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Operating Instructions **F2058HRTD**

4 to 20 mA RTD transmitter



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1 About this document

1.1 Document function

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

The document is part of the Operating Instructions and serves as a reference for parameters, providing a detailed explanation of each individual parameter of the operating menu.

The document serves as a reference for parameters, providing a detailed explanation of each individual parameter of the operating menu including service parameters.

The document provides basic information on application problems, how to identify and eliminate them as well as specific background knowledge on the devices and their functionalities.

1.2 Safety instructions

When using in hazardous areas, compliance with national regulations is mandatory. Separate Ex-specific documentation is provided for measuring systems that are used in hazardous areas. This documentation is an integral part of these Operating Instructions. The installation specifications, connection data and safety instructions it contains must be strictly observed! Make sure that you use the right Ex-specific documentation for the right device with approval for use in hazardous areas!

1.3 Symbols used

1.3.1 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.

ACAUTION

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.

1.3.2 Electrical symbols

Symbol	Meaning
	Direct current
\sim	Alternating current
\sim	Direct current and alternating current

Symbol	Meaning
÷	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective Earth (PE) A terminal which must be connected to ground prior to establishing any other connections.
	 The ground terminals are situated inside and outside the device: Inner ground terminal: Connects the protectiv earth to the mains supply. Outer ground terminal: Connects the device to the plant grounding system.

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1.3.3 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.
i	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.
L.	Result of a step.
?	Help in the event of a problem.
	Visual inspection.
A0028662	Operation via local display.

Symbol	Meaning
00029663	Operation via operating tool.
A0028665	Write-protected parameter.

Symbol	Meaning	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.	i	Tip Indicates additional information.
Ĩ	Reference to documentation.		Reference to page.
	Reference to graphic.	1., 2., 3	Series of steps.
ـ►	Result of a step.		Visual inspection.

1.3.4 Symbols in graphics

Symbol	Meaning
1, 2, 3	Item numbers
A, B, C,	Views
A-A, B-B, C-C,	Sections

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)

1.4 Tool symbols

Symbol	Meaning
	Flat-blade screwdriver
A0011220	
	Phillips head screwdriver
A0011219	
$\square \square$	Allen key
A0011221	
Ŕ	Open-ended wrench
A0011222	
0	Torx screwdriver
A0013442	

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel performing installation, commissioning, diagnostics and maintenance must satisfy the following requirements:

- Trained, qualified specialists must be suitably qualified to perform this function and task
- ► Are authorized by the plant owner/operator
- Are familiar with federal/national regulations
- They must have read and understood the instructions in the manual, supplementary documentation and certificates (depending on the application) prior to starting work
- ► They must follow instructions and comply with basic conditions

The operating personnel must satisfy the following requirements:

- They must be suitably trained and authorized by the plant operator to meet the requirements of the task
- They must 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 using the device incorrectly or for purposes for which it was not intended.

2.3 Operational safety

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

Hazardous area

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection or safety equipment):

- Based on the technical data on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area. The nameplate can be found on the side of the transmitter housing.
- Observe the specifications in the separate supplementary documentation that is an integral part of these instructions.

Electromagnetic compatibility

The measuring system complies with the general safety requirements as per EN 61010-1, the EMC requirements as per the IEC/EN 61326 series and the NAMUR recommendations NE 21.

NOTICE

► The device must be powered only by a power unit that operates using a limited-energy circuit in accordance with UL/EN/IEC 61010-1, Section 9.4 and the requirements in Table 18.

3 Incoming acceptance and product identification

3.1 Incoming acceptance

- **1.** Unpack the temperature transmitter carefully. Is the packaging or content free from damage?
 - └ Damaged components must not be installed as the manufacturer can otherwise not guarantee compliance with the original safety requirements or the material resistance, and can therefore not be held responsible for any resulting damage.
- 2. Is the delivery complete or is anything missing? Check the scope of delivery against your order.
- 3. Does the nameplate match the ordering information on the delivery note?
- **4.** Are the technical documentation and all other necessary documents provided? If applicable: are the Safety Instructions (e.g. XA) for hazardous areas provided?

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

3.2 Product identification

The following options are available for identification of the device:

- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note

3.2.1 Nameplate

The right device?

Compare and check the data on the nameplate of the device against the requirements of the measuring point:



■ 1 Nameplate of the head transmitter (example, Ex version)

1 Power supply, current consumption, ambient temperature

- 2 Firmware version, logos
- 3 Data Matrix 2D code
- 4 2 lines for the TAG name
- 5 Approval information in hazardous area
- 6 Serial number and product identification
- 7 Manufacturer identification8 Optional approval symbols
- 9 Additional logistics/sales/service information

3.2.2 Name and address of manufacturer

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

3.3 Scope of delivery

The scope of delivery of the device comprises:

- Temperature transmitter
- Mounting material (head transmitter), optional
- Printed copy of Brief Operating Instructions in English
- Additional documentation for devices which are suitable for use in the hazardous area (ATEX, CSA)

3.4 Certificates and approvals

The device left the factory in a safe operating condition. The device complies with the requirements of the standards EN 61010-1 "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use" and with the EMC requirements as per the IEC/EN 61326 21 series + NAMUR recommendation NE 21.

3.5 Transport and storage

Carefully remove all the packaging material and protective covers that are part of the transported package.

For dimensions and operating conditions, see "Mechanical construction" section.

When storing and transporting the device, pack it so that it is reliably protected against impact. The original packaging offers the best protection.

Storage temperature

Head transmitter: -50 to +100 °C (-58 to +212 °F)

4 Mounting

4.1 Mounting requirements

4.1.1 Dimensions

The dimensions of the device are provided in 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 (middle hole 7 mm).

A 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 accessory.

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

When using the device in hazardous areas, the limit values of the certificates and approvals must be observed (see Ex Safety Instructions).

4.2 Mounting requirements



4.2.1 Dimensions

2 Head transmitter version with screw terminals. Dimensions in mm (in)

- A Spring travel $L \ge 5$ mm (not for US M4 securing screws)
- B Mounting elements for attachable measured value display

C Interface for contacting measured value display

ľ

The same dimensions apply to the version with spring terminals.

4.2.2 Mounting location

- In the terminal head, flat face, as per DIN EN 50446, direct mounting on insert with cable entry (middle hole 7 mm)
- With clip on DIN rail as per IEC 60715, TH35

When installing the device in a terminal head, make sure there is enough space in the terminal head!

4.2.3 Important ambient conditions

- Ambient temperature: -40 to +85 °C (-40 to 185 °F).
- Head transmitter in accordance with climate class C1, DIN rail transmitter in accordance with B2 as per EN 60654-1
- Condensation as per IEC 60068-2-33 permitted for head transmitter, not permitted for DIN rail transmitter
- Max. rel. humidity: 95% as per IEC 60068-2-30
- Degree of protection:

Head transmitter with screw terminals: IP 00, with spring terminals: IP 30. When the device is installed, the degree of protection depends on the terminal head or field housing used.

4.3 Mounting the device

- A Phillips head screwdriver is required to mount the head transmitter:
- Maximum torque for securing screws = 1 Nm (³/₄ foot-pound), screwdriver: Pozidriv Z2
- Maximum torque for screw terminals = 0.35 Nm (¼ foot-pound), screwdriver: Pozidriv Z1



B 3 Head transmitter mounting

А	Mounting in a terminal head (terminal head flat face as per DIN 43729)	
1	Terminal head	
2	Circlips	
3	Insert	
4	Connection wires	
5	Head transmitter	
6	Mounting springs	

А	Mounting in a terminal head (terminal head flat face as per DIN 43729)	
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 fix both mounting screws with the snap rings (2).
- 5. Then tighten the head transmitter (5) along with the insert (3) in the terminal head.
- 6. After wiring , close the terminal head cover (8) tightly again.

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

4.3.1 Mounting typical of North America



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



☑ 5 Head transmitter mounting

Structure of thermometer with RTD sensors and head transmitter:

- **1.** Fit the thermowell (1) on the process pipe or the container wall. Secure the thermowell according to the instructions before the process pressure is applied.
- 2. Fit the necessary neck tube nipples and adapter (3) on the thermowell.
- 3. Make sure sealing rings are installed if such rings are needed for harsh environmental conditions or 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) in such a way that the power supply lines (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 the connection wires up to the transmitter .
- 8. Screw the terminal head (4), with the integrated and wired head transmitter, onto the ready-mounted nipple and adapter (3).

NOTICE

The terminal head cover must be secured properly to meet the requirements for explosion protection.

• After wiring, securely screw the terminal head cover back on.

4.4 Post-mounting check

After installing the device, always perform the following final checks:

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

Device condition and specifications	Notes
Are the device, the connections and connecting cables free of damage (visual inspection)?	-
Do the ambient conditions match the device specification (e.g. ambient temperature, measuring range, etc.)?	→ 🖺 11
Have connections been established correctly and with the specified torque?	-

5 Electrical connection

ACAUTION

- Switch off the power supply before installing or connecting the device. Non-compliance
 may result in the destruction of parts of the electronics.
- ▶ Do not occupy the CDI connection. An incorrect connection can destroy 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 $\rightarrow \cong$ 14. If the head transmitter is fitted with pushin terminals, pay particular attention to the information in the "Connecting to push-in terminals" section. $\rightarrow \cong$ 15
- 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



Image: Terminal assignment of head transmitter

- 1 RTD sensor input: 4-, 3- and 2-wire
- 2 Power supply
- 3 CDI interface

NOTICE

 ESD - Electrostatic discharge. Protect the terminals from electrostatic discharge. Non-compliance may result in the destruction or malfunction of parts of the electronics.

Maximum torque for screw terminals = $0.35 \text{ Nm} (\frac{1}{4} \text{ lbf ft})$, screwdriver: Pozidriv Z1

5.3 Connecting the sensor input

5.3.1 Connecting to push-in terminals



☑ 7 Push-in terminal connection, using the example of a head transmitter

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

The instrument cable is not subject to special requirements, such as shielding requirements for example.

Please also observe the general procedure on $\rightarrow \implies 14$.

- The terminals for the power supply (1+ and 2-) are protected against reverse polarity.
 - Cable cross-section, see the "Technical data", \rightarrow 🖺 28



- Fitting the CDI connector of the configuration kit for configuration, visualization and maintenance of the head transmitter via PC and configuration software • 8
- Configuration kit with USB port CDI connector 1
- 2
- Installed head transmitter with CDI interface 3

Post-connection check 5.5

Device condition and specifications	Notes
Are the device or cables undamaged (visual check)?	
Electrical connection	Notes
Does the supply voltage match the specifications on the nameplate?	Head transmitter: U = e.g. 10 to 36 V_{DC}
Do the mounted cables have adequate strain relief?	
Are the power supply and signal cables correctly connected?	→ 🗎 14
Are all the screw terminals well tightened and have the connections of the push-in terminals been checked?	
Are all cable entries mounted, firmly tightened and leak-tight?	

6 Operation options

6.1 Overview of operation options



Operation options for the transmitter via the CDI interface

- 1 Transmitter
- 2 Configuration kit
- 3 Configuration software

6.2 Structure and function of the operating menu

6.2.1 Structure of the operating menu



User roles

Navigation

System → User management

The role-based access concept consists of two hierarchical levels for the user and presents the various user roles with defined read/write authorizations derived from the NAMUR shell model.

Operator

The plant operator can only change settings that do not affect the application - and particularly the measuring path - and simple, application-specific functions that are used during operation. The operator is able to read all the parameters, however.

Maintenance

The **Maintenance** user role refers to configuration situations: commissioning and process adaptations as well as troubleshooting. It allows the user to configure and modify all available parameters. In contrast to the **Operator** user role, in the Maintenance role the user has read and write access to all the parameters.

Changing the user role

A user role - and therefore existing read and write authorization - is changed by selecting the desired user role (already pre-selected depending on the operating tool) and entering the correct password when subsequently prompted. When a user logs out, system access always returns to the lowest level in the hierarchy. A user logs out by actively selecting the logout function when operating the device.

As-delivered state

The **Operator** user role is not enabled when the device is delivered from the factory, i.e. the **Maintenance** role is the lowest level in the hierarchy ex-works. This state makes it possible to commission the device and make other process adaptations without having to enter a password. Afterwards, a password can be assigned for the **Maintenance** user role to protect this configuration. If the option *Configuration locked when delivered* was selected during device configuration, the device is set to the **Operator** user role when delivered. It is therefore not possible to change the configuration. The delivery password stored can be reset and reassigned.

Password

The **Maintenance** user role can assign a password in order to restrict access to device functions. This activates the **Operator** user role, which is now the lowest hierarchy level where the user is not asked to enter a password. The password can only be changed or disabled in the **Maintenance** user role.

Submenus

The **Standard** or **Expert** mode can be selected in the FDC operating tool. The following operating menus appear depending on the setting:

Navigation

Menu	Typical tasks	Content/meaning
"Basic setup"	 Commissioning: Configuration of the measurement. Configuration of data processing (scaling, linearization, etc.). Configuration of the analog measured value output. 	Contains parameters for basic commissioning: configuration of the measurement and the analog current output
"Device information"	Tasks during operation: Reading measured values. Information for device identification.	Contains all the current measured values and parameters for the unique identification of the device.

Standard

Navigation

Expert

Menu	Typical tasks	Content/meaning
"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 Displays the error message that is currently active "Current output simulation" submenu Used to simulate output values.
"Application"	 Commissioning: Configuration of the measurement. Configuration of data processing (scaling, linearization, etc.). Configuration of the analog measured value output. Tasks during operation: Reading measured values. 	Contains all the parameters for commissioning:
"System"	 Tasks that require detailed knowledge of the system administration of the device: Optimum adaptation of the measurement for system integration. User and access administration, password control Information for device identification 	Contains all higher-level device parameters that are assigned to system, device and user management. • "Device management" submenu Contains parameters for general device management • "User management" submenu Parameters for access authorization, password assignment, etc. • "Information" submenu Contains all the parameters for the unique identification of the device

6.3 Access to the operating menu via the operating tool

6.3.1 Field Device Configurator (FDC) Tool

Function scope

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.

Source for device description files

www.fielddeviceconfig.com



7 Commissioning

7.1 Post-installation check

Before commissioning the measuring point make sure that all final checks have been carried out:

- "Post-installation check" checklist $\rightarrow \square 10$
- "Post-connection check" checklist $\rightarrow \square 14$

7.2 Switching on the transmitter

Once you have completed the post-connection checks, switch on the supply voltage. The transmitter performs a number of internal test functions after power-up.

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

7.3 Configuring the measuring device

The starting point is in the **Basic setup** menu. Parameter settings that require specific access permissions may be disabled. In order to use a device for the designated application, one of the first steps that need to be performed is the basic setup.

Navigation \Box Standard \rightarrow Basic setup

The following parameters can be configured:

Unit Sensor type Connection type 2-wire compensation Lower range value output Upper range value output Failure mode

In the final section, a password can be defined for the "Maintenance" user role. This is strongly recommended to protect the device against unauthorized access. The following steps describe how to configure a password for the "Maintenance" role for the first time.

Navigation \Box Expert \rightarrow System \rightarrow User management

Access status Logout Delete password

1. In the "Access status" field, the **Maintenance** role appears with the two entry fields **Logout** and **Delete password**.

2. **Logout** function:

Enable the **Logout** entry field.

- └→ The **Operator** role appears in the "Access status" field. The **Enter access code** entry field is displayed.
- **3.** To return to the **Maintenance** role, enter a four-digit access code, which you have already defined, in this entry field.
 - └ The **Maintenance** role appears in the "Access status" field.

4. **Delete password** function:

Enable the **Delete password** entry field.

- 5. In the **Define software write protection code** entry field, enter a user-defined password that meets the specifications in the online help.
 - └ The startup screen as described in Step 1 appears.

Once the password has been entered successfully, parameter changes, particularly those that are needed for commissioning, process adaptation/optimization and troubleshooting, can only be implemented in the **Maintenance** user role and if the password is entered successfully.

7.4 Protecting settings from unauthorized access

7.4.1 Software locking

By assigning a password for the **Maintenance** user role, it is possible to restrict access authorization and protect the device against unauthorized access.

The parameters are also protected against modification by logging out of the **Maintenance** user role and switching to the **Operator** role. A lock symbol appears.

To disable the write protection, the user must log on with the **Maintenance** user role via the relevant operating tool.



Diagnostics and troubleshooting 8

General troubleshooting 8.1

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 faults

Fault	Possible cause	Remedial action
Device does not respond.	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.	Ensure electrical contact between the cable and the terminal.
	Electronics module is defective.	Replace the device.
Output current < 3.6 mA	Signal cable is not wired correctly.	Check wiring.
	Electronics module is defective.	Replace the device.
	'Low Alarm' failure current is set	Set the failure current to 'High Alarm'.

Error messages in the configuration software	
→ 🗎 23	

Application errors without status messages for RTD sensor connection

Fault	Possible cause	Remedial action
	Incorrect sensor orientation.	Install the sensor correctly.
	Heat conducted by sensor.	Observe the installed length of the sensor.
	Device programming is incorrect (number of wires).	Change the Connection type device function.
Measured value is incorrect/	Device programming is incorrect (scaling).	Change scaling.
maccurate	Incorrect RTD configured.	Change the Sensor type device function.
	Sensor connection.	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.
	Faulty sensor.	Check the sensor.
Failure current (≤ 3.6 mA or ≥ 21 mA)	RTD connected incorrectly.	Connect the connecting cables correctly (terminal diagram).
	Device programming is incorrect (e.g. number of wires).	Change the Connection type device function.
	Incorrect programming.	Incorrect sensor type set in the Sensor type device function. Set the correct sensor type.

8.2 Diagnostic information via communication interface

Status signals

Letter/ symbol ¹⁾	Event category	Meaning
F 😣	Operating error	An operating error has occurred.
C 🖤	Service mode	The device is in the service mode (e.g. during a simulation).
SÀ	Out of specification	The device is being operated outside its technical specifications (e.g. during warm- up or cleaning processes).
M�	Maintenance required	Maintenance is required.
N -	Not categorized	

1) As per NAMUR NE107

Diagnostic behavior

Alarm	The measurement is interrupted. The signal outputs adopt the defined alarm condition. A diagnostic message is generated.	
Warning	The device continues to measure. A diagnostic message is generated.	
Disabled	The diagnosis is completely disabled even if the device is not recording a measured value.	

8.3 Active diagnostics

If several diagnostic messages are pending at the same time, only the current diagnostic message is displayed. The status signal dictates the priority in which the diagnostic messages are displayed. The following order of priority applies: F, C, S, M.

8.4 Overview of diagnostic events

Each diagnostic event is assigned a certain event level at the factory.

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of ser	nsor			
041	Sensor interrupted	 Check electrical connection Replace sensor 1 Check connection type 	F	Alarm
043	Short circuit	 Check electrical connection Check sensor Replace sensor or cable 	F	Alarm
047	Sensor limit reached	 Check sensor Check process conditions 	S	Warning
Diagnostic of electronic				
201	Electronics faulty	 Restart device Replace electronics 	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of co	nfiguration			•
402	Initialization active	Initialization in progress, please wait	С	Warning
410	Data transfer failed	 Check connection Repeat data transfer 	F	Alarm
411	Up-/download active	Up-/download in progress, please wait	С	Warning
435	Linearization faulty	Check linearization	F	Alarm
485	Process variable simulation active	Deactivate simulation	М	Warning
491	Output simulation	Deactivate simulation	С	Warning
531	Factory adjustment missing	 Contact service organization Replace device 	F	Alarm
537	Configuration	 Check device configuration Up- and download new configuration 	F	Alarm
537	Configuration	Check current output configuration	F	Alarm
Diagnostic of pr	ocess			
801	Supply voltage too low	Increase supply voltage	S	Alarm
825	Operating temperature	 Check ambient temperature Check process temperature 	S	Warning
844	Process value out of specification	 Check process value Check application Check sensor 	S	Warning

8.5 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.
101	

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
12/2021	01.01.zz	Original firmware	BA022220/09/EN/01.21

9 Maintenance

No special maintenance work is required for the device.

Cleaning

A clean, dry cloth can be used to clean the device.

10 Repair

10.1 General information

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

10.2 Spare parts

Ask your supplier for information on available spare parts.

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Туре
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Standard - DIN mounting set (2 screws and springs, 4 lock washers, 1 CDI connector cover)
US - M4 mounting set (2 screws and 1 CDI connector cover)
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10.3 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.

10.4 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.

11 Accessories

Various accessories, which can be ordered separately from your supplier, are available for the device.

11.1 Device-specific accessories

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

11.2 Communication-specific accessories

Accessories	Description
FDC Tool	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.
Configuration kit	Configuration kit for PC-programmable transmitter – FDT/DTM-based plant asset management tool and interface cable (4-pin plug-in connector) for PC with USB port.

12 Technical data

12.1 Input

Measured variable

Temperature (temperature-linear transmission behavior)

Resistance thermometer (RTD) as per standard	Designation	α	Measuring range limits	Min. span
IEC 60751:2008	Pt100 (1) Pt1000 (4)	0.003851	-200 to +850 ℃ (-328 to +1562 ℉) -200 to +250 ℃ (-328 to +482 ℉)	10 K (18 °F)
JIS C1604:1984	Pt100 (5)	0.003916	–200 to +510 °C (–328 to +950 °F)	10 K (18 °F)
GOST 6651-94	Pt100 (9)	0.003910	-200 to +850 °C (-328 to +1562 °F)	10 K (18 °F)
-	Pt100 (Callendar van Dusen)	-	The measuring range limits are specified by entering the limit values that depend on the coefficients A to C and RO.	10 K (18 °F)
	 Type of connection: 2-wire, 3- With 2-wire circuit, compensa With 3-wire and 4-wire connection 	wire or 4-wire con ation of wire resist ection, sensor wire	ance possible (0 to 30 Ω) e resistance up to max. 50 Ω per wire	

12.2 Output

Output signal	Analog output	4 to 20 mA, 20 to 4 mA (can be inverted)
Failure information	Failure information as per NAMUR N	E43:
	Failure information is created if the me error with the highest priority is display	asuring information is missing or not valid. The red.
	Underranging	Linear drop from 4.0 to 3.8 mA
	Overranging	Linear increase from 20.0 to 20.5 mA
	Failure e.g. sensor failure; sensor short-circuit	\leq 3.6 mA ("Low") or \geq 21 mA ("High"), can be selected
Linearization/transmission behavior	Temperature-linear	
Filter	1st order digital filter: 0 to 120 s	
	Network frequency filter: 50/60 Hz (car	nnot be adjusted)
Switch-on delay	\leq 5 s, until the first valid measured value signal is present at the current output. While switch-on delay = I_a \leq 3.8 mA	



12.3 **Power supply**

- 1 RTD sensor input: 4-, 3- and 2-wire
- 2 Power supply 3
- CDI interface

Terminal

Choice of screw or push-in terminals for sensor and power supply cables:

Terminal design	Cable design	Cable cross-section
Screw terminals	Rigid or flexible	$\leq 1.5 \text{ mm}^2$ (16 AWG)
Spring terminals ¹⁾ (Cable design,	Rigid or flexible	0.2 to 1.5 mm ² (24 to 16 AWG)
stripping length = min. 10 mm (0.39 in)	Flexible with wire end ferrules with/without plastic ferrule	0.25 to 1.5 mm² (24 to 16 AWG)

1) Wire end ferrules must be used with spring terminals and when using flexible cables with a cable crosssection of $\leq 0.3 \text{ mm}^2$.

12.4 **Performance characteristics**

Response time	≤ 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 measured error	In accordance with DIN EN 60770 and the reference conditions specified above. The measured error data correspond to $\pm 2~\sigma$ (Gaussian distribution). The data include non-linearities and repeatability.
	MV = measured value

LRV = lower range value of sensor

Transmitter measured error

Version	Measured error (±)
In entire measuring range	0.15 K or 0.07 % of span $^{1)}$
Increased accuracy in limited measuring range, -50 to +250 °C (-58 to +482 °F)	0.1 K or 0.07 % of span $^{1)}$

1) whichever is higher

The measured error data correspond to 2 σ (Gaussian distribution)

Operating influences The measured error data correspond to 2 σ (Gaussian distribution).

Operating influences: ambient temperature and supply voltage for resistance temperature detector (RTD)

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change		Supply voltage: Influence (±) per V change	
		0 to +200 ℃ (+32 to +392 ℉)	Entire measuring range	0 to +200 °C (+32 to +392 °F)	Entire measuring range
Pt100 (1)	- IEC 60751:2008	0.02 °C (0.04 °F)	0.04 °C (0.07 °F)	0.01 °C (0.014 °F)	0.02 °C (0.04 °F)
Pt1000 (4)		0.01 °C (0.02 °F)	0.02 °C (0.03 °F)	0.01 °C (0.009 °F)	0.01 °C (0.02 °F)
Pt100 (5)	JIS C1604:1984	0.01 °C (0.03 °F)	0.03 °C (0.05 °F)	0.01 °C (0.011 °F)	0.02 °C (0.03 °F)
Pt100 (9)	GOST 6651-94	0.02 °C (0.04 °F)	0.04 °C (0.07 °F)	0.01 °C (0.014 °F)	0.02 °C (0.04 °F)

Long-term drift (±) ¹⁾		
after 1 year	after 3 years	after 5 years
Based on measured value		
0.05 K or 0.03 % of span	0.06 K or 0.04 % of span	0.07 K or 0.05 % of span

1) whichever is higher

Calculation of the maximum measured error of the analog value (current output): $\sqrt{(\text{Measured error}^2 + \text{Influence of ambient temperature}^2 + \text{Influence of supply voltage}^2)}$

Sensor adjustment	Sensor-transmitter-matching
	To significantly improve the temperature measurement accuracy of RTD sensors, the device enables the following method:
	Callendar-Van-Dusen coefficients (Pt100 RTD assembly) The Callendar-Van-Dusen equation is described as: $R_T = R_0[1+AT+BT^2+C(T-100)T^3]$
	The coefficients A, B and C are used to match the sensor (platinum) and transmitter in order to improve the accuracy of the measuring system. The coefficients for a standard sensor are specified in IEC 751. 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 explained 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

Current output adjuctment	Correction of the (i and (or 20 m Λ gurrent output value	
Current output aujustinent	correction of the 4 and/or 20 mA current output value.	

12.5 Environment

Ambient temperature	-40 to +85 °C (-40 to +185 °F),
Storage temperature	–50 to +100 °C (–58 to +212 °F)
Operating altitude	Up to 4000 m (4374.5 yards) above sea level.
Humidity	 Condensation: Permitted Max. rel. humidity: 95 % as per IEC 60068-2-30
Climate class	Climate class C1 according to IEC 60654-1
Degree of protection	With screw terminals: IP 00, with spring terminals: IP 30. In the installed state, it depends on the terminal head or housing used for field mounting.
Shock and vibration resistance	Vibration resistance as per DNVGL-CG-0339 : 2015 and DIN EN 60068-2-27 8.6 to 150 Hz at 3g
	Shock resistance as per KTA 3505 (section 5.8.4 Shock test)
Electromagnetic compatibility (EMC)	CE conformity
	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 measured 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, group 1 equipment
Measuring category	Measuring category II as per IEC 61010-1. The measuring category is provided for measuring on power circuits that are directly connected electrically with the low-voltage network.
Pollution degree	Pollution degree 2 as per IEC 61010-1

Mechanical construction 12.6

Design, dimensions

Dimensions in mm (in)



11 Version with screw terminals

Spring travel $L \ge 5$ mm (not for US - M4 securing screws) CDI interface for connecting a configuration tool Α

В



🖸 12 Version with spring 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 12.7 Certificates and approvals
CE mark	The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EC directives. The manufacturer confirms successful testing of the product by affixing to it the CE-mark.
Hazardous area approvals	More detailed information on the hazardous area versions that are currently available can be provided by the manufacturer. Separate Ex documentation contains all the relevant data for explosion protection.

CSA C/US	The device meets the requirements of "CLASS 2252 06 - Process Control Equipment" and "CLASS 2252 86 - Process Control Equipment (Certified to US Standards)"
Other standards and guidelines	 IEC 60529: Degrees of protection provided by enclosures (IP code) IEC/EN 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use IEC/EN 61326 series: Electromagnetic compatibility (EMC requirements)
MTTF	418 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.

