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Special Documentation
Cerabar PMP43
HART

Application package
Heartbeat Verification + Monitoring

Endress+Hauser
People for Process Automation

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

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):

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

λ_{TOT}: Rate of all theoretically possible failures

λ_{du}: Rate of dangerous undetected failures

The dangerous undetected 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 95 %.

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 measuring instrument for measured value output via 4 to 20 mA HART output
- **Simulation** parameter **Off** option
- **Failure behavior current output** parameter set to the **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 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.

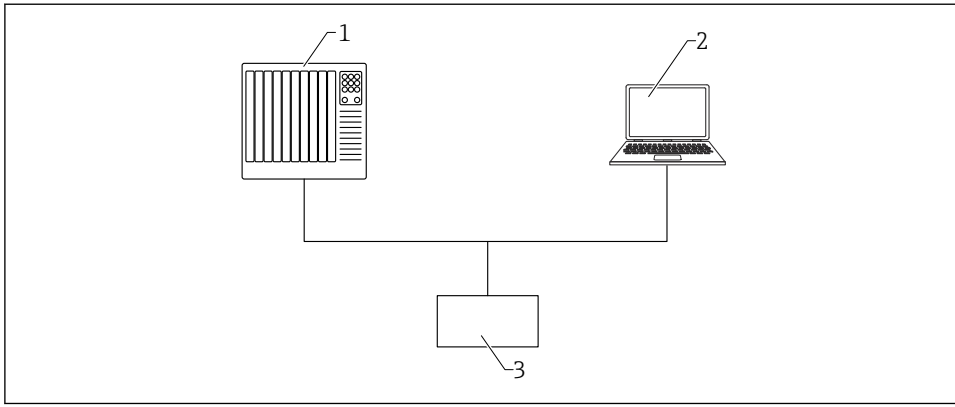
Enter the activation code in the operating menu:
Navigation: System → Software configuration → Activate SW option

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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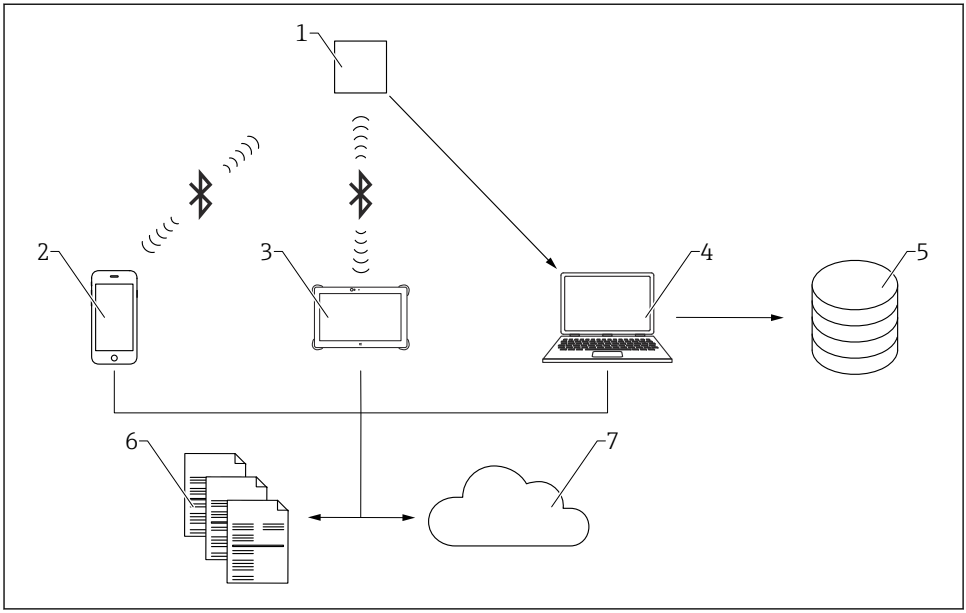
1 PLC
2 Asset management system
3 Measuring instrument



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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 of 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.

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). 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 permanent 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 on request within the specified measuring tolerance with a total test coverage TTC (Total Test Coverage) in percent.

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

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, identification of the verification result and confirmation of completion:
- Plant operator
  Customer reference
- Device information
  - Information on the place of operation
  - Device name
  - Management of the information in the measuring instrument
  - Firmware and hardware version
- Calibration/configuration
  - Setting: **Zero adjustment offset** parameter, **Lower range value** parameter, **Upper range value** parameter, **Checksum** parameter **CRC device configuration**, information on Loop diagnostics (if active): Timestamp Baseline, Resistance Baseline, Supply voltage Baseline
  - It also indicates whether the sensor used is traceable
- Verification information
  - Operating time for the clear assignment of the results. This aids the traceable documentation of the verification
  - The system time is indicated in addition to the current operating time in the measuring instrument
- Verification ID
  Displays consecutive numbering of the verification results in the measuring instrument
- Verification result
  The overall result of the verification is "passed" if all of the individual results are "passed"

4.4.2 Verification report, section 2

Details on the individual results for all test groups:
- Device and verification information
- Test groups
  - Verification pre-condition
  - Mainboard module
  - Sensor module

4.4.3 "Verification result" wizard - Values, section 3

Details with values for the individual tests from section 2

4.4.4 "Verification result" wizard, section 4

Additional data that can influence the assessment of the measurement results or the appraisal of the process conditions. Information regarding:
- Process condition
  - HART signal
  - HART signal quality
  - Sensor pressure
  - Zero adjustment offset
  - Sensor temperature
  - Electronics temperature
  - System status
- Historical values of the measuring instrument
  - Pressure min
  - Pressure max
  - Minimum sensor temperature
  - Maximum sensor temperature
  - Minimum electronics temperature
  - Maximum electronics temperature
  - Minimum terminal voltage
  - Maximum terminal voltage
- Sensor history
  - Counter limit underruns sensor Tmin
  - Counter limit overruns sensor Tmax
  - Counter limit underruns sensor Pmin
  - Counter limit overruns sensor Pmax
  - Counter limit underruns sensor Pmin
  - Counter limit overruns sensor Pmax
  - Counter underruns of user limit Pmin
  - Counter overruns of user limit Pmax
  - Counter underruns of user limit Pmin
  - Counter overruns of user limit Pmax
  - Counter for power-on
  - Counter Baseline creation SSD

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.

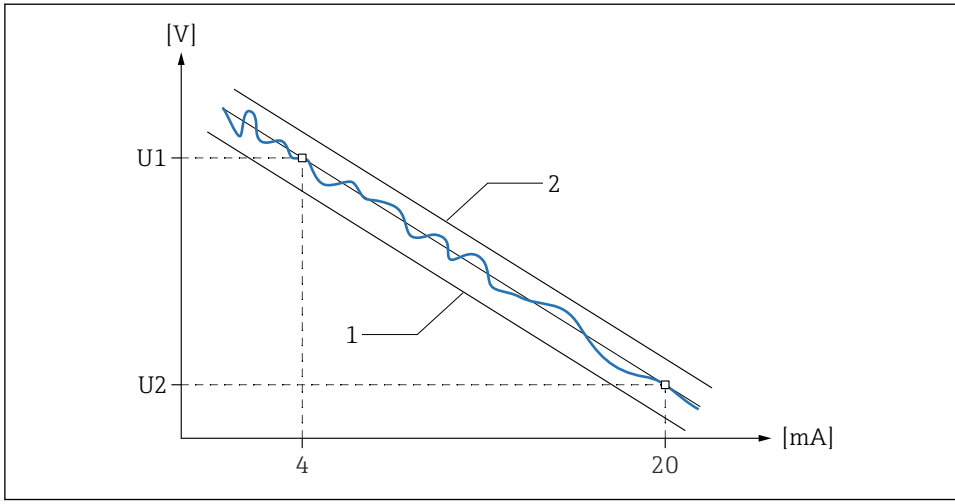
ROM check

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

Loop diagnostics

Only visible if the 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.



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 operated hours counter (time) at which the baseline was created.
At this time, the upper Terminal voltage (U1) was determined at 4 mA and the lower Terminal voltage (U2) at 20 mA.

"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 operated hours counter (time) at which the previous baseline was created.

"Resistance previous Baseline" parameter
Resistance value of the previous baseline (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

"Analog path integrity" parameter

Traceable check as to whether the current measurement path property of the production status is within the permissible tolerance.

This test can only be reliably carried out at a sensor temperature between −10 to +40 °C (14 to 104 °F).

If the result is **Failed**, a recalibration or device replacement is recommended.

If the result is **Not done**, either the sensor temperature is not within the permitted range at the time of verification or the sensor used is not traceable at that time.

"Sensor integrity" parameter/"Membrane integrity" parameter

Checks the integrity of the sensor. Scope of check depends on sensor type used.

The membrane integrity cannot be checked on all sensors.

"Statistical Sensor Diagnostics" parameter

Checks whether the actual values are within the defined signal noise thresholds. Only visible if enabled.

4.6 Further 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

"Sensor temperature" parameter
Current Sensor temperature as well as permitted Minimum/maximum values. The sensor temperature must be between −10 to +40 °C (14 to 104 °F) for a traceable test in accordance with ISO 9001.

HART signal quality
Share of defective data frames in relation to the total number of data frames received.
Possible reasons for poor signal quality include:
- EMC interference
- Defective device on the same bus
- Poor contacts
- Incorrectly dimensioned resistor

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 achieved

"Time max. sensor temperature" parameter
Time of the operating time counter at which the Maximum sensor temperature was achieved

4.6.3 Sensor history

Sensor temperature, Sensor pressure counter
Number of times the specified limit values are exceeded or undershot

Sensor temperature, Sensor pressure counter: user-defined limits
Number of the defined limit values exceeded or undershot

Counter for power-on
Number of device restarts

Counter Baseline creation SSD
Number of baselines built

4.7 Safety mode wizard

The device can be write-protected via the software using this wizard. The safety-related parameters must be confirmed in the wizard.

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

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 built 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

Several Heartbeat Monitoring Wizards are available. Furthermore, additional monitoring parameters can be displayed and used for predictive maintenance or application optimization.

5.1 Monitoring parameters

The following monitoring parameters can be assigned to the various outputs of the device for transmission to a condition monitoring system.

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.

5.1.1 Monitoring data in the cyclical HART signal

Data to detect blocked impulse lines/process KPIs
Transmission of the following data is always output as a HART signal as long as the "Activation code" software option is enabled. The following data are transmitted as a cyclical signal:
- Median of pressure signal
- Current Baseline noise
- Signal noise detected

Loop integrity data
- Terminal voltage
- Terminal current

Temperature profiling/heat tracer data
- Process Temperature
- Electronics temperature

5.1.2 Acyclical monitoring data via HART command

Mechanical stress data
- Counter limit underruns sensor Pmin
- Counter limit overruns sensor Pmax
- Counter underruns of user limit Pmin
- Counter overruns of user limit Pmax
- Pressure min
- Pressure max

Thermal stress data
- Counter limit underruns sensor Tmin
- Counter limit overruns sensor Tmax
- Counter underruns of user limit Tmin
- Counter overruns of user limit Tmax
- Minimum sensor temperature
- Maximum sensor temperature
- Minimum electronics temperature
- Maximum electronics temperature

Electrical stress data
- Minimum terminal voltage
- Maximum terminal voltage

5.2 "SSD: Statistical Sensor Diagnostics" wizard

An analysis of the signal noise can detect process anomalies that deviate from the programmed normal operation. This wizard supports the settings and threshold values that should lead to a diagnostic message.

5.2.1 Areas of application

The areas of application are all process anomalies that deviate from the programmed standard operation and affect the signal noise. Typical applications include function monitoring of spray balls, incorrect valve position following maintenance, or air pockets in water-based media, for example.

A number of conditions must be met for successful detection in the application:
- A signal noise should always be present
- There should be an adequate ratio of signal noise to actual pressure
- Process dynamics should be at a minimum so a usable baseline can be created

A number of prerequisites are checked during baseline creation or commissioning to ensure correct operation.

5.2.2 Commissioning

As the wizard does not interfere with the 4-20mA signal circuit, the SSD configuration can be performed during operation.

The settings must be adapted to the process conditions to ensure the device functions in line with user needs. Build the **Current Baseline signal** and **Current Baseline noise** parameters under recurrent process conditions. The diagnostic function is only active if the current process conditions are within the signal baseline bandwidth that is to be defined. If the current process conditions are outside the programmed process conditions, e.g. at the weekend or during system start-up, statistical analysis does not take place. Unwanted messages are avoided in this way.

The following parameters must be configured:

Current Baseline signal

Arithmetic average of the pressure signal (25 measured values). Perform under recurrent process conditions. This measured variable is analyzed in order to characterize the process conditions in the normal state. If process conditions are outside the defined limits, the function is set to the **Idle** option.

Baseline Signal Lower Control Line and Baseline Signal Upper Control Line

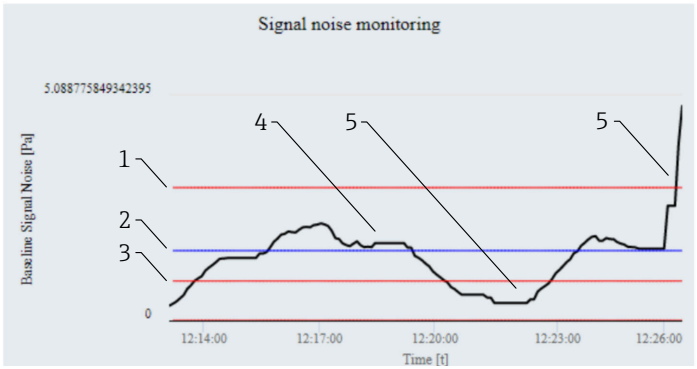
Defines the bandwidth above (UCL) or below (LCL) the baseline in which statistical analysis or anomaly detection is "**Active**".

Perform under recurrent process conditions. The recorder function and/or the min/max values in the Wizard can be used to specify as narrow a bandwidth as possible. The value must be > 0.

Current Baseline noise

The signal noise is determined with this process value.

The interquartile range indicates the width of the interval that contains the middle 50 % of the measuring points. This measured variable is analyzed in order to detect process anomalies.



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1 Upper signal noise threshold
2 Current Baseline signal
3 Lower signal noise threshold
4 Current signal noise
5 Anomaly

Baseline Signal Noise Lower Control Line and Baseline Signal Noise Upper Control Line

Ideally, these limit values are defined by actively simulating the process anomaly that is to be detected. The valve can be closed for this purpose for example. It is possible to define the limit value at precisely this point using the recorder function. If this is not possible, the user can define the LCL and UCL values that were produced when the signal baseline was built. Deviations and process anomalies can be identified on the basis of this "normal" state.

"Sample rate" parameter

Specifies the scan rate depending on the process conditions (frequency of transmission of measurement data points for analysis).

- **Fast** option: homogeneous, stable process (factory setting)
  One measured value every 200 milliseconds
- **Medium** option: dynamic process
  One measured value every second
- **Slow** option: extremely dynamic, variable process
  One measured value every 2 seconds.

The time required to build the baseline depends on the scan rate and can take between 3 minutes (**Fast** option setting) and up to several minutes (**Slow** option setting).

Default setting. **Fast** option

Only choose different settings if it is not possible to build a baseline with the **Fast** option setting.

Status information

Different status parameters are displayed in order to assess the current process conditions and the monitoring function:
- System status
- Signal noise status
- Signal status

"SSD Monitoring delay time" parameter

Period of time for which the "Out of range" status must be active before an event report is issued. This is necessary when short-term conditions are present.

Example: pump start-up phase which the user wants to ignore in order to avoid unwanted event messages.

"Diagnostic behavior" parameter

In addition to the NE107 category (default setting: Maintenance required (M)), the event behavior defines how the detected "Process anomaly" event is to be communicated:

- Logbook entry only: no digital or analog transmission of the report
- Warning: current output unchanged
  Message is output digitally (factory setting)
- Off: no logbook entry and no digital communication of the message is output

The message is always shown on the display. If an event is detected (overrange, signal noise) and the measured value returns to the permitted range due to the process conditions, the warning is no longer active in the device.

Enable/Disable

Enable or disable SSD.

After selecting "Disable", no statistical sensor diagnosis takes place. No diagnostic messages are output.

5.3 "Process window" wizard

Using user-defined limit values, undesired installation and application anomalies can be detected with this Wizard. Pressure shocks < 20 ms are detected here. Therefore it is possible to quantify thermal or mechanical stress on the device or in the process.

5.3.1 Areas of application

- Temperature:
  Defective trace heating system or insulation, frozen process connections or empty condensate pipes. Number of cleaning cycles can be quantified.
- Pressure:
  Pressure shocks from valves closing quickly or water jet from a spray ball generating dynamic pressure peaks.

5.3.2 Commissioning

The following parameters must be configured:

"High alert value" parameter/"Low alert value" parameter for min./max. temperature

Set range.
If this limit value is exceeded or undercut, a diagnostic event is generated. There is no hysteresis.

Factory setting: limit values as specified in the Technical Documentation

"High alert value" parameter/"Low alert value" parameter for min./max. pressure

Set range.
If this limit value is exceeded or undercut, a diagnostic event is generated. There is no hysteresis.

Factory setting: LRL/URL.

"Diagnostic behavior" parameter

In addition to the NE107 category (default setting: Maintenance required (M)), the event behavior defines how the detected "Process anomaly" event is to be communicated.

Select event behavior

"Logbook entry only":
no digital or analog transmission of the message

"Warning": Current output unchanged. Message is output digitally (default).

"Alarm": Current output assumes the set alarm current.

Regardless of the setting, the message appears on the display. If the permissible conditions are reached again, the warning is no longer available in the instrument.

Up to 100 events are saved in the logbook.

Disable/Enable

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

5.3.3 Analysis

The number of times values were over/under range can be used to quantify the mechanical or thermal stress of the measuring point. This information can be read out acyclically.

Navigation: Diagnostics → Minimum/maximum values

5.4 "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.

5.4.1 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

5.4.2 Loop diagnostics initialization

Enable the loop diagnostics as part of device commissioning.

Navigation: Guidance → Heartbeat Technology → Loop diagnostics → Loop diagnostics

Programming the current/voltage characteristic (baseline)

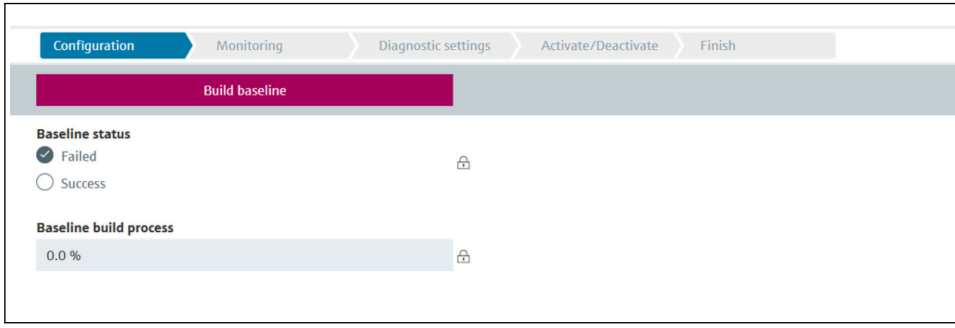
Typically, the voltage at the terminal changes in a linear manner as a function of the analog output current. After initial installation, the current/voltage baseline characteristic is recorded by the measuring circuit via an active current simulation of 4 or 20 mA.

CAUTION

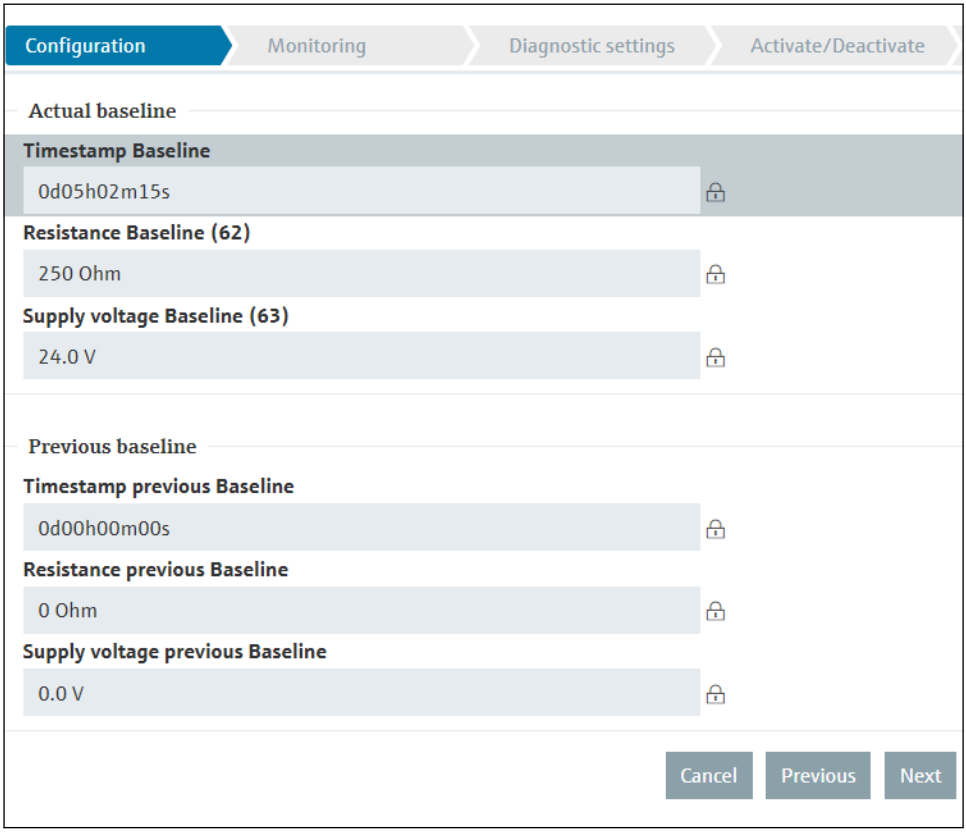
The current output is simulated. Alarms can be triggered by mistake. The behavior in the control loop can change.

- ▶ 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.



2 *Screenshot - values and entries are examples only*



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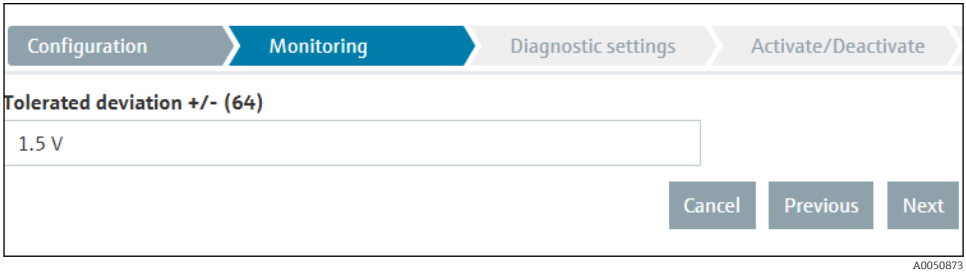
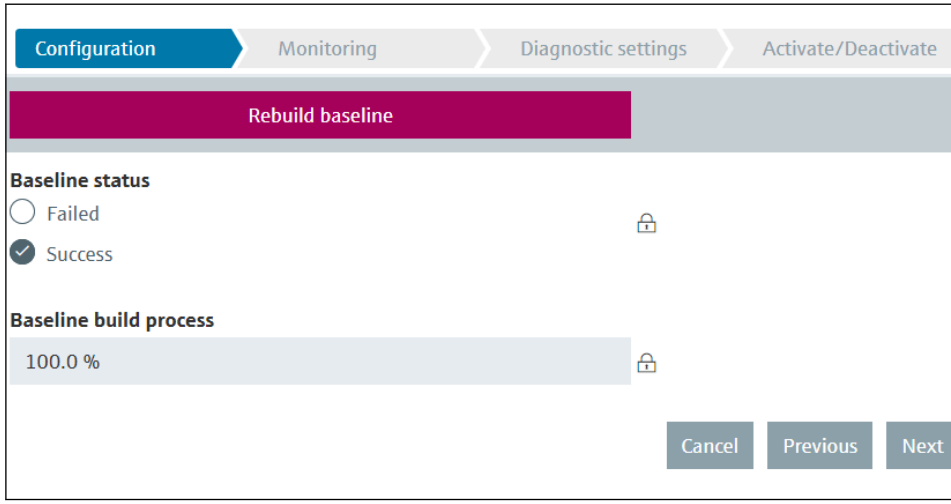


4 *Screenshot - values and entries are examples only*

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.

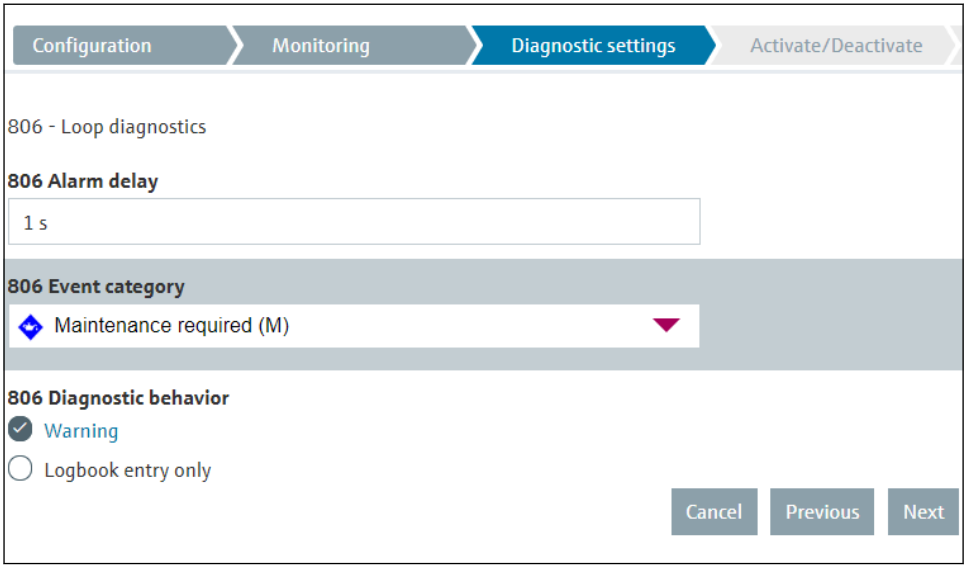


5 *Screenshot - values and entries are examples only*

Alarm delay

Period of time for which the alarm status must be active before an event report is issued. Necessary to exclude short-term signal interference. Factory settings: 1 s

Diagnostic behavior



6 Screenshot - Values and entries provided as examples

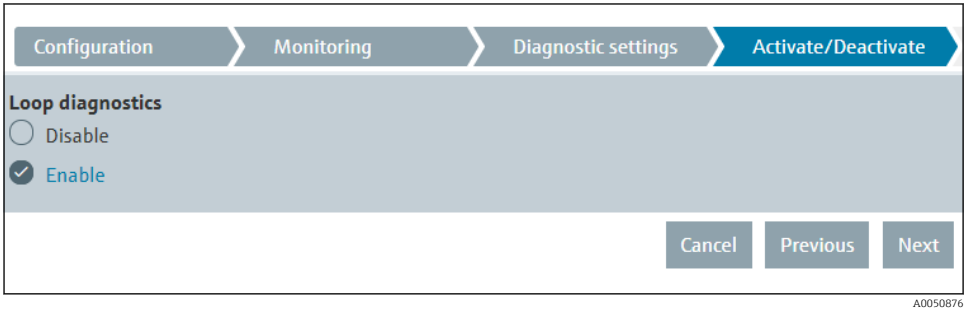
Diagnostic behavior

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)

If the permitted conditions are restored, the warning is no longer active in the device.

Disable / Enable



7 Screenshot - values and entries are examples only

Specify whether the Loop diagnostics function should be activated. If the **Disable** option 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.

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