Operating Instructions 4 to 20 mA / IO-Link compact thermometer

OTM311



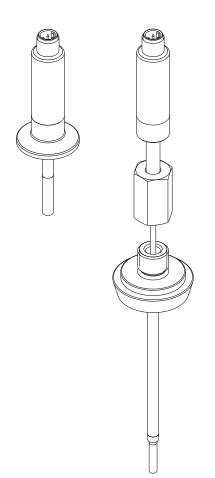


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1 About this document

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.

A 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
\sim	Alternating current
\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 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.
×	Forbidden Procedures, processes or actions that are forbidden.

Symbol	Meaning
i	Tip Indicates additional information.
<u>I</u>	Reference to documentation
	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
Ŕ	Open-ended wrench
A0011222	

1.3 Registered trademarks

♦ IO-Link[®]

Is a registered trademark. It may only be used in conjunction with products and services by members of the IO-Link Community or by non-members who hold an appropriate license. For more detailed information on the use of IO-Link, please refer to the rules of the IO-Link Community at: www.io.link.com.

2 Basic 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 Designated use

- The device is a compact thermometer for industrial temperature measurement.
- The manufacturer is not liable for damage caused by improper or non-designated use.

2.3 Operational safety

ACAUTION

Risk of injury!

- Operate the device only if it is in proper technical condition, free from errors and faults.
- The operator is responsible for the interference-free operation of the device.

NOTICE

Modifications to the device.

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

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 from the manufacturer.

2.4 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

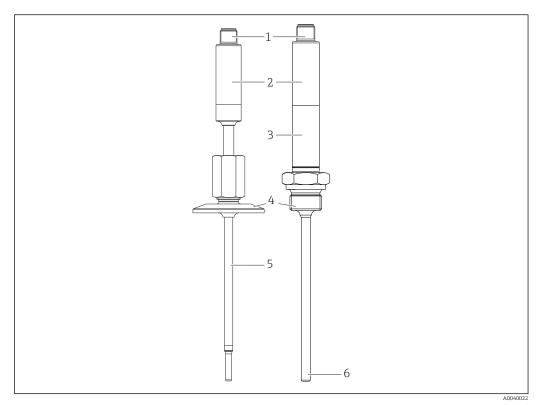
It meets general safety standards and legal requirements. It also complies with the EC directives listed in the device-specific EC Declaration of Conformity. The manufacturer confirms this by affixing the CE mark to the device.

2.5 IT security

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

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

Product description 3



- Electrical connection, output signal Transmitter, integrated (optional) 1
- 2
- 3 Extension neck
- 4 Process connection \rightarrow B 45
- 5 Thermowell
- 6 Primary sensor assembly

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Proceed as follows on receipt of the device:

- 1. Check whether the packaging is intact.
- 2. If damage is discovered:

Report all damage immediately to the manufacturer.

- 3. Do not install damaged components, as the manufacturer cannot otherwise guarantee the material resistance or compliance with the original safety requirements, and can also not be held responsible for the consequences that may result.
- 4. Compare the scope of delivery against the contents of your order.
- 5. Remove all the packaging material used for transportation.
- 6. Do the data on the nameplate match the ordering information on the delivery note?
- **7.** Are the technical documentation and all other necessary documents provided, e.g. certificates?

If one of the conditions is not satisfied, contact your Sales Center.

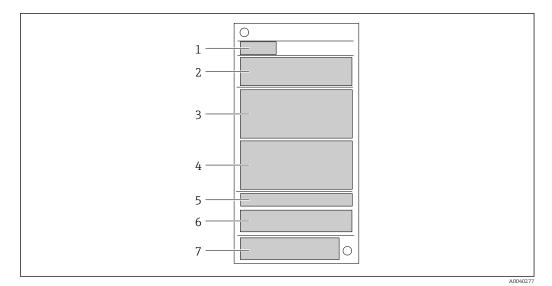
4.2 Product identification

The device can be identified in the following ways: Nameplate specifications

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 Device name
- Order code, serial number 2
- 3 Tag name (TAG)
- 4 Technical values
- 5 Degree of protection
- Pin assignment 6 Approvals with symbols 7

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
Address of manufacturing plant:	See nameplate

4.4 Storage and transport

For dimensions, see "Technical data" \rightarrow \cong 37

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

5 Mounting

5.1 Mounting requirements

Information on the conditions that must be present at the mounting location to ensure correct use (e.g. ambient temperature, degree of protection, climate class, etc.) and information on the device dimensions $\rightarrow \square 32$

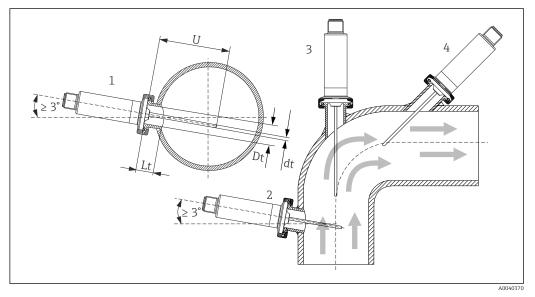
5.1.1 Orientation

No restrictions. However, self-draining in the process must be guaranteed. 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 accuracy. If the immersion length is too short, measurement errors can occur as a result of heat conduction via the process connection and the vessel wall. Therefore, if installing in a pipe, the immersion length should ideally correspond to half of the pipe diameter.

Installation possibilities: pipes, tanks or other plant components.



2 Installation examples

1, 2 Perpendicular to flow direction, installed at a minimum angle of 3°, to ensure self-draining

3 On elbows

4 Inclined installation in pipes with a small nominal diameter

U Immersion length

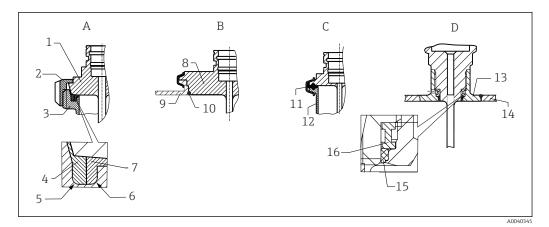
 \mathbf{H}

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

Installation instruction EHEDG/cleanability: $Lt \leq (Dt-dt)$

Installation instruction $3-A/cleanability: Lt \le 2(Dt-dt)$

In the case of pipes with a small nominal diameter, it is advisable for the tip of the thermometer to project well into the process so that it extends past 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 (depends on version ordered)
- 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 Groove slip-on nut
- 3 Counterpart connection
- 4 Centering ring
- 5 RO.4
- 6 R0.4 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 counterparts for the process connections and the seals or sealing rings are not supplied with the thermometer. weld-in adapters with associated seal kits are available as accessories.

NOTICE

The following actions must be taken if a sealing ring (O-ring) or seal fails:

- ► The thermometer must be removed.
- ▶ The thread and the O-ring joint/sealing surface must be cleaned.
- The sealing ring or seal must be replaced.
- CIP must be performed after installation.

In the case of weld-in connections, exercise the necessary degree of care when performing the welding work on the process side:

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

Pay attention to the following when installing the thermometer to ensure that the cleanability is not affected:

- 1. The installed sensor is suitable for CIP (cleaning in place). Cleaning is performed together with the pipe or tank. In the case of internal tank fixtures using process connection nozzles, it is important to ensure that the cleaning assembly sprays this area directly so that it is cleaned properly.
- 2. The Varivent[®] connections enable flush-mounted installation.

5.1.3 General installation instructions

The device generates diagnostic message **S825** if a device temperature of 100 °C is reached due to unfavorable conditions (high process temperature, high ambient temperature, electronics close to the process). 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)
----------------	--------------------------------

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

Pt100 TF, standard version, without extension neck	-50 to +150 °C (-58 to +302 °F)
Pt100 TF, standard version, with extension neck	−50 to +150 °C (−58 to +302 °F)
fast-response sensor, without extension neck	−50 to +200 °C (−58 to +392 °F)
fast-response sensor, with extension neck	−50 to +200 °C (−58 to +392 °F)

Device version with electronics

Pt100 TF, standard version, without extension neck	−50 to +150 °C (−58 to +302 °F)
Pt100 TF, standard version, with extension neck	−50 to +150 °C (−58 to +302 °F)
fast-response sensor, without extension neck	−50 to +150 °C (−58 to +302 °F)
fast-response sensor, with extension neck	−50 to +200 °C (−58 to +392 °F)

5.2 Mounting the thermometer

Proceed as follows to mount 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 loading capacity.

Please contact the supplier if you have any questions.

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 T-piece or elbow piece thermowell	5
Process connection, metal sealing system	10
Compression fitting, spherical, PEEK seal	10
Compression fitting, spherical, 316L seal	25
Compression fitting, cylindrical, Elastosil seal	5

- 1. Replace with a suitable seal if necessary.
- 2. Replace the seals following disassembly.
- 3. As all threads must be firmly tightened, using the appropriate torques.

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.? $\rightarrow \square$ 32	

6 Electrical connection

6.1 Connection conditions

If the 3-A Standard is required, electrical connecting cables must be smooth, corrosion-resistant and easy to clean.

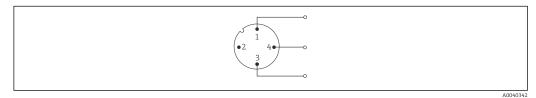
6.2 Connecting the measuring device

NOTICE

Damage to the device!

 Do not overtighten the M12 plug, as this could damage the device. Maximum torque: 0.4 Nm (M12 knurl)

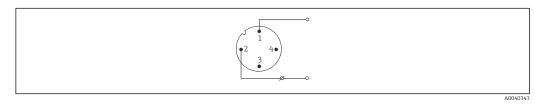
IO-Link operating mode



Imassignment, 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)

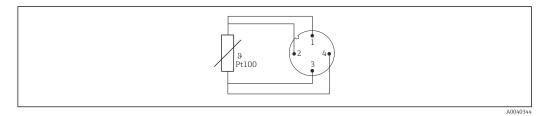
4 to 20 mA operating mode



🖻 5 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



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

6.3 Ensuring the degree of protection

The indicated degree of protection is ensured if the M12x1 cable connector meets the required degree of tightness. For compliance with IP69 protection, suitable device connecting cables with straight or elbowed connectors are available .

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 enables direct access to the process and diagnostic data. It also provides the option of configuring the device while in operation.

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
Speed	COM2; 38.4 kBaud
Minimum cycle time	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)

The device supports the following features:

7.1.2 Device description

In order to integrate field devices into a digital communication system, the IO-Link system needs a description of the device parameters, such as output data, input data, data format, data volume and supported transfer rate.

This data is available in the device description (IODD ¹⁾), which is provided to the IO-Link master via generic modules when the communication system is commissioned.

¹⁾ IO Device Description

System integration 8

Identification 8.1

Device ID	0x030100
Vendor ID	0x0011 (17)

8.2 **Process data**

When the measuring device 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 device's process data are transmitted cyclically in 32-bit chunks.

Byte 1								Byte 2							
31 30 29 28 27 26 25 24						24	23	22	21	20	19	18	17	16	
sint16	sint16														
Tomp	oratur	o (writh	one dec	imal nl	200)										

Temperature (with one decimal place)

Byte 3								Byte 4							
15	15 14 13 12 11 10 9 8						7	6	5	4	3	2	1	0	
sint8											Enun	14			Bool
Scale	Scale (-1)										Meas	ured va	alue sta	atus	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 °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			
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			

Process value	Values	Meaning			
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 the following parameter values or device conditions:

8.3.1 Specific device data



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

Identifier	Index (dec)	Index (hex)	Size (byte)	Data type	Access	Default value	Value range	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
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)	-50000 to 50000 °C	Yes
20 mA value	8219	0x201B	4	Float	r/w	150 °C	-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

Identifier	Index (dec)	Index (hex)	Size (byte)	Data type	Access	Default value	Value range	Data storage
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/-	-	-	-
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/-	-	-	-

Identifier	Index (dec)	Index (hex)	Size (byte)	Data type	Access	Default value	Value range	Data storage
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

Identifier	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

Identifier	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
IO-Link 1.1 system test command 242	242	0xF2
IO-Link 1.1 system test command 243	243	0xF3

9 Commissioning

If an existing configuration is changed, measuring operation continues.

9.1 Post-installation check

Perform the following checks prior to commissioning the measuring point:

- **1.** Perform the post-installation check using the checklist $\rightarrow \square$ 14.
- **2.** Perform the post-connection check using the checklist $\rightarrow \square$ 16.

9.2 Configuring the measuring device

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

IO-Link devices are typically configured via the automation system. The device supports IO-Link Data Storage, which enables easy device replacement.

10 Diagnostics and troubleshooting

10.1 General troubleshooting

Pue to the device's particular design, it cannot be repaired.

Error	Possible cause	Solution
Device is not responding.	Supply voltage does not match the value indicated on the nameplate.	• Apply correct voltage.
	The polarity of the supply voltage is wrong.	 Correct the polarity of the supply voltage.
Device measures incorrectly.	The device has been incorrectly configured.	 Check and correct the parameter configuration.
	The device has been incorrectly connected.	• Check the pin assignment $\rightarrow \square$ 15.
	Incorrect device orientation.	• Install the device correctly $\rightarrow \square 11$.
	Heat dissipation over the measuring point.	 Observe the installed length of the sensor.
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 an error in the device.	 Correct errors 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	V	Service mode	The device is in service mode (e.g. during a simulation).
S	A	Out of specification	The device is being operated outside its technical specifications (e.g. during warm-up or cleaning processes).
М	\$	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	Reason	Corrective measure	
F001	Alarm	IO-Link Error	0x1817	Device failure	Device fault	 Restart the device. Replace device. 	
F004	Alarm	IO-Link Error	0x1818	Sensor defective	The sensor is defective (e.g.: sensor failure or sensor short-circuit)	• Replace device.	
S047	Warning	IO-Link Warning	0x1819	Sensor limit reached	Sensor limit has been 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 active	 Initialization active, 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.1. Check device configuration.Upload and dow 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) Diagnostic only possible in SIO mode

2) Diagnostic only possible in the 4 to 20mA mode.

10.3.1 Behavior of the device in the event of a fault

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.

IO-Link

The device displays warnings and faults via IO-Link. All the device warnings and faults are for information purposes only and do not have a safety function. The errors diagnosed by the device are displayed via IO-Link in accordance with NE107. 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 error occurs. The output signal adopts its fault state (value in the event of an error see the following section).
 - 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 errors.

10.4 Diagnostic list

If two or more diagnostic events are pending simultaneously, only the 3 diagnostic messages with the highest priority are shown in the diagnostic list. The status signal dictates the priority in which the diagnostic messages are displayed. The following order of priority applies: F, C, S, M. If two or more diagnostic events with the same status signal are active simultaneously, the numerical order of the event number dictates the order of priority in which the events are displayed, 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

No special maintenance work is required.

11.1 Cleaning

The device must be cleaned whenever necessary. Cleaning can also be done when the device is installed (e.g. CIP Cleaning in Place / SIP Sterilization in Place). When cleaning the device, care must be taken to ensure that it is not damaged.

NOTICE

Avoid damage to the device and the system

• Pay attention to the specific IP code when cleaning.

11.2 Services

Service	Description
Calibration	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 the device's particular design, it cannot be repaired.

12.1 Spare parts

1. Ask your supplier for information on available spare parts.

2. When ordering spare parts:

Indicate the serial number of the device.

Туре
Plug screw fitting G½, 1.4435
Spare part kit, pressure screw G½, d=6
Weld-in adapter G¾, d=50, 316L, 3.1
Weld-in adapter G ³ /4, d=29, 316L, 3.1
Welding boss for G ¹ /2" sealing system
Weld-in adapter M12 × 1.5 1.4435/316L
0-ring 14.9 × 2.7 VMQ, FDA, 5 pcs
Weld-in adapter G^{3}_{4} , d=55, 316L
Weld-in adapter G ³ /4, 316L, 3.1
O-ring 21.89 × 2.62 VMQ, FDA, 5 pcs
Weld-in adapter G1, d=60, 316L
Weld-in adapter G1, d=60, 316L, 3.1
Weld-in adapter G1, d=53, 316L, 3.1
O-ring 28.17 × 3.53 VMQ, FDA, 5 pcs
Compression fitting
Spare part kit, seal
Thermowell

12.2 Return

X

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), our products are marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Such products may not be disposed of as unsorted municipal waste and can be returned to the manufacturer for disposal at conditions stipulated in our General Terms and Conditions or as individually agreed.

12.3 Disposal

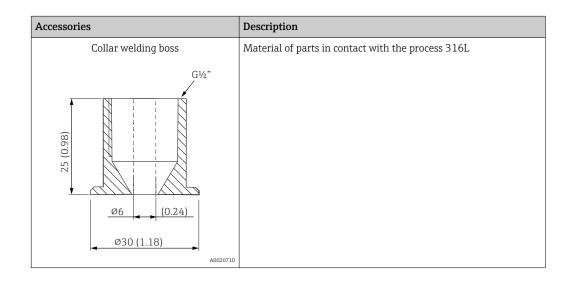
The device contains electronic components and must, therefore, be disposed of as electronic waste in the event of disposal. Please pay particular attention to the local regulations governing waste disposal in your country. Ensure proper separation and reuse of the device components where possible.

13 Accessories

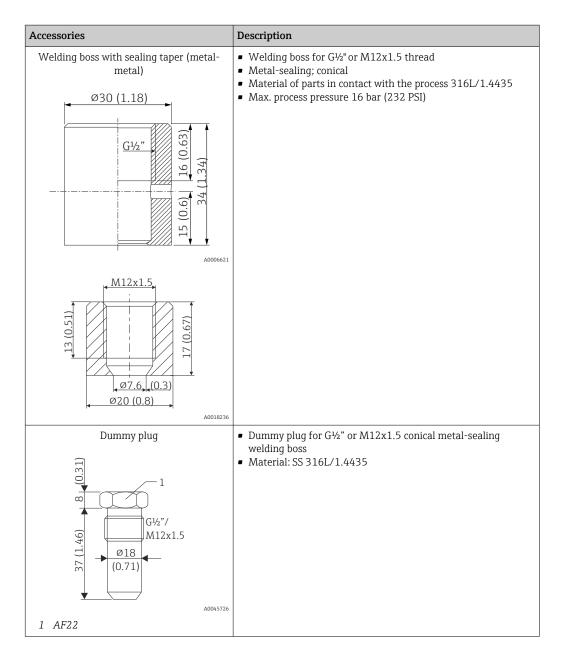
All dimensions in mm (in).

13.1 Device-specific accessories

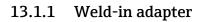
Accessories	Description
Welding boss with sealing taper	 Collar welding boss movable with sealing taper, washer and pressure screw G¹/₂" Material of parts in contact with the process 316L, PEEK Max. process pressure 10 bar (145 psi)
2 Washer, 303/304	
3 Sealing taper, PEEK	
4 Collar welding boss, 316L	

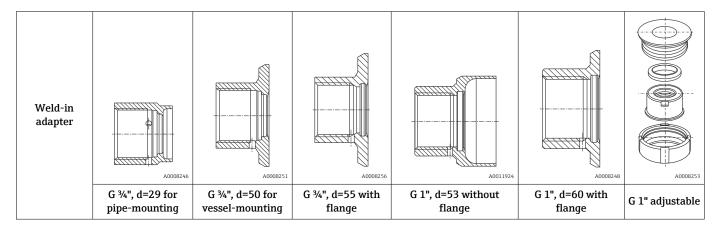


Accessories	Description		
Compression fitting 06 (0.24) 000 L L T 000 L	 Movable clamping ring, process connection G¹/₂" Material of compression fitting and parts in contact with the process, 316L 		
1 AF14 2 AF27			



More detailed information on weld-in adapters is available from your supplier.





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)

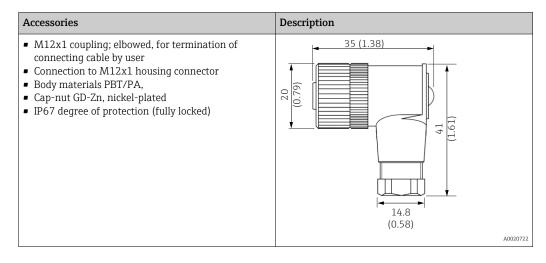
Maximum process pressure for the weld-in adapters:

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

13.2 Communication-specific accessories

More detailed information on configuration tools is available from your supplier.

13.2.1 Coupling



Accessories	Description
 PVC cable, 4 x 0.34 mm² (22 AWG) with M12x1 coupling, elbow plug, screw plug, length 5 m (16.4 ft) IP67 degree of protection Wire colors: 1 = BN brown 2 = WH white 3 = BU blue 4 = BK black 	1 (BN) 2 (WH) 3 (BU) 4 (BK) 4 (BK) A0020723

Accessories	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) IP67 degree of protection Wire colors: 1 = BN brown 2 = WH white 3 = BU blue 4 = BK black 	1 4 3 1 (BN) 2 (WH) 3 (BU) 4 (BK) A0020725

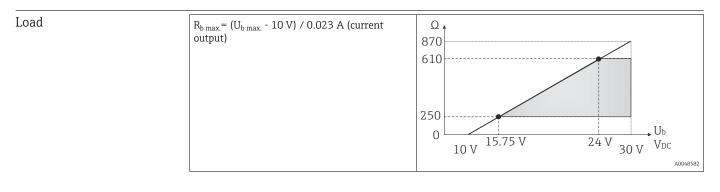
14 Technical data

14.1 Input

Measuring range	Standard Pt100	-50 to +150 °C (-58 to +302 °F)
	Fast-response sensor	-50 to +200 °C (-58 to +392 °F)

14.2 Output

Output signal	Version without integrated electronics				
	Sensor output	Pt100, 4-wire co	nnection, class A		
	4 to 20 mA version	1			
	Analog output	4 to 20 mA; variable measuring range			
	Digital output	C/Q (IO-Link or s	switch output)		
	IO-Link version				
	Analog output	4 to 20 mA; me	asuring range 0 to 150 °C (32 to 302 °F)		
	Digital output	C/Q (IO-Link or switch output)			
Failure information	device displays the In the IO-Link mod In the 4 to 20 mA r	three diagnostic m e, the device transm	e measuring information is missing or not valid. The essages with the highest priority. nits all the failure information digitally. ansmits the failure information according to NAMUR		
	NE43: Switch output The switch output switches to open in the fault stat				
	Underranging		Linear drop from 4.0 to 3.8 mA		
	Overranging Failure e.g. sensor defective		Linear increase from 20.0 to 20.5 mA \leq 3.6 mA (low) or \geq 21 mA (high) can be selected		



Linearization/transmission behavior	Temperature - linear
Protocol-specific data	→ 🗎 17

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	
	4 to 20 mA	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.	
		nust be operated with a type-examined transmitter power supply unit. wervoltage protection is required for marine applications.	
Power supply failure	 To meet electrical safety according to CAN/CSA-C22.2 No. 61010-1 or UL 61010-1, the device may only be powered by a power supply unit with a limited energy electric circul in accordance with UL/EN/IEC 61010-1 chapter 9.4 or Class 2 according to UL 1310, "SELV or Class 2 circuit". Behavior in the event of overvoltage (> 30 V) The device works continuously up to 35 V_{DC} without any damage. If the supply voltage exceeded, the specified characteristics are no longer guaranteed. 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). 		
Maximum current consumption	≤23 mA for 4 to	20 mA	
Switch-on delay	2 s		
Overvoltage protection	the thermometer	st overvoltage in the power supply and signal/communication cables for c electronics, the use of a suitable surge arrester is recommended. Please plier for further information.	

14.4 Performance characteristics

Reference operating conditions	Adjustment temperature (ice bath)	0 °C (32 °F) for sensor
	Ambient temperature range	25 °C ± 3 °C(77 °F ± 5 °F) for electronics
	Supply voltage	$24~V_{DC}\pm10~\%$
	Relative humidity	< 95 %

 $\begin{array}{ll} \mbox{Maximum measured error} & \mbox{In accordance with DIN EN 60770 and the reference conditions specified above. The} \\ & \mbox{measured error data correspond to } \pm 2 \ \sigma \ \mbox{(Gaussian distribution). The data include non-linearities and repeatability.} \end{array}$

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

|T| = Numerical value of the temperature in °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)		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 °F, the results in °C must be multiplied by a factor of 1.8.

Thermometer with electronics

Standard Description	Description	Mooguring rongo	Measured error (±)			
Stanuaru	Description	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)	≤ 0.48 °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	Standard Description Measuring range —		Measured error (±)			
Stanuaru			Dig	jital 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.

2) 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 = $\sqrt{(Measured error digital^2 + Measured error D/A^2)}$

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 °C (302 °F)	0.08 °C (0.14 °F)
Measured error digital value (IO-Link):	0.14 ℃ (0.25 °F)
Measured error analog value (current output): $\sqrt{(Measured error digital^2 + Measured error D/A^2)}$	0.16 °C (0.29 °F)

Sample calculation with Pt100, measuring range 0 to +150 $^{\circ}$ C (+32 to +302 $^{\circ}$ F), ambient temperature +35 $^{\circ}$ C (+95 $^{\circ}$ 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 °C (302 °F)	0.08 °C (0.14 °F)
Influence of ambient temperature (digital) = (35 - 25) x (0.004 % x 200 °C (360 °F)), at least 0.008 °C (0.014 °F)	0.08 °C (0.14 °F)
Influence of ambient temperature (D/A) = (35 - 25) x (0.003 % x 150 °C (302 °F))	0.05 °C (0.09 °F)
Influence of supply voltage (digital) = (30 - 24) x (0.004 % x 200 °C (360 °F)), at least 0.008 °C (0.014 °F)	0.05 °C (0.09 °F)
Influence of supply voltage (D/A) = (30 - 24) x (0.003 % x 150 °C (302 °F))	0.03 °C (0.05 °F)
Measured error digital value (IO-Link): $\sqrt{(Measured error digital^2 + Influence of ambient temperature (digital)^2 + Influence of supply voltage (digital)^2)}$	0.49 °C (0.88 °F)
Measured error analog value (current output): $\sqrt{(Measured error digital^2 + Measured error D/A^2 + Influence of ambient temperature (digital)^2 + Influence of ambient temperature (D/A)^2 + Influence of supply voltage (digital)^2 + Influence of Supply voltage (D/A)^2}$	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 μΑ	±4.3 μA	±5.4 μΑ	± 6.4 µA	± 8.0 µA	±8.8 µA

Operating influences The

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

Standard	Designation	Ambient temperature Influence (+-) per 1 °C (1.8 °F) change			Supply voltage Influence (+-) per 1 V change		
		Digital ¹⁾		D/A ²⁾	Digital 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 measured error for the specified measuring range.

4) Deviations from maximum measured error possible due to rounding.

MV = Measured value

LRV = Lower range value of relevant sensor

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

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	Standard Pt100	5 s	< 20 s
6 mm direct contact, straight tip	Fast-response Pt100	1 s	1.5 s
6 mm thermowell, straight tip (4.3 × 20 mm)	Fast-response Pt100	1 s	3 s

*Response time with heat transfer paste*¹⁾

Design	Sensor	t63	t ₉₀
6 mm thermowell, straight tip $(4.3 \times 20 \text{ mm})$	Fast-response Pt100	1 s	2.5 s

1) Between the insert and the thermowell

14.5 Environment

Ambient temperature range	T _a	-40 to +85 °C (-40 to +185 °F)	
Storage temperature		ce so that it is reliably protected against impact when it is stored (and The original packaging offers the best protection.	
	T _s	-40 to +85 °C (-40 to +185 °F)	
Operating altitude	Up to 2 000 m (6 600 ft) above sea level		
Climate class	In accordance with IEC/EN 60654-1, climate class Dx, class 4K4H		
Degree of protection	As per IEC/EN 60529 IP69 Depends on the degree of protection of the connection cable $\rightarrow \cong 28$		
Shock and vibration resistance	The thermometer meets the requirements of IEC 60751, which specifies shock and vibration resistance of 3 g in the 10 to 500 Hz range.		
Electromagnetic compatibility (EMC)	•		

- Maximum measured error under EMC tests: < 1 % of the span
- Interference immunity according to IEC/EN 61326 series, requirements for industrial fields
- Interference emission according to IEC/EN 61326 series, Class B equipment

IO-Link

Only the requirements of IEC/EN 61131-9 are met in I/O-Link mode.

The connection between the IO-Link master and thermometer is via an unshielded 3wire cable, maximum 20 m (65.6 ft) in length.

4 to 20 mA

Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21).



For more information, see the Declaration of Conformity.

1. With a connection cable length of 30 m (98.4 ft): always use a shielded cable.

2. The use of shielded connection cables is generally recommended.

Electrical safety

- Protection class III
- Overvoltage category II
- Pollution level 2

14.6 Mechanical construction

Design, dimensions

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

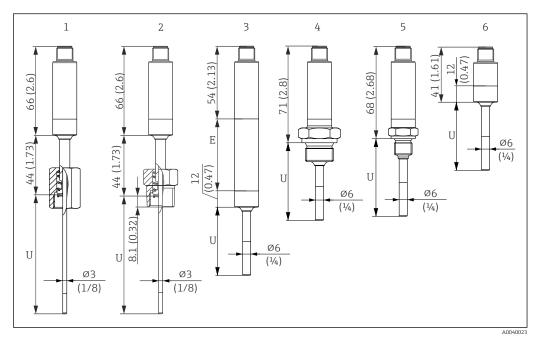
- Thermometer without thermowell
- Thermowell diameter 6 mm (¹/₄ in)
- T-piece and corner-piece thermowell version as per DIN 11865/ASME BPE 2012 for welding in

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:

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

Without thermowell

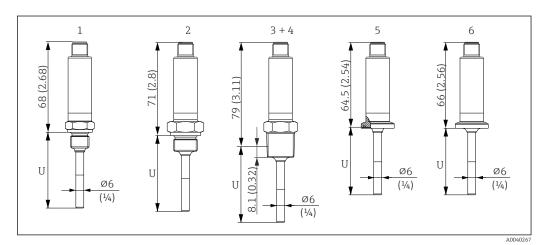


- 1 Thermometer with spring-loaded cap-nut, G3/8" thread 3 mm for existing thermowell
- 2 Thermometer with spring-loaded NPT¹/₂" male thread 3 mm for existing thermowell
- 3 Thermometer without process connection for compression fitting, with extension neck
- 4 Thermometer with $G^{1/2}$ " male thread
- 5 Thermometer with G¹/4" male thread
- 6 Thermometer without electronics

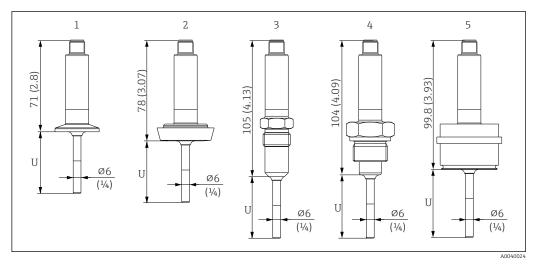
When using an extension neck, the overall length of the device always increases by the length in question, E = 50 mm (1.97 in), regardless of the process connection.

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

Version 1 (G3/8" cap-nut)	$U = U_{(thermowell)} + T_{(thermowell)} + 3 mm - B_{(thermowell)}$
Version 2 (NPT½" male thread)	$ \begin{array}{l} U = U_{(thermowell)} + T_{(thermowell)} - 5 \ mm \ \mbox{(-8 mm screw-in depth + 3mm spring travel)} - \\ B_{(thermowell)} \end{array} $



- 1 Thermometer with M14 male thread
- 2 Thermometer with M18 male thread
- 3 Thermometer with NPT¹/₂" male thread
- 4 Thermometer with NPT¹/4" male thread
- 5 Thermometer with Microclamp, DN18 (0.75")
- 6 Thermometer with Tri-Clamp, DN18 (0.75")

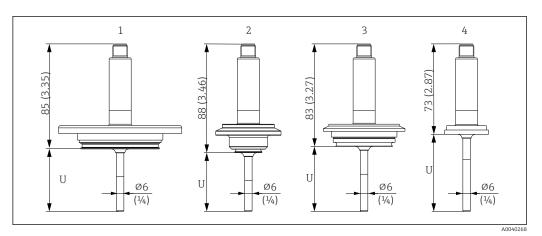


Thermometer with Clamp ISO2852 for DN12 to 21.3, DN25 to 38, DN40 to 51 Thermometer with milk pipe connection DIN11851 for DN25/DN32/DN40/DN50 1

2

3 Thermometer with metal sealing system G¹/₂"

- 4 Thermometer with G³/4" male thread ISO228 for FTL31/33/20/50 Liquiphant adapter
- 5 Thermometer with D45 process adapter

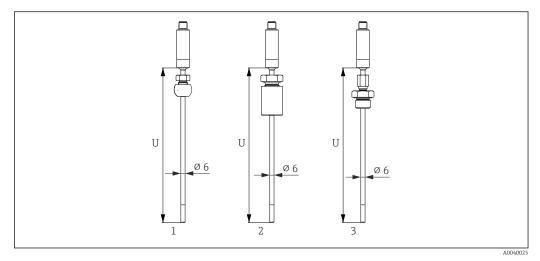


1 Thermometer with APV in-line, DN50

Thermometer with Varivent type B, D 31 mm 2

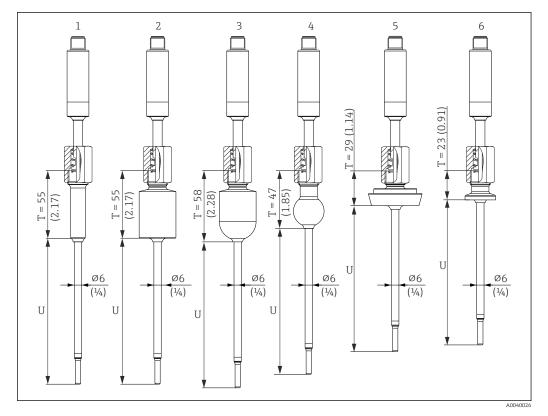
- Thermometer with Varivent type F, D 50 mm and Varivent type N, D 68 mm 3
- 4 Thermometer with SMS 1147, DN25/DN38/DN51

With compression fitting

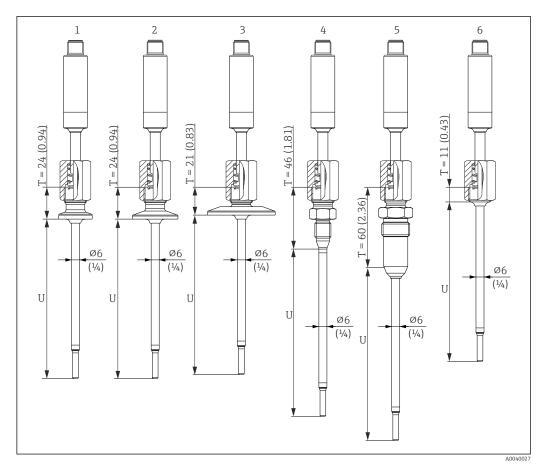


- 1 Thermometer with compression fitting spherical, PEEK/316L, sleeve, Ø 25 mm, for welding in
- 2 Thermometer with compression fittingcylindrical, Elastosil sleeve, Ø 25 mm, for welding in
- *3 Thermometer with compression fitting G*¹/₂" *external thread, 316L*

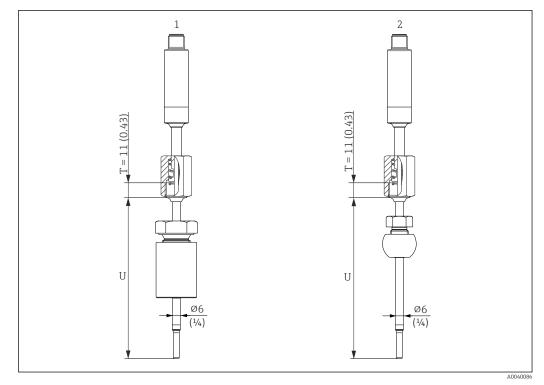
With thermowell diameter 6 mm $(\frac{1}{4} in)$



- 1 Thermometer with weld-in adapter cylindrical, D 12 \times 40 mm40mm
- 2 Thermometer with weld-in adapter cylindrical, D 30 x 40 mm
- 3 Thermometer with weld-in adapter spherical-cylindrical, D 30 x 40 mm
- 4 Thermometer with weld-in adapter spherical, D 25 mm
- 5 Thermometer with milk pipe connection DIN11851, DN25/DN32/DN40
- 6 Thermometer with Microclamp, DN18 (0.75")

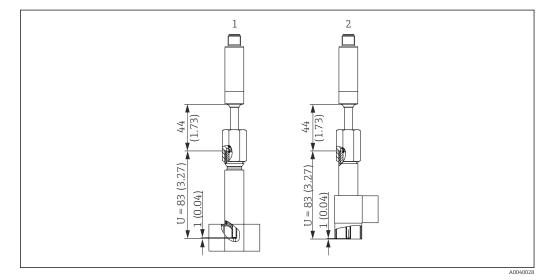


- 1 Thermometer with Tri-Clamp version DN18
- 2 Thermometer with Clamp version DN12 to 21.3
- Thermometer with Clamp version DN25 to 38/DN40 to 51 3
- Thermometer with metal sealing system version, $M12 \times 1.5$
- 4 5 6 Thermometer with metal sealing system version, G¹/2"
- Thermometer without process connection



- 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





- 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 \geq 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 fast-response sensors is recommended.

Process connection and size	Direct contact,6 mm (¼ in)	Thermowell,6 mm (¼ in)
Without process connection (for installation with compression fitting)	\checkmark	\checkmark
Process adapter D45	V	-
Compression fitting		
Thread G½"		
Cylindrical Ø30 mm	V	
Spherical Ø25 mm	V	
Thread		
G½"		-
G¼"	V	-
M14x1.5	V	-
M18x1.5		-
NPT ¹ /2"		-
Weld-in adapter		
Cylindrical Ø30 x 40 mm	-	V
Cylindrical Ø12 x 40 mm	-	V
Spherical-cylindrical Ø30 x 40 mm	-	V
Spherical Ø25 mm (0.98 in)	-	✓
Clamps according to ISO 2852		
Microclamp/Tri-clamp DN18 (0.75 in)		V
DN12 - 21.3		V
DN25 -38 (1 - 1.5 in)		V
DN40 - 51 (2 in)		
Milk pipe connection according to DIN 11851		
DN25		V
DN32		
DN40		V
DN50		-
Metal sealing system		
M12x1	-	V
G ¹ ⁄2"		\checkmark
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 [®]		<u> </u>
Type B, Ø31 mm		-
Type F, Ø50 mm		-
	1	

Possible combinations of the thermowell versions with the available process connections

Process connection and size	Direct contact,6 mm (¼ in)	Thermowell,6 mm (¼ in)
SMS 1147		
DN25	\checkmark	-
DN38	V	-
DN51	V	-

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 ntent 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 °C (1472 °F) for low compressive loads and in non-corrosive media. More information is available from the sales organization.

Surface roughness

Values for wetted surfaces:

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

1) Or equivalent treatment that guarantees R_a max

2) Not compliant with ASME BPE

Process connections

Compression fitting

Screw-in version	Version	Version			Technical properties
Screw-III version	Version	Ødi	L	Across flats	reclinical properties
A0039490 1 Nut 2 Clamping sleeve 3 Process connection	G ½" , ferrule material 316L	6 mm (0.24 in)	Approx. 47 mm (1.85 in)	G½": 27 mm (1.06 in)	 P_{max.} = 40 bar (104 psi) at T = +200 °C (+392 °F) for 316L P_{max.} = 25 bar (77 psi) at T = +400 °C (+752 °F) for 316L Tightening torque = 40 Nm

Screw-in version		Version	Version Dimensions			• Technical properties ¹⁾
		Spherical or cylindrical	Ødi	ΦD	h	Technical properties
øb øb		Spherical Material of sealing taper PEEK or 316L Thread G¼"	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 = +150 °C (+302 °F), tightening torque = 10 Nm P_{max.} = 50 bar (725 psi) T_{max.} for 316L sealing taper = +200 °C (+392 °F), tightening torque = 25 Nm The TK40 PEEK sealing taper is EHEDG tested and 3- A marked
	A0017582	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 = +150 °C (+302 °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 Ød = 6 mm (0.236 in).1)

2)

Releasable process connection

			Dimensions		
Туре	Version G	L1 thread length	A	Across flats	Technical properties
Thread	G¼" ISO228	16 mm	25 5 mm (1 in)	32	- D - 25 han (262 noi) at
	G½" ISO228	(0.63 in)	25.5 mm (1 in)	52	 P_{max.} = 25 bar (362 psi) at max. 150 °C (302 °F) P_{max.} = 40 bar (580 psi) at
0000000A	M14x1.5	18.6 mm (0.73 in)	29.5 mm (1.16 in)	41	max. 100 °C (212 °F)

			Dimensions		
Туре	Version G	L1 thread length	A	Across flats	Technical properties
	M18x1.5				
	½" NPT ANSI				

Time	Version	D	limensions	- Technical properties		
Туре	Ød 1)	ΦD	Øa	- rechinical properties		
Clamp according to ISO 2852	Microclamp ²⁾ DN8-18 (0.5"-0.75") ³⁾	25 mm (0.98 in)	-	 P_{max.} = 16 bar (232 psi), depends on clamp ring and 		
	Tri-clamp DN8-18 (0.5"-0.75") ³⁾	23 mm (0.98 m)	-	suitable seal • 3-A marked		
	DN12-21.3	34 mm (1.34 in)	16 to 25.3 mm (0.63 to 0.99 in)	• P _{max.} = 16 bar (232 psi), depends on clamp ring and		
	DN25-38 (1"-1.5")	50.5 mm (1.99 in)	29 to 42.4 mm (1.14 to 1.67 in)	suitable seal • 3-A marked and EHEDG certified (in connection with		
	DN40-51 (2")	64 mm (2.52 in)	44.8 to 55.8 mm (1.76 to 2.2 in)	Combifit seal) • ASME BPE compliance		
ØD A B B C C C C C C C C C C C C C						
A Different seal geometries for Microclamp and Tri-clamp						

1)

2)

Pipes in accordance with ISO 2037 and BS 4825 Part 1 Microclamp (not in ISO 2852); no standard pipes DN8 (0.5") only possible with thermowell diameter = 6 mm (¼ in) 3)

	Туре								
Milk pipe connection according to DIN 11851					A0009561	 3-A marked and EHEDG certified (only with EHEDG certified and self-centering sealing ring) ASME BPE compliance 			
Version ¹⁾			Dimensions	I	1	P _{max.}			
	ΦD	А	В	Øi	Фа	indx.			
DN25	44 mm (1.73 in)	30 mm (1.18 in)	10 mm (0.39 in)	26 mm (1.02 in)	29 mm (1.14 in)	40 bar (580 psi)			
DN32	50 mm (1.97 in)	36 mm (1.42 in)	10 mm (0.39 in)	32 mm (1.26 in)	35 mm (1.38 in)	40 bar (580 psi)			
DN40	56 mm (2.2 in)	42 mm (1.65 in)	10 mm (0.39 in)	38 mm (1.5 in)	41 mm (1.61 in)	40 bar (580 psi)			
DN50	68 mm (2.68 in)	54 mm (2.13 in)	11 mm (0.43 in)	50 mm (1.97 in)	53 mm (2.1 in)	25 bar (363 psi)			

1) Pipes in accordance with DIN 11850

Ту	Version	Technical properties				
Metal seal	Metal sealing system					
M12x1.5	G½"					
$\begin{array}{c} 14 & 8 (0.3) \\ \hline 0.55 & G3/8^{*} \\ \hline 12 & 1.5 \\ \hline 20^{*} & 22 (0.87) \\ U & T = 46 (1.81) \\ \hline 10009574 \end{array}$	$\begin{array}{c} 14 \\ 6 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7$	Thermowell diameter 6 mm (¼ in)	P _{max.} = 16 bar (232 psi) Maximum torque = 10 Nm (7.38 lbf ft)			

			Dimensions		
Туре	Version G	L1 thread length	A	1 (SW/AF)	Technical 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) 3-A marked and EHEDG tested ASME BPE compliance
U A0009572	G1" for FTL50 adapter	18.6 mm (0.73 in)	29.5 mm (1.16 in)	41	

Туре	Version	Technical properties
Process adapter		
Ø50 (1.97) Ø45 (1.77) (07) (07) (07) (07) (07) (07) (07) (D45	

For welding in

Туре	Version	Dimensions	Technical properties
Weld-in adapter	1: Cylindrical	¢d x h = 12 mm (0.47 in) x 40 mm (1.57 in), T = 55 mm (2.17 in)	
	2: Cylindrical	Ød x h = 30 mm (1.18 in) x 40 mm (1.57 in)	
$h \downarrow \mathcal{O}d_{\bullet}$ $T T h \downarrow \mathcal{O}d_{\bullet}$	3: Spherical- cylindrical	Φd x h = 30 mm (1.18 in) x 40 mm (1.57 in)	
	4: Spherical	¢d = 25 mm (0.98 in) h = 24 mm (0.94 in)	 P_{max.} depends on the weld-in process 3-A marked and EHEDG
h d T h d			certified • ASME BPE compliance
A0039503			

Туре	Version	Dimensions					Technical properties
Туре	VEISIOII	Ød	ΦA	ØΒ	М	h	recinical properties
APV Inline							
ØB M Ød Ød W M U 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

Туре	Version		Dimer	nsions			Technical properties
туре	Version	ΦD	ΦA	ØΒ	h	P _{max.}	
Varivent®	Туре В	31 mm (1.22 in)	105 mm (4.13 in)	-	22 mm (0.87 in)		
	Type F	50 mm (1.97 in)	145 mm (5.71 in)	135 mm (5.31 in)	24 mm (0.95 in)	10 bar	 3-A marked and EHEDG
	Туре N	68 mm (2.67 in)	165 mm (6.5 in)	155 mm (6.1 in)	24.5 mm (0.96 in)	(145 psi)	certified • ASME BPE compliance
A0021307 Image: A0021307 Image: The VARINLINE® housing connection flange is suitable for weld-in into the conical or torispherical head in tanks or vessels with a small diameter (< 1.6 m (5.25 ft)) and up to a wall thickness of 8 mm (0.31 in).							

Time	Version		Dimensions	Technical properties				
Туре	version	ΦD	ØΑ	h	Technical properties			
SMS 1147	DN25	32 mm (1.26 in)	35.5 mm (1.4 in)	7 mm (0.28 in)				
	DN38	48 mm (1.89 in)	55 mm (2.17 in)	8 mm (0.31 in)				
	DN51	60 mm (2.36 in)	65 mm (2.56 in)	9 mm (0.35 in)	P _{max.} = 6 bar (87 psi)			
1 Cap-nut 2 Sealing ring 3 Counterpart connection								
The counterpart connection must fit the sealing ring and fix it in place.								

T-piece, optimized (no welding, no dead legs)

Туре		Version	Dime	ensions in mm (i	n)	Technical properties
Type			ΦD	L	s 1)	recifical properties
	Series A	DN10 PN25	13 mm (0.51 in)			
		DN15 PN25	19 mm (0.75 in)			
		DN20 PN25	23 mm (0.91 in)		1.5 mm (0.06 in)	
T-piece for weld-in as per DIN 11865 (series A, B and C)		DN25 PN25	29 mm (1.14 in)			
<u>G3/8"</u>		DN32 PN25	32 mm (1.26 in)			
	Series B	DN13.5 PN25	13.5 mm (0.53 in)		1.6 mm (0.063 in)	
<u>Ø18</u> (0.71) 88		DN17.2 PN25	17.2 mm (0.68 in)	48 mm		 P_{max.} = 25 bar (362 psi) 3-A marked and EHEDG certified for ≥ DN25
<u>95.1</u>		DN21.3 PN25	21.3 mm (0.84 in)	(1.89 in)		 ASME BPE compliance for ≥ DN25
		DN26.9 PN25	26.9 mm (1.06 in)	-		
		DN33.7 PN25	33.7 mm (1.33 in)	-	2 mm (0.08 in)	
A0035898	Series C ²⁾	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) Wall thickness

2) Pipe dimensions as per ASME BPE 2012

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

Time	Version			Dimen	sions		- Technical properties
Туре			ΦD	L1	L2	s ¹⁾	Technical properties
	Series A	DN10 PN25	13 mm (0.51 in)	24 m (0.95		1.5 mm (0.06 in)	
		DN15 PN25	19 mm (0.75 in)	25 m (0.98			
		DN20 PN25	23 mm (0.91 in)	27 m (1.06			
Corner piece for weld-in as per DIN 11865 (series A, B and C)		DN25 PN25	29 mm (1.14 in)	30 m (1.18			
<u>L2</u> <u>G3/8</u> "		DN32 PN25	35 mm (1.38 in)	33 m (1.3			
	Series B	DN13.5 PN25	13.5 mm (0.53 in)	32 m (1.26		1.6 mm (0.063 in)	
		DN17.2 PN25	17.2 mm (0.68 in)	34 m (1.34			• $P_{max.} = 25$ bar (362 psi) • 3-A marked and EHEDG certified for \geq DN25
<u>Ø3.1</u> (0.12) 3 (3) 003 003 003 003 003 003 003 003 003 003		DN21.3 PN25	21.3 mm (0.84 in)	36 m (1.41			 ASME BPE compliance for ≥ DN25
		DN26.9 PN25	26.9 mm (1.06 in)	29 m (1.14			
		DN33.7 PN25	33.7 mm (1.33 in)	32 m (1.26		2.0 mm (0.08 in)	
(0.18) D	Series C	DN12.7 PN25 (½") ²⁾	12.7 mm (0.5 in)	24 m (0.95		1.65 mm (0.065 in)	
		DN19.05 PN25 (¾")	19.05 mm (0.75 in)	25 m (0.98			
		DN25.4 PN25 (1")	25.4 mm (1 in)	28 m (1.1			
		DN38.1 PN25 (1½")	38.1 mm (1.5 in)	35 m (1.38			

1) Wall thickness

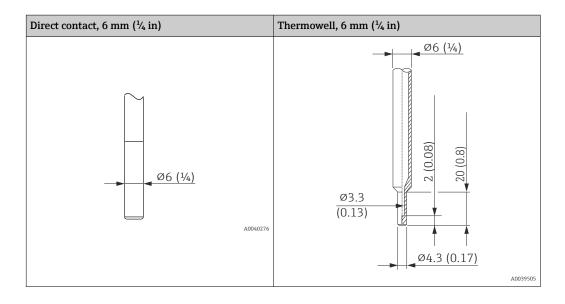
2) Pipe dimensions as per ASME BPE 2012

Tip shape

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
- The flow characteristics are optimized
- Thermowell stability is increased



Please contact the supplier if you have any questions regarding the mechanical loading capacity as a function of the installation and process conditions.

14.7 Certificates and approvals

MTBF	For the transmitter: 327 years, according to Siemens Standard SN29500
Hygiene standard	 EHEDG certification type EL - CLASS I. EHEDG-certified/tested process connections. → ● 45 3-A Authorization No. 1144, 3-A Sanitary Standard 74-07. Listed process connections. → ● 45 ASME BPE, declaration of conformity can be ordered for options indicated 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 materials of the thermometer in contact with food/product (FCM) comply with the following European regulations: (EC) No. 1935/2004, Article 3, paragraph 1, Articles 5 and 17 on materials and articles intended to come into contact with food. (EC) No. 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food. (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. Contact the supplier if necessary.
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.

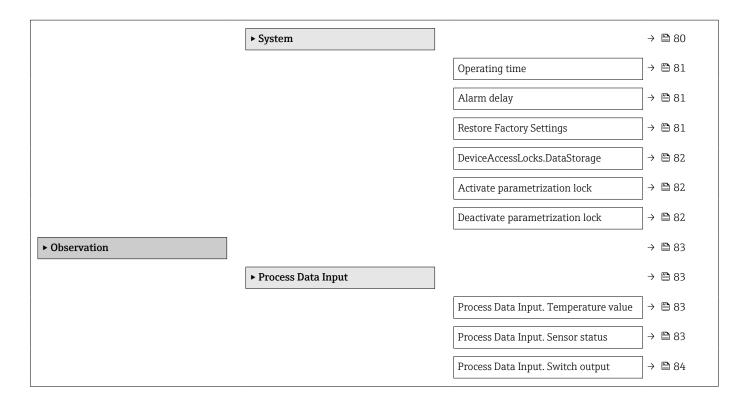
Operation concept

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			→ 🗎 56
	Application Specific Tag		→ 🗎 57
	Product Name		→ 🖺 57
	Product Text		→ 🖺 57
	Vendor Name		→ 🖺 58
	Serial Number		→ 🖺 58
	Firmware Version		→ 🗎 58
	Hardware Version		→ 🗎 58
	Order code		→ 🗎 59
	Extended order code		→ 🗎 59
	Device type		→ 🗎 59
► Diagnosis			→ 🗎 60
	► Diagnostic list		→ 🗎 60
		Actual diagnostics 1	→ 🗎 60
		Actual diagnostics 2	→ 🗎 60
		Actual diagnostics 3	→ 🗎 61
	► Event logbook		→ 🗎 61
		Previous diagnostics 1 5	→ 🗎 61
		Timestamp 1 5	→ 🗎 61
	► Simulation		→ 🗎 62
		Current output simulation	→ 🗎 62
		Value current output	→ 🗎 63

		Sensor simulation	→ 🖺 63
		Sensor simulation value]→ 🖺 63
		Switch output simulation]→ 🖺 64
	► Sensor temperature		→ 🖺 64
		Sensor max value]→ 🖺 65
		Sensor min value]→ 🖺 65
		Reset sensor min/max values]→ 🗎 65
		Lower boundary operating time sensor]→ 🖺 66
		Lower extended operating time sensor]→ 🗎 66
		Standard operating time sensor]→ 🗎 66
		Upper extended operating time sensor]→ 🖺 67
		Upper boundary operating time sensor]→ 🖺 67
	► Device temperature		→ 🗎 68
		Device temperature]→ 🖺 68
		Device temperature max] → 🖺 68
		Device temperature min]→ 🖺 69
		Reset device temp. min/max values]→ 🖺 69
		Lower boundary operating time device]→ 🖺 69
		Lower extended operating time device]→ 🖺 70
		Standard operating time device]→ 🖺 70
		Upper extended operating time device]→ 🖺 70
		Upper boundary operating time device]→ 🗎 71
	► Measuring data channel		→ 🗎 71
		MDC Descriptor.Lower limit]→ 🖺 72
		MDC Descriptor.Upper limit]→ 🗎 72
		MDC Descriptor.Unit code]→ 🖺 72
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► Parameter			→ 🖺 73
	► Application		→ 🗎 73
		► Sensor]→ 🗎 73
		► Switch output] → 🗎 75
		► Current output	→ 🖺 78



15.1 Description of device parameters

15.1.1 Identification

Navigation

Identification

► Identification		
	Application Specific Tag	→ 🗎 57
	Product Name	→ 🗎 57
	Product Text	→ 🗎 57
	Vendor Name	→ 🗎 58
	Serial Number	→ 🗎 58
	Firmware Version	→ 🗎 58
	Hardware Version	→ 🗎 58
	Order code	→ 🗎 59
	Extended order code	→ 🖺 59
	Device type	→ 🖺 59

Application Specific Tag		
Navigation	□ Identification \rightarrow 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 \rightarrow Product Name	
Description	Displays the product name	
User interface	Character string comprising numbers, letters and special characters	
Additional information	ormation User role • Operator • Maintenance • Specialist	

Product Text		Ê
Navigation	$\Box \qquad \text{Identification} \rightarrow \text{Product Text}$	
Description	Displays the product text	
User interface	Character string comprising numbers, letters and special characters	
Additional information	User role	
	 Operator Maintenance Specialist 	

Vendor Name		Ê
Navigation	□ Identification \rightarrow Vendor Name	
Description	Displays the manufacturer name	
User interface	Character string comprising numbers, letters and special characters	
Additional information	formation User role • Operator • Maintenance • Specialist	

Serial Number		
Navigation	$\Box \qquad \text{Identification} \rightarrow \text{Serial Number}$	
Description	Displays the serial number of the device. It can also be found on the nameplate.	
User interface	Character string comprising numbers, letters and special characters	
Additional information	<i>User role</i> • Operator • Maintenance • Specialist	

Firmware Version	on
------------------	----

Navigation	□ Identification \rightarrow Firmware Version	
Description	Displays the firmware version	
User interface	Character string comprising numbers, letters and special characters	
Additional information	User role	
	OperatorMaintenanceSpecialist	

	Hardware Version	
_		

Navigation		Identification \rightarrow Hardware Version
Description	Displ	ays the hardware version

User interface

Character string comprising numbers, letters and special characters

Additional information

- *User role* • Operator
- Maintenance
- Specialist

Order code		
Navigation	$\Box \qquad \text{Identification} \rightarrow \text{Order code}$	
Description	Displays the order code	
User interface	Character string comprising numbers, letters and special characters	
Additional information	User role • Operator • Maintenance • Specialist	

Extended order code	
Navigation	$\Box \qquad \text{Identification} \rightarrow \text{Extended order code}$
Description	Displays the extended order code.
User interface	Character string comprising numbers, letters and special characters
Additional information	User role Operator Maintenance Specialist

Device type	
Navigation	$\Box \qquad \text{Identification} \rightarrow \text{Device type}$
Description	Displays the device type
Additional information	User role Operator Maintenance Specialist

15.1.2 Diagnosis

Navigation

Diagnosis

▶ Diagnosis ▶ Diagnostic list → ➡ 60 ▶ Event logbook → ➡ 61 ▶ Simulation → ➡ 62 ▶ Sensor temperature → ➡ 64 ▶ Device temperature → ➡ 68 ▶ Measuring data channel → ➡ 71

Diagnostic list

Navigation

Diagnosis → Diagnostic list

► Diagnostic list			
	Actual diagnostics 1]	→ 🗎 60
	Actual diagnostics 2]	→ 🖺 60
	Actual diagnostics 3]	→ 🖺 61

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		බ
Navigation		Diagnosis \rightarrow Diagnostic list \rightarrow Actual diagnostics 2
Description	Disp	lays the diagnostic message with the second-highest priority that is currently active.

Additional information

- User role
- Operator
- Maintenance
- Specialist

Actual diagnostics 3		Ê
Navigation	□ Diagnosis \rightarrow Diagnostic list \rightarrow Actual diagnostics 3	
Description	Displays the diagnostic message with the third-highest priority that is currently active.	
Additional information	User role • Operator • Maintenance • Specialist	

Event logbook

Navigation

► Event logbook		
	Previous diagnostics 1 5	→ 🗎 61
	Timestamp 1 5	→ 🗎 61

Previous diagnostics 1 5		
Navigation	□ Diagnosis \rightarrow Event logbook \rightarrow 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		Ê

Navigation		Diagnosis \rightarrow Event logbook \rightarrow Timestamp 1 5
Description	Displa count	ys the time of the last diagnostic message. The time comes from the operating time er.

Additional information User role

Specialist

Simulation

Navigation

□ □ Diagnosis → Simulation

► Simulation		
	Current output simulation	→ 🖺 62
	Value current output	→ 🖺 63
	Sensor simulation	→ 🖺 63
	Sensor simulation value	→ 🖺 63
	Switch output simulation	→ 🗎 64

Current output simulation

Navigation	$\square \text{Diagnosis} \rightarrow \text{Simulation} \rightarrow \text{Current output simulation}$
Description	Use this function to switch simulation of the current output on and off.
Selection	OffOn
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	
Navigation	□ Diagnosis \rightarrow Simulation \rightarrow Value current output
Description	Use this function to enter a current value for the simulation. In this way, users can verify the correct adjustment of the current output and the correct function of downstream switching units.
User entry	3.58 to 23 mA
Additional information	User role
	OperatorMaintenanceSpecialist

Sensor simulation					
Navigation	□ Diagnosis \rightarrow Simulation \rightarrow Sensor simulation				
Description	Use this function to enable the simulation of the process variable.				
Selection	OffOn				
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				
	OperatorMaintenanceSpecialist				

Sensor simulation value	
Navigation	□ 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 to +200 °C

Additional information

User role

- Operator
- Maintenance
- Specialist

Switch output simulation					
Navigation	□ 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 in the normal mode. 				
	User role				
	 Operator 				

- Maintenance
- Specialist

Sensor temperature

Navigation

□ □ Diagnosis → Sensor temperature

► Sensor temperature			
	Sensor max value]	→ 🗎 65
	Sensor min value		→ 🖺 65
	Reset sensor min/max values		→ 🖺 65
	Lower boundary operating time sensor]	→ 🖺 66
	Lower extended operating time sensor		→ 🖺 66
	Standard operating time sensor		→ 🖺 66
	Upper extended operating time sensor]	→ 🗎 67

Upper boundary operating time sensor		→ 🖺 67

Sensor max value	
Navigation	□ Diagnosis \rightarrow Sensor temperature \rightarrow Sensor max value
Description	Displays the maximum temperature measured in the past at the sensor input (maximum indicator).
Additional information	User role
	OperatorMaintenance

Specialist

Sensor min value				
Navigation	□ Diagnosis \rightarrow Sensor temperature \rightarrow 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 \rightarrow Sensor temperature \rightarrow 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		

A0040333

Lower boundary operating time sensor

Navigation

□ Diagnosis \rightarrow Sensor temperature \rightarrow Lower boundary operating time sensor

Description

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

	Lower boundary	Lower extended	Standard	Upper extended	Uppe bounda	
-40 (-40			°C 2 °F)		5 ℃ 49 °F)	85 ℃ (185 ℉)
						A00403

Additional information

User role Specialist

Lower extended operating time sensor

Navigation

□ Diagnosis \rightarrow Sensor temperature \rightarrow Lower extended operating time sensor

Description

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

Lower boundary	Lower extended	Standard	Uppe extend		Upper ooundary
	5 °C 0 ° 3 °F) (32	-	°C 4 °F)	65 °C (149 °F	85 7) (18

Additional information

User role Specialist

Standard operating time sensor		

Navigation

Description

Diagnosis \rightarrow Sensor temperature \rightarrow Standard operating time sensor

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



Additional information

User role Specialist

Upper extended operating time sensor

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Navigation

 \square Diagnosis \rightarrow Sensor temperature \rightarrow Upper extended operating time sensor

Description

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

	wer ndary		ver nded	Standard		Upj exte		Up bour	per 1dary	
-40 °C	_	5 °C	0°C		40			S°C		5°C
(-40 °F)	(-1)	3 °F)	(32 °F)		(10	4 °F)	(14	⊧9 °F)	(18	85 °F)

Additional information

User role Specialist

Upper boundary operating time sensor

A

Navigation

Description

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

	ver idary	Lower extende				Upj boun	per Idary	
-40 °C (-40 °F)	-25 (-13	-	0 °C (32 °F)		°C 4 °F)	°C 9 °F)		°C 5 °F)

ß

Additional information

User role Specialist

Device temperature

Navigation

□ □ Diagnosis → Device temperature

► Device temperature			
	Device temperature		→ 🗎 68
	Device temperature max		→ 🖺 68
	Device temperature min		→ 🖺 69
	Reset device temp. min/max values		→ 🖺 69
	Lower boundary operating time device		→ 🖺 69
	Lower extended operating time device		→ 🖺 70
	Standard operating time device		→ 🖺 70
	Upper extended operating time device		→ 🗎 70
	Upper boundary operating time device]	→ 🛱 71

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

Device temperature max

Navigation		Diagnosis \rightarrow Device temperature \rightarrow Device temperature max
Description	Displa	ys the maximum device temperature measured in the past (maximum indicator).

Additional information

- User role
- Operator
- Maintenance
- Specialist

Device temperature min			
Navigation		Diagnosis \rightarrow Device temperature \rightarrow Device temperature min	
Description	Displa	ays the minimum device temperature measured in the past (minimum indicator).	
Additional information	 Mai 	role erator intenance cialist	

Reset device temp. min/max values						
Navigation	□ Diagnosis \rightarrow Device temperature \rightarrow Reset device temp. min/max values					
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 \rightarrow Device temperature \rightarrow Lower boundary operating time device

Description

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

	ower undary	Low exter				Up bour	per 1dary	
-40 °C (-40 °F)	_	5 ℃ 3 ℉)	0 °C (32 °F)) °C 04 °F)	5 ℃ 9 °F)		5 °C 5 °F)

Additional information

User role Specialist

A0040333

Lower extended operating time device A Navigation Diagnosis \rightarrow Device temperature \rightarrow Lower extended operating time device Description Displays the operating time of the device in the lower ambient temperature range (Lower extended). Lower Upper boundary boundary extended 0 °C (32 °F) 40 °C (104 °F) 65 °C (149 °F) 85 ℃ (185 ℉) -25 ℃ (-13 ℉) -40 °C (-40 °F) Additional information User role Specialist Standard operating time device æ Navigation Diagnosis \rightarrow Device temperature \rightarrow Standard operating time device

Description

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

Lower	Lower	Standard	Upper	Upper
boundary	extended		extended	boundary
	°C 0 °C °F) (32 °F)			5°C 8 49°F) (18

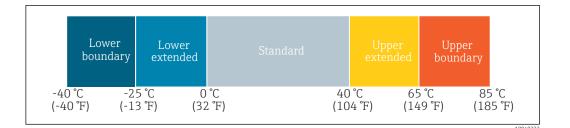
Additional information

User role Specialist

Upper extended operating time device	

Navigation

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



Additional information

User role Specialist

Upper boundary operating time device

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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).

	wer 1dary	Lowe extend					Upj bour	per Idary	
-40 °C	-25	-	0 °C		°C		°C		ъ°С
(-40 °F)	(-13	3°F)	(32 °F)	(10	4 °F)	(14	9°F)	(18	5 °F)

Additional information

User role Specialist

Measuring data channel

Navigation \square \square Diagnosis \rightarrow Measuring data channel

► Measuring data channel			
	MDC Descriptor.Lower limit]	→ 🖺 72
	MDC Descriptor.Upper limit]	→ 🗎 72
	MDC Descriptor.Unit code]	→ 🖺 72
	MDC Descriptor.Scale]	→ 🗎 72

ß

MDC Descriptor.Lower limit		
Navigation	□ Diagnosis \rightarrow Measuring data channel \rightarrow 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 lir	mit	
Navigation	□ Diagnosis \rightarrow Measuring data channel \rightarrow MDC Descriptor.Upper limit	
Description	Displays the upper value of the measuring range. According to Smart Sensor Profile 2^{nd} Edition.	
Additional information	User role Operator Maintenance Specialist 	

MDC Descriptor.Unit code	
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Navigation	□ 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 2^{nd} Edition.
Additional information	User role • Operator • Maintenance • Specialist

MDC Descriptor.Scale		
Navigation	□ Diagnosis \rightarrow Measuring data channel \rightarrow MDC Descriptor.Scale	
Description	Displays the scaling of the measured value (10 ^{scale}). According to Smart Sensor Profile 2 nd Edition.	

User role

- Operator
- Maintenance
- Specialist

15.1.3 Parameters

Navigation

Parameter

► Parameter			
	► Application		→ 🗎 73
	► System		→ 🖺 80
Application			
Naviga	tion \square Parameter \rightarrow .	Application	
► Application			
	► Sensor		→ 🖺 73
	► Switch output		→ 🖺 80
	► Current output		→ 🖺 81
SensorNavigation \Box Parameter \rightarrow Application \rightarrow Sensor			
► Sensor			
	Unit]	→ 🗎 73
	Damping		→ 🗎 74
	Sensor offset		→ 🖺 74

Unit	
Navigation	Parameter \rightarrow Application \rightarrow Sensor \rightarrow Unit
Description	Use this function to select the engineering unit for all the measured values and parameters.

Selection	● ℃ ● ℉ ● K
Factory setting	°C
Additional information	User role
	 Operator

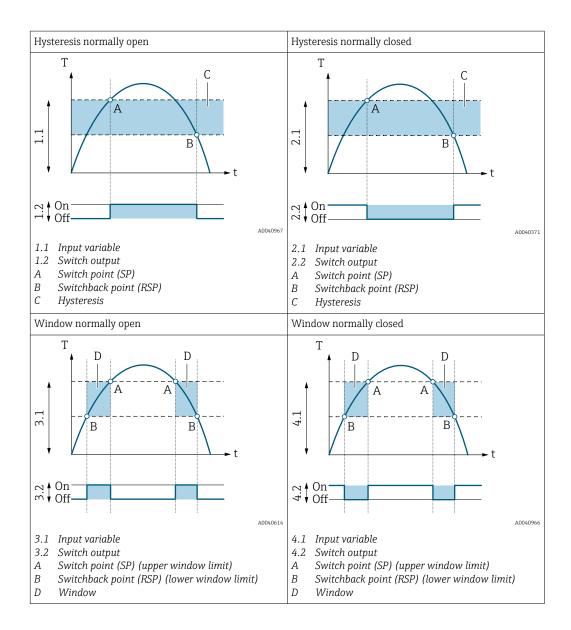
- Maintenance
- Specialist

Damping	
Navigation	□ Parameter \rightarrow Application \rightarrow Sensor \rightarrow Damping
Description	Use this function to enter the time constant for measured value damping.
User entry	0 to 120 s
Factory setting	0 s
Additional information	User role
	OperatorMaintenanceSpecialist

Sensor offset	
Navigation	□ Parameter \rightarrow Application \rightarrow Sensor \rightarrow Sensor offset
Description	Use this function to enter the zero point correction (offset) of the sensor measured value. The value indicated is added to the measured value.
User entry	–10 to +10 °C (14 to 50 °F)
Factory setting	℃ ℃
Additional information	User role
	OperatorMaintenanceSpecialist

Switch output Navigation Parameter → Application → Switch output • Switch output Operating mode Switch point value Switch back point value Switch delay Switch back delay

Operating mode	
Navigation	□ Parameter \rightarrow Application \rightarrow Switch output \rightarrow Operating mode
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). 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

Switch point value		
Navigation	□ Parameter \rightarrow Application \rightarrow Switch output \rightarrow Switch point value	
Description	Use 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	

- User role
- Operator Maintenance
- Specialist

Switchback point value		
Navigation	□ Parameter \rightarrow Application \rightarrow Switch output \rightarrow Switchback point value	
Description	Use 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	
	OperatorMaintenanceSpecialist	

Switch delay		
Navigation	□ Parameter \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	□ Parameter \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	

- *User role* • Operator
- Maintenance
- Specialist

Current output

Navigation

Parameter \rightarrow Application \rightarrow Current output

► Current output			
	4 mA value]	→ 🗎 78
	20 mA value]	→ 🖺 79
	Current trimming 4 mA]	→ 🗎 79
	Current trimming 20 mA]	→ 🖺 79
	Failure mode]	→ 🖺 80
	Failure current]	→ 🗎 80

4 mA value	
Navigation	Parameter \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	–50000 to +50000 °C (-89968 to +90032 °F)
Factory setting	0°C
Additional information	User role
	OperatorMaintenanceSpecialist

20 mA value	
Navigation	□ Parameter \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.
	1 The span between the 4 mA value and the 20 mA value must be at least 10 K.
User entry	–50000 to +50000 °C (–89968 to +90032 °F)
Factory setting	150 °C
Additional information	User role
	 Operator Maintenance Specialist

Current trimming 4 mA		
Navigation	□ Parameter \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	□ Parameter \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	

- *User role* • Operator
- Maintenance
- Specialist

Failure mode	
Navigation	□ Parameter \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
	OperatorMaintenanceSpecialist

Failure current	
Navigation	□ Parameter \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
	OperatorMaintenanceSpecialist

System

Navigation

 $\ \ \, \square \ \ \, Parameter \rightarrow System$

► System		
	Operating time	→ 🖺 81

[Alarm delay		→ 🖺 81
[Restore Factory Settings		→ 🖺 81
[DeviceAccessLocks.DataStorage		→ 🖺 82
[Activate parametrization lock		→ 🖺 82
[Deactivate parametrization lock]	→ 🖺 82

Operating time	8
Navigation	□ Parameter \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
	OperatorMaintenanceSpecialist

Alarm delay	
Navigation	□ Parameter \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 • Operator • Maintenance • Specialist

Restore Factory Settings		
Navigation		Parameter \rightarrow System \rightarrow Restore Factory Settings
Description	Use t	his function to reset the entire device configuration to the factory settings.

User role

- Operator
- Maintenance
- Specialist

DeviceAccessLocks.DataStorage		
Navigation	□ Parameter \rightarrow System \rightarrow DeviceAccessLocks.DataStorage	
Description	Use this function to lock data storage. Standard function of IO-Link.	
Selection	UnlockedLocked	
Factory setting	Unlocked	
Additional information	User role • Operator • Maintenance • Specialist	

Activate parametrization lock		
Navigation	□ Parameter \rightarrow System \rightarrow Activate parametrization lock	
Description	Use this function to lock the parameterization of the device.	
Additional information	User role • Maintenance • Specialist	

Deactivate parametrization lock

Navigation	$ \begin{tabular}{lllllllllllllllllllllllllllllllllll$	
Description	Use this function to unlock the parameterization of the device.	
Additional information	User role	
	 Maintenance Specialist 	

Specialist

15.1.4 Observation

	Navigation		Observation	
► Observation	► Process Da	ata Inpu	t] → 🗎 83
	Process Data Inpu	ut		

Navigation

□ Observation \rightarrow Process Data Input

► Process Data Input		
	Process Data Input. Temperature value	→ 🗎 83
	Process Data Input. Sensor status	→ 🖺 83
	Process Data Input. Switch output	→ 🖺 84

Process Data Input. Temperature value		
Navigation	□ Observation \rightarrow Process Data Input \rightarrow Process Data Input. Temperature value	
Description	Displays the temperature value that is currently measured.	
Additional information	<i>User role</i> • Operator • Maintenance • Specialist	

Process Data Input. Sensor status		
Navigation	□ Observation \rightarrow Process Data Input \rightarrow Process Data Input. Sensor status	
Description	Displays the current sensor status.	
Additional information	User role • Operator • Maintenance • Specialist	

Process Data Input. Switch output

Navigation	□ Observation \rightarrow Process Data Input \rightarrow Process Data Input. Switch output	
Description	Displays the current switch status.	
User interface	 0 (Off) 1 (On) 	
Additional information	User role • Operator • Maintenance	

Specialist

