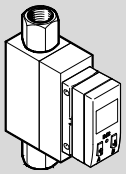
# Flow sensor SFAW



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Operating instructions 754493
1012NH

Original: de

**Note**

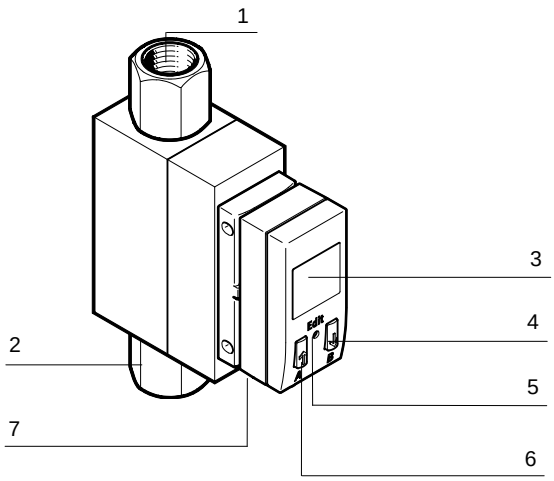
Installation and commissioning may only be performed in accordance with these instructions by technicians with appropriate qualifications.

**Note**

The product is suitable for use only for industrial purposes.
In residential areas, measures for radio interference suppression may be necessary. It is not suitable for calculation purposes in business, e.g. for measuring water volume in supply equipment.

## 1 Product description

### 1.1 Overview




1 Fluid connection 1
2 Fluid connection 2
3 Display
4 B button
5 Edit button
6 A button
7 Plug for electrical connection (M12)

Fig. 26

### 1.2 Features

| Key features | Order code | Design |
|---|---|---|
| Series | SFAW | Flow sensor for water |
| Flow measuring range | -32 | Max. 32 l/min |
| | -85 | Max. 85 l/min |
| Flow input | U | Unidirectional |
| Fluid connection | G12 | G1/2" |
| | G1 | G1" |
| Electrical output | -2SVA | 2x PNP or NPN, 1 analogue output (4 ... 20 mA or 0 ... 10 V) |
| Electrical connection | -M12 | Plug M12x1, 5-pin, A-coded |

Fig. 27

## 2 Function and application

The SFAW has been designed for monitoring the flow, volume and temperature of mains water in pipeline systems or terminal equipment in industry. Measurement is carried out by means of the vortex principle, with a piezoceramic sensor element measuring the frequency of vortex shedding on an impediment upstream of the sensor element. Above a minimum flow velocity, the frequency of vortex shedding is proportional to the flow velocity. The flow rate and the accumulated volume are calculated from the flow velocity and shown on the display. In addition to the flow velocity, the sensor also records the temperature of the medium as a further physical measured input variable. Connection to higher-order systems is established via two binary outputs (Out A/B) and an analogue output (Out C). Switching points can be defined for both binary outputs. For flow measurement, switching points are possible for both binary outputs. An adjustable volume switching pulse can be selected at output A (Out A) for the accumulated volume measurement. Switching points for the temperature of the medium can be output at output B (Out B). The setting options for binary outputs Out A and Out B result in various different combinations. The analogue output can be used to output either the flow rate or the temperature of the medium.

Setting options for the electrical outputs

| Electrical output | Measured variable | Signal |
|---|---|---|
| Out A (pin 4) | Flow (default) or volume | Binary (PNP or NPN) |
| Out B (pin 2) | Flow (default) or temperature | Binary (PNP or NPN) |
| Out C (pin 5) | Flow (default) or temperature | Analogue (0 ... 10 V) or (4 ... 20 mA) |

Fig. 28

### 2.1 Description of the function range

**Configuring the switching outputs**

Switching output Out A
can either be allocated the physical input variable "flow" [FLW] or the derived volume measurement [CONS].

Switching output Out B
can either be allocated the physical input variable "flow" [FLW] or "temperature" [t]

Switching outputs Out A/Out B can be configured according to the setting range in the Technical Data ➔ Fig. 48.
The switching functions "threshold value comparator" or "window comparator" can be selected independently for switching outputs Out A and Out B. The switching element functions "normally closed" (NC) or "normally open" (NO) can be assigned separately to each switching output ➔ Fig. 29.

Switching points [SP] and hysteresis [HY] can be set according to the setting range in the Technical Data table ➔ Fig. 48.

**Switching point and hysteresis with flow measurement for Out A/Out B and temperature measurement for Out B**

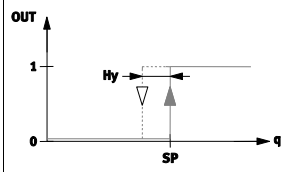
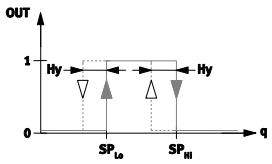
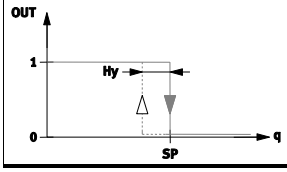
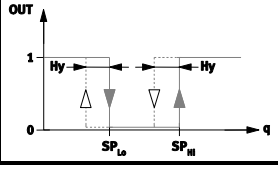
| Threshold value comparator | Window comparator |
|---|---|
| Switching element function NO (normally open) | |
|  |  |
| Switching element function NC (normally closed) | |
|  |  |



Fig. 29

If switching output Out A is allocated volume measurement, a pulse is generated when an adjustable switching point [SP] is reached ➔ Fig. 30.
The switching point [SP] and pulse length [Puls] can be set in Edit mode ➔ chapter 5.5 EDIT mode.

**Volume switching pulses for accumulated volume measurement**

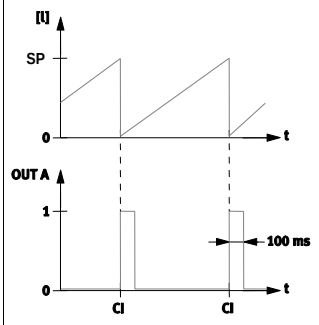
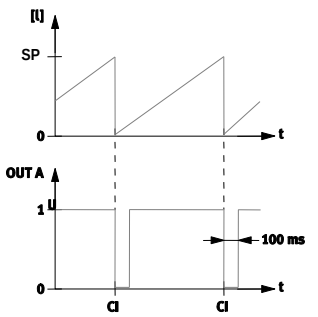
| Setting NO (normally open) | Setting NC (normally closed) |
|---|---|
|  |  |



Fig. 30

**Setting the colour change**
A red colour change can be set to appear on the display for both Out A and Out B, depending on the switching status. As a result, you can visualise the equipment status over a large distance. In the event of a red colour change, the measured variable (flow, volume, temperature) that triggered the colour change is automatically shown on the display. If a colour change is selected for both switching outputs (Out A and Out B), the display always shows the measured variable that first caused the colour change. In this case, the display remains red until both switching outputs have returned to the blue status.

The following settings can be chosen:

r.ON = Display is red when the switching status is High (1).
Display is blue when the switching status is Low (0).

r.OFF = Display is red when the switching status is Low (0).
Display is blue when the switching status is High (1).

bLUE = Display is always blue. The colour change function is switched off.

**Setting the digital filter and analogue filter**

The digital filter [diG.F ] and analogue filter [An.Fil ] can be assigned filter constants independently of each other, as per the signal flow diagram ➔ Fig. 31.
Note that the digital filter equally affects the display and the switching output.

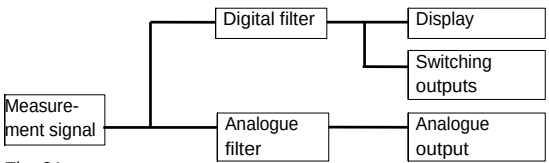



Fig. 31

The display values can be smoothed with the digital filter [diG.F]. The filter time constant for smoothing can be adjusted in 6 stages from d.25 = 25 ms (minimal smoothing) to d.600 = 600 ms (maximum smoothing). With increasing smoothing, the switch-on/switch-off time of the switching outputs rises. With d.OFF, the switch-on/switch-off time equals the sensor element's response time.
The analogue filter [An.Fil] can be used in the same way to configure smoothing of the analogue output (default = 50 ms). This alters the rise and drop-off time of the analogue output

**Configuring the analogue signal**

The signal from the analogue output [A.S-] can either be allocated the physical input variable "flow" [F] or "temperature" [t]. The physical input variable "flow" is the default configuration.

**Zooming the analogue output**

The zoom function can be used to scale a section of the physical input variable flow [F] or temperature [t] to the output characteristic range [0 ... 10 V or 4 ... 20 mA] voltage or current. The upper limit of the physical input variable [AS.Hi] can be selected between 10 and 100% FS (80% in example Fig. 32). The lower limit of the physical input variable [AS.Lo] can be selected between 0 and 90% FS (20% in example Fig. 32). The zoom function can be used to improve the resolution of the analogue output.

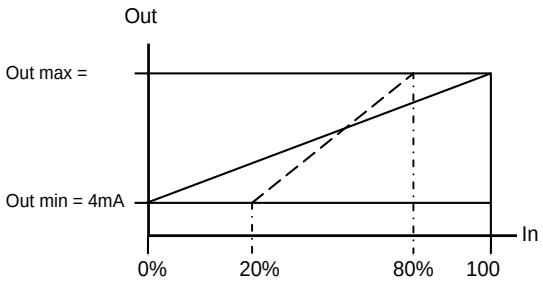



Fig. 32

**Configuring the electrical output signal on the analogue output**

The analogue output [A.O-] can be operated as either a voltage output [U] 0 ... 10 V or as a current output [I] 4 ... 20 mA. The voltage output [U] is the default configuration.

**Security code**

To protect the device settings from unauthorized access, a 4-digit numerical code can be set [Lock]. This security code [Lock] has to be entered each time the settings are changed (EDIT mode and TEACH mode).

**INFO mode**

INFO mode makes it possible to quickly switch between the input variables flow, volume and temperature on the display by pressing the A button or the B button.


Fig. 33

**Min/max values**

In SHOW mode, you can display and reset the minimum/maximum values for flow or temperature measurement:
➔ chapter 5.4 SHOW mode.

➔ **Note**

When the supply voltage is switched off, the minimum/maximum values are reset.

**RECORDER mode**

RECORDER mode can be used to carry out a manual accumulated volume measurement. Pressing the A button and B button at the same time activates recorder mode. ➔ chapter 5.7 RECORDER mode

## 3 Requirements for product use

⚠ **Warning**

Depending on the functionality of the machine/system, manipulation of signal states can cause serious personal injury.
- Note that if the switching status of the outputs is modified in Edit mode, the new status will be effective immediately.
- Activate the password protection (security code) in order to prevent unintentional alteration by unauthorized third parties
  ➔chapter 5.5 EDIT mode, section Security code.

⚠ **Warning**

Use of the product in combination with prohibited media can result in personal injury.
- Do not use it in conjunction with inflammable, corrosive, evaporating or other media that pose a risk to health. The product is only intended for measuring the flow rate of media listed as suitable in chapter 11 Technical data.

⚠ **Attention**

Foreign matter and other dirt in the measured medium can damage the product and cause incorrect measurements and functional disorders.
- Make sure that the product is only used for the intended operating medium ➔ chapter 11 Technical data.

➔ **Note**

Improper handling can result in malfunctions.
- Make sure that the following specifications are always observed.

Compare the maximum values specified in these operating instructions with your actual application (e.g. operating media, pressures, forces, torques, temperatures, masses, speeds, operating voltages, flow rates).

- Take into consideration the ambient conditions on site.
- Please comply with national and local safety laws and regulations.
- Remove all transport packing such as protective wax, foils (polyamide), caps (polyethylene), cardboard boxes (except for the sealing elements of the pneumatic connections).
- The packaging is intended for recycling (except for: oiled paper = other waste).
- Use the product in its original state. Unauthorized modification is not permitted.

## 4 Installation

### 4.1 Mechanical installation

➔ **Note**

Interference due to electromagnetic influences can cause damage.
- When installing the SFAW in applications that are sensitive to electro-static discharge, make sure that the basic housing of the SFAW is earthed via the available earth terminals.

It can be fitted in any position.

The SFAW can be installed directly onto a plate, via the holes on its rear side.

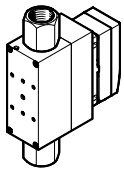


Fig. 34

The SFAW can be installed directly or via flanged couplings onto fixed piping. For ease of replacement, we recommend using flanged couplings for installation on fixed piping.

**Turn the display**
The display can be rotated in 90° steps. The range of rotation is limited by a stop to about 270°.

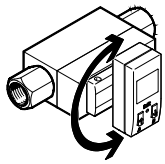


Fig. 35

### 4.2 Fluid connection

The operating medium is supplied in the flow of direction shown on the device.

Hook up pipes or hoses to the SFAW as follows:
Screw in the corresponding connection fittings by holding the relevant Fluid connection against the SFAW. The following installation conditions must be observed for the SFAW to function correctly.

- The pipe's internal diameter must not be smaller than the internal diameter of the sensor.
- To avoid twists forming, which could lead to inaccurate measurements, there must not be multiple pipe bends at the same level.
- A straight section measuring at least 10 times the internal diameter of the sensor shall be used for the infeed.
- A straight section measuring at least twice the internal diameter of the sensor shall be used for the outlet.

| Type | Internal diameter (ID) of sensor |
|---|---|
| SFAW-32U | 13 mm |
| SFAW-85U | 20 mm |

Fig. 36

### 4.3 Electrical connection

⚠ **Warning**

Use only power sources which guarantee reliable electrical isolation of the operating voltage to IEC/DIN EN 60204-1.
Also observe the general requirements for PELV power circuits to IEC/DIN EN 60204-1.
Switched-mode power supplies are permitted, providing they guarantee reliable isolation to EN 60950/ VDE 0805.

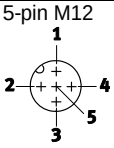
**Note**

Long signal lines reduce the resistance to interference.
- Make sure that the signal cables are shorter than 10 m.

**Note**

The binary outputs at pin 2 and pin 4 can be wired as PNP or NPN connections as needed.
- Make sure that you also configure the binary outputs according to your wiring ➔ chapter 5.5 EDIT mode, section Setting special menu [SPEC]..

- Wire the SFAW as follows:

| Pin | Allocation | Core colours[1)] | Plug[2)] |
|---|---|---|---|
| 1 | DC +24 V operating voltage | Brown (BN) | 5-pin M12  |
| 2 | Binary output B (Out B) | White (WH) | |
| 3 | 0 V | Blue (BU) | |
| 4 | Binary output A (Out A) | Black (BK) | |
| 5 | Analogue output C (Out C) | Grey (GY) | |



1) The tightening torque for the union nut at the plug is max. 0.5 Nm.
2) Voltage U and current I ➔ chapter 11 Technical data

Fig. 37

**Circuit diagrams**

**SFAW-...-2SVA**

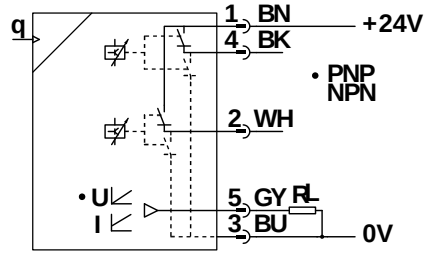



Fig. 38

## 5 Commissioning

### 5.1 Symbols on the display

| Symbols | Description |
|---|---|
| Out A/Out B | Switching output A/switching output B |
| ■ □ | Switching output set/not set |
| ConS | Volume measurement (consumption) |
| PULS | Pulse length for volume pulse |
| FLUJ | Flow rate |
| t | Temperature |
| ⎍ | Threshold value comparator |
| ⎍⎍ | Window comparator |
| SP | Switching point |
| SPLo | Lower switching point |
| SPHi | Upper switching point |
| HY | Hysteresis |
| no | Contact (normally open) |
| nc | Contact (normally closed) |
| rOn | Display red with switching status ON or logical 1 |
| rOFF | Display red with switching status OFF or logical 0 |
| SPEC | Special menu |
| d IGF | Digital filter |
| AS- | Physical input variable for analogue output (analogue signal) |
| ASHi | Upper limit of physical input variable (analogue signal high) |
| ASLo | Lower limit of physical input variable (analogue signal low) |
| AnFi | Analogue filter |
| A.O- | Electrical output signal (analogue output) |
| PnP | Output plus switch |
| nPn | Output zero switch |
| Lock | Security code is active (locked against unauthorized programming) |
| Run | Accumulated volume measurement is active in RECORDER mode. |
| Option | Zoom function for analogue output not equal to 0 ... 100% FS (AS.Lo, AS.Hi) |
| Stop | Accumulated volume measurement stopped |
| FLo | Minimum flow (low flow) |
| FHi | Maximum flow (high flow) |
| t.Lo | Minimum temperature (low temperature) |
| t.Hi | Maximum temperature (high temperature) |
| ■■■■■□□□□□ | Segments light up: graphic display of the current measured value in relation to the max. measured value of the measuring range. |
| □□■□□□□□□□ | Running light (1 segment): Volume measurement for Out A or RECORDER mode active |
| □□■■■□□□□□ | 3 segments flashing: Hysteresis value is displayed |
| □□□□□■□□□□ | 1 segment flashes:<br>z Segment 6: Switching point SP or SP.Lo will be displayed<br>z Segment 8: Switching point SP.Hi will be displayed<br>z Segment 1: Minimum value (F.Lo) or (t.Lo) is displayed<br>z Segment 10: Maximum value (F.Hi) or (t.Hi) is displayed |

Fig. 39

### 5.2 Symbols for representing the menu structure

| Icon | Meaning |
|---|---|
| (Timeout) ⏲ ···➔80s | Automatic return to the basic status (RUN mode) when the monitoring time has expired (here 80 seconds) |
| EDIT(Cancel) ⏲ ···➔3s ○ | In order to return to the basic status (RUN mode), press the Edit button for 3 seconds. |
| ⇒⇒ Flow 1 | Create flow (for teaching the measured value - here flow 1) |
| Out B | Symbol on the display flashes (here Out B) |
| 🔒 | Security code active (Lock - blocked against unauthorized programming) |
| 🔓 | Security code inactive (Lock) |
| ↑ | Press button (here A button) |
| ↑ / ↓ | Press A button or B button. Then the SFAW switches to the setting shown by the arrows. |
| ↑ + ↓ | Press A button and B button simultaneously |
| ↑ + ○ EDIT | Press button (here A button) and Edit button simultaneously |
| ↑ ↓ 0.00 A B | Press button A or button B and set the desired value |
| SPLo | Display for a value or switching point. Value can be set. |
| ○ EDIT | Press the Edit button |
| 2 x ↑ < 1 sec | Double-click |
| If | Branched in the menu |

Fig. 40

### 5.3 RUN mode

In the basic state, the product is in RUN mode. The current measurement values are displayed. The basic state can be reached from other modes by:

- pressing Edit button for 3 seconds or
- passing of monitoring time, timeout

In RUN mode

z the measurement values for flow (in l/min, scfm or l/h)
z the measurement values for volume (in m³, scf or l) and
z the signal states of the switching outputs Out A, Out B (set, not set) are displayed.

4. Switch on the operating voltage.
   The SFAW is in RUN mode.
5. Check the settings of the SFAW ➔ chapter 5.4 SHOW mode.

### 5.4 SHOW mode

In SHOW mode, the current settings for the switching outputs Out A and Out B are displayed, depending on whether you press the A button or the B button.

The SFAW must be in RUN mode.

- Pressing the A button (switching output Out A) or the B button (switching output Out B) first shows all the recorded measured variables (flow, temperature, volume only if activated), one after the other on the display. INFO mode ➔ chapter 2.1 Description of the function range, section INFO mode.
- If you double-click on the A button or the B button, you reach SHOW mode itself.

➔ **Note**

If there are faults, double-click the A button/B button to first display the corresponding fault numbers.

- Repeated pressing of the A button/B button displays the settings of the respective switching output one after another ➔ Fig. 41.
- At the end of SHOW mode, the minimum value [F.Lo for flow measurement and t.Lo for temperature measurement] and the maximum value [F.Hi for flow measurement and t.Hi for temperature measurement] are displayed.
  If you do not press any more buttons, the minimum/maximum values remain on the display (no timeout). Segment 1 or segment 10 in the bar graph flashes to indicate whether the minimum or maximum is on display.
  ➔ chapter 5.1 Symbols on the display.
- You can reset the values by pressing the Edit button. Pressing the A button/B button again exits SHOW mode. The device is now in RUN mode and displays the current measured value for the relevant output.

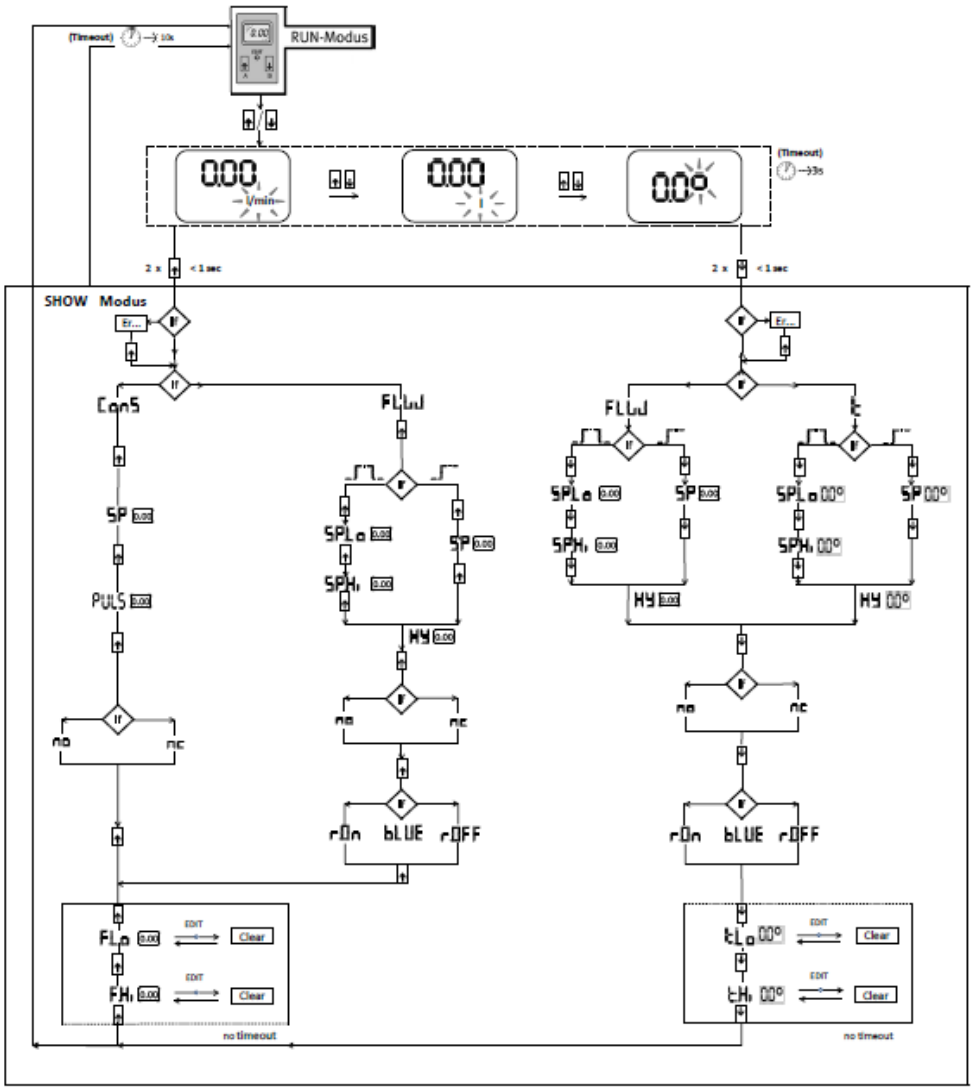



Fig. 41

## 5.5 EDIT mode

In Edit mode, you can configure settings for switching output Out A, switching output Out B and the special menu [Spec].

**Starting EDIT mode**

**Warning**

Depending on the functioning of the machine/system, manipulation of signal states may cause serious personal injury.

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

6. Press the Edit button.
   The EDIT mode is active and [Out A] flashes or flashes when the security lock is active [Lock].
7. Press the A/B buttons until the chosen security code is set.
8. Press the Edit button.
   The EDIT mode is active and [Out A] flashes.
9. Press the A/B buttons to switch between the setting modes Out A, Out B and Spec.

**Setting the switching characteristics at switching output Out A**

c) Setting flow monitoring

The SFAW is in EDIT mode and [Out A] is flashing, ➔ section Starting EDIT mode.

10. Press the Edit button to confirm the selection.
    [FLW] or [ConS] flashes.
11. Select flow monitoring (FLW) with the A/B buttons.
12. Press the Edit button to confirm the selection.
    The currently set switching function flashes.
13. Select the desired switching function with the A/B buttons.
14. Press the Edit button to confirm the selection.
    [SP] or [SP.Lo] flashes.
15. Set the switching point (SP or SP.Lo) with the A/B buttons.
16. Press the Edit button to confirm the set value.
    Only with Window comparator switching function.
    [SP.Hi] flashes
    - Set the value (SP.Hi) with the A/B buttons.
    - Press the Edit button to confirm the set value.

    [Hy] flashes.
17. Set the value for the hysteresis (Hy) with the A/B buttons.
18. Press the Edit button to confirm the set value.
    [no] or [nc] flashes.
19. Select the switching element function (no/nc) with the A/B buttons.
20. Press the Edit button to confirm the set value.
    [rON], [rOFF] or [bLUE] flashes.
21. Select the setting you require for the colour change on the display (rON, rOFF or bLUE) with the A/B buttons. ➔ chapter 2.1 Description of the function range, Setting the colour change.
22. Press the Edit button to confirm the selection.
    The SFAW is in RUN mode.

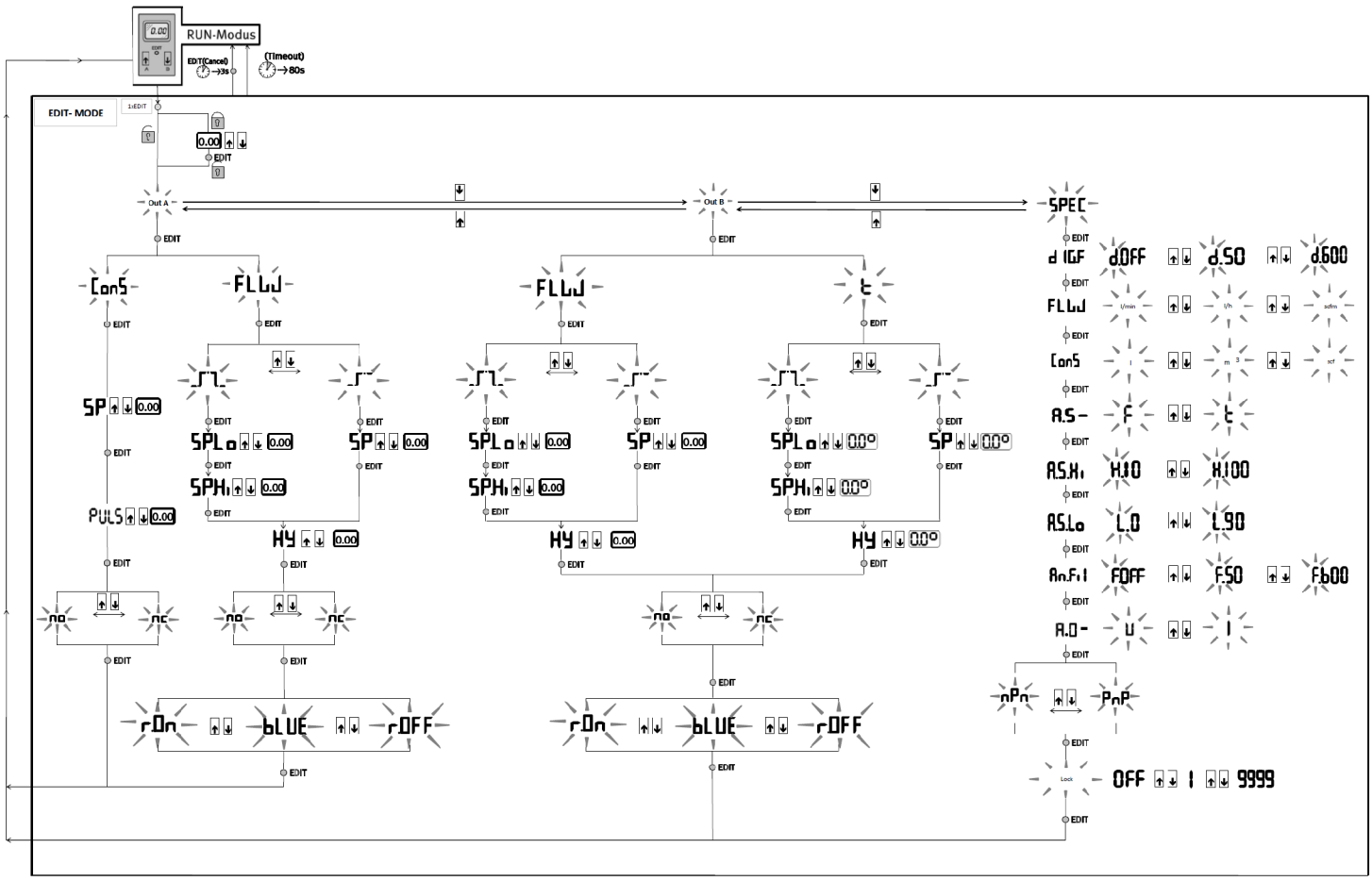



Fig. 42

d) Setting volume monitoring

Volume measurement [Cons] can only be activated for switching output Out A.
The SFAW is in EDIT mode and [Out A] is flashing, ➔ section Starting EDIT mode.

23. Press the Edit button to confirm the selection.
    [FLW] or [ConS] flashes.
24. Select volume monitoring [ConS] with the A/B buttons.
25. Press the Edit button to confirm the selection.
    [SP] flashes.
26. Set the switching point [SP] with the A/B buttons.
27. Press the Edit button to confirm the set value.
    [no] or [nc] flashes.
28. Select the switching element function (no/nc) with the A/B buttons.
29. Press the Edit button to confirm the set value.
30. [rON], [rOFF] or [bLUE] flashes.
31. Select the setting you require for the colour change on the display (rON, rOFF or bLUE) with the A/B buttons. ➔ chapter 2.1 Description of the function range, Setting the colour change.
32. Press the Edit button to confirm the selection.
    The SFAW is in RUN mode.

**Setting the switching characteristics at switching output Out B**

The SFAW is in EDIT mode and [Out B] is flashing, ➔ section Starting EDIT mode.
e) Setting flow monitoring
Flow measurement at Out B can be set in the same way as flow measurement at Out A.
f) Setting temperature monitoring

Temperature monitoring can only be activated for switching output Out B.
The SFAW is in EDIT mode and [Out B] is flashing, ➔ section Starting EDIT mode.

33. Press the Edit button to confirm the selection.
    [FLW] or [t] flashes.
34. Select temperature monitoring [t] with the A/B buttons.
35. Press the Edit button to confirm the selection.
    The currently set switching function flashes.
36. Select the desired switching function with the A/B buttons.
37. Press the Edit button to confirm the selection.
    [SP] or [SP.Lo] flashes.
38. Set the switching point (SP or SP.Lo) with the A/B buttons.
39. Press the Edit button to confirm the set value.
    Only with Window comparator switching function.
    [SP.Hi] flashes
    - Set the value [SP.Hi] with the A/B buttons.
    - Press the Edit button to confirm the set value.

    [Hy] flashes.
40. Set the value for the hysteresis [Hy] with the A/B buttons.
41. Press the Edit button to confirm the set value.
    [no] or [nc] flashes.
42. Select the switching element function (no/nc) with the A/B buttons.
43. Press the Edit button to confirm the set value.
    [rON], [rOFF] or [bLUE] flashes.
44. Select the setting you require for the colour change on the display (rON, rOFF or bLUE) with the A/B buttons. ➔ chapter 2.1 Description of the function range, Setting the colour change.
45. Press the Edit button to confirm the selection.
    The SFAW is in RUN mode.

**Setting special menu [SPEC]**

This is how you reach the special menu:

The SFAW is in EDIT mode and [SPEC] is flashing, ➔ section Starting EDIT mode.
46. Press the Edit button to confirm the selection. [dIGF] is displayed. This enables:

**Setting the digital filter [dIGF]**

47. [d.] flashes. Select the desired filter constants (OFF, 25, 50, 100, 150, 300 or 600 ms) with the A/B buttons. d.25 = minimal smoothing to d.600 = maximum smoothing.
48. Press the Edit button to confirm the selection.
    [FLW] is displayed. You can now continue with:

**Setting the physical unit for the flow [FLW]**

49. The currently set unit flashes. Select the desired unit (l/h, scfm or l/min) with the A/B buttons.
50. Press the Edit button to confirm the selection.
    [Cons] is displayed. You can now continue with:

**Setting the physical unit for the volume [ConS]**

51. The currently set unit flashes. Select the desired unit ($m^3$, scf or l) with the A/B buttons.
52. Press the Edit button to confirm the selection.
    [AS-] is displayed. You can now continue with:

**Setting the physical input variable [AS-] for the analogue output**

53. The currently set physical input variable flashes. Select the desired physical input variable flow [F] or temperature [t] with the A/B buttons.
54. Press the Edit button to confirm the selection.
    [A.S.Hi] is displayed for about 1s. You can now continue with:

**Specifying the upper limit [A.S.Hi] of the physical input variable for the analogue output**

55. [H] flashes. Select the desired upper limit for the physical input variable flow [F] or temperature [t] in %FS with the A/B buttons.
56. Press the Edit button to confirm the selection.
    [A.S.Lo] is displayed for about 1s. You can now continue with:

**Specifying the lower limit [A.S.Lo] of the physical input variable for the analogue output**

57. [L] flashes. Select the desired lower limit for the physical input variable flow [F] or temperature [t] in %FS with the A/B buttons.
58. Press the Edit button to confirm the selection.
    [An.Fil] is displayed for about 1s. You can now continue with:

**Setting the analogue filter [An.Fil]**

59. [F] flashes. Select the desired filter constants (OFF, 25, 50, 100, 150, 300 or 600 ms) with the A/B buttons.
60. Press the Edit button to confirm the selection.
    [A.O-] is displayed. You can now continue with:

**Setting the electrical output signal [AO-] at the analogue output**

61. The current setting flashes. Select the desired output signal voltage output [U] or current output [I] with the A/B buttons.
62. Press the Edit button to confirm the selection.
    The current setting for the switching output [PnP] or [nPn] flashes.
    You can now continue with (for both switching outputs):

**Setting the switching output characteristic [PnP] or [nPn]**

63. The current setting flashes. Select the desired switching output characteristic [PnP] or [nPn] for both switching outputs with the A/B buttons.
64. Press the Edit button to confirm the selection.
    [Lock] flashes. You can now continue with:

**Setting a security code**

65. The current setting is displayed. Select either an inactive security code (OFF) or a security code with up to 4 digits with the A/B buttons.
66. Press the Edit button to confirm the selection.
    The sensor is in RUN mode.

**Note**

Keep the security code in a safe place. If the security code is forgotten ➔ chapter 6.1 Resetting SFAW to the factory settings.

### 5.6 TEACH mode

In TEACH mode, the switching points for flow or temperature monitoring can be learned.

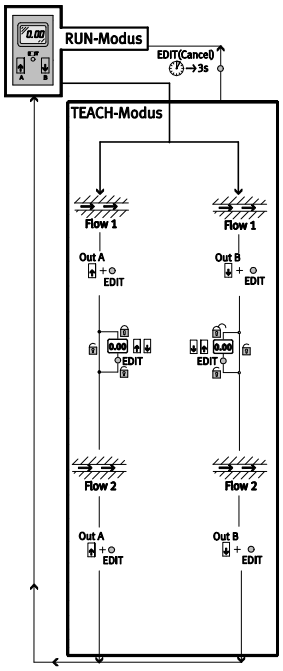



Fig. 43

- Before teaching in EDIT mode, select the desired switching function (threshold value or window comparator) ➔ chapter 5.5 EDIT mode.

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

Fig. 44

**Note**

The process is the same for teaching the switching outputs Out A (A button) and Out B (B button). A sample process is described below using the switching output Out A for flow monitoring.

For teaching the switching variables:

67. Generate a flow (measured value 1)
68. First press the A button and then also the Edit button.

Only with active security blocking [Lock]:

- Press the A/B buttons until the chosen security code is set.
- Press the Edit button. [Out A] and the bar display flash and the measured value is taken over as the first Teach point.

69. Generate a second flow (measured value 2).
70. First press the A button and then also the Edit button.
    The second Teach point is taken over and the switching point (SP) or switching points (SP.Lo and SP.Hi) become valid.
    The SFAW is in RUN mode.

### 5.7 RECORDER mode

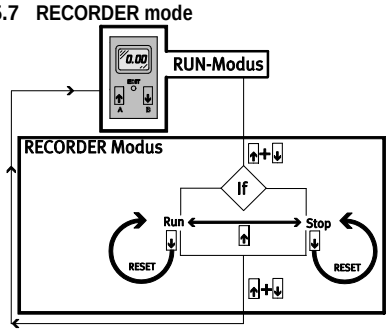



Fig. 45

In RECORDER mode, a manual accumulated volume measurement can be performed.

71. Press the A button and B button at the same time.
    The SFAW is in RECORDER mode.
    The status of the volume measurement [Run] or [Stop] is displayed.
72. You can start or stop volume measurement by pressing the A button.
73. You can reset volume measurement to zero by pressing the B button.
74. Press the A button and B button at the same time.
    The SFAW is in RUN mode.

**Note**

If the RECORDER mode is exited during an ongoing volume measurement [Run], the volume measurement will continue in the background.

## 6 Operation

**Attention**

Hydraulic shock can impair the SFAW's service life.

- Avoid hydraulic shock by installing the SFAW upstream of of a shut-off valve in the direction of flow. Otherwise, the SFAW is exposed to mechanical stresses that could impair its service life.

### 6.1 Resetting the SFAW to the factory settings

(also in case the security code cannot be found)

**Note**

By resetting to the factory settings, the current settings are lost. If needed, write down these settings before resetting.

To reset the SFAW to the factory settings, proceed as follows:

75. Switch off the operating voltage
76. Press all three setting elements (A button + B button + Edit button) simultaneously and hold them down.
77. Switch the operating voltage back on. Then release all the buttons.

The SFAW is in RUN mode.

## 7 Service and maintenance

- Switch off the following sources of energy before cleaning the exterior of the device:
  - z Operating voltage
  - z Operating medium
- If necessary, clean the exterior of the SFAW.
  Soap suds (max. + 60 °C), petroleum ether and all non-abrasive cleaning agents may be used.

## 8 Dismantling

- Switch off the following sources of energy before dismantling:
  - z Operating voltage
  - z Operating medium
- Disconnect the respective connections from the SFAW.

## 9 Troubleshooting

| Fault | Possible cause | Remedy |
|---|---|---|
| Incorrect measurement display | SFAW operated with non-permissible medium | Operate SFAW only with permissible media |
| | SFAW dirty | Replace device |
| With flow measurement: measured value is displayed flashing | Measurement outside permissible measuring range | Accuracy refers only to the permissible measuring range |
| With volume measurement: measured value is displayed flashing | Measuring range end value is exceeded at least once. Specified accuracy cannot therefore be maintained. | Make sure that the limit value of the measurement range is not exceeded. |
| Outputs do not switch according to the setting. | Short circuit/overload at relevant output | Eliminate short circuit/overload |
| Settings cannot be edited (Lock) | Access protection active | Enter the security code |
| O.FLO | Measurement range exceeded (is displayed in RUN mode) | Check operating conditions |
| Er1, Er2, Er4 | Device defective. | Replace device |
| Er9 | Flow measurement range fallen below (is displayed in SHOW mode) | Check operating conditions |
| Er10 | Flow measurement range exceeded (is displayed in SHOW mode) | Check operating conditions |
| Er11 | Temperature measurement range fallen below (is displayed in SHOW mode) | Check operating conditions |
| Er12 | Temperature measurement range exceeded (is displayed in SHOW mode) | Check operating conditions |
| Er17 | Undervoltage | Maintain operating voltage |
| | | Check electrical wiring |

Fig. 46

## 10 Accessories

| Designation | Type |
|---|---|
| Connecting cable, straight socket | NEBU-M12G5-K-2.5-LE5 |
| | NEBU-M12G5-K-5-LE5 |
| | NEBU-M12G5-K-10-LE5 |
| Connecting cable, angled socket | NEBU-M12W5-K-2.5-LE5 |
| | NEBU-M12W5-K-5-LE5 |

Fig. 47

Select the appropriate accessories from our catalogue.

➔ www.festo.com/catalogue

## 11 Technical data

| SFAW | | -32U | -85U |
|---|---|---|---|
| **General information** | | | |
| Certification | | C tick | |
| CE marking (➔ Conformity declaration) | | to EU EMC Directive | |
| Note on materials | | RoHS-compliant | |
| **Input signal/Measuring element** | | | |
| Measured variable | | Flow, volume, temperature | |
| Direction of flow | | Unidirectional Fluid connection 1 ➔Fluid connection 2 | |
| Measuring principle | | Vortex | |
| Flow measuring range | [l/min] | 1,8 ... 32 | 6 ... 85 |
| Operating pressure:<br>at 60°C<br>at 100°C | [bar] | <br>12<br>6 | |
| Nominal pressure | [bar] | 6 | |
| Pressure drop | [mbar] | ≤ 100 (at typical 50%FS flow | |
| Ambient temperature | [癈] | 0 ... +50 | |
| Temperature of medium | [癈] | 0 ... +70 | |
| Nominal temperature | [癈] | 23 | |
| Operating medium | | Normal mains water with no harmful, aggressive additives | |
| **Output – General**[1), 2)] | | | |
| Precision zero point<br>Flow ≤ 50%FS | [%]FS | ±1 | |
| Accuracy range<br>Flow ≥ 50%FS | [%]FS | ±2 | |

| SFAW | | -32U | -85U |
|---|---|---|---|
| Repetition accuracy zero point<br>Flow ≤ 50%FS | [%]FS | ±0,5 | |
| Repetition accuracy range<br>Flow ≥ 50%FS | [%]FS | ±1 | |
| Precision<br>Temperature measurement ± °C | [°C] | ±2 | |
| **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 | |
| Filter time constants | [ms] | Adjustable (OFF, 25, 50 factory setting, 100, 150, 300 or 600) | |
| Inductive protective circuit | | Yes | |
| **Analogue output** | | | |
| Characteristic curve – flow rate | [l/min] | 0 ... 32 | 0 ... 85 |
| Output characteristic curve – current | [mA] | 4 ... 20 | |
| Output characteristic curve – voltage | [V] | 0 ... 10 | |
| Max. load resistance at current output | [ohms] | 500 | |
| Min. load resistance at voltage output | [kohms] | 20 | |
| Filter time constants | [ms] | Adjustable (OFF, 25, 50 (factory setting), 100, 150, 300 or 600) | |
| **Output, additional data** | | | |
| Protection against short circuit | | Yes | |
| Protection against overloading | | Yes | |
| **Electronic components** | | | |
| Operating voltage range DC | [V] | 18 ... 30 | |
| Reverse polarity protection | | For all electrical connections | |
| **Electromechanical components** | | | |
| Electrical connection | | Straight plug, M12x1, 5-pin | |
| Max. connecting cable length | [m] | 10 | |
| **Mechanical components** | | | |
| Mounting position | | Any | |
| Length of inlet section | | 10x ID measurement pipe | |
| Length of outlet section | | 2x ID measurement pipe | |
| Internal diameter of feed/outlet section | | ≥ ID measurement pipe | |
| Internal diameter of measurement pipe | [mm] | 13 | 20 |
| Mechanical connection | | G1/2" | G1" |
| Product weight | [g] | 580 | 1120 |
| Materials | | Housing:<br>Reinforced polyamide, anodised aluminium, stainless steel<br>Materials with media contact:<br>ETFE, reinforced PA6T/6I, EPDM (perox.) | |
| **Display/operation** | | | |
| Display type | | Illuminated LCD, blue | |
| Displayable units: | | Flow rate: l/min, l/h, scfm, | |
| | | Volume: l, $m^3$, scf | |
| | | Temperature: 癈 | |
| Setting range for flow rate threshold value | | 1%FS to 100%FS | |
| Setting range for volume impulse threshold value | [l] | 0,2 ... 1999,9 | 0,4 ... 1999,9 |
| | [$m^3$] | 0,01 ... 199,99 | 0,01 ... 199,99 |
| | [scf] | 0,01 ... 199,99 | 0,02 ... 199,99 |
| Hysteresis setting range | | 0%FS to 90%FS | |
| **Immissions/emissions** | | | |
| Storage temperature | [°C] | –20 ... +80 | |
| Protection class | | IP40 | |
| Protection class | | III | |

1) % FS = % of the measuring range final value (full scale)

Fig. 48

**Calculation example for precision calculation:**

Case A)
The display of the SFAW-32U shows a flow rate of 20 l/min. How large can the actual flow rate that flows through the sensor be?
As the flow rate is > 50%FS, the precision range is ±2 %FS, according to the specification. A range error in the measurement signal (= error in the characteristic curve gradient) has a greater effect, the larger the measured value is (➔ Fig. 49). The largest measured value FS=32 l/min results in the maximum error. According to the specifications, the error there is ±2%FS. The maximum error is therefore calculated as follows:

±2%FS = ±2% x 32 l/min = ±2/100 x 32 l/min = ±0.64l/min

A measured value of 20 l/min results in a maximum error of:

$$\pm 0{,}64 l/min \times \frac{20\ l/min}{32\ l/min} = \pm 0{,}4\ l/min$$

The actual flow through the sensor could therefore have values between 19.6 l/min and 20.4 l/min.

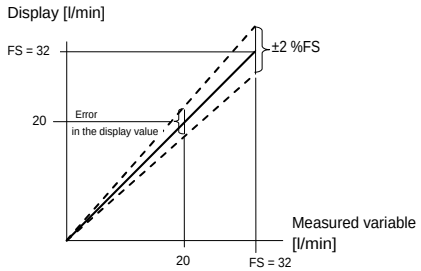



Fig. 49

Case B)
The display of the SFAW-32U shows a flow rate of 10 l/min. How large can the actual flow rate that flows through the sensor be?
As the flow rate is < 50%FS, the precision zero point is ±1%FS, according to the specification. In this case, FS = 32 l/min. A zero point error in the measurement signal has the same effect on each point of the characteristic curve, i.e. it is independent of the measured value observed (➔ Fig. 50).

This results in
±1%FS = ±1/100 x 32 l/min = ±0.32 l/min

10 l/min therefore results in an error of ±0.32 l/min. The actual flow through the sensor could therefore have values between 9.68 l/min and 10.32 l/min.

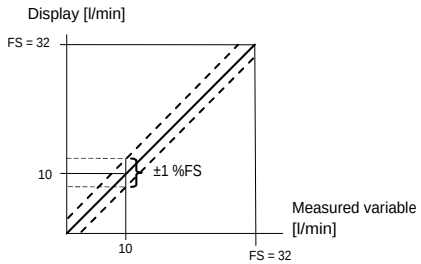



Fig. 50