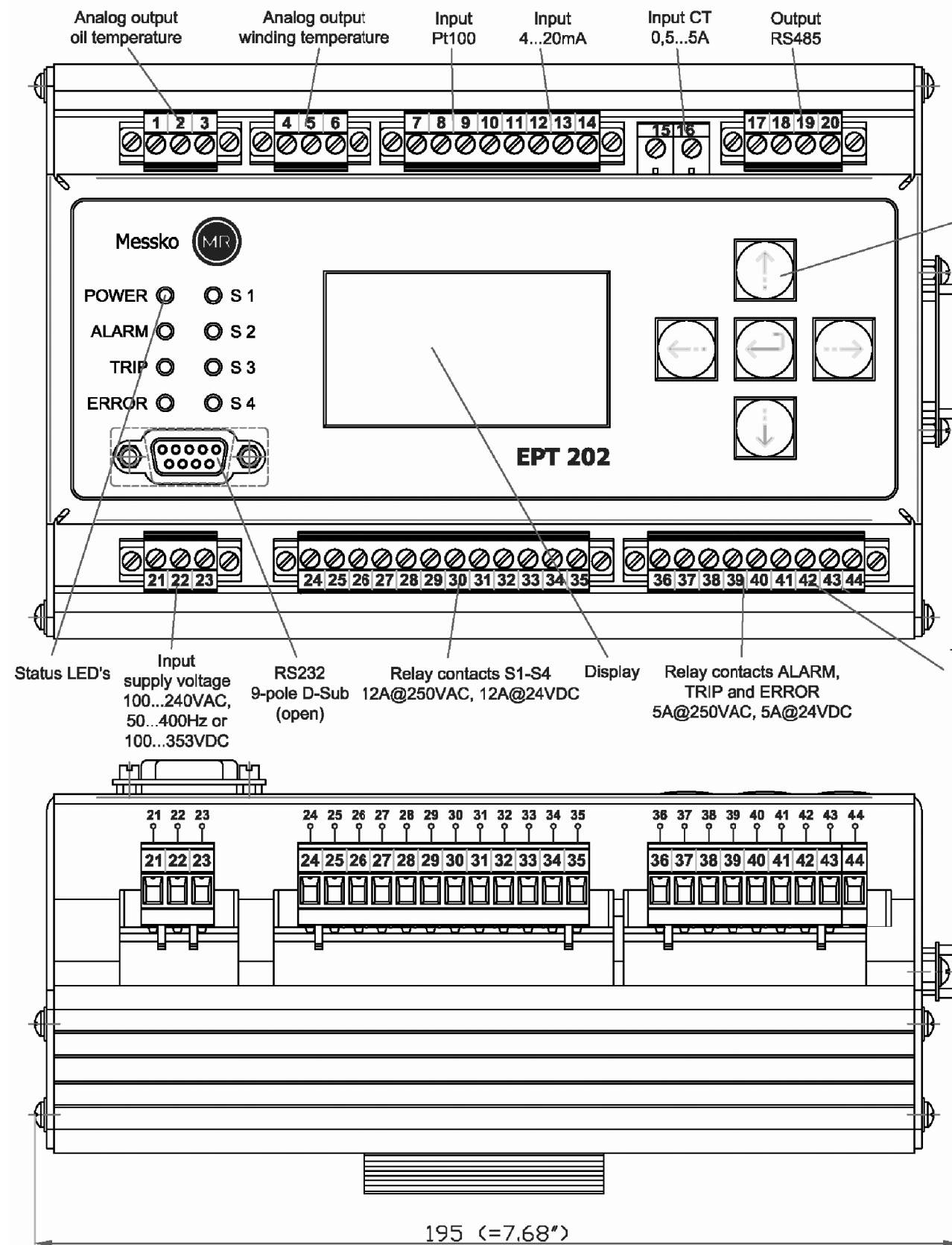
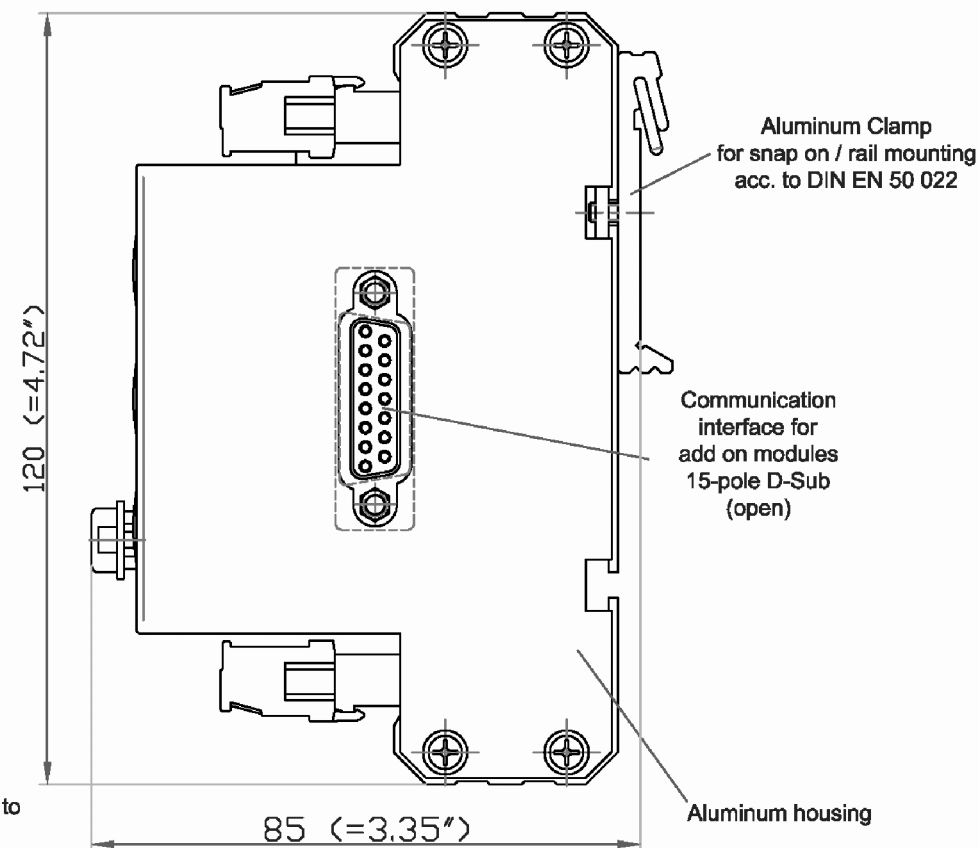


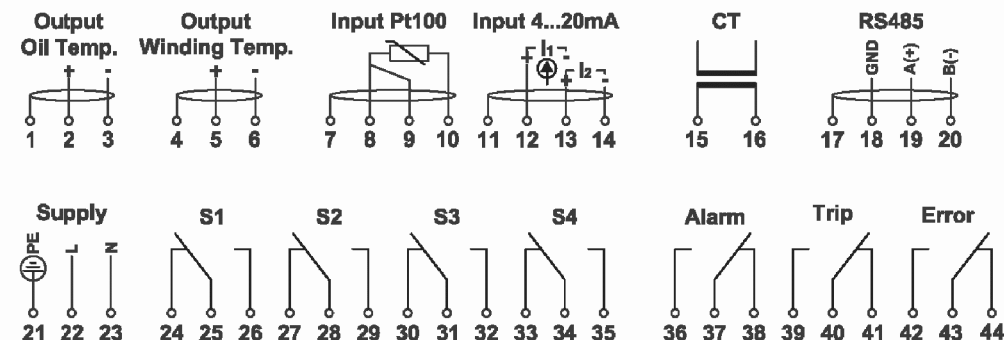


Push buttons

Terminals for leads up to 2,5mm², AWG 24-12 solid and stranded



Analog outputs
factory preset 4...20mA,
0...20mA, 0...1mA or 0...10V



Basic technical data

1xoil/1xambient temperature input(Pt100/4...20mA)
1xcurrent transformer input 0.5...5A for winding temperature calculation
7xrelay contacts;2xanalog outputs
1xRS485; 1XUSB
Supply voltage standard 80-265VAC and 80-353VCD
Rail mounting acc. to EN 60715 TH35-7,5 or TH35-15
Input range -20...+140°C
Protection mode: IP00 acc.to IEC 751
Weight: Approx. 1.2 kg

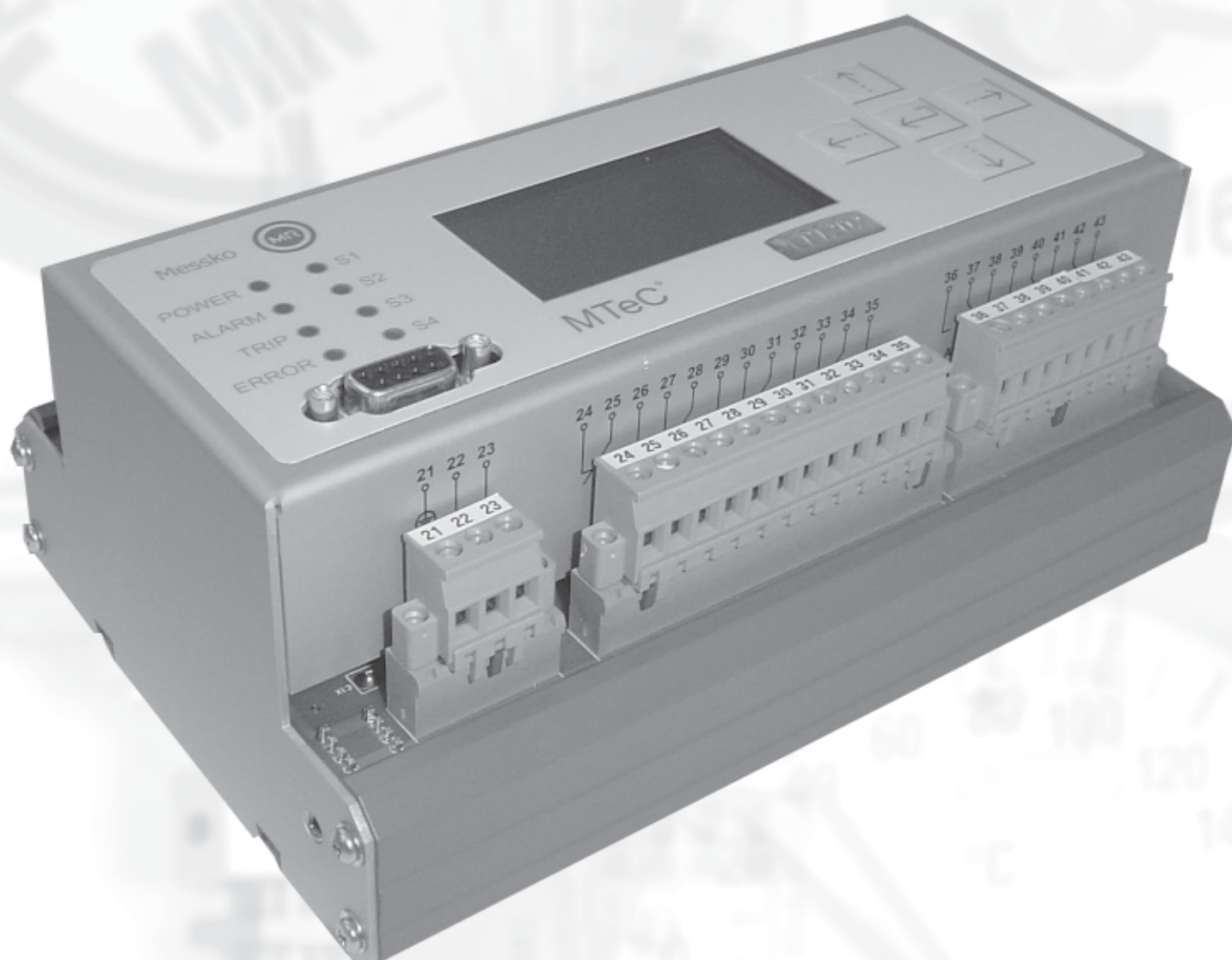
Part no.:66421-00-00-00

Manufacturer:MESSKO;GERMANY

Transformer number:			Transformer type:		Project name:		Scale:	
Free dimensions tolerances:			Material number:		Material name:			
Date:	11.2011.		Title: ELECTRONIC TRANSFORMER MONITOR EPT202-basic module -rail mounting					KPT ED
Designed:	Kufrin							AutoCAD/A4
Checked:	Tomić							
Approved:	Kranjčec							
Končar Power Transformers Ltd.			Revision number:	Release: 1	Drawing number: B51 79 030		Mass:	Sheet/Sheets: 1 / 1

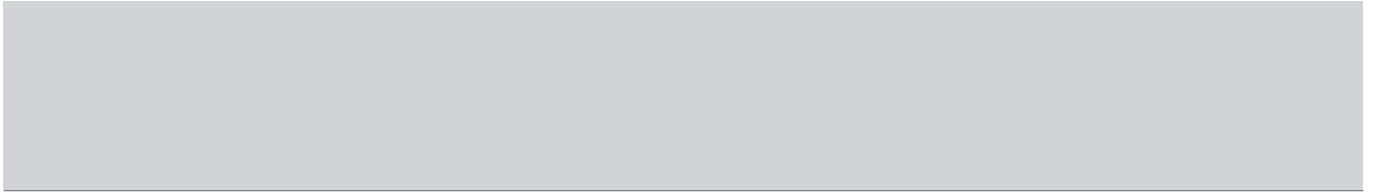
MTeC® - EPT202 Digital Thermometer

Operating Instructions BA 2076/02/01



Messko







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**NOTE**

The information in these operating instructions may differ from the actually delivered device.

Subject to change without prior notice.



Keep for future reference!

1 General

1.1. Safety Instructions

All personnel involved in installation, commissioning, operation, maintenance or repair of the 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 property of the operator and
- 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 warnings can lead to serious or fatal injury.



CAUTION

This information indicates particular danger to the equipment or other property of the operator, risk of serious or fatal injury.



NOTE

These notes provide important information on a certain topic.

1.2 Use as Specified

Together with a temperature sensor, the EPT202 device from the MTeC® series indicates the oil and winding temperature of oil-insulated transformers, reactors or on-load tap-changers. The device can be used to control the individual cooling stages based on load and temperature and, in emergencies, shut down the entire transformer.

Before commissioning the device, it is essential to read and adhere to the limit values for the application specified on the nameplate and operating instructions.

1.3 Notes on the Operation of the Device

User adherence to national accident prevention regulations is mandatory.

It is also pointed out that work on active (i.e., parts which are hazardous to touch) is only permitted when these parts are potential free or are protected against direct touch.

National regulations pertaining to electrical installation must be observed. To ensure correct operation, it is essential to connect the protective conductor (PE).

1.4 Design

The device is available in 4 models.

- Compact device in an aluminum housing for installation on a rail in accordance with EN 60 715 TH 35-7.5 and TH 35-15
- 19" Rack (3 HE, 42 TE, depth: 176 mm) for insertion in a 19" cabinet system
- Device for control panel installation with panel cutout, 236 mm x 142 mm
- 19" subrack for installation in the motor drive ED of the MR on-load tap-changer

The electrical connection is performed with plug-in connectors in accordance with DIN 41 612. An SPI interface is available on the side of the device for the connection of extra modules (OL/CT).



NOTE

When using the additional modules EPT202OL, EPT202CT or EPT202OL/CT, please refer to the operating instructions BA2078.



CAUTION

Make sure that all power supplies leading to the digital thermometer are disconnected at the switchgear cubicle before doing impulse voltage testing or any other kind of applied voltage testing to the transformer.

1.5 Capacity Features of the Basic Device

The basic device indicates one oil and winding temperature each on an LCD display. This requires the connection to the device of a temperature sensor with Pt100 or 4...20mA output which measures the „TopOil“ temperature in the transformer. The minimum and maximum values of the oil and winding temperature as well as the maximum value of the load current are indicated and can be called later. Two analog outputs and one RS 485 interface are available for remote indication of the temperature values.

The data logging function is used to store the temperature-specific data on the device at regular intervals so that it can be called at all times.

The thermal image of the transformer is simulated in accordance with IEC 60354 or ANSI standard. For this the CT current which indicates the load of the transformer must be connected to the device. Parameterization of the transformer and cooling stage can be performed via the keys on the front or via visualization software which is available as an option.

An Easy-Set function is also available with the visualization software with which the parameterization can be performed in accordance with the IEC standard.

Four relays are used to control 5 cooling stages. These can also be selectively controlled during load changing operation. This permits a time-equalized load of the individual cooling stages. In addition one relay each is available for Alarm and Trip. The switching point, the hysteresis and the delay time of the individual relays can be set as desired and they can be addressed via the oil or winding temperature. Manual operation is also possible as an alternative.

A further special feature is the life management calculation in accordance with the IEC or ANSI standard.

A temperature sensor can be connected to the 4-20mA sensor input to record the ambient temperature. A Pt100 sensor must then be used to detect the Top-Oil temperature.

2 Technical Data

Protective housing

Rail mounting:	Aluminum housing, can be snapped on for carrying rail in accordance with DIN EN 60715 TH 35-7.5 and TH 35-15, protection rating: IP 00 in accordance with IEC 60529, weight: approx. 1.2 kg
19" Subrack 42TE:	19" rack in accordance with DIN 41494, part 5, 223 x 133 x 178 mm (W x H x D) for installation in 19" cabinet system, protection rating: IP 00 in accordance with IEC 60529, weight: approx. 1.5 kg
Control panel mounting:	Aluminum housing, 270 x 200 x 133 mm (W x H x D) for panel cutout 236 x 142 mm (W x H), protection rating: IP 00 in accordance with IEC 60529, weight: approx. 1.5 kg
19" Subrack 84TE:	19" rack in accordance with DIN 41494, part 5, 483 x 133 x 178 mm (W x H x D), protection rating: IP 00 in accordance with IEC 60529, weight: approx. 2.5 kg

Temperature range

Operation:	-25°C ... +70°C
Storage:	-30°C ... +85°C

Operator elements, indication, terminals

Operator elements:	5 function buttons with perceptible pressure point
Indication:	Monochrome display, white letters on blue backlight, 128 x 64 pixels
Status LEDs:	1 LED, green, for „POWER“ operational indication 1 LED, yellow, for „ALARM“ switching contact 1 LED, red, for „TRIP“ switching contact 1 LED, red, for „ERROR“ switching contact 4 LEDs, yellow, for switching contacts S1, S2, S3 and S4
Terminals:	Safety screw terminals, for rigid braided leads: 0.2 - 2.5 mm ² , AWG 24 - 12, flexible braided leads (with core end sleeves): 0.2 - 2.5 mm ² , AWG 24 - 12



Inputs

Supply voltage:	100 to 240 V AC, 50 to 400 Hz 100 to 353 V DC optional: 20-72VDC
Power consumption:	Max. of 10 VA or 10 W
Temperature sensor:	Pt100 signal in accordance with IEC 751 in 2 or 3-conductor technology or 4 to 20 mA signal (active or passive), standard measuring range: -20 °C to +140 °C (others on request) Measuring converters can be provided for other input signals e.g. 0 to 1 mA or 0 to 10 V. Optional: The 4-20mA input can be used to record the ambient temperature (active or passive signal), the standard measuring range is -40 to +120°C.
Current transformer input:	0.5 to 5 A CT rated current Continuous load capacity: 10 A for 8 hours Short-time current: 500 A for 1 second Optional: Design including a split core current transformer for cable diameters up to max. Ø10

Outputs

Analogue outputs:	1 oil temperature, temperature range: -20 °C to +140 °C 1 winding temperature, temperature range: 0 °C to 160 °C
	Both analogue outputs can be set as desired to: 0 to 10 V 0 to 1 mA 4 to 20 mA (error signal < 3.6 mA) 4 to 20 mA (error signal > 22 mA) 0 to 20 mA (error signal > 22 mA)
Interfaces:	1 RS 232 on 9-pin, sub D plug for parameterization and data logging via PC 1 RS 485 on screw terminals 1 SPI bus on 15-pin, sub D plug for connection of additional modules (for DIN rail mounting only)
Relays:	4 c/o contacts for switching points S1 to S4, contact capacity AC: 250 V / 12A, DC: 110V / 0.4 A 2 c/o contacts for ALARM and TRIP, contact capacity AC: 250 V / 5A, DC: 110V / 0.4 A 1 n/c contact for ERROR message, contact capacity AC: 250 V / 5A, DC: 110V / 0.4 A

Tests

Electrical safety:	Protection class 1 in accordance with IEC 60536 Protection rating IP00 in accordance with IEC 60529 Degree of soiling 2 in accordance with IEC report 664-1 Overvoltage category III in accordance with IEC report 664-1																		
Electromagnetic compatibility:	<table> <tr> <td>IEC 61000-4-2</td><td>Interference immunity against electrostatic discharge with 6/8 kV</td></tr> <tr> <td>IEC 61000-4-3</td><td>Interference immunity against HF fields with 10 V/m, 80 to 1000 MHz</td></tr> <tr> <td>IEC 61000-4-4</td><td>Interference immunity against bursts with 2 kV</td></tr> <tr> <td>IEC 61000-4-5</td><td>Interference immunity against surges with 2 kV</td></tr> <tr> <td>IEC 61000-4-6</td><td>Interference immunity against HF on lines with 10 V, 150 kHz to 80 MHz</td></tr> <tr> <td>IEC 61000-4-8</td><td>Interference immunity against magnetic fields with 30 A/m, 50 Hz, continuous</td></tr> <tr> <td>IEC 61000-4-11</td><td>Interference immunity against voltage drops with AC supply: 30 % / 0.5 period 60 % / 5 periods; with DC supply 100 % / 10 ms and 60 % / 100 ms</td></tr> <tr> <td>EN 61000-6-2</td><td>CE conformity</td></tr> <tr> <td>EN 61000-6-4</td><td>CE conformity</td></tr> </table>	IEC 61000-4-2	Interference immunity against electrostatic discharge with 6/8 kV	IEC 61000-4-3	Interference immunity against HF fields with 10 V/m, 80 to 1000 MHz	IEC 61000-4-4	Interference immunity against bursts with 2 kV	IEC 61000-4-5	Interference immunity against surges with 2 kV	IEC 61000-4-6	Interference immunity against HF on lines with 10 V, 150 kHz to 80 MHz	IEC 61000-4-8	Interference immunity against magnetic fields with 30 A/m, 50 Hz, continuous	IEC 61000-4-11	Interference immunity against voltage drops with AC supply: 30 % / 0.5 period 60 % / 5 periods; with DC supply 100 % / 10 ms and 60 % / 100 ms	EN 61000-6-2	CE conformity	EN 61000-6-4	CE conformity
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EN 61000-6-2	CE conformity																		
EN 61000-6-4	CE conformity																		
Temperature and climate resistance:	<table> <tr> <td>IEC 60068-2-1</td><td>Dry cold, -25 °C/20 hours</td></tr> <tr> <td>IEC 60068-2-2</td><td>Dry heat, +70°C / 16 hours</td></tr> <tr> <td>IEC 60068-2-3</td><td>Moist heat, constant, +40°C/93 % / 2 days, no moisture condensation</td></tr> <tr> <td>IEC 60068-2-30</td><td>Moist heat, cyclic (12 x 12 hours) + 55°C / 93 % / 6 cycles</td></tr> </table>	IEC 60068-2-1	Dry cold, -25 °C/20 hours	IEC 60068-2-2	Dry heat, +70°C / 16 hours	IEC 60068-2-3	Moist heat, constant, +40°C/93 % / 2 days, no moisture condensation	IEC 60068-2-30	Moist heat, cyclic (12 x 12 hours) + 55°C / 93 % / 6 cycles										
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Setting ranges

Parameter	Remarks	Step Size
Temperature range, analog output 1 (specifies the range of sensor input and analog output 1)	Calibration at plant: -20 to +140 °C (others on request)	1 °C
Temperature range analog output 2	Calibration at plant: 0 to +160 °C (others on request)	1 °C
Data logging interval	5 to 1440 min.	1 min.
Test function	0 to 150% of temperature range (standard -20 to +220 °C)	0.1 °C
Zero point correction	± 10 % of temperature range (standard -16.0 to 16.0 K)	0.1 K
RS 485 address	0 to 79	
Load change interval	0 to 9999 h	1 h
Switching points S1 to S4	Adjustable between hysteresis and 150% of temperature range	0.1 °C
Hystereses S1 to S4	Min. of 1% of temperature range	0.1 K
Delay times S1 to S4	0 to 120 sec.	0.1 sec.
Switching points ALARM, TRIP	Adjustable between hysteresis and 150% of temperature range	0.1 °C
Hystereses ALARM, TRIP	Min. of 1% of temperature range	0.1 K
Delay times ALARM, TRIP	0 to 120 sec.	0.1 sec.
CT transformer ratio	1 to 5000:1	1
Hotspot factor (H)	1.0 to 2.0	0.1
CT rated current	0.50 to 5.00 A	0.01A
Gradient (gr)	0.0 to 50.0 K	0.1 K
Winding exponent	1.0 to 2.0	0.1
Time constant	0 to 30 min.	1 min.

3 Mounting

3.1 EPT202 for Rail Mounting

The EPT202 (see Fig. 1) is designed for mounting on a rail in accordance with EN 60715 TH 35-7.5 or TH 35-15. To install, the device must be placed on the rail with the mounting clamps and pressed down until the device snaps in onto the rail. For the dimensions, see the appendix (chap. 9.1).



CAUTION

The device may only be mounted, electrically connected and commissioned by qualified, trained personnel as specified by these operating instructions.

The user must ensure that the device is used for its intended purpose.

Arbitrary and incorrect work which is performed without previously consulting Messko is forbidden for safety reasons!

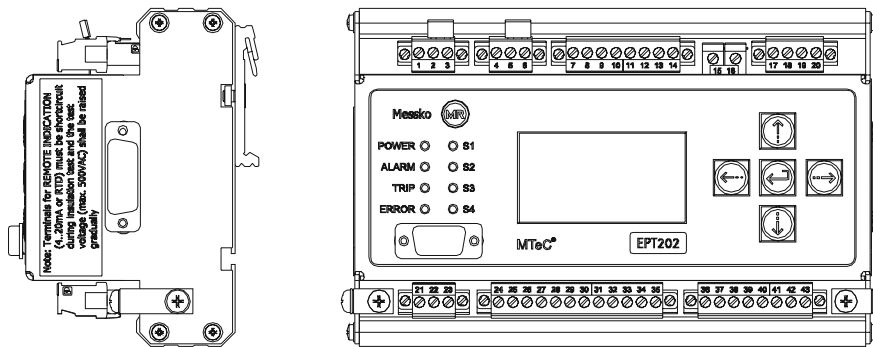


Fig. 1

3.2 EPT202 as 19" subrack 42TE

The standardized rack of the EPT202 is designed for installation in a 19" cabinet system. Slide the subrack into the cabinet system and secure it using the bore holes on the front (see appendix, chap. 9.2).

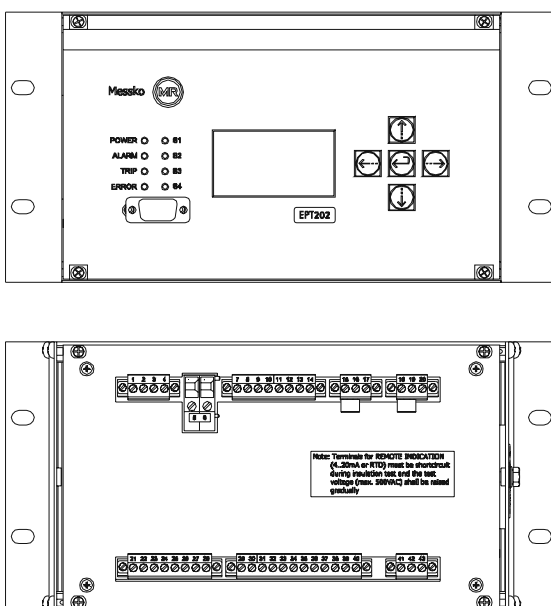


Fig. 2

3.3 EPT202 for Control Panel Mounting

A panel cutout must be provided in the switching cabinet for the installation of the EPT202. For dimensions, see appendix, chap. 9.3. Slide the device into the cutout and secure with the help of the bored holes on the front.

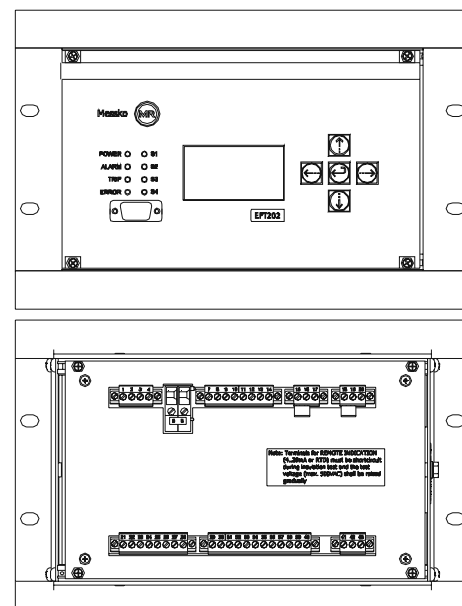


Fig. 3

4 Electrical Connection

3.4 EPT202 for subrack 84TE

A 19" subrack of double width (84TE) is available for integration into the motor drive ED of a MR on-load tap-changer or any other switching cabinet application.

Installation is the same as previously described for the 19" subrack in chapter 3.2. Please refer to the appendix for all relevant dimensions.

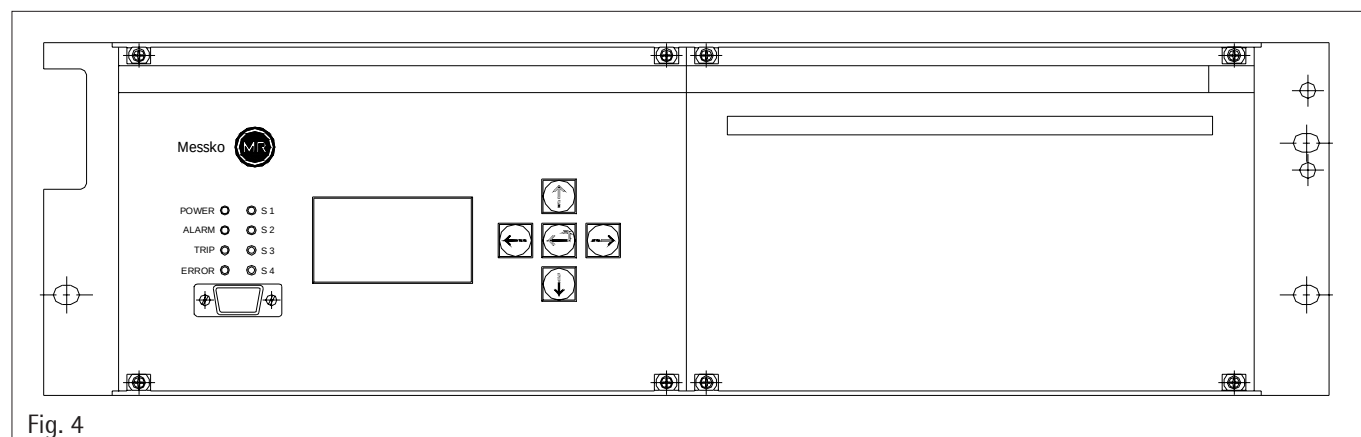


Fig. 4

4 Electrical Connection

The EPT202 must be connected as shown in the device-specific connection diagrams in the appendix (see chap. 9.5 to 9.7). The individual connections will now be described in more detail below. The numbering of the terminals is deviating between the EPT202 for rail mounting and the EPT202 for panel mounting or 19" rack. The numbering for panel mounting and 19" rack is given in brackets in the following description



WARNING

Make sure that the electrical connection of the EPT202 and particularly the grounding is performed carefully. Otherwise there is a danger to life!

Do not switch on the supply voltage until the electrical connection has been made correctly.

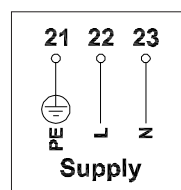


NOTE

The EPT202 was developed in accordance with applicable EMC standards. To maintain the EMC characteristics, the following points must be adhered to.

- Ensure that the EPT202 is properly grounded via the grounding connection on the device.
- Use the shielded cables for the data and signal connection from the EPT202 to other devices. Ground the shield to the terminals provided for this purpose.

4.1 Supply Voltage

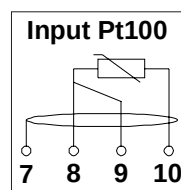


The EPT202 is equipped with a wide-range input: 100 to 240 V AC or 100 to 353 V DC. Connect the supply voltage to terminals 22 (42) L and 23 (41) N and the grounding to terminal 21 (43) PE.

4.2 Sensor Inputs

The EPT202 can be operated with either a Pt100 or a 4-20mA temperature sensor. In case, the ambient temperature is to be recorded as well, a 4-20mA sensor must be used. Measurement of the Top-Oil temperature is then achieved by means of a Pt100 sensor.

4.2.1 Pt100-Signal (RTD) using 2 or 3 conductor wire technology

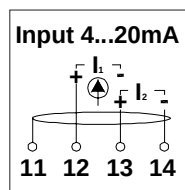


Sensor connection: Terminals 9 and 10
Equalizing line: Terminal 8
Shield: Terminal 7

Caution: When using 2-conductor wire technology, terminals 8 and 9 must be jumpered!

4.2.2 4 to 20 mA active Sensor I_1

Input I_1 has an internal voltage supply for a sensor with 4 to 20 mA output and **no own** voltage supply (e.g., MT-ST160SK/TT)

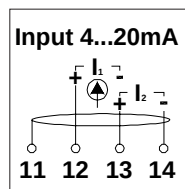


Sensor connection (+): Terminal 12
 Sensor connection (-): Terminal 13
 Shield: Terminal 11

Caution: Adhere to the maximum load of the sensor and the circuiting.

4.2.3 4 to 20 mA passive Sensor I_2

Input I_2 is designed for a sensor with 4 to 20 mA output and its **own** voltage supply (e.g., TT-PWM60).

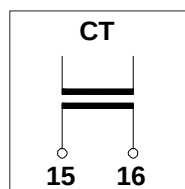


Sensor connection (+): Terminal 13 (8),
 Sensor connection (-): Terminal 14 (7),
 Shield: Terminal 11 (10)

Supply voltage: 24 VDC $\pm$ 10%

Caution: Adhere to the maximum load of the sensor and the circuiting.

4.3 CT Input (Secondary Current Transformer)



Connect the lines of the CT transformer to terminals 15 and 16.

If the EPT202 is equipped with a split core transformer, then it must also be connected to terminals 15 and 16.

This input can be deactivated during parameter assignment so that only the oil temperature is indicated, for example.



WARNING

High voltage, when the CT lines are disconnected and the transformer is operating.

4.4 Analog Outputs

The analog outputs for oil and winding temperature can be parameterized as desired to the following values.

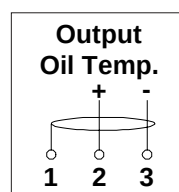
- 0 to 10 V
- 0 to 1 mA
- 4 to 20 mA (error signal < 3.6 mA)
- 4 to 20 mA (error signal > 22 mA)
- 0 to 20 mA (error signal > 22 mA)

The error signal is output on the analog output when the input sensor is defective.

With the current outputs, the maximum load (total resistance of the lines and connected devices) of 750 Ω may not be exceeded. The internal voltage supply is 24 V DC $\pm$ 10%. When a current output is not used, its terminals (+) and (-) must be jumpered. Otherwise an error message is output.

When an analog output is parameterized to 0 - 10 V, this must be loaded with at least 1 k Ω . The voltage output may not be jumpered. An open or defective voltage output is not detected.

Analog output 1 "Output Oil-Temp"



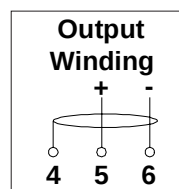
Line connection (+): Terminal 2
 Line connection (-): Terminal 3
 Shield: Terminal 1

The range of analog output 1 corresponds to the input range of the sensor (refer to nameplate), standard: -20 to +140 °C.

Example: 4 to 20 mA output:

4 mA corresponds to -20 °C
 20 mA corresponds to +140 °C

Analog output 2 "Output Winding"



Line connection (+): Terminal 5
 Line connection (-): Terminal 6
 Shield: Terminal 4

The range of analog output 2 is specified on the nameplate (standard: 0 to +160 °C).

Example: 4 to 20 mA output:

4 mA corresponds to 0 °C
 20 mA corresponds to +160 °C

4.5 Digital interfaces

To be able to parameterize the EPT202 with the visualization software and call up the data, the EPT202 must be connected via an interface with a PC. The following interfaces are available for this purpose.

- RS 232
- RS 485 (bus-capability)

RS 232

To transmit data between a PC and the EPT202 via the RS 232 interface, connect the RS 232 interface of the PC (or an interface converter) with a suitable 9-pin connection cable to the sub D plug connector on the front of the device.

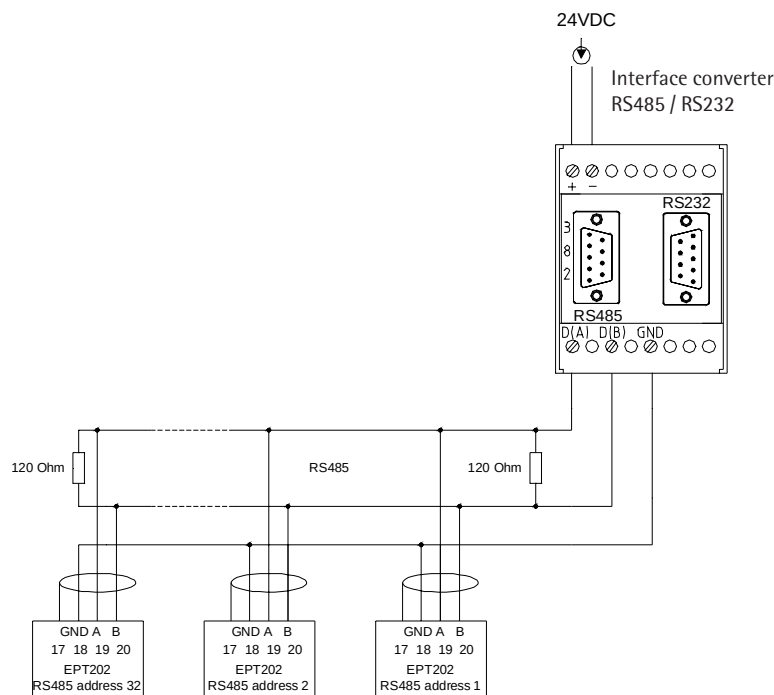
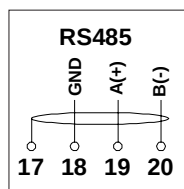


Fig. 5

RS485



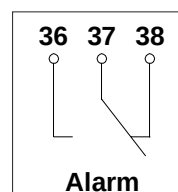
Data line A: Terminal 19 (2)
 Data line B: Terminal 20 (1)
 Ground connection: Terminal 18 (3)
 Shield: Terminal 17 (4)

The RS 485 interface can be used to set up a subsystem as shown in Fig. 4 with a maximum of 32 devices.

The RS 485 interface uses a separate company protocol. The description and additional protocols are available on request.

Parallel to the contacts, the EPT202 switches the cooling-phase-specific winding parameters (for more details, see chapter 5). This must be considered when connecting the relays.

Switching contacts ALARM and TRIP

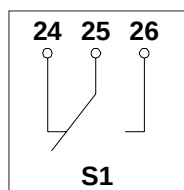


These two switching contacts can be used to generate an alarm message or trip the transformer.

Connect the two relay contacts as required for the application.

4.6 Switching Contacts

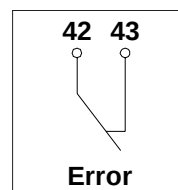
Switching contacts S1 to S4



The switching contacts S1 to S4 can be used to switch on or off the individual cooling stages of a transformer based on the temperature.

Connect the lines of the fans/pumps to the relay contacts for this.

ERROR contact



The ERROR contact is switched by the internal self-monitoring function of the device. (See chap. 5.4.)

When the device is in operation and there is no device error, the contact is open between terminals 42 (21) and 43 (22).

When there is a device error, the contact is closed (fail-safe programming).

This contact can be used to generate an error message for remote transmission. For a description of the self-monitoring function of the device, see chapter 5.4.

5 Function Description

5.1 Basic Function

The EPT202 is used to measure the temperature of transformers or similar devices. The oil temperature is fed in to the EPT202 via a temperature sensor. Internally the EPT202 calculates the thermal image (Hotspot temperature) in acc. with IEC 354 or ANSI standard and indicates the oil and winding temperature on its display.

The winding temperature (Hotspot) is calculated acc. to the following equations:

Calculation acc. to IEC 354:

$$\theta_{HotSpot}(t) = \theta_{Top Oil} + H \times g_r \times K^y \times \left(1 - e^{-\frac{t}{\tau}}\right)$$

Calculation acc. to ANSI IEEE Std. C57.91:1995

$$\theta_{HotSpot}(t) = \theta_{Top Oil} + \Delta\theta_{H,R} \times K^{2m} \times \left(1 - e^{-\frac{t}{\tau}}\right)$$

Whereby:

- $\theta_{HotSpot}(t)$: Hotspot temperature
- θ_{TopOil} : Top-Oil temperature
- H : Hotspot factor
- g_r : Gradient of the average winding temperature over average oil temperature at rated current
- $\Delta\theta_{H,R}$: Gradient of the Hotspot temperature over the Top-Oil temperature at rated load
- K : Load factor (actual current / rated current)
- y : Winding exponent
- m : Exponent for the calculation of the actual Hotspot temperature
- τ : Time constant of oil

If the calculation is to be done according to ANSI standards, a Hotspot factor of 1,0 must be used and instead of the winding exponent the appropriate ANSI exponent (2m) must be put in to the equation.

5.2 Sensor Inputs

A Pt100 sensor or a sensor with an active or passive 4 to 20 mA output signal can be used as an input sensor. The sensor type (Pt100 or 4 to 20 mA) must be parameterized by the user.

Through the use of an optional 4 to 20mA sensor, the EPT202 can record and store the ambient temperature by means of a data logging function. The Top-Oil temperature must then be detected by a Pt100 sensor.

The temperature range of the oil temperature sensor input is set to -20 to +140 °C (standard). Other temperature ranges are also available on request. The temperature range is also used to indicate the event of a defect sensor, which happens when the temperature exceeds or drops below the admissible range.

When a sensor with 4 to 20 mA output signal is used, the measuring range of the sensor output must comply to the temperature range of the EPT202. Please check the nameplate information.

5.3 Analog Outputs

The basic device is equipped with one analog output each for transmission of the oil temperature and the winding temperature. The output signal can be parameterized. The following output signals can be set as standard.

- 0 to 20 mA (error signal > 22 mA)
- 4 to 20 mA (error signal > 22 mA)
- 4 to 20 mA (error signal < 3.6 mA)
- 0 to 1 mA
- 0 to 10 V

Additional output signals can be implemented with a signal converter. The error signal is output when a defective sensor or an open analog output is detected.

5.4 Device Self-Monitoring

The EPT202 continuously monitors itself. The following errors are detected by the device.

- Defective sensor
- Analog output 1 (oil temperature) open
- Analog output 2 (winding temperature) open
- Error of the supply voltage

When one of these errors has been detected, the ERROR contact is closed, the ERROR LED goes on, the error is indicated on the display and in the visualization software, and the analog outputs (if current output) indicate the error signal.



CAUTION

When the device detects the error „sensor defective“ or an error of the supply voltage, the switching contacts S1 to S4 are closed and the ALARM and TRIP contacts retain their current status.

5.5 Switching Contacts S1 to S4

The EPT202 is equipped with 4 relay contacts to activate fans or pumps. These contacts can be turned on and off via the oil or the winding temperature or, as an alternative, can be turned permanently on by hand. The hysteresis and the delay time of the contacts can be parameterized as desired.

The switching contacts S1 to S4 also switch the cooling-phase-specific winding parameters.

5.6 Cooling-Phase-Specific Parameter Records

The winding parameters for 5 different cooling stages can be stored on the EPT202 with the following values.

- Rated CT current
- Gradient gr
- Winding exponent y
- Winding time constant τ

The cooling stages are called COOLING 0 to COOLING 4 on the EPT202. The parameter record of the last cooling stage is always active and thus provides the basis for the calculation of the winding temperature and life management consumption.

The parameter records of the cooling stages are linked with the switching contacts as shown below.

- No switching contact switched – COOLING 0 active
- Switching contact S1 switched – COOLING 1 active
- Switching contact S2 switched – COOLING 2 active
- Switching contact S3 switched – COOLING 3 active
- Switching contact S4 switched – COOLING 4 active

5.7 Load Change Operation

The load change function permits the fans or pumps connected to the switching contacts to be loaded equally. Each switching point can be individually assigned to load change operation. During load change operation the relays of the assigned switching contacts are switched in sequence after the adjustable load change internal has expired. The LED display and the winding parameters of the active cooling stage remain as they were before.

The load change function will now be explained using the following example.

Cooling stage 1 of a transformer is ONAF1. The left fan group is turned on with switching point S1 and the related parameter record of the COOLING1 cooling stage is activated.

Cooling stage 2 is ONAF2. The right fan group is switched through with switching point S2 and the related parameter record of the COOLING2 cooling stage is activated.

Without load change operation, the runtime of the left fan group (active during COOLING1 and COOLING2) would be greater than that of the right fan group (only active during COOLING2).

Switching points S1 and S2 are now assigned to the load change operation and a load change interval of 100 hours is parameterized. If cooling stage ONAF1 was now active for a total of 100 hours (the left fan group has run 100 hours alone), switching contacts S1 and S2 then change the relays. Switching contact S1 now switches with the actual relay of switching contact S2 and vice versa. This turns off the left fan group and turns on the right fan group. The status of the LED display and the parameter record of the active cooling stage (COOLING1 in our example) are not affected by this.

When activation is performed by switching point S2 (ONAF2 or COOLING2), then S2 switches the left fan group through with the actual relay of S1.

When cooling stage ONAF1 was active for another 100 hours, the relays are then changed again.

The same principle applies when 3 or 4 cooling stages are assigned to load change operation.

5.8 Switching Contacts ALARM and TRIP

The EPT202 is equipped with 2 additional switching contacts to generate an alarm message and to trip the transformer. By assigning parameters, these contacts can be assigned to the oil or the winding temperature and the hysteresis and delay time can be set.

5.9 Calculation of Life Consumption



CAUTION

The calculation of life consumption of the EPT202 is based on the thermal aging of a transformer winding in accordance with ANSI or IEC standards. Remember that the value calculated here may not reflect actual conditions.

Life consumption only refers to the insulation system of a transformer winding and not to the complete transformer.

The life consumption calculation can be configured with 2 algorithms (calculation as per ANSI or as per IEC standard) or can be masked out.

Both algorithms are a function of the hotspot temperature. The calculation can only supply a realistic value when the winding parameters are assigned correctly.

Both algorithms supply the life consumption as a percentage of the expected lifespan. The expected lifespan must be parameterized for this.



NOTE

The expected lifespan for the insulation system of a transformer winding depends on the materials used and the construction.

This value can be obtained from the manufacturer of the transformer.

Calculation in accordance with ANSI standard C57.91-1995 (+errata)

Recommended for transformers whose construction is dominated by the US American standards ANSI or IEEE.



Calculation in accordance with IEC 354, second edition 1991-9

Recommended for transformers whose construction was based on IEC standards.

With this calculation algorithm, the EPT202 places relative thermal rate of aging as per IEC 354 in relation to the expected lifespan and calculates the life consumption as a percentage (like the ANSI standard).

5.10 Data Logging

The EPT202 is equipped with an internal memory in which data are stored. The time interval between storage (data logging) of two data records can be parameterized as desired. In addition, data sets are also stored when the following events occur:

- Power supply - on / off
- Test mode - activated / deactivated
- Trip - activated / deactivated
- Alarm - activated / deactivated
- Device error - activated / deactivated
- Switching contacts (S1 to S4) - activated / deactivated
- Device lock - locked / unlocked

The data memory can hold a total of approx. 32,000 data records. At an interval of 10 minutes, this means that data covering a period of approx. 7.5 months can be stored.

The data records can be loaded with the visualization software and evaluated with an Excel spreadsheet. A data record contains the following information.

- Set no.
- Date
- Time
- Device status with status indication of the switching contacts and all relevant device data
- Event (is usually not used)
- Error code with status indication of the individual errors
- Oil temperature
- 3 winding temperatures (winding temperature 1 for basic device, winding temperature 2 and 3 only with appropriate extra module)
- Load current (load current 1 for basic device, load current 2 and 3 only with corresponding extra module)
- Life consumption
- Oil level of the oil conservator of the transformer tank (only with corresponding extra module)
- Oil level of the oil conservator of the OLTC/LTC (only with corresponding extra module)
- 3 in reserve (not usually used)

5.11 Masking Out the Winding Temperature

When the EPT202 is only used to indicate the oil temperature and to control the switching contacts via the oil temperature, the simulation of the thermal image (winding temperature) can be masked out with the <Winding off> function.

The following functions are then deactivated.

- CT input
- Analog output 2 (winding temperature)
- Life consumption calculation
- Parameterization of the winding parameters for the device and the visualization software
- All menu items on the device and all setting options in the visualization software which are related to the winding temperature

The menu items which are masked out with this function are marked in the short operating instructions with an asterisk (*).

6 Operation

6.1 Front plate

The design of the front plate is the same for all 4 models (refer to Fig. 4) whereby, the connection terminals of the EPT202 for control panel mounting and 19" subrack assembly are at the rear. The SPI-Bus connection is located internally.

The menus, measured values and parameters are indicated on the 8-line LCD display.

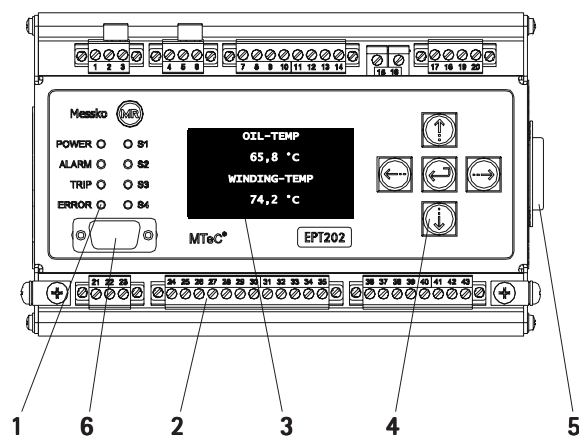
The 5 operator keys can be used to switch between the individual menus, change parameters and reset measured values.

With a suitable cable, the device can be connected via the sub D plug to a PC for parameterization or for data transmission.

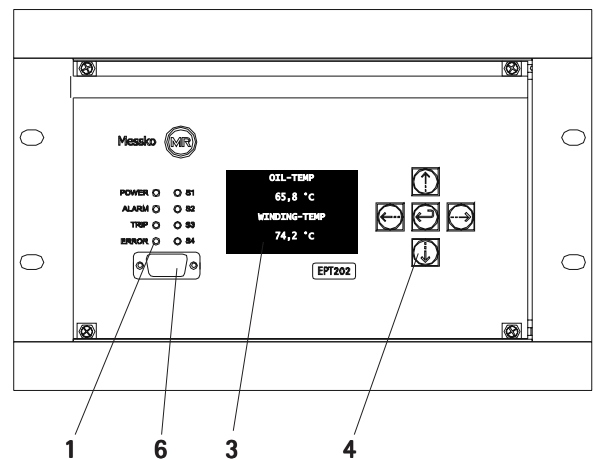
The SPI bus on the side can be used to connect extra modules such as the CT with 2 extra CT inputs.

The status LEDs signal the following operating states.

- Green POWER LED on: Device is running.
Green POWER LED flashing: Key lock released.
- Yellow ALARM LED on: ALARM contact is tripped.
- Red TRIP LED on: TRIP contact is tripped.
- Red ERROR LED on: Device error
- Yellow LED S1 to S4 on: Specific contact S1 to S4 was tripped and the related parameter record is activated.



- 1 - Status-LED's
2 - Connection terminals
3 - LCD display



- 4 - Operator keys
5 - SPI-Bus for add-on modules
6 - D-Sub-Stecker für RS232

Fig. 6

6.2 Menu Prompting

The 5 operator keys can be used to indicate the set parameters and measured values.

The parameters cannot be changed until the key lock is released.

The entire menu structure and prompting can be found in the included short operating instructions.

Temperature indication mode

When in operation the device is always in temperature indication mode. When a menu item is selected and no key is pressed on the device for 30 seconds, a change is automatically made to the higher-level menu or to temperature indication mode.

OIL-TEMP
65,8 °C
WINDING-TEMP
74,2 °C

When a device error occurs, this is indicated in the bottom line of temperature indication mode.

```

OIL-TEMP
 65,8 °C
WINDING-TEMP
 74,2 °C
  
```

The following errors are indicated.

- <Sensor Defect> Either the sensor is defective (e.g., line break) or the wrong sensor type was selected during parameterization.
- <Oil-Analog open> The device connected to the output <Output Oil Temp.> is defective or not correctly connected.
When this output is not used, jumper terminals 2 and 3.
- <Wind-Analog open> The device connected to the output <Output Winding> is defective or is not wired correctly.
When this output is not used, jumper terminals 5 and 6.
- <Power Down> The supply voltage is too low. Check the source of voltage and the wiring.

Releasing the key lock and key code change

In the temperature indication mode, press the keys <UP> and <DOWN> simultaneously.

```

OIL-TEMP
 65,8 °C
WINDING-TEMP
 74,2 °C
  
```



As a result, a mask opens for key code entry. The key code entry is made by using the 4 direction keys (factory set at 1111). When this is done successfully, the green power LED flashes and the key lock is released. If after 60 a period of 60seconds, no further key is pressed, the key lock is automatically locked again.

```

Enter Key-Code
2536
  
```



The key code can be changed when the key lock is unlocked. By pressing the the keys <UP> and <DOWN> simultaneously, the mask <Change Key-Code> appears, enabling a change to be made by means of the 4 direction keys and finally confirmed by pressing the <Enter> key.

```

Change Key-Code
2636
Save ?
YES NO
  
```



Changing to the menu level

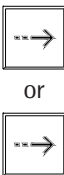
To change from the temperature indication mode to the menu level (jump to the main menu <PEAK VALUES>), press the <ENTER> key.

Changing the main menu

The main menus are arranged in rings. The <LEFT> or <RIGHT> key can be used to select the appropriate menu.

```

<-PEAK-VALUES->
Max. Oil-Temp.
Min. Oil-Temp.
Max. Winding-Temp.
Min. Winding-Temp.
Max. Load-Current
Max. Ambient-Temp.
Min. Ambient-Temp.
  
```

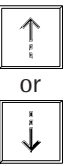


Selecting a menu item

The <UP> and <DOWN> keys can be used to highlight an individual menu item. Selection is done using the <ENTER> key.

```

<-PEAK-VALUES->
Max. Oil-Temp.
Min. Oil-Temp.
Max. Winding-Temp.
Min. Winding-Temp.
Max. Load-Current
Max. Ambient-Temp.
Min. Ambient-Temp.
  
```




To return to temperature indication mode, the title of the main menu must be highlighted. When the menu title is selected, press the <ENTER> key.

Functions of the menu items

When the submenu is only used for indication or no parameter is changed, the <ENTER> key can be used to jump from the menu to the higher-level menu.

```

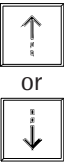
Load-Factor (K)
0,63
  
```



To change a parameter, change it with the <UP> or <DOWN> key and confirm with <ENTER>.

```

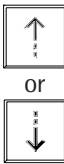
Offset-Correct.
25 K
Save ?
YES NO
  
```




The MIN and MAX values can be reset by use of the <UP> and <DOWN> keys. Any changes must be confirmed using the option <YES>. The peak value is then overwritten by the momentary value.

```

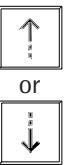
Min. Oil-Temp.
- 12,2 °C
Save ?
YES NO
  
```




When a menu item has submenus itself, the title must be selected to change to the higher-level menu (<UP> or <DOWN>) and confirmed with <ENTER>.

```

-CONTACT S1-
Description
Configuration
Switch-Point
Hysteresis
Delay-Time
Alternate
  
```




7 Indication and Parameterization

A description now follows of the individual menus and parameters which appear on the display of the device and which can be parameterized via the operator buttons.

Parameterization of the EPT202 via the visualization software is described in chapter 8.

The memory for date and time is retained for approx. 2 weeks without power. After this time, these data will be lost.

When the device is connected for the first time or is powered up after approx. 2 weeks without power, the current date and the current time must be set. The device jumps automatically to this menu item.

Correct functioning of the EPT202 is not ensured unless the device is completely parameterized.

The following description of the individual menu items is based on the order in which they appear during parameterization. However, the menus are arranged so that during operation the user can access the most important menus quickly. For the menu structure, see the short operating instructions.

7.1 Input and Output Configuration

This menu can be used to configure the inputs and outputs and to mask out the calculation of the winding temperature.

```
<-I/O CONFIG->
Oil-Temp.Input
Oil-Temp.Output
Amb.Temp. On/Off
Winding On/Off
Wind.Temp.Output
```

Sensor input

The input sensor can be selected in this menu. Please also abide to the information on page 13 of chapter 5.2.

```
Oil-Temp.Input
4-20 mA
PT100
Save ?
YES NO
```

Parameterization of the analog outputs

The analog outputs for the oil and the winding temperature are parameterized in this menu.

```
Oil-Temp.Output
0-1 V
4-20 mA (>22)
4-20 mA (<3,6)
4-20 mA (>22)
Save ?
YES NO
```

For more information regarding analog outputs, please refer to page 13 of chapter 5.3.

Recording of the ambient temperature

In this menu item the recording of the ambient temperature can be activated. For more information on this function, please refer to page 13 of chapter 5.3.

```
Amb.Temp. On/Off
Ambient-Temp On
Ambient-Temp Off
Save ?
YES NO
```

Only the 4 to 20mA input can be used as an input sensor for ambient temperature. A Pt100 sensor must be used for the input of the Top-Oil temperature. The sensor input is then automatically parameterized for Pt100

Masking out the winding temperature

The winding temperature can be masked out in this menu. For more information, please refer to page 15 of chapter 5.11.

```
winding On/Off
Winding On
Winding Off
Save ?
YES NO
```

7.2 Winding-Specific Parameters

The winding-specific parameters are entered in this menu. These values provide the basis for the calculation of the winding temperature and life management.

```
<-WINDING->
CT-Ratio
Hotspot-Fact. (H)
Cooling 0
Cooling 1
Cooling 2
Cooling 3
Cooling 4
```



NOTE

For the values of the winding parameters, please refer to the transformer documentation or contact the manufacturer. These values must be correctly entered since they provide the basis for the internal calculations.

Current transformer ratio <CT-Ratio>

This menu item is used to parameterize the ratio of the CT current transformer. The EPT202 is fed by the CT current transformer so that it can image the load of the transformer.

The actual load current is calculated from the current transformer ratio and the actual CT current.

```
CT-Ratio
1000 :1
Save ?
YES NO
```

Parameterizing the hotspot factor (H)

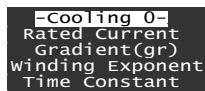
This parameter is an empirical value with which the hotspot temperature according to IEC354 is determined. It depends on the size of the transformer, the short-circuit impedance as well as other factors.

When this parameter is set to 1.0, then according to IEC354 the average temperature of the upper winding layer is calculated and indicated. For calculations according to ANSI standards, the value must be set at 1,0 because it is not used in the calculation.

```
Hotspot-Fact. (H)
1,2
Save ?
YES NO
```

Parameterizing the cooling-phase-specific winding parameters

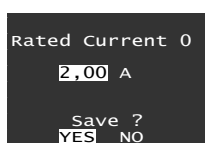
This menu item can be used to parameterize all winding parameters of the cooling stage <Cooling 0>. Parameterization of the cooling stages <Cooling 1> to <Cooling 4> is similar.



For more information on linking the winding parameters with the switching contacts, see page 13 in chapter 5.6.

Rated CT current

The rated CT current is the value of the CT output at the rated load of the transformer. This can be set in this menu item for every cooling stage between 0.5 and 5.0 A.



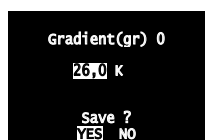
The rated CT current is calculated from the rated current of the transformer (this may depend on which cooling stage is active) divided by the ratio of the CT transformer.

Example: Rated current of transformer I_N : 820A
CT ratio R: 1000 : 1

$$I_{CT} = I_N / R = 820A / 1000 = 0.82A$$

Gradient (gr)

The gradient specifies the difference between oil and winding temperature at the rated load. If, for example, a gradient of 26 K is set and the transformer is operated at rated load, then the average winding temperature (Hotspot factor 1,0) is 26 K higher than the oil temperature. If the transformer has been off for some time, the winding temperature is the same as the oil temperature.



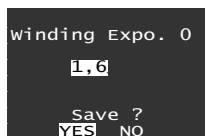
The value of the gradient may differ for the individual cooling stages.

Winding exponent y

The winding exponent can be set within a range of 1.0 to 2.0.

IEC 60354 specifies the following values for different types of cooling.

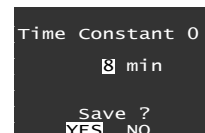
Cooling ON... Y = 1.6
Cooling OF... Y = 1.6
Cooling OD... Y = 2.0



For calculations to ANSI standards, the value of y to be applied, is the result of (2xm). According to ANSI standards, the values for m range from 0,8 to 1,0.

Time constant τ

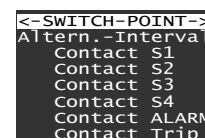
A sudden change of the load current does not result in a sudden change of the winding temperature. The winding temperature approaches its actual final value according to an e-function (please refer to page 13). Due to a sudden rise of load current the winding temperature will reach 63,5% of the peak value after a duration of τ and 95% of the peak value after a duration of 3τ .



Since the time constant can be different for each cooling stage, it can be set individually from 0.0 to 30.0 minutes for each cooling stage.

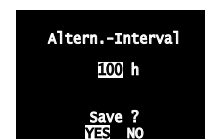
7.3 Switching Contacts

This menu can be used to set and configure the switching points S1 to S4, ALARM and TRIP.



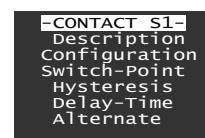
Load change interval

This menu item can be used to parameterize the load change interval. Setting the value to 0 here deactivates the load change interval.



Menu for switching points S1 to S4, ALARM and TRIP

Switching points S1 to S4 are designed for the control of fans, for example, or pumps. The ALARM switching point generates an alarm message and the TRIP switching point is used to trip the transformer.



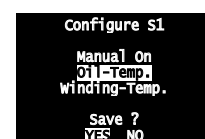
Parameterization of the individual switching points is the same except that the submenus <Description> and <Alternate> are omitted for the two switching points ALARM and TRIP.

The menu item <Description> indicates the designation of the switching point. This can only be entered via the visualization software.

Configuring the switching point

Control of the switching points can be configured in different ways.

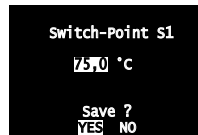
- With <Manual On>. The switching contact is set to continuous operation. This setting cannot be made for the switching points ALARM and TRIP.
- With <Oil-Temp.>. The switching contact is activated via the oil temperature.
- With <Winding-Temp.>. The switching contact is activated via the winding temperature.



Setting the switching point

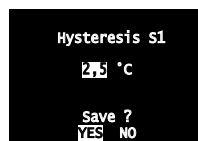
The temperature value can be set here at which the switching contacts are to be switched on.

The temperature value refers either to the oil temperature or to the winding temperature depending on the setting in the menu item <Configuration>.



Setting the hysteresis

The adjustable hysteresis always becomes active when switching back (dropping temperature). The respective relay is switched when the switching point is exceeded. Switch back takes place at the value (switching point hysteresis).



The amount of hysteresis is set in this menu item. A minimum hysteresis of 1% of the measuring range cannot be dropped below.

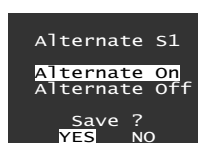
Setting the delay time

The delay time can be used to provide a time delay in the switching contact. If the switching contact is not to be switched until 30 seconds after the switching point is reached, for example, this value must be set in this menu item.



Assigning the switching contact to load change operation

If the switching contact is added to the load change circuit, <Alternate On> must be set in this menu item. For more information on the load change circuit, see page 14 in chapter 5.7.

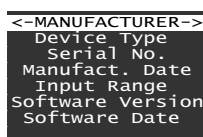


<Alternate Off> means that the switching contact is not assigned to load change operation.

7.4 <MANUFACTURER> Menu

The following manufacturer-specific data are stored under this menu.

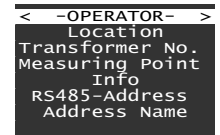
- Device type
- Serial number
- Date of manufacture
- Input range of the sensor
- Software version
- Software date



7.5 <OPERATOR> Menu

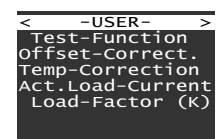
Information of the operator can be called under this menu. Except for the setting of the RS485 address, this information can only be entered with the visualization software.

The RS485 address is set with the <UP> and <DOWN> keys and confirmed.



7.6 <USER> Menu

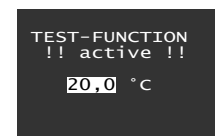
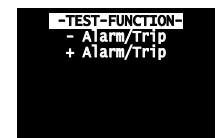
The test function, the zero point correction, the correction for temperature losses and the indication of the actual load current and the load factor are set up under this menu.



Test function

This test function can be used to check the relays of the switching points S1 to S4 as well as the optional relays of the switching contacts for alarm and tripping.

The optional switching contacts for alarm and tripping can be either included or excluded during testing. Please select according to requirement.



Warning

Depending on application, testing of the trip contact can result in the shut-down of the transformer

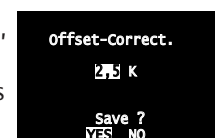
For the test function the actual temperature is superimposed by a simulated test temperature. The switching points S1 to S4, alarm, trip and relevant relays are activated by means of the test temperature. The test temperature values can be changed using the <UP> and <DOWN> keys, whereby the switching contacts are switched on or off accordingly.

The actual temperature continues in the background. This means that life consumption and data logging are not distorted.

Test mode is deactivated when no key has been pressed for 10 minutes.

Zero point setting

Zero point errors which result, for example, from the fact that the sensor is installed in the wrong place can be corrected with this function.



Temperature correction

This function can be used to correct temperature losses on the thermometer pocket.

The default setting is „temperature correction“ off <Temp-Cor.OFF>.

When <Temp-Cor.ON> is activated, a correction value is set internally which was determined from studies of temperature measuring devices and sensors on transformers. The temperature loss due to the thermometer pocket begins at an oil temperature of approx. 30 °C and increases as the oil temperature rises.

```
Temp-Correction
Temp-Cor. ON
Temp-Cor. OFF
Save ?
YES NO
```

Actual load current

This menu item can be used to indicate the actual load current. This results from the actually fed in CT current multiplied by the CT current ratio.

```
Act.Load-Current
426 A
```

Current load factor

The load factor K specifies the ratio between load current and rated current. If the rated current is 1000 A and the actual load current is 500 A, the load factor is 0.5 (the load of the transformer is 50%).

```
Load-Factor (K)
56,29
```

7.7 <DATA-LOGGING> Menu

This menu can be used to parameterize the default settings for the data logging function. This function can only be performed with visualization software which is available as an option.

```
<-DATA-LOGGING->
Date/Time
DataLog-Counts
DataLog-Interval
```

For more information on this function, see page 15 in chapter 5.10.

<Date/Time> Menu item

This submenu can be used to set the current time and date. This menu also appears when the device is powered up for the first time or after a longer period of time.

```
-DATE-
[dd.mm.yyyy]
05.11.2004
Save ?
YES NO
```



NOTE

Please take into consideration that this device does not automatically switch between summer and winter time and subsequently, time differences can occur.

<DataLog-Counts> and <DataLog-Interval> Menu Items

The <DataLog-Counts> menu item is used to indicate the number of data records which are currently stored.

```
DataLog-Counts
12684
```

The <DataLog-Interval> menu item can be used to set the data logging interval when the key lock has been released. The default setting is 10 minutes.

```
DataLog-Interval
15 min
Save ?
YES NO
```

7.8 <LIFE-CONSUM.> Menu

This menu can be used to parameterize the life consumption calculation and indicate the hotspot temperature and the life consumption.

```
<-LIFE-CONSUM.->
Config Life-Con.
normal Life
Life-Consumption
```

For more information on the life consumption calculation, see page 14 in chapter 5.9.

Configuring the life consumption calculation

This menu item can be used to configure the calculation algorithm (calculation as per ANSI or IEC standard) or to mask out the calculation.

```
Config Life-Con.
Calculate ANSI
Calculate IEC354
Off
Save ?
YES NO
```

Calculation as per ANSI standard C57.91-1995 (+errata)

Recommended for transformers whose construction is dominated by the US American standards ANSI or IEEE.

Calculation as per IEC 354, second edition 1991-9

Recommended for transformers whose construction was based on IEC standards.

Masking out the calculation (OFF)

When the device is installed on a transformer as a retrofit and the expected lifespan is unknown, the calculation algorithm can be masked out.

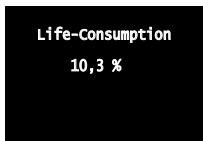
Expected lifespan

This menu item can be used to parameterize the expected lifespan for the insulation system of the transformer.

```
normal Life
30 Year
Save ?
YES NO
```

Menu item <Life-Consumption>

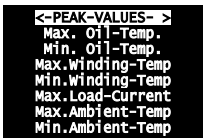
This menu item can be used to indicate current lifespan consumption.



Life-Consumption
10,3 %

7.9 <PEAK-VALUES> Menu

This menu can be used to store the following minimum and maximum values.



<PEAK-VALUES>
Max. Oil-Temp.
Min. Oil-Temp.
Max. Winding-Temp.
Min. Winding-Temp.
Max. Load-Current
Max. Ambient-Temp.
Min. Ambient-Temp.

- Max. oil temperature
- Min. oil temperature
- Max. winding temperature
- Min. winding temperature
- Max. load current
- Min. ambient temperature
- Max. ambient temperature

When the key lock is released, the maximum values can be reset by using the <UP> and <DOWN> keys

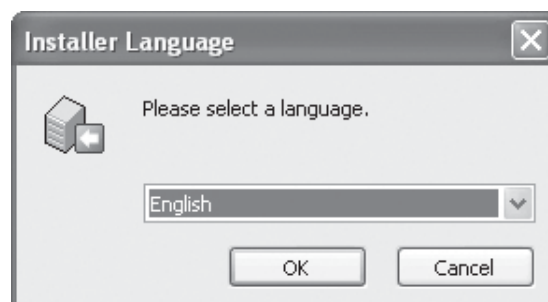
The peak value are reset to the actual measurement values.

The peak values are updated once every minute.

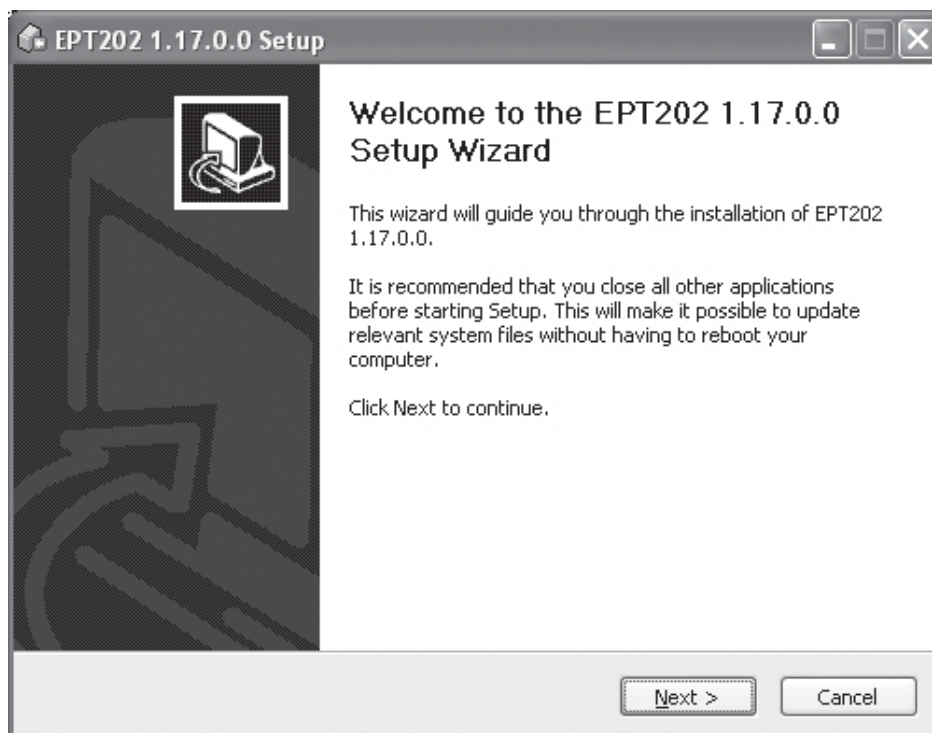
8 Visualization Software

8.1 Installation

- Place the EPT202 monitor CD-ROM in its drive and start the EPT202 Setup.exe located there.
- Then select the desired installation language.



- The installation assistant will now accompany you through the individual steps.

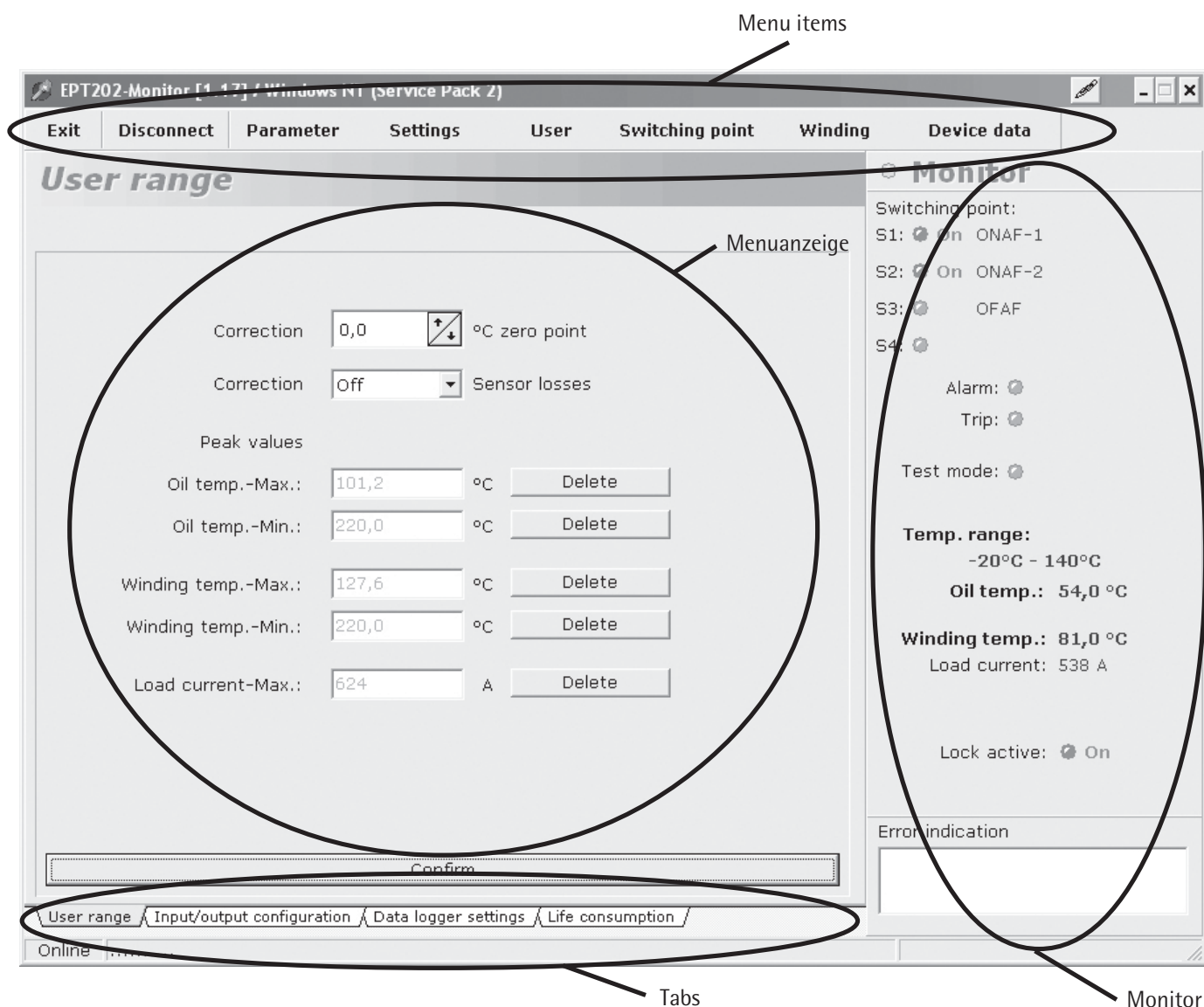


- You can use the entries suggested by the installation program or change them to meet your requirements.
- After installation, the program starts automatically (if this function was not deactivated).

8.2 Design of the Software

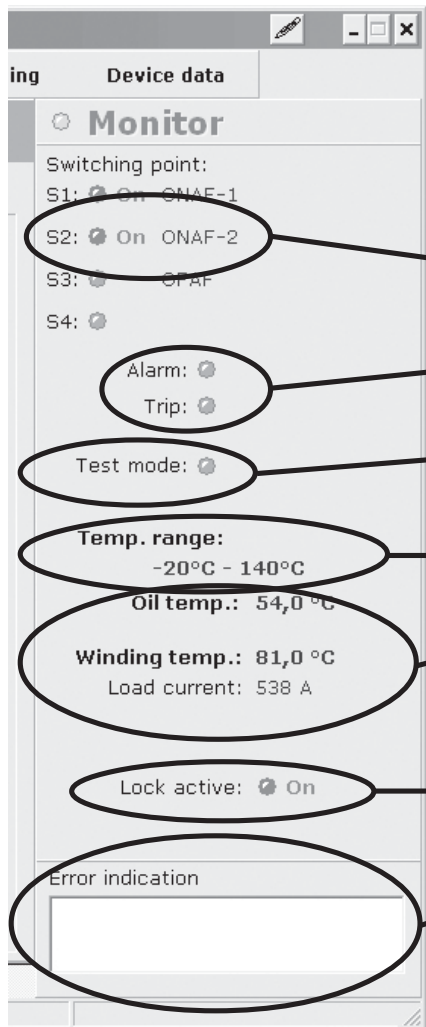
The screen of the visualization software is divided into 3 fields.

- The menu items are located at the top.
- The left side contains the display of the currently selected menu item. The display may be subdivided into individual tabs in the lower left area.
- On the right side is the EPT202 monitor. The current measured values and the status of the device are shown here.



8.3 The EPT202-Monitor

The following states and parameters can be viewed in the <Monitor> field:

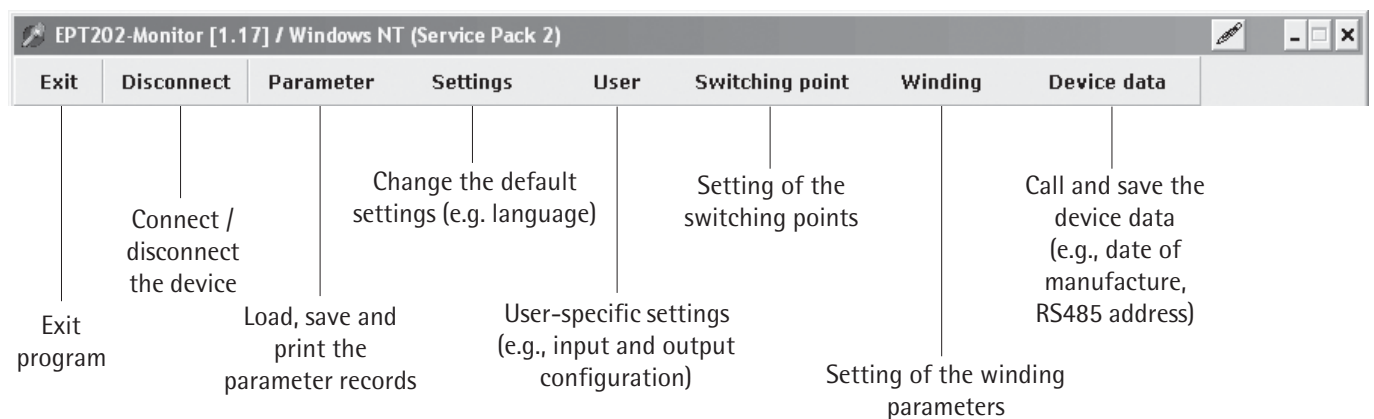


The screenshot shows the 'Monitor' window with the following elements circled and annotated:

- S1: On ONAF-1** and **S2: On ONAF-2**: Status of contacts S1 to S4 (red = on: contact is circuited) and designation of the assigned cooling stage (ONAF1 1 here).
- Alarm: On** and **Trip: On**: Status of the ALARM and TRIP contacts (red = on: contact is circuited).
- Test mode: On**: Status of test mode (red: test mode is activated via the software or via the device).
- Temp. range: -20°C - 140°C**: Input range.
- Oil temp.: 54,0 °C** and **Winding temp.: 81,0 °C**: Current oil temperature, winding temperature and actual load current.
- Load current: 538 A**: Current oil temperature, winding temperature and actual load current.
- Lock active: On**: Status of the key lock (red = on: key lock on device locked, off: key lock on device released).
- Error indication**: The <error indication> shows the device errors (e.g., defective sensor).

8.4 Menu Bar

The individual menu items are briefly discussed below. For a detailed explanation, see the next few chapters.

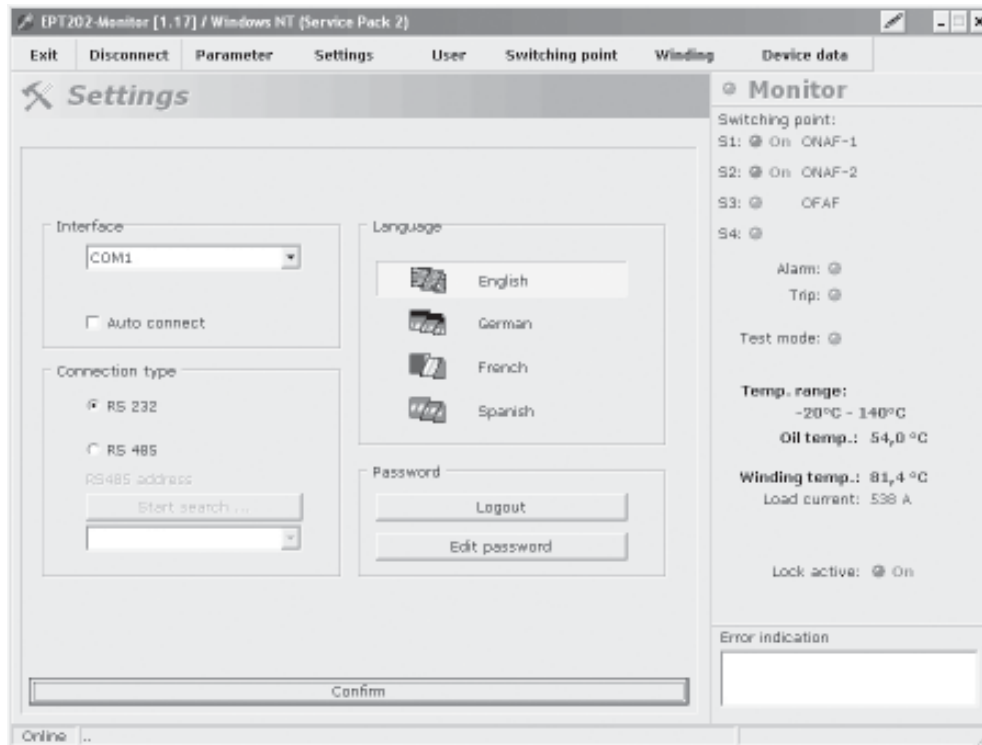


The screenshot shows the menu bar of the EPT202-Monitor software with the following items and their functions:

Menu Item	Function
Exit	Exit program
Disconnect	Connect / disconnect the device
Parameter	Load, save and print the parameter records
Settings	Change the default settings (e.g. language)
User	User-specific settings (e.g., input and output configuration)
Switching point	Setting of the switching points
Winding	Setting of the winding parameters
Device data	Call and save the device data (e.g., date of manufacture, RS485 address)

8.5 <Settings> Menu

After the software is started, the menu item <Settings> appears.



When a field is clicked or a parameter was changed, this must always be confirmed. Press the <Confirm> button.

Language:

The software language can be set in the Language field.

Password (default setting: aaaa):

The device can only be parameterized via the software when the user has logged in. The <Login> button is used to log in. Caution: Remember that the first time you log in, the default **password aaaa** must be used. After the user has logged in, the <Login> button changes to <Logout> and a second button <Edit password> appears. The user can change the password by pressing this button. The user can log out again by pressing the <Logout> button. The software can then continue to be used but no more parameter changes can be performed.

Connection type:

Here you can select whether you want to communicate with the EPT202 via the RS232 or the RS485 interface. If the EPT202 is to communicate via the RS485 interface, you can use the RS485 address field <Start search> for all connected devices and then select the desired device (up to 32 devices in the bus system).

Interface:

If you have selected the RS232 interface as the connection type, the correct COM interface of your PC must then be set in this field.

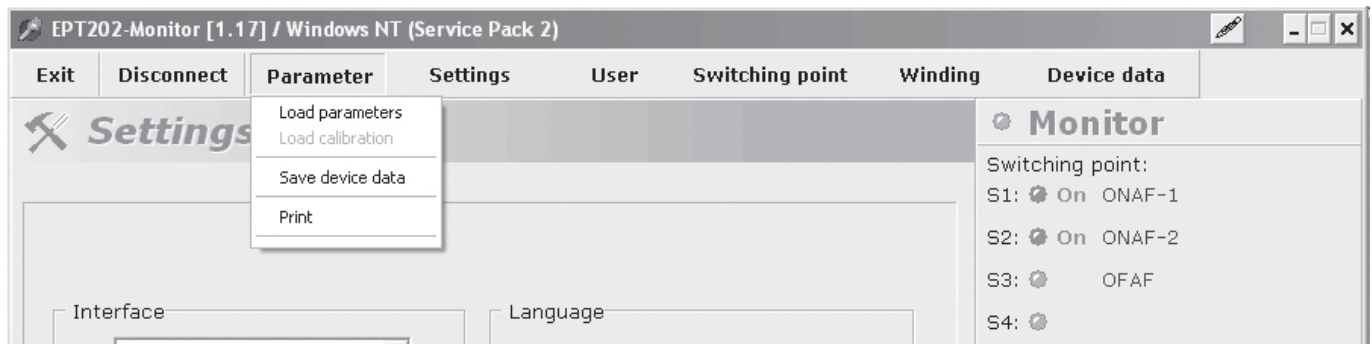
If the field <Auto connect> is clicked, the software attempts to establish a connection to a connected device for each new start. This function is important when the device is to communicate continuously with a PC, for example. For this purpose, this function should be activated and the EPT202 software should be loaded into the autostart menu. When the PC is started again (e.g., after a crash), the connected device is then automatically connected with the software.

The menu item <connect> is used to connect the device with the software.

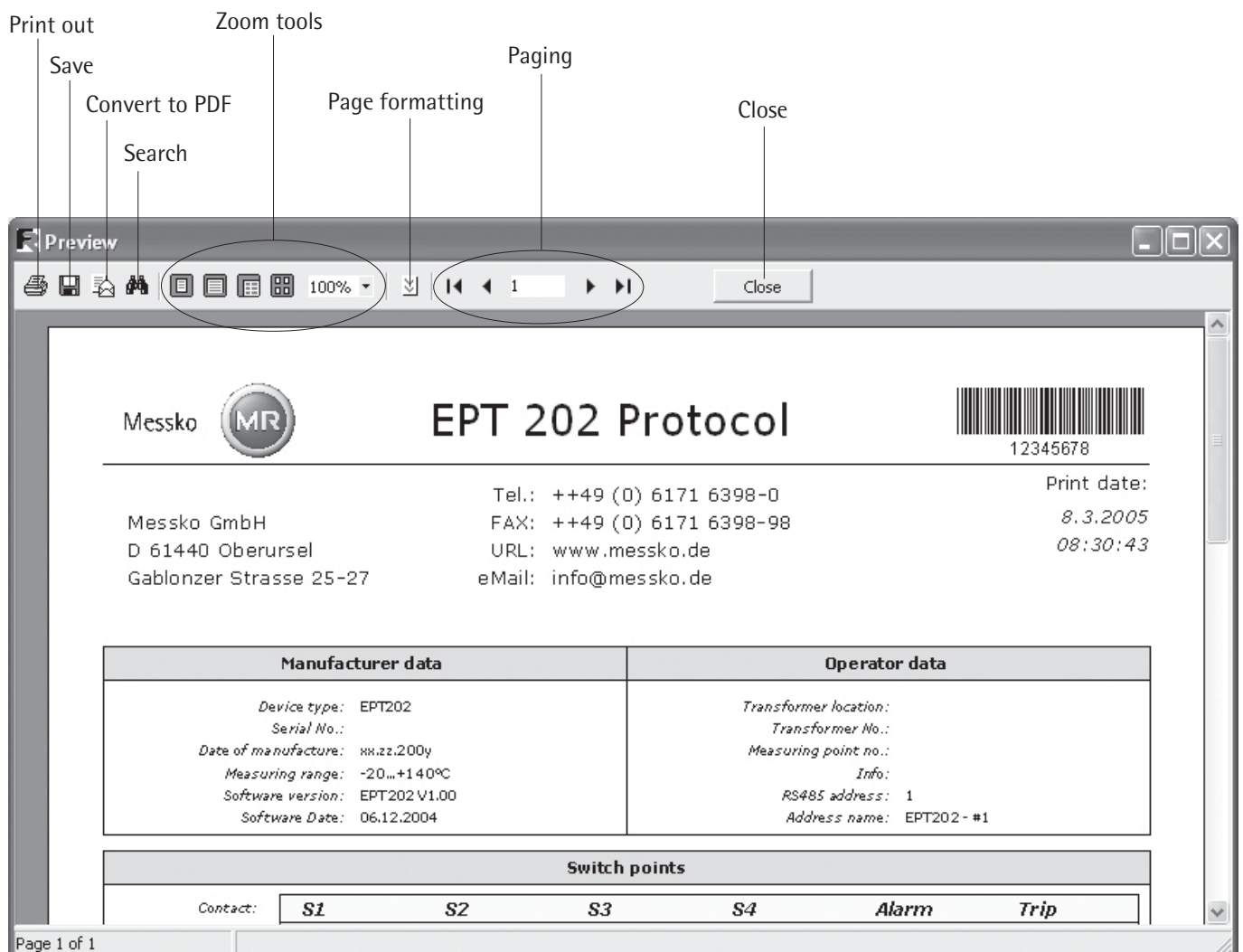
8.6 <Parameter> Menu

The <Parameter> menu can be used to call the following functions.

- **Open file:** If no device is connected with the software, you can use this to load parameter records and print them out.
- **Save device data:** This can be used to save the parameters of the connected EPT202.
- **Print:** Protocol printout of the parameters of the connected device



8.7 The Print Assistant



8.8 <User> Menu

The User menu can be used to make the basic settings of the EPT202. This menu item consists of 4 tabs.

<User range> tab

- **Correction of the zero point:** Zero point errors which may be caused, for example, by installing the sensor at the wrong location can be corrected with this function.
- **Correction of the sensor losses:** This function can be used to correct temperature losses on the thermometer pocket. When it is activated (ON), a correction value is set internally which was determined from studies of temperature measuring devices and sensors on transformers. The temperature loss due to the thermometer pocket begins at an oil temperature of approx. 30 °C and increases as the temperature rises.
- **MIN/MAX values:** The following minimum and maximum values which can be reset with <Delete> are stored in this menu.
 - Max. / Min. oil temperature
 - Max. / Min. winding temperature
 - Max. / Min. ambient temperature
 - Max. load current

EPT202-Monitor [1.17] / Windows NT (Service Pack 2)

Exit Disconnect Parameter Settings User Switching point Winding Device data

User range

Correction: °C zero point

Correction: Sensor losses

Peak values

Oil temp.-Max.: °C

Oil temp.-Min.: °C

Winding temp.-Max.: °C

Winding temp.-Min.: °C

Load current-Max.: A

Monitor

Switching point:

S1: ☒ On ONAF-1

S2: ☒ On ONAF-2

S3: ☐ OFAF

S4: ☐

Alarm: ☒

Trip: ☒

Test mode: ☒

Temp. range:

-20°C - 140°C

Oil temp.: 54,0 °C

Winding temp.: 82,1 °C

Load current: 538 A

Lock active: ☒ On

Error indication

User range / Input/output configuration / Data logger settings / Life consumption

Online



< Input/output configuration > tab

- **Ambient temperature:** This function activates a recording of the ambient temperature. For further details, please refer to page 10 of chapter 4.2 (Electrical connection – Sensor inputs) as well as page 13 of chapter 5.2 (Function Description – Sensor inputs).
- **Oil temperature input:** This field can be used to parameterize your input sensor (Pt100 or 4...20mA). For more information, see page 10 in chapter 4.2 (Electrical Connection of the Sensor Inputs) and page 13 in chapter 5.2 (Function Description of the Sensor Inputs).
- **Oil temperature and winding temperature output:** This field can be used to parameterize the two analog outputs separately from each other to the following output signals:
 - 0 to 20 mA (error signal > 22 mA)
 - 4 to 20 mA (error signal > 22 mA)
 - 4 to 20 mA (error signal < 3.6 mA)
 - 0 to 1 mA
 - 0 to 10 V

For more information on the output signals, see page 11 in chapter 4.4 (Electrical Connection of the Analog Outputs) and page 13 in chapter 5.3 (Function Description of the Analog Outputs).

- **Winding configuration:** This function can be used to mask out the simulation of the winding temperature when you only want to use the device for cooling system control via the oil temperature, for instance. When the simulation of the winding temperature is masked out <Winding off>, all fields and menus which pertain to the winding temperature also disappear. These include, among others, the life consumption calculation, the winding parameterization and the analog output for the winding temperature.

The screenshot shows the EPT202-Monitor [1.17] / Windows NT (Service Pack 2) window. The 'Input/output configuration' tab is active, displaying several configuration options:

- Oil temp. input:** PT 100
- Oil temp. output:** 4 - 20 mA (> 22 mA, Error-Signal)
- Winding config:** Winding On
- Winding temp. output:** 0 - 10 V

A 'Confirm' button is located at the bottom of the configuration area. To the right, the 'Monitor' panel displays real-time data:

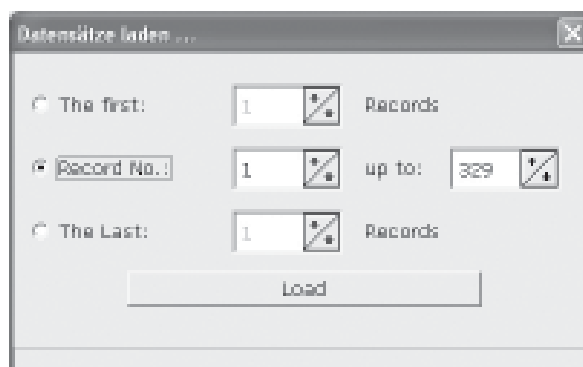
- Switching point:** S1: On ONAF-1, S2: On ONAF-2, S3: OFAF, S4: (empty)
- Alarm:** (empty), **Trip:** (empty)
- Test mode:** (empty)
- Temp. range:** -20°C - 140°C
- Oil temp.:** 54,0 °C
- Winding temp.:** 82,2 °C
- Load current:** 538 A
- Lock active:** On

The bottom status bar shows 'Online' and navigation tabs for 'User range', 'Input/output configuration', 'Data logger settings', and 'Life consumption'.

<Data logger settings > tab

- **Data logging:** The top fields can be used to read the number of stored data records and the date of the first and the last entry. The <Log Interval> field can be used to set the interval at which the data are to be saved. An interval of 10 minutes means that data covering a period of approx. 7.5 months can be saved. The data memory can retain the information over many years even when the power is switched off. For more information on the data logging function, see page 15 in chapter 5.10.

After the <Read out data records> button is pressed a screen (see right) opens in which you can select the data records which you want to read (<Load> button). The data records are saved in an Excel file.



- **Date and time:** This field can be used to save the current date and time. A gold cap capacitor retains the date and time memory for approximately 2 weeks after the power has been turned off. After this time, the information is lost and must be set again when the device is commissioned again.

**NOTE**

This device does not automatically switch between summer and winter time. Please take into consideration, that due to this, time differences of stored data can occur.

EPT202-Monitor [1.17] / Windows NT (Service Pack 2)

Exit Disconnect Parameter Settings User Switching point Winding Device data

Data logger settings

Number of data sets: 329

First data record: 1 vom: 03.12.04, 11:00

Last data record: 329 vom: 08.03.05, 08:28

Read out data records ...

Log interval: 10 [Min]

Date: 8. 3 .2005

Time: 08:34:32

Confirm

Monitor

Switching point:

S1: On ONAF-1

S2: On ONAF-2

S3: OFAF

S4:

Alarm:

Trip:

Test mode:

Temp. range:

-20°C - 140°C

Oil temp.: 54,2 °C

Winding temp.: 82,4 °C

Load current: 538 A

Lock active: On

Error indication

User range / Input/output configuration / Data logger settings / Life consumption

Online

The Excel file for data storage contains the following information.

- Set no.
- Date
- Time
- Event
- Status of the device: „Test mode 0“:Device 1: Visu (which test mode was activated) only applies when „test mode active“ = 1.
 - „S1 to S4, alarm, trip and error active shows which relay was switched.
 - „Lock active“ shows whether the lock was on (released = 0).
 - „Time changed“ shows whether the date or time was changed during the last interval (no change = 0).
 - „Winding on“ shows whether the simulation of the winding temperature was activated.
- Error: If a field is 1, then the applicable error occurs.
- Oil temperature
- Winding temperature 1 and load current 1
- Life consumption
- Winding temperature 2 and load current 2 (function of the additional module EPT202CT)
- Winding temperature 3 and load current 3 (function of the additional module EPT202CT)
- Oil level of transformer (function of the additional module EPT202OL)
- Oil level of OLTC/LTC (function of the additional module EPT202OL)

All fields labeled „In reserve“ are not used at this time.

<Life consumption> tab

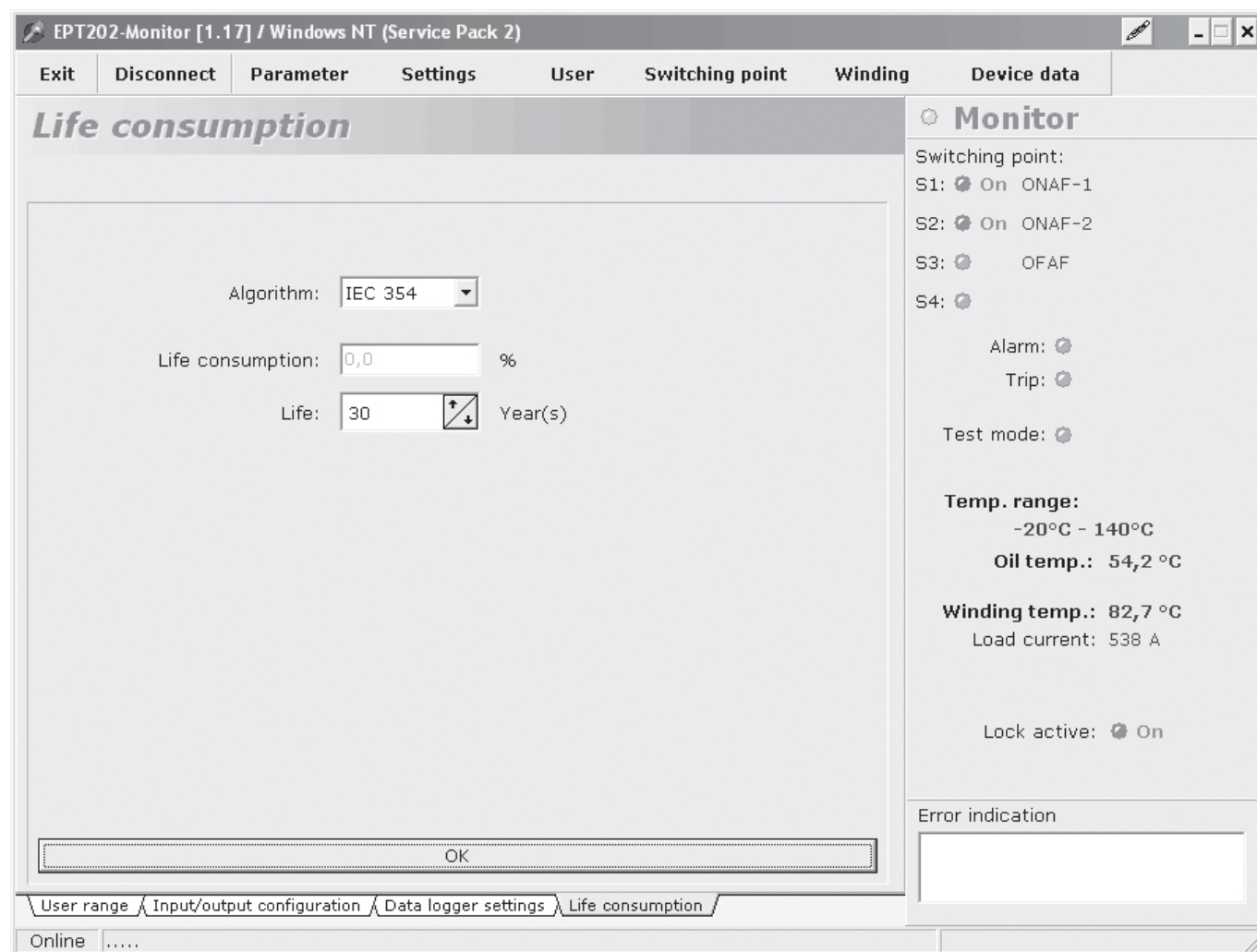
This menu can be used to parameterize and display life consumption.

The calculation can be switched off <OFF> under <Algorithm>, or the desired calculation algorithm can be selected: As per IEC 354 or as per ANSI/IEEE standard.

The expected life span of the transformer must be parameterized in the <Life> field. This value refers to the expected life of the insulation system at rated load. For the assumed value, see the documentation of the transformer or contact the transformer manufacturer.

The <life consumption> is specified as a percentage. If, for instance, the transformer has an expected life span of 30 years and a life consumption value of 50% is indicated, the expected life span of the transformer at rated load would be 15 years. However, the transformer ages with its thermal load and not at a constant rate of time.

For more information on life consumption calculation, see chapter 5.9.



The screenshot shows the EPT202-Monitor [1.17] / Windows NT (Service Pack 2) application window. The main menu bar includes Exit, Disconnect, Parameter, Settings, User, Switching point, Winding, and Device data. The 'Life consumption' tab is active, displaying the following parameters:

- Algorithm: IEC 354 (dropdown menu)
- Life consumption: 0,0 %
- Life: 30 Year(s) (with a spin button)

At the bottom of the main area is an 'OK' button. The right-hand 'Monitor' panel displays the following information:

- Switching point:
 - S1: On ONAF-1
 - S2: On ONAF-2
 - S3: OFAF
 - S4:
- Alarm: (checkbox)
- Trip: (checkbox)
- Test mode: (checkbox)
- Temp. range: -20°C - 140°C
- Oil temp.: 54,2 °C
- Winding temp.: 82,7 °C
- Load current: 538 A
- Lock active: On (checkbox)
- Error indication: (empty text box)

The bottom status bar shows 'Online' followed by a series of dots.

8.9 <Switching points> Menu

Contacts S1 to S4 for cooling system control and the Alarm and Trip contacts are configured in the switching points menu. The parameterization of the individual fields is described below.

1) Description: A description (e.g., the designation of the cooling stage, here ONAF1) can be assigned in a text field for each of the contacts S1 to S4.

2) Control of the contacts: The contacts can be activated via the oil or the winding temperature. This means that when the oil or winding temperature exceeds the set switching point, the contact (change-over contact) is switched. When switched back, the contact drops below the switching point hysteresis. Contacts S1 to S4 can also be switched permanently with <Manual on>.

3) Switching point: The switching points can be set as desired. When you activate the contacts via the oil temperature, ensure that the switching point setting is within the range of the sensor input. If the contact is not to be used, we recommend setting the switching point to the end value.

4) Hysteresis: The hysteresis cannot be set to 0. The smallest possible hysteresis is 1% of the input range. The maximum hysteresis which can be set is calculated from the switching point so that the contact can still be switched back within the input range.

EPT202-Monitor [1.17] / Windows NT (Service Pack 2)

Exit Disconnect Parameter Settings User Switching point Winding Device data

Switching points

	Description	Switching point: [°C]	Hysteresis: [K]	Delay: [s]	Alt.:
Contact S1:	ONAF-1 Winding temp.	75,0	2,5	0,0	☐
Contact S2:	Oil temp. Manual On Winding temp.	80,0	2,5	0,0	☐
Contact S3:	OFAF Winding temp.	85,0	2,5	0,0	☐
Contact S4:	Winding temp.	90,0	2,5	0,0	☐
Alarm:	Winding temp.	100,0	2,0	0,0	☐
Trip:	Winding temp.	120,0	1,8	0,0	☐

Test value in [°C] Test Alternate Interval: [h]

Confirm

Online

Monitor

Switching point:
S1: ☒ On ONAF-1
S2: ☒ On ONAF-2
S3: ☒ OFAF
S4: ☐

Alarm: ☒
Trip: ☒
Test mode: ☒

Temp. range:
-20°C - 140°C
Oil temp.: 54,0 °C
Winding temp.: 82,6 °C
Load current: 538 A

Lock active: ☒ On

Error indication

5) Delay: The delay time of the contacts can be set in this field. The switching point must be exceeded by at least the set time. Otherwise the contact is not switched. The same behavior also applies to switching back.

6) Alternate: Clicking this field assigns the contact to load changing mode. For more information on load changing mode, see chapter 5.7.

7) & 8) Test: Through the use of field 7, one can decide whether the test function will include the ALARM and TRIP contacts or not. The test function and field 9 are activated by means of test button (8).



Warning

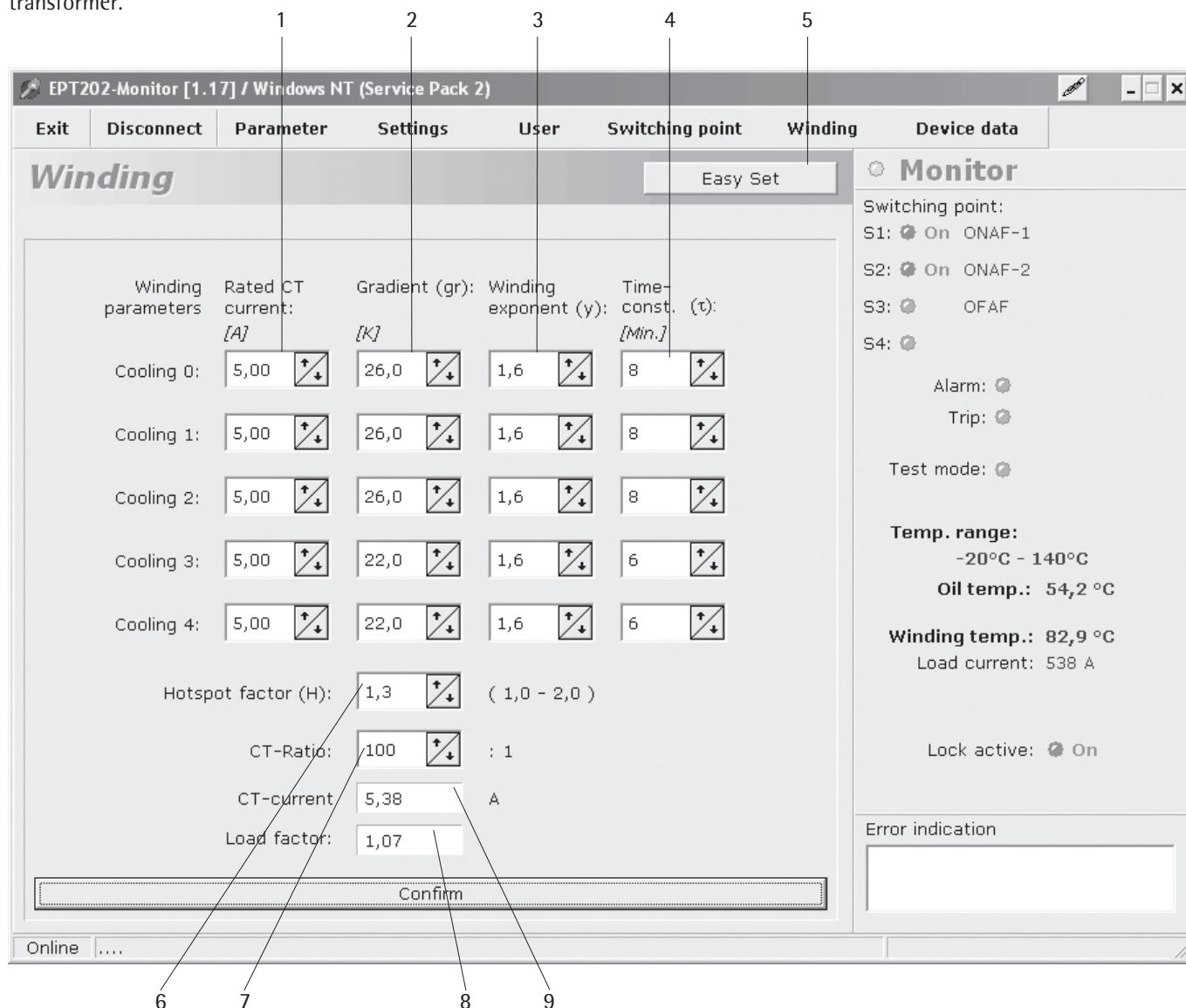
Depending on the application, testing of the TRIP contact can result in the shut-down of the transformer

9) Test temperature: In this field the test temperature can be adjusted to check the switching contacts S1 to S4 as well as the optional features ALARM and TRIP. This test temperature is a superimposed temperature. All functions continue to run in the background so that the calculation of life consumption and data logging etc. are not affected.

10) Alternate interval: The Alternate interval is set in this field. When the value is set to 0, the load changing function is deactivated.

8.10 <Winding> Menu

This menu can be used to set the winding parameters. Parameterization of the individual fields is explained below. For the individual parameters, see the nameplate, the documentation of the transformer or contact the manufacturer of the transformer.



EPT202-Monitor [1.17] / Windows NT (Service Pack 2)

Exit Disconnect Parameter Settings User Switching point **Winding** Device data

Winding Easy Set

Winding parameters	Rated CT current: [A]	Gradient (gr): [K]	Winding exponent (y):	Time-const. (τ): [Min.]
Cooling 0:	5,00	26,0	1,6	8
Cooling 1:	5,00	26,0	1,6	8
Cooling 2:	5,00	26,0	1,6	8
Cooling 3:	5,00	22,0	1,6	6
Cooling 4:	5,00	22,0	1,6	6

Hotspot factor (H): 1,3 (1,0 - 2,0)

CT-Ratio: 100 : 1

CT-current: 5,38 A

Load factor: 1,07

Confirm

Monitor

Switching point:

S1: ☒ On ONAF-1

S2: ☒ On ONAF-2

S3: ☒ OFAF

S4: ☒

Alarm: ☒

Trip: ☒

Test mode: ☒

Temp. range:

-20°C - 140°C

Oil temp.: 54,2 °C

Winding temp.: 82,9 °C

Load current: 538 A

Lock active: ☒ On

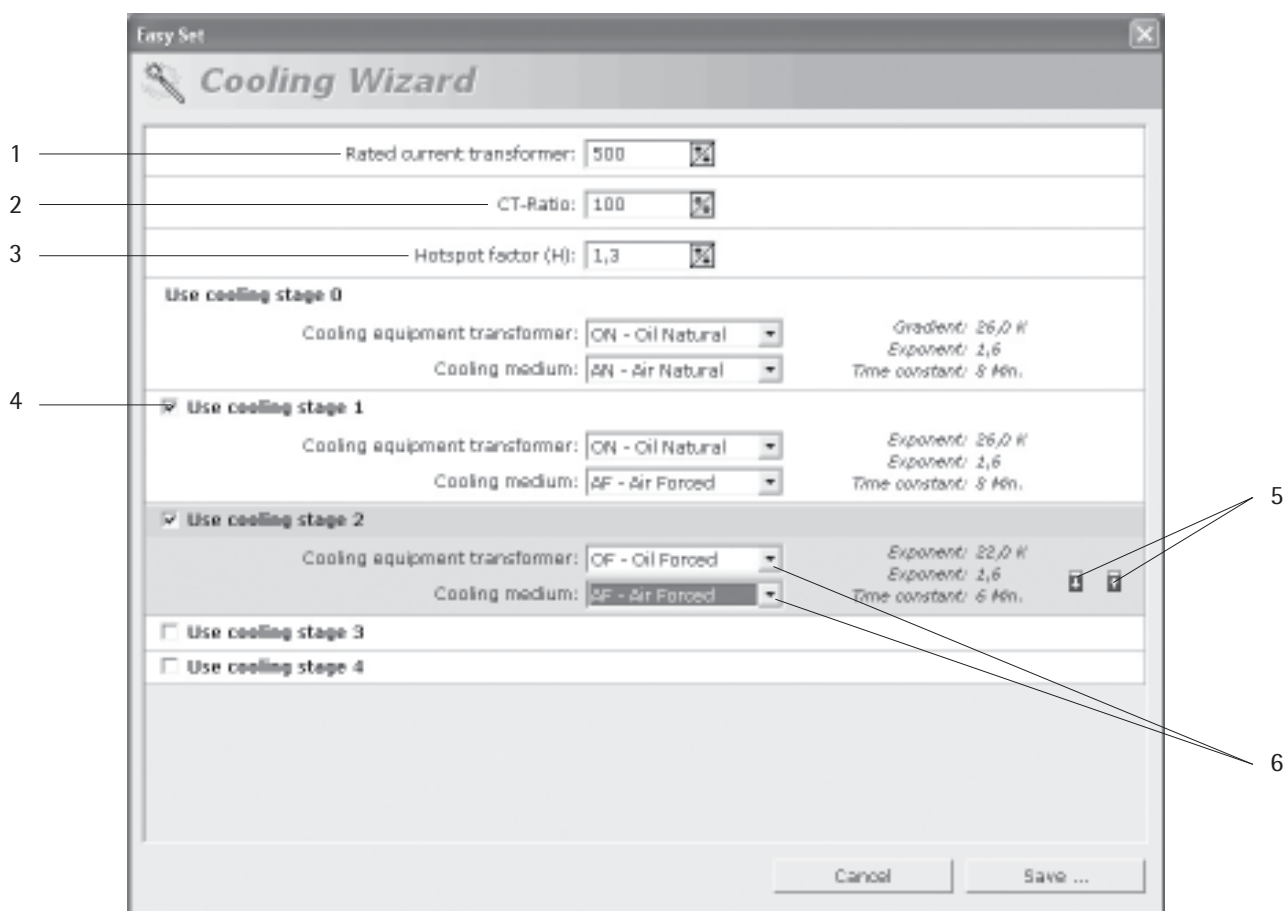
Error indication

Online

- 1) Rated CT current:** The rated CT current is the output current of the secondary current transformer at the rated load of the transformer. This can vary for the individual cooling stages. Setting range: 0.5 A to 5 A.
- 2) Gradient (gr):** The gradient is the temperature jump between the average oil temperature and the average winding temperature at the rated load of the transformer.
- 3) Winding exponent (y):** Exponential power of current versus winding temperature rise. The exponent can be set in the range of 1.0 to 2.0.
- 4) Time constant τ :** This is the thermal time constant of the oil. When a time constant of 8.0 minutes is set for example, this means that after 8.0 minutes, 63.2% of the final value of the winding temperature will have been reached. The time constant can be set from 0.0 to 30.0 minutes.
- 5) Easy Set:** Press this button to access a submenu with which you can set the preset parameter records in accordance with IEC 60354. This will make parameterization easier when, for example, the exact parameters of the transformer are no longer known. The function is explained in more detail below.
- 6) Hotspot factor (H):** The hotspot factor describes the difference between the hotspot temperature and the average winding temperature of the top winding layer. Setting range: 1.0 to 2.0.
- 7) CT-Ratio:** The CT-Ratio is the ratio of the rated current of the transformer to the rated CT current of the secondary current transformer. Setting range: 1:1 to 3000:1
- 8) CT-current:** The actual CT current is indicated in this field.
- 9) Load factor:** The actual load factor is indicated in this field.

8.11 Easy Set-Function

The Easy Set function makes parameterization easier. The Cooling Wizard can be used to parameterize your cooling system with parameters preset in accordance with IEC 60354.



The individual fields must be parameterized in succession with the Easy Set function. The  or  key can be used to change to the upper or lower field.

The following three parameters must be set first.

- Rated current transformer (1)
- CT-Ratio (2)
- Hotspot factor (H) (3)

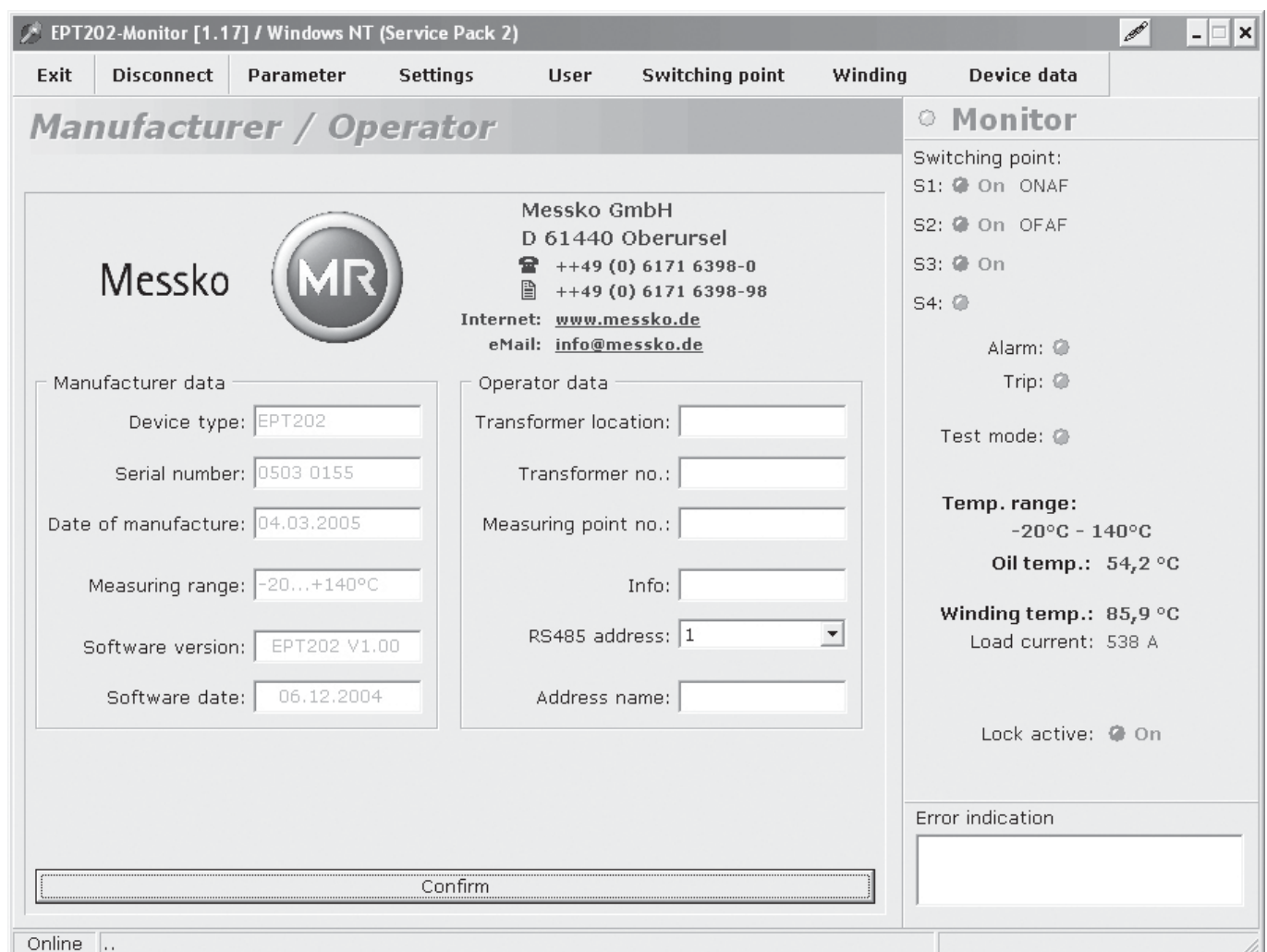
Then the cooling equipment and the cooling medium of the individual cooling stages must be set (5). The parameters (rated CT current, gradient, winding exponent and time constant) are set automatically. If a further cooling stage is used, a checkmark must be placed in the field (4).

<Save> exits the Cooling Wizard and the values are saved.

After parameterization with the Cooling Wizard, be sure to check the settings of the switching points and correct them as necessary.

8.12 <Device data> Menu

The manufacturer's data are stored in this menu. The user can also store his own data such as transformer location, transformer no., and so on here.



EPT202-Monitor [1.17] / Windows NT (Service Pack 2)

Exit Disconnect Parameter Settings User Switching point Winding Device data

Manufacturer / Operator

Messko 

Messko GmbH
D 61440 Oberursel
++49 (0) 6171 6398-0
++49 (0) 6171 6398-98
Internet: www.messko.de
eMail: info@messko.de

Manufacturer data

Device type: EPT202
Serial number: 0503 0155
Date of manufacture: 04.03.2005
Measuring range: -20...+140°C
Software version: EPT202 V1.00
Software date: 06.12.2004

Operator data

Transformer location:
Transformer no.:
Measuring point no.:
Info:
RS485 address: 1
Address name:

Monitor

Switching point:
S1: ☒ On ONAF
S2: ☒ On OFAF
S3: ☒ On
S4: ☐

Alarm: ☒
Trip: ☒
Test mode: ☒

Temp. range:
-20°C - 140°C
Oil temp.: 54,2 °C
Winding temp.: 85,9 °C
Load current: 538 A

Lock active: ☒ On

Error indication

Confirm

Online ..

9. Appendix

9.1 Dimension Drawing of the EPT202 for Rail Mounting

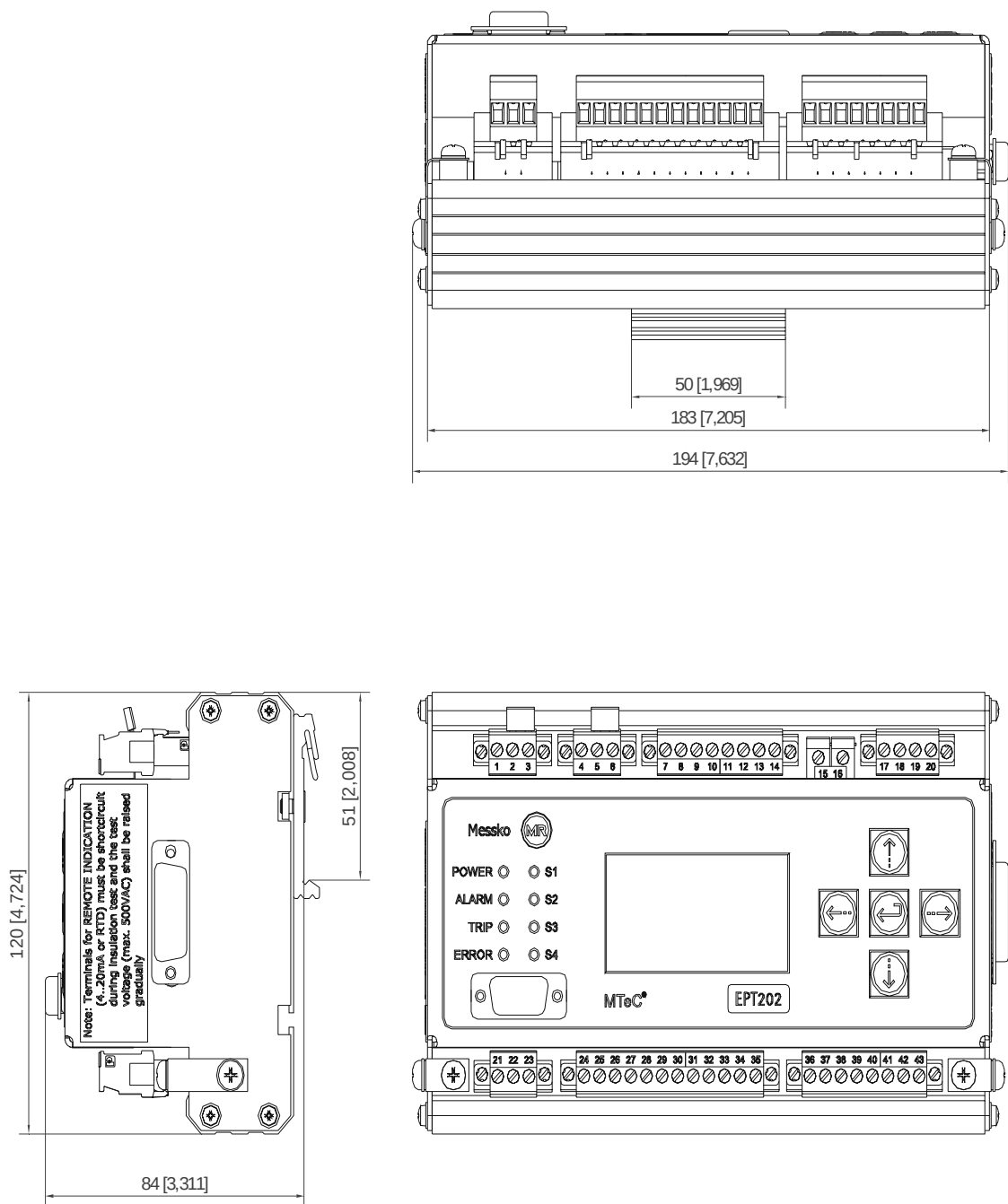


Fig. 6

9.2 Dimension Drawing of EPT202 for 19" Rack

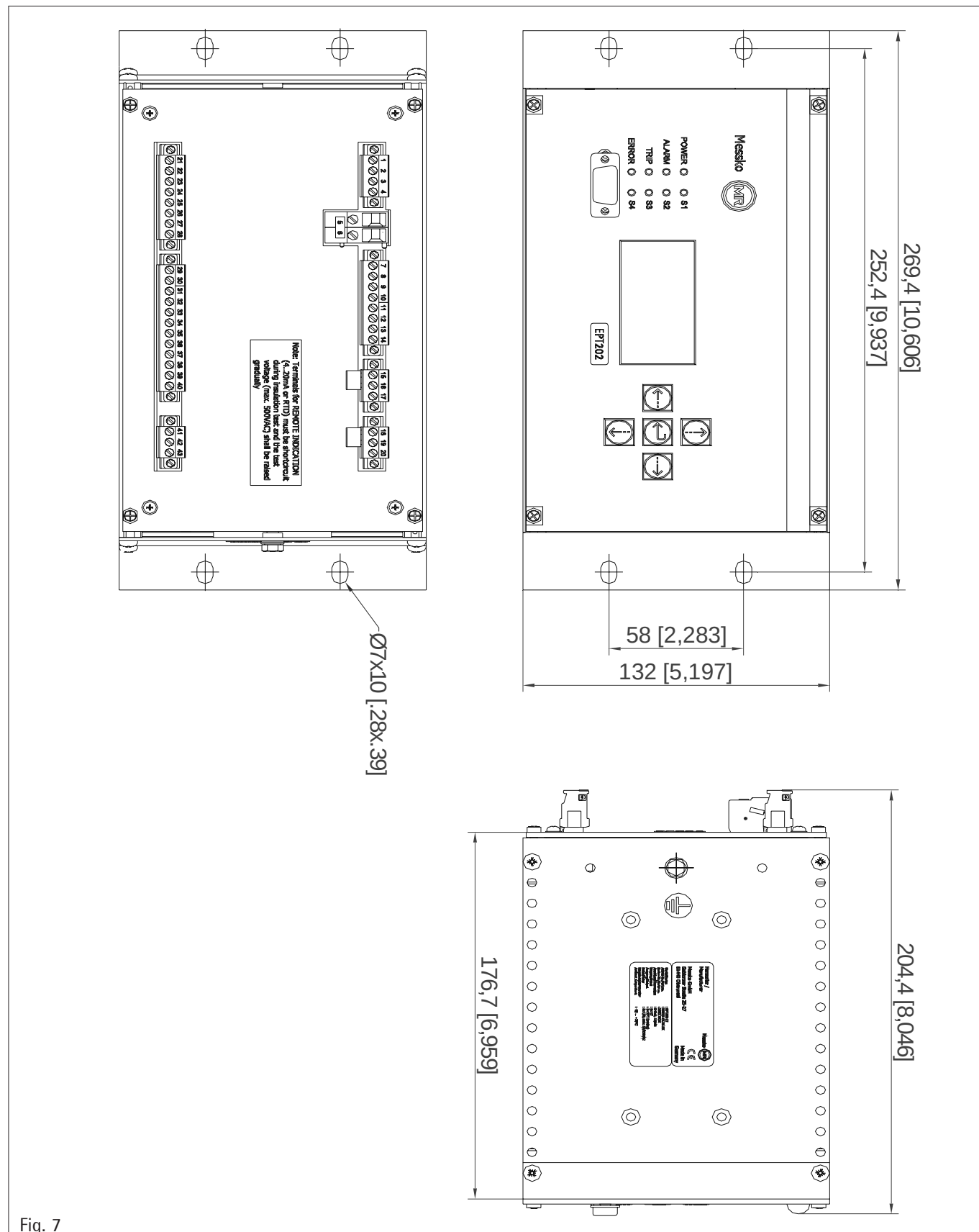


Fig. 7

9.3 Dimension Drawing of EPT202 for Control Panel Mounting

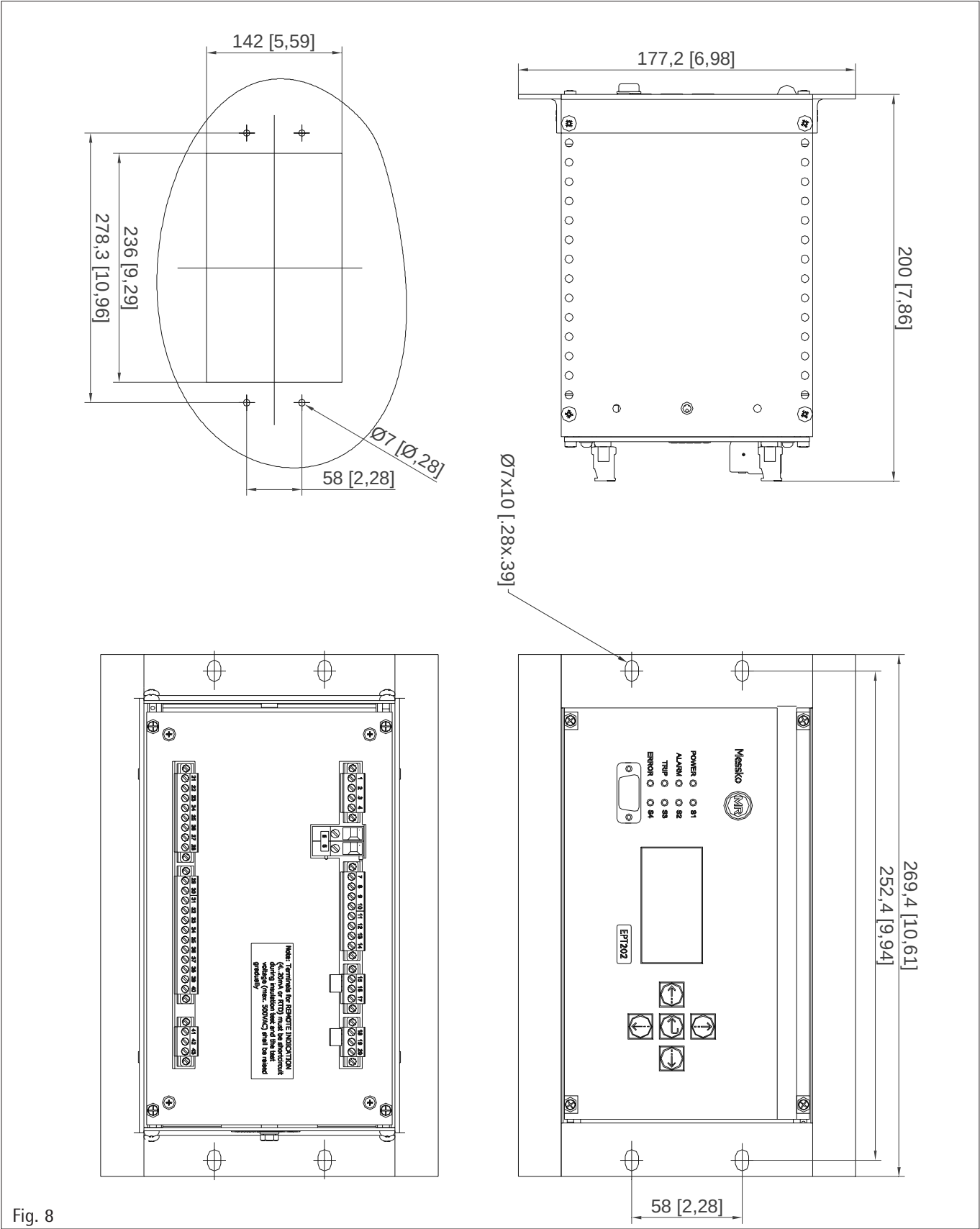


Fig. 8

9.4 Dimension Drawing of EPT202 for Installation in Motor Drive ED of the MR On-Load Tap-Changer

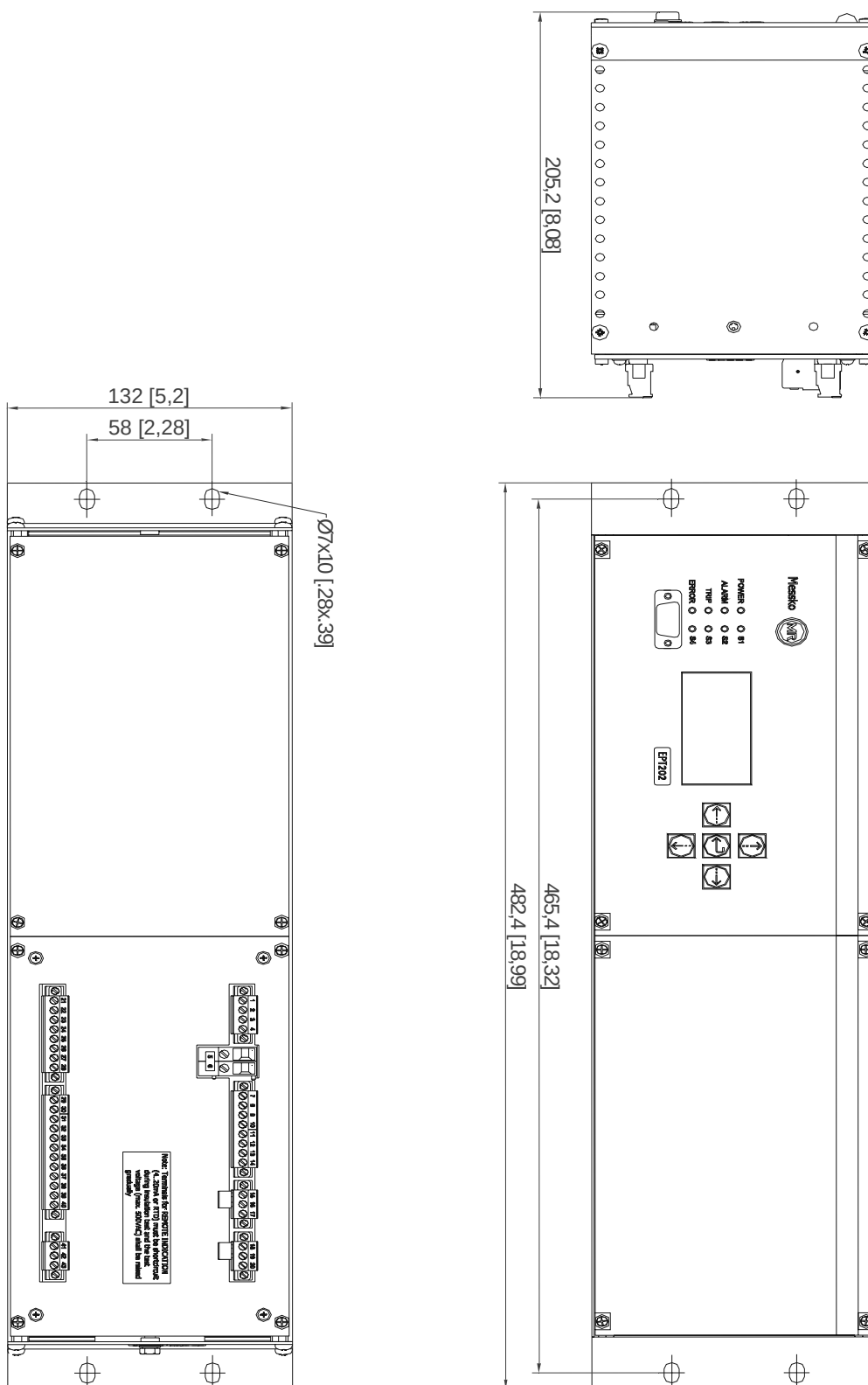


Fig. 9

9.5 Connection Diagram of the EPT202 for Top-Hat Rail Mounting

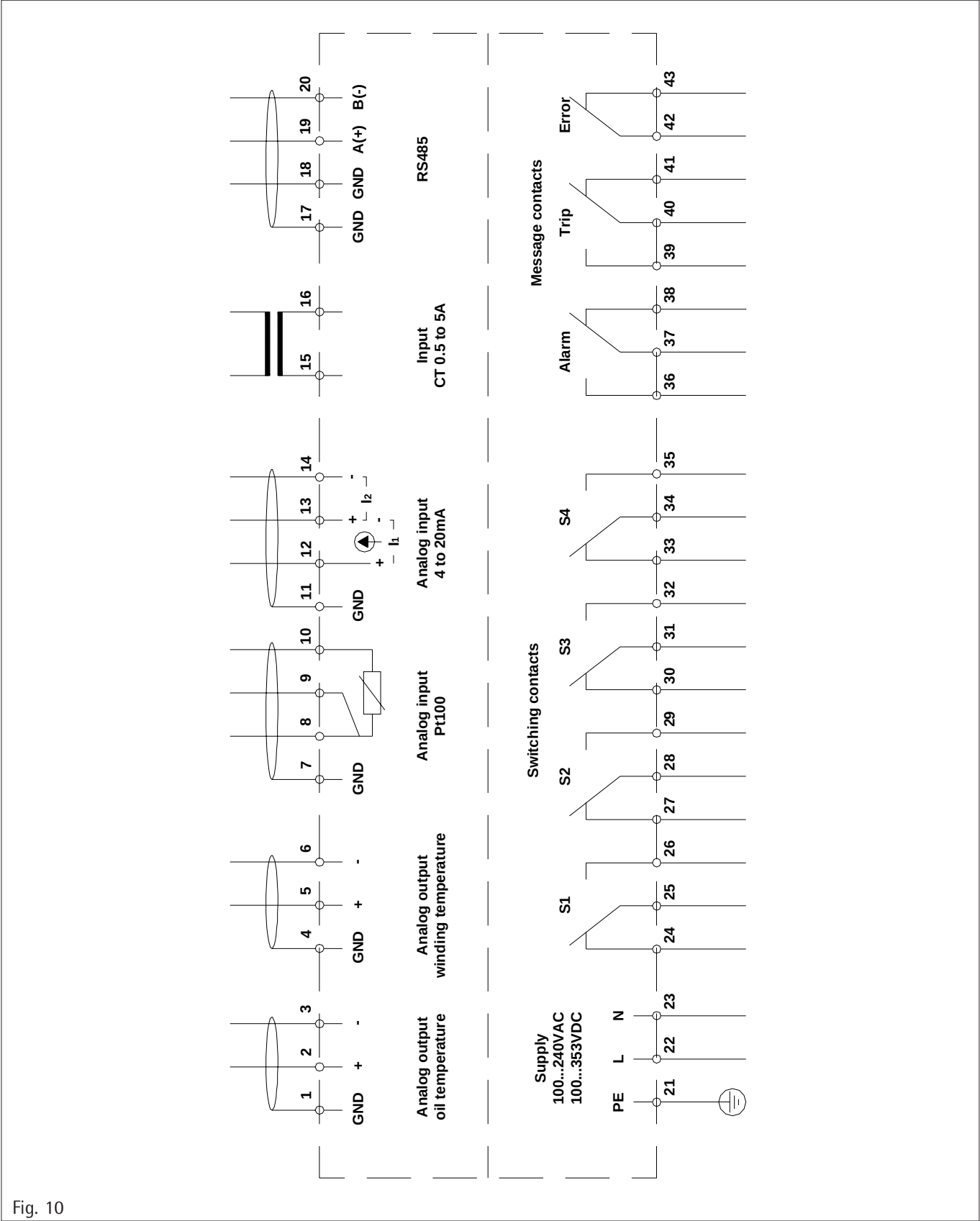


Fig. 10

9.6 Connection Diagram of the EPT202 for Control Panel Installation and 19" Subrack

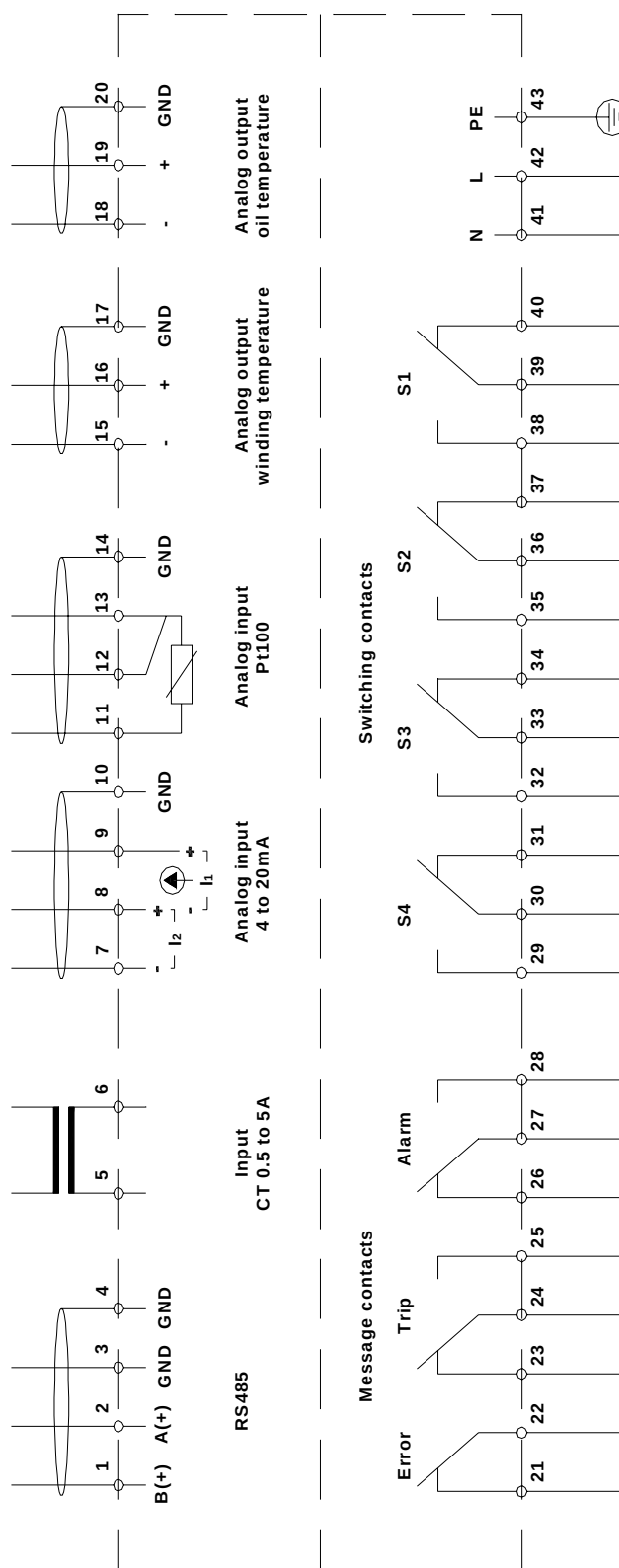


Fig. 11

9.7 Circuit Diagram for 4 to 20 mA Sensor Connection

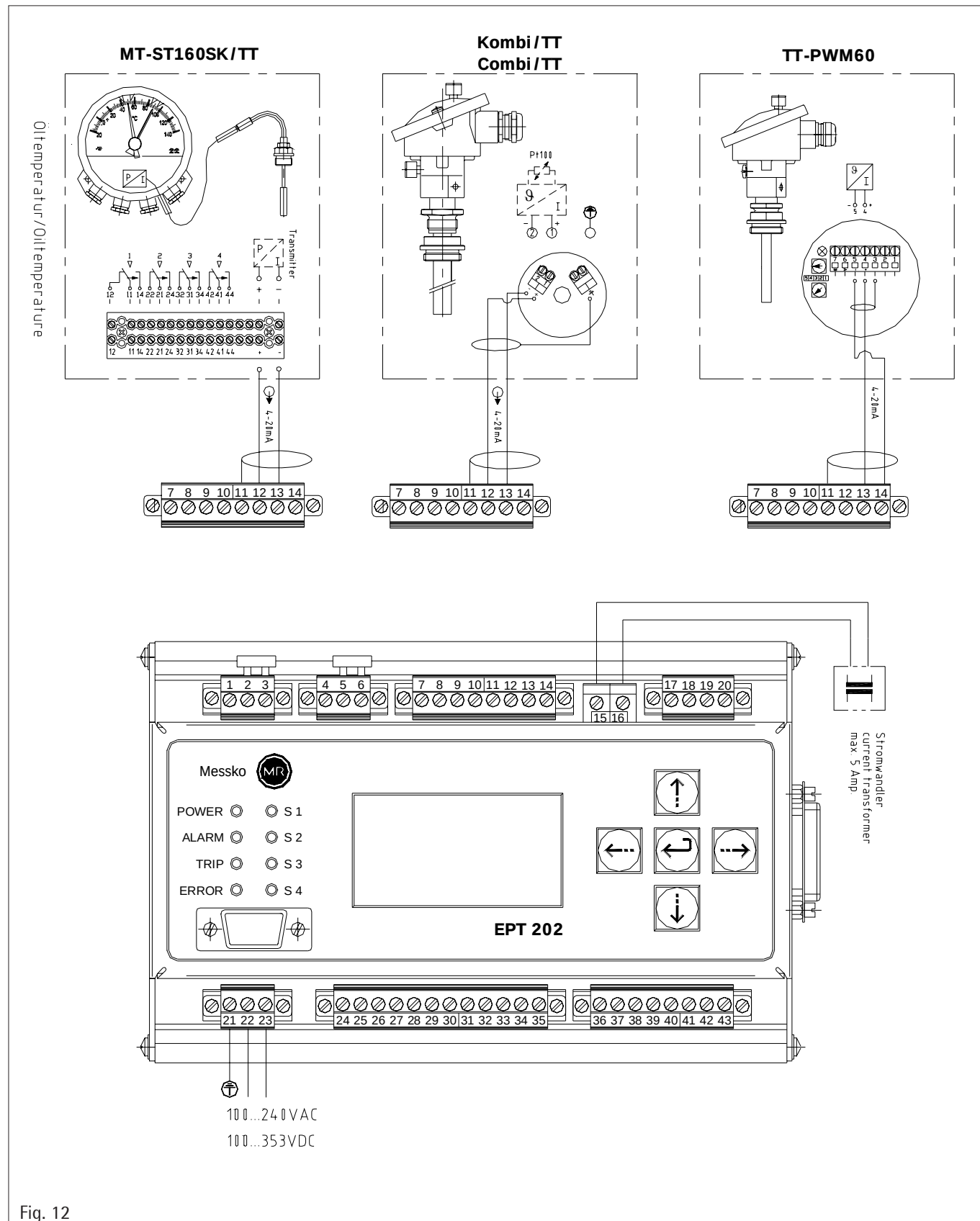


Fig. 12

9.8 Circuit Diagram for Pt100 Sensor Connection

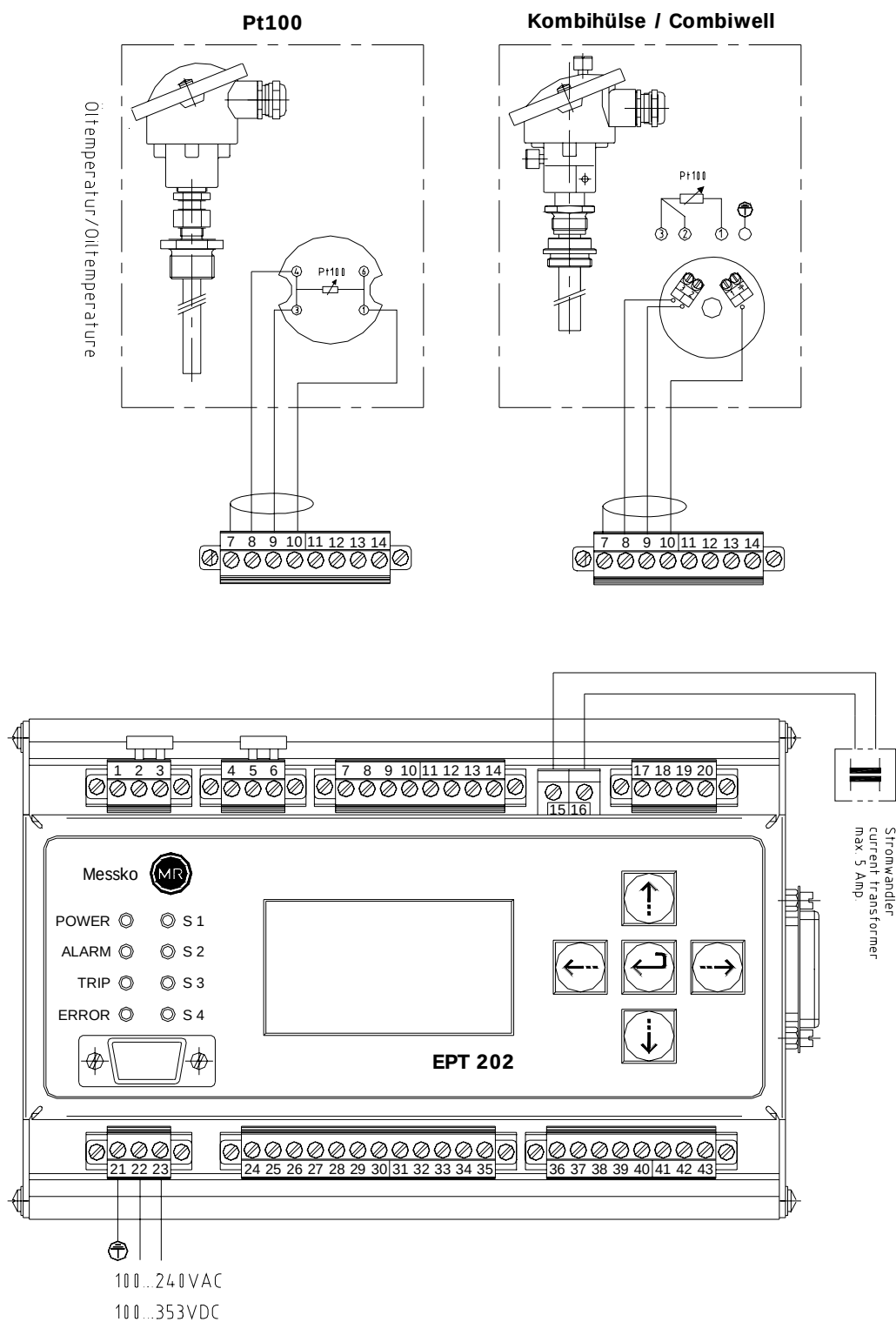
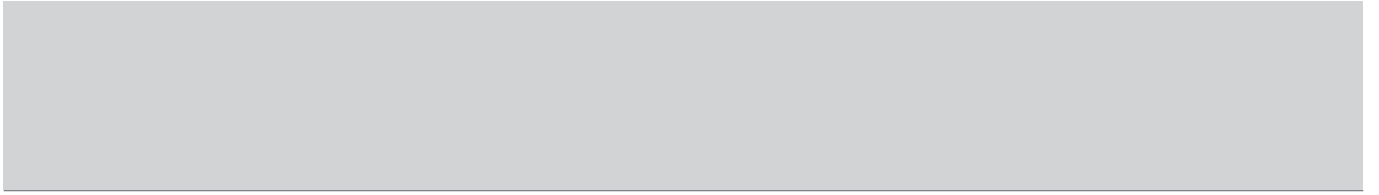


Fig. 13





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61440 Oberursel
Germany

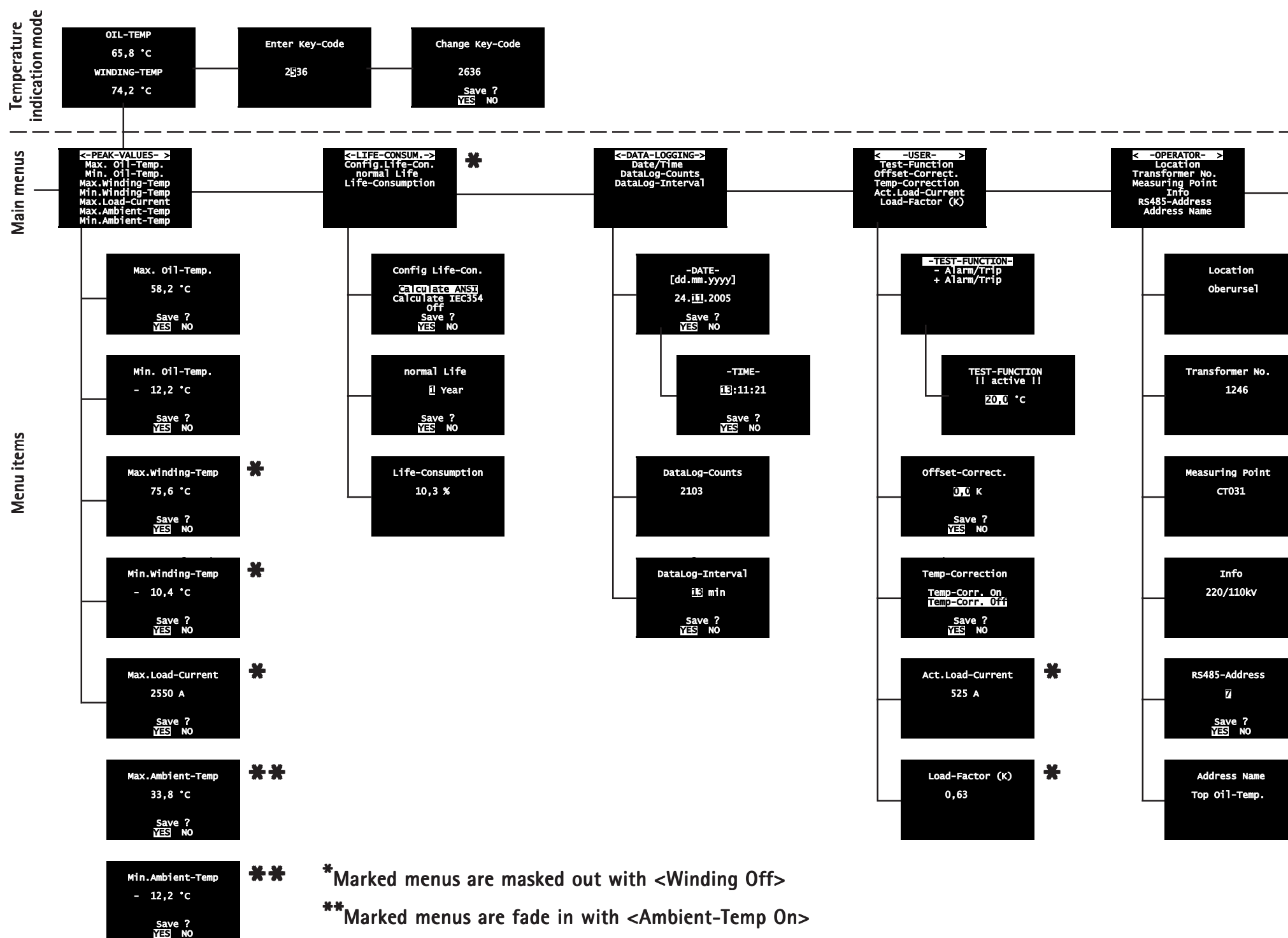
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BA2076/02/01 • Printed in Germany • Art.-Nr./Art.No. 990953

Messko





Menu prompting

Releasing the key lock and key code change

In the temperature indication mode, press the keys <UP> and <DOWN> simultaneously. As a result, a mask opens for key code entry. The key code entry is made by using the 4 direction keys (factory set at 1111). When this is done successfully, the green power LED flashes and the key lock is released. If after a period of 60seconds, no further key is pressed, the key lock is automatically locked again. The key code can be changed when the key lock is unlocked. By pressing the the keys <UP> and <DOWN> simultaneously, the mask <Change Key-Code> appears, enabling a change to be made by means of the 4 direction keys and finally confirmed by pressing the <Enter> key.

Changing to the menu level

To change from the temperature indication mode to the menu level (jump to the main menu <PEAK VALUES>), press the <ENTER> key.

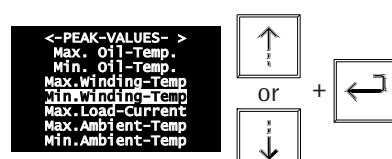
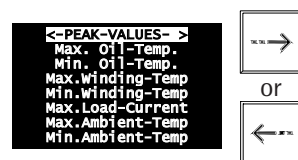
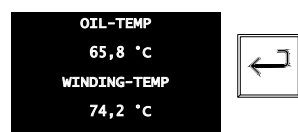
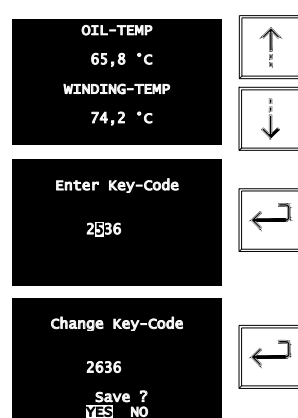
Changing the main menu

The main menus are arranged in rings. The <LEFT> or <RIGHT> key can be used to select the appropriate menu.

To return to temperature indication mode, the title of the main menu must be highlighted. When the menu title is selected, press the <ENTER> key.

Selecting a menu item

The <UP> and <DOWN> keys can be used to highlight an individual menu item. Selection is done using the <ENTER> key.

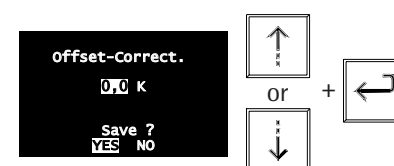


Functions of the menu items

(Only with released key lock)

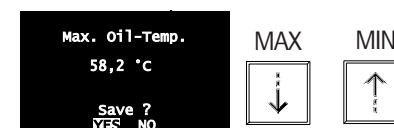
- Changing parameters:

change it with the <UP> or <DOWN> key and confirm with <ENTER>.



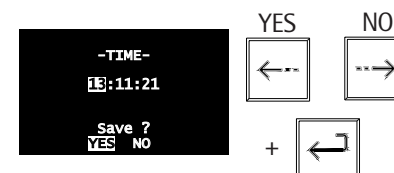
- Resetting MIN/MAX values:

The MIN and MAX values can be reset by use of the <UP> and <DOWN> keys.



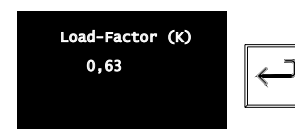
- Confirming changes:

Any changes must be confirmed using the option <YES>



- Returning to higher-level menus:

After changing a parameter the device jumps automatically to the higher-level menu. When the submenu is only used for indication or no parameter is changed, the <ENTER> key can be used to jump from the menu to the higher-level menu.



When a menu item has submenus itself, the title must be selected to change to the higher-level menu (<UP> or <DOWN>) and confirmed with <ENTER>.

