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01.01 (device version)

Operating Instructions
F2060

IO-Link temperature transmitter

IO-Link

Table of contents

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 used

1.2.1 Safety symbols

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

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

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

NOTICE
This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	**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
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Notice or individual step to be observed
1., 2., 3...	Series of steps
	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
	Hazardous area		Safe area (non-hazardous area)

1.3 Tool symbols

Symbol	Meaning
A0011220	Flat blade screwdriver
A0011219	Phillips screwdriver
A0011221	Allen key
A0011222	Open-ended wrench
A0013442	Torx screwdriver

1.4 Registered trademarks

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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 Intended use

The device is a universal and configurable temperature transmitter with a sensor input for resistance thermometers (RTD). The head transmitter version of the device is intended for mounting in a terminal head (flat face) as per DIN EN 50446. It is also possible to mount the device on a DIN rail using the optional DIN rail clip.

If the device is used in a manner not specified by the manufacturer, the protection provided by the device may be impaired.

The manufacturer is not liable for damage caused by improper or unintended use.

2.3 Workplace safety

When working on and with the device:
- Wear the required personal protective equipment as per national regulations.

2.4 Operational safety

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

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers!
- If modifications are nevertheless required, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability:
- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to the repair of an electrical device.
- Use only original spare parts and accessories.

2.5 Product safety

This 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 EU directives listed in the device-specific EU Declaration of Conformity. The manufacturer confirms this by affixing the CE mark to the device.

2.6 IT security

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

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

3 Incoming acceptance and product identification

3.1 Incoming acceptance

On receipt of the delivery:

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

If one of the conditions is not satisfied, contact the manufacturer.

3.1.1 Product identification

Nameplate

Do you have the correct device?

The nameplate provides you with the following information on the device:
- Manufacturer identification, device designation
- Serial number
- Tag name (TAG) (optional)
- Technical values, e.g. supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols

▶ Compare the information on the nameplate with the order.

Name and address of manufacturer

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

3.2 Storage and transport

Storage temperature: −50 to +100 °C (−58 to +212 °F)

Maximum relative humidity : < 95 % as per IEC 60068-2-30

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

Avoid the following environmental influences during storage and transport:
- Direct sunlight
- Proximity to hot objects
- Vibration
- Aggressive media

4 Mounting

4.1 Mounting requirements

4.1.1 Dimensions

For device dimensions, see the "Technical data" section.

4.1.2 Mounting location

In the terminal head, flat face, as per DIN EN 50446, direct mounting on insert with cable entry (center hole 7 mm (0.28 in).

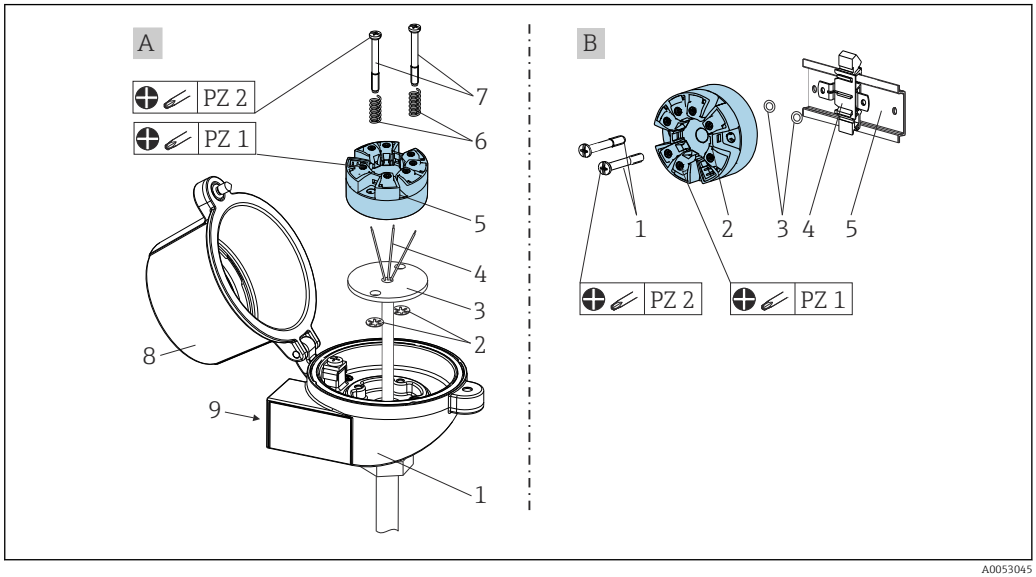
Make sure there is enough space in the terminal head!

It is also possible to mount the head transmitter on a DIN rail as per IEC 60715 using the DIN rail clip as accessory.

Information about the conditions (such as the ambient temperature, degree of protection, climate class etc.) that must be present at the mounting location so that the device can be mounted correctly is provided in the "Technical data" section.

4.2 Mounting the device

A Phillips head screwdriver is required to mount the head transmitter:
- Maximum torque for securing screws = 1 Nm (¾ lbf ft), screwdriver: Pozidriv PZ2
- Maximum torque for screw terminals = 0.35 Nm (¼ lbf ft), screwdriver: Pozidriv PZ1



A Terminal head, flat face, as per DIN EN 50446, direct mounting on insert with cable entry (center hole 7 mm (0.28 in)
B With DIN rail clip on DIN rail as per IEC 60715 (TH35)

A	Mounting in a terminal head (terminal head flat face as per DIN 50446)
1	Terminal head
2	Circlips
3	Insert
4	Connection wires

A	Mounting in a terminal head (terminal head flat face as per DIN 50446)
5	Head transmitter
6	Mounting springs
7	Mounting screws
8	Terminal head cover
9	Cable entry

Procedure for mounting in a terminal head, item A:

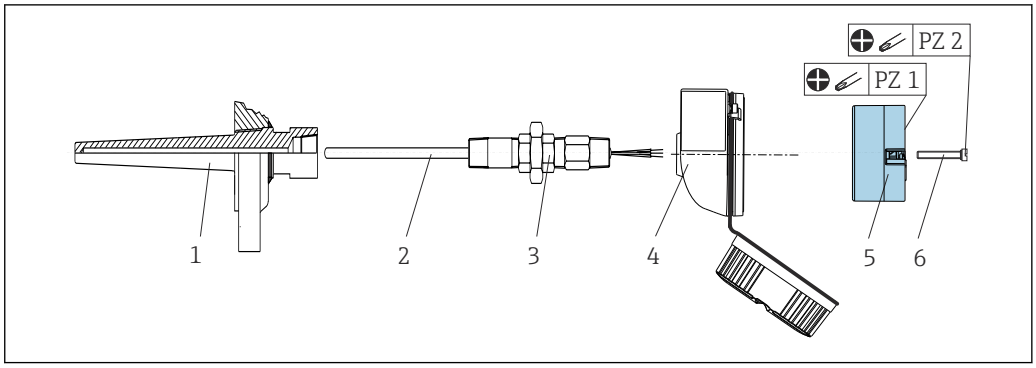
1. Open the terminal head cover (8) on the terminal head.
2. Guide the connection wires (4) of the insert (3) through the center hole in the head transmitter (5).
3. Fit the mounting springs (6) on the mounting screws (7).
4. Guide the mounting screws (7) through the side boreholes of the head transmitter and the insert (3). Then secure both mounting screws with the retaining rings (2).
5. Then tighten the head transmitter (5) along with the insert (3) in the terminal head.
6. After wiring (see 'Electrical connection' section), seal the terminal head cover (8) once again.

B	Mounting on DIN rail (DIN rail as per IEC 60715)
1	Mounting screws with springs
2	Head transmitter
3	Circlips
4	DIN rail clip
5	DIN rail

Procedure for mounting on a DIN rail, item B:

1. Press the DIN rail clip (4) onto the DIN rail (5) until it engages with a click.
2. Guide the mounting screws (1) through the side boreholes of the head transmitter (2) and secure with the retaining rings (3).
3. Screw the head transmitter (2) onto the DIN rail clip (4).

4.2.1 Mounting for North America



1 *Head transmitter mounting*

1 Thermowell
2 Insert
3 Adapter, coupling
4 Terminal head
5 Head transmitter
6 Mounting screws

Structure of thermometer with RTD sensors and head transmitter:

1. Fit the thermowell (1) on the process pipe or on the process vessel wall. Secure the thermowell according to the instructions before the pressure is applied.
2. Fit the necessary neck tube nipples and adapter (3) on the thermowell.
3. Make sure sealing rings are installed if they are required for harsh environmental conditions or compliance with special regulations.
4. Guide the mounting screws (6) through the lateral bores of the head transmitter (5).
5. Position the head transmitter (5) in the terminal head (4) so that the terminals for the power supply (terminals 1 and 2) point to the cable entry.
6. Using a screwdriver, screw down the head transmitter (5) in the terminal head (4).
7. Guide the connection wires of the insert (3) through the lower cable entry of the terminal head (4) and through the middle hole in the head transmitter (5). Wire together the connection wires and transmitter (see the 'Electrical connection' section).
8. Screw the terminal head (4), with the integrated and wired head transmitter, onto the ready-mounted nipple and adapter (3).

4.3 Post-mounting checks

After mounting the device, always perform the following checks:

Device condition and specifications	Note
Are the device, the connections and connecting cables free of damage?	
Do the ambient conditions match the device specification (e.g. ambient temperature, measuring range, etc.)?	See 'Technical data' section.
Have connections been established correctly and with the specified torque?	-

5 Electrical connection

⚠ CAUTION

- Switch off power supply before installing or connecting the device. Failure to observe this may result in the destruction of parts of the electronics.
- Mixing up the terminal connections L+, L- and C/Q does not cause damage to the electronics.

5.1 Connecting requirements

A Phillips head screwdriver is required to wire the head transmitter with screw terminals. The push-in terminal version can be wired without any tools.

Proceed as follows to wire a mounted head transmitter:

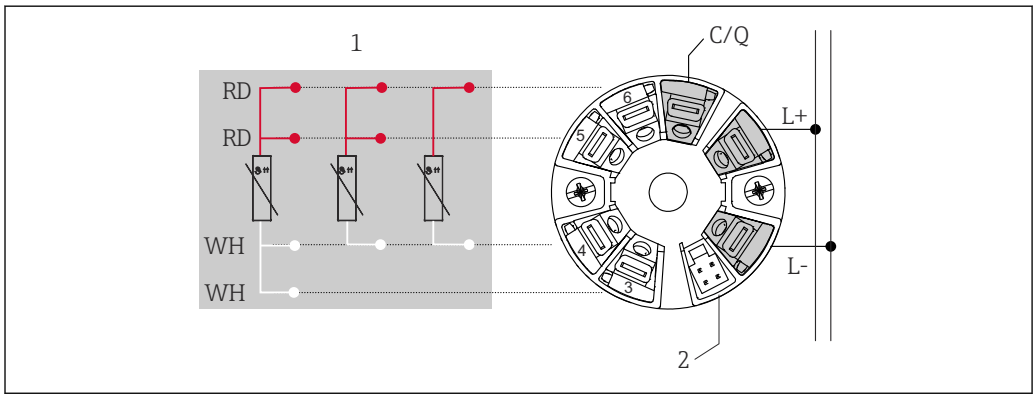
1. Open the cable gland and the housing cover on the terminal head or the field housing.
2. Feed the cables through the opening in the cable gland.
3. Connect the cables as shown in → 12. If the head transmitter is fitted with push-in terminals, pay particular attention to the information in the "Connecting to push-in terminals" section. → 13
4. Tighten the cable gland again and close the housing cover.

In order to avoid connection errors always follow the instructions in the post-connection check section before commissioning!

5.2 Quick wiring guide

NOTICE

- ESD - Electrostatic discharge Protect the terminals from electrostatic discharge. Failure to observe this may result in the destruction or malfunction of parts of the electronics.



2 Terminal assignment of head transmitter

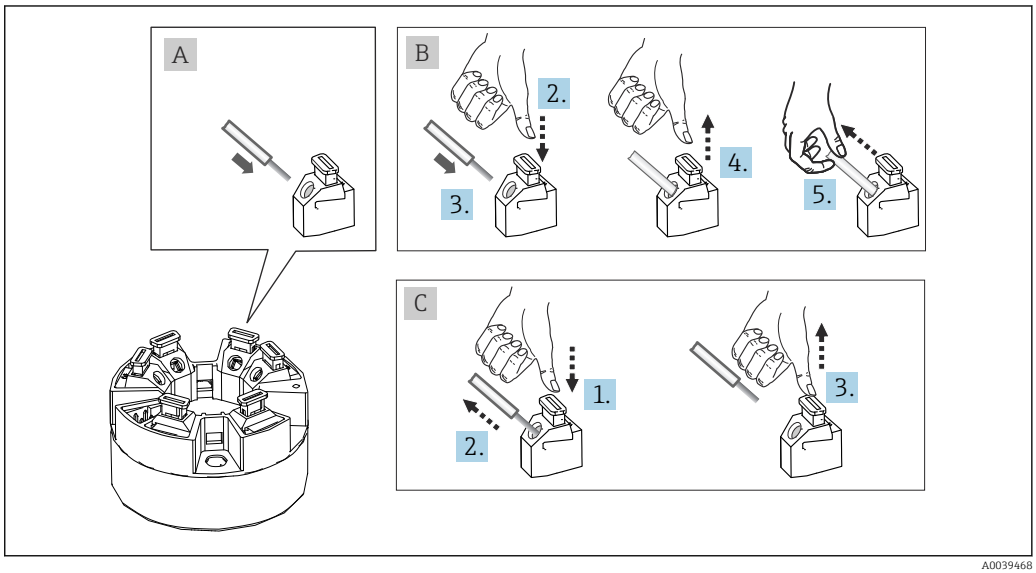
1 RTD sensor input: 4-, 3- and 2-wire
2 Display connection
L+ 18 to 30 V_{DC} power supply
L- 0 V_{DC} power supply
C/Q IO-Link or switch output

5.3 Connecting the sensor

5.3.1 Connecting to screw terminals

Maximum torque for screw terminals = 0.35 Nm (¼ lbf ft), screwdriver: Pozidriv Z1

5.3.2 Connecting to push-in terminals



3 *Connecting to push-in terminals*

Item A, solid wire:

1. Strip wire end. Min. stripping length 10 mm (0.39 in).
2. Insert the wire end into the terminal.
3. Pull the wire gently to ensure it is connected correctly. Repeat from step 1 if necessary.

Item B, fine-strand wire without ferrule:

1. Strip wire end. Min. stripping length 10 mm (0.39 in).
2. Press down on the lever opener.
3. Insert the wire end into the terminal.
4. Release lever opener.
5. Pull the wire gently to ensure it is connected correctly. Repeat from step 1 if necessary.

Item C, releasing the connection:

1. Press down on the lever opener.
2. Remove the wire from the terminal.
3. Release lever opener.

5.4 Connecting the transmitter

Cable specification

- Maximum cable length in IO-Link operation: ≤ 20 m (65.6 ft). There are no requirements with respect to shielding.
- For cable cross-section, see the "Technical data", → 36

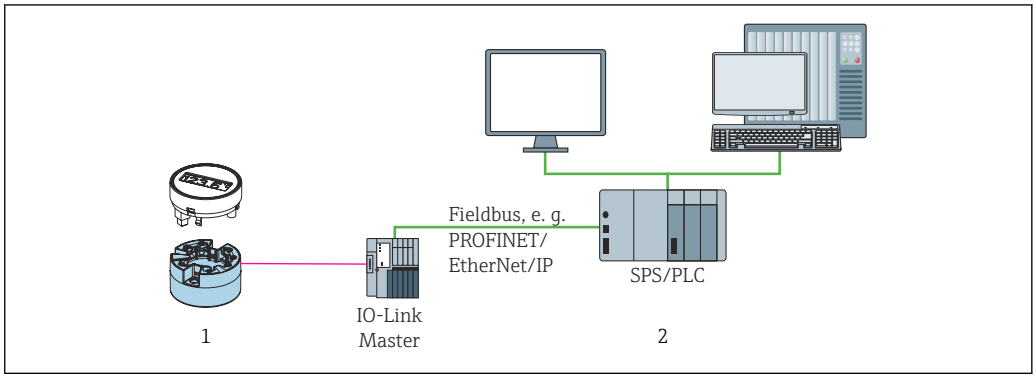
Follow the general procedure for connecting terminals.→ 12.

5.5 Post-connection check

Device condition and specifications	Notes
Are the device and cable undamaged?	
Electrical connection	**Notes**
Does the supply voltage match the specifications on the nameplate?	Head transmitter: U = e.g. 18 to 30 V_{DC}
Are the mounted cables relieved of tension?	
Are the power supply and signal cables connected correctly?	→ 12
Are all the screw terminals well tightened and have the connections of the push-in terminals been checked?	--
Are all the cable entries installed, tightened and leak-tight?	--

6 Operation options

6.1 Overview of operation options



1 Temperature transmitter with attachable display unit
2 Remote operation in the automation system. e.g. PLC) via IO-Link interface

Configuration programs

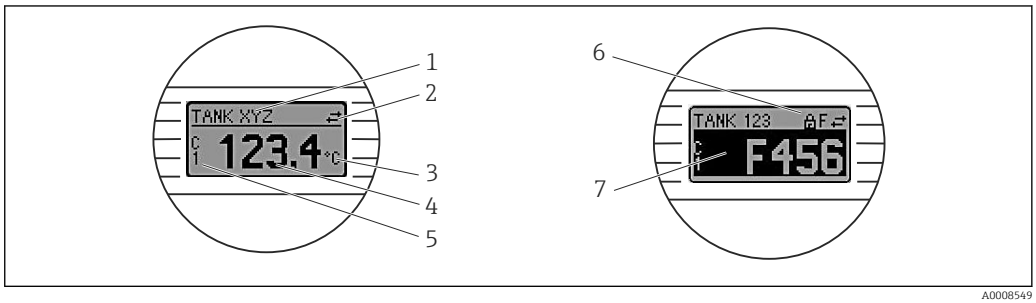
IO-Link functions and device-specific parameters are configured via the device's IO-Link communication. Special configuration kits are available, e.g. the FieldPort SFP20. Every IO-Link device can be configured with it. IO-Link devices are typically configured via the automation system (e.g. Siemens TIA Portal + Port Configuration Tool).

6.2 Measured value display and operating elements

For the head transmitter, display and operating elements are available locally only if the head transmitter was ordered with a display unit! The display can also be ordered at a later stage; see the "Accessories" section.

6.2.1 Display elements

Head transmitter



4 Optional LC display for head transmitter

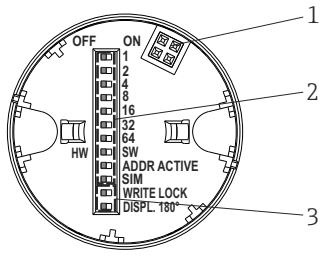
Item no.	Function	Description
1	Display device tag	Device tag, length 32 characters.
2	'Communication' symbol	The communication symbol appears in the event of read and write access via IO-Link.
3	Unit display	Unit display for the measured value displayed.
4	Measured value display	Displays the current measured value.

Item no.	Function	Description
5	Values/channel display	PV = process value P1 = switching signal channel SSC.1 P2 = switching signal channel SSC.2 DT = device temperature
6	'Configuration locked' symbol	The 'configuration locked' symbol appears when configuration is locked via the hardware.
7	Status signals	
	Symbols	Meaning
	F	**"Failure" error message** An operating error has occurred. The measured value is no longer valid. The display alternates between the error message and "- - - -" (no valid measured value present); see "Diagnostics and troubleshooting" section
	C	**"Function check"** The device is in service mode (e.g. during a simulation).
	S	**"Out of specification"** The device is being operated outside its technical specifications (e.g. during startup or cleaning processes).
	M	**"Maintenance required"** Maintenance is required. The measured value remains valid. The display alternates between the measured value and the status message.

6.2.2 Local operation

NOTICE

▶ ESD - Electrostatic discharge. Protect the terminals from electrostatic discharge. Failure to observe this may result in the destruction or malfunction of parts of the electronics.



5 *Hardware settings via DIP switches*

1: Connection to head transmitter

2: DIP switch

3: DIP switch functions:
1-64, HW/SW, ADDR ACTIVE (no function)
SIM = simulation mode (no function);
WRITE LOCK = write protection;
DISPL. 180° = rotate the display monitor 180°

Procedure for setting the DIP switch:

1. Open the cover of the terminal head or field housing.
2. Remove the attached display from the head transmitter.
3. Configure the DIP switch on the rear of the display accordingly. In general: switch to ON = function enabled, switch to OFF = function disabled.
4. Fit the display onto the head transmitter in the correct position.
5. Secure the cover back onto the terminal head or field housing.

Switching write protection on/off

Write protection is switched on and off via a DIP switch on the rear of the optional attachable display.

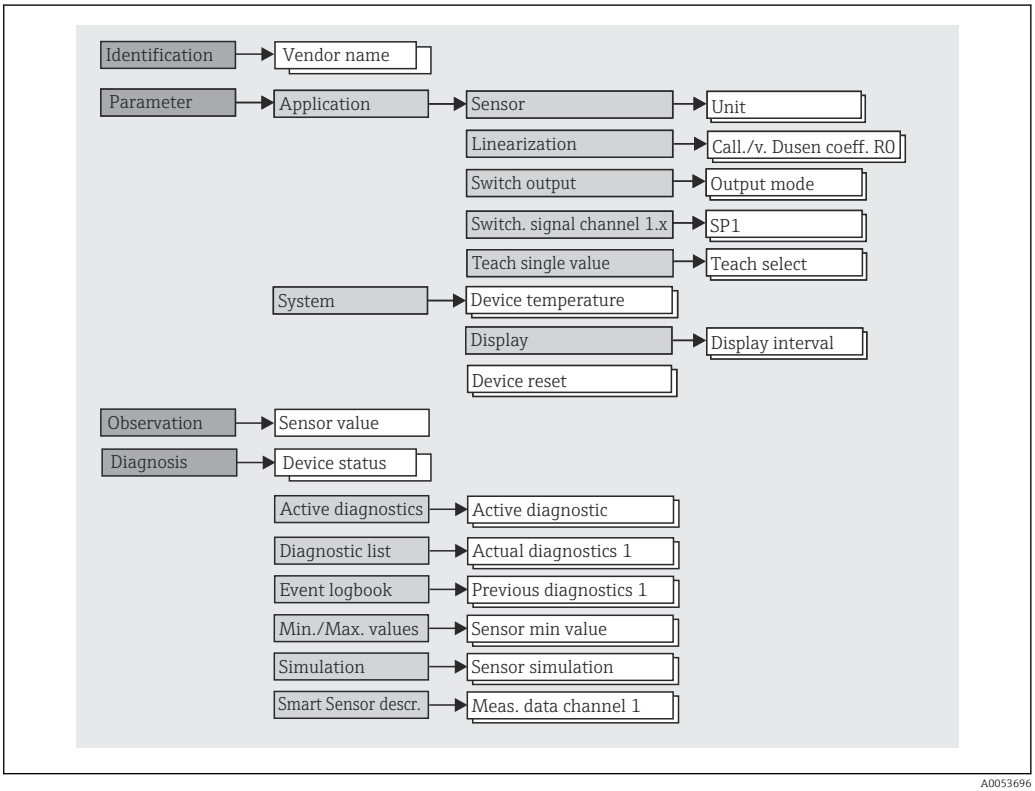
When write protection is active, parameters cannot be modified. A lock symbol on the display indicates that write protection is on. Write protection remains active even when the display is removed. To disable write protection, the display must be attached to the transmitter with the DIP switch deactivated (WRITE LOCK = OFF). The transmitter adopts the setting during operation and does not need to be restarted.

Turning the display

The display can be rotated 180° via the DIP switch.

6.3 Structure and function of the operating menu

6.3.1 Structure of the operating menu



If the measured value unit is switched to °F, the process data is retained in °C for further process calculations. Switching of the unit only applies to the measured value display.

Submenus

Menu	Typical tasks	Content/meaning
"Identification"	Information on manufacturer and device identification	Contains all the parameters for unique identification of the manufacturer and device
"Parameter"	Commissioning, tasks and information on the device configuration: ▪ Configuration of the measurement ▪ Configuration of data processing (scaling, linearization, etc.) ▪ Configuration of the switching signal ▪ Display of device temperature and operating time ▪ Information about display configuration ▪ Resetting the device	Contains all parameters for commissioning: ▪ **"Sensor" submenu** Contains all the parameters for configuring the measurement ▪ **"Linearization" submenu** Contains all the parameters for linearization of the measurement ▪ **"Switching signal channel submenu"** Contains all the parameters for configuring the switch output, e.g. entering the switch points, defining the switch logic (high active, low active), switching mode (1-point, window or 2-point function), teach function. Contains all higher-level device parameters that are assigned to device information and adjustment. **"Display" submenu** Configuration of the display
"Observation"	Observation of process data	Contains all the parameters for displaying the process data: Current value at sensor input, extended device status and status at switching signal channel
"Diagnostics"	Troubleshooting: ▪ Diagnosing and eliminating process errors ▪ Error diagnostics in difficult cases. ▪ Interpretation of device error messages and correcting associated errors	Contains all parameters for detecting and analyzing errors: ▪ **Active diagnostics, diagnostic list** Displays the currently pending and triggered error messages, sorted by priority See 'Diagnostics and troubleshooting' section. ▪ **"Event logbook" submenu** Displays all diagnostic and information events in chronological order ▪ **"Minimum/maximum values" submenu** Displays all minimum and maximum measured process and device temperatures ▪ **"Simulation" submenu** Used to simulate input and output values

6.4 Access to the operating menu via the operating tool

The IO-Link interface allows direct access to process and diagnostics data and enables the user to configure the device during operation.

More information on IO-Link is available at: www.io-link.com

6.4.1 Field Device Configurator (FDC) Tool

Function range


A0051704

The FDC Tool is a configuration tool that is available free of charge. The devices can be connected directly via a modem (point-to-point). DeviceCare is fast, easy and intuitive to use. It can run on a PC, laptop or tablet with a Windows operating system.
For more information, please contact your local supplier.

7 System integration

7.1 Overview of IODD device description file

In order to integrate field devices into a digital communication system, the IO-Link system requires a description of the device parameters such as output data, input data, data format, quantity of data and supported IO-Link transfer rate. This data is available in the IODD (IO Device Description) which is provided to the IO-Link master via generic modules when the communication system is commissioned.

Download via ioddfinder

1. ioddfinder.io-link.com
2. Enter product name **F2060**.
   ↳ A list of search results is displayed.
3. Download the appropriate version.

7.2 Integrating the device in the system

Device ID	0x93FE01
Manufacturer ID	0x0011 (17)

7.2.1 Process data

When the 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 SIO mode (Standard IO mode). Digital IO-Link communication starts as soon as the IO-Link master sends the "Wake Up" command.

- In SIO mode, the switch output is switched at the C/Q terminal. In the IO-Link communication mode, this terminal is reserved exclusively for communication.
- The device's process data are transmitted cyclically in 48-bit chunks.

Description	Bit offset	Data type
Temperature	16	Float32
Extended device status	8	Uinteger8
Switching signal SSC. 2	1	Boolean
Switching signal SSC. 1	0	Boolean

Explanation

Process value	Value	Meaning
Temperature	$-1.7014118 \cdot 10^{+38}$ to $+1.7014118 \cdot 10^{+38}$ °C	Temperature value currently measured
	$3.3 \cdot 10^{+38}$ = No measurement data	Process value if no valid measured value is available
	$-2.65 \cdot 10^{+38}$ = Out of range (-)	Process value if the measured value is below the lower limit value
	$+2.65 \cdot 10^{+38}$ = Out of range (+)	Process value if the measured value is above the upper limit value
Extended device status	36 = Failure	Summarized status as per PI specifications
	37 = Failure simulation	

Process value	Value	Meaning
	60 = Functional check	
	61 = Functional check simulation	
	120 = Out of spec	
	121 = Out of spec simulation	
	128 = Good	
	129 = Good simulation	
	164 = Maintenance	
	165 = Maintenance simulation	
Switching signal status SSC .2	0 = Off	Switch output open/low
	1 = On	Switch output closed/high
Switching signal status SSC .1	0 = Off	Switch output open/low
	1 = On	Switch output closed/high

7.3 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:

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

7.3.1 Identification

Designation	Index dec - (hex)	Subin dex	Size (byte)	Data type	Access	Default value	Value range	Data storag e
Manufacturer name	16 - (0x0010)	0	32	String	r/-	"32 spaces"	-	-
Manufacturer text	17 - (0x0011)	0	32	String	r/-	"32 spaces"	-	-
Product name	18 - (0x1019	0	32	String	r/-	F2060	-	-
Product text	20 - (0x0014)	0	32	String	r/-	Temperat ure transmitt er	-	-
Product ID	19 - (0x0013)	0	32	String	r/-	F2060	-	-
Serial number	21 - (0x0015)	0	16	String	r/-	-	-	-
Hardware revision	22 - (0x0016)	0	16	String	r/-	-	-	-
Firmware version	23 - (0x0017)	0	8	String	r/-	-	-	-
Application-specific identification	24 - (0x0018)	0	32	String	r/w	***	-	Yes
Function identification	25 - (0x0019)	0	32	String	r/w	***	-	Yes
Location identification	26 - (0x001a)	0	32	String	r/w	***	-	Yes

Designation	Index dec - (hex)	Subin dex	Size (byte)	Data type	Access	Default value	Value range	Data storag e
Order code	12375 - (0x3057)	0	20	String	r/-	-	-	-
Extended order code	259 - (0x0103)	0	20	String	r/-	-	-	-

7.3.2 Parameters

Designation	Index dec - (hex)	Subin dex	Size (byte)	Data type	Access	Default value	Value range	Data storag e
Unit	8274 - (0x2052)	0	1	UInteger8	r/w	°C	32 = °C 33 = °F	Yes
Sensor type	8242 - (0x2032)	0	1	UInteger8	r/w	Pt100 IEC60751 , a = 0.00385 (1)	12 = Pt100 IEC60751, a = 0.00385 (1) 15 = Pt1000 IEC60751, a = 0.00385 (4) 3 = RTD platinum (Callendar-van Dusen)	Yes
Connection	8248 - (0x2038)	0	1	UInteger8	r/w	4-wire	2 = 2-wire 3 = 3-wire 4 = 4-wire	Yes
2-wire compensation	8249 - (0x2039)	0	4	Float	r/w	0.0	0.0 to 30.0 Ω	Yes
Sensor offset	8247 - (0x2037)	0	4	Float	r/w	0.0	±10.0 °C	Yes
Damping	8265 - (0x2049)	0	1	UInteger8	r/w	0	0 to 120 s	Yes
Call./v. Dusen coeff. R0	8253 - (0x203d)	0	4	Float	r/w	100.0	10 to 2 000 Ω	Yes
Call./v. Dusen coeff. A	8250 - (0x203a)	0	4	Float	r/w	0.0039083	0.003 to 0.004	Yes
Call./v. Dusen coeff. B	8251 - (0x203b)	0	4	Float	r/w	$-5.775 \cdot 10^{-7}$	$\pm 2 \cdot 10^{-06}$	Yes
Call./v. Dusen coeff. C	8252 - (0x203c)	0	4	Float	r/w	$-4.183 \cdot 10^{-12}$	$\pm 1 \cdot 10^{-09}$	Yes
Sensor lower limit	8244 - (0x2034)	0	4	Float	r/w	−200.0	−200 to +850 °C	Yes
Sensor upper limit	8243 - (0x2033)	0	4	Float	r/w	−850.0	−200 to +850 °C	Yes
Output mode	8263 - (0x2047)	0	2	UInteger16	r/w	PNP	4951 = PNP 4952 = NPN 495 = PushPull	Yes
Fail-safe value	8264 - (0x2048)	0	2	UInteger16	r/w	HighZ	33193 = Low 33192 = High 4950 = HighZ	Yes
SSC .1 Param								
SP1	60 - (0x003c)	1	4	Float	r/w	90.0	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$ °C	Yes
SP2	60 - (0x003c)	2	4	Float	r/w	100.0	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$ °C	Yes
SSC. 1 Config								

Designation	Index dec - (hex)	Subindex	Size (byte)	Data type	Access	Default value	Value range	Data storage
Logic	61 - (0x003d)	1	1	UInteger8	r/w	High active	0 = High active 1 = Low active	Yes
Mode	61 - (0x003d)	2	1	UInteger8	r/w	Two point	0 = Deactivated 1 = Single point 2 = Window 3 = Two point	Yes
Hysteresis	61 - (0x003d)	3	4	Float	r/w	0.0	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$ °C	Yes
SSC .2 Param								
SP1	62 - (0x003e)	1	4	Float	r/w	90.0	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$ °C	Yes
SP2	62 - (0x003e)	2	4	Float	r/w	100.0	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$ °C	Yes
SSC. 2 Config								
Logic	63 - (0x003f)	1	1	UInteger8	r/w	High active	0 = High active 1 = Low active	Yes
Mode	63 - (0x003f)	2	1	UInteger8	r/w	Two point	0 = Deactivated 1 = Single point 2 = Window 3 = Two point	Yes
Hysteresis	63 - (0x003f)	3	4	Float	r/w	0.0	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$ °C	Yes
Teach select	58 - (0x003a)	0	1	UInteger8	r/w	SSC 1.1	1 = SSC 1.1 2 = SSC 1.2	-
Teach result	59 - (0x003b)	0	1	UInteger8	r/-	Idle	0 = Idle 1 = SP 1 success 2 = SP 2 success 3 = SP 1, SP2 success 4 = Wait for command 5 = Busy 7 = Error	-
Device temperature	8313 - (0x2079)	0	4	Float	r/-	-	-	-
Operating time	8280 - (0x2058)	0	4	UInteger32	r/-	-	-	-
Alarm delay	8279 - (0x2057)	0	1	UInteger8	r/w	2	0 to 5 s	Yes
Display interval	8225 - (0x2021)	0	1	UInteger8	r/w	4	4 to 20 s	Yes
Value 1 display	8226 - (0x2022)	0	1	UInteger8	r/w	Process value	13 = Process value 20 = SSC.1 21 = SSC.2 1 = Device temperature	Yes
Decimal places 1	8227 - (0x2023)	0	1	UInteger8	r/w	x.x	255 = Automatic 0 = x 1 = x.x 2 = x.xx	Yes
Value 2 display	8228 - (0x2024)	0	1	UInteger8	r/w	Off	12 = Off 13 = Process value 20 = SSC.1 21 = SSC.2 1 = Device temperature	Yes

Designation	Index dec - (hex)	Subindex	Size (byte)	Data type	Access	Default value	Value range	Data storage
Decimal places 2	8229 - (0x2025)	0	1	UInteger8	r/w	x.x	255 = Automatic 0 = x 1 = x.x 2 = x.xx	Yes
Value 3 display	8230 - (0x2026)	0	1	UInteger8	r/w	Off	12 = Off 13 = Process value 20 = SSC.1 21 = SSC.2 1 = Device temperature	Yes
Decimal places 3	8231 - (0x2027)	0	1	UInteger8	r/w	x.x	255 = Automatic 0 = x 1 = x.x 2 = x.xx	Yes

7.3.3 Observation

Designation	Index dec - (hex)	Subindex	Size (byte)	Data type	Access	Default value	Value range	Data storage
External process data								
Sensor value	40 - (0x0028)	1	4	Float	r/-	0	– $1.7014118 \cdot 10^{+38}$ to $+1.7014118 \cdot 10^{+38}$ °C $3.3 \cdot 10^{+38}$ = No measurement data $-2.65 \cdot 10^{+38}$ = Out of range (-) $+2.65 \cdot 10^{+38}$ = Out of range (+)	-
Extended device status	40 - (0x0028)	2	1	UInteger8	r/-	Not specified	36 = Failure 37 = Failure - simulation 60 = Function check 61 = Function check - simulation 120 = Out of specification 121 = Out of specification - simulation 128 = Good 164 = Maintenance required 165 = Maintenance required - simulation 129 = Good - simulation 0 = Not specified	-
Switching signal channel .2	40 - (0x0028)	3	1	Boolean	r/-	0	0 = Off 1 = On	-
Switching signal channel .1	40 - (0x0028)	4	1	Boolean	r/-	0	0 = Off 1 = On	-

7.3.4 Diagnostics

Designation	Index dec - (hex)	Subindex	Size (byte)	Data type	Access	Default value	Value range	Data storage
Device status	36 - (0x0024)	0	1	UInteger8	r/-	0	0 = Device is OK 1 = Maintenance required 2 = Out of specification 3 = Functional check 4 = Failure	-
Detailed device status	37 - (0x0025)	0	15	OctetString	r/-	0x00	-	-

Designation	Index dec - (hex)	Subindex	Size (byte)	Data type	Access	Default value	Value range	Data storage
Actual diagnostics 1	8284 - (0x205c)	0	2	UInteger16	r/-	-	-	-
Actual diagnostics 2	8285 - (0x205d)	0	2	UInteger16	r/-	-	-	-
Actual diagnostics 3	8286 - (0x205e)	0	2	UInteger16	r/-	-	-	-
Previous diagnostics 1	8295 - (0x2067)	0	2	UInteger16	r/-	-	-	-
Time stamp 1	8290 - (0x2062)	0	4	UInteger32	r/-	-	-	-
Previous diagnostics 2	8296 - (0x2068)	0	2	UInteger16	r/-	-	-	-
Time stamp 2	8291 - (0x2063)	0	4	UInteger32	r/-	-	-	-
Previous diagnostics 3	8297 - (0x2069)	0	2	UInteger16	r/-	-	-	-
Time stamp 3	8292 - (0x2064)	0	4	UInteger32	r/-	-	-	-
Previous diagnostics 4	8298 - (0x206a)	0	2	UInteger16	r/-	-	-	-
Time stamp 4	8293 - (0x2065)	0	4	UInteger32	r/-	-	-	-
Previous diagnostics 5	8299 - (0x206b)	0	2	UInteger16	r/-	-	-	-
Time stamp 5	8294 - (0x2066)	0	4	UInteger32	r/-	-	-	-
Sensor min value	8246 - (0x2036)	0	4	Float	r/-	-	-	-
Sensor max value	8245 - (0x2035)	0	4	Float	r/-	-	-	-
Device temperature min value	8319 - (0x207f)	0	4	Float	r/-	-	-	-
Device temperature max value	8318 - (0x207e)	0	4	Float	r/-	-	-	-
Sensor simulation	8259 - (0x2043)	0	1	UInteger8	r/w	Off	0 = Off 1 = On	-
Sensor simulation value	8254 - (0x203e)	0	4	Float	r/w	0.0	$\pm 1 \cdot 10^{+20}$	-
Switch output simulation 2	8482 - (0x2122)	0	2	UInteger16	r/w	Off	4166 = Off 4167 = High 4168 = Low	-
Switch output simulation 1	8418 - (0x20e2)	0	2	UInteger16	r/w	Off	4166 = Off 4167 = High 4168 = Low	-
Measurement data channel 1								
Lower value	16512 - (0x4080)	1	4	Float	r/-	–200.0	-	-
Upper value	16512 - (0x4080)	2	4	Float	r/-	850.0	-	-

Designation	Index dec - (hex)	Subindex	Size (byte)	Data type	Access	Default value	Value range	Data storage
Unit	16512 - (0x4080)	3	2	UInteger16	r/-	°C	1001 = °C	-
Scaling	16512 - (0x4080)	4	1	Integer8	r/-	0	-	-

8 Commissioning

8.1 Function check

Perform the following checks prior to commissioning the measuring point:

1. Perform the post-mounting check using the checklist.
2. Perform the post-connection check using the checklist.

8.2 Switching on the device

During the switch-on procedure, the transmitter runs through internal test functions. The following sequence of messages appears on the display:

Step	Display
1	Text "Display" and firmware version of the display
2	Device name with firmware, hardware version and the IO-Link device ID in hexadecimal format
3	Information on the sensor configuration (sensor element and type of connection)
4	Displays the switch points
5a	Current measured value or
5b	Current status message If the switch-on procedure is not successful, the relevant diagnostic event is displayed, depending on the cause. For a detailed list of diagnostic events and the corresponding troubleshooting instructions, see the "Diagnostics and troubleshooting" section.

The device works after approx. 5 seconds. Normal measuring mode commences as soon as the switch-on procedure is completed.

8.3 Configuring the 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.

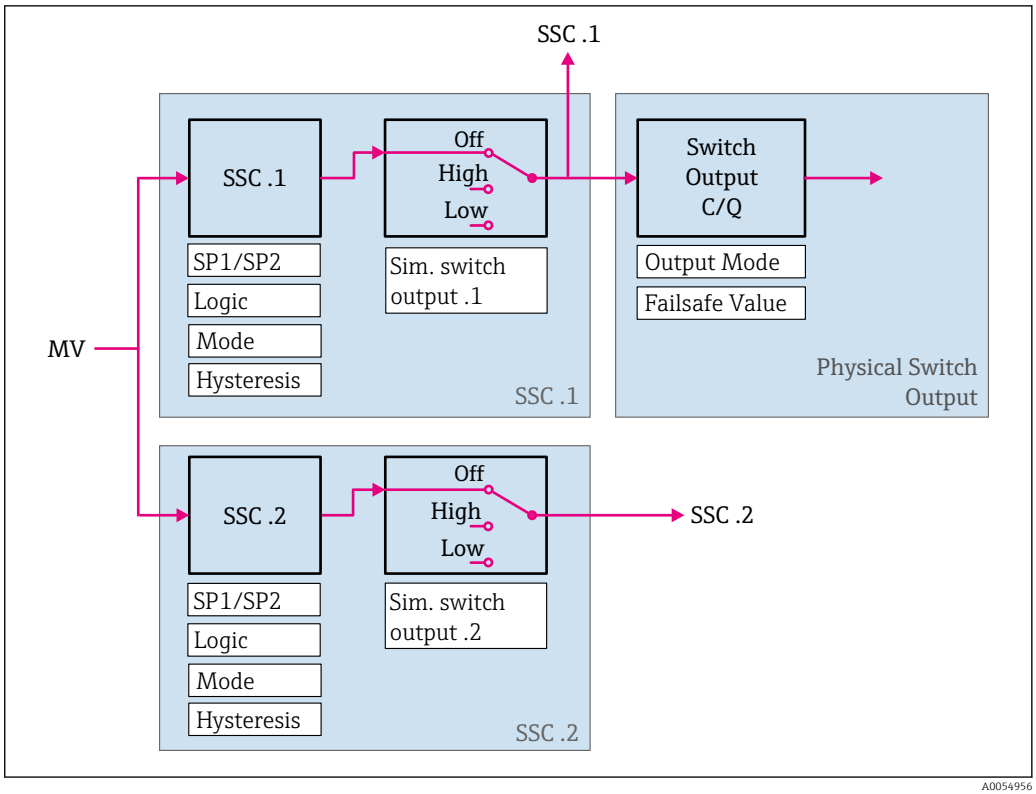
IO-Link devices are typically configured via the automation system (e.g. Siemens TIA Portal + Port Configuration Tool). The device supports IO-Link Data Storage, which enables easy device replacement.

8.3.1 Switching signal channels and switch output

IO-Link switching signal channels (SSC)

SSCs are specified by the IO-Link Smart Sensor Profile. The device has two independent SSCs (SSC. 1 and SSC. 2). Based on the measured process temperature, each of the two channels issues a binary switching signal (OFF or ON) which is transferred to the IO-Link process data as **Switching signal channel 1** and **Switching signal channel 2**. Both channels can be configured with the parameters: **SP1/SP2**, **Logic**, **Mode** and **Hysteresis**; see section on System Integration. In addition, the output values can be set to a fixed value using the **Simulation switch output .1/.2** parameter ('High' becomes ON and 'low' becomes OFF).

In addition to manual configuration for switch points **SP1/SP2**, a teach mechanism is also available in the Teach menu. This mechanism writes the current process value to the selected SSC via a system command.



Physical switch output

The C/Q output signal is generated based on the binary signal in the **Switching signal channel 1**. The output signal is only available at the C/Q terminal if the IO-Link communication is disabled (SIO mode). The voltage of the C/Q output signal is displayed according to the binary value of **Switching signal channel 1** and the **Output Mode** parameter as per the following table.

Assignment of binary switching signal and C/Q output signal

Output mode	Switching signal channel 1	C/Q switch output
PNP	OFF	Not connected (HighZ)
	ON	L+
NPN	OFF	Not connected (HighZ)
	ON	L-
PushPull	OFF	L-
	ON	L+

If the value of the **Logic** parameter is set to Low active, the binary switching signals are inverted compared to the values specified in the table.

OFF -> ON, ON -> OFF.

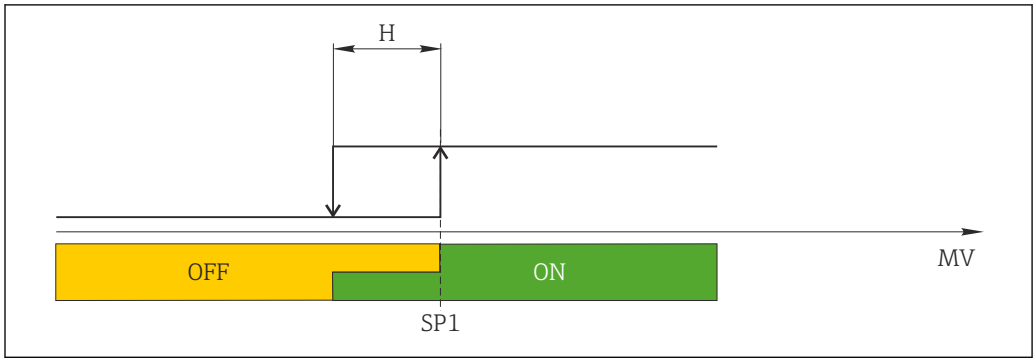
In the event of an error, the C/Q output signal can be defined using the **Fail-safe value** parameter: Low (L-), High (L+) and HighZ (not connected). This value applies, irrespective of the **Output Mode** parameter setting.

Switching signals

The switching signals offer a simple way of monitoring the measured values for limit violations. The following section illustrates the different switching behaviors of the modes available for selection.

Mode Single Point

SP2 is not used in this mode.

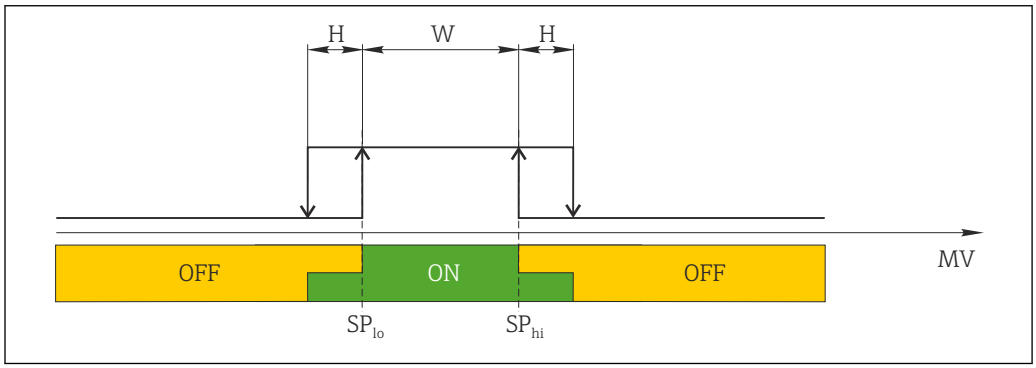


6 *SSC, Single Point*

H Hysteresis
SP1 Switch point 1
MV Measured value

Mode Window

SP_{hi} always corresponds to whichever value is higher, SP1 or SP2, while SP_{lo} always corresponds to whichever value is lower, SP1 or SP2.

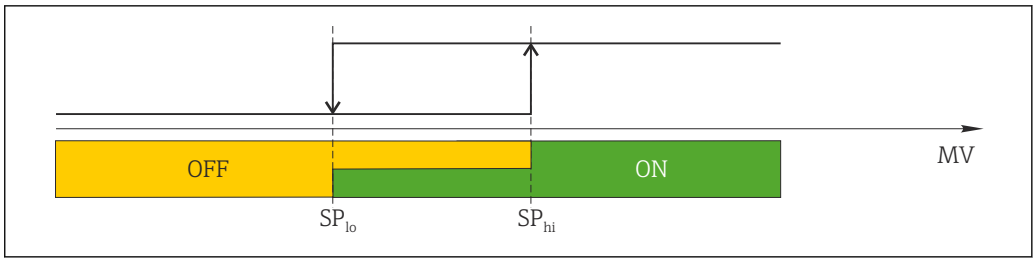


7 *SSC, Window*

H Hysteresis
W Window
SP_{lo} Switch point with lower measured value
SP_{hi} Switch point with higher measured value
MV Measured value

Mode Two-point

SP_{hi} always corresponds to whichever value is higher, SP1 or SP2, while SP_{lo} always corresponds to whichever value is lower, SP1 or SP2.
Hysteresis is not used.



8 SSC, Two-Point

SP_{lo} Switch point with lower measured value
SP_{hi} Switch point with higher measured value
MV Measured value

8.4 Protecting settings from unauthorized access

Write protection can be activated using A WRITE LOCK DIP switch on the back of the optional plug-on display. See also the 'Local operation' section.

When write protection is active, parameters cannot be modified. A lock symbol on the display indicates that write protection is on. Write protection remains active even when the display is removed. To disable write protection, the display must be attached to the transmitter with the DIP switch deactivated (WRITE LOCK = OFF). The transmitter adopts the setting during operation and does not need to be restarted.

9 Diagnosis and troubleshooting

9.1 General troubleshooting

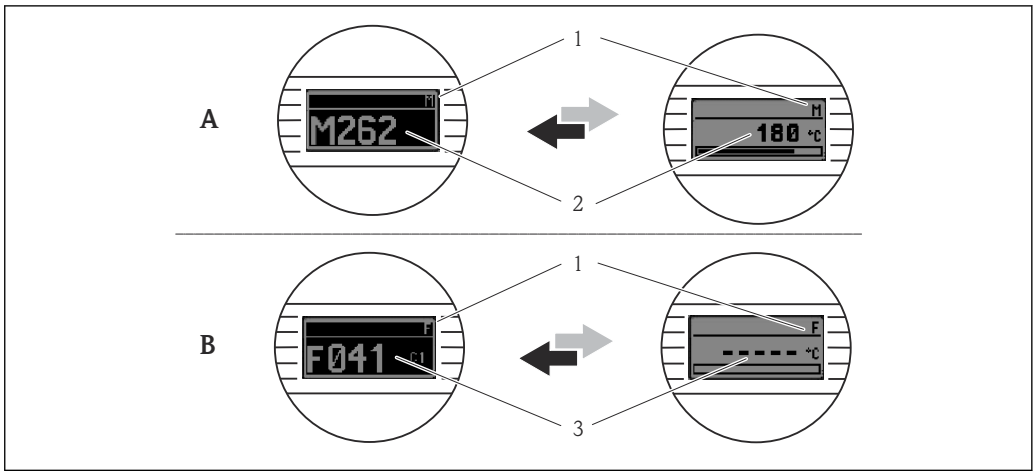
Always start troubleshooting with the checklists below if faults occur after startup or during operation. The checklists take you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

Due to its design, the device cannot be repaired. However, it is possible to send the device in for examination. See the information in the "Return" section.

General errors

Error	Possible cause	Remedial action
Device is not responding.	Supply voltage does not match the voltage specified on the nameplate.	Check the voltage at the transmitter directly using a voltmeter and correct.
	Connecting cables are not in contact with the terminals.	Check the contacting of the cables and terminals and correct if necessary.
	Electronics module is defective.	Replace the device.
Measured value is incorrect/ inaccurate.	Incorrect sensor orientation.	Install the sensor correctly.
	Heat conducted by sensor.	Observe the installed length of the sensor.
	Device configuration is incorrect (number of wires).	Change the **Connection type** device function.
	Incorrect RTD configured.	Change the **Sensor type** device function.
	Connection of the sensor (number of wires or incorrectly connected)	Check that the sensor is connected correctly.
	The cable resistance of the sensor (2-wire) was not compensated.	Compensate the cable resistance.
	Offset incorrectly set.	Check offset.
No communication	Communication cable is not connected.	Check wiring and cables.
	Communication cable is incorrectly attached to the IO-Link master.	

9.2 Diagnostic information on local display



A0014837

A Display in the event of a warning
B Display in the event of an alarm
1 Status signal in the header
2 The display alternates between the primary measured value and the status - indicated by the appropriate letter (M, C or S) - plus the defined error number.
3 The display alternates between "- - - -" (no valid measured value) and the status - indicated by the appropriate letter (F) - plus the defined error number.

9.3 Diagnostic information via communication interface

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	⊗	Operating error	An operating error has occurred.
C	▽	Service mode	The device is in service mode (e.g. during a simulation).
S	⚠	Out of specification	The device is being operated outside its technical specifications (e.g. during startup or cleaning processes).
M	◈	Maintenance required	Maintenance is required.

9.3.1 Behavior of the device in the event of a failure

All diagnostic messages are saved in the event logbook and can be called up there.

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 NE 107. A distinction must be made between the following types of diagnostic behavior in this context:

- Warning
  The device continues measuring in the event of warning-type diagnostic behavior. The output signal is not affected (exception: simulation of the process variable is active).
- Alarm
  - The device does **not** continue measuring if this type of error occurs. The output signal assumes its error status (value in the event of an error - see section 'Overview of diagnostic information').
  - The PDValid Flag indicates that the process data are invalid.
  - The fault state is displayed via IO-Link.

9.3.2 Overview of the diagnostic information

Diagnostic message	Diagnostic behavior	IO-Link Event Qualifier	IO-Link Event Code	Cause	Corrective measure
F041	Alarm	IO-Link error	0x8D3D	Sensor breakage detected	1. Check electrical connection. 2. Replace sensor. 3. Check configuration of connection type.
F043	Alarm	IO-Link error	0x8D00	Sensor short circuit detected	1. Check electrical connection. 2. Check sensor. 3. Replace sensor or cable.
S047	Warning	IO-Link warning	0x1819	Sensor limit reached	1. Check sensor. 2. Check process conditions.
F201	Alarm	IO-Link error	0x8D02	Electronics faulty	1. Restart the device. 2. Replace electronics.
C401	Warning	IO-Link Notification	0x181F	Factory reset active	▶ Factory reset in progress, please wait.
C402	-	-	-	Initialization active	▶ Initialization in progress, please wait.
F410	Alarm	IO-Link error	0x8D0A	Data transfer failed	1. Check connection. 2. Repeat data transfer.
C411	Warning	IO-Link warning	0x1808	Up-/download active	▶ Up-/download in progress, please wait.
F419	Alarm	IO-Link error	0x1856	Power cycle required	▶ Power cycle device.
C485	Warning	IO-Link warning	0x181A	Process variable simulation active	▶ Deactivate simulation.
C494	Warning	IO-Link warning	0x181C	Switch output simulation active	▶ Deactivate simulation switch output.
F537	Alarm	IO-Link error	0x181D	Configuration	1. Check device configuration. 2. Up- and download new configuration.
S801	Warning	IO-Link warning	0x181E	Supply voltage too low	▶ Increase supply voltage.
S804	Alarm	IO-Link warning	0x1801	Switch output overloaded	1. Increase load resistance at switch output. 2. Check the output. 3. Replace device.
S825	Warning	IO-Link warning	0x1812	Electronics temperature out of range	1. Check ambient temperature. 2. Check process temperature.

9.4 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.

9.5 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.

9.6 Firmware history

Revision history

The firmware version (FW) on the nameplate and in the Operating Instructions indicates the device release: XX.YY.ZZ (example 01.02.01).

XX Change to main version. No longer compatible. The device and Operating Instructions change.

YY Change to functions and operation Compatible. The Operating Instructions change.

ZZ Fixes and internal changes No changes to the Operating Instructions.

Date	Firmware version	Changes	Documentation
04/2024	01.01.zz	Original firmware	BA02291O/09/EN/01.23

10 Maintenance and cleaning

No special maintenance work is required for the device.

10.1 Cleaning of surfaces not in contact with the medium

- Recommendation: Use a lint-free cloth that is either dry or slightly dampened using water.
- Do not use any sharp objects or aggressive cleaning agents that corrode the surfaces (displays, housing, for example) and seals.
- Do not use high-pressure steam.
- Observe the degree of protection of the device.

The cleaning agent used must be compatible with the materials of the device configuration. Do not use cleaning agents with concentrated mineral acids, bases or organic solvents.

11 Repair

11.1 General information

Due to its design, the device cannot be repaired.

11.2 Spare parts

Ask your supplier for information on spare parts available.

Type
Standard - DIN securing set (2 screws and springs, 4 shaft lock-down rings, 1 plug for the display interface)
US - M4 securing set (2 screws and 1 plug for the display interface)

11.3 Return

The requirements for safe device return can vary depending on the device type and national legislation. Please contact your supplier for further information.

11.4 Disposal

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

12 Accessories

Various accessories, which can be ordered separately from your supplier, are available for the device. Contact your service organization for detailed information on the relevant order code. When ordering accessories, please quote the serial number of the device!

12.1 Device-specific accessories

Adapter for DIN rail mounting, clip as per IEC 60715 (TH35) without securing screws
Standard - DIN mounting set (2 screws + springs, 4 securing disks and 1 display connector cover)
US - M4 securing screws (2 M4 screws and 1 CDI connector cover)
Attachable display unit for head transmitter

12.2 Communication-specific accessories

Accessory	Description
FieldPort SFP20	**Mobile configuration tool for all IO-Link devices:** ▪ The FieldPort SFP20 is a USB interface for the configuration of IO-Link devices. The FieldPort SFP20 can be connected to a laptop or tablet via a USB cable. ▪ A point-to-point connection between the laptop and IO-Link devices is possible with the FieldPort SFP20. ▪ M12 connection for IO-Link field devices
IO-Link master BL20	IO-Link master from Turck for DIN rails supports PROFINET, EtherNet/IP and Modbus TCP. With web server for easy configuration.

13 Technical data

13.1 Input

Measured variable: Temperature

Resistance thermometer (RTD) as per standard	Description	α	Measuring range limits
IEC 60751:2022	Pt100 (1) Pt1000 (4)	0.003851	−200 to +850 °C (−328 to +1 562 °F) −200 to +500 °C (−328 to +932 °F)
-	Callendar-Van Dusen	-	The measuring range limits are specified by entering the limit values that depend on the coefficients A to C and R0.
	▪ Type of connection: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA ▪ Cable resistance compensation possible in 2-wire version (0 to 30 Ω) ▪ With 3-wire and 4-wire connection, sensor wire resistance up to max. 50 Ω per wire		

13.2 Output

Output signal: C/Q (IO-Link or switch output)

Switch output:
- 1 × PNP, NPN or push-pull switch output, configurable
- Switching capacity Ia ≤ 150 mA
- Voltage drop PNP, NPN ≤ 2 V
- Overload protection: The switching current load is automatically tested. The device switches to a safe state if an overload is detected. The diagnostic message **Overload at the switch output** is issued.
- Switch functions:
  - Hysteresis or window function
  - NC contact or NO contact

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

The fault state of the switch output can be configured: On, off, high-impedance.

Damping:

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

Protocol-specific data:

IO-Link specification	Version 1.1.3
Device ID	0x93FE01
Manufacturer ID	0x0011 (17)
IO-Link Smart Sensor Profile 4.3.1	Supported: ▪ Identification and diagnosis ▪ Measuring and switching sensor, floating point, 1 channel
SIO	Yes
IO-Link transmission rate	COM2; 38.4 kBaud

Minimum cycle time	10 ms
Process data width	6 bytes
IO-Link data storage	Yes
Block configuration	Yes

Switch-on delay

≤ 5 s, until the first valid measured value signal is present

13.3 Power supply

Supply voltage

U = 18 to 30 V_{DC}, protected against reverse polarity

Current consumption

I ≤ 11 mA

Terminals

Choice of screw-type or push-in terminals:

Terminal design	Cable design	Cable cross-section
Screw terminals	Rigid or flexible	≤ 1.5 mm² (16 AWG)
Push-in terminals [1] (Cable design, stripping length = min. 10 mm (0.39 in)	Rigid or flexible	0.2 to 1.5 mm² (24 to 16 AWG)
	Flexible with ferrules (with or without plastic ferrule)	0.25 to 1.5 mm² (24 to 16 AWG)

1) Ferrules must be used with push-in terminals and when using flexible cables with a cable cross-section of ≤ 0.3 mm².

13.4 Performance characteristics

Response time

Response time:

Resistance temperature detector (RTD)	≤ 0.5 s

Reference operating conditions

- Calibration temperature: +25 °C ±3 K (77 °F ±5.4 °F)
- Supply voltage: 24 V DC
- 4-wire circuit for resistance adjustment

Maximum measurement error

In accordance with DIN EN 60770 and the reference conditions specified above. The measurement error data correspond to ±2 σ (Gaussian distribution). The data include non-linearities and repeatability.

	Measurement error (±)
in the entire measuring range	0.15 K

Sensor adjustment

Sensor-transmitter-matching

The device enables the following method to improve the temperature measurement accuracy of RTD sensors significantly:

Callendar-Van Dusen equation:
$R_T = R_0[1+AT+BT^2+C(T-100)T^3]$

The coefficients A, B and C are used to match the sensor and transmitter in order to improve the accuracy of the measuring system. The coefficients for a standard sensor are specified in IEC 60751. If no standard sensor is available or if greater accuracy is required, the coefficients for each sensor can be determined specifically with the aid of sensor calibration.

Sensor-transmitter matching using the method mentioned above significantly improves the temperature measurement accuracy of the entire system. This is because the transmitter uses the specific data pertaining to the connected sensor to calculate the measured temperature, instead of using the standardized sensor curve data.

1-point adjustment (offset)

Shifts the sensor value

Operating influences

Influence of ambient temperature and supply voltage on operation for resistance thermometers (RTD) in the entire measuring range

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change	Supply voltage: Influence (±) per V change
Pt100 (1)	IEC 60751:2022	0.04 °C (0.07 °F)	0.02 °C (0.04 °F)
Pt1000 (4)		0.02 °C (0.03 °F)	0.01 °C (0.02 °F)

Long-term drift (±)		
after 1 year	after 3 years	after 5 years
Based on measured value		
0.05 K	0.06 K	0.07 K

Calculation of the maximum measurement error:
√(Measurement error² + Influence of ambient temperature² + Influence of supply voltage²)

13.5 Ambient conditions

Ambient temperature: −40 to +85 °C (−40 to +185 °F)

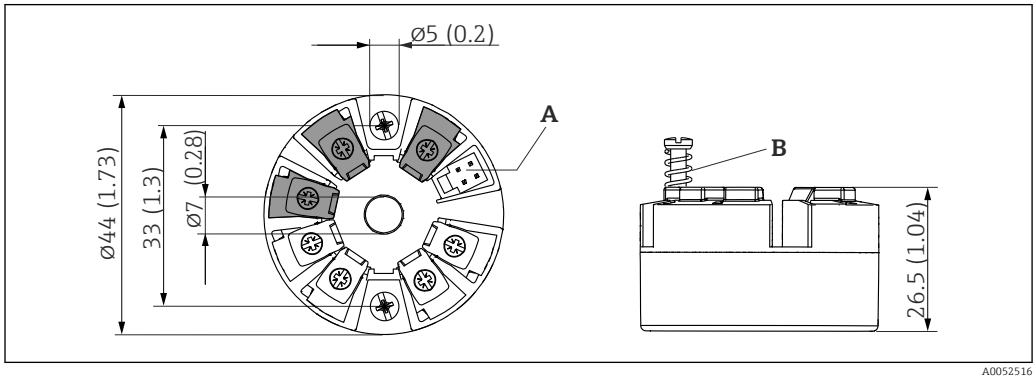
Storage temperature: −50 to +100 °C (−58 to +212 °F)

Altitude: Up to 4 000 m (13 123 ft) above sea level.

Humidity	▪ Condensation: Permitted ▪ Maximum relative humidity: 95 % as per IEC 60068-2-30
Climate class	Climate class C1 as per IEC 60654-1
Degree of protection	Head transmitter with screw-type or push-in terminals: IP 20. In the installed state, it depends on the terminal head used.
Shock and vibration resistance	Vibration resistance according to IEC 60068-2-6: ▪ 5 to 25 Hz, 1.6 mm ▪ 25 to 100 Hz, 4 g Vibration resistance according to IEC 60068-2-27: ▪ 30 g, 18 ms ▪ KTA 3505 (Section 5.8.4)
Electromagnetic compatibility (EMC)	**CE compliance** Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21). For details, refer to the Declaration of Conformity. Maximum measurement error <1% of measuring range. Interference immunity as per IEC/EN 61326 series, industrial requirements Interference emission as per IEC/EN 61326 series (CISPR 11), Class B equipment, Group 1 **IO-Link** The requirements of IEC/EN 61131-9 are met in IO-Link mode.
Overvoltage category	Overvoltage category II
Pollution degree	Pollution degree 2

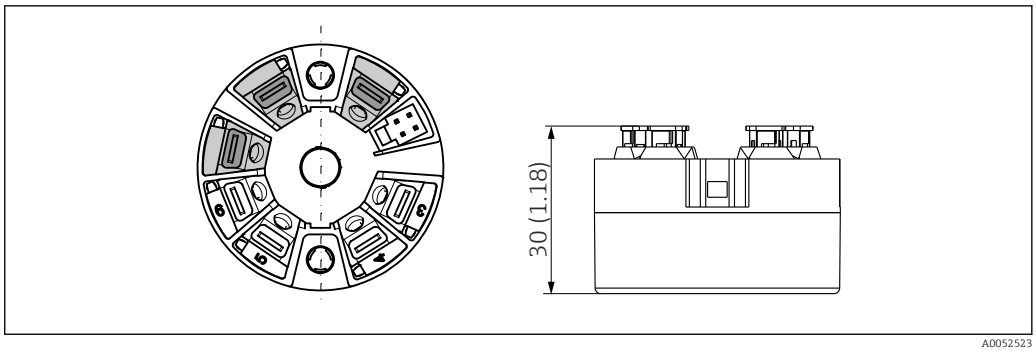
13.6 Mechanical construction

Design, dimensions	Dimensions in mm (in)



9 Version with screw terminals

A Display connection
B Spring travel L ≥ 5 mm (0.2 in) (not for US - M4 securing screws)



10 Version with push-in terminals. Dimensions are identical to the version with screw terminals, apart from housing height.

Weight

40 to 50 g (1.4 to 1.8 oz)

Materials

All the materials used are RoHS-compliant.

- Housing: polycarbonate (PC)
- Terminals:
  - Screw terminals: nickel-plated brass
  - Push-in terminals: tin-plated brass, contact springs 1.4310, 301 (AISI)
- Potting compound: SIL gel

13.7 Certificates and approvals

Currently available certificates and approvals for the product are available from the supplier.

MTTF

371 years

The mean time to failure (MTTF) denotes the theoretically expected time until the device fails during normal operation. The term MTTF is used for systems that cannot be repaired, e.g. temperature transmitters.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