

Resistance Thermometers for Flue Gas Temperature Measurement Model TR81 with Thermowell Model TW81

WIKA Data Sheet TE 60.81

Applications

- Blast furnaces, air heaters
- Red-heat and heat treatment processes
- Combustion of waste and special waste products
- Major heating plants, heat generation

Special Features

- Application ranges up to +600 °C
- Thermowell made of heat resistant steel
- Measuring insert exchangeable
- Gastight process connection (optional)

Description

These straight resistance thermometers assemblies consist of a connection head Form B, a measuring insert per DIN 43 735 and a thermowell Model TW81. Form A or C DIN-thermowells as well as thermowells with customer specific design are available.

Process connection can be provided with a stop flange or pipe coupling, the latter type gives a gastight connection.

These temperature probes are suitable for gaseous media in low pressure ranges (up to approx. 1 bar). Various thermowell materials are used with or without enamelling to meet the requirements of thermal stress.

The measuring insert is replaceable. This makes inspection and, when servicing is necessary, replacement possible during operation and while the plant is running. Selection of normal or standard lengths enables short delivery time and the possibility of stocking spare components.



Resistance Thermometer for Flue Gas Temperature Measurement, Model TR81

Thermowell material, connection head and sensor can be selected individually for the respective application.

A transmitter can be fitted as an option.

One of the advantages of a built-in transmitter is the increased reliability of the signal transmission.

Sensor

The sensor is located in the measuring insert, which is exchangeable and spring-loaded.

Sensor method of connection

- 2-wire The lead resistance compounds the error.
- 3-wire With a cable length of approx. 30 m or longer measuring deviations can occur.
- 4-wire The inner lead resistance of the connecting wires is negligible.

Sensor limiting error

- Class B per DIN EN 60 751
- Class A per DIN EN 60 751

It makes no sense to combine 2-wire connection with class A, because the lead resistance error of the measuring insert over-rides the higher sensor accuracy.

Basic values and limiting errors

Basic values and limiting errors for the platinum measurement resistances are laid down in DIN EN 60 751. The nominal value of Pt100 sensors is 100 Ω at 0 °C. The temperature coefficient α can be stated simply to be between 0 °C and 100 °C with:

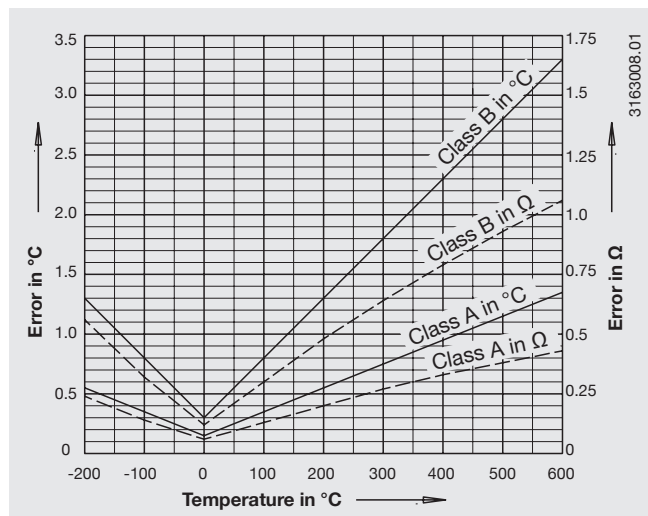
$$\alpha = 3.85 \cdot 10^{-3} \text{ }^{\circ}\text{C}^{-1}$$

The relationship between the temperature and the electrical resistance is characterised by polynomials which are defined in DIN EN 60 751. Furthermore, this standard lays down the basic values in °C stages.

Class	Limiting error in °C
A	$0.15 + 0.002 \cdot t $ ¹⁾
B	$0.3 + 0.005 \cdot t $

1) |t| is the value of the temperature in °C without consideration of the sign

Temperature (ITS 90) °C	Basic value Ω	Limiting error DIN EN 60 751			
		Class A		Class B	
°C	Ω	°C	Ω	°C	Ω
-50	80.31	± 0.25	± 0.10	± 0.55	± 0.22
0	100.00	± 0.15	± 0.06	± 0.30	± 0.12
50	119.40	± 0.25	± 0.10	± 0.55	± 0.21
100	138.51	± 0.35	± 0.13	± 0.80	± 0.30
200	175.86	± 0.55	± 0.20	± 1.30	± 0.48
300	212.05	± 0.75	± 0.27	± 1.80	± 0.64
400	247.09	± 0.95	± 0.33	± 2.30	± 0.79
500	280.98	± 1.15	± 0.38	± 2.80	± 0.93
600	313.71	± 1.35	± 0.43	± 3.30	± 1.06



Measuring insert

The measuring insert is made of a vibration-resistant sheathed measuring cable (mineral-insulated cable).

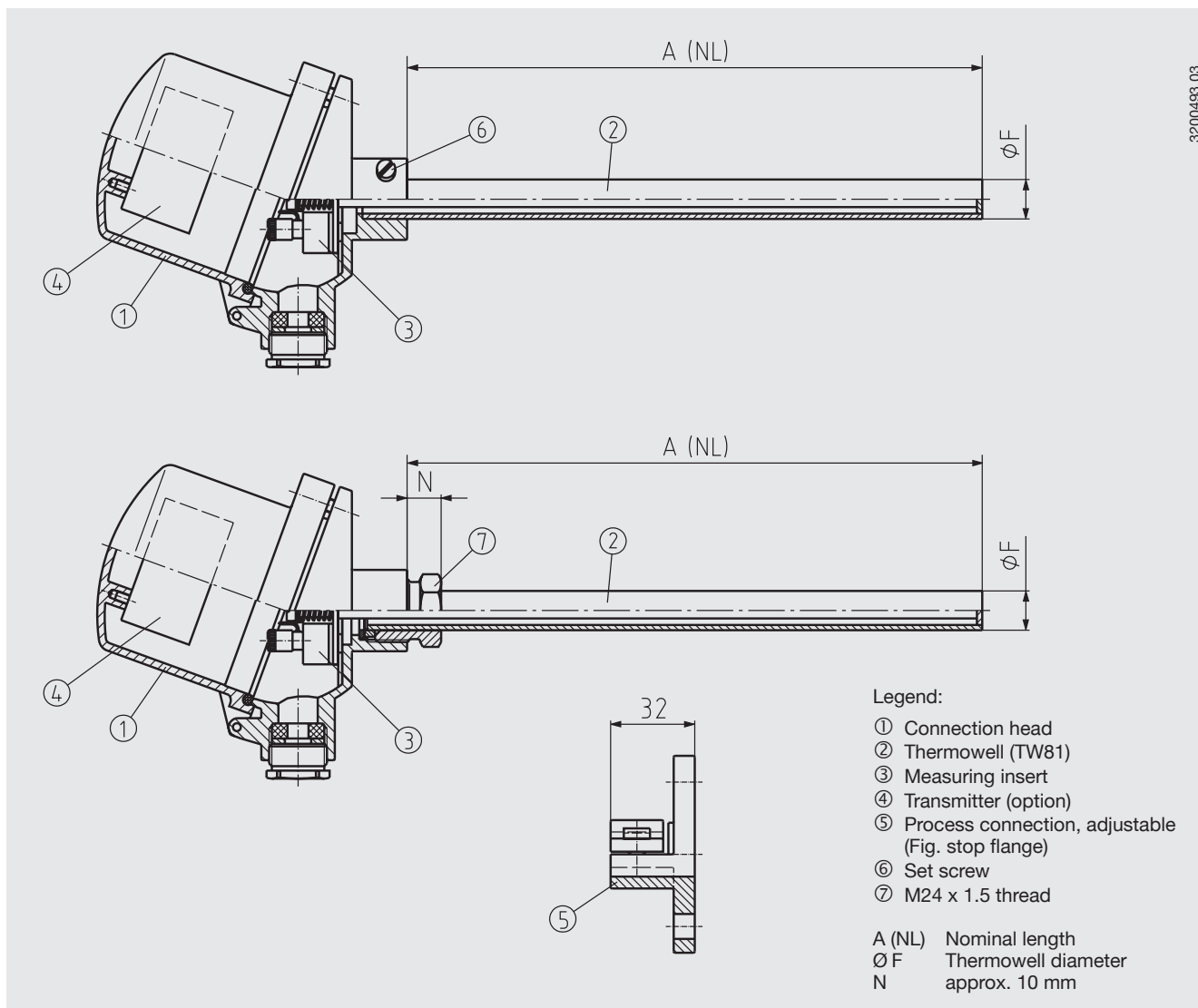
It is possible to ensure a spring-loaded installation of the measuring insert by means of two screws and springs in a connection head (form B). Due to this installation method, the measuring insert is easily exchangeable.

When fitting the measuring insert with a thermowell, it is very important to determine the correct insertion length (= thermowell length with bottom thicknesses of 5.5 mm).

In this connection the fact that the measuring insert is spring-loaded (spring travel: max. 10 mm) has to be taken into account in order to ensure that the measuring insert presses against the bottom of the thermowell.

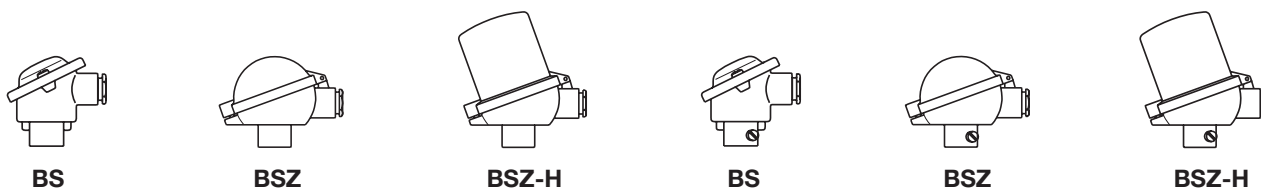
The standard material used for the measuring insert sheath is stainless steel. Other materials may be offered on request.

TR81 components (with thermowell TW81)



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Connection head



Model	Material	Cable entry	Ingress protection ¹⁾	Cap	Surface finish
BS	Aluminium	M20 x 1.5	IP 53 / IP 65	Cap with 2 screws	blue, painted ²⁾
BSZ	Aluminium	M20 x 1.5	IP 53 / IP 65	Flap cap with screw	blue, painted ²⁾
BSZ-H	Aluminium	M20 x 1.5	IP 53 / IP 65	Flap cap with screw	blue, painted ²⁾

1) IP 53: lateral set screw; IP 65: M24 x 1.5 thread
 2) RAL5022, polyester paint saltwater-proof

Transmitter (option)

The transmitter can be directly mounted into the head. The permissible ambient temperature of the transmitter as specified in the matching data sheet. We recommend mounting the transmitter in the cap of a connection head Model BSZ-H. Here the sensor is indirectly connected to the transmitter via a connection line between terminal block and transmitter.

Connection head	Transmitter Model					
	T12	T19	T24	T32	T91	T53
BS	-	-	-	-	-	-
BSZ	-	-	-	-	-	-
BSZ-H	•	•	•	•	•	•

- Mounted within the cap of the connection head
- Mounting is not recommendable because of thermal reasons

Model	Description	Data sheet
T19	Analogue transmitter, configurable	TE 19.03
T24	Analogue transmitter, PC-configurable	TE 24.01
T91	Analogue transmitter, fixed measuring ranges	TE 91.01
T12	Digital transmitter, PC-configurable	TE 12.03
T32	Digital transmitter, HART protocol	TE 32.03 + TE 32.04
T53	Digital transmitter FOUNDATION™ Fieldbus and PROFIBUS® PA	TE 53.01

Thermowell Model TW81

Metal thermowell

The thermowells are made of tube. The bottom of the thermowell is either flat or dished, in the case of enamelled thermowells it is always dished. The thermowell is plugged into the connection head and compression fitted. Additionally we offer the possibility of a connection head screwed at the thermowell. This allows ingress protection IP 65. A slideable process connection is compression fitted on the thermowell, thus allowing a variable insertion length. Preference is to be given to standard nominal lengths to DIN EN 50 446.

Standard nominal lengths

A = 500, 710, 1000, 1400, 2000 mm

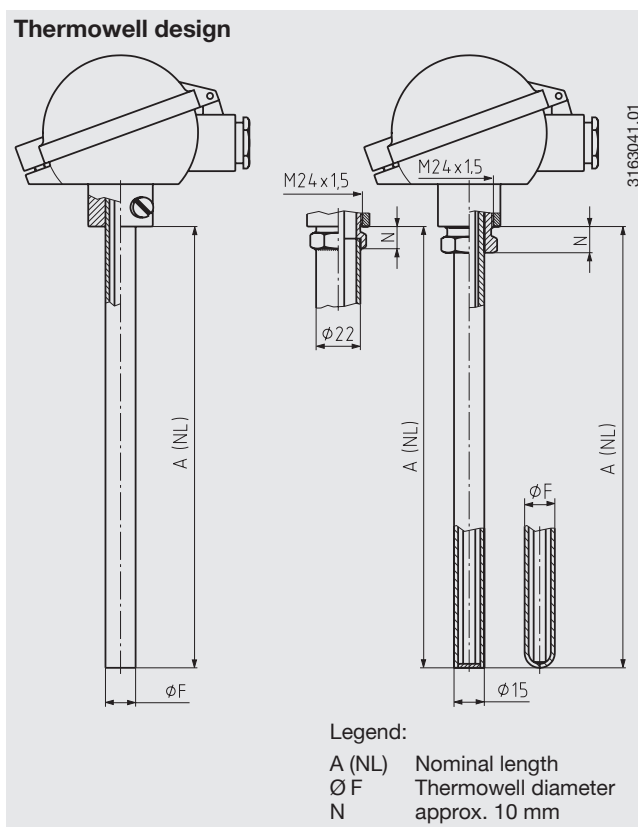
Others on request

Thermowell materials

- Carbon steel 1.0305
up to 550 °C (air), low corrosion resistance to sulphurous gases, medium corrosion resistance to nitrogenous gases
- Carbon steel 1.0305, enamelled
up to 550 °C, resistance to a max. applied pressure of 1 bar, for the low pressure range in furnaces and flue gas ducts
- Stainless steel 1.4571
up to 700 °C ¹⁾ (air), good corrosion resistance to aggressive media
- Stainless steel 1.4841
up to 1150 °C ¹⁾ (air), low corrosion resistance to sulphurous gases; high corrosion resistance to nitrogenous gases and gases with low oxygen content; high long-time rupture strength
- Stainless steel 1.4762
up to 1200 °C ¹⁾ (air), high corrosion resistance to sulphurous gases; low corrosion resistance to nitrogenous gases

Other materials on request

¹⁾ Please note: The max. application range of the sensor (Pt100: +600 °C) limits the max. application temperature.



Dimensions in mm

Metal thermowell	
outer Ø	tube thickness
Ø F	s
22	2
15	2

Remarks on the selection and operation of metal thermowells

The following table does not claim to be extensive. All information is non-binding and does not represent guaranteed characteristics. They should be fully tested by the customer using the conditions of the respective application.

Please note:

The max. application range of the sensor (Pt100: +600 °C) limits the max. application temperature

Resistance when in contact with gases

Material No.	AISI Nr.	Usable in air up to °C	Resistance against sulphurous gases oxidizing	Resistance against reducing	nitrogenous, low-oxygen gases	Carburisation
1.0305		550	low	low	medium	low
1.4571	316Ti	800	low	low	medium	medium
1.4762		1200	very high	high	low	medium
1.4841	310 / 314	1150	very low	very low	high	low

Operation with gases

Material No.	Application
1.0305 (St35.8)	Temperature furnaces for heat treatment processes, galvanising and tinning plants, carbon-dust-air mixture pipelines in steam power stations
1.0305 enamelled (St35.8 enamelled)	Flue-gas desulphurisation plants, white metal, lead and tin smelters
1.4762 X 10 CrAlSi 25	Combustion exhaust gases, cement and ceramic furnaces, heat treatment processes, annealing furnaces
1.4841 X 15 CrNiSi 25-21	Combustion chambers, industrial furnaces, petrochemical industry, cowper stoves, cyanide baths

Process connection

Not gastight

A stop flange is sufficient; a mating flange is not necessary. The stop flange slides onto the thermowell and is secured using a clamp. The insertion length of the thermometer is variable and can be easily adjusted at the mounting point.

Gastight up to 1 bar

A threaded bushing or a combination stop flange / mating flange is required.

Threaded bushing:

This is secured onto the metal thermowell using a clamp. After loosening the clamp, the threaded bushing slides onto the thermowell. The insertion length of the thermometer is variable and can be easily adjusted at the mounting location.

Stop flange / mating flange:

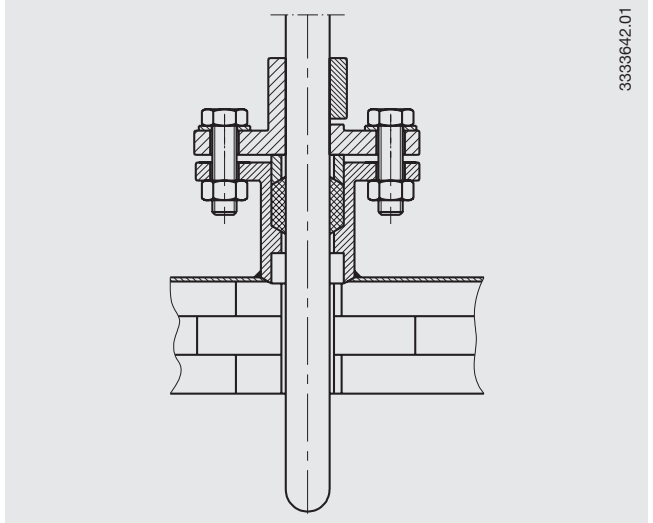
Sealing is made via a stuffing-box packing between mating flange and thermowell. The assembly is secured by clamping the stop flange and thermowell together. The insertion length of the thermometer is adjustable.

Enamelled thermowell

When using enamelled thermowells a threaded bushing should be used to prevent the enamelled surface layer from being damaged.

Mounting example:

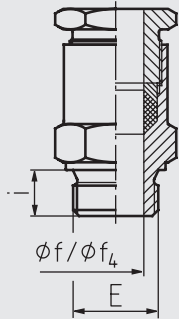
Resistance thermometer with metal thermowell



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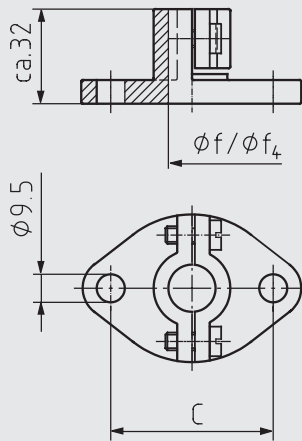
Pipe coupling

adjustable,
gastight up to 1 bar
Seal: asbestos free,
up to max. 300 °C,
higher temperatures
on request



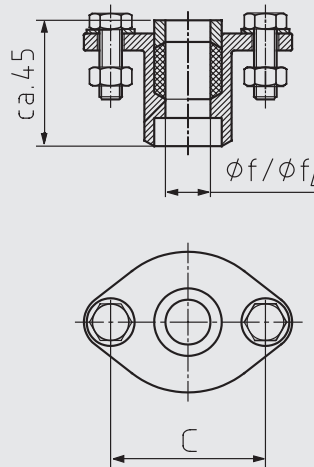
Material:
Carbon steel or
stainless steel 1.4571

Stop flange nach DIN EN 50 446 adjustable

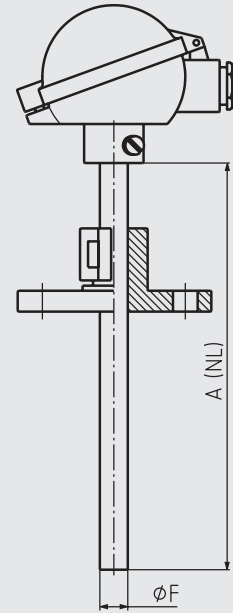


Material:
Carbon steel or malleable cast iron
others on request

Mating flange only applic- able in conjunction with a stop flange adjustable, gastight up to 1 bar Seal: asbestos free



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Selectable pipe coupling

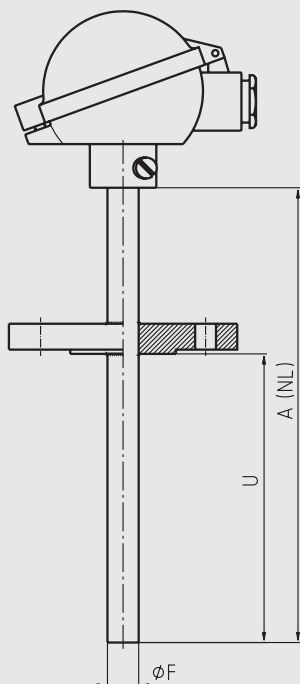
Thermowell outer ϕ	Dimensions in mm		Process connection
	$\phi f / \phi f_4$	i min.	
22	22.5	20	G 1, G 1½
15	15.5	20	G ½, G ¾, G 1

Other threads on request

Selectable stop flange

Thermowell outer ϕ	Dimensions in mm	
	$\phi f / \phi f_4$	C (hole spacing)
22	22.5	70
15	15.5	55

Flange connection with welded thermowell



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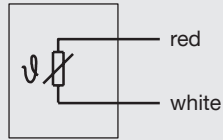
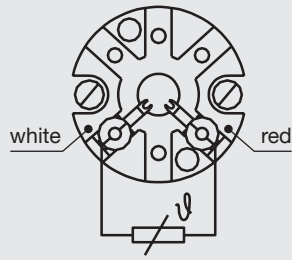
Selectable flange sizes

Flange ϕ	Material
1 ½ inch, 150 lbs, RF	316 SS
1 ½ inch, 300 lbs, RF	316 SS
2 inch, 150 lbs, RF	316 SS
2 inch, 300 lbs, RF	316 SS
3 inch, 150 lbs, RF	316 SS
3 inch, 300 lbs, RF	316 SS
4 inch, 150 lbs, RF	316 SS
4 inch, 300 lbs, RF	316 SS

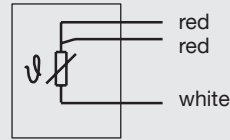
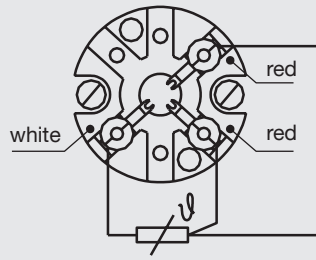
Other flange sizes on request

Electrical connection

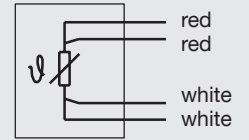
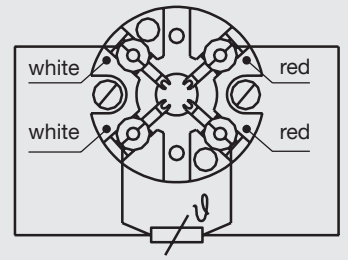
1 x Pt100, 2-wire



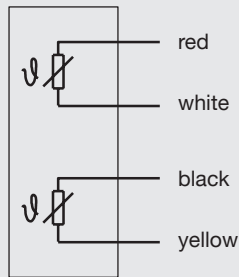
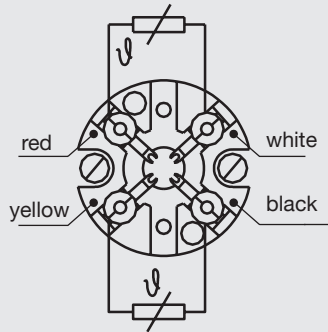
1 x Pt100, 3-wire



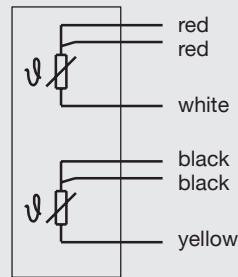
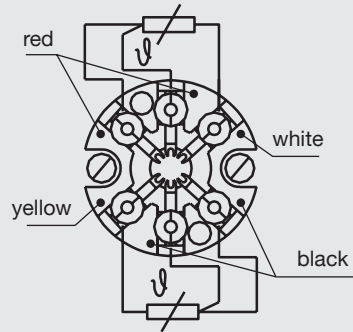
1 x Pt100, 4-wire



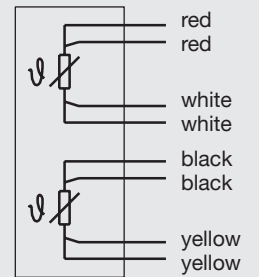
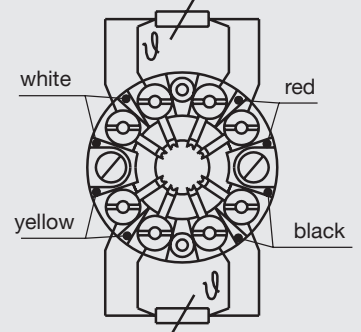
2 x Pt100, 2-wire



2 x Pt100, 3-wire



2 x Pt100, 4-wire



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



WIKAI Alexander Wiegand SE & Co. KG
Alexander-Wiegand-Straße 30
63911 Klingenberg/Germany
Tel. (+49) 9372/132-0
Fax (+49) 9372/132-406
E-mail info@wika.de
www.wika.de