Operating Instructions
DUSTHUNTER SB-FSS

Fail Safe Shutter

Endress+Hauser
People for Process Automation

Described Product
Product name: DUSTHUNTER SB-FSS
Basic device: DUSTHUNTER SB100

Manufacturer
Endress+Hauser SICK GmbH+Co. KG
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Legal information

Original document
This document is an original document of Endress+Hauser SICK GmbH+Co. KG.

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1 Important information

1.1 About this document

This Addendum is only complete in combination with the Operating Instructions and Service Manual of the DUSTHUNTER SB measuring system. Availability and knowledge of the Operating Instructions and Service Manual of the DUSTHUNTER SB are assumed.

The valid Operating Instructions (OI) and Service Manual (SM) contain basic information on safety, measuring procedure, design, function and usage of the measuring system and its components and therefore only supplementary information is provided where necessary to understand the function. This Addendum is therefore only to be used in combination with the valid Operating Instructions (Part No. 8012422) and Service Manual (Part No. 8013017).

NOTE:
Always read the Operating Instructions and Service Manual before starting work! Be sure to observe all safety and warning information in the Operating Instructions and Service Manual!

1.2 Main hazards

Observe the following hazards in addition to those described in the Operating Instructions and Service Manual.

1.2.1 Hazard through moving fail-safe shutter

There is a risk of crushing between the shutter and measuring openings especially when the shutter closes.

WARNING: Risk of crushing
- ▶ Do not reach into the area of the moving parts of the fail-safe shutter.

1.3 Intended use

Purpose of the device

The fail-safe shutter DUSTHUNTER SB-FSS only serves to close off and release the measuring openings in the DUSTHUNTER SB device.

NOTE: No protection for persons
The device described in this document is intended solely to protect the measuring device.
- ▶ Familiarize yourself with the function of the measuring device.
- ▶ Observe information on personal protection and personal protective equipment.

NOTE:
Appropriate protective devices and personal protective equipment must be available in sufficient quantity and must be used by the personnel in accordance with the respective hazard potential.

Correct use

- ▶ Use the device only as described in this Addendum. The manufacturer bears no responsibility for any other use.
- ▶ Observe all measures necessary for conservation of value, e.g., for maintenance and inspection and/or transport and storage.
- Do not remove, add or modify any components to or on the device unless described and specified in the official manufacturer information. Otherwise
  - the device could become dangerous
  - the manufacturer's warranty becomes void

Restrictions of use

- The DUSTHUNTER SB-FSS fail-safe shutter is not approved for use in potentially explosive atmospheres.

1.4 Responsibility of user

1.4.1 General information

Designated users

The DUSTHUNTER SB-FSS fail-safe shutter may only be installed and operated by persons who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.

Special local requirements

- ▶ Observe the local laws, regulations and company internal operating instructions applicable at the installation location.

Keeping documents

Keep the Operating Instructions belonging to the measuring system as well as equipment documentation onsite for reference at all times. Pass the respective documentation on to any new owner when selling the measuring system.

2 Product description

2.1 Function

The fail-safe shutter is an option for the DUSTHUNTER SB measuring system. The shutter can only be used as part of the DUSTHUNTER SB measuring system.

The fail-safe shutter closes off the 3 measuring openings when the purge air or the power voltage fails. When the shutter is closed, only small amounts of gas from the duct can penetrate into the device attachment. The non-return valve additionally closes the purge gas inlet and prevents backflow into the purge air supply. This protects the device as far as possible from damage through hot or aggressive flue gas. However, the closed fail-safe shutter is not absolutely gas-tight. Therefore the measuring head may not remain on the exhaust duct for too long without purge air.

An electric motor triggers the movements (open, close) of the fail-safe shutter. A capacitor battery provides power to the motor when the power voltage fails. The shutter opens the measuring openings as soon as the power voltage returns or when purge air is running again.

The fail-safe shutter is preset to the standard purge air supply SLV4 (fan 2BH13). The purge air supply of the MCU-P (with integrated fan) is not suitable for operating the fail-safe shutter. Please contact Endress+Hauser (https://www.endress.com/contact) when using a different purge air supply version.

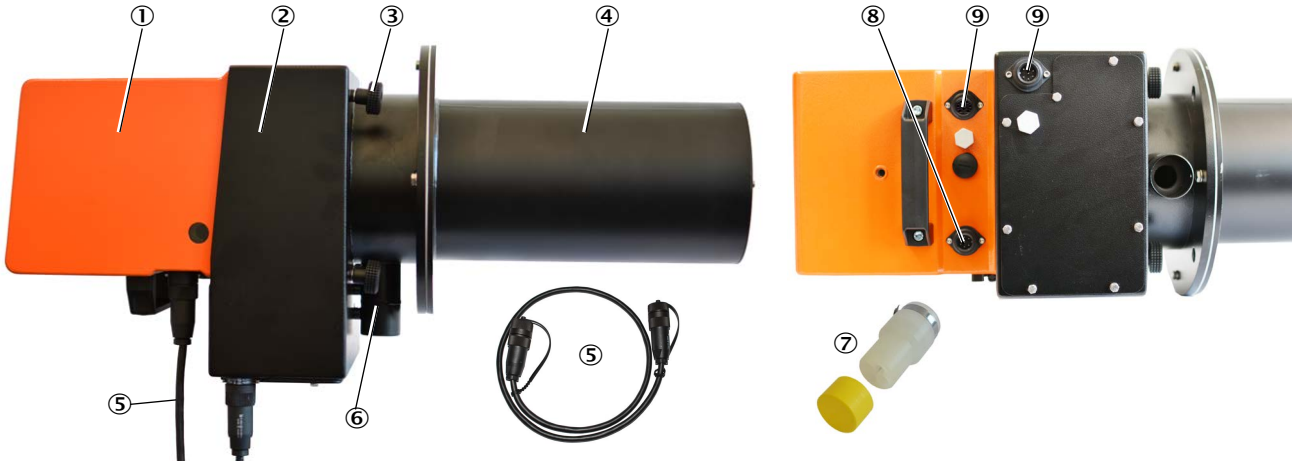
2.2 Retrofitting the fail-safe shutter

It is possible to retrofit the fail-safe shutter on a DUSTHUNTER SB100 without fail-safe shutter but this must be done by our customer support. The retrofitting steps are therefore not described in these Instructions.

The following components, among others, are replaced or modified when retrofitting the fail-safe shutter:

- Device attachment with shutter, motor, electronic part etc.
- Protective cover
- Cable with socket fitted in the electronics unit
- Connection cable (electronic unit with device attachment, 1:1 assignment)
- Non-return valve
- Firmware update

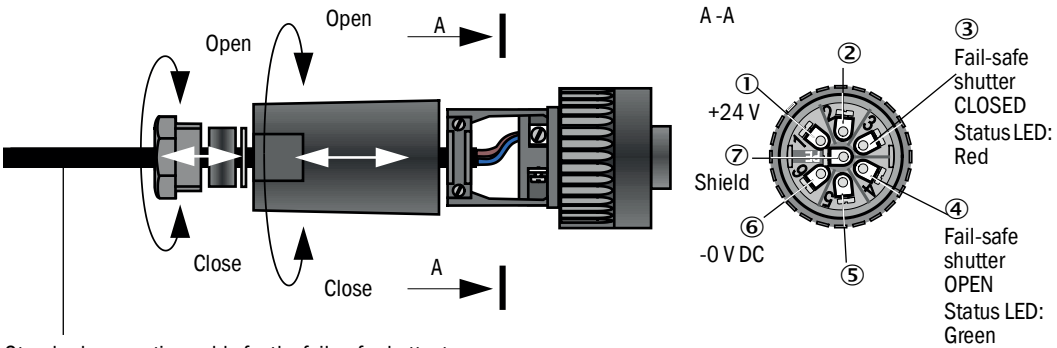
Fig. 1: Retrofitting the DUSTHUNTER SB-FSS



① Electronics unit
② Device attachment
③ Knurled screws
④ Screen attachment
⑤ Connection cable 1:1
⑥ Purge air connection
⑦ Non-return valve
⑧ Socket connection on MCU
⑨ Connection cable socket 1:1

2.2.1 Connection cable pin assignment

Fig. 2: Connection cable 1:1

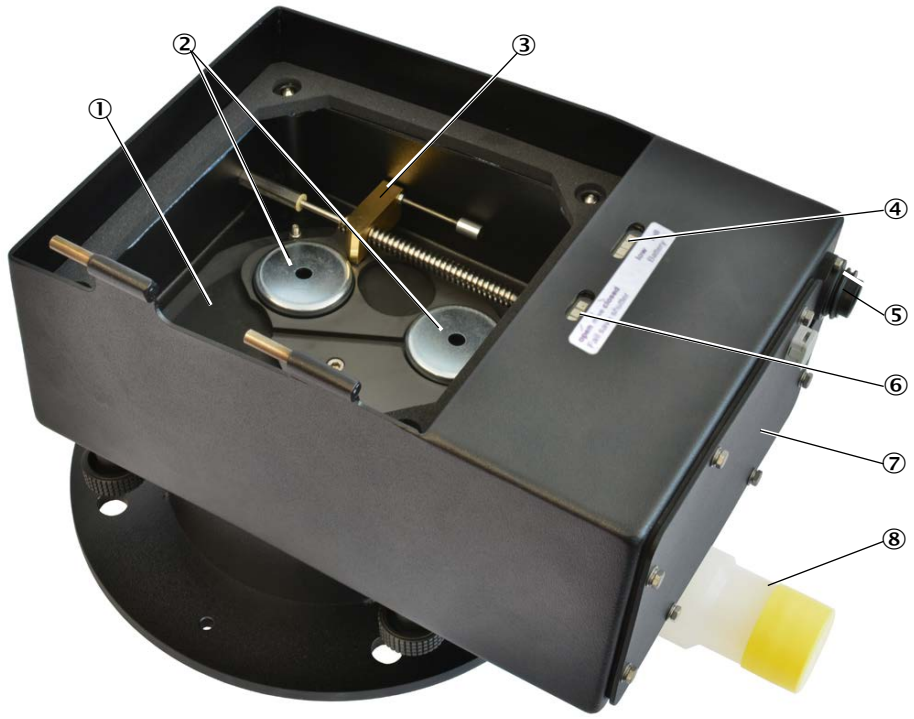


Standard connection cable for the fail-safe shutter to connect to socket (9), see Fig. 1

Note
To open, insert the plug-in connector into the plug on the electronics unit or the device attachment.

2.3 Device attachment

Fig. 3: Device attachment



① Shutter
② Magnetic discs
③ Sliding mechanism
④ Charge level indicator
⑤ Plug for connection cable
⑥ Status indicator
⑦ Electronic part with electric motor in housing
⑧ Non-return valve

Status indicator

Green: Shutter is OPEN (measuring operation),
Marking: “open”

Yellow: SHUTTER MOVING (opening or closing)
Marking: “move”

Red: Shutter CLOSED or Service switch set to OFF (no measuring operation)
Marking: “closed”

Trouble-free measuring operation with the DUSTHUNTER SB is only possible when the green LED is on.

IMPORTANT:
The shutter is in an undefined position when no LED is on.

WARNING: Hazard through flue gas

- In installations with harmful gases, high pressure, high temperatures, a risk of injury cannot be ruled out if the shutter position is undefined.
- It must be assumed that the measuring openings to the duct are not closed when the shutter position is undefined.
- Proceed with great caution and wear personal protective equipment.

Charge level indicator

Green: Capacitor battery is charged. Shutter movement possible.
Marking: “full”

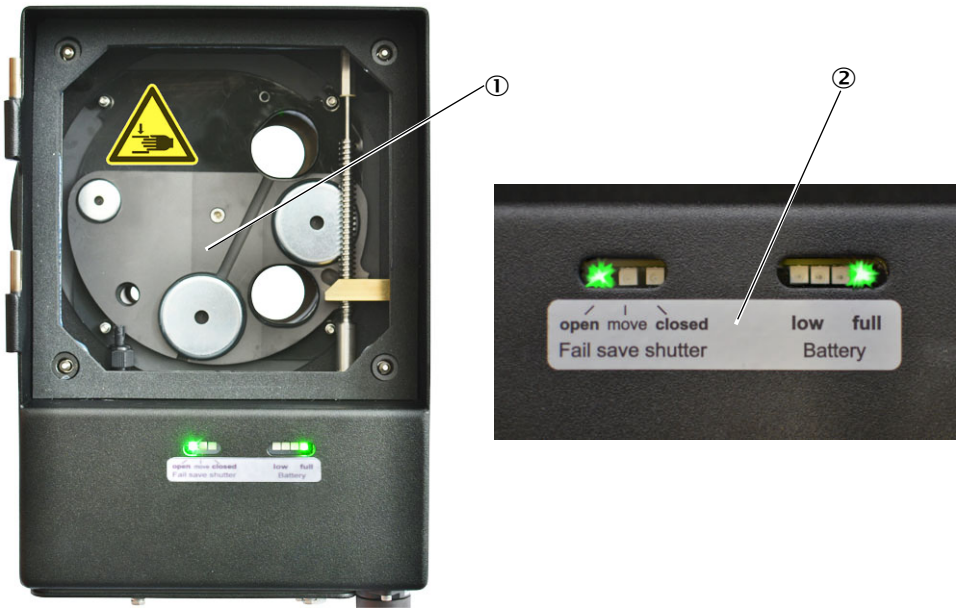
Yellow, orange: Lower charge level. The shutter can be closed.

Red: Charge level too low for shutter movement
Marking: “low”

When the red LED is on, this can also indicate a weak capacitor battery (see “Function check and capacitor battery test”, page 11).

The charge level of the capacitor battery drops from green to red. The fail-safe shutter is charged when voltage is applied until the green LED goes on. After the supply voltage has failed, the red LED will continue to light for approx. 2 hours.

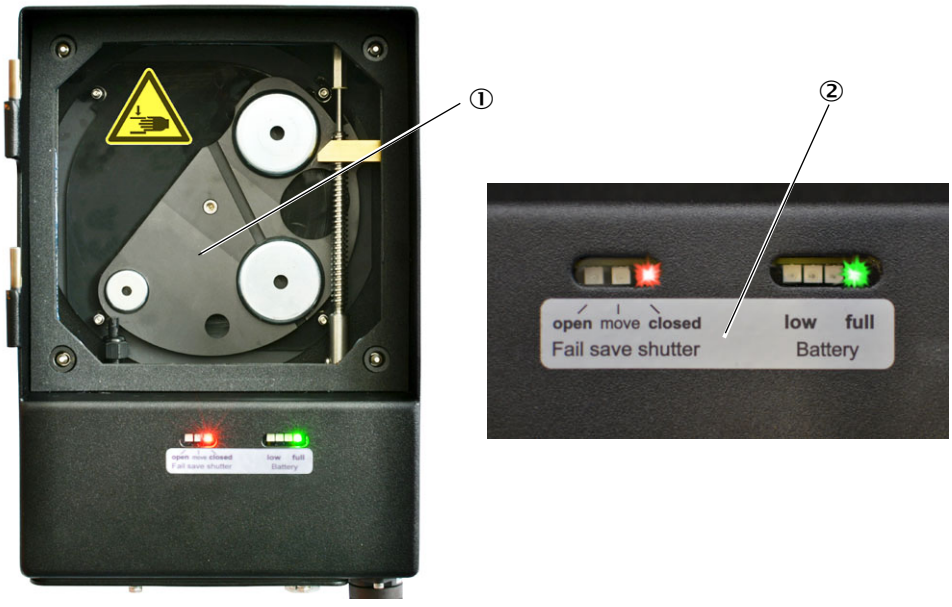
Fig. 4: Fail-safe shutter status: Open



① Shutter open position

② Detail: Status LEDs with shutter open

Fig. 5: Fail-safe shutter status: Closed



① Shutter closed position

② Detail: Status LEDs with shutter closed

3 Maintenance

3.1 General information

Maintenance work to be carried out is limited to cleaning the fail-safe shutter and checking the capacitor battery. Further maintenance work is not required. Lubricating mechanical components is not necessary. Replace components when corrosion is visible.

▶ Set the measuring system to “Maintenance” state before starting maintenance work (see Operating Instructions “DUSTHUNTER SB“, Chapter “Maintenance“).

WARNING:
Observe the relevant safety regulations as well as the safety notices (see “Responsibility of user”, page 5) during all work.

IMPORTANT:
▶ Do not damage any device parts during maintenance work.
▶ Do not interrupt the purge gas supply.

WARNING:
For maintenance work requiring the sender/receiver unit on the device flange to be opened, take suitable protective measures against possible escaping sample gas and wear personal protective equipment.

Maintenance intervals

Together with the normal maintenance intervals of the basic device.

Maintenance work on the DUSTHUNTER SB remains identical when the fail-safe shutter is fitted and must be carried out in the specified intervals.

3.2 Function check and capacitor battery test

Test goal

To check the function of the device attachment with integrated fail-safe shutter under usage conditions at the measuring location.

Function check

Carry out the following procedure in regular intervals (maintenance interval of basic device) to check the function.

▶ Interrupt the voltage supply to the fail-safe shutter control. To do this, disconnect the connection plug of the connection cable from the device attachment.
  – The shutter is now closed by the energy in the integrated capacitor battery. The yellow status LED indicates the closing process. The shutter mechanism can also be heard.
  – The shutter is closed after 20 to 30 seconds. The end of the closing process is indicated by the yellow LED going off and the red LED on. A mechanism malfunction can be assumed when the yellow LED remains on for longer than 30 seconds (see “Malfunction messages”, page 15).
  – “Closure shutter” is displayed in the MCU and “Closure shutter not open” by the DUSTHUNTER SB in SOPAS ET.
  – The status LEDS (see “Device attachment”, page 8) remain operational for about 2 hours after the power supply has been interrupted.

- ▶ The electronics unit can be separated from the device attachment when the shutter is closed.
  To do this, loosen the 4 knurled screws. Swivel the electronics unit away from the device attachment.
- ▶ Make a visual check to ensure the shutter has reached the correct stop position “closed” inside the device attachment (see “Fail-safe shutter status: Closed”, page 10).
- ▶ When required, the maintenance work on the DUSTHUNTER SB can now be carried out, especially checking and cleaning the optical interfaces and a visual check of the shutter mechanism.
- ▶ After completion of the work, swivel the electronics unit back into the device attachment. Close with the 4 knurled screws.

Capacitor battery test

Carry out this test immediately after the 24 V power supply has been interrupted, otherwise the result may be incorrect due to the discharge of the capacitor battery.

- ▶ Reconnect the plug connection of the connection cable to the device attachment and then observe the LEDs (see “Device attachment”, page 8).
  The charging indicator with the LED band “red - orange - yellow - green” shows how far the capacitor battery has discharged during the closing process immediately after the power supply has been restored.
  - Yellow or green LED on: Condition of the capacitor battery is good.
  - Orange LED on: The capacitor battery has discharged to a relatively low level.
    »» Check whether the shutter mechanism is heavily soiled or sluggish which causes the motor power needed to close the shutter to be very high.
    Further symptoms of the mechanism being sluggish are a longer closing time and the noise of a motor under heavy load.
    If no defects can be determined on the shutter mechanism, it is recommended to replace the capacitor battery at the next opportunity as a precaution.
  - Red LED on: The capacitor pack has discharged to a much too low level.
    »» Check whether the shutter mechanism is heavily soiled or sluggish.
    Replace the capacitor battery when the shutter mechanism is not defective.
- ▶ Check whether the fail-safe shutter reacts to not enough purge air:
  - ▶ Hold the suction connection to the air filter on the fan closed. If the fan still sucks in sufficient “pseudo purge air” through the housing, the purge air hose between the fan and the filter can alternatively be removed for a short time and reattached immediately after the fail-safe shutter has responded.
  - The yellow status LED goes on and the shutter closes when the green status LED goes off.
  - ▶ The filter can be opened immediately again.
  - The shutter opens, the yellow LED goes off and the green status LED goes on.

The device is ready for operation when 2 green LEDs are on after completing the test.

The manufacturer recommends replacing the capacitor battery after approx. 5 years or a corresponding test result for reliable operation of the fail-safe shutter.

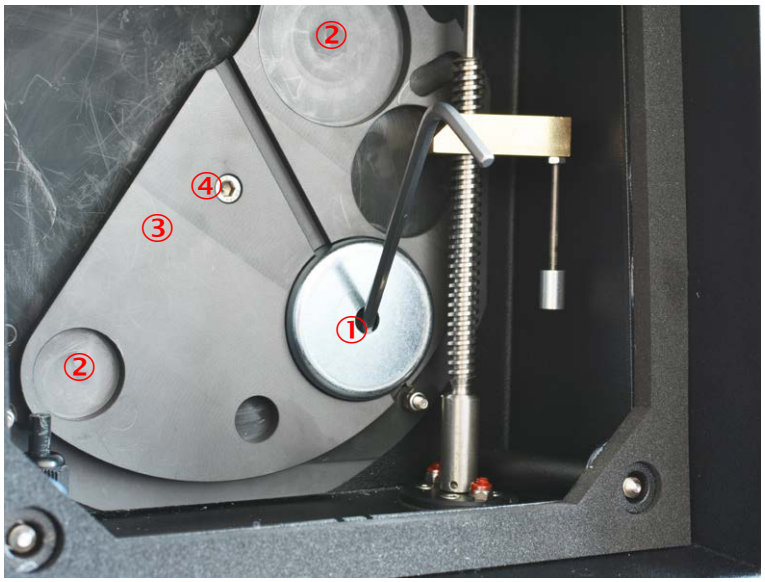
3.3 Cleaning the purge air mask

The purge air mask of the fail-safe shutter must also be checked for contamination and corrosion during the regular maintenance on the DUSTHUNTER SB.

The electronics unit must be removed from the device attachment and the device attachment removed from the duct in order to clean the purge air mask. It is recommended to carry this out in a workshop when the equipment is at a standstill.

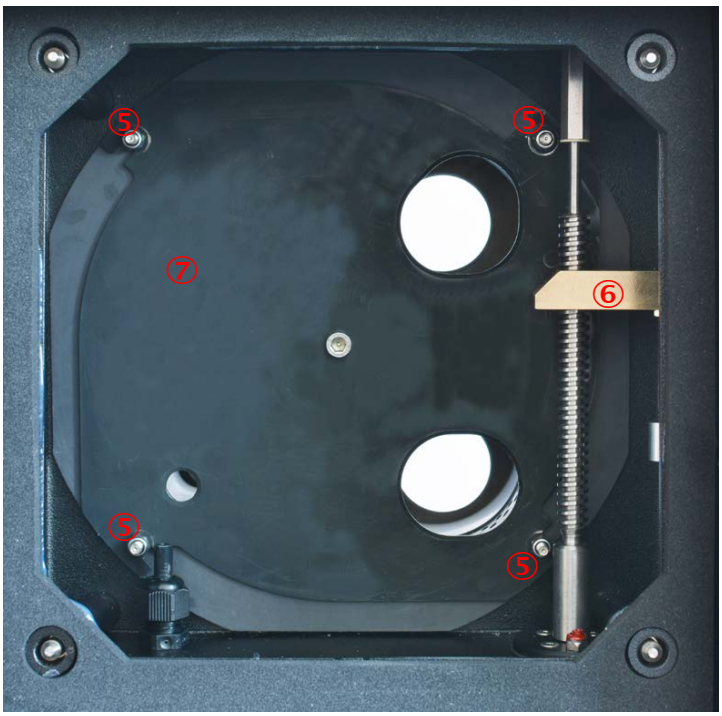
- ▶ Lever out the magnets of the pivoted shutter (Pos. 1, quantity 3) with a suitable Allen key, see Figure 5.
  Information: Two magnets have already been removed in the Figure.
  The center screw (Pos. 4) only serves for centering and need not be loosened.
- ▶ Remove the swivel disc.

Fig. 6: Removing the magnets



① Magnet
② Position of further magnets
③ Pivoted shutter
④ Do not loosen the centering screw

Fig. 7: Pivoted shutter removed



⑤ Purge air mask nuts
⑥ Sliding mechanism
⑦ Purge air mask

- Remove the sliding mechanism (Pos. 6) (see “Remove the sliding mechanism”, page 20).
- Loosen the nuts of the purge air mask (Fig. 6: Pos. 5, quantity 4) by two turns, do not remove.
- Turn the purge air mask (Pos. 7) clockwise and remove.
- Check the purge air mask for contamination and corrosion. Clean contamination. Note: The mask can be ordered as a spare part when it can no longer be cleaned or needs to be replaced due to corrosion (see “Spare parts”, page 24).
- Assemble in reverse sequence.

4 Malfunction messages

Malfunctions

WARNING: Hazard through escaping sample gas
In the event of a malfunction or fault message from the fail-safe shutter, sample gas may escape when the device is removed.
▶ Proceed with the utmost caution in all work. Take appropriate personal protection measures.

IMPORTANT:
Malfunctions can cause damage to the device.

Symptom	Possible cause	Action
LEDs of the sender/receiver are not on.	• No supply voltage • Connection cable not connected correctly or defective. • Plug-in connector defective	• Check plug connectors and cables. • Contact customer support.
Charging status display LED of the fail-safe shutter on device attachment lights red after connecting the supply voltage (longer than 10 minutes).	• Capacitor battery has aged.	• Replace capacitor battery.
Fail-safe shutter stuck.	• Fail-safe shutter does not open or close properly.	• Check fail-safe shutter runs freely. • Contact customer support.
Closing takes longer than 20 to 30 seconds.	• Sliding mechanism contaminated or damaged.	• Clean the sliding mechanism (see “Remove the sliding mechanism”, page 20). • Contact customer support.
Power supply established, charging status is displayed, no display on status display.	• Capacitor battery defective or not connected	• Check capacitor battery connector, check capacitor battery (see “Function check and capacitor battery test”, page 11).

5 Repair work

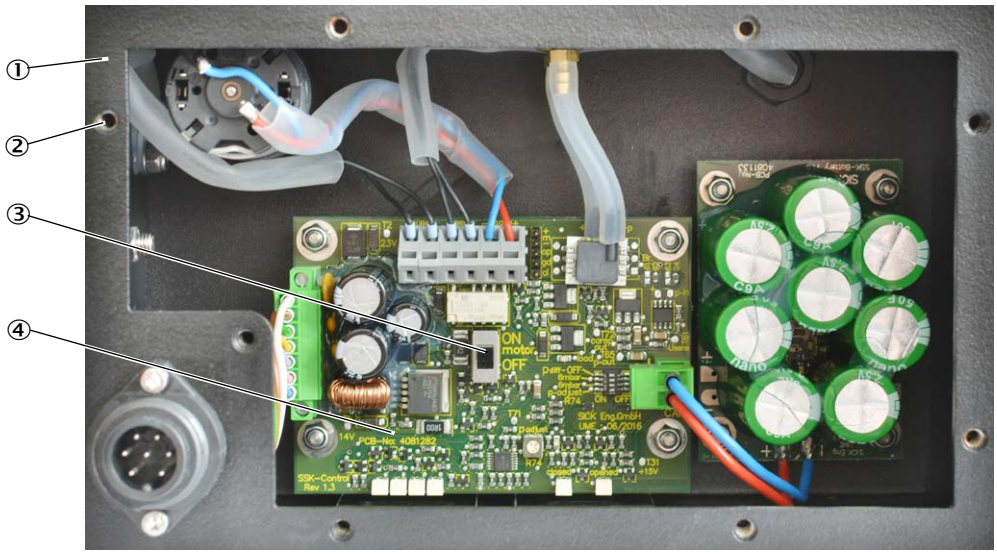
5.1 Service switch

A Service switch is located on the circuit board in the device attachment for tests and checks.

The switch is “ON” in normal state. If the switch is “OFF”, the motor for shutter movement is switched free from current (red LED on). The shutter remains in the current position.

- ▶ Sender/receiver unit: Unscrew the connection cable to the MCU.
- ▶ Unscrew the cover on the device attachment (8 screws).
- ▶ Switch Service switch to OFF.
- ▶ Carry out tests and checks.
- ▶ Switch Service switch to ON.
- ▶ Screw the cover back on the device attachment.
- ▶ Sender/receiver unit: Screw the connection cable to the MCU.
- ▶ Carry out the function test, see “Function check and capacitor battery test”, page 11.

Fig. 8: Service switch



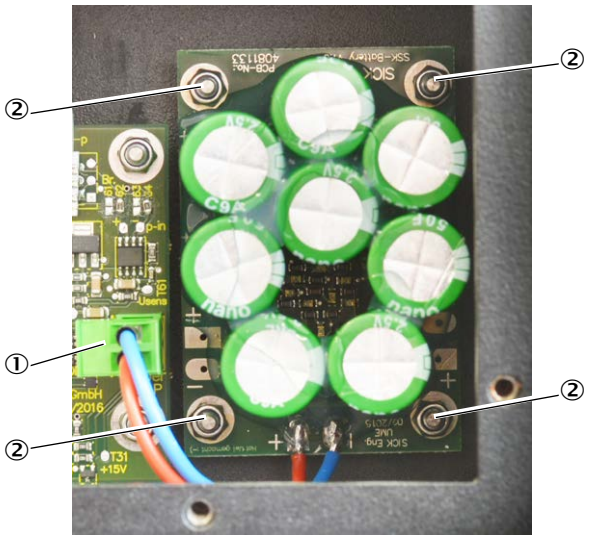
① Device attachment
② Screw-on point for the cover
③ Service switch
④ Circuit board

5.2 Replacing the capacitor battery

The capacitor battery should be replaced after 5 years (see “Spare parts”, page 24) or when the red LED (charge level) goes on during the test (see “Function check and capacitor battery test”, page 11).

- Sender/receiver unit: Unscrew the connection cable to the MCU.
- Unscrew the cover on the device attachment (8 screws).
- Remove the plug (Pos. 1) of the connection cable of the capacitor battery from the circuit board.
- Unscrew the nuts of the capacitor battery (Pos. 2; 4 nuts).
- Unpack the new capacitor battery and lay ready.
- Remove the capacitor battery to be replaced and lay it in the packing of the new battery. **CAUTION!** A short circuit in the residual charge in the capacitors can lead to the risk of fire!
- Screw the new capacitor battery tight.
- Connect the plug of the capacitor battery to the circuit board.
- Test the new capacitor battery (see “Function check and capacitor battery test”, page 11).
- Screw the cover back on the device attachment.
- Sender/receiver unit: Screw the connection cable to the MCU.

Fig. 9: Replacing the capacitor battery



① Plug of connection cable between capacitor battery - circuit board

② Fastening nuts of capacitor battery on circuit board

5.3 Setting the pressure sensor

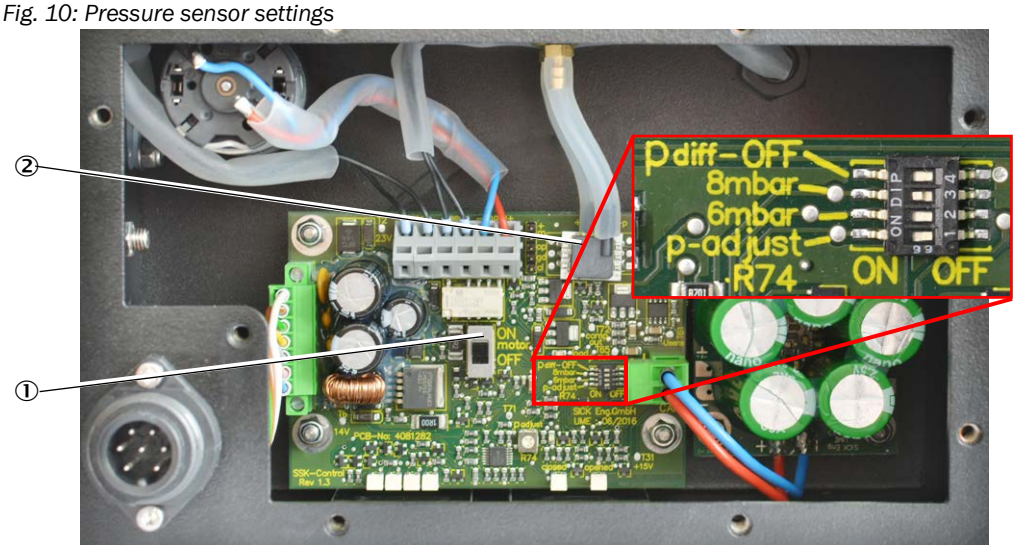
A mask is fitted in the purge air connection. The purge air is guided via hoses in front and behind the mask to a pressure sensor on the circuit board which measures the pressure difference. The fail-safe shutter determines whether sufficient purge air is available or not depending on the pressure difference.

The fail-safe shutter is preset to the standard purge air supply SLV4 (fan 2BH13). The purge air supply of the MCU-P (with integrated fan) is not suitable for operating the fail-safe shutter.

A DIL switch is located on the circuit board in the device attachment which serves to set the pressure sensor sensitivity. The switching settings are marked on the circuit board.

- **Pdiff–OFF,** position ON: Deactivates purge air monitoring. The shutter only closes when the power fails.
- **8 mbar,** position ON: The shutter closes when the differential pressure on the measuring mask is less than 8 mbar.
  A minimum purge air volume of 30 m^3/h is required to operate the fail-safe shutter.
- **6 mbar,** position ON: The shutter closes when the differential pressure on the measuring mask is less than 6 mbar.
  A minimum purge air volume of 30 m^3/h is required to operate the fail-safe shutter.
- **p-adjust:** Not used.

Fig. 10: Pressure sensor settings



① DIL switch ② Pressure sensor

Standard setting for purge air supply SLV4:

- P_{diff} = OFF
- 8 mbar = ON
- 6 mbar = OFF
- P-adjust = OFF

Contact Endress+Hauser for settings of a different purge air supply.

Procedure for changing the switch setting

- Sender/receiver unit: Unscrew the connection cable to the MCU.
- Unscrew the cover on the device attachment (8 screws).
- Switch the DIL switch.
- Sender/receiver unit: Screw the connection cable to the MCU.
- Check whether the fail-safe shutter reacts to not enough purge air (see “Function check and capacitor battery test”, page 11).
- Screw the cover back onto the device attachment.
  Note: The capacitor battery does not have to be checked after changing the switch setting.

5.4 Replacing the main circuit board

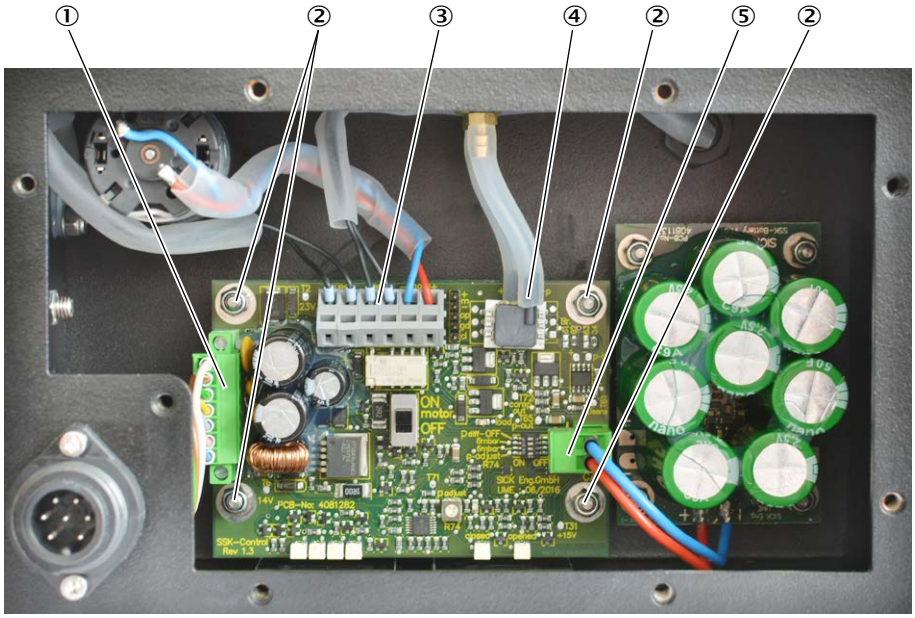
The circuit board can be replaced without assistance from customer support because no data are stored on the board.

Spare part: see “Spare parts”, page 24

Replace the main circuit board

- Sender/receiver unit: Unscrew the connection cable to the MCU.
- Unscrew the cover on the device attachment (8 screws).
- Unscrew and unplug the cable connector (Pos. 1) from the circuit board.
- Remove the plug (Pos. 5) of the connection cable of the capacitor battery from the circuit board.
- Unplug the hoses of the differential pressure sensor (Pos. 4).
- Disconnect the connection cables for reed contacts, motor and power supply (Pos. 3).
- Unscrew fastening nuts M4 (Pos. 2; quantity 4) on the circuit board.
- Remove the circuit board and fit a new one.
- Assemble in reverse sequence.
- Set the pressure sensor (see “Setting the pressure sensor”, page 18).

Fig. 11: Pressure sensor settings



① Cable connector
② Circuit board fastening nuts
③ Connection cable clamping
④ Hoses
⑤ Plug of connection cable between capacitor battery - circuit board

5.5 Replacing the sliding mechanism

Replace the mechanism when the function of the sliding mechanism is no longer guaranteed due to corrosion or damage.

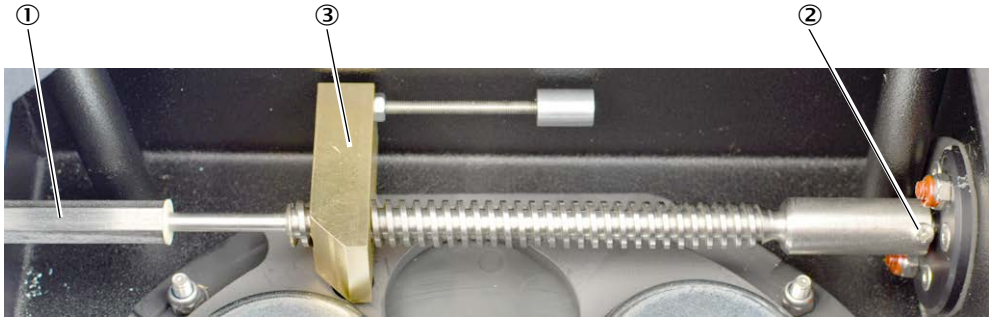
Spare part: see “Spare parts”, page 24

The shutter must be removed because it cannot remain in the closed position during the work. These Instructions assume this is the case. The position of the shutter (open or closed) is irrelevant for replacement.

5.5.1 Remove the sliding mechanism

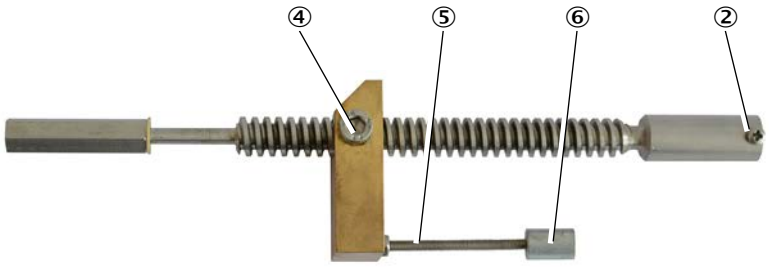
- ▶ Turn the upper fastening of the sliding mechanism (Pos. 1) counter-clockwise with a jaw wrench (size 8) until the upper fastening is completely out of the thread.
- ▶ Turn the spindle until the lower fastening screw (Pos. 2) is in a suitable position to be turned out.
  NOTE: The nuts marked red only serve for centering the motor and must not be loosened!
- ▶ Turn fastening screw (Pos. 2) completely out.
- ▶ Now pull the complete sliding mechanism off the shaft (Pos. 3) of the motor towards the upper fastening (Pos. 4)
- ▶ Fit the mechanism in reverse sequence.
  OBSERVE: Guide screw (Pos. 4) of the brass block must sit in recess (Pos. 8) of the shutter. Pos. 3 shows the brass block in the correct position when the shutter is closed.

Fig. 12: Sliding mechanism fitted



① Upper fastening
② Spindle fastening screw
③ Correct position of the brass block when the shutter is closed

Fig. 13: Sliding mechanism, complete



② Spindle fastening screw
④ Brass block guide screw
⑤ Threaded rod
⑥ Magnet

Fig. 14: Sliding mechanism removed

⑦ Upper fastening
⑧ Recess for the brass block guide screw
⑨ Motor shaft

5.5.2 Set the stop position

Check the shutter stop position after replacing the sliding mechanism and readjust when necessary. The shutter must be fitted ready for operation and provided with current during stop position adjustment. A magnet recognizes the stop position through a reed contact near the motor shaft (Pos. 9).

- ▶ Deactivate purge air monitoring on the circuit board (switch Pdiff to ON, see “Setting the pressure sensor”, page 18).
- ▶ Provide voltage supply.
  – The shutter opens.
- ▶ Check the openings cover the holes below.
- ▶ Deviations can be corrected by adjusting the magnets (Pos. 6) on the threaded rod (Pos. 5), loosen the locknut to do this.
  Tighten the locknut of the threaded rod when the stop position of the open shutter is correct.
- ▶ Reactivate purge air monitoring on the circuit board (switch Pdiff to OFF).

6 Specifications

6.1 Technical data

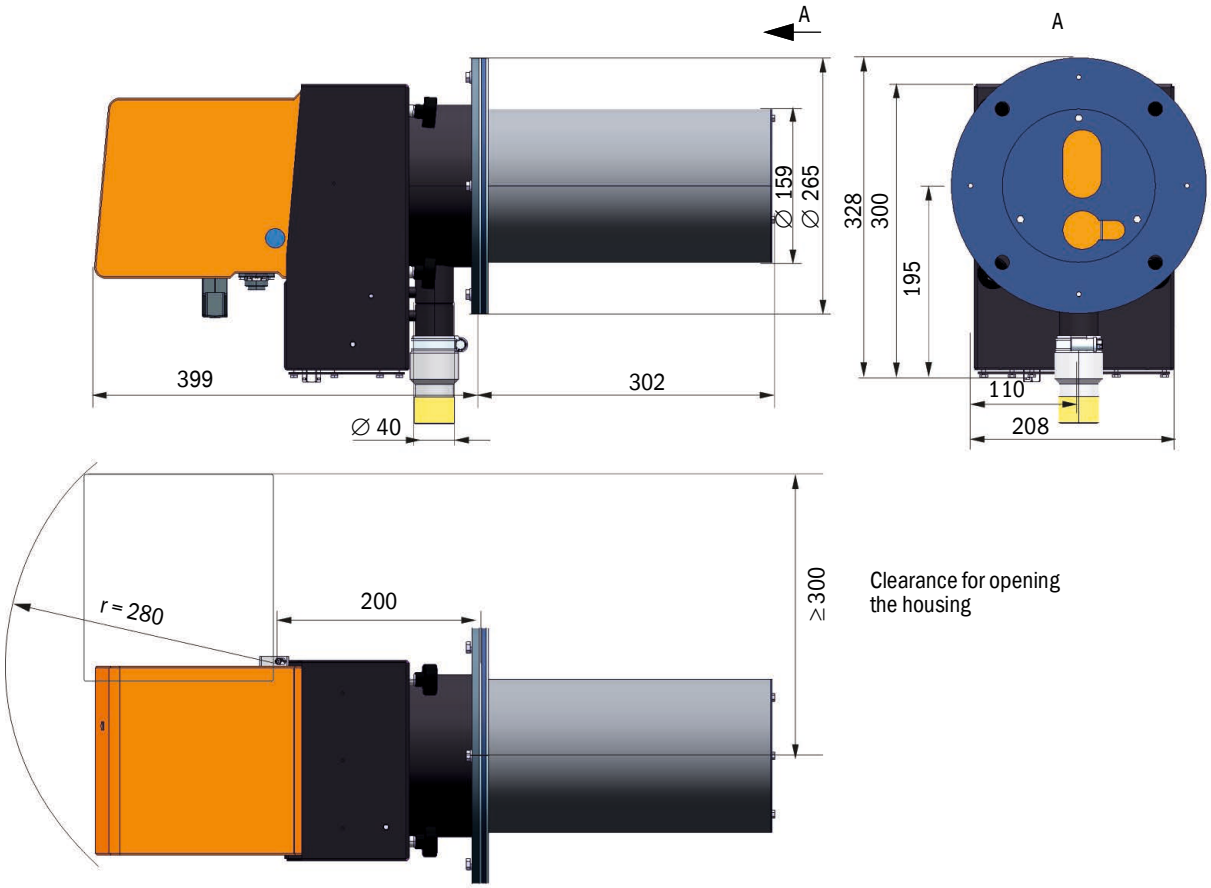
Measurement parameter			
Measured variable	Monitoring supply voltage and purge air volume on the device attachment		
Response pressure (preset)	Approx. 8 mbar		
Closing time of the fail-safe shutter	Approx. 20 s		
Power supply			
Gas temperature (above dew point)	Standard version DHSP-T2xxxNNXX: Version for internal duct pressure up to +200 kPa: High temperature version DHSP-T4xxxNXX:		-45 ... 220 °C -40 ... 250 °C -45 ... 400 °C
Voltage supply	Rated voltage 24 V DC	Tolerance range 19...28 V	
Internal duct pressure	Sender/receiver unit DHSP-T2xxxNNXX and DHSP-T4xxxNNXX	Control unit MCU-P	-50 hPa ... +10 hPa
		External purge air unit option	-50 hPa ... +30 hPa
		with on-site instrument air	-50 hPa ... +100 hPa
	DHSP-T4V11NNXX 2 bar		-80 kPa ... +200 kPa
Power consumption	During shutter movement and when charging the capacitor battery: Approx. 300 mA		
Capacitor battery charging time	Approx. 10 minutes when capacitor battery fully discharged (Check the capacitor battery only after charging)		
Ambient temperature	-40 ... +60 °C -40 ... +45 °C	Sender/receiver unit, control unit MCU-N Control unit MCU-P, suction temperature for purge air	
Characteristics			
Ambient temperature	-40 ... +65 °C		
Capacitor battery storage time	Up to 5 years (also in discharged condition)		

6.2 Dimensions, Part Nos.

All dimensions in mm.

6.2.1 Sender/receiver unit

Fig. 15: Sender/receiver unit



Designation	Part No.
Sender/receiver unit DHSB-T10 with fail-safe shutter, with contamination measurement, distance flange - measuring range 400 mm, supply voltage 24 V DC	1078055
Sender/receiver unit DHSB-T11 with fail-safe shutter, with contamination measurement, distance flange - measuring range 800 mm, supply voltage 24 V DC	1078060
Fail-safe shutter retrofit kit for existing device DHSB-T10 or DHSB-T11	2083293

7 Spare parts

Designation	Part No.
Capacitor battery	2080107
Non-return valve	2035098
Purge air mask	2039113
Main circuit board	2072705
Sliding mechanism, complete	2092815
Cover, electronics	2092813
Seal, electronics	4086911
Seal, fail-safe shutter	4086890
Fail-safe shutter connection cable	2055750

Fig. 16: Spare part, capacitor battery

The capacitor battery is delivered “discharged” to a low residual voltage.

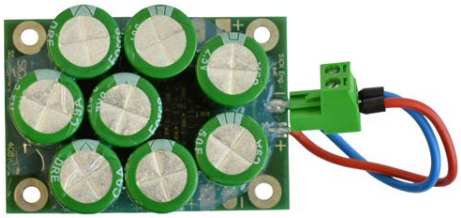


Fig. 17: Spare part, purge air mask

Fig. 18: Spare part, main circuit board

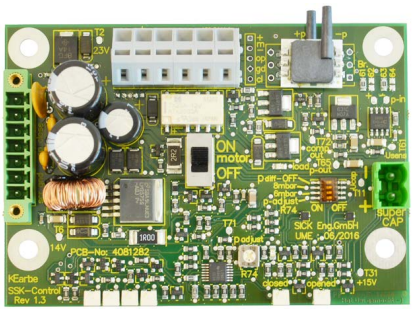


Fig. 19: Spare part, sliding mechanism, complete

Fig. 20: Spare part, cover, electronics

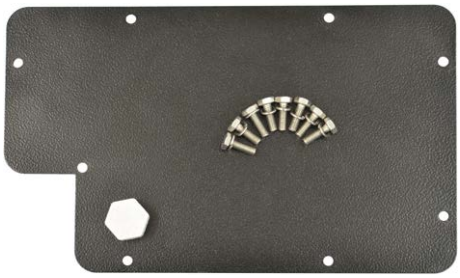


Fig. 21: Spare part, seal, electronics

Fig. 22: Spare part, seal, fail-safe shutter

Fig. 23: Spare part, fail-safe shutter, connection cable

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