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Valid as of version
01.00.zz (Device firmware)

Products   Solutions   Services

Special Documentation
Proline Teqwave M 300

Heartbeat Verification application package
Modbus RS485

Endress+Hauser

People for Process Automation

Table of contents

1   Certification

1.1   Traceability according to ISO 9001

Heartbeat Verification verifies the requirement for the measuring device within the specified measuring tolerance with a confirmed total test coverage over the service life of the device. It thus fulfills the requirements for traceable verification according to ISO 9001:2015, Clause 7.1.5.2 Measurement traceability.

The certificate issued by an independent body (TÜV SÜD Industrieservices GmbH) is available via: *Device Viewer* (www.endress.com/deviceviewer): Enter serial number from nameplate.

1.2   TÜV certificate

Heartbeat Technology with Heartbeat Diagnostics and Heartbeat Verification is a test method integrated into the measuring device for the diagnosis and verification of measuring devices in the application over the service life of the device. The test is based on reference values that are incorporated in the measuring device, traceable from the factory and redundant in the device.

1.2.1   Test principles

- IEC 61508-2:2010-04, Annex C
- IEC 61508-3:2010-04, Clause 6
- ISO 9001:2015, Clause 7.1.5 Resources for monitoring and measuring

1.2.2   Test results

Heartbeat Verification confirms on demand that the device is functioning with the specified total test coverage (TTC). 95% (Total Test Coverage)

Heartbeat Technology fulfills the requirement for traceable verification according to ISO 9001:2015, Clause 7.1.5.2 Measurement traceability. According to the standard, the user is responsible for specifying the verification interval in accordance with requirements.

2 About this document

2.1 Document function

This manual is a Special Documentation and does not replace the Operating Instructions included in the scope of supply. It is a part of the Operating Instructions and serves as a reference for using the Heartbeat Technology function integrated in the measuring device.

2.2 Content and scope

This document contains descriptions of the additional parameters and technical data of the application package and detailed explanations regarding:

- Application-specific parameters
- Advanced technical specifications

2.3 Symbols

2.3.1 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.

⚠ CAUTION

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

NOTICE

This symbol contains information on procedures and other facts which do not result in personal injury.
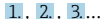
2.3.2 Symbols for certain types of information

Symbol	Meaning
✔	**Permitted** Procedures, processes or actions that are permitted.
✗	**Forbidden** Procedures, processes or actions that are forbidden.
🛈	**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

2.3.3 Symbols in graphics

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

2.4 Documentation

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

This Special Documentation and other documentation is available:
In the Download Area of the Endress+Hauser website: www.endress.com → Downloads

This documentation is an integral part of the following Operating Instructions:

Measuring device	Documentation code
Teqwave M 300 Modbus RS485	BA02321D

The following certification is available for this documentation:

Certification	Documentation code
Teqwave M 300/500 manufacturer declaration	HE_01847_01.23

2.5 Registered trademarks

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

3 Product features and availability

3.1 Product features

Heartbeat Technology offers diagnostic functionality through continuous self-monitoring, the transmission of additional measured variables to an external Condition Monitoring system and the in-situ verification of measuring devices in the application.

The test scope achieved using these diagnostic and verification tests is expressed as the **total test coverage** (TTC). The TTC is calculated using the following formula for random errors (calculation based on FMEDA as per IEC 61508):

$$TTC = (\lambda_{TOT} - \lambda_{du}) / \lambda_{TOT}$$

λ_{TOT}:   Rate of all theoretically possible failures

λ_{du}:   Rate of undetected dangerous failures

Only the dangerous undetected failures that are not captured by the device diagnostics can falsify the measured value that is output or interrupt the output of measured values.

Heartbeat Technology checks the device function within the specified measuring tolerance with a defined TTC. The defined TTC is indicated in the product-specific TÜV certificate (TÜV = Technical Inspection Association).

The current value for the TTC depends on the configuration and integration of the measuring device. It is determined under the following basic conditions:
- Simulation operation not active
- Error behavior, current output set to **Minimum alarm** or **Maximum alarm** and evaluation unit recognizes both alarms
- Settings for diagnostic behavior correspond to factory settings

3.2 Availability

The application package can be ordered together with the device or can be activated subsequently with an activation code. Detailed information on the order code is available via the Endress+Hauser website www.endress.com or from your local Endress+Hauser Sales Center.

3.2.1 Order code

If ordering directly with the device or later on as a retrofit kit:
Order code for "Application package", option EB "Heartbeat Verification"

The availability of the application package can be checked as follows:
- Order code with breakdown of the device features on the delivery note
- Call up the Device Viewer via the website www.endress.com/deviceviewer: enter the serial number from the nameplate and check whether the feature is displayed
- In the operating menu Expert → System → Administration : The **Software option overview** parameter indicates whether the application package is enabled

3.2.2 Activation

A retrofit kit is supplied if the application package is ordered subsequently. This kit includes a tag plate with device data and an activation code.

For detailed information on "Activating application packages via the software license code", see Installation Instructions EA01164D

3.2.3   Access

Heartbeat Technology is compatible with all the system integration options. Interfaces with digital communication are required to access the data saved in the device. The speed of data transmission depends on the type of communication interface used.

4 System integration

The **Heartbeat Technology** features are available via the local display module and the digital interfaces. The features can be used via an asset management system and also via the automation infrastructure (e.g. PLC).
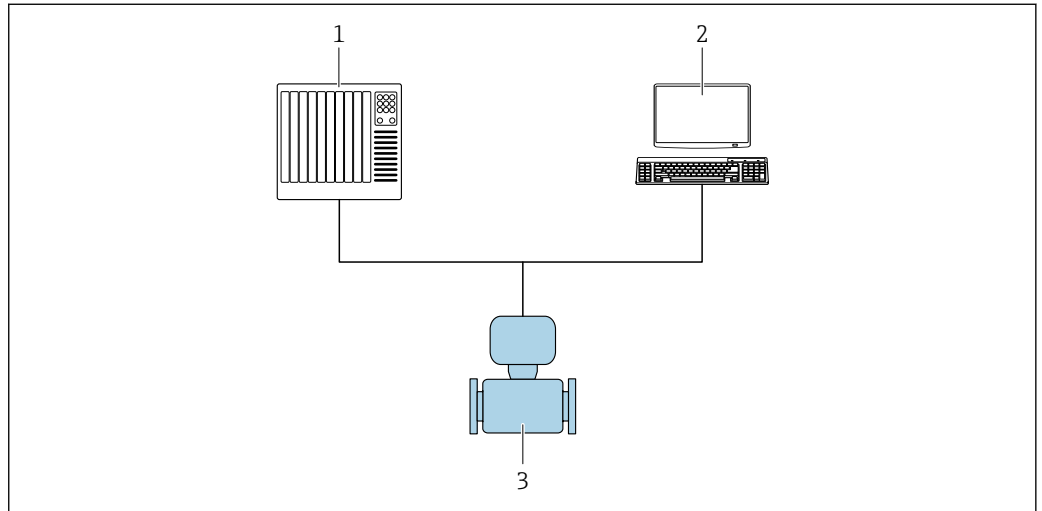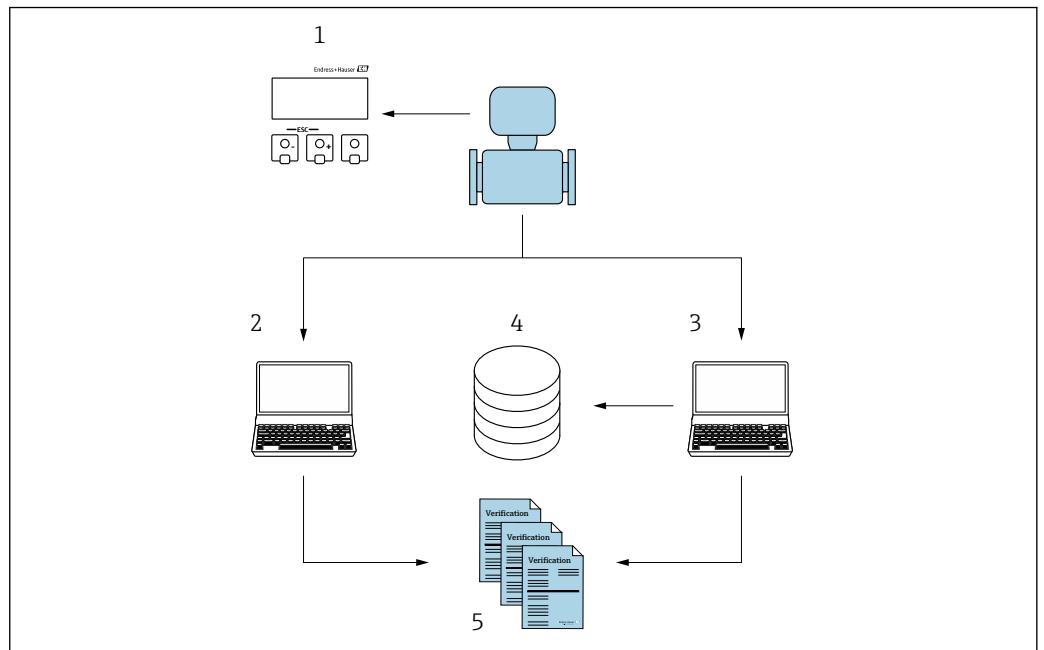

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▣ 1   General screen layout

1   PLC
2   Asset management system
3   Measuring device

4.1 Performing the verification and creating a verification report

A0031421

1   Local display
2   Web browser
3   FieldCare
4   Data memory in the measuring device
5   Verification report

Run **Heartbeat Verification** via one of the following interfaces:
- System integration interface of a higher-level system
- Local display
- WLAN interface
- CDI-RJ45 service interface (CDI: Common Data Interface)

The device must be accessed externally from a higher-level system via the system integration interface in order to start a verification and signal the verification result (Passed or Failed). It is not possible to start the verification via an external status signal and relay the results to a higher-level system via the status output.

The detailed results of the verification (8 data records) are saved in the device and provided in the form of a verification report.

Verification reports can be generated with the help of the device DTM, web server integrated in the measuring device or Endress+Hauser's FieldCare plant asset management software.

With the Flow Verification DTM, FieldCare also offers the possibility of data management and of archiving the verification results to create traceable documentation.

The Flow Verification DTM also enables trend analysis – i.e. the ability to monitor, compare and track the verification results of all the verifications performed on the device. This can be used for evaluation purposes, for example to extend factory recalibration.

Data exchange can take place automatically or be triggered by a user.

4.2   Integration in the PLC system

The verification function integrated in the measuring device can be activated by a control system and the results checked.

📖 For further information on "System integration", see the Operating Instructions (documentation code)

The following procedure must be implemented for this purpose:
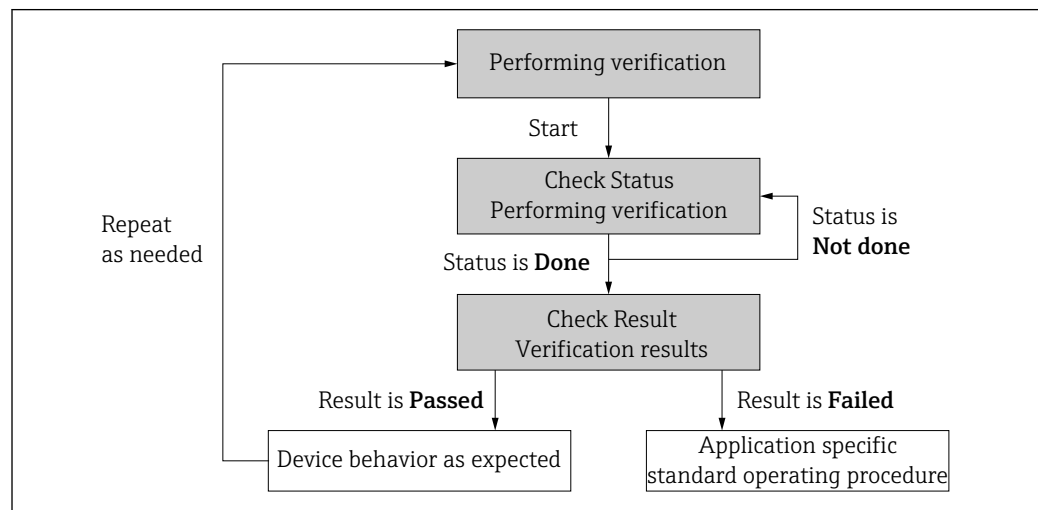
A0020258-EN

Verification result: The overall verification result is indicated in the **Overall result** parameter. Depending on the result, different application-specific measures must be performed by system routines; e.g. a "Maintenance Required" alert is triggered if the result is **Failed**.

4.3 Data availability for the user

4.3.1 Device

Heartbeat Verification
- Start verification.
- Read out the last verification result.

4.3.2 Asset management system

Heartbeat Verification
- Start verification in the operating menu.
- Read out, archive and document the verification results including detailed results with flow verification DTM and devices DTM.

4.3.3 PLC system

Heartbeat Verification
- Start verification.
- The user can read the verification result (pass/fail) in the system.

4.4 Data management

The results of a **Heartbeat Verification** are saved as a non-volatile parameter set in the measuring device memory:
- Availability of 8 storage locations for parameter data sets
- New verification results overwrite old data following the FIFO [1] principle

The results can be documented in the form of a verification report using the web server integrated in the measuring device the Endress+Hauser FieldCare asset management software and Netilion Health.

FieldCare also offers additional capabilities with the Flow Verification DTM:
- Archiving of verification results
- Export of data from these archives
- Trend analysis of verification results (line recorder function)

4.4.1 Data management via Web browser

Thanks to the integrated web server, the device can be operated and configured and a **Heartbeat Verification** performed. The results of the verification can be displayed and a verification report can be created.

Printing a verification report

A verification report is created in PDF format.

Prerequisite: A verification has already been performed.

User interface in the Web browser following login:

---

1)   First In – First Out

A0031439

1. Click the navigation buttons **Data management** → **Documents** → **Verification report**.
   ↳ The input area for downloading verification reports is displayed.
2. Enter the necessary information in the **Plant operator** and **Location** fields.
   ↳ The information entered here appears in the verification report.
3. Select the result data set.
   ↳ A result data set is indicated as a time stamp in the drop-down list.
   If no verification has been performed, the message "No result data set" is displayed here.
4. Click **Upload**.
   ↳ The Web server generates a verification report in PDF format.

4.4.2 Data management via device DTM

Thanks to the device DTM the device can be operated and a **Heartbeat Verification** performed. The results of the verification can be displayed and a verification report can be created.

4.4.3 Data management via Flow Verification DTM

The Flow Verification DTM allows you to perform a **Heartbeat Verification**. The results of the verification can be displayed and a verification report can be created.

The Flow Verification DTM offers advanced capabilities for managing and visualizing the results.
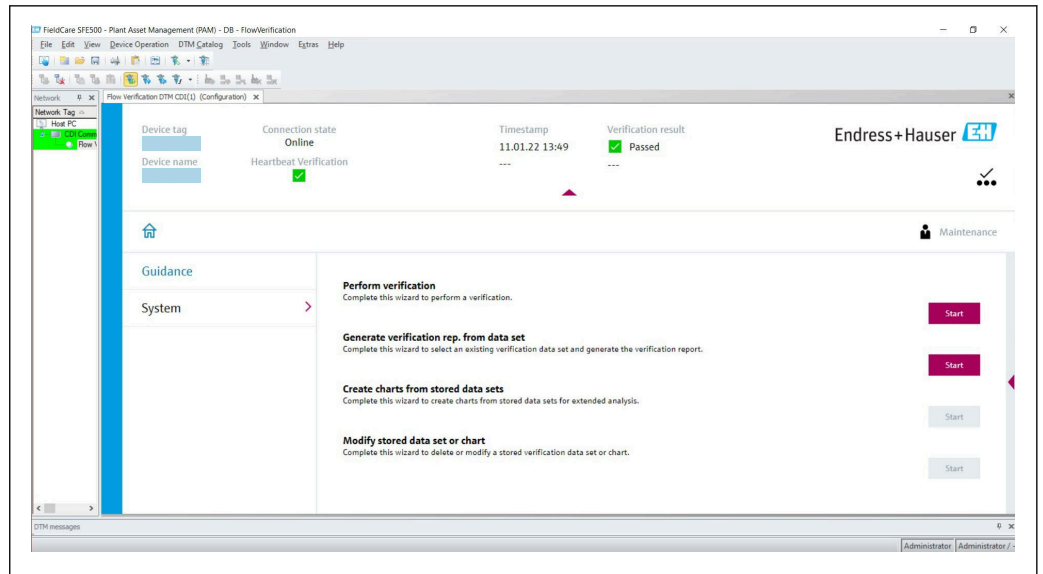
🔲 *2   "Flow Verification DTM" home page in FieldCare SFE500*

ℹ️ A wizard guides the user through four different processes step by step with help text.

| Entry point	Process description
Perform verification ℹ️ *Online connection to the device required.*	Perform verification and generate a verification report.
Generate verification report using a verification data set • from the device (online) • from archive (offline)	Select the existing verification data set and create the verification report.
Create charts for selected diagnostic parameters from stored verification data sets	Create charts for selected diagnostic parameters from archived verification data sets for the purpose of advanced analysis and trending.
Maintain stored verification data sets or chart templates	Delete or modify archived verification data sets or chart templates.

Perform verification
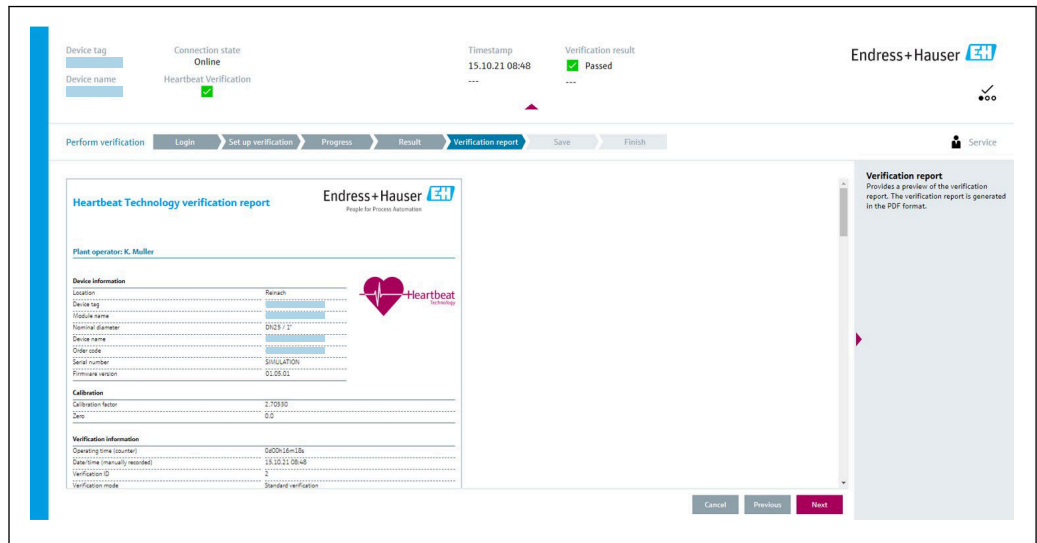
 3   *Example: Verification report displayed after verification has been performed*

ℹ️ Online connection to the device required.

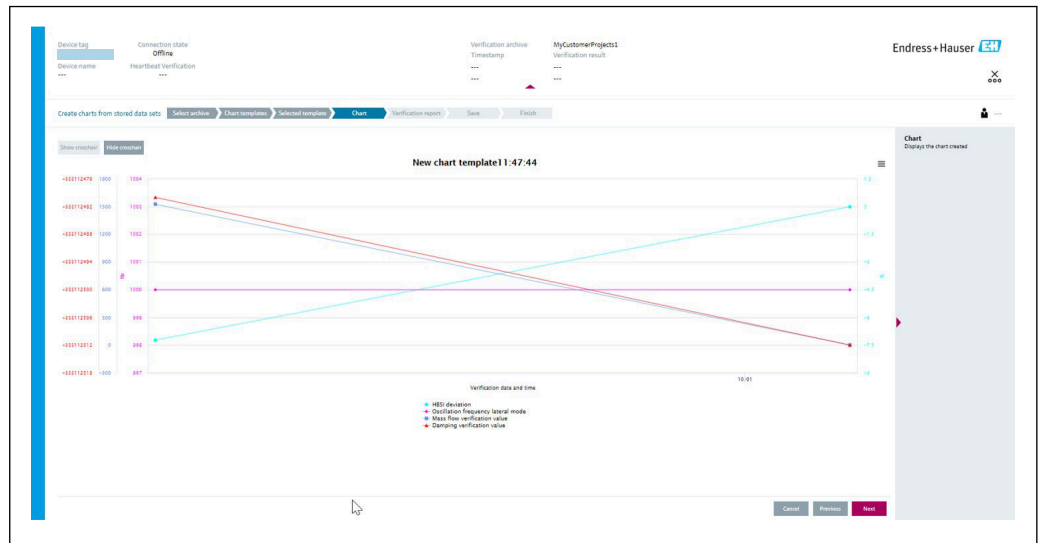**Generate verification report using a verification data set**
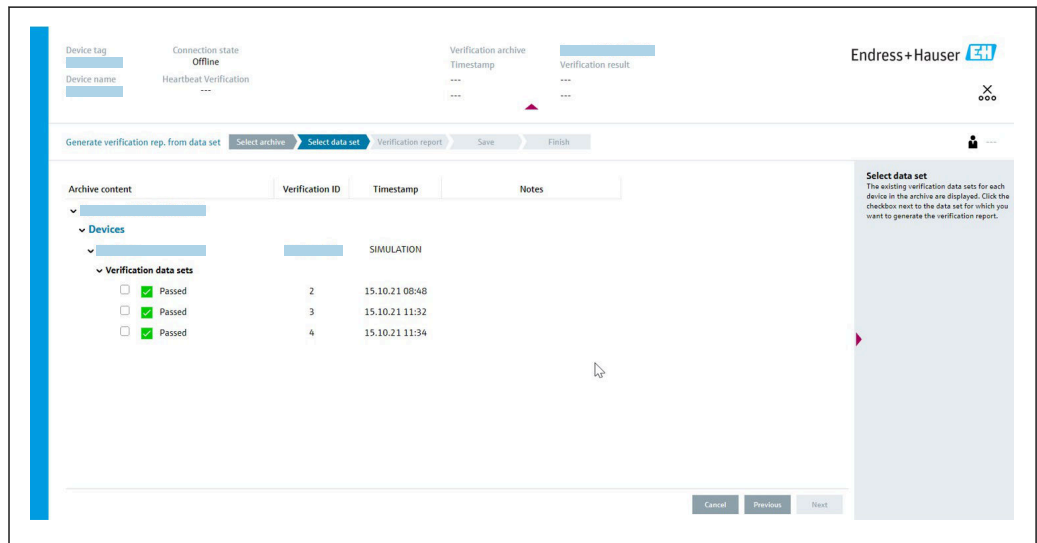
 4   *Example: Generating verification report using a verification data set*

ℹ️ Read the verification data set from
- Device: Online connection to device required.
- Archive: Offline operation sufficient.

Creating charts for selected diagnostic parameters from stored verification data sets

 🖼 *5*   *Example: Create charts you have edited yourself for selected diagnostic parameters from stored verification data sets*

i You can create your own templates.

Maintaining stored verification data sets or chart templates

 🖼 *6*   *Example: Deleting or modifying stored verification data sets or chart templates*

5 Heartbeat Verification

Heartbeat Verification checks the device function within the specified measuring tolerance on demand. The result of the verification is "Passed" or "Failed".

The verification data are saved in the device and optionally archived on a PC with the Asset Management Software DeviceCare or FieldCare on a PC. Based on this data, a verification report is generated automatically to ensure that traceable documentation of the verification results is available.

Heartbeat Technology offers two options for performing Heartbeat Verification:
- standard verification → 🖺 18
  Verification is performed by the device without manual checking of external measured variables.
- Extended verification → 🖺 21
  Verification includes the entry of external measured variables.

5.1 Performance characteristics

Heartbeat Verification is performed on demand and supplements permanent self-monitoring with additional checks .

The standard verification also checks the following analog inputs and outputs:
- 4 to 20 mA current output, active and passive
- Pulse/frequency output, active and passive
- 4 to 20 mA current input, active and passive
- Relay output

- 4 to 20 mA current output, active and passive
- Pulse/frequency output, active and passive

> 🛈 **Heartbeat Verification** does not check the digital inputs and outputs and does not issue a result for this.

> 🛈 For more information on traceability, test procedures and results, as well as on certification → 🖺 4.

5.2 Commissioning

The configuration (factory reference) required as part of **Heartbeat Verification** is recorded during recalibration at the factory and permanently stored in the measuring device.

When verification is performed in the application, the current measuring device situation is compared with this factory reference.

> 🛈 Recommendation: During the process of commissioning the measuring device, an initial verification (and all additional verifications during the life cycle) is performed under process or reference conditions → 🖺 11.
>
> The results are saved as an initial situation in the measuring device life cycle up until the 8th verification. From the 9th verification onwards, a printout of the verification reports or an upload of the data using the Flow Verification DTM is recommended to avoid losing the data from the previous verifications.

5.2.1 Recording reference data

It is possible to manually record reference data relating to the operator and the location. These reference data appear on the verification report.

Navigation
"Setup" menu → Advanced setup → Heartbeat setup → Heartbeat base settings

Navigation

"Expert" menu → Diagnostics → Heartbeat → Heartbeat base settings

► Heartbeat base settings	
Plant operator	→ 🕮 17
Location	→ 🕮 17
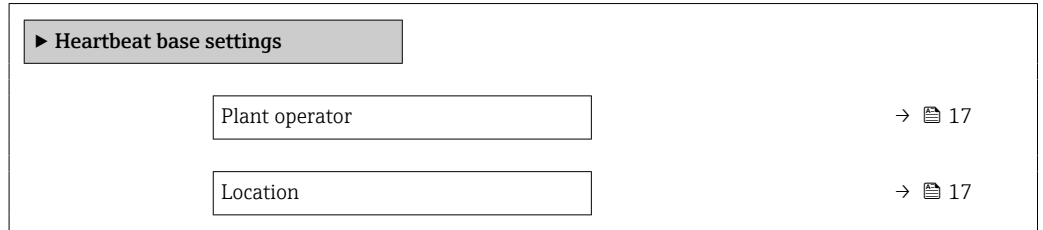
Parameter overview with brief description

Parameter	Description	User entry
Plant operator	Enter the plant operator.	Max. 32 characters such as letters, numbers or special characters (e.g. @, %, /)
Location	Enter the location.	Max. 32 characters such as letters, numbers or special characters (e.g. @, %, /)

5.3   Operation

5.3.1   Initial verification

▶ When commissioning the measuring device:
Perform an initial verification so you can save the results as an initial situation in the measuring device life cycle. As of the 9th verification, printing the verification reports or uploading the data using the Flow Verification DTM is recommended.

Initial verification can be performed in 2 ways:
- Standard verification → 🕮 18
- Extended verification → 🕮 21

5.3.2   Device behavior and interpretation

Result is "Passed"

All test results are within the specifications, and there is a high degree of certainty that the measuring device complies with the specification for dry matter concentration.

Verification generally delivers the result Passed in most applications.

Result is "Failed"

One or more test results are outside the specifications. If the result of the verification is "Failed", take the following measures:

▶ Repeat verification.
↳ Repeat verification "Passed"
If the result of the second verification is "Passed", the result of the first verification can be ignored. In order to identify possible deviations, compare the current process conditions with the process conditions of a previous verification.

If the result of the verification is "Failed" again, take the following measures:

1. Take remedial action on the basis of the verification results and the diagnostic information of the measuring device.
   - You can narrow down the cause of the error by identifying the test group with a "Failed" verification.

2. Provide Endress+Hauser Service with the verification result with the current process conditions.

3. Return the measuring device to the place of manufacture for inspection.

5.3.3   Standard verification

Standard verification is performed automatically by the device and without manual checking of external measured variables.

Diagnostic behavior

The device signals that standard verification is being performed: ⚠**C302 Device verification in progress** diagnostic message
- Factory setting for diagnostic behavior: warning
- The device continues to measure.
- The signal outputs and totalizers are not affected.
- All measured values during the verification are added to the totalizers.
- Test duration: approx. 60 seconds.

- The diagnostic behavior can be changed by the user if necessary:
  Expert → System → Diagnostic handling → Diagnostic behavior
  If **Alarm** is selected as the diagnostic behavior, the output of measured values is interrupted in the event of an error and the signal outputs and totalizers adopt the defined alarm condition.
- A category is assigned to the relevant diagnostic message of the outputs in the **Diagnostic configuration** submenu.
  Expert → Communication → Diagnostic configuration
  If the device does not have outputs, they are output as an error. To prevent an error from being output, assign the **No effect (N)** option to any outputs that are not present on the device.

For detailed information on diagnostics and troubleshooting and for diagnostics information and associated remedial measures, see the Operating Instructions → 📖 6.

Performing standard verification

Before verification starts

The date and time are saved with the current operating time and the verification results and also appear in the verification report.

The **Year** parameter, **Month, Day, Hour, AM/PM and Minute** are used to manually record the data at the time of verification.

1. Enter date and time.

Select the verification mode

2. In the **Verification mode** parameter, select the **Standard verification** option.

Starting the verification test

3. In the **Start verification** parameter, select the **Start** option.
   - While the verification is being performed, the progress of the verification is indicated as a % (bar graph indicator) in the **Progress** parameter.

Displaying the verification status and result

The current status of standard verification is displayed in the **Status** parameter
(→ 🖺 21):
- Done
  The verification test is finished.
- Busy
  The verification test is running.
- Not done
  A verification has not yet been performed on this measuring device.
- Failed
  A precondition for performing the verification has not been met, the verification cannot
  start (e.g. due to unstable process parameters) → 🖺 17.

The result of the verification is displayed in the **Overall result** parameter (→ 🖺 21):
- Passed
  All the verification tests were successful.
- Not done
  A verification has not yet been performed on this measuring device.
- Failed
  One or more verification tests were not successful → 🖺 17.

> - The overall result of the last verification can always be accessed in the menu.
> - Navigation:
>   Diagnostics → Heartbeat Technology → Verification results
> - Detailed information on the verification result (test groups and test status) are
>   shown in the verification report in addition to the overall verification result
>   → 🖺 31.
> - If the device does not pass the verification, the results are saved nonetheless and
>   indicated in the verification report.
> - This helps users to perform a targeted search for the cause of the error → 🖺 17.

"Performing verification" submenu

Navigation
"Diagnostics" menu → Heartbeat Technology → Performing verification

▸ Performing verification	
Year	→ 🖺 20
Month	→ 🖺 20
Day	→ 🖺 20
Hour	→ 🖺 20
AM/PM	→ 🖺 20
Minute	→ 🖺 20
Verification mode	→ 🖺 20
Start verification	→ 🖺 20

Progress	→ 🕮 20
Status	→ 🕮 21
Overall result	→ 🕮 21

Parameter overview with brief description

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Year	ℹ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 1): enter the year verification is performed.	9 to 99	21
Month	ℹ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 2): enter the month verification is performed.	• January • February • March • April • May • June • July • August • September • October • November • December	January
Day	ℹ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 3): enter the day verification is performed.	1 to 31 d	1 d
Hour	ℹ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 4): enter the hour verification is performed.	0 to 23 h	12 h
AM/PM	ℹ Can be edited if Heartbeat Verification is not active. The **dd.mm.yy hh:mm am/pm** option or the **mm/dd/yy hh:mm am/pm** option is selected in the **Date/ time format** parameter (2812).	Entry for date and time (field 5): enter the morning or afternoon.	• AM • PM	AM
Minute	ℹ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 6): enter the minute verification is performed.	0 to 59 min	0 min
Verification mode	ℹ Can be edited if Heartbeat Verification is not active.	Select the verification mode. Standard verification Verification is performed automatically by the device and without manual checking of external measured variables.	Standard verification	Standard verification
Start verification	–	Start the verification. Start the verification with the **Start** option.	• Cancel • Start	Cancel
Progress	–	Shows the progress of the process.	0 to 100 %	–

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Status	–	Displays the current status of the verification.	• Done • Busy • Failed • Not done	Done
Verification result	–	Displays the overall result of the verification. ℹ️ Detailed description of the classification of the results: → 🕮 30	• Not supported • Passed • Not done • Failed	Not done

5.3.4 Extended verification

During the verification process, these measured variables are recorded manually with the help of external measuring equipment, for example, and entered in the measuring device → 🕮 26. The value entered is checked and verified by the measuring device to ensure that it complies with the factory specifications. A status (Passed or Failed) is issued accordingly and is documented as an individual result of the verification and taken into account in the overall result.

Permanently predefined output signals, which do not represent the current measured value, are simulated during extended verification of the outputs. To measure the simulated signals, it may be necessary to set the higher-level process control system to a safe state beforehand. In order to perform a verification, the pulse/frequency/switch output must be enabled and assigned to a measured variable.

Extended verification measured variables
Output current (current output)
• Simulation of the measured values for every output physically present on the device
• Simulation "Low value" and "High value"
• Measurement of the two values
• Entry of the two measured values in the verification screen

Output frequency (pulse/frequency output)
• Simulation of the measured values for every output physically present on the device
• Simulation value pulse output: Simulated frequency depending on the pulse width configured
• Simulation value frequency output: Maximum frequency

📖 For more information on simulation, see the Operating Instructions .

Measuring equipment requirements

Recommendations for the measuring equipment

DC current measuring uncertainty	±0.2 %
DC current resolution	10 μA
DC voltage measuring uncertainty	±0.1 %
DC voltage resolution	1 mV
Frequency measuring uncertainty	±0.1 %
Frequency resolution	1 Hz
Temperature coefficient	0.0075 %/°C

Connecting the measuring equipment in the measuring circuit

⚠️ **WARNING**

Danger to persons from non-approved equipment in the hazardous area!

▸ Only use intrinsically safe measuring equipment in hazardous zones.
▸ Measure intrinsically safe circuits with approved equipment only.
▸ Outputs (passive) for the hazardous area may only be connected to suitable intrinsically safe circuits.

*Determining the terminal assignment for the outputs*

The terminal assignment depends on the specific device version.

To determine the device-specific terminal assignment:
• See the adhesive label in the terminal cover
• Check the operating menu via the local display, Web browser or operating tool
  • Setup → I/O configuration → I/O module 1 to n terminal numbers
  • Expert → I/O configuration → I/O module 1 to n terminal numbers

📖 For detailed information on terminal assignment, see the Operating Instructions for the device

Active current output
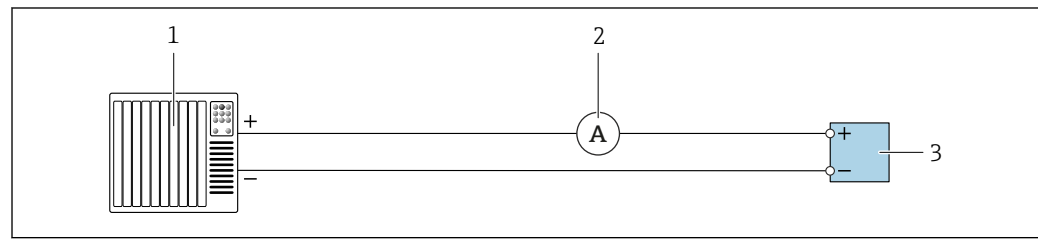
🖼 *7   Extended verification of the active current output*

1   Automation system with current input (e.g. PLC)
2   Ammeter
3   Transmitter

Extended verification of the active current output

▸ Connect the ammeter to the transmitter by looping it in series into the circuit.

If the automation system is switched off, the measuring circuit may be interrupted as a result. It is then not possible to perform a measurement. If this is the case, proceed as follows:

1. Disconnect the output cables of the current output (+/−) from the automation system.

2. Short the output cables of the current output (+ / -).

3. Connect the ammeter to the transmitter by looping it in series into the circuit.

Passive current output

A0034446

🖾 *8   Extended verification of the passive current output*

1   Automation system with current input (e.g. PLC)
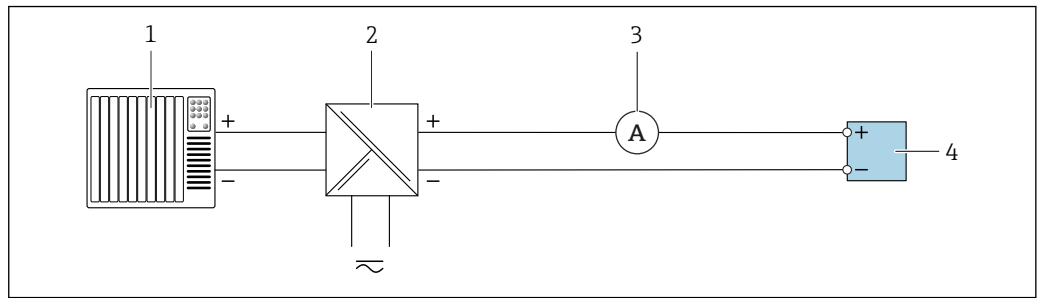*2   Power supply unit*
3   Ammeter
4   Transmitter

Extended verification of the passive current output

1. Connect the ammeter to the transmitter by looping it in series into the circuit.

2. Connect the power supply unit.

Active pulse/frequency/switch output
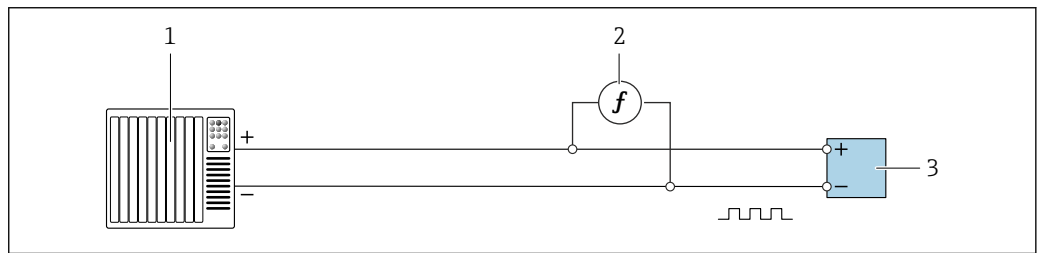
A0033911

🖾 *9   Extended verification of the active pulse/frequency output*

1   Automation system with pulse/frequency input (e.g. PLC)
2   Frequency meter
3   Transmitter

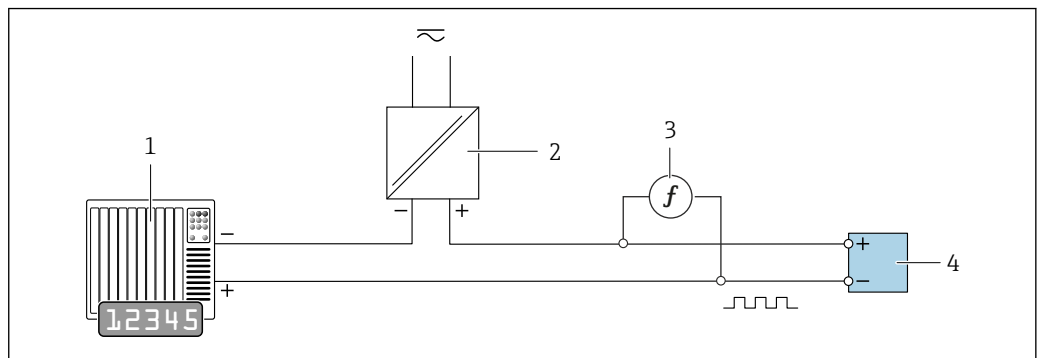*Passive pulse/frequency/switch output*

A0034445

🖾 *10   Extended verification of the passive pulse/frequency output*

1   Automation system with pulse/frequency input (e.g. PLC)
2   Power supply unit
3   Frequency meter
4   Transmitter

Extended verification of the passive pulse/frequency output

1. Connect the power supply unit

2. Connect the frequency meter in parallel to the pulse/frequency output of the transmitter

Diagnostic behavior

A diagnostic event signals that the extended verification is being performed:
- The screen alternates between the status signal "C" (Function Check) and the operational display:
  Verification is currently active in the device.
- Different diagnostic behaviors, along with the relevant diagnostic codes, can be displayed depending on the device version.
  The output selected under the **Start verification** parameter is displayed in all cases, however:
  Output 1...n low value option, **Output 1...n high value** option

Diagnostic code	Diagnostic behavior	Options in Start verification
C491	**Current output 1 to n simulation** active	Output 1...n low value Output 1...n high value
C492	**Simulation frequency output 1 to n** active	Frequency output 1...n
C493	**Simulation pulse output 1 to n** active	Pulse output 1...n
C302	△C302 Device verification in progress	

    An extended verification (simulation mode) may be started only if the process plant is not in the automatic mode.

If the **Start** option is selected in the **Start verification** parameter, the following diagnostic event is output on the display (second part of the external verification): △**C302 Device verification in progress** diagnostic message
Factory setting for diagnostic behavior: warning

- The diagnostic behavior can be changed by the user if necessary:
  Expert → System → Diagnostic handling → Diagnostic behavior
  If **Alarm** is selected as the diagnostic behavior, the output of measured values is interrupted in the event of an error and the signal outputs and totalizers adopt the defined alarm condition.
- A category is assigned to the relevant diagnostic message of the outputs in the **Diagnostic configuration** submenu.
  Expert → Communication → Diagnostic configuration
  If the device does not have outputs, they are output as an error. To prevent an error from being output, assign the **No effect (N)** option to any outputs that are not present on the device.

    For detailed information on diagnostics and troubleshooting and for diagnostics information and associated remedial measures, see the Operating Instructions → 🖹 6.

Performing extended verification

A full standard verification is performed in the course of the verification. The validity of the entered and measured values of the outputs is checked. Additional standard verification of the outputs does not take place.

> **NOTICE**
>
> **If the electrical connections have not been established and the ammeter is not looped in during verification, extended verification is not possible.**
> ▶ Establish the electrical connection before starting the extended verification.
> ▶ Loop in ammeter before extended verification starts.

Before verification starts

ℹ The date and time are saved with the current operating time and the verification results and also appear in the verification report.

The **Year** parameter, **Month, Day, Hour, AM/PM and Minute** are used to manually record the data at the time of verification.

1. Enter date and time.

Select the verification mode

2. In the **Verification mode** parameter, select the **Extended verification** option.

Further parameter settings

3. In the **External device information** parameter, enter a unique ID (e.g. serial number) of the measuring equipment used (max. 32 characters).

4. In the **Start verification** parameter, select one of the options available (e.g. the **Output 1 low value** option).

5. In the **Measured values** parameter, enter the value shown on the external measuring equipment.

6. Repeat steps 4 and 5 until all the output options are checked.

7. Adhere to the sequence indicated and enter the measured values.

The duration of the process and number of outputs depend on the device configuration, on whether the output is switched on and on whether the output is active or passive.

The value displayed in the **Output values** parameter (→ 🕮 28) shows the value simulated by the device at the selected output → 🕮 22

Starting the verification test

8. In the **Start verification** parameter, select the **Start** option.
   ↳ While the verification is being performed, the progress of the verification is indicated as a % (bar graph indicator) in the **Progress** parameter.

Displaying the verification status and result

The current status of standard verification is displayed in the **Status** parameter (→ 🕮 21):
- Done
  The verification test is finished.
- Busy
  The verification test is running.
- Not done
  A verification has not yet been performed on this measuring device.
- Failed
  A precondition for performing the verification has not been met, the verification cannot start (e.g. due to unstable process parameters) → 🕮 17.

The result of the verification is displayed in the **Overall result** parameter ($\rightarrow$ 🗎 21):
• Passed
  All the verification tests were successful.
• Not done
  A verification has not yet been performed on this measuring device.
• Failed
  One or more verification tests were not successful $\rightarrow$ 🗎 17.

> • The overall result of the last verification can always be accessed in the menu.
> • Navigation:
>   Diagnostics → Heartbeat Technology → Verification results
> • Detailed information on the verification result (test groups and test status) are
>   shown in the verification report in addition to the overall verification result
> $\rightarrow$ 🗎 31.
> • If the device does not pass the verification, the results are saved nonetheless and
>   indicated in the verification report.
> • This helps users to perform a targeted search for the cause of the error $\rightarrow$ 🗎 17.

"Performing verification" submenu

Navigation
"Diagnostics" menu → Heartbeat Technology → Performing verification

▶ Performing verification	
Year	$\rightarrow$ 🗎 27
Month	$\rightarrow$ 🗎 27
Day	$\rightarrow$ 🗎 27
Hour	$\rightarrow$ 🗎 27
AM/PM	$\rightarrow$ 🗎 27
Minute	$\rightarrow$ 🗎 27
Verification mode	$\rightarrow$ 🗎 27
External device information	$\rightarrow$ 🗎 27
Start verification	$\rightarrow$ 🗎 28
Progress	$\rightarrow$ 🗎 28
Measured values	$\rightarrow$ 🗎 28
Output values	$\rightarrow$ 🗎 28
Status	$\rightarrow$ 🗎 28
Verification result	$\rightarrow$ 🗎 28

Parameter overview with brief description

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Year	ⓘ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 1): enter the year verification is performed.	9 to 99	21
Month	ⓘ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 2): enter the month verification is performed.	• January • February • March • April • May • June • July • August • September • October • November • December	January
Day	ⓘ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 3): enter the day verification is performed.	1 to 31 d	1 d
Hour	ⓘ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 4): enter the hour verification is performed.	0 to 23 h	12 h
AM/PM	ⓘ Can be edited if Heartbeat Verification is not active. The **dd.mm.yy hh:mm am/pm** option or the **mm/dd/yy hh:mm am/pm** option is selected in the **Date/ time format** parameter (2812).	Entry for date and time (field 5): enter the morning or afternoon.	• AM • PM	AM
Minute	ⓘ Can be edited if Heartbeat Verification is not active.	Entry for date and time (field 6): enter the minute verification is performed.	0 to 59 min	0 min
Verification mode	ⓘ Can be edited if Heartbeat Verification is not active.	Select the verification mode. Extended verification Standard verification is extended by the additional entry of external measured variables: **Measured values** parameter.	Extended verification	Standard verification
External device information	With the following conditions: • The **Extended verification** option is selected in the **Verification mode** parameter. • Can be edited if Heartbeat Verification is not active.	Record measuring equipment for extended verification.	Free text entry	–

Parameter	Prerequisite	Description	User entry / Selection / User interface	Factory setting
Start verification	–	Start the verification. To carry out a complete verification, select the selection parameters individually. Once the external measured values have been recorded, verification is started using the **Start** option.	• Cancel • Output 1 low value * • Output 1 high value * • Output 2 low value * • Output 2 high value * • Output 3 low value * • Output 3 high value * • Frequency output 1 * • Pulse output 1 * • Frequency output 2 * • Pulse output 2 * • Start	Cancel
Measured values	One of the following options is selected in the **Start verification** parameter (→ 🗏 20): • Output 1 low value • Output 1 high value • Output 2 low value • Output 2 high value • Output 3 low value • Output 3 high value • Frequency output 1 • Pulse output 1 • Frequency output 2 • Pulse output 2	Use this function to enter the measured values (actual values) for the external measured variables:. • Current output: Output current in [mA] • Pulse/frequency output: Output frequency in [Hz]	Signed floating-point number	0
Progress	–	Shows the progress of the process.	0 to 100 %	–
Output values	–	Displays the simulated output values (target values) for the external measured variables:. • Current output: Output current in [mA]. • Pulse/frequency output: Output frequency in [Hz].	Signed floating-point number	-
Status	–	Displays the current status of the verification.	• Done • Busy • Failed • Not done	Done
Verification result	–	Displays the overall result of the verification. ℹ️ Detailed description of the classification of the results: → 🗏 30	• Not supported • Passed • Not done • Failed	Not done

* Visibility depends on order options or device settings

5.3.5 Verification results

Access to the verification results:
In the operating menu via the onsite display, operating tool or Web browser
• Diagnostics → Heartbeat Technology → Verification results
• Expert → Diagnostics → Heartbeat Technology → Verification results

Navigation
"Diagnostics" submenu → Heartbeat → Verification results

Navigation
"Expert" menu → Diagnostics → Heartbeat → Verification results

▶ Verification results		
Date/time (manually entered)		→ 🗎 29
Verification ID		→ 🗎 29
Operating time		→ 🗎 29
Verification result		→ 🗎 29
Sensor		→ 🗎 29
Sensor electronic module (ISEM)		→ 🗎 29
I/O module		→ 🗎 30
System status		→ 🗎 30

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface	Factory setting
Date/time (manually entered)	The verification has been performed.	Date and time.	dd.mmmm.yyyy; hh:mm	1 January 2010; 12:00
Verification ID	The verification has been performed.	Displays consecutive numbering of the verification results in the measuring device.	0 to 65 535	0
Operating time	The verification has been performed.	Indicates how long the device has been in operation up to the verification.	Days (d), hours (h), minutes (m), seconds (s)	–
Verification result	–	Displays the overall result of the verification. ⓘ Detailed description of results classification: → 🗎 30	• Not supported • Passed • Not done • Failed	Not done
Sensor	The **Failed** option is shown in the **Overall result** parameter.	Displays the result for the sensor. ⓘ Detailed description of results classification: → 🗎 30	• Not supported • Passed • Not done • Failed	Not done
Sensor electronic module (ISEM)	The **Failed** option is shown in the **Overall result** parameter.	Displays the result for the sensor electronics module (ISEM). ⓘ Detailed description of results classification: → 🗎 30	• Not supported • Passed • Not done • Failed	Not done

Parameter	Prerequisite	Description	User interface	Factory setting
I/O module	The **Failed** option is shown in the **Overall result** parameter.	Displays the result for I/O module monitoring of the I/O module. • For current output: Accuracy of the current • For pulse output: Accuracy of pulses • For frequency output: Accuracy of frequency • Current input: Accuracy of the current • Relay output: Number of switching cycles ℹ **Heartbeat Verification** does not check the digital inputs and outputs and does not issue a result for this. ℹ Detailed description of results classification: → 🗎 30	• Not supported • Passed • Not done • Not plugged • Failed	Not done
System status	The **Failed** option is shown in the **Overall result** parameter.	Displays the system condition. Tests the measuring device for active errors. ℹ Detailed description of results classification: → 🗎 30	• Not supported • Passed • Not done • Failed	Not done

Classification of results

Individual results

Verification result	Description
Failed	At least one individual test in the test group was outside the specifications.
Not supported	The result is used for internal purposes.
Passed	All individual tests in the test group complied with the specifications. The result is also "Passed" if the result of an individual test is "Check not done" and the result of all other tests is "Passed".
Not done	No test has been performed for this test group.
Not plugged	The result is displayed if no I/O module is plugged into the slot.

Overall result

Verification result	Description
Failed	At least one test group was outside the specifications.
Not supported	The result is used for internal purposes.
Passed	All verified test groups complied with the specifications (result "Passed"). The overall result is also "Passed" if the result for an individual test group is "Check not done" and the result for all other test groups is "Passed".
Not done	No verification was performed for any of the test groups (result for all test groups is "Check not done").
Not plugged	The result is displayed if no I/O module is plugged into the slot.

ℹ For more information on traceability, test procedures and results, as well as on certification → 🗎 4.

Test groups

Test group	Description
Sensor	Electrical components of the sensor (signals, circuits and cables)
Sensor electronics module (ISEM)	Electronics module for activating and converting the sensor signals
I/O module	Results of the input and output modules installed on the measuring device
System condition	Test for active measuring device errors of "alarm"-type diagnostic behavior

For more information on the test groups and individual tests → 🖺 31.

ℹ️ The partial results for a test group (e.g. sensor) contain the result of several individual tests. All the individual tests must be passed for the partial result to pass.

The same applies to the overall verification result: All the partial results must pass for the overall verification result to pass. Information on the individual tests is provided in the verification report and in the partial results by test groups, which can be retrieved with the flow verification DTM.

Limit values

I/O module

Output; input	Standard verification	Extended verification
Current output 4 to 20 mA, active and passive	± (100 µA (offset) + 1 % of reading)	• Lower value 4 mA: ±1 % • Upper value 20 mA: ±0.5 %
Pulse/frequency/switch output, active and passive	±0.05 %, with a 120 s cycle	• Pulse: ±0.3 % • Frequency: ±0.3 %
Current input 4 to 20 mA, active and passive	• −20 %: 24 V − 20 % = 19.2 V • Read back the supply voltage: >24 V − 20 % − 5 % = 18 V (min. 18 V applied)	–
Relay output	The number of switching cycles depends on the hardware.	Only standard verification possible.

5.3.6   Detailed verification results

Partial results by test groups and detailed verification results can be viewed in the verification report and retrieved using the flow verification DTM.

This also applies to the process conditions determined at the time of verification.

Process conditions

To increase the comparability of the results, the process conditions that apply at the time of verification are recorded and documented as process conditions on the last page of the verification report.

Process conditions	Description
Dry matter concentration	Current measured value for dry matter concentration
Primary temperature	Current measured value for primary temperature
Secondary temperature	Current measured value for secondary temperature
Electronics temperature	Current measured value for the electronic temperature in the transmitter

Individual test group results

The individual test group results listed below provide information on the results of the individual tests within a test group.

Sensor

Parameter/ individual test	Description	Result/limit value	Interpretation/cause	Remedial action
Antenna cable	A signal sent to every antenna via the HF cables. Part of this signal is reflected at the antenna connection. The run time of the signal can be used to determine how far from the transmitter the reflection occurred. If the run time is below a certain threshold, you can assume that the cable is interrupted.	Displays the run time in seconds.	Interruption in cable or cable connection to the interface between antenna and transmitter.	Return device: Contact your Endress +Hauser service organization. The sensor is sealed with the HF cable. It is not intended to be replaced.
Primary temperature	Temperature sensor condition: • Intact (short-circuit) • Not intact (interrupted)	No value range • Passed • Failed	Possible interruption or short-circuit: • In the connection between temperature sensor and transmitter (cable, connection interfaces) • In temperature sensor.	Replace the sensor.
Secondary temperature	Temperature sensor condition: • Intact (short-circuit) • Not intact (interrupted)	No value range • Passed • Failed	Possible interruption or short-circuit: • In the connection between temperature sensor and transmitter (cable, connection interfaces) • In temperature sensor.	Replace the sensor.

Sensor electronics module (ISEM)

Parameter/ individual test	Description	Result/limit value	Interpretation/cause	Remedial action
Supply voltage	Monitoring of the main supply voltage of the sensor electronics module (ISEM).	No value range • Passed • Failed	Possible defect at: • Sensor electronics module (ISEM) • Power unit	Replace accordingly: • Sensor electronics module (ISEM) • Power unit
Internal voltage	Is necessary to ensure signal processing is functioning correctly. Check the voltage to see if it exceeds or falls below the permitted range. A warning message is output if the limit value is exceeded or undershot more than ten times.	No value range • Passed • Failed	–	Replace the sensor electronics module (ISEM).
Heartbeat Result HF ASIC	Is necessary to ensure signal processing is functioning correctly. Status of the Heartbeat Verification of the Application Specific Integrated Circuits (ASIC).	No value range • Passed • Failed	–	Replace the sensor electronics module (ISEM).
HF circuit calibration	Is necessary to ensure signal processing is functioning correctly. Calculate the error terms of the HF ASIC calibration, comparison with limit values and the main path.	No value range • Passed • Failed	–	Replace the sensor electronics module (ISEM).
HF circuit reflection adjustment	Is necessary to ensure signal processing is functioning correctly. Evaluation of the reflection of the signal.	No value range • Passed • Failed	–	Replace the sensor electronics module (ISEM).

Parameter/ individual test	Description	Result/limit value	Interpretation/cause	Remedial action
HF circuit reference path	Is necessary to ensure signal processing is functioning correctly. Check the reference line.	No value range • Passed • Failed	–	Replace the sensor electronics module (ISEM).
Measuring system frequencies	Is necessary to ensure signal processing is functioning correctly. Check the measuring system frequencies.	No value range • Passed • Failed	–	Replace the sensor electronics module (ISEM).
Reference temperature resistance	Monitoring of temperature measurement. The temperature is measured by means of the resistance of a temperature sensor. This resistance must lie within certain limits compared to a reference resistance.	No value range • Passed • Failed	Sensor electronics module (ISEM) defective.	Replace the sensor electronics module (ISEM).

System condition

Parameter/ individual test	Description	Result/limit value	Interpretation/cause	Remedial measures
System condition	Monitoring of system condition.	No value range • Pass • Fail	System error during verification	Check diagnostic events in the **Event logbook** submenu.

I/O modules

Parameter/ individual test	Description	Result/limit value	Interpretation/cause	Remedial measures
Output 1 to n	Checking of all the input and output modules installed at the measuring device	No value range • Pass • Fail • Not done	• Output values are out of specification. • I/O modules defective	Possible measures: • Check cabling. • Check connections. • Check load (current output). • Replace I/O modules.

5.3.7   Heartbeat Technology verification report

The verification results can be documented via the web server, DeviceCare or FieldCare operating tools in the form of a verification report → 🖺 11. The verification report is created on the basis of the data records saved in the measuring device after verification. As the verification results are automatically and uniquely identified with a verification ID and the operating time, they are suitable for the traceable documentation of the verification of measuring devices.

First page: identification
Measuring point identification, identification of the verification results and confirmation of completion:
- Plant operator: customer reference
- Device information
  - Site of operation
  - Serial number
  - Tag name
  - Module name
  - Nominal diameter
  - Device name
  - Order code
  - Firmware version
- Verification information
  - The operating time and verification ID are used to uniquely assign the verification results for the traceable documentation of the verification
  - Storage and display of the manual date and time entry as well as the current operating time in the device
  - Verification mode: standard verification or extended verification
- Overall verification result
  - Overall result of the verification "Passed": All the results have been "Passed"
  - Overall result of the verification "Failed": One or more individual results have been "Failed"
- Confirmation
- Comments

Second page: test results
Details on the individual results for all test groups:
- System operator
- Device and verification information
- Test groups → 🖺 31
  - Sensor
  - Sensor electronics module (ISEM)
  - System condition
  - I/O modules

Third page (and subsequent pages, if applicable): measured values and visualization
Numerical values and graphic presentation of all the values recorded:
- System operator
- Device and verification information
- Test object
- Unit
- Current: measured value
- Min.: lower limit
- Max.: upper limit
- Visualization: graphic presentation of the measured value, within the lower and upper limits.

Last page: process conditions
Information on the process conditions that applied during the verification:
- System operator
- Device and verification information
- Total solids value

- Primary temperature value
- Secondary temperature value
- Electronics temperature

As a prerequisite for the validity of the verification report, the **Heartbeat Verification** feature must be activated on the measuring device concerned and must have been performed by an operator tasked to carry out this job by the customer. Alternatively, an Endress+Hauser service technician or a service provider authorized by Endress+Hauser can be tasked with performing the verification.

Individual test groups and description of individual tests: → 🖺 31

5.3.8 Interpreting and using the verification results

Heartbeat Verification uses the self-monitoring function of the Proline devices to check the measuring device functionality. During the verification process, the system checks whether the measuring device components comply with the factory specifications. Both the sensor and the electronics modules are included in the tests.

Heartbeat Verification carries out a functional test on the measuring chain from the sensor to the outputs. During this process, device-internal parameters that are correlated with measurement of dry matter concentration are checked (secondary measured variables, comparative values).

If a verification is passed, this confirms that the comparison values that are checked are within the factory specification and that the measuring device is working correctly. To ensure that the measuring device complies with the factory specification, these values must be within the specified limits.

> Heartbeat Verification confirms on demand that the device is functioning within the specified measuring tolerance and the specified total test coverage TTC.

Recommended course of action if the result of a verification is "Failed"

If the result of a verification is **Failed**, it is advisable to begin by repeating the verification.

Additional remedial measures if the result of a verification is "Failed"

- Direct remedial measures
  Take remedial action on the basis of the verification results and the diagnostic information of the measuring device. Narrow down the possible cause of the error by identifying the test group that **failed** the verification.
- Return the measuring device to the place of manufacture for inspection.

> For detailed information on diagnostics and troubleshooting and for diagnostics information and associated remedial measures, see the Operating Instructions → 🗎 6.

6 Modbus RS485 register information

6.1 Notes

6.1.1 Structure of the register information

The individual parts of a parameter description are described in the following section:

Navigation: navigation path to the parameter					
Parameter	Register	Data type	Access type	User interface/ Selection/User entry	→ 📖
Name of parameter	Indicated in decimal numerical format	• Float length = 4 byte • Integer length = 2 byte • String length, depending on parameter	Possible type of access to parameter: • Read access via function codes 03, 04 or 23 • Write access via function codes 06, 16 or 23	**Options** List of the individual options for the parameter • Option 1 • Option 2 • Option 3 (+) ℹ️ (+) = Factory setting depends on country, order options or device settings **User entry** Specific value or input range for the parameter	Page number information and cross-reference to the standard parameter description

NOTICE

If non-volatile device parameters are modified via the MODBUS RS485 function codes 06, 16 or 23, the change is saved in the EEPROM of the measuring device.
The number of writes to the EEPROM is technically restricted to a maximum of 1 million.
▶ Make sure to comply with this limit since, if it is exceeded, data loss and measuring device failure will result.
▶ Avoid constantly writing non-volatile device parameters via the MODBUS RS485.

6.1.2 Address model

The Modbus RS485 register addresses of the measuring device are implemented in accordance with the "Modbus Applications Protocol Specification V1.1".

In addition, systems are used that work with the register address model "Modicon Modbus Protocol Reference Guide (PI-MBUS-300 Rev. J)".

Depending on the function code used, a number is added at the start of the register address with this specification:
• "3" → "Read" access
• "4" → "Write" access

| Function code	Access type	Register in accordance with "Modbus Applications Protocol Specification"	Register in accordance with "Modicon Modbus Protocol Reference Guide"
03 04 23	Read	XXXX Example: total solids = 52245	3XXXX Example: total solids = 352245
06 16 23	Write	XXXX Example: reset totalizer = 2609	4XXXX Example: reset totalizer = 42609

6.2   Overview of the Heartbeat operating menu

The following tables provide an overview of the structure of the Heartbeat Technology operating menu along with the parameters. The page reference indicates where the associated description of the submenu or parameter can be found.

6.2.1   "Heartbeat setup" submenu

Navigation
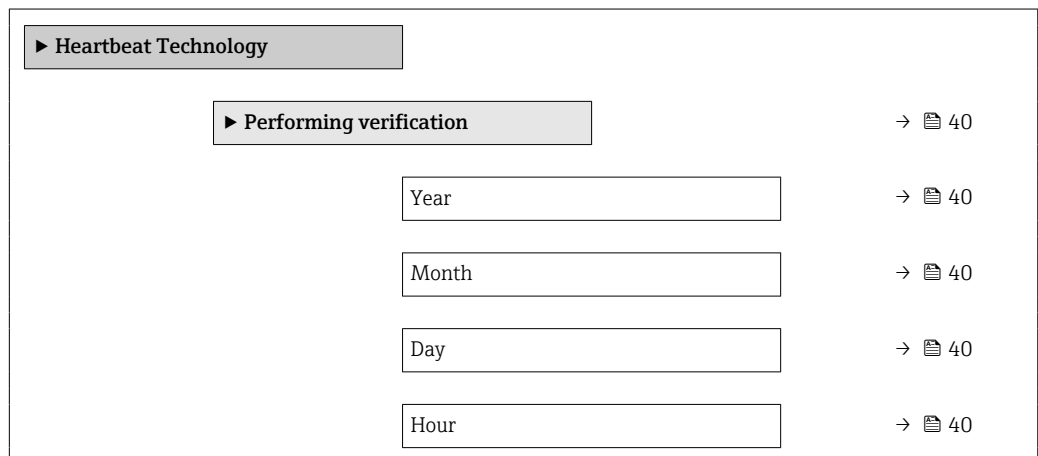"Setup" menu → Advanced setup → Heartbeat setup

▸ Heartbeat setup	
▸ Heartbeat base settings	→ 🖺 38
Plant operator	→ 🖺 38
Location	→ 🖺 38
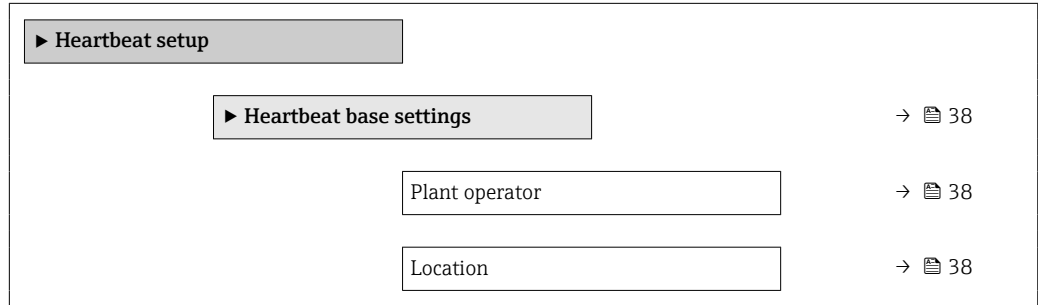
6.2.2   Register information

"Heartbeat base settings" submenu

Navigation: Heartbeat setup → Heartbeat base settings					
Parameter	Register	Data type	Access	Selection / User entry / User interface	→ 🖺
Plant operator	3414 to 3429	String	Read / Write	Max. 32 characters such as letters, numbers or special characters (e.g. @, %, /)	17
Location	3430 to 3445	String	Read / Write	Max. 32 characters such as letters, numbers or special characters (e.g. @, %, /)	17

6.2.3   "Heartbeat" submenu

Navigation
"Heartbeat" submenu

▸ Heartbeat Technology	
▸ Performing verification	→ 🖺 40
Year	→ 🖺 40
Month	→ 🖺 40
Day	→ 🖺 40
Hour	→ 🖺 40

6.2.4 Register information

"Performing verification" wizard

Navigation: Heartbeat Technology → Performing verification					
Parameter	Register	Data type	Access	Selection / User entry / User interface	→ 🖹
Year	2495	Integer	Read / Write	9 to 99	20
Month	2494	Integer	Read / Write	**0 = January** 1 = February 2 = March 3 = April 4 = May 5 = June 6 = July 7 = August 8 = September 9 = October 10 = November 11 = December	20
Day	2493	Integer	Read / Write	1 to 31 d	20
Hour	2492	Integer	Read / Write	0 to 23 h	20
AM/PM	2496	Integer	Read / Write	**0 = AM** 1 = PM	20
Minute	2467	Integer	Read / Write	0 to 59 min	20
Verification mode	2366	Integer	Read / Write	**0 = Standard verification**	20
External device information	20493 to 20508	String	Read / Write	Free text entry	27
Start verification	2270	Integer	Read / Write	**0 = Cancel** 1 = Start	20
Progress	6797	Integer	Read	0 to 100 %	20
Measured values	5512 to 5513	Float	Read / Write	Signed floating-point number	28
Output values	5516 to 5517	Float	Read	Signed floating-point number	28
Status	2079	Integer	Read	**0 = Done** 1 = Failed 3 = Not done 8 = Busy	21
Verification result	2355	Integer	Read	1 = Failed 2 = Passed **3 = Not done** 250 = Not supported	21

"Verification results" submenu

Navigation: Heartbeat Technology → Verification results					
Parameter	Register	Data type	Access	Selection / User entry / User interface	→ 🖹
Date/time (manually entered)	2372 to 2381	String	Read	dd.mmmm.yyyy; hh:mm	29
Verification ID	2315	Integer	Read	0 to 65 535	29
Operating time	3346	String	Read	Days (d), hours (h), minutes (m), seconds (s)	29
Verification result	2355	Integer	Read	1 = Failed 2 = Passed **3 = Not done** 250 = Not supported	21

Navigation: Heartbeat Technology → Verification results					
Parameter	Register	Data type	Access	Selection / User entry / User interface	→ 📖
Sensor	2384	Integer	Read	1 = Failed 2 = Passed **3 = Not done** 250 = Not supported	29
Sensor electronic module (ISEM)	2385	Integer	Read	1 = Failed 2 = Passed **3 = Not done** 250 = Not supported	29
I/O module	2386	Integer	Read	1 = Failed 2 = Passed **3 = Not done** 250 = Not supported 254 = Not plugged	30
System status	5790	Integer	Read	1 = Failed 2 = Passed **3 = Not done** 250 = Not supported	30

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