Flow sensors

Flow sensors

Key features

Flow rate measurement

Flow rate

The flow rate is the quantity of a flowing medium per unit of time t, measured in volumetric units (QV = V/t) or in mass units (QM = m/t).

Application examples

Various measured variables can be used for measurement. Flow meters are widely used in the industrial sector.

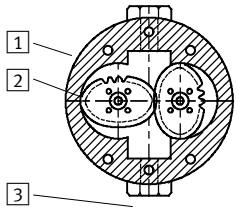
Typical applications include:

- Monitoring of coolant and lubricant circuits. Water-cooled spot welding guns must be continuously monitored, for example. If the cooling system remains off, this can lead to unclean welded joints and, in extreme cases, to the tip breaking off the welding gun. The water flow rate is therefore monitored with a pressure sensor and flow rate sensor in the coolant advance and return.
- Monitoring and measuring of delivery rates in pipe systems such as water distribution systems (protection against dry running for pumps), discharge monitoring, leakage detection, press hydraulics and vacuum units in the wood working industry, for example.
- Monitoring of ventilation systems, ventilators, filter technology and blowers in air conditioning and ventilation technology.
- Measurement of filling quantities and control of flow rates in process engineering and in industries that use liquids and gases.

Method of measurement

So how is the flow rate determined? There are more than 30 different methods. These include methods that use ultrasonics, magneto-inductive and thermal methods, methods that use the Coriolis effect and, last but not least, many designs using turbine or impeller wheels, which are driven by the flow.

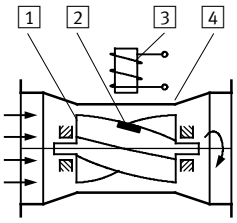
Volumetric flow meters



1 Housing
2 Oval wheel (stainless steel or plastic)
3 Connection

Direct volumetric meters

In this case, "portions" of the medium are typically measured and added, e.g. by means of rotating measuring cells and rotary pistons.

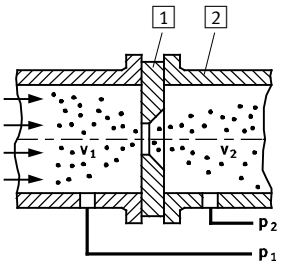


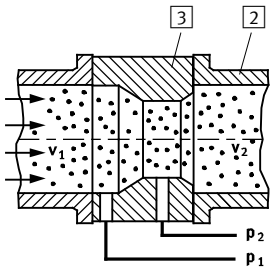
1 Turbine wheel
2 Permanent magnet
3 Coil
4 Measuring tube

Indirect volumetric meters

Indirect volumetric meters include those meters with which an impeller wheel is set in motion by the flow. The number of rotations is thus an initial approximation for the flow volume. The rotational frequency is measured magnetically. The result is then multiplied by the delivery chamber volume to produce the volumetric flow rate.

Differential pressure method





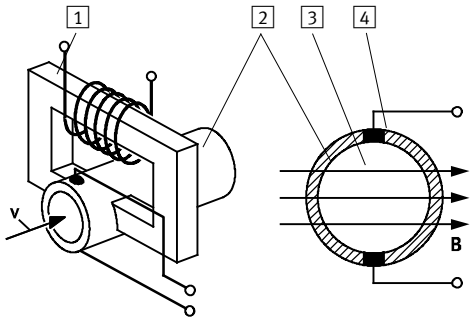
1 Standard orifice
2 Tube
3 Venturi nozzle

The differential pressure measurement principle uses the fluid-mechanical changes in the medium that result from a speed increase through a localised narrowing of the flow cross section. Orifices of different designs are used for narrowing purposes. Information about the flow rate is obtained by evaluating the difference between pressures p1 and p2 measured before and after the orifice. This method is particularly suited to large flow rates in liquids and gases, as well as higher pressures, higher temperatures and aggressive media. For small flow rates, however, calorimetric measurement methods are more suitable. Almost 60% of orifice systems are used in industrial applications.

Flow sensors

Key features

Magneto-inductive flow measurement

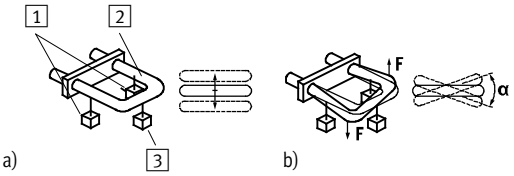


1 Solenoid
2 Insulated lined tube
3 Flowing measured material
4 Electrode

B Magnetic induction
v Flow rate

The effect of force on moving electrical charges Q in a magnetic field is used to measure the flow rate.
A magnetic flux density B is generated by an externally fitted magnet. The required charges Q are present in liquids in the form of ions due to dissociation (disintegration of molecules). The resulting electrical voltage is tapped by two diametrically opposed electrodes. The material to be measured flows through an insulated lined tube piece. and a measuring transducer separates the required signal from the much larger noise signals. The voltage is proportional to the mean flow velocity.
To keep measurement error to a minimum, a stabilising zone of 3 to 5 times the tube diameter is used. The same applies following major cross section changes or elbows. This reference value for the length of the stabilising zone applies to most flow sensors, since a usable and repeatable signal is only produced by measurement in a stabilised (laminar) flow.

Flow measurement according to the Coriolis principle



a) Medium does not flow
b) Medium flows

1 Converter to verify torsion
2 Tube
3 Excitation converter

The Coriolis flow meter has been around for over 50 years, but has only gained popularity in recent years. It uses the Coriolis force, which is produced when a mass flows through a U-shaped tube.
An electromagnetic converter, for example, causes the tube to vibrate, so that when there is no mass flow, the vibration mode is retained. When the medium flows, Coriolis forces are generated, which cause torsional vibration of the elbow. This is measured using sensitive converters. The measured angle is directly proportional to the mass flow. There is thus no conversion of volume to mass and the mass flow is obtained directly in kg/h.
The method is ideally suited to the metering of very small to medium amounts with measurement accuracies of approximately 0.5%.
Measuring devices based on the Coriolis force are expensive, but can also be used for extremely small quantities, short-term metering, pulsed flow, high and low temperatures, tubes that are not completely filled and high pressures.

Flow sensors

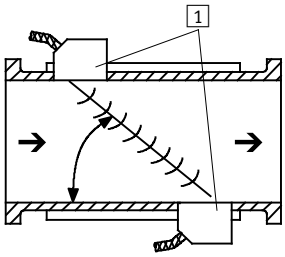
Key features

Flow measurement with ultrasonics

Ultrasonics let you successfully "look into" the liquid and thus obtain the volumetric flow rate. The effect is due to the propagation speed of sound waves in moving liquids, which changes with the flow velocity of the transmission medium. Ultrasonic flow meters are used externally on the tube.

In order to be able to use ultrasonics for compact and inexpensive flow meters, capacitive ultrasonic membrane arrays are being developed, which can be produced using microsystems technologies. The sensors and electronics should be integrated on a single chip.

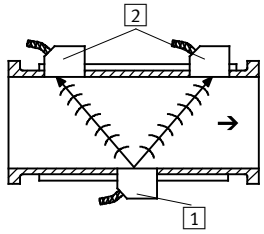
The origins of ultrasonic location go back to the First World War. In the wake of the sinking of the "Titanic", attempts were made (unsuccessfully at the time) to locate moving icebergs using sonar.



1 Measuring probe

Transmission principle

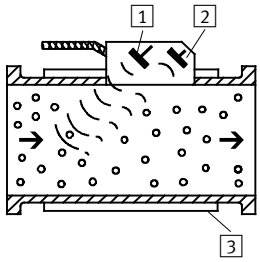
With the transit time method (transmission principle), the liquid must be "clean". 2 Measuring probes that send ultrasonic signals back and forth alternately lie at an angle of 45° to one another. The signal travelling against the direction of flow is slowed down, while the signal travelling with the flow is speeded up. A transit time difference (frequency difference) results, which is not influenced by material or temperature and is dependent on the flow velocity.



1 Transmitter
2 Receiver

Drift method

With the drift method, the directed sound beam undergoes deflection as a result of the flow. There is therefore a difference between the output amplitudes of both receivers.



1 Transmitter
2 Receiver
3 Tube

The mode of action of the various methods can also be illustrated when the vectors for the speeds are added both lengthwise and crosswise.

Doppler measuring method

With the Doppler measuring method, acoustic signals are reflected by air bubbles or solid particles. However, as reflectors, these particles must not be too small. The relative motion of the reflected body causes the sound to be compressed into a shorter wavelength, i.e. a higher frequency. The difference in frequency is now directly proportional to the flow velocity. The flow volume can be determined from the tube cross section and the speed.

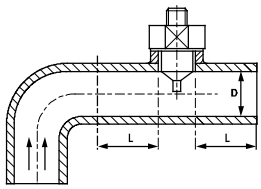
Flow sensors

Key features

Calorimetric flow measurement

In the case of thermal-based flow measurement, the flow volume of a gas or a liquid is extrapolated from a temperature, a temperature difference or a variable derived from it. Measurement is therefore based on the quantification of the heat transport.

The flow monitor can be used as an immersion device as shown in the diagram. In order to avoid measuring errors, a distance L from elbows or cross section changes should be maintained. The minimum length of the stablising zone for calorimetric flow measurements should be L = 10 x D before the measuring point and L = 6 x D after. This results in a low-turbulence and mainly laminar flow at the measuring device.



L Stabilising zone

Hot-wire method

This method is based on measurement of the heat transport. An electrically heated metal wire with temperature-dependent electrical resistance is brought into the gas flow and cooled down. The electrical data for the heating and the ohmic resistance of the hot wire provide information about the flow velocity and produce a volume value when the tube cross section is taken into account (provided the tube cross section is completely filled).

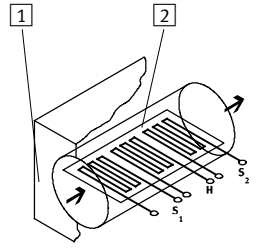
Measurement with thermoelectric detector

NTC thermistors are introduced into the flow and heated electrically. A state of equilibrium is reached depending on the cooling by the flow. The prevailing temperature of the sensors determines its electrical resistance, from which a measuring signal is derived.

Measurement with PTC thermistor

A defined heat source is also cooled down by the flow in this case, but a PTC thermistor is used. This is a temperature-dependent resistance, which becomes more highly resistance with increasing temperature.

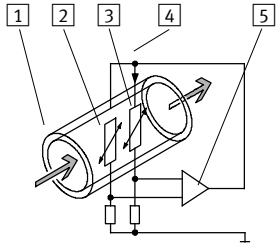
Measurement based on the warming-up method



1 Flow channel
2 Chip
H Micro-heater
S_1 Temperature sensor
S_2 Temperature sensor for output temperature

A value for the mass flow rate is derived from a heat balance.
A heating element and two temperature sensors are used in this case. The principle is illustrated in the diagram, whereby the measurement structure consists of a grid of thin-film resistors on a chip. The temperature sensor S1 measures the initial temperature of the liquid. This is then heated by element H and the sensor S2 measures the temperature rise in the liquid. The temperature difference between the sensors provides a measurement for the volumetric flow rate when the heat output remains constant. When the medium is at rest the temperature difference is zero.

Measurement with hot-film anemometer



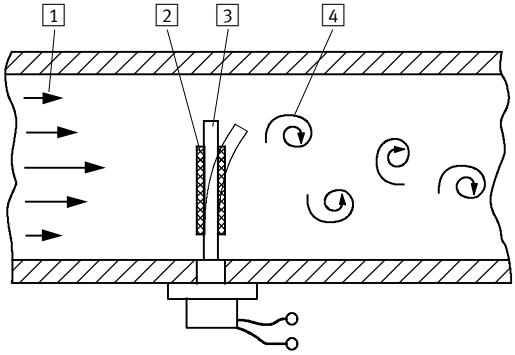
1 Flow channel
2 Thin-film resistor for fluid temperature
3 Thin-film resistor heated
4 Heating current
5 Controller

The diagram shows a thermal mass flow meter for gases such as compressed air. The flow channel or a bypass contains platinum foil resistors arranged in parallel with the flow. The heated resistor 3 is surrounded by the fluid and cooled down. A controller 5 ensures that its temperature remains constant. Therefore if the flow velocity increases, the current 4 also increases, producing the value for the mass flow. The resistor 2 acts as a reference for the fluid temperature, whereby the temperature difference between the resistor 3 and the fluid can be kept constant by the controller. Festo flow sensors are based on this principle.

Flow sensors

Key features

Vortex shedding flow measurement



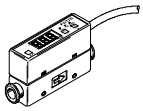
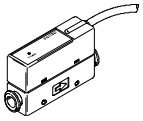
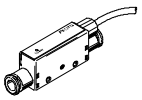
1 Laminar flow
2 Strain gauge
3 Flexible flow disrupter
4 Breakaway vortex

If a flow disrupter is integrated in the flow path, a vortex stream is created. The number of vortices is proportional to the flow velocity within a wide area. The shedding of vortices must thus be measured. This can be done using various methods, e.g. by measuring the pressure that is influenced by the vortices.
The figure shows a sensor principle, whereby a flow disrupter with a strain gauge projects into the laminar flow at a right angle to the flow. Vortices are created in the air flow, which separate periodically (vortex shedding frequency). This process is in turn characterised by local differential pressures, which cause the flow disrupter, which is also flexible, to vibrate. This is detected via the strain gauge. The frequency of break-off pulses is proportional to the volumetric flow rate.

Flow sensors SFE

Flow sensors SFE

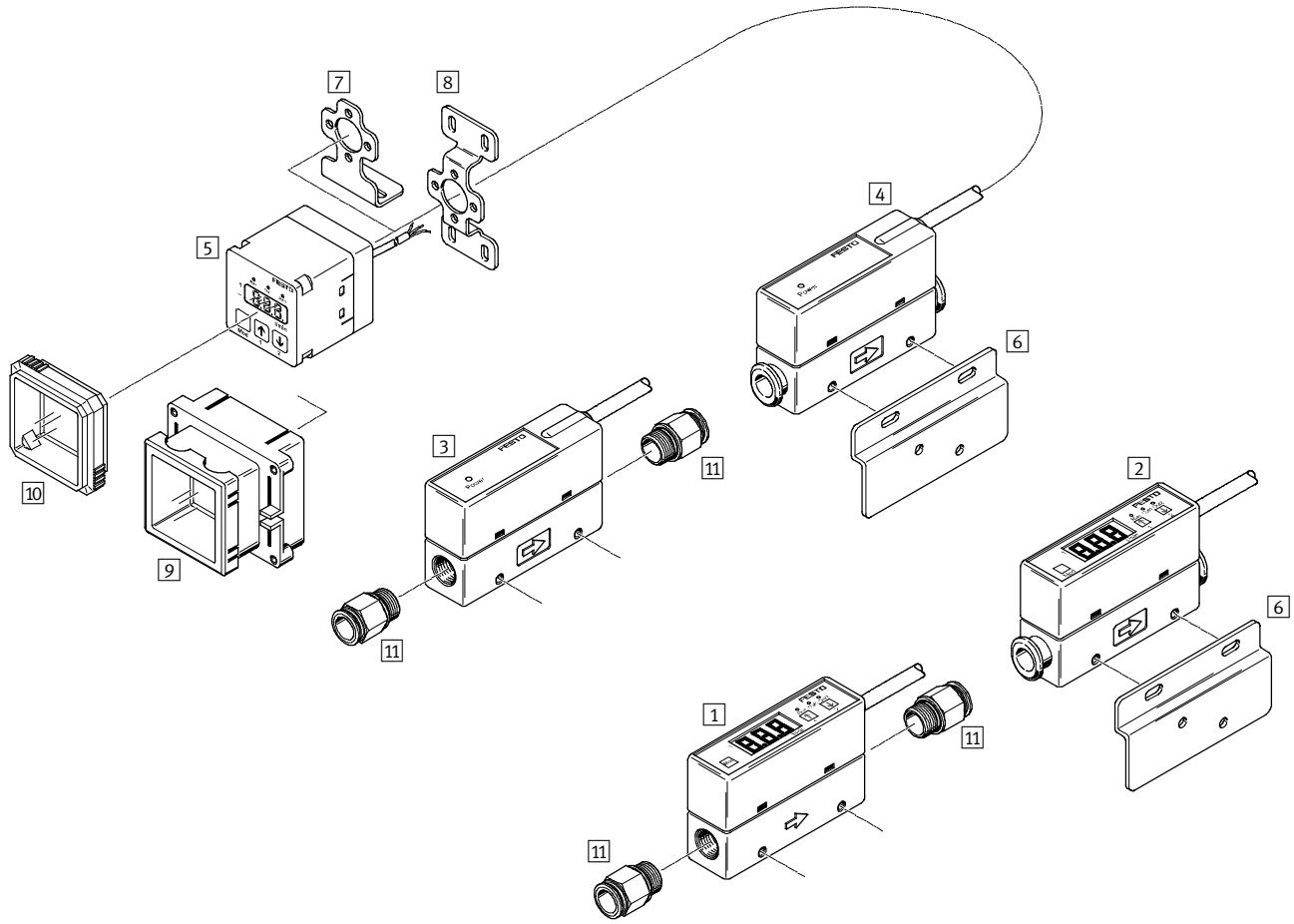
Product range overview

Type	Operating pressure [bar]	Flow measuring range [l/min]	Pneumatic connection	Type of mounting	Electrical output		➔ Page/ online
					Digital	Analogue	
Flow sensor SFE3, with integrated digital display							
	–0.7 … +7	0.05 … 0.5 0.1 … 1 0.5 … 5 1 … 10	Push-in fitting 6 mm	Via through-hole, via mounting bracket	2x PNP 2x NPN	1 … 5 V	271
		5 … 50	Female thread G1⁄8				
Flow sensor SFET-F, unidirectional							
	–0.7 … +7	0.05 … 0.5 0.1 … 1 0.5 … 5 1 … 10	Push-in fitting 6 mm	Via through-hole, via mounting bracket	2x PNP[1)] 2x NPN[1)]	1 … 5 V	273
		5 … 50	Female thread G1⁄8				
Flow sensor SFET-R, bidirectional							
	–0.9 … +2	–0.05 … +0.05 –0.1 … +0.1 –0.5 … +0.5 –1 … +1 –5 … +5 –10 … +10	Push-in fitting 4 mm	Via through-hole, via mounting bracket	2x PNP[1)] 2x NPN[1)]	1 … 5 V	275

1) In combination with flow indicator. Must be ordered separately as an accessory.

Flow sensors SFE

Peripherals overview



Mounting attachments and accessories	
	→ Page/online
1 Flow sensor SFE3-...-W18 with female thread	271
2 Flow sensor SFE3-...-WQ... with QS push-in fitting	271
3 Flow sensor SFET-...-W18 with female thread	273
4 Flow sensor SFET-...-WQ... with QS push-in fitting	273
5 Flow indicator SFEV for flow sensor SFET	277
6 Mounting bracket SFEZ-BW1	278
7 Mounting bracket SFEV-BW1	278
8 Mounting bracket SFEV-WH1	278
9 Front panel installation kit SFEV-FH1	279
10 Protective cover SFEV-SH1	279
11 Push-in fitting QS-G1⁄8	279

Flow sensors SFE

Type codes

FESTO

SFE	3	–	F	100	–	L	–	W	Q6	–	2P	B	–	K1

Type	
SFE	Flow sensor

Design	
3	With integrated digital display
T	Flow transmitter

Flow input	
F	Unidirectional
R	Bidirectional

Flow measuring range [l/min]	
Unidirectional	
005	0.05 ... 0.5
010	0.1 ... 1
050	0.5 ... 5
100	1 ... 10
500	5 ... 50
Bidirectional	
0005	–0.05 ... +0.05
0010	–0.1 ... +0.1
0050	–0.5 ... +0.5
0100	–1 ... +1
0500	–5 ... +5
1000	–10 ... +10

Medium	
L	Compressed air

Mounting	
W	Wall or surface mounting

Pneumatic connection	
Q4	Push-in fitting 4 mm
Q6	Push-in fitting 6 mm
18	Female thread G1⁄8

Switching output	
2P	2x PNP
2N	2x NPN

Analogue output	
B	1 ... 5 V
D	1 ... 5 V

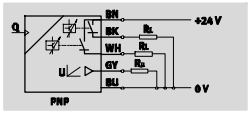
Electrical connection	
K1	1 m cable, open end
K3	3 m cable, open end

Flow sensors SFE3, with integrated digital display

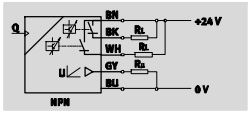
Technical data

FESTO

Function



Switching output 2x PNP



Switching output 2x NPN

- Switching output 2x PNP or 2x NPN
- Analogue output 1 … 5 V
- 3½-character digital display

Technical data						
Type		SFE3-F005	SFE3-F010	SFE3-F050	SFE3-F100	SFE3-F500
General technical data						
Flow measuring range	[l/min]	0.05 … 0.5	0.1 … 1	0.5 … 5	1 … 10	5 … 50
Pneumatic connection		QS-6				Female thread G⅛
Display range	[l/min]	0.05 … 0.5	0.1 … 1	0.5 … 5	1 … 10	5 … 50
Type of display		3½-character, alphanumeric				
Mounting position		Vertical, horizontal				
Accuracy FS[1)]	[%]	8	5			
Electrical data						
Switching output		2x PNP				
		2x NPN				
Analogue output	[V]	1 … 5				
Switching element function		N/O contact				
		N/C contact				
Switching function		Window comparator				
		Threshold comparator				
Operating voltage range DC	[V]	12 … 24				
Electrical connection		Cable				
Protection class		IP40				

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

Operating and environmental conditions		
Operating pressure	[bar]	–0.7 … +7
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [1:4:2]
		Nitrogen
Ambient temperature	[°C]	0 … 50
CE mark (see declaration of conformity)		To EU EMC Directive
Certification		C-Tick

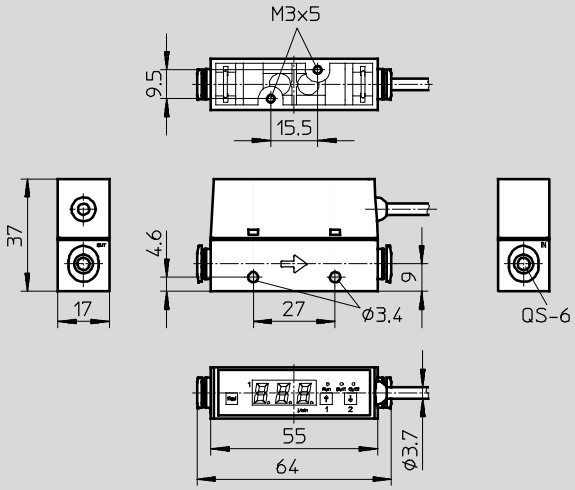
Materials						
Type		SFE3-F005	SFE3-F010	SFE3-F050	SFE3-F100	SFE3-F500
Housing		Polyamide				Polyamide, aluminium
Cable sheath		Polyvinyl chloride				
Note on materials		Contains PWIS (paint-wetting impairment substances)				

Flow sensors SFE3, with integrated digital display

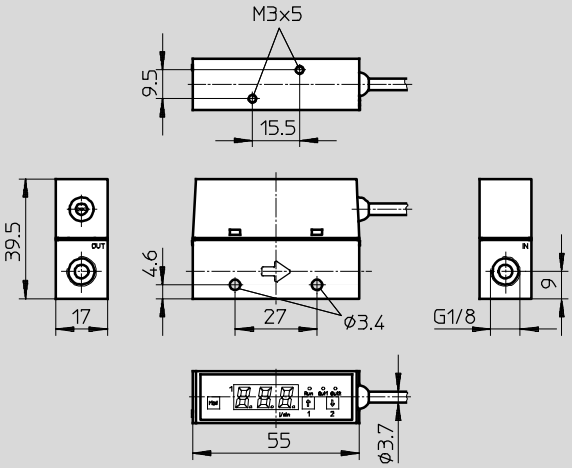
Technical data

Dimensions Download CAD data ➔ **www.festo.com/en/engineering**

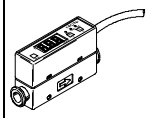
Push-in fitting QS-6



Female thread G1/8



Ordering data

Version	Flow measuring range [l/min]	Switching output 2x PNP Part No.	Type	2x NPN Part No.	Type
	0.05 ... 0.5	**538519**	**SFE3-F005-L-WQ6-2PB-K1**	**538524**	**SFE3-F005-L-WQ6-2NB-K1**
	0.1 ... 1	**538520**	**SFE3-F010-L-WQ6-2PB-K1**	**538525**	**SFE3-F010-L-WQ6-2NB-K1**
	0.5 ... 5	**538521**	**SFE3-F050-L-WQ6-2PB-K1**	**538526**	**SFE3-F050-L-WQ6-2NB-K1**
	1 ... 10	**538522**	**SFE3-F100-L-WQ6-2PB-K1**	**538527**	**SFE3-F100-L-WQ6-2NB-K1**
	5 ... 50	**538523**	**SFE3-F500-L-W18-2PB-K1**	**538528**	**SFE3-F500-L-W18-2NB-K1**

Flow sensors SFET, unidirectional

Technical data

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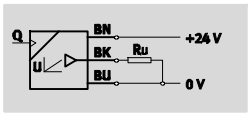
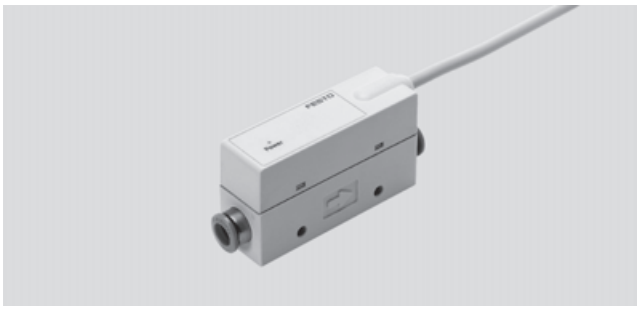
Function



- Analogue output 1 … 5 V
- Connection of a separate digital display SFEV-F possible



Technical data						
Type		SFET-F005	SFET-F010	SFET-F050	SFET-F100	SFET3-F500
General technical data						
Flow measuring range	[l/min]	0.05 … 0.5	0.1 … 1	0.5 … 5	1 … 10	5 … 50
Pneumatic connection		QS-6				Female thread G1⁄8
Mounting position		Vertical, horizontal				
Linearity error FS[1)]	[%]	8	5			
Electrical data						
Analogue output	[V]	1 … 5				
Operating voltage range DC	[V]	12 … 24				
Electrical connection		Cable				
Protection class		IP40				

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

Operating and environmental conditions		
Operating pressure	[bar]	–0.7 … +7
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [1:4:2]
		Nitrogen
Ambient temperature	[°C]	0 … 50
CE mark (see declaration of conformity)		To EU EMC Directive
Certification		C-Tick

Materials						
Type		SFET-F005	SFET-F010	SFET-F050	SFET-F100	SFET-F500
Housing		Polyamide				Polyamide, aluminium
Cable sheath		Polyvinyl chloride				
Note on materials		Contains PWIS (paint-wetting impairment substances)				

Flow sensors SFET, unidirectional

Technical data

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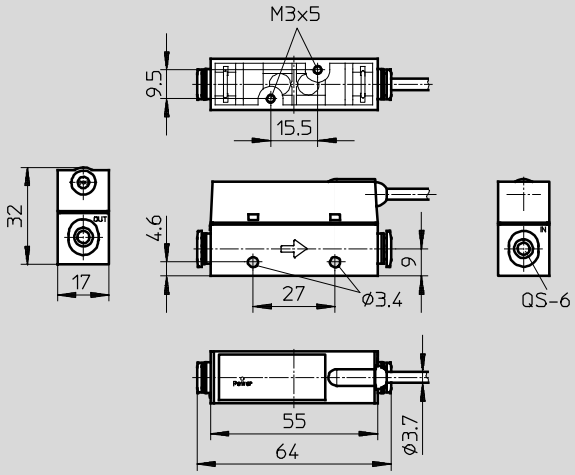
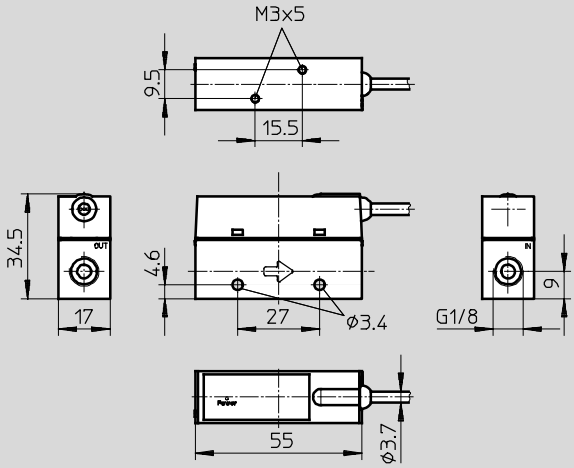
Dimensions Download CAD data ➔ **www.festo.com/en/engineering**

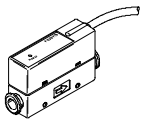
Push-in fitting QS-6



Female thread G1/8



Ordering data

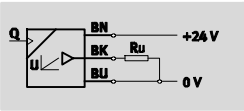
Version	Flow measuring range [l/min]	Part No.	Type
	0.05 ... 0.5	**538529**	**SFET-F005-L-WQ6-B-K1**
	0.1 ... 1	**538530**	**SFET-F010-L-WQ6-B-K1**
	0.5 ... 5	**538531**	**SFET-F050-L-WQ6-B-K1**
	1 ... 10	**538532**	**SFET-F100-L-WQ6-B-K1**
	5 ... 50	**538533**	**SFET-F500-L-W18-B-K1**

Flow sensors SFET, bidirectional

Technical data

FESTO

Function



- Suitable for vacuum
- Bidirectional flow
- Analogue output 1 … 5 V
- Connection of a separate digital display SFEV-R possible

Technical data							
Type		SFET-R0005	SFET-R0010	SFET-R0050	SFET-R0100	SFET-R0500	SFET-R1000
General technical data							
Flow measuring range	[l/min]	−0.05 … +0.05	−0.1 … +0.1	−0.5 … +0.5	−1 … +1	−5 … +5	−10 … +10
Pneumatic connection		QS-4					
Mounting position		Vertical, horizontal					
Linearity error FS[1)]		5					
Electrical data							
Analogue output	[V]	1 … 5					
Operating voltage range DC	[V]	12 … 24					
Electrical connection		Cable					
Protection class		IP40					

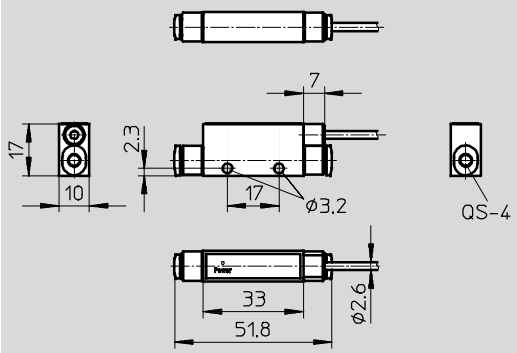
1) % FS = % of the measuring range (full scale)

Operating and environmental conditions		
Operating pressure	[bar]	−0.9 … +2
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [1:4:2]
		Nitrogen
Ambient temperature	[°C]	0 … 50
CE mark (see declaration of conformity)		To EU EMC Directive
Certification		C-Tick

Materials	
Housing	Polyamide
Cable sheath	Polyvinyl chloride
Note on materials	Contains PWIS (paint-wetting impairment substances)

Dimensions Download CAD data ➔ **www.festo.com/en/engineering**

Push-in fitting QS-4

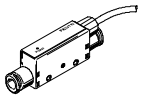


Flow sensors SFET, bidirectional

Technical data

FESTO

Ordering data

Version	Flow measuring range [l/min]	Part No.	Type
	−0.05 ... +0.05	538534	SFET-R0005-L-WQ4-D-K3
	−0.1 ... +0.1	538535	SFET-R0010-L-WQ4-D-K3
	−0.5 ... +0.5	538536	SFET-R0050-L-WQ4-D-K3
	−1 ... +1	538537	SFET-R0100-L-WQ4-D-K3
	−5 ... +5	538538	SFET-R0500-L-WQ4-D-K3
	−10 ... +10	538539	SFET-R1000-L-WQ4-D-K3

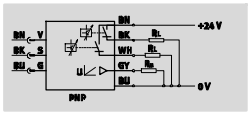
Flow sensors SFE

Accessories

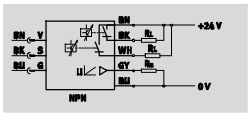
FESTO

Flow indicator SFEV
for flow sensor SFET

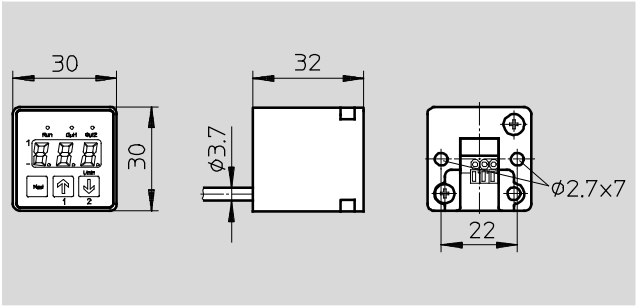
Function



Switching output 2x PNP



Switching output 2x NPN

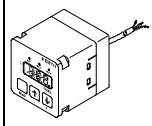
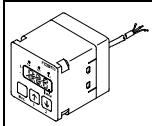


Electrical data		
Type of display		3½-character, alphanumeric
Switching output		2x PNP
		2x NPN
Analogue output	[V]	1 … 5
Switching element function		N/C contact, N/O contact
Switching function		Window comparator
		Threshold comparator
Operating voltage range DC	[V]	12 … 24
Electrical connection		Cable
Protection class		IP40

Operating and environmental conditions		
Ambient temperature	[°C]	0 … 50
CE mark (see declaration of conformity)		To EU EMC Directive
Certification		C-Tick

Materials	
Housing	Polyamide
Cable sheath	Polyvinyl chloride
Note on materials	Contains PWIS (paint-wetting impairment substances)

Ordering data — Download CAD data ➔ **www.festo.com/en/engineering**

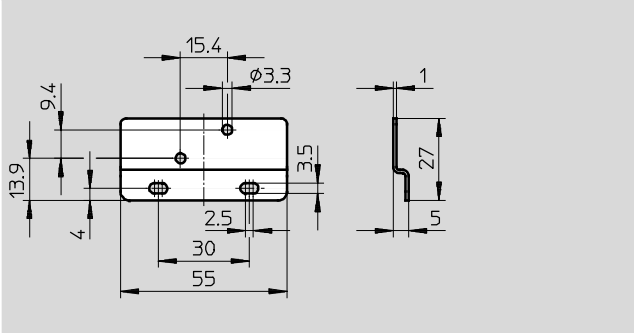
Version	Analogue output	Display range	Switching output			
			2x PNP		2x NPN	
	[V]	[l/min]	Part No.	Type	Part No.	Type
For flow sensor SFET-F, unidirectional						
	1 … 5	0.05 … 0.5	**538540**	**SFEV-F005-L-2PB-K1**	**538545**	**SFEV-F005-L-2NB-K1**
		0.1 … 1	**538541**	**SFEV-F010-L-2PB-K1**	**538546**	**SFEV-F010-L-2NB-K1**
		0.5 … 5	**538542**	**SFEV-F050-L-2PB-K1**	**538547**	**SFEV-F050-L-2NB-K1**
		1 … 10	**538543**	**SFEV-F100-L-2PB-K1**	**538548**	**SFEV-F100-L-2NB-K1**
		5 … 50	**538544**	**SFEV-F500-L-2PB-K1**	**538549**	**SFEV-F500-L-2NB-K1**
For flow sensor SFET-R, bidirectional						
	1 … 5	−0.05 … +0.05	**538550**	**SFEV-R0005-L-2PD-K1**	**538556**	**SFEV-R0005-L-2ND-K1**
		−0.1 … +0.1	**538551**	**SFEV-R0010-L-2PD-K1**	**538557**	**SFEV-R0010-L-2ND-K1**
		−0.5 … +0.5	**538552**	**SFEV-R0050-L-2PD-K1**	**538558**	**SFEV-R0050-L-2ND-K1**
		−1 … +1	**538553**	**SFEV-R0100-L-2PD-K1**	**538559**	**SFEV-R0100-L-2ND-K1**
		−5 … +5	**538554**	**SFEV-R0500-L-2PD-K1**	**538560**	**SFEV-R0500-L-2ND-K1**
		−10 … +10	**538555**	**SFEV-R1000-L-2PD-K1**	**538561**	**SFEV-R1000-L-2ND-K1**

Flow sensors SFE

Accessories

Mounting bracket SFEZ-BW1

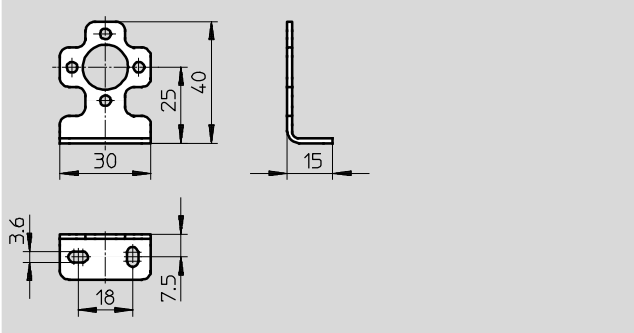
Material:
Nickel-plated steel
Free of copper and PTFE



Ordering data		
Use	Part No.	Type
Flow sensors SFE3, SFET	**538562**	**SFEZ-BW1**

Mounting bracket SFEV-BW1

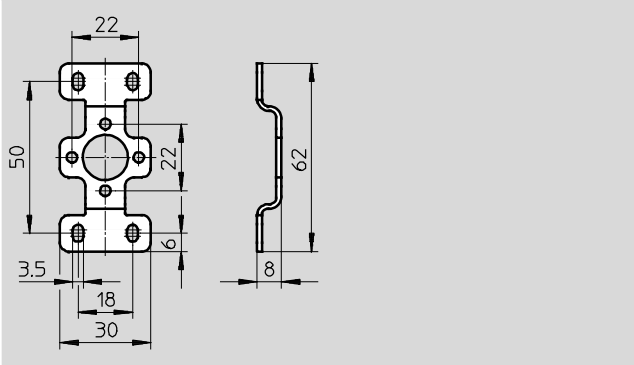
Material:
Nickel-plated steel
Free of copper and PTFE



Ordering data	Download CAD data ➔ www.festo.com/en/engineering	
Use	Part No.	Type
Flow indicator SFEV	**538563**	**SFEV-BW1**

Mounting bracket SFEV-WH1

Material:
Nickel-plated steel
Free of copper and PTFE



Ordering data	Download CAD data ➔ www.festo.com/en/engineering	
Use	Part No.	Type
Flow indicator SFEV	**538564**	**SFEV-WH1**

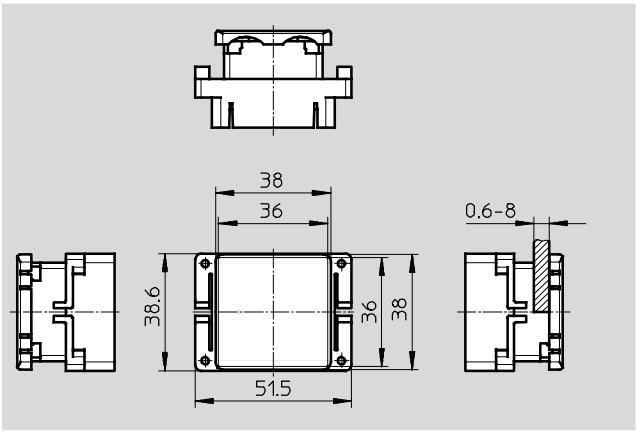
Flow sensors SFE

Accessories

FESTO

Front panel installation kit SFEV-FH1

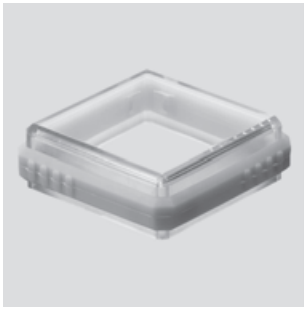
Material:
Reinforced polyamide
Free of copper and PTFE

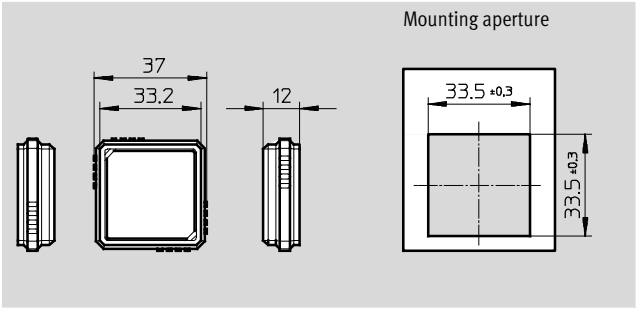


Ordering data	Download CAD data ➔ www.festo.com/en/engineering	
Use	Part No.	Type
Flow indicator SFEV	**538565**	**SFEV-FH1**

Protective cover SFEV-SH1

Material:
Reinforced polyamide
Free of copper and PTFE



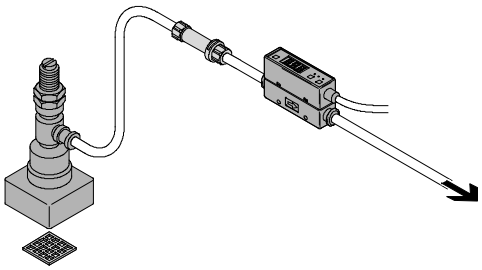


Ordering data	Download CAD data ➔ www.festo.com/en/engineering	
Use	Part No.	Type
Flow indicator SFEV	**538566**	**SFEV-SH1**

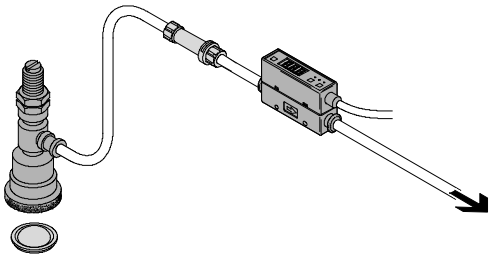
Ordering data – Push-in fittings			Technical data ➔ Internet: quick star	
	Threaded connection	Push-in fitting for tubing O.D. [mm]	Part No.	Type
	G⅛	4	**186095**	**QS-G⅛-4**
		6	**186096**	**QS-G⅛-6**
		8	**186098**	**QS-G⅛-8**

Flow sensors SFE...

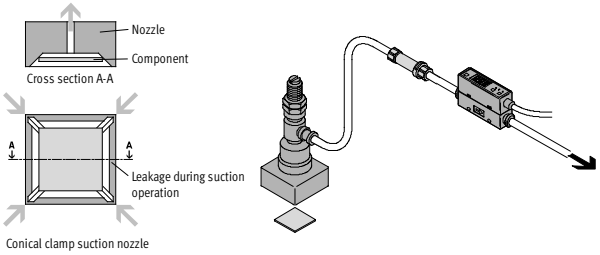
Application examples



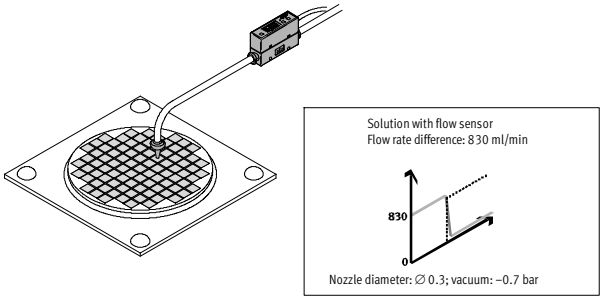
- Placement monitoring of lattice components with a small contact surface



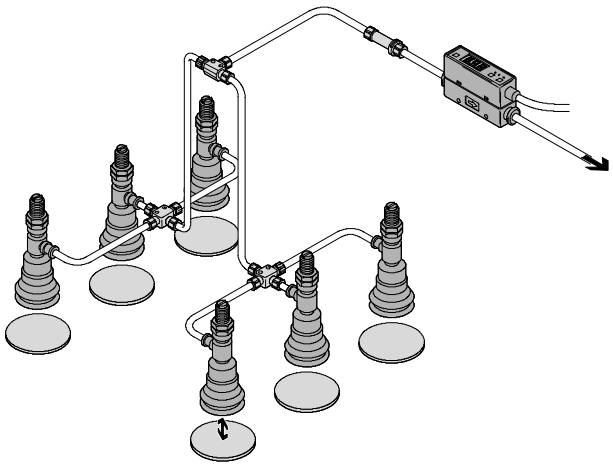
- Placement monitoring of components with delicate surfaces



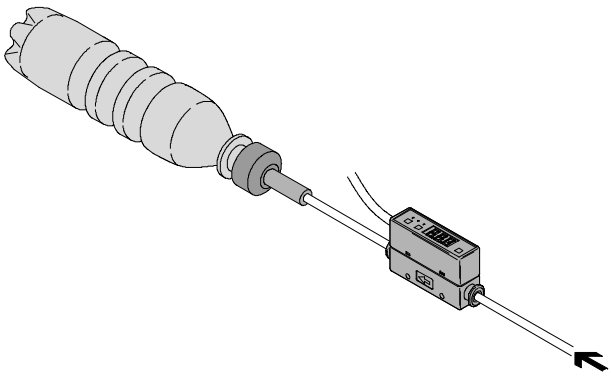
- Placement monitoring of a component with conical clamp nozzle (concentrated support)



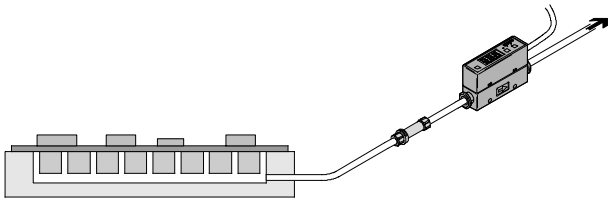
- Detection of very small parts (<1 mm) with a flow sensor suitable for a vacuum.



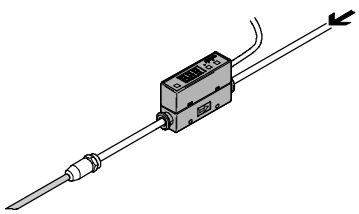
- Vacuummonitoring of multiple components with just one flow sensor on a suction cup array



- Leak testing of plastic bottles



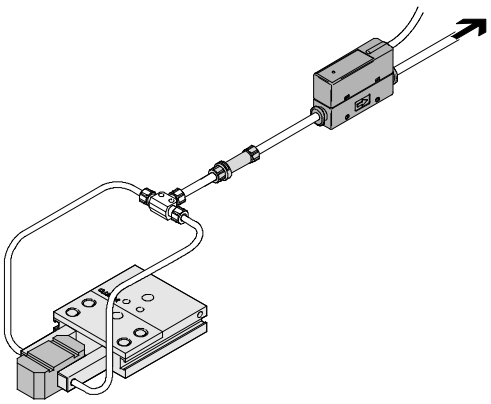
- Used as an air gap sensor for monitoring the gap between the printed circuit board and hotplate



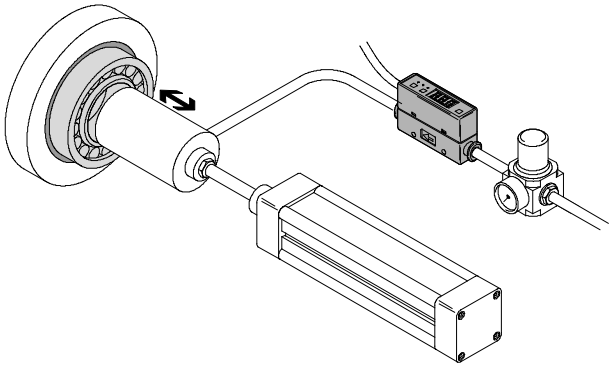
- Checking the continuity and diameter of hypodermic needles

Flow sensors SFE...

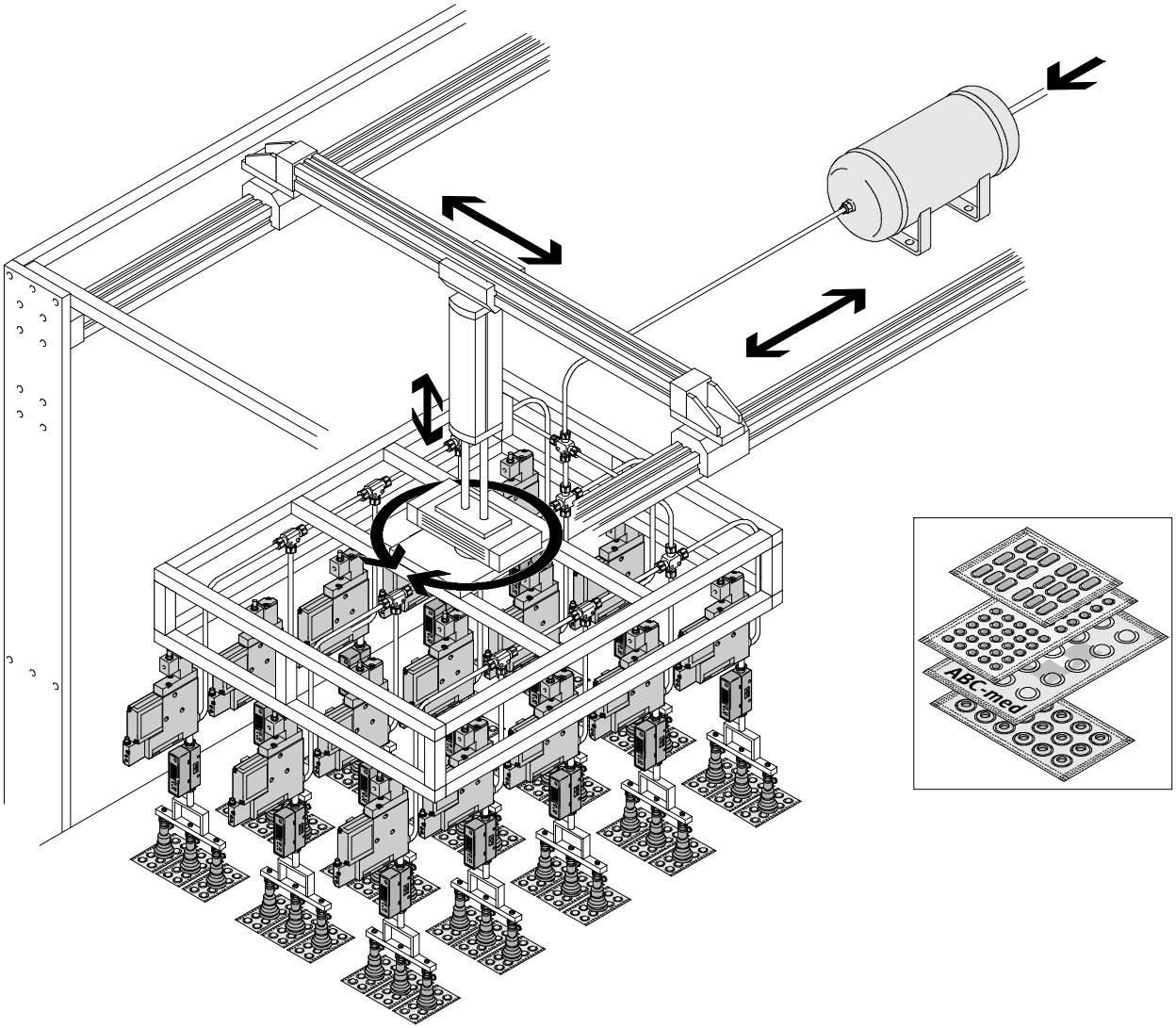
Application examples



- Gripper sensing with flow sensor SFE3/SFET. Essential, when other measuring systems cannot be used, e.g. with magnetised components.

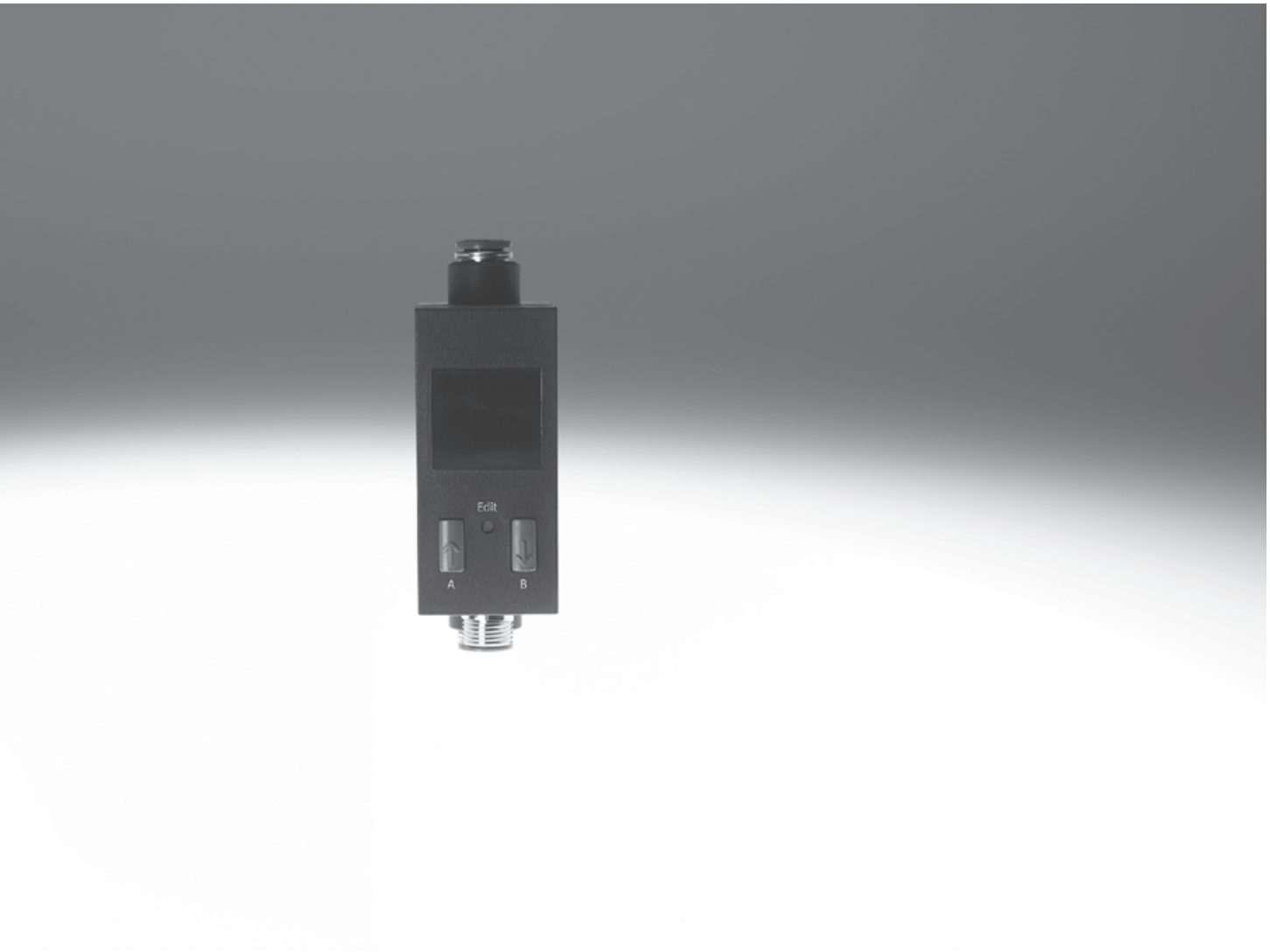


- Quality inspection “Seal present and OK” when inserting bearings into the fixture



- Vacuum monitoring of the suction cup arrays, used to handle blister packaging in the pharmaceuticals industry

Flow sensors SFAB



New

Flow sensors SFAB

Key features

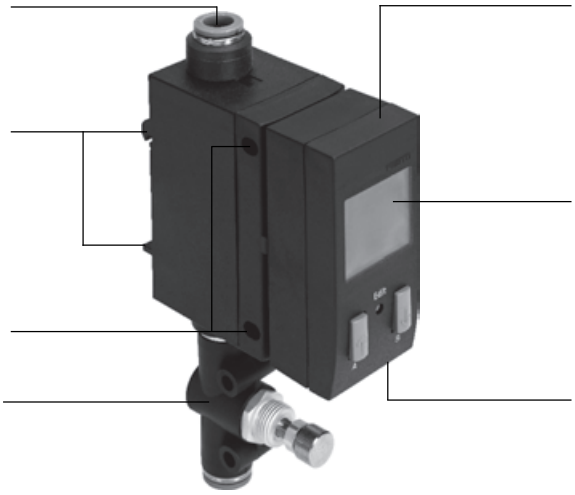
At a glance

Quick and secure installation thanks to QS fitting

Manifold assembly of the sensor via H-rail or individual assembly via adapter plate for wall mounting

Plate assembly of the sensor using mounting screws

Values up to 200 l/min, optional with integrated flow control valve/flow control element



Display can be rotated 270°

- High-contrast LCD display with blue background and white 9-segment display
- Bar graph visualises the current measured value
- Switching point-dependent colour change

Central electrical connection via M12 plug

Impressive, simple, reliable

Designed according to the attractive display and operation concept, the flow sensors have produced outstanding results in the areas of:

- Leakage detection in production
- Leakage tightness testing of end products
- Flow monitoring in parts feeding

The sensor supplies:

- Absolute flow rate information
  - with threshold values and
  - convenient switching point adjustment via a display
- Cumulative air consumption measurement
- Patented – adjustable consumption-based switching impulse for the cumulative air consumption measurement via the switching output

Easier to operate

- A large, illuminated LCD display increases the operational safety and makes the currently displayed flow rate or consumption values easy to read
- Measured values outside the measuring range are visualised: flow rate values are shown flashing
- Values falling below or above the threshold can also be detected remotely or, if the sensor is in an inaccessible location, by means of the display changing colour
- Simple checking of the current sensor settings in SHOW mode
- Simple switching between consumption and flow rate display
- An integrated flow control valve can be ordered as a flow control element via the modular product system for values up to 200 l/min

Flexible installation

This is enabled by the extremely compact design that does away with the need for an upstream and downstream smoothing section; the SFAB has an integrated stabilising flow channel.

Systematically more reliable

The sensor supplies precise information thanks to its very large measuring range, even in the case of fluctuating or unreliable flow rate conditions.

User-friendly

- Quick and easy menu navigation
- Integrated QS fittings
- Ultra-fast teach-in function as with the proven pressure sensor SDE1
- Secure connections with extremely short assembly times
- Manual consumption measurement with start/stop and reset functionality
- Rotatable display
- With or without flow control valve

Advantages

For the designer

- During design, minimal information is required regarding the applied flow rate
- Plug and work solution
- The same device can be used for different applications
- The sensor covers a large measuring range with a specified accuracy thanks to its high dynamic response of 1:100
- NPN/PNP switching via the software
- Minimal assembly times
- Alternatively with 4 ... 20 mA or 0 ... 10 V analogue output
- Flexible installation without restrictions imposed by smoothing sections, any installation position
- High pneumatic connection variance possible via the modular product system
- Design of more efficient machines

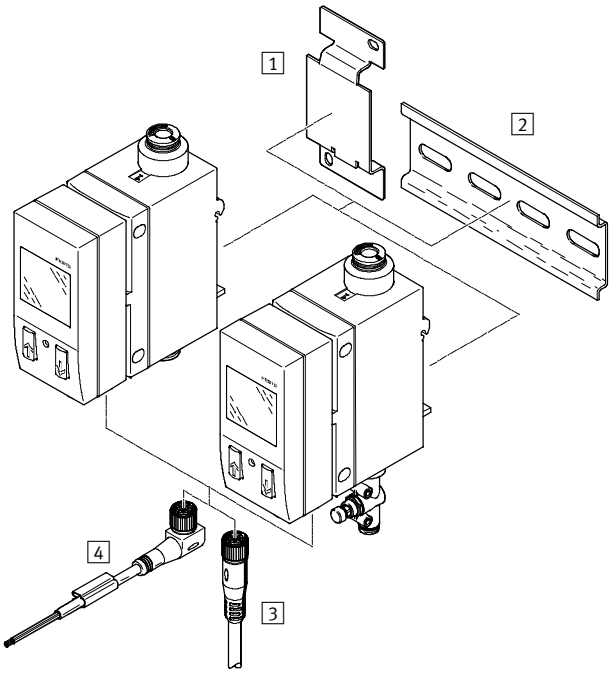
For the machine operator

- Precise information is available even in the event of fluctuating pressure conditions
- Flow rates can be read easily and reliably
- Visualisation (colour change, flashing measured value) of deviations
- Easy operation without the need for training
- Greater system reliability
- Displayed values:
  - Can be displayed for flow rate and consumption for different standard conditions
  - Can be filtered/averaged with highly dynamic measuring independently of the analogue output
- Fast commissioning thanks to easy-to-use, intuitive teach-in function

Flow sensors SFAB

Peripherals overview

Peripherals overview



Mounting attachments and accessories		➔ Page/online
1	Adapter plate SDE1-...-W-... (included in the scope of delivery with SFAB-...-W...)	293
2	Mounting rail to DIN EN 60715	nrh
3	Connecting cable NEBU-M12G5, straight socket	293
4	Connecting cable NEBU-M12G5, angled socket	293

New

Flow sensors SFAB

Type codes

SFAB	–	600	U	–	H	Q8	–	P2	–	M12

Type	
SFAB	Flow sensor

Flow measuring range [l/min]	
10	Max. 10
50	Max. 50
200	Max. 200
600	Max. 600
1000	Max. 1,000

Flow input	
U	Unidirectional

Type of mounting	
H	Via H-rail
W	Via wall bracket

Pneumatic connection	
Q6	Push-in connector 6 mm
Q8	Push-in connector 8 mm
Q10	Push-in connector 10 mm

Electrical output	
2SA	2x PNP or NPN, 1 analogue output 4 ... 20 mA
2SV	2x PNP or NPN, 1 analogue output 0 ... 10 V

Electrical connection	
M12	Straight plug, M12x1, 5-pin

Additional variants can be ordered using the modular system ➔ 292

- Pneumatic connection
- Additional function (flow control element)
- Electrical accessories
- EU certification (ATEX)

New

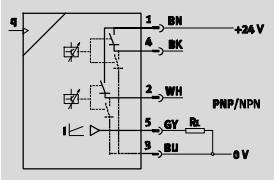
Flow sensors SFAB

Technical data

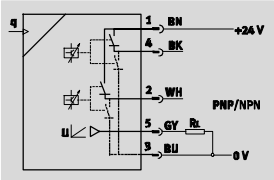
FESTO

Function

Current output 2SA



Voltage output 2SV



- Analogue output 0 ... 10 V, adjustable switching outputs 2x PNP or 2x NPN
- Analogue output 4 ... 20 mA, adjustable switching outputs 2x PNP or 2x NPN
- Freely selectable pulse output for consumption measurement
- Analogue filter for setting the rise time
- Digital filter for smoothing the display values
- Flow control element (flow control valve) for setting the flow rate

General technical data						
		-10U	-50U	-200U	-600U	-1000U
General						
Certification		C-Tick				
		c UL us - Recognized (OL)				
CE mark (see declaration of conformity)		To EU EMC Directive				
		In accordance with EU Explosion Protection Directive (ATEX)				
Note on materials		RoHS-compliant				
Input signal/measuring element						
Measured variable		Flow rate, consumption				
Direction of flow		Unidirectional P1 ⟶ P2				
Measuring principle		Thermal				
Flow measuring range	[l/min]	0.1 ... 10	0.5 ... 50	2 ... 200	6 ... 600	10 ... 1,000
Operating pressure	[bar]	0 ... 10				
Nominal pressure	[bar]	6				
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [6:4:4]		Compressed air in accordance with ISO 8573-1:2010 [7:4:4]		
		Nitrogen		Nitrogen		
Temperature of medium	[°C]	0 ... 50				
Ambient temperature	[°C]	0 ... 50				
Nominal temperature	[°C]	23				

New

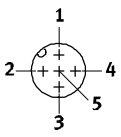
Flow sensors SFAB

Technical data

FESTO

Electrical data						
		-10U	-50U	-200U	-600U	-1000U
Output, general[1), 2)]						
Accuracy of flow rate values		–		+/- (3% o.m.v. + 0,3% FS)		
Accuracy of zero point ±FS	[%]	0.3		–		
Accuracy of margin ±FS	[%]	3		–		
Repetition accuracy of zero point ±FS	[%]	0.2				
Repetition accuracy of margin ±FS	[%]	0.8				
Temperature coefficient of margin ±FS/K	[%]	≤0.1				
Pressure dependence of margin ±FS/bar	[%]	0.5				
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				
Switch-on time		Adjustable (factory setting: approx. 80 ms)				
Switch-off time		Adjustable (factory setting: approx. 80 ms)				
Max. output current	[mA]	100				
Voltage drop	[V]	Max. 1.5				
Inductive protective circuit		Adapted to MZ, MY, ME coils				
Analogue output						
Characteristic flow rate curve	[l/min]	0 ... 10	0 ... 50	0 ... 200	0 ... 600	0 ... 1,000
Output characteristic curve for current	[mA]	4 ... 20				
Output characteristic curve for voltage	[V]	0 ... 10				
Rise time	[ms]	Possible settings: 15, 30, 60 (factory setting), 125, 250, 500, 999				
Max. load resistance at current output	[ohms]	500				
Min. load resistance at voltage output	[kohms]	10				
Output, additional data						
Protection against short circuit		Yes				
Protection against overloading		Yes				
Electronic components						
Operating voltage range DC	[v]	15 ... 30				
Protection against polarity reversal		For all electrical connections				
Electromechanical components						
Electrical connection		Straight plug, M12x1, 5-pin				
Max. length of connecting cable	[m]	<10				

1) Accuracy with nominal conditions (6 bar, 23 °C and horizontal installation position).
2) % FS = % of the measuring range final value (full scale).

Pin allocation		
Plug M12x1, 5-pin	Pin	Meaning
	1	Operating voltage +24 V DC
	2	Binary output B
	3	0 V
	4	Binary output A
	5	Analogue output C

Flow sensors SFAB

Technical data

FESTO

Mechanical components						
		-10U	-50U	-200U	-600U	-1000U
Temperature dependence of the flow control valve setting[1] ±FS (0 … 50 °C)	[%]	8	8	2	–	–
Mounting position		Any				
Pneumatic connection[2]		QS6	QS6	–	–	–
		QS8	QS8	QS8		
		QS10	QS10	QS10	QS10	QS10
		QS12	QS12	QS12	QS12	QS12
		QS¼	QS¼	–	–	–
		QS5/16	QS5/16	QS5/16	–	–
		QS⅜	QS⅜	QS⅜	QS⅜	QS⅜
Product weight	[g]	160				
Material		Housing				

1) The flow rate value set using the flow control valve is additionally dependent on the operating pressure. This means that the flow rate value changes if the operating pressure is changed, even if the flow control valve setting remains the same.

2) The pneumatic connections cannot be freely selected when configuring a sensor with flow control element, modular product system ➔ 292.

Display/operation						
		-10U	-50U	-200U	-600U	-1000U
Indicator type		Illuminated LCD, blue				
Displayable units		l/min, l/h, scfm, l, m^3, scf			l/min, scfm, l, m^3, scf	
Setting range for flow rate threshold value		1% FS … 100% FS				
Setting range for consumption impulse threshold value	[l]	0.1 … 1,999.9	0.2 … 1,999.9	1 … 1,999.9	2 … 1,999.9	3 … 1,999.9
	[m^3]	0.01 … 199.99			0.1 … 1,999.9	1 … 19,999
	[scf]	0.01 … 199.99		0.03 … 199.99	0.1 … 1,999.9	
Hysteresis setting range		0% FS … 90% FS				

Immissions/emissions						
		-10U	-50U	-200U	-600U	-1000U
Storage temperature	[°C]	–20 … +80 (characteristic -D: –10 … +60)				
Degree of protection		IP65				
Pressure drop	[mbar]	<100				
Electrical protection class		III				

New

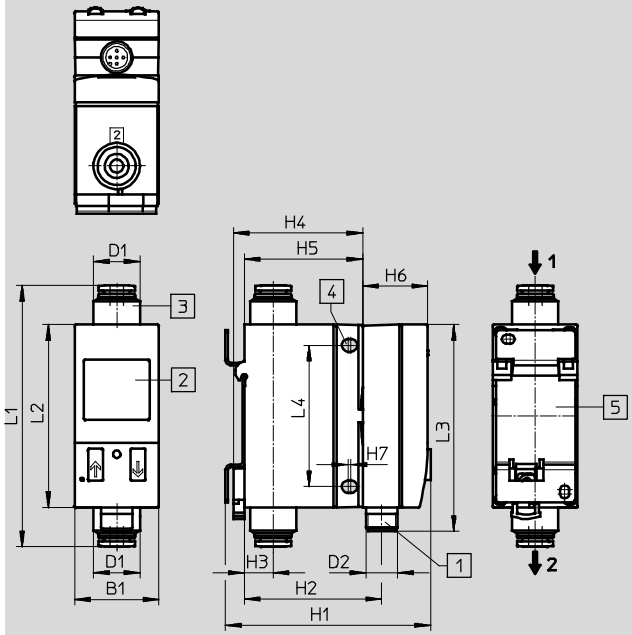
Flow sensors SFAB

Technical data

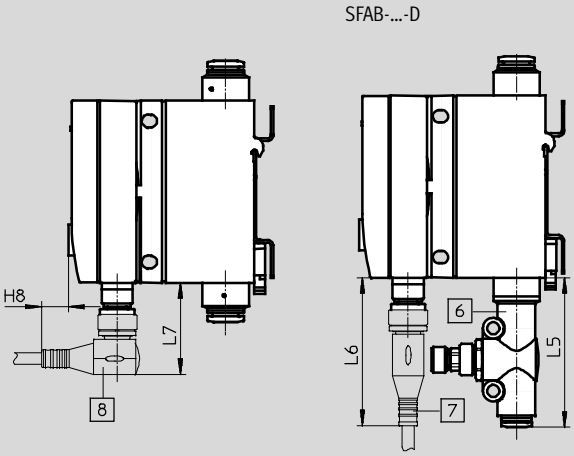
FESTO

Dimensions Download CAD data ➔ **www.festo.com/en/engineering**

SFAB-...-H/-W



SFAB-...-D

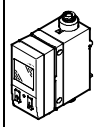
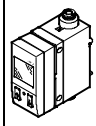


1 Plug M12x1 to EN 60947-5-2
2 LCD display
3 Pneumatic connection
4 Hole for mounting screw M4
5 Adapter plate for wall mounting
6 Flow control element (rotatable)
7 Connecting cable, straight socket
8 Connecting cable, angled socket

Type	B1	D1	D2	H1	H2	H3	H4	H5	H6	H7	H8	L1	L2	L3	L4	L5	L6	L7
SFAB-...-HQ6	32.3	17.7	M12x1	–	52.5	11	49.4	45.2	24.8	1.1	11	95.6	69.8	78.9	54	–	56	35
SFAB-...-HQ6-...-D												–				57.1		
SFAB-...-HQ8												99.8				–		
SFAB-...-HQ8-...-D												–				59.2		
SFAB-...-HQ10		22										119.8				–		
SFAB-...-HQ12												124.4				–		
SFAB-...-WQ6	32.3	17.7	M12x1	79	52.5	11	49.4	45.2	24.8	1.1	11	95.6	69.8	78.9	54	–	56	35
SFAB-...-WQ6-...-D												–				57.1		
SFAB-...-WQ8												99.8				–		
SFAB-...-WQ8-...-D												–				59.2		
SFAB-...-WQ10		22										119.8				–		

Flow sensors SFAB

Technical data

Ordering data				
Version	Electrical output	Flow measuring range [l/min]	Part No.	Type
H-rail mounting				
	2x PNP or NPN, 1 analogue output 4 ... 20 mA	0.1 ... 10	565385	SFAB-10U-HQ6-2SA-M12
		0.5 ... 50	565389	SFAB-50U-HQ6-2SA-M12
		2 ... 200	565393	SFAB-200U-HQ8-2SA-M12
		2 ... 200	565397	SFAB-200U-HQ10-2SA-M12
		6 ... 600	565401	SFAB-600U-HQ10-2SA-M12
		10 ... 1,000	565405	SFAB-1000U-HQ10-2SA-M12
	2x PNP or NPN, 1 analogue output 0 ... 10 V	0.1 ... 10	565386	SFAB-10U-HQ6-2SV-M12
		0.5 ... 50	565390	SFAB-50U-HQ6-2SV-M12
		2 ... 200	565394	SFAB-200U-HQ8-2SV-M12
		2 ... 200	565398	SFAB-200U-HQ10-2SV-M12
		6 ... 600	565402	SFAB-600U-HQ10-2SV-M12
		10 ... 1,000	565406	SFAB-1000U-HQ10-2SV-M12
Wall or surface mounting				
	2x PNP or NPN, 1 analogue output 4 ... 20 mA	0.1 ... 10	565387	SFAB-10U-WQ6-2SA-M12
		0.5 ... 50	565391	SFAB-50U-WQ6-2SA-M12
		2 ... 200	565395	SFAB-200U-WQ8-2SA-M12
		2 ... 200	565399	SFAB-200U-WQ10-2SA-M12
		6 ... 600	565403	SFAB-600U-WQ10-2SA-M12
		10 ... 1,000	565407	SFAB-1000U-WQ10-2SA-M12
	2x PNP or NPN, 1 analogue output 0 ... 10 V	0.1 ... 10	565388	SFAB-10U-WQ6-2SV-M12
		0.5 ... 50	565392	SFAB-50U-WQ6-2SV-M12
		2 ... 200	565396	SFAB-200U-WQ8-2SV-M12
		2 ... 200	565400	SFAB-200U-WQ10-2SV-M12
		6 ... 600	565404	SFAB-600U-WQ10-2SV-M12
		10 ... 1,000	565408	SFAB-1000U-WQ10-2SV-M12

New

Flow sensors SFAB

Ordering data – Modular products

FESTO

Ordering table

			Condi-tions	Code	Enter code
M	Module No.	**563795**			
	Function	Flow sensor		**SFAB**	-SFAB
				-	
O	Medium	Compressed air		_	
M	Flow measuring range l/min	Max. 10		**10**	
		Max. 50		**50**	
		Max. 200		**200**	
		Max. 600		**600**	
		Max. 1,000		**1000**	
	Flow input	Unidirectional		**U**	U
	Type of mounting	H-rail mounting		**-H**	
		Wall mounting		**-W**	
	Pneumatic connection	Push-in connector 6 mm	1	**Q6**	
		Push-in connector 8 mm	2	**Q8**	
		Push-in connector 10 mm		**Q10**	
		Push-in connector 12 mm		**Q12**	
		Push-in connector for tubing ¼	1	**T14**	
		Push-in connector for tubing $^5/_{16}$	2	**T516**	
		Push-in connector for tubing ⅜		**T38**	
	Electrical output	2x PNP or NPN, 1 analogue output 4 ... 20 mA		**-2SA**	
		2x PNP or NPN, 1 analogue output 0 ... 10 V		**-2SV**	
	Electrical connection	Plug M12, A-coded		**-M12**	M12
O	Additional function	Not specified			
		Control element	3	**-D**	
	Electrical accessories	Not specified			
		Angled plug socket, cable 2.5 m		**-2.5A**	
		Straight socket, cable 2.5 m		**-2.5S**	
		Angled plug socket, cable 5 m		**-5A**	
		Straight socket, cable 5 m		**-5S**	
	EU certification	Not specified			
		II 3GD		**-EX2**	

1 **Q6, T14** Not with flow measuring range 200; 600; 1,000
2 **Q8, T516** Not with flow measuring range 600; 1,000
3 **D** Only with flow measuring range 10, 50 in combination with pneumatic connection Q6
Only with flow measuring range 200 in combination with pneumatic connection Q8

Transfer order code

563795	SFAB	–		–		–	-U	–		–		–		–	M12	–		–		–	

New

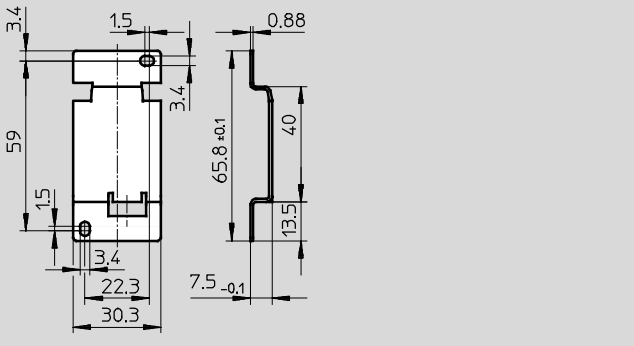
Flow sensors SFAB

Accessories

FESTO

Adapter plate SDE1-...-W...
for wall or surface mounting

Material:
Steel



Ordering data		
	Part No.	Type
Adapter plate[1)]	**194 297**	**SDE1-...-W...**

1) Included in the scope of delivery with SFAB-...-W...

Ordering data – Connecting cables			Technical data → Internet: nebu	
	Number of wires	Cable length [m]	Part No.	Type
M12x1, straight socket				
	5	2.5	**541330**	**NEBU-M12G5-K-2.5-LE5**
		5	**541331**	**NEBU-M12G5-K-5-LE5**
M12x1, angled socket				
	5	2.5	**567843**	**NEBU-M12W5-K-2.5-LE5**
		5	**567844**	**NEBU-M12W5-K-5-LE5**

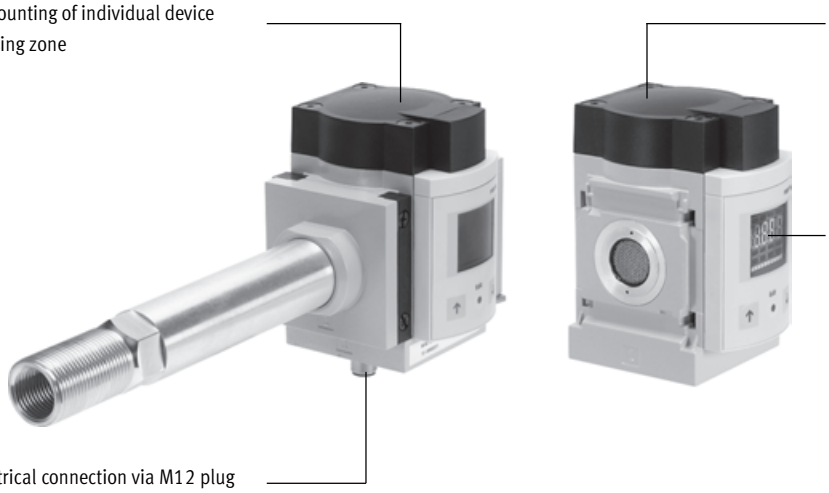
Flow sensors SFAM

Flow sensors SFAM

Key features

At a glance

Threaded mounting of individual device with stabilising zone



Central electrical connection via M12 plug

Can be combined with MS6 or MS9 series service units

- Illuminated LCD display with blue background and white 9-segment display
- Bar graph visualises the current measured value
- Switching point-dependent colour change

Compact and capable of high flow rates

This modular flow sensor can operate either as a standalone unit or can be easily combined with the MS series service units.
The sensor provides:

- Absolute flow rate information
  - with threshold values and
  - convenient switching point adjustment via a display
- Cumulative air consumption measurement
- Patented – adjustable consumption-based switching pulse for cumulative air consumption measurement via the switching output

Systematically more reliable

The sensor covers a large measuring range with a specified accuracy thanks to its high dynamic response of 1:100.
It can provide precise information even when flow conditions are fluctuating and unreliable.

Easy to operate

- A large, illuminated LCD display increases the operational safety and makes the currently displayed flow rate or consumption values easy to read
- Measured values outside the measuring range are visualised: flow rates are shown flashing
- Switching outputs (NPN/PNP) can be switched over via the menu
- Values that fall below or exceed the threshold values can also be identified from a distance or if the sensor is in an inaccessible location by means of the display changing colour
- Simple checking of the current sensor settings in SHOW mode
- Simple switching between consumption and flow rate indication
- Values shown on the display:
  - can be shown for different standard conditions (DIN 1343, ISO 2533, ISO 6358)
  - can be filtered/averaged independently of the analogue output in the case of high measuring dynamics

Convenient

- Plug and work solution
- Quick and easy menu prompting
- Fast commissioning thanks to easy-to-use, intuitive teach-in function
- Manual consumption measurement with start/stop and reset functionality

Easy to combine

With MS6 or MS9 series service unit combination thanks to innovative prism clamping technology. This saves additional installation time.

Flexible installation

The SFAM has an extremely compact, space-saving design optimised for flow performance.

Right or left?

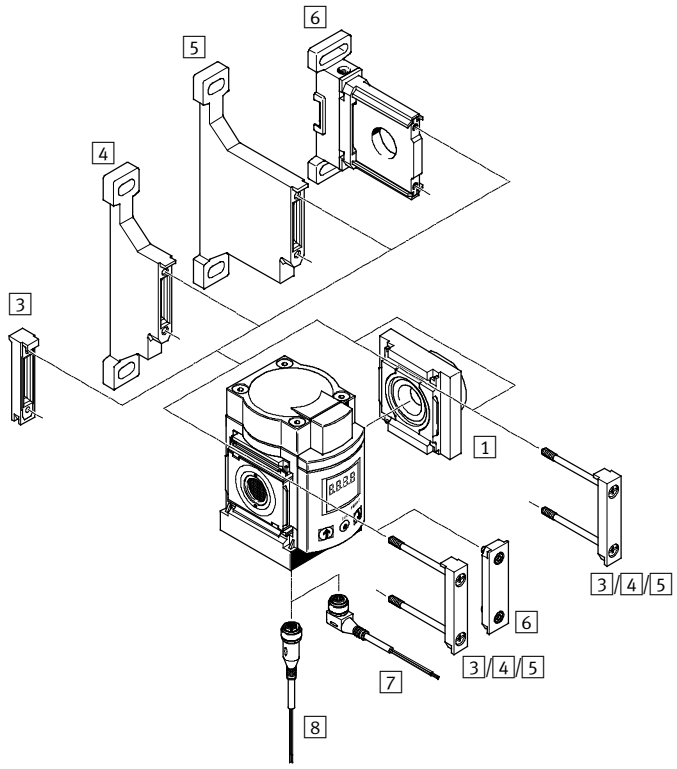
The fluid stream of the unidirectional flow sensor can be selected: either from left to right or from right to left.

Flow sensors SFAM

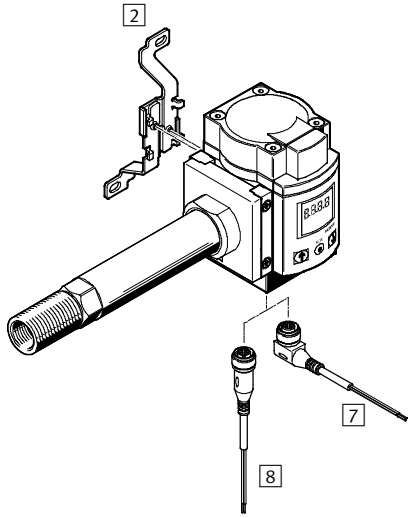
Peripherals overview

FESTO

SFAM-62-...-M for manifold assembly in MS6 series service unit combination
with laminar flow cartridge



SFAM-62-...-T/-W for individual assembly
with connecting plates and stabilising zone



Mounting attachments and accessories			
	In MS6 series service unit combination	Individual device	➔ Page/online
1 Connecting plate MS6-AG...	■	■ Included in the scope of delivery	ms6-ag
2 Mounting bracket MS6-WB	–	■ Included in the scope of delivery with mounting type -W	ms6-wb
3 Module connector MS6-MV	■	–	ms6-mv
4 Mounting bracket MS6-WP	■	–	ms6-wp
5 Mounting bracket MS6-WPB	■	–	ms6-wpb
6 Mounting bracket MS6-WPM	■	–	ms6-wpm
7 Connecting cable NEBU-M12W5, angled socket	■	■	308
8 Connecting cable NEBU-M12G5, straight socket	■	■	308

Note

Additional accessories:

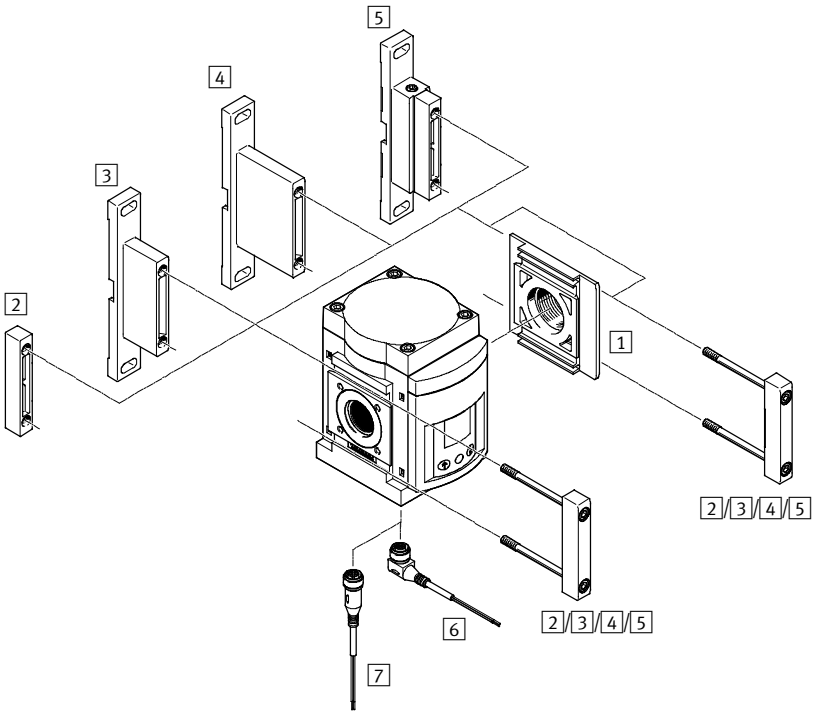
– Module connector for combination with size MS4/MS6 or size MS9
➔ online: amv, rmv, armv

– Adapter for mounting on profiles
➔ online: ipm-80, ipm-40-80, ipm-80-80

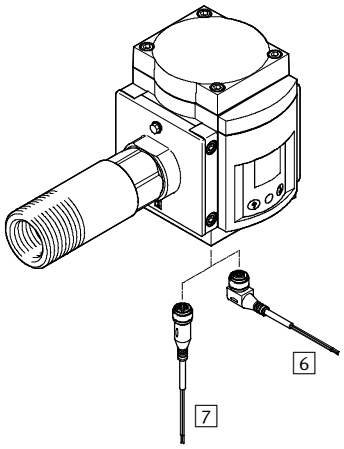
Flow sensors SFAM

Peripherals overview

SFAM-90-...-M for manifold assembly in MS9 series service unit combination
with laminar flow cartridge



SFAM-90-...-T for individual assembly
with connecting plates and stabilising zone



Mounting attachments and accessories			
	In MS9 series service unit combination	Individual device	➔ Page/online
1 Connecting plate MS9-AG...	■	■ Included in the scope of delivery	ms9-ag
2 Module connector MS9-MV	■	–	ms9-mv
3 Mounting bracket MS9-WP	■	–	ms9-wp
4 Mounting bracket MS9-WPB	■	–	ms9-wpb
5 Mounting bracket MS9-WPM	■	–	ms9-wpm
6 Connecting cable NEBU-M12W5, angled socket	■	■	308
7 Connecting cable NEBU-M12G5, straight socket	■	■	308

Note

Additional accessories:
– Module connector for combinations with size MS6, MS9 or MS12
➔ online: rmv, armv

Flow sensors SFAM

Type codes

SFAM	–	62	–	1000	L	–	T	G12	–	2SA	–	M12

Type	
SFAM	Flow sensor

Grid dimension	
62	Grid dimension 62 mm
90	Grid dimension 90 mm

Flow measuring range [l/min]	
SFAM-62	
1000	Max. 1,000
3000	Max. 3,000
5000	Max. 5,000
SFAM-90	
5000	Max. 5,000
10000	Max. 10,000
15000	Max. 15,000

Flow input	
L	Unidirectional, from left to right

Type of mounting	
M	Manifold assembly
T	Threaded mounting

Pneumatic connection	
SFAM-62	
G12	Female thread G1½
SFAM-90-5000L	
G1	Female thread G1
SFAM-90-10000L/15000L	
G112	Female thread G1½

Electrical output	
2SA	2x PNP or NPN, 1 analogue output 4 ... 20 mA
2SV	2x PNP or NPN, 1 analogue output 0 ... 10 V

Electrical connection	
M12	Straight plug, M12x1, 5-pin

Additional variants can be ordered using the modular product system ➔ 307

- Flow input
- Type of mounting
- Pneumatic connection
- Electrical accessories
- EU certification (ATEX)

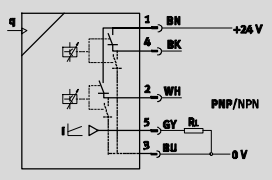
Flow sensors SFAM

Technical data

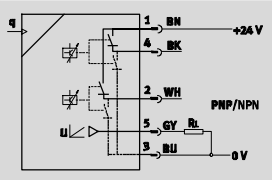
FESTO

Function

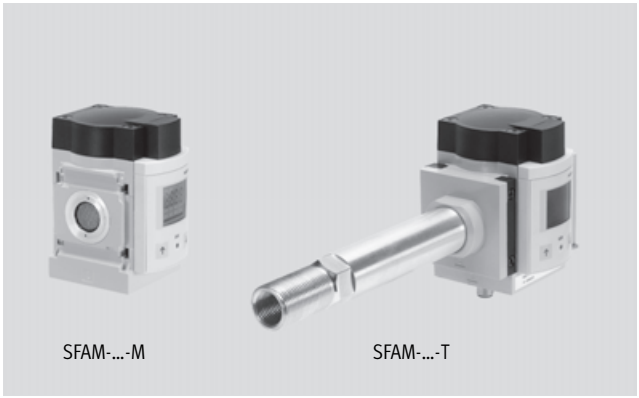
Current output 2SA



Voltage output 2SV



- Flow rate
  10 ... 1,000 l/min
  30 ... 3,000 l/min
  50 ... 5,000 l/min
  100 ... 10,000 l/min
  150 ... 15,000 l/min
- Temperature range
  0 ... +50 °C
- Operating pressure
  0 ... 16 bar



SFAM-...-M SFAM-...-T

- Analogue output 0 ... 10 V, adjustable switching outputs 2x PNP or 2x NPN
- Analogue output 4 ... 20 mA, adjustable switching outputs 2x PNP or 2x NPN
- Freely selectable pulse output for consumption measurement

- Analogue filter for setting the rise time
- Digital filter for smoothing the display values

Note

To comply with the specified accuracies, the SFAM must be supplied via the following connections:
– SFAM-62-...-M via a pneumatic connection of at least G½, SFAM-90-...-M via a pneumatic connection of at least G¾.
– SFAM-62-...-T/W via a connection with an inside diameter of at least 10 mm, SFAM-90-...-T via a connection with an inside diameter of at least 20 mm.

Note

When using a filter regulator MS-LFR or a pressure regulator MS-LR, a branching module MS6-FRM-½ (with size MS6) or MS9-FRM-G (with size MS9) must be installed between the filter regulator or pressure regulator and the (downstream) flow sensor SFAM in order to maintain the specified accuracies.

General technical data	
Certification	C-Tick
	cULus recognized (OL)
CE marking (see declaration of conformity)	To EU EMC Directive[1)]
Note on materials	RoHS-compliant

1) For information about the applicability of the component see the manufacturer's EC declaration of conformity at: www.festo.com → Support → User documentation.
If the component is subject to restrictions on usage in residential, office or commercial environments or small businesses, further measures to reduce the emitted interference may be necessary.

ATEX	
EU certification	EX2
ATEX category for gas	II 3G
Explosion ignition protection type for gas	Ex nA IIC T5 X Gc
ATEX category for dust	II 3D
Explosion ignition protection type for dust	Ex tc IIIB T80°C X Dc IP54
Explosion-proof temperature rating	0 °C ≤ Ta ≤ +50 °C
CE marking (see declaration of conformity)	To EU Explosion Protection Directive (ATEX)

Flow sensors SFAM

Technical data

FESTO

Input signal/measuring element							
Type		SFAM-62			SFAM-90		
Flow measuring range		-1000	-3000	-5000	-5000	-10000	-15000
Measured variable		Flow rate, consumption					
Direction of flow	-L	Unidirectional P1 → P2					
	-R	Unidirectional P2 ← P1					
Measuring principle		Thermal					
Flow measuring range	[l/min]	10 … 1,000	30 … 3,000	50 … 5,000	50 … 5,000	100 … 10,000	150 … 15,000
Operating pressure	[bar]	0 … 16					
Nominal pressure	[bar]	6					
Operating medium		Compressed air in accordance with ISO 8573-1:2010 [7:4:4]					
		Nitrogen					
Note on operating/pilot medium		Operation with lubricated medium not possible					
Temperature of medium	[°C]	0 … +50					
Ambient temperature	[°C]	0 … +50					
Nominal temperature	[°C]	23					

Output, general[1), 2)]		
Accuracy of flow rate values		+/- (3% o.m.v. + 0.3% FS)
Repetition accuracy of zero point in ±%FS	[%FS]	0.2
Repetition accuracy of margin in ±%FS	[%FS]	0.8
Temperature coefficient of margin in ±%FS/K	[%FS/K]	Typically 0.1
Pressure dependence of margin in ±%FS/bar	[%FS/bar]	0.5

1) Accuracy with nominal conditions (6 bar, 23 °C and horizontal installation position)
2) % FS = % of the measuring range final value (full scale)

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
Switch-on time		Adjustable (factory setting: approx. 60 ms)
Switch-off time		Adjustable (factory setting: approx. 60 ms)
Max. output current	[mA]	100
Voltage drop	[V]	Max. 1.5
Inductive protective circuit		Adapted to MZ, MY, ME coils

Analogue output							
Type		SFAM-62			SFAM-90		
Flow measuring range		-1000	-3000	-5000	-5000	-10000	-15000
Characteristic curve for flow rate	[l/min]	0 … 1,000	0 … 3,000	0 … 5,000	0 … 5,000	0 … 10,000	0 … 15,000
Output characteristic curve for current	[mA]	4 … 20					
Output characteristic curve for voltage	[V]	0 … 10					
Rise time	[ms]	Possible settings: 15, 30, 60 (factory setting), 125, 250, 500, 999					
Max. load resistance at current output	[ohms]	500					
Min. load resistance at voltage output	[kohms]	10					

Output, additional data	
Protection against short circuit	Yes
Protection against overloading	Yes

Flow sensors SFAM

Technical data

Electronic components		
Operating voltage range DC	[V]	15 … 30
Reverse polarity protection		For all electrical connections

Electromechanical components		
Electrical connection		Straight plug, M12x1, 5-pin
Max. connecting cable length	[m]	30

Mechanical components									
Type		SFAM-62			SFAM-90				
Type of mounting		-M	-TG12/-WG12	-TN12/-WN12	-M	-TG1	-TN1	-TG112	-TN112
Mounting position		Horizontal							
Pneumatic connection		–	G½	NPT½	–	G1	NPT1	G1½	NPT1½
Product weight	[g]	600	1,100	1,100	1,500	2,400	2,400	2,750	2,750
Housing materials		PA-reinforced, die-cast aluminium							

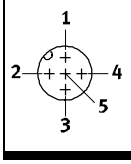
Display/operation							
Type		SFAM-62			SFAM-90		
Flow measuring range		-1000	-3000	-5000	-5000	-10000	-15000
Display type		Illuminated LCD, blue					
Displayable units		l/min, scfm, l, m^3, scf					
Setting range for flow rate threshold values	[%FS]	1 … 100					
Setting range for consumption pulse threshold values	[l]	3 … 19,999	10 … 19,999	15 … 19,999	15 … 19,999	30 … 19,999	50 … 19,999
	[m^3]	1 … 19,999					
	[scf]	0.1 … 1,999.9	0.4 … 1,999.9	0.5 … 1,999.9	0.5 … 1,999.9	1 … 1,999.9	2 … 1,999.9
Hysteresis setting range	[%FS]	0 … 90					

Immissions/emissions							
Type		SFAM-62			SFAM-90		
Flow measuring range		-1000	-3000	-5000	-5000	-10000	-15000
Storage temperature	[°C]	–20 … +80					
Protection class		IP65					
Pressure drop at 50 %FS flow rate and 6 bar with mounting type -M	[mbar]	0 … 100	0 … 100	0 … 100	0 … 40	0 … 100	0 … 200
Pressure drop at 50 %FS flow rate with mounting type -T/-W	[mbar]	0 … 100	0 … 100	0 … 100	0 … 100	0 … 100	0 … 100
Electrical protection class		III					
Corrosion resistance class CRC[1)]		2					

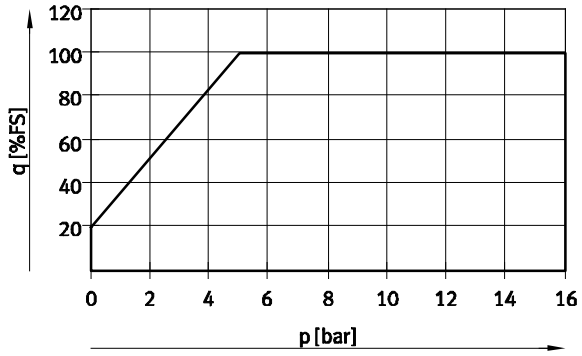
1) Corrosion resistance class 2 according to Festo standard 940 070
Components subject to moderate corrosion stress. Externally visible parts with primarily decorative surface requirements which are in direct contact with a normal industrial environment or media such as coolants or lubricating agents.

Flow sensors SFAM

Technical data

Pin allocation		
Plug M12x1, 5-pin	Pin	Meaning
	1	Operating voltage +24 V DC
	2	Binary output B
	3	0 V
	4	Binary output A
	5	Analogue output C

Flow measuring range[1] qn as a function of operating pressure p1



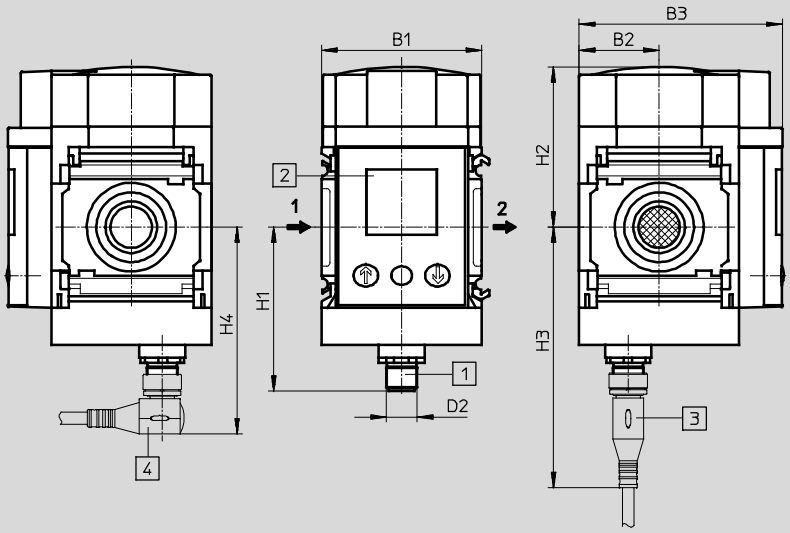
1) For an operating pressure of more than 5 bar, the flow sensor can determine measured values with the specified accuracy over the entire measuring range. For an operating pressure below 5 bar, the measuring range with the specified accuracy is reduced as shown in the graph.

Flow sensors SFAM

Technical data

Dimensions – SFAM-62 Download CAD data ➔ **www.festo.com/en/engineering**

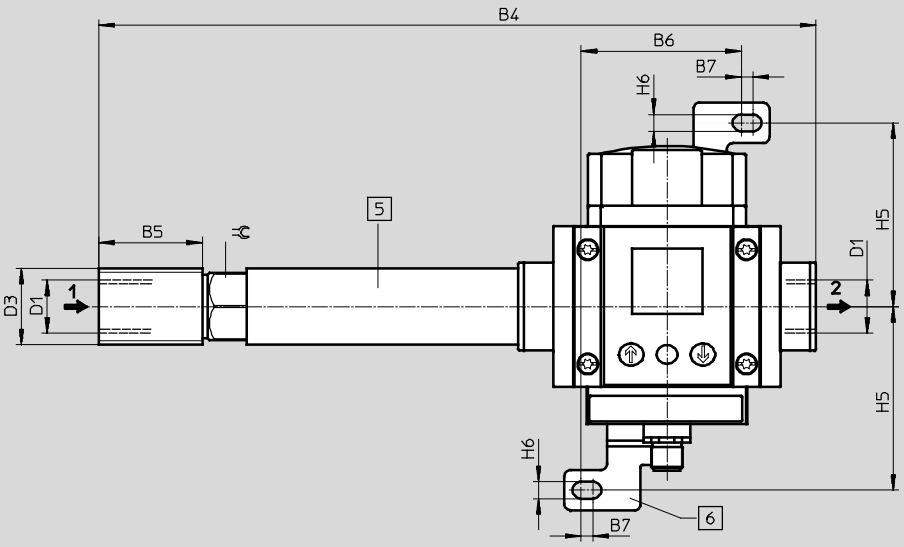
SFAM-62-...-M for manifold assembly in MS6 series service unit combination



1 Plug M12x1 to EN 60947-5-2
2 LCD display
3 Connecting cable, straight socket
4 Connecting cable, angled socket

➔ Flow direction

SFAM-62-...-T/W for individual assembly



5 Stabilising zone
6 Wall mounting (only with mounting type -W) with mounting bracket MS6-WB

➔ Flow direction

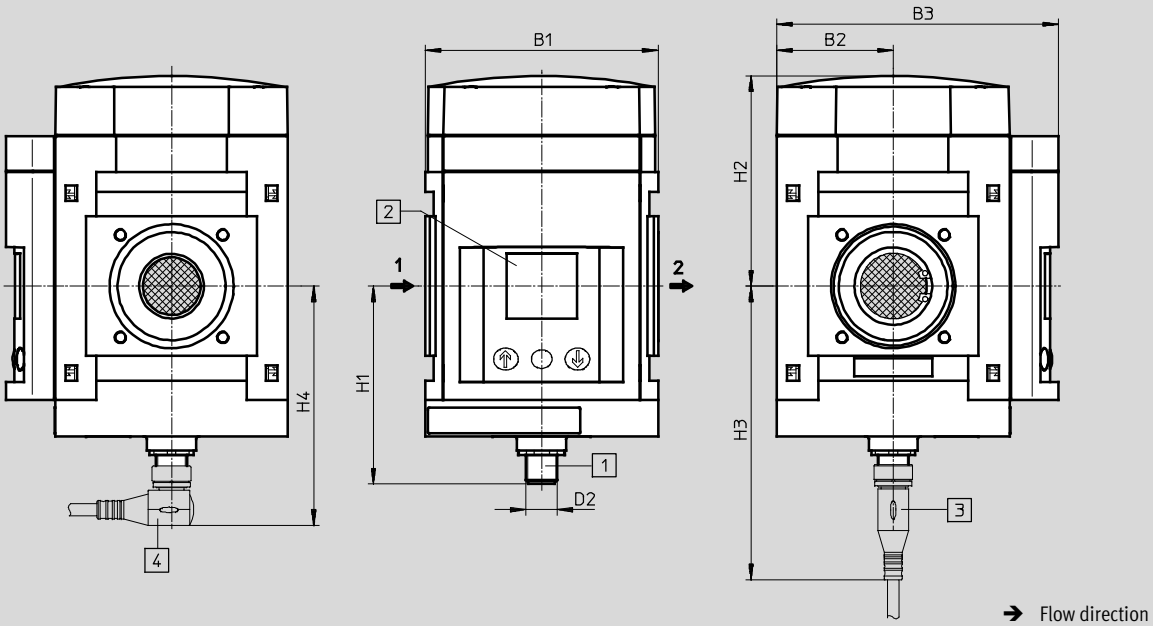
Type	B1	B2	B3	B4	B5	B6	B7	D1	D2	D3	H1	H2	H3	H4	H5	H6	⌀C
SFAM-62-...-M	62	31	78.7	–	–	–	–	–	M12x1	–	63.5	62.1	101	80	–	–	–
SFAM-62-...-TG12	62	31	78.7	277	40	–	–	G½	M12x1	G¾	63.5	62.1	101	80	–	–	26
SFAM-62-...-WG12						61.9	4.5								71	6.6	
SFAM-62-...-TN12	62	31	78.7	277	40	–	–	NPT½	M12x1	NPT¾	63.5	62.1	101	80	–	–	26
SFAM-62-...-WN12						61.9	4.5								71	6.6	

Flow sensors SFAM

Technical data

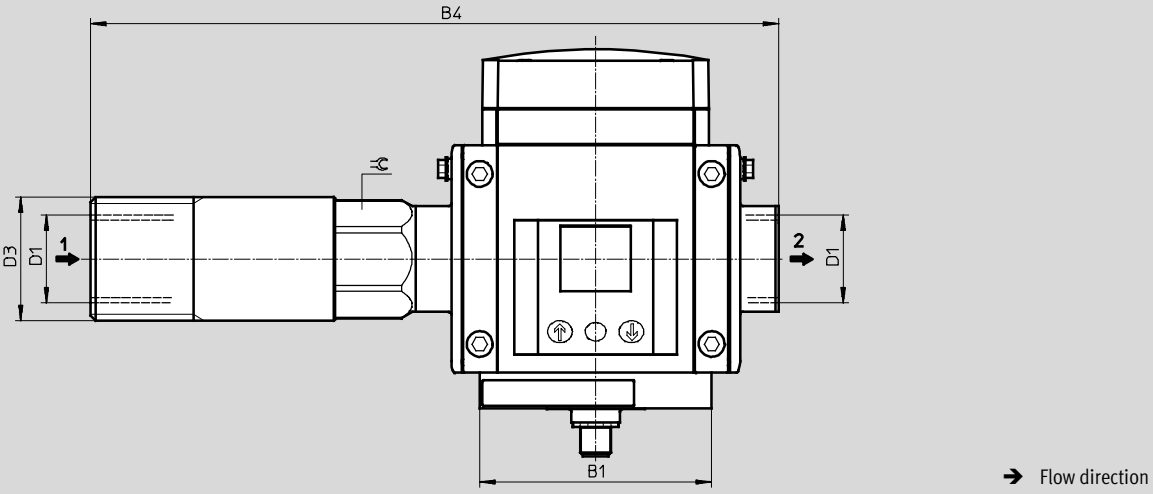
Dimensions – SFAM-90 Download CAD data ➔ **www.festo.com/en/engineering**

SFAM-90-...-M for manifold assembly in MS9 series service unit combination



1 Plug M12x1 to EN 60947-5-2
2 LCD display
3 Connecting cable, straight socket
4 Connecting cable, angled socket

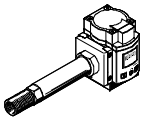
SFAM-90-...-T for individual assembly



Type	B1	B2	B3	B4	D1	D2	D3	H1	H2	H3	H4	⫷
SFAM-90-...-M	90	45	109	–	–	M12x1	–	76.5	81.3	114	93	–
SFAM-90-...-TG1	90	45	109	267	G1	M12x1	G1½	76.5	81.3	114	93	41
SFAM-90-...-TG112				301	G1½		G2					55
SFAM-90-...-TN1	90	45	109	267	NPT1	M12x1	NPT1½	76.5	81.3	114	93	41
SFAM-90-...-TN112				301	NPT1½		NPT2					55

Flow sensors SFAM

Technical data

Ordering data					
Version	Grid dimension [mm]	Electrical output	Flow measuring range [l/min]	Part No.	Type
Manifold assembly in MS series service unit combination					
	62	2x PNP or NPN, 1 analogue output 4 ... 20 mA	10 ... 1,000	**564930**	**SFAM-62-1000L-M-2SA-M12**
			30 ... 3,000	**564934**	**SFAM-62-3000L-M-2SA-M12**
			50 ... 5,000	**564938**	**SFAM-62-5000L-M-2SA-M12**
		2x PNP or NPN, 1 analogue output 0 ... 10 V	10 ... 1,000	**564932**	**SFAM-62-1000L-M-2SV-M12**
			30 ... 3,000	**564936**	**SFAM-62-3000L-M-2SV-M12**
			50 ... 5,000	**564940**	**SFAM-62-5000L-M-2SV-M12**
	90	2x PNP or NPN, 1 analogue output 4 ... 20 mA	50 ... 5,000	**573346**	**SFAM-90-5000L-M-2SA-M12**
			100 ... 10,000	**573348**	**SFAM-90-10000L-M-2SA-M12**
			150 ... 15,000	**573350**	**SFAM-90-15000L-M-2SA-M12**
		2x PNP or NPN, 1 analogue output 0 ... 10 V	50 ... 5,000	**573347**	**SFAM-90-5000L-M-2SV-M12**
			100 ... 10,000	**573349**	**SFAM-90-10000L-M-2SV-M12**
			150 ... 15,000	**573351**	**SFAM-90-15000L-M-2SV-M12**
Threaded mounting of individual device					
	62	2x PNP or NPN, 1 analogue output 4 ... 20 mA	10 ... 1,000	**565375**	**SFAM-62-1000L-TG12-2SA-M12**
			30 ... 3,000	**565379**	**SFAM-62-3000L-TG12-2SA-M12**
			50 ... 5,000	**565383**	**SFAM-62-5000L-TG12-2SA-M12**
		2x PNP or NPN, 1 analogue output 0 ... 10 V	10 ... 1,000	**565376**	**SFAM-62-1000L-TG12-2SV-M12**
			30 ... 3,000	**565380**	**SFAM-62-3000L-TG12-2SV-M12**
			50 ... 5,000	**565384**	**SFAM-62-5000L-TG12-2SV-M12**
	90	2x PNP or NPN, 1 analogue output 4 ... 20 mA	50 ... 5,000	**573352**	**SFAM-90-5000L-TG1-2SA-M12**
			100 ... 10,000	**573354**	**SFAM-90-10000L-TG112-2SA-M12**
			150 ... 15,000	**573356**	**SFAM-90-15000L-TG112-2SA-M12**
		2x PNP or NPN, 1 analogue output 0 ... 10 V	50 ... 5,000	**573353**	**SFAM-90-5000L-TG1-2SV-M12**
			100 ... 10,000	**573355**	**SFAM-90-10000L-TG112-2SV-M12**
			150 ... 15,000	**573357**	**SFAM-90-15000L-TG112-2SV-M12**

Flow sensors SFAM

Ordering data – Modular products

FESTO

Ordering table

			Conditions	Code		Enter code
M	Module No.	**563796**				
	Function	Flow sensor		**SFAM**		-SFAM
	Grid dimension	62 mm		**-62**		
		90 mm		**-90**		
	Flow measuring range	Max. 1,000 l/min	1	**-1000**		
		Max. 3,000 l/min	1	**-3000**		
		Max. 5,000 l/min		**-5000**		
		Max. 10,000 l/min	2	**-10000**		
		Max. 15,000 l/min	2	**-15000**		
	Flow input	Unidirectional, from left to right		**L**		
		Unidirectional, from right to left		**R**		
	Type of mounting	Manifold assembly		**-M**		
		Threaded mounting		**-T**		
		Wall mounting	1 4	**-W**		
O	Pneumatic connection	Not specified				
		G½	1 3	**G12**		
		G1	2 3	**G1**		
		G1½	2 3	**G112**		
		½" NPT	1 3	**N12**		
		1" NPT	2 3	**N1**		
		1½" NPT	2 3	**N112**		
M	Electrical output	2x PNP or NPN, 1 analogue output 4 ... 20 mA		**-2SA**		
		2x PNP or NPN, 1 analogue output 0 ... 10 V		**-2SV**		
	Electrical connection	Plug M12, A-coded		**-M12**		M12
O	Electrical accessories	Not specified				
		Angled socket, 2.5 m cable		**-2.5A**		
		Straight socket, 2.5 m cable		**-2.5S**		
		Angled socket, 5 m cable		**-5A**		
		Straight socket, 5 m cable		**-5S**		
	EU certification	Not specified				
		II 3GD		**-EX2**		

1 **1000, 3000, G12, N12, W**
Not with grid dimension 90

2 **10000, 15000, G1, G112, N1, N112**
Not with grid dimension 62

3 **G12, G1, G112, N12, N1, N112**
Not with mounting type M
Mandatory data for mounting type T, W

4 **W** Not with EX2

Transfer order code

563796	SFAM	–		–			–			–		–	M12	–		–	

Flow sensors SFAM

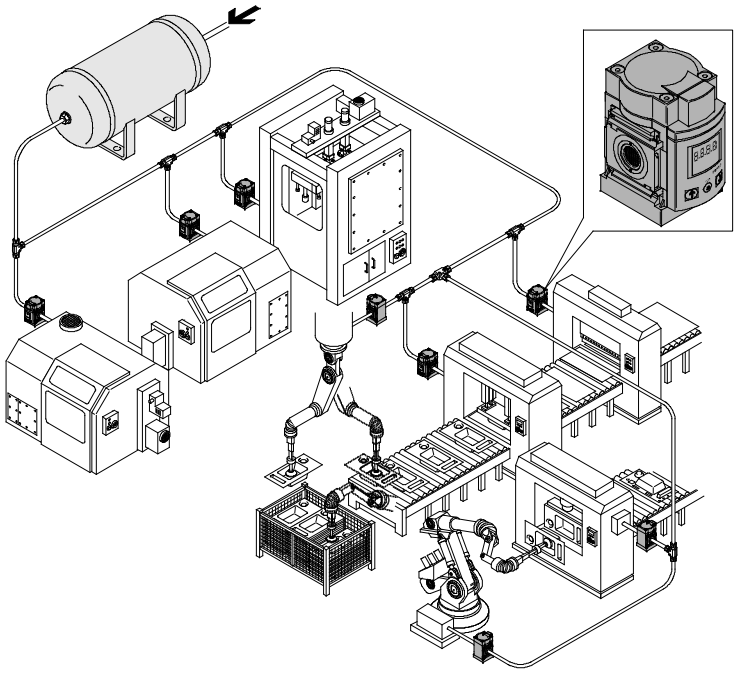
Accessories and Application example

Ordering data – Connecting cables

Technical data ➔ Internet: nebu

	Number of wires	Cable length [m]	Part No.	Type
M12x1, straight socket				
	5	2.5	**541330**	**NEBU-M12G5-K-2.5-LE5**
		5	**541331**	**NEBU-M12G5-K-5-LE5**
M12x1, angled socket				
	5	2.5	**567843**	**NEBU-M12W5-K-2.5-LE5**
		5	**567844**	**NEBU-M12W5-K-5-LE5**

Application example



- Compressed air consumption and function monitoring of various systems in the production process