MESSKO® BeTech
POINTER THERMOMETER

Operating Instructions
Contents

1 Safety .................................................. 4
  1.1 Safety instructions ........................................ 4
  1.2 Intended use .............................................. 4
  1.3 Important notes on equipment operation .............. 4

2 Product specification ................................. 4
  2.1 BeTech Oil temperature indicator ..................... 4
  2.2 BeTech Winding temperature indicator ............... 4
  2.3 TT version (option) ..................................... 5
  2.4 Pt 100 version (option) ................................ 5

3 Installation ............................................. 5
  3.1 Mounting the device ..................................... 5
  3.2 Capillary tube ........................................... 5
  3.3 Pockets .................................................. 5
  3.4 Kick protection ........................................... 5

4 Electrical connection ................................. 6
  4.1 Connecting the microswitches ......................... 6
  4.2 Analog output 4 - 20 mA current loop signal ....... 6
  4.3 Analog output 4 - 20 mA current loop signal and 0 - 5 V DC Voltage output ................. 7
  4.4 Analog output 0 - 5 V DC Voltage output ........... 8
  4.5 Analog output Pt 100 Ohm resistance signal ....... 9
  4.6 Switch settings .......................................... 10
  4.7 Switch setting check ................................... 10

5 Calibration ............................................... 10
  5.1 Calibration check ...................................... 10

6 Adjustment of the gradient ......................... 11
  6.1 Adjustment via heating current ................... 11

6.2 Adjustment via built-in Matching Resistance MRB110-1 or MRB110-2 .................... 12

7 Technical data .......................................... 13

8 Appendix ............................................... 14
  8.1 Dimensions ............................................. 14
  8.2 Analogue Output / 4 - 20 mA Current Loop Signal ............ 15
  8.3 Analogue Output / 4 - 20 mA Current Loop Signal and 0 - 5 V DC Voltage output ...... 16
  8.4 Analogue Output / 0 - 5 V DC Voltage output ........ 17
  8.5 Analogue Output / Pt100 Ohm resistance signal .......... 18
  8.6 Wiring diagram / OTI 5 switches and WTI 5 switches and WTI 4 switches + MRB110 .... 19
  8.7 Connection terminals .................................. 20
  8.8 Dimensions bulb no. 1 ................................. 21
  8.9 Dimensions bulb no. 2 ................................. 21
  8.10 Dimensions bulb no. 2F ............................... 21
  8.11 Dimensions bulb no. 5 ................................. 21
  8.12 Dimensions bulb no. 6 ................................. 22
  8.13 Dimensions bulb no. 8 ................................. 22
  8.14 Dimensions bulb no. 9 ................................. 23
  8.15 Dimensions bulb no. 10 ................................ 23
  8.16 Dimensions bulb no. 27 .............................. 23

NOTE

Data contained herein may differ in details from the equipment delivered.
We reserve the right to make alterations without notice.

Please keep this manual for future reference!
1 Safety

1.1 Safety instructions

All personnel involved in installation, commissioning, operation or maintenance of this equipment must:
- be suitably qualified and
- strictly observe these operating instructions.

Improper operation or misuse can lead to
- serious or fatal injury,
- damage to the equipment and other property of the user
- a reduction in the efficiency of the equipment.

Safety instructions in this manual are presented in three different forms to emphasize important information.

WARNING
This information indicates particular danger to life and health. Disregarding such a warning can lead to serious or fatal injury.

CAUTION
This information indicates particular danger to the equipment or other property of the user. Serious or fatal injury cannot be excluded.

NOTE
These notes give important information on a certain issue.

1.2 Intended use

MESSKO® BeTech Oil and Winding temperature indicators are used to measure temperatures on power and distribution transformers, reactors or similar equipment.

They always consist of a temperature sensor which is connected to the bellow type measuring device with a capillary tube.

The measuring device is equipped with a pointer which turns to show the temperature on a scale. The measuring system consisting of sensor, capillary tube. The measuring device is non pressurized and filled with a liquid.

CAUTION
Installation, electrical connection, commissioning, and maintenance of the device may only be carried out by qualified, skilled personnel and only in accordance with these operating instructions.

It is the responsibility of the user to make sure that the device is used for the specified application only.

For safety reasons, any未经授权 and improperly executed work, i.e. installation, modification, alteration of the equipment, electrical connection, or commissioning of the equipment, are forbidden without first consulting MESSKO!

Electrical installation is subject to the relevant national safety regulations. It is imperative to connect the ground wire in order to ensure trouble-free operation.

2 Product specification

MESSKO® BeTech Oil and Winding temperature indicators are used to measure temperatures on power and distribution transformers, reactors or similar equipment.

They always consist of a temperature sensor which is connected to the bellow type measuring device with a capillary tube.

The measuring device is equipped with a pointer which turns to show the temperature on a scale. The measuring system consisting of sensor, capillary tube. The measuring device is non pressurized and filled with a liquid.

CAUTION
Measuring instruments are sensitive. All parts should therefore be protected against falling and against knocks and vibrations.

The capillary tube may not be shortened otherwise the measuring system will be damaged.

2.1 BeTech Oil temperature indicator

Pointer thermometers with up to five adjustable microswitches for indicating the oil temperature. The indicated temperature is the oil temperature on the sensor of the device. The mechanical measuring system functions independently and requires no power input.

2.2 BeTech Winding temperature indicator

Pointer thermometers with up to five adjustable microswitches for indicating the winding temperature (thermal image). The temperature rise between cooling liquid
(oil) and winding depends on the current in the winding. The secondary current of the transducer is proportional to the current in the winding. This transducer feeds a heating element inside the mechanical thermometer. That causes an increasing indication (gradient) of the measured oil temperature according to the transformer load.

The pointer thermometer with heating element (chapter 6.1) has to be adjusted by setting the heating current.

The type with heating element and built-in matching resistance MRB110-1 or MRB110-2 (chapter 6.2) has to be adjusted by setting the resistor.

2.3 TT version (option)
These devices are additionally equipped with a sensor which converts the temperature value into an electrical signal (4 to 20 mA and/or 0 to 5 V DC). The sensor requires a power supply (24 V DC).

2.4 Pt100 version (option)
In this device the simulated Pt100 Ohm resistance output is linear and proportional to the indicated temperature on the instrument dial.

3 Installation
3.1 Mounting the device

⚠️ CAUTION
The operating and installation conditions demanded by this installation and operating instructions must be strictly complied with.

Anti-vibration mountings are included in the delivery and must be used to prevent mechanical wear of the instruments.

3.2 Capillary tube (Fig. 1/8)
Never carry the thermometer by the capillary tube. Do not twist or bend it too sharply. The minimal bending radius is 25 mm. Clamp the capillary at approx. 400 mm intervals. Any excess capillary should be wound into a spiral with diameter of minimum 200 mm.

3.3 Pockets
Oil filled pockets should not be over-filled – leave 15% space for thermal expansion of the oil, once the bulb is inserted into the pocket. Make sure the gasket or seal is appropriate.

3.4 Kick protection
For safety reasons the bulbs are provided with a built-in kick protection.
4 Electrical connection

**4.1 Connecting the microswitches**

To connect the microswitches open the housing via the four screws of the housing cover (Fig. 1/2). Remove the outer sheaths of the connecting cables to a length of approx. 160 mm and then the insulation of the individual conductors to a length of approx. 6 mm. Install the cable glands provided loosely to the incoming cables and housing.

Pay close attention to cable gland assembly and ensure that the seal is properly fitted to avoid any water ingress. Connect the incoming wiring to the terminal strip (Appendix, chap. 8.7) in accordance with the connection diagram (Appendix, chapter 8.2 - 8.6).

**4.2 Analog output 4 - 20 mA current loop signal** (see also chapter 8.2 for installation examples)

This analogue output is an optional feature to the MESSKO® BeTech Oil and Winding Temperature Indicators. The output is linear and proportional to the indicated temperature on the instrument dial, where 4 mA is provided at the lowest value on the dial and 20 mA at the highest value, for instance 4 mA at 0 °C and 20 mA at 150 °C (see graph).

The output can be used for several purposes such as connection to a computer, to a SCADA system or for remote monitoring by Remote Analogue or Digital Indicators. Because of the high load allowed, the same output can be used for more than one purpose at the same time.

Since the output is provided from the indication, the same temperature is displayed both locally and remotely - no differences because of settings etc as if separate transmitters are used.

The electrical wiring is easily connected to the terminal board inside the OTI or WTI (see appendix, chapter 8.2).

---

**CAUTION**

When closing the housing tighten the screws with a torque of max. 1 Nm.

---

**WARNING**

Electrical voltages, danger to life!

All connecting wiring must be free of voltage before opening the device.
A separate shielded cable is recommended for the wiring to the 4 - 20 mA analogue output. This includes the Supply Voltage and the mA output signal (= terminals 61, 62 and 63). No other signals should be wired through the same cable and make sure the shield is connected to ground on one side only.

### 4.3 Analog output 4 - 20 mA current loop signal and 0 - 5 V DC Voltage output (see also chapter 8.3 for installation examples)

This analogue output is an optional feature to the MESSKO® BeTech Oil and Winding Temperature Indicators. There are two outputs provided, both are linear and proportional to the indicated temperature on the instrument dial, where 4 mA and 0 V DC is provided at the lowest value on the dial and 20 mA and 5 V DC at the highest value (see graph).

The outputs can be used for several purposes such as connection to a computer, to a SCADA system or for remote monitoring by Remote Analogue or Digital Indicators. A common installation is to use the mA signal for remote monitoring and the V DC output for a SCADA or computer connection.

Since the outputs are provided from the indication, the same temperature is displayed both locally and remotely - no differences because of settings etc as if separate transmitters are used.

The electrical wiring is easily connected to the terminal board inside the OTI or WTI (see appendix, chapter 8.3). A separate shielded cable is recommended for the wiring to this analogue output. This includes the Supply Voltage and the mA and V DC output signals (= terminals 61, 62, 63 and 64). No other signals should be wired through the same cable and make sure the shield is connected to ground on one side only.

If only the Voltage output is to be used, the mA output must remain short circuited. Please leave the clamp in place on terminals 61 and 62.

---

**CAUTION**

The terminals 61, 62, 63 and 64 must be short-circuited during insulation test. The test voltage must be raised gradually. Remove the clamps on the terminal board once the tests are finished.
4.4 Analog output 0 - 5 V DC Voltage output (see also chapter 8.4 for installation examples)

This analogue output is an optional feature to the MESSKO® BeTech Oil and Winding Temperature Indicators. The output is linear and proportional to the indicated temperature on the instrument dial, where 0 V DC is provided at the lowest value on the dial and 5 V DC at the highest value, for instance 0 V DC at 0 °C and 5 V DC at 150 °C (see graph/Fig. 5).

The output can be used for several purposes such as connection to a computer, to a SCADA system or perhaps for remote monitoring. Commonly the V DC output is used for a SCADA or computer connection.

Since the outputs are provided from the indication, the same temperature is displayed both locally and remotely - no differences because of settings etc as if separate transmitters are used.

The electrical wiring is easily connected to the terminal board inside the OTI or WTI (see appendix, chapter 8.4).

⚠️ CAUTION

The terminals 61, 63 and 64 must be short-circuited during insulation test. The test voltage must be raised gradually. Remove the clamps on the terminal board once the tests are finished.

A separate shielded cable is recommended for the wiring this analogue output. This includes the Supply Voltage and the V DC output signal (= terminals 61, 63 and 64). No other signals should be wired through the same cable and make sure the shield is connected to ground on one side only.

![Output signal vs. temperature, example](image)

Fig. 5
4.5 Analog output Pt100 Ohm resistance signal (see also chapter 8.5 for installation examples)

This analogue output is an optional feature to the MESSKO® BeTech Oil and Winding Temperature Indicators. The simulated Pt100 Ohm resistance output is linear and proportional to the indicated temperature on the instrument dial. For typical resistance values - please see graph and table.

The output can be used for several purposes such as connection to a computer, to a SCADA system or for remote monitoring. This output is provided with a 3-wire connection as standard, to facilitate compensation for wire resistance etc. Often the output is connected to the Signal Transducer Pt-MU for transmission over longer distances.

Since the output is provided from the indication, the same temperature is displayed both locally and remotely - no differences because of settings etc. as if separate transmitters are used.

The electrical wiring is easily connected to the terminal board inside the OTI or WTI - (see appendix, chapter 8.5).

![Output signal vs. temperature, example](image)

<table>
<thead>
<tr>
<th>Temperature [° C]</th>
<th>Resistance Value [Ohm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100.00</td>
</tr>
<tr>
<td>25</td>
<td>109.73</td>
</tr>
<tr>
<td>50</td>
<td>119.40</td>
</tr>
<tr>
<td>100</td>
<td>138.50</td>
</tr>
<tr>
<td>150</td>
<td>157.31</td>
</tr>
</tbody>
</table>

CAUTION

The terminals 61, 62 and 63 must be short-circuited during insulation test. The test voltage must be raised gradually. Remove the clamps on the terminal board once the tests are finished.

A separate shielded cable is recommended for the wiring to this analogue output. This includes all the terminals 61, 62 and 63. No other signals should be wired through the same cable and make sure the shield is connected to ground on one side only.
4.6 Switch settings
The switches are individually adjustable and can be set to any temperature on the individual scale, regardless of other switch settings. The setting is done in the following steps:

a. Loosen the set screw on the orange pointer
b. Rotate the drum while holding the set screw in position until the orange pointer points at the desired temperature setting on the scale.
c. Tighten the set screw in this position.
d. Check the switch setting as per below.

4.7 Switch setting check
Keep the instrument in vertical position and turn the shaft with the drums towards higher temperatures (check that the pointer for the indication moves this way) and check that contact is obtained at the desired value. If necessary please re-adjust the setting.

5 Calibration

```
CAUTION
Do not turn the shaft of the drums in the other direction, since calibration may change.
```

Every instrument is factory calibrated so no additional calibration is necessary. This applies for all functions, including Indication, Switches and Analogue Output if applicable.

5.1 Calibration check
Put the bulb (completely) in boiling water and check the reading after 15 minutes. If the error is larger than the stated tolerance (like ±3 °C) please contact your local representative or the manufacturer. As an alternative to boiling water a well-stirred (oil) bath of min 5 l volume with control thermometer or the MESSKO® Calibration Bath can be used.
6 Adjustment of the gradient for Winding Temperature Indicator WTI

6.1 Adjustment via heating current

A) Gradient

The gradient is the temperature rise above oil temperature for the Winding Temperature Indicator, WTI. The WTI is showing a Thermal Image of the transformer winding temperature.

B) Calculation

You can use the graphs or the table to get the gradient - or calculate the temperature rise as:

\[ G = K \times I_h^2 \]

where

- \( G \) = the gradient (°C)
- \( I_h \) = the heating current (A)
- \( K \) = a constant which is depending on the bulb type.

C) Technical data

Max heating current, \( I_h = 2.3 \) A continuously
Max heating current, \( I_h = 10 \) A for 5 seconds
Thermal time constant: 9 minutes
The gradients are shown for oil temperature 60°C

D) Verification

To verify the gradient (temperature rise), please:
- Keep the sensing bulb at a constant temperature during the test, preferably in an oil or water bath
- Feed a stable current (AC or DC) to the WTI heating element, corresponding to the required temperature rise
- Keep the instrument cover mounted on the instrument
- Wait 45 minutes before checking the temperature indication
- The difference between the final temperature and the temperature of the bath is the gradient
6.2 Adjustment via built-in Matching Resistance MRB110-1 or MRB110-2

A) Determine the required gradient in °C (or K) (from the heat-run tests).

B) Check the current (in Amps) from the CT at 100% load.

C) Follow the line for the CT current to where the gradient on the x-axis cuts the line.

D) Check the resistance value (in Ohms) on the y-axis for this point. This is the total resistance value over terminals 5 – 5 (meaning the resistance of the heating element in parallel with the matching resistance) (refer to chapter 8.6, Figure 14).

E) Connect an Ohm-meter to terminals 5 – 5 and adjust the Matching Resistance MRB110-1 or MRB110-2 until the determined resistance value is reached. Secure the lock-nut to this value.

F) With this setting you should reach the required gradient for the 100% CT current you have chosen.

G) To verify the setting, please feed a stable current (AC or DC) equivalent to the 100% CT current to the terminals 5 – 5, keep the instrument cover on the instrument and wait 45 minutes before verifying the reading and the achieved temperature gradient. If adjustments of the gradient are necessary please adjust:
   a. towards a higher resistance value to get a higher gradient
   b. towards a lower resistance value to get a lower gradient

H) For more details please also refer to chapter 6.1.

Fig. 8 Temperature gradient graph for bulb types 1, 2, 2F, 5, 8, 22, 27 and measuring ranges 0...150 °C and -20...130 °C
7 Technical data

**Dimensions**
Refer to chap. 8.1

**Materials**

- **Housing:** Die casted aluminium, polyester powder coated, RAL 7033
- **Viewing glass:** Laminated safety glass (standard); UV stabilized polycarbonate (optional)
- **Capillary tube:** Square flange 4 holes; G3/4"; G1"; 7/8"-14UNF; other thread joints on request
- **Cable glands:** Up to 3 x M20 x 1.5 and 1 x M16 for analogue output

**Specifications**

- **Measuring ranges:**
  - 0...150 °C or -20...130 °C or 0...160 °C or -40...160 °C;
  - other ranges on request
- **Indication accuracy:** ± 3 °C (30-150 °C)
  - (optional: ± 2 °C or 1.5 °C)
- **Place of installation:** Indoors and outdoors, tropical and arctic climate
- **Ambient temperature:** -40 ... +70 °C
  - (optional: polar execution down to -60 °C)
- **Insulation voltage:** 2.5 kV 50 Hz 1 min
- **Protection class:** IP 55 in accordance with IEC 60 529;
  - (optional: IP 65)
- **Analog output:** 4-20 mA; 4-20 mA and 5 V DC; 5 V DC; Pt100
- **Weight:** Approx. 4 kg

**Microswitches**

- **Number:** 2, 3, 4 or 5
- **Switch rating:**
  - Standard SPDT 250 V AC / 15 A;
  - (optional: MBO SPDT 250 V AC/10 A or 250 V DC / 5 A, DPDT or gold plated SPDT)
- **Switch hysteresis:** 12 °C ± 2 °C; others on request
8.1 Dimensions

Fig. 9
8.2 Analogue Output / 4 - 20 mA Current Loop Signal (optional)

**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.

Fig. 10
8.3 Analogue Output / 4 - 20 mA Current Loop Signal and 0 - 5 V DC Voltage output (optional)

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.
8.4 Analogue Output / 0 - 5 V DC Voltage output (optional)

Installation Example A:

![Diagram of Installation Example A]

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

![Diagram of Installation Example B]

Abbreviations:
SNT36 = Power Supply Unit

For more details on this product please refer to separate operating instructions.
8.5 Analogue Output / Pt100 Ohm resistance signal (optional)

Installation Example:

Wiring Diagram Example: OTI with 4 switches + Pt100

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

Abbreviations:
RIA = Remote Indicator Analogue
D1272AT = Remote Indicator Digital
Pt-MU = Signal Transducer
MRB = Matching resistance
8.6 Wiring diagram / OTI 5 switches and WTI 5 switches and WTI 4 switches + MRB110 (optional)

**OTI with 5 switches**

```
11 12 14 21 22 24 31 32 34 41 42 44
C  NC NO C  NC NO C  NC NO C  NC NO
```

**WTI with 5 switches**

```
5 5 11 12 14 21 22 24 31 32 34 41 42 44
C  NC NO C  NC NO C  NC NO C  NC NO
```

**WTI with 4 switches and MRB110**

```
5 5 11 12 14 21 22 24 31 32 34 41 42 44
C  NC NO C  NC NO C  NC NO C  NC NO
```

Fig. 14
8.7 Connection terminals

Fig. 15
8.8 Dimensions bulb no. 1

8.9 Dimensions bulb no. 2

8.10 Dimensions bulb no. 2F
8.11 Dimensions bulb no. 5

Fig. 19

8.12 Dimensions bulb no. 6

Fig. 20

8.13 Dimensions bulb no. 8

Fig. 21
8.14 Dimensions bulb no. 9

8.15 Dimensions bulb no. 10

8.16 Dimensions bulb no. 27