexible • Model TC002

Electronic Temperature Measurement

Services intended
Exchangeable measuring insert for all industrial and laboratory applications.

General
The measuring inserts for thermocouples described here are designed for installation in a protection assembly. Operation without thermowell is only recommended in certain applications.

Model TC001
This model series features a rigid insert tube in which the measuring point of the thermocouple and the thermal wires are found. The measuring point can be insolated from the insert tube or welded to it.

Model TC002
In the case of this model series the measuring insert is made of a flexible, mineral insulated sheathed thermocouple. The measuring point of the thermocouple is located on the tip of the measuring insert. The measuring point can be insolated from the sheathing or welded to it. As a general rule the precious metal thermocouples have insulated measuring points. Apart from being flexible this model series is outstanding for the higher resistance to vibration given compared with the model series TC001.

Both model series are spring loaded with pressure springs to ensure that the measuring insert is pressed down on the thermowell bottom and are standardised in DIN 43 735.

Customer specific versions are available apart from the DIN versions, for example:
- with tapered tip
- with mounted tubing for adaptation to the appropriate inner diameter of the thermowell
- without connection socket
- with transmitter

Type and number of sensors, accuracy and measuring point can be selected individually for the appropriate application.

Particular attention must be paid to the dimensions of the measuring insert when combined with a thermowell. Adequate heat transfer between thermowell and measuring insert is only ensured when the measuring insert is of correct length and diameter.
Selection of normal or standard length enables short delivery time and low cost stocking as spare measuring insert for the appropriate standard length.

Intrinsically safe designs with manufacturer's certification are available for applications in hazardous areas.
Manufacturer's certification to NAMUR NE 24 or in accordance with DIN VDE 0165 is available.

The range of applications is completed by designs without connection socket for direct transmitter installation. Optionally we can fit analogue or digital transmitters from the WIKA range.
(- analogue, fixed measuring ranges:
Model T20 to data sheet TE 20.01,
- analogue, measuring range selectable with soldered bridges:
Model T21 to data sheet TE 21.01,
- digital, Model T12 to data sheet TE 12.01,
- digital, with HART® Protocol: Model T32 to data sheet TE 32.01)

Sensor

Listed types of sensors are possible both as single or duplex thermocouple. The measuring point of the measuring insert is supplied with insulated measuring point unless specified otherwise. As a general rule the precious metal thermocouples have insulated measuring points.

Type	Thermal pair	Standard	Recommended max. operating temperature
K	NiCr-Ni	DIN IEC 584	1100 °C
J	Fe-CuNi	DIN IEC 584	800 °C
E	NiCr-CuNi	DIN IEC 584	800 °C
T	Cu-CuNi	DIN IEC 584	400 °C
N	NiCrSi-NiSi	DIN IEC 584	1100 °C
L	Fe-CuNi	DIN 43710 : 1985-12	800 °C
U	Cu-CuNi	DIN 43710 : 1985-12	400 °C

Type	Thermal pair	Standard
R	PtRh-Pt	DIN IEC 584
S	PtRh-Pt	DIN IEC 584
B	PtRh-PtRh	DIN IEC 584

In the case of **typ K** there is a risk of blue mould between 850 °C and 950 °C . We recommend the use of a sensor type N, if the working temperature fluctuates continuously in this range.

Type L and **type U** are provided for use in older plants. These types are no longer defined in international standards.

It is not sensible to make general recommendations with regards to the maximum operating temperature for measuring inserts with precious metal thermocouples. Apart from the type of sensor other parameters have to be considered such as the material from which the measuring insert sheathing is made.

Sensor limiting error

- Class 1 to DIN IEC 584
- Class 2 to DIN IEC 584
- Class 3 to DIN IEC 584
- ANSI Standard to MC96.1
- ANSI Special to MC96.1
- Standard to DIN 43710 : 1985-12 (sensor type L and type U)

The full range of sensors is not available in all standards and classes.

The basic values and limiting deviations of thermocouples are standardised. Taken as basis for this is a cold junction temperature of 0 °C.
The different types of sensors are not defined in all standards and classes. The restricted limiting deviation is not available for measuring inserts with precious metal thermocouple (i.e. sensors type R and type S are only available in Class 2, type B only in Class 3).
Class 3 is used for applications at temperatures below - 40 °C for non precious material thermocouples.

Sensor	Limiting deviation [1]				
Type	DIN IEC 584			MC96.1	
	Class 1	Class 2	Class 3	Standard	Special
K, E	± 1.5 K or 0.0040 t	± 2.5 K or 0.0075 t	± 2.5 K or 0.0015 t	± 2.2 K or 0.0075 t	± 1.1 K or 0.0040 t
N				–	–
J	± 1.5 K or 0.0040 t	± 2.5 K or 0.0075 t	–	± 2.2 K or 0.0075 t	± 1.1 K or 0.0040 t
T	± 0.5 K or 0.0040 t	± 1 K or 0.0075 t	± 1 K or 0.0015 t	± 0.5 K or 0.0040 t	± 1 K or 0.0075 t
R, S	± 1 K or [1 + 0.003 (t - 1100)] K	± 1.5 K or 0.0025 t	–	± 1.5 K or 0.0025 t	± 0.6 K or 0.0010 t
B	–	0.0025 t	± 4 K or 0.005 t	0.0050 t	–
L, U	Standard to DIN 43710 : 1985-12	3 K or 0.0075 t		–	

1) whichever is larger, t = temperature

Basic values and limiting deviations for thermocouples per DIN IEC 584

Temperature		°C	Sensor type	200	350	500	700	900	1100
Basic value (thermal voltage)		mV	K	8.14	14.29	20.64	29.13	37.33	45.12
			J	10.78	19.09	27.39	39.13	51.88	63.79
			E	13.42	24.96	37	53.11	68.79	–
			T	9.29	17.82	–	–	–	–
			N	5.91	11.14	16.75	24.53	32.37	40.09
			R	1.47	2.89	4.47	6.74	9.2	11.85
			S	1.44	2.79	4.23	6.27	8.45	10.76
			B	–	–	–	2.43	3.96	5.78
Limiting deviation	Class 1	K	K, J, E, N	± 1.5	± 1.5	± 2.0	± 2.8	± 3.6	–
			T	± 0.8	± 1.4	–	–	–	–
			R, S	± 1.0	± 1.0	± 1.0	± 1.0	± 1.0	± 1.0
	Class 2		K, J, E, N	± 2.5	± 2.5	± 3.7	± 5.2	± 6.7	± 8.2
			T	± 1.5	± 2.6	–	–	–	–
			R, S	± 1.5	± 1.5	± 1.5	± 1.7	± 2.2	± 2.7
			B	–	–	–	± 1.7	± 2.2	± 2.7
	Class 3		B	–	–	–	± 4.0	± 4.5	± 5.5

Measuring insert diameter and length

The diameter of the measurement insert should be approx. 1 mm less than the diameter of the thermowell hole in which the measuring insert is to be fitted. Gaps greater than 0.5 mm between hole and measuring insert have a negative effect on the heat transfer.
The length of the measuring insert is to be selected so that the measuring insert stands on the thermowell bottom. This ensures good heat transfer.
The measuring inserts are spring loaded (spring travel: max. 10 mm) to ensure that they are pressed down on the bottom of the thermowell.

The mentioned standard lengths are equivalent to the normal lengths and are matched to the nominal length of standard thermometers. This ensures exchangeability with the same measuring certainty. Special lengths are possible.
In the case of customer specific thermometers it is thus expedient to combine the required insertion length with a non-standard extension neck length to again give a standard length for the measuring insert length. Since measuring inserts with standard dimensions can be delivered quicker and are less expensive than special length measuring inserts this will have a positive effect on possible purchasing and stocking of spare parts.

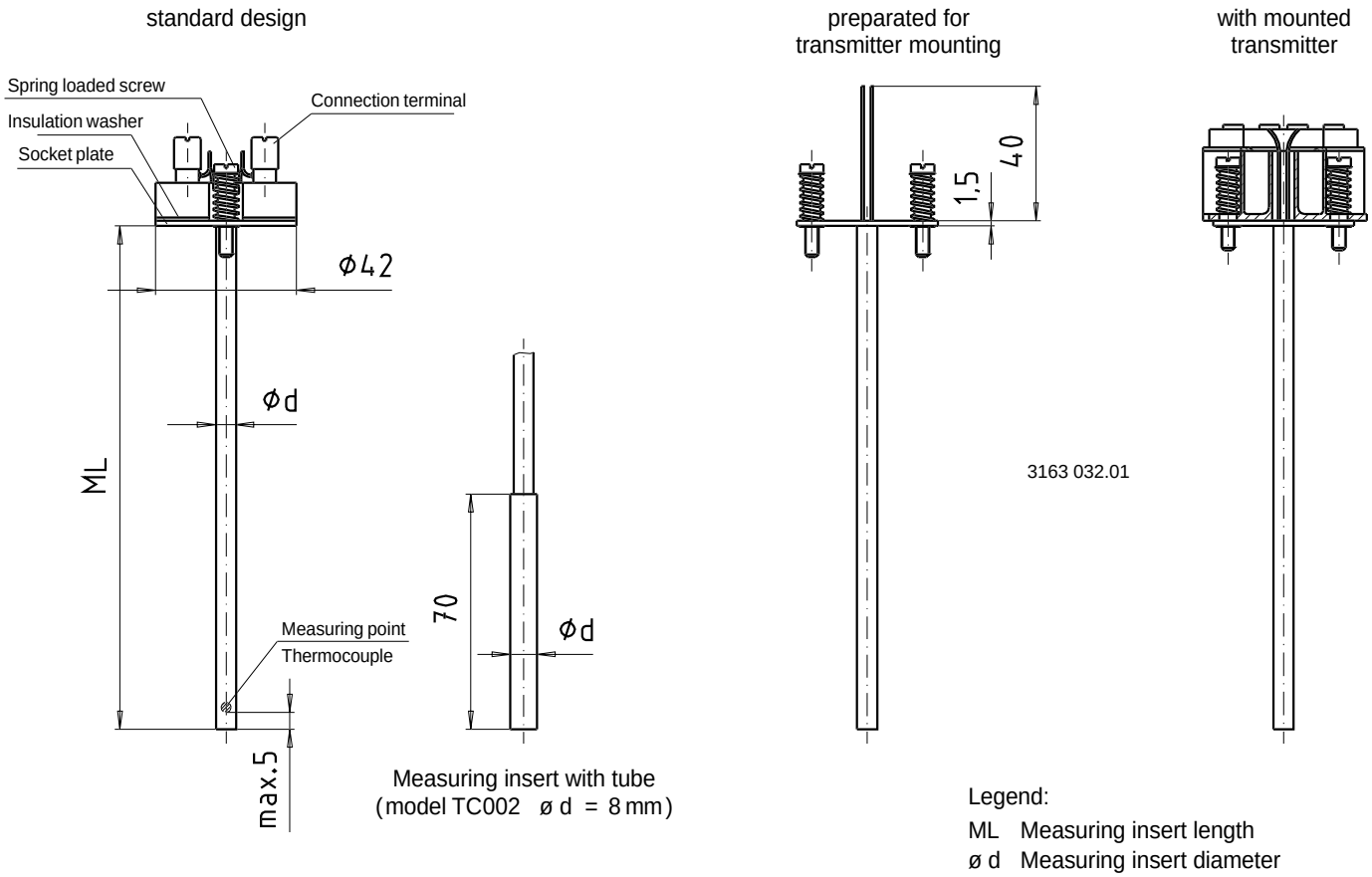
Measuring insert dia. in mm	Standard length in mm												
3 [1)]	145	205	275	290	315	375	405	435	525	555	–	–	–
6	–	–	275	–	315	375	405	435	525	555	655	735	1025
8	–	–	275	–	315	375	405	435	525	555	655	735	1025

1) only sheathed cable design, model TC002

Material

Model TC001, tube: stainless steel 1.4571
Model TC002, cable sheath: Ni-alloy 2.4816 (Inconel 600) preferential for sensor type K and type N, stainless steel 1.4541
other on request

Dimensions in mm



Measuring insert with tube (model TC002 ø d = 8 mm)

Legend:
ML Measuring insert length
ø d Measuring insert diameter

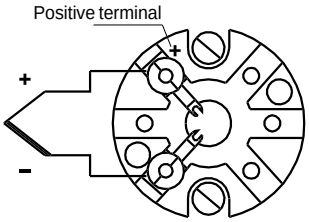
Connection socket

- 42 mm diameter (standard)
- 25 mm diameter (on request)
- without (measuring insert preparated for transmitter mounting)

other on request

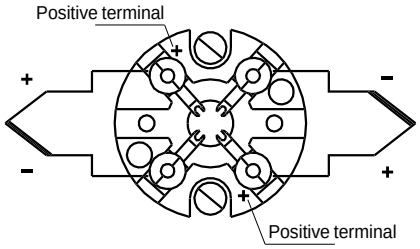
Terminal appropriation and marking

single thermocouple



3166 822.01

duplex thermocouple



Transmitter (optional)

A transmitter can be mounted on the measuring insert. In this case the transmitter is fastened directly to the measuring insert socket plate instead of to the connection socket, see Page 3. Two transmitters on request.

Model	Description	Explosion protection	Data sheet
T20	analogue transmitter with fixed measuring range	optional	TE 20.01
T21	analogue transmitter, measuring range selectable with soldered bridges	without	TE 21.01
T12	digital transmitter, configurable	optional	TE 12.01
T32	digital transmitter with HART-Protocol, configurable	optional	TE 32.01

Explosion protection (optional)

Suitability for Ex i use can be certified in different ways:

- in accordance to NAMUR NE 24 with manufacturer's certification
- in accordance to DIN VDE 0165/2.91 with manufacturer's certification

Fitted transmitters have their own conformity certificate.

Order code for Measuring Insert, flexible, for Thermocouples Model TC002

Field No.		Code	Instrument design		
			Explosion protection		
		Z	without		
		B	intrinsically safe with manufacturer's certification to NAMUR NE 24		
1		**C**	intrinsically safe with manufacturer's certification, DIN VDE 0165		
			Type and number of sensors		
		A	1 x Type K		
		B	2 x Type K		
		C	1 x Type J		
		D	2 x Type J		
2		**?**	other		
			Sensor limiting error		
		1	Class 1 to DIN IEC 584		
		2	Class 2 to DIN IEC 584		
		8	ANSI Standard to MC96.1		
		9	ANSI Special to MC96.1		
3		**?**	other		
			Measuring point		
		1	insulated		
4		**2**	not insulated		
			Measuring insert diameter		
		1	3 mm		
		3	6 mm		
		4	8 mm *tubing*		
5		**?**	other		
			Measuring insert length		
		1	275 mm		
		9	290 mm		
		2	315 mm		
		3	375 mm		
		4	405 mm		
		5	435 mm		
		6	525 mm		
		7	555 mm		
		8	655 mm		
6		**?**	other		
			Cable sheath material		
		A	Ni-alloy 2.4816 (Inconel 600)	*not with sensor type J*	
		U	stainless steel 1.4541		
7		**?**	other		
			Connection socket		
		1	42 mm diameter for connection head form B		
		?	other		
8		**2**	transmitter instead of connection socket	*see field no. 9 and no. 10*	
			Transmitter		
		ZZ	without		
		A0	model T20, without explosion protection		
		A2	model T20, with explosion protection EEx ia		
		A4	model T20, with explosion protection EEx ib		
		B0	model T21, without explosion protection		
		D0	model T12, without explosion protection	*configured to customer specification*	
		D2	model T12, with explosion protection EEx ia	*configured to customer specification*	
		D4	model T12, with explosion protection EEx ib	*configured to customer specification*	
		E0	model T32, without explosion protection	*configured to customer specification*	
		E2	model T32, with explosion protection EEx ia	*configured to customer specification*	
		E4	model T32, with explosion protection EEx ib	*configured to customer specification*	
9		**??**	other		
			Transmitter measuring range		
		ZZ	without		
		KK	customer's specification	*only transmitter model: T12, T32*	*please use sheet "help to order"*
			standard range	*only transmitter model: T20, T21*	*code see price list*
10		**??**	special range	*only transmitter model: T20, T21*	*please state as additional text*
			Quality certificates		
		Z	without		
11		**1**	with *Please state in clearly understandable text !*		

Additional order details			
YES	**NO**		
T	**Z**	additional text	*Please state in clearly understandable text !*

Order code for Model TC002

	1		2	3	4		5	6	7	8	9	10	11		12
TC002	–		–			–								–	

Additional text: _____

Order code for Measuring Insert, rigid, for Thermocouples Model TC001

Field No.	Code	Instrument design		
		Explosion protection		
	Z	without		
	B	intrinsically safe with manufacturer's certification to NAMUR NE 24		
1	**C**	intrinsically safe with manufacturer's certification, DIN VDE 0165		
		Type and number of sensors		
	A	1 x Type K		
	B	2 x Type K		
	C	1 x Type J		
	D	2 x Type J		
2	**?**	other		
		Sensor limiting error		
	1	Class 1 to DIN IEC 584		
	2	Class 2 to DIN IEC 584		
	8	ANSI Standard to MC96.1		
	9	ANSI Special to MC96.1		
3	**?**	other		
		Measuring point		
	1	insulated		
4	**2**	not insulated		
		Measuring insert diameter		
	3	6 mm		
	4	8 mm		
5	**?**	other		
		Measuring insert length		
	1	275 mm		
	2	315 mm		
6	**?**	other		
		Tube material		
	1	stainless steel 1.4571		
7	**?**	other		
		Connection socket		
	1	42 mm diameter for connection head form B		
	?	other		
8	**2**	transmitter instead of connection socket	*see field no. 9 and no. 10*	
		Transmitter		
	ZZ	without		
	A0	model T20, without explosion protection		
	A2	model T20, with explosion protection EEx ia		
	A4	model T20, with explosion protection EEx ib		
	B0	model T21, without explosion protection		
	D0	model T12, without explosion protection	*configured to customer specification*	
	D2	model T12, with explosion protection EEx ia	*configured to customer specification*	
	D4	model T12, with explosion protection EEx ib	*configured to customer specification*	
	E0	model T32, without explosion protection	*configured to customer specification*	
	E2	model T32, with explosion protection EEx ia	*configured to customer specification*	
	E4	model T32, with explosion protection EEx ib	*configured to customer specification*	
9	**??**	other		
		Transmitter measuring range		
	ZZ	without		
	KK	customer's specification	*only transmitter model: T12, T32*	*please use sheet "help to order"*
		standard range	*only transmitter model: T20, T21*	*code see price list*
10	**??**	special range	*only transmitter model: T20, T21*	*please state as additional text*
		Quality certificates		
	Z	without		
11	**1**	with *Please state in clearly understandable text !*		

Additional order details			
YES	**NO**		
12 **T**	**Z**	additional text	*Please state in clearly understandable text !*

Order code for Model TC001

	1		2	3	4		5	6	7	8		9		10		11		12
TC001		–				–					–						–	

Additional text: _____

Specifications and dimensions given in this leaflet are correct at the time of printing.
Modifications may take place and materials specified may be replaced by others without prior notice.

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