# Flow sensors SFAW

# Key features

## General

The SFAW is intended to measure and monitor the flow, volume and temperature of liquid media in piping systems or in terminals in industry. 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 the media. Connection to higher-level systems is provided by 2 switching outputs, an analogue output and/or an IO-Link interface, depending on the type. The outputs can be configured as appropriate to the application.

The switching outputs can be configured to monitor a threshold value or a range. Either PNP or NPN and either normally open (NO) or normally closed (NC) can be set for the outputs. Process values can be read out and parameters changed and transmitted to additional devices via the IO-Link interface.

## Application

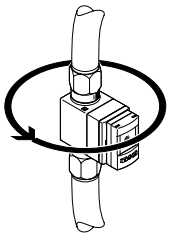
- Cooling circuit monitoring
- Monitoring for leaks and line breaks
- Process water monitoring
- Filling volume monitoring

## Overview

An installation concept with short mounting and dismounting times that is easy to implement in all installation situations.

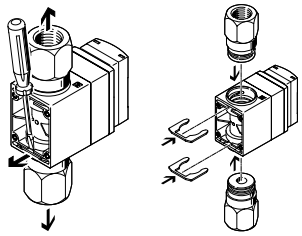
### Mounting

The sensor can be rotated through 360° in the direction of flow, so that once it has been installed it can be aligned without the need for tools.



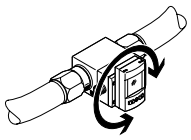
### Dismounting

After the screwed-in locking plate (not shown) has been disconnected, it can be removed. The sensor can then be exchanged quickly by undoing the clamps on the sensor body and removing them. The fluid connections can then be detached from the sensor body.



### Display

A large, illuminated LCD display increases the operational safety and makes the displayed values for flow rate or medium temperature and the accumulated volume easy to read. The rotatable display ensures ease of readability and usability when mounted either horizontally or vertically.



### Change in colour

Depending on the switching status
(e.g. a flow threshold has not been achieved or media temperature exceeded) a change in colour to red can be set in the display for the switching outputs. As a result, it is possible to reliably identify the system status from a large distance or in inaccessible areas.

### Media connections

- Free choice of various media connections:
  – Threaded connection (female thread) (G, R)
- Free choice of media connection type on sensor input and sensor output side
- Basic sensor body and media connections can be obtained separately
- Ultra-simple and fast mounting of media connections using clamps
- Option of designing dedicated, application-specific connections

### Electronics

Maximum flexibility and reduced warehousing thanks to switchable electrical outputs:

- PNP/NPN
- NC/NO contact function
- Current output 4 ... 20 mA
  or voltage output
  1 ... 5 V, 0 ... 10 V

### Sensor signal monitoring

Flow signal monitoring to detect unstable flows. Possible causes for unstable flows include:

- Air in the line
- Line filling during start-up
- Turbulent flows as a result of unfavourable or incorrect installation

# Key features

**Operation**

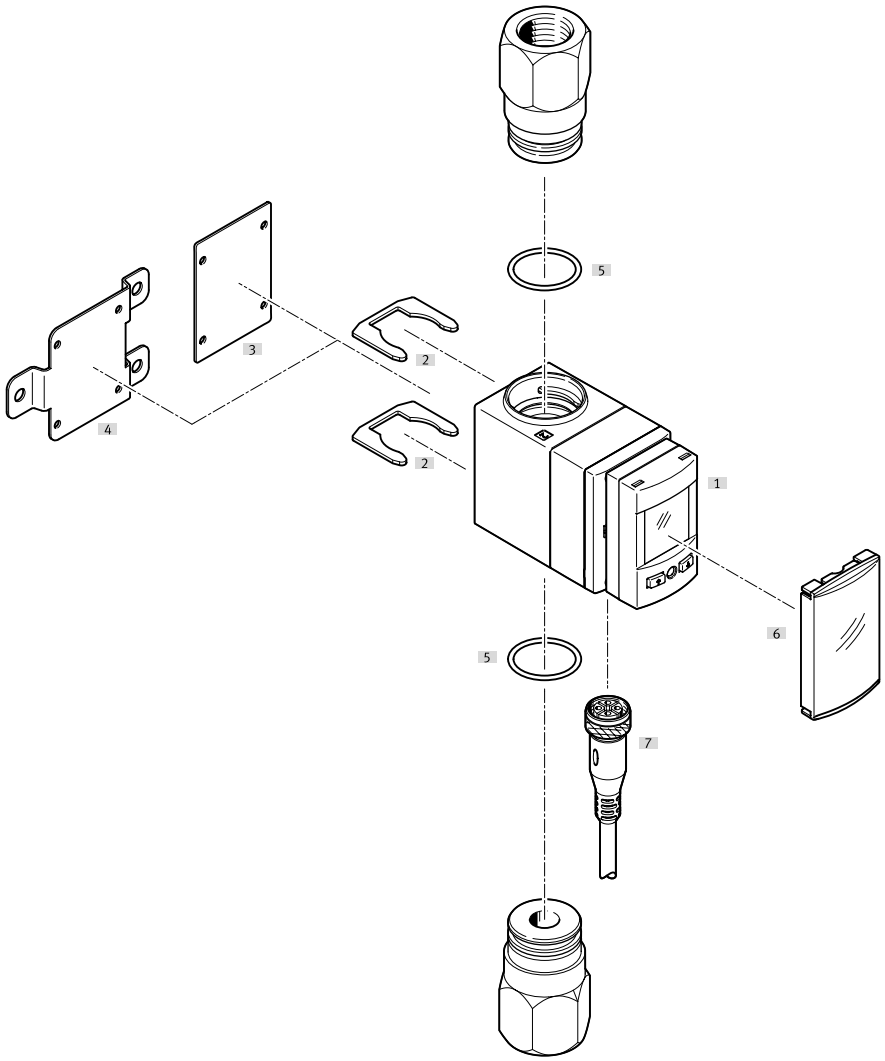
Monitoring and setting a flow threshold, a flow range, a temperature threshold and a temperature range using a teach-in function or by entering values.

- Flow indication, medium temperature indication, switching outputs and analogue value output for flow rates and temperature can be set on site in one device
- Fast commissioning of the flow sensor thanks to intuitive menu navigation
- Display colour red/blue as visual feedback that the flow rate or temperature thresholds are not met or have been exceeded
- Min./max. value memory for monitoring the flow and temperature (storage of flow and temperature peaks)
- To prevent undesirable switching status changes – an integrated adjustable filter damps the sensor signal generated by flow peaks
- Scaling the analogue output to increase the signal dynamics
- Switchable flow and volume units l/min, l/h, US gal/min, cfm, l, $m^3$, US gal, cft
- Switchable temperature units °C, °F
- ECO function with option to switch off the display
- Optional security code can be freely chosen (4-digit code)
- All settings that have been carried out on one sensor (master) can be transferred (replication) to other, identical sensors (device). This significantly shortens the commissioning time.
- Recorder mode for manual volume measurements with start, stop and reset functionality
- Adjustable volume pulse

**IO-Link**

- Serial communication integrated using IO-Link 1.1
- Analogue process values are provided digitally
- The sensor can be parameterised and maintained remotely at control level using an IO-Link master
- Automatic parameterisation following a sensor change means there is no need to repeat parameterisation and sensor settings after changing the sensor

# Peripherals overview




**Mounting components and accessories**

| | | Description | → Page |
|---|---|---|---|
| [1] | Flow sensor<br>SFAW | For measuring and monitoring flow rate, volume and temperature of liquid media | 6 |
| [2] | Clamp<br>SAMH-FW-SB | For mounting the fluid connections on the body of the flow sensors | 13 |
| [3] | Locking plate<br>SFAW | For securing the clamps (locking plate is screwed to the sensor body) | – |
| [4] | Wall mounting<br>SAMH-FW-W | For wall or surface mounting of the flow sensor | 12 |
| [5] | Seal<br>SASF-FW-S-E | For sealing the fluid connections against the body of the flow sensors | 12 |
| [6] | Safety guard<br>SACC-PU-G | For covering the display and operating components | 13 |
| [7] | Connecting cable<br>NEBU | – | 14 |

# Type codes

| 001 | Series | |
|---|---|---|
| **SFAW** | Flow sensor | |

| 002 | Flow measuring range | |
|---|---|---|
| **32** | Max. 32 l/min | |
| **100** | Max. 100 l/min | |

| 003 | Additional measured variable | |
|---|---|---|
| | None | |
| **T** | Temperature | |

| 004 | Connection type, input | |
|---|---|---|
| **T** | Female thread | |
| **X** | Connection provided by the user | |

| 005 | Connection size, input | |
|---|---|---|
| | Standard | |
| **G1** | G1 | |
| **G12** | G1/2 | |
| **G34** | G3/4 | |
| **N12** | 1/2 NPT | |
| **R12** | R1/2 | |
| **R34** | R3/4 | |

| 006 | Connection type, output | |
|---|---|---|
| **E** | As input | |
| **T** | Female thread | |
| **X** | Connection provided by the user | |

| 007 | Connection size, output | |
|---|---|---|
| | Standard | |
| **G1** | G1 | |
| **G12** | G1/2 | |
| **G34** | G3/4 | |
| **N12** | 1/2 NPT | |
| **R12** | R1/2 | |
| **R34** | R3/4 | |

| 008 | Type of mounting | |
|---|---|---|
| | None | |
| **W** | Wall mounting | |

| 009 | Electrical output 1 | |
|---|---|---|
| **PNLK** | PNP/NPN/IO-Link | |

| 010 | Electrical output 2 | |
|---|---|---|
| **PN** | PNP or NPN | |
| **PNVBA** | PNP or NPN or 0 ... 10 V or 1 ... 5 V or 4 ... 20 mA | |

| 011 | Electrical output 3 | |
|---|---|---|
| | None | |
| **VBA** | 0 ... 10 V or 1 ... 5 V or 4 ... 20 mA | |

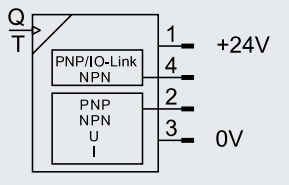
| 012 | Electrical connection | |
|---|---|---|
| **M12** | Plug M12, A-coded | |

| 013 | Electrical accessories | |
|---|---|---|
| | None | |
| **2.5S** | Straight socket, cable 2.5 m | |
| **5S** | Straight socket, cable 5 m | |

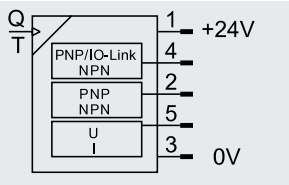
| 014 | Protective devices | |
|---|---|---|
| | None | |
| **G** | Protective hood | |

# Data sheet

Function
SFAW-...-PNLK-PNVBA




SFAW-...-PNLK-PN-VBA




- Maximum flexibility and reduced warehousing thanks to switchable electrical outputs:
  – PNP/NPN, switchable
  – N/C or N/O contact, switchable
  – Current output 4 ... 20 mA or voltage output
    1 ... 5 V, 0 ... 10 V, switchable
- Pulse output for volume measurement can be freely selected
- Measuring signal filter for setting the rise time
- Additional filter for smoothing the display values

| **General technical data** | |
|---|---|
| Certification | RCM |
| | c UL us listed (OL) |
| CE marking (see declaration of conformity)[1] | To EU EMC Directive |
| | To EU RoHS Directive |
| UKCA marking (see declaration of conformity)[1] | To UK instructions for EMC |
| | To UK RoHS instructions |
| Note on materials | RoHS-compliant |

1) For information about the area of use, see the declaration of conformity at: www.festo.com/catalogue/... ➔ Support/Downloads.
If the devices are subject to usage restrictions in residential, commercial or light-industrial environments, further measures for the reduction of the emitted interference may be necessary.

| **Input signal, measuring element** | | | |
|---|---|---|---|
| | | -32 | -100 |
| Measured variable | | Flow, temperature | |
| Flow direction | | Unidirectional P1 → P2 | |
| Measurement method: flow | | Vortex | |
| Measurement method: temperature | | PT1000 | |
| Flow measuring range | [l/min] | 1.8 ... 32 | 5 ... 100 |
| Temperature measuring range | [°C] | 0 ... 90 | |
| Operating pressure | [bar] | 0 ... 12 | |
| | [MPa] | 0 ... 1,2 | |
| | [psi] | 0 ... 174 | |
| Note on operating pressure | | Max. 1.2 MPa (12 bar / 174 psi) at 40°C | |
| Max. overload pressure | [bar] | 40 | |
| | [MPa] | 4 | |
| | [psi] | 580 | |
| Operating medium[1] | | Liquid media, neutral liquids, water | |
| Note on the operating/pilot medium | | Compatibility of the media with the substances in contact with the media must be ensured | |
| Temperature of medium | [°C] | 0 ... 90 | |
| Ambient temperature | [°C] | 0 ... 50 | |
| Nominal temperature | [°C] | 23 | |

1) Media with a kinematic viscosity ≤ 1.8 mm²/sec. [cSt]. Compatibility of the media with the substances in contact with the media must be ensured.

# Data sheet

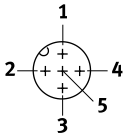
| Electrical data | | | |
|---|---|---|---|
| | | -32 | -100 |
| **General output** | | | |
| Accuracy of zero point<br>Flow ≤ 50% FS[1)] | [% FS] | ±2 | |
| Accuracy of margin<br>Flow ≥ 50% FS[1)] | [% FS] | ±3 | |
| Repetition accuracy of zero point<br>Flow ≤ 50% FS[2)] | [% FS] | ±0.5 | |
| Repetition accuracy of spread<br>Flow ≥ 50% FS[2)] | [% FS] | ±1 | |
| Accuracy of temperature | [°C] | ±2 | |
| Temperature coefficient of margin | [% FS] | Typ. ±0.05% FS/K | |
| **Switching output** | | | |
| Switching output | | 2 x PNP or 2 x NPN or IO-Link, 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 with filter time constant 150 ms (adjustable) | |
| Switch-off time | [ms] | 300 with filter time constant 150 ms (adjustable) | |
| Max. output current | [mA] | 100 | |
| Voltage drop | [V] | Max. 1.5 | |
| Pull-down / pull-up resistor | | PNP: integrated; NPN: not integrated | |
| Inductive protective circuit | | Available | |
| **Analogue output** | | | |
| Characteristic flow rate curve | [l/min] | 0 ... 32 | 0 ... 100 |
| Characteristic curve for temperature | [°C] | 0 ... 100 | |
| Output characteristic curve for current | [mA] | 4 ... 20 | |
| Output characteristic curve for voltage | [V] | 0 ... 10 or 1 ... 5, adjustable | |
| Rise time | [ms] | 900 with filter time constant 150 ms (adjustable) | |
| Max. load resistance at current output | [ohm] | 500 | |
| Min. load resistance of voltage output | [kOhm] | 15 | |
| **Output, additional data** | | | |
| Short circuit current rating | | Yes | |
| Overload protection | | Available | |
| **Electronics** | | | |
| Operating voltage range DC | [v] | 18 ... 30 | |
| Max. current consumption | [mA] | 260 | |
| Reverse polarity protection | | For all electrical connections | |
| **Electromechanical systems** | | | |
| Electrical connection | | | |
| Function | | Analogue output | |
| | | IO-Link | |
| | | Switching output | |
| | | Power supply | |
| Connection type | | Plug | |
| Connection technology | | M12x1, codificación A según EN 61076-2-101 | |
| Number of pins/wires | | 5 | |
| Type of mounting | | Screw-type lock | |
| Max. cable length | [m] | 30, for IO-Link operation 20 | |

1) Accuracy of flow rate value = ± 2% FS for flow rate ≤ 50% FS and ± 3% of measured value for flow rate ≥ 50% FS

2) Repetition accuracy of flow rate = < ± 0.5% FS for flow rate ≤ 50% FS < ± 1% of measured value for flow rate ≥ 50% FS

# Data sheet

**Pin allocation**

| | Pin | Meaning |
|---|---|---|
| Plug M12x1, 5-pin | | |
|  | 1 | Operating voltage +24 V DC |
| | 2 | Switching output OutB or OutD or analogue output |
| | 3 | 0 V |
| | 4 | Switching output OutA or OutC or IO-Link (C/Q line) |
| | 5 | Analogue output or not assigned |

**Mechanics**

| | -32 | -100 |
|---|---|---|
| Type of mounting | Wall bracket | |
| Mounting position | Any | |
| Materials in contact with the media | ETFE, PA6T/6I reinforced, EPDM (perox.), stainless steel | |
| Information on materials | | |
| Housing | Reinforced PA | |
| Wall bracket | Stainless steel | |
| Safety guard | PA | |
| Keypad | TPE-O | |
| Inspection window | PA | |
| Sealing ring | EPDM | |

**Display/operation**

| | | -32 | -100 |
|---|---|---|---|
| Display type | | Illuminated LCD, blue | |
| Displayable units | | l/min, l/h, ft³/min, US gal/min, l, m³, ft³, US gal, °C, °F | |
| Switching status indication | | Visual | |
| Setting options | | Teach-in, IO-Link, via display and keys | |
| Tamper-proof | | Electronic locking | |
| Setting range for threshold value | [l] | 0.1 ... 1999.9 | |
| Volume pulse | [m³] | 0.01 ... 199.99 | |
| | [ft³] | 0.01 ... 199.9 | |
| | [US gal] | 1 ... 19999 | |
| Adjustable hysteresis | [% FS] | 0 ... 90 | |

**Immissions/emissions**

| | | -32 | -100 |
|---|---|---|---|
| Storage temperature | [°C] | –20 ... +80 | |
| Degree of protection | | IP65 | |
| Protection class | | III | |
| Shock resistance | | Shock test SG2 to FN/EN | |
| Vibration resistance | | EN60068-2-6/2-200Hz/0.7 mm | |
| Corrosion resistance class CRC[1)] | | 3 | |
| PWIS conformity | | VDMA24364-B2-L | |

1) Corrosion resistance class CRC 3 to Festo standard FN 940070
High corrosion stress. Outdoor exposure under moderate corrosive conditions. Externally visible parts with primarily functional surface requirements which are in direct contact with a normal industrial environment.

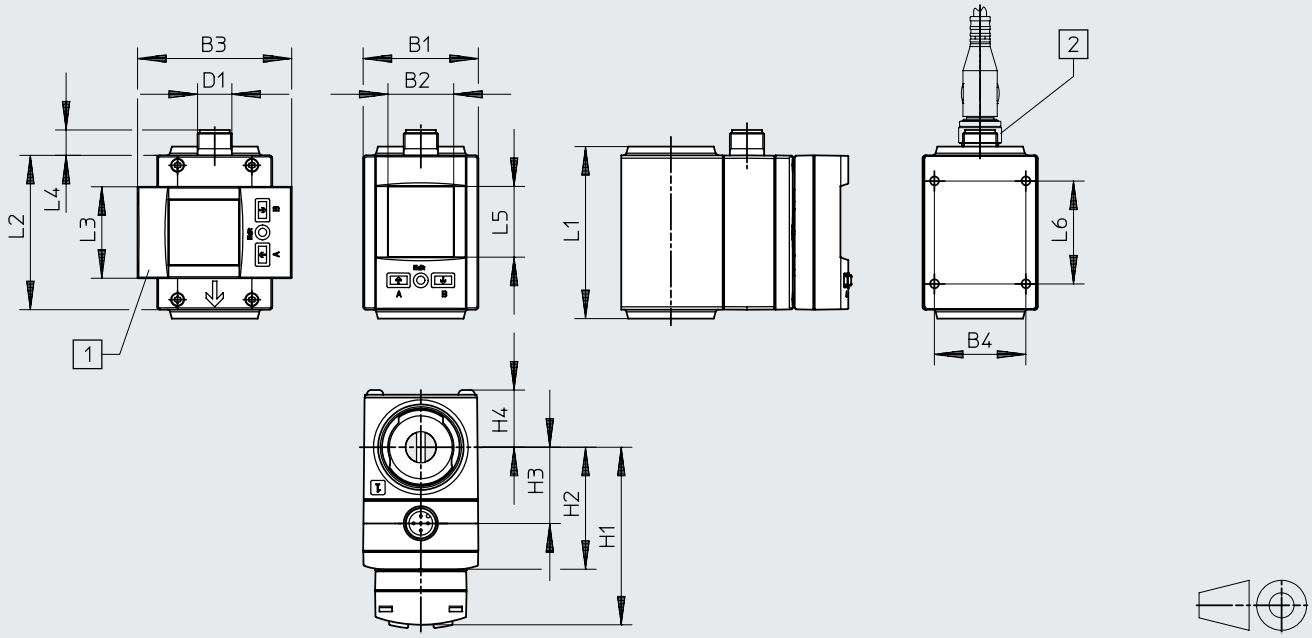
# Data sheet

| **IO-Link** | SFAW-...T- | SFAW-...- |
|---|---|---|
| Protocol | IO-Link | |
| Protocol version | Device V 1.1 | |
| Profile | Smart sensor profile | |
| Function classes | Binary data channel (BDC) | |
| | Process data variable (PDV) | |
| | Identification | |
| | Diagnostics | |
| | Teach channel | |
| Communication mode | COM2 (38.4 kBd) | |
| SIO mode support | Yes | |
| Port class | A | |
| Process data width OUT | 0 bytes | |
| Process data width IN | 5 bytes | 3 bytes |
| Process data content IN | 1 bit BDC (temperature monitoring) | – |
| | 14 bit PDV (measured temperature value) | – |
| | 14 bit PDV (measured flow value) | |
| | 2 bit BDC (flow monitoring) | |
| | 1 bit BDC (volume monitoring) | |
| IO-Link, service data contents IN | 32 bit PDV (measured volume value) | |
| IO-Link, minimum cycle time | 5 ms | |
| IO-Link, data memory required | 0.5 KB | |

# Data sheet

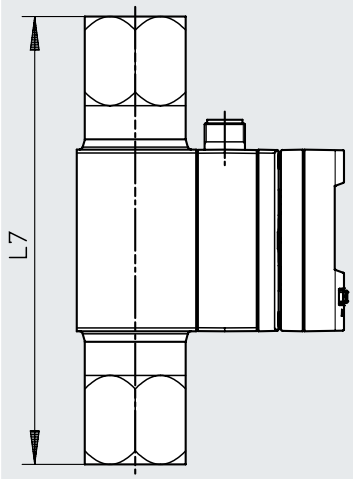
**Dimensions** Download CAD data ➔ www.festo.com

SFAW-...-PNLK-PNVBA-M12




[1] Rotatable display
90° anticlockwise
180° clockwise
[2] Connection for connecting cable, straight

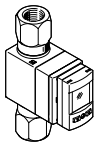
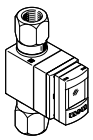
SFAW-...-T-...




| Type | B1 | B2 | B3 | B4 | D1 | H1 | H2 | H3 | H4 | L1 | L2 | L3 | L4 | L5 | L6 | L7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFAW-32...-X-E-PNLK-PNVBA-M12 | 40.3 | 23 | 54 | 32 | M12x1 | 62.2 | 42.7 | 26.7 | 20 | 60.2 | 54 | 32 | 8.9 | 24.8 | 36 | – |
| SFAW-32...-T-E-PNLK-PNVBA-M12 | | | | | | | | | | | | | | | | 133.2 |
| SFAW-100...-X-E-PNLK-PNVBA-M12 | | | | | | 66.2 | 46.7 | 30.7 | | | | | | | | – |
| SFAW-100...-T-E-PNLK-PNVBA-M12 | | | | | | | | | | | | | | | | 133.2 |

# Data sheet

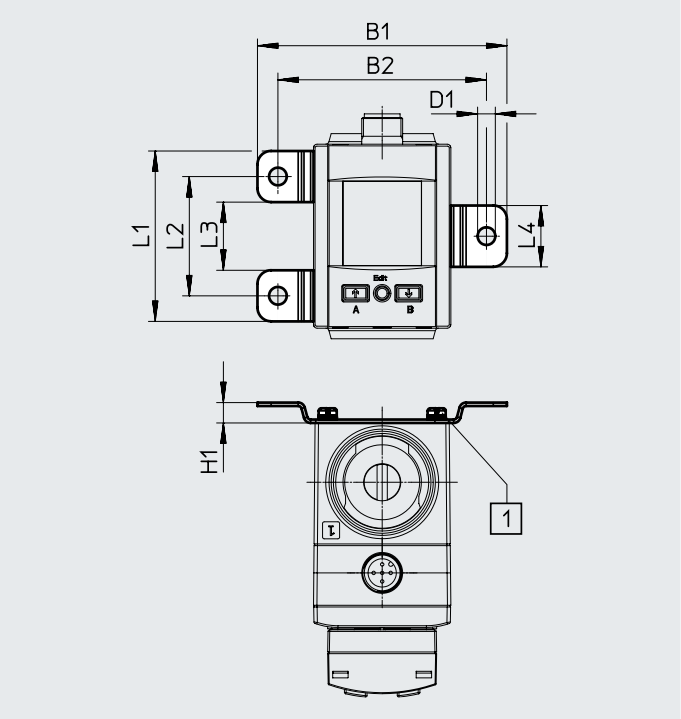
**Ordering data**

| Design | Flow measuring range [l/min] | Measured variable | Fluid connector | Product weight [g] | Part no. | Type |
|---|---|---|---|---|---|---|
|  | 32 | Without temperature measurement | Female thread G1/2 | 400 | **8036871** | **SFAW-32-TG12-E-PNLK-PNVBA-M12** |
| | | | Female thread G3/4 | 530 | **8036873** | **SFAW-32-TG34-E-PNLK-PNVBA-M12** |
| | | | Connection by the user | 140 | **8036887** | **SFAW-32-X-E-PNLK-PNVBA-M12** |
| | | With temperature measurement | Female thread G1/2 | 400 | **8036872** | **SFAW-32T-TG12-E-PNLK-PNVBA-M12** |
| | | | Female thread G3/4 | 530 | **8036874** | **SFAW-32T-TG34-E-PNLK-PNVBA-M12** |
| | | | Connection by the user | 140 | **8036888** | **SFAW-32T-X-E-PNLK-PNVBA-M12** |
|  | 100 | Without temperature measurement | Female thread G1 | 400 | **8036877** | **SFAW-100-TG1-E-PNLK-PNVBA-M12** |
| | | | Female thread G3/4 | 530 | **8036875** | **SFAW-100-TG34-E-PNLK-PNVBA-M12** |
| | | | Connection by the user | 140 | **8036889** | **SFAW-100-X-E-PNLK-PNVBA-M12** |
| | | With temperature measurement | Female thread G1 | 400 | **8036878** | **SFAW-100T-TG1-E-PNLK-PNVBA-M12** |
| | | | Female thread G3/4 | 530 | **8036876** | **SFAW-100T-TG34-E-PNLK-PNVBA-M12** |
| | | | Connection by the user | 140 | **8036890** | **SFAW-100T-X-E-PNLK-PNVBA-M12** |

# Accessories

**Wall mounting SAMH-FW-W**
For wall or surface mounting

Material:
Stainless steel



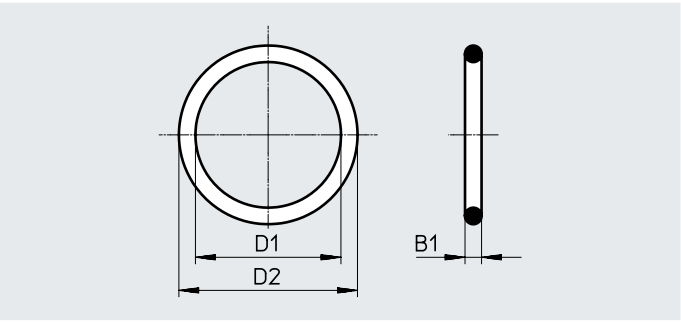

**Dimensions**

| Type | B1 | B2 | D1<br>ø | H1 | L1 | L2 | L3 | L4 |
|---|---|---|---|---|---|---|---|---|
| SAMH-FW-W | 73.2 | 61.2 | 5.2 | 6 | 50 | 35 | 20 | 18 |

**Ordering data**

| | Part no. | Type |
|---|---|---|
| Wall mounting | **8036909** | **SAMH-FW-W** |

**Seal SASF-FW-S-E**
For sealing the fluid connections
against the body of the flow sensors




**Dimensions**

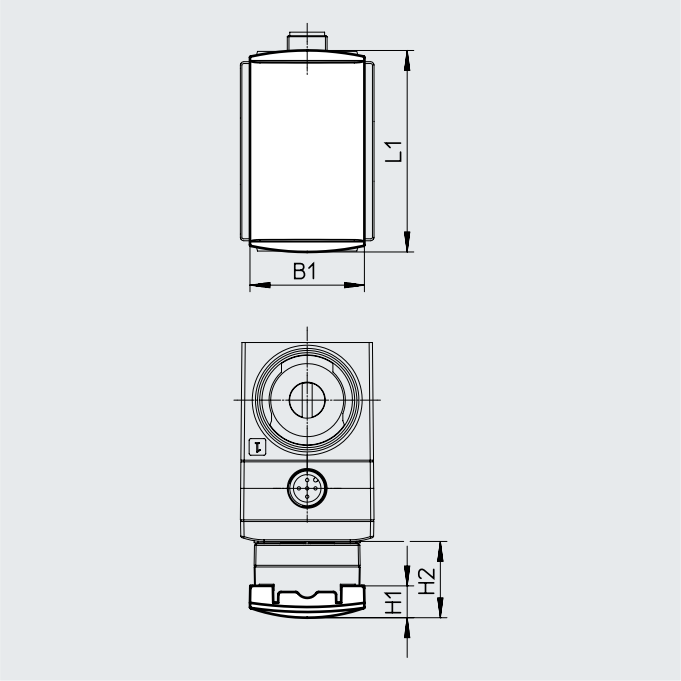
| Type | B1 | D1<br>ø | D2<br>ø |
|---|---|---|---|
| SASF-FW-S-E | 2.5 | 22 | 27 |

**Ordering data**

| | Part no. | Type |
|---|---|---|
| Seal | **8036907** | **SASF-FW-S-E** |

# Accessories

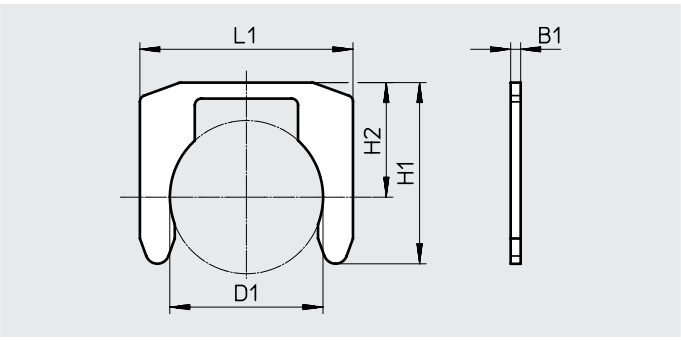
**Safety guard SACC-PU-G**
For covering the display and operating components




| Dimensions | | | | |
|---|---|---|---|---|
| Type | B1 | L1 | H1 | H2 |
| SACC-PU-G | 34.5 | 60.8 | 9.6 | 23 |

| Ordering data | | |
|---|---|---|
| | Part no. | Type |
| Safety guard | **8003353** | **SACC-PU-G** |

**Clamp SAMH-FW-SB**
For mounting the fluid connections on the body of the flow sensors



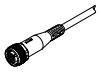
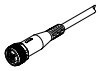

| Dimensions | | | | | |
|---|---|---|---|---|---|
| Type | B1 | D1<br>ø | H1 | H2 | L1 |
| SAMH-FW-SB | 1.5 | 23 | 27.2 | 17.2 | 32 |

| Ordering data | | |
|---|---|---|
| | Part no. | Type |
| Clamp | **8036908** | **SAMH-FW-SB** |

# Accessories

**Ordering data – Connecting cables**

Data sheets → Internet: nebu

| | Number of wires | Cable length [m] | Part no. | Type |
|---|---|---|---|---|
| **M12x1, straight socket** | | | | |
|  | 4 | 2.5 | **550326** | **NEBU-M12G5-K-2.5-LE4** |
| | | 5 | **541328** | **NEBU-M12G5-K-5-LE4** |
| **M12x1, straight socket** | | | | |
|  | 5 | 2.5 | **541330** | **NEBU-M12G5-K-2.5-LE5** |
| | | 5 | **541331** | **NEBU-M12G5-K-5-LE5** |