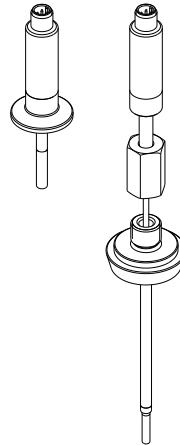


# Brief Operating Instructions iTHERM CompactLine TM311

Compact thermometer with IO-Link



These instructions are Brief Operating Instructions; they do **not** replace the Operating Instructions included in the scope of supply.

Detailed information can be found in the Operating Instructions and the additional documentation.

All device versions available via:

- Internet: [www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)
- Smart phone/tablet: Endress+Hauser Operations App



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# 1 About this document

## 1.1 Symbols

### 1.1.1 Safety symbols

#### DANGER

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

#### WARNING

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





#### 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.






### 1.1.2 Electrical symbols

Symbol	Meaning	Symbol	Meaning
	Direct current		Alternating current
	Direct current and alternating current		<b>Ground connection</b> A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.



Symbol	Meaning
	<b>Protective Earth (PE)</b> A terminal which must be connected to ground prior to establishing any other connections.  The ground terminals are situated inside and outside the device: <ul style="list-style-type: none"> <li>▪ Inner ground terminal: Connects the protective earth to the mains supply.</li> <li>▪ Outer ground terminal: Connects the device to the plant grounding system.</li> </ul>

### 1.1.3 Symbols for certain types of information


Symbol	Meaning	Symbol	Meaning
	<b>Permitted</b> Procedures, processes or actions that are permitted.		<b>Preferred</b> Procedures, processes or actions that are preferred.
	<b>Forbidden</b> Procedures, processes or actions that are forbidden.		<b>Tip</b> Indicates additional information.

Symbol	Meaning	Symbol	Meaning
	Reference to documentation.		Reference to page.
	Reference to graphic.	1., 2., 3. ...	Series of steps.
	Result of a step.		Visual inspection.

#### 1.1.4 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
	Hazardous area		Safe area (non-hazardous area)

#### 1.1.5 Tool symbols

Symbol	Meaning
 A0011222	Open-ended wrench

## 1.2 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](http://www.io.link.com).

## 2 Basic safety instructions

### 2.1 Requirements for the personnel

The personnel must fulfill the following requirements for its tasks:

- ▶ 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.

## 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

Risk of injury.

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

## 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. Endress+Hauser 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.

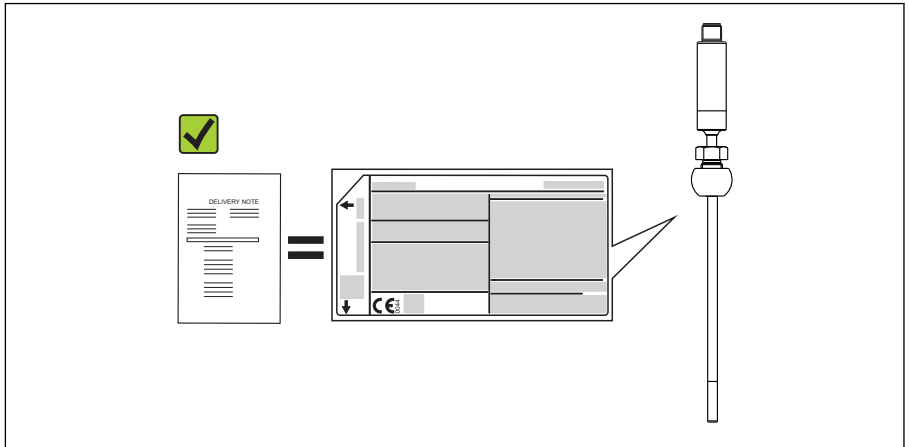
# 3 Incoming acceptance and product identification

## 3.1 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.

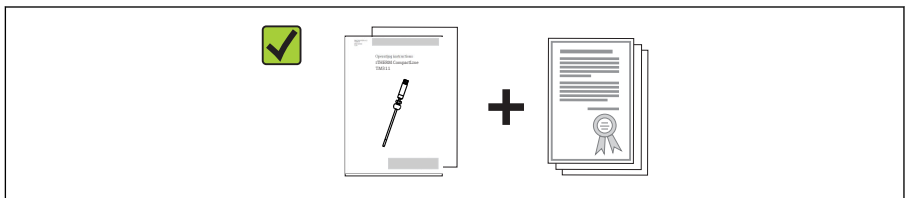
6.



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Do the data on the nameplate match the ordering information on the delivery note?

7.



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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.

## 3.2 Product identification

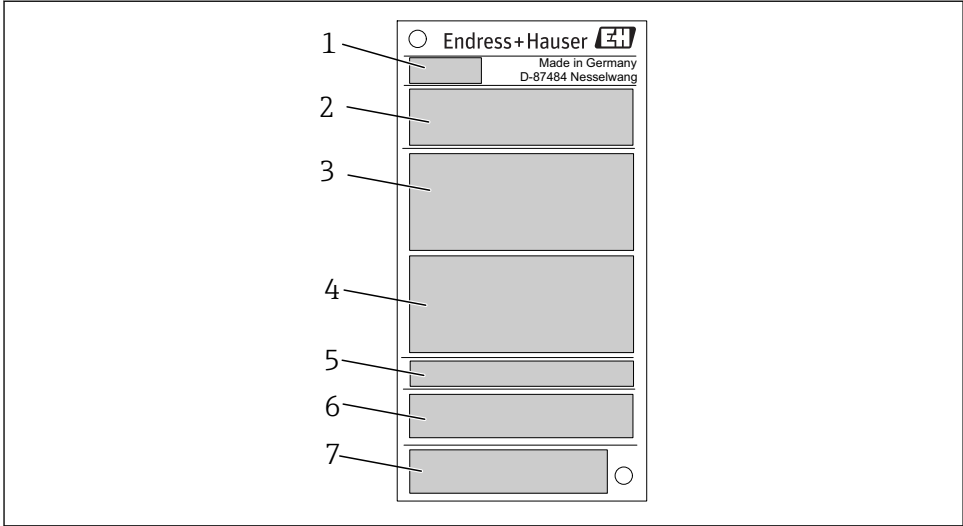
The device can be identified in the following ways:

- Nameplate specifications
- Enter the serial number from the nameplate in the *W@M Device Viewer* [www.endress.com/deviceviewer](http://www.endress.com/deviceviewer): All data relating to the device and an overview of the Technical Documentation supplied with the device are displayed.


### 3.2.1 Nameplate

#### The correct device?

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



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 1 *Sample graphic*

- 1 *Product root, device designation: TM311*
- 2 *Order code, serial number*
- 3 *Tag name*
- 4 *Technical values: supply voltage, current consumption, ambient temperature*
- 5 *Degree of protection*
- 6 *Pin assignment*
- 7 *Approvals with symbols: CE mark, EAC*

### 3.2.2 Scope of delivery

The scope of delivery comprises:

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

### 3.3 Name and address of manufacturer

<b>Name of manufacturer:</b>	Endress+Hauser Wetzler GmbH + Co. KG
<b>Address of manufacturer:</b>	Obere Wank 1, D-87484 Nesselwang or <a href="http://www.endress.com">www.endress.com</a>
<b>Address of manufacturing plant:</b>	See nameplate

### 3.4 Storage and transport

 Pack the device so that it is reliably protected against impact when it is stored and transported. The original packaging offers the best protection.



### 3.4.1 Storage temperature

$T_s$	-40 to +85 °C (-40 to +185 °F)
-------	--------------------------------

## 4 Installation

### 4.1 Installation conditions



Information on the conditions that must be present at the installation location in order to ensure designated use (e.g. ambient temperature, degree of protection, climate class etc.), and information on the device dimensions, see the Technical Information

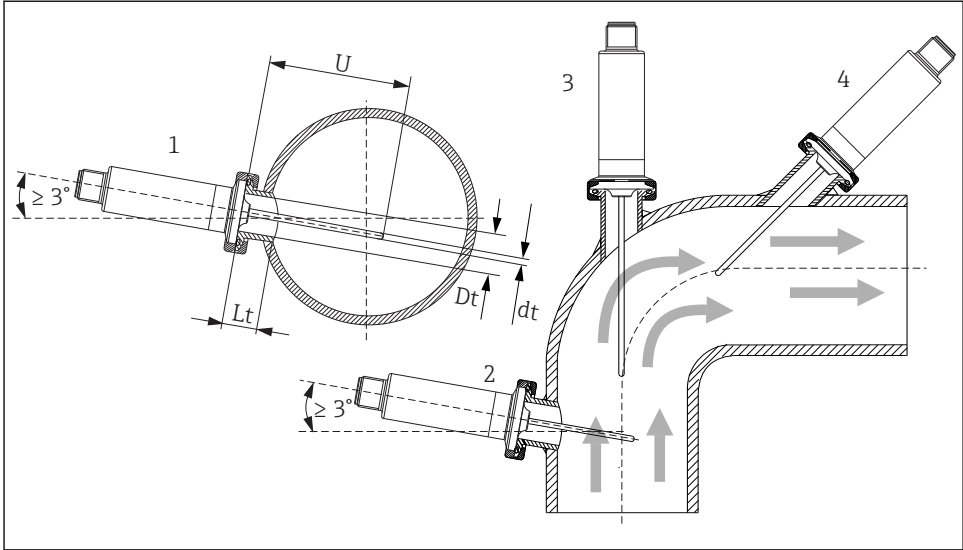
#### 4.1.1 Orientation

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.

#### 4.1.2 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. 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.



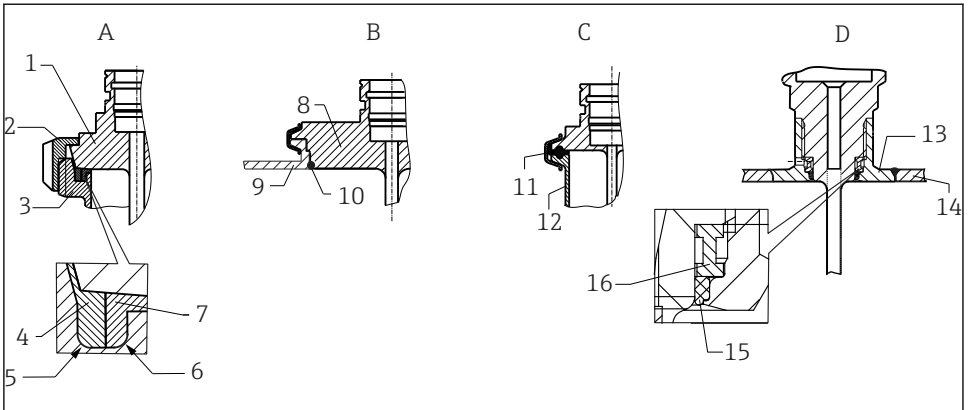
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## 2 Installation examples

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

**i** The requirements of the EHEDG and the 3-A Sanitary Standard must be adhered to.  
 Installation instructions EHEDG/cleanability:  $L_t \leq (D_t - d_t)$   
 Installation instructions 3-A/cleanability:  $L_t \leq 2(D_t - d_t)$

**i** 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 length or installation depth all the parameters of the thermometer and of the medium to be measured must be taken into account (e.g. flow velocity, process pressure).



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### 3 Detailed installation instructions for hygiene-compliant installation

**A** Milk pipe connection according to DIN 11851, only in connection with EHEDG certified and self-centering sealing ring

- 1 Sensor with milk pipe connection
- 2 Groove slip-on nut
- 3 Counterpart connection
- 4 Centering ring
- 5 R0.4
- 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 counterpieces for the process connections and the seals or sealing rings are not included in the scope of supply for the thermometer. Liquiphant M weld-in adapters with associated seal kits are available as accessories. See Technical Information.

### 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 polished,  $R_a \leq 0.76$   $\mu\text{m}$  (30  $\mu\text{in}$ ).

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 directly sprays this area so that it is cleaned properly.
2. The Varivent® couplings enable flush-mount installation.

#### 4.1.3 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 °C (185 °F) by an extension neck of the appropriate length.

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

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

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

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

## 4.2 Installing the thermometer

Prior to installation:

1. Inspect the device for any damage caused during transportation.
2. Obvious damage must be reported immediately.
3. Pay attention to whether the thermometer may be installed directly in the process or whether a thermowell must be used.



For detailed information, see the Technical Information

Proceed as follows to install 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.



It is possible to verify the mechanical loading capacity as a function of the installation and process conditions using the online TW Sizing Module for thermowells in the Endress+Hauser Applicator software.

Technical Information TI01439T, Accessories section

### 4.2.1 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.

#### 4.2.2 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.

### 4.3 Post-installation check


<input type="checkbox"/>	Is the device undamaged (visual inspection)?
<input type="checkbox"/>	Is the device correctly secured?
<input type="checkbox"/>	Does the device correspond to the specifications at the measuring point, e.g. ambient temperature, measuring range etc.?  For detailed information, see the Technical Information TI01439T


## 5 Electrical connection

### 5.1 Connection conditions

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

## 5.2 Supply voltage

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

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

## 5.3 Power supply failure

- To meet electrical safety according to CAN/CSA-C22.2 No. 61010-1 or UL Std. No 61010-1, the device must be operated with a power supply unit with an appropriately limited circuit according to 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 is exceeded, the specified characteristics are no longer guaranteed.
- Behavior in the event of undervoltage  
If the supply voltage falls below the minimum value  $\sim 7 V$ , the device switches off in a defined manner (status as if not supplied with power).

## 5.4 Maximum current consumption

$\leq 23$  mA for 4 to 20 mA

## 5.5 Electrical safety

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

## 5.6 cCSAus

The product meets the requirements for electrical safety according to CAN/CSA-C22.2 No. 61010-1-12 or UL 61010-1.

## 5.7 Operating altitude

Up to 2 000 m (6 600 ft) above sea level

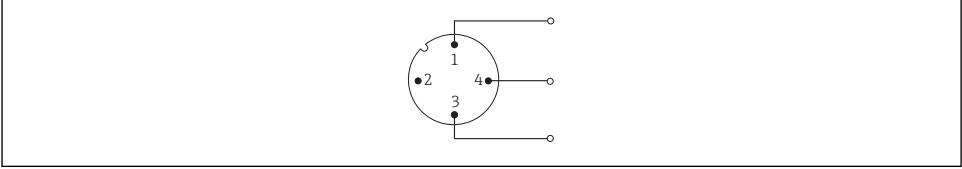
## 5.8 Connecting the measuring device

### 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

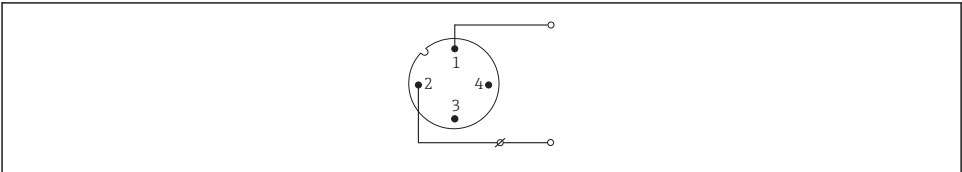


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#### 4 Pin assignment, device plug

- 1 Pin 1 - power supply 15 to 30 V<sub>DC</sub>
- 2 Pin 2 - not used
- 3 Pin 3 - power supply 0 V<sub>DC</sub>
- 4 Pin 4 - C/Q (IO-Link or switch output)

#### 4 to 20 mA operating mode



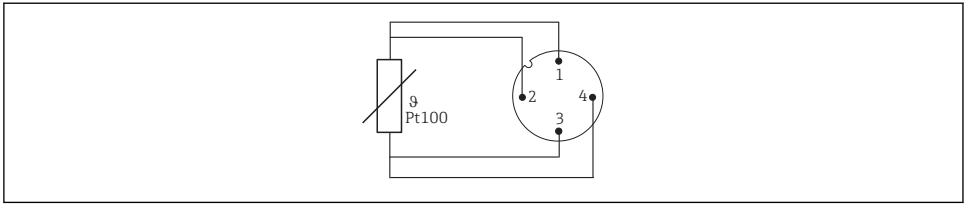
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#### 5 Pin assignment, device plug

- 1 Pin 1 - power supply 10 to 30 V<sub>DC</sub>
- 2 Pin 2 - power supply 0 V<sub>DC</sub>
- 3 Pin 3 - not used
- 4 Pin 4 - not used

#### Without electronics





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

## 5.9 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 .

## 5.10 Post-connection check

<input type="checkbox"/>	Are the device and cable undamaged (visual check)?
<input type="checkbox"/>	Do the mounted cables have suitable strain relief?
<input type="checkbox"/>	Does the supply voltage match the information on the nameplate?

# 6 Operation options

## 6.1 Protocol-specific data

### 6.1.1 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 transmission rate.

These data are available in the device description (IODD<sup>1)</sup>) which is provided to the IO-Link master via generic modules when the communication system is commissioned.



The IODD can be downloaded as follows:

- Endress+Hauser: [www.endress.com](http://www.endress.com)
- IODDfinder: [ioddfinder.io-link.com](http://ioddfinder.io-link.com)

1) IO Device Description

## 7 System integration

### 7.1 Identification

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

### 7.2 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	23	22	21	20	19	18	17	16
sint16															
Temperature (with one decimal place)															

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

#### Explanation

Process value	Values	Meaning
Temperature	-32.000 to 32.000	Temperature value with one decimal place Example: a transmitted value of 123 corresponds to a measured temperature value of 12.3 °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 - 3]	0 = Bad	Measured value cannot be used



Process value	Values	Meaning
	1 = Uncertain	Measured value can only be used to a limited extent, e.g.: device temperature is outside the permitted range (S825)
	2 = Manual/Fixed	Measured value can only be used to a limited extent, e.g.: simulation of the measured variable is active (C485)
	3 = Good	Measured value is good
Measured value status [bit 2 - 1]	0 = Not limited	Measured value without limit value violation
	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 Commissioning

If an existing configuration is changed, measuring operation continues.

### 8.1 Post-installation check

Perform the following checks prior to commissioning the measuring point:

1. Perform the post-installation check using the checklist →  14.
2. Perform the post-connection check using the checklist →  17.

### 8.2 Configuring the measuring device

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

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

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



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[www.addresses.endress.com](http://www.addresses.endress.com)

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