Sapphire-design thermocouple
High-temperature thermocouple
Model TC83

For further approvals, see page 8

Calitum®

Applications

- Sulphur recovery units (SRU)
- Waste-to-Energy plants (WtE)
- Processes with high hydrogen sulphide content
- Hydrogen-based DRI plants (“direct reduced iron”) in the steel industry

Special features

- Cost saving by non-purge system
- Reduction of unplanned downtimes
- Increased safety against escape of toxic media through double sealing system
- High variance of thermowell / protection tube materials
- High process safety with processes up to 1,700 °C [3,092 °F]

Sapphire-design thermocouple, model TC83-F

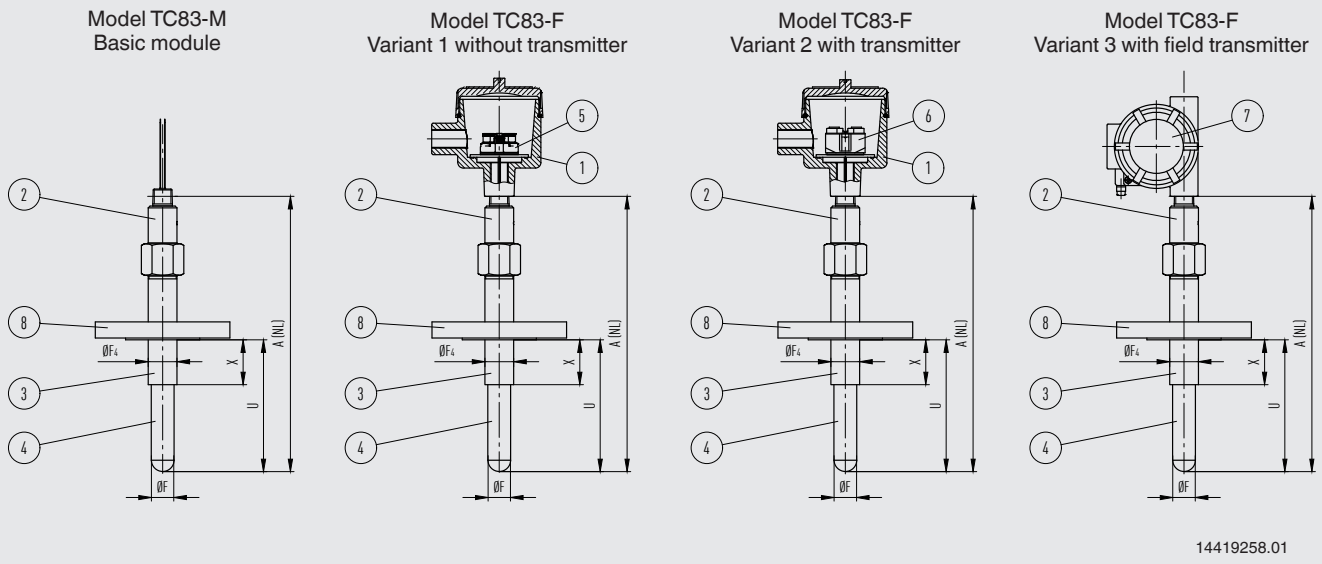
Description

This high-temperature thermocouple with a gas-tight sapphire protection tube has been specifically developed for use in hydrogenous atmosphere.
Through the monocrystalline structure, the sapphire protects the noble metal of the thermocouple from poisonous toxic media in the aggressive process atmosphere.

Hermetically sealed junctions prevent toxic gases from being able to escape the reactor.
The high temperatures in the process place very high demands on protection tubes and thermocouples.
These process conditions often lead to shutdowns and interruptions in operation.

Utilising the sapphire design can significantly improve life expectancy of the thermocouple and reduce downtime.

Components model TC83

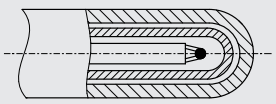


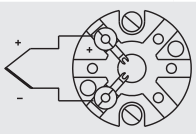
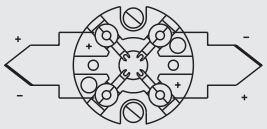
Legend:

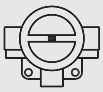
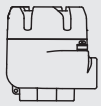
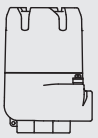
① Connection head
② Neck tube
③ Metal support tube
④ Protection tube
⑤ Terminal block
⑥ Transmitter (selectable)
⑦ Field transmitter
⑧ Process connection

A (NL) Nominal length
U Insertion length
X Support tube length below process connection

Basic information		
Dimensions		
Outer protection tube Ø F	24 ... 26 mm [0.945 ... 1.024 in]	
Inner protection tube Ø	■ Sapphire ■ Monocrystalline	8 mm [0.315 in]
Insertion length U	300 ... 1,000 mm [11.81 ... 39.37 in]	
	→ Further diameters and lengths on request	

Measuring element		
Type of measuring element	Thermocouple per IEC 60584-1 or ASTM E230 Types K, J, E, R, S, B	
Probe tip design (hot junction)		
Design with outer and inner protection tube	■ Insulation rod ■ Welded thermocouple (hot junction) ■ Sapphire inner protection tube ■ Outer protection tube	
Marking of the polarity	The colour code at the positive poles of the instrument decides the correlation of polarity and terminal.	

Measuring element		
Single thermocouple		
Dual thermocouple		
Validity limits of the class accuracy in accordance with IEC 60584-1		
Type K	Class 2	-40 ... +1,200 °C [-40 ... +2,192 °F]
	Class 1	-40 ... +1,000 °C [-40 ... +1,832 °F]
Type J	Class 2	-40 ... +750 °C [-40 ... +1,382 °F]
	Class 1	-40 ... +750 °C [-40 ... +1,382 °F]
Type E	Class 2	-40 ... +900 °C [-40 ... +1,652 °F]
	Class 1	-40 ... +800 °C [-40 ... +1,472 °F]
Type R	Class 2	0 ... 1,600 °C [32 ... 2,912 °F]
	Class 1	0 ... 1,600 °C [32 ... 2,912 °F]
Type S	Class 2	0 ... 1,600 °C [32 ... 2,912 °F]
	Class 1	0 ... 1,600 °C [32 ... 2,912 °F]
Type B	Class 3	600 ... 1,700 °C [1,112 ... 3,092 °F]
	Class 1	600 ... 1,700 °C [1,112 ... 3,092 °F]
Validity limits of the class accuracy in accordance with ASTM E230		
Type K	Standard	0 ... 1,260 °C [32 ... 2,300 °F]
	Special	0 ... 1,260 °C [32 ... 2,300 °F]
Type J	Standard	0 ... 760 °C [32 ... 1,400 °F]
	Special	0 ... 760 °C [32 ... 1,400 °F]
Type E	Standard	0 ... 870 °C [32 ... 1,598 °F]
	Special	0 ... 870 °C [32 ... 1,598 °F]
Type R	Standard	0 ... 1,480 °C [32 ... 2,696 °F]
	Special	0 ... 1,480 °C [32 ... 2,696 °F]
Type S	Standard	0 ... 1,480 °C [32 ... 2,696 °F]
	Special	0 ... 1,480 °C [32 ... 2,696 °F]
Type B	Standard	-
	Special	870 ... 1,700 °C [1,598 ... 3,092 °F]

Model		Material	Cable inlet thread size	Ingress protection (max.) [1) 2)] IEC/EN 60529	Cap	Surface	Connection to neck tube
	**1/4000 F**	Aluminium	■ ½ NPT ■ ¾ NPT ■ M20 x 1.5	IP66	Screw-on lid	Blue, painted (RAL 5022)	½ NPT
	1/4000 S	Stainless steel	■ ½ NPT ■ ¾ NPT ■ M20 x 1.5	IP66	Screw-on lid	Natural finish	½ NPT
	**5/6000**	Aluminium	■ 3 x ½ NPT ■ 3 x ¾ NPT ■ 3 x M20 x 1.5	IP66	Screw-on lid	Blue, painted (RAL 5022)	½ NPT
	5/6000	Stainless steel	■ 3 x ½ NPT ■ 3 x ¾ NPT ■ 3 x M20 x 1.5	IP66	Screw-on lid	Natural finish	½ NPT
	**7/8000 W**	Aluminium	■ ½ NPT ■ ¾ NPT ■ M20 x 1.5	IP66	Screw-on lid	Blue, painted (RAL 5022)	½ NPT
	7/8000 S	Stainless steel	■ ½ NPT ■ ¾ NPT ■ M20 x 1.5	IP66	Screw-on lid	Natural finish	½ NPT
	**PIH-L**	Aluminium	■ ½ NPT / closed ■ M20 x 1.5 / closed ■ 2 x ½ NPT ■ 2 x M20 x 1.5	IP66	Screw-on lid, flat	Blue lid, painted Grey lower body, painted	■ ½ NPT ■ M20 x 1.5
	**PIH-H**	Aluminium	■ ½ NPT / closed ■ M20 x 1.5 / closed ■ 2 x ½ NPT ■ 2 x M20 x 1.5	IP66	Screw-on lid, high	Blue lid, painted Grey lower body, painted	■ ½ NPT ■ M20 x 1.5

1) IP ingress protection of the connection head. The IP ingress protection of the complete TC83-F instrument does not necessarily have to correspond to the connection head
2) Suitable sealing / cable gland required..

Field temperature transmitter, model TIF50 (on request)

As an alternative to the standard connection head, the sensor can also be fitted with a model TIF50 field temperature transmitter. A remote version for tube/surface mounting for the sensor designs with connection cable is also possible. The field temperature transmitter comprises a model T38 transmitter with 4 ... 20 mA/HART® protocol output and is equipped with an LCD indication module.

Fig. left: model TIF50, head version
Fig. right: model TIF50, wall mounting

Cable inlet

Cable inlet		Colour	Ingress protection (max.) IEC/EN 60529 [1]	Cable inlet thread size	Min./Max. ambient temperature
	Standard cable inlet	Natural finish	IP65	■ M20 x 1.5 ■ ½ NPT	-40 ... +80 °C [-40 ... +176 °F]
	Plastic cable gland (cable Ø 6 ... 10 mm)	■ Black ■ Grey	IP66	■ M20 x 1.5 ■ ½ NPT	-40 ... +80 °C [-40 ... +176 °F]
	Plastic cable gland (cable Ø 6 ... 10 mm), Ex e	■ Light blue ■ Black	IP66	■ M20 x 1.5 ■ ½ NPT	■ -20 ... +80 °C [-4 ... +176 °F] ■ -40 ... +70 °C [-40 ... +158 °F]
	Nickel-plated brass cable gland (cable Ø 6 ... 12 mm)	Natural finish	IP66	■ M20 x 1.5 ■ ½ NPT	-60 [2] / -40 ... +80 °C [-76 / -40 ... +176 °F]
	Nickel-plated brass cable gland (cable Ø 6 ... 12 mm), Ex e	Natural finish	IP66	■ M20 x 1.5 ■ ½ NPT	-60 [2] / -40 ... +80 °C [-76 / -40 ... +176 °F]
	Stainless steel cable gland (cable Ø 7 ... 12 mm)	Natural finish	IP66	■ M20 x 1.5 ■ ½ NPT	-60 [2] / -40 ... +80 °C [-76 / -40 ... +176 °F]
	Stainless steel cable gland (cable Ø 7 ... 12 mm), Ex e	Natural finish	IP66	■ M20 x 1.5 ■ ½ NPT	-60 [2] / -40 ... +80 °C [-76 / -40 ... +176 °F]
	Plain threaded	-	IP00	■ M20 x 1.5 ■ ½ NPT	-
	Sealing plugs for shipping	Transparent	-	■ M20 x 1.5 ■ ½ NPT	-40 ... +80 °C [-40 ... +176 °F]

1) IP ingress protection of the cable gland. The IP ingress protection of the complete TC83-F instrument does not necessarily have to correspond to the cable gland.
2) Special version on request (explosion-protected versions only available with specific approvals)

Cable inlet	Explosion protection					
	Without	Ex i (gas) Zone 0, 1, 2	Ex i (dust) Zone 20, 21, 22	Ex e (gas) Zone 1, 2	Ex t (dust) Zone 21, 22	Ex nA (gas) Zone 2
Standard	x	x	-	-	-	-
Plastic cable gland	x	x	-	-	-	-
Plastic cable gland (light blue), Ex e	x	x	x	-	-	-
Plastic cable gland (black), Ex e	x	x	x	x	x	x
Brass cable gland, nickel-plated	x	x	x	-	-	-
Brass cable gland, nickel-plated, Ex e	x	x	x	x	x	x
Stainless steel cable gland	x	x	x	-	-	-
Stainless steel cable gland, Ex e	x	x	x	x	x	x
Plain threaded	x	x	x [1)]	x [1)]	x [1)]	x [1)]
Sealing plugs for shipping	Not applicable, transport protection [1)]					

1) Suitable cable gland required for operation

Transmitters

Transmitter models	Model T16	Model T38
Transmitter data sheet	TE 16.01	TE 38.01
Figure		
Output		
4 ... 20 mA	x	x
HART® protocol	-	x
Cable inlet	■ Type K ■ Type J ■ Type E ■ Type R ■ Type S ■ Type B	■ Type K ■ Type J ■ Type E ■ Type R ■ Type S ■ Type B
Explosion protection	Ex version possible	

Possible connection heads for transmitter mounting	Model T16	Model T38
1/4000	○	○
5/6000	○	○
7/8000	○	○
TIF50	-	○
PIH-L/PIH-H	○	○

Legend:
○ Mounted instead of terminal block
- Mounting not possible

The mounting of a transmitter is possible with all the connection heads listed here. For a correct determination of the overall measuring deviation, the sensor and transmitter measuring deviations must be added.

→ For detailed specifications for thermocouples, see IEC 60584-1 or ASTM E230 and technical information IN 00.23 at www.wika.com.

Functional safety with model T32 and T38 temperature transmitter

In safety-critical applications, the entire measuring chain must be taken into consideration in terms of the safety parameters. The SIL classification allows the assessment of the risk reduction achieved by the safety installations. Selected thermocouples, in combination with a suitable temperature transmitter (e.g. T38, TÜV-certified SIL version for protection systems developed in accordance with IEC 61508), are suitable as sensors for safety functions to SIL 2.
For SIL 3 applications, WIKA recommends the use of two individual thermocouples with one SIL-certified T38 transmitter connected to each.

→ For details, see technical information IN 00.19 on www.wika.com.

Neck/Support tube		
Versions		
Thread sizes	■ M20 x 1.5 ■ ½ NPT	
Neck/Support tube length N	Min. 330 mm [13 in]	
	→ Others on request	
Metal support tube Ø F_4	32 mm [1.259 in]	

Materials		
Non-wetted		
Neck tube	Stainless steel	
Material of inner protection tube	Ceramic C530	T_{max} = 1,600 °C [2,912 °F]
	Ceramic C610	T_{max} = 1,500 °C [2,732 °F]
	Ceramic C799	T_{max} = 1,600 °C [2,912 °F]
	→ Others on request	
Wetted		
Support tube	■ Stainless steel 310 ■ 446 ■ Alloy 600	
Material of outer protection tube	Ceramic C530	T_{max} 1) = 1,600 °C [2,912 °F]
	Ceramic C610	T_{max} = 1,500 °C [2,732 °F]
	Ceramic C799	T_{max} 1) = 1,600 °C [2,912 °F]
	Silicon carbide (Hexoloy ®)	T_{max} 1) = 1,650 °C [3,000 °F]
	→ Others on request	

1) Upper operating temperature in air up to 1,700 °C [3,082 °F]

Process connection	
Standard	■ ASME ■ EN 1092-1
Nominal size	
ASME	1.5 ... 6"
EN 1092-1	DN40 ... DN100
Pressure ratings	
ASME	150 ... 1,500 lb
EN 1092-1	PN 40 ... PN 100
Sealing face	
ASME	Stock finish (125 ... 250 AARH)
EN 1092-1	Form B1 (R_a 3.2 ... 12.5 µm)

→ Other process connections on request

Operating conditions	
Operating temperature	
Ceramic protection tube	Max. 1,700 °C [3,082 °F]
	→ Others on request
Ambient and storage temperature range	-60 [1] / -40 ... +80 °C [-76 [1] / -40 ... +176 °F]

1) Special version on request (only available with specific approvals)

Approvals

Logo	Description	Region
CE	**EU declaration of conformity**	European Union
	EMC Directive EN 61326 emission (group 1, class B) and immunity (industrial environments)	
	RoHS directive	

Optional approvals

Logo	Description	Region
Ex	**EU declaration of conformity**	European Union
	ATEX directive Hazardous areas	
	- Ex d Zone 1 gas — II 2/-G Ex db IIC T6 ... T1 Gb/-	
	Zone 1 gas — II 2/-G Ex db IIC Gb/-	
	- Ex i Zone 1 gas — II 2/- G Ex ia IIC T* Gb/-	
	Zone 21 dust — II 2/- D Ex ia IIIC T* Db/-	
	Zone 1 gas — II 2/- G Ex ia IIC Gb/-	
	Zone 21 dust — II 2/- D Ex ia IIIC Db/-	
IEC IECEx	**IECEx** Hazardous areas	International
	- Ex d Zone 1 gas — Ex db IIC T6 ... T1 Gb/-	
	Zone 1 gas — Ex db IIC Gb/-	
	- Ex i Zone 1 gas — Ex ia IIC T* Gb/-	
	Zone 21 dust — Ex ia IIIC T* Db/-	
	Zone 1 gas — Ex ia IIC Gb/-	
	Zone 21 dust — Ex ia IIIC Db/-	
EAC Ex	**EAC**	Eurasian Economic Community
	Hazardous areas	
	- Ex d Zone 1 gas — 1Ex d IIC T6...T1 Gb X	
	- Ex i Zone 21 dust — Ex ia IIIC T135°C Db X	
	Zone 1 gas — 1Ex ia IIC T6...T1 Gb X	
	PAC Kazakhstan Metrology, measurement technology	Kazakhstan
-	**PAC Ukraine** Metrology, measurement technology	Ukraine
	PAC Uzbekistan Metrology, measurement technology	Uzbekistan

Certificates

Certificates	
Certificates	■ 2.2 test report per EN 10204 (e.g. state-of-the-art manufacturing, material proof, indication accuracy) ■ 3.1 inspection certificate per EN 10204 (e.g. material proof for wetted metal parts, indication accuracy, calibration certificate) ■ Calibration at 3 test points (900 °C [1,652 °F], 1,000 °C [1,832 °F] and 1,100 °C [2,012 °F]) ■ Calibration at 3 test points (1,000 °C [1,832 °F], 1,200 °C [2,192 °F] and 1,400 °C [2,552 °F])

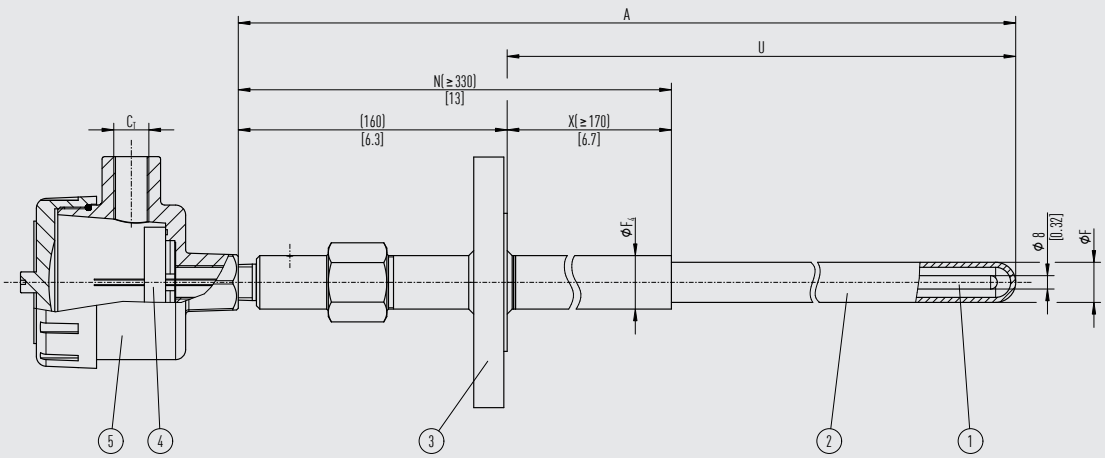
→ For approvals and certificates, see website

Manufacturer's information and certificates

Logo	Description
SIL	SIL 2 Functional safety

Dimensions in mm [in]

Model TC83-F



① Inner protection tube, sapphire with thermocouple
② Ceramic outer protection tube
③ Process connection
④ Terminal block / Transmitter (selectable)
⑤ Connection head

Legend:

A	Nominal length
U	Insertion length
N	Neck tube / Support tube length
X	Neck tube / Support tube length below process connection
Ø F	Diameter of outer protection tube

Ordering information

Model / Explosion protection / Ignition protection type / Sensor / Sensor specification / Measuring location / Connection housing / Thread size at cable outlet / Cable outlet / Transmitter / Support tube / Connection to housing, connection head / Process connection / Outer protection tube / Neck tube support tube length / Support tube length X (process side) / Insertion length U / Nominal length A / Options

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