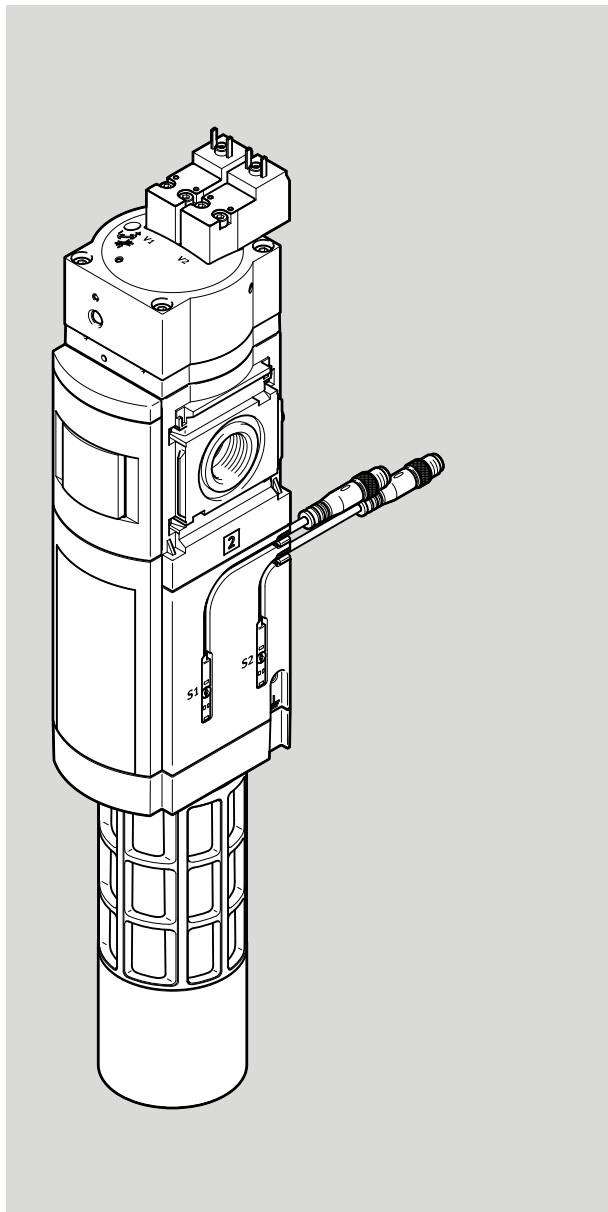


MS6-SV-...-D-10V24

Soft start/quick exhaust valve



FESTO

Instructions |
Assembly, Installation,
Safety func.



8111040
2019-05b
[8111042]

Translation of the original instructions

Table of contents

1	Applicable documents	4
1.1	Specified standards.....	4
2	Safety	4
2.1	Safety instructions.....	4
2.2	Intended use.....	4
2.3	Foreseeable misuse.....	5
2.4	Training of qualified personnel.....	5
3	Additional information	5
4	Service	5
5	Product overview	6
5.1	Design.....	6
5.1.1	Product design.....	6
5.2	Function.....	7
5.3	Safety function in accordance with EN ISO 13849.....	12
6	Assembly	15
6.1	Assembly with MS-series service unit components.....	16
7	Installation	16
7.1	Pneumatic installation.....	16
7.2	Electrical installation.....	17
8	Commissioning	18
9	Operation	18
10	Maintenance	18
10.1	Maintenance work.....	18
10.2	Cleaning.....	19
11	Malfunctions	19
11.1	Fault clearance.....	19
12	Disassembly	19
13	Disposal	20
14	Technical data	20
14.1	Technical data, mechanical.....	20
14.2	Technical data, pneumatic.....	20
14.3	Technical data, electrical.....	22
14.4	Safety engineering characteristics.....	23
14.5	Filling flow.....	24
14.6	Exhaust time.....	25

1 Applicable documents



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

1.1 Specified standards

Version
2006/42/EG
EN 1037 + A1:2008-04
EN ISO 4414:2010-11
EN ISO 13849-1:2015-12
EN ISO 13849-2:2012-10

Tab. 1 Standards/directives specified in the document

2 Safety

2.1 Safety instructions

- Only use the product in original status without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Observe labelling on the product.
- Take into consideration the ambient conditions at the location of use.
- Prior to mounting, installation and maintenance work: Switch off power supply and secure it from being switched back on.
- Observe tightening torques. Unless otherwise specified, the tolerance is $\pm 20\%$.

2.2 Intended use

The product is intended solely for venting quickly and safely and for building up pressure gently in pneumatic piping systems and terminal equipment in industry.

The product is intended for installation in a machine or automated system and must be used exclusively as follows:

- In an industrial environment
- Within the limits of the product defined by the technical data → 14 Technical data.
- In its original condition, without unauthorised modifications
- In perfect technical condition
- In standard operation, which includes standstill, set-up and service operation, as well as emergency operation

2.3 Foreseeable misuse

The following examples of foreseeable misuse are among those not approved as intended use:

- Outdoor use
- Use as press safety valve
- Bypass of the safety function
- Use in reversible operation (using supply air instead of exhaust air, and vice versa)
- Vacuum operation

2.4 Training of qualified personnel

Installation, commissioning, service and disassembly should only be conducted by skilled personnel. The skilled personnel must be familiar with the installation of electrical and pneumatic control systems.

3 Additional information

- Accessories → www.festo.com/catalogue.
- Spare parts → www.festo.com/spareparts.

4 Service

Contact your regional Festo contact person if you have technical questions → www.festo.com.

5 Product overview

5.1 Design

5.1.1 Product design

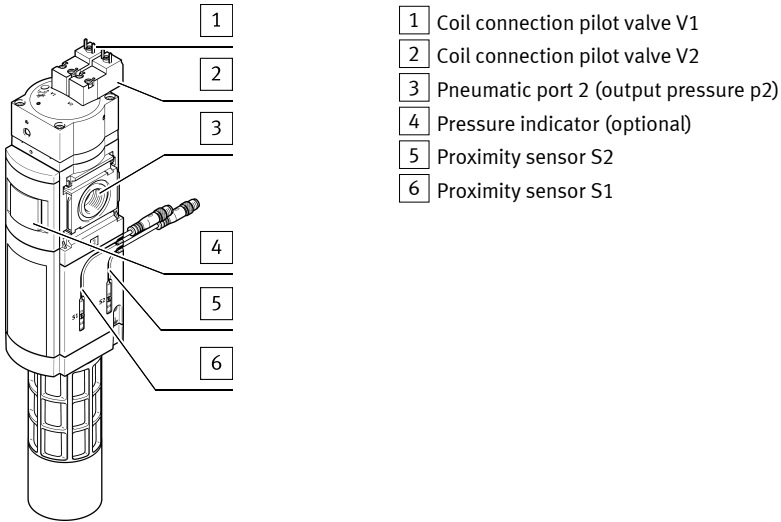


Fig. 1 Operating elements and connections

Product overview

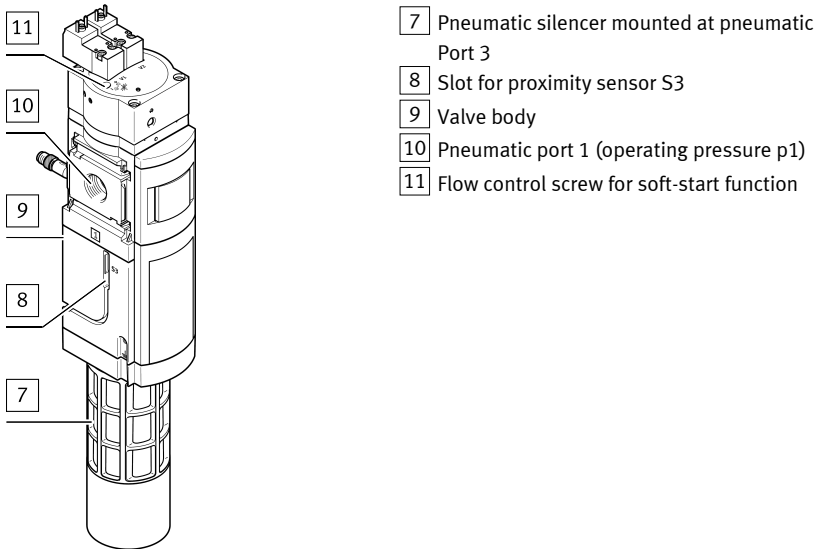


Fig. 2 Operating elements and connections

5.2 Function

The product changes from the normal position to the switching position when both coils are energised simultaneously. The normal position is achieved by switching off both coils.

The product has two safety functions:

- Pressure release
- Protection from unexpected start-up (non-switching)

The product has queries from proximity sensors, which are intended for diagnostics of the internal valves. Performance level d/e in category 3 can be achieved by using proximity sensors S1 and S2. Performance level e in category 4 can be achieved by using an additional proximity sensor S3.

Designations

Connection	Identifier	Functional principle	Position
Port 1 (operating pressure p1)	1	Pneumatic	→ 5.1.1 Product design.
Port 2 (output pressure p2)	2		
Port 3 (exhaust p3)	3		
Coil connection pilot valve V1	V1	Electrical	
Coil connection pilot valve V2	V2		
Proximity sensor S1	S1	Magnetic	
Proximity sensor S2	S2		
Proximity sensor S3 ¹⁾	S3		
Flow control	DR	Mechanical	

1) Optional.

Tab. 2 Interfaces

Switching logic

In the normal position (completely exhausted product), the pilot valves V1 and V2 are not actuated. If both pilot valves are actuated, the product switches first to the switching position 1 and then, when the switch-through pressure is reached, automatically into switching position 2 → Fig.3.

V1	V2	S1	S2	S3	MS6-SV-D
Voltage [V]		Switching position			Status
0	0	1	1	1	Normal position Port 1 blocked, passage from port 2 to 3 opened.
24	0	0	1	1	Normal position, optional testing condition → Tab. 6 Recommendation for activation and diagnostics. Port 1 blocked, passage from port 2 to 3 opened.
0	24	1	0	1	Normal position, optional testing condition → Tab. 6 Recommendation for activation and diagnostics. Reduced flow rate via flow control valve from port 1 to 2, passage from port 2 to 3 opened.
24	24	0	0	4	Switching position 1. Reduced flow rate over flow control valve from connection 1 to 2, passage from connection 2 to 3 blocked.
24	24	0	0	0	Switching position 2. Full flow from connection 1 to 2, passage from connection 2 to 3 closed.

Tab. 3 Switching logic

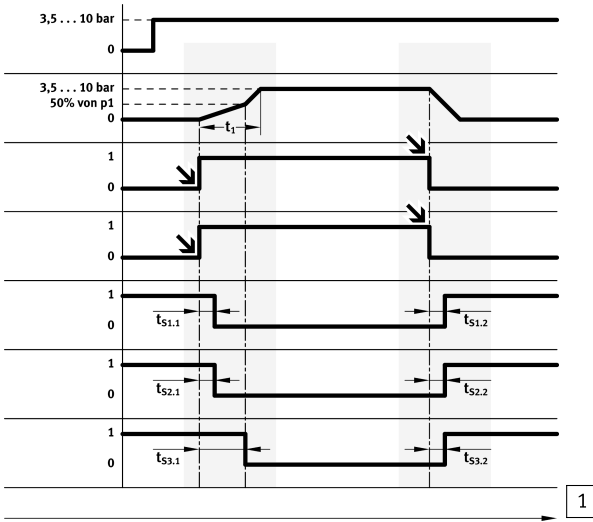
Function

Symbol	Function
	Soft-start/quick exhaust valve, electrically actuated.

Tab. 4 Circuit symbol for the function

Switching behaviour

Switching behaviour of the product's internal valves. The normally exhausted position is sensed by the proximity sensors. Switching logic → Tab. 3 Switching logic.



1 Time

Fig. 3 Input and output switching characteristics in normal status

Proximity switch reaction times ¹⁾			
Switch on		Switch off	
t_1	Depending on p_1 , flow control valve setting and system volume at p_2 .		
$t_{S1.1}$	Maximum of 4 s after signal at V1.	$t_{S1.2}$	Maximum of 4 s after signal drop at V1.
$t_{S2.1}$	Maximum of 4 s after signal at V2.	$t_{S2.2}$	Maximum of 4 s after signal drop at V2.
$t_{S3.1}$	After signal at V1 and V2. Depending on p_1 , flow control valve setting and system volume at p_2 .	$t_{S3.2}$	Maximum of 5 s after signal drop at V1 and V2. Depending on system volume at p_2 .

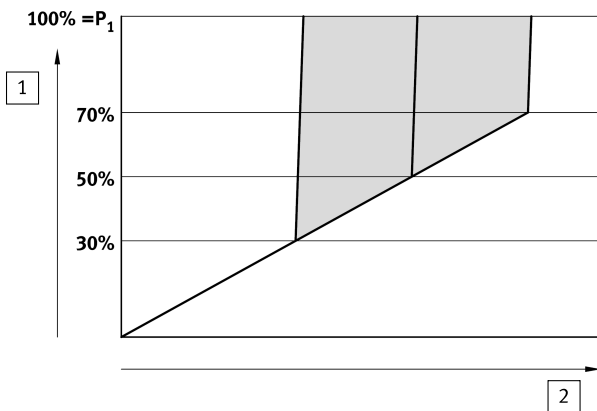
1) After the reaction time the signals are applied statically. The maximum specified reaction times must be considered in the diagnostics. These reaction times are normally shorter.

Tab. 5 Proximity switch reaction times

Switch-through pressure

There is a flow control screw in the cover of the product. The flow control screw can be used to generate a gradual pressure build-up of output pressure p_2 → 14.5 Filling flow.

The flow rate and thus the pressure rise can be adjusted by turning the flow control screw. When the output pressure p_2 reaches about 50 % of the operating pressure p_1 , the maximum flow rate performance is enabled.



1 Ratio of p2 to p1 [%]

2 Filling time t

Fig. 4 Switch-through pressure tolerance field

Activation and diagnostics

If the results of activation and the sensor signals S1, S2 and S3 are not plausible, carry out the following measures:

1. Switch off voltage to pilot valves V1 and V2.
2. Output error message.
3. Prevent new switching.

Sequence	Activity	Status and status transitions
Diagnostics at each switching operation		
1.	Apply voltage to pilot valves V1 and V2.	V1 = 1; V2 = 1
2.	Record edge change at proximity sensors S1 and S2.	S1 = 1 → 0; S2 = 1 → 0
Optional, when using a third proximity switch S3		
3.	Record edge change at proximity switch S3.	S3 = 1 → 0
Corresponding reaction times → Fig.3.		
Diagnostics at each resetting to the normal position		
1.	Switch off voltage to pilot valves V1 and V2.	V1 = 0; V2 = 0
2.	Record edge change at proximity sensors S1 and S2.	S1 = 0 → 1; S2 = 0 → 1

Sequence	Activity	Status and status transitions
Optional, when using a third proximity switch S3		
3.	Record edge change at proximity switch S3.	S3 = 0 → 1
Corresponding reaction times → Fig.3.		
Diagnostics in normal position		
Pay attention to forced switch on/off → 14.4 Safety engineering characteristics.		
1.	Apply voltage to pilot valve V1.	V1 = 1
2.	Record edge change at proximity switch S1.	S1 = 1 → 0
3.	Switch off voltage to pilot valve V1.	V1 = 0
4.	Record edge change at proximity switch S1.	S1 = 0 → 1
5.	Apply voltage to pilot valve V2.	V2 = 1
6.	Record edge change at proximity switch S2.	S2 = 1 → 0
7.	Switch off voltage to pilot valve V2.	V2 = 0
8.	Record edge change at proximity switch S2.	S2 = 0 → 1
Corresponding reaction times → Fig.3.		

Tab. 6 Recommendation for activation and diagnostics

5.3 Safety function in accordance with EN ISO 13849

The product achieves a performance level for the following safety functions:

- Safe venting
- Protection against unexpected start-up (pressurisation) after EN 1037

NOTICE!

Failure of the safety function.

Common cause failures (CCF) cause the failure of the safety function, since in this case both channels in a two-channel system fail simultaneously.

If measures to control the CCFs are not observed, the safety function of the soft-start/quick exhaust valve can be impaired.

- Make sure that the described measures are observed
 - Failures due to a common cause (Common Cause Failure – CCF).
 - 14.4 Safety engineering characteristics

NOTICE!

Failure of the safety function.

Non-compliance with the technical data can lead to loss of the safety function.

- Observe the technical data → 14 Technical data.

Failures due to a common cause (Common Cause Failure – CCF)

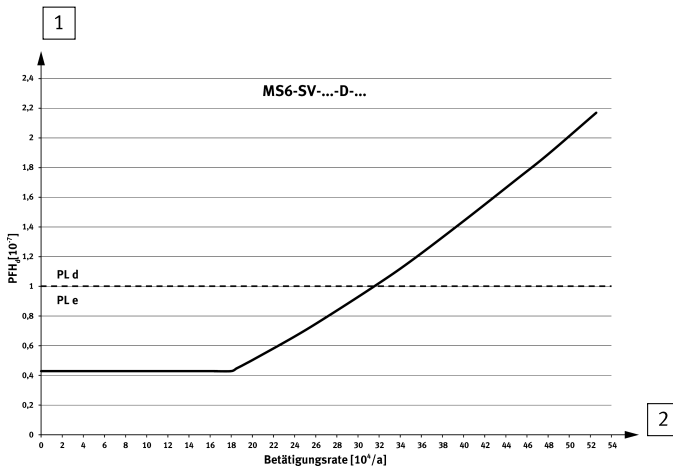
To achieve the desired performance level, the applicable measures against CCF must be implemented in accordance with the specifications of EN ISO 13849-2.

PFH_d value



The PFH_d value depends on the model of the product and the annual actuation rate (n_{op}).

PFH_d value MS6-SV-...-D



1 PFH_d [10⁻⁷]

2 Actuation rate (n_{op}) [10⁴/a]

Fig. 5 PFH_d value MS6-SV-...-D

PFH_d value MS6-SV-...-D-S3

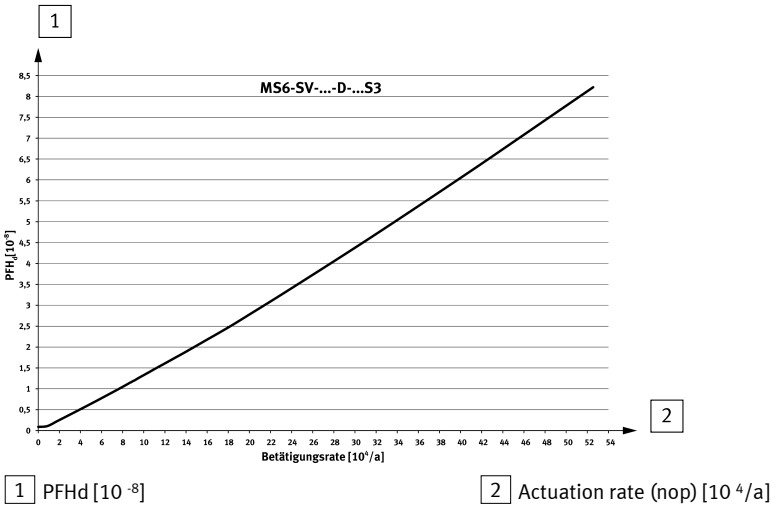


Fig. 6 PFH_d value MS6-SV-...-D-S3

6 Assembly

NOTICE!

Failure of the safety function.

Failure to comply with the minimum distance of 15 mm between the silencer and base can result in the loss of the safety function.

- Observe minimum distance of 15 mm below the silencer → Fig.7.
The free space ensures the exhaust can escape.

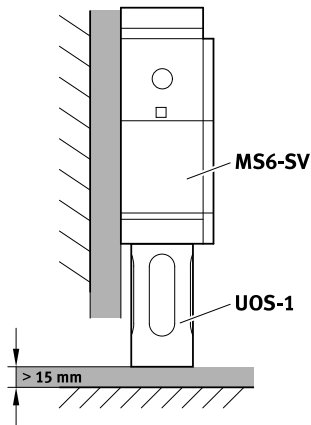


Fig. 7 Installation

- Observe the direction of flow from port 1 to port 2. Items 1 and 2 on the housing → Fig.8 are provided for orientation.

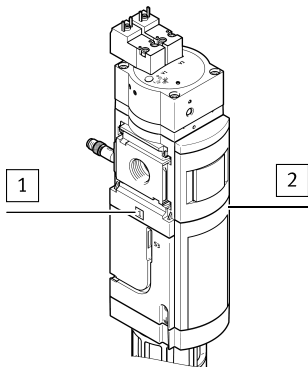


Fig. 8 Flow direction

6.1 Assembly with MS-series service unit components

⚠ WARNING!

Failure of the safety function.

Incorrect installation in the service unit combination can result in failure of the exhaust safety function.

- Only devices that do not impair the exhaust process, even after a possible malfunction of the device, may be placed downstream from the MS6-SV-....

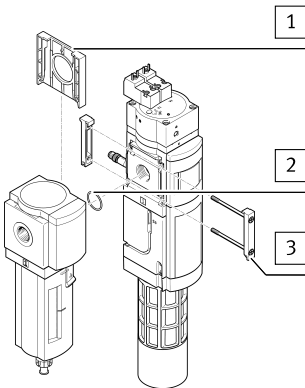


Fig. 9 Assembly

1. Slide the cover cap MS6-END **1** upwards and remove it.
2. Insert a seal **2** between the individual devices (module connector MS6-MV in scope of delivery).
3. Place module connector **2** in the slots of the individual devices.
4. Fasten the module connector with two screws (product scope of delivery).
Tightening torque: maximum 1.2 Nm.

7 Installation

7.1 Pneumatic installation

Port 1 and 2

If using screw connectors:

- Note the screw-in depth of the connector thread: 10 mm.
- Make sure that the compressed air lines are connected correctly.
- Screw the connectors into the pneumatic ports using a suitable sealing material.

Port 3



Exhausting a system using the product results in high noise levels.

- Recommendation: use silencer → www.festo.com/catalogue.
-
- Screw the silencer into pneumatic port 3.
 - Make sure that there is unrestricted exhausting. Neither the silencer nor port 3 may be blocked.

7.2 Electrical installation

⚠ WARNING!

Risk of injury due to electric shock.

- For the electrical power supply, use only PELV circuits in accordance with IEC 60204-1/EN 60204-1 (Protective Extra-Low Voltage, PELV).
- Observe the general requirements of IEC 60204-1/EN60204-1 for PELV circuits.
- Only use voltage sources that ensure a reliable electric separation from the mains network in accordance with IEC 60204-1/EN 60204-1.

Connecting the product

- Connect pilot valves and proximity switches.

Example of circuits

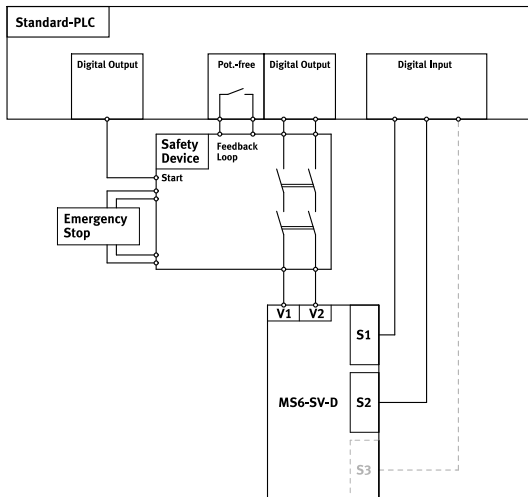


Fig. 10 Example of circuits

Designations	
S1	Proximity sensor S1
S2	Proximity sensor S2
S3	Proximity sensor S3
V1	Pilot valve 1
V2	Pilot valve 2
Pot.-free	Potential-free contact
Emergency stop	Emergency stop (input circuit)
Feedback loop	Feedback circuit
Safety device	Safety relay unit or safety PLC
Digital output	Digital output
Digital input	Digital input
Standard PLC	Programmable logic controller

Tab. 7 Designations in circuit examples

8 Commissioning

i

The product does not have its own control logic and must therefore be integrated into the control system through appropriate measures.

Graphic display of commissioning → Fig.3.

Proceed as follows to commission the product:

- Apply operating pressure p_1
 - ↳ The product is now ready for operation and can be actuated.

The filling speed of the pneumatic system can be adjusted with the flow control valve → Fig.2.

9 Operation

i

Perform a forced switch-off at least once a month if the process-related switching frequency is lower.

10 Maintenance

10.1 Maintenance work

A dirty silencer can extend the time needed for exhausting the system and thus restrict the safety function.

- Check the silencer regularly and replace if necessary.

10.2 Cleaning

1. Switch off energy sources:
 - Operating voltage
 - Compressed air
2. Clean the outside of the product as required. Approved cleaning agents are soap solutions (max. +50 °C), petroleum ether and all non-abrasive cleaning agents.

11 Malfunctions

11.1 Fault clearance

- Check compressed air supply
- Check power supply
- Check installation of the signal lines
- Start device → 8 Commissioning.
- Implement possible remedies → Tab. 8 Fault clearance.
- If the fault occurs again: contact Festo service → www.festo.com.

Malfunction	Possible cause	Remedy
Product does not switch	Power supply is insufficient	– Provide sufficient power supply.
	Pressure supply interrupted	– Restore compressed air supply.
	Malfunction due to electrical or electromagnetic effects (EMC measures not complied with).	<ul style="list-style-type: none"> – Note maximum length of the signal lines. – Run the control and power lines separately. – Use screened cables. – Provide low-impedance paths to earth.
Pressure p1 collapses briefly at every switching operation	The cross-section of the MS6-SV-D pressure supply is too small.	<ul style="list-style-type: none"> – Tighten flow control screw a little. – Attach reservoir in front of inlet p1. – Modify the compressed air supply, e. g. increase cross-section of the power supply cable.

Tab. 8 Fault clearance

12 Disassembly

1. Switch off energy sources
 - Operating voltage
 - Compressed air
2. Separate the applicable connections from the product.

13 Disposal

ENVIRONMENT!

Send the packaging and product for environmentally sound recycling in accordance with the current regulations → www.festo.com/sp.

14 Technical data

14.1 Technical data, mechanical

MS6-SV-D		
Type of mounting	In-line installation With accessories	
Constructive design	Piston seat has no overlap	
Position sensing principle	Piston magnet principle	
Reset method	Mechanical spring	
Mounting position	Any	
Sound pressure level	[dB(A)]	75 with silencer UOS-1
Environmental conditions		
Shock resistance	Shock test with severity level 2 in accordance with EN 60068-2-27	
Vibration resistance	Transport application test with severity level 2 in accordance with EN 60068-2-6	
Degree of protection		
Degree of protection	IP65 (fully mounted and connected)	
Protection class	III	
Materials		
Housing	Die-cast aluminium	
Seal	NBR	

Tab. 9 Technical data, mechanical

14.2 Technical data, pneumatic

MS6-SV-E		
Pneumatic port 1, 2	[G]	1/2
Pneumatic port 3	[G]	1

Technical data

MS6-SV-E		
Pilot air supply		Internal
Exhaust function		Without flow control option
Manual override		None
Type of control		Piloted
Valve function		3/2-way valve, monostable, closed Soft-start function
Medium		
Operating medium		Compressed air according to ISO 8573-1:2010 [7:4:4]
Note		Lubricated operation possible, in which case lubricated operation will always be required
Temperature		
Medium	[°C]	-10 ... +50
Environment	[°C]	-10 ... +50
Bearing	[°C]	-10 ... +50
Operating pressure		
Operating pressure	[bar]	3.5 ... 10
Residual pressure in normal operation	[bar]	0 (no residual pressure)
Residual pressure in the event of error	[bar]	≤ 0.4 (at p ₁ = 10 bar and flow control fully open)
C value	[l/(s bar)]	19.3
B value	[l/(s bar)]	0.21
Flow rate values		
Standard nominal flow rate 1 → 2	[l/min]	4300 (at p ₁ = 6 bar, p ₂ = 5 bar)
Standard flow rate 2 → 3	[l/min]	9000 (at p ₁ = 6 bar)
Standard flow rate 2 → 3 in the event of a critical fault	[l/min]	≥ 6000 (at p ₁ = 6 bar)
Switch-through point		Approx. 50% of p ₁
Filling flow		Adjustable by flow control
Minimum pause time after exhaust	[s]	≥ 1

Tab. 10 Technical data, pneumatic

14.3 Technical data, electrical

MS6-SV-D	
Actuation type	Electrical
Protection against electric shock (protection against direct and indirect contact in accordance with EN/IEC 60204-1)	by PELV fixed power supply
Pilot valves	
Nominal operating voltage DC [V]	24
Permissible voltage fluctuations [%]	±10
Duty cycle [%]	100
Nominal power per solenoid coil [W]	1.8 (at 24 V DC)
Proximity sensor SMT-8M-A-PS-24V-E	
Nominal operating voltage [V]	24
Permissible voltage fluctuations [%]	±10
Switching element function	N/O contact
Measuring principle	Magneto-resistive
Switching status display	LED
Switching output	PNP

Tab. 11 Technical data, electrical

14.4 Safety engineering characteristics

Type	MS6-SV-D
Safety function	Safe venting and protection against unexpected pressurisation
Service-life value B ₁₀	0.9 mill. switching cycles
Service life [Years]	20
Achievable performance level (PL) in accordance with EN ISO 13849-1	
With sensing of S1 and S2	Category 3, PL d or category 3, PL e ¹⁾
With sensing of S1, S2 and S3	Category 4, PL e
Probability of dangerous failure per hour	
PFH _d value MS6-SV-...-D	→ Fig.5.
PFH _d value MS6-SV-...-D-S3	→ Fig.6.
CCF measures	Relevant requirements EN ISO 13849-2 → Failures due to a common cause (Common Cause Failure – CCF).
Note on forced checking procedure	Switching frequency at least 1/month

1) Depending on the average number of actuations per year (nop).

Tab. 12 Safety engineering characteristics

14.5 Filling flow

Throttle flow rate q_n , as a function of the number of rotations n of the flow control screw

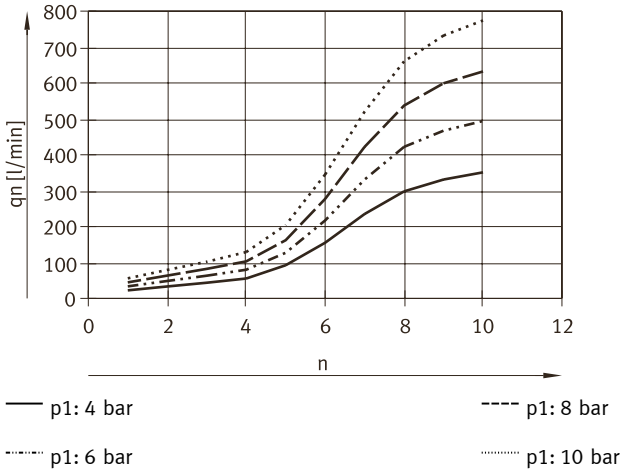


Fig. 11 Flow diagram

14.6 Exhaust time

The following table shows the exhaust time in normal operation (N) and in the event of a fault (F) for different volumes and operating pressures.

NOTICE!

In the case of a fault (F) the worst possible fault in the valve's interior is assumed (worst case).

Normal operation: N Fault case: F		Operating pressure 3.5 bar		Operating pressure 6 bar		Operating pressure 10 bar		
		Exhaust time [s] to 1.0 bar	Exhaust time [s] to 0.5 bar	Exhaust time [s] to 1.0 bar	Exhaust time [s] to 0.5 bar	Exhaust time [s] to 1.0 bar	Exhaust time [s] to 0.5 bar	
Volume [l]	2	N	0.1	0.2	0.24	0.3	0.3	0.4
		(F)	(0.16)	(0.22)	(0.28)	(0.35)	(0.36)	(0.52)
	10	N	0.3	0.45	0.55	0.7	0.7	0.9
		(F)	(0.4)	(0.6)	(0.8)	(1.1)	(1.2)	(1.9)
	20	N	0.5	0.85	1.0	1.3	1.4	1.7
		(F)	(0.8)	(1.25)	(1.5)	(2.2)	(2.4)	(3.9)
	40	N	1.2	1.9	2.2	3.0	3.0	3.9
		(F)	(1.7)	(2.8)	(3.4)	(5.3)	(5.1)	(8.1)
	150	N	3.2	5.0	6.0	8.2	11.0	12.8
		(F)	(4.8)	(8.2)	(9.8)	(15.4)	(16.2)	(29.0)

Tab. 13 Exhaust time

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