


Operating Instructions

Electrical Thermometers

Thermocouples (TC) / Resistance Thermometers (RTD)



NOTE	
	<p><i>Important! - Read carefully before use - Keep for later use!</i></p> <p><i>These operating instructions have been prepared in accordance with the standards DIN EN ISO 20607:2019-10 and ISO/IEC/IEEE 82079-1:2019-05.</i></p> <p><i>The aim of the operating instructions is to provide users with the information they need to use the thermometers effectively and safely throughout their life cycle.</i></p> <p><i>These operating instructions are an integral part of the thermometers and must be available to the operating and maintenance personnel at all times. The safety instructions contained therein must be observed.</i></p> <p><i>When reselling the thermometers, these operating instructions must always be supplied with them. Only the current version of the operating instructions is to be used. All previous operating instructions lose their validity with the current version.</i></p>

Warning and safety symbols

The warning and safety symbols are explained in chapter 2.1.

Warranty and guarantee provisions

See chapter 6.3 Warranty and guarantee provisions.

Translation

For delivery to the countries of the EEA, the operating instructions must be translated accordingly into the language of the country of use. If there are any discrepancies in the translated text, the original operating instructions (German) must be consulted for clarification or the manufacturer must be contacted.

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Document name

Original operating instructions
Designation: Electrical thermometers
Type: Thermocouples (TE) / Resistance Thermometers (WTH) Edition Version 1 / November 2021

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2 Safety / Occupational health and safety

2.1 Factory safety measures

2.1.1 Notes and explanations

The safety instructions (hazard warnings and mandatory instructions) according to DIN EN ISO 7010 listed in the operating instructions serve to ensure the personal safety of the operating personnel as well as the safety of the described products and the connected devices. The meaning of the following symbols and instructions must be observed. The symbols and instructions are divided into four danger levels.

	<p style="text-align: center;">DANGER</p> <p><i>Indicates an imminent danger. If the information is not heeded, death or serious bodily injury (disability) will result.</i></p>
	<p style="text-align: center;">WARNING</p> <p><i>Indicates a possible dangerous situation. If the information is not heeded, death or serious bodily injury (invalidity) will result.</i></p>
	<p style="text-align: center;">CAUTION</p> <p><i>Indicates a potentially dangerous situation. If the information is not heeded, damage to property as well as slight or moderate bodily injury are the consequences.</i></p>
	<p style="text-align: center;">NOTE</p> <p><i>Designates general information, useful user tips and work recommendations. If the information is not observed, property damage and problems during operation will result.</i></p>

2.1.2 General safety instructions

The general safety instructions (danger and mandatory instructions) below must be observed when operating the machine. The **general safety instructions** (danger and mandatory instructions) are supplemented in these operating instructions by **specific safety instructions**. These specific safety instructions are assigned to the relevant chapters.

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2.1.3 Target groups of these operating instructions

The operator must bear in mind that the work described in these operating instructions is aimed at different target groups. Accordingly, the work described in these operating instructions is intended for

- in the chapters *Operation / Operation and Cleaning / Disinfection* must be understood by an **instructed person**,
- in the chapters *Delivery / Transport / Storage; Installation / Commissioning; Inspection / Functional Testing / Maintenance; Troubleshooting / Troubleshooting / Repair* and *Decommissioning / Dismantling / Disposal* must be understood by a **qualified person**.

2.2 Operator safety measures

2.2.1 Staff

The installation, commissioning and maintenance of the unit may only be carried out by qualified personnel. Qualified personnel as defined in these instructions have a technical training and knowledge of measurement and control technology as well as the country-specific regulations. They should be able to carry out the installation safely and recognise possible dangers independently.

The skilled personnel must have understood the instructions and follow the given instructions.

2.2.2 Connections

Before operating the machine, the operator must ensure that the local regulations (e.g. for the electrical connection) are observed during installation and commissioning, if this is carried out by the operator himself.

2.2.3 Rules and regulations

Both the installer and the operator of the system must always comply with the national regulations and provisions applicable in their country.

3 Overview of designs and series

3.1 Thermometer Overview Types/Series

- 1 TEM - Modular Thermometers
- 2 TES - Sheath thermometer
- 3 TEB - Bayonet probe
- 4 TEG - Straight thermocouples
- 5 TEU - Multilevel thermometer
- 6 TEF - Flex thermometer
- 7 TEE - Screw-in thermometer
- 8 TEK - Small probe

In addition, various application-specific designs are possible.

3.1.1 Construction of electrical thermometers

Electrical thermometers, to which this operating instruction refers, usually consist of a measuring insert, connection head, neck tube and protection tube with process connection.

The connection head can be equipped with a transducer that converts the weak signals of the sensors into a standard signal that is insensitive to interference, e.g. 4-20 mA. There is also a very large number of special designs, e.g. with permanently connected cables.

3.1.2 Thermocouples

The actual sensor is a standardised thermocouple, e.g. according to DIN EN 60584. The thermometer has one or two (rarely also 3) measuring circuits, which are usually insulated from the ground and from each other.

3.1.3 Resistance thermometer

The actual sensor is a standardised platinum measuring resistor, The thermometer has one or two (rarely 3) measuring circuits which are insulated from earth (earth-free) and from each other. Unless otherwise specified, the resistance thermometer must be operated with a measuring current of 2 mA per measuring circuit in order to keep measuring errors due to self-heating small.

3.2 Measuring leads

3.2.1 General

Ensure good contact for all line connections; the influence of corrosion, moisture, dirt must be avoided. Measuring lines should be laid separately and 0.5 m away from power lines and cross the latter at right angles.

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The insulation must be selected according to the environment (hot/cold, dry/humid, chemically aggressive).

All measuring circuits should be grounded as far as possible; if necessary, ground only at one point. To suppress electrostatic or magnetic interference, the cables should be shielded or have twisted pairs.

When laying measuring lines, a distance of at least 0.5 m from power lines is recommended. If power lines have to be crossed, this should be done at right angles if possible. Applicable standards and regulations must be observed.

3.2.2 Cables for thermocouples

Between the thermometer and the measuring device, matching compensating or thermocouple cables must be laid and connected in the correct polarity. Line balancing is not necessary, even for leads longer than 25 m, if the input resistance of the measuring device is 1 M. The colour coding of the compensating cables is done according to the respective applied standard for thermocouples, for Europe DIN EN 60584-3.

3.2.3 Cable for resistance thermometers

Cables with copper conductors must be laid between the thermometer and the measuring device. In order to keep the errors due to line resistance and its temperature-related changes small, the largest possible conductor cross-section should be selected, preferably 1.5 mm².

Resistance thermometers are operated in 2-, 3- and 4-wire circuits, depending on the accuracy requirements. The 2-wire circuit causes the greatest measuring errors. For the 2- and 3-wire circuit, a so-called lead compensation is recommended if the downstream instruments are designed for it. With this, lead errors can be drastically reduced or almost completely suppressed.


3.2.4 Cable entries in the connection heads

Proceed according to the usual installation methods. After the connections have been made at the connection base, make sure that the connection head is carefully closed again and the cable gland is tightened. This is the only way to ensure the IP protection class of the unit.

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3.3 Intended use

The resistance thermometers and thermocouples are used for temperature measurement in a wide variety of process engineering systems. The devices are intended exclusively for use within the operating conditions specified on the type plate. These values correspond to the values given in the data sheets.

	DANGER
	<p><i>All thermometers are intended exclusively for the purpose listed above. Any other use or modification of the thermometers without the written consent of the manufacturer is considered improper use. The manufacturer is not liable for any damage resulting from this. The risk is borne solely by the operator.</i></p>

The service life of the thermometers depends on the load level, the temperature influence, corrosive influences and other parameters.

Foreseeable misuse

1. Commissioning, operation, operation and maintenance of the machine by unqualified personnel or without **complete reading and understanding of the operating instructions**.
2. **Material selection:** An unsuitable material pairing leads to premature wear and defects in the thermometer. The material selection or the material pairing of the installed thermometer must be agreed with the manufacturer.


3.4 Technical data

The specific technical data of the thermometer used in each case can be found in its enclosed data sheet.

3.4.1 Electromagnetic compatibility (EMC)

Interference emission: Industrial area

Interference: Industrial sector

	NOTE
	<p><i>Note on the application of the EU directive EMC 2014/308/EU: According to DIN EN 61000-6-4 (basic standard for emitted interference, industrial area), the system must not be operated in residential areas, in business and commercial areas and in small businesses. In residential areas, in business and commercial areas as well as in small businesses, interference with other electrical consumers may occur. Risk of malfunction of other machines.</i></p>

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3.4.2 Operating conditions

The electrical thermometer or its protection tube must have the best possible contact with the medium. It must be exposed to the undisturbed flow and be immersed sufficiently deep in the medium to avoid heat conduction errors. For this purpose, the immersion length must be

for liquids 5 to 8 times

for gases 10 to 15 times

correspond to the outer diameter of the protective tube.

Attention: the installation length is usually greater than the immersion length, and only the latter is decisive!

The following applies to thermometers without protection tube

for liquids 5 times diameter

for gases 10 times diameter

plus **temperature-sensitive length of** the sensor element (10-40 mm).

If the available installation space is too short for the required immersion depth, the thermowell must be

diagonally against the current

into a pipe extension

into a pipe bend or a T-piece against the flow.

3.4.3 Ambient conditions at the connection head

The ambient temperatures should be in the range -25 °C to +70 °C. The load capacity of seals, cable insulation, material of the connection heads, etc. must be taken into account. If electronic transmitters are installed in the connection head, their temperature limits must be observed. The permissible temperature for the most sensitive component is always decisive.

The protection class of the connection heads should be selected according to the expected effects of humidity, dust, sun, marine climate, mechanical/chemical effects, etc. Some connection heads or thermometer constructions (designs based on DIN 43733;43764) should not be inclined more than 60 ° from the vertical, with the connection head on top.

4 Delivery / Transport / Storage

4.1 Scope of delivery

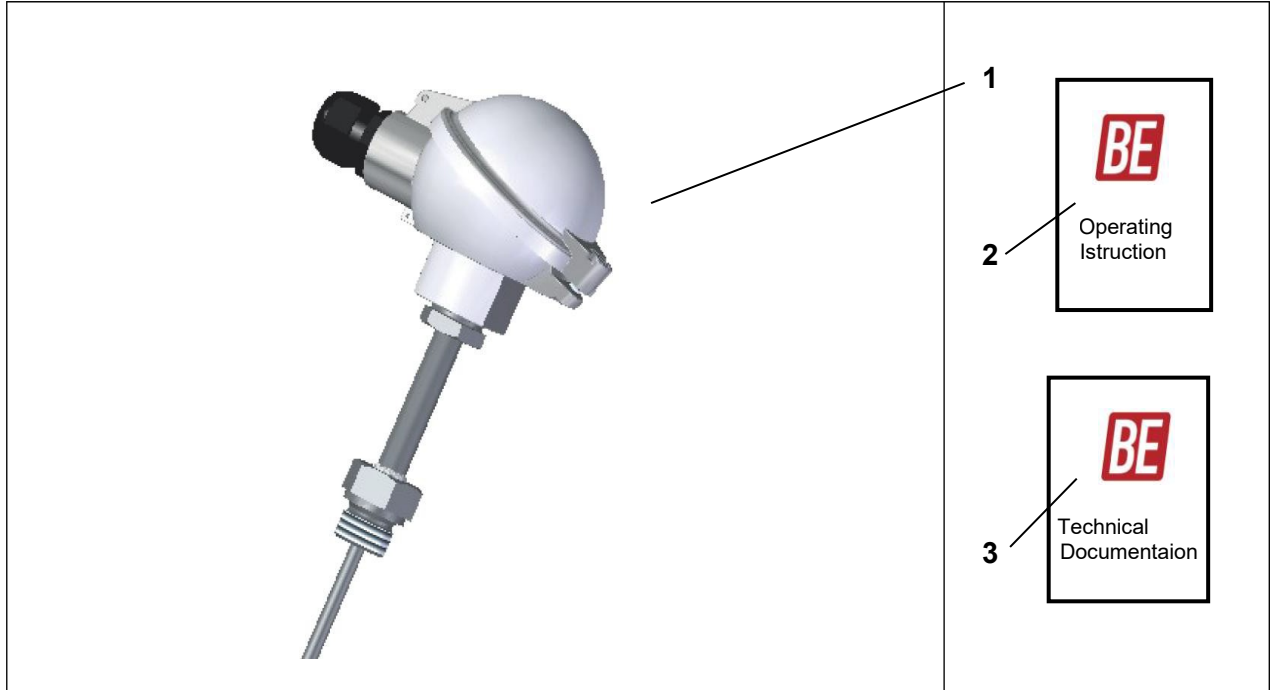


Fig. 4-1 Scope of delivery

The scope of delivery includes:

- 1 Thermometer
- 2 Original operating instructions
- 3 If applicable, further technical documentation



NOTE

Which technical documents in detail are part of the scope of delivery of Böhme + Ewert GmbH can be found in the respective order or delivery documents.

4.2 Delivery and packaging

Before the delivery begins, a list of the scope of delivery is provided in the order confirmation. It contains information about the delivery date and, if applicable, about the number and type of transport items. Units are carefully checked and packed before shipment, but damage during transport cannot be ruled out.

The customer must pay attention to the following during delivery:

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4.2.1 Incoming inspection:

- Check completeness against the delivery note.

In case of damage

- Check the delivery (packaging) for damage (visual inspection).
check.


In case of complaints

Has the packaging been damaged during transport:

- Contact the last carrier immediately.
- Keep the packaging (in case of inspection by the carrier or for return shipment).

Packaging for return shipment

If possible, use the original packaging and packing materials.

	NOTE
	<p><i>All thermometers and components returned to Böhme + Ewert GmbH must be free of any hazardous substances (acids, alkalis, solids).</i></p>

4.2.2 Transport to the installation site

Electrical thermometers, in this case thermocouples (TE) and resistance thermometers (WT), must be handled carefully in order to maintain their full functionality. When unpacking the shipping containers (cartons, boxes), check for loose parts, e.g. assembly instructions and associated documents.

The functionality should be checked after receipt and after assembly according to *chapter 5 in order* to detect transport and assembly damage in good time.

4.2.3 Thermometer with ceramic protection tubes

To avoid damage, long thermometers and thermometers equipped with ceramic protection tubes must be lifted, transported and installed carefully.

4.3 Storage / Interim storage

Storage temperature -40 to +80 °

Humidity 20 to 90 % relative humidity

The freight packaging of the system and the spare parts is designed for a storage period of 3 months upon delivery. In individual cases and on request, an additional corrosion protection coating is applied.

5 Installation / Commissioning / Operation

The installation, commissioning and operation of the thermometers may only be carried out by qualified personnel who must be trained for this work.

5.1 Installation of thermometer or thermowell

5.1.1 Metal protection tubes

If the process connection is a threaded connection or a flange, the complete thermometer can be installed according to the rules of technology. Protective tubes for oxygen are supplied grease-free and must remain so during installation!

Non-binding guide values for tightening torques for process connections:

Thread G ½; ½	" NPTM _d = 40-50 Nm
Thread G 1;	1" NPTM _d = 80-100 Nm
	Flange bolts

M12M_d 30 Nm (applies to strength class 5.6)

If the protection tube has to be welded in, it must be dismantled from the thermometer. Before reassembling, make sure that the bore of the protective tube is free of grease and dirt of any kind.

5.1.2 Ceramic protection tubes

Ceramic protection tubes must be protected from mechanical stress (bending, impact) and from thermal shocks. If they are installed or replaced while the process is running, they must be inserted slowly. Guide values are:

10-20 cm/min at 1,200 °C

1-2 cm/min at 1,600 °C.

Horizontal unsupported lengths of more than 500 mm at temperatures above 1,200 °C are to be avoided.

5.1.3 Positioning of the cable gland

The connection head with the cable gland can be turned for safe cable routing. To do this, loosen the screw connection of the neck tube on the connection head or in the neck tube, turn the connection head in the desired direction and tighten the screw connection again.

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5.2 Thermometer commissioning

5.2.1 Spatial arrangement of thermometers

Basically, electric thermometers work completely independent of their position. The preferred mounting position is vertical, i.e. the connection head is at the top, the protection tube points downwards.

Exceptions:

Ambient temperatures at the connection head due to radiation or heat conduction via the neck tube 70 °C.

Recommended installation:

Connection head sideways or downwards or neck tube
100 mm above the container surface or insulation.

Ceramic protective pipes should only be installed in exceptional cases with the connection head pointing downwards or horizontally.

5.2.2 Assembly room

The mounting space must be freely accessible above/below/side of the process connection according to the total length of the thermometer, also for possible replacement of measuring inserts or thermocouples.

5.2.3 Supply and disposal connections

The operator must ensure that the specific supply and disposal connections required for commissioning the respective thermometers are available in accordance with the locally applicable technical and safety requirements.

5.3 Installation / Commissioning

The installation / commissioning is carried out by the end customer or user.

5.4 Operation / Regular operation

The thermometers may only be operated when all safety systems have been tested for full function, are functioning without restriction and are fully assembled.

If malfunctions occur during operation/controlled operation, the thermometers must be sent to Böhme & Ewert GmbH after consultation.

6 Maintenance / inspection / functional test

To ensure trouble-free operation of the thermometers, it is essential that thermometers and measuring circuits are inspected and tested at regular intervals.



WARNING

*The chapter on **maintenance / inspection / functional testing** is intended for qualified personnel only. All work in this regard may only be carried out by qualified personnel.*



NOTE

Any work on assemblies, components and auxiliary parts with their own CE marking must be carried out on the basis of the manufacturer's operating instructions. These are part of the technical documentation and are enclosed with it.

6.1 Maintenance

6.1.1 Recurrent inspections

Thermometers and their measuring circuits should be checked at regular intervals (1 to 12 months) for

- Mechanical, thermal, chemical damage
- Corrosion and bad contacts on cable connections
- Tightness of the connection heads
- Protection tube: wear and - corrosion
- Functionality of the measuring circuits (drifts, insulation resistance)

6.1.2 Checking the measuring circuits on site

Loosen the cable connections in the connection head and adjust them according to the operating temperature.

- for thermocouples with an mV signal
- for resistance thermometers with a test resistor, check the instruments.

This makes it possible to determine whether the thermometer or the instrumentation is the cause of the error.

6.1.3 Checking the measuring circuits in the operating state

In the operating state, the following variables can be checked for a measuring insert/sensor

- the continuity or loop resistance of all conductors
- Insulation resistance

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- EMF of thermocouples or resistance of Pt sensors
- Incorrect polarity for thermocouples

The insulation resistance of the entire unearthed measuring circuit, cables and thermometer, should be greater than 100 M measured with 10 V DC. Process temperature and material of the line insulation must be taken into account!

6.1.4 Checking measuring inserts/sensors in the workshop

Recommended instruments:

- Ohm meter (for low resistances)
- Insulation meter with test voltage 10 to 100 V DC

The evaluation of the measurement results is carried out according to the following table (the values apply to a measuring insert length of 1 m, at room temperature)

Sensor	Contact resistance	Insulation resistance
Thermocouple	0.5 to 20 per	
	by wire	
	Diameter	> 100 M
Measuring resistor		(test voltage 100 V DC)
Pt 100	approx. 110	

If the measuring inserts are heated to approx. 200 to 400 °C (see also 5.2.3), one finds interruptions

- Incorrect polarity for thermocouples
- Insulation fault,
- possibly wrong element type (only with exactly known temperature).

6.1.5 Checking the protective tubes

Protection tubes are wearing parts. At measuring points with particularly strong mechanical, abrasive or chemical attack, every downtime should be used to check the condition of the thermowells and replace them if necessary to prevent unplanned interruptions to operation.

6.1.6 Checks after completion of work

After completion of **maintenance / inspection / functional test** work:

- Check whether all safety devices are functional. The system must not be put into operation without a check.

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- Check the completeness of the repair work carried out.

If all functions are faultless, the **handover** to the operator takes place.

6.2 Spare and wear parts / Customer service

Spare and wear parts:

For spare and wear parts Böhme & Ewert GmbH gives a delivery guarantee of 10 years from the date of delivery or handover on site after commissioning. All spare and wear parts must be ordered from us. DIN parts such as screws, bearings etc. can also be obtained from specialist dealers.

Spare parts ordering / customer service:

Böhme + Ewert GmbH
Am Spielacker 4
D-63571 Gelnhausen
Tel.: +49 6051 91 66 56-0
Fax: +49 6051 91 66 56-9
E-mail: sales@be-temp.de
Web: www.be-temp.com

6.3 Warranty and guarantee provisions

The manufacturer's / distributor's warranty depends on the defined operating conditions of the respective thermometer. All provisions regarding warranties and guarantees must therefore be agreed in advance with Böhme + Ewert GmbH.

6.4 Return

For information on return, see *chapter 4 Delivery / Transport / Storage*.



NOTE


All thermometers and components returned to Böhme + Ewert GmbH must be free of any hazardous substances (acids, alkalis, solids).

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7 Cleaning / Disinfection

7.1 General notes

Thermometers returned for repair must be cleaned and decontaminated.

	NOTE
	<p><i>All thermometers and components returned to Böhme + Ewert GmbH must be free of any hazardous substances (acids, alkalis, solids).</i></p>


7.2 Cleaning

	DANGER
	<p><i>Risk of injury from aggressive cleaning fluids.</i></p> <p>Severe skin and eye injuries can be the result.</p> <p><i>Wear personal protective equipment when using aggressive cleaning liquids (e.g. caustic soda).</i></p>


Do not use aggressive solvents or concentrated alkaline solutions to clean the thermometers. If it is really necessary to use aggressive agents, their reaction times should be kept as short as possible.

7.3 Disinfection


Thermometers returned for repair must be cleaned and decontaminated.

	NOTE
	<p><i>All thermometers and components returned to Böhme + Ewert GmbH must be free of any hazardous substances (acids, alkalis, solids).</i></p>

8 Troubleshooting / Troubleshooting / Repair

	DANGER
	<p><i>The facts and information on troubleshooting / fault rectification / repair described in this manual are designed to be understood by persons with specialist training in electrics / electronics or mechanics / maintenance.</i></p> <p><i>Failure to do so may result in serious injury or death.</i></p> <p><i>Appropriate tools and testing equipment shall be made available to the personnel.</i></p>

8.1 Analysis and elimination of malfunctions

	NOTE
	<p><i>Any work (troubleshooting / fault elimination / repair) on assemblies, components and auxiliary parts with their own CE marking must be carried out on the basis of the manufacturer's operating instructions. These are part of the technical documentation and are enclosed with it.</i></p>

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8.1.1 Typical faults with thermometers in general

Malfunction	Possible cause	Troubleshooting
Measuring signal is		
fluctuating	Electrical/magnetic interference, switching operations	Check cable routing
		> 0.5 m distance between measuring and power lines
		Shielding; earthing at <u>one</u> point
		Pair stranding cores
too high or too low	Earth loops	Measuring circuit preferably floating/operate without earthing
	through multiple contact	
	due to insulation faults in earthed Measuring circuits	
drifting	Insulation faults due to	Dry/seal measuring insert
Incorrect temperature readings compared to comparable measuring points	Humidity	Select a suitable sensor element len
	Thermal overload	
	Protective tube in the "flow shadow"	Installation location with undisturbed flow select
Time response disproportionately sluggish	Immersion depth too shallow	longer protective tube or favourable-ren installation
	Influence of an additional heat source	Select another installation location
Measuring circuit interruptions	Deposits on the protection tube	Clean the protective tube during inspections
	Protective tube "too thick"	Smallest possible protection tube adapted to operating conditions select
	Measuring insert without sufficient contact to the thermowell	Other protective tube construction
		The measuring insert must be mounted on the rest on the pipe bottom <u>and</u> touch the protective pipe wall
Protective tube Heavily corroded	Medium does not correspond to original ch specification	Use "contact agent": Liquid-metal foils, metal sleeves, metal
		Possibly other installation location
		Dampen" plant
		stiffer protection tube
damaged by abrasion	Flow	Special constructions of trade fair ins-set and protective tube
	very frequent temperature changes	Use special constructions
broken	wrong material specified or elected	more suitable protective tube mat-Select material
	Medium was not specified correctly	Select suitable construction
	Flow velocity too high	Reduce immersion length

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	Solid particles in the medium	Other protective tube construction
	Turbulence of the medium	Other installation location with as Select laminar flow

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8.1.2 Typical faults with thermocouples

Incorrect temperature display	Too high internal resistance of the Measuring circuit	Instrument must have 1 Mohms input resistance
	Instrument with too low internal resistance	
	Measuring insert with wrong thermopair	Check, replace if necessary
	Decreasing insulation resistance at very high temperatures	Sensor under operating conditions
		Calibrate again
		Keeping the "hot zone" small
	Line connections dirty, damp, corroded	Clean connections, make new ones
	with large Temperature gradients	Eliminate causes of errors
	Correct compensating cable connected with wrong polarity	Type and polarity of the output Check the equalisation line, replace the lead if necessary.
Wrong compensating line applied closed	Lay connections	
Ambient temperature too high		
Temperature display changes over time	Ageing causes structural changes	Protective pipes for tightness and Check material suitability
		Diameter of the thermocouple wires too small; choose as large as possible
	Influence of pollutants	"Flush" thermowells with air or operate them under overpressure to prevent pollutant diffusion. prevent.
Close-order error	Insert pre-annealed thermocouple wires Insert thermocouple type N	

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8.1.3 Typical faults with resistance thermometers


Process temperature too low with correct indication by the electrical thermometer	Influence of the circuit or line resistances, especially with 2-wire circuits.	<ul style="list-style-type: none"> – Conductor cross-sections larger ver-lay – Shorten line – Transition to 3- or 4-leader circuit, possibly only from the connection socket of the Measuring insert
	Self-heating	Check measuring current, reduce if necessary
Variable temperature indicators	2-wire circuit, cable in areas of fluctuating temperature	Switching to 3-wire circuit
	Power supply not constant	Use a suitable power supply unit
Measuring error (display too low) increases with rising temperature	Decrease in insulation resistance with increasing temperature (0.1 M in parallel to a Pt100 doubles the tolerance) at 600°C)	<ul style="list-style-type: none"> – Check measuring inserts/sensor unit, dry out if necessary.
dubious measurements	<ul style="list-style-type: none"> – Impurities or corrosion and moisture on chimney connections, parasitic tensions 	<ul style="list-style-type: none"> – Clean contact points – Causes of contamination Eliminate – Possibly measure with alternating current (if system-dependent). possible)
	<ul style="list-style-type: none"> – Thermoelectric voltages at the Joints due to temperature gradients 	<ul style="list-style-type: none"> – Ensure even temperature distribution
Displayed temperature decreases over time (process temperature increases)	Ageing of the sensor due to thermal/chemical influences	<ul style="list-style-type: none"> – Short maintenance/testing intervals at important measuring points and, if necessary, replacement of the measuring inserts for reliable measuring results. ensure that the measurement is
		<ul style="list-style-type: none"> – through special constructions (flushing, overpressure) Reduce/prevent diffusion
		<ul style="list-style-type: none"> – Ensure that the thermometer is operated within the permissible temperature range. will.

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8.2 Repair

If the specified measures do not lead to success, please contact the customer service of Böhme + Ewert GmbH. See here- to *chapter 6.2 Customer service*.

9 Commissioning / Dismantling / Disposal

	DANGER
	<p><i>The facts and information on decommissioning / dismantling / disposal described in these instructions are designed to be understood by persons with specialist training in electrics / electronics or mechanics / maintenance.</i></p> <p><i>Serious injuries and death can result.</i></p> <p><i>Appropriate tools and test equipment must be made available to these personnel. Before carrying out any work, the shutdown procedures must be carried out.</i></p>

9.1 Decommissioning / Dismantling

Decommissioning / disassembly may only be carried out by qualified personnel. Before starting dismantling work, ensure that the unit is properly decommissioned.

- Disconnect supply and disposal lines.
- Dismantle all other assemblies, components and auxiliary parts.

9.2 Disposal

The thermometers are mainly made of iron, steel and/or nickel-based alloys, to a certain extent also of aluminium (except for the electrical equipment). They must be disposed of in accordance with the local environmental regulations in force **at the time**.

Before disposal, all parts in contact with the media must be decontaminated. Depending on the nature, existing regulations and in compliance with current regulations, the components are to be disposed of as:



- Electrical scrap (transmitters, digital indicators),
- Plastics (housing),
- Sheet metal, steel, copper, aluminium (separate by type).
- Precious metals (platinum and rhodium)
- Contaminated cleaning tools (brushes, rags, etc.) must also be disposed of according to the manufacturer's instructions.

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