

# Diagnostic modules GFDM



# Diagnostic modules GFDM

Key features

## Overview


The diagnostic module GFDM is a diagnostic system for the continuous monitoring of the pressure, flow and cycle consumption of a pneumatic system.

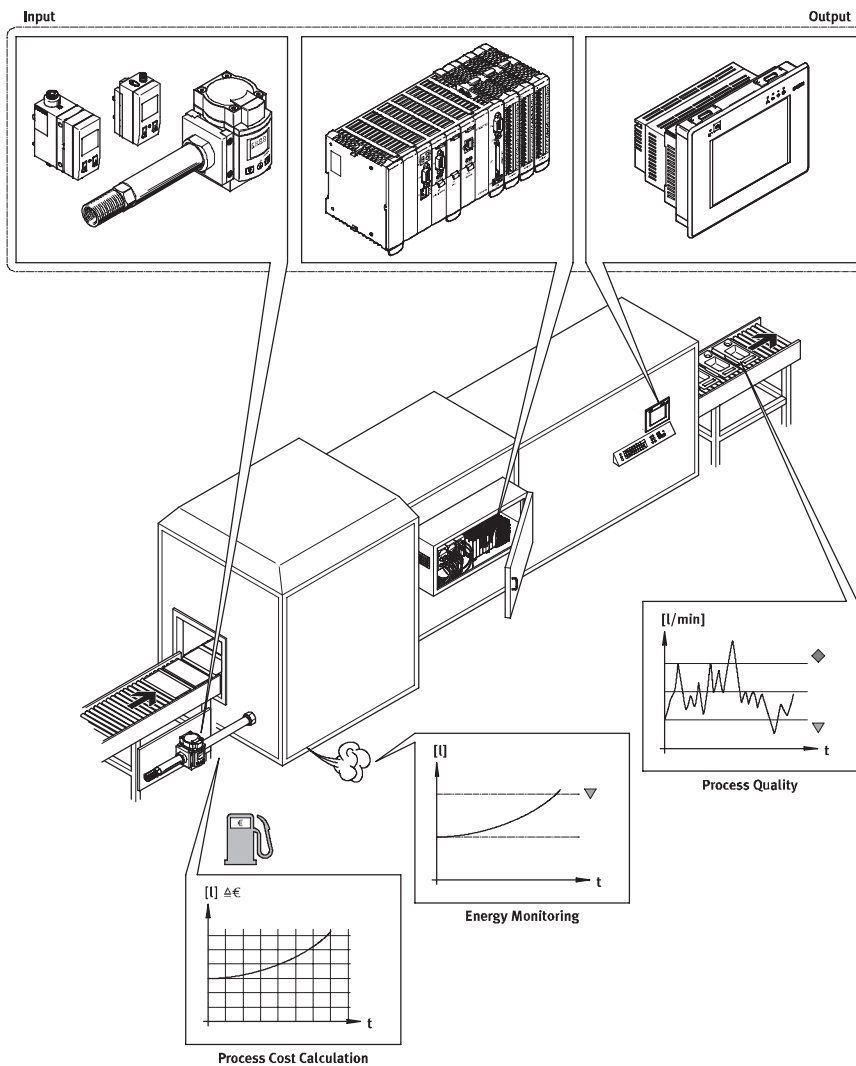
By permanently comparing the measured values with reference data, it is possible to evaluate the

monitored parameters using multi-stage limit values. The monitoring parameters can also be mapped and exported to trend data report over a longer period.

Faults can thus be detected early and maintenance intervals can be planned efficiently.

The system includes sensors (a flow sensor and a pressure sensor) for recording the measured values, a controller for evaluation and one of two visualisation options.

 **Note**  
There are also accompanying services for this product. Information is available from our consultants or on the Internet at [www.festo.com](http://www.festo.com).



## Key features

- Autonomous system, which is equally suitable for retrofitting in existing systems or for installation in new systems.
- Limit monitoring and trend information for the timely detection of deviations.
- Automatic reference data acquisition (teach-in) and easy operation.
- Trigger signals for the measurement duration of air consumption can be adapted to different processes and can be linked directly to GFDM.
- Separate monitoring of different operating states of a system such as automatic or stop.
- Monitoring of up to 16 different process sequences on one system.
- Status analysis directly for the system operator.
- Decentralised visualisation in the office using the SCADA system.

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System requirements			
Air quality	Flow	Trigger	Network environment
<p>The quality of compressed air must comply with air quality class 5:4:3 to DIN ISO 8573-1 as a minimum. If there is any uncertainty in this regard, Festo can offer the “Festo Air Quality Test” service.</p>	<p>You can prevent sensors from being affected dynamically by switching the compressor on and off in normal, buffered operation.</p> <p>When configuring the GFDM you must define a flow measuring range. There are two flow sensors available for flow measurement. The flow sensor SFE1-LF covers the 10 ... 200 l/min range, while the flow sensor MS6-SFE covers the 200 ... 5,000 l/min range. Determine the flow rate at the position in your system where the flow rate is later to be monitored.</p> <p>Festo offers the “Festo Energy Saving Service” service for this purpose.</p>	<p>To measure the air consumption of cyclical process sequences, external trigger signals from a PLC are required; these determine the start and stop time for consumption measurement. They can be communicated to the controller via one or two digital signals.</p> <p>Alternatively, a time trigger can be used, which determines the cycle consumption for a selected period independently of the process. No additional digital signals are required in this case.</p>	<p>Either a front-end display FED or a PC can be used to view the results. The front-end display FED is designed to display the results directly at the system.</p> <p>To transfer the results to a PC over a longer distance, a TCP/IP connection via Ethernet is required.</p>

Recommendations and instructions for installation			
Bypass before installation	Controller	PLC	Digital controller outputs
<p>Installing a bypass in the system’s supply line, e.g. downstream of the service unit, means that the sensors for GFDM can be replaced during commissioning or at any other time without disrupting system operation.</p>	<p>The controller should be positioned as close to the PLC as possible.</p> <p>The following points must be observed with respect to control cabinet installation:</p> <ul style="list-style-type: none"> <li>• Power supply, electrical isolation.</li> <li>• Sufficient space for H-rail mounting.</li> <li>• Cable length of max. 2.5 m for the serial connection between the controller and operator unit (if using the front-end display FED for visualisation).</li> <li>• The scope of delivery only includes M12 sockets, 5-pin, for the sensor connection. The screened cable for connecting the sensors to the controller must be assembled by the user.</li> </ul>	<p>If you wish to assign the system status to the current operating mode (automatic, stop mode) or the current batch/product number, this information must be communicated to the controller from the PLC. An 8-bit interface is available for this purpose, which connects the digital outputs of the PLC with the inputs of the controller. A distinction can then be made between max. 16 different operating states and max. 16 different product numbers.</p>	<p>The digital outputs of the controller with the overall status display can be used as a traffic light signal on the system.</p> <p>Alternatively, the signals can be read in from a controller in order to generate warnings in a monitoring system.</p>

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## Software

### Overview

The easy-to-use software was specially developed for the diagnostic module GFDM.

In addition to providing basic visualisation and data acquisition functions, the software also handles networking, data archiving or alerting tasks. It also supports the development of application-specific projects.

The software performs the following functions:

- Parameterisation of the diagnostic module.
- Recording of measured values and diagnostic results (logging).
- Visualisation of current and archived measured values and diagnostic results.
- Configurable error messages.

- Creation and saving of multiple projects.
- Open, standard OPC interface (OLE for Process Control) for data exchange in all directions.

 **Note**

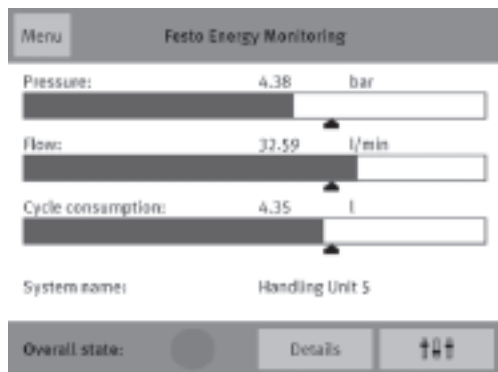
The software runs on the Windows platforms 2000, Server 2003 and XP.

For external visualisation on a standard or industrial PC, a USB port is required for the supplied dongle.

## Sample views

Master view:

- Numerical display of the most recent measured values for pressure, flow and cycle consumption.
- Graphical display of the current measured values in comparison with the reference value.

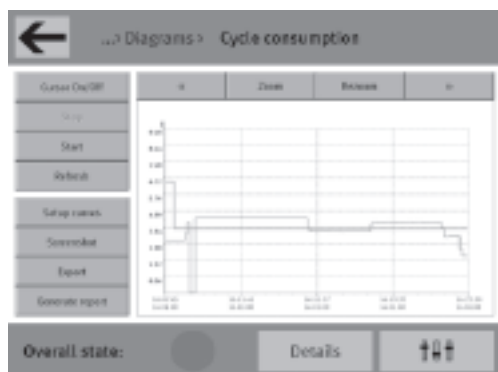


Display settings menu:

- Language selection for menu, dialogues and information.
- Unit selection for measured values.



Graphical display of the measured values over a period of time:



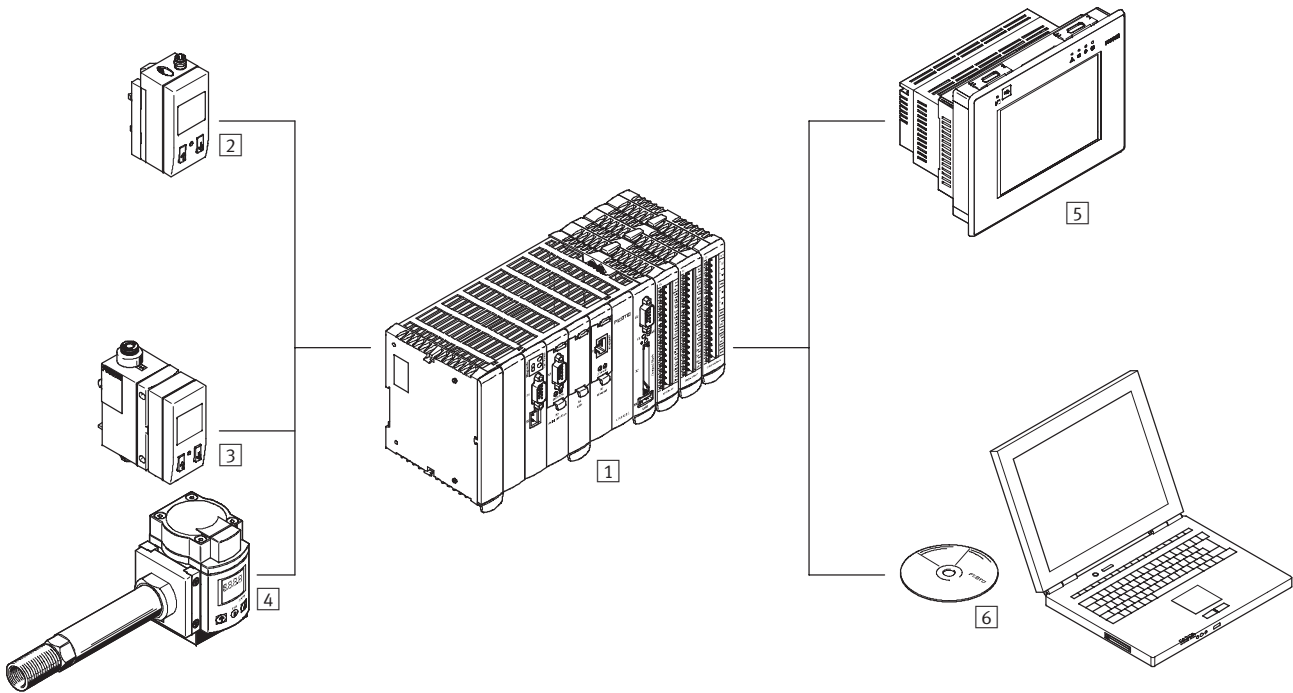
Tabular display of the measured values over a period of time:



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## System overview



Components of the GFDM		Technical data → Page/Internet	Modular product system → Page/Internet
1	Controller CECX-K-D1	6	17
2	Pressure monitoring with pressure sensor SDE1	9	
3	Flow monitoring with flow sensor SFE1-LF	11	
4	Flow monitoring with flow sensor MS6-SFE	13	
5	Direct visualisation with front-end display FED using software "GFDM for FED-500"	15	
6	External visualisation on a standard or industrial PC using software "GFDM for VipWin"	-	

## Diagnostic modules GFDM

Technical data – Controller CECX



General technical data	
Monitoring options	Pressure
	Flow
	Cycle consumption
Measuring rate	[ms] 10
Displayable unit(s)	SI units
	US units
Accuracy	$\pm(3\% \text{ o.m.v.} + 0.3\% \text{ FS})^1$
Reproducibility of analogue value	$\pm(0.8\% \text{ o.m.v.} + 0.2\% \text{ FS})^1$
Process interfacing	Digital interface
Reference data	For operating status
	For product number
Monitoring state/status	Green – normal operation
	Yellow – warning
	Orange – maintenance instruction
	Red – alarm
	Grey – no status available
Serial interface, number	1

1) % o.m.v. = % of measured value  
% FS = % of the measuring range (full scale)

Electrical data	
Operating voltage	[V DC] 24 +25%/–15%
Switching output	PNP
	NPN
Trigger signal	Two signals: start + stop
	One signal: stop = start
	No signal: time trigger
Update rate	[s] 2
Protection class	IP20

Materials	
Note on materials	Contains paint wetting impairment substances

## Diagnostic modules GFDM

Technical data – Controller CECX

Digital inputs		
Number		10
Input voltage/current	[V DC]	24
Nominal value for TRUE	[V DC]	$\geq 15$
Nominal value for FALSE	[V DC]	$\leq 5$
Input signal delay		20 ms, 200 ms, adjustable
Electrical isolation		Yes, via optocoupler
Status display		LED

Analogue inputs		
Number		2
Signal range	[mA]	4 ... 20
Resolution	[bit]	14
Conversion time	[ms]	1
Absolute accuracy at 25 °C	[%]	$\pm 0.01$

Digital outputs		
Number		4
Contact		Transistor
Output voltage	[V DC]	24
Output current	[A]	2 (at 50% concurrence)
Short circuit proof		Yes
Electrical isolation		Yes, via optocoupler
Electrical isolation in groups		Yes, in 2 groups
Status display		LED

Analogue outputs		
Number		0

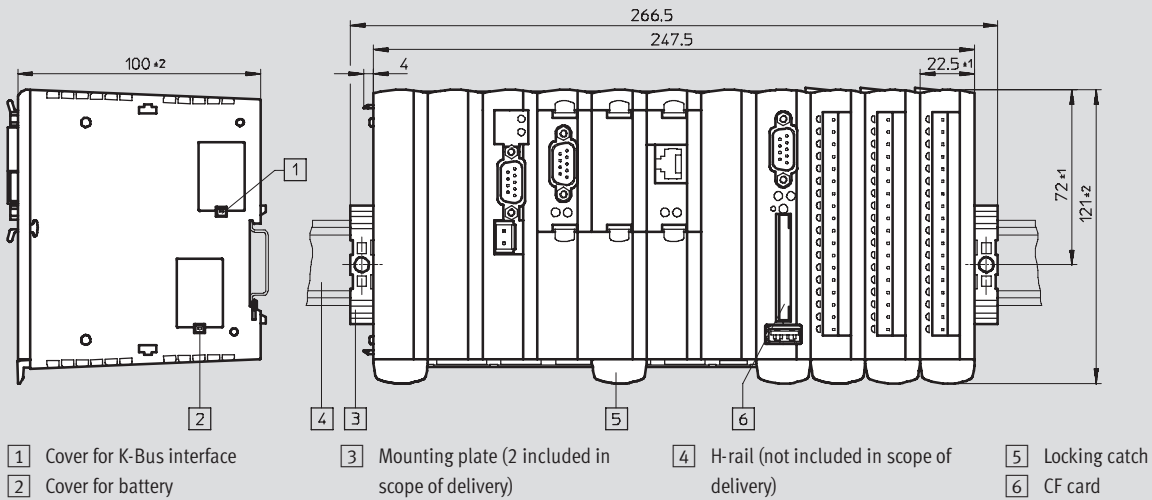
Ethernet		
Number		1
Supported protocols		OPC

# Diagnostic modules GFDM

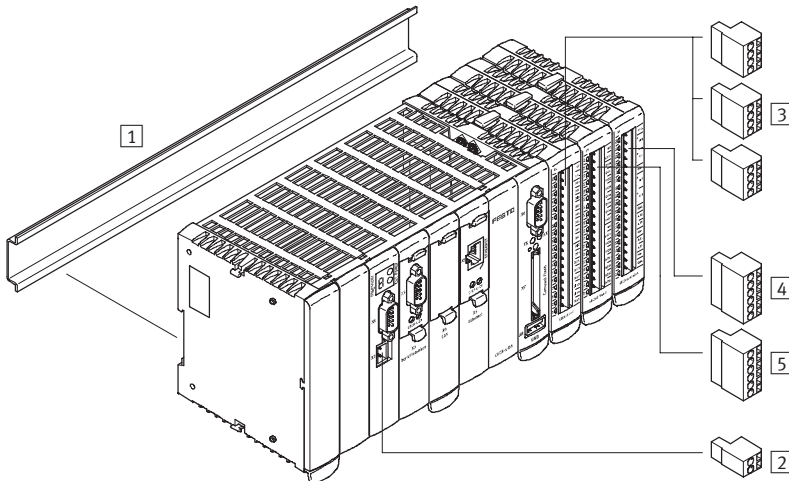
Technical data – Controller CECX

## Dimensions

Download CAD data → [www.festo.com](http://www.festo.com)



## Peripherals overview



Accessories		Included in scope of delivery
1	H-rail TS3 35x7.5 For H-rail mounting	–
2	Plug NECC-L1G2-C1 2-pin, for power supply	■
3	Plug NECC-L1G4-C1 4-pin, for the digital inputs of signals of a PLC (2 lines for trigger signals, 4 lines each for operating status and product number)	■
4	Plug NECC-L1G6-C1 6-pin, for the analogue input of sensor signals (pressure and flow)	■
5	Plug NECC-L1G6-C1 6-pin, for the digital output of status signals, e.g. for the connection of an external traffic light with 4 indicators	■



## Diagnostic modules GFDM – Pressure monitoring

Technical data – Pressure sensor SDE1

Variant:

Pressure monitoring P

→ Modular product system on page 17



General technical data		
Pressure measuring range	[bar]	0 ... 10
Pneumatic connection		G $\frac{1}{8}$
Type of display		Illuminated LCD
Accuracy		$\pm 2\%$ FS <sup>1)</sup>
Mounting position		Any
Type of mounting		Via H-rail Via wall/surface bracket
Product weight	[g]	85

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

- | - Note: This product conforms with the ISO 1179-1 standard and the ISO 228-1 standard.

Electrical data		
Analogue output	[mA]	4 ... 20
Max. output current	[mA]	150
Switching element function		Switchable
Switching function		Freely programmable
Operating voltage range	[V DC]	15 ... 30
Electrical connection		Plug M12x1, 4-pin
Protection against short circuit		Pulsed
Protection class		IP65

Operating and environmental conditions		
Operating medium		Filtered compressed air, lubricated or unlubricated, grade of filtration 40 $\mu$ m
Ambient temperature	[°C]	0 ... 50
CE mark (see declaration of conformity)		In accordance with EU EMC directive
Certification		c UL us - Recognised (OL) C tick

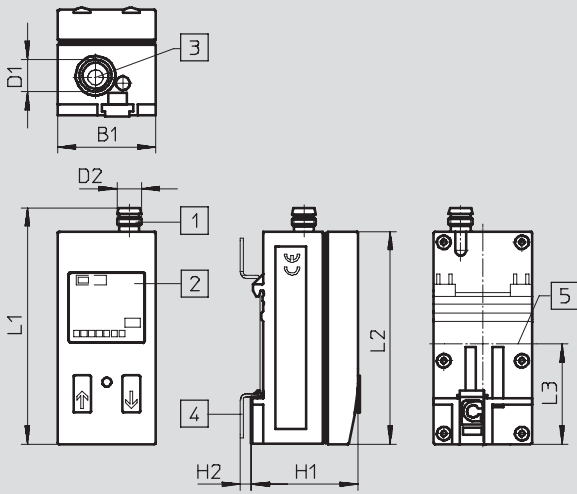
Materials		
Housing		Polyacetate, reinforced, polyamide

# Diagnostic modules GFDM – Pressure monitoring

Technical data – Pressure sensor SDE1

## Dimensions

Download CAD data → [www.festo.com](http://www.festo.com)

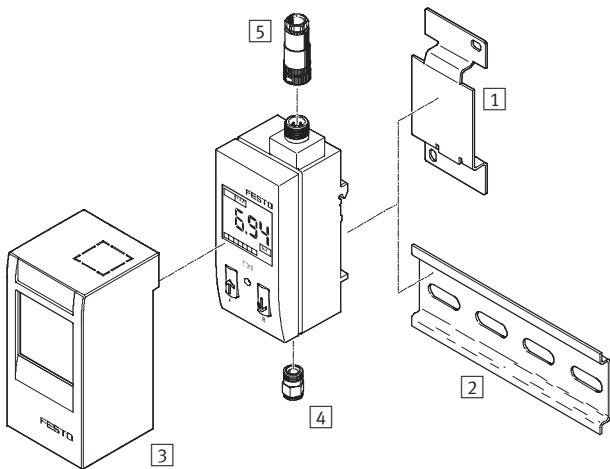


- 1 Plug M12x1 to EN 60 947-5-2
- 2 LCD display
- 3 Pneumatic connection G1/8
- 4 Adapter plate for wall mounting
- 5 Centre with H-rail mounting

B1	D1	D2	H1	H2	L1	L2	L3
32.3	G1/8	M12	35.2	3.5	87	70	33

⚠ Note: This product conforms with the ISO 1179-1 standard and the ISO 228-1 standard.

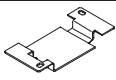

## Peripherals overview



⚠ Note  
The screened cable for connecting the sensor to the controller is not included in the scope of delivery.

Accessories		Included in scope of delivery
1	Adapter plate SDE1-...-W-...	For wall mounting → 10
2	Mounting rail to DIN EN 50022	For H-rail mounting -
3	Protective cover SDE1-SH	Protects the SDE1 from unauthorised adjustment → 10
4	Push-in fitting QS-1/8-8	For tubing O.D. of 8 mm ■
5	Plug socket FBSD-GD-9-5POL	For electrical connection ■

## Ordering data – Accessories

		Part No.	Type
	Adapter plate	194 297	SDE1-...-W-...
	Protective cover	537 074	SDE1-SH

## Diagnostic modules GFDM – Flow monitoring

Technical data – Flow sensor SFE1-LF

Variant:

Flow monitoring QA

→ Modular product system on  
page 17



General technical data		
Flow measuring range	[l/min]	10 ... 200
Pneumatic connection		QS-8
Measurement principle		Thermal
Type of display		Illuminated LCD (optimised display)
Accuracy		±(3% o.m.v. + 0.3% FS) <sup>1)</sup>
Mounting position		Any
Type of mounting		Via through-holes Via H-rail Via wall/surface bracket
Product weight	[g]	160

1) % o.m.v. = % of measured value  
% FS = % of the measuring range (full scale)

Electrical data		
Analogue output	[mA]	4 ... 20
Max. output current	[mA]	≤ 100
Switching element function		N/O contact N/C contact
Switching function		Threshold comparator Window comparator
Operating voltage range	[V DC]	15 ... 30
Electrical connection		Straight plug, M12x1, 5-pin
Protection against short circuit		Yes
Protection class		IP65

Operating and environmental conditions		
Operating pressure	[bar]	0 ... 10
Operating medium		Filtered compressed air, unlubricated, grade of filtration 40 µm, air quality class 5:4:3 to DIN ISO 8573-1 Nitrogen
Ambient temperature	[°C]	0 ... 50
CE mark (see declaration of conformity)		In accordance with EU EMC directive
Certification		C tick

Materials	
Housing	Polyamide, reinforced

# Diagnostic modules GFDM – Flow monitoring

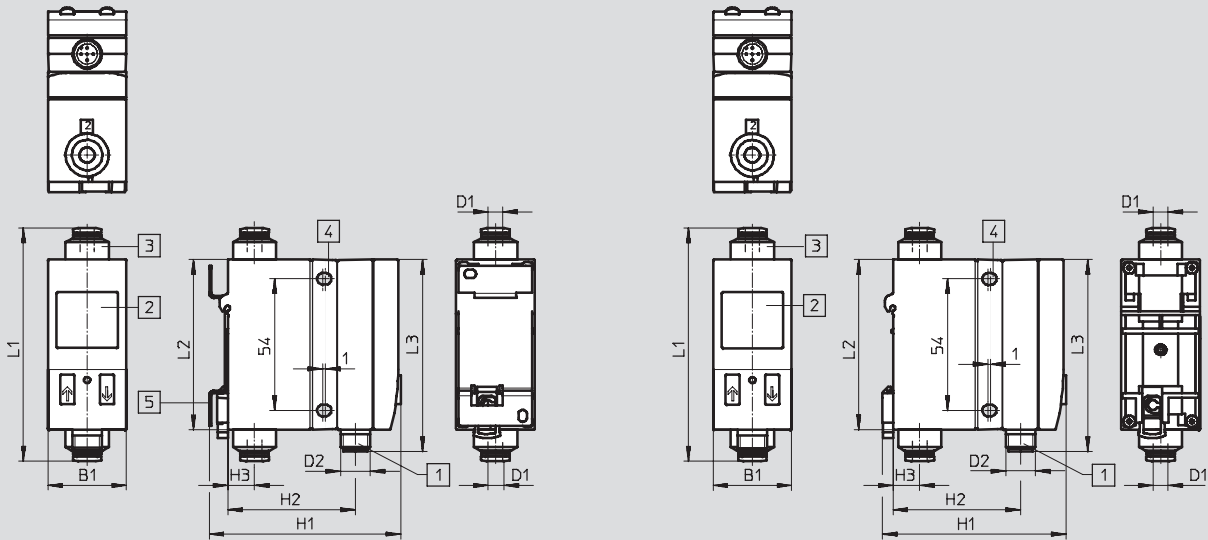
Technical data – Flow sensor SFE1-LF

## Dimensions

Download CAD data → [www.festo.com](http://www.festo.com)

### Wall or surface mounting

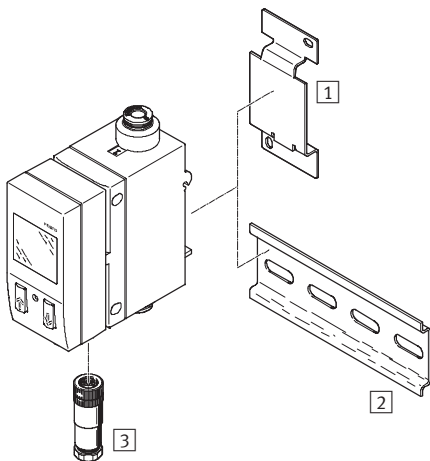
### H-rail mounting




- 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

Type of mounting	B1	D1	D2	H1	H2	H3	L1	L2	L3
Wall or surface mounting	32.3	QS-8	M12x1	75.7	52.5	11	99.8	69.8	78.9
H-rail mounting	32.3	QS-8	M12x1	79	52.5	11	99.8	69.8	78.9

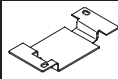
## Peripherals overview



 Note  
The screened cable for connecting the sensor to the controller is not included in the scope of delivery.

Accessories	Included in scope of delivery
1 Adapter plate SDE1-...-W-...	For wall mounting → 12
2 Mounting rail to DIN EN 50022	For H-rail mounting -
3 Plug socket FBSD-GD-9-5POL	For electrical connection ■

## Ordering data – Accessories

	Part No.	Type
 Adapter plate	194 297	SDE1-...-W-...

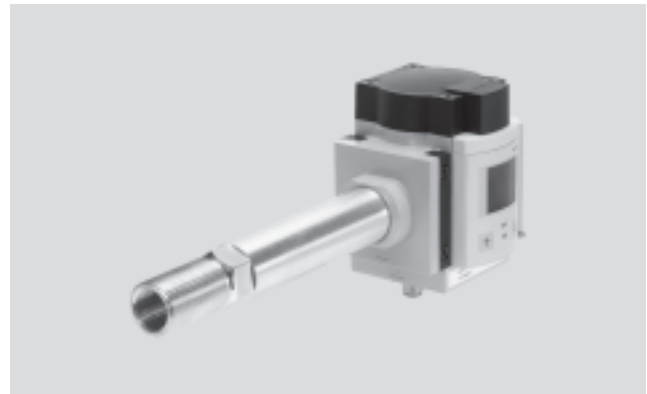
## Diagnostic modules GFDM – Flow monitoring

Technical data – Flow sensor MS6-SFE

Variant:

Flow monitoring QB

→ Modular product system on  
page 17



General technical data		
Flow measuring range	[l/min]	200 ... 5 000 <sup>1)</sup>
Pneumatic connection 1		G½, G¾ <sup>2)</sup>
Pneumatic connection 2		G½
Measurement principle		Thermal
Type of display		Illuminated LCD (optimised display)
Accuracy		±(3% o.m.v. + 0.3% FS) <sup>3)</sup>
Mounting position		Horizontal
Type of mounting		Via wall/surface bracket
Product weight	[g]	1,100

- 1) Restricted at operating pressure < 5 bar, diagram → [www.festo.com](http://www.festo.com)  
 2) Inlet laminar flow section with female thread G½ and male thread G¾  
 3) % o.m.v. = % of measured value  
 % FS = % of the measuring range (full scale)

Electrical data		
Analogue output	[mA]	4 ... 20
Max. output current	[mA]	≤ 100
Switching element function		N/O contact
		N/C contact
Switching function		Threshold value with variable hysteresis
		Window comparator
Operating voltage range	[V DC]	15 ... 30
Electrical connection		Straight plug, M12x1, 5-pin
Protection against short circuit		Yes
Protection class		IP65

Operating and environmental conditions		
Operating pressure	[bar]	0 ... 16
Operating medium		Filtered compressed air, unlubricated, grade of filtration 40 µm, air quality class 5:4:3 to DIN ISO 8573-1
		Nitrogen
Ambient temperature	[°C]	0 ... 50
CE mark (see declaration of conformity)		In accordance with EU EMC directive
Certification		C tick

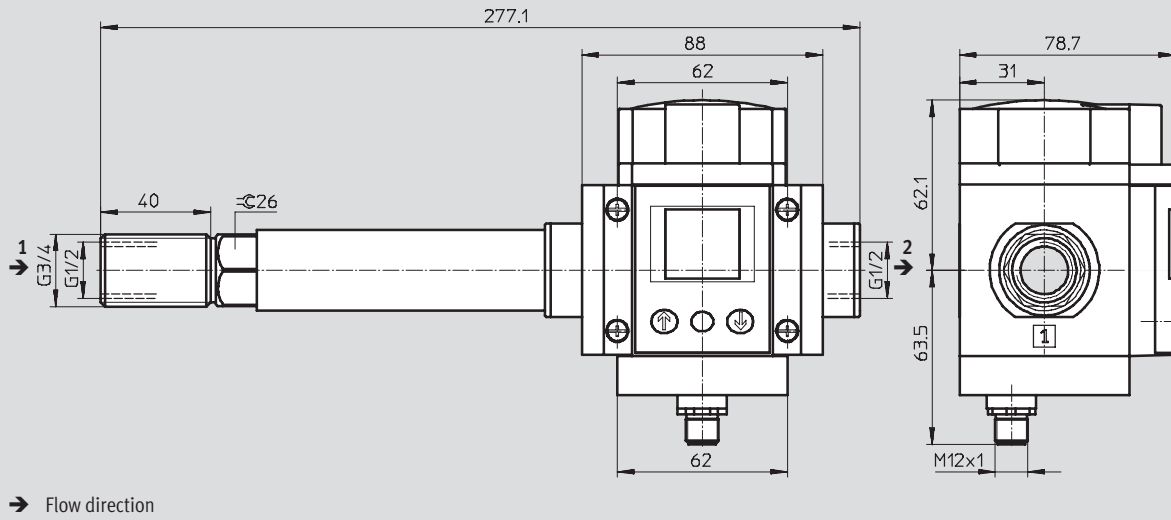
Materials	
Housing	Die-cast aluminium, reinforced polyamide

# Diagnostic modules GFDM – Flow monitoring

Technical data – Flow sensor MS6-SFE

## Dimensions

Download CAD data → [www.festo.com](http://www.festo.com)

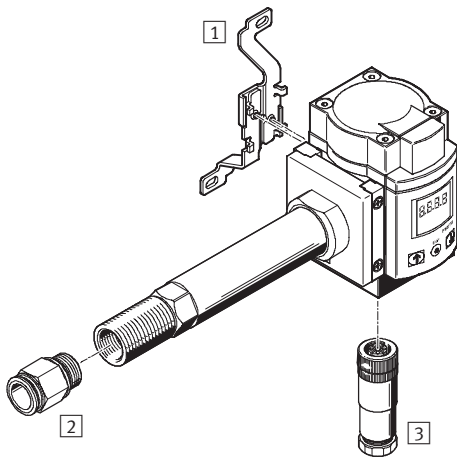


Note: This product conforms with the ISO 1179-1 standard and the ISO 228-1 standard.

Note  
To comply with the specified accuracies, the MS6-SFE must be supplied with a connection of inside diameter of at least 10 mm.

## Peripherals overview

with connecting plates and laminar flow inlet section



Note  
The screened cable for connecting the sensor to the controller is not included in the scope of delivery.

Accessories		Included in scope of delivery	
1	Mounting bracket MS6-WB	For fitting onto a wall	■
2	Push-in fitting QS-1/2-10	For tubing O.D. of 10 mm	■
3	Plug socket FBSD-GD-9-5POL	For electrical connection	■

## Diagnostic modules GFDM – Direct visualisation

Technical data – Front-end display FED

FESTO

Variant:

Visualisation FD

→ Modular product system on  
page 17



General technical data	
Display properties	Touchscreen
Display	Colour STN
Display size	5.6"
Display resolution	1/4 VGA, 320x240 pixels
Number of colours	256
Number of function keys	1
Number of user LEDs	1
Number of system LEDs	4
User memory	32 MB
Recipe memory	32 KB
Event lists	1,024
Alarms	1,024
Type of mounting	Front panel mounting
Product weight	[g] 1,400

Electrical data	
Nominal operating voltage	[V DC] 24
Operating voltage range	[V DC] 18 ... 30
Current consumption at nominal operating voltage	[A] 0.8
AUX interface	Sub-D socket, 9-pin
Printer interface	Sub-D socket, 15-pin, RS232
Ethernet interface	Optional, 10 MBd
PC interface	Sub-D socket, 15-pin, RS232
Programming interface	9.6 ... 38.4 kBd
PLC interface	Sub-D plug, 15-pin, RS232
Backup battery	3 V / 270 mA lithium
Real-time clock	Yes
Accuracy of real-time clock	130 s/month
Protection class	IP65 at the front face following installation into control panel, IP20 at the back

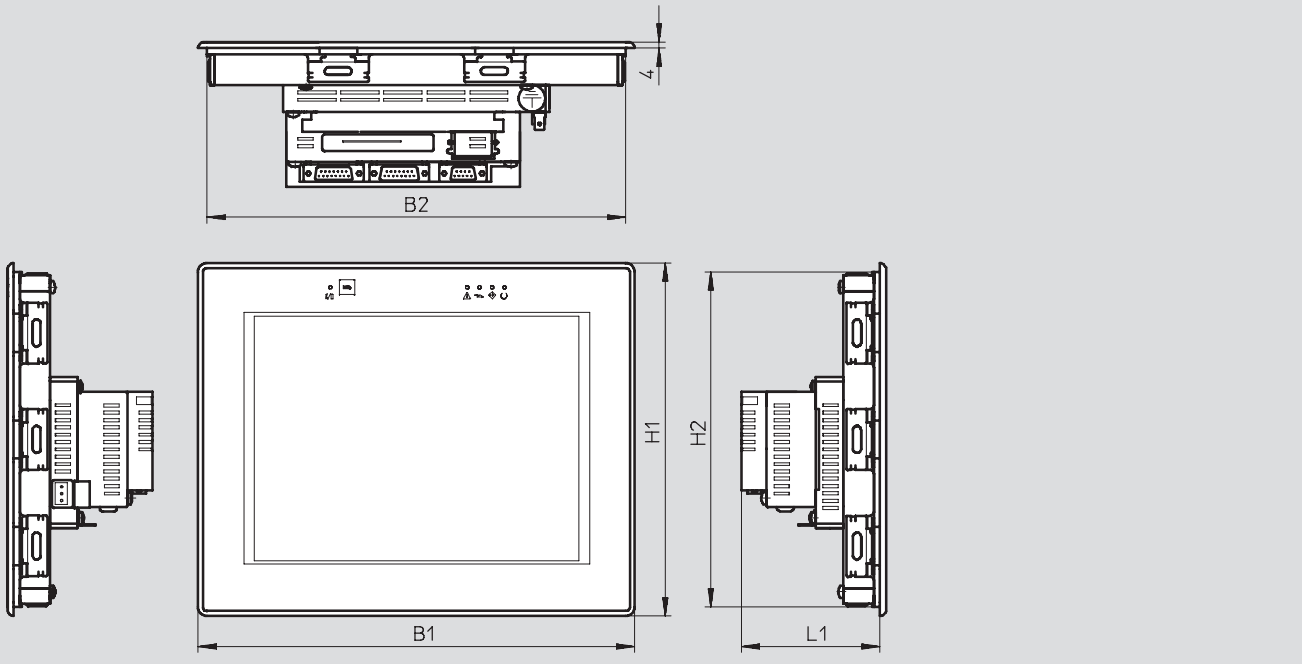
Operating and environmental conditions	
Ambient temperature	[°C] 0 ... 45
Relative air humidity	[%] 5 ... 85, non-condensing
CE mark (see declaration of conformity)	In accordance with EU EMC directive
Certification	C-UL-US listed (HL) C tick

# Diagnostic modules GFDM – Direct visualisation

Technical data – Front-end display FED

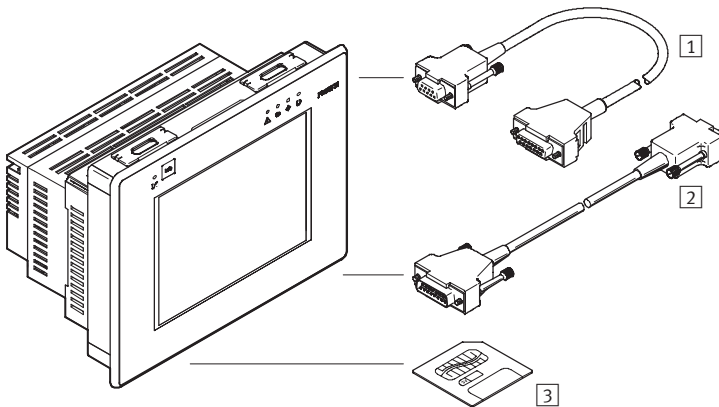
**Dimensions**

Download CAD data → [www.festo.com](http://www.festo.com)




B1	B2	H1	H2	L1
187	175	147	135	90.5

**Peripherals overview**



Accessories		Included in scope of delivery	
1	Connecting cable NEBC-S1G15-K-2.5-N-B-S1G9	For controller CECX, 2.5 m long	■
2	Programming cable FEDZ-PC	For PC, 3 m long	■
3	Memory card FEDZ-MEM32	User memory 32 MB	→ 16
-	Mounting kit FED	Front mounting (4 pieces), front seal and 3-pin connector for power supply	■

**Ordering data – Accessories**

		Part No.	Type
	Memory card	543 514	FEDZ-MEM32
	Fieldbus interface, Ethernet interface module for FED		



# Diagnostic modules GFDM

Ordering data – Modular product system

M Mandatory data									
Module No.		Pressure monitoring		Controller type		Setpoint value		Visualisation	
Product type		Flow monitoring		Bus protocol/Activation		Switching output for monitoring			
552 054	GFDM	P	QA QB	S	EA	A4	N P	FD VW	
<b>Ordering example</b>									
552 054	- GFDM	- P	QA	- S	EA	- A4	N	- FD	

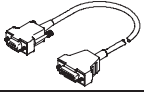
Ordering table			Condi- tions	Code	Enter code
M	Module No.	552 054			
	Product type	Diagnostic module		GFDM-	GFDM-
	Pressure monitoring [bar]	0 ... 10		P	P
	Flow monitoring [l/min]	10 ... 200		QA	
		200 ... 5000		QB	
	Controller type	Standalone (CECX-K-D1)		-S	-S
	Bus protocol/Activation	Input/output		EA	EA
	Setpoint value [mA]	4 ... 20		-A4	-A4
	Switching output for monitoring	NPN		N	
		PNP		P	
	Visualisation	Direct (FED)		-FD	
		External (VipWin)		-VW	

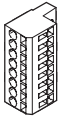
**Transfer order code**

552 054	-	GFDM	-	P		-	S	EA	-	A4		-	
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## Diagnostic modules GFDM

Accessories

Ordering data – Connecting cable NEBC						
	Electrical connection	Cable composition [mm <sup>2</sup> ]	Cable diameter [mm]	Cable length [m]	Part No.	Type
	15-pin socket, Sub-D 9-pin socket, Sub-D	3x0.34, screened	5.2	2.5	<b>553 949</b>	<b>NEBC-S1G15-K-2,5-N-B-S1G9</b>

Ordering data – Plug NECC						
	Operating voltage range [V AC]	Connection cross section [mm <sup>2</sup> ]	Number of pins	Part No.	Type	
	300	0.2 ... 2.5	2-pin	<b>553 857</b>	<b>NECC-L1G2-C1</b>	
			4-pin	<b>553 858</b>	<b>NECC-L1G4-C1</b>	
			6-pin	<b>553 859</b>	<b>NECC-L1G6-C1</b>	
			8-pin	<b>553 860</b>	<b>NECC-L1G8-C1</b>	
			18-pin	<b>553 861</b>	<b>NECC-L1G18-C1</b>	