

Risk reduction and increased efficiency in proof testing with Heartbeat Verification

Advantages at a glance:

Increased safety

Detection of application-specific systematic faults while avoiding human interaction

Operational efficiency

In-situ verification without process interruption or removal

Simplicity

Easy activation and configuration of additional diagnostics using guided Heartbeat Monitoring wizards



Heartbeat Technology
Taking the pulse of your measurement



Micropilot FMR6xB / Liquiphant FTL51B /
Deltabar PMD75B / Promass 300

How Heartbeat Verification enhances proof testing procedures

In proof testing, the focus is often on the detection of random failures. Random failures are mostly hardware-related issues that occur unpredictably. Manufacturers publish device-specific safety manuals with proof test procedures and corresponding PTC (Proof Test Coverage) values that are intended to identify and manage these failures during proof testing.

In the real world, however, systematic faults rather than random failures are the main causes of safety shutdowns. Systematic Faults are associated with the process or human actions, making them deterministic. Meaning they will consistently produce the same result under the same conditions. Systematic faults and their detection, however, cannot be quantified using safety parameters such as λ_{du} (Dangerous Undetected Failure Rate) or PTC.

Depending on the measurement principle, Heartbeat Monitoring can generate additional diagnostic messages that can indicate systematic faults. These often remain undetected with the standard diagnostics. Heartbeat Technology thus offers important added values in proof testing.

Examples of how Heartbeat Technology can increase plant performance and enhance measurement reliability and safety are given in the following application examples.

Application examples

Detection of buildup and corrosion - Liquiphant FTL51B HART

Using the Heartbeat Monitoring function Process Window, the user can define an application-specific plausibility range for the fork frequency. If the frequency during a Heartbeat Verification is outside the defined range, the result is "FAILED". This result can indicate buildup (vibration frequency too low) or corrosion of the fork, e.g. due to a damaged coating (vibration frequency too high).



Deposits forming on the vibrating fork of the Liquiphant

Buildup detection - Micropilot FMR6xB on antenna

Once the Heartbeat Monitoring function Buildup Detection is activated and thresholds configured, the buildup index (0–100%) can be monitored. If the Heartbeat Verification result is "FAILED", the level measurement continues to be valid, but buildup can reduce measurement performance and may lead to a temporary loss of signal. Early detection of buildup increases reliability and safety by enabling planned countermeasures, such as cleaning the antenna with a compressed air system.



Deposit buildup on Micropilot antenna

Loop integrity - Cerabar/Deltabar/Micropilot/Liquiphant

Using the Heartbeat Monitoring function Loop Diagnostics, the measuring point-specific current/voltage baseline is created by simulating the 4 mA and 20 mA current output. Then thresholds are set at which the loop diagnostics generates a warning message. A Heartbeat Verification result "FAILED" indicates leakage currents in the measurement circuit or a faulty power supply. System shutdowns and dangerous plant conditions are avoided by informing the user before an undervoltage occurs.



Terminal corrosion in a junction box

Plugged impulse lines - Deltabar PMD75B

The Heartbeat Monitoring function Statistical Sensor Diagnostics can be used to define the "normal" signal noise baseline in flow applications. A Heartbeat Verification result "FAILED" may indicate a plugged impulse line or a closed valve that was not reopened during the last zero adjustment.



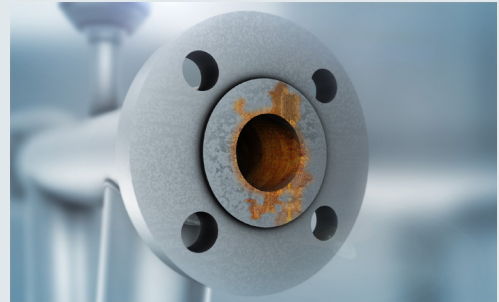
Obstruction within the impulse line

Abrasion / Corrosion - Proline Promass 10, 100, 300 and 500

The Heartbeat Sensor Integrity (HBSI) parameter enables reliable monitoring of the integrity of sensor components using Heartbeat Verification or Heartbeat Monitoring. The HBSI value indicates the relative change in sensor integrity compared to the factory reference value (0%).

If the measuring tubes are affected by corrosion or abrasion, their elastic properties change due to the reduced wall thickness. This typically leads to a deterioration in the accuracy of density and mass flow measurement.

A Heartbeat Verification result of "FAILED" indicates that the measuring tube has been worn due to corrosion or abrasion.



Sensor Electrode Test - Proline Promag H/P/W 300 and 500

During the electrode impedance test, the electrical resistance between the measuring electrodes and the reference electrode is determined. This measurement is used to verify the integrity of the wiring and to check the insulation performance of the electrodes, including the detection of possible short circuits.

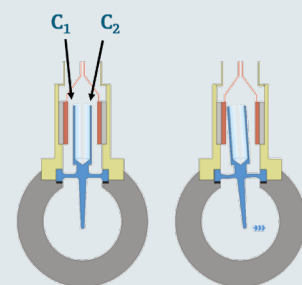
A Heartbeat Verification result of "FAILED" indicates a fault in the electrodes or the associated wiring, for example due to corrosion.



DSC Sensor Gap Capacitance Test - Proline Prowirl D/O/R/F 200

During the gap capacitance test, the difference between the capacitance values (C_1 and C_2) in the DSC sensor is checked. If this difference is outside the specified range, the mechanical integrity of the sensor is compromised.

A Heartbeat Verification result of "FAILED" indicates that the integrity of the sensor signals has been impaired, for example by water hammer.





Working together for safe processes

Relevance for the safety function

A failed Heartbeat Verification result caused by a triggered Heartbeat Monitoring function usually has no direct impact on the output current. This means that the device does not automatically switch to a safe state (e.g. alarm current of 3.6 mA). In this case, the operator must evaluate the potential systematic fault as part of the proof test and, if necessary, take corrective measures to ensure the safe operation of the measuring point.

If Heartbeat Verification does not actively intervene in signal processing, the verification can be performed with write protection enabled.

Some Heartbeat Monitoring functions require application or measuring point specific thresholds. In this case, the Monitoring functions must be configured and activated before performing a Heartbeat Verification. This should be done during the initial device commissioning.

Heartbeat Verification can be executed on site via the local HMI or service interface, as well as via Bluetooth or digital communication, without interrupting the process. Heartbeat Verification is certified by TÜV as a traceable verification method according to ISO9001.

Summary

It is recommended to integrate Heartbeat Verification into existing proof testing procedures. This expands the scope of proof testing to include the detection of systematic faults. Integrating Heartbeat Verification into existing proof test procedures helps reduce unscheduled shutdowns and maintenance activities while enhancing operational efficiency.

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