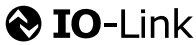


Special Documentation

Micropilot FMR43

IO-Link

Application package
Heartbeat Verification + Monitoring



1 About this document

1.1 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.

1.2 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

1.3 Symbols

1.3.1 Safety symbols

CAUTION

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

DANGER

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

NOTICE

This symbol contains information on procedures and other facts which do not result in personal injury.

WARNING

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

1.3.2 Symbols for certain types of information and graphics

Tip

Indicates additional information

Reference to another section

1, 2, 3. Series of steps

1, 2, 3, ...

Item numbers

Bluetooth

Wireless data transmission between devices over a short distance.

1.4 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.

1.5 Registered trademarks

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2 Product features and availability

2.1 Product features

The Heartbeat Verification + Monitoring application package 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 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

The undetected dangerous failures are not diagnosed by the device diagnostics. If these failures occur, they can falsify the measured value that is displayed or interrupt the output of measured values.

Heartbeat Technology confirms that the device is functioning within the specified measuring tolerance with a defined TTC.

The TTC is at least:

- 98 % for the current output
- 95 % for the IO-Link communication



The current value for the TTC depends on the configuration and integration of the measuring instrument. It is determined under the following basic conditions:

- Integration of the measuring instrument for output of measured values via 4 to 20 mA current output, switch output or IO-Link output
- **Simulation** parameter **Off** option
- **Failure behavior current output** parameter set to **Min.** option or **Max.** option and evaluation unit detects both alarms (when the current output is used)
- Settings for diagnostic behavior correspond to factory settings

2.2 Availability

The Heartbeat Verification + Monitoring application package can be ordered together with the device or subsequently enabled using an activation code. Detailed information on the order code is available from the website www.endress.com or from an Endress+Hauser sales organization.

The availability of the application package can be checked as follows:

- Order code with breakdown of the device features on the delivery note
- On the Web using the Device Viewer: enter the serial number from the nameplate and check whether the order code is displayed
- In the operating menu: The menu indicates whether the application package is activated. Navigation: System → Software configuration → Software option overview
- Heartbeat Verification is shown in the IODD. Heartbeat Monitoring must be set in the operating menu of the SmartBlue app. The Heartbeat Monitoring events can be read out in the IODD via the active and last diagnosis.

2.2.1 Activation code

If ordered at a later date, a conversion kit will be supplied. This includes a tag with modified device data and an activation code.

Enter the activation code in the operating menu under:

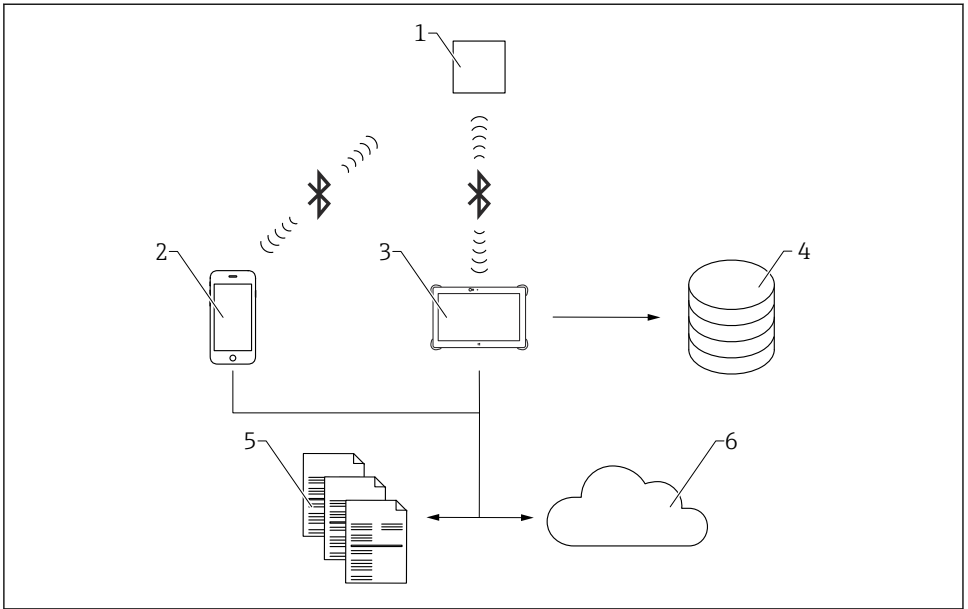
Navigation: System → Software configuration → Activate SW option

2.2.2 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.

3 System integration

The functions of Heartbeat Technology are accessible through digital interfaces and can be used both via an asset management system and via the automation infrastructure (e.g. PLC).



A0055180

- 1 Device with local display
- 2 Mobile terminals with SmartBlue app
- 3 FieldXpert
- 4 Data archive
- 5 Verification report
- 6 Netilion Library

Perform Heartbeat Verification using one of the following interfaces:

- System integration interface of a higher-level system
- Local display (optional)
- Bluetooth (optional)

External access to the device via IO-Link in order to start a verification and signal the result (**Passed** option or **Failed** option) must be performed by a higher-level system through a system integration interface. 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 are saved in the device and provided in the form of a verification report. The last result in each case is saved in the device.


Verification reports can be generated using the SmartBlue app.

3.1 Data exchange performed by the user (asset management system)

Heartbeat Verification

- Start verification.
- Read out the verification results.

Heartbeat Monitoring via Bluetooth

- Configuration of the monitoring function: specify which monitoring parameters are output continuously via the system integration interface.
- The user can read the monitoring measured variables in the operating menu.
- Events for Foam detection or Buildup detection can be used to switch valves ( see the "Heartbeat Monitoring" section → "Monitoring parameters")

3.2 Data management

The result of a verification is saved as a non-volatile parameter set in the measuring device memory. Previous data are overwritten by new Verification results; only the last result is saved.

3.2.1 Verification report

Printing the Verification report

The Verification report can be output via the SmartBlue app and Bluetooth in PDF format.



Prerequisite: A verification has already been performed.

3.2.2 File management

Netilion Library

Heartbeat verification reports can be saved in Netilion with the Netilion Library (www.netilion.endress.com). They can be uploaded by notebook, smartphone or a Field Xpert tablet.

The verification reports are then:

- online
- automatically assigned to their digital twin
- easier to find
- always readily available

4 Heartbeat Verification

Heartbeat Verification is performed on demand via the IODD or Bluetooth and supplements continuous self-monitoring with additional checks. During verification, the system checks whether the device components comply with the factory specifications. Both the sensor and the electronics modules are included in the tests.

Heartbeat Verification confirms the device function within the specified measuring tolerance on demand, using a total test coverage TTC (Total Test Coverage) as a percentage.

Heartbeat Verification meets the requirements for metrological traceability in accordance with ISO 9001:2015 Clause 7.1.5.2.

The Heartbeat Verification test result **Passed** confirms that, for example, the level accuracy is ± 1 mm (0.04 in) under reference operating condition within the measuring range of 3 300 mm (130 in) with a specified total test coverage of > 95 %.

The result of verification is either **Passed** or **Failed**. The verification data are stored in the device using the FIFO method (First In – First Out) and optionally archived using the asset management software FieldCare on a PC or in the Netilion Library. Based on this data, a verification report is generated automatically to ensure that traceable documentation of the verification results is available.

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

4.1 Device behavior and interpretation

- Result: **Passed**
All test results are within the specification.
- Result: **Failed**
One or more test results are **Out of specification (S)**.



Recommendations in the event of a verification with the verification result: Failed

If a verification returns the result **Failed**, repeat the verification. In doing so, follow the measures below:

- Create defined and stable process conditions in order to rule out process-specific influences as much as possible.
- Compare current process conditions with those of the previous verification to identify possible deviations.
- Take remedial measures based on the diagnostic information of the device.

The cause of the error can be narrowed down by identifying the test group that has a **Failed** verification.



Operation continues during the entire Heartbeat Verification.

4.2 Verification

Perform verification via SmartBlue app and Bluetooth:

1. Navigation: Guidance → Heartbeat Technology → Heartbeat Verification → Heartbeat Configuration → Heartbeat Verification
2. Select **Start verification** option.

Show status:

- ▶ Navigation: Diagnostics → Heartbeat Technology → Heartbeat Verification → Status

Show result:

- ▶ Navigation: Guidance → Heartbeat Technology → Heartbeat Verification → Verification result → Verification result

Verification via IO-Link:

Common	Process Data	Identification	Observation	Parameter	Diagnosis	Scope	Generic	IODD	Name	R/W	Value	State	Unit
									Device Status	ro	Device is OK	i	
									Detailed Device Status [1]	ro		i	
									Detailed Device Status [2]	ro		i	
									Detailed Device Status [3]	ro		i	
									Detailed Device Status [4]	ro		i	
									Detailed Device Status [5]	ro		i	
									[+] Active diagnostics				
									[+] Simulation				
									[+] Electronics temperature				
									[-] Heartbeat Verification				
									Start verification	wo	Start		
									Verification result	ro	Not done	i	
									Operating time (Verification)	ro		i	
									[+] Block parameterization error message				
									[+] Smart sensor descriptor				




 1 IODD for Heartbeat Verification

4.3 Verification results



Access to the verification results via the SmartBlue app.


4.3.1 Classification of results

Individual result:

-  **Failed**
At least one individual test in the test group was **Out of specification (S)**.
-  **Passed**
All individual tests in the test group complied with the specifications.
The result is **Passed** even if the result of an individual test is **Not done** and the result of all other tests is **Passed**.
-  **Not done**
No test has been performed for this test group. For example, because this parameter is not available or activated in the current device configuration.

Overall result:

-  **Failed**
At least one test group has **Failed**.
-  **Passed**
All verified test groups were within the specification.
The overall result is **Passed** even if the result of individual test groups is **Not done** and the result of all other tests is **Passed**.

 Heartbeat Verification confirms on demand that the device is functioning within the specified measuring tolerance with a total test coverage (TTC) specified as a percentage.

4.4 Verification report

The results of the verification can be documented via the SmartBlue app in a Verification report. Since the Verification results are automatically and uniquely identified with the Operating time, they are suitable for the traceable documentation of the verification of devices.

The following information is provided on each report page/section for unique identification:

- Serial number
- Device tag
- Operating time (Verification)

4.4.1 Verification report, section 1

Measuring point identification, presentation of the overall verification result and confirmation of completion:

- **Device information**
Information on the location, Device tag, Device name, Order code, Firmware version, Hardware version
- **Calibration / Configuration**
Information on device configuration such as Empty calibration, Full calibration, Medium type, media group, CRC device configuration, CRC linearization table
- **Verification information**
Operating time (Verification) and verification ID for the clear assignment of the Verification results. This aids the traceable documentation of the verification.
- **Verification result**
Overall result of the verification is **Passed** if all individual results are **Passed**.

4.4.2 Verification report, section 2

Details on the individual results of the following test groups:

- Verification pre-condition
- Mainboard module
- Sensor module

4.4.3 Verification report, section 3

Details with values for the individual tests from section 2.

4.4.4 Verification report, section 4

Additional data and information that can influence the assessment of the measurement results or the appraisal of the process conditions:

- Process condition (at the time of verification)
- Device history
- Sensor history

4.5 Test criteria for the test objects

4.5.1 Verification pre-condition

System status

Checks active measurement device errors at diagnostical behavior "alarm". If an active error is detected, then verification will be performed but the overall result will always be "Failed".

4.5.2 Mainboard module

Terminal voltage

Checks whether the voltage at the supply terminals is within the specified limits. Exceeding the maximum terminal voltage can damage the device. If the supply voltage is permanently in the maximum range, the useful life of the device can be reduced. If the terminal voltage falls below the minimum, the device can fail.



The Terminal voltage is measured between pins 1 and 2. In 2-wire operation, this corresponds to the supply voltage. In 3- or 4-wire operation, this corresponds to the supply voltage minus the voltage drop at the load.

Terminal voltage value

The Terminal voltage currently applied is measured and compared with the limit values (Minimum terminal voltage and Maximum terminal voltage).

Limit values: 12 to 30 V

Output current

The Output current is continuously read back and compared with the configured current in accordance with the measured value.

Current deviation

Checks whether read-back current at the output matches the current set by the device.

Limit values: -0.5 to +0.5 mA

Software integrity

Checks whether the function blocks of the software are executed in the correct order. Checks whether certain events are currently present e.g. incrementing of the sequence counter in the mainboard is checked with each new measured value in the sensor module. If this is not the case, **Failed** is displayed.

RAM check

Checks the correct function of the RAM (Random Access Memory). If a RAM cell is defective, this is detected by the value read back from the RAM cell and **Failed** is displayed.

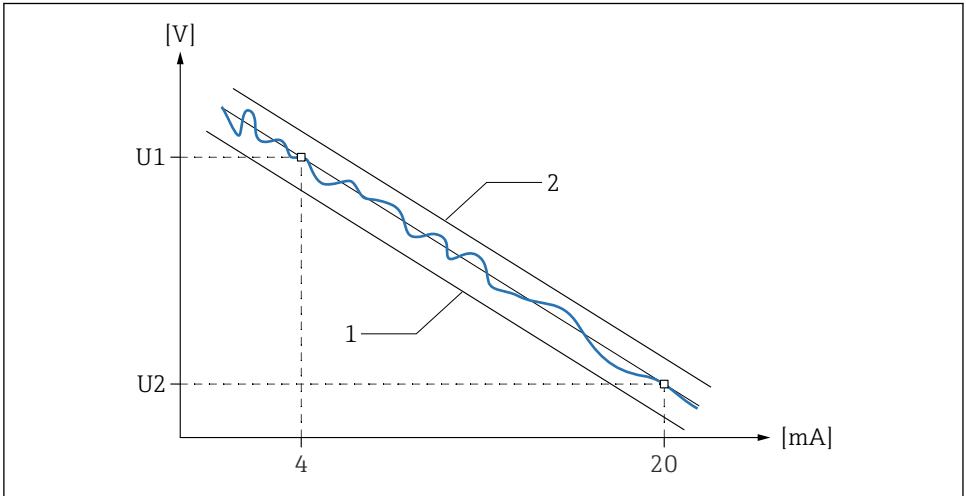
ROM check

Checks the correct function of the ROM memory (Read-Only-Memory). If the checksum of the checked program code area does not match, Failed is output.

Loop diagnostics

Only visible if Heartbeat Monitoring functionality Loop diagnostics was enabled via the wizard.

Checks whether the voltage/current values are within range or the voltage/current baseline defined with wizard. "Failed" can indicate faulty power supply or grounding / wiring.



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 2 *Current/voltage baseline*


1 *Clamping voltage lower threshold*

2 *Clamping voltage upper threshold*

"Terminal voltage 1" parameter

Shows the current terminal voltage that is applied at the output

The voltage is continuously monitored to ensure it falls within the characteristic curve band defined by the **Clamping voltage lower threshold** parameter and **Clamping voltage upper threshold** parameter.

 The Terminal voltage is measured between pins 1 and 2. In 2-wire operation, this corresponds to the supply voltage. In 3- or 4-wire operation, this corresponds to the supply voltage minus the voltage drop at the load.

"Timestamp Baseline" parameter

Shows the operating time counter when the baseline was created.

At this time the upper Terminal voltage (U1) at 4 mA and the lower Terminal voltage (U2) at 20 mA was determined.

"Resistance Baseline" parameter

Baseline resistance value (slope of the current-voltage baseline).

"Supply voltage Baseline" parameter

Data point of the baseline; voltage at the point where the current-voltage baseline is established.

"Timestamp previous Baseline" parameter

Shows the operating time counter (time) when the previous baseline was created.

"Resistance previous Baseline" parameter

Previous baseline resistance value (slope of the previous current-voltage baseline).

"Supply voltage previous Baseline" parameter

Data point of the previous baseline; voltage at the point where the previous current-voltage baseline is established.

4.5.3 Sensor module

Signal quality

The Relative echo amplitude is used for evaluation purposes.

"Signal quality" parameter

Shows the quality of the evaluated level signal.

- Strong (>10 dB)
- Medium (≤ 10 dB)
- Weak (≤ 5 dB)
- No signal (0 dB)

"Relative echo amplitude" parameter

Shows the relative amplitude (i.e. the distance to the evaluation curve) of the evaluated level signal.

Radar Accuracy Index (RAI)

The Radar Accuracy Index (RAI) evaluates the Micropilot reference accuracy. The test method to determine the RAI is based on the generation of a test signal via the high-frequency oscillator and the measurement of the signal using the sample oscillator.

"Radar Accuracy Index (RAI)" parameter

The Radar Accuracy Index (RAI) [ppm] is output as the relative deviation between two RAI measurements:

- Traceable measurement which was performed during production as part of device calibration
- Measurement which is performed in the application as part of Heartbeat Verification

Failed option is output if the relative RAI deviation exceeds or drops below the limit values.

Limit values: -200 to +200 ppm

Clock and analog path

To ensure correct measurement, a test signal is generated and evaluated via the normal measuring path (frequency and amplitude).

"Reference echo frequency" parameter

The frequency of the test signal is evaluated and compared with the limit values

Limit values: 990 000 to 1 010 000 Hz

"Reference echo amplitude" parameter

The amplitude of the test signal is evaluated and compared with the limit values

Limit values: device-specific

IF signal

The check of the intermediate frequency signal (IF signal) ensures the sensor electronics and the associated signal path are functioning correctly. The permitted range is defined by limit values for the amplitude and amplitude swing.

"Maximum value IF amplitude" parameter

Measured maximum value of the IF amplitude

Limit values: max. 65 525 digits

"Minimum value IF amplitude" parameter

Measured minimum value of the IF amplitude

Limit values: min. 10 digits

"IF amplitude span" parameter

Amplitude swing; difference between the maximum value for the IF amplitude and the minimum value for the IF amplitude

Limit values: min. 10 digits

Sensor integrity

Checks the function of the sensor (no event active).

Energy boundaries

Checks whether the energy states are within the limits.

Energy monitoring

Checks the energy balance on the sensor.

"Energy storage capacity" parameter

Checks if the measuring capacitors are within the valid range

Limit value: 500 to 3 000 μF

"Radar signal input strength" parameter

Checks the input power in the sensor module

Limit value: $>8 \text{ mW}$

"Measurement energy consumption" parameter

Checks whether the energy consumption of the sensor module is in the valid range

Limit value: 1 to 20 mWs

Sensor module voltage

Checks the supply voltages.

"Value for power supply 1.8 V" parameter

Supply voltage for the logic part of the sensor module (processor, memory)

Limit value: 1.71 to 1.95 V

"Value for DCS power supply" parameter

Supply voltage transmitted by the mainboard to the sensor module

Limit value: 6 to 20 V

RAM check

Checks the correct function of the RAM (Random Access Memory). If a RAM cell is defective, this is detected by the value read back from the RAM cell and **Failed** is displayed.

ROM check

Checks the correct function of the ROM memory (Read-Only-Memory). If the checksum of the checked program code area does not match, Failed is output.

Buildup detection

Prerequisite: The Heartbeat Monitoring buildup detection function has been activated beforehand via the wizard. Checks whether there is buildup on the antenna.

"Buildup index" parameter

Build-up index 0% means: no build-up. Build-up index 100% means: maximum detectable build-up.

Limit value: customer-specific setting

Foam detection

Prerequisite: The Heartbeat Monitoring foam detection function has been activated beforehand via the wizard. Checks whether there is foam on the liquid medium.

"Foam index" parameter

Foam index 0% means: no foam. Foam index 100% means: maximum detectable foam.

Limit value: customer-specific setting

4.6 Other Verification information



The following parameters are information values only and do not include an evaluation with respect to **Passed/Failed**.

4.6.1 Process conditions at the time of verification

"Signal quality" parameter

Possible causes of poor signal quality are EMC interference, a defective device on the same bus, poor contacts, an incorrectly dimensioned resistor

EMC interference

"Electronics temperature" parameter

Current Electronics temperature and permitted Minimum/maximum values

"Sensor temperature" parameter

Current Sensor temperature and permitted Minimum/maximum values

"Level linearized" parameter

Displays linearized level

"Absolute echo amplitude" parameter

Shows the absolute amplitude of the evaluated level signal.

"Relative echo amplitude" parameter

Shows the relative amplitude (i.e. the distance to the evaluation curve) of the evaluated level signal.

4.6.2 Device history**Terminal voltage value**

Shows the current terminal voltage that is applied at the output. Including the Minimum/maximum values achieved since the last reset



The Terminal voltage is measured between pins 1 and 2. In 2-wire operation, this corresponds to the supply voltage. In 3- or 4-wire operation, this corresponds to the supply voltage minus the voltage drop at the load.

Electronics temperature

Displays the current temperature of the main electronics. Including the Minimum/maximum values achieved since the last reset.

"Sensor temperature" parameter

Displays the current temperature of the sensor electronics. Including the Minimum/maximum values achieved since the last reset.

"Time min. sensor temperature" parameter

Time of the operating time counter at which the Minimum sensor temperature was reached

"Time max. sensor temperature" parameter

Time of the operating time counter at which the Maximum sensor temperature was reached

4.6.3 Sensor history**"Max. filling speed" parameter**

Shows the maximum Filling speed achieved since the last reset; used to detect possible measurement peaks

"Max. draining speed" parameter

Shows the maximum Draining speed achieved since the last reset; used to detect possible measurement peaks

"Level linearized" parameter

Displays the linearized level. Including the Minimum/maximum values achieved since the last reset.

"Time min. level" parameter

Time of the operating time counter at which the Min. level value was reached. Helps assign the recorded measurement peak to the process sequence

"Time max. level" parameter

Time of the operating time counter at which the Max. level value was reached. Helps assign the recorded measurement peak to the process sequence

"Counter underfilling" parameter

Number of level undershoots less than 0%

"Counter overfilling" parameter

Number of level overshoots greater than 100%

"Switch-on operations" parameter

Number of switch-on operations of the device

4.7 Safety mode wizard



This wizard can be used to write-protect the device via software. The safety-related parameters must be confirmed or unlocked in the wizard.

1. On the preparation screen, enter the locking code "7452".
2. Go through the wizard step by step.
3. Enter the locking code "7452".

The current **CRC device configuration** parameter is saved at the end of the wizard and the device is locked. The **CRC device configuration** parameter is unique and is based on the current settings of safety-relevant parameters.

If a device is unlocked and locked again, the current **CRC device configuration** parameter is compared with the **Stored CRC device configuration** parameter. If there is no difference in the configuration, the device is locked immediately. If there is a difference in the configuration, the safety-related parameter settings must be confirmed again.

5 Heartbeat Monitoring

Loop diagnostics wizard, **Foam detection** wizard and **Buildup detection** wizard are available. In addition, other monitoring parameters can be output for use in predictive maintenance or application optimization.

5.1 Monitoring parameters

The following monitoring parameters can be assigned to the various outputs of the device for continuous transmission to a Condition Monitoring system:

- **Level linearized**
Displays the linearized level.
- **Distance**
Distance from process connection to product surface
- **Terminal voltage 1**
Shows the current terminal voltage that is applied at the output



The Terminal voltage is measured between pins 1 and 2. In 2-wire operation, this corresponds to the supply voltage. In 3- or 4-wire operation, this corresponds to the supply voltage minus the voltage drop at the load.

- **Electronics temperature**
Temperature measured in the main electronics
- **Sensor temperature**
Temperature measured in the sensor electronics
- **Absolute echo amplitude**
Shows the absolute amplitude of the evaluated level signal.

- **Relative echo amplitude**
Shows the relative amplitude (i.e. the distance to the evaluation curve) of the evaluated level signal.
- **Area of incoupling**
Ringing integral within the detection area. Shows the area under the echo curve in the range up to 1 m (3.28 ft) in order to determine the buildup quantity on the antenna.
- **Buildup index**
Visibility depends on order options or device settings
Build-up index 0% means: no build-up. Build-up index 100% means: maximum detectable build-up.
- **168 Build-up detected**
Visibility depends on order options or device settings. Shows whether the customer-specific threshold for buildup detection has been exceeded.
- **Foam index**
Visibility depends on order options or device settings
Foam index 0% means: no foam. Foam index 100% means: maximum detectable foam.
- **952 Foam detected**
Visibility depends on order options or device settings
Shows whether the customer-specific threshold for foam detection has been exceeded.
- **Percentage range**
Measured variable of the first dynamic variables (PV) as a percentage.
- **Loop current**
The loop current is the current at the output which is determined by the analyzed level signal.
- **Terminal current**
The terminal current is the current that is read back at the terminal block.

Monitoring parameters via IO-Link:

1. Run the Heartbeat Monitoring wizard in the SmartBlue app.
2. Heartbeat Monitoring parameters can be used via IO-Link function blocks from Endress+Hauser or read out acyclically via ISDU parameters. IO-Link function blocks can be found in the download area of the Endress+Hauser website (www.endress.com/downloads).

Selecting the measured value that is shown on the local display:

1. Navigation: System → Display
2. Select the measured value.

5.2 "Loop diagnostics" wizard


The **Loop diagnostics** wizard is only available if the current output is enabled.

Using this wizard, changes in the current-voltage loop characteristics (baseline) can be used to detect unwanted installation anomalies such as creep currents caused by terminal corrosion or a deteriorating power supply that can lead to an incorrect 4-20 mA measured value.

5.2.1 Areas of application

- Detection of changes in the measuring circuit resistance due to anomalies
Examples: Contact resistance or leakage currents in wiring, terminals or grounding due to corrosion and/or moisture
- Detection of faulty power supply

5.2.2 Loop diagnostics initialization

 Activate the loop diagnostics during device commissioning.

Guidance → Heartbeat Technology → Loop diagnostics → Loop diagnostics

Programming the current-voltage baseline

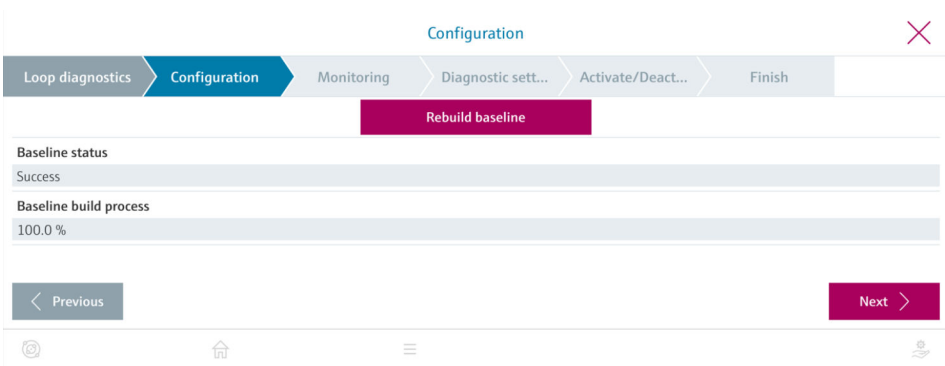
Typically, the voltage at the terminal changes in a linear manner as a function of the analog output current. Following the initial installation, the current-voltage baseline of the measuring circuit is recorded via an active current simulation of 4 or 20 mA.

CAUTION

The current output is simulated. Alarms can be triggered by mistake. The behavior in the control loop can change.

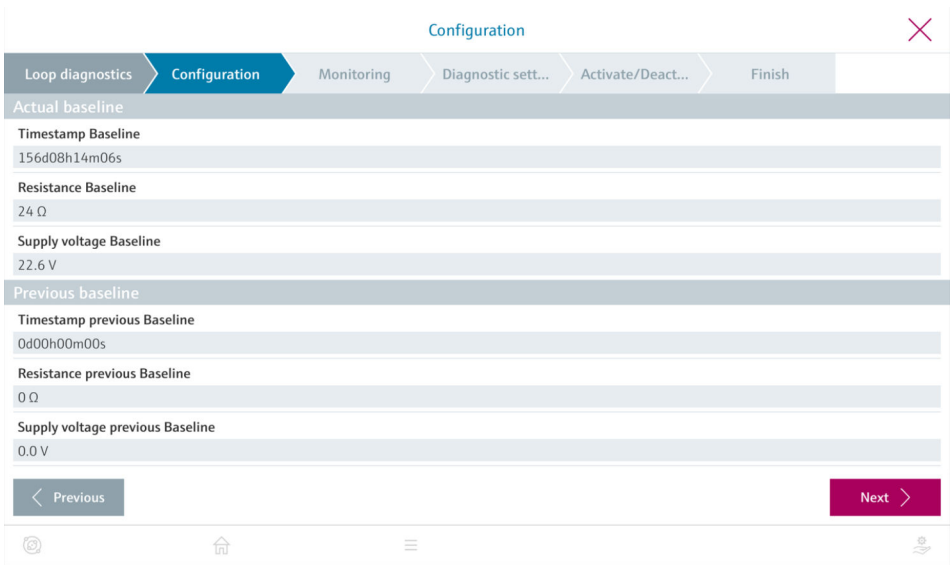
- ▶ Take appropriate measures.
- ▶ Bridge the PLC if necessary.
- ▶ The baseline cannot be programmed on a write-protected device.

The bandwidth about this baseline (Factory settings 1.5 V) determines when an event is reported.

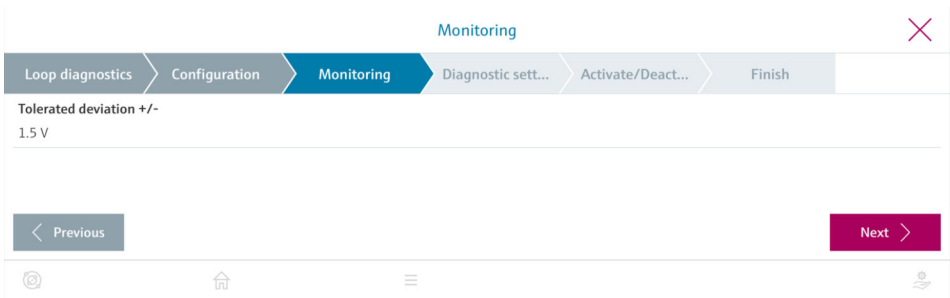


The screenshot displays a configuration screen for loop diagnostics. At the top, a progress bar indicates the current step is 'Configuration', with other steps being 'Loop diagnostics', 'Monitoring', 'Diagnostic sett...', 'Activate/Deact...', and 'Finish'. A 'Rebuild baseline' button is prominently displayed in the center. Below this, the 'Baseline status' is shown as 'Success'. The 'Baseline build process' is also shown as 100.0% complete. Navigation buttons for 'Previous' and 'Next' are located at the bottom of the main content area.

 3 Screenshot - Values and entries provided as examples



4 Screenshot - Values and entries provided as examples



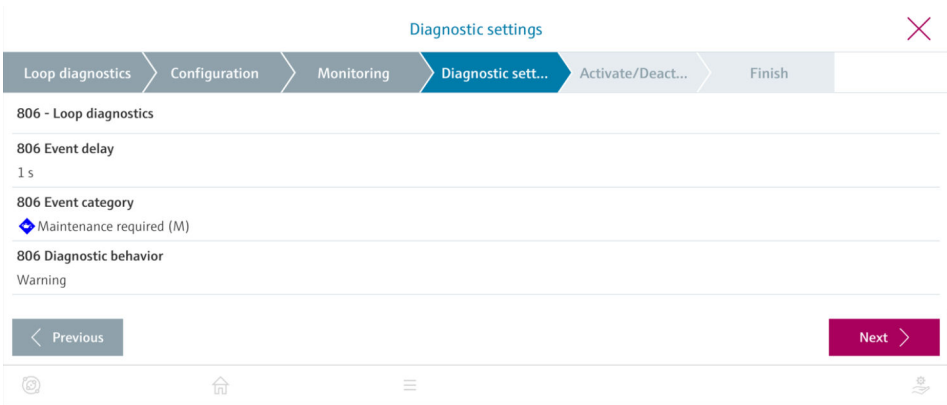
5 Screenshot - Values and entries provided as examples

The current and last baseline of the current-voltage baseline are saved in the device. Reprogram the baseline if changes have been made in the measuring circuit.

Alarm delay

Time during which the status triggering the Alarm must be present before an event message is displayed. Required to rule out short-term signal interferences. Factory settings: 1 s

Diagnostic behavior



6 Screenshot - Values and entries provided as examples

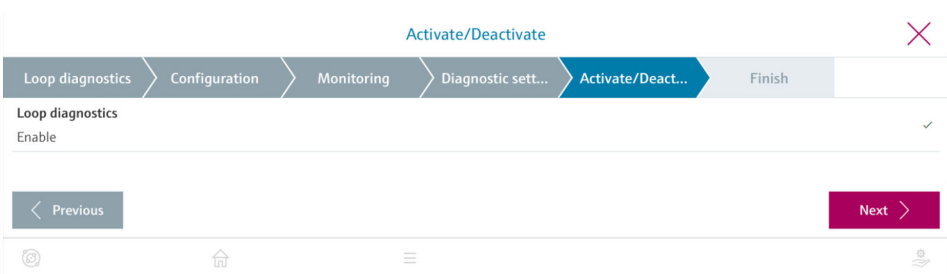
Diagnostic behavior

Determines how the detected **Loop diagnostics** diagnostic message event is to be communicated:

- **Logbook entry only** option: No digital or analog transmission of the report
- **Warning** option: Current output remains unchanged; report is output digitally (Factory settings)

The warning is no longer available in the device once the permissible conditions are met again.

Disable / Enable



7 Screenshot - Values and entries provided as examples

Specify whether the Loop diagnostics function should be enabled. If the **Disable** option option is selected, no analysis and therefore no event reporting take place.

i In some cases, changes in the measuring circuit resistance can only be detected at high output currents. By rebuilding the baseline, characteristic values can be compared and changes detected.

5.3 "Foam detection" wizard

This wizard configures the automatic foam detection.

Foam detection can be linked to an output variable or status information e.g. to control a sprinkler used to dissolve the foam. It is also possible to monitor the foam increase in a so called foam index. The foam index can also be linked to an output variable and can be shown on the display.

Preparation:

The Foam monitoring initialization should only be done without or less foam.

5.3.1 Areas of application

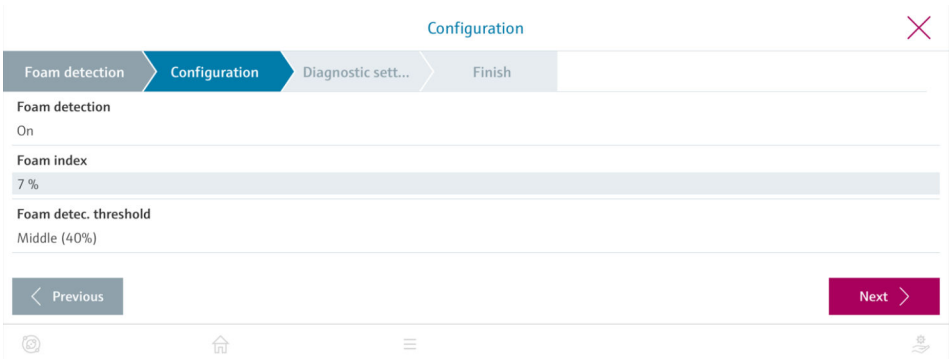
- Measurement in liquids
- Reliable detection of foam on the medium

5.3.2 Foam detection initialization

Foam detection wizard is only available for Medium type= Liquid.

Navigation: Guidance → Heartbeat Technology → Heartbeat Verification → Foam detection

i Foam detection should only be initialized with little or no foam.



8 Screenshot - Values and entries provided as examples

Configuration ✕

Foam detection > **Configuration** > Diagnostic sett... > Finish

Lower level range limit
0.00 mm

Upper level range limit
2000.00 mm ✓

< Previous Next >

9 Screenshot - Values and entries provided as examples

Diagnostic settings ✕

Foam detection > Configuration > **Diagnostic sett...** > Finish

952 Foam detected

952 Diagnostic behavior
Warning

952 Event category
⚠ Out of specification (S)

< Previous Next >

10 Screenshot - Values and entries provided as examples

952 Diagnostic behavior

Determines how the detected Foam detection result is to be communicated:

- **Logbook entry only** option: No digital or analog transmission of the report
- **Warning** option: Current output remains unchanged; report is output digitally (Factory settings)
- **Alarm** option: Current output adopts the configured alarm current

5.4 "Buildup detection" wizard

This wizard configures the build-up detection.

Basic idea:

The build-up detection can, for example, be linked to a compressed-air system to clean the antenna.

With the build-up monitoring the maintenance cycles can be optimized.

Preparation:

The build-up monitoring initialization should only be done without or less build-up.

5.4.1 Areas of application

- Reliable measurement in liquids and solids
- Detection of buildup on the antenna, enables optimization of maintenance cycles

5.4.2 Buildup detection initialization

Guidance → Heartbeat Technology → Heartbeat Verification → Buildup detection



Buildup detection should only be initialized with little or no buildup.

Configuration

Buildup detecti... Configuration Diagnostic sett... Finish

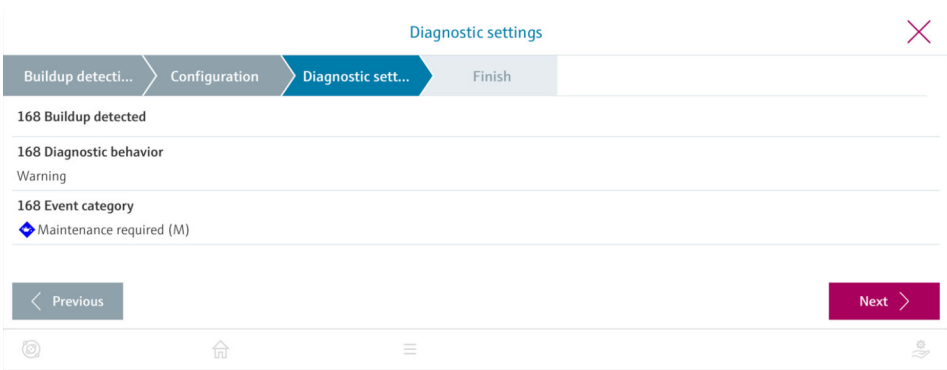
Buildup detection
On

Buildup index
0 %

Buildup detection threshold
Middle (40%)

Previous Next

11 Screenshot - Values and entries provided as examples



12 Screenshot - Values and entries provided as examples

168 Diagnostic behavior

Determines how the detected Buildup detection result is to be communicated:

- **Logbook entry only** option: no digital or analog transmission of the report
- **Warning** option: Current output remains unchanged; report is output digitally (Factory settings)
- **Alarm** option: Current output adopts the configured alarm current



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