LoopSeries Detectors
LB 430

Service Manual

69691BA29 Rev.00 01/2025

BERTHOLD

Table of Contents

1. Tools for Service Deployment

The following tools are available for servicing the LB 430 LoopSeries:

1) Service Modem (ID 73566) for connection to the service interface

2) Flashloader 3

- **Software** for connecting the detector to the PC via the service interface.
- Required for software updates.
- The following software and data must be installed on the PC in advance:
  - FlashLoader_Setup.exe DC00942SW
  - CP210xVCPInstaller_x64.exe
  - V:\DatenPC\Entwicklung\Software\freigegeben\LB43x (I-10111 Loop-Powered Detektor)\Service Interface\Treiber

- Updatable software:
  - Level update DC00910SW (Aktuelle Version: 01.00.00)
  - Density update DC00912SW (Aktuelle Version: 01.00.00)
  - Ext Flash update DC00908SW LB 430 PI Applications Firmware ext. Flash
  - Frontend update DC00914SW LB 430 FEU SiPM (Firmware-Update)

3) ORB-Explorer (Internal use/service only)

- Software for full device access. Also used for commissioning, recalibration, etc.
- The following software and data must be installed on the PC in advance:
- ORB_Explorer_Setup_x.x.xn84.exe DC00216SW (V:/DatenService)
- OrbData (V:/DatenService)
- See also ID 58913AA
- Device firmware

4) Operating Software for HART

- Level HART FDI DC00918SW (Latest version:)
- Level HART DTM DC00919SW (Latest version:)
- Level HART DD DC00917SW (Latest version:)
- Density HART FDI DC00922SW (Latest version:)
- Density HART DTM DC00923SW (Latest version:)
- Density HART DD DC00921SW (Latest version:)

2. Device Connection and Commissioning

The commissioning of the device at the end customer's site can be performed using the following software-tool combinations:

- HART-DD / AMS-Trex: **DC00917SW Level, DC00921SW Density**
- HART DTM / Host (Control Room): **DC00919SW Level, DC00923SW Density**
- HART DTM, HART FDI / PC (e.g., PACTware 6.1): **DC00918SW Level, DC00922SW Density**
- ORB-Explorer / Service Modem

3. Firmware Update via Flash Loader

While the operating software is updated to the latest version on the HOST system being used (e.g., AMS Trex, PACTware, etc.), the detector firmware must be updated separately.

The firmware update can only be carried out via the service interface in combination with the Service Modem and the Flash Loader tool.

For this, the service interface must be connected via USB to the PC and the Service Modem must be connected to the detector.

3.1 Connecting the Service Modem to the Detector and PC

Use the cables supplied with the Service Modem to connect it to both the PC (via USB) and the detector. See Fig. 1 for details.

1. Connect the cable leading to the detector to the service interface, as shown in Fig. 2.
2. Connect the cable leading to the PC to a USB port.

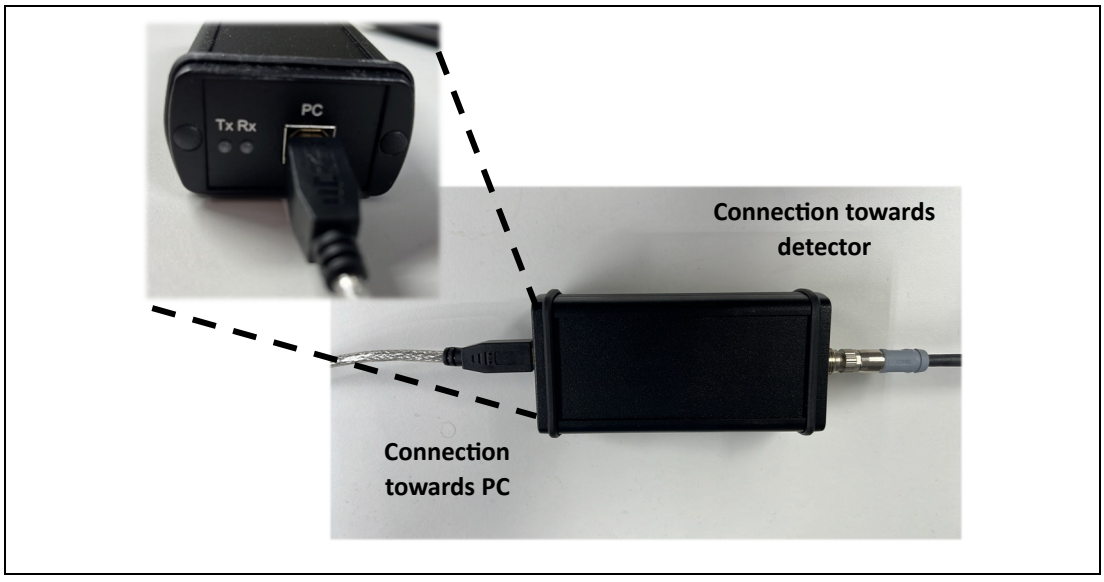

Figure 1 Service Modem connection towards detector and PC.

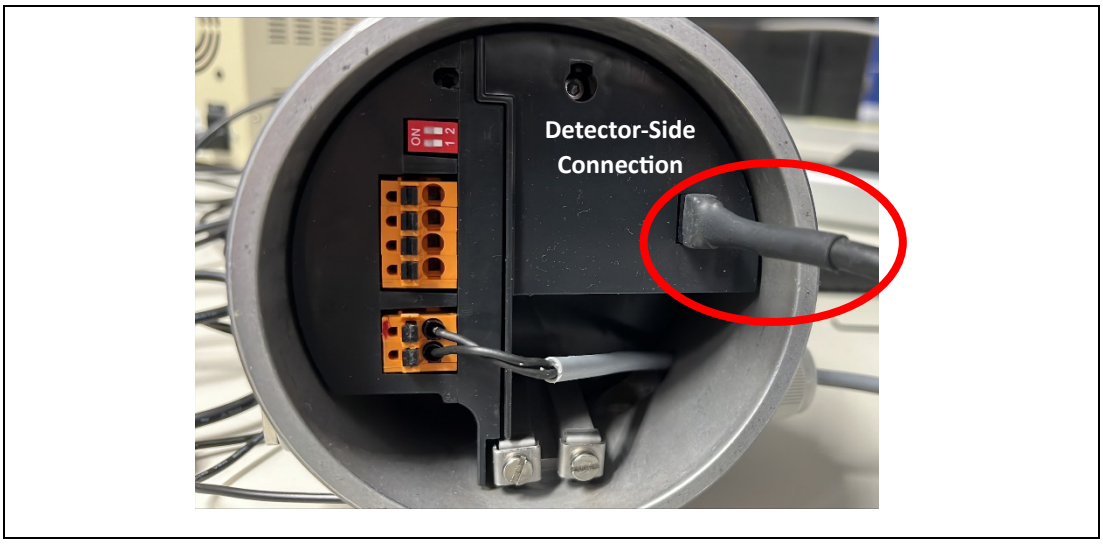

Figure 2 Service Modem connection at the detector.

3.2 Installing Software for the Service Interface

1) Copy the "Service Interface" folder to the PC.
2) Connect the service modem.
3) Open the Device Manager as an administrator on the PC.
4) Right-click on the modem:

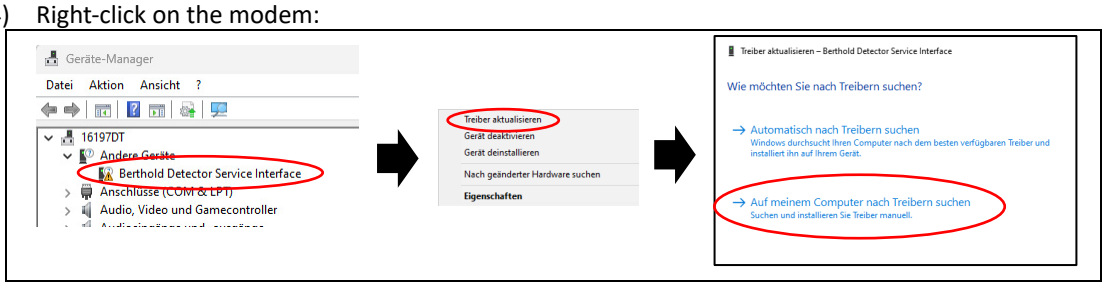

Figure 3 Installing the service modem drivers (part 1).

5) Locate the "Service Interface" folder on the PC:

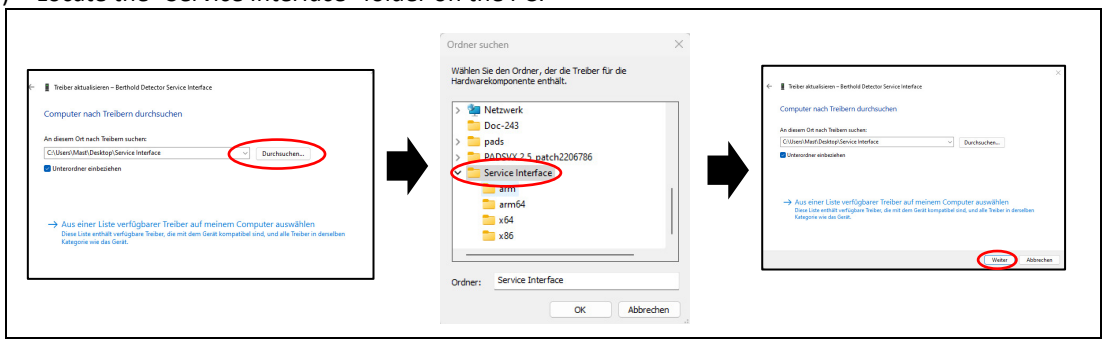

Figure 4 Installing the service modem drivers (part 2).

➢ The installation of the service modem drivers is complete!

3.3 Connecting the Detector Using FlashLoader 3

Next, start the Flash Loader 3 software on the PC and establish a connection with the detector. In the "USB" tab, you can configure the settings for "Port," "Baudrate," and "Parity." For connecting to the LB 430 LoopSeries detector, the following settings should be applied:

- ***Port:*** Select the correct COM port (USB port) for the service modem. Refer to the information box and Figure 6 below.
- ***Baudrate:*** 19200
- ***Parity:*** None

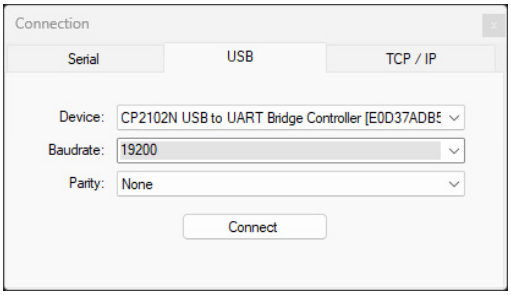

Figure 5 Connection parameters to Flash Loader 3

IMPORTANT

It is particularly important to ensure that the correct COM port is selected. Normally, the selection should automatically be correct. However, if it does not work, a check can be performed. Open the Device Manager and check the section **"Ports (COM & LPT)."** The service interface and the associated COM port will then be visible, as shown in Figure 6.

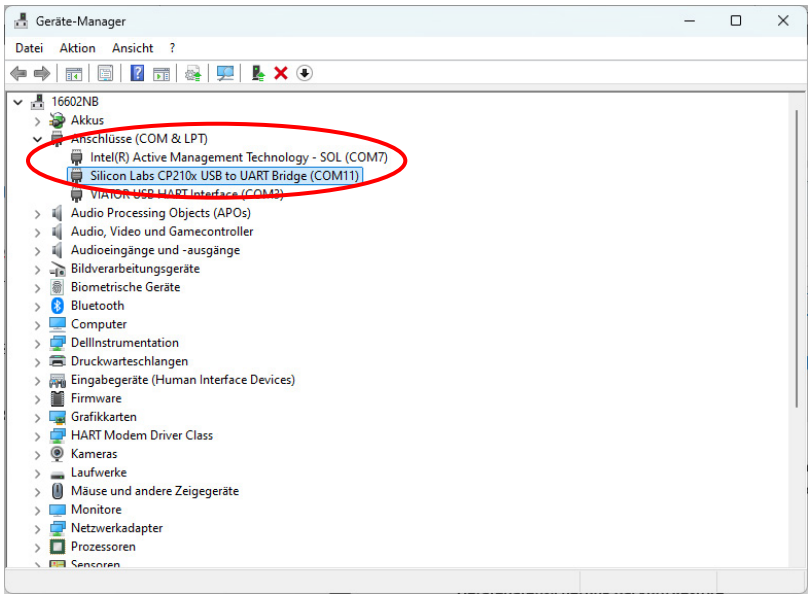

Figure 6 Checking the COM-Port of the service modem in the device manager.

By clicking "Connect," a window for searching the detector will open. Here, the settings for detector search must be adjusted for a connection with the LB 430 LoopSeries detector. This is done by clicking the wrench icon [1]. Once the settings are correctly configured, the device search can be initiated by clicking [2].

- ***Timeout:*** 500 - 1000 ms
- ***Comm Synchronization:*** 0
- ***Comm Latency Time:*** 10 - 20 ms

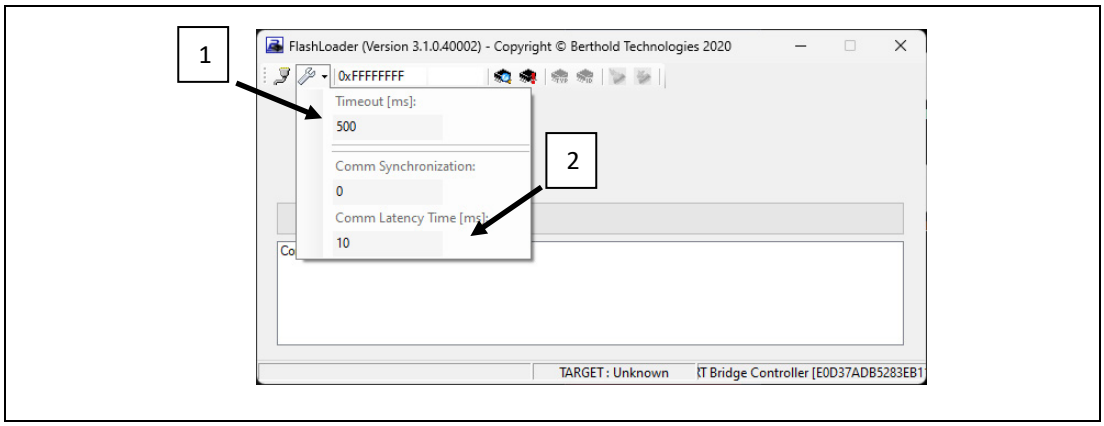

Figure 7 Connection parameters

3.4 Performing the Application Update Using FlashLoader 3

If the settings are configured correctly, the connected device should be detected within a few seconds. A window will then appear, allowing you to start the bootloader.

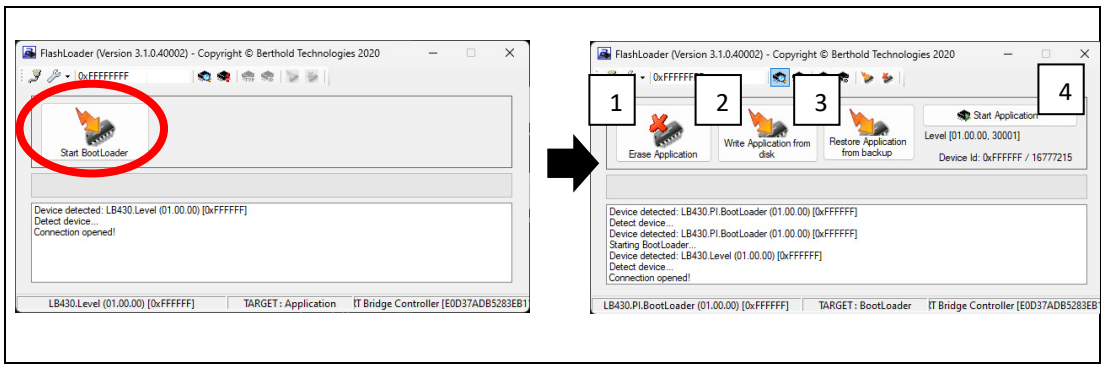

Figure 8 Application update

The following four options are available in the window:

(1) Erase Application
(2) Write Application from disk
(3) Restore Application from backup
(4) Start Application

3.4.1 Erase Application

Deletes the application from the device's internal flash memory. After restarting the device, only the bootloader will continue to run.

3.4.2 Write Application from disk

Overwrites the existing application in the device's internal flash memory. The new application must be a *.bta* file located on the PC's local hard drive. This *.bta* file could represent a new or older version of the current application (update/downgrade) or an entirely different application (application switch). The writing process takes approximately 10–12 minutes.

3.4.3 Restore Application from backup

Overwrites the existing application in the device's internal flash memory. The new application must be a *.bta* file located in the device's external backup storage.

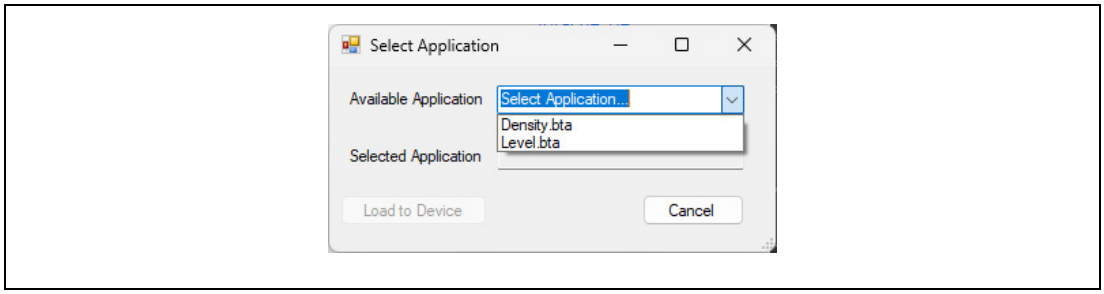

Figure 9 Application selection.

After selecting the application, click **"Load to Device"** to start the writing process. This will take approximately 3–4 minutes.

Backup Storage:

The device's backup storage can also be overwritten. The following options are available:

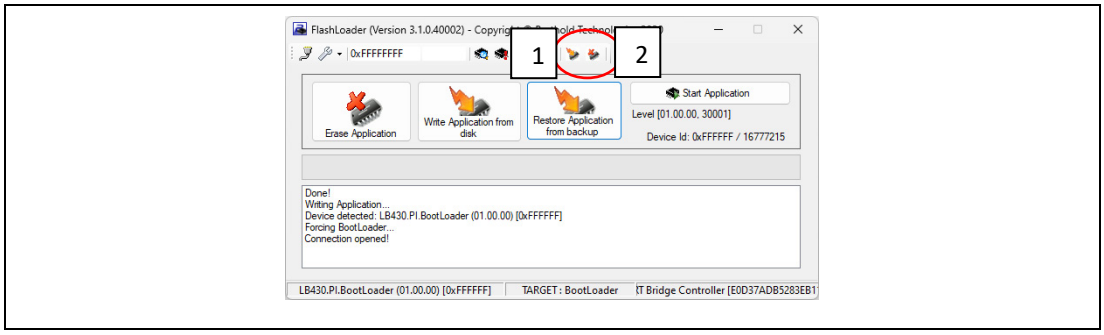

Figure 10 Write / Erase Backup.

(1) Write Backup:

The contents of the external backup storage will be overwritten. To do this, an **"ExternalFlash.bin"** file, located on the PC's local hard drive, is required. This *.bin* file contains all the application files (*.bta*) suitable for the device. The writing process takes approximately 45 minutes.

A restart of the device is required so that the bootloader can offer the newly available *.bta* files for selection.

(2) Erase Backup:

The contents of the external backup storage will be deleted. After pressing **"Restore Application from backup,"** no *.bta* file will be available for selection.

3.4.4 Start Applikation

This option briefly disconnects the device from the power supply and restarts it, causing the new application to start. Depending on the action performed, a simple (e.g., update from 1.0.0 to 1.1.0) or double (e.g., from Level to Density) **factory reset** may be necessary to return the application to an event-free state.

3.5 Performing the Frontend Update Using FlashLoader 3

To perform a software update of the device's frontend, the bootloader must first be started, just as in the application update process. Then, it is important to redirect the FlashLoader commands using the location prefix **"feu"** and connect the FlashLoader to the frontend by selecting **"Detect Device."**

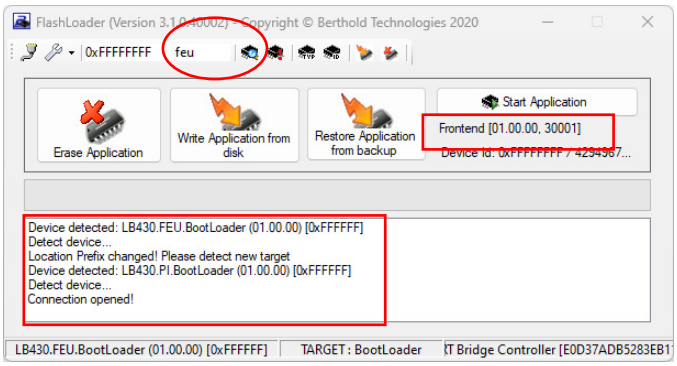

Figure 11 Select Application

Using **"Write Application from disk"**, a **"Frontend.bta"** file should be written. The process takes approximately 6–7 minutes.
It is not possible to change the frontend software from the external backup storage.

4. Event-Handling

n the software, all events are displayed along with a group ID. The messages associated with the group ID are described in the software manual for the LB 430 LoopSeries (69691BA24 – Chapter 6, Diagnosis). Each group ID is associated with one or more Service IDs (SID), which provide a more detailed technical description of the event.

Event messages can impact the device's status. The NAMUR status transmitted may also depend on the event mapping. For example, an event in standard mode may transmit the status "Out of Specification" (S), while in safety mode, the status "Failure" (F) may be transmitted.

Symbol	Name	Description
N	No effect	The event is not considered for the device status.
S	Out of specification	One or more parameters are outside the specified limits.
M	Maintenance required	Maintenance required, e.g., replacement of the radiation source.
C	Function check	Routine in progress, e.g., calibration.
F	Failure	Hardware or software error detected. The measurement is affected.

Code	Message	NAMUR Status		Description/Instruction
		Mode: Standard	Mode: Safety	
100	Test Mode	F	F	The device is in test mode. This is only relevant for production testing. ▶ If the event occurs during operation, restart the device. If the error persists, the device must be replaced.
101	HW module integrity	F	F	The device does not recognize the installed modules. Possible causes: Ex-d/Ex-i modules mixed, hardware revisions of the modules are incompatible, or an untested or faulty circuit board is installed. ▶ Restart the device. If the error persists, the device should be replaced.
102	Data-set integrity	F	F	Parameter shift due to software update or shift caused by communication with the FRAM. ▶ Perform a repair reset. If the error persists, try a factory reset. If the issue continues, replace the device.
103	RAM test failure	F	F	Memory error during runtime. ▶ Restart the device. If the error persists or occurs frequently, replace the device.
104	Invalid Reset Code	F	F	This can only occur during device testing in production or after a master reset. ▶ If the event is reported during operation, restart the device. If the error persists, replace the device.
105	Date/Time not guaranteed	F	F	The battery/capacitor of the internal clock is empty, or the date/time has not been set. ▶ Reset the system time.

106	Simulation on	C	C	Simulation mode is active. No action required. ▶ Exit simulation mode manually or restart the device.
107	Watchdog reset	F	F	Program crash/unexpected execution of program sections detected. ▶ Restart the device. If the event occurs frequently, replace the device.
109	Watchdog off	S	S	Watchdog disabled. Only relevant for production testing. Should not occur during operation. ▶ If the event occurs during operation, restart the device. If the error persists, the device must be replaced.
111	Ext. clock failure	F	F	The external (main) oscillator (frontend) does not maintain the target frequency. ▶ Check the connection between the frontend and PI, then restart the device. If the error persists or occurs frequently, replace the device.
112	Int. clock failure	F	F	The internal (auxiliary) oscillator (frontend) does not maintain the target frequency. ▶ Check the connection between the frontend and PI, then restart the device. If the error persists or occurs frequently, replace the device.
113	Int. device failure	F	F	Device initialization failed. ▶ Restart the device. If the error persists, replace the device.
Monitoring of the current output				
700	Data Flow	F	F	The data flow is disrupted or interrupted. A measurement cycle is skipped. If the next measurement cycle is also skipped, the error will be signaled. ▶ Restart the device. If the error persists, replace the device.
701	Terminal voltage too low	F	F	The terminal voltage is too low. The device does not have enough power available. ▶ Check the terminal voltage. It must be greater than 14V.
702	Terminal voltage too high	S	S	Terminal voltage exceeds specification. Risk of overvoltage. ▶ Check the terminal voltage. It should be less than 30V.
703	Power supply deviation (3.38V)	F	F	The internal power supply is not maintained. The allowable deviation is approximately 0.2V. A possible cause could be a calibration error. ▶ Replace the process interface.
704	Reference Supply deviation (4.1V)	S	S	The internal reference voltage supply is not maintained. The allowable deviation is approximately 0.1V. A possible cause could be a calibration error. ▶ Replace the process interface.

705	CurrentLoop Failure	F	F	This only occurs with the current output monitoring activated. ▶ Recalibrate the current output. Check the loop resistance (<250 Ohm, >500 Ohm).
Monitoring of frontend remote communication				
332	FEU communication problem	F	F	Communication with the frontend is disrupted. ▶ Restart the device. If the error persists, check the connection between the process interface and frontend. If the error continues, replace the device.
333	FEU data invalid	F	F	The cyclically sent data packets (every 500ms) are not reaching the process interface. ▶ Check the connection between the process interface and frontend. If the error continues, replace the device.
334	Plateau recording	C	C	Plateau recording active. ▶ Wait, no further action is required.
336	FEU Pairing	F	F	Incompatible software versions between frontend and process interface. ▶ Perform a software update for the frontend and process interface if necessary. If the software is already compatible, check the connection between the modules and restart the device. If the error persists, replace the device.
337	Power consumption too high (Iballast)	F	F	The device's power consumption is too high. The cause could be aging, high radiation intensity (emptying of a pipeline/tank), or a regulation error. ▶ Set the regulation to "manual" and set a new default bias voltage. Then, set the regulation back to "automatic." If the event occurs again, replace the device.
Backup/Restore				
408	Backup/Restore in progress	C	F	Backup/Restore process active. ▶ Wait, no further action is required.
409	Backup/Restore failed	F	F	Backup/Restore process was interrupted. ▶ Check the device connection and restart the backup/restore process.
410	Backup/Restore not complete	S	F	Backup/Restore compatible but incomplete. This may occur when restoring device settings after a software update, especially if additional parameters become available with the update. ▶ Compare the software versions at the time of the backup and restore. Ideally, create a backup after every software update.

411	Backup/Restore incompatible	S	F	Conflict of software versions between the device and backup file. This occurs only when the detector software is newer than the version at the time of the backup. Newly added parameters cannot be restored because they are not present in the backup file. ▶ Manually reconfigure the parameters and create a new backup.
412	Backup/Restore unit mismatch	S	F	A unit in the backup does not match the device's set units (e.g., g/cm³ <-> kg/m³). ▶ Adjust the units on the device according to the information in the backup file and restart the restore process.
Application				
600	Data flow	F	F	The data flow is disrupted or interrupted. A measurement cycle is skipped. If the next measurement cycle is also skipped, the error will be signaled. ▶ Restart the device. If the error persists, replace the device.
604	Decay compensation failure	M	M	Error in decay compensation. ▶ Check if the system time is set correctly. If necessary, reset it and calibrate the device. If the error persists, replace the device.
605	Source exchange	M	M	Adjustable warning for the replacement of the radiation source. ▶ Replace the radiation source and recalibrate the device. The event can be acknowledged at any time.
606	XIP	S	S	Interference radiation detected. The measurement value is frozen. ▶ No action required. If the XIP mode persists for too long or is reported continuously, check the XIP measurement settings or the measurement arrangement for crosstalk.
613	Alarm1 active	S	S	Alarm 1 is active. ▶ Depending on the individual settings, check the affected process variable.
614	Alarm2 active	S	S	Alarm 2 is active. ▶ Depending on the individual settings, check the affected process variable.
Specific for level application				
615	LevelSwitch Alarm active	S	S	The switch alarm is active. ▶ Depending on the individual settings, check the affected process variable.
616	Level underflow	N	N	Level < 0%. Possible causes: – Incorrect calibration – Interference radiation

617	Level overflow	N	N	Level > 100%. Possible causes: – Incorrect calibration – Radiation shield closed
619	Read-In active	C	C	Count rate is being read-in. ▶ No action required.
620	Cal active	C	C	Calibration is being performed. ▶ No action required.
621	Rapid Switch active	S	S	Rapid switch is active. The time constant is automatically set to 1/10 of the set value for rapid process changes. This is only applicable if it is compatible with the time constant of the host system.
622	Adjust active	C	C	The calibration curve is being adjusted. This is applicable after replacing the radiation source or when recalibrating wall mountings.
Specific for density application				
615	ApplicationSwitch Alarm active	S	S	The switch alarm is active. ▶ Depending on the individual settings, check the affected process variable.
616	PV underflow	N	N	PV lower than the set measurement range. Possible causes: – Incorrect calibration – Process influences ▶ Check if the cause is related to the process and adjust the measurement range if necessary.
617	PV overflow	N	N	PV greater than the set measurement range. Possible causes: – Incorrect calibration – Process influences ▶ Check if the cause is related to the process and adjust the measurement range if necessary.
619	Read-In active	C	C	Count rate is being read-in. ▶ No action required.
620	Cal active	C	C	Calibration is being performed. ▶ No action required.
621	Rapid Switch active	S	S	Rapid switch is active. The time constant is automatically set to 1/10 of the set value for rapid process changes. This is only applicable if it is compatible with the time constant of the host system.
622	Insufficient count rate	C	C	The measurement count rate after background compensation is < 2 cps. ▶ Check if the background count rate is correctly set and whether the radiation source is open. If the issue persists, contact Berthold Service.
Gemeldet von Frontend				

1100	Test mode	F	F	The device is in test mode. Only relevant for production testing. ▶ If the event occurs during operation, restart the device. If the error persists, the device must be replaced.
1101	HW module integrity	F	F	The device does not recognize the installed modules. Possible causes: – Ex-d/Ex-i modules mixed up or hardware revisions of the modules are incompatible – Unsuccessfully tested or faulty circuit board installed ▶ Restart the device. If the error persists, the device should be replaced.
1102	Data-set integrity	F	F	Parameter shift due to software update or shift caused by communication with the FRAM. ▶ Perform a repair reset. If the error persists, try a factory reset. If the error continues, replace the device.
1103	RAM test failure	F	F	Memory error during runtime. ▶ Restart the device. If the error persists or occurs frequently, replace the device.
1104	Invalid Reset Code	F	F	Can only occur during device testing in production or after a master reset. ▶ If the event occurs during operation, restart the device. If the error persists, replace the device.
1105	Date/Time not guaranteed	F	F	The battery/capacitor of the internal clock is empty, or the date/time has not been set. ▶ Set the system time again.
1107	Watchdog reset	F	F	Simulation mode is active. No action required. ▶ Manually exit the simulation mode or restart the device.
1109	Watchdog off	S	F	Program crash/unexpected execution of program parts detected. ▶ Restart the device. If the event occurs frequently, replace the device.
1110	Watchdog failure	S	S	Watchdog disabled. Only important for production testing. Should not occur during operation. ▶ If the event occurs during operation, restart the device. If the error persists, the device needs to be replaced.
1112	Internal clock failure	F	F	Internal (auxiliary) oscillator (frontend) does not maintain the target frequency. ▶ Check the connection between the frontend and PI, then restart the device. If the error persists or occurs frequently, replace the device.
1113	Internal device failure	F	F	Device initialization failed. ▶ Restart the device. If the error persists, replace the device.

1200	Data flow	F	F	The data flow is disturbed or interrupted. A measurement cycle is skipped. If the following measurement cycle is also skipped, the error will be signaled. ▶ Restart the device. If the error persists, replace the device.
1201	Dead-time compensation limit	F	F	The device is receiving too many pulses and is saturated. It is possible that the pipeline/tank in combination with a strong radiation source has run empty. ▶ The event will automatically clear once the counting rates fall below the limit. If the error occurs frequently, the radiation source-detector arrangement and the strength of the radiation source should be checked.
1202	Temperature - sensor failure	F	F	One or both temperature sensors are not transmitting values. ▶ The device must be replaced.
1203	Temperature - sensor deviation	S	S	Both temperature sensors show different temperature values with a difference greater than 3°C. A reliable temperature value cannot be determined. ▶ The device should be replaced if necessary.
1300	Data flow	F	F	The data flow is disturbed or interrupted. A measurement cycle is skipped. If the following measurement cycle is also skipped, the error will be signaled. ▶ Restart the device. If the error persists, replace the device.
1303	Power supply deviation (3.38V)	F	F	The internal power supply is not maintained. The permissible deviation is approximately 0.25V. The cause could be, for example, a calibration error. ▶ Replace the process interface.
1304	Reference Supply deviation (VREF)	F	F	The internal reference voltage supply is not maintained. The permissible deviation is approximately 0.025V. The cause could be, for example, a calibration error. ▶ Replace the process interface.
1307	Zero countrate - measure	F	F	No pulses are received within the specified time (depending on the detector code) in the measurement channel. ▶ Check the bias voltage to ensure the regulation is functioning. If this is not the cause, replace the device.

1308	Zero countrate - control	F	F	No pulses are received within the specified time (depending on the detector code) in the control channel. ▶ Check the bias voltage to ensure the regulation is functioning. If this is not the cause, replace the device.
1309	Zero countrate - cosmic	F	F	No pulses are received within the specified time (depending on the detector code) in the high radiation channel. ▶ Check the bias voltage to ensure the regulation is functioning. If this is not the cause, replace the device.
1313	Countrate - filtering failed	F	F	Faulty or no filtered count rate. In this case, a software error has occurred.
1314	Voltage threshold deviation - measure	F	F	Deviation of the voltage threshold in the measurement channel from the nominal value > 0.05V. ▶ The device must be replaced.
1316	Voltage threshold deviation - control	F	F	Deviation of the voltage threshold in the control channel from the nominal value > 0.05V. ▶ The device must be replaced.
1318	Voltage threshold deviation - cosmic	F	F	Deviation of the voltage threshold in the high radiation channel from the nominal value > 0.05V. ▶ The device must be replaced.
1320	VBIAS1 voltage deviation	F	F	Deviation of bias voltage (1st group SiPM) from the nominal value > 0.1V. ▶ The device must be replaced.
1321	VBIAS2 voltage deviation	F	F	Deviation of bias voltage (2nd group SiPM) from the nominal value > 0.1V. ▶ The device must be replaced.
1323	Bias warning	S	S	The regulation reaches a +/- 1.0 V limit. The cause is likely the aging of the scintillator. ▶ The device must be replaced.
1324	Bias alarm	F	F	The regulation reaches a +/- 2.0 V limit. The regulation is no longer functioning. The cause is likely the aging of the scintillator. ▶ The device must be replaced.
1326	IMON alarm	F	F	Excessive currents (> 120 µA) at SiPM. The cause may be high radiation intensity. ▶ Check the bias voltage to ensure the regulation is functioning. If this is the case, replace the device.
1328	Temperature limits - warning	S	S	Internal temperature > 60°C. The device is approaching the specification limit. ▶ Lower the internal temperature. Consider using water cooling if necessary.

1329	Temperature limits - alarm	F	F	Internal temperature > 63°C. The device has reached the specification limit and will shut down. ▶ Lower the internal temperature. Consider using water cooling if necessary. The device must be restarted after cooling down.
1330	Detector configuration	F	F	Possible incorrect detector code. ▶ Check the detector code against the list in the operating manual (69691BA24, Chapter 3.4.1.6 – Input of sensor parameters).
1334	Noise control - warning	M	M	The signal-to-noise ratio (AUX/Measurement channel) has reached the warning threshold (Standard = 0.7, adjustable). Possible causes include aging of the scintillator or incorrect measurement setup. ▶ Verify the measurement setup for accuracy and replace the device if necessary.
1335	Noise control - alarm	F	F	The signal-to-noise ratio (AUX/Measurement channel) has reached the error threshold (Standard = 0.8, adjustable). Possible causes include aging of the scintillator or incorrect measurement setup. ▶ Verify the accuracy of the measurement setup and replace the device if necessary.