

Resistance thermometer for civil nuclear applications Model TRN, with IEEE conformity

WIKA data sheet TE 75.02

IEC/IEEE 60780-323:2016

Applications

- Reactor building
- Peripherals
- Heating, ventilation, air-conditioning
- Accident-proof applications
- Temperature measurement of primary, secondary and tertiary circuits and also temperature monitoring in fuel pools

Special features

- Measuring range from $-50 \dots +600 \text{ }^{\circ}\text{C}$ [$-58 \dots +1,112 \text{ }^{\circ}\text{F}$]
- For mounting in all standard thermowell/protection tube designs
- Spring-loaded measuring insert
- Pt100 measuring resistors

Description

Thermometer for use in nuclear power plants comprise:

- Resistance thermometer, model TRN
- Thermowell/protection tube
- Accessories

The model TRN resistance thermometer can be combined with a large number of thermowell/protection tube designs. Operation without thermowell/protection tube is only recommended in certain applications.

Cable couplings are available as accessories.



Exemplary resistance thermometer, model TRN

A wide variety of possibilities for the combination of insertion length, neck length, thermowell/protection tube, plug connections etc. are available to be able to offer suitable resistance thermometers for any application.

Specifications

Qualification

The current qualification is based on IEC/IEEE 60780-323:2016. Depending on plant specification, an extended qualification evaluation is required. This can be made on the basis of KTA, RCC or project-specific.

Output signal

Model TRN: 80 ... 314 Ω

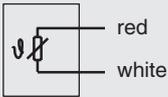
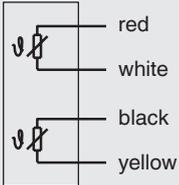
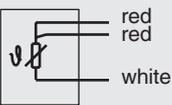
Accident conditions (qualified)

- ΔT max. 195 °C; 5.4 bar (g) saturated steam: 24 h
- Radiation resistance to: 850 kGy
- Vibration resistance 10 ... 35 Hz: constant deflection 0.35 mm
- Vibration resistance 15 ... 500 Hz: 0.3 g (max. reaction acceleration measured at the instrument, peak value up to 41 g)
- Throughput speed: 1 Oct. / min, 10 cycles
- Vibration resistance 0 ... 3 Hz: constant deflection
- Vibration resistance 3 ... 100 Hz: max. 35 g
- Boric acid resistance 24 h at 60 °C up to 150 °C, concentration 6,200 ppm

BDBA (Beyond Design Basis Accident), qualified

- ΔT max. 209 °C; max. 9.8 bar (g) saturated steam: 184 h
- Short time ΔT max. 250 °C, 1 h
- Radiation resistance to: 1,850 kGy

Plant-specific qualifications on request

Measuring element			
Type of measuring element		Pt100	
Measuring current		0.1 ... 1.0 mA	
Connection method			
Single elements		Dual elements	
1 x 2-wire		2 x 2-wire	
1 x 3-wire		-	-
1 x 4-wire		-	-
Validity limits of the class accuracy in accordance with IEC 60751			
Class B ± (0.30 + 0.0050 t) ¹⁾		-50 ... +400 °C [-58 ... +752 °F]	
Class A ²⁾ ± (0.15 + 0.0020 t) ¹⁾		-30 ... +300 °C [-22 ... +572 °F]	

1) | t | is the numerical value of the temperature in °C without consideration of the sign
 2) Not for 2-wire connection method

→ For detailed specifications for Pt100 sensors, see technical information IN 00.17 at www.wika.com.

The table shows the temperature ranges listed in the respective standards, in which the tolerance values (class accuracies) are valid.

The combination of a 2-wire connection with class A is not permissible, since the lead resistance of the MI cable and the connection lead negates the higher sensor accuracy.

Maximum probe length including connection cable:

- Class B, 3-wire connection: ~ 30 m [98 ft]
- Class A, 3-wire connection: ~ 10 m [33 ft]

Longer probe/cable lengths should be designed with a 4-wire connection, since this connection method has no length effect on the accuracy.

Overview of versions

	Measurement principle	Design	Operating conditions (connector)
Code / Placeholder	X	Y	Z
Example	TRN-	I	H
Description	Resistance thermometer	Immersed	Harting connector

Instrument version

Model	Description
TRN-Iz	Immersed, with and without thermowell/protection tube (I = immersed)
TRN-Az	Room air sensor (A = ambient)
TRN-Sz	Surface probe (S = surface); for versions, see model TR50, data sheet TE 60.50
TRN-Pz	Resistance Thermometer for cooling ponds and similar applications (P = pool)
TRN-Gz	Combined sensor (G = gradient)

Construction and functionality of the combined sensor

The combined sensor consists of a resistance thermometer and two thermocouples. The resistance thermometer is used for directly measuring the current temperature. The two thermocouples have their measuring points at different positions inside the sensor tip and are connected electrically against each other. The thermocouples thus only give a differential signal between the two measuring points.

Since one of the two measuring points can heat up faster than the other, the gradient of the temperature change can be measured by this measuring signal. The response time of the gradient measurement is much shorter than the actual temperature measurement.

Combined sensors are therefore intended for installation in the primary cooling circuit to determine the current coolant temperature on the one hand, and rapid temperature changes of the coolant on the other hand.

Operating conditions

Operational radiation: ≤ 250 kGy (gamma equivalent)
 Humidity: 100 % relative humidity

	TRN-yH (14481879)	TRN-yA (14479583)	TRN-yC (14529466)
Connector description	Harting (HAN7D...)	TS connector LOCA	Connector LOCA + SA
IP ingress protection	IP65 (IP67 possible without radiation)	IP68	IP68
IEEE rating	N1E Harsch	1E	1E + SA
Qualified lifetime	12 years at 45 °C ambient temperature	55 years at 45 °C ambient temperature	55 years at 45 °C ambient temperature
Maximum radiation during normal operation	100 kGy TID - "Total Integrated Dose"	250 kGy TID - "Total Integrated Dose"	250 kGy TID - "Total Integrated Dose"
Maximum radiation during accident	-	600 kGy (TID: 850 kGy)	600 kGy (TID: 850 kGy)
LOCA test conditions	-	max. 195 °C, 5.4 bar (g), 24 h	1 h at 250 °C; 5 h at 207 °C
Accidental radiation after LOCA	-	-	1,000 kGy (TID: 1,850 kGy)
Humidity	90 % relative humidity	100 % relative humidity	100 % relative humidity
Ambient and storage temperature	-40 ... +80 °C [-40 ... +176 °F]	-40 ... +80 °C [-40 ... +176 °F]	-40 ... +80 °C [-40 ... +176 °F]

Examples of response time

	Measuring tip Ø 4 mm	Measuring tip Ø 4 mm
Thermometer version		
Sensor	1 x Pt100	1 x Pt100 / Differential thermocouple ¹⁾
Connection method	4-wire	3-wire
Diameter	4 mm	Pt100: 4 mm / Differential thermocouple: 1.2 mm
Probe length	150 ... 1,100 mm	150 ... 1,100 mm
Material	Stainless steel 1.4571	Stainless steel 1.4571
Response time in seconds (+/-10 %)		
$t_{0.5}$	5.0	Pt100: 5.0 / Differential thermocouple: < 3 incl. calculation in the transmitter
$t_{0.63}$	6.0	Pt100: 6.0 / Differential thermocouple: < 3 incl. calculation in the transmitter
$t_{0.9}$	12.0	Pt100: 12.0 / Differential thermocouple: < 3 incl. calculation in the transmitter

1) A specific transmitter is required for reading the signal.

Fundamentals of the measurements

- VDI/VDE directive 3522 part 1: Dynamic behaviour of contact thermometers / Principles and characteristic values
- VDI/VDE directive 3522 part 2 Dynamic behaviour of contact thermometers / Experimental determination of time percentage values
- IEC 60751 Definition of thermal response time / Specification of measurement parameters
- IEC 60751 Thermal response time

Medium to be measured: water

Response times of resistance thermometers in other dimensions, configurations or materials result in different response times.

Approvals

Logo	Description	Region
CE	EU declaration of conformity	European Union
	RoHS directive	
UK CA	UKCA	United Kingdom
	Restriction of hazardous substances (RoHS) regulations	

→ For approvals and certificates, see website

Certificates

Certificates	Measurement accuracy	Material certificate ¹⁾
2.2 test report	x	x
3.1 inspection certificate	x	x
DAkkS calibration certificate	x	-

1) For selected components

Accessories and spare parts

Model	Description	Order number
Cable couplings	Mounting type depending on cable / customer specification	customer-specific

Ordering information

Model / ... / Options

To order the described product the order number is sufficient.

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