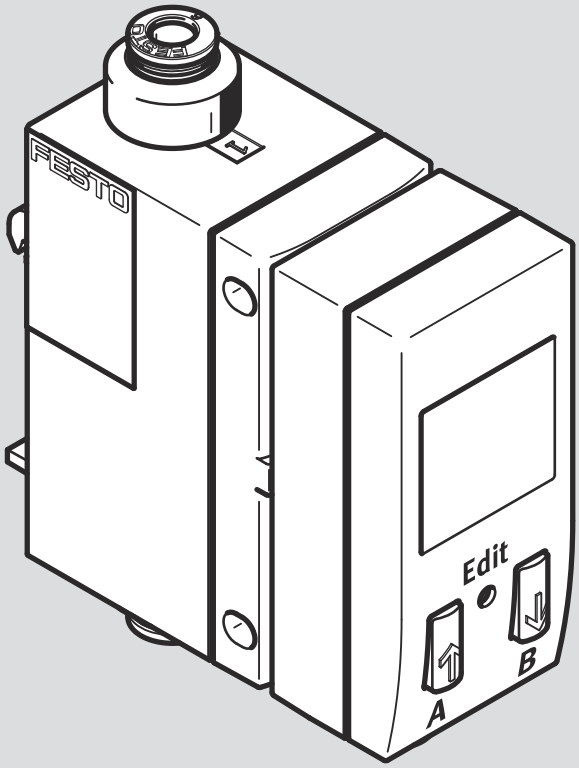
# SFAB
## Flow sensor




FESTO

Operating instruction

8228238

8228238
2024-12e
[8228240]

Original instructions

# Table of contents

# 1 About this document

## 1.1 Applicable documents

All available documents for the product ➔ www.festo.com/sp.

# 2 Safety

## 2.1 Safety instructions

- Only use the product in its original condition without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Observe the identifications on the product.
- Condensation, oil mist, foreign matter and other contaminants in the compressed air can damage the product. Use media only in accordance with the specifications ➔ 12 Technical data.
- The product may generate high frequency interference, which may require interference suppression measures in residential areas.

## 2.2 Intended use

The flow sensor monitors the flow rate, volume and temperature of gaseous media in piping systems or terminals in industry.

## 2.3 Training of qualified personnel

Work on the product may only be carried out by qualified personnel who can evaluate the work and detect dangers. The qualified personnel have skills and experience in dealing with electropneumatic (open-loop) control technology.

## 2.4 UL/CSA certification

In combination with the UL inspection mark on the product, the information in this section must also be observed in order to comply with the certification conditions of Underwriters Laboratories Inc. (UL) for USA and Canada.

| **UL/CSA approval information** | |
|---|---|
| Product category code | QUYX, QUYX7 |
| File number | E322346 |
| Considered standards | UL 61010-1, CAN/CSA-22.2 No. 61010-1 |
| UL mark | c UL us LISTED |
| Product identity | PROC. CONT. EQ (Process Control Equipment) |

Tab. 1: UL/CSA certification information

Only for connection to a NEC/CEC Class 2 supply.

**⚠ WARNING**

The unit shall be supplied by a power source which fulfils the requirements on a limited-energy circuit in accordance to IEC/EN/UL/CSA 61010-1 or on a Limited Power Source (LPS) in accordance to IEC/EN/UL/CSA 60950-1 or IEC/EN/UL/CSA 62368-1 or a Class 2 circuit in accordance to NEC or CEC.

# 3 Additional information

– Contact the regional Festo contact if you have technical problems
  ➔ www.festo.com.
– Accessories ➔ www.festo.com/catalogue.

# 4 Product overview

## 4.1 Product design

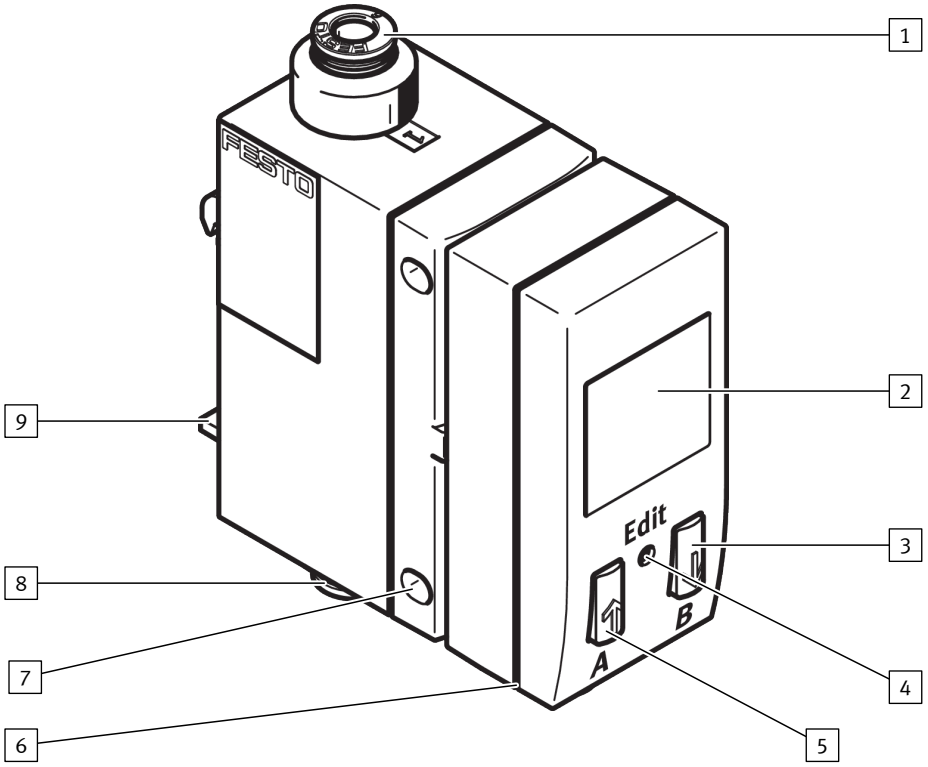



Fig. 1: SFAB

1 Supply port 1
2 Display
3 B pushbutton
4 Edit button
5 A pushbutton
6 Plug for the electrical connection (M12)
7 Hole for panel mounting
8 Supply port 2
9 Mounting slide for DIN rail and wall mounting (rear)

## 4.2 Display components

| Symbol | Description |
|---|---|
| OutA / OutB | Switching output A/switching output B |
| Lock | Security code active (blocked against unauthorised programming) |
| Run | Accumulated air consumption measurement is active in RECORDER mode |
| Option | Sensor is set to a standard condition that differs from the factory setting. |
| Stop | Air consumption measurement stopped |
| ■ □ | Switching output set/not set |
|  | Threshold value comparator |
|  | Window comparator |
|  | Air consumption switching mode (consumption – only for OutA) |
|  | Pulse for accumulated air consumption (consumption impulse) |
|  | Switching point |
|  | Lower switching point (switching point - low) |
|  | Upper switching point (switching point - high) |
|  | Hysteresis |
|  | N/O contact (normally open) |
|  | N/C contact (normally closed) |
|  | Switching mode flow rate (flow - only for OutA) |
|  | Minimum flow rate (flow low) |
|  | Maximum flow rate (flow high) |
|  | Special menu |
|  | Analogue filter |
|  | Digital filter |
|  | Display red with switching status ON and/or logic 1 |
|  | Display red with switching status OFF and/or logic 0 |
|  | Positive switch output |
|  | Zero switch output |
| ■■■■■□□□□□ | Segments are lighted: graphic display of the current measured value related to the maximum measured value of the measuring range |
| □□■□□□□□□□ | Running light (1 segment): air consumption measurement for OutA or RECORDER mode active |
| □□■■■□□□□□ | 3 segments flash: hysteresis value is displayed |
| □□□□□■□□□□ | 1 segment flashes:<br>– Segment 6: switching point SP or SP.Lo is displayed<br>– Segment 8: switching point SP.Hi is displayed<br>– Segment 1: min. flow rate (F.Lo) is displayed<br>– Segment 10: max. flow rate (F.Hi) is displayed |

Tab. 2: Symbols on the display

## 4.3 Function

### 4.3.1 Functional principle

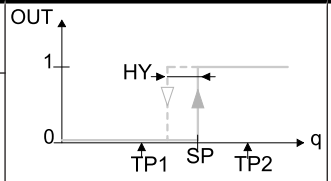
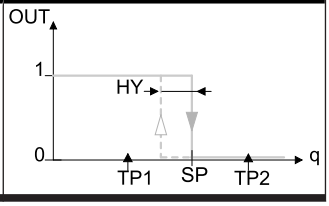
The SFAB uses a thermal measurement method. This determines the amount of heat that is removed from a heated area of the sensor by the medium as it flows past. Through the amount of heat removed, the flow rate or accumulated air consumption is determined and shown on the display. The higher-level systems are connected by 2 binary outputs (OutA/OutB) and one analogue output. Switching points can be defined for both binary outputs. Switching points for both binary

outputs are possible for flow rate measurement, a consumption switching pulse for output A (OutA) is possible for cumulative air consumption measurement. The cumulative air consumption measurement (OutA) and flow rate measurement (OutB) can be combined. The flow value is output via the analogue output.

### 4.3.2 Switching outputs

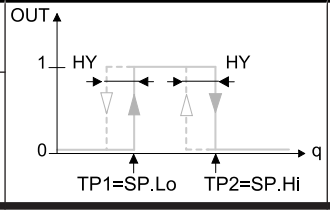
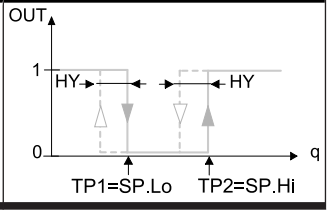
#### 4.3.2.1 Switching functions

**Threshold value comparator**

| Function | Normally open contact (N/O) | Normally closed contact (N/C) |
|---|---|---|
| Switching function:<br>– 1 switching point (SP)<br>TEACH mode:<br>– 2 teach points (TP1, TP2)<br>– SP = ½ (TP1 + TP2) |  |  |

Tab. 3: Threshold value comparator

**Window comparator**

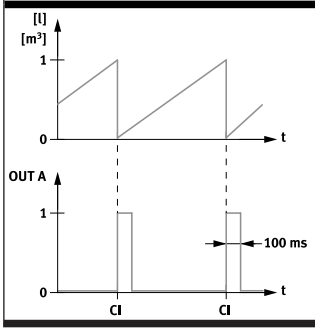
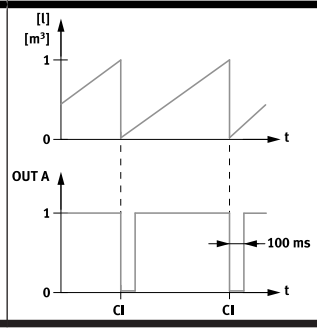
| Function | Normally open contact (N/O) | Normally closed contact (N/C) |
|---|---|---|
| Switching function:<br>– 2 switching points (SP.Lo, SP.Hi)<br>TEACH mode:[1)]<br>– 2 teach points (TP1, TP2)<br>– TP1 = SP.Lo, TP2 = SP.Hi |  |  |

1) SP.Lo = lower value, SP.Hi = higher value, independent of the teach sequence

Tab. 4: Window comparator

**Consumption switching pulses [CI] for cumulative air consumption measurement for OutB**

A threshold value for air consumption can be set with the consumption switching impulse [CI]. If the set threshold value is reached, a switching impulse is emitted at the output Out A for 100 ms. With each switching impulse, measurement of the air consumption is started again.

| Setting NO (N/O (normally open) contact) | Setting NC (N/C (normally closed) contact) |
|---|---|
|  |  |

Tab. 5: Consumption switching pulses

# 5 Mounting

## 5.1 DIN rail (battery assembly)

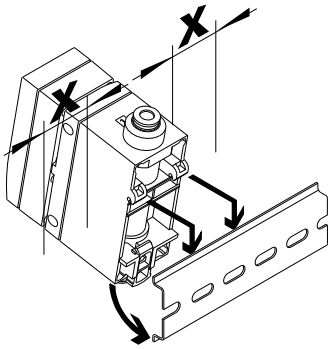



Fig. 2: Mounting on DIN rail

1. Maintain lateral distance x = 10 mm to earthed surfaces.
2. Attach SFAB to DIN rail and press in the direction of the arrow.
   ⇨ SFAB snaps into place.

## 5.2 Wall mounting

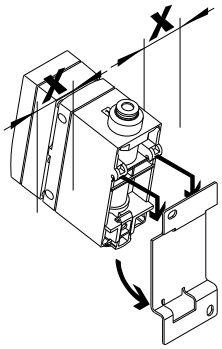



Fig. 3: Wall mounting

1. Maintain lateral distance x = 10 mm to earthed surfaces.
2. Mount adapter plate with 2 M3 screws.
3. Insert SFAB into adapter plate and press in the direction of the arrow.
   ⇨ SFAB snaps into place.

## 5.3 Mounting on plate

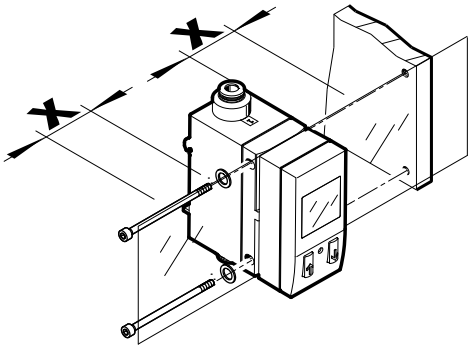



Fig. 4: Mounting on plate

1. Maintain lateral distance x = 10 mm to earthed surfaces.
2. Fasten SFAB with washers and 2 screws M4.
   – Tightening torque: 1 Nm

### 5.4 Rotating display

The display can be rotated in 90° steps. The turning range is limited to approx. 270° by a stop.

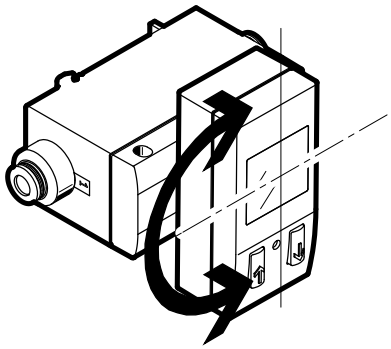


Fig. 5: Rotating display

## 6 Installation

### 6.1 Pneumatic installation

- Mount the tubing at port 1 and port 2 (flow direction ➔ identification on the product).

If the tubing is incorrect, the measured values are shown flashing on the display.

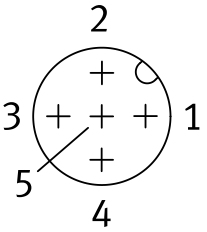
### 6.2 Electrical installation

**⚠ WARNING**

**Risk of injury due to electric shock.**

- Use exclusively PELV circuits in accordance with IEC 60204-1/EN 60204-1 for the electrical power supply (Protective Extra-Low Voltage, PELV).
- Observe the general requirements of IEC 60204-1/EN 60204-1 for PELV circuits.
- Use exclusively voltage sources that guarantee reliable electrical isolation from mains power in accordance with IEC 60204-1/EN 60204-1.

1. Use signal lines that are shorter than 10 m.
2. Configure binary outputs according to the wiring.
   – Tightening torque for the union nut at the plug: max. 0.5 Nm

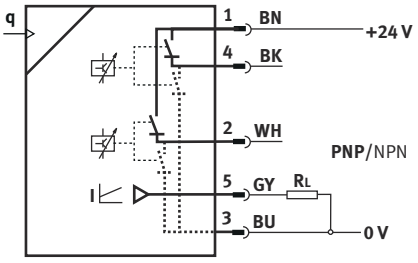
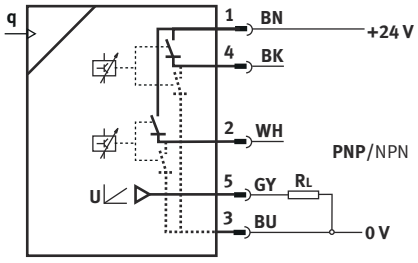
| Pin | Wire colour[1)] | Assignment | Plug |
|---|---|---|---|
| 1 | Brown (BN) | Operating voltage +24 V DC | M12, 5-pin  |
| 2 | White (WH) | Binary output B (OutB) | |
| 3 | Blue (BU) | 0 V | |
| 4 | Black (BK) | Binary output A (OutA) | |
| 5 | Grey (GY) | Analogue output C | |



1) When using the connecting cable from the accessories.

Tab. 6: Pin allocation

**Circuit diagrams**

| SFAB-...-2SA | SFAB-...-2SV |
|---|---|
|  |  |



Tab. 7: Circuit diagrams

# 7 Commissioning

## 7.1 Switching on the Sensor

- Switch on the operating voltage.
  - ⇨ The current measured value is displayed. The sensor is in the basic status.

The sensor is in the basic status in RUN mode. The sensor shows the current measured values. The basic status can be reached as follows from other modes:
– Press and hold the [Edit] key for 3 seconds.
– After expiration of a monitoring period (timeout).

## 7.2 Symbols for representing the menu structure

| Symbol | Description |
|---|---|
|  | Automatic return to the basic status (RUN mode) when the monitoring time has expired (here 80 seconds) |
|  | In order to return manually to the basic status (RUN mode), press the EDIT button for 3 seconds. |
|  | Generate flow rate (for teaching the measured value - here Flow 1) |
|  | The symbol on the display flashes (here OutB) |
|  | Security code active (lock - blocked against unauthorised programming) |
|  | Security code inactive (lock) |
|  | Press key (here A key). |
|  | Press A key or B key. SFAB switches to the setting indicated by the arrows. |
|  | Press A and B keys simultaneously. |
|  | Press key (here A key) and EDIT button simultaneously. |
|  | Press A key or B key to set the desired value. |
|  | Display for a value or switching point. Value can be set. |
|  | Press the Edit button. |
|  | Branching in the menu |

Tab. 8

## 7.3 RUN mode

The following values are displayed in RUN mode:
– Measurement values for the flow rate (in l/min, scfm or l/h)
– Measurement values for air consumption (in m³, scf or l)
– Signal states of the switching outputs OutA, OutB (set, not set)

If the measured value display flashes, one of the following errors has occurred:
- Measured value outside the permissible measuring range,
- incorrect tubing.

## 7.4 SHOW mode

In SHOW mode, the current settings for the switching outputs Out A and Out B are displayed. The SFAB must be in RUN mode.

- To start the SHOW mode for the respective switching output, press the A key (OutA) or B key (OutB).

If there are errors, the corresponding error numbers are displayed first after pressing the A / B pushbutton.

- To display the settings one by one, press the A/B pushbutton repeatedly.

When all settings have been displayed, the SFAB goes back into RUN mode when the A pushbutton / B pushbutton are pressed again and displays the current measurement value for the corresponding output.
Thus, the SHOW mode can also be used to switch the display, e. g. to switch between the displayed measured values for a combination of air consumption measurement and flow rate measurement.
The following settings will be displayed for outA:

– With flow measurement [FLW]:
  – Switching function [threshold value or window comparator]
  – Switching point [SP], Switching points [SP.Lo] and [SP.Hi]
  – Hysteresis [Hy]
  – Switching element function [no/nc] (N/O contact/N/C contact)
  – Minimum flow rate [F.Lo] (flow low)
  – Maximum flow rate [F.Hi] (flow high)
    To delete the minimum or maximum value, press the EDIT button.
– For air consumption measurement [ConS]:
  – air consumption switching pulse [CI]
  – Switching element function [no/nc] (N/O contact/N/C contact)
  – Minimum flow rate [F.Lo]
  – Maximum flow rate [F.Hi]
    To delete the minimum or maximum value, press the EDIT button.

The following settings will be displayed for OutB:

– Switching function [threshold value or window comparator]
– Switching point [SP], Switching points [SP.Lo] and [SP.Hi]
– Hysteresis [Hy]
– Switching element function [no/nc] (N/O contact/N/C contact)
– Status colour change [bLUE/rON/rOFF]
– Minimum flow rate [F.Lo]
– Maximum flow rate [F.Hi]
  To delete the minimum or maximum value, press the EDIT button.

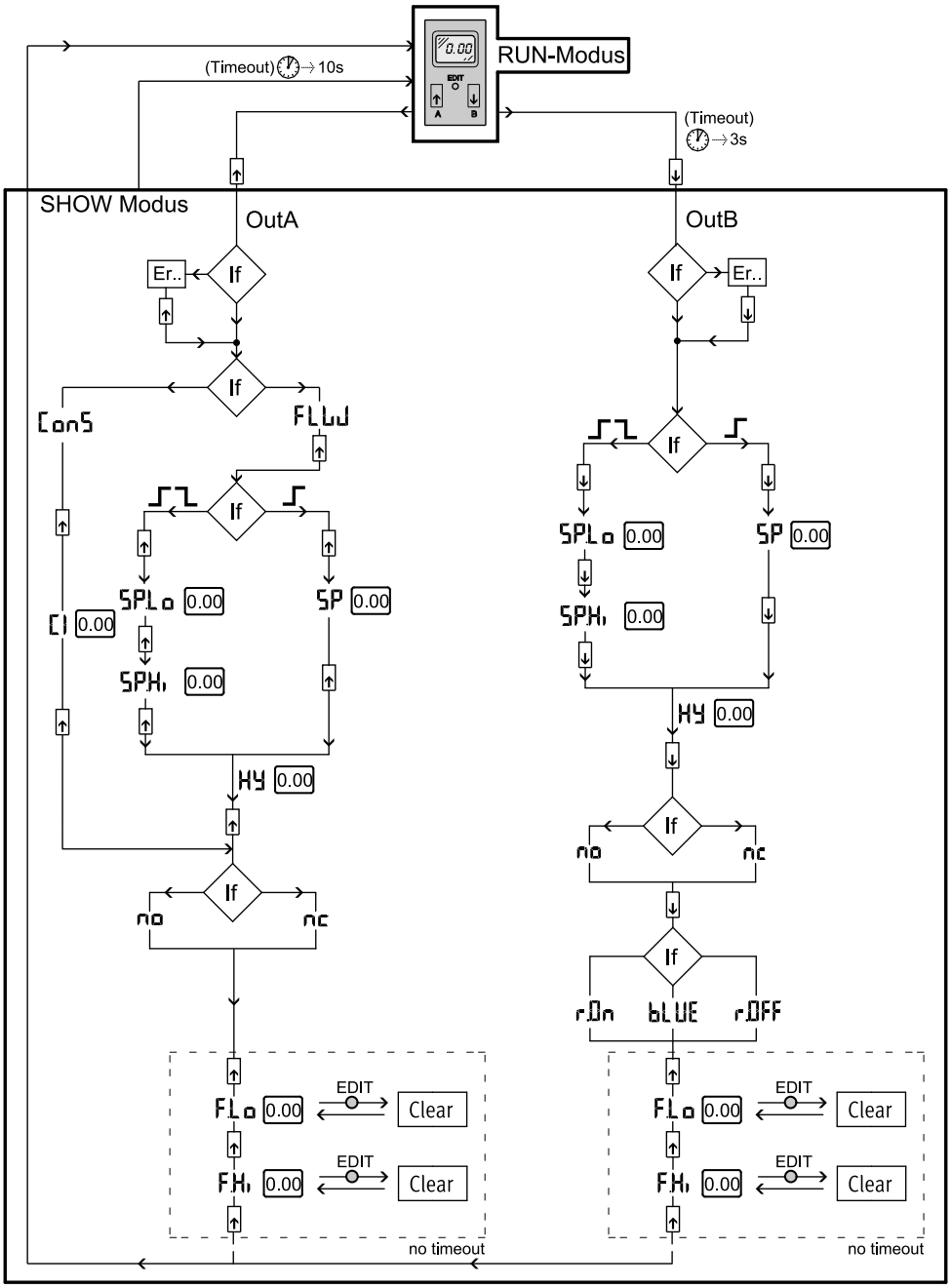



Fig. 6: Menu structure for SHOW mode

## 7.5 EDIT mode

The following settings can be made in EDIT mode:

- Switching mode for OutA (air consumption [ConS] or flow rate [FLW])
- Switching function (threshold value or window comparator for OutA and OutB)
- Switching points [SP] for OutA and OutB
- Air consumption switching impulse [CI] only for OutA in switching mode [ConS]
- Hysteresis [Hy] for OutA and OutB
- Switching element function [no/nc] for OutA and OutB
- Colour change of the display from blue to red for flow mode (for OutB)

In addition, the following settings can be made in the special menu:

- Switching of the standard conditions via [Option] (OFF, 1, 2)
- Physical units for flow rate [FLW] (l/h, scfm, l/min)
- Analogue filter [AnA.F]
- Digital filter [dIG.F]

– Physical units for air consumption [ConS] (m3, scf, l)
– Switching output [nPn/PnP]
– Security code [Lock]

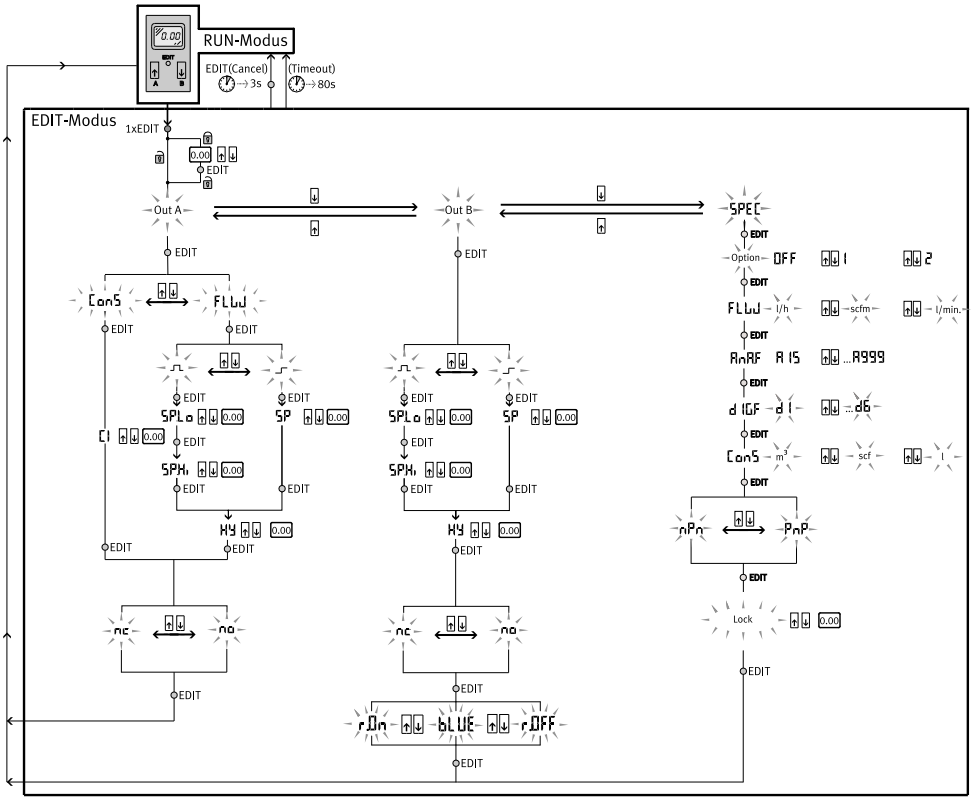



Fig. 7: EDIT mode menu structure

### 7.5.1 Starting EDIT Mode

**⚠ WARNING**

**Manipulation of signal statuses may cause serious personal injury, depending on the functioning of the machine/system.**

- Note that if the switching status of the outputs is modified in EDIT mode, the new status will be effective immediately.

The following settings can be selected with the control buttons (A/B pushbutton):
– Switching output for which the characteristics is to be set
– Special menu

1. Press the Edit button.
   ⇨ EDIT mode is active and [OutA] flashes. Lock flashes with active security blocking.
2. Press the A/B pushbuttons until the chosen security code is set.
3. Press the Edit button.
   ⇨ EDIT mode is active and [OutA] flashes.

### 7.5.2 Setting the switching characteristics of the switching outputs

Both switching outputs (OutA/OutB) can be set for flow measurement. Switching output OutA can alternatively be set for the cumulated air consumption measurement. The cumulative air consumption measurement (OutA) and flow rate measurement (OutB) can be combined.

#### 7.5.2.1 Setting the switching function for flow measurement

The process for setting the switching outputs is fundamentally the same. Additionally, the switching mode [FLW] must be selected for Out A since Out A can also be configured for air consumption measurement. The colour change for the display can also be set for OutB. In the following, the process is described using the OutA switching output.

Requirement: SFAB is in EDIT mode and [OutA] is flashing.

1. Press the Edit button to confirm the selection.
   ⇨ [FLW] or [ConS] flashes.
2. Select flow rate measurement (FLW) with the A-/B pushbuttons.
3. Press the Edit button to confirm the selection.
   ⇨ The currently set switching function flashes.
4. Select the desired switching function with the A/B pushbuttons.
5. Press the Edit button to confirm the selection.
   ⇨ [SP] or [SP.Lo] flashes.
6. Set the switching point (SP or SP.Lo) with the A/B buttons.
7. Press the Edit button to confirm the set value.
   ⇨ With switching function window comparator: [SP.Hi] flashes. For switching function threshold value comparator: continue with step 10.
8. Set the value (SP.Hi) with the A/B pushbuttons.
9. Press the Edit button to confirm the set value.
   ⇨ [Hy] flashes.
10. Set the value for the hysteresis (Hy) with the A/B pushbuttons.
11. Press the Edit button to confirm the set value.
    ⇨ [N/O] or [N/C] flashes.
12. Select the switching element function N/O/N/C with the A/B pushbuttons.
13. Press the Edit button to confirm the set value.
    ⇨ SFAB is in RUN mode.
14. Check that the SFAB switches as required with a test run (vary flow rate).

#### 7.5.2.2 Setting the switching function for air consumption measurement

Requirement: SFAB is in EDIT mode and [OutA] is flashing.

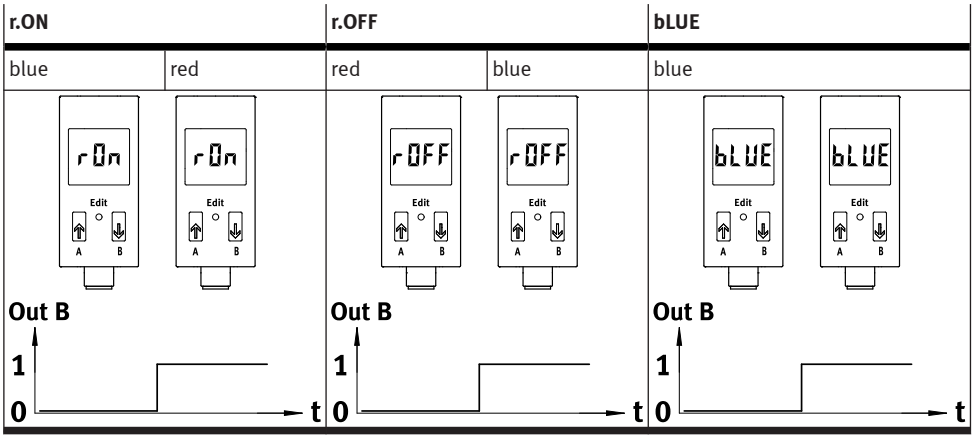
1. Press the Edit button to confirm the selection.
   ⇨ [FLW] or [ConS] flashes.
2. Select flow measurement [ConS] with the A/B buttons.
3. Press the Edit button to confirm the selection.
   ⇨ [CI] flashes.
4. Set the value for the air consumption switching impulse [CI] with the A/B buttons.
5. Press the Edit button to confirm the set value.
   ⇨ [N/O] or [N/C] flashes.
6. Select the switching element function N/O/N/C with the A/B pushbuttons.
7. Press the Edit button to confirm the set value.
   ⇨ SFAB is in RUN mode.
8. Check that the SFAB switches as required with a test run (flow rate).

### 7.5.3 Setting the colour change (only for OutB)

In order to detect the system status over longer distances, a colour change can be set at the OutB output. If the set switching threshold is exceeded or not reached, the colour of the display changes.

The following settings can be selected:

- r.ON
  - Display is red when the switching output is High (1).
  - Display is blue if the switching output is Low (0).
- r.OFF
  - Display is red when the switching output is Low (0).
  - Display is blue if the switching output is High (1).
- bLUE
  - Display is blue; the colour change function is switched off.




Tab. 9: Colour change

Requirement: SFAB is in EDIT mode and [OutA] is flashing.

1. Press B button.
   ⇨ [OutB] flashes.
2. Press the Edit button to confirm the selection.
3. Press the Edit button repeatedly until [rON], [rOFF] or [bLUE] flashes in the display.
4. Select the desired setting (rON, rOFF or bLUE) using the A/B pushbuttons.
5. Press the Edit button to confirm the selection.
   ⇨ SFAB is in RUN mode.

### 7.5.4 Setting the special menu

The following settings can be undertaken in the special menu:

- Standard conditions
- Physical units for flow rate (l/h, scfm or l/min)
- Analogue filter [AnA.F] with filter time constant in ms
- Digital filter [dIG.F] with smoothing in 7 levels for display and switching output
- Physical units for air consumption (m3, scf or l)
- Select the switching output [PnP] or [nPn]
- Remove security blocking [Lock] with security code

Requirement: SFAB is in EDIT mode and [OutA] is flashing.

1. Press the A or B pushbutton repeatedly until the menu (SPEC) is selected.
   ⇨ [SPEC] flashes.

2. Press the Edit button to confirm the selection.
   ⇨ [Option] flashes. The standard conditions (OFF, 1 or 2) can be set.

#### 7.5.4.1 Setting standard conditions

The air mass flow measured and output by the SFAB refers to standard conditions. The SFAB is factory calibrated to the physical standard conditions according to DIN 1343.

Changing the reference standard only adjusts the display on the sensor. The analogue value at the analogue output still refers to DIN 1343 and must be converted.

- Multiply the end value of the flow measurement range by the specified correction factor.
- End value of the analogue output refers to the end value of the measuring range. This changes the transfer function.

| REF/Cond | | Off | 1 | 2 |
|---|---|---|---|---|
| Standard | | DIN 1343 | ISO 2533 | ISO 6358 |
| Air pressure (absolute) | [kPa] | 101.325 | 101.325 | 100 |
| Temperature | [°C] | 0 | 15 | 20 |
| Humidity | [%] | 0 | 0 | 65 |
| Correction factor for measurement range end value | | 1 | 1.055 | 1.087 |

Tab. 10: Standard conditions for flow rate and volume units

1. Select the desired setting (OFF, 1 or 2) using the A-/B pushbuttons.
2. Press the Edit button to confirm the selection.
   ⇨ [FLW] is displayed and the set value flashes. The unit for the flow rate (l/h, scfm or l/min) can be set.

#### 7.5.4.2 Setting the physical unit for the flow rate

For the types SFAB-600U and SFAB-1000U, the unit l/h cannot be set due to display reasons.

1. Select the desired setting (l/h, scfm or l/min) using the A-/B pushbuttons.
2. Press the Edit button to confirm the selection.
   ⇨ [AnA.F] and the set value are displayed. The analogue filter can be set.

The selected physical unit is shown in RUN mode in the display at the bottom right.

#### 7.5.4.3 Setting filter time constant for the analogue filter

The rise time (filter time constant) of the analogue output can be changed (default value = 60 ms) with the analogue filter.

1. Select the value for the filter time constant (15 ms, 30 ms, 60 ms, 125 ms, 250 ms, 500 ms or 999 ms) with the A/B pushbuttons.
2. Press the Edit button to confirm the set value.
   ⇨ [dIG.F] and the set value flash. The digital filter can be set.

#### 7.5.4.4 Setting smoothing for the digital filter

The display values can be smoothed with the digital filter. The degree of smoothing can be set in 6 steps from d1 = low smoothing to d6=maximum smoothing. The switch-on/switch-off time of the switching outputs rises as the smoothness is increased. With d.OFF the smoothing is deactivated.

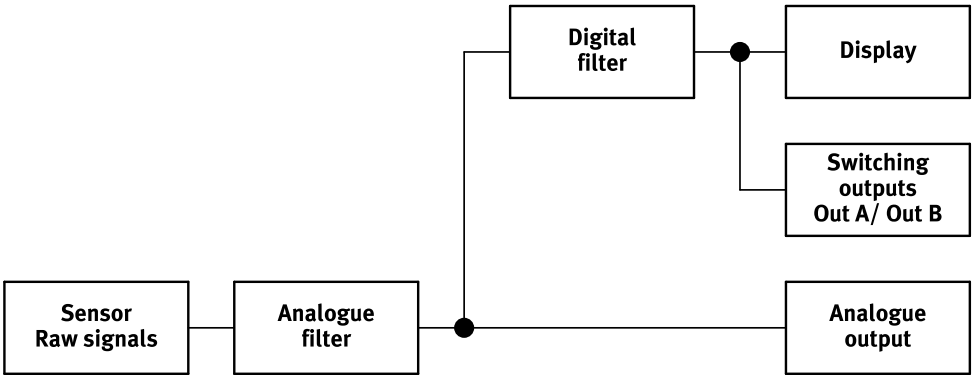



Fig. 8: Signal flow from the analogue filter to the digital filter

A high filter time constant and high smoothing can result in a switching time of several seconds.

1. Select the value for cushioning (d1 to d6 or d.OFF) with the A/B pushbuttons.
2. Press the Edit button to confirm the set value.
   ⇨ [ConS] is displayed and the currently selected value flashes. The unit for the air consumption (m3, scf or l) can be set.

#### 7.5.4.5 Setting the physical unit for the air consumption

1. Select the desired setting (m3, scf or l) with the A/B pushbuttons.
2. Press the Edit button to confirm the set value.
   ⇨ The currently set value [PnP] or [nPn] for the switching element output flashes. The switching element output can be set.

#### 7.5.4.6 Setting switching element output

The two switching outputs can be set as positive switches (PNP) or as zero switches (NPN) with the integrated push-pull step.

1. Select the desired setting (PNP or NPN) with the A/B pushbuttons.
2. Press the Edit button to confirm the selection.
   ⇨ [Lock] flashes. The security code can be set.

#### 7.5.4.7 Setting the security code

A numerical code of up to 4 digits can be set to protect the setting from unauthorised access. The security code must be entered every time the settings are changed (EDIT mode and TEACH mode).

1. Set the desired security code with the A/B buttons.
2. Press the Edit button to confirm the selection.
   ⇨ The SFAB is in RUN mode.

## 7.6 TEACH mode

The switching points can be set in the TEACH mode.

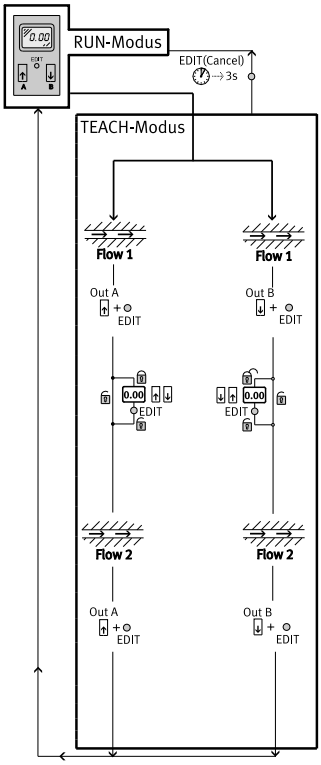



Fig. 9: TEACH mode menu structure

- Before teach-in select the desired switching function (threshold value or window comparator) in EDIT mode.

| Threshold value comparator | Window comparator |
|---|---|
| The (taught) switching point is derived from the average of the two measured values:<br>– SP = 1/2(Flow 1 + Flow 2)<br>– Special case: SP = Flow 1 = Flow 2 | The taught switching window is derived from the measured values:<br>– SP.Lo = Flow 1<br>– SP.Hi = Flow 2 |

Tab. 11: Switching functions

### 7.6.1 Teaching switching variables

The process for teaching the switching outputs for OutA (A button) and OutB (B button) is the same. In the following, the process is described using the OutA switching output.

1. Generate flow rate (Flow 1).
2. Press the A button and the EDIT button simultaneously.
   ⇨ The measured value is accepted as the first teach point. [OutA] and the bar graph flash.
   Lock flashes with active security blocking. Set the security code with the A or B button. To accept the measured value, press the Edit button.
3. Generate flow rate (Flow 2).
4. Press the A button and the EDIT button simultaneously.
   ⇨ The measured value is accepted as the second teach point. The switching point (SP) or the switching points (SP.Lo and SP.Hi) become valid. The SFAB is in RUN mode.

## 7.7 RECORDER mode

A manual accumulated air consumption measurement can be performed in RECORDER mode.

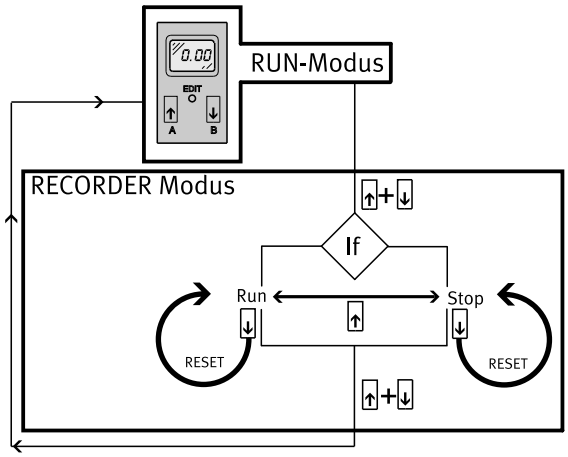



Fig. 10: RECORDER mode menu structure

1. Press the A and B buttons simultaneously.
   ⇨ The SFAB is in RECORDER mode. The status of the air consumption measurement [Run] or [Stop] is displayed.
2. When [Stop] is displayed, press the A button.
   ⇨ [Run] and a running light are displayed. The air consumption measurement has started.
3. Press the A button.
   ⇨ [Stop] is displayed. The air consumption measurement is stopped.
4. Press the A and B buttons.
   ⇨ The SFAB is in RUN mode.

If the RECORDER mode is left during the consumption measurement, the consumption measurement is continued in the background.

### 7.7.1 Resetting measured values to zero

- To reset a measure value to zero, press the B button in RECORDER mode.

# 8 Operation

Changes to the device settings take effect immediately at the outputs.

**Ready-state delay**
Note the ready-state delay. After this time, the electrical outputs take a defined, stable condition.

The flow rate displayed refers to the standard condition that was set in the Spec menu under ‘REF’ / ‘Cond’.
When comparing volumetric flow rates, note the following:
– Make sure that the volumetric flow rates to be compared refer to the same standard conditions, e.g. operating volumetric flow rate, amount supplied by a compressor, measured values of a sensor from another manufacturer.
– After the supply voltage is switched on, the SFAB needs a warm-up time of 5 minutes before it reaches the specified accuracy.

## 8.1 Reset sensor to factory setting

The current settings of the sensor will be lost if factory settings are restored.

1. Switch off the operating voltage.
2. Press and hold the [A] button, the [B] button, and the [Edit] button.
3. Switch on the operating voltage.
   ⇨ The sensor is in RUN mode.

# 9 Cleaning

1. Turn off energy source and compressed air.
2. Clean the outside of the sensor with media that are gentle on the material.

# 10 Fault clearance

| Malfunction | Cause | Remedy |
|---|---|---|
| Incorrect measured value indicator | Impermissible medium | – Operate the sensor only with permitted media. |
| | SFAB contaminated | – Replace the device. |
| The measured value flashes during the flow rate measurement | Measurement outside permitted measuring range | – Observe the measuring range → 12 Technical data. Accuracy refers only to the permitted measuring range. |
| | Flow direction is incorrect | – Correct the tubing connection. |
| The measured value flashes during the air consumption measurement | The end value of the measuring range was exceeded at least once. The specified accuracy therefore can probably not be maintained. | – Do not exceed the end value of the measuring range. |
| The outputs do not switch corresponding to the setting | Short circuit or overload at output | – Correct short circuit or overload. |
| The settings cannot be edited (Lock) | The access protection is active | – To deactivate access protection: input security code. |
| O.FLO | Measurement range exceeded, displayed in RUN mode | – Check the operating conditions. |
| Er1, Er3, Er4 | The device is faulty | – Replace the device. |
| Er2 | Moisture or dirt in the compressed air | – Replace the device. |
| Er9 | Measurement range undershot, displayed in SHOW mode | – Check the operating conditions. |
| Er10 | Measurement range exceeded, displayed in SHOW mode | – Check the operating conditions. |
| Er17 | Undervoltage | – Maintain the operating voltage.<br>– Check the electrical connection. |

Tab. 12: Fault clearance

# 11 Removal

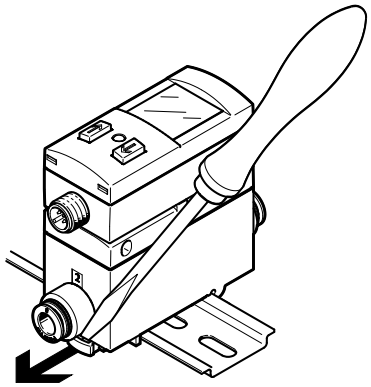


Fig. 11: Removal

1. Turn off energy source and compressed air.
2. Disconnect connections from the sensor.
3. For panel mounting: loosen retaining screws.
   For DIN rail mounting or wall mounting:: loosen the mounting slide.

# 12 Technical data

| SFAB | | -10U | -50U | -200U | -600U | -1000U |
|---|---|---|---|---|---|---|
| General | | | | | | |
| Certificates, declaration of conformity | | ➔ www.festo.com/sp | | | | |
| | | | | | | |
| Measured variable | | Flow rate, consumption | | | | |
| Flow direction | | unidirectional P1 ➔ P2 | | | | |
| Measurement principle | | thermal | | | | |
| Flow measuring range | [l/min] | 0.1 ... 10 | 0.5 ... 50 | 2 ... 200 | 6 ... 600 | 10 ... 1000 |
| Operating pressure | [bar] | 0 ... 10 | | | | |
| Operating pressure | [kPa] | 0 ... 1000 | | | | |
| Nominal pressure | [kPa] | 600 | | | | |
| Pressure drop | [kPa] | < 10 | | | | |
| Ambient temperature | [°C] | 0 ... 50 | | | | |
| Temperature of medium | [°C] | 0 ... 50 | | | | |
| Nominal temperature | [°C] | 23 | | | | |
| Operating medium | | Compressed air in accordance with ISO 8573-1:2010 [6:4:4] | | Compressed air in accordance with ISO 8573-1:2010 [7:4:4] | | |
| | | Nitrogen | | | | |
| Output general[1)2)] | | | | | | |
| Precision of zero point[3)] | [% FS] | ±0.3 | | | | |
| Accuracy of spread[3)] | [% FS] | ±3 | | | | |
| Repetition accuracy of zero point | [% FS] | ±0.2 | | | | |
| Repetition accuracy of spread | [% FS] | ±0.8 | | | | |
| Temperature coefficient of spread | [% FS/K] | ≤ 0.1 | | | | |
| Pressure-dependent spread | [% FS/ 100 kPa] | ±0.5 | | | | |

| SFAB | | -10U | -50U | -200U | -600U | -1000U |
|---|---|---|---|---|---|---|
| Switching output | | | | | | |
| Switching output | | 2x PNP or 2x NPN, adjustable | | | | |
| Switching function | | Window comparator or threshold value comparator, adjustable | | | | |
| Switching element function | | N/C or N/O contact, adjustable | | | | |
| Max. output current | [mA] | 100 | | | | |
| Voltage drop | [V] | max. 1.5 | | | | |
| Switch-on time | | adjustable (factory setting: approx. 80 ms) | | | | |
| Switch-off time | | adjustable (factory setting: approx. 80 ms) | | | | |
| Inductive protective circuit | | adapted to MZ, MY, ME coils | | | | |
| Analogue output | | | | | | |
| Characteristic flow rate curve | [l/min] | 0 ... 10 | 0 ... 50 | 0 ... 200 | 0 ... 600 | 0 ... 1000 |
| Current output characteristic curve | [mA] | 4 ... 20 | | | | |
| Max. load resistance of current output | [Ω] | 500 | | | | |
| Min. load resistance at voltage output | [kΩ] | 10 | | | | |
| Rise time | [ms] | adjustable:<br>15, 30, 60 (factory setting), 125, 250, 500, 999 | | | | |
| Output, additional data | | | | | | |
| Short circuit current rating | | yes | | | | |
| Overload protection | | available | | | | |
| Electronics | | | | | | |
| Operating voltage range | [V DC] | 15 ... 30 | | | | |
| Reverse polarity protection | | for all electrical connections | | | | |
| Electromechanics | | | | | | |
| Electrical connection | | Straight plug, M12x1, 5-pin | | | | |
| Max. connecting cable length | [m] | < 10 | | | | |
| Mechanics | | | | | | |
| Mounting position | | any | | | | |
| Product weight | [g] | 160 | | | | |
| Note on materials for housing | | Reinforced polyamide, polycarbonate | | | | |
| Display/operation | | | | | | |
| Display type | | Illuminated LCD, blue | | | | |
| Displayable units | | l/min, scf, scfm, l, m³, scf, l/h | | | l/min, scf, scfm, l, m³ | |
| Setting range for flow rate threshold value | | 1% FS ... 100% FS | | | | |
| Setting range for consumption impulse threshold value | [l] | 0.1 ... 1999.9 | 0.2 ... 1999.9 | 1 ... 1999.9 | 2 ... 1999.9 | 3 ... 1999.9 |
| | [m³] | 0.01 ... 199.99 | | | 0.1 ... 1999.9 | 1 ... 19999 |
| | [scf] | 0.01 ... 199.99 | | 0.03 ... 199.99 | 0.1 ... 999.9 | |
| Hysteresis setting range | | 0% FS ... 90% FS | | | | |

| SFAB | | -10U | -50U | -200U | -600U | -1000U |
|---|---|---|---|---|---|---|
| Immission/Emission | | | | | | |
| Storage temperature | [°C] | –20 … +80 | | | | |
| Degree of protection | | IP65 | | | | |
| Protection class | | III | | | | |

1) Accuracy at nominal conditions (6 bar, 23 °C and horizontal mounting position)
2) % FS = % of the flow range end value (full scale)
3) The precision of the zero point and precision of the spread together correspond to the precision of the flow rate: precision of flow rate = ± (0.3% FS + 3% of measured value). % o.m.v. = % of measured value

Tab. 13: Technical data

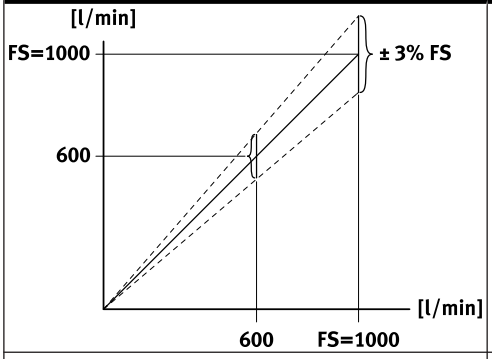
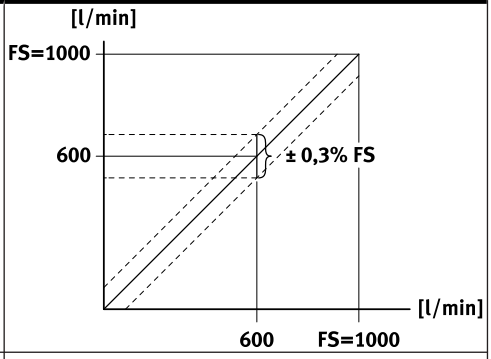
## 12.1 Technical data for UL/CSA approval

| Electrical and environmental ratings UL/CSA | |
|---|---|
| Maximum input voltage | 30 V DC |
| Total current consumption | max. 0.350 A |
| Maximum power | 10.5 W |
| Maximum operating pressure | 1.0 MPa |
| Pollution degree | 2 |
| Permissible humidity | 93 % |
| Ambient temperature | 0 … 50 °C/0 … 122 °F |
| Installation site | for indoor use only |
| Maximum installation height | 2000 m |
| Degree of protection | IP65, not evaluated by UL |
| Type Rating to UL 61010- 1 | Open Type |

Tab. 14: Technical data for UL/CSA approval

## 12.2 Examples for calculating the maximum error of the display

– Flow rate measuring range: 10 … 1000 l/min (FS = 1000)
– Measured value: 600 l/min

| Spread error (e.g. ± 3 % FS) | Zero point error |
|---|---|
|  |  |



Tab. 15: Spread error and zero point error

**Spread error and zero point error**

The spread error is proportional to the measured value. At 600 l/min, the spread error is 3% of the measured value = 18 l/min.
The zero point error is independent of the measured value. It is 0.3% FS = 3 l/min.

**Display error under nominal conditions (6 bar, 23 °C):**

The display error under nominal conditions is the result of adding the spread and zero point errors. The actual flow rate is in the range of 600 ± (18+3) l/min = 600 ± 21 l/min.

**Display error under deviating nominal conditions (e.g. 8 bar, 40 °C):**

Temperature and pressure errors are spread errors. The temperature error at 40 °C is ±0.1% FS/K x 17 K = ±1.7% of the measured value = ±10.2 l/min.
The pressure error at 8 bar is
±0.5% FS/bar x 2 bar = ±1% of the measured value = ±6 l/min.
The error of the display at deviating nominal conditions results from the addition of all error values (span, zero point, temperature, pressure). The actual flow rate is therefore in the range of 600 ± (18+3+10.2+6) l/min = 600 ± 37.2 l/min.

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