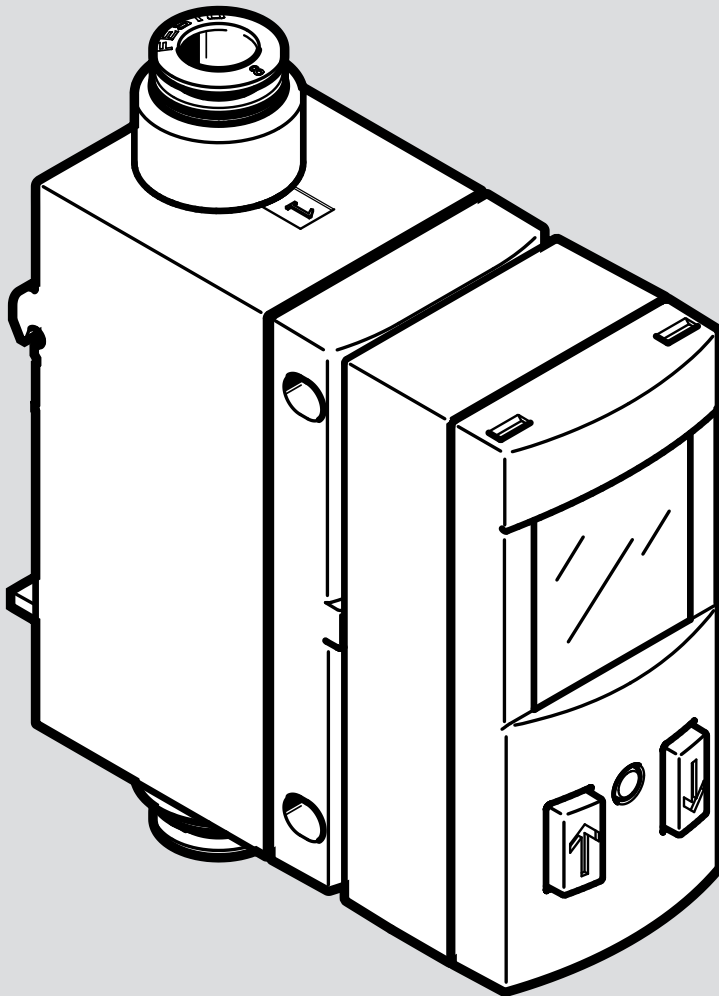


SFAB-...-PNLK
Flow sensor

FESTO

Operating instruction



8210575

8210575
2024-12a
[8210577]

Original instructions

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

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1 Applicable documents



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

2 Safety

2.1 Safety instructions

- Only use the product in its original condition without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Observe the identifications on the product.
- Condensation, oil mist, foreign matter and other contaminants in the compressed air can damage the product. Use media only in accordance with the specifications → 13 Technical data.
- The product may generate high frequency interference, which may require interference suppression measures in residential areas.

2.2 Intended use

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

2.3 Training of qualified personnel

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

2.4 UL/CSA certification

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

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

Tab. 1: UL/CSA certification information

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

⚠ WARNING

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

3 Additional information

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

4 Product overview

4.1 Design

4.1.1 Product design

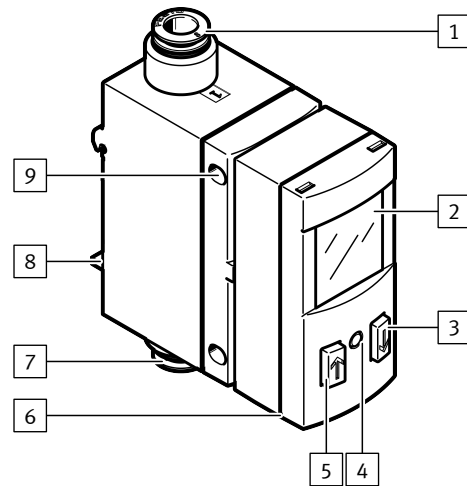


Fig. 1: Control elements and connection elements

- | | |
|---------------------------|---|
| 1 Pneumatic port 1 | 6 Plug for M12 electrical connection |
| 2 Display | 7 Pneumatic port 2 |
| 3 [B] key | 8 Mounting slide for DIN rail mounting and wall mounting, rear |
| 4 [Edit] key | 9 Hole for panel mounting |
| 5 [A] key | |

4.1.2 Display components

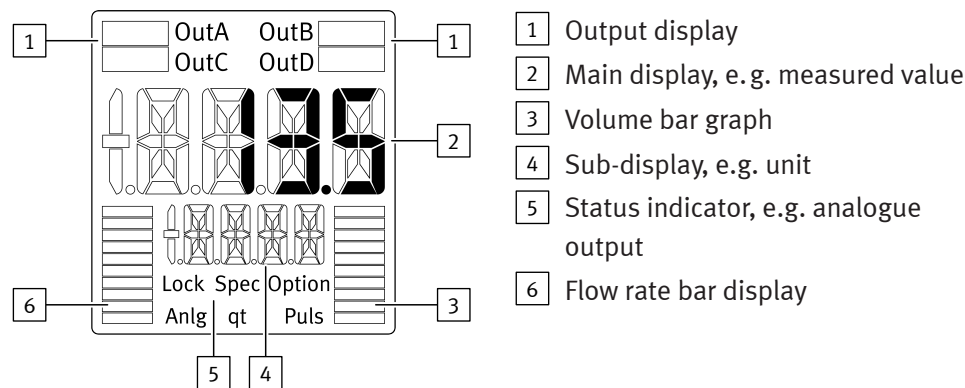


Fig. 2: LCD display

Symbols on the display

Example for LCD display		Meaning
Output display		
	' OutA'	Switching output OutA selected, flashes when IO-Link is active.
	' OutA'	Switching output OutA set.
	'OutC'	Volume pulse OutC selected, flashes when IO-Link is active.
	'OutC'	Volume pulse OutC set.
	'OutB'	Switching output OutB selected.
	'OutB'	Switching output OutB set.
	'Pulse'	Volume pulse selected.
	'Anlg'	Analogue output selected.
Information/input display		
		Graphic display of flow measurement
		Graphic display of volume measurement
	'q'	Input signal flow rate selected.
	't'	Input signal temperature selected.
	'Lock'	Security code activated.
	'Spec'	Special menu selected.
	'Option'	Illuminates when parameters having a special influence on the measured value indicator have been changed compared to the factory setting: reference condition (standard), gas.

Tab. 2: Symbols on the display

Example for LCD display		Meaning
Main display	Secondary display	
Measured value indicator and unit in RUN mode		
'17.3'	'l/min'	Measured value indicator and unit
Menu for the switching outputs OutA, OutB, OutC		
'Edit'	'Flow'	Edit menu for the switching outputs
'OFF'	'Fctn'	Switching function deactivated.
'_I_'	'Fctn'	Threshold value comparator
'_I'_I_'	'Fctn'	Window comparator

Example for LCD display		Meaning
Main display	Secondary display	
┌┐	'Fctn'	2-point threshold value comparator
'18.0'	'SP'	Switching point value
'8.0'	'SP.Lo'	Value of lower switching point
'12.2'	'SP.Hi'	Value of upper switching point
'2.8'	'HY'	Hysteresis value
'NO'	'logic'	Switching characteristics of the switching outputs: 'NO' = N/O contact, normally open 'NC' = N/C contact, normally closed
'bLUE'	'COLR'	Display colour
'200'	'PULS' / 'MSEC'	Width of the volume pulse or mass pulse
Menu for the analogue output		
'1_5V'	'Out'	Analogue output type '0_10V', '1_5V', '4_20mA'
'38'	'In.Hi'/'%'	Scaling of the analogue output: end value
'3'	'In.Lo'/'%'	Scaling of the analogue output: start value
Menu for extreme values and mean values (SHOW menu)		
'5.1'	'MIN'/'l/Min'	Minimum measured flow rate since switch-on or the last reset
'30.8'	'MAX'/'l/Min'	Maximum measured flow rate since switch-on or the last reset
'20.8'	'AVER'/'l/Min'	Average of the flow rate measurement, filter time constants switchable
Menu for device settings (SPEC menu)		
'64'	'Filt'/'MSEC'	Value of the filter time constant for the flow rate measurement signal
'l/min'	'FLOW'/'Unit'	Display unit for flow rate measurement
'0°C'	'REF'/'Cond'	Reference standard for gas volume
'Air'	'GAS'	Selection of the operating medium
'OFF'	'Z.Adj'	Activation of the zero point synchronisation
'°C'	'tEMP'/'Unit'	Display unit for temperature measurement
'Unit'	'Sub.d'	Settings of the secondary display in RUN mode
'10'	'Eco'/'SEC'	Economy mode: time after which the display background lighting is switched off.
'PNP'	'bin'/'Out'	Switchover of the switching outputs between PNP and NPN
'FLOW'	'bin'/'Pin4'	Switchover of the switching signal at pin 4 between flow monitoring and volume pulse
'FLOW'	'bin'/'Pin2'	Switchover of the signal at Pin2 between flow monitoring, flow measurement and temperature recording
'OFF'	'Lock'/'Code'	Activation and specification of the security code
'OFF'	'MAST'	Activation of the IO-Link master function for replication of parameters

Tab. 3: Example for LCD display

4.2 Function

4.2.1 Functional principle

The sensor measures the standard volumetric flow rate or mass flow rate by a thermal process. The sensor measures the amount of heat extracted from the heated surface of a micro-mechanical sensor element by the medium as it flows past. The sensor determines the flow rate or the accumulated volume from the amount of heat removed and shows this on the display. The sensor calculates the

temperature of the medium from the sensor signals. The sensor is connected to higher-level systems via switching outputs, a volume switching pulse, an analogue output or an IO-Link interface. Depending on the configuration, the switching outputs monitor a threshold value or a signal range. The outputs can be set as PNP or NPN and normally open (NO) or normally closed (NC). The analogue output can be operated either as a voltage output or as a current output. Process values can be read out and parameters can be changed and transmitted to additional devices through the IO-Link interface. If the flow rate is integrated, a volume signal or mass signal can be calculated and output via a pulse output and an accumulated measured value via IO-Link.

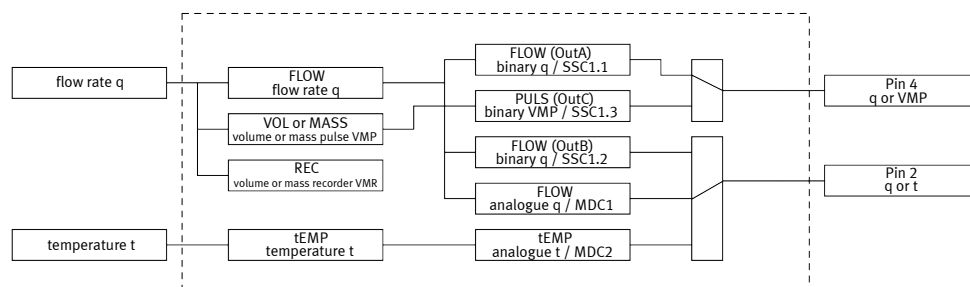


Fig. 3: Signal structure SFAB

4.2.2 Operating statuses

Operating status	Function
RUN mode	- Basic state after the operating voltage has been applied. - Display of the current measured value. - Display of the selected inputs and outputs. - Switchover between the measured variables of flow rate, volume and temperature.
SHOW mode	- Display of the current settings for the switching outputs and the analogue output. - Display and reset of the minimum and maximum values. - Display of the average flow rate measurement.
EDIT mode	Setting or modification of parameters.
TEACH mode	Acceptance of the current measured value to specify switching points.
RECORDER mode	Manual measurement of the accumulated volume.

Tab. 4: Operating statuses SFAB

4.2.3 Switching outputs

4.2.3.1 Switching functions

Threshold value comparator

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

Tab. 5: Threshold value comparator

Window comparator

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

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

Tab. 6: Window comparator

2-point threshold value comparator

Function	N/O (normally open)	N/C (normally closed)
Switching function: – 2 switching points (SP.Lo, SP.Hi)		
TEACH mode: ¹⁾ – 2 teach-in points (TP1, TP2) – TP1 = SP.Lo, TP2 = SP.Hi		

1) SP.Lo = smaller value, SP.Hi = larger value, independent of the teach sequence

Tab. 7: 2-point threshold value comparator

4.2.3.2 Colour change

A red colour change can be set in the display for the switching outputs OutA and OutB depending on the switching status. The colour change enables the system status to be identified from a greater distance. The red display is always dominant.

Parameters	Meaning
'bLUE'	The display is always blue; the colour change function is switched off.
'R.On'	The display is red when the switching output is set (high = 1). The display is blue when the switching output is not set (low = 0).
'R.OFF'	The display is red when the switching output is not set (low = 0). The display is blue when the switching output is set (high = 1).

Tab. 8: Change in colour of display

4.2.3.3 Volume measurement and mass measurement

A threshold value for the volume or the mass is set in the accumulated volume measurement or mass measurement. If the configured threshold value is reached, the SFAB outputs a switching pulse at the switching output OutC. The volume measurement or mass measurement is restarted at every switching pulse. The pulse width is adjustable.

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

Tab. 9: Volume pulse with accumulated volume measurement

4.2.4 Filter

The filter smoothes the flow rate measurement signal in 12 stages. Smoothing affects all outputs. The switching times of the flow-related switching outputs and the rise time and fall time of the analogue output change. The filter time equals the time constant T of a low-pass filter.

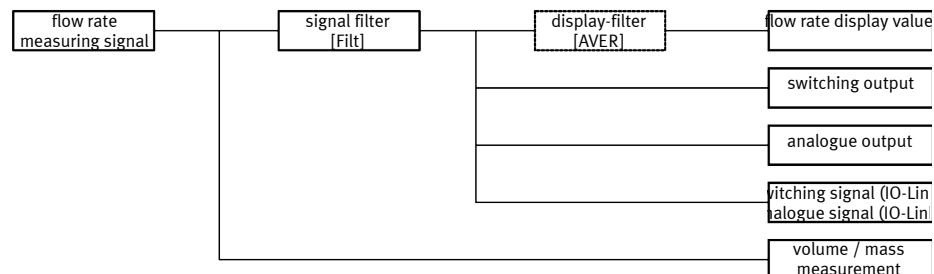


Fig. 4: Effect of filter settings

The display filter only affects the flow rate measured value in SHOW mode [AVER].

4.2.5 Analogue output

Analogue signal

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

Output signal

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

Scaling of the analogue signal

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

The analogue output can also be scaled in the negative range up to -100%FS.

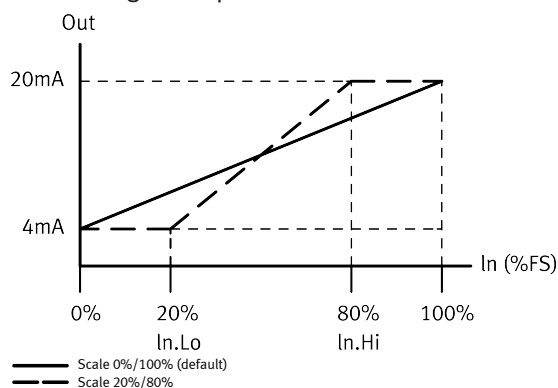


Fig. 5: Example: scaling of the analogue signal at the current output

4.2.6 Minimum value and maximum value

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



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

4.2.7 Security code

A 4-digit numeric code can be set to protect the device settings from unauthorised access. The security code must be entered in EDIT mode and TEACH mode when changing settings.

The IO-Link interface offers additional options for blocking access → 8 IO-Link interface description.

4.2.8 Replicate parameter function

This function enables all settings that have been carried out on one sensor (master) to be transferred to other identical sensors (device).

Parameters are transferred with the IO-Link functions. The configured sensor is set to a master mode and can then send its parameters to an identical device sensor (identical device ID).

4.2.9 Switchover of standard condition

The represented flow rate units and volume units can be related to different standard conditions. It is possible to switch between the following standard conditions. In the menu navigation on the display, the corresponding standard is determined by selecting the reference temperature.

REF / Cond	Off	15 °C	20 °C
Standard	DIN 1343	ISO 2533	ISO 6358 / ISO 8778
Air pressure (absolute) [kPa]	101.325	101.325	100
Temperature [°C]	0	15	20
Humidity [%]	0	0	65
Status information "Option"	Does not light up	Lights up	Lights up
Correction factor, measurement range end value	1	1.055	1.087

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

Calibration of the sensor refers back to the physical standard conditions in accordance with DIN 1343.

If a standard other than DIN 1343 is selected, the specified measurement range (± 100 % FS) changes in value by the factor specified in → Tab. 10 Standard conditions for flow rate units and volume units. This change is visualised in the display through 'Option'.

Changing the reference standard only adjusts the display on the sensor. If necessary, the effect on the nominal measurement range of the respective sensor must also be considered when evaluating the analogue output.

4.2.10 Zero point synchronisation

If the sensor is installed in a vertical position, the measurement may deviate at high pressures. The zero point can be adjusted to compensate for the measurement deviation. The zero point adjustment affects the display and all outputs. The zero point adjustment is possible only for the Zero Adjust = ON setting and the zero range hiding is no longer active. The offset error is visible on the display and can be set to zero using a zero-adjust teach process.

5 Mounting



When selecting the mounting position, make sure that no condensation water can accumulate in the sensor.

5.1 Mounting sensor on DIN rail

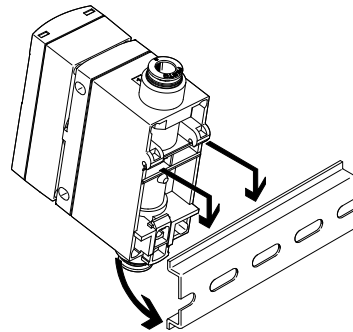


Fig. 6: Mounting on DIN rail

1. Attach the sensor to the DIN rail.
2. Press the sensor in the direction of the arrow.
⇒ The sensor snaps into place.

5.2 Mounting sensor with wall mounting

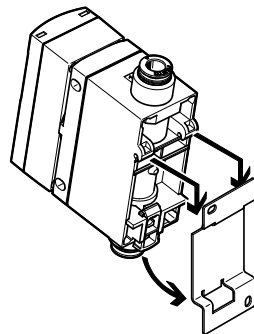


Fig. 7: Wall mounting

1. Fasten the adapter plate with 2 M3 screws.
2. Attach the sensor to the adapter plate.
3. Press the sensor in the direction of the arrow.
⇒ The sensor snaps into place.

5.3 Mounting sensor on plate

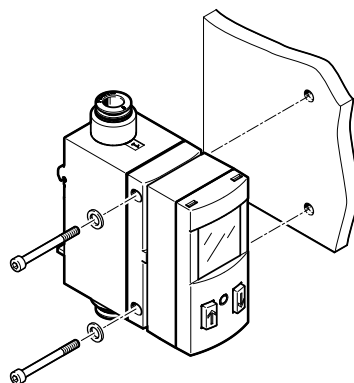


Fig. 8: Mounting on plate

- Fasten the sensor with washers and 2 screws M4.
– Max. tightening torque: 1 Nm

5.4 Rotate the display

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

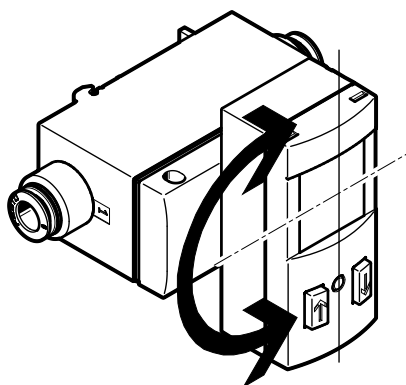


Fig. 9: Rotate the display

6 Installation

6.1 Installation, pneumatic

The flow rate is supplied at connection 1 and withdrawn at connection 2. The direction of flow is indicated on the sensor by an arrow.

If the hoses are installed incorrectly, the negative measured values will flash on the display.

6.2 Installation, electrical

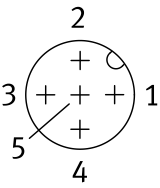
⚠ WARNING

Risk of injury due to electric shock.

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

1. Observe signal line length ➔ 13 Technical data.

2. Configure binary outputs according to the wiring.
 - Tightening torque for the union nut at the plug connector: max. 0.3 Nm

Plug	Pin	Wire colour ¹⁾	Assignment
M12, 5-pin 	1	Brown (BN)	Operating voltage +24 V DC
	2	White (WH)	Electrical output 2 (OutB or analogue)
	3	Blue (BU)	Operating voltage 0 V
	4	Black (BK)	Electrical output 1 (OutA, pulse, C/Q line with IO-Link)
	5	Grey (GY)	n.c.

1) When using the connecting cable from the accessories.

Tab. 11: Pin allocation

Circuit diagram

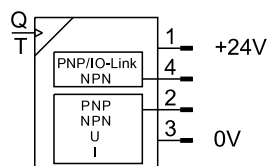


Fig. 10: Circuit diagram

7 Commissioning

7.1 Switching on the sensor in RUN mode

- Switch on the operating voltage.
 - ⇒ The current measured value is displayed. The sensor is in the basic status.
- The sensor is in the basic status in RUN mode. The sensor shows the current measured values. The basic status can be reached as follows from other modes:
- Press and hold the [Edit] key for 3 seconds.
 - Expiration of monitoring time (timeout).

Switchover of measured value indicator

The measured value indicator can be switched between flow rate, temperature and volume/mass in RUN mode.

1. Briefly press the [A] or [B] key.
2. Repeat the process with a 1...3 second pause until the desired measured variable is displayed.

7.2 Displaying parameters in SHOW mode

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

Switching output OutA or volume output

1. Press the [A] key twice in rapid succession.
 - ⇒ The first parameter set 'Pin4'/'bin' is displayed.
2. Press the [A] key to display the following parameters → Fig. 11.
 - At the end, the flow rate values 'MIN', 'MAX' and 'AVER' are displayed.

Switching output OutB or analogue output Anlg

1. Press the [B] pushbutton twice in rapid succession.
 - ⇒ The first set parameter 'Pin2'/'ANLG' or 'Pin2'/'bin' is displayed.
2. Press the [B] key to display the following parameters → Fig. 11.

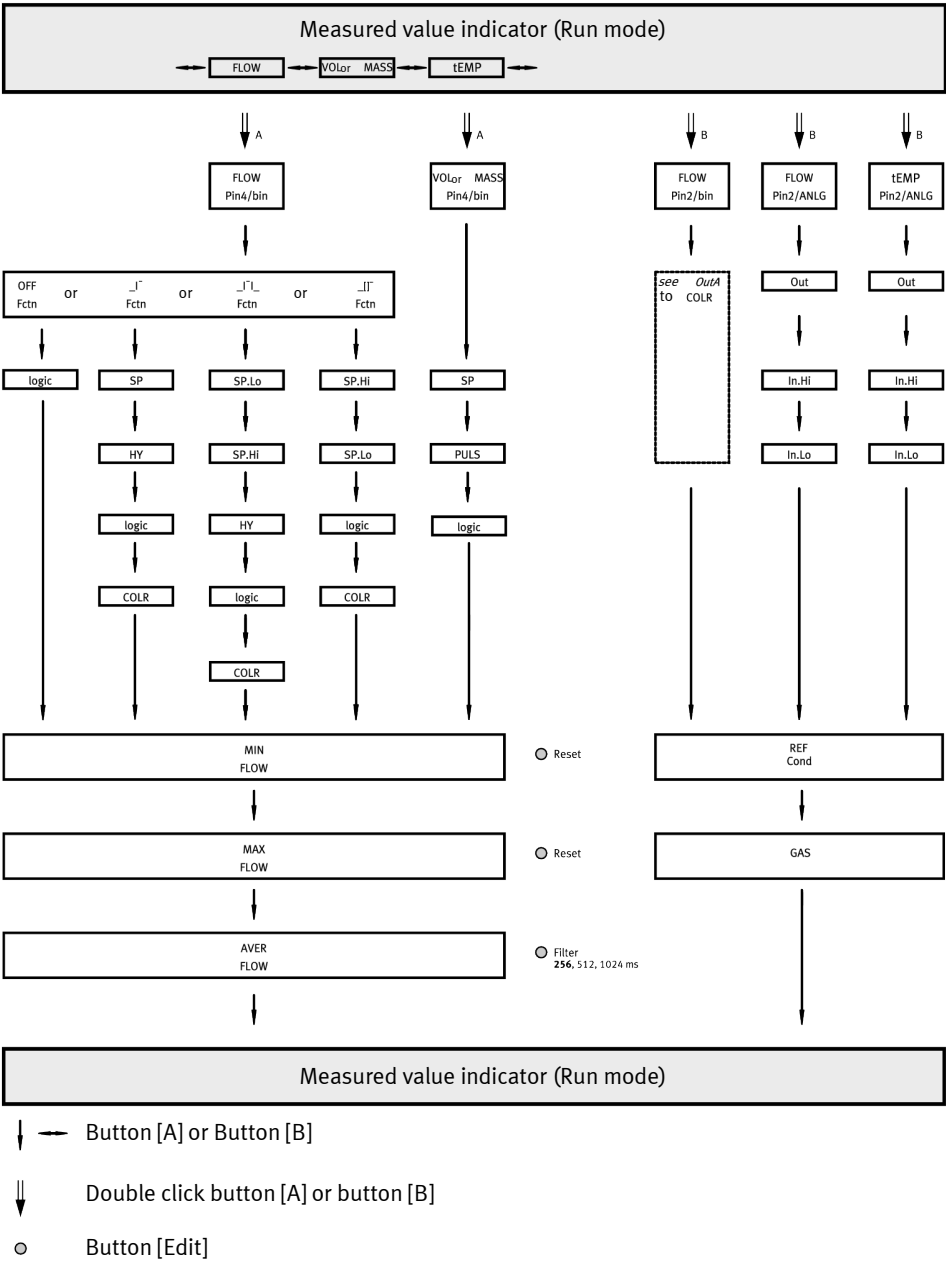


Fig. 11: Menu structure for SHOW mode

7.3 Configuring the sensor in EDIT mode

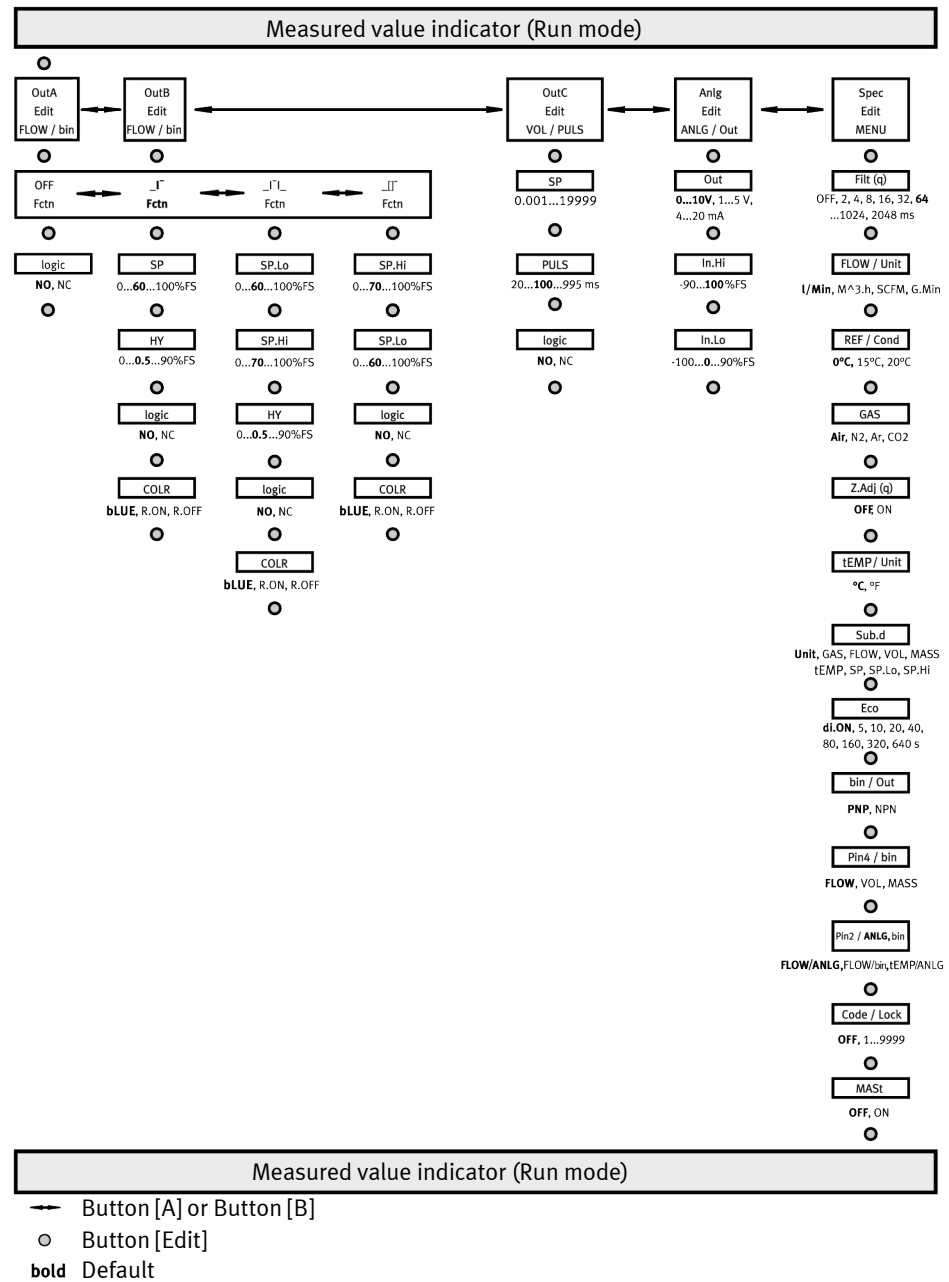


Fig. 12: EDIT mode menu structure

7.3.1 Starting EDIT Mode

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

1. Press the [Edit] key.
⇒ The EDIT mode is active. 'OutA' and 'Edit' are displayed.
2. If the security code 'LOCK' is active, enter the security code using the [A] pushbutton or the [B] pushbutton and press the [Edit] key.
⇒ The EDIT mode is active. 'OutA' and 'Edit' are displayed.

7.3.2 Configuring the switching output



The sequence for configuring the OutA and OutB switching outputs is identical. In the following, the process is described using the OutA switching output.

Requirement: EDIT mode is active.

1. Press the [Edit] key.
⇒ 'Fctn' flashes.
2. Select the switching function 'OFF', '┐', '┐┐' or '┐┐' with the [A] or [B] key.
3. Press the [Edit] key.
⇒ The set value is saved. The next adjustable parameter is shown.
4. Set the parameter with the [A] or the [B] key.
5. Repeat steps 3 and 4 until all parameters are set → Fig. 12.
6. Press the [Edit] key.
⇒ RUN mode is active.

7.3.3 Changing device settings

Requirement: EDIT mode is active.

1. Select the 'Spec' with the [A] or the [B] key.
⇒ 'Spec' is displayed.
2. Press the [Edit] key.
⇒ 'Filt' / 'MSEC' flashes.
3. Set the parameter with the [A] or the [B] key.
4. Press the [Edit] key.
⇒ The set value is saved. The next adjustable parameter is shown.
5. Repeat steps 3 and 4 until all parameters are set.
6. Press the [Edit] key.
⇒ RUN mode is active.

7.3.4 Setting the volume pulse output

Requirement: EDIT mode is active.

1. Select 'Puls' / 'VOL' with the A key or B key.
2. Press the [Edit] key.
⇒ 'SP' / 'Volume Unit' flashes.
3. Set the parameter with the [A] or the [B] key.
4. Press the [Edit] key.
⇒ The set value is saved. The next adjustable parameter is shown.
5. Repeat steps 3 and 4 until all parameters are set.
6. Press the [Edit] key.
⇒ RUN mode is active.

7.3.5 Setting the analogue output

Requirement: EDIT mode is active.

1. Select 'ANLG'/'Out' with the A or the B key.
2. Press the [Edit] key.
⇒ 'Out'/'V' or 'Out'/'MA' flashes.
3. Set the parameter with the [A] or the [B] key.
4. Press the [Edit] key.
⇒ The set value is saved. The next adjustable parameter is shown.
5. Repeat steps 3 and 4 until all parameters are set.
6. Press the [Edit] key.
⇒ RUN mode is active.

7.3.6 Replicating parameters

Requirements:

- The configured sensor (master sensor) is operational and in RUN mode.
- The master sensor and device sensor are identical with reference to the parameters, i.e. they have the same device ID.
- The master sensor is connected with the device sensor → Fig. 13.
- Parameterisation of the device sensor must not be blocked via IO-Link®.

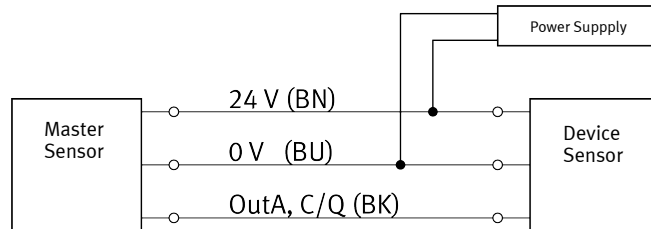


Fig. 13: Replicate pin allocation parameters

1. Select the 'SPEC' special menu from the device settings on the master sensor.
2. Press the [Edit] key repeatedly until 'MASt' appears.
3. Select 'ON' with the [A] or the [B] key.
4. Press the [Edit] key.
 - ⇒ 'REPL' and 'REdY' appear.
5. Press the [A] or the [B] key.
 - ⇒ 'REPL' and 'RUN' appear briefly. The parameters are transmitted to the device sensor. 'REPL' and 'REdY' appear. If an error occurs, an error message appears → 11 Fault clearance.
6. Repeat point 5 if an additional sensor is to be parameterised.
7. Press the [Edit] key.
 - ⇒ RUN mode is active.

7.3.7 Zero point synchronisation

Requirements:

- 'Z.Adj' 'ON' is set.
 - The operating pressure is present, but there is no flow rate.
 - RUN mode is active.
 - The measured value lies in the range 0 l/min ± 3 %FS.
1. Press the [A] key and the [B] key.
 2. Also press the [Edit] key.
 - ⇒ – If 'OK' appears: the zero point synchronisation was successful.
 - 'FAIL' appears: the zero point synchronisation was not successful. Check requirements.



If 'Z.Adj' 'OFF' is set for a later time, the sensor uses the factory-set calibration values.

7.4 Teaching the switching points in TEACH mode

The switching points for flow monitoring can be established in the TEACH mode
 ➔ 4.2.3 Switching outputs.



Before the teach-in, set the switching function to EDIT mode ➔ 7.3 Configuring the sensor in EDIT mode.

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

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

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

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

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

7.5 Measuring volume manually in RECORDER mode

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

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



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

When the operating voltage is switched off, the volume measurement is saved with a degree of inaccuracy, because the value is saved to the non-volatile memory area every 2 minutes.

8 IO-Link interface description

8.1 General information, IO-Link

Characteristics	Specification
Protocol	IO-Link
Revision ID	V1.1
Device profiles	Smart Sensor - SSP 4.1.2 Firmware Update identification and diagnosis Function Measurement data, standard resolution Function Multiple switching signal Function Teach single value Function Extended identification Function Locator Function Product URI
Transmission rate	COM3
SIO-Mode support	Yes
Port type	class A
Process data output length	0 bit
Process data input length	64 bit
Process data content IN	Flow measurement value 16 bit MDC Flow monitoring 2 bit SSC Temperature measurement value 16 bit MDC Temperature monitoring 2 bit SSC Volume / mass pulse 1 bit SSC
Service data IN	Volume /mass measurement value 32 bit
Min. cycle time	1,2 ms
Data storage required	0,5 kByte
Device ID	➔ Tab. 13 Device ID values

Tab. 12: General IO-Link specification

Device ID [dec]	Device ID [hex]	Order code
329417	0x0506C9	SFAB-10
329418	0x0506CA	SFAB-50
329419	0x0506CB	SFAB-200
329420	0x0506CC	SFAB-600
329421	0x0506CD	SFAB-1000

Tab. 13: Device ID values

8.2 Identification parameters

Index	Subindex	Access ¹⁾	Name	Value	String length
0x0010 (16)	0x00	R	Vendor Name	Festo	5
0x0011 (17)	0x00		Vendor Text	http://www.festo.com	20
0x0012 (18)	0x00		Product Name	Order Code, e.g. SFAB-10U-HQ6-PNLK-PNVBA-M12	Max. 64
0x0013 (19)	0x00		Product ID	e.g. 563795 SFAB-10	
0x0014 (20)	0x00		Product Text	Flow sensor	11
0x0015 (21)	0x00		Serial Number	Product Key, e.g. MW3N10KCP3X	11
0x0016 (22)	0x00		Hardware Revision	e.g. REV01	5
0x0017 (23)	0x00		Firmware Revision	e.g. V8.8.5	Max. 8
0x0018 (24)	0x00	R/W	Application Specific Tag	***	Max. 32
0x0019 (25)	0x00		Function Tag	***	
0x001A (26)	0x00		Location Tag	***	
0x001B (27)	0x00	R	Product URI	e.g. https://pk.festo.com/MW3N10KCP3X	Max. 32
0x2101 (8449)	0x00	R	Part Number	e.g. 8162824	7

1) R = read, R/W = read and write

Tab. 14: Identification parameters

8.3 IO-Link default parameters

Index	Subindex	Access ¹⁾	Name	Value	Format
0x0002 (2)	0x00	W	System Command	➔ 8.4 IO-Link system commands	UIntergerT8
0x000C (12)	0x00	R/W	Device Access Locks ➔ Tab. 16 Device access blocking	bitwise 0: unlocked 1: locked	RecordT (16 bit)
0x0020 (32)	0x00	R	Error Count	0 ... $2^{16} - 1$	UIntergerT16
0x0024 (36)	0x00		Device Status	0: Device is operating properly 2: Out-of-Specification 4: Failure	UIntergerT8
0x0025 (37)	0x00		Detailed Device Status	Octet1 = event identifier Octet2,3 = event code ➔ 8.10 IO-Link diagnostics	ArrayT of Octet-StringT3
0x0028 (40)	0x00		Process Data Input	➔ 8.9 Process data IN	RecordT (64 bit)

1) R = read, W = write, R/W = read and write

Tab. 15: IO-Link default parameters

Bit no.	Description
0	no used
1	no used
2	Local parameterization lock (EDIT- and TEACH-modes)
3	Local user interface lock (SHOW-, EDIT- and TEACH-modes)

Tab. 16: Device access blocking

8.4 IO-Link system commands

Value [dec]	Value [hex]	Command	Description
65	0x41	SP1 Single Value Teach	Determines Teachpoint for Set-point SP1
66	0x42	SP2 Single Value Teach	Determines Teachpoint for Set-point SP2
75	0x4B	Specific Teach	Two point teach according to the teach flag
76	0x4C	Teach Cancel	Cancels the Teach sequence
126	0x7E	Locator Start	Display double flashing for localization
127	0x7F	Locator Stop	Stop double flashing
128	0x80	Device reset	Device warm start
129	0x81	Application Reset	Reset the technology specific application
130	0x82	Restore factory settings	Sets the factory settings operative again
131	0x83	Back-to-box	Restore parameters to the original delivery values
160	0xA0	Reset Min MDC1 (q)	Minimal measured flow value reset
161	0xA1	Reset Max MDC1 (q)	Maximal measured flow value reset
166	0xA6	Reset Min MDC2 (t)	Minimal measured temperature value reset
167	0xA7	Reset Max MDC2 (t)	Maximal measured temperature value reset
168	0xA8	Adjust flow zero point	User defined flow zero point adjustment
176	0xB0	Reset volume / mass recorder	
177	0xB1	Run / resume volume / mass recorder	
178	0xB2	Pause volume / mass recorder	

Tab. 17: IO-Link system commands

8.5 Smart sensor profile parameters

Index	Subindex	Access ¹⁾	Name	Value	Format
0x000D (13)	0x00	R	Profile Characteristics	0x0011, 0x0031, 0x8101, 0x8102	ArrayT of UIntegerT16
	0x01		Device Profile ID	0x0011: Measuring and switching sensor, 2-channel (SSP 4.1.2)	UIntegerT16
	0x02			0x0031: Firmware update	
	0x03		Function Class ID	0x8101: Extended identification/localisation	
	0x04		Function Class ID	0x8102: Product URI	
0x000E (14)	0x00	R	PD Input Descriptor	0x03, 0x10, 0x30, 0x03, 0x08, 0x28, 0x01, 0x03, 0x20, 0x03, 0x10, 0x10, 0x03, 0x08, 0x08, 0x01, 0x02, 0x00	ArrayT of Octet-StringT3
	0x01		Flow value MDC1	0x03, 0x10, 0x30	Octet-StringT3

Index	Subindex	Access ¹⁾	Name	Value	Format
0x000E (14)	0x02	R	Flow scale MDC1	0x03, 0x08, 0x28	Octet-StringT3
	0x03		Flow monitoring SSC1.1 (OutA), SSC1.2 (OutB),Volume / mass pulse SSC1.3 (OutC, Puls)	0x01, 0x03, 0x20	
	0x04		Temperture value MDC2	0x03, 0x10, 0x10	
	0x05		Tempertaure scale MDC2	0x03, 0x08, 0x08	
	0x06		Temperature monitoring SSC2.1, SSC2.2	0x01, 0x02, 0x00	
0x003A (58)	0x00	R/W	Teach Channel	0: SSC1.1 (OutA) 1: SSC1.1 (OutA), factory setting 2: SSC1.2 (OutB) 11: SSC2.1 12: SSC2.2	UIntegerT8
0x003B (59)	0x00	R	Teach Result	Combined value	RecordT (8 bit)
	0x01		Teach State	0: Idle, default 1: SP1 Success 2: SP2 Success 3: SP12 Success 4: Wait for command 5: Busy 7: Error	UIntegerT4 (4 bit)
	0x02		teach flag TP1 for SP1	0: not set 1: set	BooleanT (1 bit)
	0x03		teach flag TP2 for SP1		
	0x04		teach flag TP1 for SP2		
	0x05		teach flagTP2 for SP2		
	SSC1.1, flow rate monitoring (OutA)				
0x003C (60)	0x00	R/W	SSC1.1Param	Combined value	RecordT (64 bit)
	0x01		Setpoint SP1 (SP, SP.Lo, SP.Hi)	SFAB-10: 0 ... 6000 SFAB-50: 0 ... 3000 SFAB-200: 0 ... 12000 SFAB-600: 0 ... 3600 SFAB-1000: 0 ... 6000	IntegerT32
	0x02		Setpoint SP2 (SP, SP.Lo, SP.Hi)	SFAB-10: 0 ... 6000 SFAB-50: 0 ... 3000 SFAB-200: 0 ... 12000 SFAB-600: 0 ... 3600 SFAB-1000: 0 ... 6000	
0x003D (61)	0x00	R/W	SSC1.1Config	Combined value	RecordT (48 bit)
	0x01		Switchpoint logic (logic)	0: High-active (normally open NO) 1: Low-active (normally close NC)	UIntegerT8
	0x02		Switchpoint mode (Fctn)	0: Deactivated 1: Single point mode (┌┐) 2: Window mode (┌┐┐) 3: Two point mode (┌┐┐)	
	0x03		Hysteresis (HY)	SFAB-10: 0 ... 5400 SFAB-50: 0 ... 2700 SFAB-200: 0 ... 10800 SFAB-600: 0 ... 3240 SFAB-1000: 0 ... 5400	IntegerT32

Index	Subindex	Access ¹⁾	Name	Value	Format
SSC1.2, flow rate monitoring (OutB)					
0x003E (62)	0x00	R/W	SSC1.2Param	Combined value	RecordT (64 bit)
	0x01		Setpoint SP1 (SP, SP.Lo, SP.Hi)	SFAB-10: 0 ... 6000 SFAB-50: 0 ... 3000 SFAB-200: 0 ... 12000 SFAB-600: 0 ... 3600 SFAB-1000: 0 ... 6000	IntegerT32
	0x02		Setpoint SP2 (SP, SP.Lo, SP.Hi)	SFAB-10: 0 ... 6000 SFAB-50: 0 ... 3000 SFAB-200: 0 ... 12000 SFAB-600: 0 ... 3600 SFAB-1000: 0 ... 6000	
0x003F (63)	0x00	R/W	SSC1.2Config	Combined value	RecordT (48 bit)
	0x01		Switchpoint logic (logic)	0: High-active (normally open NO) 1: Low-active (normally close NC)	UIntegerT8
	0x02		Switchpoint mode (Fctn)	0: Deactivated 1: Single point mode (┘) 2: Window mode (┘┐) 3: Two point mode (┘┐)	
	0x03		Hysteresis (HY)	SFAB-10: 0 ... 5400 SFAB-50: 0 ... 2700 SFAB-200: 0 ... 10800 SFAB-600: 0 ... 3240 SFAB-1000: 0 ... 5400	IntegerT32
SSC2.1, temperature monitoring					
0x400C (16396)	0x00	R/W	SSC2.1Param	Combined value	RecordT (64 bit)
	0x01		Setpoint SP1	0 ... 999	IntegerT32
	0x02		Setpoint SP2	0 ... 999	
0x400D (16397)	0x00	R/W	SSC2.1Config	Combined value	RecordT (48 bit)
	0x01		Switchpoint logic (logic)	0: High-active (normally open NO) 1: Low-active (normally close NC)	UIntegerT8
	0x02		Switchpoint mode (Fctn)	0: Deactivated 1: Single point mode (┘) 2: Window mode (┘┐) 3: Two point mode (┘┐)	
	0x03		Hysteresis (HY)	0 ... 900	IntegerT32
SSC2.2, temperature monitoring					
0x400E (16398)	0x00	R/W	SSC2.2Param	Combined value	RecordT (64 bit)
	0x01		Setpoint SP1	0 ... 999	IntegerT32
	0x02		Setpoint SP2	0 ... 999	
0x400F (16399)	0x00	R/W	SSC2.2Config	Combined value	RecordT (48 bit)
	0x01		Switchpoint logic (logic)	0: High-active (normally open NO) 1: Low-active (normally close NC)	UIntegerT8

Index	Subindex	Access ¹⁾	Name	Value	Format
0x400F (16399)	0x02	R/W	Switchpoint mode (Fctn)	0: Deactivated 1: Single point mode (┘┐) 2: Window mode (┘┐┘) 3: Two point mode (┘┐┘)	UIntegerT8
	0x03		Hysteresis (HY)	0 ... 900	IntegerT32
MDC1, flow measurement descriptor					
0x4080 (16512)	0x00	R	MDC1Descr	Combined value	RecordT (88 bit)
	0x01		Lower value of measurement range	SFAB-10: 60 SFAB-50: 30 SFAB-200: 120 SFAB-600: 36 SFAB-1000: 60	IntegerT32
	0x02		Upper value of measurement range	SFAB-10: 6000 SFAB-50: 3000 SFAB-200: 12000 SFAB-600: 3600 SFAB-1000: 6000	
	0x03		Unit code	1349 (m³/h)	UIntegerT16
	0x04		Scale	SFAB-10: −4 (10 ^{−4}) SFAB-50: −3 (10 ^{−3}) SFAB-200: −3 (10 ^{−3}) SFAB-600: −2 (10 ^{−2}) SFAB-1000: −2 (10 ^{−2})	IntegerT8
	MDC2, temperature measurement descriptor				
0x4081 (16513)	0x00	R	MDC2Descr	Combined value	RecordT (88 bit)
	0x01		Lower value of measurement range	0	IntegerT32
	0x02		Upper value of measurement range	500	
	0x03		Unit code	1001 (°C)	UIntegerT16
	0x04		Scale	−1 (10 ^{−1})	IntegerT8

1) R = read, R/W = read and write, — = no access

Tab. 18: Smart sensor profile parameters

8.6 Device-specific parameters

Index	Subindex	Access ¹⁾	Name	Value	Format
0x0118 (280)	0x00	R/W	backlight color (COLR)	0: always blue (bLUE) 1: red if OutA = 0, (R.OFF) 2: red if OutA = 1, (R.ON)	UIntegerT16
			backlight color (COLR)	0: always blue (bLUE) 1: red if OutB = 0, (R.OFF) 2: red if OutB = 1, (R.ON)	
0x0136 (310)	0x00		backlight color (COLR)	0: always blue (bLUE) 1: red if OutB = 0, (R.OFF) 2: red if OutB = 1, (R.ON)	
0x3142 (12610)	0x00		Threshold of volume / mass pulse (PULS, SP)	Typically 1 ... 200000000 Scale: m³: SFAB-10: x 0,00001 SFAB-50: x 0,0001 SFAB-200: x 0,001 SFAB-600: x 0,001 SFAB-1000: x 0,001	UIntegerT32

Index	Subindex	Access ¹⁾	Name	Value	Format
0x0147 (327)	0x00	R/W	Volume / mass pulse switch point logic (PULS, logic)	0: High-active (normally open NO) 1: Low-active (normally close NC)	UIntegerT16
0x0149 (329)	0x00		Volume /mass pulse length (PULS, MSEC)	20 ... 995 ms	
0x016A (362)	0x00		Analog output scaling, start value (Anlg, In.Lo / %)	−100 ... 90	IntegerT16
0x016B (363)	0x00		Analog output scaling, end value (Anlg, In.Hi / %)	−90 ... 100	
0x016C (364)	0x00		Analog output type (Anlg, Out)	0: 0 ... 10 V voltage output 1: 1 ... 5 V voltage output 2: 4 ... 20 mA current output	UIntegerT16
0x017F (383)	0x00		flow unit of the display (q, FLOW/Unit)	0: l/min 2: m³/h 3: scfm 4: g/min	
0x0181 (385)	0x00		Flow display filter MDC1 (q, AVER)	8: 256 ms 9: 512 ms 10: 1024 ms	
0x0182 (386)	0x00		Flow filter response time MDC1 (q, Filt)	0: Filter off 1: 2 ms 2: 4 ms 3: 8 ms 4: 16 ms 5: 32 ms 6: 64 ms 7: 128 ms 8: 256 ms 9: 512 ms 10: 1024 ms 11: 2048 ms	
0x0184 (388)	0x00		User zero adjustment on/off (Z.Adj)	0: off 1: on	
0x01A7 (423)	0x00	R	Volume / mass unit	0: l 1: m³ 2: scf 3: g	
0x01BB (443)	0x00	R/W	Temperature unit MDC2 (t, tEMP/Unit)	0: °C 1: °F	
0x01DC (476)	0x00		Show local SSCs in RUN mode on the display	0: Only active SSCs 1: All local SSCs	
0x01DD (477)	0x00		Measured value display	0: flow 1: Volume / mass pulse 2: temperature	
0x01E1 (481)	0x00		Digital output hardware mode (Out/bin)	0: NPN 1: PNP	

Index	Subindex	Access ¹⁾	Name	Value	Format
0x01E2 (482)	0x00	R/W	Pin2 selection	0: Flow monitoring SSC1.2 (OutB, FLOW, bin) 2: Flow measurement value MDC1 (FLOW, ANLG, q) 4: Temperature measure- ment value MDC2 (tEMP, ANLG, t)	UInTe- gerT16
0x01E3 (483)	0x00		Pin4 selection	0: Flow monitoring SSC1.1 (OutA, FLOW, bin) 1: Volume / mass pulse SSC1.3 (OutC, VOL, bin)	
0x01E8 (488)	0x00		Backlight duration (Eco)	0: always on 1: 5 s 2: 10 s 3: 20 s 4: 40 s 5: 80 s 6: 160 s 7: 320 s 8: 640 s	
0x01E9 (489)	0x00		Sub-display mode (Sub.d)	0: units (Unit) 1: Gas type (GAS) 2: Flow measurement value (FLOW) 3: Volume /mass meas- urement value (VOL, MASS) 5: Temperature measure- ment value (tEMP) 6: SP1 OutA (SP, SP.Lo, SP.Hi) 7: SP2 OutA (SP, SP.Lo, SP.Hi)	
0x01EA (490)	0x00		Lock code, local param- eter lock (Code, Lock)	0: Off 1 ... 9999	
0x01EE (494)	0x00		Gas type (GAS)	0: air (Air) 1: nitrogen (N2) 2: argon (Ar) 3: carbon dioxid (CO2)	
0x01F0 (496)	0x00	R/W	Reference condition for volume values (REF/ Cond)	0: DIN 1343 (0 °C) 1: ISO 2533 (15 °C) 2: ISO 6358 (20 °C)	
0x2081 (8321)	0x00	R	Flow value MDC1 (q)	$-2^{15} \dots 2^{15} - 1$	IntegerT16
0x2083 (8323)	0x00		value of volume / mass pulse (PULS)	Typically 1 ... 200000000 Scale m ³ : SFAB-10: x 0,00001 SFAB-50: x 0,0001 SFAB-200: x 0,001 SFAB-600: x 0,001 SFAB-1000: x 0,001	UInTe- gerT32
0x2084 (8324)	0x00		Temperture value MDC2 (t)	$-2^{15} \dots 2^{15} - 1$	IntegerT16

Index	Subindex	Access ¹⁾	Name	Value	Format
0x2085 (8325)	0x00	R	value of volume / mass recorder (REC)	Typically 1 ... 200000000 Scale m ³ : SFAB-10: x 0,00001 SFAB-50: x 0,0001 SFAB-200: x 0,001 SFAB-600: x 0,001 SFAB-1000: x 0,001	UIntegerT32
0x2088 (8328)	0x00		minimum measured flow value MDC1 (MIN, q)	$-2^{15} \dots 2^{15} - 1$	IntegerT16
0x2089 (8329)	0x00		maximum measured flow value MDC1 (MAX, q)	$-2^{15} \dots 2^{15} - 1$	
0x208E (8334)	0x00		Time of volume / mass recorder	0 ... $2^{32} - 1$ s	UIntegerT32
0x208F (8335)	0x00		Error time of volume / mass recorder	0 ... $2^{32} - 1$ s	
0x2090 (8336)	0x00		Supply voltage	Scale x 0,1 V Example: 240: 24,0 V	UIntegerT16
0x2092 (8338)	0x00		minimal measured temperature value MDC2 (MIN, t)	$-2^{15} \dots 2^{15} - 1$	IntegerT16
0x2093 (8339)	0x00		maximal measured temperature value MDC2 (MAX, t)	$-2^{15} \dots 2^{15} - 1$	
0x2094 (8340)	0x00		Flow value averaged MDC1 (AVER, q)	$-2^{15} \dots 2^{15} - 1$	
0x2095 (8341)	0x00		Analogue output voltage in V	Scale x 0,001 V Example: 2874: 2,874 V	
0x2096 (8342)	0x00		Current at the analogue output in mA	Scale x 0,01 mA Example: 861: 8,61 mA	

1) R = read, R/W = read and write, — = no access

Tab. 19: Device-specific parameters

8.7 IO-Link teach-in

The sensor supports two different IO-Link teach functions for all IO-Link switching channels (SSC):

- Single value teach-in according to IO-Link specification
- Device-specific teach-in

Carry out the following steps before teach-in:

1. Configure the switching channel according to the application including switching mode, switching logic and hysteresis.
The switching mode must not be deactivated (OFF).
2. Set the teach channel to the desired switching channel (parameter 0x003A).

Single value teach-in according to IO-Link specification

With the single value teach-in, SP1 and SP2 are taught in with separate commands. After each command, the parameter set of the switching channel is checked for validity. If the parameter set is valid, the teach point is immediately accepted as the switching point. If the parameter set is invalid, the process is aborted.

1. Set the desired flow rate.
2. Perform the teach-in process: 0x41 for SP1 and 0x42 for SP2.
3. To set the second switching point, repeat steps 1 and 2.

For more information, see IO-Link Smart Sensor Profile.

Device-specific teach-in

The device-specific teach-in (0x4B) behaves in the same way as the manual teach-in on the device. Instead of pressing a button manually, the two teaching points are set with the IO-Link command. The chronological order is irrelevant. In the window mode and in the two-point mode, the 2 teaching points are assigned to the switching points SP1 and SP2 in such a way that the parameter set is valid. The teach values are only accepted after the second teach-in. With the teach-in of the single point mode, the switching point results from the mean value of the two teaching points: $SP = 1/2 (TP1 + TP2)$. The [A], [B] and [Edit] keys are locked during teach-in. The display flashes alternately 't-IN' and 'IOL'.

1. Set the first desired flow rate.
2. Send the teach-in command 0x4B.
3. Set the second desired flow rate.
4. Send the teach-in command 0x4B.

The teach-in process is aborted with the command 0x4C.

Recommendation: after teach-in, read out the parameter set and check that the settings match the application.

8.8 Block parameterisation

Block parameterisation is used to prevent individual parameter values from being incompatible with the values stored in the device. All parameters transmitted as a block will be simultaneously accepted and activated.

Index	Subindex	Name
0x003C (60)	0x01	Setpoint SP1
	0x02	Setpoint SP2
0x003D (61)	0x02	Switchpoint mode
	0x03	Hysteresis

Tab. 20: Block parameterisation for flow rate monitoring SSC1.1 (OutA)

Index	Subindex	Name
0x003E (62)	0x01	Setpoint SP1
	0x02	Setpoint SP2
0x003F (63)	0x02	Switchpoint mode
	0x03	Hysteresis

Tab. 21: Block parameterisation for flow rate monitoring SSC1.2 (OutB)

Index	Subindex	Name
0x3142 (12610)	0x00	Threshold of volume / mass pulse
0x0149 (329)	0x00	Volume /mass pulse length

Tab. 22: Block parameterisation for volume pulse/mass pulse SSC1.3 (OutC)

Index	Subindex	Name
0x400C (16396)	0x01	Setpoint SP1
	0x02	Setpoint SP2
0x400D (16397)	0x02	Switchpoint mode
	0x03	Hysteresis

Tab. 23: Block parameterisation for temperature monitoring SSC2.1

Index	Subindex	Name
0x400E (16398)	0x01	Setpoint SP1
	0x02	Setpoint SP2
0x400F (16399)	0x02	Switchpoint mode
	0x03	Hysteresis

Tab. 24: Block parameterisation for temperature monitoring SSC2.2

Index	Subindex	Name
0x016A (362)	0x00	Analog output scaling, start value
0x016B (363)	0x00	Analog output scaling, end value

Tab. 25: Block parameterisation for analogue output scaling

8.9 Process data IN

Bit	63 ... 48	47 ... 40	39 ... 35	34	33	32
Process data	MDC1-Value	MDC1 scaling	no used	SSC1.3	SSC1.2	SSC1.1
Data content	16-Bit flow (q)	8-bit decimal expo- nent		OutC Puls	OutB	OutA
Index	0x00028			0x0028		
SubIndex	0x01	0x02		0x05	0x04	0x03
Data type	Integer16	Integer8		Boolean		

Tab. 26: Process data IN MDC1 (flow rate)

Bit	31 ... 16	15 ... 8	7 ... 2	1	0
Process data	MDC2-Value	MDC2-Scale	no used	SSC2.2	SSC2.1
Data content	16-bit temperature (t)	8-bit decimal exponent			
Index	0x00028			0x0028	
SubIndex	0x0B	0x0C		0x0E	0x0D
Data type	Integer16	Integer8		Boolean	

Tab. 27: Process data IN MDC2 (temperature)

8.10 IO-Link diagnostics

Event code [hex]	Device status	Event type	Local display	Possible cause
0x1000	4: Failure	3: Error	Er01	Device error
0x1808			Er08	Moisture or dirt in the compressed air
0x1815			Er21	Overload or short circuit at the switching output OutA/Puls
0x1816			Er22	Overload or short circuit at the switching output OutB
0x181F	0: Device is operating properly	1: Notification		Volume/mass recorder counter overflow
0x4000	4: Failure	3: Error	Er20	Temperature fault in IO-Link driver
0x5111	2: Out-of-Specification	2: Warning	Er17	Supply voltage under-run

Tab. 28: IO-Link diagnostics

9 Operation



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



Ready-state delay

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

The flow rate displayed refers to the standard condition that was set in the Spec menu under 'REF' / 'Cond'.

When comparing volumetric flow rates, note the following:

- Make sure that the volumetric flow rates to be compared refer to the same standard conditions, e.g. operating volumetric flow rate, amount supplied by a compressor, measured values of a sensor from another manufacturer.
- After the supply voltage is switched on, the SFAB needs a warm-up time of 5 minutes before it reaches the specified accuracy.

9.1 Reset sensor to factory setting



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

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

10 Cleaning

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

11 Fault clearance

Malfunction / display		Possible cause	Remedy
Main display	Secondary display		
Settings cannot be edited; 'Lock' appears.		Security code activated.	– Enter security code or restore factory settings → 9.1 Reset sensor to factory setting.
'Er01'	Error related	Device error.	– Replace sensor.
'Er08'	'diaP'	Moisture or dirt in the compressed air.	– Replace sensor.
–200%FS	'Er09'/'UNdR'	Below sensing range.	– Maintain flow rate measuring range.
+200%FS	'Er10'/'OVER'	Sensing range exceeded	– Maintain flow rate measuring range.
⟨Measured value⟩	'Er17'/'SUPL'	Power supply too low.	– Check power supply.
⟨Measured value⟩	'Er20'/'t.Hi'	Temperature error in IO-Link driver.	– Eliminate short circuit or overload.
⟨Measured value⟩	'Er21'/'SHRt'	Overload or short circuit at the OutA, OutC switching output.	– Eliminate short circuit.

Malfunction / display		Possible cause	Remedy
Main display	Secondary display		
<Measured value>	'Er22'/'SHRt'	Overload or short circuit at the switching output OutB.	– Eliminate short circuit.
<Measured value> flashes	–	Measured value was outside the measuring range.	
'Err'/'Id'	'REPL'	IO-Link DeviceID error, devices are not identical.	– When replicating, use sensors with the same measuring range or type.
'Err'/'COM'	'REPL'	IO-Link communication error.	– Check line OutA.

Tab. 29: Fault clearance

12 Removal

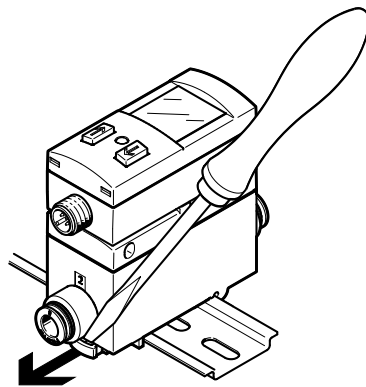


Fig. 14: Removal

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

13 Technical data

SFAB	-10U	-50U	-200U	-600U	-1000U
General					
Certificates, declaration of conformity	➔ www.festo.com/sp				
Input signal and measurement signal					
Measured variable	– Volumetric flow rate – Mass flow rate – Temperature – Volume				
Flow direction	Unidirectional P1 ➔ P2				
Measurement principle	Thermal				
Measurement method	Heat loss				
Warm-up time [min]	≥ 5				
Flow measuring range, compressed air [l/min]	0.1 ... 10	0.5 ... 50	2 ... 200	6 ... 600	10 ... 1000
Flow measuring range, argon [l/min]	0.1 ... 10	0.5 ... 50	2 ... 200	6 ... 500	10 ... 500
Flow measuring range, CO ₂ [l/min]	0.1 ... 5	0.5 ... 25	2 ... 100	6 ... 300	10 ... 500
Temperature measuring range [°C]	0 ... 50				

SFAB		-10U	-50U	-200U	-600U	-1000U
Operating pressure	[MPa]	0 ... 1				
	[bar]	0 ... 10				
	[psi]	0 ... 145				
Nominal pressure	[MPa]	0.6				
	[bar]	6				
	[psi]	87				
Ambient temperature	[°C]	0 ... 50				
Temperature of medium	[°C]	0 ... 50				
Operating medium		Compressed air to ISO 8573-1:2010 [6:4:4]		Compressed air to ISO 8573-1:2010 [7:4:4]		
		Nitrogen				
		Argon				
		Carbon dioxide				
Output, general ¹⁾²⁾						
Values for flow rate						
Accuracy of compressed air zero point ³⁾	[% FS]	± 0.3				
Accuracy of zero point argon, CO ₂ ⁴⁾	[% FS]	± 2				
Accuracy of spread ¹⁾	[% FS]	± 3				
Repetition accuracy of zero point	[% FS]	± 0.2				
Repetition accuracy of spread	[% FS]	± 0.8				
Temperature coefficient zero point	[% FS/K]	Max. ± 0.05 (typically 0)				
Temperature coefficient of spread	[% FS/K]	Typically ± 0.1				
Pressure influence of spread	[% FS/MPa]	Typ. ± 5				
	[% FS/bar]	Typ. ± 0.5				
	[% FS/psi]	Typ. ± 0.035				
Accuracy of measured temperature value	[°C]	Typically ± 5 In the thermally steady state in the flow rate range: 20 ... 100 % FS				
Switching output						
Switching output		2 PNP or 2 NPN, switchable				
Switching function		Window comparator Threshold value comparator 2-point threshold value comparator				
Switching element function		N/C contact or N/O contact, switchable				
Max. output current	[mA]	100				
Voltage drop	[V]	Max. 1				
Max. switch-on time	[ms]	10 (at Filt = OFF)				
Max. switch-off time	[ms]	10 (at Filt = OFF)				
Pull down resistor		PNP: integrated				
Pull-up resistor		NPN: integrated				
Inductive protective circuit		Present				

SFAB		-10U	-50U	-200U	-600U	-1000U
Analogue output						
Characteristic flow rate curve	[l/min]	0 ... 10	0 ... 50	0 ... 200	0 ... 600	0 ... 1000
Characteristic temperature curve	[°C]	0 ... 100				
Output characteristic analogue output	[V]	0 ... 10 or 1 ... 5				
	[mA]	4 ... 20				
Max. load resistance of current output	[Ω]	500				
Min. load resistance at voltage output	[kΩ]	20				
Rise time t ₉₀	[ms]	10 (at Filt = Off)				
Output, additional data						
Short circuit current rating		Yes				
Overload protection		Present				
Communication interface						
IO-Link, Revision ID		V1.1				
IO-Link, device profile		– Smart Sensor - SSP 4.1.2 – Firmware update – Identification and diagnostics – Function measurement data, standard resolution – Function multiple switching signal – Function teach single value – Function extended identification – Function locator – Function Product URI				
IO-Link, transmission rate		COM3				
IO-Link, SIO mode support		Yes				
IO-Link, port type		Class A				
IO-Link, process data length output	[bit]	0				
IO-Link, input process data length	[bit]	64				
IO-Link, process data content IN		– Flow rate measurement 16 bit MDC – Flow rate monitoring 2 bit SSC – Measured temperature value 16 bit MDC – Temperature monitoring 2 bit SSC – Volume pulse/mass pulse 1 bit SSC				
IO-Link, service data content IN		Volume reading/mass reading 32 bit				
IO-Link, minimum cycle time	[ms]	1.2				
IO-Link, data memory required	[Kbyte]	0.5				
Electronics						
Operating voltage range	[V DC]	15 ... 30				
No-load current (at 24 V DC and 100% flow)	[mA]	90				
Max. ready-state delay	[ms]	500				
Reverse polarity protection		For all electrical connections				

SFAB	-10U	-50U	-200U	-600U	-1000U
Electromechanics					
Electrical connection	Plug connector, M12x1, A-cod., according to EN 61076-2-101				
Max. connecting cable length [m]	30 20 for IO-Link operation				
Mechanics					
Mounting position	Any				
Note on materials for housing	PA-reinforced				
Note on materials for inspection window	PA				
Display and operation					
Displayable units	– l/min – m³/h – scfm – g/min – l – m³ – scf – g				
Immission and emission					
Storage temperature [°C]	–20 ... +80				
Degree of protection in accordance with EN 60 529	IP65				
Standard nominal flow rate [l/min] according to ISO6358/ISO 8778	43.5	163	760	1630	1630

- 1) Accuracy under nominal conditions (6 bar, 23 °C and horizontal mounting position)
- 2) % FS = % of the flow rate range end value (full scale)
- 3) The accuracy of the zero point and accuracy of the spread together correspond to the accuracy of the flow rate: accuracy of the flow rate = $\pm (0.3\% \text{ FS} + 3\% \text{ o.m.v.})$. % o.m.v. = % of measured value
- 4) In relation to the flow rate measuring range end value for air

Tab. 30: Technical data

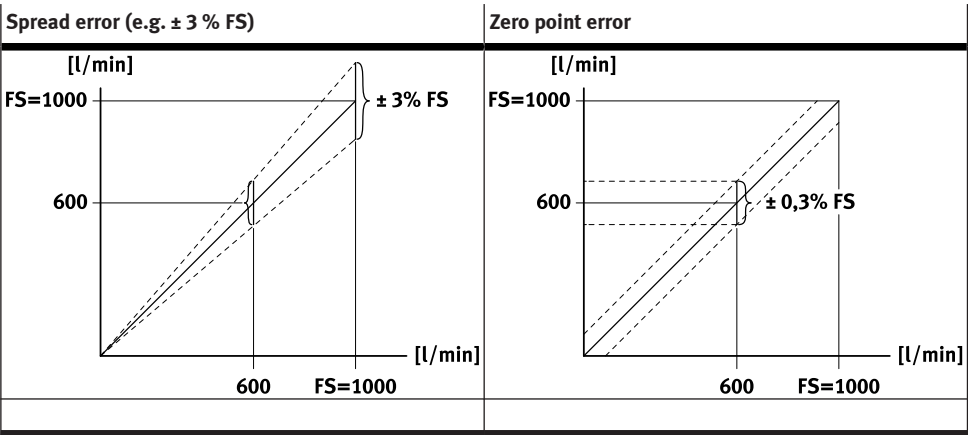
13.1 Technical data for UL/CSA approval

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

Tab. 31: Technical data for UL/CSA approval

13.2 Examples for calculating the maximum error of the display

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



Tab. 32: Spread error and zero point error

Spread error and zero point error

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

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

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

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

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

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