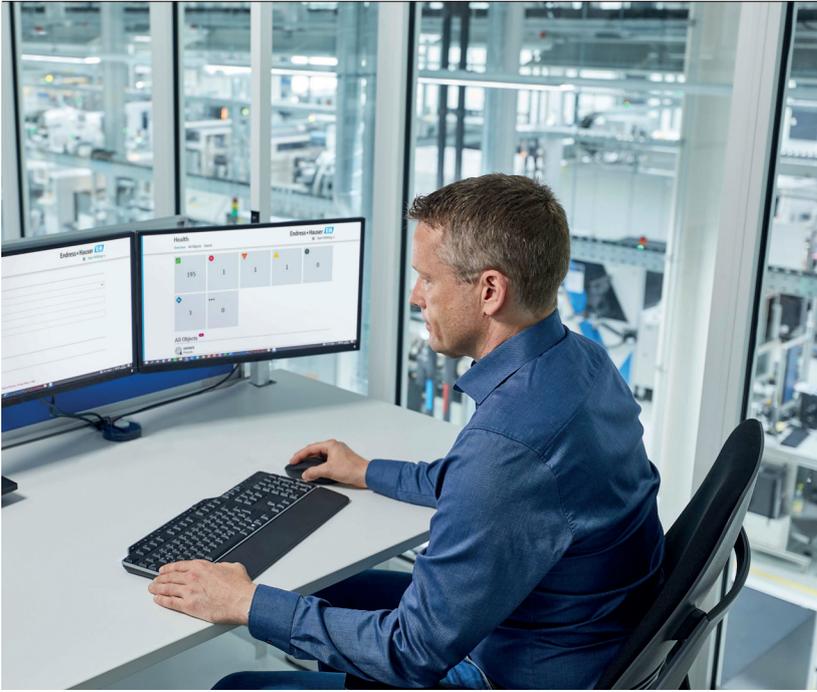


Heartbeat Technology

Taking the pulse of
your measurement





What if your field devices had their own pulse and could tell you about operation optimization potential?

Professionals in various industries are continuously challenged to keep their productivity high, while at the same time keeping their operating and maintenance costs low. In addition, legal requirements must be complied with and product quality and safe operation ensured. Consequently, the requirements on plant instrumentation are steadily increasing. There are many fields to be considered, if operations are to be successful.

To understand how measuring devices can support the overall goal of efficient and safe production, questions like these often arise:

 *“To be competitive, I need to maximize my uptime. How can I ensure a high degree of availability and that process interruptions are avoided?”*

 *“How do I know if something is wrong, and how do I get the necessary information to correct it?”*

 *“How can the device help me to keep operations safe in a reliable and efficient manner?”*

 *“How can the device inform me about problems before they occur, so I can optimize my maintenance activities?”*

 *“I need my operations to run efficiently, but my staff is quite new. Are there intuitive interfaces allowing actions to be performed quickly and easily on the device while minimizing the risk of mistakes?”*

 *“How can I profit from the efficiency potential offered by digitalization and IIoT? Are there technologies that help me to realize this potential?”*

Heartbeat Technology gives you the answer

It takes the pulse of your measurement and provides in-depth insights

To support you, as a plant operator, in reaching your goals, we at Endress+Hauser have implemented Heartbeat Technology into numerous measuring devices across our product portfolio. Its unique diagnostic, verification and monitoring functions all aim to support you in your daily striving to increase plant performance.



Enhanced measuring reliability and safety
 Highest confidence in device performance due to outstanding diagnostic coverage and international standard-compliant development.

Productivity gains while ensuring compliance
 Optimized calibration/proof test cycles through traceable device verification without process interruption.

Higher efficiency in operations
 Efficient operations are supported by timely, clear and standardized diagnostic messages, providing easy-to-follow recommendations on the actions needed.

Fewer unpleasant surprises
 Improved insights on device and process conditions to optimize the process and to keep operations stable.

Increase your plant performance and ...		
... boost reliability as well as safety levels	... reduce your verification efforts	... improve your process insights
Heartbeat Technology		
for diagnostics	for verification	for monitoring
<p>Permanent process and device diagnostics</p>	<p>Documented device functionality without process interruption</p>	<p>Information for process optimization and predictive maintenance</p>

 www.endress.com/heartbeat-technology



Heartbeat Diagnostics

Stay on top of things by getting the right information at the right time

Measuring devices with permanent and extensive self-monitoring capabilities offer a high degree of confidence regarding reliable performance. This is exactly what Heartbeat Diagnostics is about: an outstanding diagnostic coverage with clearly understandable diagnostic messages in the event of a device error or upset process conditions. In addition, you are immediately informed about suitable countermeasures to bring your measuring point back to its intended state.

- **Reliable and safe** – Increase measuring reliability, safeguard product quality and retain required safety levels longer due to continuous best-in-class diagnostic coverage (up to 97%) and device development according to IEC 61508
- **Fast** – Immediately get informed of any device failures or processes being run out of device specifications
- **Efficient** – Increase plant availability and maintain safe operations by avoiding unplanned shutdowns

- **Clear** – Enable timely, efficient and correct maintenance by obtaining standardized diagnostic messages that provide clear text instructions regarding cause and remedy according to NAMUR NE 107

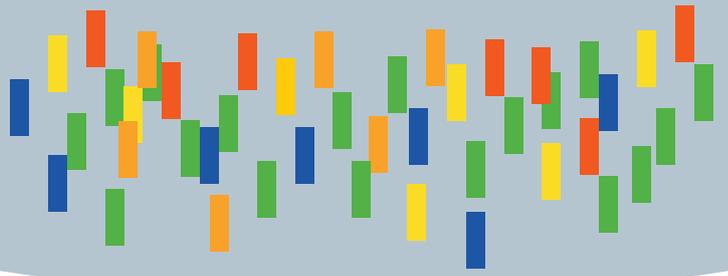
i Standards in brief

IEC 61508 is an international standard series, specifying how to design measuring devices suitable for safety-related systems. It prescribes a highly structured, documented and transparent development method, leading to a very high instrument reliability.

NAMUR NE 107 prescribes how to categorize diagnostic information for field devices in a uniform manner, thereby assisting users to take timely and correct actions in case of a diagnostic event.



Various kinds of diagnostic information ...



... are sorted into the defined NE 107 categories



Standardized diagnostic messages according to NAMUR NE 107

Status signal	Meaning	Action
 Diagnostics active	Device diagnostics is running and all is ok	None
 Failure	Output signal is invalid due to device malfunction or the device's surrounding environment	Analyze issue and take required action (high probability that device maintenance is required)
 Function check	Output signal is likely to be temporarily invalid, e.g., due to ongoing simulation performed on the device	Ensure that the process performs as required until the device is in an active measuring mode again
 Out of specification	Output signal is still valid, but the device is operated out of its specification	Analyze issue and take required action (check process/environmental conditions and evaluate if device maintenance is required)
 Maintenance required	Output signal is still valid, but device maintenance is required	Analyze issue and plan maintenance action as required



Heartbeat Verification

Improve efficiency in production and maintenance in a comfortable, safe and compliant manner

With Heartbeat Verification, the functionality of your measuring device can be evaluated at any time – in-situ and cost-efficiently without any need for external tooling or process interruption. The verification not only involves checking if the device components still comply with their original reference values, but also indicates the presence of systematic faults which could have a negative impact on device or process performance, e.g., corrosion, abrasion or build-up. In addition, verification with Heartbeat Technology is traceable and its results can be documented in compliance with relevant standards and norms.

- **Reliable** – Highest confidence in device functionality via in-situ device verification at the push of a button and without interrupting the process
- **Clear** – Verification result is “Passed” or “Failed”
- **Comprehensive** – All verification details are available in the verification report, which helps to reduce your documentation and audit efforts
- **Compliant** – Verification concept is third-party attested and traceable according to ISO 9001
- **Easy** – Enables optimization of calibration and proof test cycles with minimal effort and without device removal, thereby reducing the risk of introducing systematic faults



Endress+Hauser
People for Process Automation

Heartbeat Technology verification report

Plant operator: Mrs. Miller

Device information		
Location	Building 3.1.5	
Serial number	M3000X19001	
Device tag	Promass	
Module name	C303-02	
Pipe ID	D170022765	
Device name	Promass F 300	
Order code	BF3B25-1025/0	
Firmware version	01.06.00	

Calibration	
Calibration factor	2.7053
Zero point	0.0

Verification information	
Operating time (counter)	182 408h37m20s
Date/time (manually recorded)	17.01.22 08:12
Verification ID	4
Verification mode	Standard verification

Verification result

Passed Details see next page

*Result of the complete device functionality test via Heartbeat Technology

Confirmation

Heartbeat Verification verifies the function of the flowmeter within the specified measuring tolerance with confirmed total test coverage over the useful lifetime of the device and complies with the requirements for measurement traceability according to ISO 9001. You can find the attestation issued by an independent body on www.endress.com.

Notes

Date
Operator's signature
Inspector's signature

www.endress.com
Page 1

95% Total Test Coverage (TTC) in a passed verification – What does this mean?

Random failures (device functionality)

In the very unlikely scenario of a random failure occurring in the device, Heartbeat Technology detects it with an extraordinary probability of 95%



Systematic faults (process related)

Heartbeat Technology is also capable of indicating the presence of specific systematic faults in the application, e.g., corrosion, abrasion and build-up

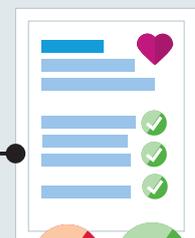


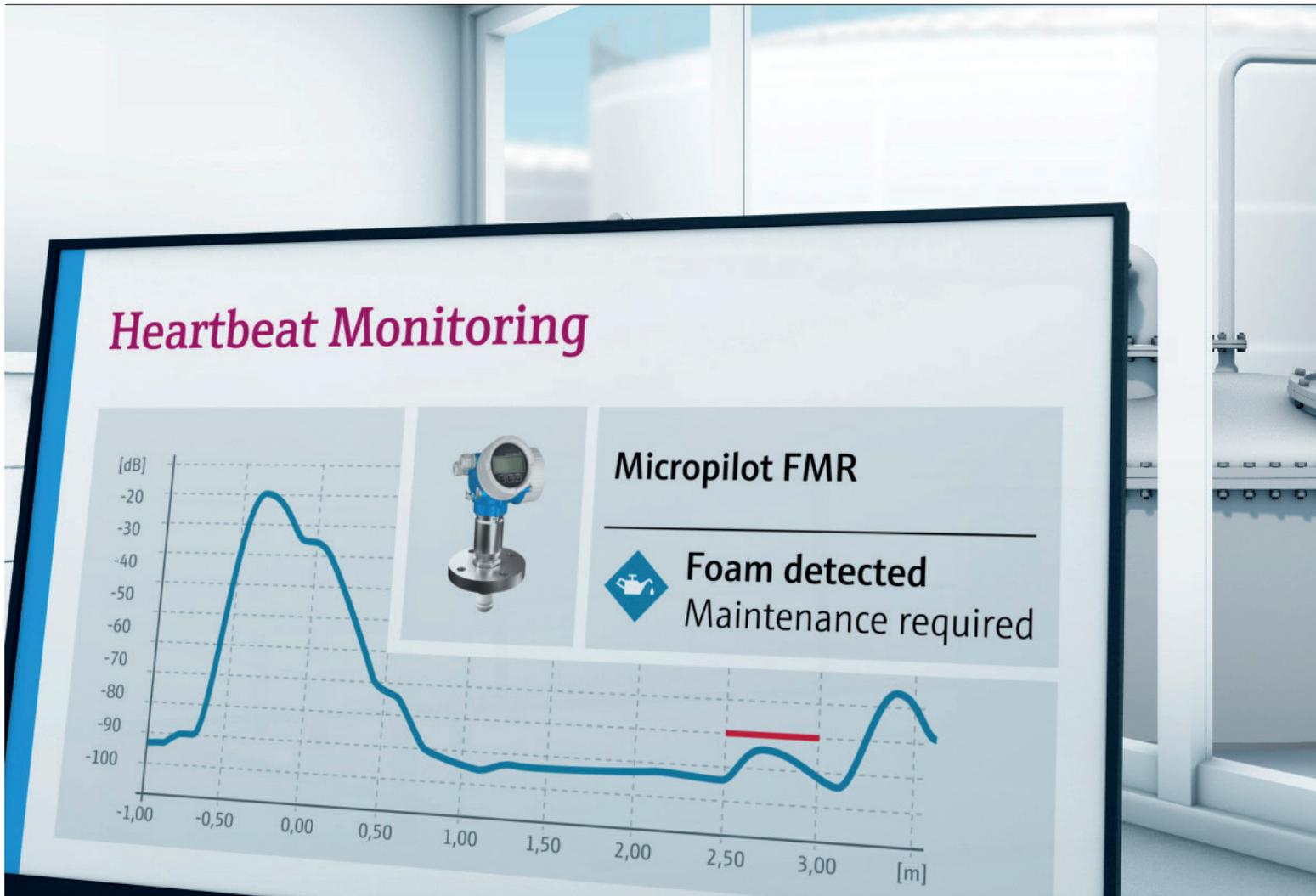
"All ok"



"Indication"

Heartbeat Technology verification report



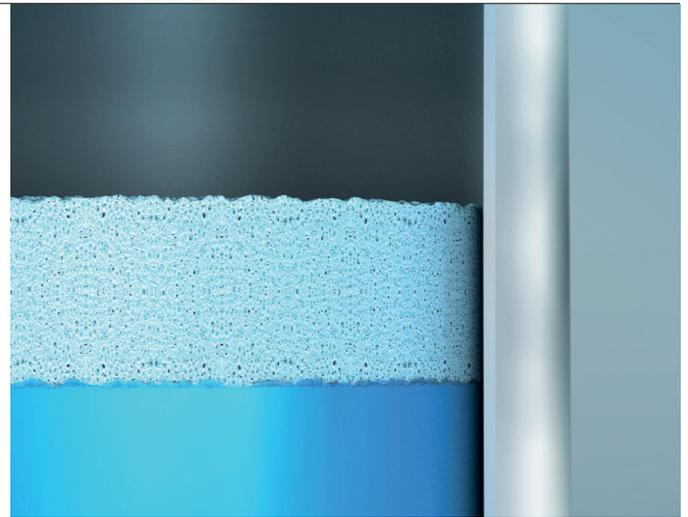


Heartbeat Monitoring

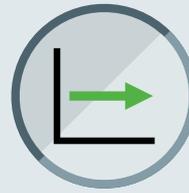
Be efficient and proactive in your operations by having insights into your process and device conditions

The measuring performance of a device is expected to be very stable over time if it is operated within its intended range of use, as process conditions will have a minimal influence on the sensor components. However, for particularly challenging process conditions some impact may prevail which could influence the performance and reliability of a device. Examples of such events are corrosion or abrasion of the sensor's wetted parts, the occurrence of foam in a tank or build-up on the sensor's surface. These events will influence the physical responses of the sensor. Heartbeat Technology detects these influences and converts them into easily understandable information providing process and device insights, which can be monitored via the Heartbeat Monitoring function. This supports you in optimizing your processes and in predicting maintenance needs.

- **Informative** – Physical responses from the sensors are converted into easily understandable process and device insights
- **Specific** – Monitor dedicated device parameters to optimize operations by identifying any anomalies in the process and predicting maintenance needs
- **Predictive** – Take measures in a timely manner to avoid any potentially unsafe process conditions or device malfunction
- **Reliable** – Increase plant availability by planning maintenance activities exactly when needed and avoiding unplanned shutdowns



Foam layer in a tank



"All ok"



"Indication"



Monitor dedicated device parameters to optimize operations and predict potential maintenance needs

Heartbeat Technology parameters – the key for comprehensive device and process insights

Heartbeat Technology parameters make the invisible visible. By observing the relevant parameters over time, you can reliably and promptly detect the presence of undesirable changes in the process, e.g., corrosion or build-up. In this way, you can also determine if the parameter has changed or was affected by a sudden change in process conditions. Additionally, it enables you to take appropriate and timely countermeasures if needed.

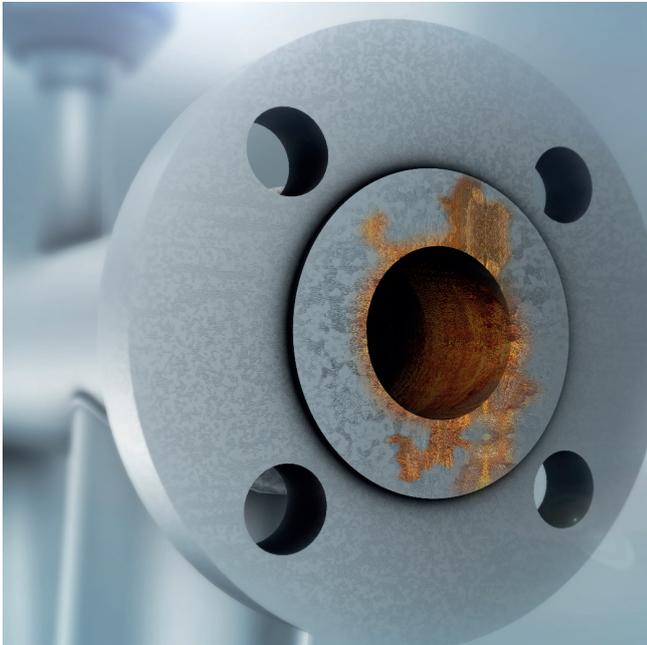


The use cases on the following pages describe real-life examples in various applications and demonstrate the value Heartbeat Technology provides in your daily operations.

Condition monitoring

Corrosion

Identification of sensor material removal due to corrosion



Impact on device/process/operations

- Reduced reliability and measuring performance
- Sensor integrity could be jeopardized if no actions are taken
- Potential negative impact on further process components (depending on material)

Benefits of Heartbeat Technology

- Increased reliability and process safety by early detection of corrosion
- Reveals the level of sensor degradation and consequently enables maintenance actions to be planned accordingly

Heartbeat Technology parameters

Flow measurement:

Heartbeat Sensor Integrity (HBSI) – Coriolis (Promass)

Point level measurement:

Fork frequency – Limit switch (Liquiphant)

How it works

Flow: Coriolis (Promass)

- The Heartbeat Sensor Integrity (HBSI) value represents the relative change of the sensor's integrity compared to its reference value from the factory (0%).
- As corrosion occurs, the sensor integrity is affected and the HBSI value increases.
- When the HBSI value exceeds 4%, the meter is, with a very high level of confidence, no longer fit for purpose and replacement is recommended.
- Often, the HBSI value is monitored to confirm the absence of a wear mechanism in the process. In that case the HBSI value will remain at a stable low level.

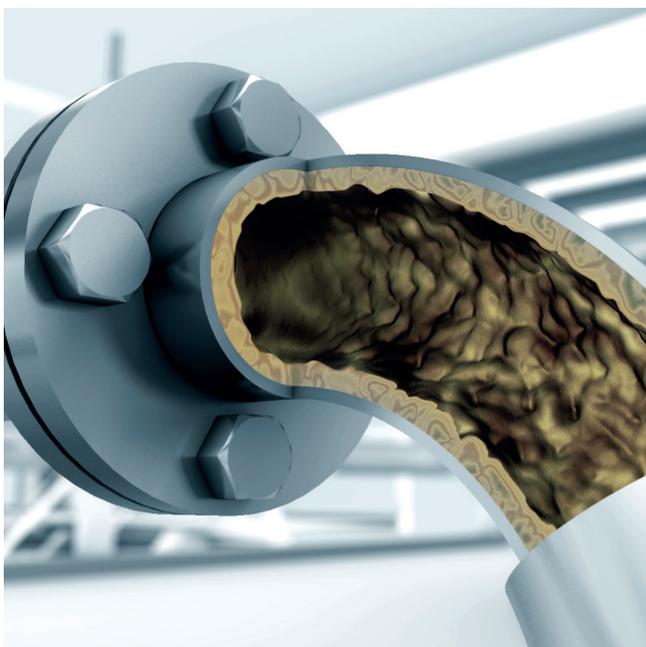


- i** Like corrosion, abrasion also removes material from the sensor and consequently has a comparable effect on the sensor's physical response. Thus, the same Heartbeat Technology parameters used for detecting corrosion can also be used to detect abrasion.

Condition monitoring

Build-up

Identification of build-up on the sensor surface



Impact on device/process/operations

- Reduced reliability and measuring performance
- Flow could be restricted if no actions are taken
- Potential negative impact on further process components

Benefits of Heartbeat Technology

- Increased reliability and process safety by early detection of build-up
- Allows you to monitor the formation of build-up and consequently plan maintenance actions accordingly, e.g., cleaning

Heartbeat Technology parameters

Flow measurement:

- Build-up index – Magmeter (Promag)
- Oscillation damping – Coriolis (Promass)
- Signal strength – Ultrasonic (Prosonic Flow)

Level measurement:

- Fork frequency – Point level (Liquiphant)
- Area of incoupling – Free space radar (Micropilot)
- Relative echo amplitude – Guided radar (Levelflex)

Pressure measurement:

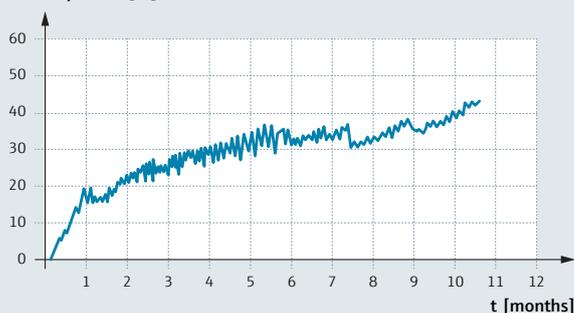
Signal noise and signal median (Cerabar and Deltabar)

✓ How it works

Flow: Magmeter (Promag)

- The build-up index is based on the difference in electrical conductivity between the fluid and the build-up
- The distribution of electrical conductivity within the measuring tube is analyzed to compute an indexed value that changes proportionally when the build-up increases
- The baseline of 0% is set during factory calibration of a new device without build-up and ranges to 100%, which represents the maximum detectable build-up formation

Build-up index [%]



Pressure: Deltabar

- The signal noise is monitored during operation
- In the case of a plugged impulse line (e.g., due to build-up), the signal noise will be affected
- If the defined threshold is exceeded, the device will create a diagnostic event (maintenance required)

Signal noise [mbar]



Process optimization

Foam detection

Dosing optimization of defoaming agents



Impact on device/process/operations

- Reduced measuring performance
- Sub-optimal usage of tank capacity
- Potential overflow of foam

Benefits of Heartbeat Technology

- Increased reliability and safety by early detection of foam creation
- Enables timely and optimized dosage of defoaming agents

Heartbeat Technology parameters

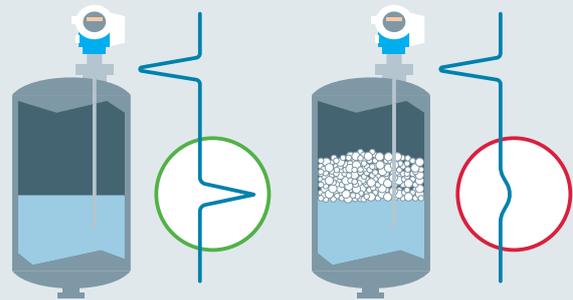
Level measurement:

Relative echo amplitude (Micropilot and Levelflex)

How it works

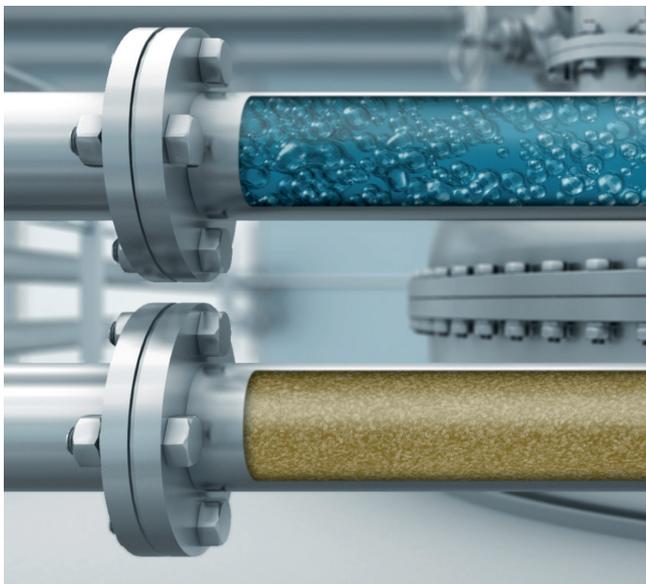
Continuous level (Micropilot and Levelflex)

- When foam is present in the tank, the echo amplitude will be reduced
- By monitoring the echo amplitude, information on the amount of foam in the tank is given
- When a certain application specific limit is reached, i.e., when echo amplitude is reduced, a signal can automatically be sent to activate the sprinkler system in order to reduce the foam level in the tank
- Effective usage of the defoaming agent is achieved by sending a signal to the sprinkler system to stop when the corresponding (higher) level of echo amplitude has been reached again



Inhomogeneous medium

Identification of inhomogeneities in the process fluid



- Such inhomogeneities could be:
 - entrained gas or solids in liquid media, or
 - liquid content in gas media
- Inhomogeneities could be caused by instable and undesired process conditions, but also be present in applications where a certain mixture of the media is desired, e.g., a specific amount of air in ice cream or cream cheese

Impact on device/process/operations

Device performance, process efficiency and product quality could be affected

Benefits of Heartbeat Technology

- Reliable identification of prevailing process conditions
- Support in process optimization to achieve desired efficiency and product quality

Heartbeat Technology parameters

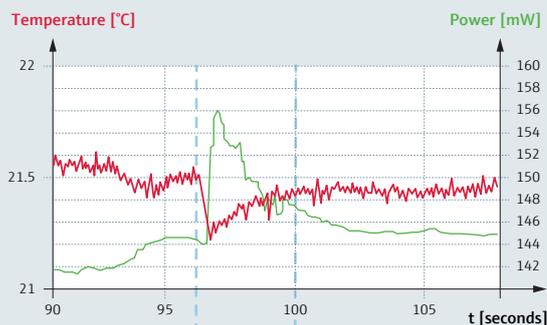
Flow measurement:

- Inhomogeneous medium index – Coriolis (all Promass)
- Suspended bubbles index – Coriolis (Promass Q)
- Acceptance rate – Ultrasonic (Prosonic Flow)
- Process stability – Thermal (t-mass)

How it works

Flow: Thermal (t-mass)

- Wetness has a significant impact on the calculated gas mass flow rate for thermal flowmeters as the liquid formed on the sensor has very high heat transfer characteristics compared to most gases
- Consequently, when liquid forms on the sensor the device reports an overreading
- The stability of the sensor response during the preceding minutes is analyzed using a statistical approach to determine if an anomaly exists
- The device can be configured to issue an alarm or warning in case of an observed anomaly
- This functionality provides confidence that your operations are running as expected



i When a water droplet interacts with the sensor, an artificially induced increase in gas mass flow is observed

Process optimization

Availability

Identification of the most maintenance-intensive measuring points



Impact on device/process/operations

Potential impact on the measuring point's reliability as well as process uptime

Benefits of Heartbeat Technology

- Detection of low performing measuring points, enabling corrective actions to be taken in an efficient manner. This allows you to find the optimal balance between effort spent and process availability.
- Increased maintenance efficiency by timely scheduling of sensor service.

Heartbeat Technology parameters

Analysis measurement:

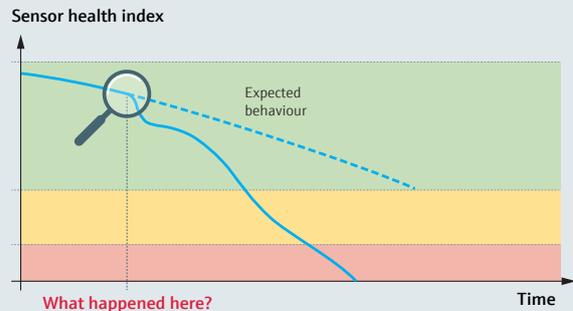
- Liquiline analytical sensors (pH, ORP, disinfection, dissolved oxygen, turbidity, photometry and conductivity)
- Liquistation liquid samplers

The above sensors and samplers all provide the sensor health index and Key Performance Indicators (KPIs). As the KPIs are based on real events in operation (and not derived as statistical average values), they offer clear and application relevant information about the effects of your optimization actions, e.g., higher availability and reduced number of failures.

How it works

Liquid analysis

- By monitoring the change of the sensor health index compared to its expected behavior, you can evaluate if an optimization action has been successful or not
- Also, the gained experience will assist you in achieving a more efficient sensor usage for future operations



Heartbeat Technology status

- 😊 No action necessary
- 😐 Maintenance not urgent, but should be scheduled in due time
- 😞 Maintenance is recommended

Sensor aging

Identification of sensor aging and remaining sensor lifetime



Impact on device/process/operations

Device performance or remaining lifetime could be affected

Benefits of Heartbeat Technology

- Increased reliability, process availability and safety by early detection of deterioration of sensor health or lifetime
- Enables maintenance intervals to be optimized

Heartbeat Technology parameters

Level measurement:

- Expected source operating time – Radiometric (Gammapilot)
- Remaining useful lifetime of the photomultiplier – Radiometric (Gammapilot)

Analysis measurement:

- Sensor health index – Liquiline analytical sensors (pH, ORP, dissolved oxygen, disinfection and photometers)
- Device health index – Liquistation liquid samplers

Temperature measurement:

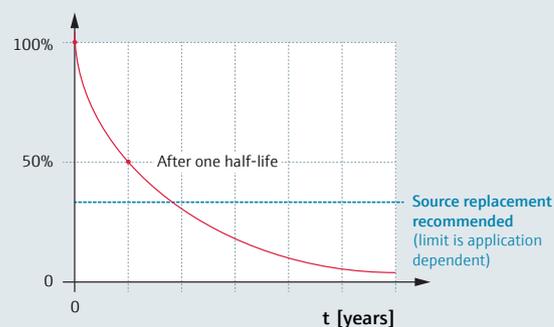
Measurement of temperature deviation (at the self-calibration point) – TrustSens

How it works

Level: Radiometric (Gammapilot)

- Radiation sources decay over time. For a radiometric level measurement device, this practically means that the amount of radiation arriving at the detector reduces over time, i.e., the measuring signal.
- The device automatically compensates for this effect to a large extent, but if the radiation falls below a certain level, the measuring reliability may be compromised.
- To estimate the expected remaining operating time, the detector evaluates if the source activity is still strong enough to achieve the specified measuring accuracy.
- This provides increased confidence in measuring reliability and optimally timed information on source replacement.

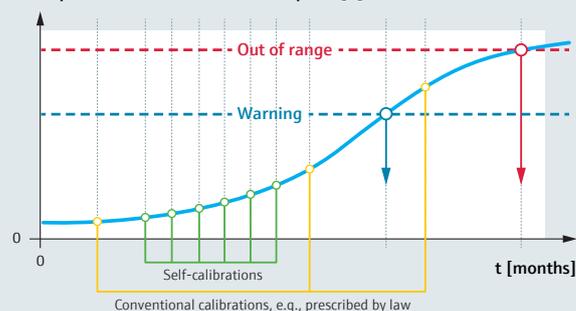
Source activity [radiation]



Temperature (TrustSens)

As the self-calibration temperature of the RTD sensor is recorded and stored in a memory, any deviation (Δ) over time can easily be detected. If a predefined limit is reached, both a diagnostic message and proposed remedy actions are provided.

Δ temperature at the self-calibration point [K]

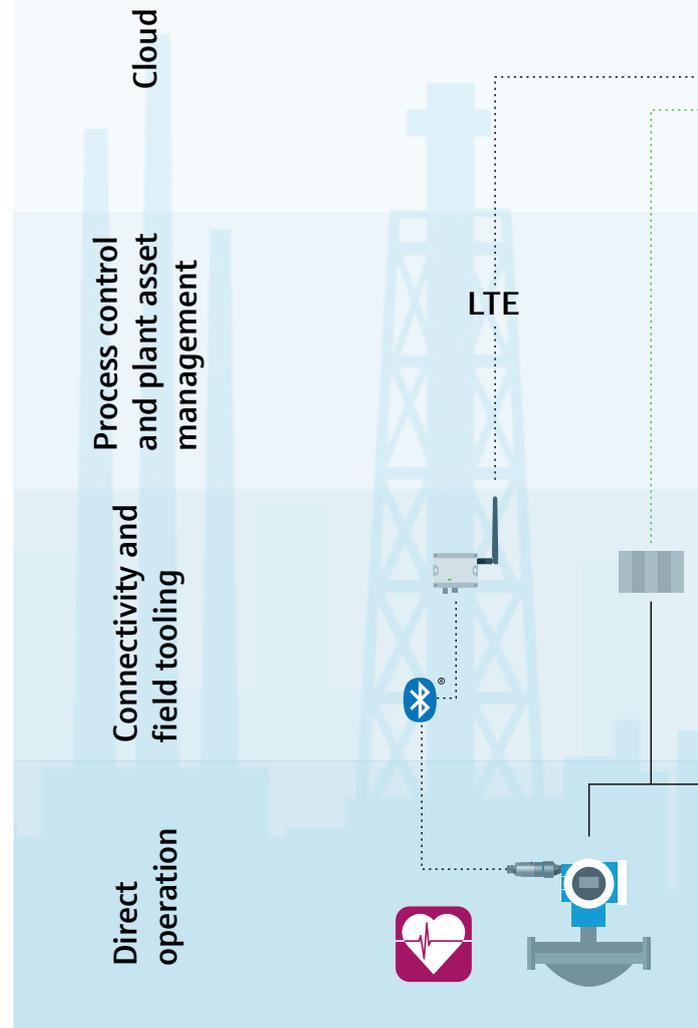


Take the next step

Use Heartbeat Technology in a connected environment and turn data into knowledge

Even though most of the Heartbeat Technology functionalities can be accessed on-site via direct device operation, the potential for value creation increases significantly when the devices are operated via field tooling, connected to the process control/asset management systems or even to the cloud. Tasks are not only performed more efficiently and conveniently in a connected environment, but also additional functionality is available, e.g., generation of a verification report or monitoring of Heartbeat Technology parameters.

- **Connect** – Optimize your processes by integrating Heartbeat Technology functionalities into your infrastructure
- **Create value** – Exploit the full saving and efficiency potential of digitalization and IIoT by connecting your Heartbeat Technology field devices to the cloud
- **Expand the scope** – Obtain insights, not only on the individual device, but also on the overall health condition of all your installed devices via digital services
- **Increase efficiency** – Save time, reduce personnel exposure in the field and minimize risk of mistakes by accessing device specific information from anywhere
- **Stay secure** – Keep your information protected with our digital offering, which is designed in compliance with the highest industrial automation security standards



Digitalization according to your needs

Endress+Hauser is committed to support you in a seamless integration of your field devices into all major host systems and communication protocols. This enables a reliable transmission of your measured values and diagnostic data from the field to your process control and/or asset management system.

In addition to the traditional integration paths, Endress+Hauser also offers a wide selection of field tooling, digitalization solutions and services.

Either enjoy a seamless experience via the Netilion IIoT ecosystem, or have the required functionalities integrated into your own IT landscape.

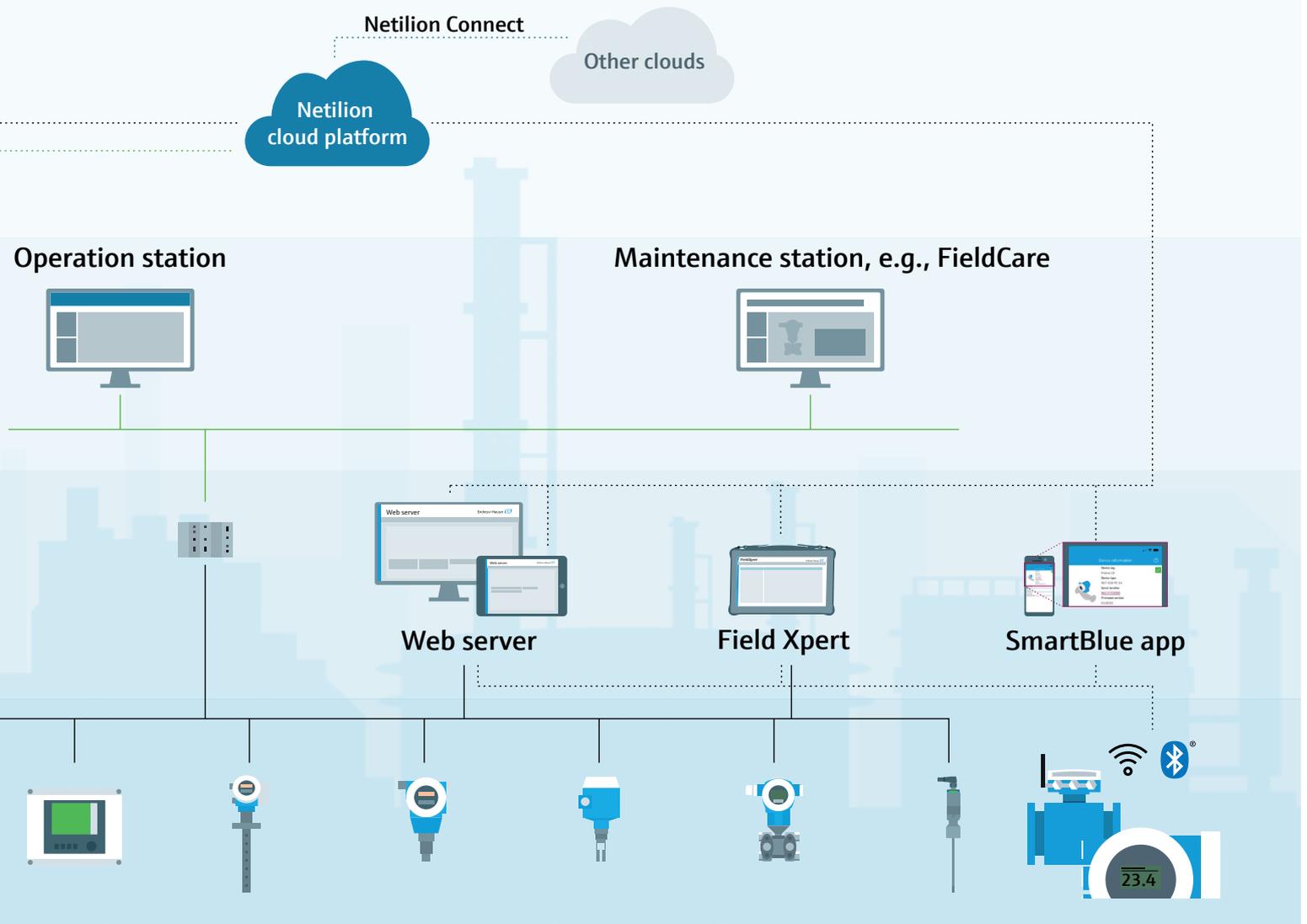
EtherNet/IP

PROFI
NET

HART
COMMUNICATION PROTOCOL

Modbus

PROFI
BUS



Expand the scope of Heartbeat Technology via the Netilion IIoT ecosystem

The screenshots demonstrate the user interface for monitoring industrial assets. The laptop screen shows a **Health** dashboard for **Endress+Hauser** with a summary table:

119	1	1	2
0	3	0	

Assets with status: **Check Function**

- Microplot FMRS1
- Check-function

The smartphone displays a mobile version of the health dashboard. To the right, the **Product Details** for **Microplot FMRS1** are shown, including manufacturer information and health conditions. A specific health condition is detailed in the **Health Condition Details** panel:

- Health Status:** Failure
- Diagnosis Code:** F941
- Cause:** Echo lost
- Remedy:** Check parameter 'DC value'

Simple and fast mobile access – anywhere, anytime
 Netilion is a cloud-based IIoT ecosystem, designed for industrial processes. Associated digital services enable mobile workers to benefit from Heartbeat Technology functionalities.

 More information: www.netilion.com

Certified and traceable

Attested by independent third parties

BESCHNEIGUNG ◆ ATTESTATION ◆ 证明书 ◆ СВИДЕТЕЛЬСТВО ◆ CONSTANCIA ◆ ATTESTAZIONE

ATTESTATION

The Certification Body of
TÜV SÜD Industrie Service GmbH
Business Area Energy and Systems

confirms that the product

Proline Promass 300,
Proline Promass 500
with Heartbeat Technology™

manufactured by

Endress + Hauser Flowtec AG
Kägenstraße 7
4153 Reinach BL
Switzerland

complies with the following requirements:

Heartbeat Technology™ is a test method integrated in the diagnostics and verification of flowmeters when used throughout the useful lifetime of the measuring device. The factory-traceable references which are redundantly reproduced with Heartbeat Technology™ includes Heartbeat Diagnostics and

Test specifications:
DIN EN IEC 61508-2:2011-02, Appendix C
DIN EN IEC 61508-3:2011-02, Section 6
DIN EN ISO 9001:2008, (Section 7.6 a), Control of monitoring

Test results:
Heartbeat Verification verifies the function of Proline Promass 500 on demand within the specified measuring tolerance ("TTC" of TTC > 95%).

Heartbeat Technology™ complies with the requirements according to DIN EN ISO 9001:2008 – Section 7.6 a) "Controlling equipment". In accordance with this standard, the user is responsible for a definition of the verification interval that satisfies the particular requirements.

This Attestation is based on report no.: TR.2065342.014.17, 2017.

Munich, October 26, 2017

Katrin Hausmann
Certification Body Energy and Systems

TÜV SÜD Industrie Service GmbH · Certification Body Energy and Systems · Westend

Example of an attestation for Coriolis mass flowmeters

Inspektionsbescheinigung Inspection Certificate

Bescheinigung Nr. Certificate No	968/INS 371.00/21
Kunde / Bescheinigungs-Inhaber Client / Certificate Owner	Endress+Hauser SE + Co. KG Hauptstraße 1 79689 Maulburg Germany
Produkt Product	Heartbeat Technology mit Heartbeat Diagnostics und Heartbeat Verification integriert in Liquiphant Heartbeat Technology including Heartbeat Diagnostics and Heartbeat Verification integrated in Liquiphant
Typbezeichnung Type designation	FTL51B, FTL62 or FTL64
Grundlagen der Inspektion Standards applied for inspection	IEC 61508-2:2010 (in extracts) IEC 61508-3:2010 (in extracts)
Inspektionsergebnis Inspection Results	Heartbeat Verification bestätigt auf Anforderung die Gerätefunktion des Liquiphanten FTL51B, FTL62 oder FTL64 innerhalb der Gebrauchsdauer des Geräts mit einer Testabdeckung (Total Test Coverage) von 89 % bis 96 %. Die Heartbeat Technology unterstützt den Anwender bei der Verifizierung gemäß ISO 9001:2008, Kapitel 7.6 a "Lenkung von Überwachungs- und Messmitteln" bzw. ISO 9001:2015, Kapitel 7.1.5.2 a "Messtechnische Rückführbarkeit" umzusetzen, indem die aus der Werkskalibrierung definierte Schaltfunktion des Gerätes mit der oben angegebenen Testabdeckung bestätigt wird. Zur Aufrechterhaltung der Schaltfunktion ist eine regelmäßige Prüfung des Gerätes erforderlich. Gemäß Norm obliegt dem Anwender die anforderungsgerechte Festlegung des Verifikationsintervalls. Heartbeat Verification verifies on request the function of the Liquiphant FTL51B, FTL62 or FTL64 within the useful lifetime with a total test coverage (TTC) from 89 % to 96 %. The Heartbeat Technology supports the user during the verification process according to ISO 9001:2008, chapter 7.6 a) "Control of monitoring and measuring equipment" and ISO 9001:2015 chapter 7.1.5.2a "Measurement traceability" by verifying the device switching function defined from the factory calibration with the test coverage given above. Regular testing of the device is required in order to maintain the switching function. According to the standard, the user is responsible for determining the verification interval in accordance with the requirements.
Zeitraum der Inspektion Inspection Period	17.10.2020 - 10.12.2020 2020-10-17 - 2020-12-10
Cologne, 2021-01-08	 Dr.-Ing. Thorsten Gantevoort TÜV Rheinland Industrie Service GmbH Bereich Automation Funktionale Sicherheit Am Grauen Stein, 51105 Köln
TÜV Rheinland Industrie Service GmbH Am Grauen Stein, D-51105 Köln	Inspection Body of TÜV Rheinland Industrie Service GmbH Automation - Functional Safety, www.tuv.com

www.tuv.com

Example of an attestation for Liquiphant point level devices

Verification of the entire signal chain – from the sensor, via the transmitter to the outputs.

Third-party attestations confirm compliance to the ISO 9001 requirements for traceable verification.

Product portfolio with Heartbeat Technology

				
Flow	Level	Pressure	Temperature	Analysis
<p>Mass flow</p> <ul style="list-style-type: none"> ■ Coriolis Promass 10/100/ 200/300/500 ■ Thermal t-mass 300/500 <p>Volume flow</p> <ul style="list-style-type: none"> ■ Electromagnetic Promag 10/100/ 200/300/400/ 500/800 ■ Ultrasonic Prosonic Flow 200/300/400/500 ■ Vortex Prowirl 200 	<p>Point level</p> <ul style="list-style-type: none"> ■ Vibronic Liquiphant FTL51B/62/64 ■ Radiometric Gammapilot FMG50 <p>Continuous level</p> <ul style="list-style-type: none"> ■ Free space radar Micropilot FMR5x/6x/6xB ■ Guided wave radar Levelflex FMP5x ■ Radiometric Gammapilot FMG50 	<ul style="list-style-type: none"> ■ Metal membrane Cerabar PMP71B ■ Ceramic membrane Cerabar PMC71B <p>Differential pressure</p> <p>Metal membrane Deltabar PMD75B/78B</p>	<p>Self-calibrating TrustSens TM371/372</p>	<p>Liquid</p> <ul style="list-style-type: none"> ■ Liquiline CM44x pH and ORP Dissolved oxygen Disinfection Turbidity Photometry Conductivity ■ Liquistation CSF34/48 Samplers <p>Gas</p> <p>J22 TDLAS Gas Analyzer Concentration</p>



More information: www.endress.com/heartbeat-technology

Searching for your optimum?

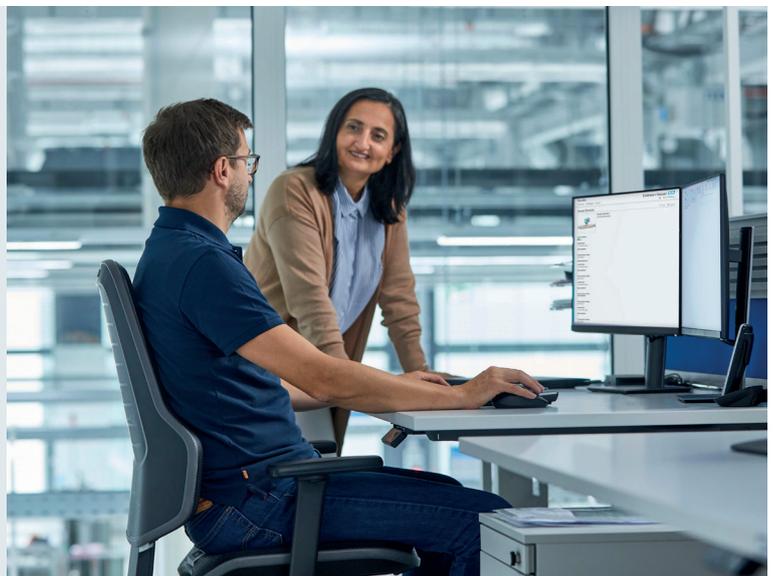
We are happy to help

Do you want to get further insights about a specific functionality for your application? Or maybe learn more about the possibilities that Heartbeat Technology brings in a connected environment?

In this case, please consult with your local Endress+Hauser partner. We will be more than happy to find your optimum solution.



More information:
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