



# Pointer thermometer MESSKO® COMPACT

## Technical data

5613687/02 EN



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The product may have been altered since this document was published.

We reserve the right to change the technical data, design and scope of supply.

Generally the information provided and agreements made when processing the individual quotations and orders are binding.

The original operating instructions were written in German.



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## 1 Design/versions

This technical document contains detailed information about the technical properties of the product. To place an order, please use the "Bestellangabenblatt (Inquiry and order specifications)" form, which you will find on our website <http://www.reinhausen.com> below the respective product. Further information is available in the MR Reinhausen customer portal: <https://portal.reinhausen.com>.

### 1.1 Compact Standard overview

Depending on your order, the pointer thermometer features cable glands or NPT adapters.

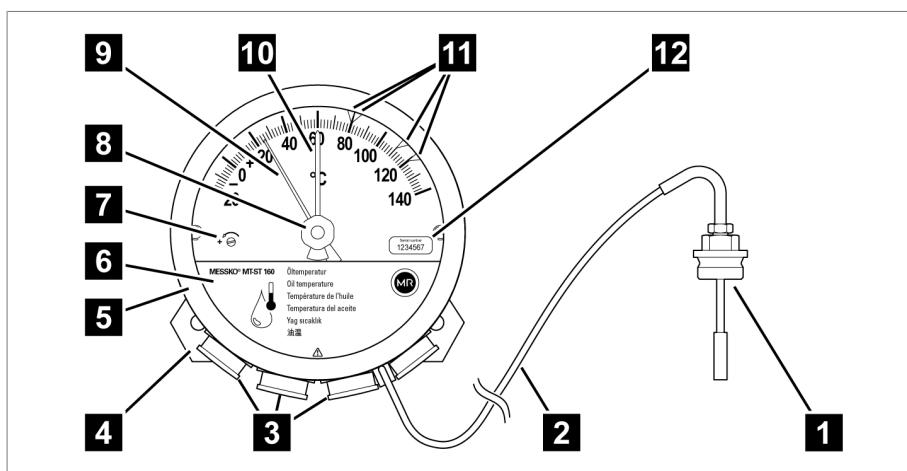


Figure 1: Pointer thermometer

1 Temperature sensor	2 Capillary line
3 Cable glands/adapters	4 Vibration-damping plate
5 Bayonet seal ring, glass pane and gasket	6 Cover plate
7 Calibration screw	8 Drag hand reset
9 Pointer	10 Drag hands
11 Adjustable micro-switches	12 Label with serial number

The pointer thermometer is calibrated at the factory. Do not adjust the calibration screw **7**, or else the device's warranty will be voided!





## 1.2 Overview Compact RM

Depending on your order, the pointer thermometer features an ANSI or M connector, cable glands or NPT adapters.

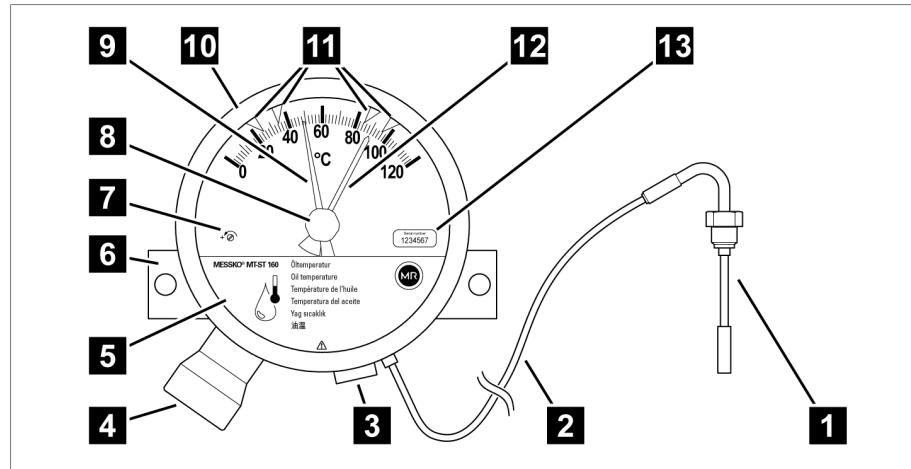


Figure 2: Pointer thermometer

1 Temperature sensor	2 Capillary line
3 Adapter	4 Connector plug
5 Cover plate	6 Mounting plate
7 Calibration screw	8 Drag hand reset button
9 Pointer	10 Bayonet seal ring
11 Micro-switches	12 Drag hands
13 Label with serial number	

The pointer thermometer is calibrated at the factory. Do not adjust the calibration screw **7**, or else the device's warranty will be voided!





## 2 Device versions

This document applies to the device versions of the MESSKO® Compact pointer thermometer illustrated in the following overview. These device versions are available both for the MESSKO® Compact Standard version (with cable glands) and for the MESSKO® Compact RM version (with plug connection).

Device version	Type key	Meaning
MESSKO® Compact Standard	MTST160..., without "RM"	With cable glands
MESSKO® Compact RM	MTST160...RM	With plug connection (e.g. ANSI connector)
Oil temperature indicator	MTST160SK/...(RM)	Without interface
	MTST160SK/TT/...(RM)	Passive 4...20 mA analog output
	MTST160SK/TTM/...(RM)	Active 4...20 mA analog output and Modbus RTU
Winding temperature indicator	MTST160W...	Gradient setting by heating current
	MTST160WR...	Gradient setting by resistance value
	MTST160W(R)/...(RM)	Without interface
	MTST160W(R)/TT/...(RM)	Passive 4...20 mA analog output
	MTST160W(R)/TTM/...(RM)	Active 4...20 mA analog output and Modbus RTU

Table 1: Abbreviations in the device designation

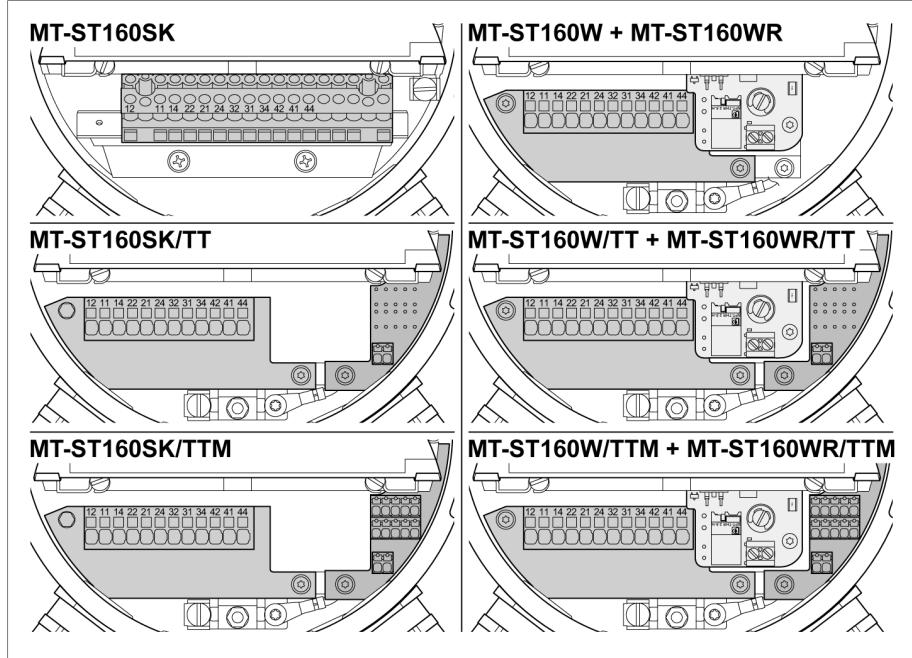


Figure 3: Device versions overview

#### **Oil temperature indicator**

- Display of the oil temperature.
- Pointer thermometer with adjustable micro-switches.
- The displayed temperature corresponds to the oil temperature at the temperature sensor of the pointer thermometer.
- The mechanical measurement system functions independently and without a power source.

#### **Winding temperature indicator**

- Display of the winding temperature.
- Pointer thermometer with adjustable micro-switches.
- The displayed temperature corresponds to the winding temperature based on the oil temperature, secondary transformer current and the temperature difference.
- The secondary transformer current supplies a heating resistor in the mechanical pointer thermometer with power, thus causing a temperature increase that corresponds to the loading of the transformer, as compared to the actual oil temperature that was measured.

### 3 Function description

Depending on the device version, the pointer thermometer measures the oil temperature or determines the winding temperature in power transformers, distribution transformers or reactors. The temperature sensor of the pointer thermometer is located in the thermometer pocket mounted in the transformer tank. The measured value is displayed directly on the pointer thermometer.

Depending on the device version, you can use the following interfaces for transmitting measured values:

- Type TT: Passive 4...20 mA analog output
- Type TTM (24 VDC power supply necessary):
  - Active 4...20 mA analog output
  - RS485 interface for Modbus RTU

In addition, the contacts of the micro-switches switch when threshold values are exceeded.

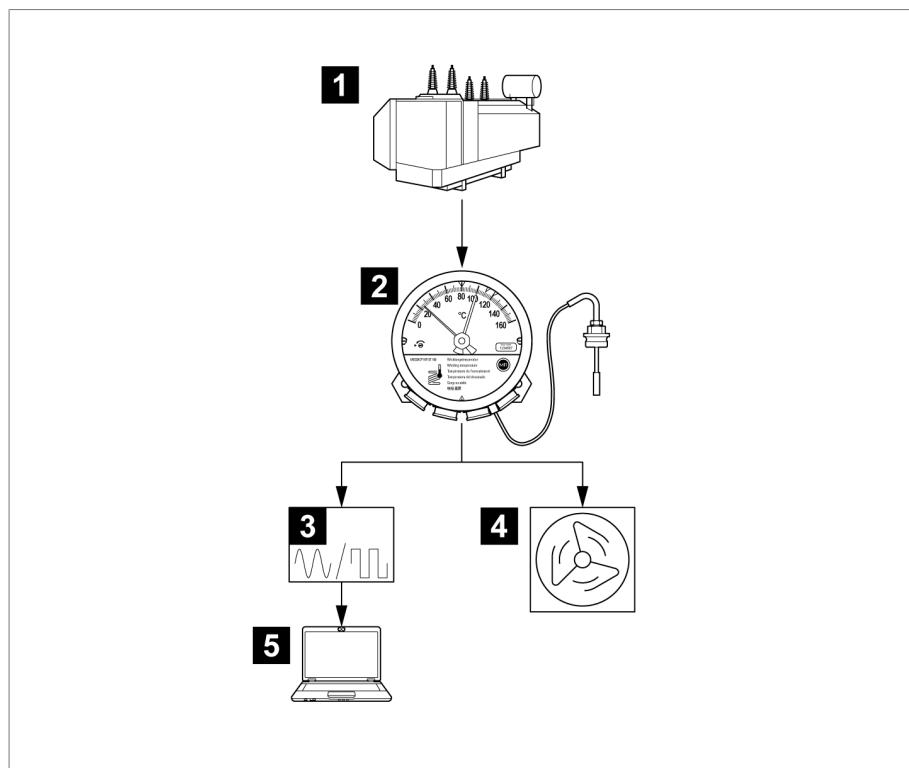


Figure 4: Example temperature measurement and temperature display

1 Transformer	2 Pointer thermometer for winding temperature (or oil temperature)
3 Digital display / analog display	4 Transformer cooling system control
5 SCADA	



## 4 Temperature sensor

### 4.1 Overview Compact temperature sensor

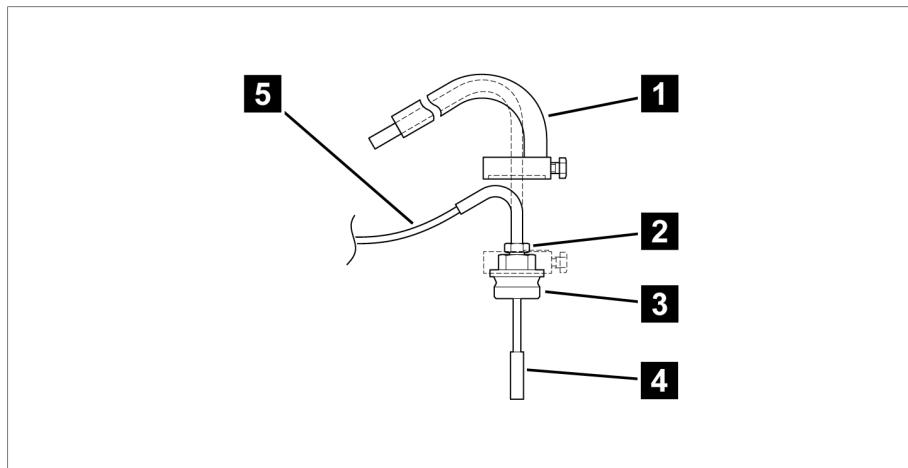


Figure 5: Temperature sensor

1 Step protection (optional) \*

2 Small screw connection on temperature sensor

3 Large screw connection on temperature sensor \*

4 Temperature sensor

5 Capillary line

\*) only for No. 6 VA and No. 7 sensors [► Section 6.3, Page 19]



## 5 Technical data

### 5.1 Ambient conditions

Permissible ambient conditions	
Location of use	Indoors and outdoors, tropic-proof
Operating temperature <sup>1)</sup>	-40...+80 °C
Storage temperature <sup>1)</sup>	-50...+80 °C
Ambient air temperature <sup>1)</sup>	-50...+80 °C
Relative humidity	Fog-free up to 80%
Installation altitude <sup>1)</sup>	2,000 m above mean sea level
Degree of protection	IP55 in accordance with IEC 60529
Protection class	I
Oversupply category	III
Contamination level	2 (within the device)

<sup>1)</sup> Extended ranges on request.

### 5.2 Technical data

	Pointer thermometer for oil temperature	Pointer thermometer for winding temperature
Compact measuring range	-20...+140 °C	0...+160 °C
Compact RM measuring range	0...+120 °C 0...+160 °C	0...+160 °C 0...+180 °C
Tolerance	±3 °C in accordance with DIN EN 13190 Class 1 and DIN 16196	
Basic materials		
Front ring and housing	Sheet steel, galvanized, coated in RAL 7033 in accordance with DIN EN ISO 12944-9 corrosion protection class C4H	
Inspection window	Laminated safety glass	
Temperature sensor	Bare brass	
Retaining plate	Stainless steel	
Capillary line	Copper capillary with protective jacket	
Offshore optional	As per the requirements in accordance with DIN EN ISO 12944-9 with corrosion-protection class CX	



<b>Dimensions and weight</b>	
Compact housing	Ø 173 mm [Ø 6.81"]; depth 98 mm [3.86"]
Compact RM housing	Ø 173 mm [Ø6.81"]; depth 71 mm [2.80"]
Weight	Approx. 2.5 kg (with 6 m capillary line)
<b>Passive 4...20 mA analog output (type TT)</b>	
Feed-in voltage of the passive current loop	18...30 VDC unregulated, max. 10% residual ripple, protected against polarity reversal
Output signal	4...20 mA; passive; 2-conductor wiring <3.6 mA: Device diagnoses error
Max. load resistance	750 Ω at U <sub>b</sub> = 24 VDC
Rated insulation voltage	500 VDC/1 min; terminals to ground
Repetition accuracy	≤ ±0.1% from the end value
<b>Active 4...20 mA analog output (type TTM)</b>	
Supply voltage	24 VDC unregulated, max. 10% residual ripple, protected against polarity reversal
Output signal	4...20 mA; active; 4-conductor wiring <3.6 mA: Device diagnoses error
Max. current consumption	40 mA
Max. load resistance	750 Ω at U <sub>b</sub> = 24 VDC
Rated insulation voltage	500 VDC/1 min; terminals to ground
Repetition accuracy	≤ ±0.1% from the end value
<b>RS485 interface for Modbus RTU (type TTM)</b>	
Supply voltage	24 VDC unregulated, max. 10% residual ripple, protected against polarity reversal
Standard	EIA/TIA-485
Protocol	Modbus RTU
Wiring	2-wire; half-duplex
Terminal designation	Polarity: A = D+; B = D-; COM=common ground Expected voltage between A and B in the idle state: >+200 mV
Rated insulation voltage	500 VDC/1 min; terminals to ground



### 5.3 Micro-switches

Micro-switch technical data	
Quantity	1...6 adjustable micro-switches
Minimum switching distance	6% of the measuring range for standard switch arrangement; <1 K for narrowing
Switching hysteresis	Approx. 5 K (for decreasing temperature)
Protection	Miniature circuit breaker 6 A, type C
Rated insulation voltage in accordance with IEC 60076-22-1	2,500 VAC/1 min; terminals to ground 1,000 V AC/1 min; between open terminals
Lightning impulse withstand voltage in accordance with IEC 60076-22-1	4,000 V; terminals to ground 3,000 V; between open contacts
Contact material	Standard: silver alloy Optional: gold-plated contacts
Contact type	Change-over contact, normally open contact

#### Utilization category in accordance with IEC 60947-5-1

Utilization category in accordance with IEC 60947-5-1	Typical application	Rating/nominal operation	
		U <sub>N</sub>	I <sub>N</sub>
AC-12 (50/60 Hz)	Regulation of resistive load and semi-conductor load resistance with disconnection via optocoupler	230 V	5 A
AC-15 (50/60 Hz)	Regulation of electromagnetic load resistance with AC voltage	230 V	0.26 A
		120 V	0.5 A
		24 V	2 A
DC-12	Regulation of resistive load and semi-conductor load resistance with disconnection via optocoupler	220 V	0.2 A
		120 V	0.4 A
		30 V	5 A
DC-13	Regulation of electromagnets with DC voltage	220 V	0.11 A
		120 V	0.21 A
		24 V	1.04 A



### Switching capacity in accordance IEC 60076-22-1

Micro-switch version	$U_N$	Switching capacity in accordance IEC 60076-22-1
Standard switch	230 VAC	Making capacity: 250 VA, $\cos \varphi > 0.5$ Breaking capacity: 60 VA, $\cos \varphi > 0.5$
	24... 220 VDC	Making capacity: 130 W, L/R < 40 ms Breaking capacity: 25 W, L/R < 40 ms
Switch with gold-plated contacts <sup>1)</sup>	230 VAC	Max. 6.9 VA, $\cos \varphi = 0.9$
	24... 220 VDC	Max. 6.6 W, L/R < 25 ms

<sup>1)</sup> Switching higher loads destroys the gold plating.

### Micro-switch arrangement (examples)



Depending on your order, the micro-switch arrangements can deviate from the following versions.

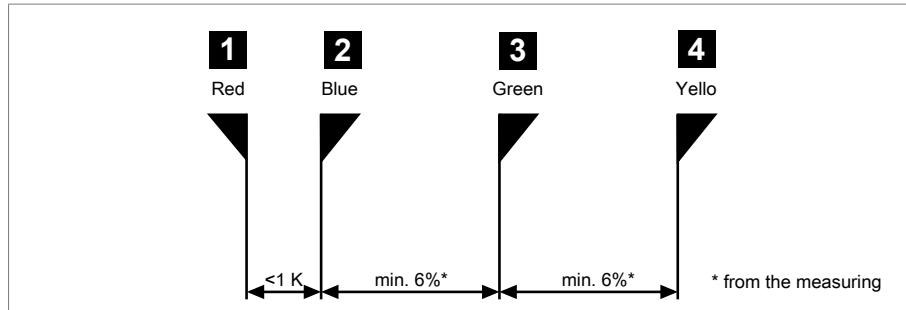


Figure 6: Switch arrangement 1+2

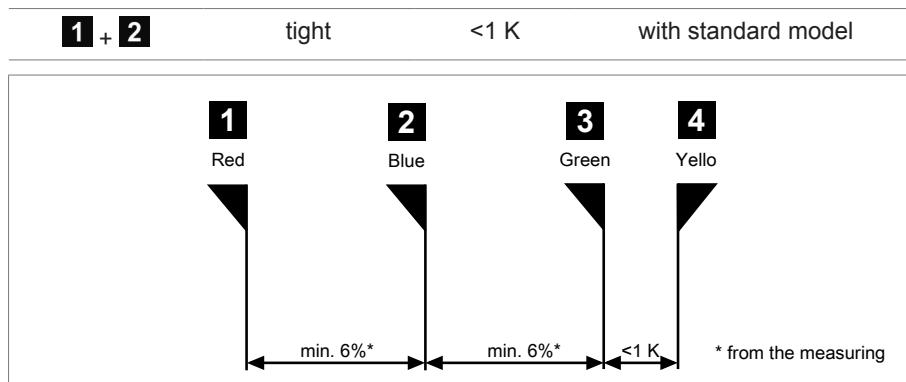


Figure 7: Switch arrangement 3+4

<b>3 + 4</b>	tight	<1 K

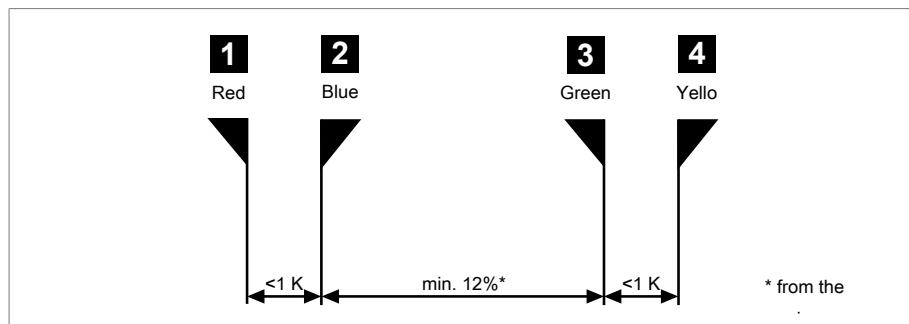


Figure 8: Switch arrangement 1+2 and 3+4

**1 + 2** and **3 + 4**      tight

<1 K



## 5.4 Modbus RTU

### Factory settings

Device version	Modbus address	Baud rate	Parity
MESSKO® COMPACT (RM) Oil temperature indicator MT-ST160SK/... MT-ST160SK/.../RM	21	19200	EVEN
MESSKO® COMPACT (RM) Winding temperature indicator MT-ST160W(R)/... MT-ST160W(R)/.../RM	22	19200	EVEN

Table 2: Modbus RTU factory settings

### Input register

Function code "04" to read the information.

Validity of the measured value stored in the INPUT register addresses 1...3: It can be seen via the DISC register address with address 4 (Boolean) whether the measured value is invalid (0) or valid (1). We recommend evaluating this register address alongside the measured value query.

#### Device status:

The INPUT register address 0 indicates the device status (0: the device self-diagnostic could not find any errors). We recommend querying the device status either parallel to the measured values or when needed (e.g. during troubleshooting, fault elimination).

For details, see Fault elimination.



Address	Data type	Designation
0	UINT16	Device status, see under status codes
1, 2	FLOAT32	Measured value (temperature in °C) with decimal places; Oil temperature or Winding temperature
3	SINT16	Measured value (temperature in °C) as an integer; Oil temperature or Winding temperature
4...16	-	Reserved for future use
17	UINT16	Firmware version major
18	UINT16	Firmware version minor
19	UINT16	Firmware version patch

Table 3: Input register

With FLOAT parameters, the MSB (Most Significant Bit) is stored in the lower address and the LSB (Least Significant Bit) in the higher address.



### Configuration via holding register

Each address must be unique in the BUS system. Therefore, for example, when using two identical devices (same default address!), configure them to different addresses before commissioning!

Use function code "03" to read the information and function code "06/16" to write the information.

Address	Data type	Designation	Setting option
0	UINT16	Modbus address	1...247 21 <sup>1)</sup> (oil temperature indicator) 22 <sup>1)</sup> (winding temperature indicator)
1	UINT16	Modbus baud rate	0: 4800 1: 9600 2: 19200 <sup>1)</sup> 3: 38400 4: 57600 5: 115200
2	UINT16	Modbus parity	0: None 1: Even <sup>1)</sup> 2: Odd
3	-	Reserved	-
4	-	4...20 mA analog output	0: Deactivated 1: Activated <sup>1)2)</sup>
5...72	-	Reserved	-
73...79 <sup>3)</sup>	STRING	Serial number	7-digit, 1 number per register in ASCII-format

Table 4: Holding register

<sup>1)</sup> Delivery condition/default settings

<sup>2)</sup> We recommend deactivating the 4...20 mA analog output when it is not needed. This will prevent the pseudo-error "4...20 mA output defective". This will also reduce the power loss in the device and extend its service life.

<sup>3)</sup> Cannot be overwritten by the user.



**Validity of the measured value via DISC register**

Use function code "02" to read the information from DISC register address 4.

Address	Data type	Designation
4	BOOL	Validity of the measured value (input register 1...3): 0: Invalid 1: Valid

## 6 Appendix

### 6.1 Compact pointer thermometer dimensions

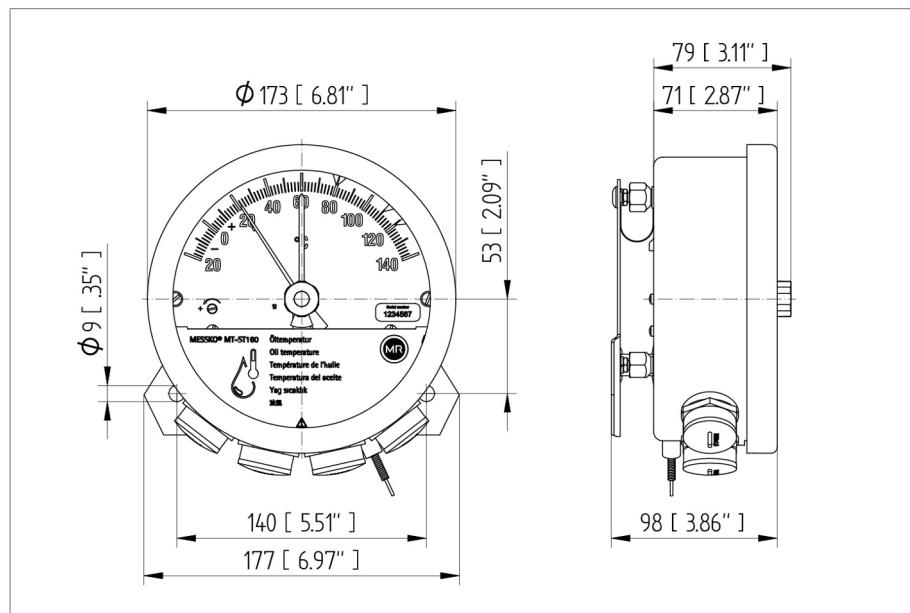


Figure 9: MESSKO® Compact

### 6.2 Compact RM pointer thermometer dimensions

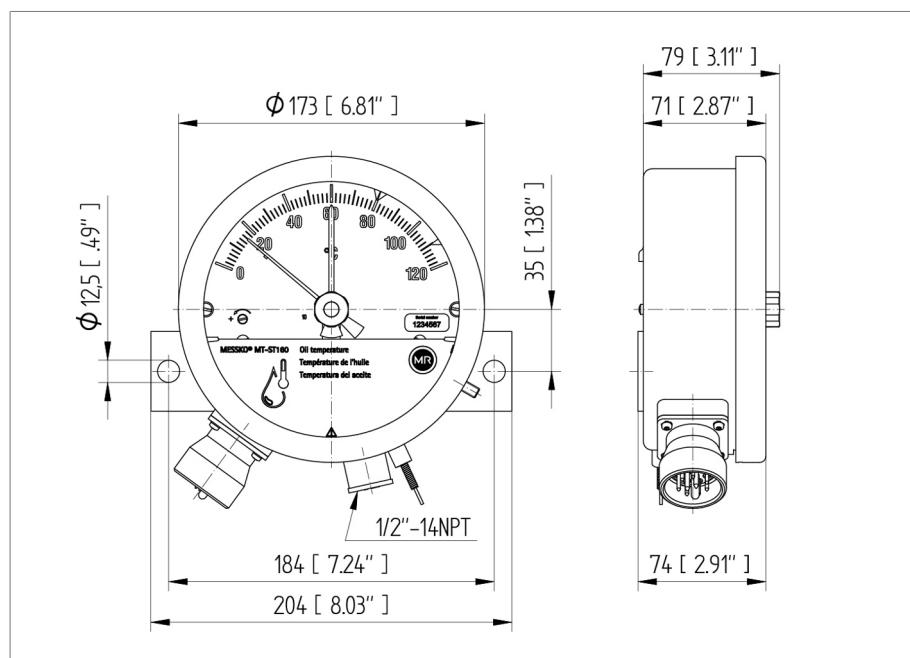


Figure 10: MESSKO® Compact RM



### 6.3 Temperature sensor

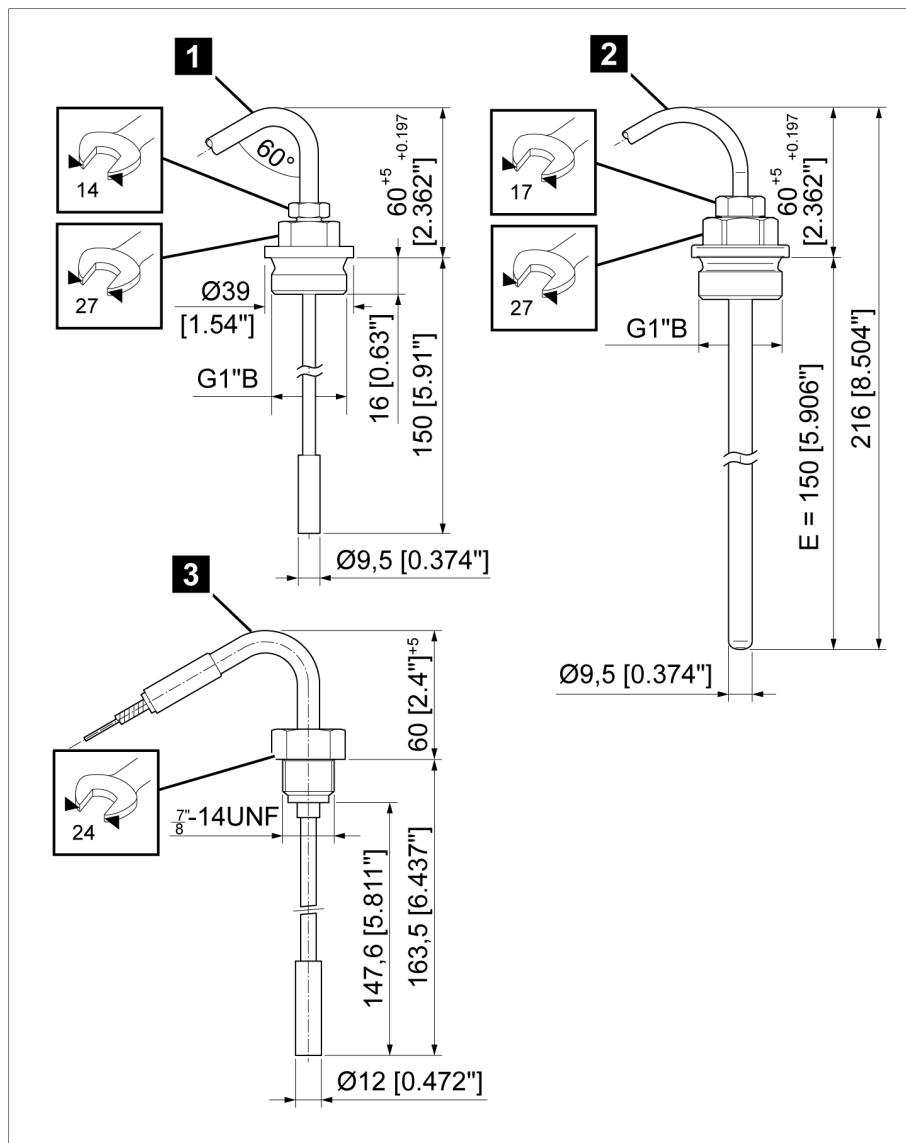


Figure 11: Temperature sensor

1 Standard variant (No. 7)

2 Offshore variant (No. 6 VA)

3 For Compact RM (No. 7 RM)

## 6.4 Step protection

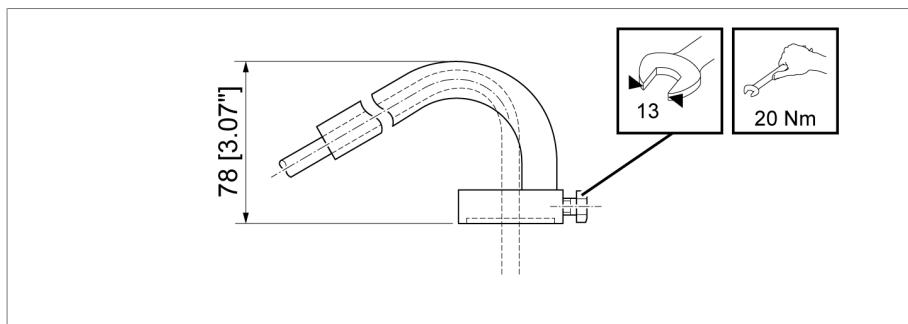


Figure 12: Step protection (only in combination with sensor No. 6 VA and sensor No. 7)

## 6.5 Vibration-damping plate/Mounting plate

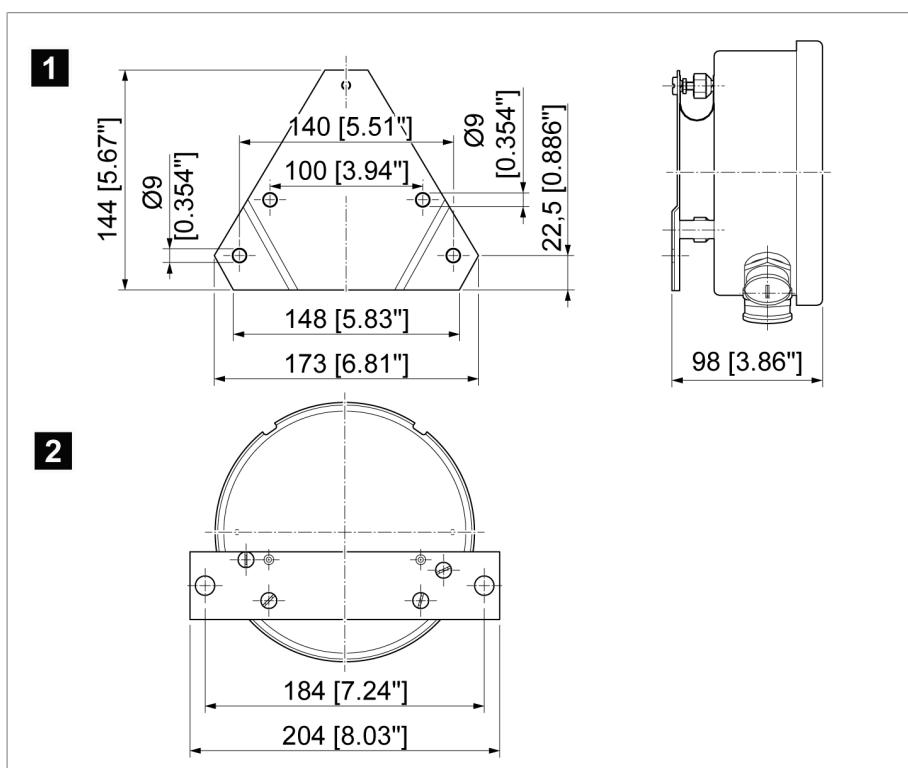


Figure 13: Dimensional drawing for vibration-damping plate and mounting plate

1 Vibration-damping plate (Compact standard)

2 Mounting plate (Compact RM)



## 6.6 Cable gland dimensions

### Standard cable gland

M25x1.5 nickel-plated brass

Clamping range 9...20 mm

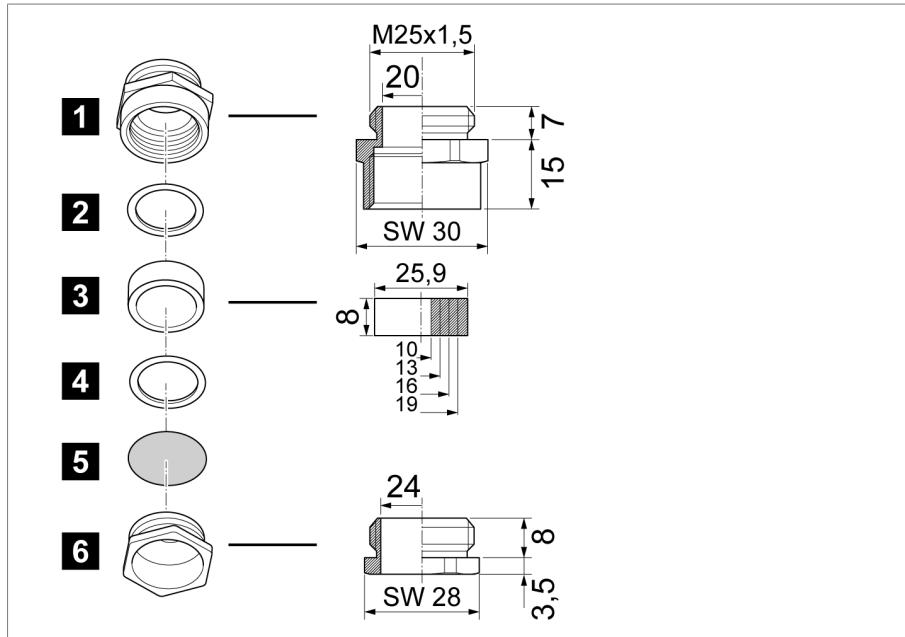


Figure 14: Standard cable gland

1 Gland base

2 Pressure ring

3 Universal sealing ring, NBR

4 Pressure ring

5 Dust protection disk

6 Pressure screw

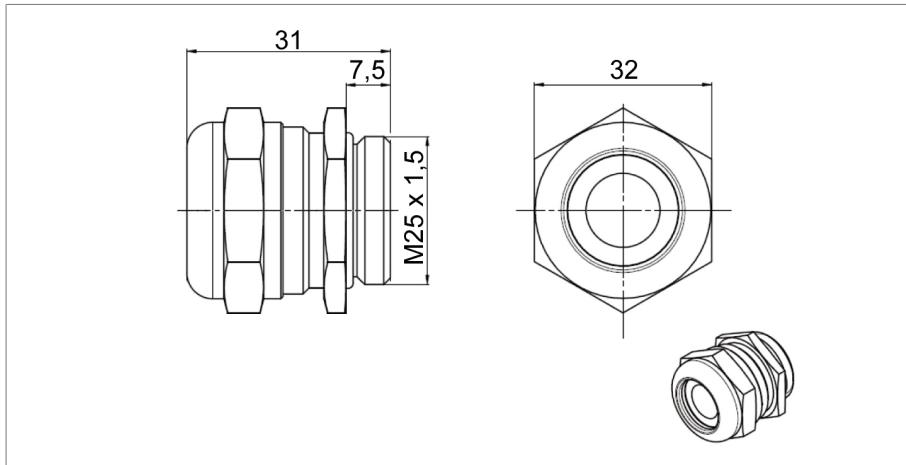
**WADI cable screw connection (water-tight; optional)**

Figure 15: WADI cable screw connection; material: nickel-plated brass; clamping range 13...20 mm

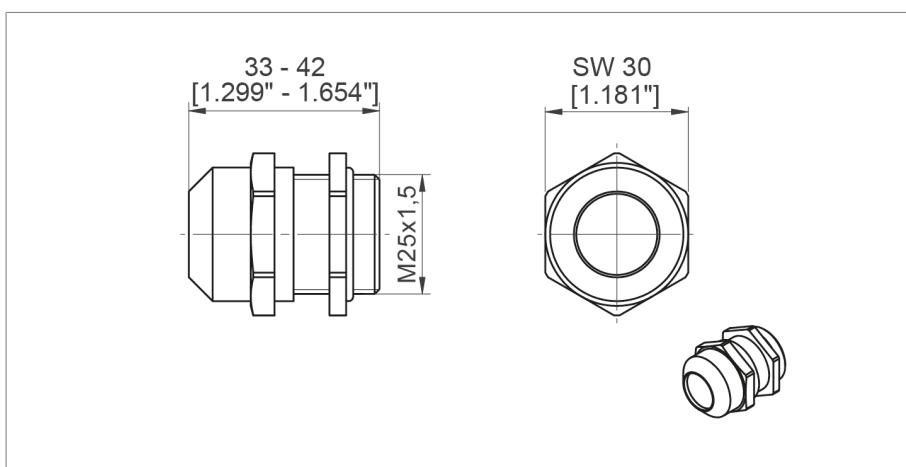
**Offshore cable screw connection (optional)**

Figure 16: Offshore cable screw connection; material: stainless steel (V4A); clamping range 9...17 mm



### NPT adapters (optional)

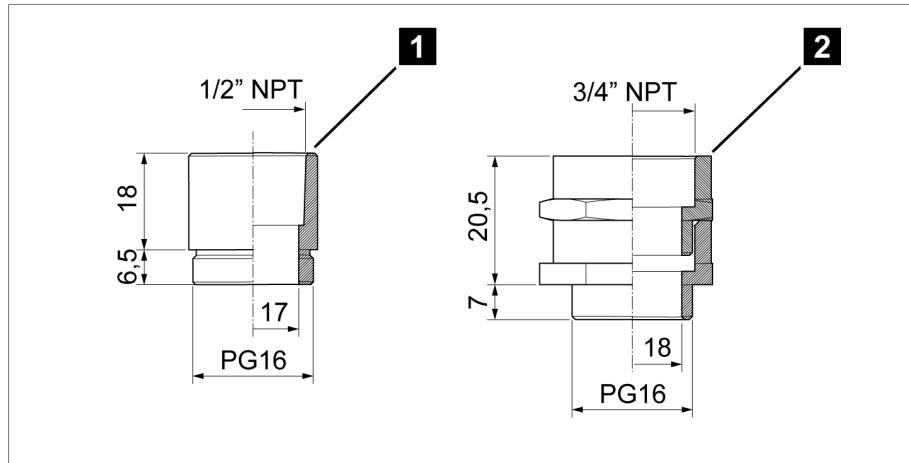


Figure 17: NPT adapters

**1** 1/2" NPT**2** 3/4" NPT

### EMC double cable gland (optional)

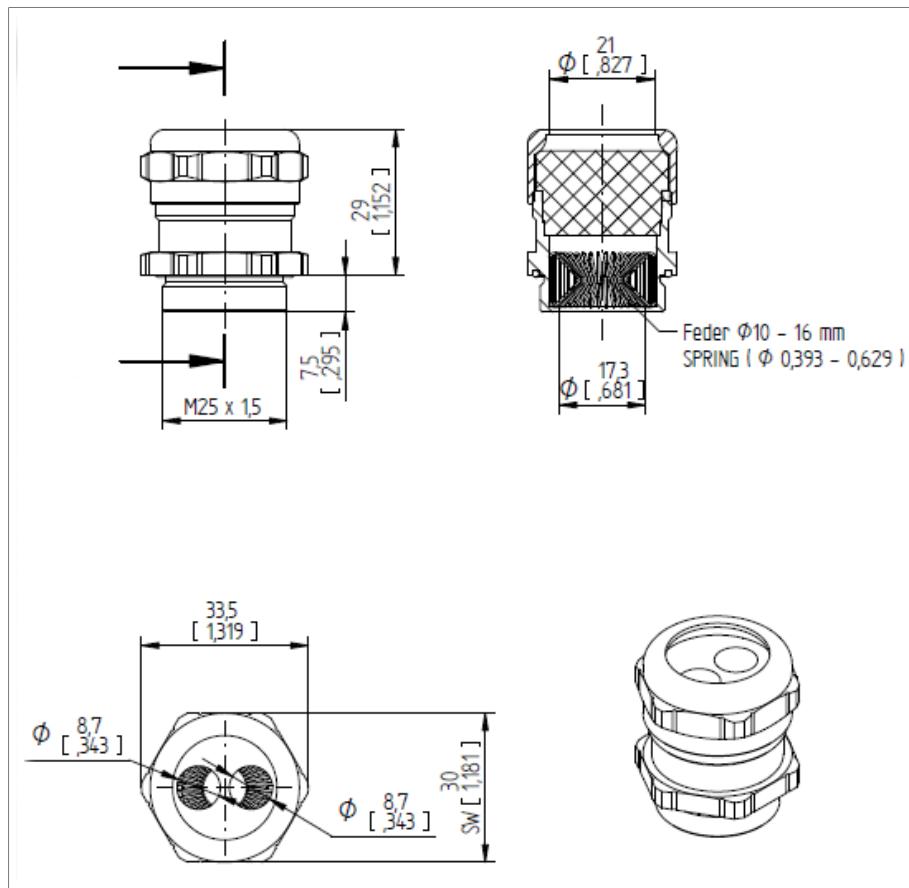


Figure 18: EMC double cable gland



## Glossary

### Ambient air temperature

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

### Operating temperature

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

### SCADA

### Storage temperature

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



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