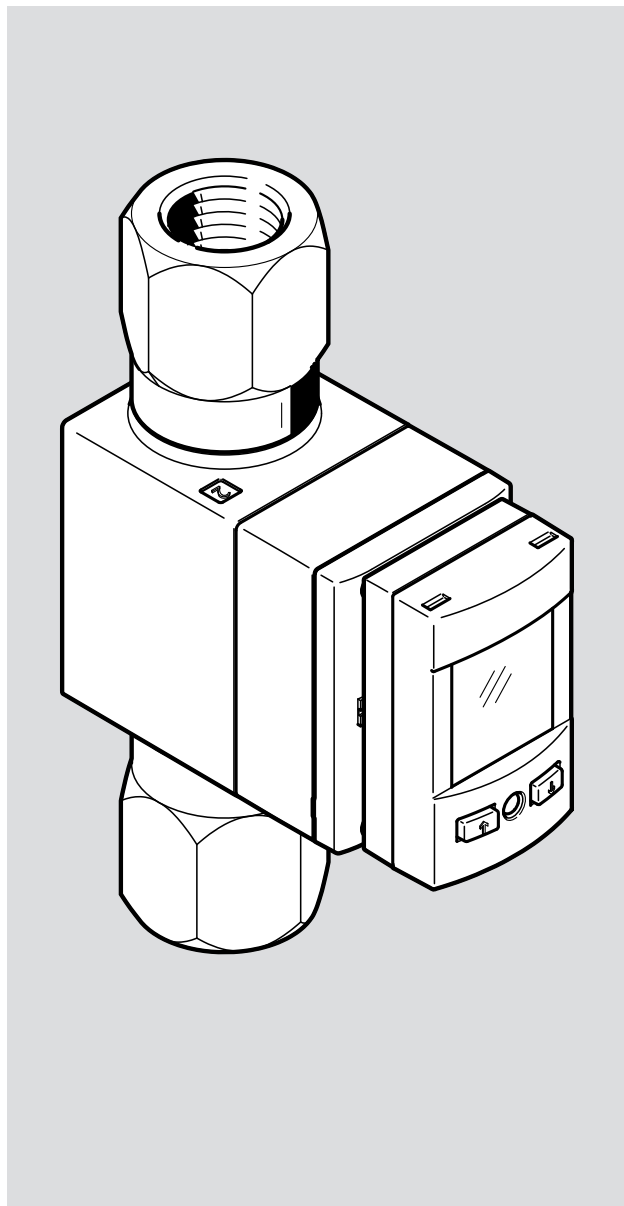


# SFAW

Flow sensor



# FESTO

Operating instruc-  
tion



8196855

8196855  
2023-07d  
[8196857]

Translation of the original instructions

IO-Link is a registered trademark of its respective trademark holder in certain countries.

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# 1 Applicable documents



All available documents for the product → [www.festo.com/sp](http://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.
- Do not use the product in combination with flammable, caustic, vapour-emitting or other media hazardous to health.
- Take into account the ambient conditions at the location of use.
- Only use media in accordance with the specifications → Technical data.
- Foreign matter and other contaminants in the operating medium may damage the product and cause incorrect measurements and malfunctions.
- Check the operating medium to determine the media compatibility with the materials it contacts.
- Observe the identifications on the product.
- Remove all transport packaging.

### 2.2 Intended use

The flow sensor monitors the flow rate, volume and temperature of liquid media in piping systems or terminal devices 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 technicians have knowledge and experience in handling fluidic systems in the intended area of application.

### 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 610101, CAN/CSA-22.2 No. 61010-1
UL mark	

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](http://www.festo.com).
- Accessories and spare parts → [www.festo.com/catalogue](http://www.festo.com/catalogue).

### 4 Product overview

#### 4.1 Structure

##### 4.1.1 Product design

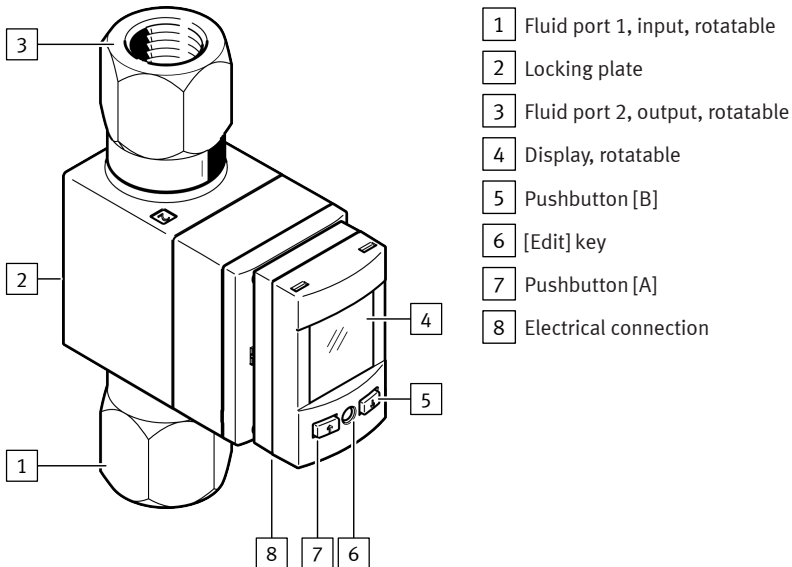


Fig. 1: Control elements and connection elements

### 4.1.2 Display components

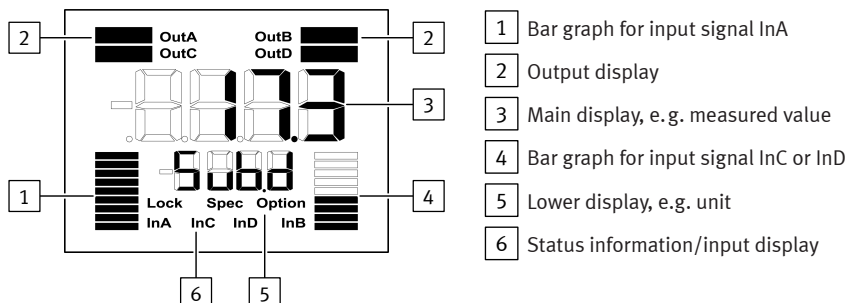


Fig. 2: LCD display

### Symbols on the display

Example for LCD display	Meaning
<b>Output display</b>	
'OutA'	Switching output OutA selected, flashes with active IO-Link
'OutA'	Switching output OutA set
'OutC'	Switching output OutC selected
'OutC'	Switching output OutC set
'OutB'	Switching output OutB selected
'OutB'	Switching output OutB set
'OutD'	Analogue output OutD selected
'OutD'	Switching output OutD set
<b>Information/input display</b>	
	Input signal InA: graphic display of the current measured value related to the maximum measured value of the measuring range
	Input signal InC: graphic display of the volume measurement
'InA'	Input signal InA selected

Example for LCD display	Meaning
'InC'	Input signal InC selected
'InB'	Input signal InB selected
'Lock'	Security code activated
'Spec'	Special menu activated

Tab. 2: Symbols on the display

Example for LCD display		Meaning
Main display	Lower display	
Measured value indicator and unit in the RUN mode		
'17.3'	'l/min'	Measured value indicator and unit
Menu for the switching outputs		
'Edit'	'Flow'	Edit menu for the switching outputs
'_l'	'Fctn'	Setting the switching function: threshold value comparator
'_l_l'	'Fctn'	Setting the switching function: window comparator
'18.0'	'SP'	Value of switching point, only for threshold value comparator
'8.0'	'SP.Lo'	Value of lower switching point, only for window comparator
'12.2'	'SP.Hi'	Value of upper switching point, only for window comparator
'2.8'	'HY'	Hysteresis value
'N/O'	'logic'	Switching characteristics of the switching outputs: 'NO' = N/O contact, 'NC' = N/C contact
'bBLUE'	'COLR'	Display colour: 'bBLUE' = blue, colour change function deactivated 'R.ON' = red when switching output set 'R.OFF' = red when the switching output not set
'200'	'PULS'/'MSEC'	Width of the volume pulse
Menu for the analogue output		
'l/min'	'Flow'/'Unit'	Display unit for the flow measurement
'1_5V'	'Out'	Analogue output, switchable between '0_10V', '1_5V', '4_20MA'
'93.0'	'In.Hi'/'%'	Scaling of the analogue output: set end value of the flow rate characteristic or temperature characteristic, specified in % FS



Example for LCD display		Meaning
Main display	Lower display	
'3.1'	'In.Lo'/'%'	Scaling of the analogue output: set start value of the flow rate characteristic or temperature characteristic, specified in % FS
'Ltr'	'VOL'/'Unit'	Display unit for volume measurement
'°C'	'tEMP'/'Unit'	Display unit for temperature measurement
Menu for extreme values and mean values		
'5.1'	'MIN'/'l/Min'	Minimum measured flow rate since switch-on or the last reset
'30.8'	'MAX'/'l/Min'	Maximum measured flow rate since switch-on or the last reset
'20.2'	'MIN'/'°C'	Minimum measured temperature since switch-on or the last reset
'50.5'	'MAX'/'°C'	Maximum measured temperature since switch-on or the last reset
'20.8'	'AVER'/'l/Min'	Average of the flow measurement, filter time constant switchable between 650 ms, 1200 ms, 2500 ms
Menu for the device settings in the special menu		
'1200'	'Filt'	Value of the filter time constant for the flow rate measurement signal
'10'	'Eco'	Economy mode: time after which the display background lighting is switched off
'PNP'	'bin'/'Out'	Switchover of the switching outputs between PNP and NPN
'FLOW'	'bin'/'Pin4'	Switchover of the switching signal at pin 4 between flow monitoring and volume pulse
'FLOW'	'bin'/'Pin2'	Switchover of the switching signal or the analogue output signal at pin 2 between flow rate and temperature monitoring
'FLOW'	'ANLG'/'Pin5'	Switchover of the analogue output signal at pin 5 between flow measurement and temperature measurement
'OFF'	'Lock'/'Code'	Activation and specification of the security code
'OFF'	'MASt'	Activation of the IO-Link master function for replication of parameters

Tab. 3: Example for LCD display

## 4.2 Function

### 4.2.1 Operating statuses

Operating status	Function
RUN mode	<ul style="list-style-type: none"> <li>– Basic state after the operating voltage has been applied.</li> <li>– Display of the current measured value.</li> <li>– Display of the selected inputs and outputs.</li> <li>– Switchover between the measured variables of flow rate, volume and temperature.</li> </ul>
SHOW mode	<ul style="list-style-type: none"> <li>– Display of current settings of the switching outputs and analogue output.</li> <li>– Display and reset of the minimum and maximum values.</li> </ul>
EDIT mode	<ul style="list-style-type: none"> <li>– Setting or modification of parameters.</li> </ul>
TEACH mode	<ul style="list-style-type: none"> <li>– Acceptance of the current measured value to specify switching points.</li> </ul>
RECORDER mode	<ul style="list-style-type: none"> <li>– Manual measurement of the accumulated volume.</li> </ul>

Tab. 4: SFAW operating statuses

### 4.2.2 Switching outputs

#### 4.2.2.1 Switching functions

**Threshold value comparator in the flow measurement for OutA or OutD and in the temperature measurement for OutB**

Function	Normally open contact (N/O)	Normally closed (N/C contact)
Switching function: – 1 switching point (SP) TEACH mode <sup>1)</sup> : – 2 teach points (TP1, TP2) – $SP = \frac{1}{2} (TP1 + TP2)$		

1) Only with flow measurement

Tab. 5: Threshold value comparator: setting of switching point SP and hysteresis HY

**Window comparator in the flow measurement for OutA or OutD and in the temperature measurement for OutB**

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

1) Only with flow measurement

2) SP.Lo = smaller value, SP.Hi = larger value, independent of the Teach sequence

Tab. 6: Window comparator: setting of switching points SP.Lo and SP.Hi and hysteresis HY

**4.2.2.2 Colour change**

A red colour change can be set in the display for OutA, OutB and OutD dependent on the switching status. The colour changes enables the system status to be identified from a distance.

The display always shows the measured variable that first caused the colour change. The unit and the associated OutA, OutC or OutD output flash in the lower display. The display remains red until all switching outputs are in the ‘blue’ status again.

**4.2.2.3 Volume pulse**

A threshold value for the volume is set in the cumulative volume measurement. If the configured threshold value is reached, a switching impulse is emitted at the OutC output for a configurable period. The volume measurement is restarted at every switching pulse.

Setting of N/O contact (NO)	Setting N/C contact (NC)

Tab. 7: Volume pulse with accumulated volume measurement

**4.2.3 Analogue output**

**Analogue signal**

The signal of the analogue output can be assigned the physical measured variables of flow rate or temperature. The physical measured value of flow rate is configured as standard.

**Output signal**

The analogue output can be configured either as voltage output 0 ... 10 V oder 1 ... 5 V or as current output 4 ... 20 mA. By default the voltage output is set to 0 ... 10 V.

### Scaling of the analogue signal

The default setting for the analogue output signal is 0 ... 10 V, 1 ... 5 V or 4 ... 20 mA for the complete sensing range "Full Scale (FS)". If only part of the sensing range is to be used, the analogue value output can be scaled to the partial range.

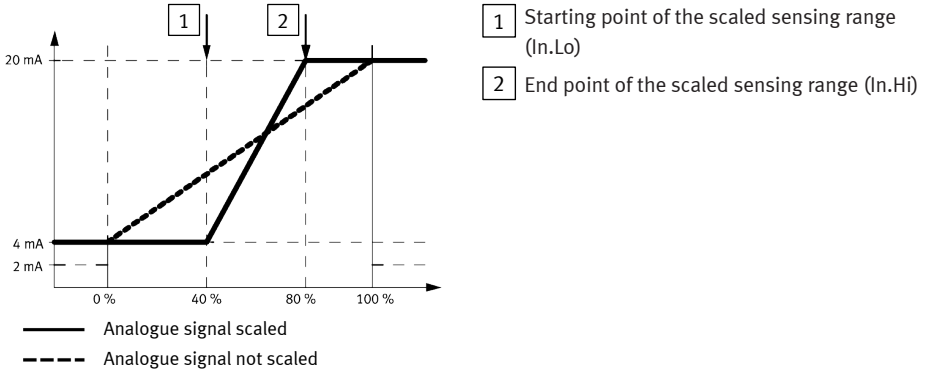


Fig. 3: Example: scaling of the analogue signal at the current output

#### 4.2.4 Filter

The filter smoothes the flow rate measurement signal. Smoothing takes place in 8 steps and affects all outputs. The switching times of the flow-related switching outputs and the rise time and fall time of the analogue output change.

#### 4.2.5 Functional principle

The flow velocity is recorded in accordance with the vortex principle. The flow rate and the accumulated volume are calculated from the flow velocity. An optional integrated temperature sensor records the temperature of medium.

Interfacing to higher-level systems is provided by 2 switching outputs via an analogue output or an IO-Link interface depending on the type.

The switching outputs can be configured to monitor a threshold value or a range. PNP or NPN and N/O contact (NO) or N/C contact (NC) can be set for each switching output as required. The process values can be read out and parameters changed and transmitted to additional devices through the IO-Link interface.

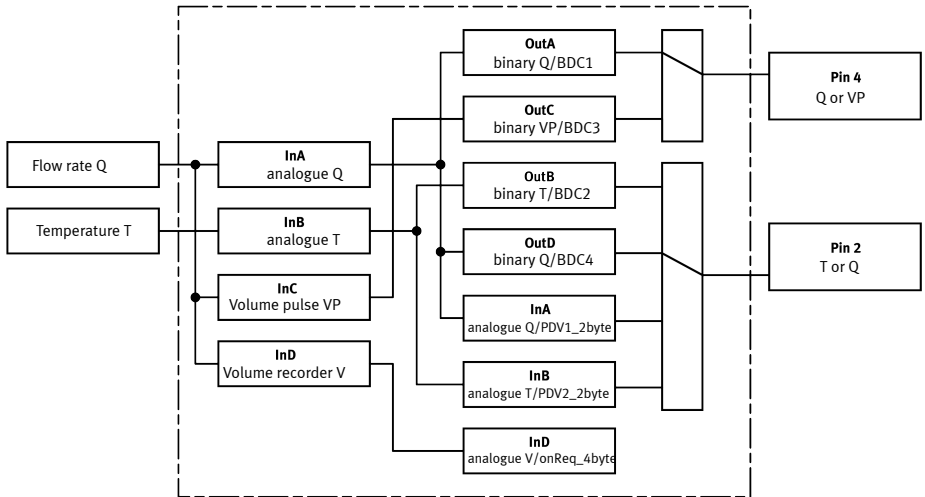


Fig. 4: SFAW-...PNLK-PNVBA-... signal structure

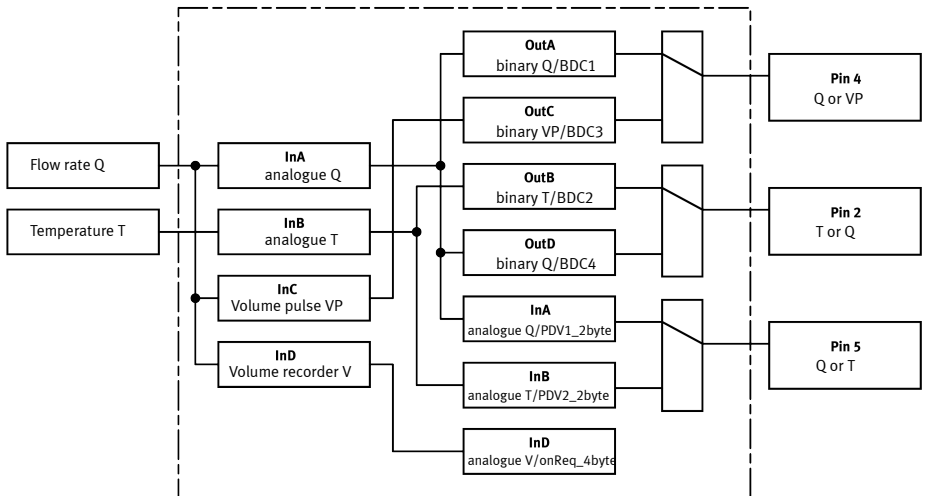


Fig. 5: SFAW-...PNLK-PN-VBA-... signal structure

#### 4.2.6 Security code

A 4-digit numeric code can be set to protect the device settings from unauthorised access. The security code must be entered in EDIT mode and TEACH mode when changing settings. The IO-Link interface offers additional options for blocking access.

#### 4.2.7 Minimum value and maximum value

The minimum values and the maximum values for the flow measurement or the temperature measurement are displayed and reset in the SHOW mode.



The minimum and maximum values are reset when the operating voltage is switched off.

## 5 Mounting

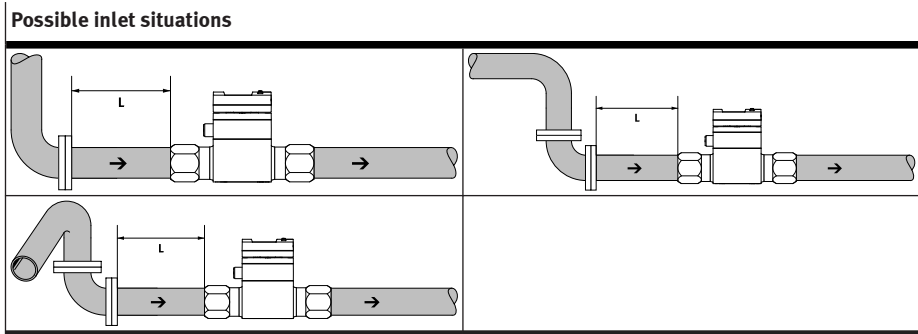
### 5.1 Inlet situation and outlet situation

The specified accuracies of the sensor are achieved if the inlet and outlet sections on the sensor are sufficiently long and straight. In addition, the sensor should not have any disruptive geometries such as edges, curves or tapering.

Before installation, observe the following conditions:

SFAW-	32-...	100-...
Inside diameter D of the flow sensor	11 mm	19 mm
Min. internal diameter of laminar flow inlet	1.1 x D	1.05 x D
Laminar flow inlet type	10 cm	
Min. laminar flow outlet	5 cm	

Tab. 8: Minimum requirements for fluid connection



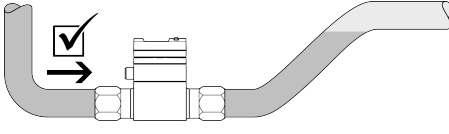
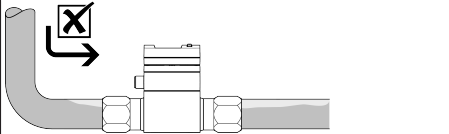
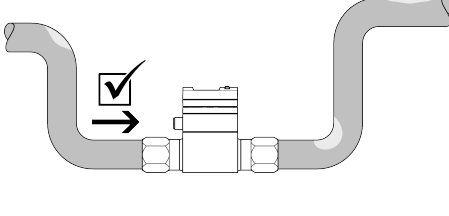
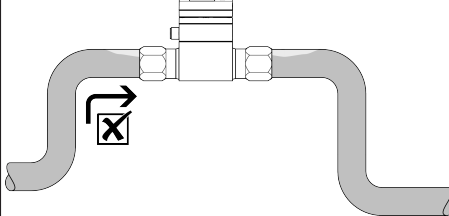
Tab. 9: Possible inlet situations

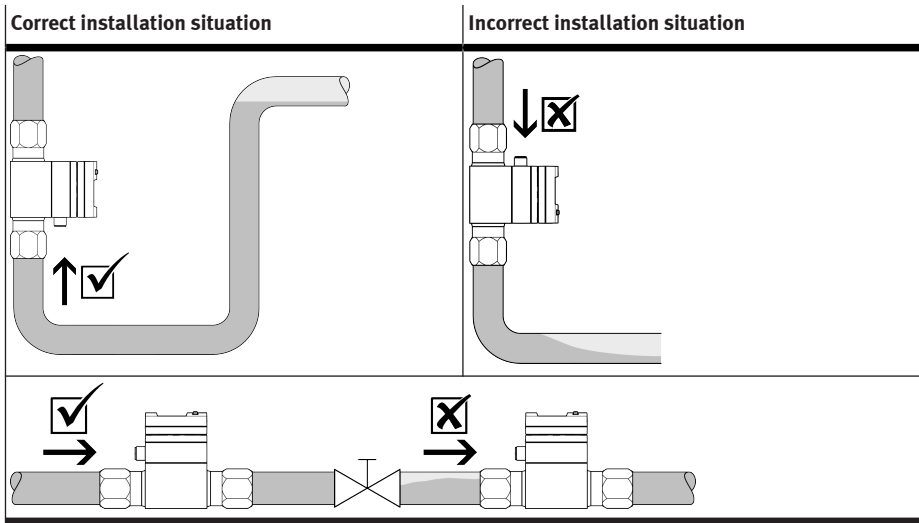
### 5.1.1 Mounting position/inflow

- The sensor is unidirectional and can therefore only provide meaningful measurement values in one direction of flow. Flow in the opposite direction also actuates the paddle, but with many irregular pulses. The defined relationship between the vortex frequency and the flow velocity no longer exists. Values that appear plausible are still shown on the display.
- If the flow direction is correct, the mounting position is arbitrary.
- The specified accuracies are maintained with inlet sections that are as long and straight as possible.
- The inside diameter of the inlet section must not be smaller than the inside diameter at the sensor measuring point.
- Vortices generated by external interfering bodies will influence the measurement result. External sources of interference can be throttles, valves, pipe bends and double pipe bends. These additional superimposed vortices falsify the measurement result and should therefore be avoided in the design.

In addition, air or air bubbles affect the measurement and lead to incorrect measurement results. Air in the fluidic system is often caused by incorrect installation situations. The correct mounting position must be observed and a back pressure that is not too low must be maintained.

The following table shows the correct and incorrect installation situations.

Correct installation situation	Incorrect installation situation
	
	



Tab. 10: Correct and incorrect installation situations

## 5.2 Mounting

### 5.2.1 Installing sensor without mounting accessories

The mounting position is as desired.

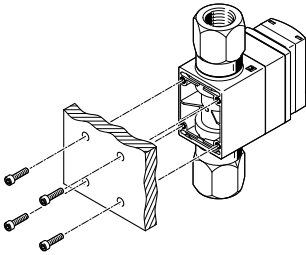


Fig. 6: Direct mounting



Note hole pattern → Fig. 11.

1. Remove the locking plate.
  - Screws: Allen key SW 2 mm
2. Mount the sensor with 4 M3 screws.
  - Wall hole diameter: maximum 3.3 mm
  - Tightening torque: maximum 0.5 Nm

### 5.2.2 Mounting sensor with wall mounting

The mounting position is as desired.



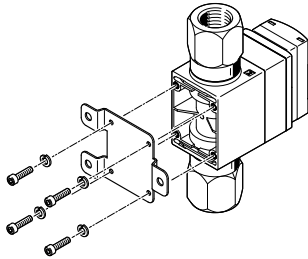


Fig. 7: Wall mounting SFAW-...-W-...



Note hole pattern → Fig. 12.

---

1. Remove the locking plate.
  - Screws: Allen key SW 2 mm
2. Install the wall mounting on the sensor with 4 M3 screws.
  - Tightening torque: maximum 0.5 Nm

### 5.3 Tubing sensor

The medium is fed in at fluid port 1 and removed at fluid port 2 → Fig. 1.

1. Screw a supply line into the fluid port 1 of the sensor. Do not tilt the thread when screwing it in.
  2. Screw in a drain line at fluid port 2 of the sensor. Do not tilt the thread when screwing it in.
- 

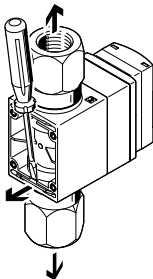


Observe the dimensional drawing for the customer-specific fluid ports → Fig. 13.

---

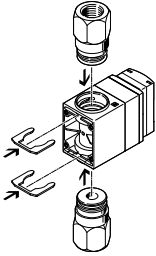
### 5.4 Changing fluid connector

1. Remove the locking plate.
2. Remove the clamps and pull out the fluid connectors.



3. Insert new fluid connectors.
  - Make sure the O-rings are seated correctly.

- Insert the clamps and push them fully into the housing.



- Mount the locking plate with 4 M3 screws.
  - Tightening torque: maximum 0.5 Nm

## 6 Installation

### 6.1 Installation, electrical

#### **⚠ WARNING**

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

- For the electrical power supply, use only PELV circuits in accordance with IEC 60204-1/EN 60204-1 (Protective Extra-Low Voltage, PELV).
- Observe the general requirements of IEC 60204-1/EN 60204-1 for PELV circuits.
- Only use voltage sources that ensure a reliable electric separation from the mains network in accordance with IEC 60204-1/EN 60204-1.

#### **i**

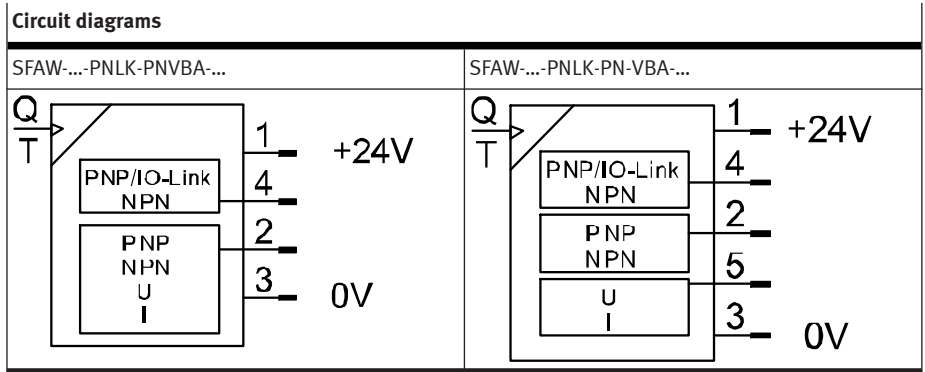
The switching outputs at pin 2 and pin 4 can be wired as PNP or NPN connections.

- Pay attention to the wiring when configuring the switching outputs → 7.3.4 Changing sensor settings.
- Connect the sensor.
  - Maximum permissible cable length: 30 m, with IO-Link 20 m
  - Plug tightening torque: maximum 0.5 Nm

Plug	Pin	Allocation <sup>1)</sup>	Wire colour
	1	+24 V DC operating voltage	Brown (BN)
	2	Switching output OutB or OutD or analogue output	White (WH)
	3	0 V	Blue (BU)
	4	Switching output OutA or OutC or IO-Link (C/Q line)	Black (BK)
	5	Analogue output or not assigned	Grey (GY)

1) Observe signal structures.

Tab. 11: Pin allocation



Tab. 12: Circuit diagrams

## 7 Commissioning

### 7.1 Switching on the sensor in RUN mode

The basic state of the sensor is the RUN mode. The current values are displayed.

The basic state can be reached from other modes:

- Press and hold the [Edit] key for 3 seconds.
  - After a monitoring time has elapsed (Timeout).
1. Switch on the operating voltage.
    - ↳ The sensor is in RUN mode.
    - ↳ The signals active at the outputs are displayed → 4.2.5 Functional principle.
  2. Press the [A] or [B] key to switch between the flow rate, volume and temperature measured variables → Fig. 8.

### 7.2 Displaying parameters in SHOW mode

Requirement: the sensor is ready for operation → 7.1 Switching on the sensor in RUN mode.

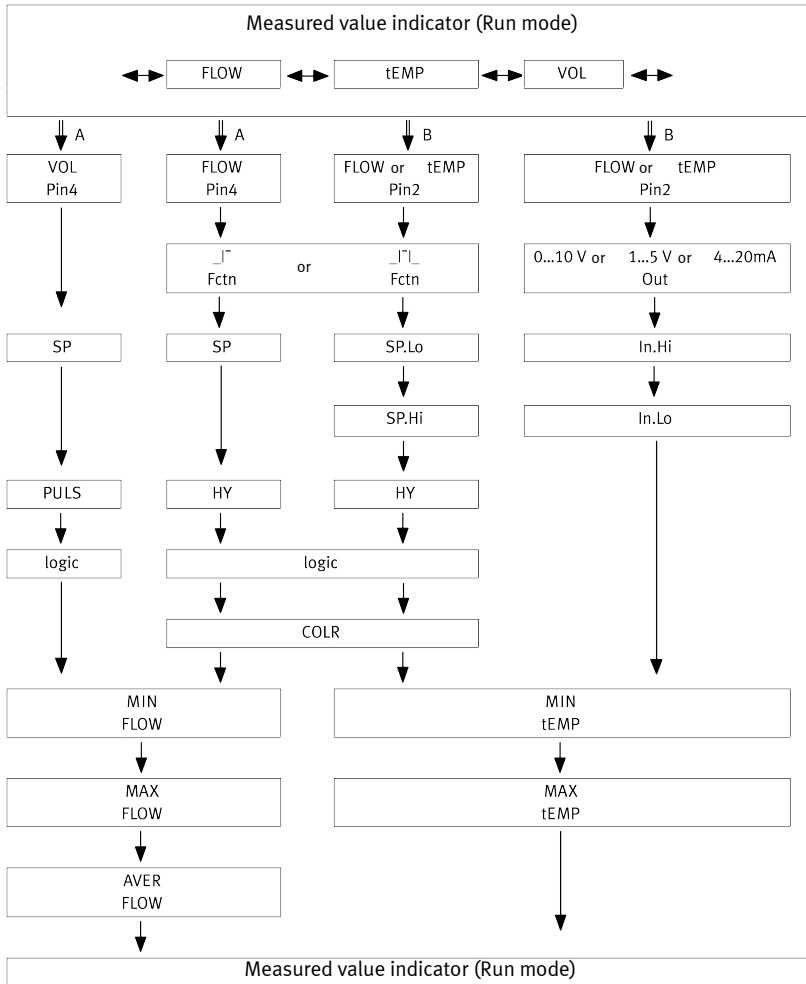


Fig. 8: Menu structure SHOW mode

Symbol	Meaning
	[A] key or [B] key
	Double-click [A] key or [B] key

Tab. 13: Symbols in the menu structure

### 7.2.1 Starting SHOW mode

Requirement: the sensor is ready for operation and is in RUN mode.

1. Depending on the switching output, press the [A] or [B] key twice.
  - ↖ The sensor is in SHOW mode. The first parameter set is displayed.
2. Press the [A] or [B] key to display the next parameter.
  - ↖ The other parameters of the selected switching output are displayed.
3. Press the [A] or [B] to switch to RUN mode.

### 7.2.2 Show and reset minimum value/maximum value

Requirement: the sensor is in the SHOW mode.

1. Depending on the switching output, press the [A] or [B] key several times.
  - ↖ The minimum value is displayed.
  - ↖ 'MIN'/'l/Min' or 'MIN'/'°C' flashes.

---

**i**

If no other key is pressed, the display remains permanent (no Timeout).

---

2. Press the [Edit] key.
  - ↖ The minimum value is reset.
3. Press the [A] or [B] key.
  - ↖ The maximum value is displayed.
  - ↖ 'MAX'/'l/Min' or 'MAX'/'°C' flashes.
4. Press the [Edit] key.
  - ↖ The maximum value is reset.
5. Press the [A] or [B] key.
  - ↖ The mean value display or RUN mode is displayed.

### 7.2.3 Display mean value and reverse related filter time constants

Requirement: the sensor is in the SHOW mode.

1. Press the [A] key several times.
  - ↖ The averaged flow rate value is displayed.
  - ↖ 'AVER'/'l/Min' flashes.

---

**i**

If no other key is pressed, the display remains permanent (no Timeout).

---

2. Press the [Edit] key.
  - ↖ The value of the filter time constant is changed (650 ms, 1200 ms, 2500 ms).
3. Press the [A] key.
  - ↖ The RUN mode is displayed.

## 7.3 Configuring the sensor in EDIT mode

The figure below shows the complete menu structure. Some menu options or setting values are not applicable depending on the product variant and the selected switching function.

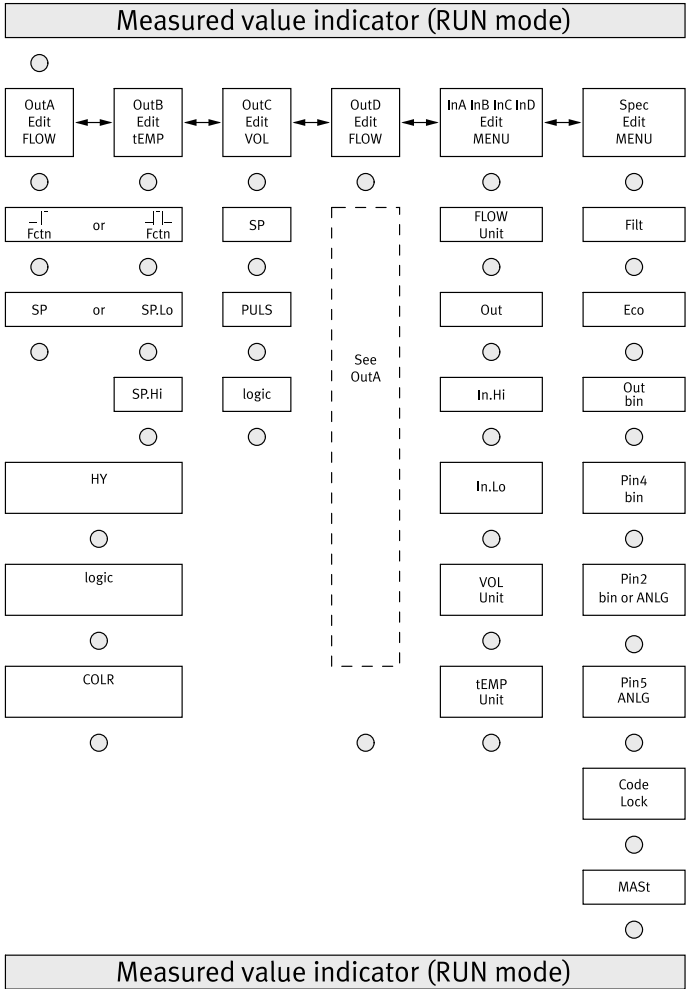




Fig. 9: EDIT mode menu structure

Symbol	Meaning
	[Edit] key
	[A] key or [B] key

Tab. 14: Symbols in the menu structure

Parameter <sup>1)</sup>	Adjustable values	Factory setting
'SP' with flow measurement	5 ... 100% Full Scale <sup>2)</sup>	60% Full Scale
'SP.Lo' with flow measurement	5 ... 99% Full Scale	60% Full Scale
'SP.Hi' with flow measurement	5.5 ... 100% Full Scale	70% Full Scale
'HY' with flow measurement	0 ... 90% Full Scale	0.5% Full Scale
'SP' with temperature measurement	1 ... 90% Full Scale	40% Full Scale
'SP.Lo' with temperature measurement	1 ... 89.5% Full Scale	40% Full Scale
'SP.Hi' with temperature measurement	1.5 ... 90% Full Scale	60% Full Scale
'HY' with temperature measurement	0 ... 80% Full Scale	0.5% Full Scale
'logic'	NO, NC	N/O
'COLR'	bBLUE, R.ON, R.OFF	bBLUE
'SP' with volume measurement	Setting range of 'SP' with volume measurement ➔ 12 Technical data	SFAW-32-...: 32.0 l SFAW-100-...: 100.0 l
'PULS'	10 ... 1000 MSEC	100 MSEC
'FLOW' 'Unit'	l/min, l/h, CFM, GPM	l/min
'Out'	0 ... 10 V, 1 ... 5 V, 4 ... 20 MA	0...10 V
'In.Hi'	10 ... 100% Full Scale	100% Full Scale
'In.Lo'	0 ... 90% Full Scale	0% Full Scale
'VOL' 'Unit'	Ltr, M <sup>3</sup> (m <sup>3</sup> ), CFt, GAL	Ltr
'tEMP' 'Unit'	°C, °F	°C
'Filt'	100, 150, 300, 650, 1200, 2500, 5000, 10000 MSEC	150 MSEC
'Eco'	di.ON, 5, 10, 20, 40, 80, 160, 320, 640 s	di.ON
'bin' 'Out'	PNP, NPN	PNP
'Pin4' 'bin'	FLOW, VOL	FLOW
'Pin2' 'bin' or 'ANLG'	FLOW, tEMP	FLOW
'Pin5' 'ANLG'	FLOW, tEMP	FLOW

Parameter <sup>1)</sup>	Adjustable values	Factory setting
'Code' 'Lock'	OFF, 1 ... 9999	OFF
'MASt'	OFF, ON	OFF

1) All parameters of the complete menu structure are listed. Some menu options or setting values are not applicable depending on the product variant and the selected switching function.

2) The values refer to the applicable measuring range.

Tab. 15: Adjustable values and factory setting

### 7.3.1 Entering the security code

Requirement: the sensor is ready for operation and is in RUN mode.

- Press the [Edit] key.
  - The EDIT mode is active.
  - With security code activated: 'Lock' flashes.
- Enter the security code with the [A] or [B] key.
- Press the [Edit] key.
  - 'OutA' flashes.

### 7.3.2 Setting the switching characteristics of the switching outputs

#### 7.3.2.1 Set flow rate monitoring or temperature monitoring



The procedure for setting the flow monitoring at the switching signal OutA or switching signal OutD is the same. In the following, the procedure for the switching signal OutA is described.

The temperature monitoring can only be set for the switching signal OutB.

---

Requirement: the sensor is in the EDIT mode. 'OutA' flashes.

- Press the [Edit] key.
  - '\_I\_' or '\_I\_-' is displayed.
  - 'Fctn' flashes.
- Select the switching function with the [A] or [B] key.
- Press the [Edit] key.
  - 'SP' or 'SP.Lo' flashes.
- Set the value for the switching point with the [A] or [B] key.
- Press the [Edit] key.
  - With window comparator switching function only: 'SP.Hi' flashes.
- For window comparator switching function only:
  - Set the value for the switching point with the [A] or [B] key.
  - Press the [Edit] key.
    - 'HY' flashes.
- Set the value for the hysteresis with the [A] or [B] key.
- Press the [Edit] key.
  - 'logic' flashes.
- Select the switching element function with the [A] or [B] key.



10. Press the [Edit] key.
  - ↳ 'COLR' flashes.
11. Select the setting for the colour change with the [A] or [B] key.
12. Press the [Edit] key.
  - ↳ The RUN mode is displayed.

### 7.3.2.2 Set volume monitoring

---



The volume monitoring can only be set for the OutC switching signal.  
The maximum pulse length depends on the magnitude of the threshold value and is automatically limited.

---

Requirement: the sensor is in the EDIT mode. 'OutA' flashes.

1. Use the [A] or [B] to select 'OutC'.
2. Press the [Edit] key.
  - ↳ 'SP' flashes.
3. Set the value for the switching point with the [A] or [B] key.
4. Press the [Edit] key.
  - ↳ 'PULS' flashes.
5. Select the pulse length with the [A] or [B] key.
6. Press the [Edit] key.
  - ↳ 'logic' flashes.
7. Select the switching element function with the [A] or [B] key.
8. Press the [Edit] key.
  - ↳ The RUN mode is displayed.

### 7.3.3 Setting display units and analogue output

Requirement: the sensor is in the EDIT mode. 'OutA' flashes.

1. Use the [A] or [B] key to select 'InA InC InD InB'.
2. Press the [Edit] key.
  - ↳ 'FLOW'/'Unit' flashes.
3. Select the display unit for the flow measurement with the [A] or [B] key.
4. Press the [Edit] key.
  - ↳ 'Out' flashes.
5. Select the output signal with the [A] or [B] key.
6. Press the [Edit] key.
  - ↳ 'In.Hi'/'%' flashes.
7. Set the end value for scaling of the measuring range with the [A] or [B] key.
8. Press the [Edit] key.
  - ↳ 'In.Lo'/'%' flashes.
9. Set the start value for scaling of the measuring range with the [A] or [B] key.
10. Press the [Edit] key.
  - ↳ 'VOL'/'Unit' flashes.

11. Select the display unit for the volume measurement with the [A] or [B] key.
12. Press the [Edit] key.
  - ↳ ‘tEMP’/‘Unit’ flashes.
13. Select the display unit for the temperature measurement with the [A] or [B] key.
14. Press the [Edit] key.
  - ↳ The RUN mode is displayed.

### 7.3.4 Changing sensor settings

Requirement: the sensor is in the EDIT mode. ‘OutA’ flashes.

1. Use the [A] or [B] to select the ‘Spec’ special menu.
2. Press the [Edit] key.
  - ↳ ‘Filt’ flashes.
3. Use the [A] or [B] key to select the parameter or value.
4. Press the [Edit] key.
  - ↳ The set value is saved.
  - ↳ The next adjustable parameter flashes.
5. Repeat steps 3 and 4 until all parameters are set → Fig. 9.

### 7.3.5 Replicating parameters

Requirement:

- The configured Master sensor is operational and in RUN mode.
- The Master sensor and the Device sensor are identical in terms of parameters, i.e. they have the same Device ID.
- The Master sensor is connected to the Device sensor → Fig. 10.
- Parameterisation of the Device sensor via IO-Link must not be blocked.
- At the Device sensor the switching output at pin 4 is configured to PNP and is in unswitched status.

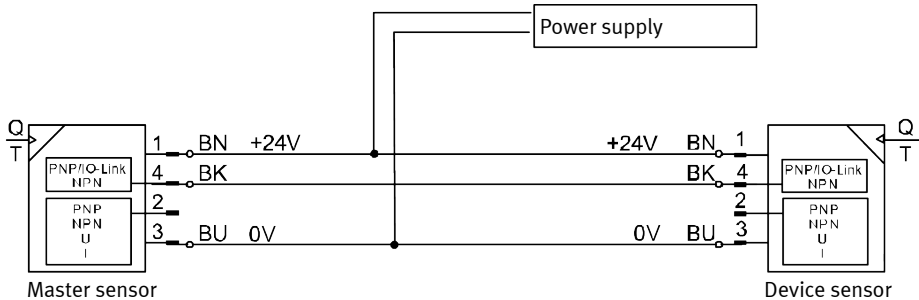


Fig. 10: Replicating parameters, using as an example SFAW-...PNLK-.../SFAW-...-PNVBA-...

1. Select the ‘Spec’ special menu at the Master sensor.
2. Press the [Edit] button repeatedly until ‘MASt’ appears.
3. Use the [A] or [B] key to select ‘ON’.
4. Press the [Edit] key.
  - ↳ ‘REPL’/‘RedY’ appears.

5. Press the [A] or [B] key.
  - ↵ 'REPL'/'RUN' appears briefly.
  - ↵ The parameters are transmitted to the Device sensor.
  - ↵ 'REPL'/'RedY' appears.
  - ↵ If an error occurs, an error message appears .
6. If another sensor is to be configured, repeat step 5.
7. Press the [Edit] key.
  - ↵ The RUN mode is displayed.

## 7.4 Teach-in switching points in TEACH mode

The switching points for flow monitoring can be established in the TEACH mode → 4.2.2.1 Switching functions.

---

### i

Before the teach-in set the switching function to EDIT mode → 7.3.2 Setting the switching characteristics of the switching outputs.

---

The procedure for teaching the OutA or OutD switching signal is in principle the same:

- OutA: press the [A] key.
- OutD: press the [B] key.

In the following, the procedure for the switching signal OutA is described.

Requirement: the sensor is ready for operation and is in RUN mode.

1. Generate the flow rate for TP1.
2. Press the [A] key and the [Edit] key.
  - ↵ With security code activated: [Lock] flashes.
3. Set the security code with the [A] or [B] key.
4. Press the [Edit] key.
  - ↵ 't-IN' flashes.
  - ↵ The measured value will then be applied as teach point (TP1).
5. Generate the flow rate for TP2.
6. Press the [A] key and the [Edit] key.
  - ↵ The measured value will then be applied as teach point (TP2).
  - ↵ The 'SP' switching point of the 'SP.Lo' and 'SP.Hi' switching points become valid.
  - ↵ The RUN mode is displayed.

## 7.5 Measure volume manually in RECORDER mode

Requirement: the sensor is ready for operation and is in RUN mode.

1. Press the [A] and [B] keys simultaneously.
  - ↵ The current status of the measurement is displayed.
2. To start or stop the measurement, press the [A] key.
3. To reset the measurement, press the [B] key.
4. To exit RECORDER mode, press the [A] and [B] key simultaneously.
  - ↵ The RUN mode is displayed.



If the RECORDER mode is exited during a volume measurement, the measurement will continue in the background.

If the operating voltage is switched off, the measurement is aborted without saving the value.

## 8 Operation

### 8.1 Reset parameters to factory setting



If the factory settings are restored, the current settings will be lost.

1. Switch off the operating voltage.
2. Press and hold the [A] and [B] keys.
3. Switch on the operating voltage.
4. In addition to the [A] and [B] keys, press the [Edit] key.
  - ↳ 'Rsto PARM' appears.
  - ↳ All parameters are reset to factory settings → Tab. 15 Adjustable values and factory setting.

## 9 Cleaning

1. Switch off the power sources.
2. If necessary, clean the outside of the sensor with media that are gentle on the material.

## 10 Fault clearance

Malfunction / display		Possible cause	Remedy
Main display	Sub-display		
Settings cannot be edited; 'Lock' appears.		Security code activated.	<ul style="list-style-type: none"> <li>– Enter the security code.</li> <li>– If the security code cannot be found, restore factory settings → 8.1 Reset parameters to factory setting.</li> </ul>
'Er01'	'FAIL'	Sensor fault.	– Replace sensor.
'Er02'	'ASIC'		
<Measured value>	'Er08'/'FLOW'	Instability in the flow rate.	– Ensure laminar flow rate.
'----'	'Er08'/'FLOW'	<ul style="list-style-type: none"> <li>– Instability in the flow rate.</li> <li>– Flow measuring range exceeded.</li> </ul>	<ul style="list-style-type: none"> <li>– Ensure laminar flow rate.</li> <li>– Maintain flow measuring range.</li> </ul>
<Measured value>/'OVER'	'Er10'/'FLOW'	Flow measuring range exceeded.	– Maintain flow measuring range.

Malfunction / display		Possible cause	Remedy
Main display	Sub-display		
⟨Measured value⟩/ ‘UNdR’	‘Er11’/‘tEMP’	Temperature measuring range of the operating medium undershot.	– Maintain temperature measurement range.
⟨Measured value⟩/‘OVER’	‘Er12’/‘tEMP’	Operating medium temperature measuring range exceeded.	– Maintain temperature measurement range.
⟨Measured value⟩	‘Er17’/‘SUPL’	Undervoltage.	– Apply permissible operating voltage.
⟨Measured value⟩	‘Er20’/‘tEMP’	Device temperature error.	– Check operating temperature and ambient temperature. – Check load conditions. – Check circuitry. – Replace sensor.
⟨Measured value⟩/‘Pin4’	‘Er21’/‘SHRt’	Short circuit at the switching output pin 4.	– Eliminate short circuit.
⟨Measured value⟩/‘Pin2’	‘Er22’/‘SHRt’	Short circuit at the switching output pin 2.	– Eliminate short circuit.
‘Err’/‘bUSY’	–	IO-Link operation: Pin 4 is actively switched in the device sensor.	– Check settings of the device sensor.
‘Err’/‘Id’	–	IO-Link operation: device ID error.	– When replicating, use sensors with the same parameters with the same device ID.
‘Err’/‘COMM’	–	IO-Link communication error.	– Check settings of the device sensor. – Check line at pin 4.

Tab. 16: Fault clearance

## 11 Removal

1. Switch off the power sources.
2. Disconnect connections from the sensor.
3. Loosen the mountings.

### i

If mounted into fixed piping, the sensor can be separated from the fluid connectors by removal of the clamps on the back → 5.4 Changing fluid connector.

## 12 Technical data

General	
Certification	RCM compliance mark, c UL us - Listed (OL)
Declaration of conformity	→ <a href="http://www.festo.com/sp">www.festo.com/sp</a>

Tab. 17: General

Input signal/measuring element		SFAW-32-...	SFAW-100-...
Measured variable		Flow rate, temperature	
Flow direction		unidirectional P1 → P2	
Measurement principle		Flow rate: vortex Temperature: PT1000	
Flow measuring range	[l/min]	1.8 ... 32	5.0 ... 100
Temperature measuring range	[°C]	0 ... 90	
Operating pressure	[MPa]	0 ... 1.2	
	[bar]	0 ... 12	
	[psi]	0 ... 174	
Information on operating pressure	[MPa]	max. 1.2 MPa at 40 °C max. 0.6 MPa at 90 °C	
	[bar]	max. 12 bar at 40 °C max. 6 bar at 90 °C	
	[psi]	max. 174 psi at 40 °C max. 87 psi at 90 °C	
Operating medium		Liquid media, neutral liquids, water	
Information on the operating medium		Media with a kinematic viscosity ≤ 1.8 mm <sup>2</sup> /s [cSt]	
Temperature of medium	[°C]	0 ... 90	
Ambient temperature	[°C]	0 ... 50	
Nominal temperature	[°C]	23	

Tab. 18: Input signal/measuring element

Output, general		
Accuracy of zero point Flow rate ≤ 50% FS	[% FS]	± 2
Accuracy of spread Flow rate ≥ 50% FS	[% FS]	± 3

<b>Output, general</b>		
Repetition accuracy of zero point Flow rate ≤ 50% FS	[% FS]	± 0.5
Repetition accuracy of spread Flow rate ≥ 50% FS	[% FS]	± 1
Accuracy of temperature	[°C]	± 2
Temperature coefficient of spread	[% FS/K]	typ. ± 0.05

Tab. 19: Output, general

<b>Switching output</b>		
Switching output		2 x PNP or 2 x NPN, switchable
Switching function		Threshold value comparator or window comparator, freely programmable
Switching element function		N/C contact or N/O contact, switchable
Switch-on time	[ms]	400 at filter time constant 150 ms
Switch-off time	[ms]	300 at filter time constant 150 ms
Max. output current	[mA]	100
Voltage drop	[V]	≤ 1.5
Pull-down/pull-up resistor		PNP: integrated NPN: not integrated
Inductive protective circuit		Available

Tab. 20: Switching output

<b>Analogue output</b>		<b>SFAW-32-...</b>	<b>SFAW-100-...</b>
Characteristic flow rate curve	[l/min]	0 ... 32	0 ... 100
Characteristic temperature curve	[°C]	0 ... 100	
Current output characteristic curve	[mA]	4 ... 20	
Voltage output characteristic curve	[V]	0 ... 10 or 1 ... 5, adjustable	
Rise time	[ms]	900 at filter time constant 150 ms	
Max. load resistance of current output	[Ω]	500	
Min. load resistance at voltage output	[kΩ]	15	

Tab. 21: Analogue output

<b>Output, additional data</b>	
Short circuit current rating	Yes
Overload protection	Available

Tab. 22: Output, additional data

<b>Electronics</b>	
Operating voltage range DC	[V] 18 ... 30
Reverse polarity protection	For all electrical connections

Tab. 23: Electronics

<b>Electromechanics</b>	
Electrical connection	Straight plug, M12x1, 5-pin
Max. connecting cable length	[m] 30, for IO-Link operation 20

Tab. 24: Electromechanics

<b>Mechanics</b>	
Mounting position	any
Housing material	Reinforced polyamide
Materials in contact with the media	ETFE, PA6T/6I reinforced, EPDM, stainless steel
Keypad material	TPE-O
Plug housing material	Brass, nickel-plated

Tab. 25: Mechanics

<b>Display/operation</b>	
Display type	Illuminated LCD, blue
Displayable units	l/min, l/h, US gal/min, cfm, l, m <sup>3</sup> , US gal, cft, °C, °F
Threshold value setting range	[l] 0.1 ... 1999.9
Volume pulse	[m <sup>3</sup> ] 0.01 ... 199.99
	[cft] 0.01 ... 199.99
	[US gal] 1 ... 19999
Hysteresis setting range	[% FS] 0 ... 90

Tab. 26: Display/operation



## Technical data

Immission/Emission		
Storage temperature	[°C]	–20 ... 80
Degree of protection		IP65
Protection class		III

Tab. 27: Immission/Emission

IO-Link®	SFAW-...-T-...	SFAW without Temperature measurement
Protocol version	Device V1.1	
Profile	Smart Sensor Profile	
Function classes	Binary data channel (BDC) Process data variable (PDV) Identification Diagnostics Teach channel	
Communication mode	COM2, 38.4 kbaud	
Port class	A	
Process data length IN	5 bytes	3 bytes
Process data content IN	Flow monitoring: 2 bit BDC Volume monitoring: 1 bit BDC Temperature monitoring: 1 bit BDC Measured flow rate value: 14 bit PDV Measured temperature value: 14 bit PDV	
Service data IN	Measured volume value: 32 bit PDV	
IODD, IO-Link device description	→ <a href="http://www.festo.com">www.festo.com</a>	

Tab. 28: IO-Link®

## 12.1 Technical data of UL/CSA certification

Electrical data and ambient conditions for UL/CSA	
Maximum input voltage	30 V DC, Class 2
Maximum input current	0.26 A
Maximum power	8 W
Maximum operating pressure	12 bar
Maximum Ambient Temperature	50 °C/122 °F
Pollution degree	2

Electrical data and ambient conditions for UL/CSA	
Permissible humidity	93%
Installation site	for indoor use only
Maximum installation height	2000 m

Tab. 29: Electrical data and ambient conditions for UL/CSA

## 12.2 Hole patterns and dimensional drawings

### 12.2.1 Hole pattern for direct mounting

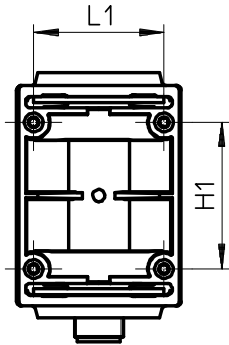


Fig. 11: Hole pattern for direct mounting

Hole pattern for direct mounting		
L1	[mm]	32
H1	[mm]	36

Tab. 30: Hole pattern for direct mounting

### 12.2.2 Hole pattern for wall mounting

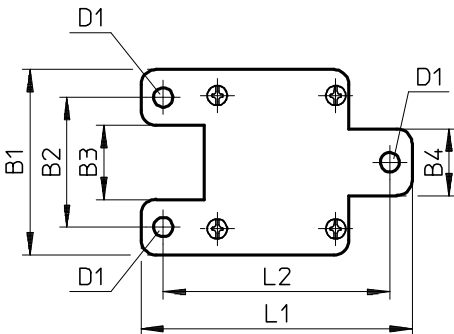


Fig. 12: Hole pattern for wall mounting

<b>Hole pattern for wall mounting</b>		
B1	[mm]	50
B2	[mm]	35
B3	[mm]	20
B4	[mm]	18
L1	[mm]	73.2
L2	[mm]	61.2
D1	[mm]	∅ 5.2

Tab. 31: Hole pattern for wall mounting

**12.2.3 Dimensional drawing of customer-specific fluid connections**

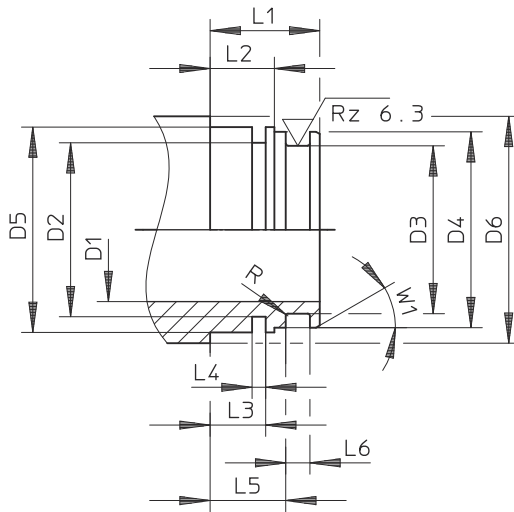


Fig. 13: Dimensional drawing of customer-specific fluid connections

<b>Dimensional drawing of customer-specific fluid connections</b>		
L1	[mm]	14.5 ±0.05
L2	[mm]	8.5 ±0.05
L3	[mm]	7.35 ±0.03
L4	[mm]	1.8 +0.1
L5	[mm]	10 ±0.05
L6	[mm]	3.2 +0.1

<b>Dimensional drawing of customer-specific fluid connections</b>		
D1	[mm]	SFAW-32-...: 11 ±0.1 SFAW-100-...:19 ±0.1
D2	[mm]	∅23 ±0.1
D3	[mm]	∅22.2 ±0.05
D4	[mm]	∅25.9 -0.05
D5	[mm]	∅27.15 <sup>f8</sup>
D6	[mm]	∅30 -0.5
R	[mm]	0.3
W1	[°]	30

Tab. 32: Dimensional drawing of customer-specific fluid connections



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