

# Sapphire-design thermocouple

## For high-temperature measurements

### Model TC83

WIKA data sheet TE 65.83



for further approvals  
see page 2

#### Applications

- Sulphur recovery units (SRU)
- Waste-to-Energy plants (WtE)
- Processes with high hydrogen sulfide content

#### Special features

- Cost saving by non-purge system
- Reduction of unplanned downtime
- Increased safety through internal sealing system
- 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 precious 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. Utilizing the sapphire design can significantly improve life expectancy of the thermocouple and reduce downtime.

## Approvals

Logo	Description	Country
	<b>EU declaration of conformity</b> <ul style="list-style-type: none"> <li>■ EMC directive <sup>1)</sup> EN 61326 emission (group 1, class B) and interference immunity (industrial application)</li> <li>■ RoHS directive</li> <li>■ ATEX directive (option) Hazardous areas II 2/-G Ex db IIC T6 ... T1 Gb/- II 2/-G Ex db IIC Gb/-</li> </ul>	European Union
	<b>IECEx (option) - in conjunction with ATEX</b> Hazardous areas Ex db IIC T6 ... T1 Gb/- Ex db IIC Gb/-	International
	<b>GOST (option)</b> Metrology, measurement technology	Russia
	<b>Uzstandard (option)</b> Metrology, measurement technology	Uzbekistan

1) Only for built-in transmitter

## Manufacturer's information and certifications

Logo	Description
	<b>SIL 2</b> Functional safety (only in conjunction with model T32 temperature transmitter)

Approvals and certificates, see website

# Sensor

## Sensor types

Type	Operating temperatures of the thermocouple			
	IEC 60584-1		ASTM E230	
	Class 2	Class 1	Standard	Special
<b>K</b>	-40 ... +1,200 °C [-40 ... +2,192 °F]	-40 ... +1,000 °C [-40 ... +1,832 °F]	0 ... 1,260 °C [32 ... +2,300 °F]	
<b>J</b>	-40 ... +750 °C [-40 ... +1,382 °F]	-40 ... +750 °C [-40 ... +1,382 °F]	0 ... 760 °C [32 ... +1,400 °F]	
<b>E</b>	-40 ... +900 °C [-40 ... +1,652 °F]	-40 ... +800 °C [-40 ... +1,472 °F]	0 ... 870 °C [32 ... +1,598 °F]	
<b>N</b>	-40 ... +1,200 °C [-40 ... +2,192 °F]	-40 ... +1,000 °C [-40 ... +1,832 °F]	0 ... 1,260 °C [32 ... +2,300 °F]	
<b>R</b>	0 ... 1,600 °C [32 ... +2,912 °F]		0 ... 1,480 °C [32 ... +2,696 °F]	
<b>S</b>	0 ... 1,600 °C [32 ... +2,912 °F]		0 ... 1,480 °C [32 ... +2,696 °F]	
<b>B</b>	600 ... 1,700 °C [1,112 ... +3,092 °F]	-	870 ... 1,700 °C [1,598 ... +3,092 °F]	-

Temperature ranges can be limited by protection tube materials.

The actual application range of these thermometers is limited by the permissible maximum temperature of the thermocouple as well as by the permissible maximum working temperature of the protection tube material.

For detailed specifications for thermocouples, see IEC 60584-1, IEC 60584-3 or ASTM E230 and Technical information IN 00.23 at [www.wika.com](http://www.wika.com).

### Tolerance value

For the tolerance value of thermocouples, a cold junction temperature of 0 °C [32 °F] has been taken as the basis.

Listed types are available both as single or dual thermocouples. The thermocouple will be delivered with an insulated measuring point, unless explicitly specified otherwise.

## Neck tube, support tube

The neck tube is screwed into the connection head. The neck length depends on the intended use. Usually an isolation is bridged by the neck tube/support tube. Also, in many cases, the neck tube/support tube serves as a cooling extension between the connection head and the medium, in order to protect a possible built-in transmitter from high medium temperatures.

Specifications	
<b>Material</b>	
Neck tube	Stainless steel
Support tube	Stainless steel 446, 310 or Alloy 600
<b>Connection thread to the head</b>	<ul style="list-style-type: none"><li>■ M20 x 1.5, adjustable lock nut</li><li>■ 1/2 NPT</li></ul>
<b>Neck tube/support tube length</b>	Min. 330 mm [13 in] Longer lengths on request

## Versions

- Ceramic outer protection tube, measuring insert with sapphire protection tube in processes with high hydrogen content
- Silicon carbide outer protection tube (e.g. Hexoloy®, Halsic®) measuring insert with sapphire protection tube in processes with high hydrogen content
- Ceramic outer protection tube, measuring insert with ceramic protection tube in processes with low or no hydrogen content

## Process connection

Process connection	
<b>Nominal size</b>	
ASME	1 1/2" ... 6"
EN 1092-1	DN 40 ... DN 100
<b>Pressure ratings</b>	
ASME	150 ... 1,500 lbs
EN 1092-1	PN 40 ... PN 100
<b>Sealing face</b>	According to ASME B16.5 or EN 1092-1

Flanges in accordance with other standards on request

## Materials

### Outer protection tube

- Ceramic C799: Ø 15 mm [0.591 in] or Ø 24 mm [0.945 in]
- Silicon carbide (Hexoloy®, Halsic®)

### Protection tube material for measuring insert

Sapphire with Ø 8 mm [0.315 in]

Other materials are available on request

## Tests

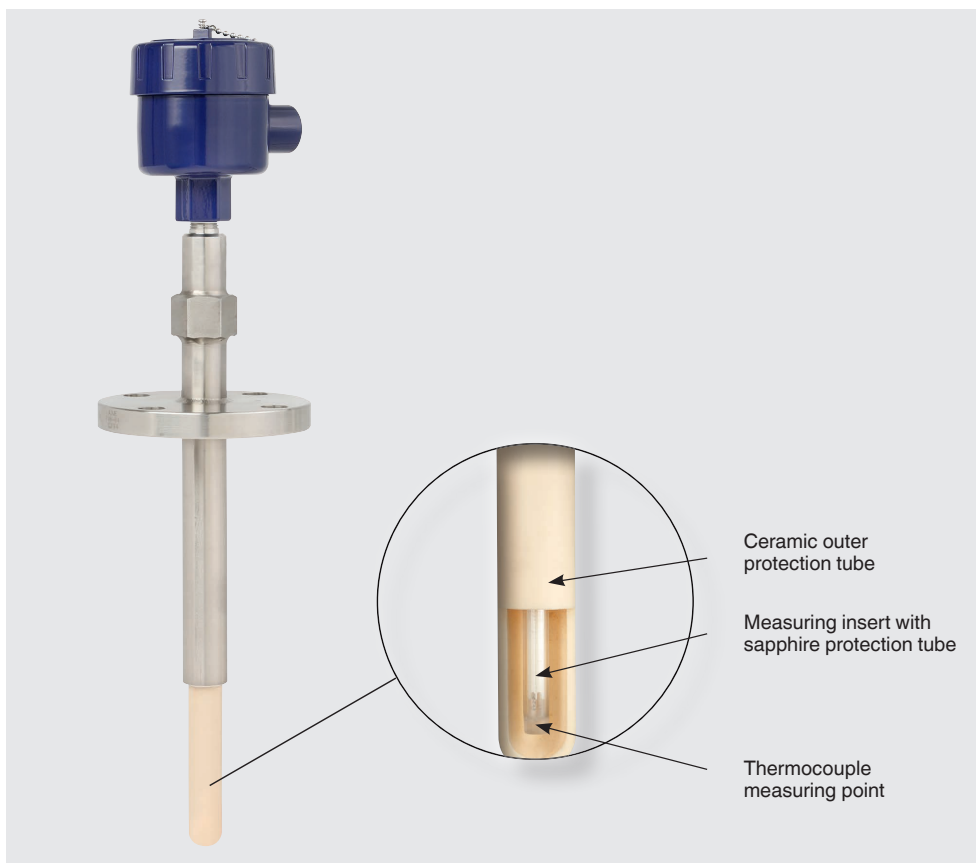
The following pressure tests are carried out on every TC83:

Pressure test for measuring insert at 100 bar [1,450 psi]

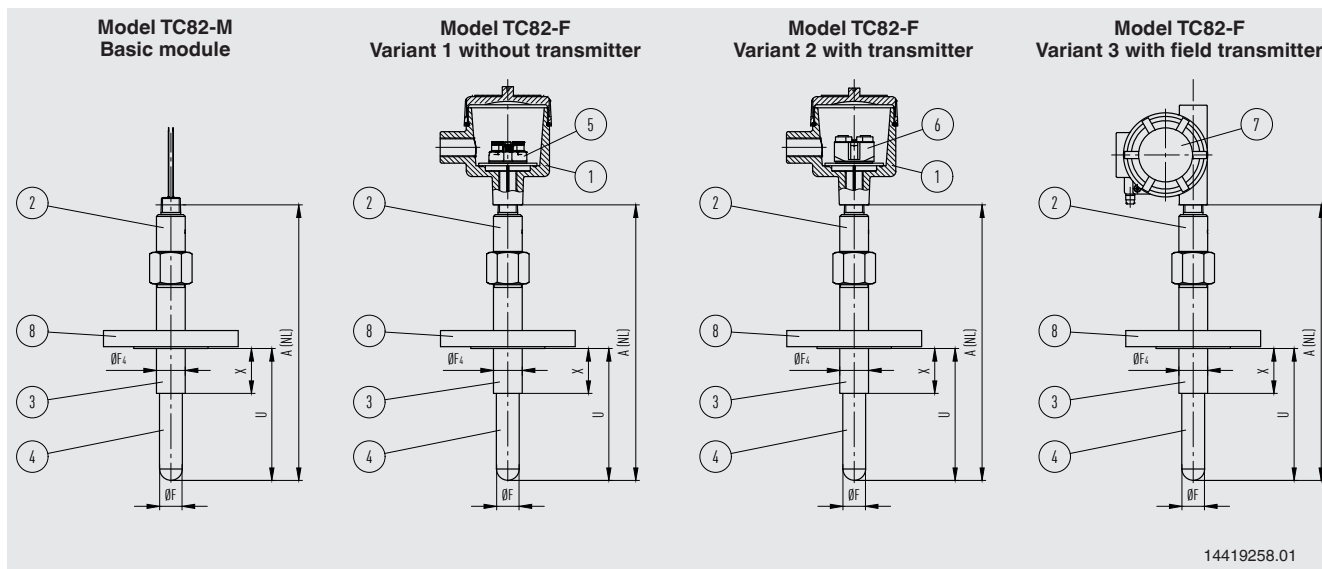
Option:

Calibration at 3 test points (1,000 °C [1,832 °F],  
1,100 °C [2,012 °F] and 1,200 °C [2,192 °F])

Further tests are available on request.



# Components model TC83



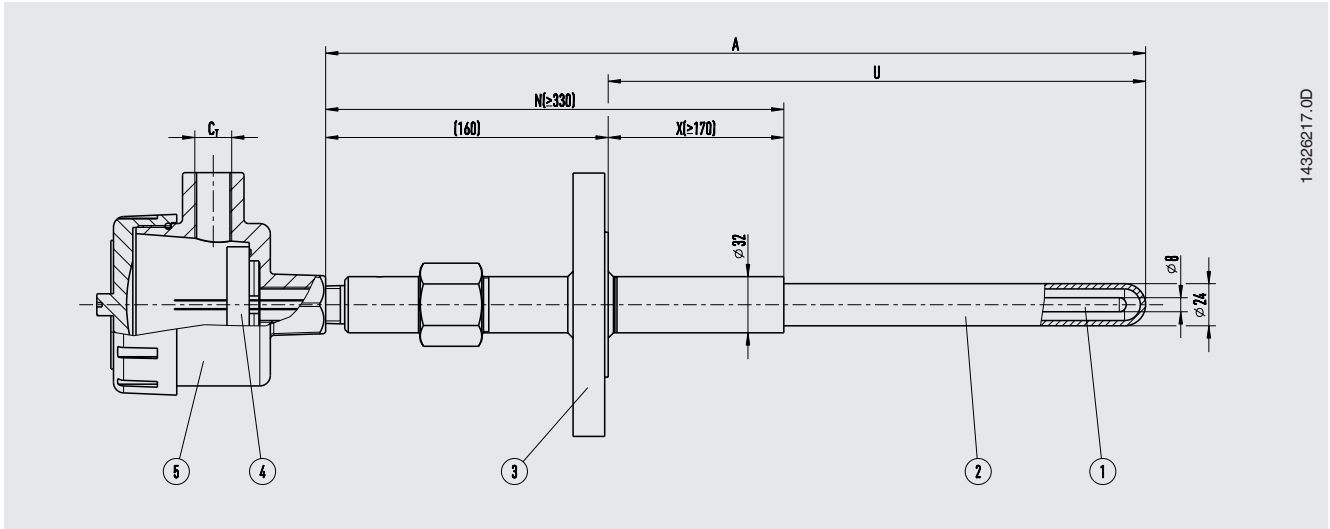
**Legend:**

- |                        |  |
|------------------------|--|
| ① Connection head      | A (NL) Nominal length                          |
| ② Neck tube            | U Insertion length                             |
| ③ Metal support tube   | X Support tube length below process connection |
| ④ Thermowell           |  |
| ⑤ Terminal block       |  |
| ⑥ Transmitter (option) |  |
| ⑦ Field transmitter    |  |
| ⑧ Process connection   |  |

## Dimensions in mm

Metal support tube:  $\varnothing$  32 mm [1.259 in]  
 Ceramic protection tube:  $\varnothing$  24 ... 26 mm [0.945 ... 1.024 in]  
 Measuring insert with protection tube: Sapphire:  $\varnothing$  8 mm [0.315 in]  
 Insertion length U: Max. 1,000 mm [39 in]

Other materials and dimensions on request



### Legend:

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

① Measuring insert with sapphire protection tube  
 ② Protection tube ceramic  
 ③ Flange  
 ④ Terminal block/transmitter (option)  
 ⑤ Connection head

## Ceramic protection tube

Ceramic protection tubes are made from fired aluminium oxide ceramics, the tip is spherical. Due to the low mechanical strength, a metal support tube is used to fix the process connection to the thermometer.

The ceramic protection tube is cemented into the support tube using a fireproof ceramic compound. The support tube is screwed into the connection head.

### Materials for ceramic protection tubes

- Ceramic C 530 not gas-tight, fine-pored, highly resistant to changes in temperature, useable up to 1,600 °C [2,912 °F], not attacked by gases

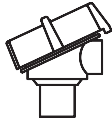
Used as outer protection tube in combination with gas-tight inner protection tube

- Ceramic C 610 gas-tight up to 1,500 °C [2,732 °F], not resistant to alkali vapours
- Ceramic C 799 gas-tight, high-purity up to 1,600 °C [2,912 °F], however only partially resistant to changes in temperature, not resistant to alkali vapours

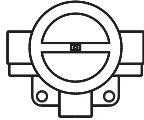
other materials on request



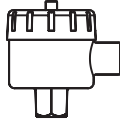
## Connection head



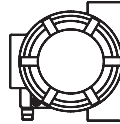
1/4000



5/6000



7/8000



other connection housings <sup>1)</sup>

Model	Material	Cable entry	Ingress protection	Cap	Surface finish
1/4000 F	Aluminium	½ NPT, M20 x 1.5	IP66 <sup>2)</sup>	Screw cover	Blue, painted <sup>3)</sup>
1/4000 S	Stainless steel	½ NPT, M20 x 1.5	IP66 <sup>2)</sup>	Screw cover	Blank
5/6000 W	Aluminium	½ NPT, M20 x 1.5	IP66 <sup>2)</sup>	Screw cover	Blue, painted <sup>3)</sup>
5/6000 S	Stainless steel	½ NPT, M20 x 1.5	IP66 <sup>2)</sup>	Screw cover	Blank
7/8000 W	Aluminium	½ NPT, M20 x 1.5	IP66 <sup>2)</sup>	Screw cover	Blue, painted <sup>3)</sup>
7/8000 S	Stainless steel	½ NPT, M20 x 1.5	IP66 <sup>2)</sup>	Screw cover	Blank

1) List of all possible connection housings see annex of the explosion certificates.

2) The indicated ingress protection only applies for TC82 with corresponding cable gland, appropriate cable dimensions.

3) RAL 5022

## Field temperature transmitter with digital display (option)

### Field temperature transmitter, models TIF50, TIF52

As an alternative to the standard connection head the thermometer can be fitted with an optional model TIF50 or TIF52 field temperature transmitter.

The field temperature transmitter comprises a 4 ... 20 mA/ HART<sup>®</sup> protocol output and is equipped with an LCD indication module.

Model TIF50: HART<sup>®</sup> slave

Model TIF52: HART<sup>®</sup> master



Field temperature transmitter models TIF50, TIF52

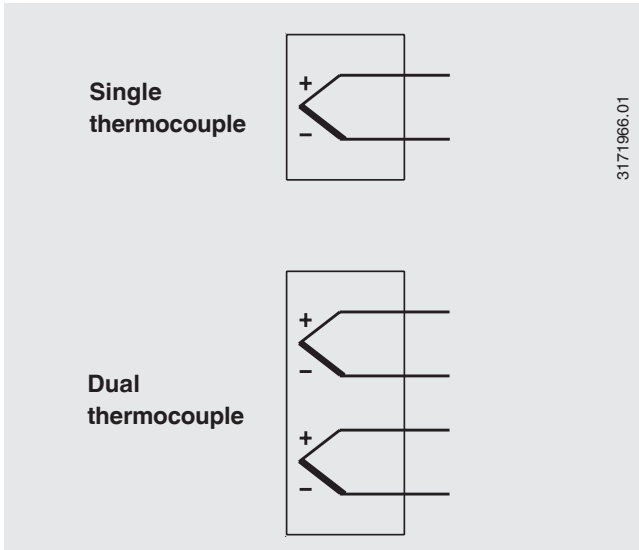
## Transmitter (option)

As an option, WIKA transmitters can be installed in the TC83 connection head.

Output signal 4 ... 20 mA, HART <sup>®</sup> protocol		
Transmitter (selectable versions)	T32	TIF50, TIF52
Data sheet	TE 32.04	TE 62.01
<b>Output</b>		
4 ... 20 mA	x	x
HART <sup>®</sup> protocol	x	x
Display	x	x
<b>Galvanic isolation</b>	x	x

Other transmitters on request

## Electrical connection



For the electrical connections of built-in temperature transmitters see the corresponding data sheets or operating instructions.

## Operating conditions

### Ambient and storage temperature

-60 <sup>1)</sup> / -40 ... +80 °C [-76 <sup>1)</sup> / -40 ... +176 °F]

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

Other ambient and storage temperatures on request

### Ingress protection

IP66 per IEC/EN 60529

The indicated ingress protection only applies for TC83-F with corresponding connection head, cable gland and appropriate cable dimensions.

### Ordering information

Model / Temperature range / Sensor / Measuring point / Connection housing / Thread size, cable entry / Protection tube / Flange nominal size / Pressure rating / Sealing face / Flange, support tube material / Support tube length SL / Insertion length U / Outer protection tube ceramic / Measuring insert / Options

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The specifications given in this document represent the state of engineering at the time of publishing.  
We reserve the right to make modifications to the specifications and materials.

## Functional safety (option)

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 TC83 process thermocouples in combination with an appropriate temperature transmitter (e.g. model T32.1S) are suitable as sensors for safety functions up to SIL 2.

## Certificates (option)

Certification type	Measuring accuracy	Material certificate for wetted metallic parts
<b>2.2 test report</b>	x	x
<b>3.1 inspection certificate</b>	x	x

The different certifications can be combined with each other.

