Technical data
MESSKO® COMPACT. Pointer thermometer

5613687/03 EN

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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.

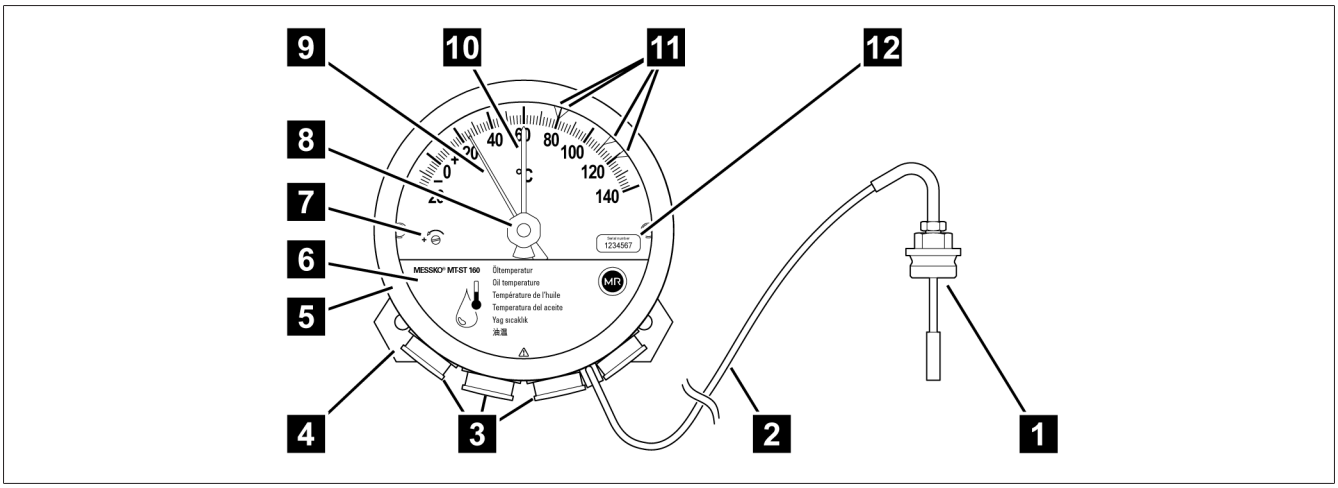

Figure 1: Pointer thermometer

1	Temperature sensor	2	Capillary line
3	Connections for four 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 become void!

1.2 Overview Compact RM

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

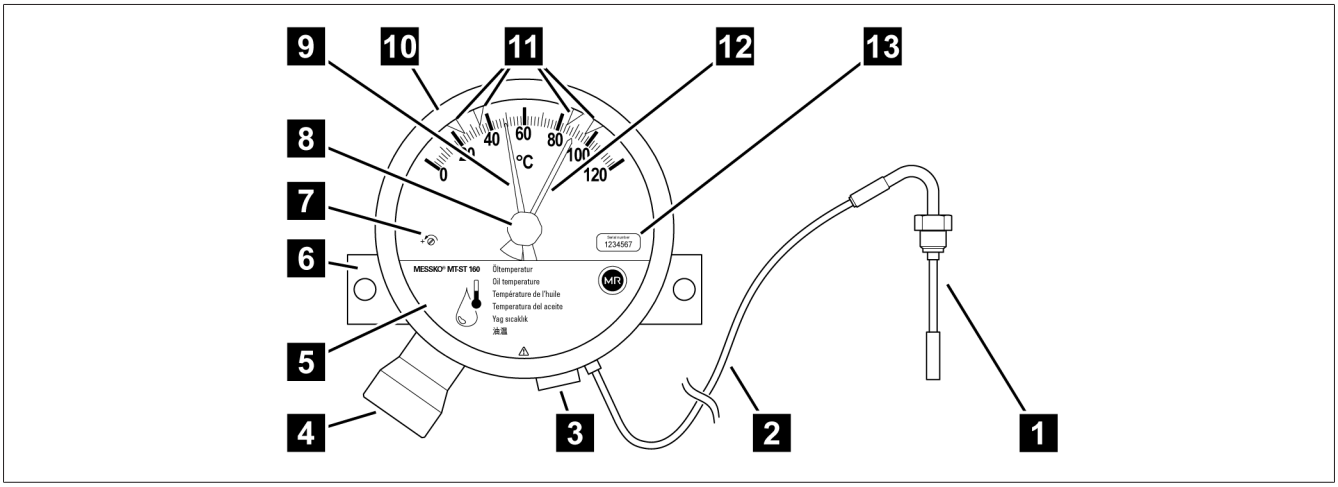

Figure 2: Pointer thermometer

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!

1.3 Cable glands/adapters

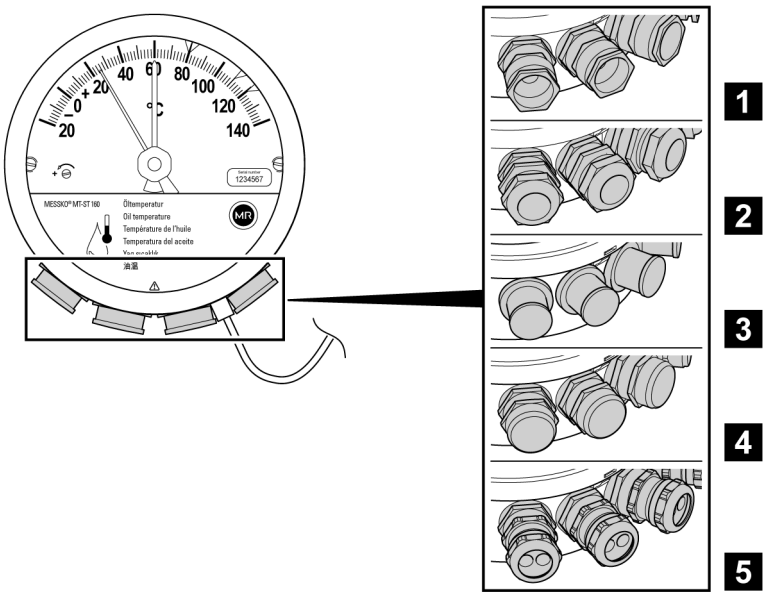

Figure 3: Cable glands

1	Standard cable gland	2	WADI cable gland
3	1/2″ 14 NPT adapter	4	3/4″ 14 NPT adapter
5	EMC double cable gland, available as an accessory: material no. 10173481		

If you have ordered the "Without cable gland" version instead of the five options listed above, your device will look like the one on the left in the figure.

In this case, you must purchase suitable cable glands that will ensure the degree of protection as listed in the technical data [▶Section 4, Page 11]. The connections present on the device have a 7.5 mm-deep M25x1.5 internal thread with a plastic screw plug to protect against contamination during transport and storage. Please observe the installation instructions in the operating instructions as well as the instructions of the cable gland supplier.

1.4 Overview Compact temperature sensor

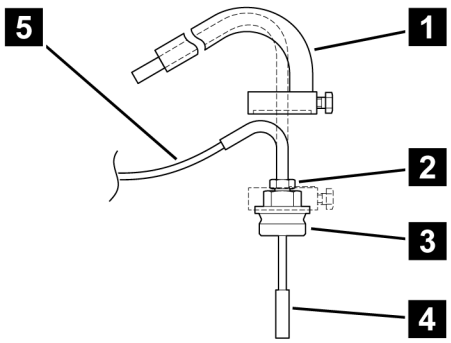

Figure 4: Temperature sensor

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 5.3, Page 19]

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 for both the MESSKO® Compact Standard version (with cable bushings) and for the MESSKO® Compact RM version (with plug connection).

Device version	Type key	Meaning
MESSKO® Compact Standard	MTST160..., without "RM"	With cable bushings
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

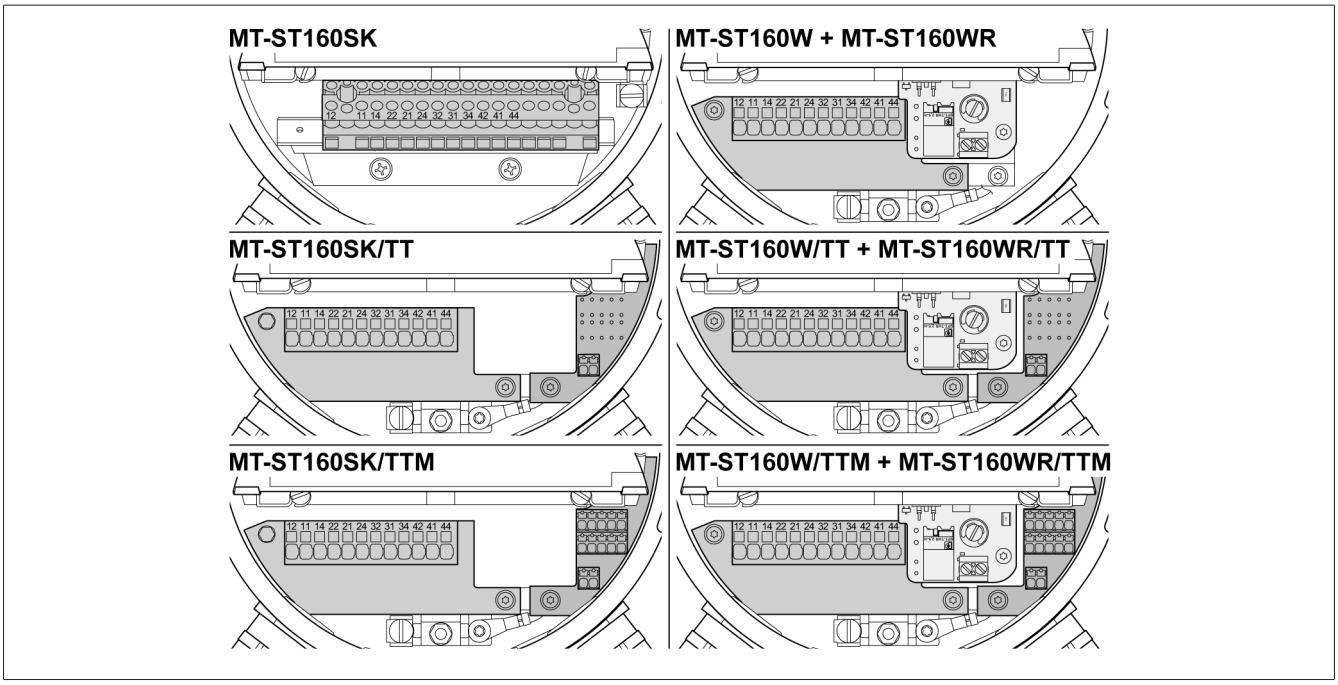

Figure 5: Device versions overview

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.

Type TT

The pointer thermometer transmits the measured temperature via a passive 4...20 mA analog output.

You will find information on the electrical connection in the chapter "Installation" in the operating instructions.

Type TTM

The pointer thermometer transmits the measured temperature via an active 4...20 mA analog output and/or an RS485 interface for Modbus RTU.

> The device needs a 24 VDC power supply for this. This is also the case even if you only connect the 4... 20 mA analog output.

You will find information on the electrical connection in the chapter "Installation" in the operating instructions.

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.

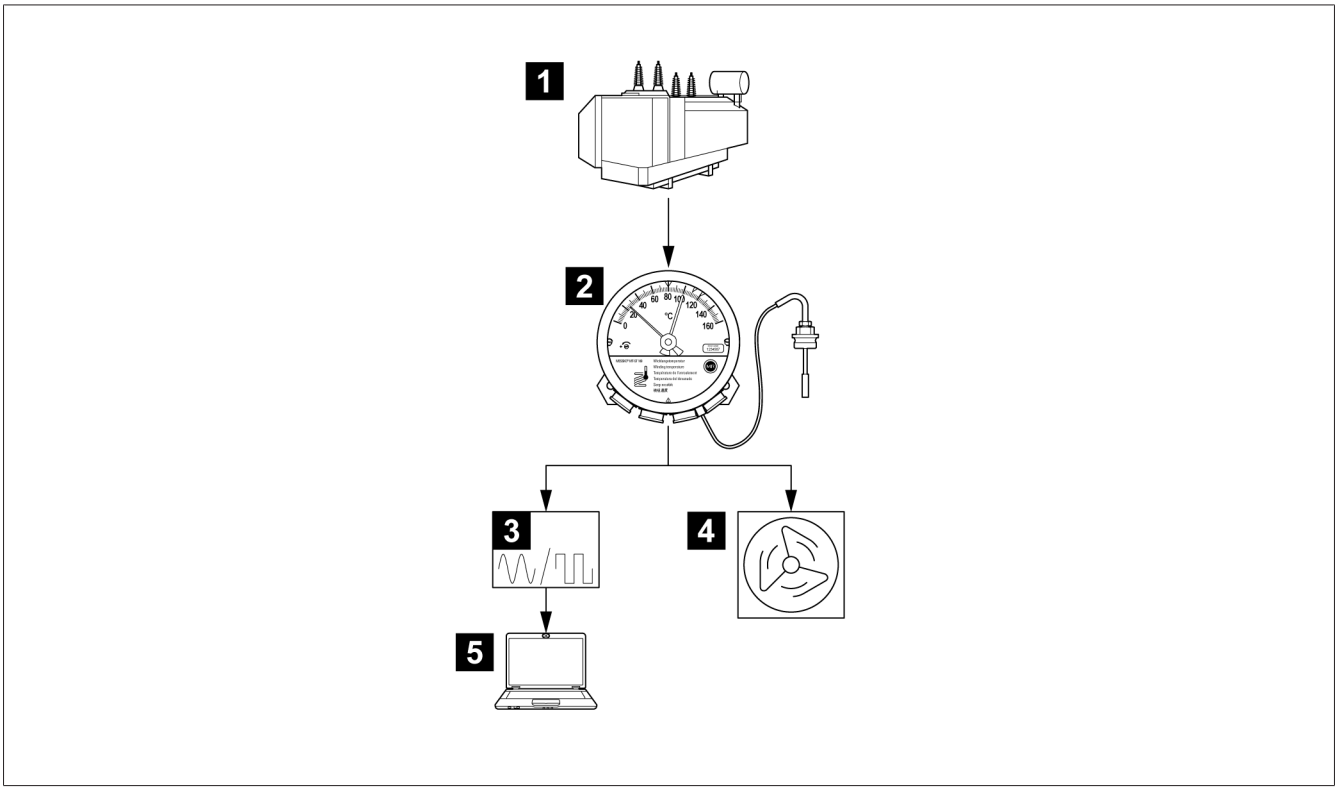

Figure 6: Example temperature measurement and temperature display

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

4 Technical data

4.1 Ambient conditions

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

[1)] Extended ranges on request.

4.2 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

Dimensions and weight	
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)

Passive 4...20 mA analog output (type TT)	
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_b= 24 VDC
Rated insulation voltage	500 VDC/1 min; terminals to ground
Repetition accuracy	≤ ±0.1% from the end value

Active 4...20 mA analog output (type TTM)	
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_b = 24 VDC
Rated insulation voltage	500 VDC/1 min; terminals to ground
Repetition accuracy	≤ ±0.1% from the end value

RS485 interface for Modbus RTU (type TTM)	
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

4.3 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 VAC/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_N	I_N
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 with IEC 60076-22-1

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

[1)] 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.

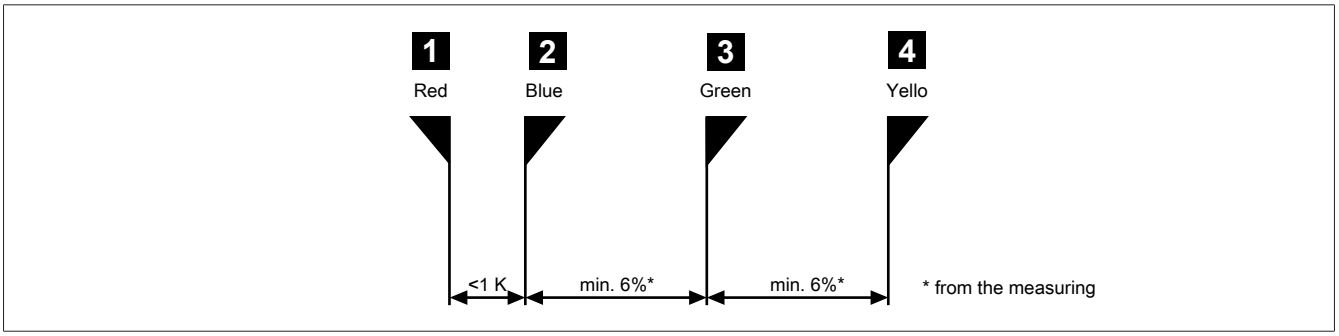

Figure 7: Switch arrangement 1+2

1 + 2	tight	<1 K	with standard model

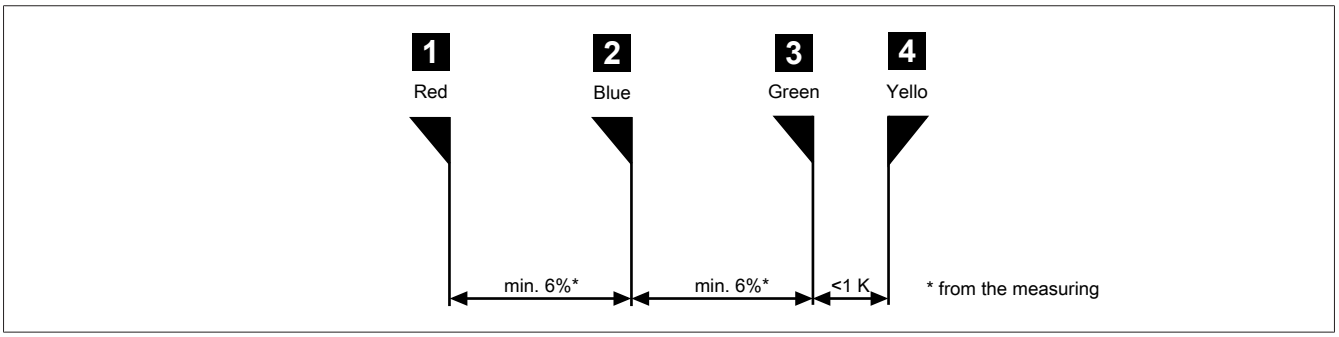

Figure 8: Switch arrangement 3+4

3 + 4	tight	<1 K

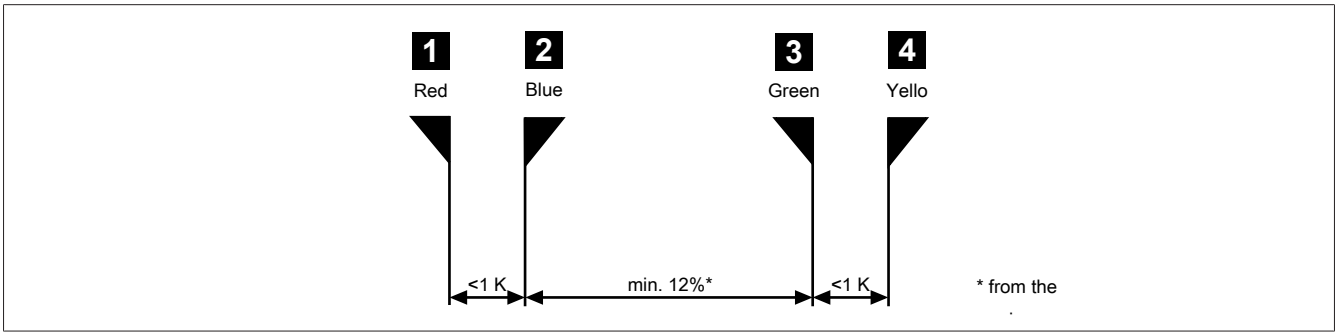

Figure 9: Switch arrangement 1+2 and 3+4

1 + 2 and 3 + 4	tight	<1 K

4.4 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[1] (oil temperature indicator) 22[1] (winding temperature indicator)
1	UINT16	Modbus baud rate	0: 4800 1: 9600 2: 19200[1] 3: 38400 4: 57600 5: 115200
2	UINT16	Modbus parity	0: None 1: Even[1] 2: Odd
3	-	Reserved	-
4	-	4...20 mA analog output	0: Deactivated 1: Activated[1][2]
5...72	-	Reserved	-
73...79[3]	STRING	Serial number	7-digit, 1 number per register in ASCII-format

Table 4: Holding register

[1] Delivery condition/default settings

[2] 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.

[3] 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

5 Drawings

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

5.1 Compact pointer thermometer dimensions

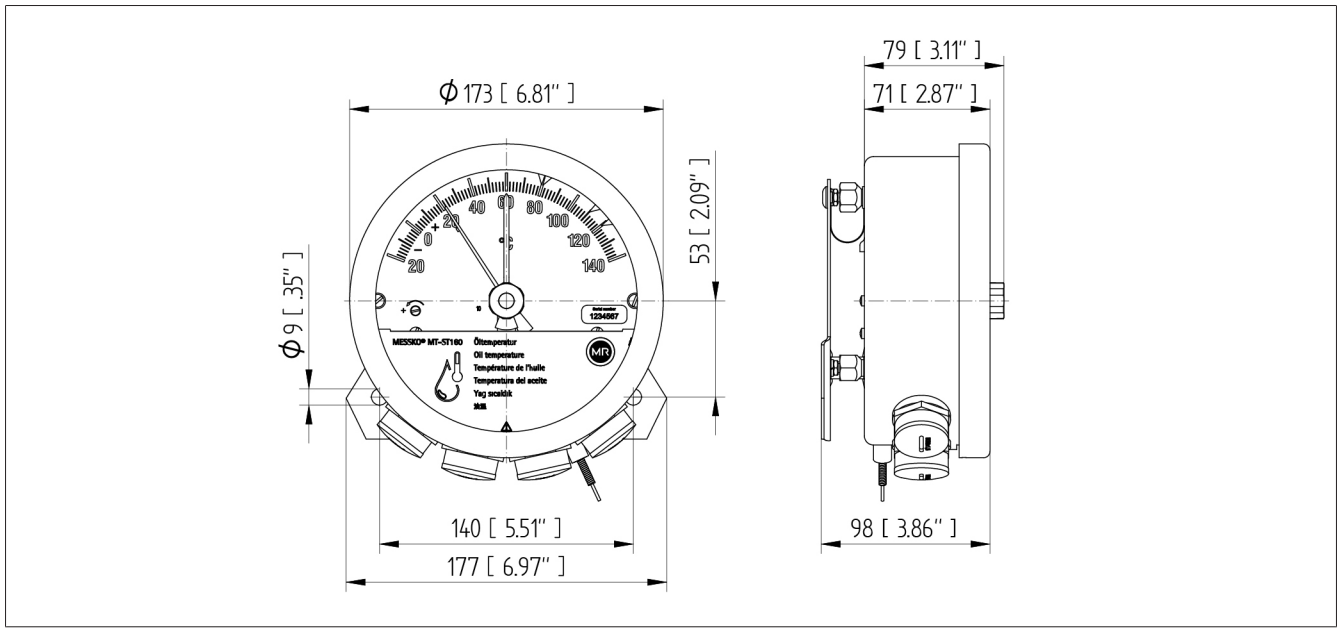

Figure 10: MESSKO® Compact

5.2 Compact RM pointer thermometer dimensions

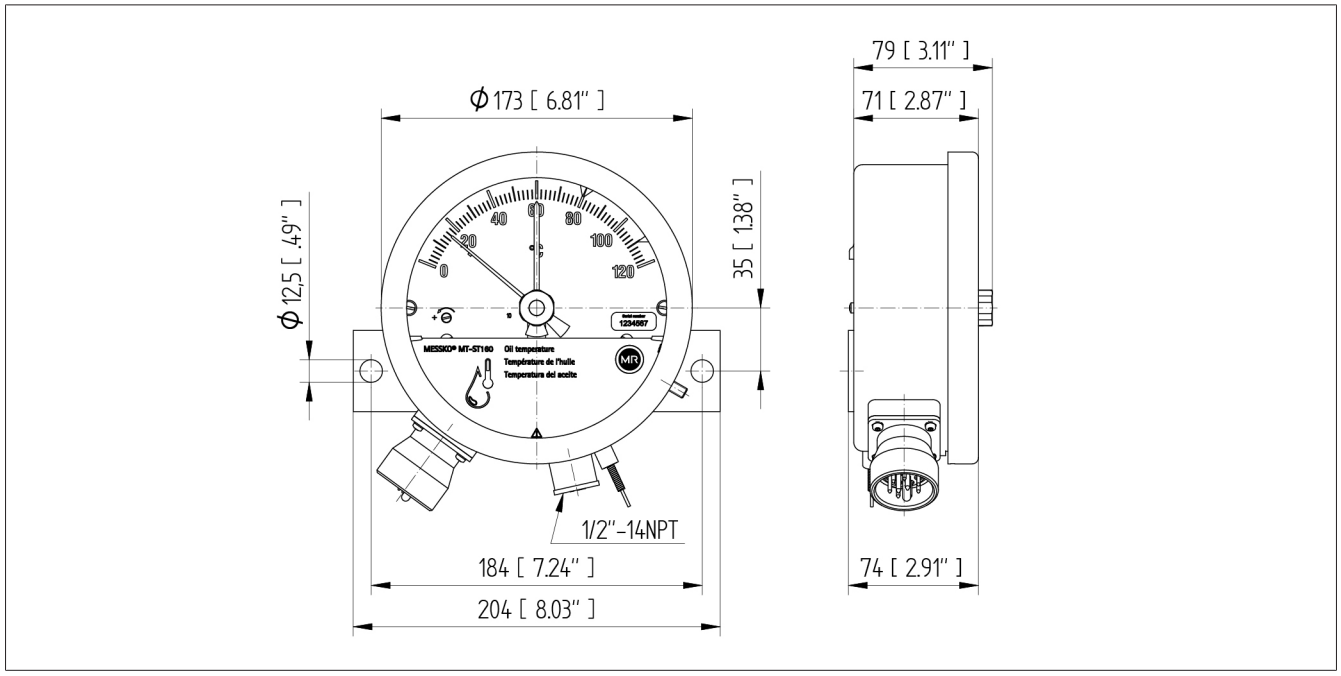

Figure 11: MESSKO® Compact RM

5.3 Temperature sensor

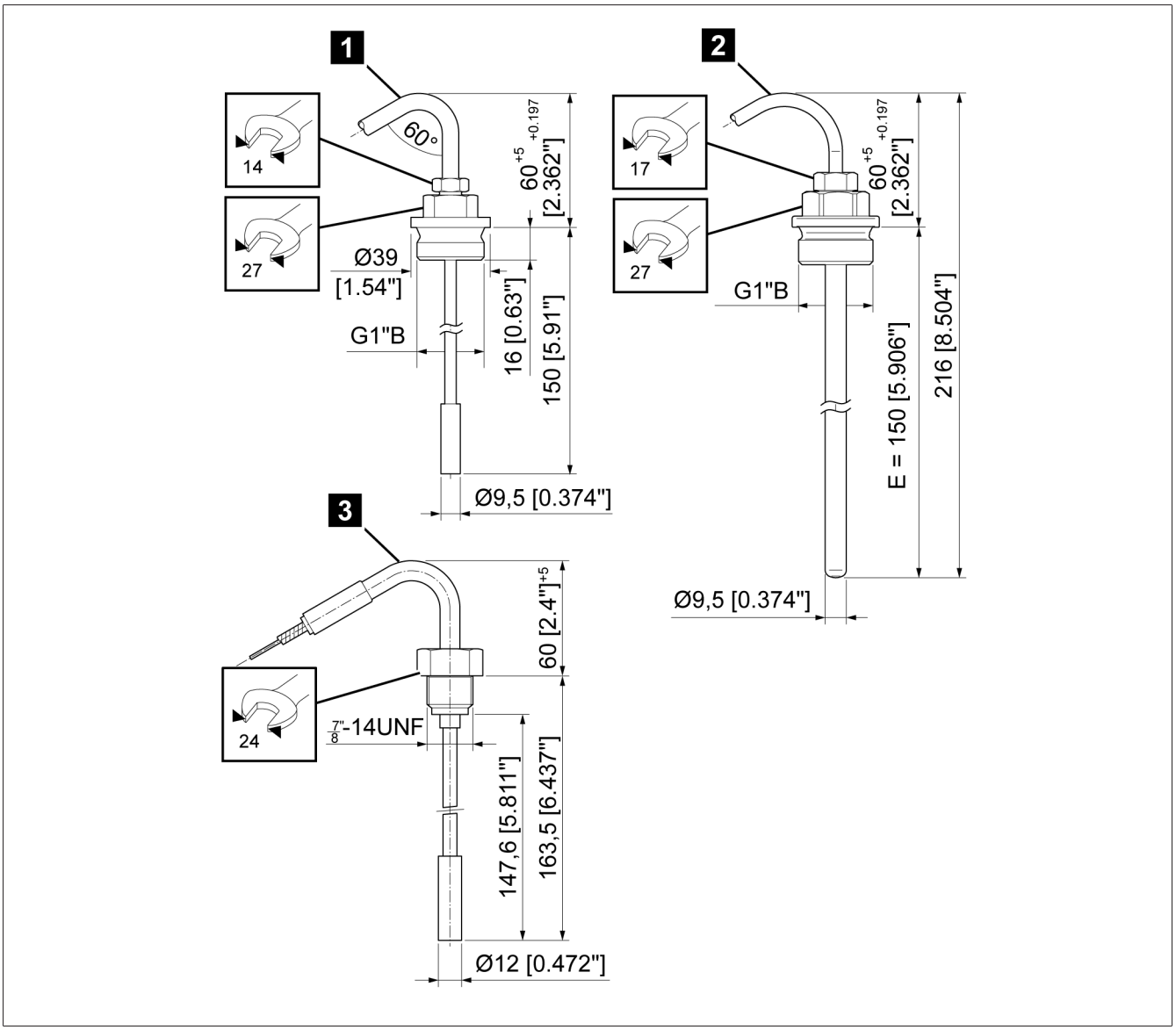

Figure 12: Temperature sensor

1	Standard variant (No. 7)	2	Offshore variant (No. 6 VA)
3	For Compact RM (No. 7 RM)		

5.4 Step protection

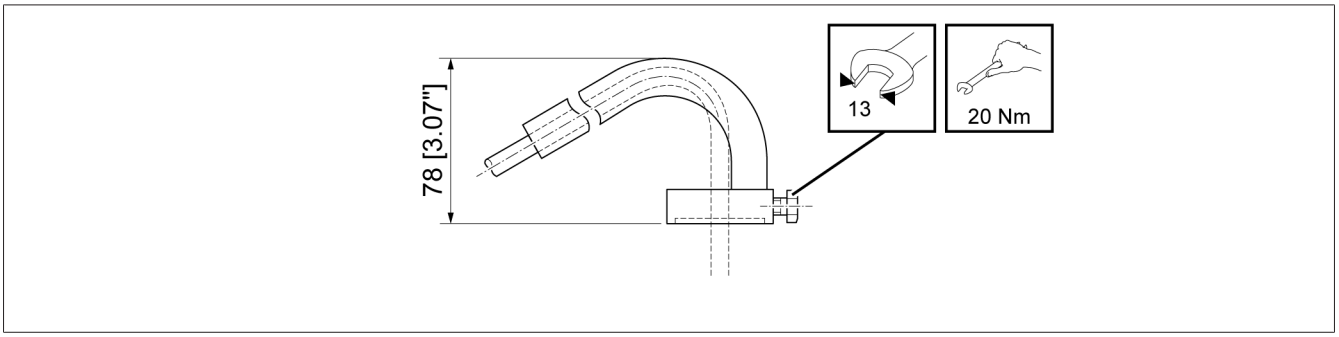

Figure 13: Step protection (only in combination with sensor No. 6 VA and sensor No. 7)

5.5 Vibration-damping plate/Mounting plate

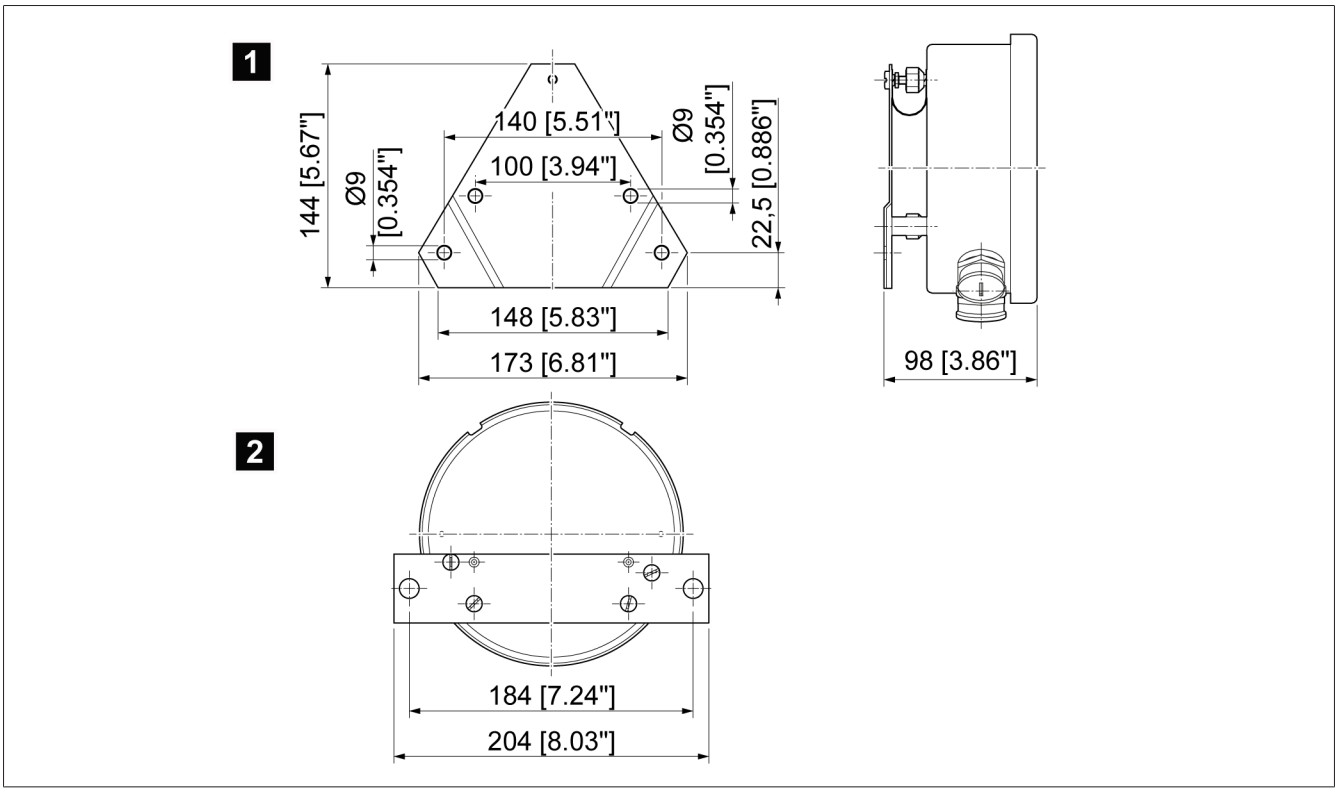

Figure 14: Dimensional drawing for vibration-damping plate and mounting plate

1	Vibration-damping plate (Compact standard)	2	Mounting plate (Compact RM)

5.6 Cable gland dimensions

Standard cable gland
M25x1.5 nickel-plated brass
Clamping range 9...20 mm

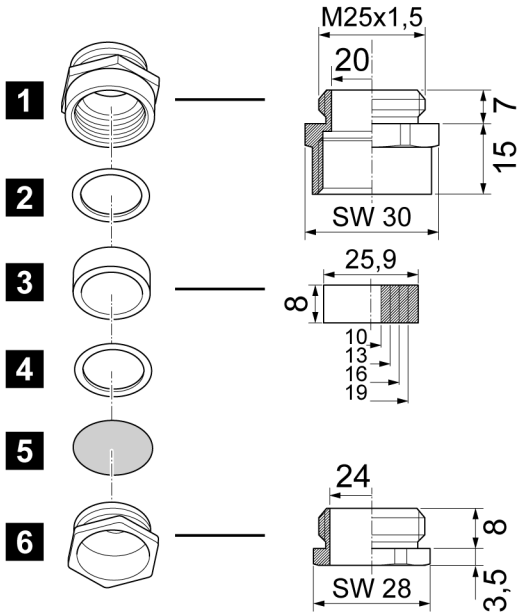

Figure 15: Standard cable gland

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)

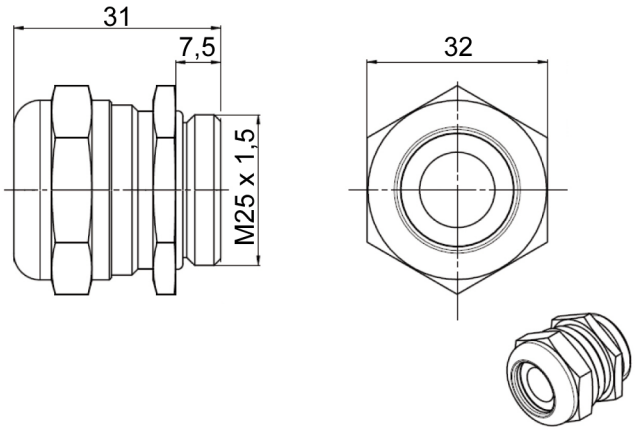

Figure 16: WADI cable screw connection; material: nickel-plated brass; clamping range 13...20 mm

Offshore cable screw connection (optional)

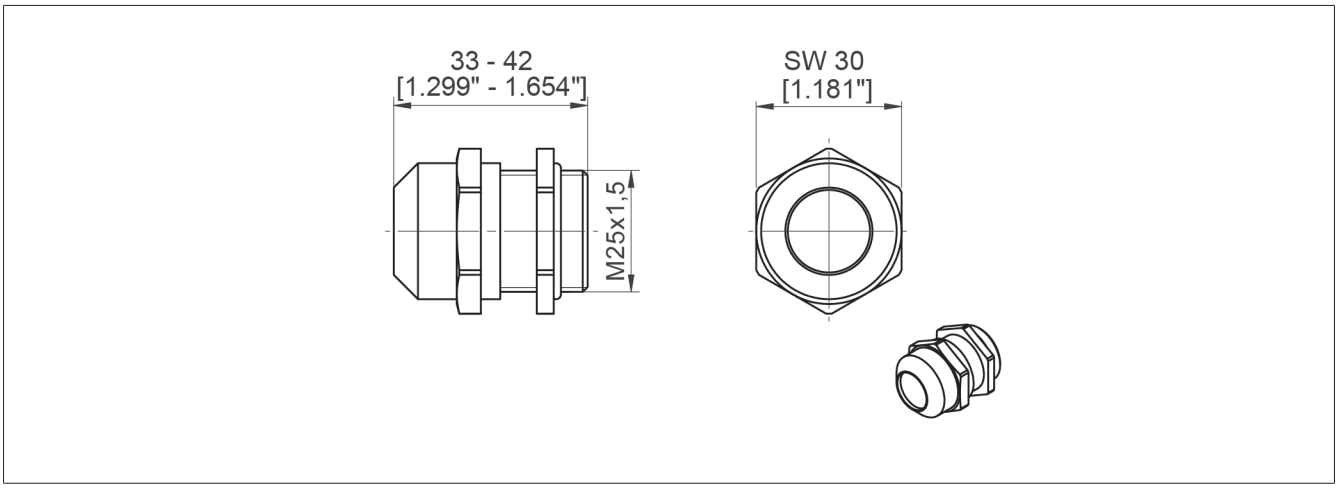

Figure 17: Offshore cable screw connection; material: stainless steel (V4A); clamping range 9...17 mm

NPT adapters (optional)

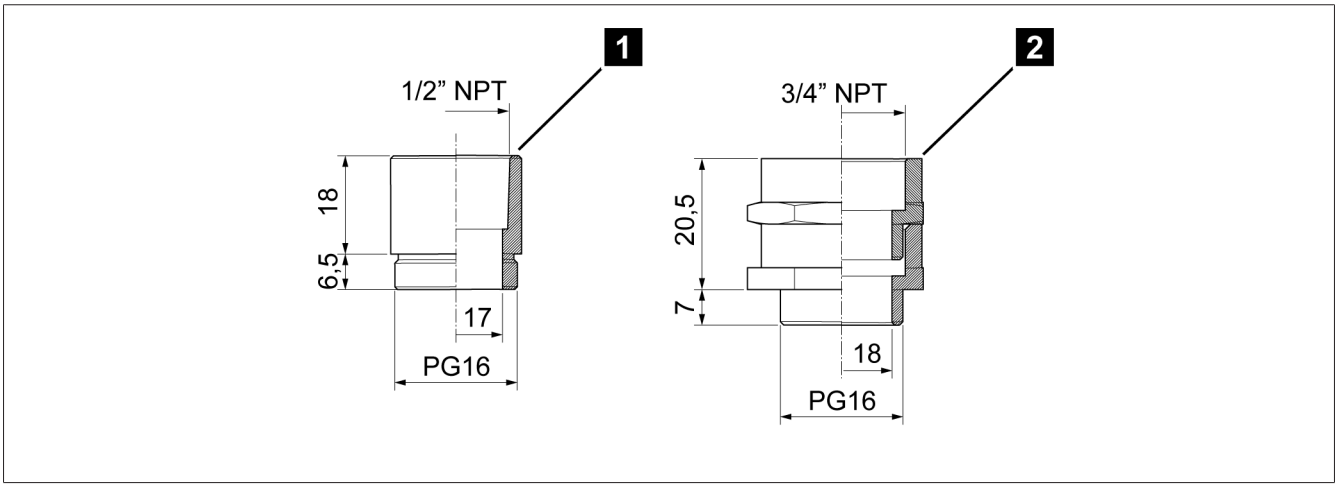

Figure 18: NPT adapters

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

EMC double cable gland (optional)

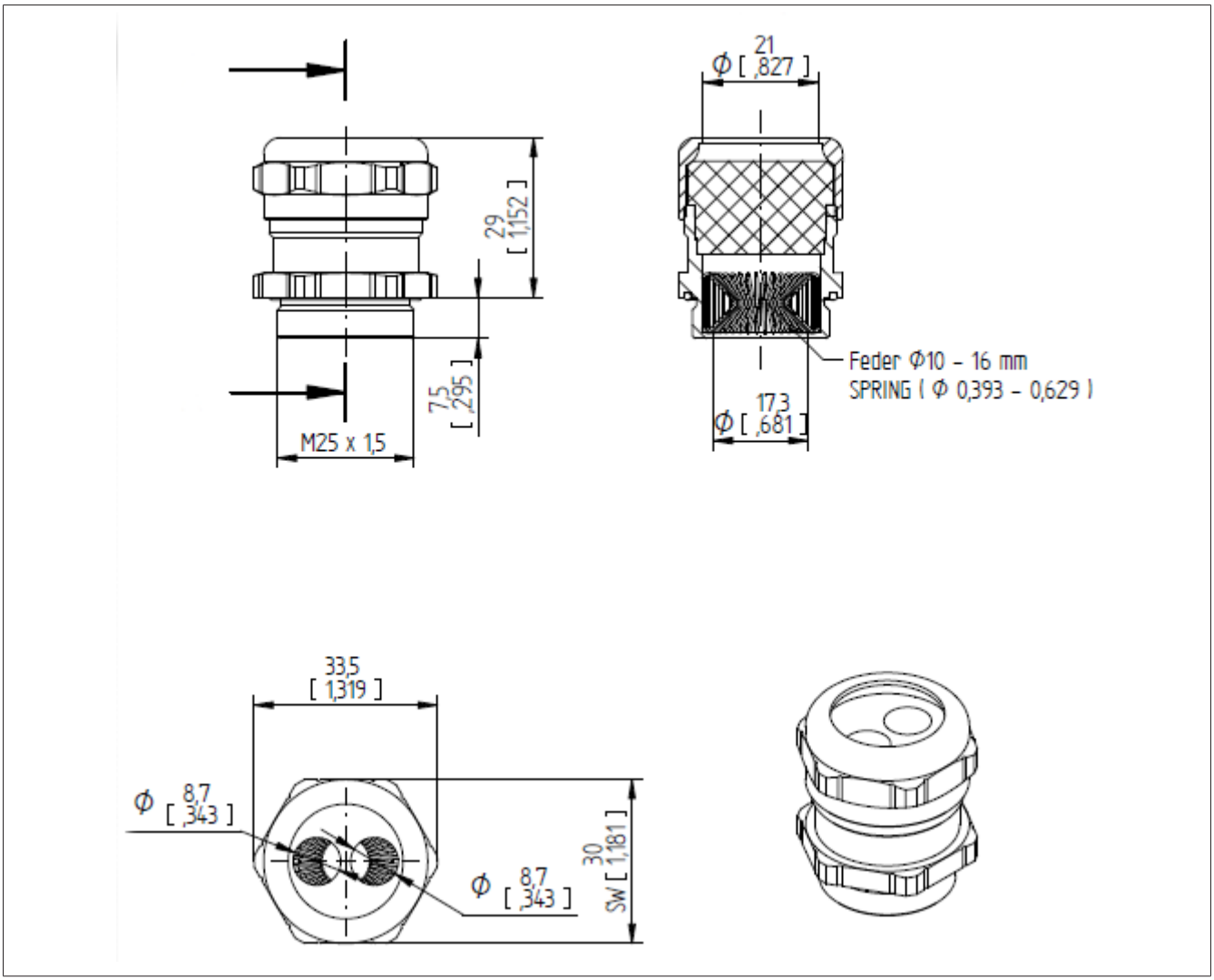

Figure 19: EMC double cable gland

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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08/24

THE POWER BEHIND POWER.