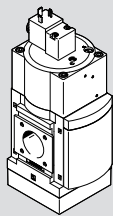


MS9-SV-...-C

Soft start/quick exhaust valve



FESTO

Festo SE & Co. KG
Rüter Straße 82
73734 Esslingen
Deutschland
+49 711 347-0

www.festo.com

Operating instructions

8164018
2022-06a
[8164020]



Translation of the original instructions

© 2022 all rights reserved to Festo SE & Co. KG

1 About this document

This document describes the use of the soft start/quick exhaust valve. The document contains additional information for use of the product in safety-related systems (safety handbook in accordance with IEC 61508).

1.1 Target group

The document is targeted towards individuals who mount and operate the product. It is additionally targeted towards individuals who are entrusted with the planning and application of the product in a safety-oriented system.

1.2 Applicable documents

- Assembly instructions for cover MS6/9-SV-C-MK/MH as tamper protection

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

1.3 Specified standards

Version	
EN 60204-1:2016-10	EN ISO 13849-2:2012-10
EN ISO 4414:2010-11	EN ISO 14118:2018-02
EN ISO 13849-1:2015-12	

Tab. 1: Standards specified in the document

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.
- Take into account the ambient conditions at the location of use.
- Before working on the product, switch off the power supply and secure it against being switched on again.
- Observe the tightening torques. Unless otherwise specified, the tolerance is ± 20%.
- Only use compressed air as an operating medium in accordance with the specification → 12 Technical data.

2.2 Intended use

The product is intended for mounting in machines or automation systems and is only to be used as follows:

- in an industrial environment
- in its original condition, without unauthorised modifications
- in safety-related systems only with cover MS9-SV-MK as tamper protection
- in perfect technical condition

2.3 Foreseeable misuse

Foreseeable misuse includes:

- outdoor operation
- Bypassing of safety functions
- use in reversible operation with reversal of supply air and exhaust air
- use in "Low Demand Mode" according to EN 61511
- vacuum operation

2.4 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.

3 Additional information

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

Designation	Type
Silencer	U-1-B
Cover, covers the manual override	MS9-SV-MH
Cover, covers the adjustment elements for the pressure switching point, the main flow control and the manual override	MS9-SV-MK

Tab. 2: Accessories

4 Product overview

4.1 Structure

4.1.1 Product design

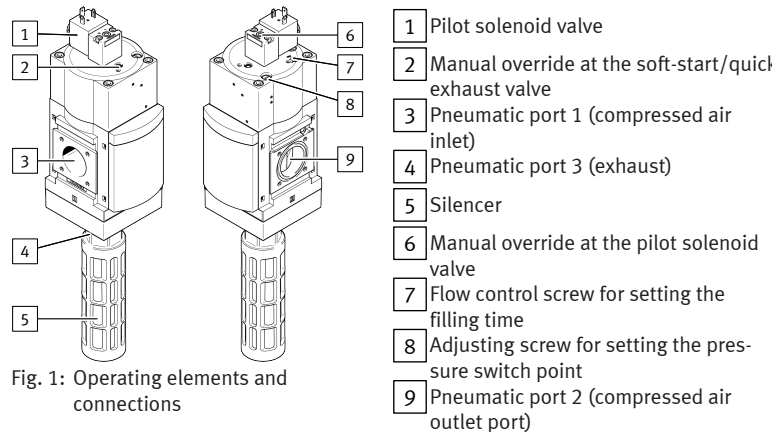


Fig. 1: Operating elements and connections

4.1.2 Product variants

The following table lists selected product characteristics and codes that are necessary for understanding the instruction manual. Complete type code → www.festo.com/catalogue.

Key features	Code	Description
Series	MS	Standard service unit
Size	9	Grid dimension 90 mm
Function	-SV	Soft-start/quick exhaust valve
Port size	-3/4	Thread G 3/4
	-1	Thread G 1
	-AGD	Sub-base G 1/2
	-AGE	Sub-base G 3/4
	-AGF	Sub-base G 1
	-AGG	Sub-base G 1 1/4
	-AGH	Sub-base G 1 1/2
	-N3/4	Thread N 3/4
	-N1	Thread N 1
	-AQR	Sub-base NPT 1/2
	-AQS	Sub-base NPT 3/4
	-AQT	Sub-base NPT 1
	-AQU	Sub-base NPT 1 1/4
	-AQV	Sub-base NPT 1 1/2
	-G	Module without connection thread, without sub-base
-NG	Module without connection thread, without sub-base (port 3 in NPT)	
Performance Level	-C	in accordance with EN ISO 13849-1
Supply voltage	-V24	24 V DC (plug pattern in accordance with EN 175301-803, type C)
	-10V24P	24 V DC (M12 in accordance with IEC 61076-2-101)
	-V110	110 V AC (plug pattern in accordance with EN 175301-803, type C)
	-V230	230 V AC (plug pattern in accordance with EN 175301-803, type C)
Options	-S	Silencer
Tamper protection	-MH	Cover - manual override (HHB) only
	-MK	Cover - pressure switching point (DUP) and main flow control valve (HD) adjusting screws, manual override (HHB)

Tab. 3: Product variants (selection)

4.2 Function

The MS9-SV-...-C electro-pneumatic pressure soft-start/quick exhaust valve is intended for rapid pressure reduction and pressurisation in pneumatic line systems and terminal equipment in industry.

Circuit symbol	Function
	Soft-start/quick exhaust valve, electro-pneumatically actuated

Tab. 4: Circuit symbol for the function

4.3 Information on functional safety

4.3.1 Achievable safety rating

The product is suitable for use as an element in a safety-related system in accordance with EN ISO 13849-1 up to category 1, performance level (PL) c.

NOTICE

The suitability for certain applications can only be determined in connection with the assessment of further components of the subsystem. These must achieve the same safety level.

4.3.2 Safety functions

The safety functions are:

- Exhausting in the downstream piping system and terminals
- Prevention of unexpected start-up (pressurisation)

The safety functions are triggered by switching off the power supply at the pilot solenoid valve. As long as the voltage at the pilot solenoid valve remains switched off, the connection between ports 2 and 3 is enabled → 4.2 Function.

This switching position represents the safe state.

4.3.3 Operating conditions

- General information on safe operation → 2 Safety
- Ambient conditions and additional technical specifications → 12 Technical data.

NOTICE

Actuate the product at least once per month to ensure the safety function works properly.

4.3.4 Limitations of use

The duration of use is limited to the maximum operating time T_{10d} or is no more than the mission time T_M → 4.3.5 Characteristic values.

4.3.5 Characteristic values

Safety characteristics	MS9-SV...-C
Safety function	Exhaust Prevention of unexpected start-up (pressurisation)
Note on forced checking procedure ¹⁾	Switching frequency min. 1/month
Performance level (PL) in accordance with EN ISO 13849-1	Exhaust: up to category 1, PL c ²⁾
Service life characteristic B_{10}	0.35 mill. switching cycles
Service life T_M [a]	20
Maximum operating time T_{10d} [a]	$2 \times B_{10}/n_{op}$ or max. T_M
Diagnostic coverage (Diagnostic Coverage) DC	0
Hardware fault tolerance (Hardware Fault Tolerance) HFT	0
Average probability of dangerous failure per hour (Average probability of dangerous failure per hour) PFH_d	→ Fig. 2
Exhaust time [s]	→ 12.4 Exhaust time
CE marking,	Declaration of conformity → www.festo.com/sp

1) Use in "low demand mode" is not permissible.

2) Applies up to the average number of actuations per year = 180,000

Tab. 5: Safety characteristics

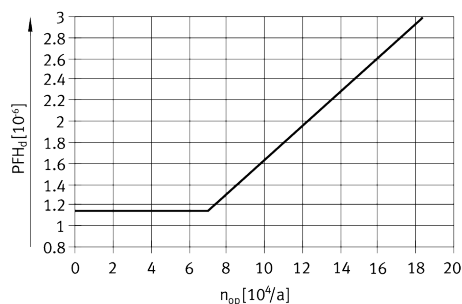


Fig. 2: PFH_d value, dependent on the average number of operations per year (n_{op})

5 Assembly

i

Information about mounting the module connector, connecting plate and mounting bracket can be found in the instruction manual enclosed with the relevant accessories.

5.1 Requirements

- Take appropriate measures to remove any particles in the supply lines.

5.2 Preparation

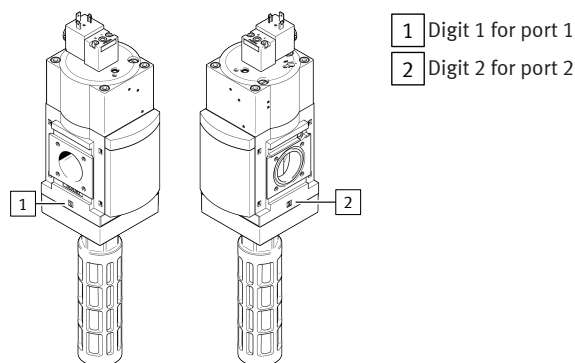


Fig. 3: Flow direction

- Place product as close as possible to the installation site.
- Place the product so that there is enough space for removing and installing the silencer.
- Observe the flow direction from port 1 to port 2. The numbers 1 and 2 on the housing of the MS9-SV...-C serve as orientation.

5.3 Assembly with MS-series service unit components

⚠ WARNING

Loss of the safety function

If devices that impair the exhaust are placed behind the pneumatic connection 2 of the soft start/quick exhaust valve, this can result in loss of the safety function.

- Only place devices that do not impair the exhaust downstream of pneumatic connection 2.

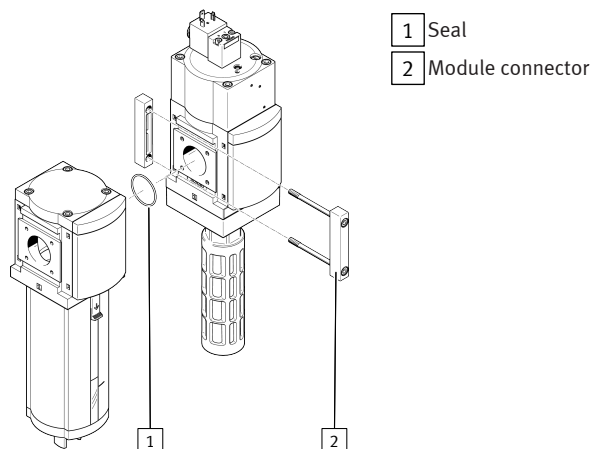


Fig. 4: Assembly

1. Insert a seal 1 between the individual devices (module connector MS9-MV in scope of delivery).
2. Place the module connector 2 in the slots of the separate devices.
3. Fasten the module connector with two screws (in scope of delivery of module connector MS9-MV). Maximum tightening torque 1.2 Nm

6 Installation

6.1 Safety

⚠ WARNING

Risk of injury from compressed air.

- Before carrying out installation and maintenance work, switch off the compressed air supply.

6.2 Pneumatic installation

Port 1 and 2

If using screw connectors:

ISO 228		NPT	
MS9...-3/4	18.5 mm	MS9...-N3/4	18.5 mm
MS9...-1	18.5 mm	MS9...-N1	18.5 mm
MS9...-AGD/AGE/AGF	18.5 mm	MS9...-AQR/AQS/AQT	18.5 mm
MS9...-AGG/AGH	31.5 mm	MS9...-AQU/AQV	31.5 mm

Tab. 6: Max. screw-in depth

1. Note the permissible screw-in depth of the connector thread.

2. Make sure that the compressed air lines are connected correctly.
3. Screw the fittings into the pneumatic ports using a suitable sealing material.

Port 3, thread size G 1 or NPT 1

i

Exhausting a system using the MS9-SV-...-C results in high noise levels.

- Recommendation: use silencer → www.festo.com/catalogue.

NOTICE

The U-1-B silencer listed in the accessories can only be retrofitted or replaced on devices with a metric thread.

If the silencer is retrofitted on a device with an NPT thread at port 3, the cover of the MS9-SV-...-C may be destroyed. An adequate silencer with NPT thread must be used for the retrofit.

1. Screw the silencer into pneumatic port 3.
2. Make sure exhaust is unhindered: neither the silencer nor port 3 may be blocked.

6.3 Electrical installation

MS9-SV-...-C-10V24P/-V24:

⚠ WARNING

Risk of injury due to electric shock.

- For the electrical power supply with extra-low voltages, use only PELV circuits that guarantee a reinforced isolation from the mains network.
- Observe IEC 60204-1/EN 60204-1.

MS9-SV-...-C-V110/-V230:

⚠ WARNING

Risk of injury due to electric shock.

- Electrical connections must only be established when the voltage is disconnected and by qualified personnel.
- Use only voltage sources in accordance with IEC 60204-1/EN 60204-1.

- Connect the pilot solenoid valve. Accessories → www.festo.com/catalogue.

7 Commissioning

7.1 Pressurising the product and piping system

1. Apply operating pressure p1 at MS9-SV-...-C.
2. Switch on supply voltage.

The outlet pressure p2 is built up slowly. The filling time "t" is set via the flow control screw on the cover → 4.1.1 Product design. The output pressure rises in accordance with the throttle position → 12.2 Pressurisation flow rate. If the pre-set pressure switching point (PSP) is reached, the main seat of the valve opens → 12.3 Pressure switching point (PSP).

↳ The downstream piping system is pressurised.

i

If the cover is not mounted as tamper protection, the pressurisation process is started with the soft-start function by actuation of one of the manual overrides (→ 4.1.1 Product design).

- Reset manual override → 7.3 Resetting the internal manual override.

7.2 Cover for tamper protection

Use:
– In a safety-related system, the setting and control elements must be equipped with a cover for tamper protection → 3 Additional information.

If the cover is mounted as tamper protection, the manual overrides cannot be actuated.

- In a non-safety-related system, use of the cover is optional.

7.3 Resetting the internal manual override

A reset will be required if the internal manual override at the soft-start/quick exhaust valve [3] was previously actuated without the cover as tamper protection being mounted. Reset can be performed through one of the following measures.

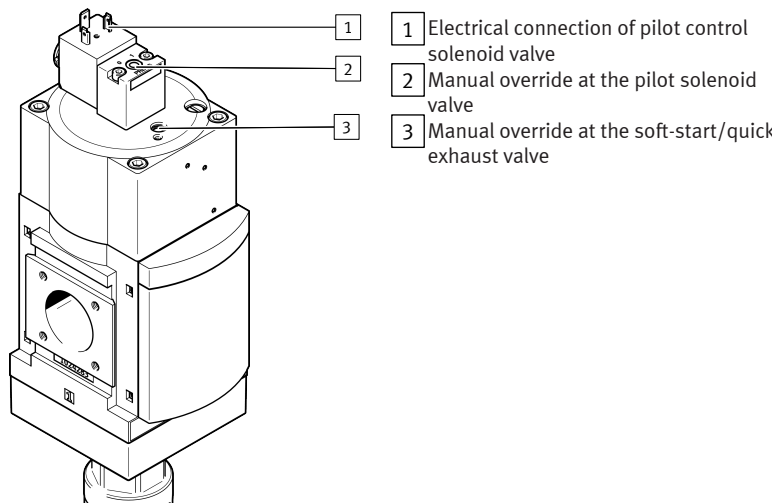


Fig. 5: Reset of the internal manual override

- Output of an electrical signal to pilot solenoid valve [1].
- or
- Actuation of the manual override at the pilot solenoid valve [2].

8 Operating

If the voltage drops, for example because the power supply is switched off, the product exhausts the downstream piping system → 4.2 Function.

After actuation of the internal manual override:

→ 7.3 Resetting the internal manual override

9 Maintenance

9.1 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.

9.2 Cleaning

1. Switch off energy sources:
 - Operating voltage
 - Compressed air
2. If necessary, clean the product on the outside. Soap suds (max. +50 °C), petroleum ether and all non-abrasive cleaning agents may be used.

10 Malfunctions

10.1 Fault clearance

Malfunction	Cause	Remedy
Valve switches abruptly.	Pressure switching point is too low.	– Correct settings.
	Main flow control valve (FCV) is opened too far.	– Correct settings.
Valve does not switch.	Pressure switching point is too high.	– Correct settings.
	Main flow control valve (FCV) is not opened far enough.	– Correct settings.
	Leakage in connected system too high. The switching pressure is not reached.	– Reduce leakage in system.

Tab. 7: Fault clearance

Repairs to the product are not permissible.

- In the event of malfunctions or failure: replace the product and let Festo know about the failure.
- Return defective product to Festo.

11 Dismantling

⚠ WARNING

Risk of injury from compressed air.

- Before dismantling work, switch off the compressed air supply.

1. Switch off energy sources:
 - Operating voltage
 - Compressed air
2. Disconnect the relevant connections of the MS9-SV-...-C.

12 Technical data

12.1 General data

MS9-SV-...-C	
Certificates, declaration of conformity	→ www.festo.com/sp
Pneumatic port 1	Port sizes → 4.1.2 Product variants
Pneumatic port 2	Port sizes → 4.1.2 Product variants
Pneumatic port 3	– G 1 – NPT 1

MS9-SV...-C	
Type of mounting	- In-line installation - with accessories
Mounting position	Any
Design	Piston gate valve
Actuation type	Electric
Exhaust function	Cannot be throttled
Type of control	Pilot-controlled
Valve function	- 3/2-way valve, closed, monostable - Adjustable soft-start function
Operating medium	Compressed air to ISO 8573-1:2010 [7:4:4] and inert gases
Information on operating medium	Lubricated operation possible, in which case lubricated operation will always be required
Operating pressure p1	[MPa] 0.35 ... 1.0
-10V24P	[bar] 3.5 ... 10
	[psi] 50.75 ... 145
Operating pressure p1	[MPa] 0.35 ... 1.6
-V24, -V110, -V230	[bar] 3.5 ... 16
	[psi] 50.75 ... 232
Pressure switching point	Adjustable → 12.3 Pressure switching point (PSP)
Pressurisation flow rate	Adjustable by flow control valve → 12.4 Exhaust time
Standard nominal flow rate 1 → 2	-3/4/-N3/4: 14150
	-1/-N1: 14140
	-N3/4: 14900
	-N1: 14100
	-AGD/-AQR: 16500
	-AGE/-AQS: 14400
	-AGF/-AQT: 13800
	-AGG/-AQU: 13200
	-AGH/-AQV: 13200
Electrical connection	
-10V24P	Plug, M12x1, 4-pin
-V24, -V110, -V230	Plug, square design, according to EN 175301-803, type A
Coil characteristics	
-10V24P	24 V DC, 2.7 W
-V24	24 V DC, 8.4 W
-V110	110 V AC 50/60 Hz, pick-up power 14.5/12 VA, holding power 10.5/7.6 VA
-V230	230 V AC, 50/60 Hz, pick-up power 14.5/12 VA, holding power 10.5/7.6 VA
Permissible voltage fluctuations	10
Operating and environmental conditions	
Ambient temperature	[°C] 0 ... +60 (0 ... +50 with pressure sensor)
Temperature of medium	[°C] 0 ... +60 (0 ... +50 with pressure sensor)
Storage temperature	[°C] 0 ... +60 (0 ... +50 with pressure sensor)
Shock resistance	Shock test with severity level 1 in accordance with FN 942017-5 and EN 60068-2-27
Vibration resistance	Transport application test with severity level 1 in accordance with FN 942017-4 and EN 60068-2-6
Sound pressure level	[dB(A)] 93
Degree of protection	IP65 with plug socket
Weight	
without silencer	[g] 2970
with silencer	[g] 3200
Materials	
Housing	Die-cast aluminium
Cover	Wrought aluminium alloy
Bottom cover	PA
Seals	NBR

Tab. 8: General technical data

Type of severity level (SL)					
Vibration load					
Frequency range [Hz]		Acceleration [m/s ²]		Deflection [mm]	
SL1	SL2	SL1	SG2	SL1	SL2
2 ... 8	2 ... 8	-	-	±3.5	±3.5
8 ... 27	8 ... 27	10	10	-	-
27 ... 58	27 ... 60	-	-	±0.15	±0.35
58 ... 160	60 ... 160	20	50	-	-
160 ... 200	160 ... 200	10	10	-	-
Shock load					
Acceleration [m/s ²]		Duration [ms]		Shocks per direction	
SL1	SL2	SL1	SL2	SL1	SL2
±150	±300	11	11	5	5

Type of severity level (SL)		
Continuous shock load		
Acceleration [m/s ²]	Duration [ms]	Shocks per direction
±150	6	1000

Tab. 9: Type of severity level (SL)

12.2 Pressurisation flow rate

Flow rate qn as a function of the number of revolutions n of the main flow control valve screw (FCV)

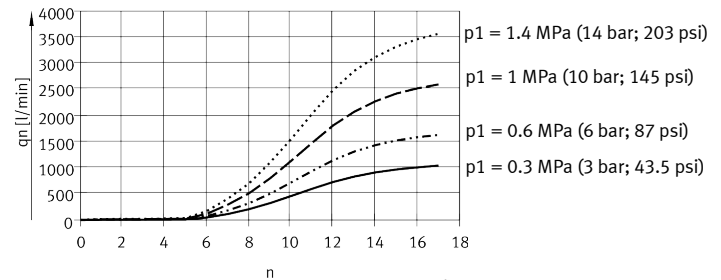


Fig. 6: Flow rate qn depending on the revolutions n

Range up to 5 revolutions

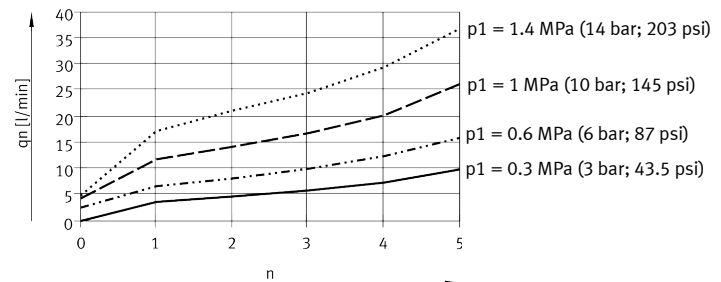


Fig. 7: Flow rate qn up to 5 revolutions

12.3 Pressure switching point (PSP)

A slow pressure build-up of outlet pressure p2 is achieved with the main flow control valve located in the cover. If the output pressure p2 has reached the switch-through pressure, the valve opens and the complete operating pressure p1 is applied at the output. The pressure switching point (PSP) can be set by turning the adjusting screw for the pressure switching point.

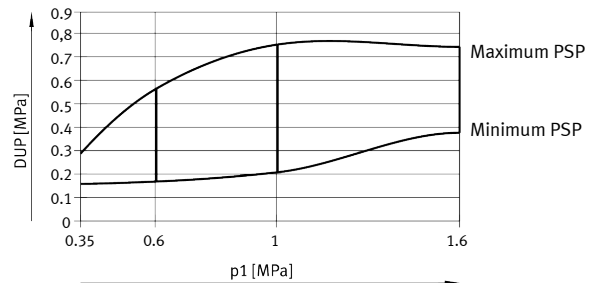


Fig. 8: Pressure switching point

Example:

At an operating pressure p1 = 6 bar, the pressure switching point can be set in a range from 1.8 ... 5.5 bar.

12.4 Exhaust time

The following table shows the exhaust time in normal operation (N) with silencer U-1-B at various volumes and operating pressures.

Normal operation N		Exhaust time [s]							
Operating pressure	[MPa]	0.4	0.6	1	1.6				
	[bar]	4	6	10	16				
	[psi]	58	87	145	232				
Exhaust to	[MPa]	0.1	0.05	0.1	0.05	0.1	0.05	0.1	0.05
	[bar]	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5
	[psi]	14.5	7.25	14.5	7.25	14.5	7.25	14.5	7.25
Volume [l]	10	0.53	0.62	0.65	0.75	0.8	0.9	0.93	1.03
	20	0.69	0.89	0.9	1.08	1.13	1.31	1.37	1.56
	40	1.17	1.55	1.62	2.02	2.02	2.44	2.56	3.02
	150	3.48	4.87	4.66	6.1	6.49	8.11	8.33	10.09

Tab. 10: Exhaust time