

# Special Documentation

## Micropilot FMR43

### HART

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](http://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

HART®

Registered trademark of the FieldComm Group, Austin, Texas, USA

# 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):

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

$\lambda_{TOT}$ : Rate of all theoretically possible failures

$\lambda_{du}$ : 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 HART communication



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

- Integration of the measuring device for the output of measured values via the 4 to 20 mA HART output
- **Simulation** parameter **Off** option
- **Failure behavior current output** parameter set to **Min.** option or **Max.** option and evaluation unit detects both alarms
- 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](http://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: here you can see if the application package is enabled.  
Navigation: System → Software configuration → Software option overview

### 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:

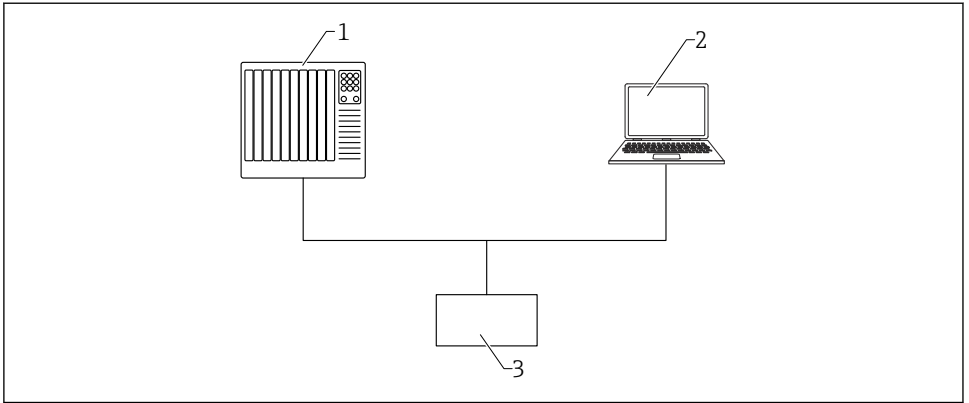
Navigation: System → Software configuration → Activate SW option

### 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.

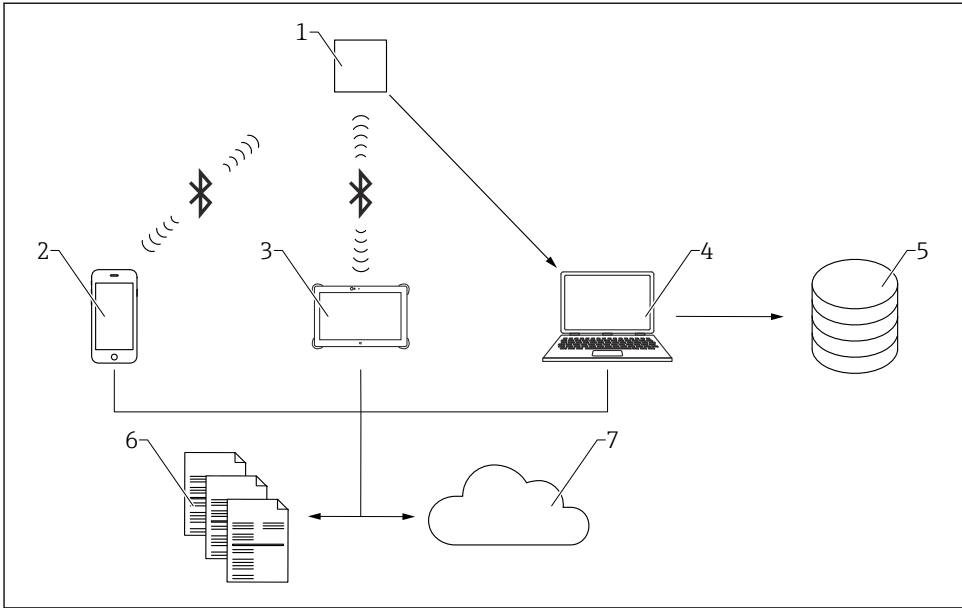
## 3 System integration

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).



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- 1 PLC
- 2 Asset management system
- 3 Measuring instrument



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- 1 Device with local display
- 2 Mobile terminals with SmartBlue app
- 3 FieldXpert
- 4 DTM-based tools, e.g. FieldCare or DeviceCare
- 5 Data archive
- 6 Verification report
- 7 Netilion Library

Perform Heartbeat Verification using one of the following interfaces:

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

External access to the device in order to start a verification and signal the verification result (**Passed** option or **Failed** option) must be performed by a higher-level system via 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 created using the Plant Asset Management Software FieldCare, DeviceCare, or the SmartBlue app and FieldXpert.

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

### Heartbeat Verification

- Start verification
- Upload, archive and document the verification results including detailed results

### Heartbeat Monitoring via HART or 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 is output 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](http://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 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  $\pm 1$  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:

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

### Show status:

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



**Show result:**

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




## 4.3 Verification results

Access to the verification results via:



- SmartBlue app
- DTM-based tools (e.g. FieldCare or DeviceCare)
- FieldXpert

### 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 DTM-based tools, the SmartBlue app or FieldXpert 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.

**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.

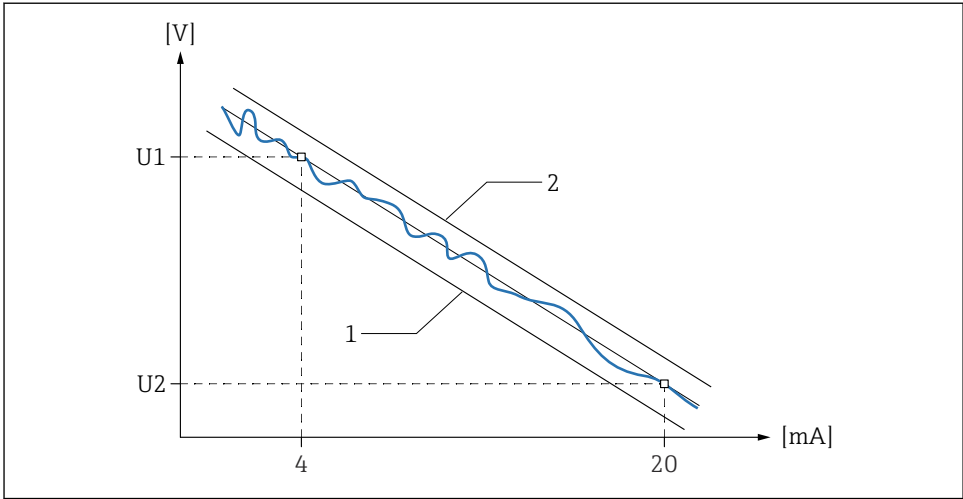
**ROM check**

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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#### 1 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 band defined by the **Clamping voltage lower threshold** parameter and **Clamping voltage upper threshold** parameter.

#### "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 ( $\leq 10$  dB)
- Weak ( $\leq 5$  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  $\mu\text{F}$

**"Radar signal input strength" parameter**

Checks the input power in the sensor module

Limit value:  $>8$  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.

#### 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.

## 4.8 Heartbeat Technology in safety instrumented systems

Verification (Heartbeat Verification) enables the documentation of the current device diagnostic or device status as a proof of testing.

- This supports the documentation of proof tests in accordance with IEC 61511-1, Section 16.3.3, "Documentation of proof tests and inspection".
- The verification is based on automatically executed device-specific test sequences. From a safety point of view, verification cannot replace the proof-testing of a sensor, since random errors are usually not detected.
- Nevertheless, verification can be usefully applied as a step in a proof-test scenario as per NA 106 as a flexible proof-testing strategy.
- The verification report should be regarded as a supplement to the proof-test report.

# 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
- **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.

**Defining monitoring parameters as HART SV/TV/QV:**

1. Navigation: Application → HART output → HART output
2. Select SV/TV/QV assignment.
3. Select monitoring parameters.

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

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

Configuration Diagnostic settings Output settings Finish

**Assign PV**

Level linearized

Distance

**Assign SV**

Distance ▼

**Assign TV**

Absolute echo amplitude ▼

**Assign QV**

Relative echo amplitude ▼

Cancel Previous Next

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2 Screenshot - Values and entries provided as examples

## 5.2 "Loop diagnostics" wizard

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 Initialization of Loop diagnostics

Activate loop diagnostics during device commissioning.

Guidance → Heartbeat Technology → Loop diagnostics → Loop diagnostics

## Programming the current/voltage characteristic (baseline)

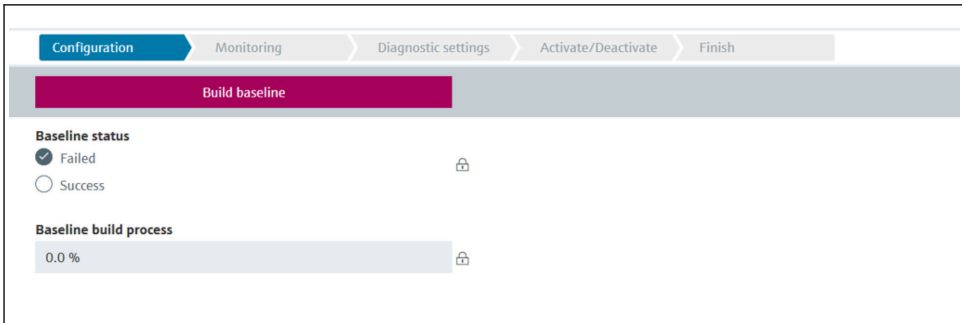
Typically, the voltage at the terminal changes in a linear manner as a function of the analog output current. After initial installation, the current/voltage baseline characteristic is recorded by the measuring circuit via an active current simulation of 4 or 20 mA.

### **⚠ 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 around this characteristic (Factory settings 1.5 V) determines when an event is reported.



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 3 Screenshot - values and entries are examples only

**Configuration** Monitoring Diagnostic settings Activate/Deactivate

**Actual baseline**

**Timestamp Baseline**  
0d05h02m15s

**Resistance Baseline (62)**  
250 Ohm

**Supply voltage Baseline (63)**  
24.0 V

**Previous baseline**

**Timestamp previous Baseline**  
0d00h00m00s

**Resistance previous Baseline**  
0 Ohm

**Supply voltage previous Baseline**  
0.0 V

Cancel Previous Next

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4 Screenshot - values and entries are examples only

Configuration **Monitoring** Diagnostic settings Activate/Deactivate

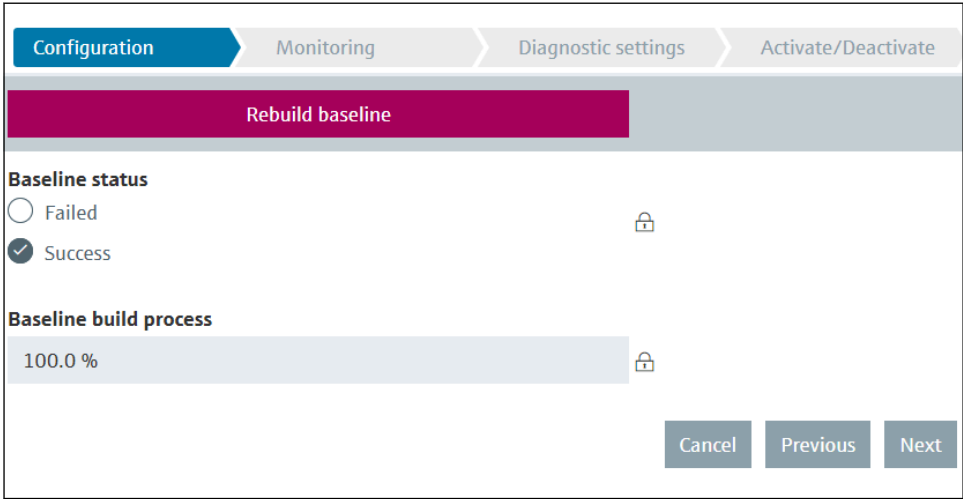
**Tolerated deviation +/- (64)**  
1.5 V

Cancel Previous Next

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5 Screenshot - values and entries are examples only

The current and last baseline of the current/voltage characteristic are saved in the device. Program the baseline again if changes have been carried out in the measuring circuit.



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6 Screenshot - values and entries are examples only

### 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

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7 Screenshot - values and entries are examples only

### Diagnostic behavior

Defines how the recognized **Loop diagnostics** diagnostic message event should be communicated:

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


If the permitted conditions are reached again, the warning is no longer available in the device.

### Disable / Enable

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8 Screenshot - values and entries are examples only

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

 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

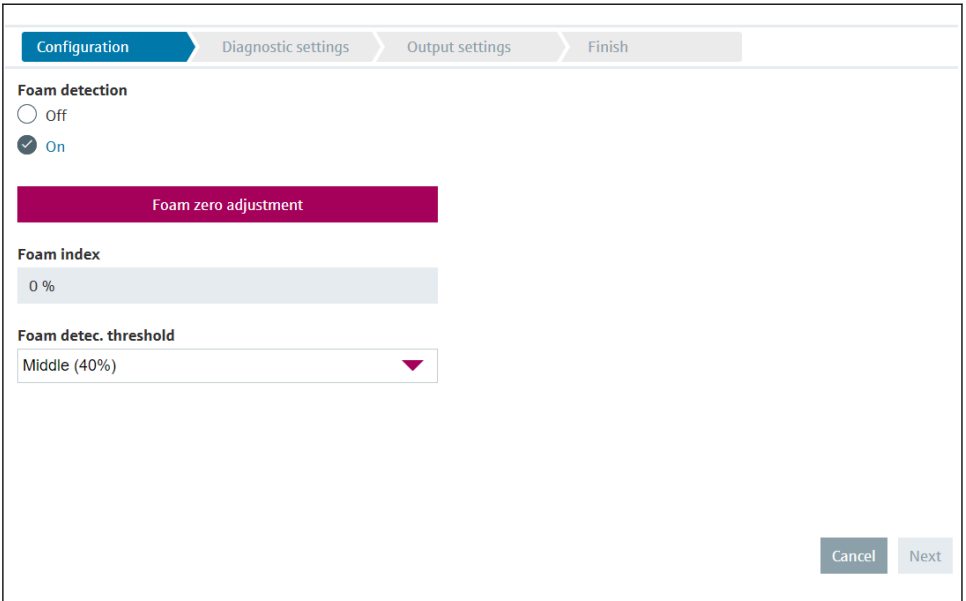
### 5.3.2 Foam detection initialization

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

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

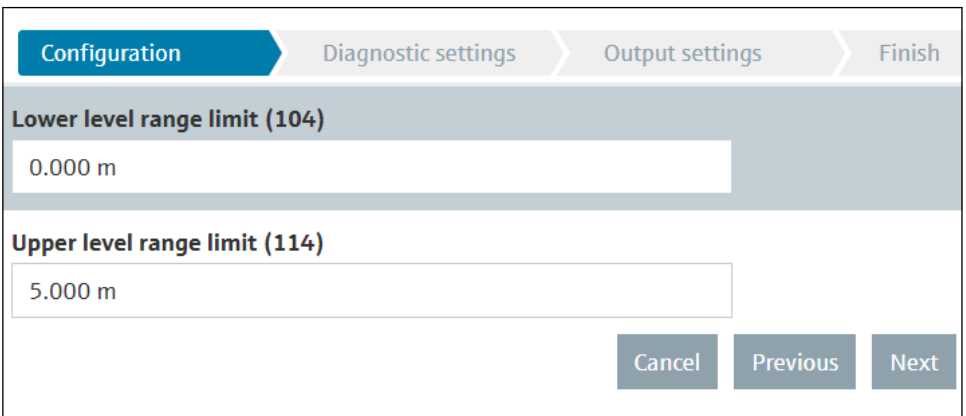
 Foam detection should only be initialized with little or no foam.





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9 Screenshot - Values and entries provided as examples



A0050878

10 Screenshot - Values and entries provided as examples

Configuration Diagnostic settings Output settings

952 Foam detected

**952 Diagnostic behavior**

Warning

**952 Event category**

Out of specification (S)

**Assign HART variables?**

No

Yes

Cancel Previous Next

A0050879

11 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 Diagnostic settings Output settings Finish

**Buildup detection**

Off

On

Buildup zero adjustment

**Buildup index**

100 %

**Buildup detection threshold**

Middle (40%) ▼

Cancel Next

A0050881

12 Screenshot - Values and entries provided as examples

Configuration Diagnostic settings Output settings Finish

168 Build-up detected

**168 Diagnostic behavior**  
Warning

**168 Event category**  
Maintenance required (M)

**Assign HART variables?**  
 No  
 Yes

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13 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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