Operating instructions
MESSKO® BETECH®. Pointer thermometer

9181336/00 EN

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1 Introduction

This technical file contains detailed descriptions on the safe and proper installation, connection, commissioning and monitoring of the product.

This technical document is intended solely for specially trained and authorized personnel.

1.1 Manufacturer

Maschinenfabrik Reinhausen GmbH
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93059 Regensburg
Deutschland
+49 941 4090-0
sales@reinhausen.com
reinhausen.com

MR Reinhausen customer portal: https://portal.reinhausen.com.

Further information on the product and copies of this technical file are available from this address if required.

1.2 Completeness

This technical file is incomplete without the supporting documents:
– Order confirmation

1.3 Safekeeping

Keep this technical file and all supporting documents ready at hand and accessible for future use at all times.

1.4 Notation conventions

This section contains an overview of the symbols and textual emphasis used.

1.4.1 Hazard communication system

Warnings in this technical file are displayed as follows.

1.4.1.1 Warning relating to section

Warnings relating to sections refer to entire chapters or sections, sub-sections or several paragraphs within this technical document. Warnings relating to sections have the following format:

⚠ WARNING

Type of danger!
Source of the danger and its consequences.

- Action
- Action

1.4.1.2 Embedded warning information

Embedded warnings refer to a particular part within a section. These warnings apply to smaller units of information than the warnings relating to sections. Embedded warnings use the following format:

⚠ DANGER! Instruction for avoiding a dangerous situation.

1.4.1.3 Signal words

Depending on the product, the following signal words are used:

Signal word	Meaning
DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates measures to be taken to prevent damage to property.

Table 1: Signal words in warning notices

1.4.2 Information system

Information is designed to simplify and improve understanding of particular procedures. In this technical file it is laid out as follows:

Important information.

1.4.3 Instruction system

This technical file contains single-step and multi-step instructions.

Single-step instructions

Instructions which consist of only a single process step are structured as follows:

Aim of action
✓ Requirements (optional).
1. Step 1 of 1.
   » Result of step (optional).
» Result of action (optional).

Multi-step instructions

Instructions which consist of several process steps are structured as follows:

Aim of action
✓ Requirements (optional).
1. Step 1.
   » Result of step (optional).
2. Step 2.
   » Result of step (optional).
» Result of action (optional).

1.4.4 Typographic conventions

Typographic convention	Purpose	Example
UPPERCASE	Operating controls, switches	ON/OFF
[Brackets]	PC keyboard	[Ctrl] + [Alt]
Bold	Software operating controls	Press **Continue** button
...>...>...	Menu paths	Parameter > Control parameter
Italics	System messages, error messages, signals	*Function monitoring* alarm triggered
[► Number of pages]	Cross reference	[► Page 41].
Dotted underscore	Glossary entry, abbreviations, definitions, etc.	Glossary entry

Table 2: Typographic conventions used in this technical file

2 Security

Read this technical file through carefully to familiarize yourself with the product. This technical file is a part of the product.
- Read and observe the safety instructions provided in this chapter in particular.
- Observe the warnings in this technical file to avoid function-related dangers.

The product is manufactured based on state-of-the-art technology. Nevertheless, danger to life and limb for the user or impairment of the product and other material assets may arise in the event of improper use.

2.1 Appropriate use

The pointer thermometer measures the temperature in power transformers, distribution transformers, reactors, shunt reactors and similar devices.

The product is designed solely for use in stationary large-scale systems.

If used as intended and in compliance with the requirements and conditions specified in this technical file as well as the warning notices in this technical file and attached to the product, then the product does not present any danger to people, property or the environment. This applies throughout the service life of the product, from delivery, installation and operation to removal and disposal.

The following is considered intended use:
- Use the product only with the transformer specified in the order.
- Operate the product in accordance with this technical documentation, the agreed-upon delivery conditions and the technical data.
- Ensure that all necessary work is performed by qualified personnel only.
- Use the equipment and special tools supplied solely for the intended purpose and in accordance with the specifications of this technical file.
- Operate the product in electrical energy systems and facilities.

- Only operate the product in industrial areas.
- Observe the notices in this technical document regarding electromagnetic compatibility and the technical data.

2.2 Fundamental Safety Instructions

To prevent accidents, disruptions and damage as well as unacceptable adverse effects on the environment, those responsible for transport, installation, operation, maintenance and disposal of the product or parts of the product must ensure the following:

Personal protective equipment

Loosely worn or unsuitable clothing increases the danger of becoming trapped or caught up in rotating parts and the danger of getting caught on protruding parts. This results in danger to life and limb.

- All necessary devices and personal protective equipment required for the specific task, such as a hard hat, safety footwear, etc. must be worn. Observe the "Personal protective equipment" [▶Section 2.4, Page 14] section.
- Never wear damaged personal protective equipment.
- Never wear rings, necklaces or other jewelry.
- If you have long hair, wear a hairnet.

Work area

Untidy and poorly lit work areas can lead to accidents.

- Keep the work area clean and tidy.
- Make sure that the work area is well lit.
- Observe the applicable laws for accident prevention in the relevant country.

Contamination level

Moisture, dust, sweat and other conductive dirt may cause malfunctions in the device. To ensure contamination level II, observe the following information:

- Wear assembly gloves.
- Ensure that no dirt or moisture enters the device when it is open.
- Close up the device after installation.

Explosion protection

Highly flammable or explosive gases, vapors and dusts can cause serious explosions and fire.

- Do not install or operate the product in areas where a risk of explosion is present.

Safety markings

Warning signs and safety information plates are safety markings on the product. They are an important aspect of the safety concept. Safety markings are depicted and described in the chapter "Product description".

- Observe all safety markings on the product.
- Make sure all safety markings on the product remain intact and legible.
- Replace safety markings that are damaged or missing.

Ambient conditions

To ensure reliable and safe operation, the product must only be operated under the ambient conditions specified in the technical data.

- Observe the specified operating conditions and requirements for the installation location.

Modifications and conversions

Unauthorized or inappropriate changes to the product may lead to personal injury, material damage and operational faults.

- Only modify the product after consultation with Maschinenfabrik Reinhausen GmbH.

Spare parts

Spare parts not approved by Maschinenfabrik Reinhausen GmbH may lead to physical injury, damage to the product and malfunctions.

- Only use spare parts that have been approved by Maschinenfabrik Reinhausen GmbH.
- Contact Maschinenfabrik Reinhausen GmbH.

Working during operation

You must only operate the product when it is in a sound operational condition. Otherwise it poses a danger to life and limb.

- Regularly check the operational reliability of safety equipment.
- Perform the inspection tasks described in this technical document regularly.

2.3 Personnel qualification

The person responsible for assembly, commissioning, operation and inspection must have the following qualifications.

Electrically skilled person

The electrically skilled person has a technical qualification and therefore has the required knowledge and experience, and is also conversant with the applicable standards and regulations. The electrically skilled person is also proficient in the following:

- Can identify potential dangers independently and is able to avoid them.
- Is able to perform work on electrical systems.
- Is specially trained for the working environment in which (s)he works.
- Must satisfy the requirements of the applicable statutory regulations for accident prevention.

Technical Service

We strongly recommend having repairs and retrofitting carried out by our Technical Service department. This ensures that all work is performed correctly. If repair work is not carried out by our Technical Service department, please ensure that the personnel who carry out the repairs are trained and authorized to do so by Maschinenfabrik Reinhausen GmbH.

Maschinenfabrik Reinhausen GmbH

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2.4 Personal protective equipment

Personal protective equipment must be worn during work to minimize risks to health.

- Always wear the personal protective equipment required for the job at hand.
- Never wear damaged personal protective equipment.
- Observe information about personal protective equipment provided in the work area.

Protective clothing	Close-fitting work clothing with a low tearing strength, with tight sleeves and with no protruding parts. It mainly serves to protect the wearer against being caught by moving machine parts.
Safety shoes	To protect against falling heavy objects and slipping on slippery surfaces.
Safety glasses	To protect the eyes from flying parts and splashing liquids.
Visor	To protect the face from flying parts and splashing liquids or other dangerous substances.
Hard hat	To protect against falling and flying parts and materials.
Hearing protection	To protect against hearing damage.
Protective gloves	To protect against mechanical, thermal and electrical hazards.

Table 3: Personal protective equipment

3 Product description

3.1 Scope of delivery

The product is packaged with protection against moisture and is delivered as follows:
- Pointer thermometer with temperature sensor
- Mounting brackets
- Technical documents

Optional:
- TT version: Connection via 4...20 mA and/or 0...5 V DC analog output; further options on request
- Pt100 version: Connection via Pt 100 analog output
- Cable gland up to 3x M20x1.5; 1x M16 for analog output; standard, WADI or offshore
- 1/2" NPT adapters
- PG16 adapters

Please note the following:
- Check the shipment against the shipping documents for completeness
- Store the parts in a dry place until installation
- The product must remain in the packaging and may only be removed immediately before installation

3.2 Function description

The pointer thermometer measures the oil temperature or determines the winding temperature in power transformers, distribution transformers or reactors, depending on the version. The sensor of the pointer thermometer is located in the thermometer pocket mounted in the transformer tank. The measured value is displayed directly on the pointer thermometer or, as an option, on an analog or digital display using a signal converter.

Depending on the device type, the electrical temperature signal can be transmitted as follows:

- TT version: Connection via 4...20 mA and/or 0...5 V DC analog output
- Pt100 version: Connection via Pt 100 analog output

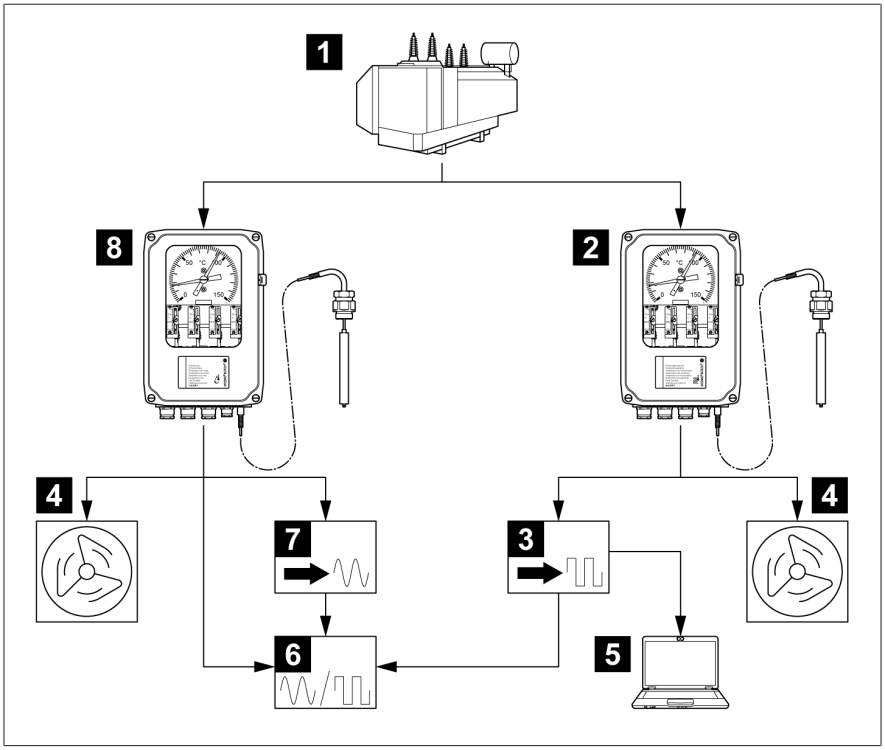


Figure 1: Example of temperature measurement and temperature display

1	Transformer	2	Pointer thermometer for winding temperature
3	Digital signal converter	4	Transformer fan
5	SCADA	6	Digital display/analog display
7	Analog signal converter	8	Pointer thermometer for oil temperature

3.3 Design

3.3.1 Pointer thermometer

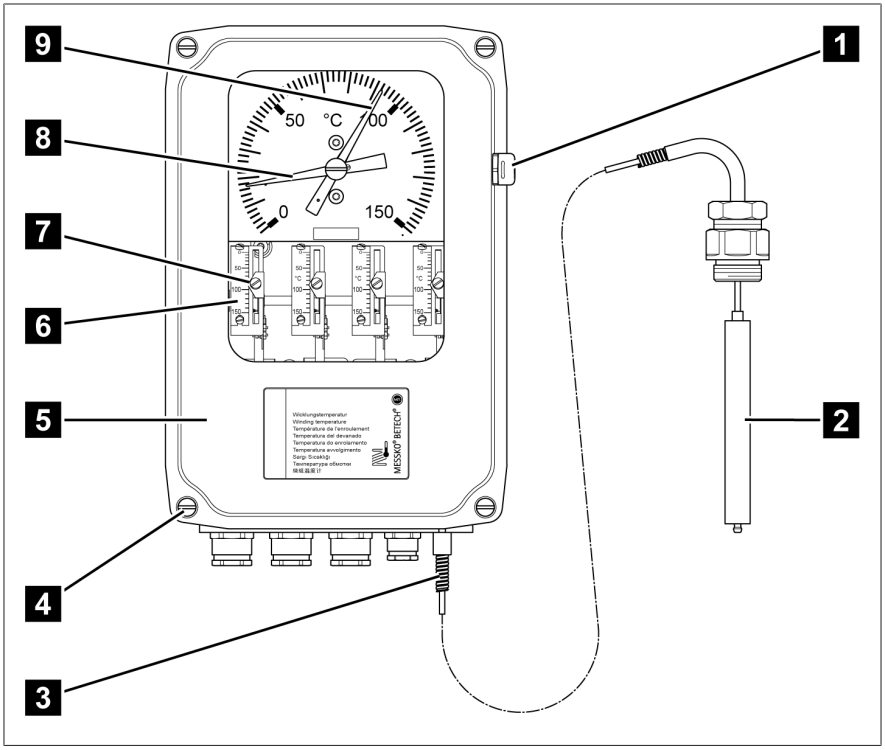


Figure 2: Pointer thermometer

1	Pressure equalization element	2	Temperature sensor
3	Capillary line with stainless steel protective tube	4	4 cover bolts
5	Housing cover	6	Switching point scale
7	Switching point configuration	8	Pointer
9	Drag hands		

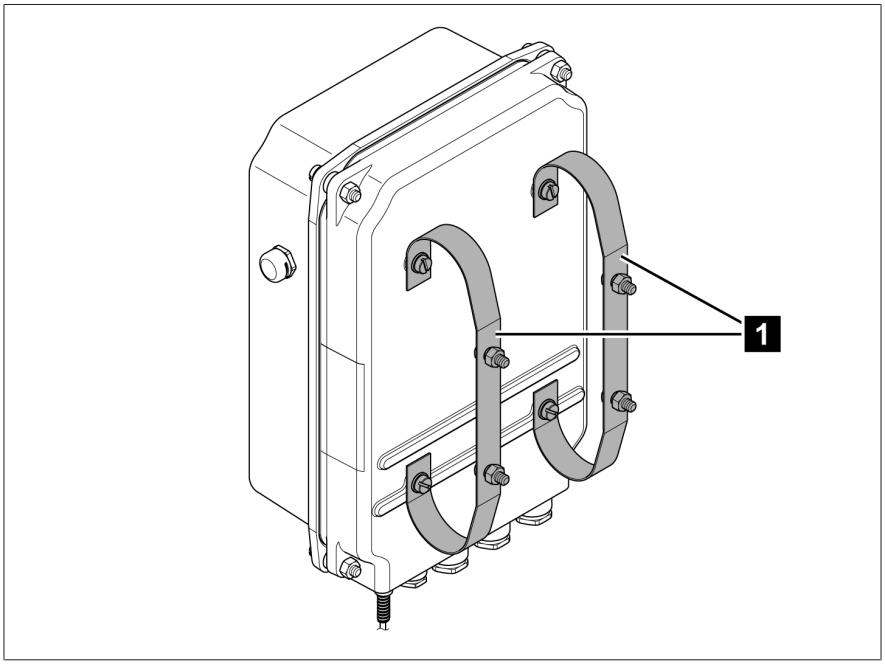


Figure 3: Mounting brackets

1	Mounting brackets		

3.3.2 Temperature sensor

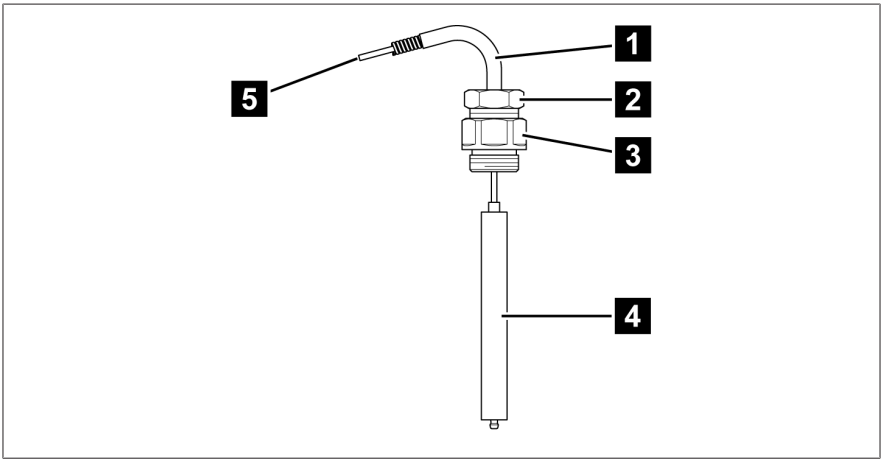


Figure 4: Example design of temperature sensor no. 2

1	Step protection	2	Small screw connection on temperature sensor
3	Large screw connection on temperature sensor	4	Temperature sensor
5	Capillary line with stainless steel protective tube		

Refer to the appendix [▶Section 9, Page 67] for dimensional information on all available temperature sensors.

3.4 Versions

The pointer thermometer is available in the following versions:

Oil temperature indicator

- Pointer thermometer with up to 6 independently configurable micro-switches. With devices with 5 or 6 micro-switches, there are limitations in terms of the number of change-over contacts; refer to the drawings in the appendix.
- The temperature displayed is that of the oil temperature at the temperature sensor of the pointer thermometer.
- The mechanical measurement system functions independently and without a power source.

Winding temperature indicator

- Pointer thermometer with up to 6 independently configurable micro-switches. With devices with 5 or 6 micro-switches, there are limitations in terms of the number of change-over contacts; refer to the drawings in the appendix.
- The temperature displayed is that of the winding temperature based on the oil temperature, secondary transformer current and the configured temperature difference.
- The secondary transformer current is proportional to the current in the winding.
- The secondary transformer current supplies a heating resistor in the mechanical pointer thermometer with power, thus causing a temperature increase corresponding to the transformer load compared to the actual oil temperature measured.
- The pointer thermometer with heating element is configured by adjusting the heating current.
- The version with heating element and integrated MRB110-1 or MRB110-2 balancing resistor is configured via the resistor.

Optional versions

- TT version [▶Section 3.4.1, Page 21]
- Pt100 version [▶Section 3.4.2, Page 22]

3.4.1 TT version (optional)

The pointer thermometer is equipped with a signal converter that signals the temperature value as an electrical signal (4...20 mA and/or 0...5 V DC). The signal converter requires a 24 V DC power supply.

The outputs are linear and proportional to the temperature displayed on the device. The same temperature value is displayed on the device and on the remote display.

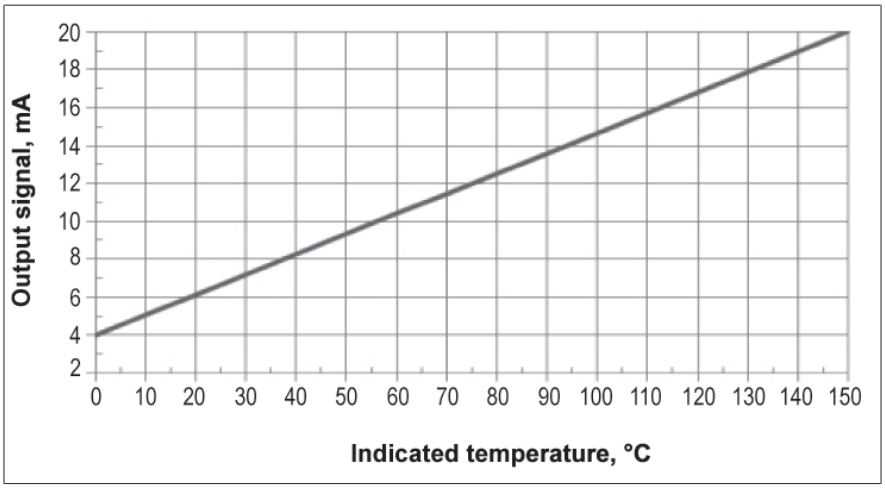


Figure 5: Example values for version with 4...20 mA analog output

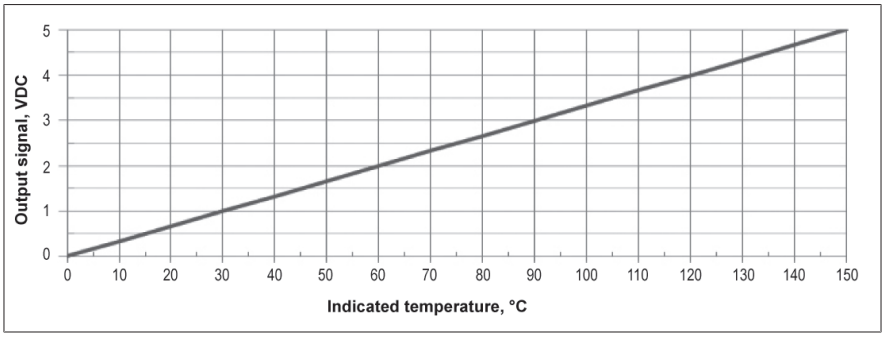


Figure 6: Example values for version with 0...5 V DC analog output

3.4.2 Pt100 version (optional)

The simulated Pt100 output is linear and proportional to the temperature displayed on the device. The same temperature value is displayed on the device and on the remote display.

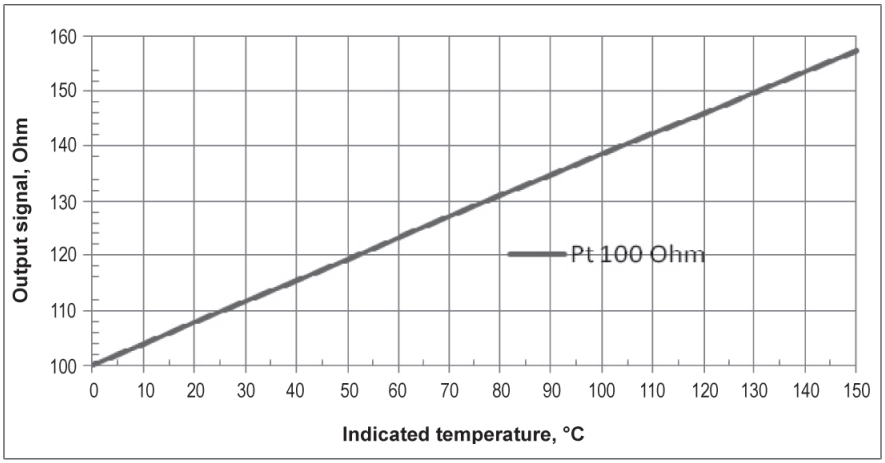


Figure 7: Example values for version with Pt100 analog output

Temperature [°C]	Resistance value [Ohm]
0	100.00
25	109.73
50	119.40
100	138.50
150	157.31

Table 4: Example Pt100 analog output values

3.5 Nameplate

The nameplate is on the right-hand side on the housing base.

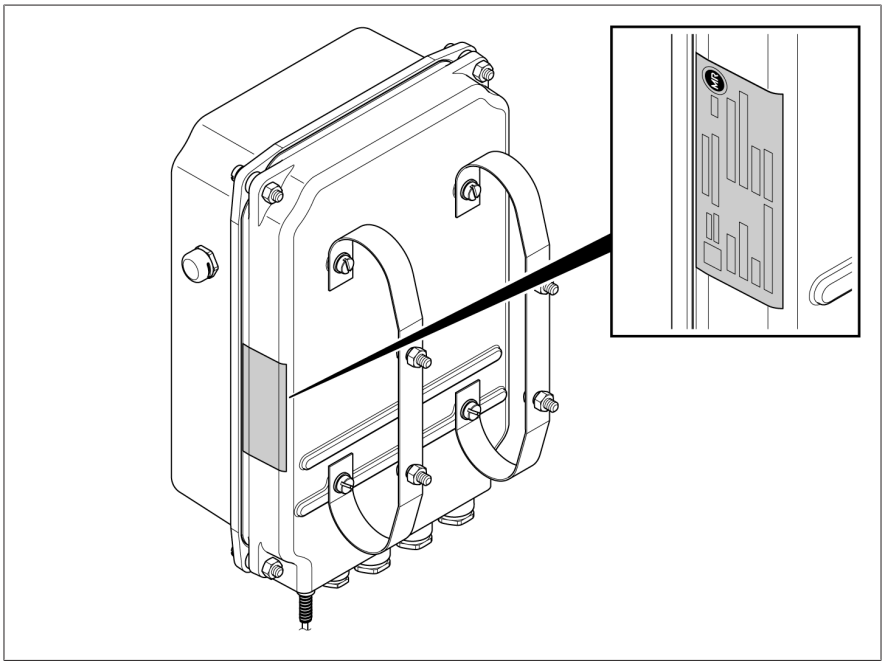


Figure 8: Nameplate

4 Packaging, transport and storage

4.1 Purpose

The packaging is designed to protect the packaged product during transport, loading, unloading and during periods of storage in such a way that no detrimental changes occur. The packaging must protect the goods against permitted transport stresses such as vibration, knocks and moisture (rain, snow, condensation).

The packaging also prevents the packaged goods from moving impermissibly within the packaging.

4.2 Suitability, structure and production

The goods are packaged in a sturdy cardboard box or solid wooden crate. These ensure that the shipment is secure when in the intended transportation position and that none of its parts touch the loading surface of the means of transport or touch the ground after unloading.

Inlays inside the box or crate stabilize the goods, preventing impermissible changes of position and protecting them from vibration.

4.3 Markings

The packaging bears a signature with instructions for safe transport and correct storage. The following symbols apply to the shipment of non-hazardous goods. Adherence to these symbols is mandatory.

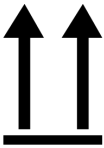
 Protect against moisture	 Top	 Fragile	 Attach lifting gear here	 Center of mass

Table 5: Shipping pictograms

4.4 Transportation, receipt and handling of shipments

In addition to vibrations, jolts must also be expected during transportation. To prevent possible damage, avoid dropping, tipping, knocking over and colliding with the product.

If the packaging tips over or falls, damage is to be expected regardless of the weight.

Every delivered shipment must be checked for the following by the recipient before acceptance (acknowledgment of receipt):
- Completeness based on the delivery slip
- External damage of any type.

The checks must take place after unloading when the cartons or transport container can be accessed from all sides.

Visible damage

If external transport damage is found upon receipt of the shipment, proceed as follows:

- Immediately record the transport damage found in the shipping documents and have this countersigned by the carrier.
- In the event of severe damage, total loss or high damage costs, immediately notify the sales department at Maschinenfabrik Reinhausen GmbH and the relevant insurance company.
- After identifying damage, do not modify the condition of the shipment further and retain the packaging material until an inspection decision has been made by the transport company or the insurance company.
- Record the details of the damage immediately on site together with the carrier involved. This is essential for any claim for damages.
- If possible, photograph damage to packaging and packaged goods. This also applies to signs of corrosion on the packaged goods due to moisture inside the packaging (rain, snow, condensation).
- Be absolutely sure to also check the sealed packaging.

Hidden damage

When damage is not determined until unpacking after receipt of the shipment (hidden damage), proceed as follows:

- Make the party responsible for the damage liable as soon as possible by telephone and in writing, and prepare a damage report.
- Observe the time periods applicable to such actions in the respective country. Inquire about these in good time.

With hidden damage, it is very hard to make the transportation company (or other responsible party) liable. Any insurance claims for such damage can only be successful if relevant provisions are expressly included in the insurance terms and conditions.

4.5 Storage of shipments

When selecting and setting up the storage location, ensure the following:
- Store the product and accessories in the original packaging until installation.
- Protect stored goods against moisture (rain, flooding, water from melting snow and ice), dirt, pests such as rats, mice, termites etc. and against unauthorized access.
- Store crates and boxes on pallets, timber beams or planks as protection against ground moisture and for improved ventilation.
- Ensure that the foundation has sufficient load-bearing capacity.
- Keep entrance paths clear.
- Check the stored goods at regular intervals. Also take appropriate action after storms, heavy rain or snow etc.

4.6 Further transport

Use the original product packaging for further transport.

If you transport the product to the final installation site in a mounted state, observe the following information in order to protect the product against mechanical damage due to external influences.

Transport packaging requirements
- Select packaging suitable for the duration of transport or storage, taking the climatic conditions into consideration.
- Ensure that the packaging protects the product against transport stress such as shaking, vibrations and impacts.
- Ensure that the packaging protects the product against moisture such as rain, snow and condensation.
- Ensure that the packaging allows for sufficient air circulation in order to prevent the formation of condensation.

5 Installation and commissioning

This chapter describes how to correctly mount and connect the device. Observe the following hazard notices prior to opening the device:

⚠ DANGER

Electric shock!

Risk of fatal injury due to electrical voltage. Always observe the following safety regulations when working in or on electrical equipment.

- Disconnect the equipment.
- Lock the equipment to prevent an unintentional restart.
- Make sure all poles are de-energized.
- Ground and short-circuit.
- Cover or cordon off adjacent energized parts.

⚠ CAUTION

Damage to the device

The measurement system is hermetically sealed. If you cut the capillary line, the measurement system will be destroyed.

- Never cut the capillary line.

NOTICE

Damage to the device!

Electrostatic discharge can lead to damage to the device.

- Take precautionary measures to prevent the build-up of electrostatic charges on work surfaces and personnel.

NOTICE

Damage to the device!

If you kink the capillary line or use the capillary line to carry the device, the device can become damaged and display incorrect measured values as a result.

- Carefully remove the device from the packaging.
- Never use the capillary line to carry the device.
- Do not damage the capillary line or sensor.
- Unroll the capillary line without bending or kinking it.
- Observe the minimum bending radius of 25 mm.

5.1 Transporting in the installed state

If transportation of the entire assembled unit is necessary between mounting the device onto the transformer / oil conservator and commissioning it, please also refer to the information on further transport [▶Section 4.6, Page 27].

NOTICE

Damage to the device

The device can become damaged during transport due to unsuitable packaging.

- Use suitable packaging for transporting the device in the installed state.
- Protect the device against mechanical damage.
- Prevent the ingress of rain water.
- Ensure sufficient air ventilation without the formation of condensation.

5.2 Checking measured temperature values

Before attaching the pointer thermometer, you can check the accuracy of the display with a reference measurement. The pointer thermometer for oil temperature is calibrated at the factory.

i The gradient for the pointer thermometer for winding temperature is not preset at the factory. Contact your representative at Maschinenfabrik Reinhausen GmbH if you want the gradient to be preset.

✓ Only perform a reference measurement in moving liquid baths. We recommend using the MESSKO® MZT1650S calibration bath.

✓ The temperature of the liquid bath must remain constant for 15 minutes.

✓ Use an additional, calibrated glass thermometer to perform the reference measurement.

1. Immerse the temperature sensor of the pointer thermometer and a calibrated glass thermometer in the liquid bath for approx. 15 minutes.
2. Compare the measured temperature values of the pointer thermometer and glass thermometer with each other.

» If the measured temperature values deviate from each other significantly (maximum permitted deviation ±3 °C), contact the service department of Maschinenfabrik Reinhausen GmbH [▶Section 2.3, Page 13].

5.3 Mounting the pointer thermometer

5.3.1 Attaching the pointer thermometer to the transformer

When attaching the thermometer to the transformer, note the following information:

– Ensure that the pointer thermometer is mounted vertically.

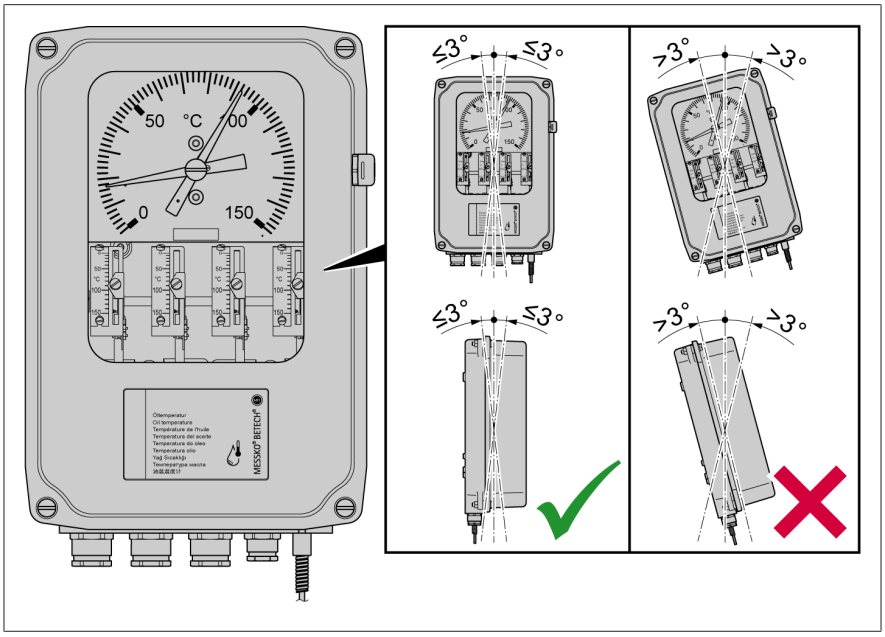


Figure 9: Mounting position

– Ensure that the pointer thermometer is not subjected to any vibrations at the installation location.
– Comply with EMC standards [▶Section 5.4.1.1, Page 38].
– Observe the dimensions in the dimensional drawings in the appendix.

5.3.1.1 Attaching the mounting brackets to the device

To attach the mounting brackets to the device, proceed as follows:

1. Use the 4 M6x8 screws included in the delivery to attach the two mounting brackets to the device via the predrilled holes on the device rear.

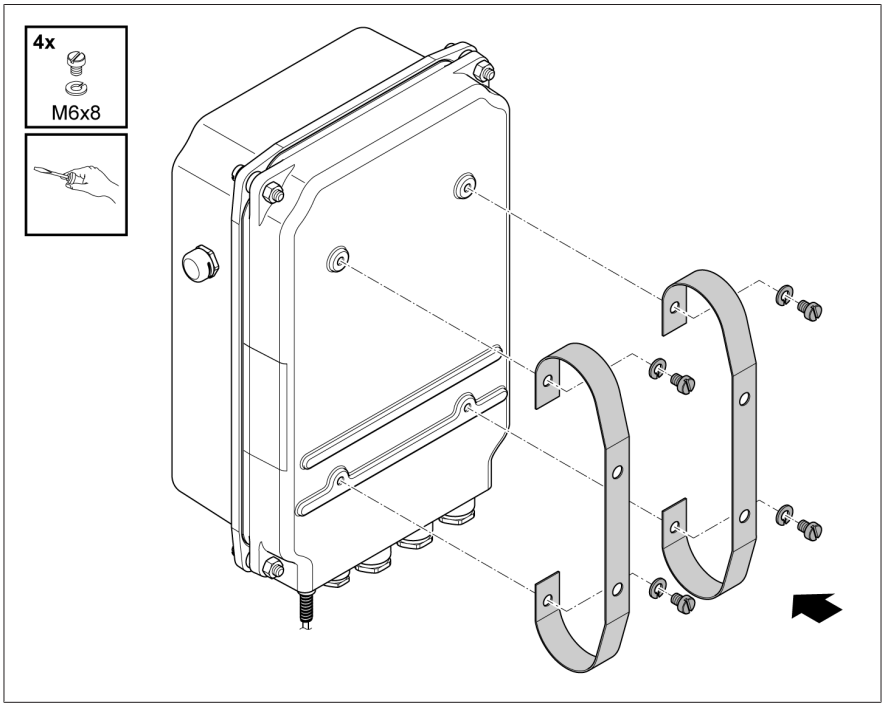


Figure 10: Attaching the mounting brackets

5.3.1.2 Attaching the pointer thermometer via mounting brackets

1. Drill four holes as shown below into a suitable bracket on the outside of the transformer, on the control cabinet mounting plate or on another suitable structure.

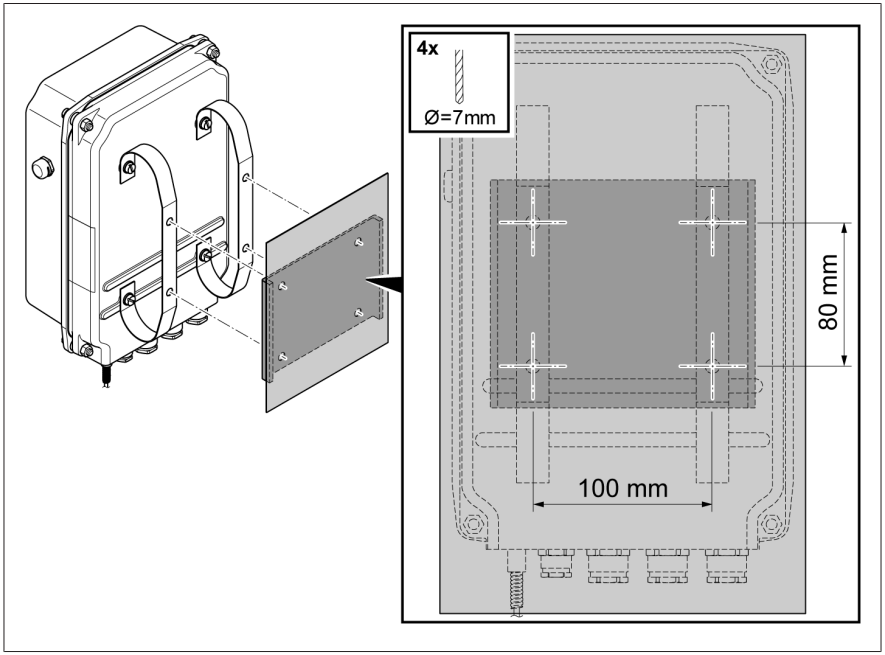


Figure 11: Drill holes

2. Attach the pointer thermometer to the transformer via the mounting brackets.

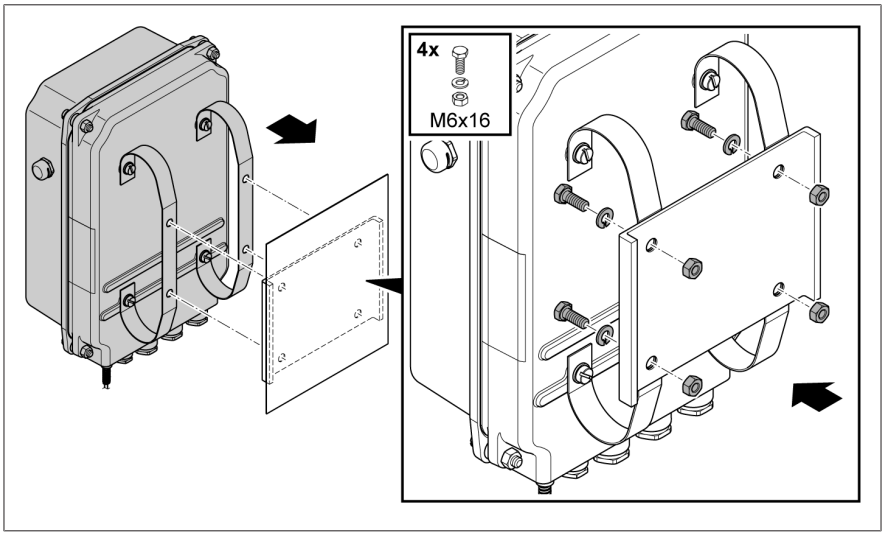


Figure 12: Attaching the pointer thermometer via mounting brackets

5.3.2 Securing the capillary line

When securing the capillary line, note the following information:

NOTICE

Damage to the device!

A capillary line bending radius that is too narrow can lead to a loss of device function.

› Ensure compliance with the minimum bending radius of 25 mm (0.98″).

– Attach the capillary line to the transformer so that it cannot be damaged during transport or operation due to factors such as impact, scuffing, pressure, vibrations or crushing.

Proceed as follows:

1. Route the capillary line to the transformer and secure it with cable ties.
2. Wind up any excess capillary line with a minimum winding diameter of 200 mm (7.87″).

5.3.3 Inserting the temperature sensor

The following steps describe how to install temperature sensor no. 2. Refer to the drawings in the appendix for wrench sizes for the other available versions of the temperature sensor.

1. Fill 85% of the transformer thermometer pocket with oil.

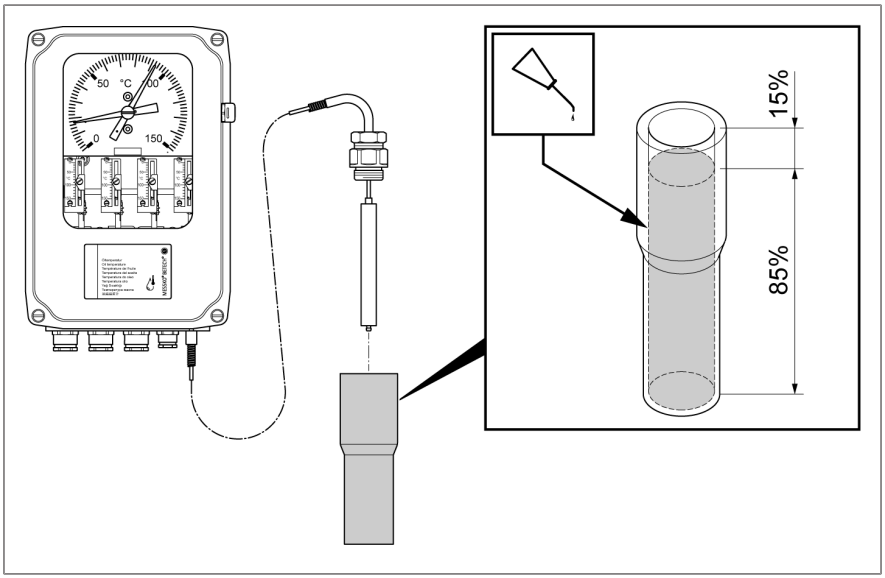


Figure 13: Filling the thermometer pocket

2. Unscrew the large screw connection on the temperature sensor from the small screw connection.

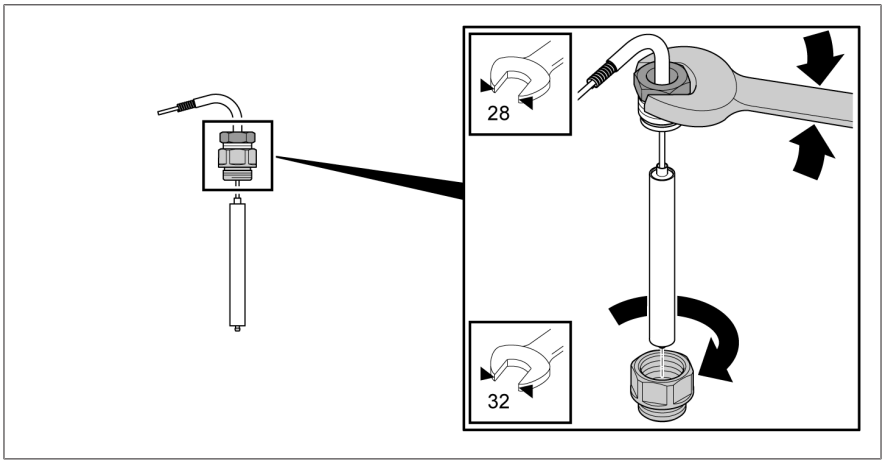


Figure 14: Unscrewing the large screw connection

3. Insert the large screw connection into the transformer thermometer pocket along with the gasket (gasket not included in the scope of delivery) and secure it.

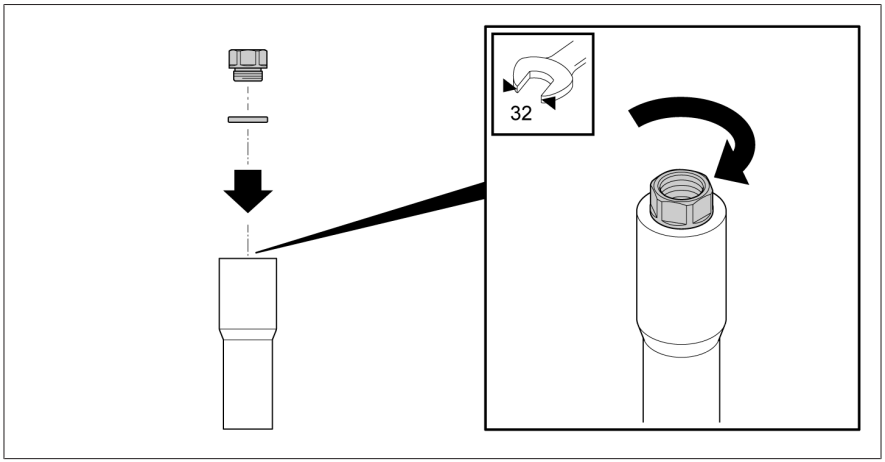


Figure 15: Securing the large screw connection

4. Insert the temperature sensor into the large screw connection and turn it to the desired position together with the capillary line. Tighten the small screw connection on the thermometer sensor.

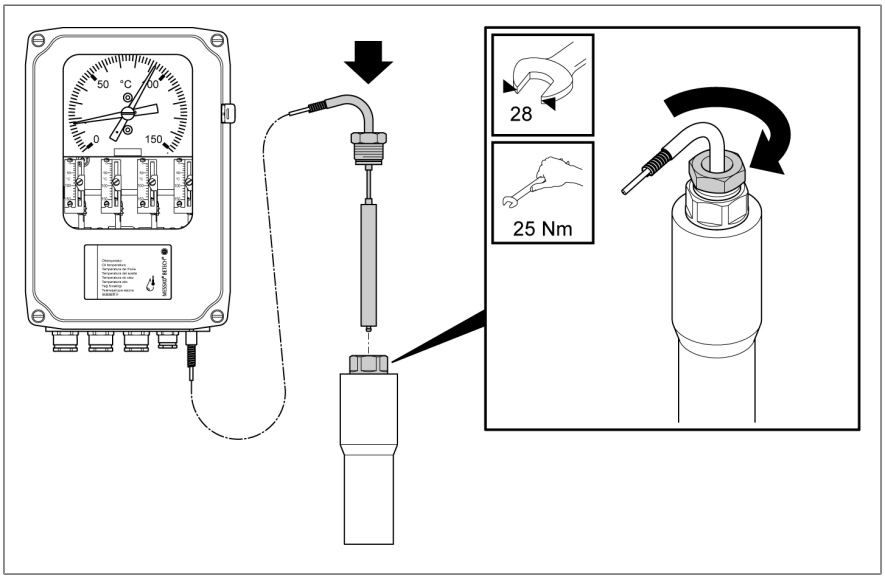


Figure 16: Inserting and securing the temperature sensor

5.4 Electrical connection

This chapter describes how to connect the device correctly. Note the connection diagrams provided. Observe the following hazard notices prior to opening the device:

⚠ DANGER

Electric shock!

Risk of fatal injury due to electrical voltage. Always observe the following safety regulations when working in or on electrical equipment.

- Disconnect the equipment.
- Lock the equipment to prevent an unintentional restart.
- Make sure all poles are de-energized.
- Ground and short-circuit.
- Cover or cordon off adjacent energized parts.

NOTICE

Damage to the device!

Electrostatic discharge can lead to damage to the device.

- Take precautionary measures to prevent the build-up of electrostatic charges on work surfaces and personnel.

5.4.1 Preparation

Observe the following information for the electrical connection.

5.4.1.1 Electromagnetic compatibility

The device has been developed in accordance with the applicable EMC standards. The following points must be noted in order to maintain the EMC standards.

5.4.1.1.1 Wiring requirement of installation site

Note the following when selecting the installation site:

- The system's overvoltage protection must be effective.
- The system's ground connection must comply with all technical regulations.
- Separate system parts must be joined by a potential equalization.

5.4.1.1.2 Wiring requirement of operating site

Note the following when wiring the operating site:

- Do not route lines which cause interference (e.g. supply lines) and lines susceptible to interference (e.g. signal lines) in the same cable duct.
- Maintain a distance of more than 100 mm (3.94") between lines which cause interference and those which are susceptible to interference.

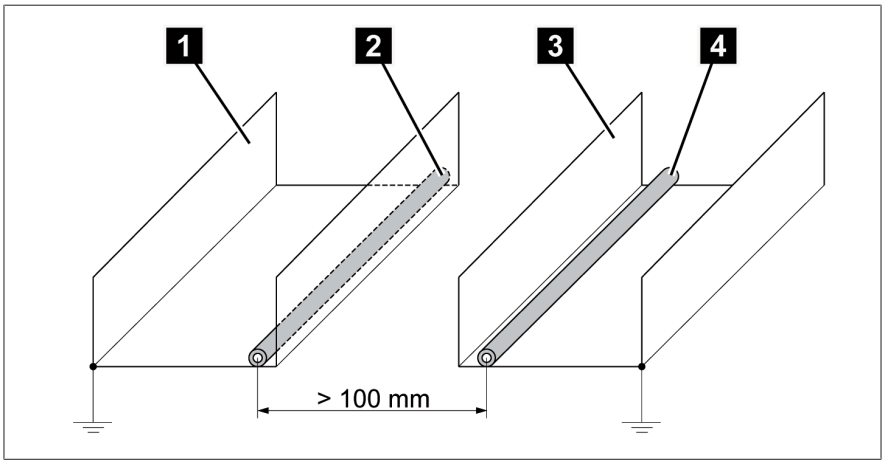


Figure 17: Recommended wiring

1	Cable duct for lines causing interference	3	Cable duct for lines susceptible to interference
2	Line causing interference (e.g. power line)	4	Line susceptible to interference (e.g. signal line)

- Never connect the device with a multi-wire collective pipe.
- Use a shielded cable for transmitting the output signal.

5.4.1.2 Safeguarding the power circuits

You may only connect the device to circuits with an external overcurrent protective device and an all-pole isolating device so that the equipment can be fully de-energized if required.

Suitable equipment includes isolating devices in accordance with IEC 60947-1 and IEC 60947-3 (e.g. circuit breakers). Observe the properties of the relevant circuits (voltage, maximum currents) when selecting the circuit breaker type. In addition, observe the following:

- It must be easy for the operator to access the isolating device.
- The isolating device must be labeled for the device and the circuits to be isolated.
- The isolating device may not be a part of the power line.
- The isolating device may not interrupt the main protective conductor.

Miniature circuit breaker

You must protect the mains circuits (supply voltage, main switching contacts) with a miniature circuit breaker. The miniature circuit breaker must have the following properties:

- Rated current: 16 A
- Triggering characteristic: C

Conductor cross-section

For all mains circuits, you must use a conductor cross-section that is appropriate for the miniature circuit breaker you have selected.

5.4.1.3 Cable recommendation

Please note the following recommendation from Maschinenfabrik Reinhausen GmbH when wiring the device:

Cable	Terminals	Conductor cross-section
Power supply and analog outputs	71, 72, 73, 74	1.5...2.5 mm^2 / 16...12 AWG
Micro-switches	11, 12, 14; 21, 22, 24; 31, 32, 33, 34; 41, 42, 43, 44; 51, 52, 53, 54; 61, 62, 63, 64	1.5...2.5 mm^2 / 16...12 AWG
Balancing resistor	5 - 5	1.5...2.5 mm^2 / 16...12 AWG
Ground connection	⏚	≥ all other conductors

Table 6: Recommendation for connection cables

5.4.2 Opening the housing

1. Unscrew the 4 bolts (standard version M5; offshore version M6) on the housing cover and remove the housing cover.

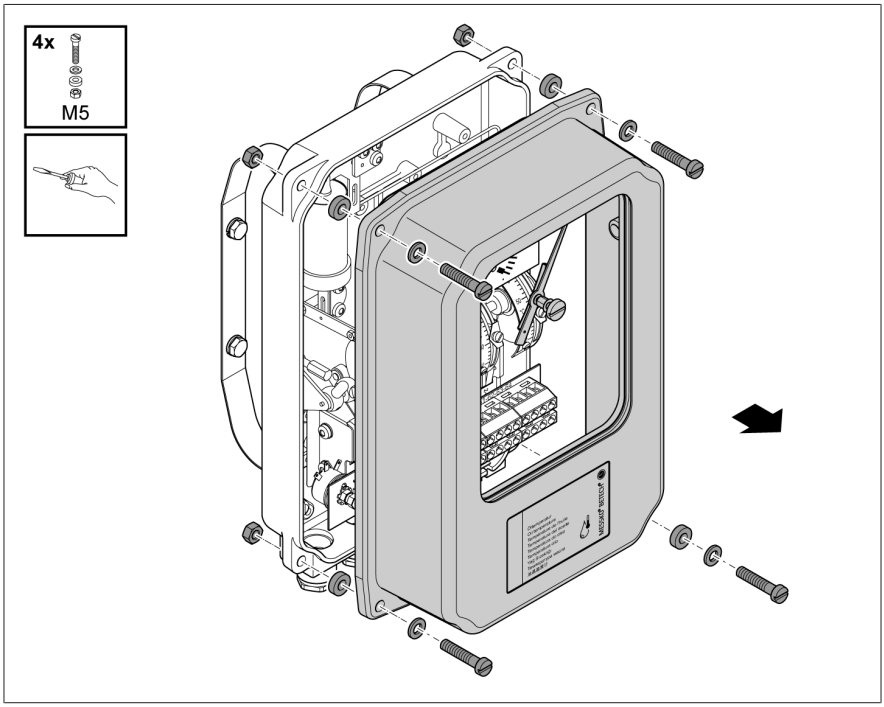


Figure 18: Opening the housing (standard version)

5.4.3 Preparing the cables

To prepare the cables correctly, proceed as follows:

1. Note cable recommendation.
2. Route the connection cables without tension and attach them so that neither the device nor the cable gland is subjected to mechanical stress.
3. Remove approx. 160 mm (6.3″) of the jacket from the cable of the respective connection lines, strip approx. 6 mm (0.24″) of the insulation from the wires and seal with ferrules.

4. Ensure that the cable for the protective conductor is 50 mm longer and equip the conductor with an M5 ring cable lug.

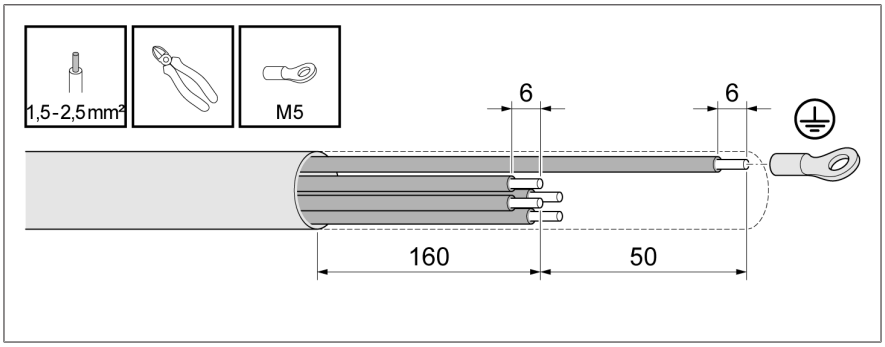


Figure 19: Stripping the cable jacket and wire insulation (example)

5.4.3.1 Standard cable gland

1. *NOTICE!* If the cable gland is not used, equip it with a sealing plug or replace the entire cable gland with a dummy plug in order to ensure the IP degree of protection.
2. Remove the protective cap in the outer nut.

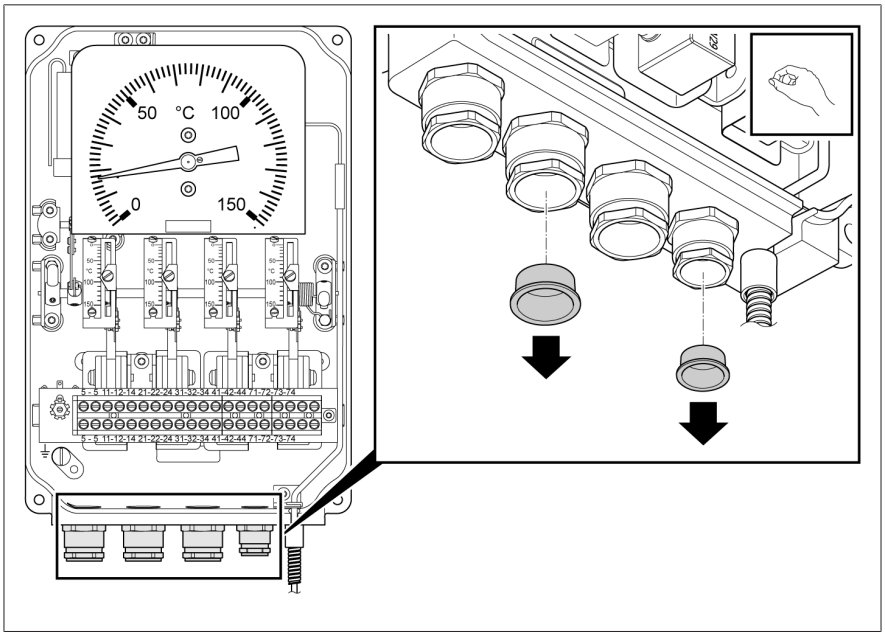


Figure 20: Removing the protective cap

3. Note the tightening zones.

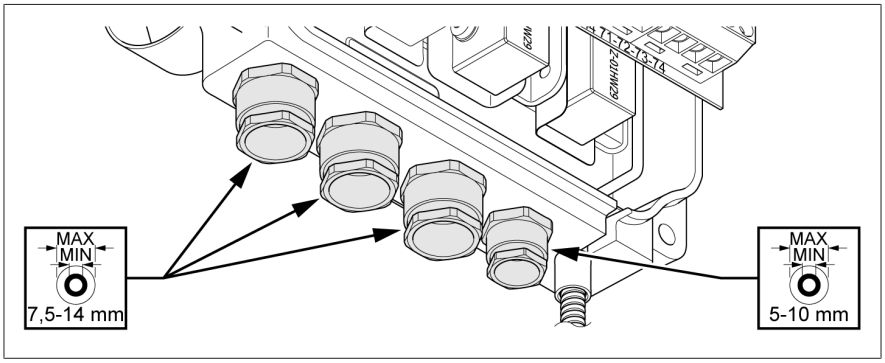


Figure 21: Tightening zones

4. Loosen the outer nut, route a sufficient length of connection cable through the cable gland and tighten the outer nut.

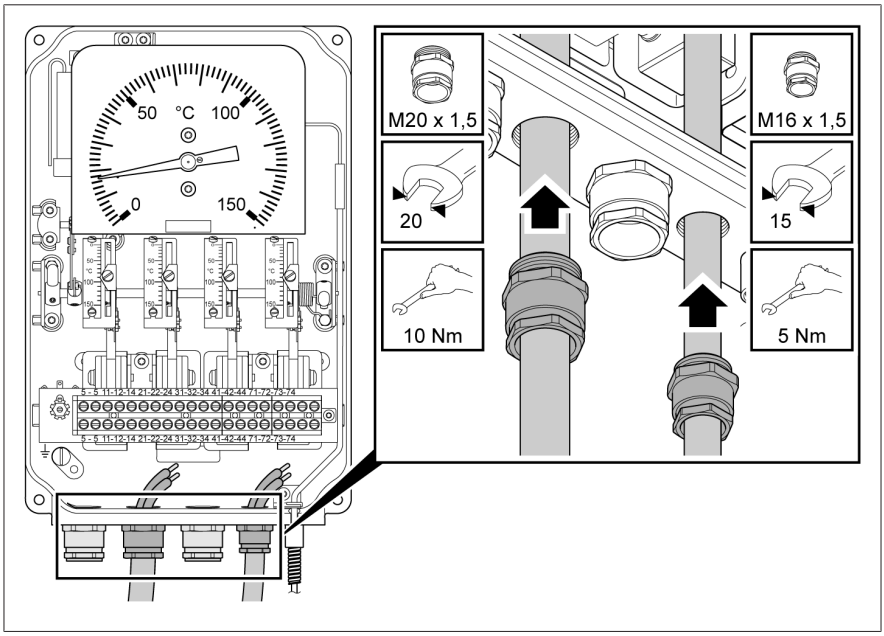


Figure 22: Cable gland

5.4.3.2 WADI cable gland (brass) and offshore cable gland (stainless steel)

The WADI cable gland and offshore cable gland differ only in the material. The WADI cable gland is made of brass and the offshore cable gland is made of stainless steel.

1. *NOTICE!* If the cable gland is not used, equip it with a sealing plug or replace the entire cable gland with a dummy plug in order to ensure the IP degree of protection.
2. Remove the protective cap in the union nut.

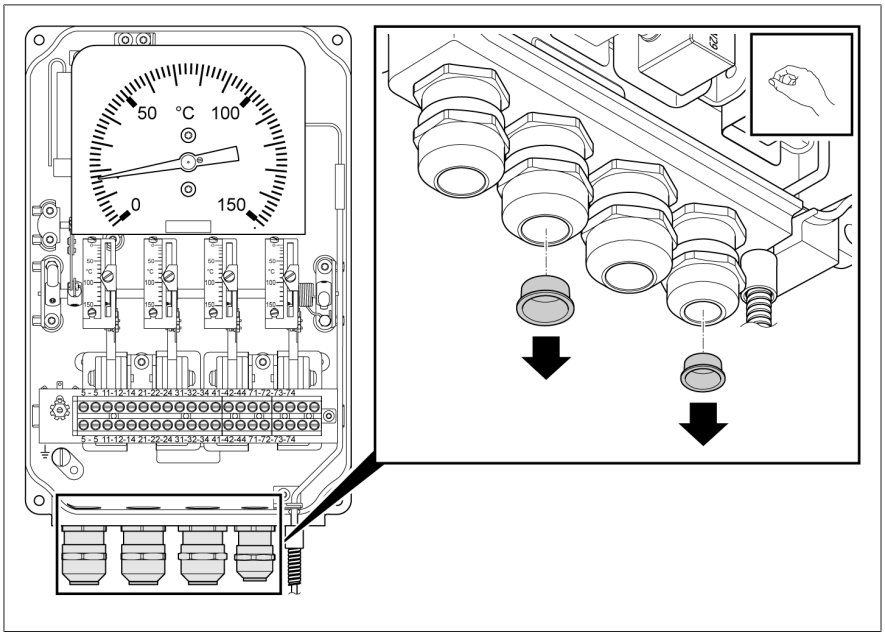


Figure 23: Removing the protective cap

3. Note the tightening zones.

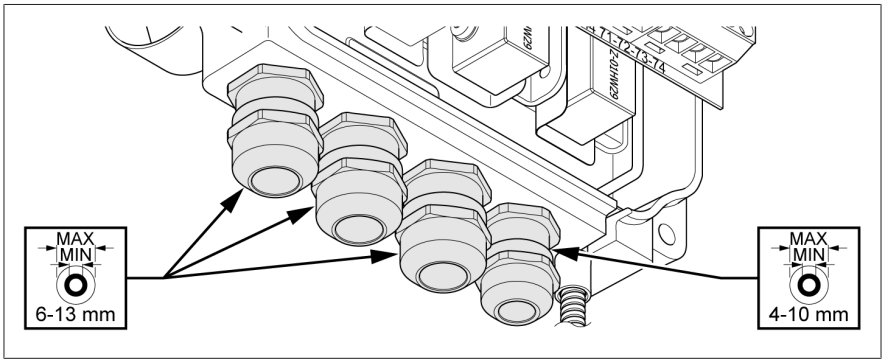


Figure 24: Tightening zones

4. Loosen the union nut, route a sufficient length of connection cable through the cable gland and tighten the union nut.

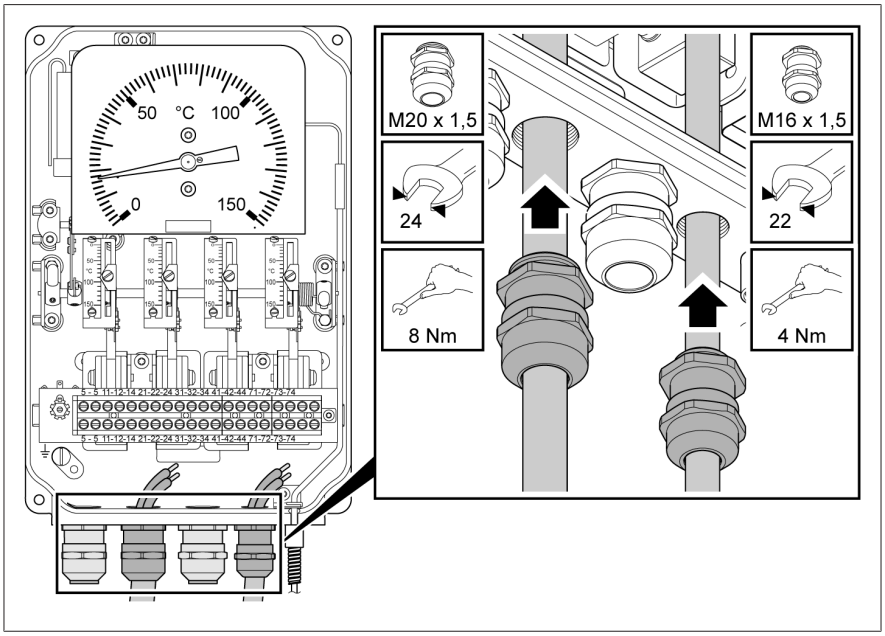


Figure 25: Cable gland

5.4.3.3 1/2″ NPT adapter

1. *NOTICE!* If the adapter is not used, equip it with a sealing plug to ensure the IP degree of protection.
2. Remove the protective cap.

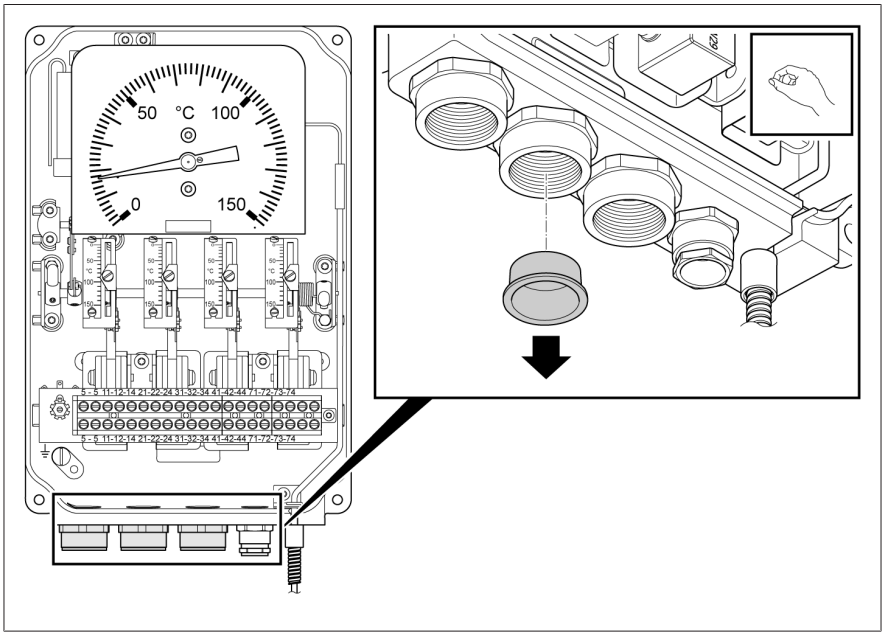


Figure 26: Removing the protective cap

3. Screw a cable conduit or cable tube with an external thread of 1/2″ 14NPT into the adapter correctly and tightly. Feed through a sufficient length of cable.

5.4.3.4 PG16 adapter

1. *NOTICE!* If the adapter is not used, equip it with a sealing plug to ensure the IP degree of protection.
2. Remove the protective cap.

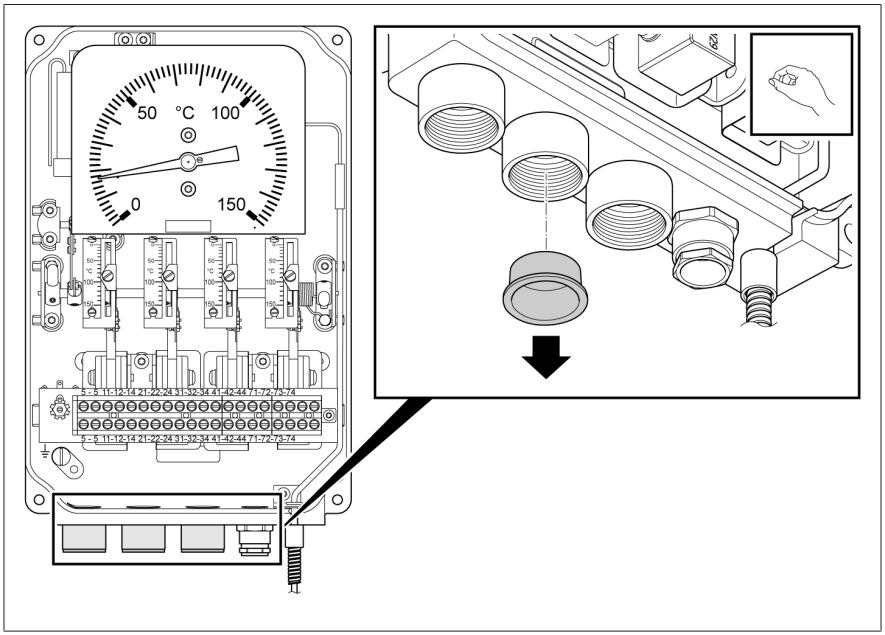


Figure 27: Removing the protective cap

3. Screw a cable conduit or cable tube with a PG16 external thread into the adapter correctly and tightly. Feed through a sufficient length of cable.

5.4.4 Protective conductor connection

To connect the protective conductor to the pointer thermometer, proceed as follows:

1. Equip the protective conductor (PE) with a forked cable lug or ring cable lug (M5) and secure it to the protective conductor screw on the pointer thermometer.

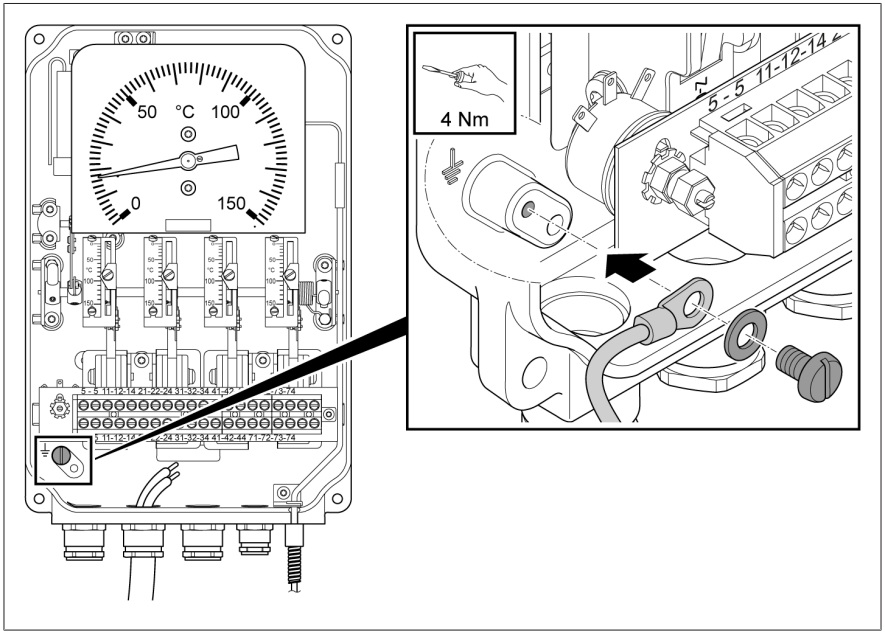


Figure 28: Connecting the protective conductor to the pointer thermometer

5.4.5 Connecting the micro-switches

⚠ WARNING

Electric shock!

When a dangerous electrical voltage is applied to one of these main switching contacts, the neighboring relay contacts must not be operated with protective extra-low voltage.

To connect the micro-switches, proceed as follows:

1. Connect the wires to the terminal strip in accordance with the connection diagram (see appendix).

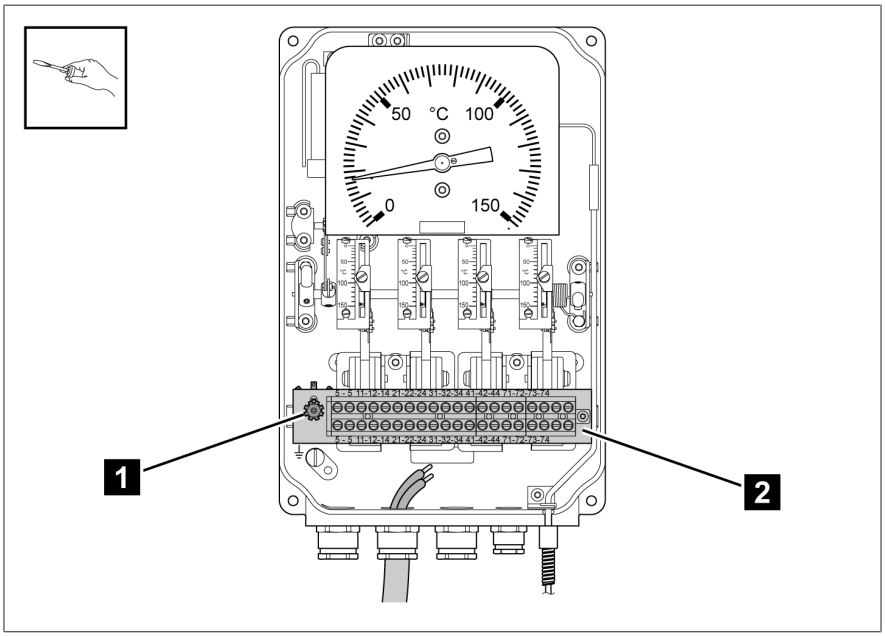


Figure 29: Connecting the micro-switches

1	Balancing resistor	2	Terminal strip

5.4.6 Connecting the analog sensor

5.4.6.1 Analog sensor, TT version (optional)

The pointer thermometer is equipped with a passive sensor that converts the temperature value into an electrical signal (4...20 mA and/or 0...5 V DC). The sensor has a 3-conductor design.

5.4.6.1.1 4...20 mA analog output

NOTICE

Damage to the device!

You must short-circuit the connection terminals 71, 72, 73 prior to the dielectric test. You must increase the test voltage step-by-step. Remove the bridges from the terminal strip after the dielectric test.

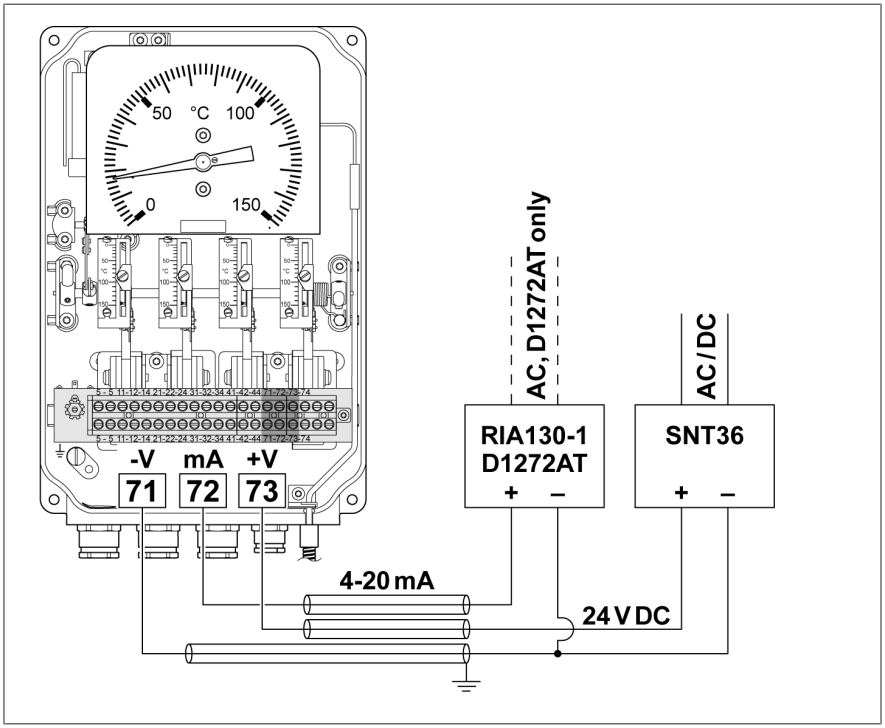


Figure 30: 4...20 mA analog output connection example

Refer to the appendix for other connection examples.

5.4.6.1.2 4...20 mA and 0...5 V DC analog output

NOTICE

Damage to the device!

You must short-circuit the connection terminals 71, 72, 73, 74 prior to the dielectric test. You must increase the test voltage step-by-step. Remove the bridges from the terminal strip after the dielectric test.

NOTICE

Damage to the device!

If you are only going to use the voltage output, the mA output must remain shorted. In this case, leave the bridges in the connection terminals 71 and 72.

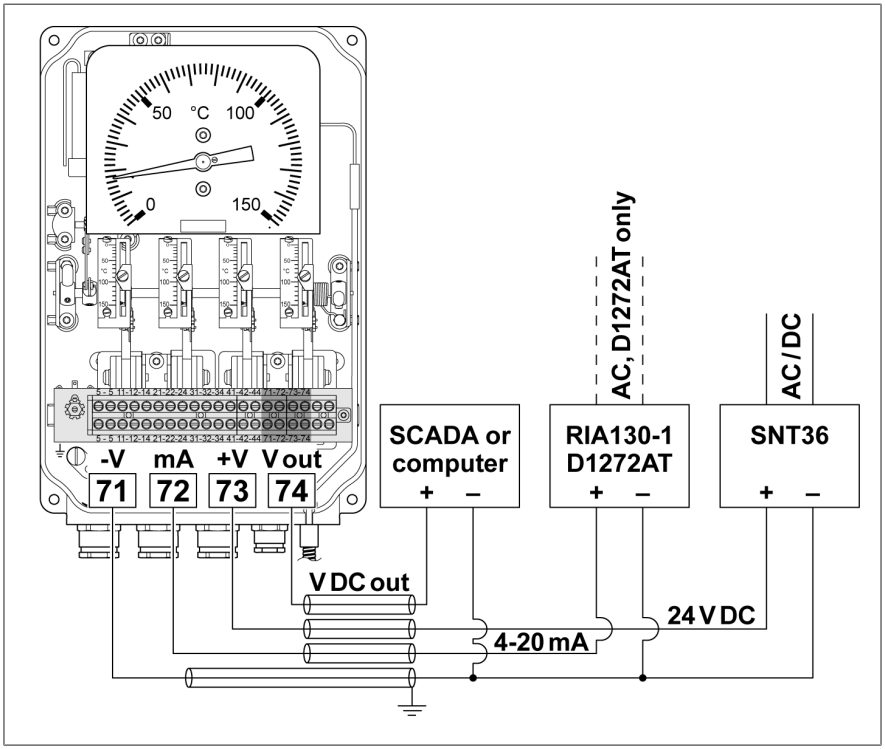


Figure 31: 4...20 mA and 0...5 V DC analog output connection example

Refer to the appendix for other connection examples.

5.4.6.1.3 0...5 V DC analog output

NOTICE

Damage to the device!

You must short-circuit the connection terminals 71, 73, 74 prior to the dielectric test. You must increase the test voltage step-by-step. Remove the bridges from the terminal strip after the dielectric test.

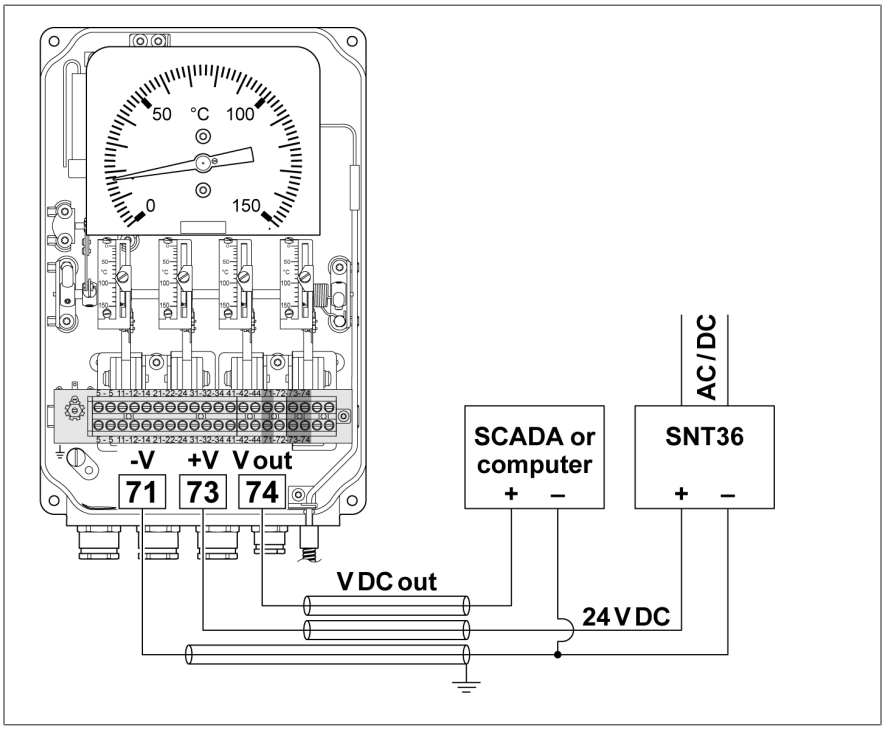


Figure 32: 0...5 V DC analog output connection example

Refer to the appendix for other connection examples.

5.4.6.2 Analog sensor, Pt100 version (optional)

The Pt100 sensor has a 3-conductor design.

NOTICE

Damage to the device!

You must short-circuit the connection terminals 71, 72 and 73 prior to the dielectric test. You must increase the test voltage step-by-step. Remove the bridges from the terminal strip after the dielectric test.

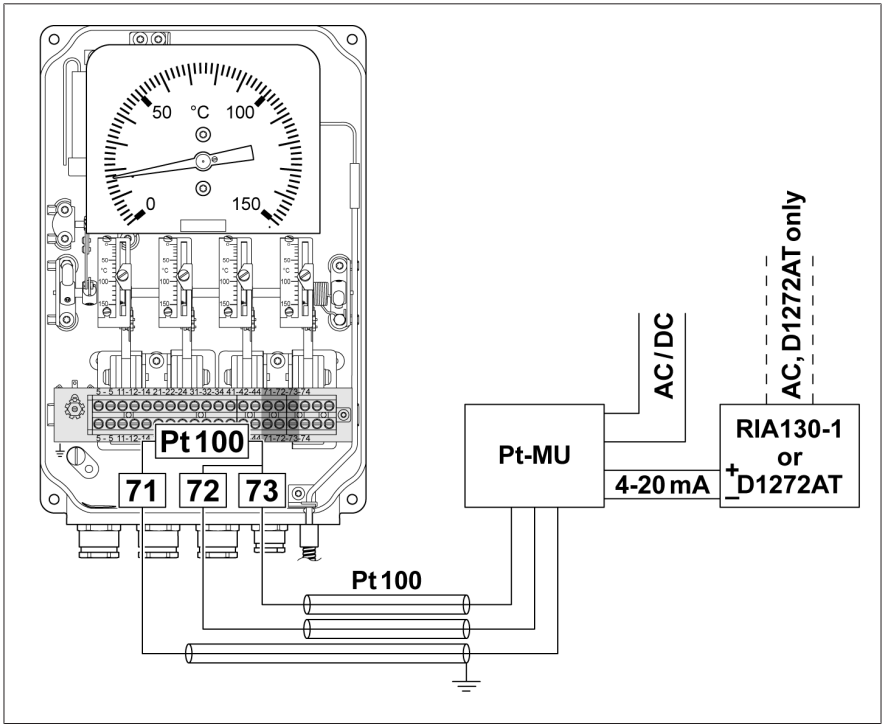


Figure 33: Pt100 connection example

5.5 Setting the micro-switches

The micro-switches can be set independently of each other and can be set to every desired temperature on the scale.

1. Loosen the setting screw on the orange pointer on one micro-switch.

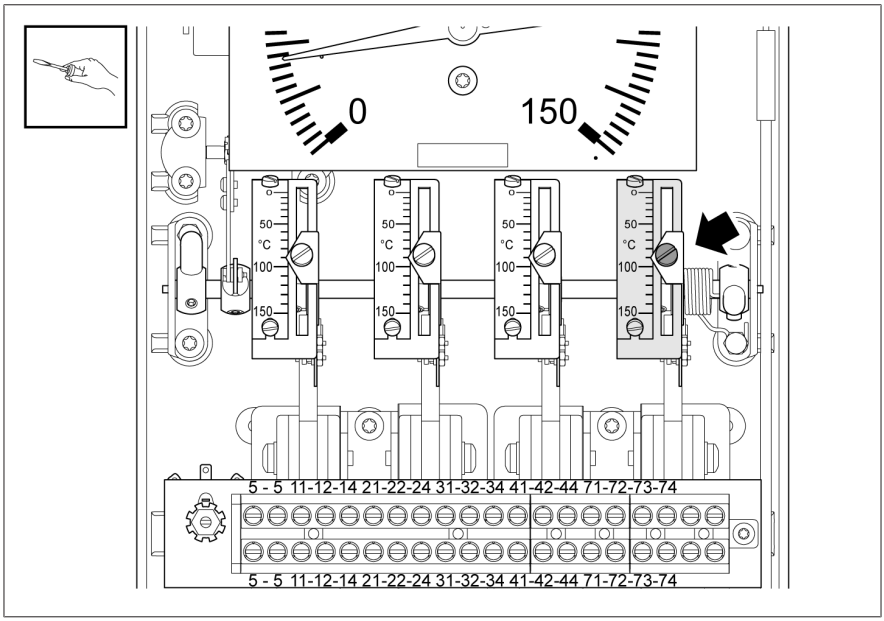


Figure 34: Loosening the setting screw on the pointer

2. Hold the setting screw in place. While doing so, turn the scale by hand until the orange pointer is pointing to the desired temperature on the scale.

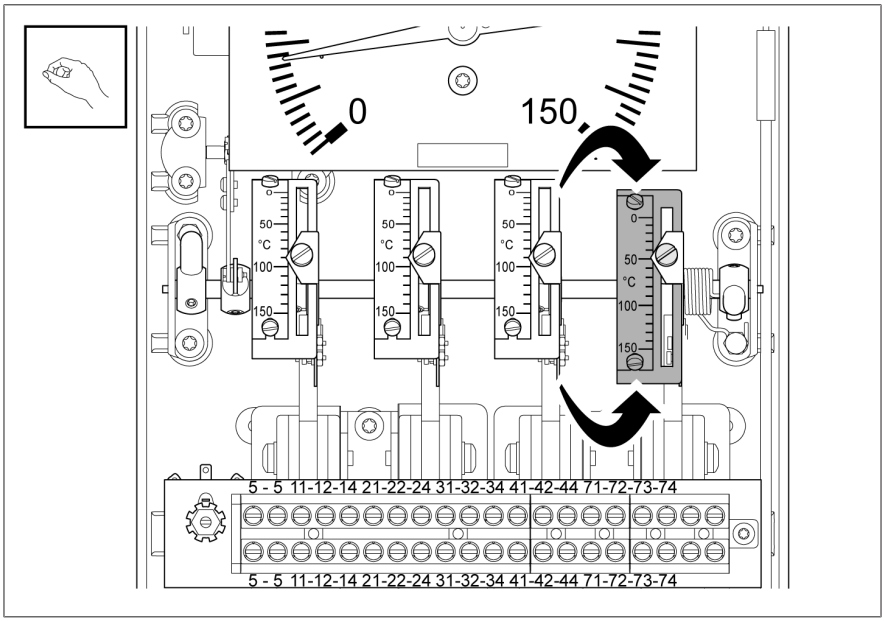


Figure 35: Turning the scale

3. Tighten the setting screw at this position with max. 3 Nm.
4. Follow these instructions precisely for the other micro-switches.

5.6 Checking the micro-switches

1. Hold the device in a vertical position.
2. *NOTICE!* Changing the calibration by turning the shaft towards the lower temperatures. Note the direction of rotation. Using the levers on the sides of the shaft, turn the scales attached to it in the direction of the higher temperatures.

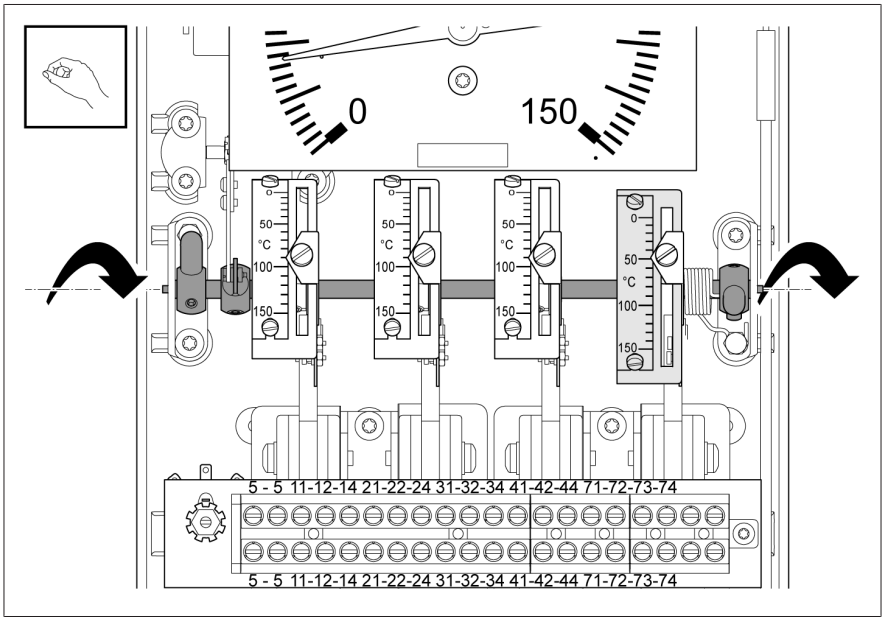


Figure 36: Turning the shaft using the levers

3. Check that the orange pointer moves in the same direction and that the micro-switch switches at the set temperature.
4. If the micro-switch does not switch, set the micro-switch again.

5.7 Closing the housing

1. Put the housing cover into position on the device and affix it using the 4 bolts (torque 1 Nm).

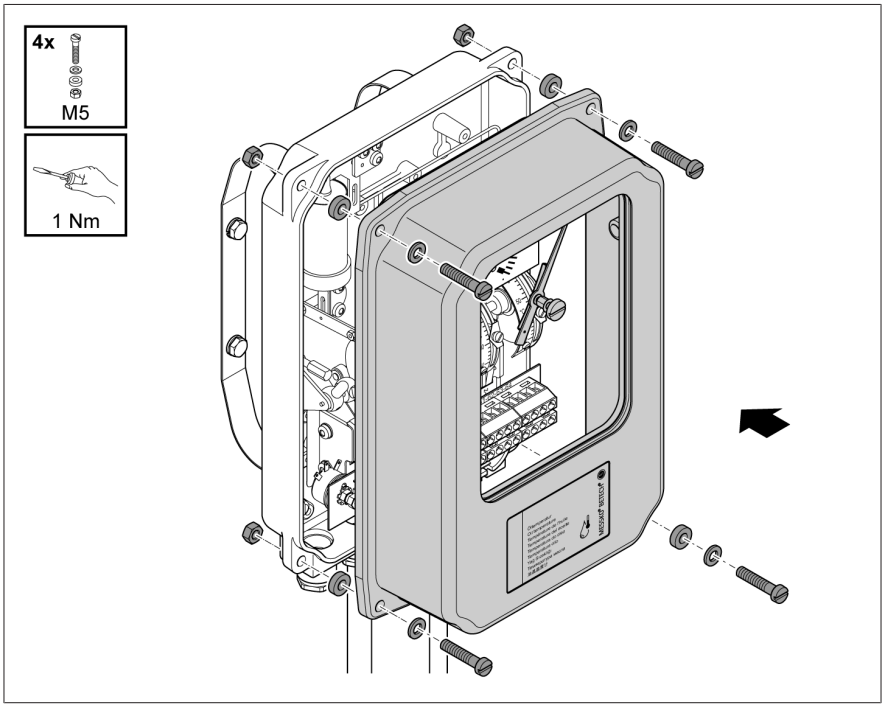


Figure 37: Closing the housing (standard version)

5.8 Setting temperature gradients (winding temperature)

5.8.1 Gradient setting by heating current

Gradient

The gradient is the temperature difference above the oil temperature for the pointer thermometer for winding temperature. The pointer thermometer for winding temperature displays a thermal image of the winding temperature on the transformer.

Calculating the gradient

You can determine the gradient using the graphs or tables, or you can calculate it using the following equation:

$G = K \times I_h^2$
where
G = gradient (°C)
I_h = heating current (A)
K = constant (depending on temperature sensor type)

Temperature sensor types	Measuring ranges		
	A: 0...+150 °C C: -20...+130 °C	E: 0...+160 °C	G: -40...+160 °C
1; 2; 2F; 5; 8; 22; 27	22	23.5	29
6	24.5	26	32.5
9; 10	24	25.5	32

Table 7: Determining constant K

	Gradient °C (or K) above the oil temperature												
	8	10	12	14	16	18	20	22	24	26	28	30	32
Heating current, I_h in A, ±5%	0.60	0.67	0.74	0.80	0.85	0.90	0.95	1.00	1.04	1.09	1.13	1.17	1.21

Table 8: Determining the gradient[1]

1 Only applies for temperature sensor types 1; 2; 2F; 5; 8; 22; 27 and for the measuring ranges A (0...+150 °C) and C (-20...+130 °C)

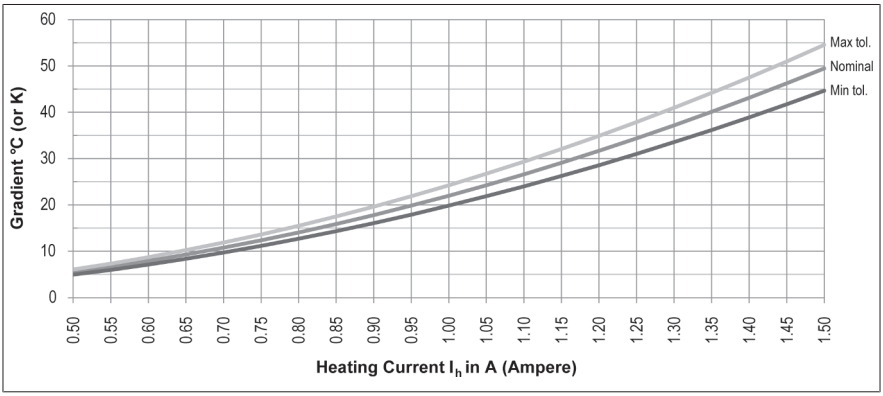


Figure 38: Determining the gradient[1]

Technical data

Max. heating current, I_h = 2.3 A continuous

Max. heating current, I_h = 10 A for 5 seconds

Thermal time constant: 9 minutes

The gradients are displayed for an oil temperature of 60 °C.

Verifying the gradient settings

To verify the gradient (temperature difference), proceed as follows:

✓ The housing cover is affixed to the device.

✓ Make sure that the temperature on the temperature sensor remains constant during the setting process.

1. Immerse the temperature sensor of the pointer thermometer in the oil bath or water bath.
2. Feed a constant current source (AC or DC) that equates to the desired temperature difference into the WTI heating element.
3. Read off the temperature displayed after 45 minutes.

» The gradient is the difference between the temperature read off and the starting temperature of the bath.

5.8.2 Setting the gradient via balancing resistor

1. Determine the necessary gradient in °C (or K) from the heating progression.
2. Check CT current (in amps) at 100% load.
3. Use the setting curve to determine at which point the curve of the determined CT current and the determined gradient cross.
   » The total resistance value of the terminals 5 - 5 is the resistance value (in ohms) on the y axis at this point.

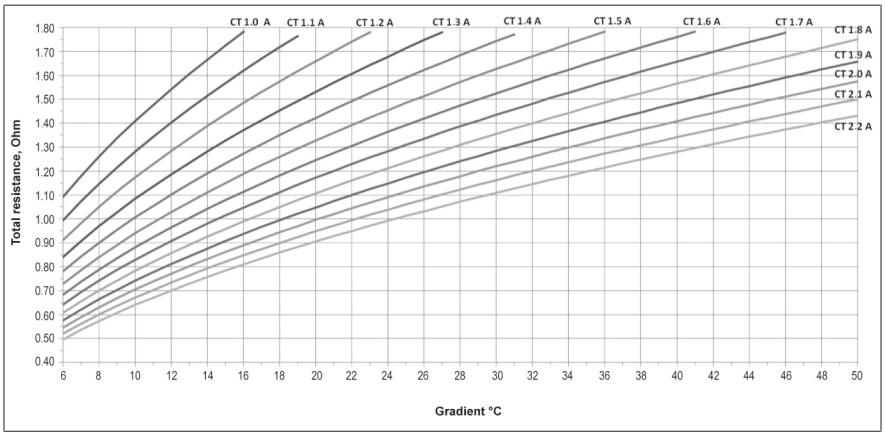


Figure 39: Resistance value setting curve[2]

4. Connect an ohmmeter to the terminals 5 - 5.
5. Adjust the MRB110-1 or MRB110-2 balancing resistor until the determined resistance value is reached.
6. Tighten the locknut when this value is reached.

Verifying the gradient settings

✓ The housing cover is affixed to the device.

1. Connect a constant current source (AC or DC) that is the same as the CT current at 100% load to the terminals 5 - 5.
2. Read off the temperature displayed after 45 minutes.

2 Only applies for temperature sensor types 1; 2; 2F; 5; 8; 22; 27 and for the measuring ranges A (0...+150 °C) and C (-20...+130 °C)

If adjustments to the gradient need to be made, proceed as follows:

› To reach a higher gradient, adjust in the direction of a higher resistance value.

OR

› To reach a lower gradient, adjust in the direction of a lower resistance value.

6 Maintenance, inspection and care

Maintenance

The device is maintenance-free.

Inspection

Depending on the conditions of use of the device and the national regulations in the respective country of use, the transformer manufacturers can specify different inspection intervals.

› Observe the inspection intervals defined in CIGRE Publication No. 445 "Guide for Transformer Maintenance" or the inspection intervals specified by the transformer manufacturer.

During occasional visual inspections of the transformer, you can inspect and clean the device as follows:

1. Clean the housing of the device with a dry cloth.
2. Ensure that the ventilation is free of dirt and deposits.
3. Check the device for external damage and contamination.

In the event of questions or irregularities, contact the Technical Service department:

Maschinenfabrik Reinhausen GmbH
MR Service & Complaint
Falkensteinstrasse 8
93059 Regensburg
Germany

E-mail: service@reinhausen.com

7 Disposal

Observe the national disposal regulations in the country of use.

7.1 SVHC information in accordance with the REACH regulation

This product complies with the provisions of European Regulation 1907/2006/EC dated December 18, 2006 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).

The following components of the product contain > 0.1% [w/w] of the SVHC substance lead (CAS no. 7439-92-1):

- Aluminum alloy
- Brass alloy
- Standard parts with a low property class

8 Technical data

Permissible ambient conditions	
Location of use	Indoors and outdoors, tropic-proof, arctic version
Ambient air temperature	-40...+70 °C (optional: arctic version to -60 °C)
Storage temperature	-40...+80 °C
Operating temperature	-40...+70 °C
Insulating fluid temperature	Measuring range ±20%
Relative humidity	Fog-free up to 80%
Installation altitude	Max. 2,000 m above mean sea level
Degree of protection	IP55 in accordance with IEC 60529 (optional: IP65)
Protection class	1
Overvoltage category	III
Contamination level	2 (within the device)

Basic materials	
Housing	Cast aluminum, powder coated, lacquered, RAL 7033 or 7038
Inspection window	Standard: Laminated safety glass with UV filter (optional: UV-stabilized polycarbonate)
Sensor screw connection	Quadratic 4-hole flange; G3/4″; G1"; 7/8″-14UNF; other screw connections on request
Cable gland	Up to 3x M20x1.5 and 1x M16 for the analog output

Specifications	
Isolation voltage	2.5 kV 50 Hz 1 min
Analog output	4...20 mA; 4...20 mA and 5 V DC; 5 V DC; Pt100

Measuring ranges (further measuring ranges on request)	Display accuracy
0...+150 °C	±3 K (optional ±2 K or ±1.5 K) in the range of 20...130 °C
-20...+130 °C	±3 K (optional ±2 K or ±1.5 K) in the range of 0...110 °C
0...+160 °C	±3 K (optional ±2 K or ±1.5 K) in the range of 20...140 °C
-40...+160 °C	±3 K in the range of -20...+140 °C

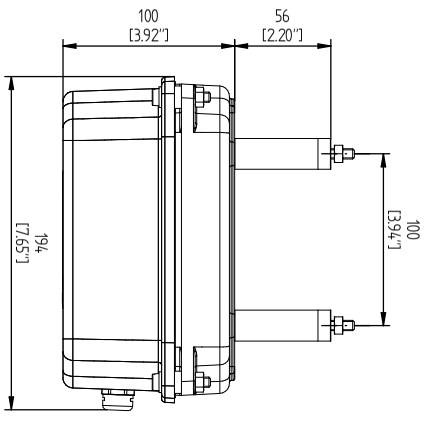
Dimensions and weight	
Dimensions	See dimensional drawings in the appendix
Weight	approx. 4 kg

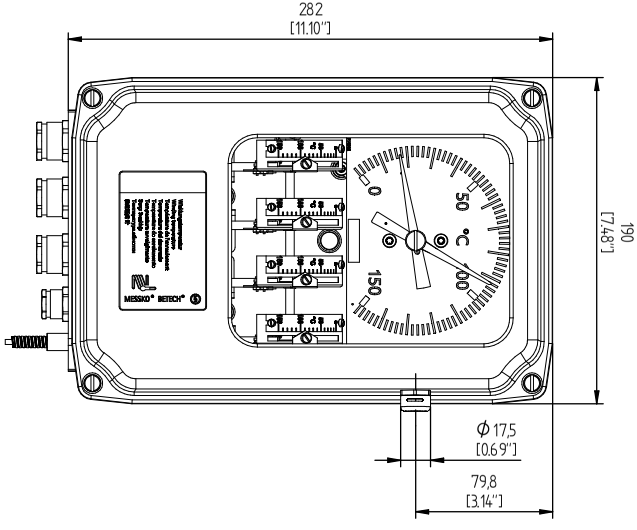
Micro-switches	
Quantity	2...6
Contact rating (switching capacity)	Standard SPDT 250 V AC / 15 A (optional: MBO SPDT 250 V AC/10 A or 250 V DC / 5 A, DPDT or SPDT gold switch)
Switching hysteresis	12 K ±2 K; others on request

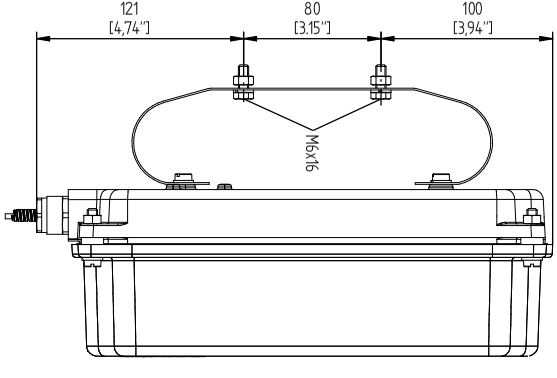
9 Appendix

	DATE	NAME	DOCUMENT NO.	
DFTR.	26.07.2023	SCHAEFERB	SED 9167569 000 01	
CHKD.	26.07.2023	KISTNERM	CHANGE NO.	SCALE
STAND.	26.07.2023	KLEYN	1123770	1:3

DIMENSION IN mm EXCEPT AS NOTED







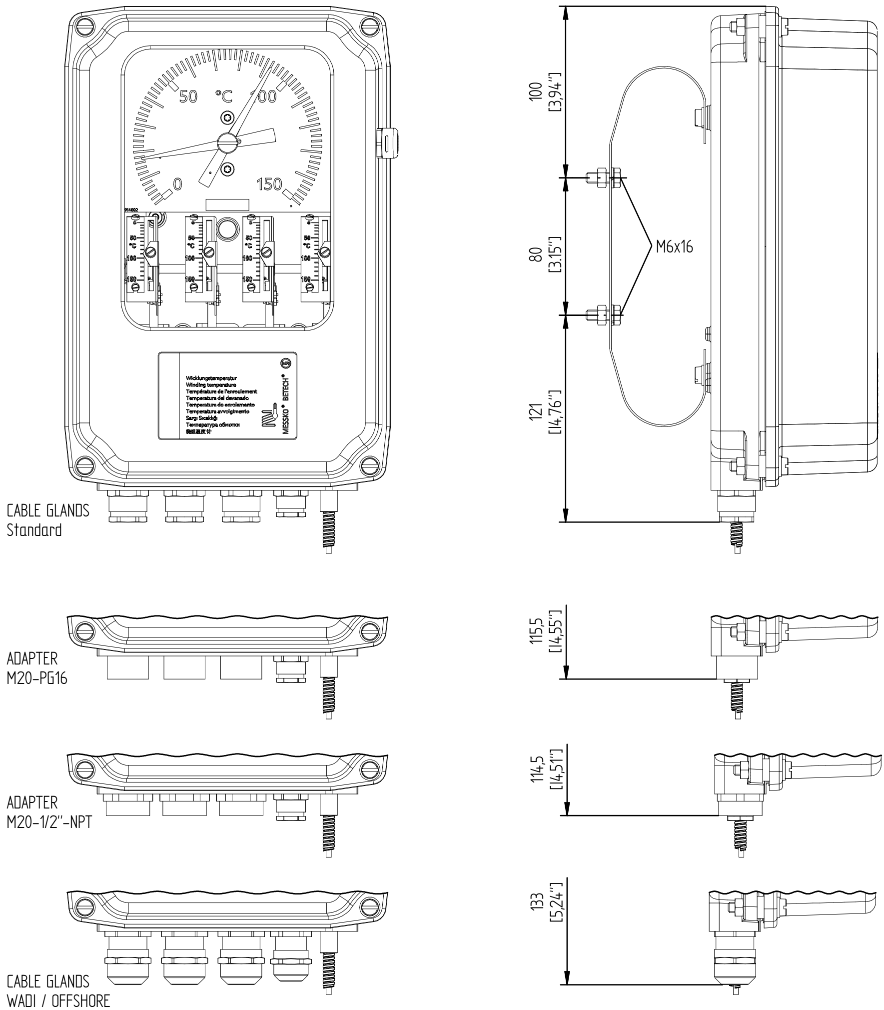
TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
638-0TI/4/1/2/6m/TT

SERIAL NUMBER

MATERIAL NUMBER
10173871 0M

SHEET
1 / 1

A4



	DATE	NAME	DOCUMENT NO.	
DFTR.	26.07.2023	SCHAEFERB	SED 9176753 000 01	
CHKD.	26.07.2023	KISTNERM	CHANGE NO.	SCALE
STAND.	26.07.2023	KLEYN	1123770	1:3

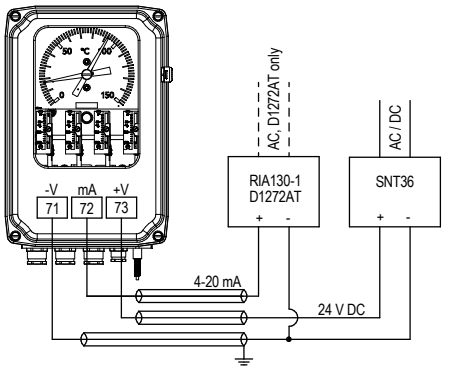
DIMENSION IN mm EXCEPT AS NOTED

TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
CABLE GLANDS

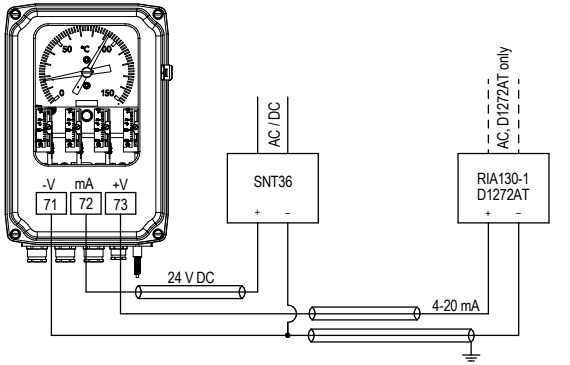
SERIAL NUMBER	
MATERIAL NUMBER	SHEET
101738720M	1/ 1

A4

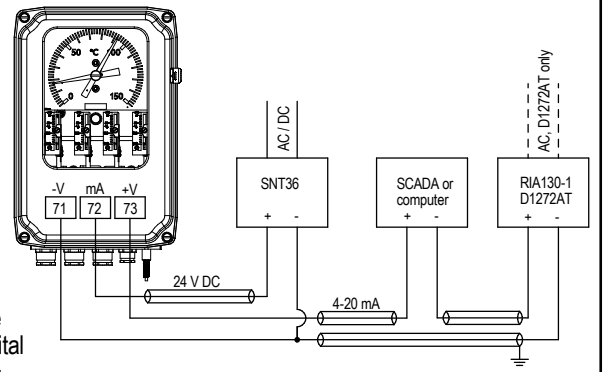
Installation Example A:



Installation Example B:
(SNT36 next to OTI/WTI and remote indicator further away)



Installation Example C:
(several loads in series)



Abbreviations:

SNT36 = Power Supply Unit
RIA = Remote Indicator Analogue
D1272AT = Remote Indicator Digital

For more details on these products please refer to separate operating instructions.

	DATE	NAME	DOCUMENT NO.	
DFTR.	26.07.2023	SCHAEFERB	SED 91724482 000 02	
CHKD	26.07.2023	KISTNERM	CHANGE NO.	SCALE
STAND	26.07.2023	KLEYN	1123770	1:6

DIMENSION IN mm EXCEPT AS NOTED

TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
ANALOGUE OUTPUT / 4-20 mA

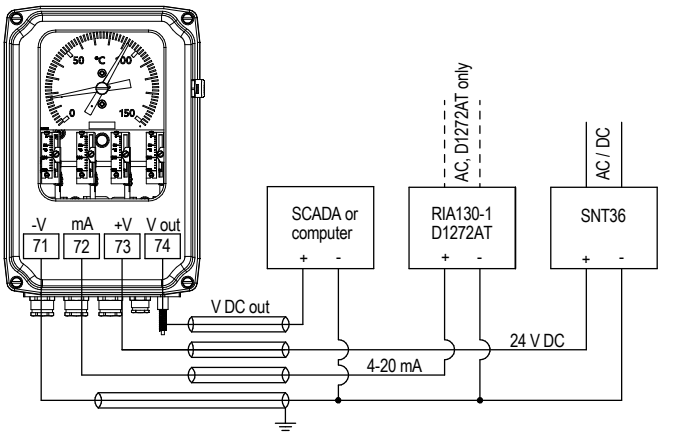
SERIAL NUMBER

MATERIAL NUMBER 101739660M

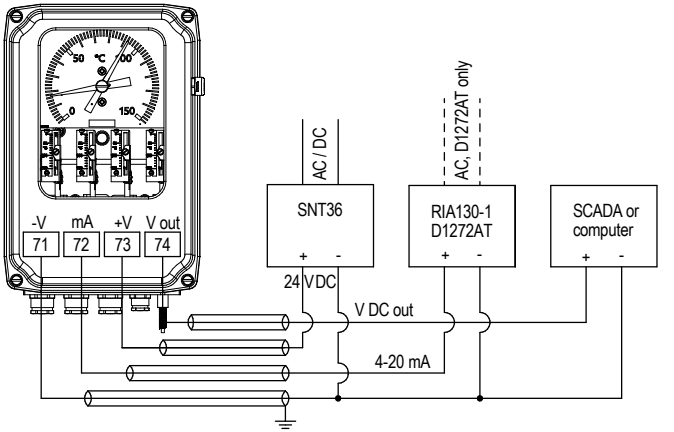
SHEET 1 / 1

A4

Installation Example A:



Installation Example B:
(SNT36 next to OTI/WTI and remote indicator and SCADA/computer further away)



Abbreviations:

SNT36 = Power Supply Unit
RIA = Remote Indicator Analogue
D1272AT = Remote Indicator Digital

For more details on these products please refer to separate operating instructions.

	DATE	NAME	DOCUMENT NO.	
DFTR.	26.07.2023	SCHAEFERB	SED 9185052 000 02	
CHKD.	26.07.2023	KISTNERM	CHANGE NO.	SCALE
STAND.	26.07.2023	KLEYN	1123770	1:5

DIMENSION IN mm EXCEPT AS NOTED

TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
ANALOGUE OUTPUT / 4-20 mA AND 0-5 VDC OUTPUT (OPTIONAL)

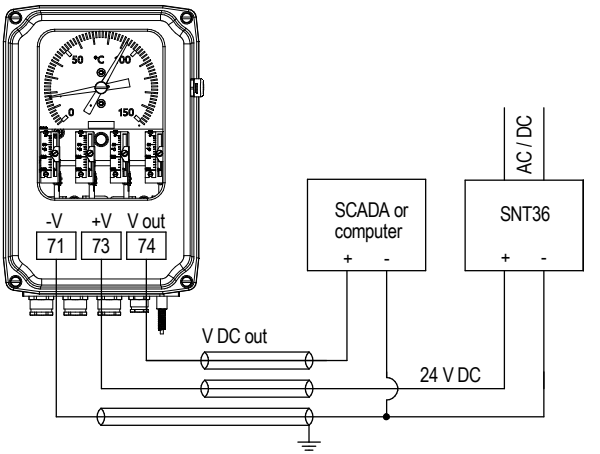
SERIAL NUMBER

MATERIAL NUMBER 101739900M

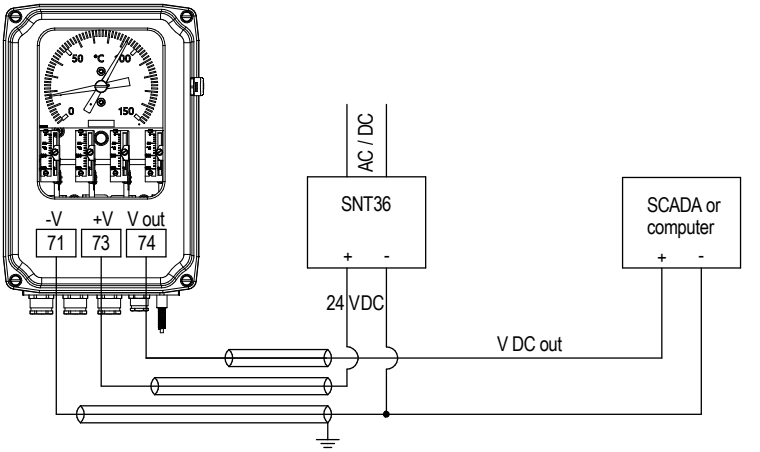
SHEET 1 / 1

A4

Installation Example A:



Installation Example B:
(SNT36 next to OTI/WTI and SCADA/computer further away)



Abbreviations:
SNT36 = Power Supply Unit
For more details on these products please refer to separate operating instructions.

	DATE	NAME	DOCUMENT NO.
DFTR.	26.07.2023	SCHAEFERB	SED 9185510 000 02
CHKD.	26.07.2023	KISTNERM	CHANGE NO. / SCALE
STAND.	26.07.2023	KLEYN	1123770 / 1:5

DIMENSION IN mm EXCEPT AS NOTED

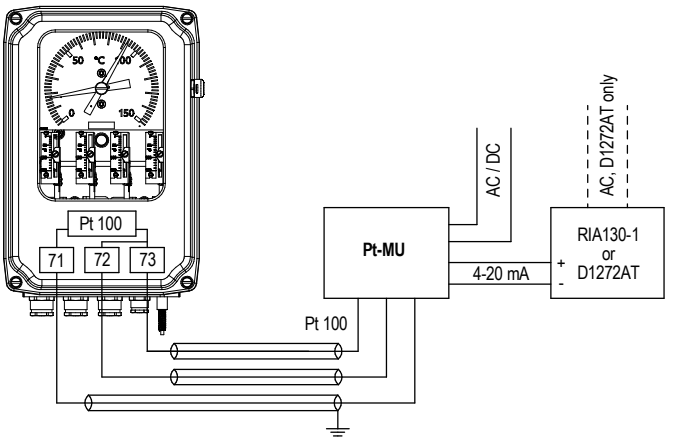
TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
ANALOGUE OUTPUT / 0 -5 VDC OUTPUT (OPTIONAL)

SERIAL NUMBER

MATERIAL NUMBER 101739950M | SHEET 1 / 1

A4

Installation Example:



Abbreviations:

RIA = Remote Indicator Analogue
D1272AT = Remote Indicator Digital
Pt-MU = Signal Transducer
MRB = Matching resistance

	DATE	NAME	DOCUMENT NO.
DFTR.	26.07.2023	SCHAEFERB	SED 9187251 000 02
CHKD.	26.07.2023	KISTNERM	CHANGE NO. / SCALE
STAND.	26.07.2023	KLEYN	1123770 / 1:5

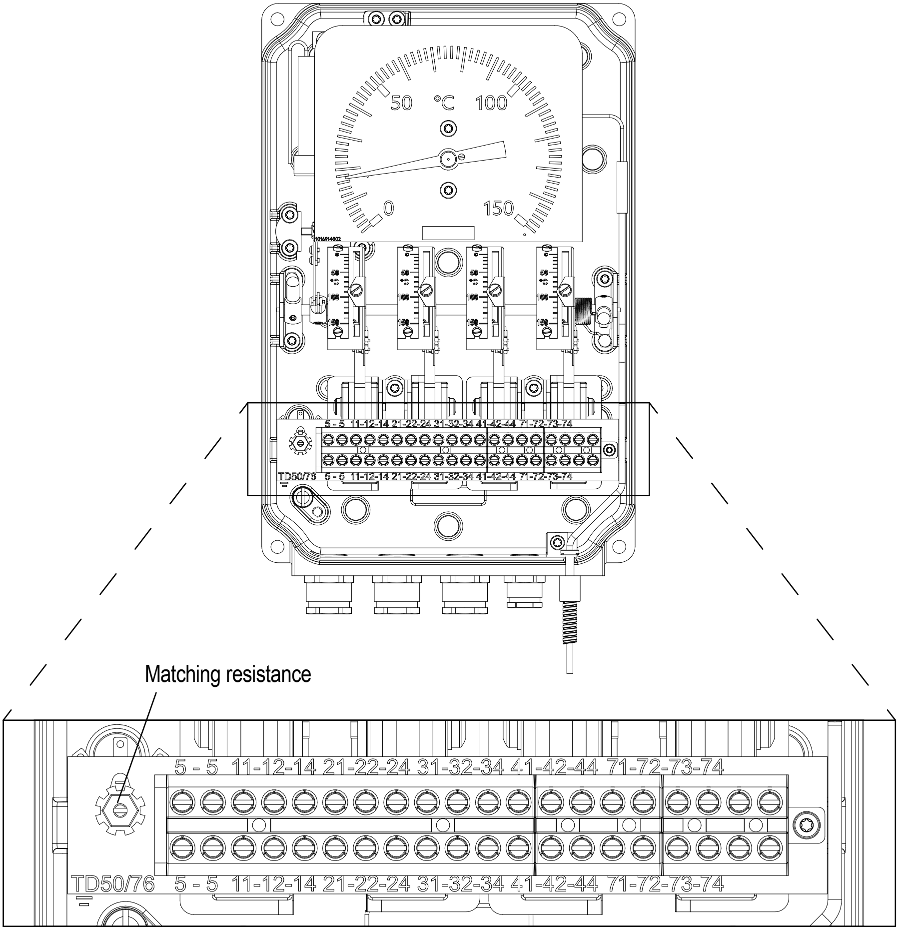
DIMENSION IN mm EXCEPT AS NOTED

TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
ANALOGUE OUTPUT / Pt100 OHM RESISTANCE SIGNAL (OPTIONAL)

SERIAL NUMBER

MATERIAL NUMBER 101739980M | SHEET 1 / 1

A4



	DATE	NAME	DOCUMENT NO.	
DFTR.	26.07.2023	SCHAEFERB	SED 9187491 000 01	
CHKD.	26.07.2023	KISTNERM	CHANGE NO.	SCALE
STAND.	26.07.2023	KLEYN	1123770	1:2,5

DIMENSION IN mm EXCEPT AS NOTED

TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
CONNECTION TERMINALS

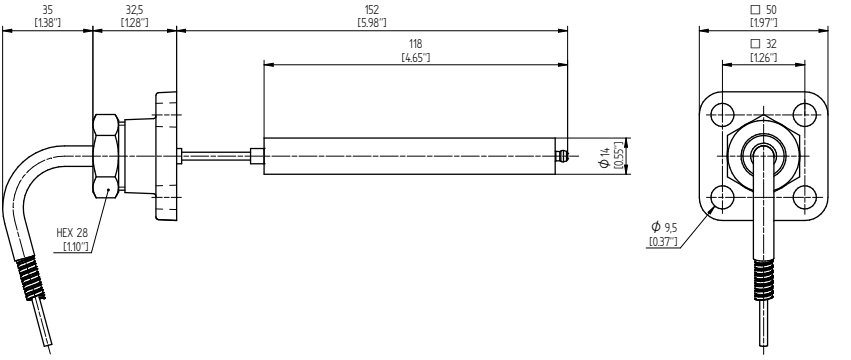
SERIAL NUMBER

MATERIAL NUMBER 101740040M

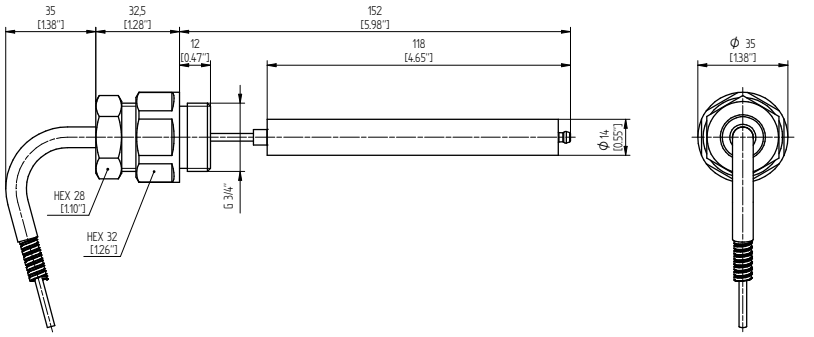
SHEET 1/ 1

A4

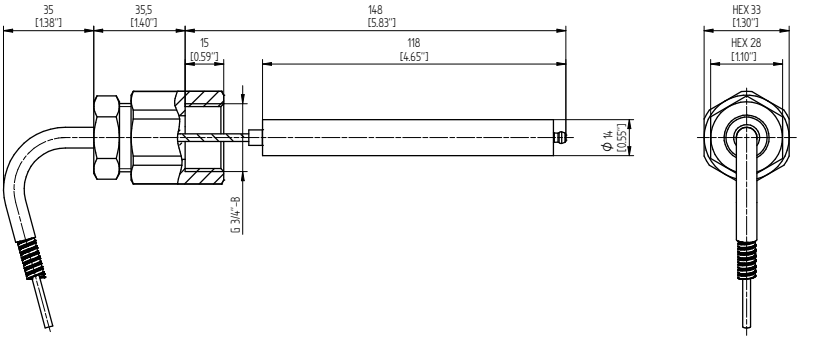
Dimensions bulb no. 1



Dimensions bulb no. 2



Dimensions bulb no. 2F



	DATE	NAME	DOCUMENT NO.	
DFTR.	14.12.2022	KISTNERM	SED 9190338 000 00	
CHKD	14.12.2022	SCHAEFFERB	CHANGE NO.	SCALE
STAND.	15.12.2022	KLEYN	1118823	1:2

DIMENSION IN mm EXCEPT AS NOTED

MR

TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
DIMENSIONS BULB NO. 1, 2, 2F

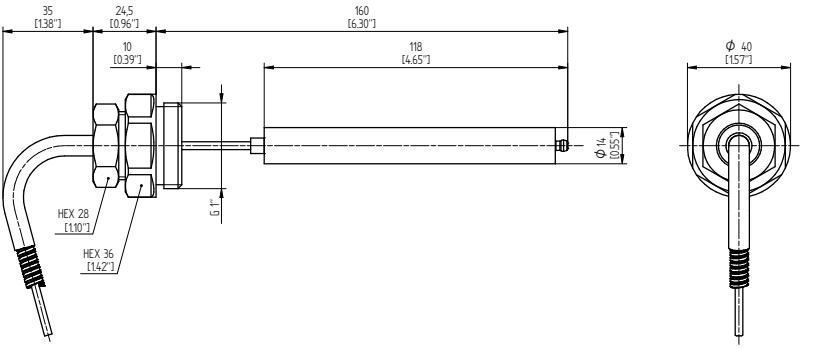
SERIAL NUMBER

MATERIAL NUMBER 101740210M

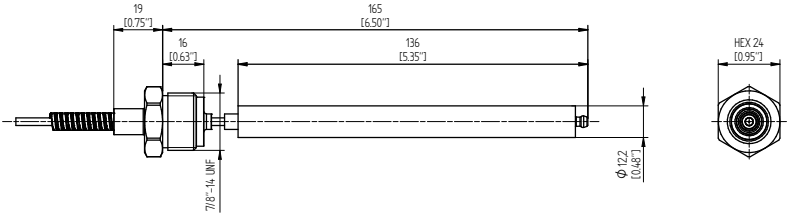
SHEET 1 / 1

A4

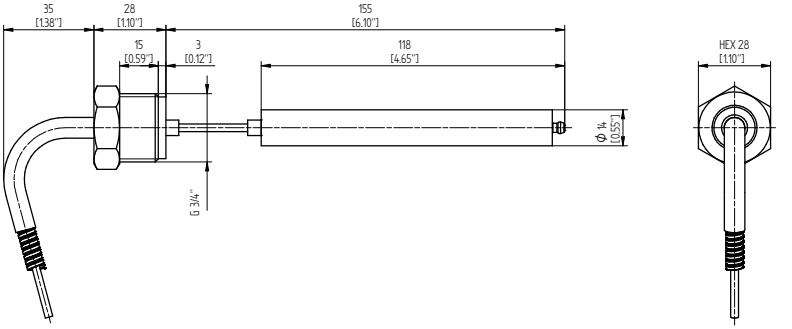
Dimensions bulb no. 5



Dimensions bulb no. 6



Dimensions bulb no. 8



	DATE	NAME	DOCUMENT NO.	
DFTR.	14.12.2022	KISTNERM	SED 9191121 000 00	
CHKD	14.12.2022	SCHAEFFERB	CHANGE NO.	SCALE
STAND	15.12.2022	KLEYN	1118823	1:2

DIMENSION IN mm EXCEPT AS NOTED

TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
DIMENSIONS BULB NO. 5, 6, 8

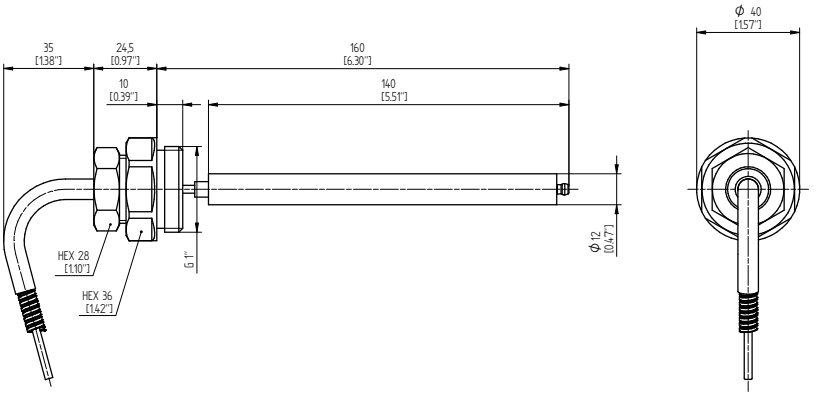
SERIAL NUMBER

MATERIAL NUMBER 101740250M

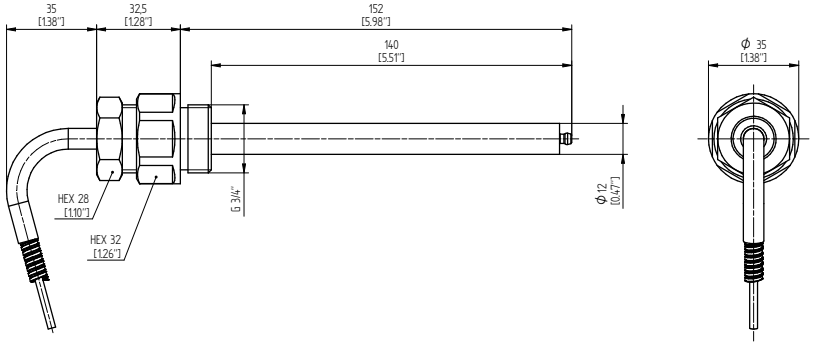
SHEET 1 / 1

A4

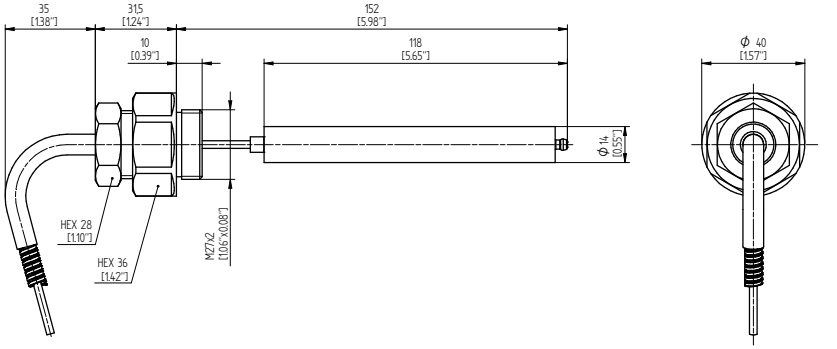
Dimensions bulb no. 9



Dimensions bulb no. 10



Dimensions bulb no. 27



	DATE	NAME	DOCUMENT NO.	
DFTR.	14.12.2022	KISTNERM	SED 9192789 000 00	
CHKD	14.12.2022	SCHAEFFERB	CHANGE NO.	SCALE
STAND.	15.12.2022	KLEYN	1118823	1:2

DIMENSION IN mm EXCEPT AS NOTED

MR

TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
DIMENSIONS BULB NO. 9, 10, 27

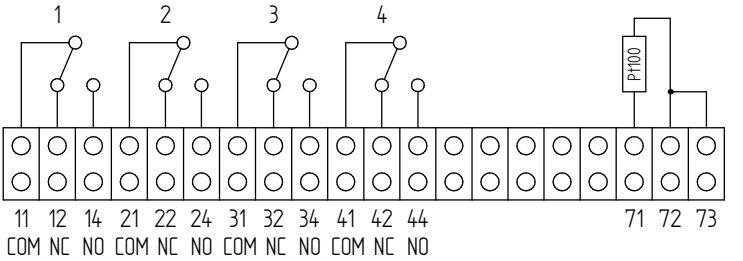
SERIAL NUMBER

MATERIAL NUMBER 101740280M

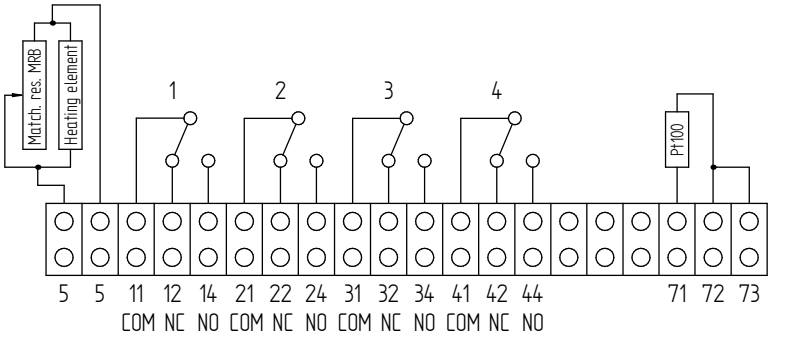
SHEET 1 / 1

A4

Wiring Diagram Example: OTI with 4 switches + Pt100



Wiring Diagram Example: WTI with 4 switches and MRB110 + Pt100



	DATE	NAME	DOCUMENT NO.	
DFTR.	14.12.2022	KISTNERM	SED 9198872 000 00	
CHKD	14.12.2022	SCHAEFERB	CHANGE NO.	SCALE
STAND.	15.12.2022	KLEYN	1118823	-

DIMENSION IN mm EXCEPT AS NOTED

TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
WIRING DIAGRAM EXAMPLE OTI / WTI 4 SWITCHES

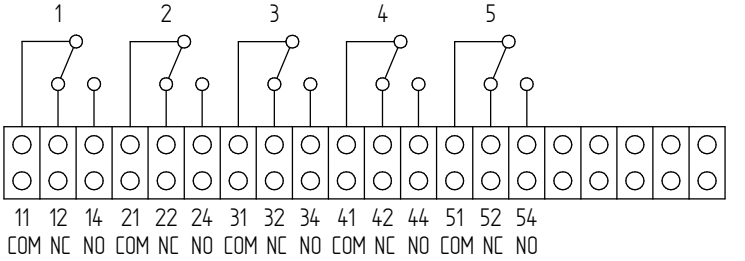
SERIAL NUMBER

MATERIAL NUMBER 101742510M

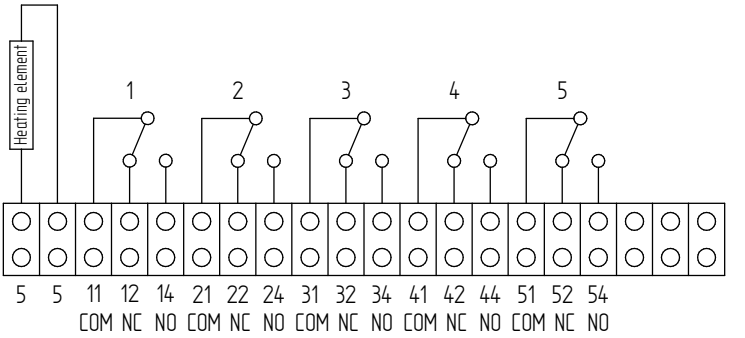
SHEET 1 / 1

A4

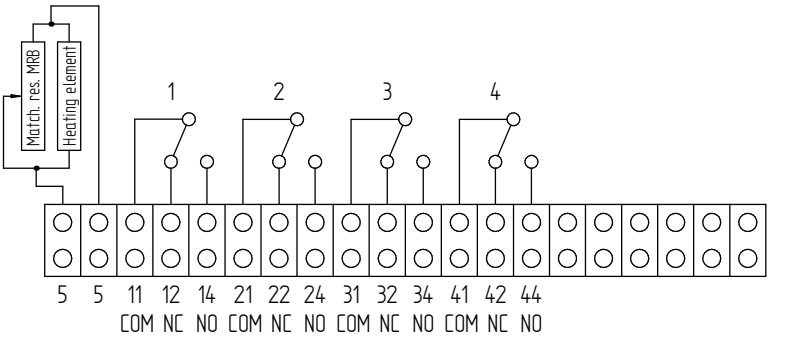
Wiring Diagram: OTI with 5 switches



Wiring Diagram: WTI with 5 switches



Wiring Diagram: WTI with 4 switches and MRB110



	DATE	NAME	DOCUMENT NO.	
DFTR.	14.12.2022	KISTNERM	SED 919894 7 000 00	
CHKD	14.12.2022	SCHAEFERB	CHANGE NO.	SCALE
STAND.	15.12.2022	KLEYN	1118823	-

DIMENSION IN mm EXCEPT AS NOTED

TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
WIRING DIAGRAM /OTI 5 SWITCHESWTI 4 SWITCHES + MRB110

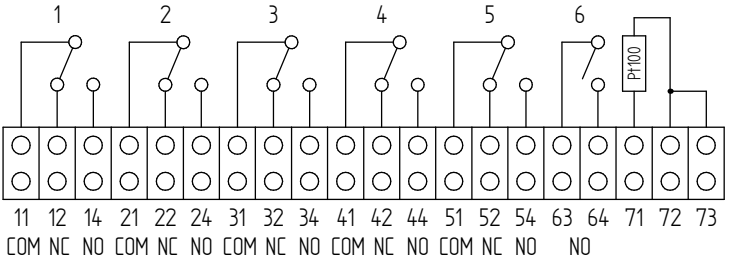
SERIAL NUMBER

MATERIAL NUMBER 101742490M

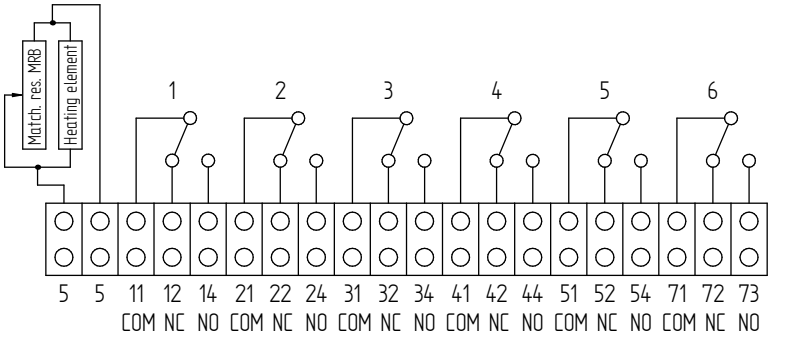
SHEET 1 / 1

A4

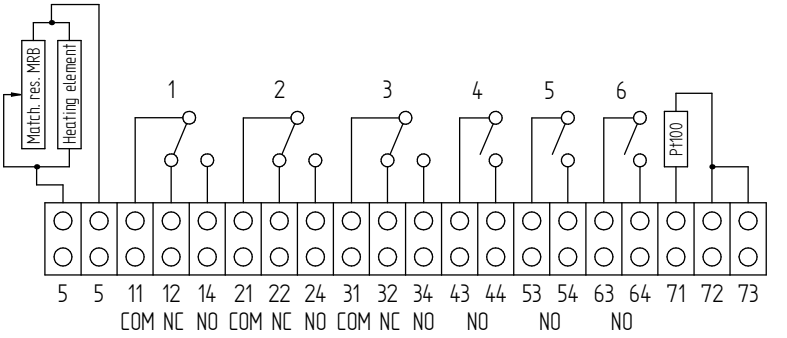
Wiring Diagram: OTI with 6 switches and Pt100



Wiring Diagram: WTI with 6 switches and MRB110



Wiring Diagram: WTI with 6 switches and MRB110 + Pt100



	DATE	NAME	DOCUMENT NO.	
DFTR.	19.01.2023	KISTNERM	SED 10098840 000 00	
CHKD	19.01.2023	SCHAEFFERB	CHANGE NO.	SCALE
STAND.	23.01.2023	WANNINGER	1118823	-

DIMENSION IN mm EXCEPT AS NOTED

TRANSFORMER ACCESSORIES
BETECH POINTER THERMOMETER
WIRING DIAGRAM/OTI 6 SWITCHES + MRB110 + PT100

SERIAL NUMBER

MATERIAL NUMBER 101748590M

SHEET 1 / 1

A4

Glossary

Ambient air temperature
Permissible temperature of the air in the surroundings of the equipment in operation on which the device is installed.

EMC
Electromagnetic compatibility

Insulating fluid temperature
Permissible temperature of the insulating fluid in the product or directly on the product.

Operating temperature
Permissible temperature in the immediate surroundings of the device during operation taking ambient influences, for example due to the equipment and installation location, into consideration.

SCADA
Technical processes are monitored and controlled using a computer system (Supervisory Control and Data Acquisition)

Storage temperature
Permissible temperature for storing the device in an unmounted state or in a mounted state so long as the device is not in operation.

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9181336/00 EN - MESSKO® BETECH® Operating instructions - F0413100 - 10/23

THE POWER BEHIND POWER.