

Special Documentation

Liquiphant FTL51B, FTL62, FTL63, FTL64

Application package
Heartbeat Verification + Monitoring



Table of contents

- 1 Inspection Certificate 3**
- 2 About this document 4**
 - 2.1 Document function 4
 - 2.2 Content and scope 4
 - 2.3 Symbols 4
 - 2.4 Documentation 5
 - 2.5 Registered trademarks 5
- 3 Product features and
 availability 5**
 - 3.1 Product features 5
 - 3.2 Availability 7
- 4 System integration 7**
 - 4.1 Data exchange by the user 8
 - 4.2 Data management 9
- 5 Heartbeat Verification 9**
 - 5.1 Performance characteristics 10
 - 5.2 Operation 10
- 6 Heartbeat Monitoring 19**
 - 6.1 Frequency history 19
 - 6.2 Monitoring data 20

1 Inspection Certificate

Inspektionsbescheinigung Inspection Certificate



Bescheinigung Nr.
Certificate No

968/INS 371.01/23

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, FTL63 and 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, FTL63 und 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 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, FTL63 and 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 9001:2015 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

29.07.2023 - 28.09.2023
2023-07-29 - 2023-09-28

Cologne, 2023-10-20

TÜV Rheinland Industrie Service GmbH
Am Grauen Stein,
51105 Cologne - Germany

Dipl.-Ing. Gebhard Bouwer

Inspection Body of TÜV Rheinland Industrie Service GmbH
Automation - Functional Safety, www.hv.ai.com

650 B

TÜV Rheinland Industrie Service GmbH
Bereich Automation
Funktionale Sicherheit
Am Grauen Stein, 51105 Köln

www.tuv.com

 **TÜVRheinland®**
Precisely Right.

10222 12 12 EA © TÜV, TÜV and TÜV are registered trademarks. Utilisation and application requires prior approval.

TÜV Rheinland Industrie Service GmbH, Am Grauen Stein, 51105 Köln / Germany
Tel. +49 221 806-1190, Fax +49 221 806-1539, E-Mail: industrie-service@trf.tuv.com

A0054372

2 About this document

2.1 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.

2.2 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

2.3 Symbols

2.3.1 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.

2.3.2 Symbols for certain types of information and graphics

Tip

Indicates additional information



Reference to page

1, 2, 3, ...

Item numbers

2.4 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.

2.5 Registered trademarks

Bluetooth®

The *Bluetooth*® word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc. and any use of such marks by Endress+Hauser is under license. Other trademarks and trade names are those of their respective owners.

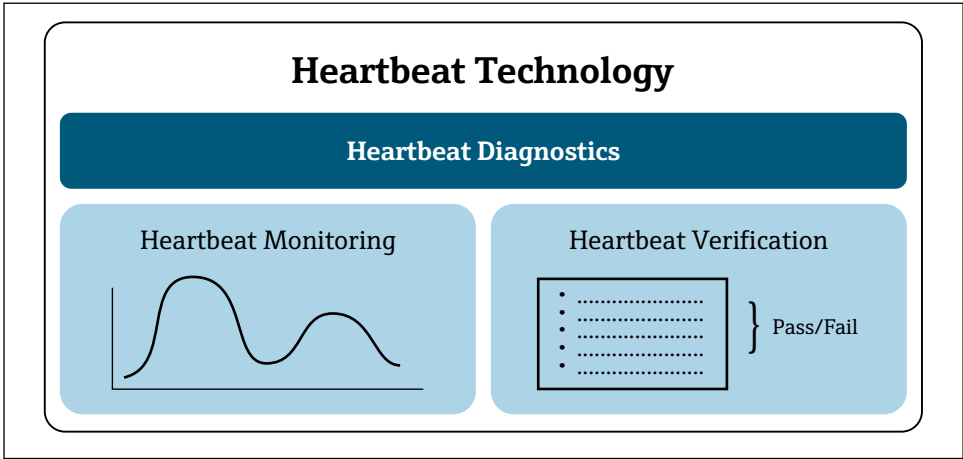
3 Product features and availability

3.1 Product features

Heartbeat Technology

The software package consists of 3 modules. These three modules combined check, evaluate and monitor device functionality and process conditions without process interruption.

- **Heartbeat Diagnostics**
 - Diagnostic functionality based on continuous self-monitoring
 - Continuously monitors and assesses the device condition and process conditions. Generates diagnostic messages when certain events occur and provides troubleshooting measures in accordance with NAMUR NE 107.
- **Heartbeat Verification**
 - In-situ verification of measuring devices in the application
 - Performs a verification of the current device condition on demand and generates the Heartbeat Technology verification report showing the verification result.
- **Heartbeat Monitoring**
 - Additional measured variables output to an external condition monitoring system
 - Continuously provides device and/or process data for an external system. Analysis of this data provides a basis for process optimization and predictive maintenance.



1 Heartbeat Technology: Overview of modules and correlated functions

i The Heartbeat Monitoring and Heartbeat Verification modules are optionally available as an application package.

The test scope achieved using these diagnostic and verification tests is expressed as the **total test coverage** (TTC). The total test coverage is calculated using the following formula for random errors (calculation based on FMEDA as per IEC 61508):

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

λ_{TOT} : Rate of all theoretically possible failures

λ_{du} : Rate of undetected dangerous failures

The undetected dangerous failures (λ_{du}) are not diagnosed by the device diagnostics.

Heartbeat Technology confirms the device functionality within the specified measuring tolerance with a test coverage of 89 % to 96 % (details provided in the "Total test coverage" table below)

i The current value for the total test coverage depends on the electronics insert used, as well as the configuration and integration of the measuring device. The total test coverage values were determined under the following conditions:

- Evaluation unit detects alarms (e.g. device error)
- Correct installation and commissioning of the device (e.g. density setting and operating mode)

No system-related parameters can be configured or adjusted via the Bluetooth module VU121.

Total test coverage (TTC)

Electronic insert	MIN safety	MAX safety
FEL61	90 %	94 %
FEL62	90 %	95 %
FEL64 1001	90 %	93 %
FEL64DC 1001	89 %	92 %
FEL67	91 %	96 %
FEL68	90 %	94 %

3.2 Availability

The application package can be ordered with the device. Detailed information on the specific order code is available on the website www.endress.com or from the Endress+Hauser sales organization.

3.2.1 Order code

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

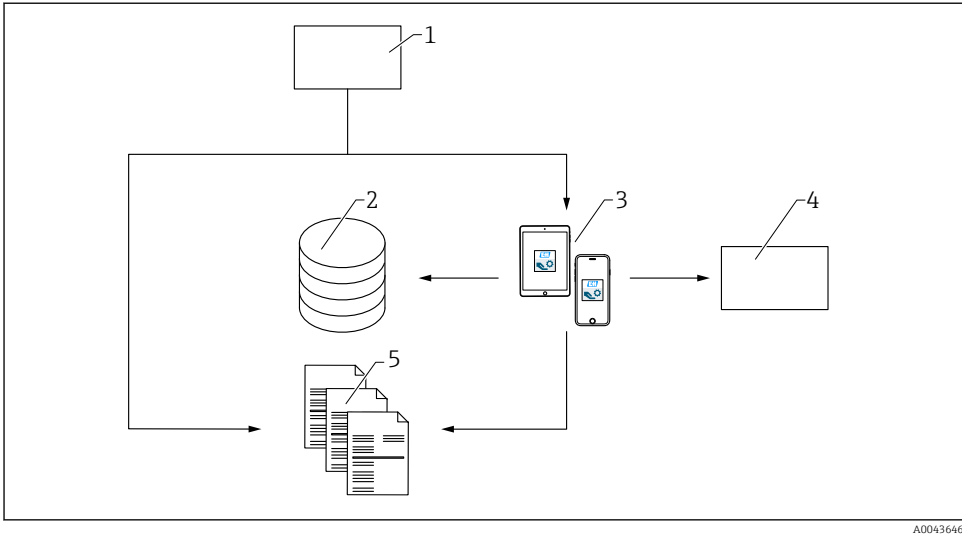
- Order code with breakdown of the device features on the delivery note
- On the Web using the Device Viewer: enter the serial number from the nameplate and check whether the order code is displayed
- Bluetooth module VU121 is integrated in the device

3.2.2 Access

Heartbeat Technology can be used with smartphones/tablets (SmartBlue App) via Bluetooth® wireless technology. Interfaces with Bluetooth communication are required to access the data saved in the device. The speed of data transmission depends on the type of communication interface used.

4 System integration

The features of Heartbeat Technology are available via the Bluetooth interfaces.



A0043646

- 1 Measuring device
- 2 Data archive
- 3 Smartphone or tablet (SmartBlue app)
- 4 Netilion Library or W@M Portal
- 5 Verification report

The SmartBlue app must be used for external access to the device at the start of a verification and for signaling a **Passed** or **Failed** result. 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 can be provided in the form of a verification report.

4.1 Data exchange by the user

Heartbeat Monitoring

Heartbeat Monitoring data can be transmitted via Bluetooth (e.g. via a FieldEdge SGC200) to higher-level systems for use in predictive maintenance. This includes transmission of the status in accordance with NE107 (e.g. maintenance required) and the monitoring of primary and secondary variables (PV, SV).

The following monitoring parameters are provided:

- PV (primary variable): Tuning fork covered or uncovered
- SV (secondary variable): Oscillating frequency of tuning fork

Heartbeat Verification

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

Prerequisites include Bluetooth-enabled smartphones.

4.2 Data management

The current sensor oscillation frequency of a Heartbeat Verification is saved as a non-volatile parameter set in the measuring device memory:

New verification results overwrite old data following the FIFO ¹⁾ principle

4.2.1 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

4.2.2 Verification report

Printing a verification report

A verification report is created in PDF format.



Prerequisite: A verification has already been performed.



Detailed information can be found in the "Verification" section.

5 Heartbeat Verification

Heartbeat Verification uses the self-monitoring function of the measuring devices to check the measuring device functionality. During verification of the current device condition, a check is performed to verify if the measuring device components comply with the factory specifications. Both the sensor and the electronics modules are included in the tests.

Heartbeat Verification confirms the device functionality within the specified measuring tolerance on demand with a total test coverage of 89 % to 96 %, (see "Total test coverage" table). Heartbeat Verification meets the requirements for measurement traceability in accordance with ISO 9001 (ISO 9001:2015 Section 7.1.5.2). The result of verification is either **Passed** or **Failed**. Users have the option of using the SmartBlue app to archive the verification data on a smartphone or send them by e-mail. Based on this data, a verification report is generated automatically to ensure that traceable documentation of the verification results is available.

1) First in First out

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



There is no interruption to the process while Heartbeat Verification is performed.

In addition to Heartbeat Verification, prescribed visual inspections and proof tests must be performed.

5.1 Performance characteristics

Heartbeat Verification:

- Performed on demand
- Supplements permanent self-monitoring with additional checks
- Generates a documented result within 15 seconds

5.2 Operation

5.2.1 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)**.

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

Suggestions of additional steps that can be taken following a **Failed** result:

1. Repeat verification if the individual tests of the sensor test group are affected.
2. Create defined and stable process conditions in order to rule out process-specific influences as much as possible.
3. Compare current process conditions with those of the previous verification to identify possible deviations.

5.2.2 Verification



- The Heartbeat Verification function can be performed for the first time during commissioning.
- The values recorded can then be compared with later values.
- The values are stored in the **Device history** and shown in the report.

Performing an internal verification

Guidance menu → **Heartbeat Verification** wizard

Function: This wizard is used to start an automatic verification of the device functionality. The results can be documented as a verification report. Starting the verification: After clicking 'Next', various device parameters are queried from the device. Furthermore, several self-checks of the device are performed.

Displaying the verification status and result

The result is indicated in the **Verification result** parameter.

5.2.3 Verification results

Access to the verification results via the operating tool.

Classification of results

Individual results:

-  **Failed**
At least one individual test in the test group was outside the specifications.
-  **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**
The "**Fork corrosion test**" parameter ( "Example of a verification report" section) cannot be performed if the tuning fork is covered. If the tuning fork is covered during verification, the result **Not done** is shown in the verification report.

Overall results:

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

 Heartbeat Verification confirms the device functionality within the specified measuring tolerance on demand with a total test coverage of 89 % to 96 %, ( see "Total test coverage" table).

5.2.4 Verification range

The results of the verification can be documented via the SmartBlue app in the form of a verification report. The verification report is created on the basis of the data records saved in the measuring device after verification. As the verification results are automatically and uniquely identified with the operating time, they are suitable for the traceable documentation of the verification of measuring devices.

Verification report, Section 1

Measuring point identification, identification of the verification results and confirmation of completion:

- **Device and verification information**

- Serial number
- Device tag
- Operating time
- Plant operator

- **Device information**

- Location
- Device tag
- Device name
- Order code
- Firmware version

- **Calibration / Configuration**

- Density setting
- MIN/MAX setting

- **Verification information**

Date of Heartbeat Verification

- **Verification result**

The overall result of the verification is "passed" if all of the individual results are "passed".

Verification result, Section 2

Details on the individual results for all test groups:

- **Device and verification information**

- Test groups
 - Mainboard module
 - Sensor module

Verification result - values, Section 3

Details with values for the individual tests from Section 2:

Fork frequency test

Verification result, Section 4

Additional data that can influence the assessment of the measurement results or the appraisal of the process conditions. Information regarding:

- **Process condition**
 - Electronics temperature
- **Device history**
 - Date of proof test
 - Number of system starts
 - Electronics temperature - current and MIN/MAX value
- **Sensor history**
 - Frequency at delivery status
 - Upper warning frequency
- **Frequency history**
 - Sensor frequency 1 to 8

Sample verification report

Heartbeat Technology verification report

Endress+Hauser

People for Process Automation



Device and verification information	
Serial number	Serial No.
Device tag	DeviceTag
Operating time	00y000d04h56m41s
Plant operator	

Device information	
Location	
Device tag	DeviceTag
Device name	Liquiphant
Order code	FTL51B-10H0/0
Firmware version	01.01.00

Calibration / Configuration	
Density setting	> 0.7 g/cm³
MIN/MAX setting	MAX

2020-11-12

1 / 5

A0044288

Heartbeat Technology verification report

Endress+Hauser

People for Process Automation



Device and verification information

Serial number	Serial No.
Device tag	DeviceTag
Operating time	00y000d04h56m41s
Plant operator	



Verification information

Date of Heartbeat Verification	12.11.2020 08:45:35
Inspector	

Verification result

Overall result	Passed
----------------	------------------------------

Notes

Notes

Confirmation

Heartbeat Verification verifies the function of the device over the useful lifetime with a total test coverage (TTC) from 89 % to 96 % and meets the requirements for measurement traceability according to ISO 9001. Details to the TTC values and the inspection attestation can be found in the special documentation (SD02662F).

Date	Operator's signature	Inspector's signature

2020-11-12

2 / 5

Heartbeat Technology verification report

Endress+Hauser

People for Process Automation

Device and verification information

Serial number	Serial No.
Device tag	DeviceTag
Operating time	00y000d04h56m41s
Plant operator	



Verification results

Verification pre-condition

Status signal	☒ OK
Actual diagnostics	-----

Mainboard module

Microprocessor test	☒ Passed
Memory test	☒ Passed

Sensor module

Fork frequency test	☒ Passed
Sensor test	☒ Passed
Fork corrosion test	☐ Not done

Heartbeat Technology verification report

Endress+Hauser

EH

People for Process Automation

Device and verification information	
Serial number	Serial No.
Device tag	DeviceTag
Operating time	00y000d04h56m41s
Plant operator	



Verification results – values	Unit	Actual	Min.	Max.
Sensor module				
Fork frequency test				
Current frequency	Hz	533.6	460.0	1115.6

Heartbeat Technology verification report

Endress+Hauser

EH

People for Process Automation



Device and verification information

Serial number	Serial No.
Device tag	DeviceTag
Operating time	00y000d04h56m41s
Plant operator	

Process condition	Unit	Value
Electronics temperature	°C	22

Device history	Unit	Actual	Min.	Max.
		12.11.2020		
Date of proof test		08:40:28		
Number of system starts		3		
Electronics temperature	°C	22	21	23

Sensor history	Unit	Value
Frequency at delivery status	Hz	1050.0
Upper warning frequency	Hz	1102.5

Frequency history	Unit	Frequency	Date
			12.11.2020
Sensor frequency 1	Hz	459.4	08:45:35
			11.11.2020
Sensor frequency 2	Hz	459.4	14:37:52
			11.11.2020
Sensor frequency 3	Hz	464.0	14:30:06

5.2.5 Verification criteria for the test objects

Prerequisite for the verification

Test: **Status signal**

Function: Test for active measuring device errors of "alarm"-type diagnostic behavior. If a measuring device error is detected, the verification is performed but the overall result will always be **Failed**.

Mainboard module

- Test: **Microprocessor test**

Function: This is the test of the internal program flow, the checksum and the watchdog.

- Test: **Memory test**

Function: This is the test of all internal memories of the device. RAM test, ROM test.

Sensor module

- Test: **Fork frequency test**

Function: In this test, the current frequency of the tuning fork is measured and verified. The measured frequency must be within a defined range.

- Test: **Sensor test**

Function: In this test, the connecting cable from the electronics to the sensor is tested. In addition, the sensor data is read out and checked.

- Test: **Fork corrosion test**

Function: This test checks whether the current oscillation frequency is below the upper warning frequency. If the fork is covered, the result "Not done" is displayed.

5.2.6 Additional verification information

Frequency history

Function: List of all current oscillation frequencies of the sensor at the time of Heartbeat Verification with time stamp

6 Heartbeat Monitoring

Furthermore, additional monitoring parameters can be displayed and used for predictive maintenance or application optimization.

6.1 Frequency history

The order configuration of the oscillation frequency in air is indicated in the verification report:

- An increased oscillation frequency indicates the presence of corrosion
- A reduced oscillation frequency indicates the presence of buildup or that the sensor is covered by the medium

Deviations in the oscillation frequency compared to the oscillation frequency in the as-delivered state (order configuration) may be due to the process temperature and process pressure.

The following conditions apply for the successful interpretation of the sensor frequencies in the application:

- To compare frequencies with the oscillation frequency of the sensor in the as-delivered state (order configuration), the sensor must be uncovered.
- The process pressure and process temperature must be as similar as possible

6.2 Monitoring data

Additional data are available with the Heartbeat Verification + Monitoring application package ( "Data exchange by the user" section). The data can be read out continuously via Bluetooth.



71637160

www.addresses.endress.com
