Operating Instructions iTHERM CompactLine TM311

Metric/imperial, compact RTD thermometer, 4-20 mA/IO-Link, for industrial and hygienic applications







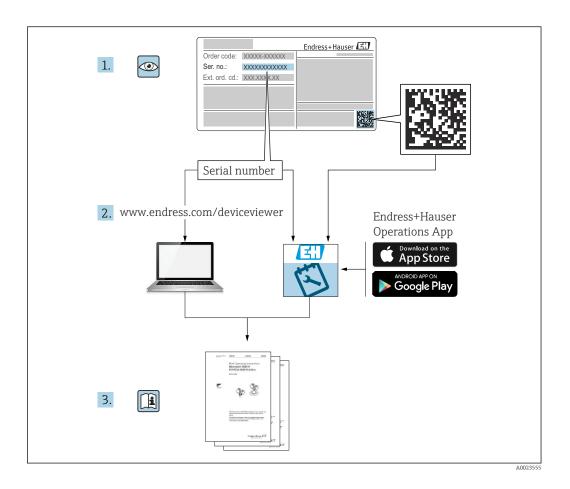


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1 About this document

1.1 Document function

These Operating Instructions contain all the information required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.

1.2 Symbols

1.2.1 Safety symbols

⚠ DANGER

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

▲ WARNING

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

A CAUTION

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE

This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning
	Direct current
~	Alternating current
$\overline{\sim}$	Direct current and alternating current
<u></u>	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Potential equalization connection (PE: Protective earth) Ground terminals that must be connected to ground prior to establishing any other connections.
	 The ground terminals are located on the interior and exterior of the device: Interior ground terminal: potential equalization connection is connected to the supply network. Exterior ground terminal: device is connected to the plant grounding system.

1.2.3 Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
✓ ✓	Preferred Procedures, processes or actions that are preferred.

Symbol	Meaning
X	Forbidden Procedures, processes or actions that are forbidden.
i	Tip Indicates additional information.
	Reference to documentation
A=	Reference to page
	Reference to graphic
>	Notice or individual step to be observed
1., 2., 3	Series of steps
L	Result of a step
?	Help in the event of a problem
	Visual inspection

1.2.4 Symbols in graphics

Symbol	Meaning	Symbol	Meaning
1, 2, 3,	Item numbers	1., 2., 3	Series of steps
A, B, C,	Views	A-A, B-B, C-C,	Sections
EX	Hazardous area	×	Safe area (non-hazardous area)

1.2.5 Tool symbols

Symbol	Meaning
Ø	Open-ended wrench
A0011222	

1.3 Documentation

- For an overview of the scope of the associated Technical Documentation, refer to the following:
 - *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
 - *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

Document type	Purpose and content of the document
Technical Information (TI)	Planning aid for your device The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	Guide that takes you quickly to the 1st measured value The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	Your reference document The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	Reference for your parameters The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

2 Safety Instructions

2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- ► Trained, qualified specialists must have a relevant qualification for this specific function and task.
- ► Are authorized by the plant owner/operator.
- ► Are familiar with federal/national regulations.
- ▶ Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ► Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- ▶ Follow the instructions in this manual.

2.2 Intended use

The device described in this document is a compact thermometer suitable for temperature measurement in industrial and hygienic processes.

Improper use

The device must only be used for temperature measurement in industrial and hygienic processes. The manufacturer is not liable for harm caused by improper or non-designated use.

2.3 Workplace safety

A CAUTION

Extreme temperatures (hot and cold) can occur at the thermometer and in the terminal head. There is a risk of burning and damage to property.

► Wear appropriate protective equipment.

A CAUTION

There is an the increased risk of electric shock if working on and with the device with wet hands:

▶ Wear appropriate protective equipment.

2.4 Operational safety

Damage to the device!

- ▶ Operate the device in proper technical condition and fail-safe condition only.
- ▶ The operator is responsible for the interference-free operation of the device.

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers!

▶ If modifications are nevertheless required, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability:

- ► Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to the repair of an electrical device.
- ▶ Use only original spare parts and accessories.

2.5 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU declaration of conformity. The manufacturer confirms this by affixing the CE mark.

2.6 IT security

The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

3 Product description

Design		Options
	1: Electrical connection, output signal 2: Transmitter housing	Your benefits: • M12, 4-pin connector, reduced cost and effort, incorrect wiring is prevented • Optimum protection, IP69 as standard • Compact, integrated transmitter (IO-Link and 4 to 20 mA)
	3: Extension neck	Optionally available if process temperature is too high for the electronics
3—	4: Process connection → 🖺 53	Over 50 different versions for industrial, hygienic and aseptic applications.
	5: Thermowell	 Versions with and without thermowell (insert in direct contact with process) Thermowell diameter 6 mm and optimized tee and elbow thermowells
5 6a 6a 6b 6b 6b 6b 6b 6b 6b 6c	6: Insert with: 6a: iTHERM TipSens 6b: Pt100 (TF), basic	Your benefits: Insert: Ø3 mm (1/6 in) or Ø6 mm (1/4 in) Fast, highly accurate measurements, delivering maximum process safety and control Quality and cost optimization Minimization of necessary immersion length: better product protection thanks to improved process flow Pt100 (TF), basic Excellent cost-performance ratio

4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

- 1. Check the packaging for damage.
 - Report all damage immediately to the manufacturer. Do not install damaged components.
- 2. Check the scope of delivery using the delivery note.
- 3. Compare the data on the nameplate with the order specifications on the delivery note.
- 4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.
- If one of the conditions is not satisfied, contact the manufacturer.

4.2 Product identification

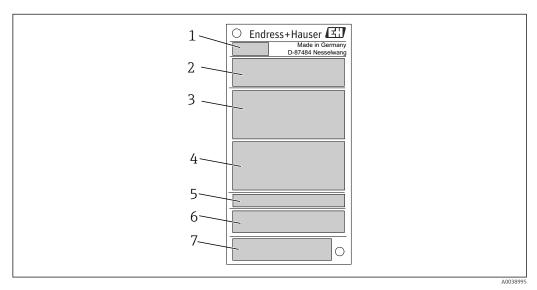
The following options are available for the identification of the device:

- Nameplate specifications
- Enter the serial number from the nameplate in the *Device Viewer* www.endress.com/deviceviewer: all data relating to the device and an overview of the Technical Documentation supplied with the device are displayed.

4.2.1 Nameplate

The correct device?

- 1. Check the data on the nameplate of the device.
- 2. Compare against the requirements of the measuring point.



■ 1 Sample graphic

- 1 Product root, device designation
- 2 Order code, serial number
- 3 Tag name
- 4 Technical values: supply voltage, current consumption, ambient temperature
- 5 Degree of protection
- 6 Pin assignment
- 7 Approvals with symbols: CE mark, EAC

4.2.2 Scope of delivery

The scope of delivery comprises:

- Compact thermometer
- Printed copy of the Brief Operating Instructions
- Accessories ordered

4.3 Name and address of manufacturer

Name of manufacturer:	Endress+Hauser Wetzer GmbH + Co. KG
Address of manufacturer:	Obere Wank 1, D-87484 Nesselwang or www.endress.com

4.4 Storage and transport

Storage temperature: -40 to +85 °C (-40 to +185 °F).

Avoid the following environmental influences during storage:

- Direct sunlight
- Proximity to hot objects
- Mechanical vibration
- Aggressive media

Maximum relative humidity: < 95%

Pack the device for storage and transportation in such a way that it is reliably protected against impact and external influences. The original packaging provides the best protection.

5 Installation

5.1 **Installation requirements**



For the intended use of the devices described in this document, certain ambient conditions must be met at the installation location. These include the ambient temperature, degree of protection, or climate class. For specifications and further details, as well as the device dimensions, refer to the corresponding Technical Information.

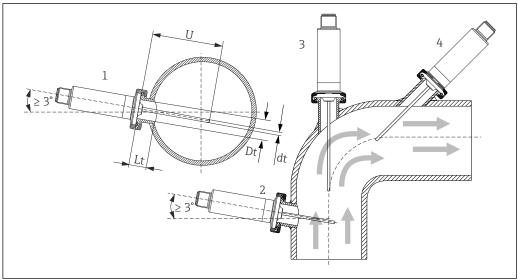
5.1.1 Orientation

No restrictions. Ensure self-draining in the process. If there is an opening to detect leaks at the process connection, this opening must be at the lowest possible point.

5.1.2 **Installation instructions**

The immersion length of the compact thermometer can considerably influence the measurement accuracy. If the immersion length is too short, measurement errors can occur as a result of heat dissipation via the process connection and the vessel wall. For installation in a pipe, an immersion length is therefore recommended that ideally corresponds to half the pipe diameter.

Installation possibilities: pipes, tanks or other plant components.



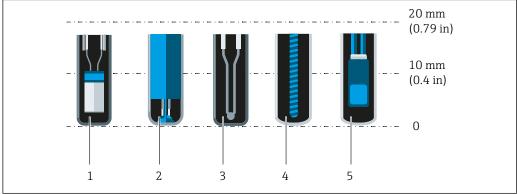
- 2 Installation examples
- 1,2 Perpendicular to the flow direction, installed at a min. angle of 3 °to ensure self-draining
- 3 On elbows
- 4 Inclined installation in pipes with a small nominal diameter
- U Immersion length
 - The requirements of the EHEDG and the 3-A Sanitary Standard must be adhered to.

 Installation instruction EHEDG/cleanability: Lt ≤ (Dt-dt)

 Installation instruction 3-A/cleanability: Lt ≤ 2 (Dt-dt)

The exact position of the sensor element in the thermometer tip must be observed. Available options depend on product and configuration.

Pay attention to the exact position of the sensor element in the thermometer tip. Available options depend on product and configuration.



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- 1 iTHERM StrongSens or iTHERM TrustSens for 5 to 7 mm (0.2 to 0.28 in)
- 2 iTHERM QuickSens for 0.5 to 1.5 mm (0.02 to 0.06 in)
- 3 Thermocouple (not grounded) for 3 to 5 mm (0.12 to 0.2 in)
- 4 Wire-wound sensor for 5 to 20 mm (0.2 to 0.79 in)
- 5 Standard thin-film sensor for 5 to 10 mm (0.2 to 0.39 in)

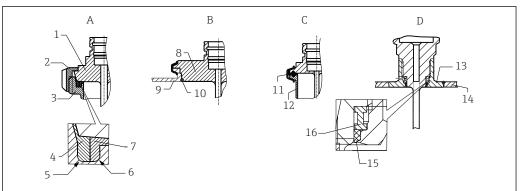
To minimize the heat dissipation, 20 to 25 mm of the sensor should extend into the medium beyond the sensor element.

This results in the following recommended minimum immersion lengths:

- iTHERM TrustSens or iTHERM StrongSens 30 mm (1.18 in)
- iTHERM QuickSens 25 mm (0.98 in)
- Wire wound sensor 45 mm (1.77 in)
- Standard thin-film sensor 35 mm (1.38 in)

Special consideration should be given to tee thermowells, as the immersion length is very short on account of their design, and the measurement error is higher as a result. It is therefore recommended to use elbow thermowells with iTHERM QuickSens sensors.

In the case of pipes with a small nominal diameter, it is advisable for the tip of the thermometer to extend far enough into the process to reach beyond the pipe axis. Installation at an angle (4) could be another solution. When determining the immersion or insertion length, all the parameters of the thermometer and of the medium to be measured must be taken into account (e.g. flow velocity, process pressure).



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- 3 Detailed installation instructions for hygiene-compliant installation
- A Milk pipe connection according to DIN 11851, only in conjunction with EHEDG-certified, self-centering sealing ring
- 1 Sensor with milk pipe connection
- 2 Grooved union nut
- 3 Counterpart connection
- 4 Centering ring
- 5 RO.4
- 6 RO.4
- 7 Sealing ring
- B Varivent® process connection for VARINLINE® housing
- 8 Sensor with Varivent connection
- 9 Counterpart connection
- 10 O-ring
- C Clamp according to ISO 2852
- 11 Molded seal
- 12 Counterpart connection
- D Process connection Liquiphant-M G1", horizontal installation
- 13 Weld-in adapter
- 14 Vessel wall
- 15 O-ring
- 16 Thrust collar
- The counterpieces for the process connections and the seals or sealing rings are not supplied with the thermometer. Liquiphant M weld-in adapters with associated seal kits are available as accessories (see 'Accessories').

A CAUTION

In the event of a defective sealing ring (O-ring) or seal, perform the following steps:

- ► Remove the thermometer.
- ► Clean the thread and the O-ring joint/sealing surface.
- ► Replace the sealing ring or seal.
- ▶ Perform process cleaning after installation.

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For welded connections, perform welding work on the process side as follows:

- 1. Ensure the surface is honed and mechanically polished, Ra \leq 0.76 µm (30 µin).
- 2. Use suitable welding material.
- 3. Avoid crevices, folds or gaps.
- 4. Flush-weld or weld with welding radius \geq 3.2 mm (0.13 in).

Welding work has been carried out properly.

To maintain cleanability, observe the following when installing the thermometer:

- 1. The installed sensor is suitable for CIP (cleaning in place). Cleaning is carried out in combination with piping or tank. For tank installation, use process connection nozzles to ensure the cleaning assembly directly sprays this area to clean it effectively.
- 2. The Varivent® connections enable flush-mounted installation.

Cleanability is retained after installation.

5.1.3 General installation instructions

If a device temperature of 100 °C is reached, the device generates diagnostic message **S825**. The device generates diagnostic message **F001** or **Failure current** if the device temperature is 125 °C or higher.

Ambient temperature range

T _a = -40 to +85 °C (-40 to +185 °F)	Ta	-40 to +85 °C (-40 to +185 °F)
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Process temperature range

The thermometer electronics must be protected against temperatures over 85 $^{\circ}$ C (185 $^{\circ}$ F) by an extension neck of the appropriate length.

Device version without electronics (order code 020, option A)

Pt100 TF, basic, without extension neck	−50 to +150 °C (−58 to +302 °F)
Pt100 TF, basic, with extension neck	−50 to +150 °C (−58 to +302 °F)
iTHERM TipSens, without extension neck	−50 to +200 °C (−58 to +392 °F)
iTHERM TipSens, with extension neck	-50 to +200 °C (-58 to +392 °F)

Device version with electronics (order code 020, option B, C)

Pt100 TF, basic, without extension neck	-50 to +150 °C (-58 to +302 °F)
Pt100 TF, basic, with extension neck	-50 to +150 °C (-58 to +302 °F)
iTHERM TipSens, without extension neck	–50 to +150 °C (–58 to +302 °F)
iTHERM TipSens, with extension neck	-50 to +200 °C (-58 to +392 °F)

5.2 Installing the thermometer

Proceed as follows before installing the device:

- 1. The permitted loading capacity of the process connections can be found in the relevant standards.
- 2. The process connection and compression fitting must comply with the maximum specified process pressure.
- 3. Make sure that the device is installed and secured before applying the process pressure.
- 4. Adjust the loading capacity of the thermowell to the process conditions.
- 5. It may be necessary to calculate the static and dynamic load capacity.
- It is possible to verify the mechanical loading capacity as a function of the installation and process conditions using the online TW Sizing Module for thermowells in the Endress+Hauser Applicator software https://portal.endress.com/webapp/applicator.

5.2.1 Cylindrical threads

NOTICE

Seals must be used for cylindrical threads.

In the case of combined thermometer and thermowell assemblies, these seals are already installed (depending on the version ordered).

► The system operator is required to verify the suitability of this seal with regard to the operating conditions.

Threaded version	Tightening torque [Nm]
Compact thermometer with thermowell as tee thermowell or elbow thermowell	5 Nm
Process connection, metal sealing system	10 Nm
Compression fitting, spherical, PEEK seal	10 Nm
Compression fitting, spherical, 316L seal	25 Nm
Compression fitting, cylindrical, Elastosil seal	5 Nm

5.2.2 Tapered threads

► The operator must verify if additional sealing by means of PTFE tape, hemp or an additional welded seam, for example, is necessary in the case of NPT threads or other tapered threads.

5.3 Post-mounting check

Is the device undamaged (visual inspection)?
Is the device correctly secured?
Does the device correspond to the specifications at the measuring point, e.g. ambient temperature, measuring range etc.?→ 31

Electrical connection 6

6.1 **Connection requirements**

To comply with the 3-A standard, it must be ensured that the electrical connection cables are smooth, corrosion-resistant, and easy to clean.

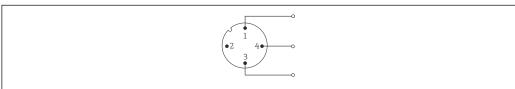
6.2 Connecting the measuring instrument

NOTICE

Damage to the device!

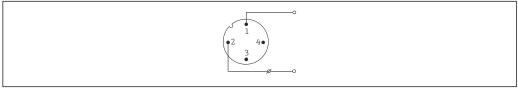
► Tighten the M12 plug to a maximum of 0.4 Nm to avoid damaging the device.

IO-Link operating mode



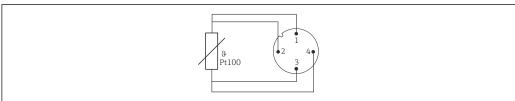
- € 4 Pin assignment, device plug
- Pin 1 power supply 15 to 30 V_{DC}
- Pin 2 not used
- Pin 3 power supply 0 $V_{\rm DC}$
- Pin 4 C/Q (IO-Link or switch output)

4 to 20 mA operating mode



- Pin assignment, device plug
- Pin 1 power supply 10 to 30 V_{DC}
- Pin 2 power supply 0 V_{DC}
- Pin 3 not used
- Pin 4 not used

Without electronics



A0040344

€ 6 Pin assignment of device plug: Pt100, 4-wire connection

6.3 Ensuring the degree of protection

6.4 Post-connection check

	Are the device and cable undamaged (visual check)?
	Do the mounted cables have suitable strain relief?
_	Does the supply voltage match the information on the nameplate?

7 Operation options

7.1 Protocol-specific data

7.1.1 IO-Link information

IO-Link is a point-to-point connection for communication between the device and an IO-Link master. The IO-Link communication interface offers the following options:

- Direct access to the process data
- Direct access to the diagnostic data
- Parameter configuration during operation

The device supports the following features:

IO-Link specification	Version 1.1
IO-Link Smart Sensor Profile 2nd Edition	Supported: Identification Diagnosis Digital Measuring Sensor (as per SSP type 3.1)
SIO mode	Yes
Transmission rate	COM2; 38.4 kBaud
Minimum period	10 ms
Process data width	4 byte
IO-Link data storage	Yes
Block configuration according to V1.1	Yes
Device operational	The device is operational $0.5~s$ after the supply voltage is applied (first valid measured value after $2~s$).

7.1.2 Device description

To integrate field devices into a digital communication system, the IO-Link system requires a description of the device parameters.

This information is contained in the device description ($IODD^{1}$), which is provided to the IO-Link master via generic modules during commissioning of the communication system.

+

The IODD can be downloaded as follows:

Endress+Hauser: www.endress.comIODDfinder: http://ioddfinder.io-link.com

8 System integration

8.1 Identification

Device ID	0x030100 (196864)					
Vendor ID	0x0011 (17)					

8.2 Process data

When the measuring instrument is operated in digital mode, the state of the switch output and the temperature value are transmitted in the form of process data via IO-Link. The signal is initially transmitted in the SIO mode (Standard IO-Mode). Digital IO-Link communication starts as soon as the IO-Link master sends the "Wake Up" command.

- In the SIO mode, the switch output is switched at pin 4 of the M12 plug. In the IO-Link communication mode, this pin is reserved exclusively for communication.
- The measuring instrument's process data are transmitted cyclically in 32-bit chunks.

Byte 1						Byte 2									
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
sint16	sint16														
Tempe	erature	(with o	ne dec	imal pla	ace)										

Byte 3							Byte 4								
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sint8	sint8										Enum4 B			Bool	
Scale	Scale (-1)										Measured value status			Switch state	

Explanation

Process value	Values	Meaning			
Temperature	-32 000 to 32 000	Temperature value with one decimal place Example: a transmitted value of 123 corresponds to a measured temperature value of 12.3 $^{\circ}$ C			
	32764 = No measurement data	Process value if no valid measured value is available			
	- 32760 = Out of range (-)	Process value if the measured value is below the lower limit value			
	32760 = Out of range (+)	Process value if the measured value is above the upper limit value			

¹⁾ Input/Output Device Description

Process value	Values	Meaning				
Scale	-1	The transmitted measured value must be multiplied by 10exp (Scale)				
Measured value status [bit 4	0 = Bad	Measured value cannot be used				
- 3	1 = Uncertain	Measured value can only be used to a limited extent, e.g.: device temperature is outside the permitted range (S825)				
	2 = Manual/Fixed	Measured value can only be used to a limited extent, e.g.: simulation of the measured variable is active (C485)				
	3 = Good	Measured value is good				
Measured value status [bit 2	0 = Not limited	Measured value without limit value violation				
- 1]	1 = Low limited	Limit value violation at lower end				
	2 = High limited	Limit value violation at upper end				
	3 = Constant	Measured value is set to a constant value, e.g.: simulation active				
Switch output [bit 0]	0 = Off	Switch output opened				
	1 = On	Switch output closed				

8.3 Reading and writing device data

Device data are always exchanged acyclically and at the request of the IO-Link master via the ISDU communication channel. The IO-Link master can read parameter values or device statuses as described in more detail in section 8.3.1.

8.3.1 Specific device data

The default values apply to parameters which are not ordered with customer-specific settings.

Name	Index (dec)	Index (hex)	Size [byte]	Data type	Access	Default value	Range of values	Data storage
Application specific tag	24	0x0018	32	String	r/w	-	-	Yes
Order code	1054	0x041E	20	String	r/-	-	-	-
Extended order code	259	0x0103	60	String	r/-	-	-	-
Device type	256	0x0100	2	UInteger16	r/-	0x93FF	-	-
Unit	5121	0x1401	1	UInteger8	r/w	32	32 = °C 33 = °F 35 = K	Yes
Damping	7271	0x1C67	1	UInteger8	r/w	0 s	0 to 120 s	Yes
Sensor offset	3082	0x0C0A	4	Float	r/w	0 °C (32 °F)	-10 to +10 °C (-18 to +18 °F)	Yes
Operating mode switch	2050	0x0802	2	UInteger16	r/w	Hysteresis normally open (0x0C9C)	Window normally open (0x0CFF) Window normally closed (0x0C96) Hysteresis normally open (0x0C9C) Hysteresis normally closed (0x0C99) Off (0x80EC)	Yes
Switch point value	2051	0x0803	4	Float	r/w	100 °C (212 °F)	-1E+20 to 1E+20	Yes
Switchback point value	2052	0x0804	4	Float	r/w	90 °C (194 °F)	-1E+20 to 1E+20	Yes
Switch delay	2053	0x0805	1	UInteger8	r/w	0 s	0 to 99 s	Yes

Name	Index (dec)	Index (hex)	Size [byte]	Data type	Access	Default value	Range of values	Data storage
Switchback delay	2054	0x0806	1	UInteger8	r/w	0 s	0 to 99 s	Yes
4 mA value	8218	0x201A	4	Float	r/w	0°C (32°F)	−50 000 to 50 000 °C	Yes
20 mA value	8219	0x201B	4	Float	r/w	150 ℃	−50 000 to 50 000 °C	Yes
Current trimming 4mA	8213	0x2015	4	Float	r/w	4.00 mA	3.85 to 4.15 mA	Yes
Current trimming 20mA	8212	0x2014	4	Float	r/w	20.00 mA	19.85 to 20.15 mA	Yes
Failure mode	8234	0x202A	1	UInteger8	r/w	0 = Low alarm	0 = Low alarm 2 = High alarm	Yes
Failure current	8232	0x2028	4	Float	r/w	22.5 mA	21.5 to 23 mA	Yes
Operating time	6148	0x1804	4	UInteger32	r/-	_	-	Yes
Alarm delay	6147	0x1803	1	UInteger8	r/w	2 s	1 to 5 s	Yes
Device status	36	0x0024	1	UInteger8	r/-	-	0 = Device is OK 1 = Maintenance required 2 = Out of specification 3 = Functional check 4 = Failure	-
Detailed device status	37	0x0025	36	OctetString	r/-	-	In accordance with IO-Link specification	-
Actual diagnostic 1	6184	0x1828	2	UInteger16	r/-	-	-	-
Actual diagnostic 2	6186	0x182A	2	UInteger16	r/-	-	-	_
Actual diagnostic 3	6188	0x182C	2	UInteger16	r/-	-	-	-
Previous diagnostics 1	6214	0x1846	2	UInteger16	r/-	-	-	_
Timestamp 1	6204	0x183C	4	UInteger32	r/-	-	-	-
Previous diagnostics 2	6216	0x1848	2	UInteger16	r/-	-	-	_
Timestamp 2	6205	0x183D	4	UInteger32	r/-	-	-	-
Previous diagnostics 3	6218	0x184A	2	UInteger16	r/-	-	-	-
Timestamp 3	6206	0x183E	4	UInteger32	r/-	-	-	-
Previous diagnostics 4	6220	0x184C	2	UInteger16	r/-	-	-	-
Timestamp 4	6207	0x183F	4	UInteger32	r/-	-	-	_
Previous diagnostics 5	6222	0x184E	2	UInteger16	r/-	-	-	_
Timestamp 5	6208	0x1840	4	UInteger32	r/-	-	-	-
Current output simulation	8210	0x2012	2	UInteger16	r/w	33004 = Off	33004 = Off 33005 = On	-
Current output simulation value	8211	0x2013	4	Float	r/w	3.58 mA	3.58 to 23 mA	-
Sensor simulation	3109	0x0C25	1	UInteger8	r/w	0 = Off	0 = Off 1 = On	-
Sensor simulation value	3104	0x0C20	4	Float	r/w	0°C (32°F)	-1E+20 to 1E+20 °C	-
Switch output simulation	2056	0x0808	2	UInteger16	r/w	0 = Disabled	0 = Disabled 33004 = Off 33006 = On	-
Sensor min value	3081	0x0C09	4	Float	r/-	-	-	-
Sensor max value	3080	0x0C08	4	Float	r/-	_	-	-
Lower boundary operating time sensor	3132	0x0C3C	4	UInteger32	r/-	-	-	-
Lower extended operation time sensor	3133	0x0C3D	4	UInteger32	r/-	-	-	_

Name	Index (dec)	Index (hex)	Size [byte]	Data type	Access	Default value	Range of values	Data storage
Standard operating time sensor	3134	0x0C3E	4	UInteger32	r/-	-	-	-
Upper extended operating time sensor	3135	0x0C3F	4	UInteger32	r/-	_	-	-
Upper boundary operating time sensor	3136	0x0C40	4	UInteger32	r/-	-	-	-
Device temperature	4096	0x1000	4	Float	r/-	_	-	-
Device temperature min	4107	0x100B	4	Float	r/-	_	-	-
Device temperature max	4106	0x100A	4	Float	r/-	-	-	-
Lower boundary operating time device	4109	0x100D	4	UInteger32	r/-	-	-	-
Lower extended operation time device	4110	0x100E	4	UInteger32	r/-	-	-	-
Standard operating time device	4111	0x100F	4	UInteger32	r/-	-	-	-
Upper extended operating time device	4112	0x1010	4	UInteger32	r/-	-	-	_
Upper boundary operating time device	4113	0x1011	4	UInteger32	r/-	-	-	_
MDC Descriptor	16512	0x4080	11	Record	r/-	-	-	-

8.3.2 IO-Link-specific device data

Name	Index (dec)	Index (hex)	Size [byte]	Data type	Access	Default value
Serial number	21	0x0015	16	String	r/-	_
Product ID	19	0x0013	32	String	r/-	TM311
Product Name	18	0x0012	32	String	r/-	iTHERM CompactLine TM311
Product Text	20	0x0014	32	String	r/-	Compact thermometer
Vendor Name	16	0x0010	32	String	r/-	Endress+Hauser
Vendor Text	17	0x0011	32	String	r/-	People for Process Automation
Hardware Version	22	0x0016	8	String	r/-	-
Firmware version	23	0x0017	8	String	r/-	-
Device Access Locks	12	0x000C	2	Record	r/w	-

8.3.3 System commands

Name	Value (dec)	Value (hex)
Reset factory settings	130	0x82
Activate parametrization lock	160	0xA0
Deactivate parametrization lock	161	0xA1
Reset sensor min/max values	162	0xA2
Reset device temp. min/max values	163	0xA3
IO-Link 1.1 system test command 240	240	0xF0
IO-Link 1.1 system test command 241	241	0xF1

Name	Value (dec)	Value (hex)
IO-Link 1.1 system test command 242	242	0xF2
IO-Link 1.1 system test command 243	243	0xF3

9 Commissioning

9.1 Function check

Perform the following checks prior to commissioning the measuring point:

- 1. Perform the post-mounting check using the checklist $\rightarrow = 14$.
- 2. Perform the post-connection check using the checklist $\rightarrow = 16$.

9.2 Configuring the measuring instrument

IO-Link functions and device-specific parameters are configured via the device's IO-Link communication.

Special configuration kits are available, e.g. the FieldPort SFP20. Every IO-Link device can be configured with it.

IO-Link devices are typically configured via the automation system (e.g. Siemens TIA Portal and Port Configuration Tool). The device supports IO-Link Data Storage, which enables easy device replacement.

9.3 Changing parameter configuration settings

If an existing configuration is changed, measuring operation continues.

10 Diagnostics and troubleshooting

10.1 General troubleshooting

Due to its design, the device cannot be repaired. It is possible to send the device in for inspection.

Fault	Possible cause	Remedial action
Device does not respond.	Supply voltage does not match the voltage specified on the nameplate.	► Connect the correct voltage.
	Supply voltage has incorrect polarity.	► Correct the polarity of the supply voltage.
Device is measuring incorrectly.	The device has been incorrectly configured.	Check and adjust parameter configuration.
	The device has been incorrectly connected.	► Check the pin assignment.
	Incorrect device orientation.	► Install the device correctly.
	Heat dissipation over the measuring point	Observe the face-to-face length of the sensor.

Fault	Possible cause	Remedial action
No communication	Communication cable is not connected.	► Check wiring and cables.
	Communication cable is incorrectly attached to the IO-Link master.	
No transmission of process data.	There is a fault in the device.	Correct faults that are displayed as a diagnostic event.

10.2 Diagnostic information via communication interface

10.2.1 Diagnostic message

The **Device Status** parameter shows the event category of the active diagnostic message with the highest priority. This category is displayed in the diagnostic list.

Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

The status signals are categorized according to NAMUR Recommendation NE 107: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required

Alphabetic character	Symbol	Event category	Meaning
F	8	Operating error	An operating error has occurred.
С	₩	Service mode	The device is in the service mode (e.g. during a simulation).
S	A	Out of specification	The device is being operated outside its technical specifications (e.g. during startup or cleaning processes).
M	\oint 	Maintenance required	Maintenance is required.

10.3 Overview of the diagnostic information

Diagnostic message	Diagnostic behavior	IO-Link Event Qualifier	IO-Link Event Code	Event text	Cause	Remedial action	
F001	Alarm	IO-Link error	0x1817	Device failure	Device malfunction	 Restart the device. Replace device. 	
F004	Alarm	IO-Link error	0x1818	Sensor defective	The sensor is defective (sensor failure or sensor short-circuit)	► Replace device.	
S047	Warning	IO-Link warning	0x1819	Sensor limit reached	Sensor limit reached	 Check sensor. Check process conditions. 	
C401	Warning	IO-Link Notification	0x181F	Factory reset active	Factory reset is active	Factory reset is active, please wait.	
C402	-	-	-	Initialization active	Initialization is in progress.	► Initialization in progress, please wait.	
C485	Warning	IO-Link warning	0x181A	Process variable simulation active	Simulation of the process variable is active.	► Deactivate simulation.	
C491	Warning	IO-Link warning	0x181B	Current output simulation active	Simulation of the current output is active.	► Deactivate simulation.	
C494	Warning	IO-Link warning	0x181C	Switch output simulation active	Simulation of the switch output is active.	► Deactivate simulation.	
F537	Alarm	IO-Link error	0x181D	Configuration invalid	Current range is invalid The difference between the 4mA value and 20mA value must be greater than or equal to 10°C.	Check device configuration. Upload and download new configuration.	
					Switch points are invalid The switch point must be greater than or equal to the switchback point.		
S801	Warning	IO-Link warning	0x181E	Supply voltage too low	Supply voltage too low	► Increase supply voltage.	
S804 ¹⁾	Alarm	-	-	Overload at switch output	Overload at the switch output	 Increase load resistance at switch output. Check the output. Replace device. 	
S825	Warning	IO-Link warning	0x1812	Operating temperature	Operating temperature of the electronics out of specification	Check ambient temperature. Check process temperature.	
S844 ²⁾	Warning	-	-	Process value out of specification	Process value is outside the specification	 Check process value. Check application. Check sensor. 	

¹⁾ Diagnosis only possible in SIO mode.

10.3.1 Behavior of the device in the event of a failure

The diagnostic behavior of the device differs depending on the selected operating mode. Irrespective of the operating mode, all the diagnostic messages are saved in the event logbook, where they can be accessed as required.

²⁾ Diagnosis only possible in 4-20mA mode.

IO-Link

The device displays warnings and failures via IO-Link. All the device warnings and faults are for information purposes only and do not have a safety function. The faults diagnosed by the device are displayed via IO-Link in accordance with NE 107. A distinction must be made between the following types of diagnostic behavior in this context:

Warning

The device continues measuring in the event of warning-type diagnostic behavior. The output signal is not affected (exception: simulation of the process variable is active).

- Alarm
 - The device does **not** continue measuring if this type of fault occurs. The output signal assumes its fault state (value in the event of a fault).
 - The PDValid Flag indicates that the process data are invalid.
 - The fault state is displayed via IO-Link.

Switch output

Warning

The switch output remains in the state defined by the switch points.

Alarm

The switch output changes to the **open** state.

4 to 20 mA

Warning

The current output is not affected.

Alarm

The current output adopts the configured failure current.

The behavior of the output in the event of a failure is regulated in accordance with NAMUR NE43.



- The failure current can be set.
- The selected failure current is used for all faults.

10.4 Diagnostic list

If several diagnostic events are pending simultaneously, only the three diagnostic messages with the highest priority are shown in the diagnostic list. The main feature of the display priority is the status signal in the following order: F, C, S, M. If several diagnostic events with the same status signal are pending, the priority is defined in numerical order of the event number, e.g. F042 appears before F044 and before S044.

10.5 Event logbook

The diagnostic messages are shown in chronological order in the **Event logbook**. In addition, a timestamp is saved with every diagnostic message. This timestamp is referenced to the operating time counter.

11 Maintenance

As a general rule, no specific maintenance work is required.

11.1 Cleaning

11.1.1 Cleaning of surfaces not in contact with the medium

- Recommendation: Use a lint-free cloth that is either dry or slightly dampened using water.
- Do not use any sharp objects or aggressive cleaning agents that corrode the surfaces (displays, housing, for example) and seals.
- Do not use high-pressure steam.
- Observe the degree of protection of the device.
- The cleaning agent used must be compatible with the materials of the device configuration. Do not use cleaning agents with concentrated mineral acids, bases or organic solvents.

11.1.2 Cleaning of surfaces in contact with the medium

Note the following for cleaning and sterilization in place (CIP/SIP):

- Use only cleaning agents to which the materials in contact with the medium are sufficiently resistant.
- Observe the permitted maximum medium temperature.

11.2 Maintenance services

Service	Description
	RTD inserts may drift depending on the application. Regular recalibration to verify accuracy is recommended. The calibration can be performed by the manufacturer or by qualified technical staff using calibration devices onsite.

12 Repair

Due to its design, the device cannot be repaired.

12.1 Spare parts

Product spare parts that are currently available can be found online at: www.endress.com/onlinetools

12.2 Return

The requirements for safe device return can vary depending on the device type and national legislation.

- 1. Refer to the web page for information: https://www.endress.com
- 2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging provides the best protection.

12.3 **Disposal**



If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

13 Accessories

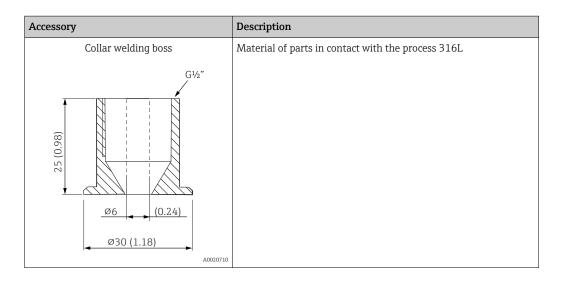
The accessories currently available for the product can be selected at www.endress.com:

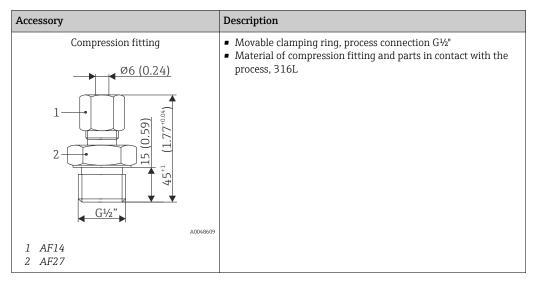
- 1. Select the product using the filters and search field.
- 2. Open the product page.
- 3. Select **Spare parts & Accessories**.

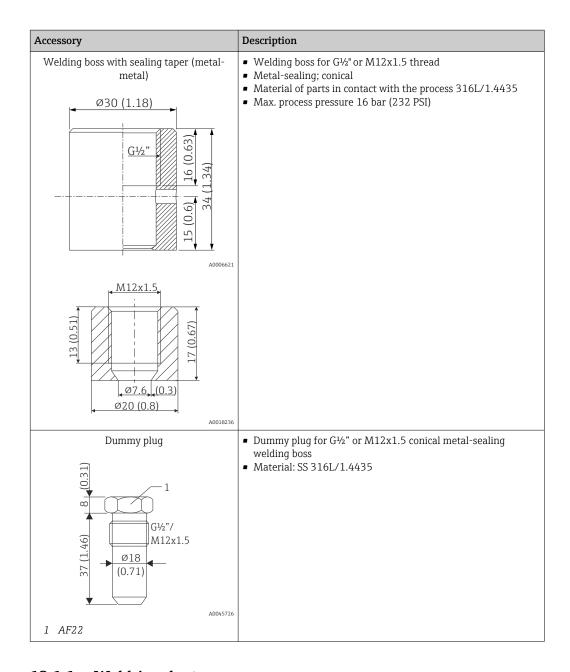
Device-specific accessory 13.1

All dimensions in mm (in).

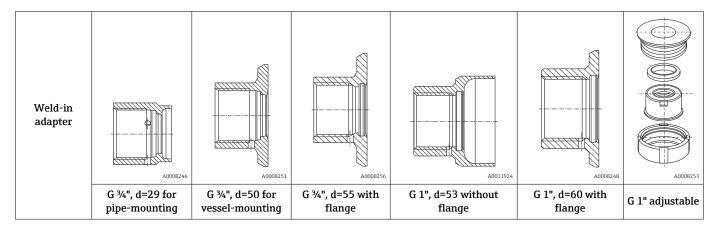
Accessory	Description
Welding boss with sealing taper	 Collar welding boss movable with sealing taper, washer and pressure screw G¹/₂" Material of parts in contact with the process 316L, PEEK Max. process pressure 10 bar (145 psi)
1 Pressure screw, 303/304, width across flats 24 mm	
2 Washer, 303/304	
3 Sealing taper, PEEK	
4 Collar welding boss, 316L	







13.1.1 Weld-in adapter



Material	316L (1.4435)					
Roughness μm (μin) process side	≤1.5 (59.1)	≤0.8 (31.5)	≤0.8 (31.5)	≤0.8 (31.5)	≤0.8 (31.5)	≤0.8 (31.5)

Maximum process pressure for the weld-in adapters:

- 25 bar (362 PSI) at maximum 150 °C (302 °F)
- 40 bar (580 PSI) at maximum 100 °C (212 °F)

13.2 Communication-specific accessory

13.2.1 IO-Link

Accessory	Description
FieldPort SFP20	 Mobile configuration tool for all IO-Link devices: The FieldPort SFP20 is a USB interface for the configuration of IO-Link devices. The FieldPort SFP20 can be connected to a laptop or tablet via a USB cable. A point-to-point connection between the laptop and IO-Link devices is possible with the FieldPort SFP20. M12 connection for IO-Link field devices
IO-Link master BL20	IO-Link master for DIN rails from Turck supports PROFINET, Ethernet/IP and Modbus TCP, including web server for simple configuration.
Field Xpert SMT50	Universal, high-performance tablet PC for device configuration in non-hazardous areas.

13.2.2 Coupling

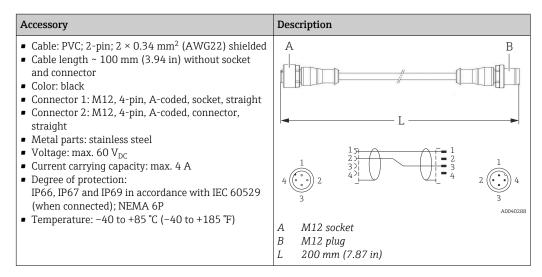
Accessory	Description
 M12x1 coupling; elbowed, for termination of connecting cable by user Connection to M12x1 housing connector Body materials PBT/PA, Union nut GD-Zn, nickel-plated IP67 degree of protection (fully locked) Voltage: max. 250 V Current carrying capacity: max. 4 A Temperature: -40 to +85 °C 	35 (1.38) 07 14.8 (0.58)
	A0020722

Accessory	Description
 PVC cable, 4 x 0.34 mm² (22 AWG) with M12x1 coupling, elbow plug, screw plug, length 5 m (16.4 ft) IP69K protection (optional) Voltage: max. 250 V Current carrying capacity: max. 4 A Temperature: -25 to +70 °C 	1 (BN) 2 (WH) 3 (BU) 4 (BK)
Wire colors: 1 = BN brown 2 = WH white 3 = BU blue 4 = BK black	A0020723

Accessory	Description
 PVC cable, 4 x 0.34 mm² (22 AWG) with M12x1 coupling nut made of epoxy coated zinc, straight socket contact, screw plug, 5 m (16.4 ft) IP69K protection (optional) Voltage: max. 250 V Current carrying capacity: max. 4 A Temperature: -20 to +105 °C 	1 (BN) 2 (WH) 3 (BU) 4 (BK)
Wire colors: 1 = BN brown 2 = WH white 3 = BU blue 4 = BK black	

13.2.3 Adapter cable

Since the IO-Link thermometers have a different pin assignment than 4-20 mA thermometers, the assignment must be adjusted in the event of device changes. To do this, either modify the wiring in the cabinet or use the adapter cable for the pin assignment between the device and the existing wiring.



13.3 Online tools

Product information about the entire life cycle of the device is available at: www.endress.com/onlinetools

13.4 Service-specific accessories

Netilion

With the Netilion IIoT ecosystem, Endress+Hauser enables the optimization of plant performance, digitization of workflows, sharing of knowledge and improved collaboration. Drawing upon decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem designed to effortlessly extract insights from data. These insights allow process optimization, leading to increased plant availability, efficiency, reliability and ultimately a more profitable plant.

www.netilion.endress.com

Applicator

Software for selecting and sizing Endress+Hauser measuring devices:

- Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections.
- Graphic illustration of the calculation results

Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.

Applicator is available:

https://portal.endress.com/webapp/applicator

Configurator

Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

The Configurator is available at www.endress.com on the relevant product page:

- 1. Select the product using the filters and search field.
- 2. Open the product page.
- 3. Select Configuration.

13.5 System components

Process indicators from the RIA product family

Easily readable process indicators with various functions: loop-powered indicators for displaying 4 to 20 mAvalues, display of up to four HART variables, process indicators with control units, limit value monitoring, sensor power supply, and galvanic isolation.

Universal application thanks to international hazardous area approvals, suitable for panel mounting or field installation..

For more information, please refer to: www.endress.com

RN series active barrier

Single- or two-channel active barrier for safe separation of 0/4 to 20 mA standard signal circuits with bidirectional HART transmission. In the signal duplicator option, the input signal is transmitted to two galvanically isolated outputs. The device has one active and one passive current input; the outputs can be operated actively or passively.

For more information, please refer to: www.endress.com

14 Technical data

14.1 Input

Measuring range	
-----------------	--

Pt100 (TF) basic	−50 to +150 °C (−58 to +302 °F)
iTHERM TipSens	−50 to +200 °C (−58 to +392 °F)

14.2 Output

Output signal

Order code 020, option A

Sensor output	Pt100, 4-wire connection, class A
---------------	-----------------------------------

Order code 020, option B

Analog output	4 to 20 mA; variable measuring range	
Digital output C/Q (IO-Link or switch output)		

Order code 020, option C

Analog output	4 to 20 mA; measuring range 0 to 150 °C (32 to 302 °F)	
Digital output C/Q (IO-Link or switch output)		

Switching capacity

- 1 × PNP switch output
- Switch status ON Ia \leq 200 mA; switch status OFF Ia \leq 10 μ A
- Switch cycles>10000000
- Voltage drop PNP ≤ 2 V
- Overload protection
 - Automatic load testing of switching current
 - If a current of over 220 mA flows in the ON switch state, the device switches to a safe state
 - Diagnostic message **Overload at switch output**
- Switch functions
 - Hysteresis or window function
 - Normally-closed contact or normally-open contact
- No pull-down resistor is integrated in the device for the switch output.

Switch output

Response time ≤ 100 ms

Failure information

Failure information is generated if the measuring information is missing or not valid. The device displays the three diagnostic messages with the highest priority.

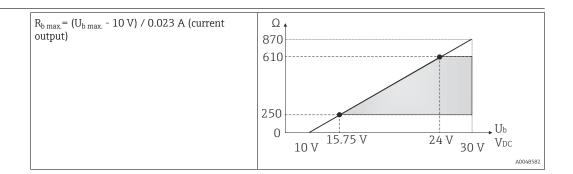
In the IO-Link mode, the device transmits all the failure information digitally.

In the 4 to 20 mA mode, the device transmits the failure information according to NAMUR NE43:

T T	Switch output	The switch output switches to open in the fault state.
-----	---------------	---

Underranging	Linear decrease from 4.0 to 3.8 mA
Overranging	Linear increase from 20.0 to 20.5 mA
Failure e.g. sensor defective	\leq 3.6 mA (low) or \geq 21 mA (high) can be selected The high alarm setting can be set between 21.5 mA and 23 mA, thus providing the flexibility needed to meet the requirements of various control systems.

Load



Linearization/transmission behavior

Temperature - linear

	Configurable sensor input damping	0 to 120 s
	Factory setting	0 s

Input current required

- \leq 3.5 mA for 4 to 20 mA
- \leq 9 mA for IO-Link

Maximum current consumption

 \leq 23 mA for 4 to 20 mA

Switch-on delay

2 s

Protocol-specific data

IO-Link information

IO-Link is a point-to-point connection for communication between the device and an IO-Link master. The IO-Link communication interface offers the following options:

- Direct access to the process data
- Direct access to the diagnostic data
- Parameter configuration during operation

The device supports the following features:

IO-Link specification	Version 1.1
IO-Link Smart Sensor Profile 2nd Edition	Supported: Identification Diagnosis Digital Measuring Sensor (as per SSP type 3.1)
SIO mode	Yes
Transmission rate	COM2; 38.4 kBaud
Minimum period	10 ms
Process data width	4 byte
IO-Link data storage	Yes
Block configuration according to V1.1	Yes
Device operational	The device is operational $0.5\mathrm{s}$ after the supply voltage is applied (first valid measured value after $2\mathrm{s}$).

Device description

To integrate field devices into a digital communication system, the IO-Link system requires a description of the device parameters.

This information is contained in the device description (IODD $^{2)}$), which is provided to the IO-Link master via generic modules during commissioning of the communication system.

The IODD can be downloaded as follows:

• Endress+Hauser: www.endress.com

■ IODDfinder: http://ioddfinder.io-link.com

Write protection for device parameters

Write protection for device parameters is implemented via system commands.

14.3 Power supply

Supply voltage

Electronic version	Supply voltage		
IO-Link/4 to 20 mA	U_b = 10 to 30 V_{DC} , protected against reverse polarity		
	IO-Link communication is guaranteed only if the supply voltage is at least 15 V. If the supply voltage is <15 V, the device displays a diagnostic message and deactivates the switch output.		

- The device must be operated with a type-examined transmitter power supply unit.
- Additional overvoltage protection is required for marine applications.

Power supply failure

- To comply with electrical safety standards CAN/CSA-C22.2 No. 61010-1 or UL 61010-1, the device must be operated using a power supply with a suitably limited current circuit in accordance with UL/EN/IEC 61010-1 Chapter 9.4 or Class 2 as per UL 1310, "SELV or Class 2 circuit".
- Overvoltage behavior (> 30 V)
 The device works continuously up to 35 V_{DC} without any damage. If the supply voltage is exceeded, the specified characteristics are no longer quaranteed.
- Behavior in the event of undervoltage If the supply voltage falls below the minimum value ~7 V, the device switches off in a defined manner (status as if not supplied with power).

Electrical connection

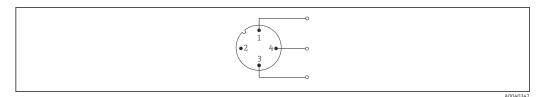
According to the 3-A Sanitary Standard and EHEDG, electrical connecting cables must be smooth, corrosion-resistant and easy to clean.

M12 plug with 4 pins and "A" coding, in accordance with IEC 61076-2-101

- ▶ Do not overtighten the M12 plug, as this could damage the device. Maximum torque: 0.4 Nm (M12 knurl)
- In the version with electronics, the device function is defined by the pin assignment of the M12 connector. Communication is either IO-Link or 4 to 20 mA.

IO-Link operating mode

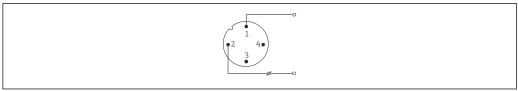
Input/Output Device Description



🗷 7 Pin assignment, device plug

- 1 Pin 1 power supply 15 to 30 V_{DC}
- 2 Pin 2 not used
- 3 Pin 3 power supply 0 V_{DC}
- 4 Pin 4 C/Q (IO-Link or switch output)

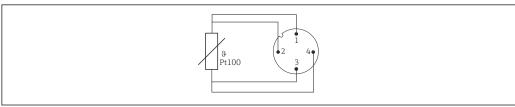
4 to 20 mA operating mode



A0040343

- 🛮 8 Pin assignment, device plug
- 1 Pin 1 power supply 10 to 30 V_{DC}
- 2 Pin 2 power supply 0 V_{DC}
- 3 Pin 3 not used
- 4 Pin 4 not used

Without electronics



A0040344

35

■ 9 Pin assignment of device plug: Pt100, 4-wire connection

14.4 Performance characteristics

Reference operating conditions

Adjustment temperature (ice bath) 0 °C (32 °F) for sensor		
Ambient temperature range	$25 ^{\circ}\text{C} \pm 3 ^{\circ}\text{C} (77 ^{\circ}\text{F} \pm 5 ^{\circ}\text{F})$ for electronics	
Supply voltage	$24V_{DC}\!\pm10\%$	
Relative humidity	< 95 %	

Maximum measured error

In accordance with DIN EN 60770 and the reference conditions specified above. The measured error data correspond to $\pm 2~\sigma$ (Gaussian distribution). The data include nonlinearities and repeatability.

Measured error (according to IEC 60751) in $^{\circ}C = 0.15 + 0.002 |T|$

i

|T| = Numerical value of the temperature in ${}^{\circ}C$ without regard to algebraic sign.

Thermometer without electronics

Standard	Description	Measuring range	Measured error (±)	
			Maximum 1)	Based on measured value 2)
IEC 60751	Pt100 Cl. A	−50 to +200 °C (−58 to +392 °F)	0.55 °C (0.99 °F)	ME = ± (0.15 °C (0.27 °F) + 0.002 * T)

- 1) Maximum measured error for the specified measuring range.
- 2) Deviations from maximum measured error possible due to rounding.
 - In order to obtain the maximum tolerances in $^{\circ}$ F, the results in $^{\circ}$ C must be multiplied by a factor of 1.8.

Thermometer with electronics

Standard Description		Measuring range	Measured error (±)		
Standard			Digital ¹⁾	D/A ²⁾	
			Maximum	Based on measured value	
IEC 60751	Pt100 Cl. A	−50 to +200 °C (−58 to +392 °F)	≤ 0.48 °C (0.86 °F)	ME = ± (0.215 °C (0.39 °F) + 0.134% * (MV - LRV))	0.05 % (≘ 8 µA)

- 1) Measured value transmitted via IO-Link.
- 2) Percentages based on the configured span of the analog output signal.

Thermometer with electronics and sensor-transmitter-matching / increased accuracy

Standard Description Measuring range		Mongaring range	Measured error (±)		
		Measuring range	Digital ¹⁾		D/A ²⁾
			Maximum	Based on measured value	
IEC 60751	Pt100 Cl. A	−50 to +200 °C (−58 to +392 °F)	≤ 0.14 °C (025 °F)	ME = ± (0.127 °C (0.23 °F) + 0.0074% * (MV - LRV))	0.05 % (≘ 8 µA)

- 1) Measured value transmitted via IO-Link.
- $\label{eq:percentages} \mbox{ Percentages based on the configured span of the analog output signal.}$

MV = measured value

LRV = lower range value of the sensor in question

Total measured error of transmitter at current output = $\sqrt{\text{(Measured error digital}^2 + \text{Measured error D/A}^2)}$

Sample calculation with Pt100, measuring range 0 to +150 °C (+32 to +302 °F), ambient temperature+25 °C (+77 °F), supply voltage24 V and sensor-transmitter matching:

Measured error digital = 0.127 °C (0.229 °F) + 0.0074 % x [150 °C (302 °F) - (-50 °C (-58 °F))]:	0.14 °C (0.25 °F)
Measured error D/A = $0.05 \% x 150 \degree C (302 \degree F)$	0.08 °C (0.14 °F)
Measured error digital value (IO-Link):	0.14 °C (0.25 °F)
Measured error analog value (current output): √(Measured error digital² + Measured error D/A²)	0.16 °C (0.29 °F)

Sample calculation with Pt100, measuring range 0 to +150 °C (+32 to +302 °F), ambient temperature +35 °C (+95 °F), supply voltage 30 V:

Measured error digital = 0.215 °C (0.387 °F) + 0.134% x [150 °C (302 °F) - (-50 °C (-58 °F))]:	0.48 °C (0.86 °F)
Measured error D/A = $0.05 \% x 150 \degree C (302 \degree F)$	0.08 °C (0.14 °F)

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Influence of ambient temperature (digital) = $(35 - 25) \times (0.004 \% \times 200 \degree C (360 \degree F))$, at least $0.008 \degree C (0.014 \degree F)$	0.08 °C (0.14 °F)
Influence of ambient temperature (D/A) = $(35 - 25) \times (0.003 \% \times 150 \degree C (302 \degree F))$	0.05 °C (0.09 °F)
Influence of supply voltage (digital) = $(30 - 24) \times (0.004 \% \times 200 ^{\circ}C (360 ^{\circ}F))$, at least $0.008 ^{\circ}C (0.014 ^{\circ}F)$	0.05 °C (0.09 °F)
Influence of supply voltage (D/A) = $(30 - 24) \times (0.003 \% \times 150 ^{\circ}C (302 ^{\circ}F))$	0.03 °C (0.05 °F)
Measured error digital value (IO-Link): $\sqrt{\text{(Measured error digital}^2 + Influence of ambient temperature (digital)}^2 + Influence of supply voltage (digital)}^2$	0.49 °C (0.88 °F)
Measured error analog value (current output): $\sqrt{\text{(Measured error D/A}^2 + Influence of ambient temperature (digital)}^2 + Influence of ambient temperature (D/A)}^2 + Influence of supply voltage (digital)}^2 + Influence of supply voltage (D/A)}^2$	0.50 °C (0.90 °F)

Long-term drift

	1 month	3 months	6 months	1 year	3 years	5 years
Digital output IO-Link	± 9 mK	± 15 mK	± 19 mK	± 23 mK	± 28 mK	±31 mK
Current output Measuring range -50 to +200 °C (-58 to +360 °F)	± 2.5 μA	± 4.3 μA	± 5.4 μA	± 6.4 µA	±8.0 µA	±8.8 μA

Operating influences

The measurement error data correspond to $\pm 2~\sigma$ (Gaussian distribution).

Standard	Designation	Ambient temperature Influence (+-) per 1 °C (1.8 °F) change			Infl	Supply voltage uence (+-) per 1 V chai	nge
		Di	gital ¹⁾	D/A ²⁾	Di	gital ¹⁾	D/A ²⁾
		Maximum ³⁾	Based on measured value ⁴⁾		Maximum ³⁾	Based on measured value ⁴⁾	
IEC 60751	Pt100 Cl. A	0.014 °C (0.025 °F)	0.004 % * (MV - LRV), min. 0.008 °C (0.0144 °F)	0.003 % (≘0.48 µA)	0.014 °C (0.025 °F)	0.004 % * (MV - LRV), min. 0.008 °C (0.0144 °F)	0.003 % (≘0.48 µA)

- 1) Measured value transmitted via IO-Link.
- 2) Percentages based on the configured span of the analog output signal.
- 3) Maximum measurement error for the specified measuring range.
- 4) Deviations from maximum measurement error possible due to rounding.

MV = measured value

LRV = lower range value of the sensor in question

Total measurement error of transmitter at current output = $\sqrt{\text{(Measurement error digital}^2 + \text{Measurement error D/A}^2)}$

Device temperature

The displayed device temperature has a maximum measured error of ±8 K.

Response time T_{63} and T_{90}

Tests in water at 0.4~m/s (1.3~ft/s) according to IEC 60751; temperature changes in increments of 10~K. Response times measured for the version without electronics.

Response time without heat transfer paste

Design	Sensor	t63	t ₉₀
6 mm direct contact, straight tip	Pt100 (TF) basic	5 s	< 20 s
6 mm direct contact, straight tip	iTHERM TipSens	1 s	1.5 s
6 mm thermowell, reduced tip $(4.3 \times 20 \text{ mm})$	iTHERM TipSens	1 s	3 s

Response time with heat transfer paste 1)

Design	Sensor	t63	t ₉₀
6 mm thermowell, reduced tip $(4.3 \times 20 \text{ mm})$	iTHERM TipSens	1 s	2.5 s

1) Between the insert and the thermowell

Electronics response time

Max. 1 s



When recording step responses, it is important to bear in mind that the response times of the sensor might be added to the specified times.

Sensor current

≤ 1 mA

Calibration

Calibration of thermometers

Calibration involves comparing the measured values of a device under test (DUT) with those of a more precise calibration standard using a defined and reproducible measurement method. The aim is to determine the deviation of the DUT's measured values from the true value of the measured variable. Two different methods are used for thermometers:

- Calibration at fixed-point temperatures, e.g. at the freezing point of water at 0 °C
- Calibration compared against a precise reference thermometer

The thermometer to be calibrated must display the fixed point temperature or the temperature of the reference thermometer as accurately as possible. Temperature-controlled calibration baths with very homogeneous thermal values, or special calibration furnaces into which the DUT and the reference thermometer, where necessary, can project to a sufficient degree, are typically used for thermometer calibrations.

Sensor-transmitter-matching

The resistance/temperature curve of platinum resistance thermometers is standardized but in practice it is rarely possible to keep to the values precisely over the entire operating temperature range. For this reason, platinum resistance sensors are divided into tolerance classes, such as class A, AA or B as per IEC 60751. These tolerance classes describe the maximum permissible deviation of the specific sensor characteristic curve from the standard curve, i.e. the maximum temperature-dependent characteristic error that is permitted. The conversion of measured sensor resistance values at temperatures in temperature transmitters or other meter electronics is often susceptible to considerable errors as the conversion is generally based on the standard characteristic curve.

When temperature transmitters are used, this conversion error can be reduced significantly by sensor-transmitter-matching:

- Calibration at least at three temperatures and determination of the actual temperature sensor characteristic curve
- Adjustment of the sensor-specific polynomial function using appropriate Calendar-van-Dusen (CvD) coefficients
- Configuration of the temperature transmitter with the sensor-specific CvD coefficients for resistance/temperature conversion, and
- another calibration of the reconfigured temperature transmitter with the connected resistance thermometer

The manufacturer offers this sensor-transmitter-matching as a separate service. Furthermore, the sensor-specific polynomial coefficients of platinum resistance thermometers are indicated on every calibration protocol where possible, e.g. at least three calibration points.

For the device, the manufacturer offers standard calibrations at a reference temperature of -50 to +200 °C (-58 to +392 °F) based on the ITS90 (International Temperature Scale). Calibrations in other temperature ranges are available from your local sales center on

request. Calibrations are traceable to national and international standards. The calibration certificate is referenced to the serial number of the device.

14.5 Installation

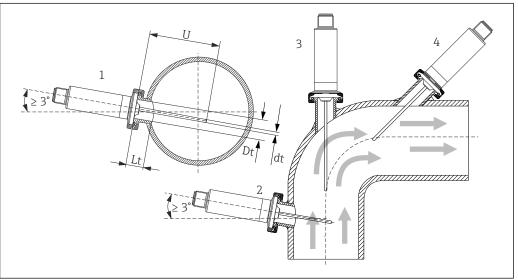
Orientation

No restrictions. Ensure self-draining in the process. If there is an opening to detect leaks at the process connection, this opening must be at the lowest possible point.

Installation instructions

The immersion length of the compact thermometer can considerably influence the measurement accuracy. If the immersion length is too short, measurement errors can occur as a result of heat dissipation via the process connection and the vessel wall. For installation in a pipe, an immersion length is therefore recommended that ideally corresponds to half the pipe diameter.

Installation possibilities: pipes, tanks or other plant components.



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■ 10 Installation examples

- 1,2 Perpendicular to the flow direction, installed at a min. angle of 3 °to ensure self-draining
- 3 On elbows
- 4 Inclined installation in pipes with a small nominal diameter
- U Immersion length

The requirements of the EHEDG and the 3-A Sanitary Standard must be adhered to.

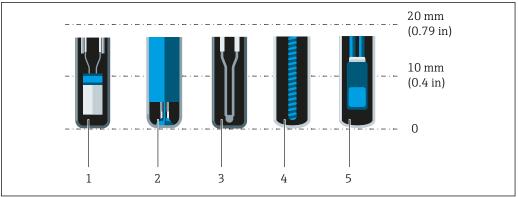
Installation instruction EHEDG/cleanability: Lt ≤ (Dt-dt)

Installation instruction 3-A/cleanability: Lt ≤ 2 (Dt-dt)

The exact position of the sensor element in the thermometer tip must be observed. Available options depend on product and configuration.

Pay attention to the exact position of the sensor element in the thermometer tip.

Available options depend on product and configuration.



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- 1 iTHERM StrongSens or iTHERM TrustSens for 5 to 7 mm (0.2 to 0.28 in)
- 2 iTHERM QuickSens for 0.5 to 1.5 mm (0.02 to 0.06 in)
- 3 Thermocouple (not grounded) for 3 to 5 mm (0.12 to 0.2 in)
- 4 Wire-wound sensor for 5 to 20 mm (0.2 to 0.79 in)
- 5 Standard thin-film sensor for 5 to 10 mm (0.2 to 0.39 in)

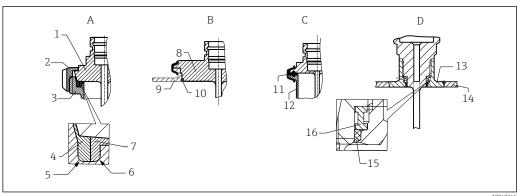
To minimize the heat dissipation, 20 to 25 mm of the sensor should extend into the medium beyond the sensor element.

This results in the following recommended minimum immersion lengths:

- iTHERM TrustSens or iTHERM StrongSens 30 mm (1.18 in)
- iTHERM QuickSens 25 mm (0.98 in)
- Wire wound sensor 45 mm (1.77 in)
- Standard thin-film sensor 35 mm (1.38 in)

Special consideration should be given to tee thermowells, as the immersion length is very short on account of their design, and the measurement error is higher as a result. It is therefore recommended to use elbow thermowells with iTHERM QuickSens sensors.

In the case of pipes with a small nominal diameter, it is advisable for the tip of the thermometer to extend far enough into the process to reach beyond the pipe axis. Installation at an angle (4) could be another solution. When determining the immersion or insertion length, all the parameters of the thermometer and of the medium to be measured must be taken into account (e.g. flow velocity, process pressure).



Detailed installation instructions for hygiene-compliant installation

- Milk pipe connection according to DIN 11851, only in conjunction with EHEDG-certified, self-centering Α sealing ring
- 1 Sensor with milk pipe connection
- 2 Grooved union nut
- 3 Counterpart connection
- 4 Centering ring
- 5 R0.4
- 6 R0.4
- Sealing ring
- В Varivent® process connection for VARINLINE® housing
- 8 Sensor with Varivent connection
- Counterpart connection
- 10 O-rina
- Clamp according to ISO 2852 С
- 11 Molded seal
- 12 Counterpart connection
- Process connection Liquiphant-M G1", horizontal installation
- Weld-in adapter 13
- 14 Vessel wall
- O-ring 15
- Thrust collar
- The counterpieces for the process connections and the seals or sealing rings are not supplied with the thermometer. Liquiphant M weld-in adapters with associated seal kits are available as accessories (see 'Accessories").

A CAUTION

In the event of a defective sealing ring (O-ring) or seal, perform the following steps:

- ▶ Remove the thermometer.
- Clean the thread and the O-ring joint/sealing surface.
- Replace the sealing ring or seal.
- ▶ Perform process cleaning after installation.

For welded connections, perform welding work on the process side as follows:

- 1. Ensure the surface is honed and mechanically polished, Ra \leq 0.76 µm (30 µin).
- 2. Use suitable welding material.
- 3. Avoid crevices, folds or gaps.
- 4. Flush-weld or weld with welding radius ≥ 3.2 mm (0.13 in).

Welding work has been carried out properly.

To maintain cleanability, observe the following when installing the thermometer:

1. The installed sensor is suitable for CIP (cleaning in place). Cleaning is carried out in combination with piping or tank. For tank installation, use process connection nozzles to ensure the cleaning assembly directly sprays this area to clean it effectively.

2. The Varivent® connections enable flush-mounted installation.

Cleanability is retained after installation.

14.6 Environment

Ambient temperature range	T _a	−40 to +85 °C (−40 to +185 °F)		
Storage temperature	Pack the device so that it is reliably protected against impact when it is stored (and transported). The original packaging offers the best protection.			
	T_s	-40 to +85 °C (-40 to +185 °F)		
Operating altitude	Up to 2 000 m (6 6	500 ft) above sea level		
Climate class	In accordance with	n IEC/EN 60654-1, climate class Dx, class 4K4H		
Degree of protection	As per IEC/EN 605	529 IP69		
	1 Depends on the	he degree of protection of the connection cable $\rightarrow~\cong$ 29		
Shock and vibration resistance		meets the requirements of IEC 60751, which specifies shock and see of 3 g in the 10 to 500 Hz range.		
Electromagnetic compatibility (EMC)		all relevant requirements of the IEC/EN 61326 series and NAMUR EMC (NE21). For details, refer to the Declaration of Conformity.		
	Interference imrenvironments	urement error during EMC tests: < 1 % of the measuring span nunity as per IEC/EN 61326 series, requirements for industrial ission as per IEC/EN 61326 series, Class B equipment		
	IO-Link			
	In I/O-Link mode,	only the requirements of IEC/EN 61131-9 are fulfilled.		
		on between the IO-Link master and thermometer is via an unshielded 3-aximum 20 m (65.6 ft) in length.		
	4 to 20 mA			
		ompatibility complies with all relevant requirements of the ies and NAMUR recommendation EMC (NE21). For more information, n of Conformity.		
	if the connect	ion cable length is 30 m (98.4 ft), a shielded cable must be used.		
Electrical safety	Protection classOvervoltage catePollution level 2	egory II		

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14.7 Process

Process temperature range

The thermometer electronics must be protected against temperatures over 85 $^{\circ}$ C (185 $^{\circ}$ F) by an extension neck of the appropriate length.

Device version without electronics (order code 020, option A)

Pt100 TF, basic, without extension neck	−50 to +150 °C (−58 to +302 °F)
Pt100 TF, basic, with extension neck	−50 to +150 °C (−58 to +302 °F)
iTHERM TipSens, without extension neck	−50 to +200 °C (−58 to +392 °F)
iTHERM TipSens, with extension neck	−50 to +200 °C (−58 to +392 °F)

Device version with electronics (order code 020, option B, C)

Pt100 TF, basic, without extension neck	−50 to +150 °C (−58 to +302 °F)
Pt100 TF, basic, with extension neck	−50 to +150 °C (−58 to +302 °F)
iTHERM TipSens, without extension neck	−50 to +150 °C (−58 to +302 °F)
iTHERM TipSens, with extension neck	-50 to +200 °C (-58 to +392 °F)

Thermal shock

Resistant to thermal shock during the CIP/SIP process with a temperature increase from +5 to +130 °C (+41 to +266 °F)within 2 seconds.

Process pressure range

The maximum possible process pressure depends on various influencing factors, such as the design, process connection and process temperature. Maximum possible process pressures for the individual process connections. $\rightarrow \implies 53$



State of aggregation of the medium

Gaseous or liquid (also with high viscosity, e.g. yogurt).

14.8 Mechanical construction

Design, dimensions

All dimensions in mm (in). The design of the thermometer depends on the thermowell version used:

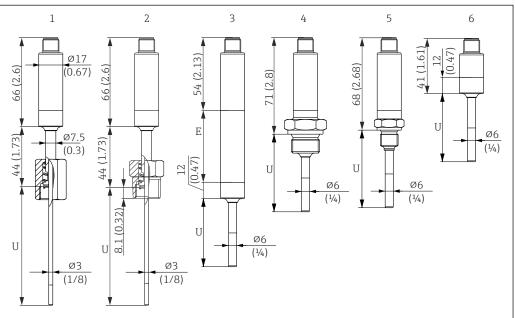
- Thermometer without a thermowell
- Thermowell diameter 6 mm (1/4 in)
- Thermowell version as tee thermowell and elbow thermowell as per DIN 11865/ASME BPE for welding in

Various dimensions, such as the immersion length U for example, are variable values and are therefore indicated as items in the following dimensional drawings.

Variable dimensions:

Position	Description
В	Thermowell bottom thickness
Е	Extension neck length, optional
T	Length of thermowell lagging, pre-defined, depending on the thermowell version
U	Variable immersion length, depending on the configuration

Without thermowell



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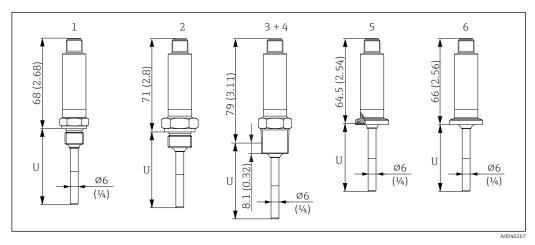
Unit of measurement mm (in)

- 1 Thermometer with spring-loaded union nut, G3/8" thread 3 mm for existing thermowell
- 2 Thermometer with spring-loaded NPT½" male thread 3 mm for existing thermowell
- ${\it 3} \quad \textit{Thermometer without process connection for compression fitting, with extension neck}$
- 4 Thermometer with G½" male thread
- 5 Thermometer with G¼" male thread
- 6 Thermometer without electronics

When using an extension neck, the overall length of the device always increases by the length in question, E = 50 mm (1.97 in), regardless of the process connection.

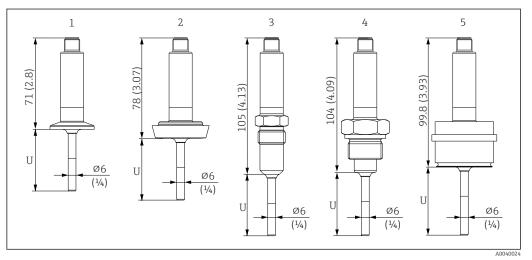
Pay attention to the following equations when calculating the immersion length $\it U$ for an existing thermowell:

Version 1 (G3/8" union nut)	$U = U_{\text{(thermowell)}} + T_{\text{(thermowell)}} + 3 \text{ mm} - B_{\text{(thermowell)}}$
Version 2 (NPT½" male thread)	$ U = U_{\text{(thermowell)}} + T_{\text{(thermowell)}} - 5 \text{ mm}_{\text{(-8 mm screw-in depth + 3mm spring travel)}} - B_{\text{(thermowell)}} $



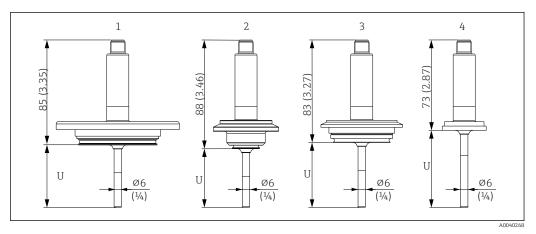
Unit of measurement mm (in)

- 1 Thermometer with M14 male thread
- 2 Thermometer with M18 male thread
- 3 Thermometer with NPT½" male thread
- $4 \qquad \textit{Thermometer with NPT14" male thread}$
- 5 Thermometer with Microclamp, DN18 (0.75")
- 6 Thermometer with Tri-Clamp, DN18 (0.75")



Unit of measurement mm (in)

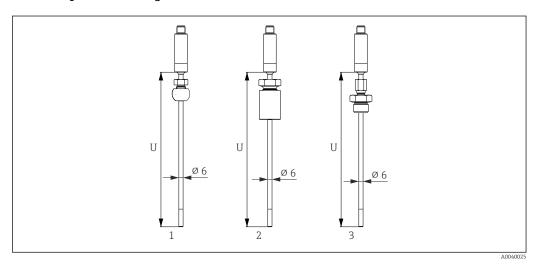
- Thermometer with Clamp ISO2852 for DN12 to 21.3, DN25 to 38, DN40 to 51
- 2 Thermometer with milk pipe connection DIN11851 for DN25/DN32/DN40/DN50
- 3 Thermometer with metal sealing system $G\frac{1}{2}$ "
- 4 Thermometer with G¾" male thread ISO228 for FTL31/33/20/50 Liquiphant adapter
- 5 Thermometer with D45 process adapter



Unit of measurement mm (in)

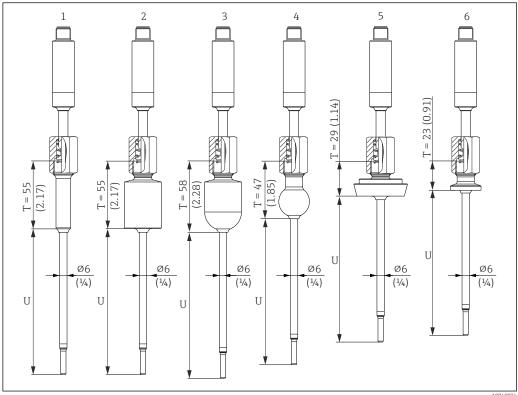
- 1 Thermometer with APV Inline, DN50
- 2 Thermometer with Varivent type B, D 31 mm
- 3 Thermometer with Varivent type F, D 50 mm and Varivent type N, D 68 mm
- 4 Thermometer with SMS 1147, DN25/DN38/DN51

With compression fitting



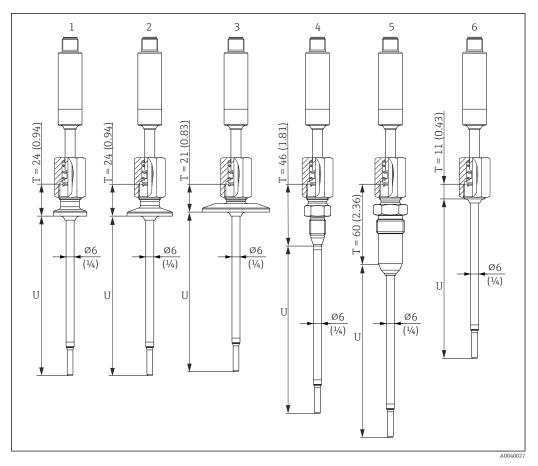
- Thermometer with compression fitting TK40 spherical, PEEK/316L, sleeve, Ø 25 mm, for welding in
- 2 Thermometer with compression fittingTK40 cylindrical, ELASTOSIL® sleeve, Ø 25 mm, for welding in
- 3 Thermometer with compression fitting $G^{1/2}$ " male thread, TK40-BADA3C, 316L

With thermowell diameter 6 mm (1/4 in)



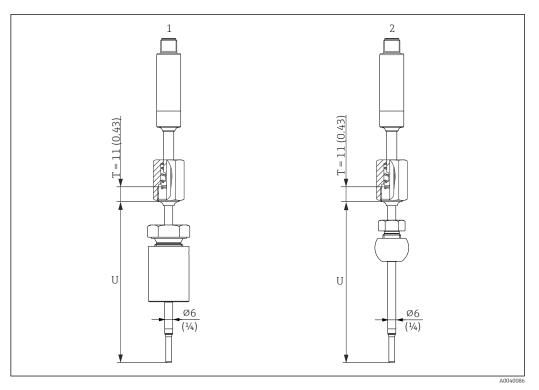
Unit of measurement mm (in)

- Thermometer with weld-in adapter, cylindrical, D 12 x 40 mm
- Thermometer with weld-in adapter, cylindrical, D 30 x 40 mm Thermometer with weld-in adapter, spherical-cylindrical, D 30 x 40 mm 3
- 4 5
- Thermometer with weld-in adapter, spherical, D 25 mm Thermometer with milk pipe connection DIN11851, DN25/DN32/DN40
- Thermometer with Microclamp, DN18 (0.75")



Unit of measurement mm (in)

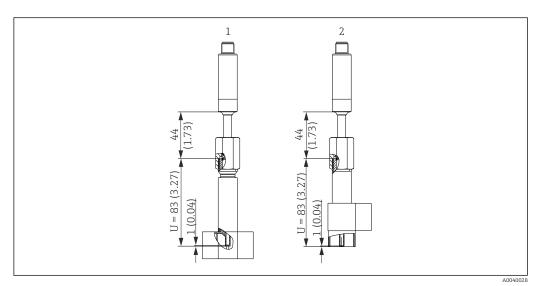
- 1 Thermometer with Tri-Clamp version DN18
- 2 Thermometer with Clamp version DN12 to 21.3
- 3 Thermometer with Clamp version DN25 to 38/DN40 to 51
- 4 Thermometer with metal sealing system version, $M12 \times 1.5$
- 5 Thermometer with metal sealing system version, G½"
- 6 Thermometer without process connection



Unit of measurement mm (in)

- 1 Thermometer with compression fitting TK40, cylindrical, ELASTOSIL® sleeve, Ø30 mm, for welding in
- 2 Thermometer with compression fitting TK40, spherical, PEEK/316L sleeve, Ø25 mm, for welding in

Thermowell version as tee thermowell or elbow thermowell



Unit of measurement mm (in)

- 1 Thermometer with tee thermowell
- 2 Thermometer with elbow thermowell
- Pipe sizes as per DIN 11865 series A (DIN), B (ISO) and C (ASME BPE)
- 3-A mark for nominal diameters ≥ DN25
- IP69 protection
- Material 1.4435+316L, delta ferrite content < 0.5%
- Temperature range -60 to +200 °C (-76 to +392 °F)
- Pressure range PN25 as per DIN11865

Due to the short immersion length U in the case of small pipe diameters, the use of iTHERM TipSens inserts is recommended.

Possible combinations of the thermowell versions with the available process connections $% \left(1\right) =\left(1\right) \left(1\right)$

Without process connection (for installation with compression fitting) □ Process adapted PdS □ □ Compression fitting □ □ □ Thread GW □ □ □ □ Spherical e25 mm □	Process connection and size	Direct contact,6 mm (1/4 in)	Thermowell,6 mm (1/4 in)			
Compression fitting		☑	☑			
Thread GW¹ ☑ ☑ Cylindrical Ø30 mm ☑ ☑ Spherical Ø25 mm ☑ ☑ Thread GW² ☑ ☑ GW² ☑ ☑ M14x1.5 ☑ ☑ M18x1.5 ☑ ☑ Weld-in adapter ☑ ☑ Cylindrical Ø30 x 40 mm ☑ ☑ Spherical cylindrical Ø30 x 40 mm ☑ ☑ Spherical Ø25 mm (0.98 in) ☑ ☑ Bylacic oli Ø180 (0.95 in) ☑ ☑ Bylacic oli Ø180 (0.75 in) ☑ ☑ Bylacic oli Ø180 (0.75 in) ☑ ☑ Bylacic oli Ø190 (0.75	Process adapter D45	✓	-			
Cylindrical Ø30 mm ☑						
Spherical Ø25 mm Ø Ø Thread GW Ø Ø GW Ø Ø M14x1.5 Ø Ø M18x1.5 Ø Ø NPTW Ø Ø Weld-in adapter Cylindrical Ø30 x 40 mm Ø Ø Cylindrical Ø30 x 40 mm Ø Ø Spherical eylindrical Ø30 x 40 mm Ø Ø Dx12 -21.3 Ø Ø Dx12 -22.3 Ø Ø Dx12 -21.3 Ø Ø Dx12 -1.3 Ø Ø Dx12 -1.3 Ø Ø Dx12 -1.3 Ø Ø Dx12 -1.3 Ø Ø	Thread G½"	✓	✓			
Thread GW □ □ GW □ □ M14x1.5 □ □ M18x1.5 □ □ NPTW □ □ Weld-in adapter Cylindrical Ø30 x 40 mm □ □ Cylindrical Ø30 x 40 mm □ □ Spherical cylindrical Ø30 x 40 mm □ □ Cylindrical Ø30 x 40 mm □ □ Byherical cylindrical Ø30 x 40 mm □ □ Byherical cylindrical Ø30 x 40 mm □ □ DN12-21.3 □ □ DN12-21.3 □ □ DN2-3 □ □ DN2-3-38 (1-1.5 in) □ □ DN2-3<	Cylindrical Ø30 mm	✓	4			
GW I - GW4 I - M14x1.5 I - M18x1.5 I - NPTW I - Weld-in adapter Cylindrical Ø30 x 40 mm I I Spherical-cylindrical Ø30 x 40 mm I I Spherical-cylindrical Ø30 x 40 mm I I Spherical e25 mm (0.98 in) I I Camps according to ISO 2852 Microclamp/Tri-Clamp DN18 (0.75 in) I I DN12 - 21.3 I I DN25 - 38 (1 - 1.5 in) I I DN25 - 38 (1 - 1.5 in) I I DN25 - 38 (1 - 1.5 in) I I DN25 - 38 (1 - 1.5 in) I I DN25 - 38 (1 - 1.5 in) I I DN25 - 38 (1 - 1.5 in) I I DN25 - 38 (1 - 1.5 in) I I DN25 - 30 (1 - 1.5 in) I I DN26 - 50 (1 - 1.5 in) I I	Spherical Ø25 mm	✓	4			
GW' □ - M14x1.5 □ - M18x1.5 □ - NPTW' □ - Weld-in adapter Cylindrical Ø30 x 40 mm □ □ Spherical-cylindrical Ø30 x 40 mm □ □ Spherical Ø25 mm (0.98 in) □ □ Camps according to ISO 2852 Microclamp/Tri-Clamp DN18 (0.75 in) □ □ DN12 - 21.3 □ □ DN25 - 38 (1 - 1.5 in) □ □ DN25 - 38 (1 - 1.5 in) □ □ DN26 - 12 in) □ □ DN27 - 12 in) □ □ DN28 - 12 in) □ □ DN29 - 12 in) □ □ DN20 - 12 in) □ □ DN21 - 12 in) □ □ DN20 - 12 in) □ □ DN21 - 12 in) □ □ DN20 - 12 in) □ □ DN30 - 12 in) □ □	Thread					
M14x1.5 ☑ M18x1.5 ☑ NPTW ☑ Weld-in adapter Cylindrical @30 x 40 mm Spherical-cylindrical @30 x 40 mm Spherical @25 mm (0.98 in) Clamps according to ISO 2852 Microclamp/Tri-Clamp DN18 (0.75 in) DN12 - 21.3 DN25 - 38 (1 - 1.5 in) DN26 - 36 (1 - 1.5 in) DN27 - 21.3 DN29 - 38 (1 - 1.5 in) DN40 - 51 (2 in) DN25 - 38 (1 - 1.5 in) DN25 - 38 (1 - 1.5 in) DN40 - 51 (2 in) DN25 - 30 (1 - 1.5 in) DN40 - 51 (2 in) DN50 DN40	G½"	✓	-			
M18x1.5 ✓ - NPTW* ✓ - Weld-in adapter Cylindrical Ø30 x 40 mm - ✓ Cylindrical Ø30 x 40 mm - ✓ Spherical-cylindrical Ø30 x 40 mm - ✓ Spherical Ø25 mm (0.98 in) - ✓ Clamps according to ISO 2852 Microclamp/Tri-Clamp DN18 (0.75 in) ✓ ✓ DN12 - 21,3 ✓ ✓ DN25 - 38 (1 - 1.5 in) ✓ ✓ DN40 - 51 (2 in) ✓ ✓ DN25 - 38 (1 - 1.5 in) ✓ ✓ DN40 - 51 (2 in) ✓ ✓ DN40 - 51 (2 in) ✓ ✓ DN52 - 38 (1 - 1.5 in) ✓ ✓ DN40 - 51 (2 in) ✓ ✓ DN52 - 50 (2 in) ✓ ✓ DN52 - 50 (2 in) ✓ ✓ DN50 - 50 (2 in) ✓ ✓ Milk pipe connection according to DIN 11851 ✓ ✓ DN50 - 50 (2 in) ✓ ✓	G ¹ / ₄ "	✓	-			
NPTW* ⋈ do - Weld-in adapter Cylindrical Ø30 x 40 mm - ✓ Spherical - Cylindrical Ø30 x 40 mm - ✓ Spherical Ø25 mm (0.98 in) - ✓ Clamps according to ISO 2852 Microclamp/Tri-Clamp DN18 (0.75 in) ✓ ✓ DN12 - 21.3 ✓ ✓ DN25 - 38 (1 - 1.5 in) ✓ ✓ DN40 - 51 (2 in) ✓ ✓ DN40 - 51 (2 in) ✓ ✓ DN25 ✓ ✓ ✓ DN32 ✓ ✓ ✓ DN40 ✓ ✓ ✓ DN50 ✓ ✓ ✓ DN50 ✓ ✓ ✓ Metalisealing system ✓ ✓ ✓ M12x1 - ✓ ✓ M2y2 ✓ ✓ ✓ Myling - ✓ ✓ Gy* for FTL50 ✓ - Gy* for FTL50	M14x1.5	✓	-			
Weld-in adapter Cylindrical Ø30 x 40 mm - ✓ Spherical Ø12 x 40 mm - ✓ Spherical Ø25 mm (0.98 in) - ✓ Spherical Ø25 mm (0.98 in) ✓ ✓ Clamps according to ISO 2852 Microclamp/Tri-Clamp DN18 (0.75 in) ✓ ✓ DN12 - 21.3 ✓ ✓ DN25 - 38 (1 - 1.5 in) ✓ ✓ DN40 - 51 (2 in) ✓ ✓ DN40 - 51 (2 in) ✓ ✓ DN25 ✓ ✓ DN32 ✓ ✓ DN40 ✓ ✓ DN50 ✓ ✓ DN50 ✓ ✓ Milzal - ✓ Milzal - ✓ Milzal - ✓ DN50 ✓ ✓ Milzal - ✓ Milzal - ✓ Milzal - ✓ Milzal - ✓	M18x1.5	✓	-			
Cylindrical Ø30 x 40 mm - ☑ Cylindrical Ø12 x 40 mm - ☑ Spherical-cylindrical Ø30 x 40 mm - ☑ Spherical Ø25 mm (0.98 in) - ☑ Clamps according to ISO 2852 Microclamp/Tri-Clamp DN18 (0.75 in) ☑ ☑ DN12 - 21.3 ☑ ☑ DN25 -38 (1 - 1.5 in) ☑ ☑ DN40 - 51 (2 in) ☑ ☑ Miki pipe connection according to DIN 11851 DN25 ☑ ☑ DN32 ☑ ☑ DN40 ☑ ☑ DN50 ☑ ☑ Metal sealing system M12x1 - ☑ G½² ☑ ☑ Gy for FTL20, FTL31, FTL33 ☑ □ Gy for	NPT½"	✓	-			
Cylindrical Ø12 x 40 mm - ☑ Spherical-cylindrical Ø30 x 40 mm - ☑ Spherical Ø25 mm (0.98 in) - ☑ Clamps according to ISO 2852 Microclamp/Tri-Clamp DN18 (0.75 in) ☑ ☑ DN12 - 21.3 ☑ ☑ DN25 -38 (1 - 1.5 in) ☑ ☑ DN40 - 51 (2 in) ☑ ☑ Milk pipe connection according to DIN 11851 DN25 ☑ ☑ DN32 ☑ ☑ DN40 ☑ ☑ DN50 ☑ ☑ Metal sealing system M12x1 - ☑ G½² ☑ ☑ Tread according to ISO 228 for Liquiphant weld-independent weld-i	Weld-in adapter					
Spherical-cylindrical Ø30 x 40 mm - ☑ Spherical Ø25 mm (0.98 in) - ☑ Clamps according to ISO 2852 Microclamp/Tri-Clamp DN18 (0.75 in) ☑ ☑ DN12 - 21.3 ☑ ☑ DN25 - 38 (1 - 1.5 in) ☑ ☑ DN40 - 51 (2 in) ☑ ☑ Milk pipe connection according to DIN 11851 DN25 ☑ ☑ DN32 ☑ ☑ DN40 ☑ ☑ DN50 ☑ ☑ Metal sealing system ☑ ☑ M12x1 □ ☑ G½* ☑ ☑ G½* ☑ ☑ Thread according to ISO 228 for Liquiphant weld-tradapter ☑ □ G¾* for FTL20, FTL31, FTL33 ☑ □ G¾* for FTL50 ☑ □ G1* for FTL50 ☑ □ APV Inline ☑ □ DN50 ☑ □ APV Inline <td< td=""><td>Cylindrical Ø30 x 40 mm</td><td>-</td><td>V</td></td<>	Cylindrical Ø30 x 40 mm	-	V			
Spherical Ø25 mm (0.98 in) - ☑ Clamps according to ISO 2852 Microclamp/Tri-Clamp DN18 (0.75 in) ☑ ☑ DN12 - 21.3 ☑ ☑ DN25 - 38 (1 - 1.5 in) ☑ ☑ DN40 - 51 (2 in) ☑ ☑ Milk pipe connection according to DIN 11851 DN25 ☑ ☑ DN32 ☑ ☑ DN40 ☑ ☑ DN50 ☑ ☑ Metal sealing system ☑ ☑ M12x1 □ ☑ G½" ☑ ☑ G½" ☑ ☑ Thread according to ISO 228 for Liquiphant weld-tadapter G¾" for FTL20, FTL31, FTL33 ☑ □ G¾" for FTL50 ☑ □ G1" for FTL50 ☑ □ APV Inline ☑ □ DN50 ☑ □ Calcapter Files G1" for FTL50 ☑ □ G2 □<	Cylindrical Ø12 x 40 mm	-	V			
Clamps according to ISO 2852 Microclamp/Tri-Clamp DN18 (0.75 in)	Spherical-cylindrical Ø30 x 40 mm	-	V			
Microclamp/Tri-Clamp DN18 (0.75 in) ☑ ☑ DN12 - 21.3 ☑ ☑ DN25 - 38 (1 - 1.5 in) ☑ ☑ DN40 - 51 (2 in) ☑ ☑ Milk pipe connection according to DIN 11851 DN25 ☑ ☑ DN32 ☑ ☑ DN40 ☑ ☑ DN50 ☑ ☑ Metal sealing system ☑ ☑ M12x1 □ ☑ G½* ☑ ☑ G½* ☑ ☑ Thread according to ISO 228 for Liquiphant weld-in adapter Thread according to ISO 228 for Liquiphant weld-in adapter G¾* for FTL20, FTL31, FTL33 ☑ □ G¾* for FTL50 ☑ □ APV Inline ☑ □ DN50 ☑ □ Varivent* Type B, Ø31 mm ☑ □ Type F, Ø50 mm ☑ □	Spherical Ø25 mm (0.98 in)	-	V			
DN12 - 21.3 DN25 - 38 (1 - 1.5 in) DN40 - 51 (2 in) Milk pipe connection according to DIN 11851 DN25	Clamps according to ISO 2852					
DN25 - 38 (1 - 1.5 in) ☑ ☑ DN40 - 51 (2 in) ☑ ☑ Milk pipe connection according to DIN 11851 DN25 ☑ ☑ DN32 ☑ ☑ DN40 ☑ ☑ DN50 ☑ □ Metal sealing system M12x1 □ ☑ G½" ☑ ☑ G½" ☑ ☑ Thread according to ISO 228 for Liquiphant weld-in-adapter G¾" for FTL20, FTL31, FTL33 ☑ □ G¾" for FTL50 ☑ □ G¾" for FTL50 ☑ □ APV Inline ☑ □ DN50 ☑ □ Varient® Type B, Ø31 mm ☑ □ Type F, Ø50 mm ☑ □	Microclamp/Tri-Clamp DN18 (0.75 in)	✓	✓			
DN40 - 51 (2 in) ☑ ☑ Milk pipe connection according to DIN 11851 DN25 ☑ ☑ DN32 ☑ ☑ DN40 ☑ ☑ DN50 ☑ □ Metal sealing system M12x1 □ ☑ G½" ☑ ☑ G½" ☑ ☑ Thread according to ISO 228 for Liquiphant weld-in-adapter ☑ □ G¾" for FTL20, FTL31, FTL33 ☑ □ G¾" for FTL50 ☑ □ G1" for FTL50 ☑ □ APV Inline ☑ □ DN50 ☑ □ Varivent® ☑ □ Type B, Ø31 mm ☑ □ Type F, Ø50 mm ☑ □	DN12 - 21.3	✓	4			
Milk pipe connection according to DIN 11851 DN25 ✓ ✓ DN32 ✓ ✓ DN40 ✓ ✓ DN50 ✓ - Metal sealing system M12x1 - ✓ G½" ✓ ✓ Thread according to ISO 228 for Liquiphant weld-in adapter G¾" for FTL20, FTL31, FTL33 ✓ - G¾" for FTL50 ✓ - G1" for FTL50 ✓ - APV Inline ✓ - DN50 ✓ - Varivent® Type B, Ø31 mm ✓ - Type F, Ø50 mm ✓ -	DN25 -38 (1 - 1.5 in)	✓	4			
DN25 ☑ ☑ DN32 ☑ ☑ DN40 ☑ ☑ DN50 ☑ - Metal sealing system M12x1 - ☑ G½" ☑ ☑ Thread according to ISO 228 for Liquiphant weld-indapter G¾" for FTL20, FTL31, FTL33 ☑ - G¾" for FTL50 ☑ - G1" for FTL50 ☑ - APV Inline ☑ - DN50 ☑ - Varivent® ☑ - Type B, Ø31 mm ☑ - Type F, Ø50 mm ☑ -	DN40 - 51 (2 in)	✓	V			
DN32 ☑ ☑ DN40 ☑ ☑ Metal sealing system M12x1 ⁻ ☑ G½" ☑ ☑ Thread according to ISO 228 for Liquiphant weld-to-to-to-to-to-to-to-to-to-to-to-to-to-						
DN40 ☑ ☑ DN50 ☑ - Metal sealing system M12x1 - ☑ G½" ☑ ☑ Thread according to ISO 228 for Liquiphant weld-in-dapter G¾" for FTL20, FTL31, FTL33 ☑ - G¾" for FTL50 ☑ - G1" for FTL50 ☑ - APV Inline ☑ - DN50 ☑ - Varivent® ☑ - Type B, Ø31 mm ☑ - Type F, Ø50 mm ☑ -	DN25	✓	V			
DN50 ☑ - Metal sealing system M12x1 - ☑ G½'' ☑ ☑ Thread according to ISO 228 for Liquiphant weld-iwalpter G¾'' for FTL20, FTL31, FTL33 ☑ - G¾'' for FTL50 ☑ - G1" for FTL50 ☑ - APV Inline ☑ - DN50 ☑ - Varivent® Type B, Ø31 mm ☑ - Type F, Ø50 mm ☑ -	DN32	✓	✓			
Metal sealing system M12x1 - ✓ ✓ G½' ✓ ✓ Thread according to ISO 228 for Liquiphant weld-in adapter G¾" for FTL20, FTL31, FTL33 ✓ - G¾" for FTL50 ✓ - G1" for FTL50 ✓ - APV Inline ✓ - DN50 ✓ - Varivent® Type B, Ø31 mm ✓ - Type F, Ø50 mm ✓ -	DN40	✓	✓			
M12x1 - ☑ G½'' ☑ ☑ Thread according to ISO 228 for Liquiphant weld-in adapter G¾" for FTL20, FTL31, FTL33 ☑ - G¾" for FTL50 ☑ - G1" for FTL50 ☑ - APV Inline ☑ - DN50 ☑ - Varivent® Type B, Ø31 mm ☑ - Type F, Ø50 mm ☑ -	DN50	✓	-			
G½" ☑ ☑ Thread according to ISO 228 for Liquiphant weld-in adapter G¾" for FTL20, FTL31, FTL33 ☑ - G¾" for FTL50 ☑ - G1" for FTL50 ☑ - APV Inline ☑ - DN50 ☑ - Varivent® ☑ - Type B, Ø31 mm ☑ - Type F, Ø50 mm ☑ -	Metal sealing system					
Thread according to ISO 228 for Liquiphant weld-in adapter G¾" for FTL20, FTL31, FTL33 ☑ - G¾" for FTL50 ☑ - G1" for FTL50 ☑ - APV Inline ☑ - DN50 ☑ - Varivent® ☑ - Type B, Ø31 mm ☑ - Type F, Ø50 mm ☑ -	M12x1	-	✓			
G¾" for FTL20, FTL31, FTL33 ✓ - G¾" for FTL50 ✓ - G1" for FTL50 ✓ - APV Inline ✓ - DN50 ✓ - Varivent® ✓ - Type B, Ø31 mm ✓ - Type F, Ø50 mm ✓ -	G½"	✓	✓			
G¾" for FTL50	Thread according to ISO 228 for Liquiphant weld-	in adapter				
G1" for FTL50	G¾" for FTL20, FTL31, FTL33	✓	-			
APV Inline Image: Control of the property of the prop	G¾" for FTL50	②	-			
DN50 ☑ - Varivent® Type B, Ø31 mm ☑ - Type F, Ø50 mm ☑ -	G1" for FTL50	4	-			
Varivent® ✓ - Type B, Ø31 mm ✓ - Type F, Ø50 mm ✓ -	APV Inline					
Type B, Ø31 mm ☑ - Type F, Ø50 mm ☑ -	DN50	Q	-			
Type F, Ø50 mm	Varivent [®]					
	Type B, Ø31 mm	✓	-			
Type N, Ø68 mm	Type F, Ø50 mm	V	-			
	Type N, Ø68 mm	✓	-			

Process connection and size	Direct contact,6 mm (1/4 in)	Thermowell,6 mm (¼ in)
SMS 1147		
DN25	☑	-
DN38	☑	-
DN51		-

Weight

0.2 to 2.5 kg (0.44 to 5.5 lbs) for standard versions

Material

The temperatures for continuous operation specified in the following table are only intended as reference values for use of the various materials in air and without any significant compressive load. The maximum operating temperatures can be reduced considerably in cases where abnormal conditions such as high mechanical load occur or in aggressive media.

Description	Short form	Recommended max. temperature for continuous use in air	Properties				
AISI 316L (corresponds to 1.4404 or 1.4435)	X2CrNiMo17-13-2, X2CrNiMo18-14-3	650 °C (1202 °F) ¹⁾	 Austenitic, stainless steel High corrosion resistance in general Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration) Increased resistance to intergranular corrosion and pitting 				
1.4435+316L, delta ferrite < 1% or < 0.5%	addition, the delta ferrite con	nits, the specifications of both materials (1.4435 and 316L) are met simultaneously. In ontent of the parts in contact with the process is limited to $<1\%$ or $<0.5\%$. Ordance with Basel Standard II)					

1) Can be used to a limited extent up to $800 \,^{\circ}$ C ($1472 \,^{\circ}$ F) for low compressive loads and in non-corrosive media. More information is available from the sales organization.

Surface roughness

Specifications for product wetted parts in accordance with EN ISO 21920:

Standard surface, mechanically polished ¹⁾	$R_a \le 0.76 \ \mu m \ (30 \ \mu in)$
Mechanically polished ¹⁾ , buffed ²⁾	$R_a \le 0.38 \ \mu m \ (15 \ \mu in)^{3)}$
Mechanically polished ¹⁾ , buffed and electropolished	$R_a \le 0.38 \ \mu m \ (15 \ \mu in)^{3)} + electropolished$

- 1) Or equivalent treatment that guarantees $R_{\text{a}}\ \text{max}.$
- 2) Not compliant with ASME BPE
- 3) T16% for direct-contact measuring inserts without thermowell, not compliant with ASME BPE

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Process connections



The 316L compression fittings can only be used once due to deformation. This applies to all the compression fitting components. A replacement compression fitting must be secured at another point (grooves in thermowell). PEEK compression fittings must never be used at a temperature that is lower than the temperature present when the compression fitting is secured. This is because the fitting would no longer be leaktight as a result of heat contraction of the PEEK material.

SWAGELOCK or similar fittings are strongly recommended for higher requirements.

Compression fitting

Model	Type of fitting 1)		Dimensions		Technical properties ²⁾
Model	Spherical or cylindrical	Φdi	ΦD	h	recuincal properties
AOOSE	Spherical Sealing taper material 316L	6.3 mm (0.25 in) ³⁾	25 mm (0.98 in)	33 mm (1.3 in)	 P_{max.} = 50 bar (725 psi) T_{max.} for 316L sealing taper = +200 °C (+392 °F), tightening torque = 40 Nm
Compression fitting TK40 for weld-in					
1 Movable 2 Fixed	Spherical Sealing taper material PEEK Thread G¼"	6.3 mm (0.25 in) ³⁾	25 mm (0.98 in)	33 mm (1.3 in)	 P_{max.} = 10 bar (145 psi) T_{max.} for PEEK sealing taper = +200 °C (+392 °F), tightening torque = 10 Nm The TK40 PEEK sealing taper is EHEDG tested and 3-A marked
Ødi	-	6.2 mm (0.24 in) 3)			
AOOSE	Cylindrical Material of sealing taper ELASTOSIL® Thread G½"	9.2 mm (0.36 in)	30 mm (1.18 in)	57 mm (2.24 in)	 P_{max.} = 10 bar (145 psi) T_{max.} for ELASTOSIL® sealing taper = +200 °C (+392 °F), tightening torque = 5 Nm The Elastosil® compression fitting is EHEDG tested and 3-A marked

- 1) Options depend on product and configuration
- 2) All the pressure specifications apply for cyclic temperature load
- For insert or thermowell diameter $\emptyset d = 6 \text{ mm } (0.236 \text{ in}).$

Compression fitting

			Dimensions		
Type TK40	Type of fitting	Φdi	L	Width across flats	Technical properties
Unit of measurement mm (in) 1 Nut 2 Ferrule 3 Process connection	G ½" , ferrule material 316L	6 mm (0.24 in)	Approx. 47 mm (1.85 in)	G ½": 27 mm (1.06 in)	 P_{max.} = 40 bar (104 psi) at T = +200 °C (+392 °F) for 316L material P_{max.} = 25 bar (77 psi) at T = +400 °C (+752 °F) for 316L material Tightening torque = 40 Nm

Type TK40 for weld-in	Type of fitting		Dimensions		Technical properties 1)
Type 1K40 for weig-in	Spherical or cylindrical	Φdi	ΦD	h	Technical properties
Ødi	Spherical Sealing taper material 316L	6.3 mm (0.25 in) ²⁾	25 mm (0.98 in)	33 mm (1.3 in)	 P_{max.} = 50 bar (725 psi) T_{max.} for 316L sealing taper = +200 °C (+392 °F), tightening torque = 40 Nm
Ødi	Spherical Sealing taper material PEEK Thread G1/4"	6.3 mm (0.25 in) ²⁾	25 mm (0.98 in)	33 mm (1.3 in)	 P_{max.} = 10 bar (145 psi) T_{max.} for PEEK sealing taper = +200 °C (+392 °F), tightening torque = 10 Nm The TK40 PEEK sealing taper is EHEDG tested and 3-A marked
ØD	Cylindrical Sealing taper material Elastosil® Thread G½"	6.2 mm (0.24 in) ²⁾	30 mm (1.18 in)	57 mm (2.24 in)	 P_{max.} = 10 bar (145 psi) T_{max.} for Elastosil® sealing taper = +200 °C (+392 °F), tightening torque = 5 Nm The TK40 Elastosil sealing taper is EHEDG tested and 3-A marked

- All the pressure specifications apply for cyclic temperature load For insert or thermowell diameter \emptyset d = 6 mm (0.236 in). 1)
- 2)

Releasable process connection

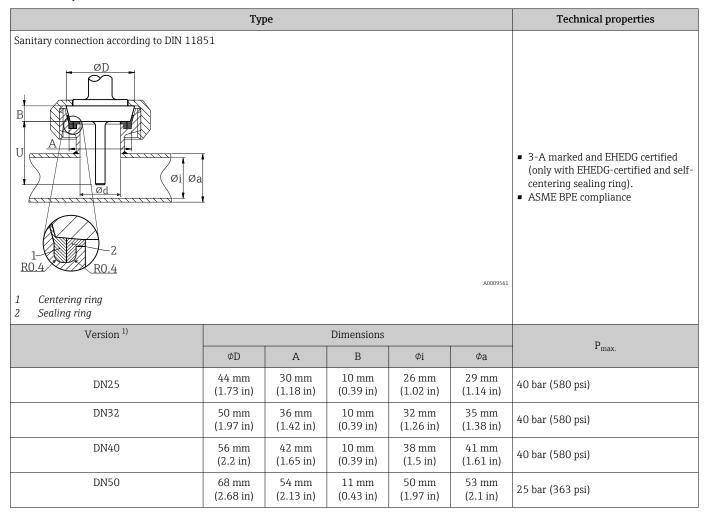
Thread Male th	led process connection hread	Туре	of fitting	Thread length TL	Width across flats	Max. process pressure
	SW/AF	M	M14x1.5	12 mm (0.47 in)	19 mm (0.75 in)	Maximum static
Е			M18x1.5	12 mm (0.47 in)	24 mm (0.95 in)	process pressure for threaded process
•		G 2)	G ¼" DIN/BSP	12 mm (0.47 in)	19 mm (0.75 in)	connection: 1)
1	TL		G ½" DIN/BSP	14 mm (0.55 in)	27 mm (1.06 in)	400 bar (5 802 psi) at
ML,		NPT	NPT ¼"	5.8 mm (0.23 in)	19 mm (0.75 in)	+400 °C (+752 °F)
L	A000862		NPT ½"	8 mm (0.32 in)	22 mm (0.87 in)	
■ 12	Cylindrical (left side) and conical (right side) version					

- 1) Maximum pressure specifications only for the thread. The failure of the thread is calculated, taking the static pressure into consideration. The calculation is based on a fully tightened thread (TL = thread length)
- 2) DIN ISO 228 BSPP

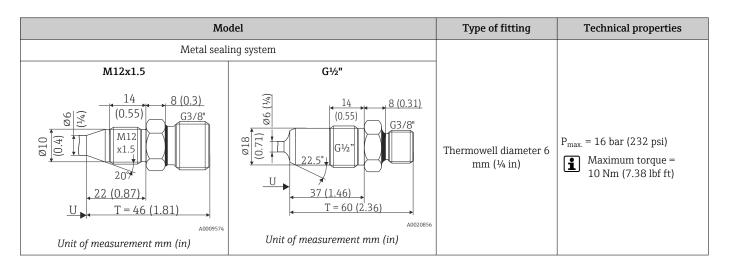
Timo	Type Version 1) Dimensions			Technical properties	Conformity
Туре	ϕd^{2} ϕD ϕa		reclinical properties	Comornity	
Clamp according to ISO 2852	Micro clamp ³⁾ DN8-18 (0.5"-0.75") ⁴⁾ , Form A	25 mm (0.98 in)	-	• P _{max.} = 16 bar (232 psi), depends on	-
	Tri-clamp DN8-18 (0.5"-0.75") ⁴⁾ , Form B	(0.50 III)	-	clamp ring and suitable seal • With 3-A symbol	Based on ISO 2852 ⁵⁾
	Clamp DN12-21.3, Form B	34 mm (1.34 in)	16 to 25.3 mm (0.63 to 0.99 in)		ISO 2852
ød ød	Clamp DN25-38 (1"-1.5"), Form B	50.5 mm (1.99 in)	29 to 42.4 mm (1.14 to 1.67 in)	• P _{max.} = 16 bar (232 psi), depends on	ASME BPE Type B; ISO 2852
ØD A	Clamp DN40-51 (2"), Form B	64 mm (2.52 in)	44.8 to 55.8 mm (1.76 to 2.2 in)	clamp ring and suitable seal 3-A marked and	ASME BPE Type B; ISO 2852
	Clamp DN63.5 (2.5"), Form B	77.5 mm (3.05 in)	68.9 to 75.8 mm (2.71 to 2.98 in)	EHEDG certified (in connection with Combifit seal)	ASME BPE Type B; ISO 2852
Form B	Clamp DN70-76.5 (3"), Form B	91 mm (3.58 in)	> 75.8 mm (2.98 in)	Combine sealy Can be used with 'Novaseptic Connect (NA Connect)' which enables flush-mount installation	ASME BPE Type B; ISO 2852
Form A: In compliance with ASME BPE Type A					
Form B: In compliance with ASME BPE Type B and ISO 2852					

- 1) Options depend on product and configuration
- 2) Pipes in accordance with ISO 2037 and BS 4825 Part 1
- 3) Micro clamp (not in ISO 2852); no standard pipes
- 4) DN8 (0.5") only possible with thermowell diameter = 6 mm ($\frac{1}{4}$ in)
- 5) Groove diameter = 20 mm

Releasable process connection



1) Pipes in accordance with DIN 11850



Туре	Version G		Technical properties		
Туре	version d	L1 thread length	Α	1 (SW/AF)	recinical properties
Thread according to ISO 228 (for Liquiphant weld-in adapter)	G¾" for FTL20/31/33 adapter G¾" for FTL50 adapter	16 mm (0.63 in)	25.5 mm (1 in)	32	 P_{max.} = 25 bar (362 psi) at max. 150 °C (302 °F) P_{max.} = 40 bar (580 psi) at max. 100 °C (212 °F) For more information about hygienic compliance in conjunction with FTL31/33/50 adapters,
U A0009572	G1" for FTL50 adapter	18.6 mm (0.73 in)	29.5 mm (1.16 in)	41	see Technical Information TI00426F.

Туре	Version	Technical properties
Process adapter		
Ø50 (1.97) Ø45 (1.77) (0.20)	D45	
Unit of measurement mm (in)		

Weld-in

Model	Model Type of fitting 1) Dimensions			
Weld-in adapter	1: Cylindrical ²⁾	ϕ d = 12.7 mm ($\frac{1}{2}$ in), U = immersion length from lower edge of thread, T = 12 mm (0.47 in)		
ød h ød Th ød	2: Cylindrical ³⁾	ϕ d x h = 12 mm (0.47 in) x 40 mm (1.57 in), T = 55 mm (2.17 in)		
$\begin{array}{c c} & & & \\ & & &$	3: Cylindrical	ϕ d x h = 30 mm (1.18 in) x 40 mm (1.57 in)		
U G U G	4: Spherical- cylindrical ϕ d x h = 30 mm (1.18 in) x 40 mm (1.57		 P_{max}, depends on the weld-in process With 3-A symbol and EHEDG certification ASME BPE compliance 	
1 2 3 5: Spherical		Φd = 25 mm (0.98 in) h = 24 mm (0.94 in)		
4 5 A0009569				

- Options depend on product and configuration For thermowell Ø12.7 mm (½ in) 1)
- 2)
- 3) For thermowell ϕ 6 mm ($\frac{1}{4}$ in)

Туре	Version	Dimensions					Technical properties
Туре	Version	Φd	ΦA	ΦВ	М	h	recinical properties
APV Inline ØB M Ød Ød ØA A0018435	DN50	69 mm (2.72 in)	99.5 mm (3.92 in)	82 mm (3.23 in)	2xM8	19 mm (0.75 in)	 P_{max.} = 25 bar (362 psi) 3-A marked and EHEDG certified ASME BPE compliance

Tymo	Type of					Technical properties		
Туре	fitting ¹⁾	ΦD	ΦA	ΦВ	h	P _{max} .		
Varivent®	Type B	31 mm (1.22 in)	105 mm (4.13 in)	-	22 mm (0.87 in)			
ØA ØB	Type F	50 mm (1.97 in)	145 mm (5.71 in)	135 mm (5.31 in)	24 mm (0.95 in)	- 10 bar (145 psi)	 With 3-A symbol and EHEDG certification ASME BPE compliance 	
U	Type N	68 mm (2.67 in)	165 mm (6.5 in)	155 mm (6.1 in)	24.5 mm (0.96 in)			
A0021307								

The VARINLINE® housing connection flange is suitable for welding into the conical or torispherical head in tanks or containers with a small diameter (≤ 1.6 m (5.25 ft)) and up to a wall thickness of 8 mm (0.31 in).

Varivent® Type F cannot be used for installations in pipes in combination with the VARINLINE® housing connection flange.

1) Options depend on product and configuration

Model	Tyme of fitting		Dimensions		Toological proportion
Model	Type of fitting	ΦD	ФΑ	h	Technical properties
SMS 1147 , ØA	DN25	32 mm (1.26 in)	35.5 mm (1.4 in)	7 mm (0.28 in)	
ØD	DN38	48 mm (1.89 in)	55 mm (2.17 in)	8 mm (0.31 in)	
1 2 3	DN51	60 mm (2.36 in)	65 mm (2.56 in)	9 mm (0.35 in)	P _{max.} = 6 bar (87 psi)
 Cap nut Sealing ring Counterpart connection 					

The counterpart connection must fit the sealing ring and fix it in place.

Tee thermowell, optimized (no welding, no dead legs)

Madal	Т	e of fitting ¹⁾	Dime	ensions in mm (i	n)	To sharing I manageries
Model	Тур	e or ritting	ΦD	L	s 2)	Technical properties
Tee thermowell for welding in as per DIN 11865 (series A, B and C)	Series A	DN10 PN25	13 mm (0.51 in)			
G3/8"		DN15 PN25	19 mm (0.75 in)			
		DN20 PN25	23 mm (0.91 in)		1.5 mm (0.06 in)	
<u>Ø18</u> (0.71) E8		DN25 PN25	29 mm (1.14 in)			
<u>05.1</u>		DN32 PN25	32 mm (1.26 in)			
(0.12)	Series B	DN13.5 PN25	13.5 mm (0.53 in)		1.6 mm (0.063 in)	
Ø4.5 (0.18) 00 L		DN17.2 PN25	17.2 mm (0.68 in)	48 mm		 P_{max.} = 25 bar (362 psi) 3-A marked ³⁾ and EHEDG
L C C A0035898		DN21.3 PN25	21.3 mm (0.84 in)	(1.89 in)		certified ³⁾ • ASME BPE compliance ³⁾
		DN26.9 PN25	26.9 mm (1.06 in)			
		DN33.7 PN25	33.7 mm (1.33 in)		2 mm (0.08 in)	
	Series C	DN12.7 PN25 (½")	12.7 mm (0.5 in)		1.65 mm (0.065 in)	
		DN19.05 PN25 (¾")	19.05 mm (0.75 in)			
		DN25.4 PN25 (1")	25.4 mm (1 in)			
		DN38.1 PN25 (1½")	38.1 mm (1.5 in)			

¹⁾ Options depend on product and configuration

²⁾ Wall thickness

³⁾ Applies to \geq DN25. The radius \geq 3.2 mm ($\frac{1}{8}$ in) cannot be maintained for smaller nominal diameters.

Elbow thermowell, optimized (no welding, no dead legs)

				Dimensio	ons		Techn
Model	Тур	e of fitting	ΦD	L1	L2	s 1)	ical prope rties
	Series A	DN10 PN25	13 mm (0.51 in)	22 mm (0.86 in)	24 mm (0.95 in)	1.5 mm (0.06 in)	■ P _{ma}
Elbary the amount of few welding in a		DN15 PN25	19 mm (0.75 in)	25 mm	(0.98 in)		25 bar
Elbow thermowell for welding in as per DIN 11865 (series A, B and C)		DN20 PN25	23 mm (0.91 in)	27 mm	(1.06 in)		(362 p
ı. L2		DN25 PN25	29 mm (1.14 in)	30 mm	(1.18 in)		mar
G3/8"		DN32 PN25	35 mm (1.38 in)	33 mm	(1.3 in)		ked and
1	Series B	DN13.5 PN25	13.5 mm (0.53 in)	22 mm (0.86 in)	24 mm (0.95 in)	1.6 mm (0.063 in)	EH ED
		DN17.2 PN25	17.2 mm (0.68 in)	24 mm	(0.95 in)		G cert
Ø3.1 (0.12) (8)		DN21.3 PN25	21.3 mm (0.84 in)	26 mm	(1.02 in)		ifie d
(0.12)		DN26.9 PN25	26.9 mm (1.06 in)	29 mm	(1.14 in)		for
83 (3)		DN33.7 PN25	33.7 mm (1.33 in)	32 mm	(1.26 in)	2.0 mm (0.08 in)	≥ D N2 5
Ø4.5 (0.18)	Series C	DN12.7 PN25 (½") ²⁾	12.7 mm (0.5 in)	22 mm (0.86 in)	24 mm (0.95 in)	1.65 mm (0.065 in)	• AS ME BPE
(0.18) <u>ND</u>		DN19.05 PN25 (¾")	19.05 mm (0.75 in)	25 mm	(0.98 in)		com
Unit of measurement mm (in)		DN25.4 PN25 (1")	25.4 mm (1 in)	28 mm	(1.1 in)		nce for
		DN38.1 PN25 (1½")	38.1 mm (1.5 in)	35 mm	(1.38 in)		≥ D N2 5

- 1) Wall thickness
- 2) Pipe dimensions as per ASME BPE

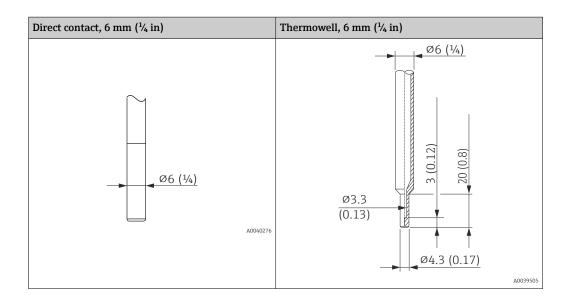
Shape of tip

The thermal response time, the reduction of the flow cross-section and the mechanical load that occurs in the process are the criteria that matter when selecting the shape of the tip.

Advantages of using reduced or tapered thermometer tips:

- A smaller tip shape has less impact on the flow characteristics of the pipe carrying the medium.
- Optimized flow characteristics
- Thermowell stability is increased.

60



14.9 User interface

Operating concept

The device-specific parameters are configured via IO-Link. There are specific configuration or operating programs from different manufacturers available to the user for this purpose. The device description file (IODD) is provided for the thermometer.

IO-Link operating concept

Operator-oriented menu structure for user-specific tasks. Guided menus divided by user category:

- Operator
- Maintenance
- Specialist

Efficient diagnostic behavior increases measurement reliability

- Diagnostic messages
- Remedial action
- Simulation options

IODD download

http://www.endress.com/download

- Select **Software** as the media type.
- Select **Device Driver** as the software type.
 Select IO-Link (IODD).
- In the "Text Search" field enter the device name.

https://ioddfinder.io-link.com/

Search by

- Manufacturer
- Article number
- Product type

Local operation

There are no operating elements directly on the device. The temperature transmitter is configured via remote operation.

Local display

There are no display elements directly on the device. The measured value and diagnostic messages, for instance, can be accessed via IO-Link.

Remote operation

IO-Link functions and device-specific parameters are configured via the device's IO-Link communication.

Special configuration kits are available, e.g. the FieldPort SFP20. Every IO-Link device can be configured with it.

IO-Link devices are typically configured via the automation system (e.g. Siemens TIA Portal and Port Configuration Tool). Parameters for device replacement can be stored in the IO-Link master.

14.10 Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

- 1. Select the product using the filters and search field.
- 2. Open the product page.
- 3. Select **Downloads**.

MTBF

For the transmitter: 327 years, according to Siemens Standard SN29500

Hygiene standard

- EHEDG certificate, type EL CLASS I. EHEDG-certified/tested process connections.
 → 🗎 53
- 3-A certificate authorization no. 1144, 3-A Sanitary standard 74-07. Listed process connections. → 🗎 53
- ASME BPE (latest edition), certificate of conformity can be ordered for indicated options
- FDA-compliant
- All surfaces in contact with the medium are free from materials derived from bovine animals or other livestock (ADI/TSE)

Materials in contact with food/product (FCM)

The process contact parts (FCM) are in conformity with the following European Regulations:

- Regulation (EC) No 1935/2004, on materials and articles intended to come into contact with food, article 3, paragraph 1, article 5 and 17.
- Regulation (EC) No 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food.
- Regulation (EU) No 10/2011 on plastic materials and articles intended to come into contact with food.

CRN approval

The CRN approval is only available for certain thermowell versions. These versions are identified and displayed accordingly during the configuration of the device.

Detailed ordering information is available for your nearest sales organization www.addresses.endress.com or in the Download Area under www.endress.com :

- 1. Select the country
- 2. Select Downloads
- 3. In the search area: select Approvals/approval type
- 4. Enter the product code or device
- 5. Start the search

Surface roughness	Free from oil and grease for O_2 applications, optional
Material resistance	Material resistance - including resistance of housing - to the following Ecolab cleaning disinfection agents:
	■ P3-topax 66
	■ P3-topactive 200
	■ P3-topactive 500
	■ P3-topactive OKTO
	 And demineralized water

15 Overview of the IO-Link operating menu

The following tables list all the parameters that are contained in the operating menu. Depending on the parameter configuration, not all submenus and parameters are available in every device.

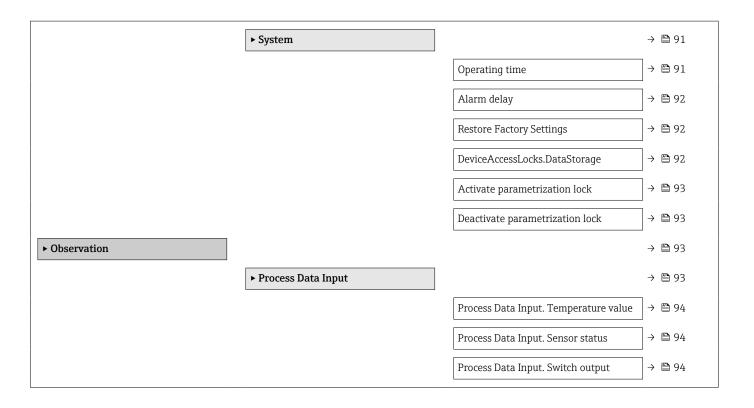
Operation concept

The IODD operating menu is based on an operation concept with different user roles.

User role	Meaning
Operator	The operator has read access to a limited selection of parameters that are required during operation.
Maintenance	The maintenance technician has read and write access to a limited selection of parameters that are required to service and maintain the device.
Specialist	The specialist (expert) has read and write access to all the parameters in the device.

► Identification			→ 🖺 66
	Application Specific Tag		→ 🖺 67
	Product Name		→ 🖺 67
	Product Text		→ 🖺 67
	Vendor Name		→ 🖺 68
	Serial number		→ 🖺 68
	Firmware version		→ 🖺 68
	Hardware Version		→ 🖺 69
	Order code		→ 🖺 69
	Extended order code		→ 🖺 69
	Device type		→ 🖺 70
► Diagnosis			→ 🖺 70
	➤ Diagnostic list		→ 🖺 70
		Actual diagnostics 1	→ 🖺 71
		Actual diagnostics 2	→ 🖺 71
		Actual diagnostics 3	→ 🖺 71
	► Event logbook		→ 🖺 71
		Previous diagnostics 1 5	→ 🖺 72
		Timestamp 1 5	→ 🗎 72
	► Simulation		→ 🖺 72
		Current output simulation	→ 🖺 72
		Value current output	→ 🖺 73

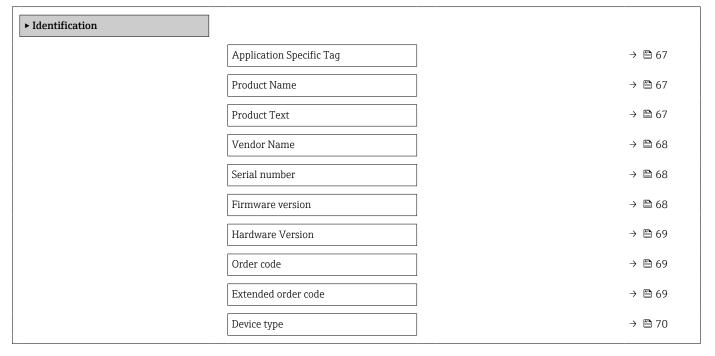
		Sensor simulation] → 🖺 73
		Sensor simulation value	→ 🖺 74
		Switch output simulation] → 🖺 74
	► Sensor temperature		→ 🖺 75
		Sensor max value	→ 🖺 75
		Sensor min value] → 🖺 76
		Reset sensor min/max values	→ 🖺 76
		Lower boundary operating time sensor] → 🖺 76
		Lower extended operating time sensor	→ 🖺 77
		Standard operating time sensor	→ 🗎 77
		Upper extended operating time sensor	→ 🖺 77
		Upper boundary operating time sensor] → 🖺 78
	► Device temperature		→ 🖺 78
		Device temperature] → 🖺 79
		Device temperature max	→ 🖺 79
		Device temperature min	→ 🖺 79
		Reset device temp. min/max values	→ 🖺 80
		Lower boundary operating time device	→ 🖺 80
		Lower extended operating time device] → 🖺 80
		Standard operating time device]→ 🖺 81
		Upper extended operating time device] → 🖺 81
		Upper boundary operating time device] → 🖺 81
	► Measuring data channel		→ 🖺 82
		MDC Descriptor.Lower limit	→ 🖺 82
		MDC Descriptor.Upper limit	→ 🖺 82
		MDC Descriptor.Unit code] → 🖺 83
		MDC Descriptor.Scale	→ 🖺 83
► Parameters			→ 🖺 83
	► Application		→ 🖺 84
		► Sensor] → 🖺 84
		► Switch output	→ 🖺 85
		► Current output	→ 🖺 88



15.1 Description of device parameters

15.1.1 Identification

Navigation 🗎 Identification



Application Specific Tag

Navigation ☐ Identification → Application Specific Tag

Description Use this function to enter a unique name for the measuring point so it can be identified

quickly within the plant.

User entry Max. 32 alphanumeric characters

Factory setting As per order specifications

Additional information *User role*

OperatorMaintenanceSpecialist

Product Name

Navigation ☐ Identification → Product Name

Description Displays the product name

User interface iTHERM CompactLine TM311

Additional information *User role*

OperatorMaintenanceSpecialist

Product Text

Navigation \square Identification \rightarrow Product Text

Description Displays the product text

User interface Compact thermometer

Additional information *User role*

- Operator
- Maintenance
- Specialist

Vendor Name Navigation Identification → Vendor Name Description Displays the manufacturer name User interface Endress+Hauser Additional information User role Operator Maintenance Specialist Serial number Identification → Serial number Navigation Description Displays the serial number of the device. It can also be found on the nameplate. To obtain specific information on the measuring device using the Device Viewer: www.endress.com/deviceviewer User interface Character string comprising numbers, letters and special characters Additional information User role Operator Maintenance Specialist Firmware version Navigation Identification → Firmware version Description Displays the firmware version User interface Character string comprising numbers, letters and special characters Additional information User role Operator Maintenance Specialist

Hardware Version

Navigation ☐ Identification → Hardware Version

Description Displays the hardware version

User interface Character string comprising numbers, letters and special characters

Additional information *User role*

OperatorMaintenanceSpecialist

Order code

Navigation \square Identification \rightarrow Order code

Description Displays the order code

User interface Character string comprising numbers, letters and special characters

Additional information *User role*

OperatorMaintenanceSpecialist

Extended order code

Navigation \square Identification \rightarrow Extended order code

Description Displays the extended order code.

The extended order code indicates the attributes for all the device features in the product

structure.

User interface Character string comprising numbers, letters and special characters

Additional information *User role*

- Operator
- Maintenance
- Specialist

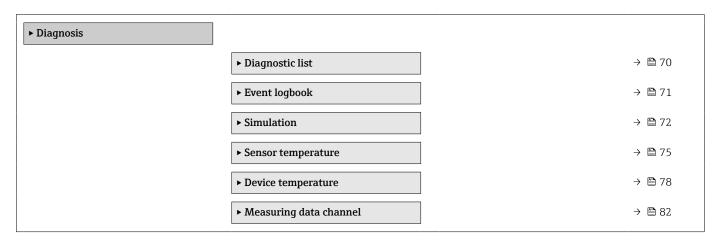
Device type Navigation Identification \rightarrow Device type Description Displays the device type User interface 37887 (0x93FF) Additional information User role • Operator • Maintenance

15.1.2 Diagnosis

■ Specialist

Navigation

Diagnosis



Diagnostic list

Navigation \Box Diagnosis \rightarrow Diagnostic list

► Diagnostic list		
	Actual diagnostics 1	→ 🖺 71
	Actual diagnostics 2	→ 🗎 71
	Actual diagnostics 3	→ 🖺 71

Actual diagnostics 1	
Navigation	☐ Diagnosis → Diagnostic list → Actual diagnostics 1
Description	Displays the diagnostic message with the highest priority that is currently active.
Additional information	User role ■ Operator ■ Maintenance ■ Specialist
Actual diagnostics 2	
Navigation	
Description	Displays the diagnostic message with the second-highest priority that is currently active.
Additional information	User role ■ Operator ■ Maintenance
	■ Specialist
Actual diagnostics 3	
_	■ Specialist
Actual diagnostics 3 Navigation Description	■ Specialist
Navigation	■ Specialist Diagnosis → Diagnostic list → Actual diagnostics 3
Navigation Description	 ■ Specialist ■ Diagnosis → Diagnostic list → Actual diagnostics 3 Displays the diagnostic message with the third-highest priority that is currently active. User role ■ Operator ■ Maintenance
Navigation Description	 Specialist Diagnosis → Diagnostic list → Actual diagnostics 3 Displays the diagnostic message with the third-highest priority that is currently active. User role Operator Maintenance Specialist
Navigation Description	■ Diagnosis → Diagnostic list → Actual diagnostics 3 Displays the diagnostic message with the third-highest priority that is currently active. User role ■ Operator ■ Maintenance ■ Specialist Event logbook
Navigation Description Additional information	■ Diagnosis → Diagnostic list → Actual diagnostics 3 Displays the diagnostic message with the third-highest priority that is currently active. User role ■ Operator ■ Maintenance ■ Specialist Event logbook

Previous diagnostics 1 ... 5 Navigation Diagnosis → Event logbook → Previous diagnostics 1 ... 5 Description Displays the diagnostic messages that occurred in the past (in chronological order). Additional information User role Specialist Timestamp 1 ... 5 **Navigation** Diagnosis \rightarrow Event logbook \rightarrow Timestamp 1 ... 5 Description Displays the time of the last diagnostic message. The time comes from the operating time counter. Additional information User role Specialist Simulation Diagnosis → Simulation Navigation ► Simulation Current output simulation → 🖺 72 Value current output → 🖺 73 Sensor simulation → 🖺 73 Sensor simulation value → 🖺 74 Switch output simulation → 🗎 74 **Current output simulation** Navigation Diagnosis → Simulation → Current output simulation Description Use this function to switch simulation of the current output on and off. Selection Off

■ On

Factory setting

Off

Additional information

Description



If a simulation is active, a warning to this effect is communicated via IO-Link (C491 -Simulation output). The simulation must be ended actively via the operating menu. If the device is disconnected from the power supply during the simulation and then power is resupplied afterwards, the simulation mode remains active. If the device is disconnected from the power supply a second time and then power is resupplied afterwards, the device resumes operation in the normal mode.

User role

- Operator
- Maintenance
- Specialist

Value	current	output
v aruc	Current	output

Navigation Diagnosis → Simulation → Value current output

Use this function to enter a current value for the simulation. In this way, users can verify Description

the correct adjustment of the current output and the correct function of downstream

evaluation units.

User entry 3.58 to 23 mA

Additional information

User role

- Operator
- Maintenance
- Specialist

Sensor simulation

Navigation Diagnosis \rightarrow Simulation \rightarrow Sensor simulation

Description Use this function to enable the simulation of the process variable.

Selection Off

■ On

Factory setting Off

Additional information

Description



If a simulation is active, a warning to this effect is communicated via IO-Link (C485 - Simulation process variable). The simulation must be ended actively via the operating menu. If the device is disconnected from the power supply during the simulation and then power is resupplied afterwards, the simulation mode remains active. If the device is disconnected from the power supply a second time and then power is resupplied afterwards, the device resumes operation in the normal mode.

User role

- Operator
- Maintenance
- Specialist

Sensor simulation value

Navigation \square Diagnosis \rightarrow Simulation \rightarrow Sensor simulation value

Description Use this function to enter a simulation value for the process variable. Subsequent

measured value processing and the signal output use this simulation value. In this way,

users can verify whether the measuring device has been configured correctly.

User entry $-50 \text{ to } +200 ^{\circ}\text{C}$

Additional information

User role

- Operator
- Maintenance
- Specialist

Switch output simulation

Navigation \square Diagnosis \rightarrow Simulation \rightarrow Switch output simulation

Description Use this function to enable and configure the simulation of the switch output.

Selection • Disabled

Off

On

Factory setting Disabled

Additional information

Description



If a simulation is active, a warning to this effect is communicated via IO-Link (C494 -Simulation switch output). The simulation must be ended actively via the operating menu. If the device is disconnected from the power supply during the simulation and then power is resupplied afterwards, the simulation mode remains active. If the device is disconnected from the power supply a second time and then power is resupplied afterwards, the device resumes operation in the normal mode.

User role

- Operator
- Maintenance
- Specialist

Sensor temperature

Navigation Diagnosis → Sensor temperature

➤ Sensor temperature		
	Sensor max value	→ 🖺 75
	Sensor min value	→ 🖺 76
	Reset sensor min/max values	→ 🖺 76
	Lower boundary operating time sensor	→ 🖺 76
	Lower extended operating time sensor	→ 🖺 77
	Standard operating time sensor	→ 🖺 77
	Upper extended operating time sensor	→ 🖺 77
	Upper boundary operating time sensor	→ 🖺 78

Sensor max value	
Navigation	☐ Diagnosis → Sensor temperature → Sensor max value
Description	Displays the maximum temperature measured in the past at the sensor input (maximum indicator).
Additional information	User role
	OperatorMaintenanceSpecialist

Sensor min value

Navigation

■ Diagnosis → Sensor temperature → Sensor min value

Description

Displays the minimum temperature measured in the past at the sensor input (minimum

indicator).

Additional information

User role

- Operator
- Maintenance
- Specialist

Reset sensor min/max values

Navigation

☐ Diagnosis → Sensor temperature → Reset sensor min/max values

Description

Resets the lowest and highest temperature value measured at the sensor (reset the minimum/maximum indicators for the sensor temperature).

Additional information

User role

- Operator
- Maintenance
- Specialist

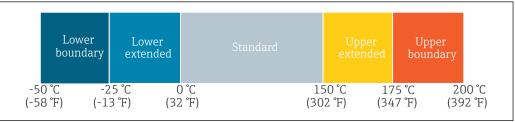
Lower boundary operating time sensor

Navigation

■ Diagnosis → Sensor temperature → Lower boundary operating time sensor

Description

Displays the operating time of the sensor in the lower process temperature boundary zone (Lower boundary).



A005148

Additional information

User role

Specialist

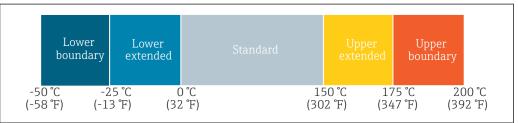
Lower extended operating time sensor

Navigation

riangleq Diagnosis riangleq Sensor temperature riangleq Lower extended operating time sensor

Description

Displays the operating time of the sensor in the lower process temperature range (Lower extended).



A0051480

Additional information

User role

Specialist

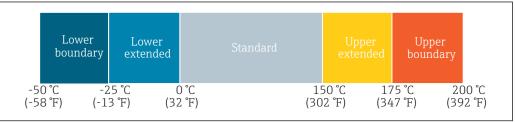
Standard operating time sensor

Navigation

riangleq Diagnosis riangleq Sensor temperature riangleq Standard operating time sensor

Description

Displays the operating time of the sensor in the normal process temperature range (Standard).



A0051480

Additional information

User role

Specialist

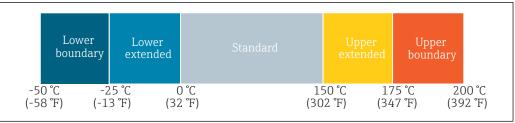
Upper extended operating time sensor

Navigation

☐ Diagnosis → Sensor temperature → Upper extended operating time sensor

Description

Displays the operating time of the sensor in the upper process temperature range (Upper extended).



A0051480

Additional information

User role

Specialist

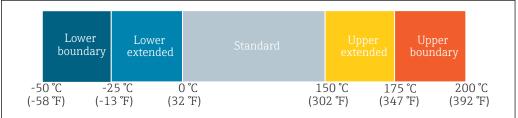
Upper boundary operating time sensor

Navigation

□ Diagnosis → Sensor temperature → Upper boundary operating time sensor

Description

Displays the operating time of the sensor in the upper process temperature boundary zone (Upper boundary).



A0051480

Additional information

User role

Specialist

Device temperature

Navigation $\blacksquare \Box$ Diagnosis \rightarrow Device temperature

► Device temperature		
	Device temperature	→ 🖺 79
	Device temperature max	→ 🖺 79
	Device temperature min	→ 🖺 79
	Reset device temp. min/max values	→ 🖺 80
	Lower boundary operating time device	→ 🖺 80
	Lower extended operating time device	→ 🖺 80
	Standard operating time device	→ 🖺 81

Upper extended operating time device	→ 🖺 81
Upper boundary operating time device	→ 🖺 81

Device temperature		
Navigation	□ Diagnosis → Device temperature → Device temperature	
Description	Displays the current device temperature (electronics).	
Additional information	User role ■ Operator ■ Maintenance ■ Specialist	

Device temperature max		
Navigation	□ Diagnosis → Device temperature → Device temperature max	
Description	Displays the maximum device temperature measured in the past (maximum indicator).	
Additional information	User role	
	OperatorMaintenanceSpecialist	

Device temperature min		
Navigation		
Description	Displays the minimum device temperature measured in the past (minimum indicator).	
Additional information	User role ■ Operator ■ Maintenance ■ Specialist	

Reset device temp. min/max values

Navigation

Description

Resets the lowest and highest device temperature that has been measured (reset the minimum/maximum indicators for the device temperature).

Additional information

User role

- Operator
- Maintenance
- Specialist

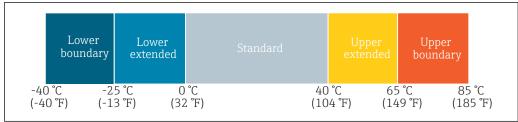
Lower boundary operating time device

Navigation

☐ Diagnosis → Device temperature → Lower boundary operating time device

Description

Displays the operating time of the device in the lower ambient temperature boundary zone (Lower boundary).



A0040333

Additional information

User role

Specialist

Lower extended operating time device

Navigation

Description

Displays the operating time of the device in the lower ambient temperature range (Lower extended).



A0040333

Additional information

User role

Specialist

80

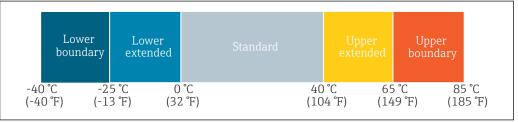
Standard operating time device

Navigation

☐ Diagnosis → Device temperature → Standard operating time device

Description

Displays the operating time of the device in the normal ambient temperature range (Standard).



A0040333

Additional information

User role

Specialist

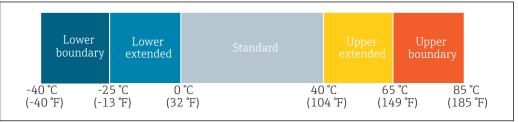
Upper extended operating time device

Navigation

□ Diagnosis → Device temperature → Upper extended operating time device

Description

Displays the operating time of the device in the upper ambient temperature range (Upper extended).



A0040333

Additional information

User role

Specialist

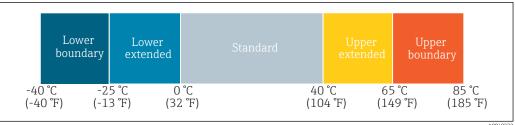
Upper boundary operating time device

Navigation

 \square Diagnosis \rightarrow Device temperature \rightarrow Upper boundary operating time device

Description

Displays the operating time of the device in the upper ambient temperature boundary zone (Upper boundary).



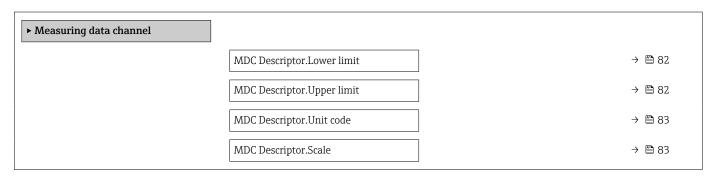
A004033

Additional information

User role

Specialist

Measuring data channel



MDC Descriptor.Lower limit

Navigation

□ Diagnosis → Measuring data channel → MDC Descriptor.Lower limit

Description

Displays the lower value of the measuring range. According to Smart Sensor Profile 2^{nd} Edition.

Additional information

User role

- Operator
- Maintenance
- Specialist

MDC Descriptor.Upper limit

Navigation

 $\begin{tabular}{ll} \hline \blacksquare & Diagnosis \rightarrow Measuring \ data \ channel \rightarrow MDC \ Descriptor. Upper \ limit \\ \hline \end{tabular}$

Description

Displays the upper value of the measuring range. $\,$

According to Smart Sensor Profile 2^{nd} Edition.

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Additional information

User role

- Operator
- Maintenance
- Specialist

MDC Descriptor.Unit code

Navigation \square Diagnosis \rightarrow Measuring data channel \rightarrow MDC Descriptor.Unit code

Description Displays the unit code for the unit according to IO-Link.

According to Smart Sensor Profile 2nd Edition.

Additional information *User role*

Operator

- Maintenance
- Specialist

MDC Descriptor.Scale

Navigation \square Diagnosis \rightarrow Measuring data channel \rightarrow MDC Descriptor. Scale

Description Displays the scaling of the measured value (10^{scale}).

According to Smart Sensor Profile 2nd Edition.

Additional information

User role

- Operator
- Maintenance
- Specialist

15.1.3 Parameters

Navigation

Parameters

► Parameters

► Application

→ 🖺 84

▶ System

→ 🖺 91

	Application				
	Navigation		Parameters →	Application	
► Application					
	► Senso	or		→ [₿ 84
	► Switch	h output		→ [₿ 91
	► Curre	nt output		→ @	₿ 91
	Sensor				
	Navigation		Parameters →	Application → Sensor	
► Sensor					
	Unit			→ [1 84
	Dampin	g		→ [1 84
	Sensor o	offset		→ [1 85 €
Unit					
Navigation	Parame	ters → Appli	cation → Sens	or → Unit	
Description	Use this function parameters.	on to select	the engineerin	ng unit for all the measured values and	
Selection	- °C				
	■ °F ■ K				
Factory setting	$^{\circ}$ C				
Additional information	User role				
	OperatorMaintenanceSpecialist	e			
Navigation	Parame	ters → Appli	cation → Sens	or → Damping	

Use this function to enter the time constant for measured value damping.

84

Description

User entry 0 to 120 s

Factory setting 0 s

Additional information *User role*

OperatorMaintenanceSpecialist

Sensor offset

Navigation Parameters \rightarrow Application \rightarrow Sensor \rightarrow Sensor offset

Description Use this function to enter the zero point correction (offset) of the sensor measured value.

The specified value is added to the measured value.

User entry -10 to +10 °C (14 to 50 °F)

Factory setting $0 \,^{\circ}\text{C}$

Additional information User role

Operator

Maintenance

Specialist

Switch output

Navigation \square Parameters \rightarrow Application \rightarrow Switch output

 Switch output

 Operating mode
 → $\stackrel{\square}{=}$ 86

 Switch point value
 → $\stackrel{\square}{=}$ 87

 Switchback point value
 → $\stackrel{\square}{=}$ 87

 Switch delay
 → $\stackrel{\square}{=}$ 88

 Switchback delay
 → $\stackrel{\square}{=}$ 88

Operating mode

Navigation

Description

Use this function to select the switch output.

Selection

- Hysteresis normally open
- Hysteresis normally closed
- Window normally open
- Window normally closed
- Off

Factory setting

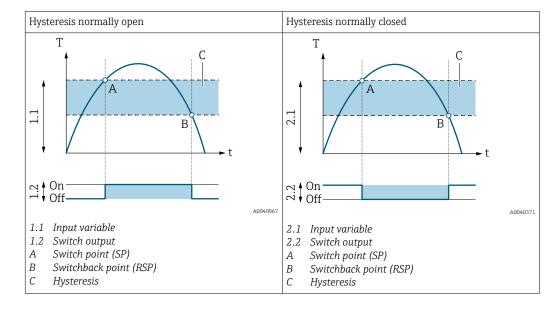
Hysteresis normally open (or as per order specifications)

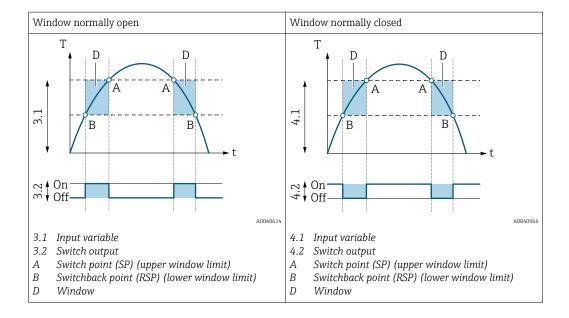
Additional information

Selection

- Hysteresis normally open The switch output is specified as a normally open (NO) contact with hysteresis properties (using SP and RSP).
- Hysteresis normally closed

 The switch output is specified as a normally closed (NC) contact with hysteresis properties (using SP and RSP).
- Window normally open The switch output is specified as a normally open (NO) contact with window properties (using SP and RSP).
- Window normally closed
 The switch output is specified as a normally closed (NC) contact with window properties (using SP and RSP).
- Off
 The switch function is not active.





User role

- Operator
- Maintenance
- Specialist

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SWITCH	noint	372 IIIA
Switch	DOME	value

Navigation Parameters \rightarrow Application \rightarrow Switch output \rightarrow Switch point value

DescriptionUse this function to enter the switch point (SP) for the hysteresis/upper value for the

window function. The value entered must be greater than the switchback point (RSP).

User entry Signed floating-point number

Factory setting 100 °C

Additional information *User role*

- Operator
- Maintenance
- Specialist

Switchback point value

Navigation Parameters \rightarrow Application \rightarrow Switch output \rightarrow Switchback point value

DescriptionUse this function to enter the switchback point (RSP) for the hysteresis/lower switch point for the window function. The value entered must be smaller than the switch point (SP).

Additional information

User role

- Operator
- MaintenanceSpecialist

Switch delay

Navigation \square Parameters \rightarrow Application \rightarrow Switch output \rightarrow Switch delay

Description Use this function to enter a delay time to prevent constant switching at values around the

switch point (SP). If the measured value leaves the switching range during the delay time,

the delay time starts again.

User entry 0 to 99 s

Factory setting 0 s

Additional information User role

Operator

Maintenance

Specialist

Switchback delay

Navigation \square Parameters \rightarrow Application \rightarrow Switch output \rightarrow Switchback delay

Description Use this function to enter a delay time to prevent constant switching at values around the

switchback point (RSP). If the measured value leaves the switching range during the delay

time, the delay time starts again.

User entry 0 to 99 s

Factory setting 0 s

Additional information *User role*

Operator

Maintenance

Specialist

Current output

Navigation Parameters \rightarrow Application \rightarrow Current output

► Current output

4 mA value		₽ 🖺 89
20 mA value	$\Big] \hspace{1cm} \rightarrow \hspace{1cm}$	▶ 🖺 89
Current trimming 4 mA	$\Big] \hspace{1cm} \rightarrow \hspace{1cm}$	→ 🖺 90
Current trimming 20 mA	→	90
Failure mode	→	→ 🖺 90
Failure current	\rightarrow	→ 🖺 91

4 mA value

Navigation \square Parameters \rightarrow Application \rightarrow Current output \rightarrow 4 mA value

Description Use this function to enter the temperature value that is to correspond to the 4 mA value. It

is possible to invert the current output by changing the assignment of the start/end of the

measuring range.

The span between the 4 mA value and the 20 mA value must be at least 10 K.

User entry −50 000 to +50 000 °C (−89 968 to +90 032 °F)

Factory setting 0 °C

Additional information User role

Operator

Maintenance

■ Specialist

20 mA value

Navigation Parameters \rightarrow Application \rightarrow Current output \rightarrow 20 mA value

Description Use this function to enter the temperature value that is to correspond to the 20 mA value.

It is possible to invert the current output by changing the assignment of the start/end of

the measuring range.

The span between the 4 mA value and the 20 mA value must be at least 10 K.

User entry −50 000 to +50 000 °C (−89 968 to +90 032 °F)

Factory setting 150 °C

Additional information *User role*

Operator

Maintenance

ullet Specialist

Current trimming 4 mA

Navigation \square Parameters \rightarrow Application \rightarrow Current output \rightarrow Current trimming 4 mA

Description Use this function to enter the correction value for the current output at the start of the

measuring range at 4 mA.

User entry 3.85 to 4.15 mA

Factory setting 4.00 mA

Additional information *User role*

OperatorMaintenanceSpecialist

Current trimming 20 mA

Navigation \square Parameters \rightarrow Application \rightarrow Current output \rightarrow Current trimming 20 mA

Description Use this function to enter the correction value for the current output at the end of the

measuring range at 20 mA.

User entry 19.85 to 20.15 mA

Factory setting 20.00 mA

Additional information *User role*

OperatorMaintenance

Specialist

Failure mode

Navigation \square Parameters \rightarrow Application \rightarrow Current output \rightarrow Failure mode

Description Use this function to select the signal on alarm level of the current output in the event of an

error.

Selection ■ 0 (Low alarm)

■ 2 (High alarm)

Factory setting 0

Additional information *User role*

Operator

Maintenance

Specialist

Failure current

Navigation Parameters \rightarrow Application \rightarrow Current output \rightarrow Failure current

Description Use this function to enter the current value for a high alarm that the current output adopts

in an alarm condition.

User entry 21.50 to 23.00 mA

Factory setting 22.5 mA

Additional information *User role*

- Operator
- Maintenance
- Specialist

System

Navigation \square Parameters \rightarrow System

► System		
	Operating time	→ 🖺 91
	Alarm delay	→ 🖺 92
	Restore Factory Settings	→ 🖺 92
	DeviceAccessLocks.DataStorage	→ 🖺 92
	Activate parametrization lock	→ 🖺 93
	Deactivate parametrization lock	→ 🖺 93

Operating time	

Navigation \square Parameters \rightarrow System \rightarrow Operating time

Description Displays the length of time in hours (h) that the device has been in operation up until now.

Additional information *User role*

- Operator
- Maintenance
- Specialist

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Navigation \square Parameters \rightarrow System \rightarrow Alarm delay

Description Use this function to enter the delay time during which a diagnostic signal is suppressed

before an error message is issued.

User entry 0 to 255 s

Factory setting 0 s

Additional information *User role*

OperatorMaintenanceSpecialist

Restore Factory Settings

Navigation \square Parameters \rightarrow System \rightarrow Restore Factory Settings

Description Use this function to reset the entire device configuration to the factory settings.

Additional information User role

Operator

Maintenance

Specialist

DeviceAccessLocks.DataStorage

Navigation Parameters \rightarrow System \rightarrow DeviceAccessLocks.DataStorage

Description Use this function to lock data storage. Standard function of IO-Link.

Selection • Unlocked

Locked

Factory setting Unlocked

Additional information User role

Operator

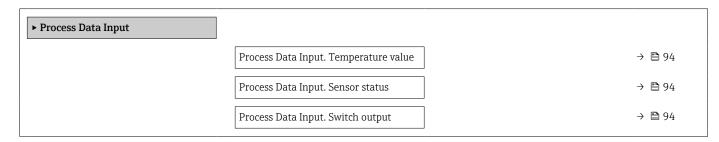
Maintenance

Specialist

Activate parametrization lock Navigation Parameters → System → Activate parametrization lock Description Use this function to lock the parameterization of the device. Additional information User role Maintenance ■ Specialist Deactivate parametrization lock Parameters → System → Deactivate parametrization lock Navigation Use this function to unlock the parameterization of the device. Description Additional information User role Maintenance ■ Specialist Observation 15.1.4 Observation Navigation ► Observation ▶ Process Data Input → 🖺 93

Process Data Input

Navigation ☐ Observation → Process Data Input



Process Data I	nput. Tem	perature	value
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Navigation $riangleq ext{Observation} o ext{Process Data Input} o ext{Process Data Input}. Temperature value$

Description Displays the temperature value that is currently measured.

Additional information *User role*

OperatorMaintenanceSpecialist

Process Data Input. Sensor status

Navigation □ Observation → Process Data Input → Process Data Input. Sensor status

Description Displays the current sensor status.

Additional information *User role*

OperatorMaintenanceSpecialist

Process Data Input. Switch output

Navigation □ Observation → Process Data Input → Process Data Input. Switch output

Description Displays the current switch status.

User interface ■ 0 (Off)

■ 1 (On)

Additional information *User role*

Operator

Maintenance

■ Specialist



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