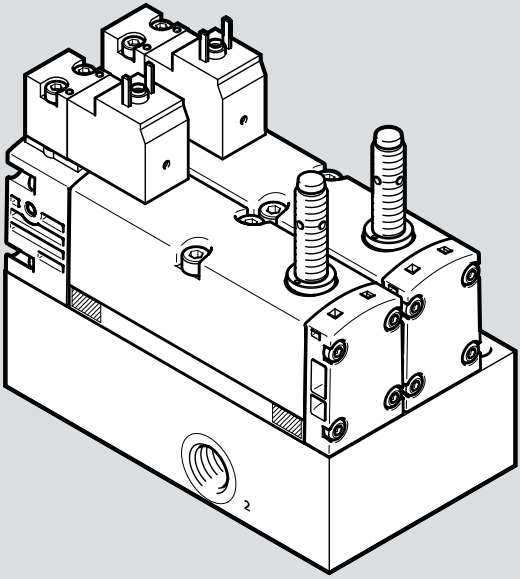
VOFA-L26-T32C-M-G14-1C1-...

Control block



FESTO

Operating instructions

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Translation of the original instructions

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1 Safety

1.1 General safety instructions

⚠ WARNING

Risk of injury by crushing and impact

If solenoid valves are disconnected from the power supply when energised, the movable parts of the drive components (cylinders, motors, etc.) can execute uncontrolled movements.

- Move the drive components to a safe position. Only then carry out work on the electrical and pneumatic equipment.

NOTICE

Loss of safety functions

If measures for managing “common cause failures” (CCF) are not observed, or if potentially faulty statuses are not discovered as a result of inadequate testing, the safety function of the control block can be impaired.

- Observe the measures for control of “common cause failures” (CCF) ➔ 2.2 Failures due to a common cause (Common Cause Failure – CCF).
- Make sure the degree of diagnostic coverage (DC) is reached ➔ 2 Requirements for product use and ➔ 13 Technical data.

NOTICE

Loss of the safety function

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

- Observe the technical data ➔ 13 Technical data.

NOTICE

Loss of the safety function

Only use the product if it is in its original condition and in perfect working order.

1.2 Intended use

The control block is designed exclusively for 2-channel venting of pneumatic drive components and can be used to implement the following safety functions:

– safe venting
  This corresponds to the safety function “safe venting” (English: Safe Torque Off, STO) for pneumatic drives and the safety function “safe de-energizing” (English: Safe De-Energization, SDE) for a pneumatic (sub) system or machine function.
– Protection against unexpected start-up (EN ISO 14118).
  This corresponds to the safety function “Prevention of unexpected start-up” (PUS) within the limits of the control block.

The product is intended for installation in machines or automated systems and may only be used as follows:

– Use only in an industrial environment: outside industrial environments, e.g. in commercial and mixed-residential areas, action to suppress interference may have to be taken.
– Use only in standard operation: this also includes downtime, set-up and service operation, as well as emergency operation.

- Use only within the limits of the product defined by the technical data ➔ 13 Technical data
- Use only in its original status without unauthorised modifications (exceptions ➔ 11 Modification, disassembly and repair) and in perfect technical condition

1.3 Foreseeable misuse

NOTICE

In the event of damage caused by unauthorised manipulation or any use other than the intended use, the guarantee will be invalidated and the manufacturer will not be liable for damages.

The following examples of foreseeable misuse are among those not approved as intended use:
- outdoor use
- bypass of the safety function
- omission of evaluation of the sensor signal change for each valve switching procedure as well as a comparable measure for diagnostics
- use in reversible operation (using supply air instead of exhaust air, and vice versa)
- operating mode with low demand mode according to IEC 61508
- Vacuum operation

1.4 Safety function in accordance with EN ISO 13849

The control block has been developed and manufactured in accordance with the corresponding basic and proven safety principles of EN ISO 13849-2. The control block exhibits structural properties which enable Performance Level e/category 4 to be achieved for implementation of the safety function. The operator is responsible for specification of the safety function. The “safe venting” safety function depends on the following factors:
- standard flow rate with exhaust of the control block including silencer
- volume of the area to be exhausted
- pressure of the area to be exhausted
- switching times when switched off ➔ 7.3 Switching characteristics at switch-off

The achievable safety level depends on the other components used to implement a safety function. The following requirements apply to the manager:
- The specifications for mounting and the operating conditions in these operating instructions must be observed.
- For use in higher categories (2 to 4), the requirements of EN ISO 13849-1 (with regard to structure, DC, CCF and systematic failures, behaviour under error conditions, ambient conditions) must be taken into account.
- The solenoid valves must be switched at least once per week to ensure intended use.
- The basic and proven safety principles of EN 13849-2 relating to the implementation and operation of the component must be met.
- When using this product in machines or systems subject to specific C standards, the requirements specified in these standards must be observed.
- The user is responsible for coordinating all applicable safety regulations and rules with the competent authorities and for compliance with them.

2 Requirements for product use

- Make these operating instructions available to the design engineer and installer of the machine or system in which this product will be used.
- Keep these operating instructions for the entire product lifecycle.
- Take into consideration the legal regulations for the location:
  - instructions and standards
  - regulations of the testing organisations and insurers
  - national specifications

2.1 Training of qualified personnel

Installation, installation, commissioning, servicing, repair and decommissioning may only be performed by qualified personnel who are familiar with the following tasks and information:
- installation and operation of electrical and pneumatic control systems
- applicable regulations for operating safety-related systems
- applicable regulations for accident prevention and occupational safety
- the documentation for the product:

NOTICE

Only authorised and appropriately trained personnel are permitted to work on safety-related systems.

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

Common cause failures cause the failure of the safety function, as both channels in a 2-channel system fail simultaneously in these cases.
The following measures ensure that common cause failures are prevented:
- compliance with the compressed air quality, in particular avoidance of flash rust particles, e.g. caused by servicing work.
- compliance with the residual oil content (maximum 0.1 mg/m³ when using ester-based oils, which are contained in the compressor oil, for example).
- compliance with the operating and control pressure limits, if applicable by the use of a pressure-relief valve.
- compliance with the temperature range.
- compliance with the permissible values for vibration and shock stress.
- longitudinal valve axes preferably arranged vertically to the main direction of vibration.
- compliance with the maximum permissible test pulse length when used at timed safety outputs.
- compliance with the maximum permissible strength of external magnetic fields.
- avoid clogging of the silencer and blockage of the port (3) ➔ 6.2 Pneumatic installation.

NOTICE

Loss of the safety function
Non-compliance with the technical data can lead to loss of the safety function.
- Observe the technical data ➔ 13 Technical data .

2.3 Diagnostic coverage (DC)

A diagnostic coverage of 99% can be achieved by appropriate integration of the control block into the control chain and corresponding test equipment. The change of the corresponding sensor signal in the machine control system must be queried here every time a valve is actuated. If a fault is detected by the test equipment (e.g. missing sensor signal), appropriate measures must be taken to maintain the safety level ➔ 8 Fault clearance.

Of particular note here are the following failure modes:

- Incomplete switching back of one of the two solenoid valves (V1 or V2): This fault can result in a reduction of the exhaust flow rate ➔ 13 Technical data, ➔ Tab. 13 Pneumatics.
- Simultaneous incomplete switching back of both solenoid valves (V1 and V2): this fault can result in a failure of the safety function.

2.4 Range of application and approvals

This product is a safety device as defined in the Machinery Directive 2006/42/EC and carries the CE marking.

CE

Fig. 1: CE marking

Safety-oriented standards and test values that the product complies with and fulfils can be found in chap. ➔ 13 Technical data. The product-relevant EC directives and standards can be found in the declaration of conformity.

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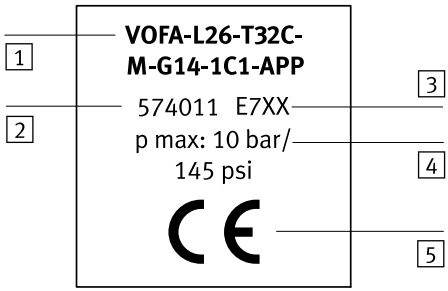
Declaration of conformity for this product ➔ www.festo.com/sp.

2.5 Product identification, versions

2.5.1 Product labelling

Product labelling (example)	Meaning
	1 Order reference 2 Part number 3 Serial number with manufacturing period (encoded ➔ 2.5.2 Manufacturing period) 4 Maximum operating pressure 5 CE marking

Tab. 1: Product labelling (rating plate) of the product

2.5.2 Manufacturing period

In the product labelling, the first 2 characters of the serial number indicate the manufacturing period in encrypted form ➔ Tab. 1 Product labelling (rating plate) of the product. The letter specifies the manufacturing year and the character after it (number or letter) indicates the manufacturing month.

Manufacturing year					
H=2016	J=2017	K=2018	L=2019	M=2020	N=2021
P=2022	R=2023	S=2024	T=2025	U=2026	V=...

Tab. 2: Manufacturing year

Manufacturing month				
1	January		2	February
3	March		4	April
5	May		6	June
7	July		8	August
9	September		O	October
N	November		D	December

Tab. 3: Manufacturing month

2.6 Service

Please consult your regional Festo contact if you have any technical queries ➔ www.festo.com.

2.7 Specified directives and standards

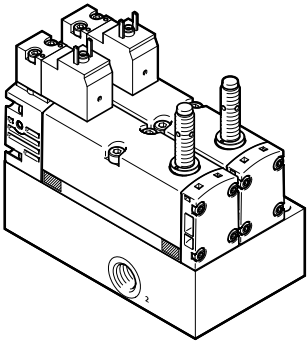
Version		
2004/108/EC:2004-12-15		IEC 60947-5-2:2007-10
2006/42/EC:2006-05-17		IEC 61076-2-104:2014-09
EN ISO 13849-1:2015-12		IEC 61508:2010-04
EN ISO 13849-2:2012-10		ISO 8573-1:2010-04
IEC 60068-2-6:2007-12		EN ISO 14118:2018-02
IEC 60068-2-27:2008-02		EN 175301-803:2006-08
IEC 60204-1:2016-10		VDE 0580:2011-11

Tab. 4: Directives and standards specified in the document

3 Product overview

The control block has been developed and manufactured under careful application of the relevant standards and directives as well as the approved technical rules. The safety function is not guaranteed if the control block is used outside the scope of its intended use ➔ 1 Safety. This can result in hazards for people.

The control block consists of a manifold sub-base and 2 solenoid valves and is supplied completely assembled.

	Control block
Product image and type code	 VOFA-L26-T32C-M-G14-1C1 -...
Electrical interface of the solenoid valves	Plug, rectangular design in accordance with EN 175301-803, form C, without PE conductor
Piston position sensing	by inductive PNP or NPN proximity switches, size M8x1, with plug connection in accordance with IEC 61076-2-104

Tab. 5: Control block overview

4 Connections and display components

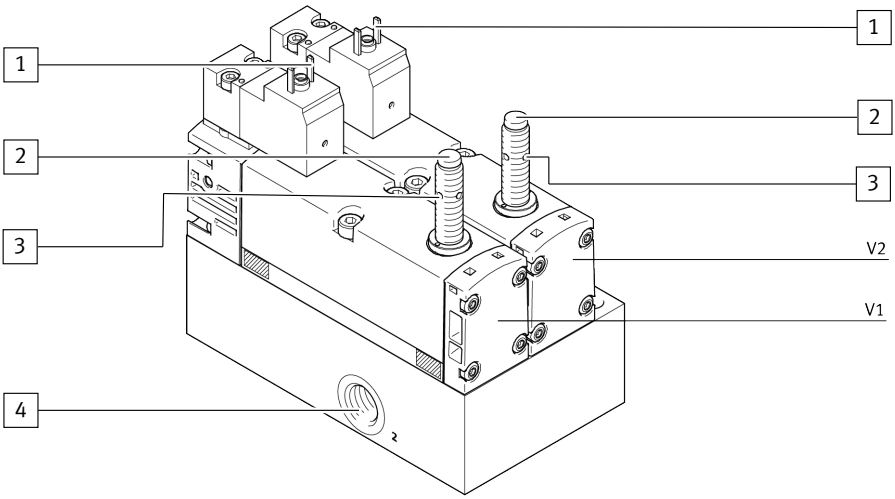


Fig. 2: Pneumatic and electrical connections and display components on the control block

1 Contacts of the solenoid coils
2 Contacts of the proximity switches
3 Yellow status display LEDs of the proximity switches (four on the periphery)
4 Pneumatic port (2), size G1/4“
Without illustration: pneumatic ports (1) and (3) on the opposite side of the control block, size G1/4”

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Explanations of the valve designations “V1” and “V2” ➔ 5 Function and application

5 Function and application

5.1 Pneumatic linking

The safety function is achieved by 2-channel pneumatic linkage of 2 monostable 5/2-way solenoid valves within the control block: Port (2) is only pressurised if both solenoid valves are switched in switching position (12), switching symbol ➔ Fig. 15.
The sensing of proximity switches (E1 and E2) at the solenoid valves (V1 and V2) enable monitoring of the switching operation of the solenoid valves. This is done by a logic operation of the control signal and the signal change of the proximity switch to check whether the piston slides of the solenoid valves are reaching or leaving the normal position (expected action).
The pneumatic connection example (➔ Fig. 3) shows the linking of the control block. It contains an upstream combination (series connection) of a pressure regulator and pressure-relief valve. The latter serves to protect the pressure-relief function of the pressure regulator.

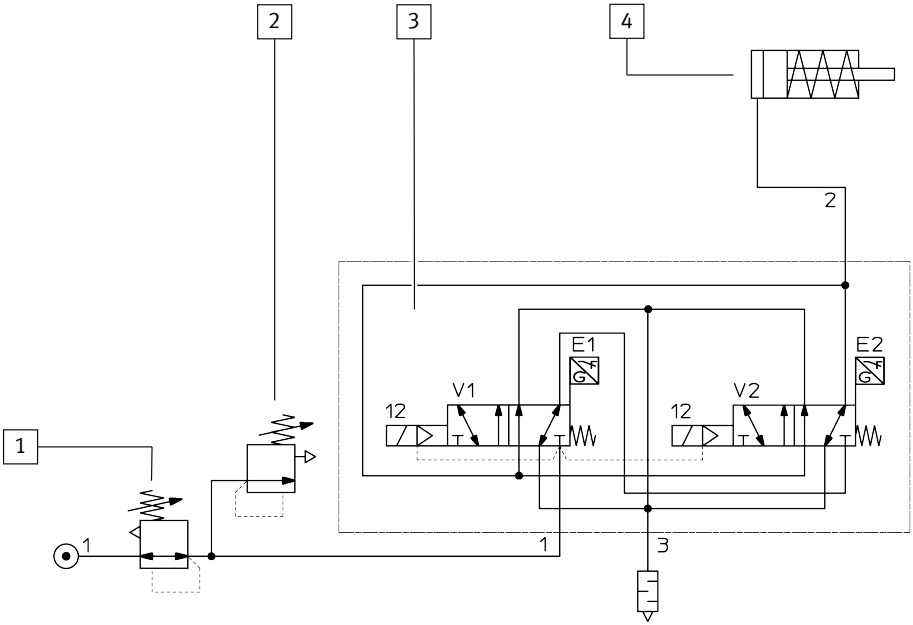

Fig. 3: Example of a 2-channel pneumatic linking of the control block

1	Pressure regulator	3	Control block
2	Pressure-relief valve	4	pneumatic drive

5.2 Electrical linkage

NOTICE

Electrical control of the solenoid valves must satisfy the requirements of the category to be achieved: it can be implemented with a common safe electrical output or 2 independent safe channels.

The electrical connection example (➔ Fig. 4) triggers the safety function by a 2-pin emergency stop switch (S1, with locking function) on a safety relay unit. The safety switching device disconnects the power supply of both solenoid valves (V1, V2) and reports the release to the PLC. The PLC records the feedback signal of the safety switching device and the two sensor signals of the control block. As a result, the solenoid valves can be tested both in standard operation and in safety conditions.

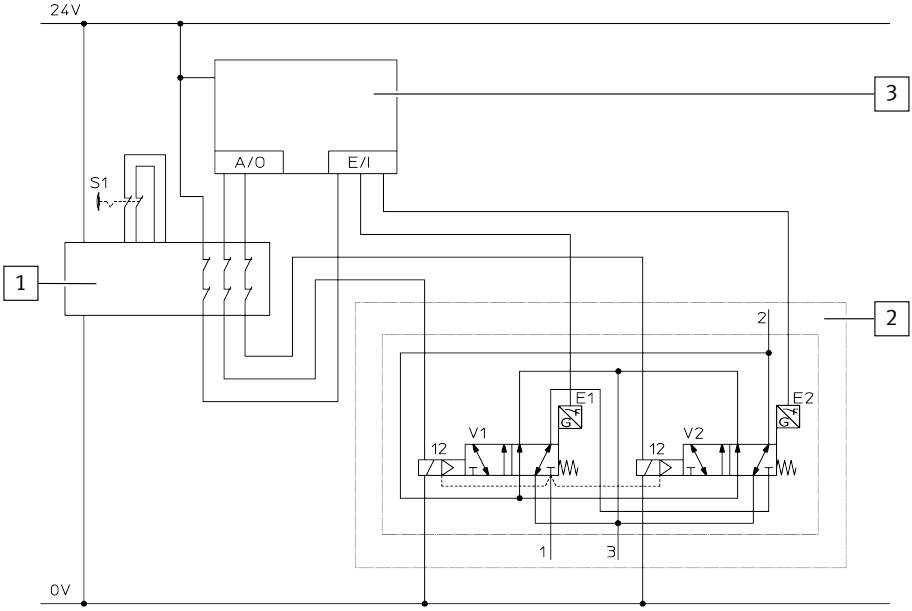

Fig. 4: Example of a 2-channel electrical linkage of the control block with diagnostic test equipment

1 Safety relay unit
2 Control block
3 Programmable logic controller (PLC)

This circuit is an example and can be replaced by other circuits, as long as both solenoid valves are controlled according to the requirements of the required category and the signals of both proximity switches (E1, E2) are evaluated.

6 Installation

⚠ WARNING

Risk of injury due to particles in the exhaust air

Exhaust air that flows out at high speed can carry particles that may injure people in the vicinity.

- Make sure that the exhaust air escapes into areas where people are not present during operation.

6.1 Mechanical installation

Mount as follows:

1. Ensure the control block is earthed by mounting toothed discs between the screw head and control block.
2. Fasten the control block using the intended drilled holes ➔ Fig. 5. Refer to the hole pattern for the required dimensions.

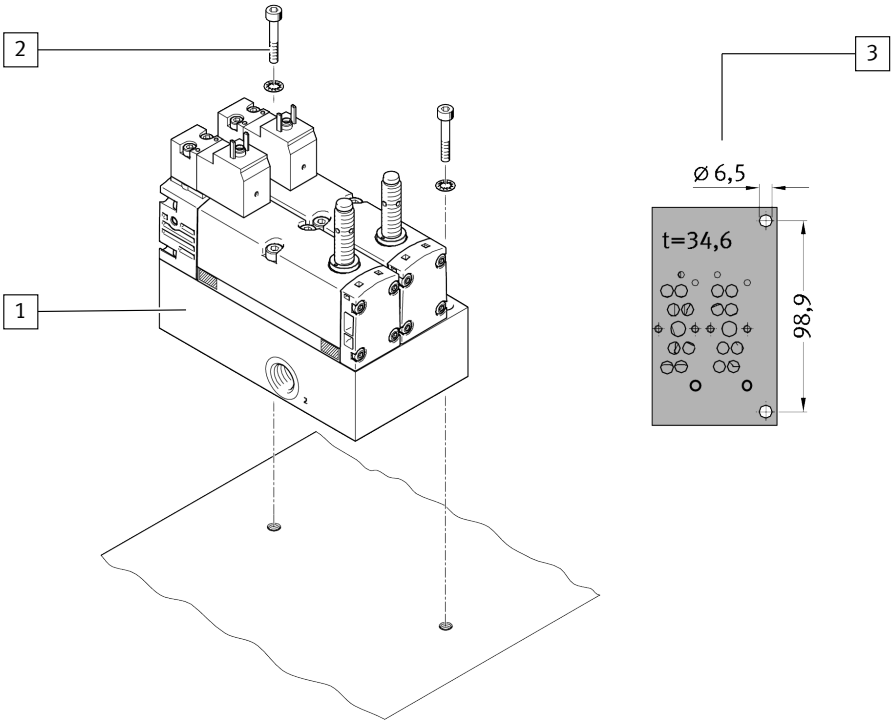

Fig. 5: Mounting/assembly of the control block

1 Control block
2 Screw with toothed disc (M6, not included in delivery)
3 Hole pattern (t corresponds to the height of the block)

6.2 Pneumatic installation

NOTICE

- Before mounting: remove particles in the supply lines by appropriate measures. This protects the control block from premature failure and higher wear.
- Observe the specifications for compressed air quality ➔ 13 Technical data.

6.2.1 Ports (1) and (2)

Mount as follows:

– Use fittings with connecting thread G1/4” to connect the tubing to the ports for operating pressure (1) and working pressure (2).

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Accessories for tubing connections ➔ www.festo.com/catalogue.

6.2.2 Port (3)

NOTICE

Loss of the safety function

If a commercially-available silencer is used, the body of the silencer may become clogged, which can result in reduced exhaust performance (back pressure) and can lead to a complete loss of the safety function.

- Use silencer type UO-1/4 (➔ 12 Spare parts and accessories) or silencers with the same properties.
- Do not use a sintered-metal silencer.
- When using a silencer make sure the air vent is unobstructed. Maintain a clearance of at least 15 mm in the axial direction of the silencer.
- Do not block silencer or connection (3).

Mount as follows:

– Turn the silencer with connecting thread G1/4” into the port (3).
– If a silencer is not used:
ensure unobstructed exhaust into areas where people are not present during operation.

6.3 Electrical installation

⚠ WARNING

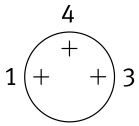
Electric voltage

Injury caused by electric shock, damage to machine and to system

- For the electrical power supply, use only PELV circuits in accordance with IEC 60204-1 (Protective Extra-Low Voltage, PELV).
- Observe the general requirements of IEC 60204-1 for PELV circuits.
- Use only voltage sources which guarantee reliable electrical isolation of the operating and load voltage in accordance with IEC 60204-1.

Mount as follows:

– Connect solenoid coils.
– Connect the proximity switch ➔ Tab. 6 Contact assignment of the proximity switch with 3-pin M8 plug in accordance with IEC 61076-2-104.

Pin allocation	Pin	Plug pattern (Top view of device)
Supply voltage 24 V DC	1	
Output (N/C contact)	4	
Connection 0 V	3	

Tab. 6: Contact assignment of the proximity switch with 3-pin M8 plug in accordance with IEC 61076-2-104

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Accessories for connecting solenoid coils and proximity switches ➔ www.festo.com/catalogue.

7 Commissioning

NOTICE

Electrical safety outputs of safety relay units can be parameterised so that they emit test pulses. The outputs are thereby tested at regular intervals. These test pulses can result in maloperation of the control block. The safety function is then no longer guaranteed.

- Make sure that the length of the test pulses from safety relay units does not exceed the maximum permissible test pulse length of the solenoid valves in use ➔ 13 Technical data.

7.1 Prior to commissioning

– Switch off the power supply before connecting or disconnecting plug connectors (danger of functional damage).
– Commission only control blocks that are completely mounted and electrically wired.

7.2 Switching characteristics during switch-on

➔ Fig. 6 shows the pneumatic and electric switch-on characteristics at the control block with PNP proximity switches and without resistive load. Query (resistive load) of the proximity switch enables the switching times to be extended by a maximum of 2 ms. When using NPN proximity switches, the signal characteristics are reversed, i.e. rising instead of falling.

Process during switch-on

Both coils are energised at time t = 0. After approx. 11 ms, the proximity switches report the exit of the solenoid valves from the neutral position, and after a total of approx. 24 ms the previously unpressurized port (2) is pressurised. Additional switching times ➔ 13 Technical data.

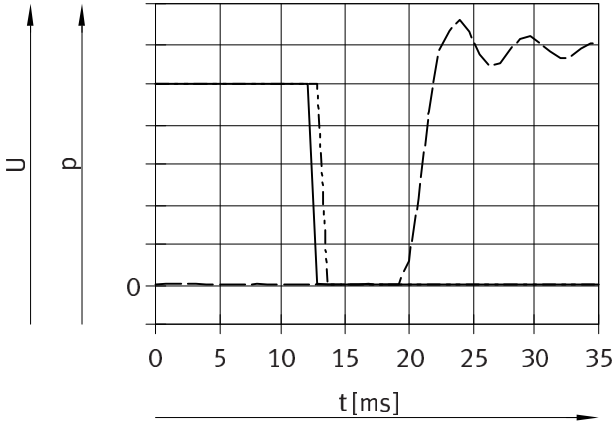

Fig. 6: Diagram with signal sequence at switch-on of the control block (diagram shows measurements with the PNP proximity switch at an operating pressure of 6 bar without resistive load.)

1 Signal voltage at proximity switch E1
2 Signal voltage at proximity switch E2
3 Pressure at port (2)

NOTICE

The switching times shown above were determined using a pressure transducer at port (2) and only apply for an operating pressure of 6 bar. Switching times for 3 bar and 10 bar ➔ 13 Technical data.

NOTICE

Switching times during switch-on are not relevant for the safety function.

7.3 Switching characteristics at switch-off

➔ Fig. 7 shows the pneumatic and electric switch-off characteristics at the control block with PNP proximity switches and without resistive load. Query (resistive load) of the proximity switch enables the switching times to be extended by a maximum of 2 ms. When using NPN proximity switches, the signal characteristics are reversed, i.e. falling instead of rising.

Process during switch-off

Voltage to both coils is switched off at time t = 0. After approx. 54 ms the pressure at port (2) falls to 0 bar and the proximity switches report that the piston slides of the solenoid valves have reached the neutral position after a total of approx. 58 ms. Additional switching times ➔ 13 Technical data.

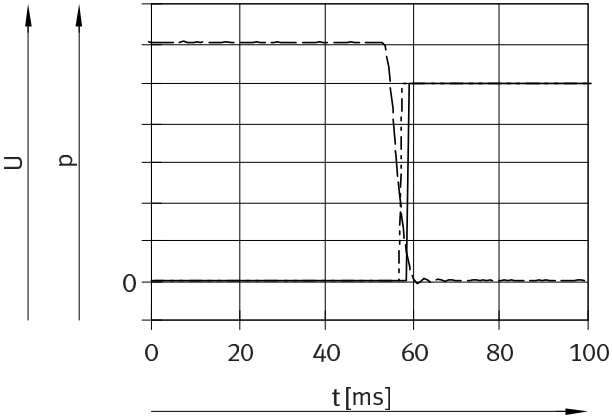

Fig. 7: Diagram with signal sequence at switch-off of the control block (diagram shows measurements with the PNP proximity switch at an operating pressure of 6 bar without resistive load.)

1 Signal voltage at proximity switch E1
2 Signal voltage at proximity switch E2
3 Pressure at port (2)

NOTICE

The switching times shown above were determined against the ambient pressure without using a silencer and only apply for an operating pressure of 6 bar. Switching times for 3 bar and 10 bar ➔ 13 Technical data.

NOTICE

Switching times during switch-off are not relevant for the “safe venting” safety function. The switching time establishes the earliest time when a change of signal of the proximity switches can take place. Due to wear, it can change with an increasing number of switching cycles.

- Check the exhaust duration after every installation.
- Determine the length of time from switching off the coils until the signal changes of the proximity switches and adjust the monitoring time of the PLC accordingly.

7.4 Function test

Requirements

– Electrical installation at the control block must be completed.
– Pneumatic installation at the control block must be completed.

Action sequence

1. Switch on operating pressure.
2. Apply operating voltage.
3. To check all possible switching position combinations of the two 5/2-way solenoid valves V1 and V2 of the control block: evaluate signals of proximity switches E1 and E2 (here: PNP proximity switches) with the following step sequences (➔ Fig. 8 ... ➔ Fig. 11).
   Pressurisation of port (2) is symbolised by p2.
   The separate periods for the step sequences depend on the specific application and are not considered here.

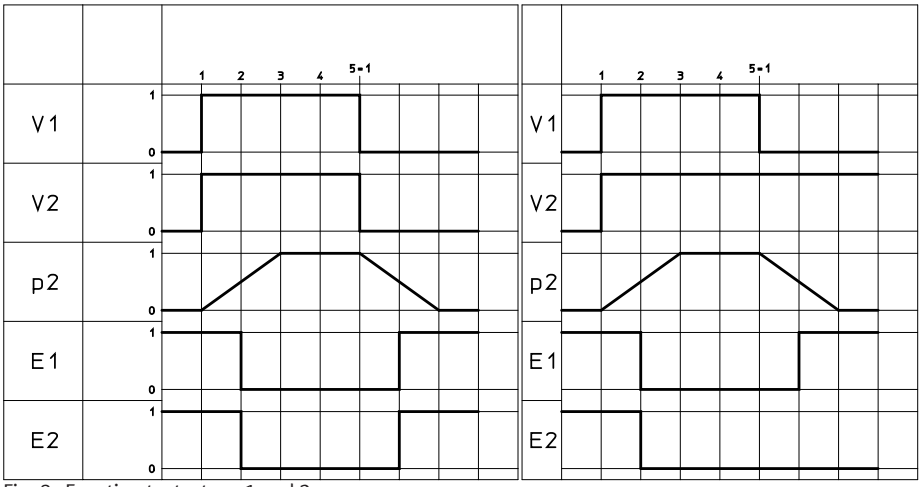

Fig. 8: Function test, steps 1 and 2

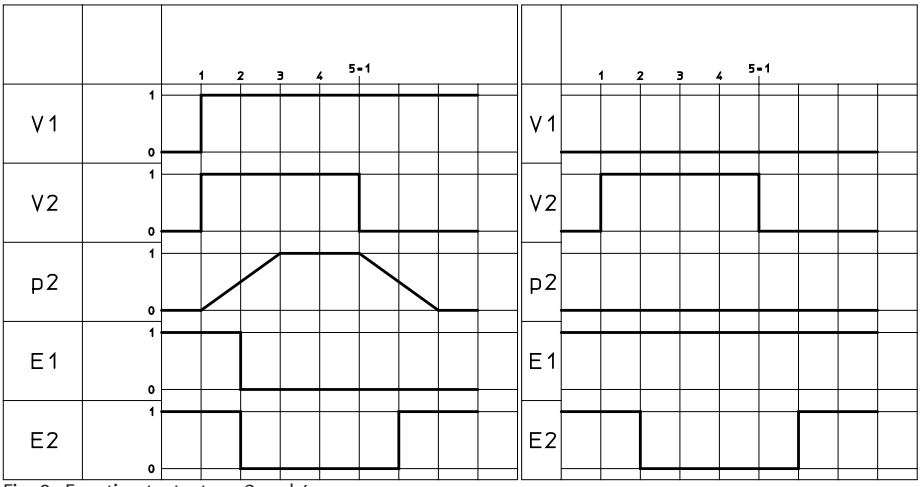

Fig. 9: Function test, steps 3 and 4

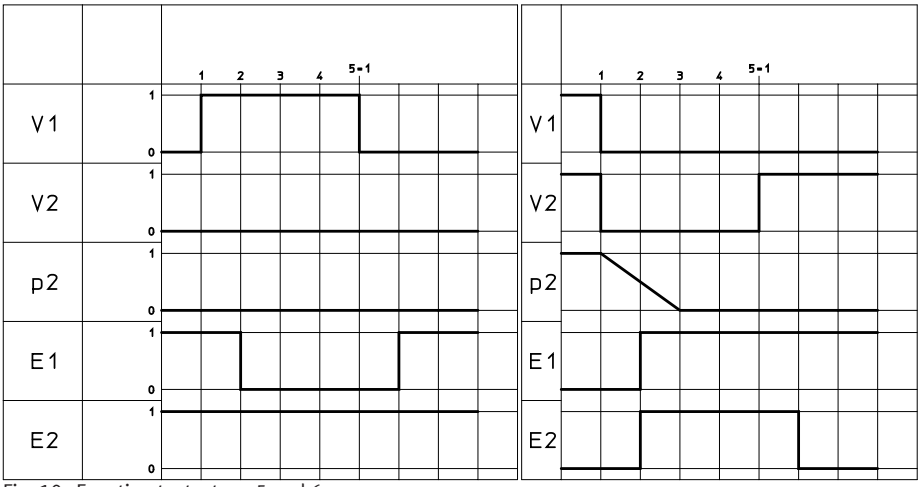

Fig. 10: Function test, steps 5 and 6

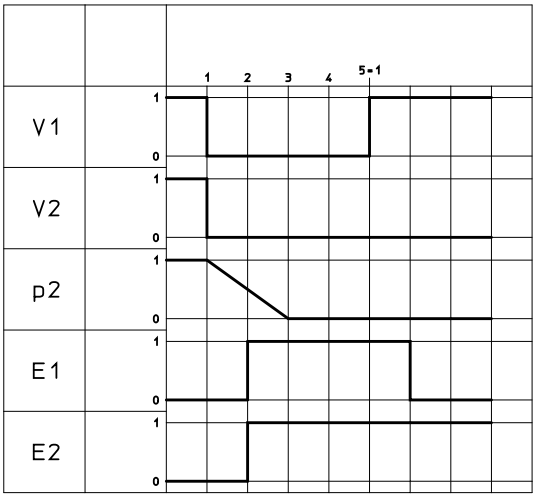

Fig. 11: Function test, step 7

Result

If malfunctions occur: ➔ 8 Fault clearance.

If the function test has been completed as expected and without any problems: the control block can now be operated safely ➔ 9 Operation and use.

8 Fault clearance

If malfunctions are noticed on the product or its function, suitable measures to maintain the safety level must be taken.

If an error or failure is recognised, a check must be made whether this is based on external or internal influences so that corresponding measures for fault clearance can be introduced.

Check control block for correct switching characteristics at the following times:

- during commissioning or after repair/fault clearance
- after interruption of the signal lines of the proximity switches
- after interruption of the signal lines of the solenoid coils

8.1 External influences

Exclude external influences that can cause an error message as follows:

1. check compressed air supply and compare it with the technical data, e.g. pressure level/filtration, ➔ 13 Technical data.
2. Check the power supply and adjust it in accordance with the technical data ➔ 13 Technical data.
3. Check the overall installation: solenoid coil control and proximity switches ➔ 5 Function and application, pneumatic ports and tubing lines.
4. Carry out a function test to ensure that control block operates properly ➔ 7 Commissioning.

8.2 Internal influences

Exclude external influences ➔ 8.1 External influences.

Exclude internal influences as follows:
1. Replace defective solenoid valves, if necessary ➔ 11 Modification, disassembly and repair.
2. Carry out a function test to ensure that control block operates properly ➔ 7 Commissioning.
3. If the malfunction continues: Replace the complete control block.
4. Carry out a function test to ensure that control block operates properly ➔ 7 Commissioning.

9 Operation and use

- Have specialised personnel instruct end users of the product.
- To maintain the functionality of the product, switch both valves at least once per week.
- Check sealing wax of the proximity switches at least once per week for sound condition.

10 Maintenance and care

- Once you have selected a medium e.g. unlubricated compressed air, stay with it for the entire service life of the product.
- Switch off the following energy sources before cleaning the exterior:
  - operating voltage
  - Compressed air
- If the control block is dirty, clean it with a soft cloth. Permissible cleaning media include: detergent at maximum 50 °C or other non-abrasive media.

11 Modification, disassembly and repair

11.1 Conversion and disassembly

NOTICE

Loss of the safety function

Modification of the control block, i.e. equipping it with solenoid valves other than the factory-installed valves ➔ 12 Spare parts and accessories, is not permitted, as this measure can result in loss of conformity.

11.2 Repair

NOTICE

If repairs are required, the solenoid valves should be replaced with identical solenoid valves only ➔ 12 Spare parts and accessories. The control block itself cannot be repaired.

- Please consult your regional Festo contact if you have any technical queries ➔ www.festo.com.

Proceed as follows to replace individual, identical solenoid valves on the control block:
1. Switch off the following energy sources:
   - operating voltage
   - compressed air.
2. Disconnect the connection to the proximity switches.
3. Loosen the screw on the plug socket of the solenoid coils with a slotted-head screwdriver and remove the socket.
4. Loosen 2 retaining screws from the solenoid valve with a SW3 Allen key and remove the solenoid valve from the control block.
5. Take a new solenoid valve of the same type.

6. Make sure that the “ISO” marking for unducted pilot exhaust air is visible on the inserted seal ➔ Fig. 12.
   If the “~~ISO~~” marking is visible: re-insert the seal ➔ Fig. 12, [3].
7. Position the solenoid valve on the control block (➔ Fig. 13) and tighten the 2 retaining screws with a SW3 Allen key (permissible tightening torque: 2 Nm ± 10 %).
8. Connect solenoid coils and proximity switches
   ➔ Tab. 6 Contact assignment of the proximity switch with 3-pin M8 plug in accordance with IEC 61076-2-10
9. Carry out a function test to ensure that control block operates properly ➔ 7 Commissioning.

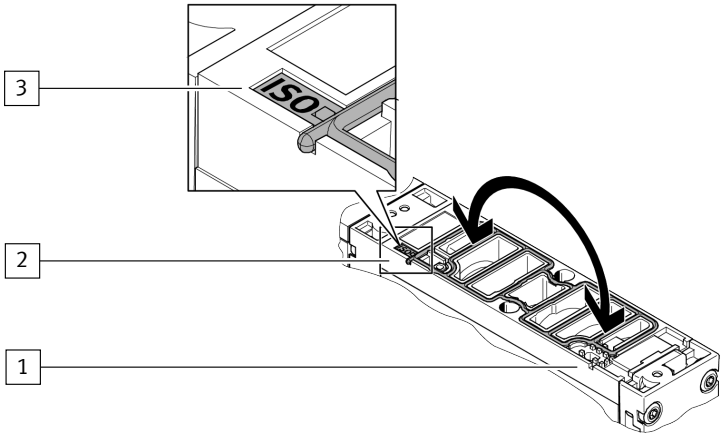

Fig. 12: Position of the valve seal (here: correct position for unducted pilot exhaust air)

1 Display window on control side 12

2 Seal visible in inspection window on control side 14

3 Identification label
When in the correct position, the “ISO” marking is visible on the identification label.

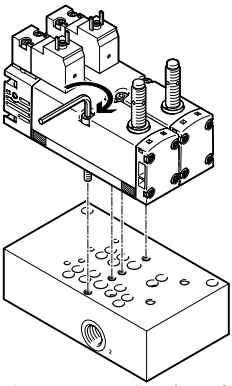

Fig. 13: Mounting the solenoid valves on the control block

11.3 Decommissioning and disposal

As part of our quality assurance process, we are interested in the return of replaced solenoid valves of the control block and would therefore ask you to send them back to Festo.

- Please get in touch with your sales contact to clarify the modalities of the return.
- If you do not return replaced solenoid valves to Festo: dispose of the product in conformity with the local waste disposal stipulations. For final disposal of the product, please contact a certified waste management company for electronic waste. The material used in the packaging has been specifically chosen for its recyclability.

12 Spare parts and accessories

NOTICE

Loss of the safety function

Modification of the control block, i.e. equipping it with solenoid valves other than the factory-installed valves is not permitted, as this measure can result in loss of conformity.

- Spare parts ➔ www.festo.com/spareparts.

Designation	Type	Part number
Solenoid valve with PNP proximity switch	VSVA-M52-A1-1C1-APP-ET	748020
Solenoid valve with NPN proximity switch	VSVA-M52-A1-1C1-ANP-ET	748021

Tab. 7: Spare part overview

Designation	Type	Part number
Silencer	UO-1/4	197584

Tab. 8: Accessories

13 Technical data

Safety engineering	
Conforms to standard	EN ISO 13849
Characteristics	
Max. achievable category	4
Max. achievable performance level	PL e
Service-life value B_{10}	10 million switching cycles
Diagnostic coverage (DC)	99% if the logic operation of the control signal and the signal change of the proximity switch (expected action) is checked with each actuation of both solenoid valves
Probability of a dangerous failure per hour (PFH_D)	➔ Tab. 10 PFH_D value (examples) as a function of the average number of annual actuations n_{op} and ➔ Fig. 14
Duration of use T_M	20 a
Proven component	Yes
Additional key features	
Fault exclusion[1)]	– Punching of the seal – Rupture of the valve housing
Design features	– positive overlap – pilot-actuated piston slide
CE marking (➔ declaration of conformity ➔ www.festo.com/sp)	– in accordance with EU EMC Directive 2014/30/EU – in accordance with EU Machinery Directive 2006/42/EC

1) Errors which do not need to be taken into consideration by the user when analysing possible errors of a safety-related part of a control system

Tab. 9: Safety engineering

The control block is a 2-channel subsystem. The characteristic values for safety engineering (➔ Tab. 9 Safety engineering) apply for each channel. The PFH_D value of the subsystem (➔ Tab. 10 PFH_D value (examples) as a function of the average number of annual actuations n_{op} and ➔ Fig. 14) can, for example, be calculated with SISTEMA using the following values:
- service-life value $B_{10D} = 2 \times B_{10}$ (in accordance with EN ISO 13849-1, Table C.1, Note 1)
- average annual number of actuations (n_{op})
- diagnostic coverage (DC) per channel of 99%
- CCF with a value of 65 points
- expert setting, limitation of the MTTF value to 2500 a

i

SISTEMA is a software wizard for "evaluation of safety-related machine controls in accordance with DIN EN ISO 13849" ➔ https://www.dguv.de/webcode.jsp?query=d11223.

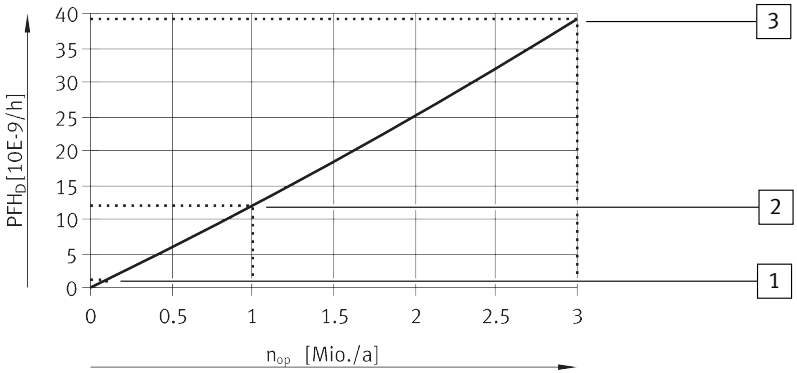

Fig. 14: PFH_D value as a function of the average number of actuations per year n_{op}

Pos. no. from Fig. 12	average annual number of actuations n_{op} [1/a]	PFH_D value [10^{-9}/h]
1	100 000	1.1
2	1 000 000	12.0
3	3 000 000	39.2

Tab. 10: PFH_D value (examples) as a function of the average number of annual actuations n_{op}

i

The PFH_Dvalue was calculated with SISTEMA in expert setting with limitation of the MTTF value to 2500 a.

NOTICE

Note the operating time of your control block (T_{10D}, in accordance with EN ISO 13849-1, C.3). The operating time is dependent on the service-life characteristic (B_{10d}) and the average number of annual actuations (n_{op}), and it may be shorter than the specified duration of use depending on your application ➔ Tab. 9 Safety engineering. The solenoid valves of the control block must be replaced at the end of the operating period at the latest.

General	
Permitted temperature ranges	
Storage[1)]	–20 °C ... +60 °C
Environment	–5 °C ... +50 °C
Medium	–5 °C ... +50 °C
Tightening torques	
Solenoid coil socket	0.5 Nm ... 0.6 Nm
Solenoid valve on control block	2 Nm (± 10%)
Materials – RoHS-compliant	
Sub-base	Wrought aluminium alloy
Housing	Die-cast aluminium, PA
Seals	NBR, FPM, HNBR
Screws	Galvanised steel
Plug connector-housing, proximity switch	Brass, chrome-plated
Sensor housing	High-alloy stainless steel
Cable sheath, proximity switch	PUR
Foil covering	PC
Spring	Stainless steel
Spring fixture	POM
Vibration and shock, severity level 2 (➔ Tab. 12 Values for vibration and shock in accordance with IEC 60068)	
Vibration (“transport application test”)	tested in accordance with IEC 60068-2-6
Shock[)] (“shock test”)	tested in accordance with IEC 60068-2-27
Electromagnetic compatibility (EMC)	
Interference emission	Declaration of conformity ➔ www.festo.com/sp
Immunity to interference	
Additional key features	
Nominal insert height[2)] above sea level	up to 1000 m
Degree of protection (with cable from Festo accessories)	IP65, Nema 4
Relative humidity	max. 90%
Corrosion protection	corrosion stress not permissible, such as from acidic or saline media

General	
Mounting position	any, valve preferably positioned with longitudinal axis vertical (90°) to the main direction of vibration
Dimensions length/width/height	113.1/65.0/105.8 mm
Weight	1134 g
Permissible magnetic field strength of a magnetic disruption field	60 mT

1) Store product in suitable packaging, protected from shock and moisture. The original packaging provides sufficient protection.
2) Design of the solenoid coil in accordance with VDE0580

Tab. 11: General information

Severity level	Vibration	Shock	Continuous shock
2	0.35 mm travel at 10 ... 60 Hz; 5 g acceleration at 60 ... 150 Hz	± 30 g at 11 ms duration; 5 shocks per direction	–

Tab. 12: Values for vibration and shock in accordance with IEC 60068

Pneumatics	
Valve design	
design	Sub-base valves with piston spool
Sealing principle	Cartridge, soft sealing
Overlap	positive overlap
Exhaust function	can be throttled
Valve function	3/2, implemented by 5/2-way valves, single-solenoid, normally closed
Reset method	mechanical spring
Direction of flow	not reversible
Suitability for vacuum	no
Control	
Type of control	piloted
Pilot air supply	internal
Pressure range of the solenoid valves	
Operating pressure	3 bar ... 10 bar
Pilot pressure	3 bar ... 10 bar

Pneumatics	
Additional key features	
Medium[1)]	Compressed air in accordance with ISO 8573-1:2010 [7:4:4]
Residual oil content[2)] when using ester oils	< 0.1 mg/m³, corresponds to ISO 8573:2010 [-:-:2]
Manual override	none
Standard nominal flow rate port (1) ⟶ (2)	1050 rpm
Standard flow rate exhaust[3)] (6 bar ⟶ 0 bar)	2650 rpm
Standard flow rate exhaust (6 bar ⟶ 0 bar) in the event of fault[3) 4)]	1050 rpm

1) The pressure dew point must be at least 10 K lower than the temperature of the medium, since ice would otherwise form in the expanded compressed air.
2) lubricated operation possible, required for further operation
3) measured in direction of exhaust (2 ⟶ 3), p= 6 bar measured with reference to atmosphere with silencer UO-1/4
4) A fault means: failure of one of the two directional control valves (V1 or V2) to switch back completely.

Tab. 13: Pneumatics

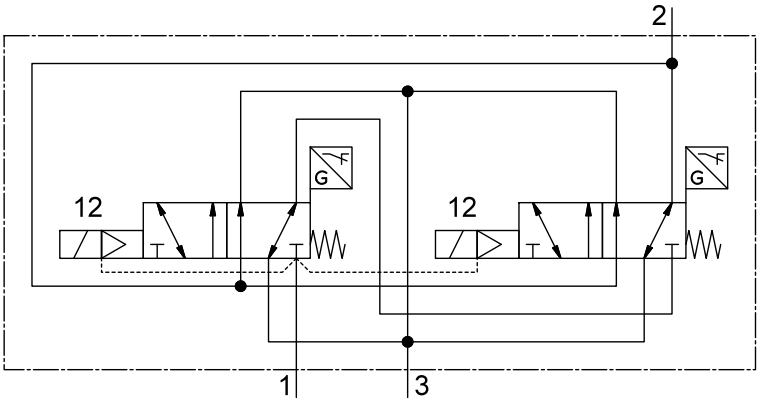

Fig. 15: Circuit symbols of the control block

Switching times[1)] ± 20%			
Operating pressure	3 bar	6 bar	10 bar
Valve switching times ON	40 ms	24 ms	17 ms
Valve switching times OFF	35 ms	54 ms	71 ms

Switching times[1] ± 20%			
Operating pressure	3 bar	6 bar	10 bar
Signal drop PNP[2] (period from energising the solenoid coil until the proximity switch is switched off)	21 ms	11 ms	9 ms
Signal rise PNP[2] (period from switching off the solenoid coil until the proximity switch is switched on)	37 ms	58 ms	74 ms

1) Applies for new products. Switching times can increase over the service life of the product due to changes in friction coefficients.
2) Signal drop and rise are interchanged when using NPN proximity switches.

Tab. 14: Switching times as a function of operating pressure

Electrical	
Operating voltage supply of solenoid valves	
Nominal voltage	24 V DC
Permissible voltage fluctuations	–15 % ... +10 %
Duty cycle	100%
Duration of the test pulses for the control system	
Max. positive test pulse with logic 0	1000 µs
Max. negative test pulse with logic 1	800 µs
Additional key features	
Drop-off current[1]	≥ 2 mA
Output per solenoid coil	1.8 W (at 24 V DC)
Minimum switching frequency of the solenoid valves	Switch at least once per week
Electrical connection	EN 175301-803, type C, without PE conductor

1) Drop-off current is the current below which the armature returns from its stroke end position back to the stroke starting position.

Tab. 15: Electrical

Proximity switch	
Operating voltage supply	
Nominal voltage	24 V DC
Operating voltage range	10 V DC ... 30 V DC
Residual ripple	± 10%
Additional key features	
Conforms to standard	EN 60947-5-2
Switching element function	N/C

Proximity switch	
Measurement principle	inductive
Switching status indication	yellow LED
Max. switching frequency	5000 Hz
Switching output	PNP or NPN
Max. output current	200 mA
No-load supply current	≤ 10 mA
Voltage drop	≤ 2 V
Short circuit current rating	yes, pulsed
Reverse polarity protection	yes, for all contacts
Electrical connection	M8x1 plug, 3-pin in accordance with EN 61067-2-104

Tab. 16: Proximity switch

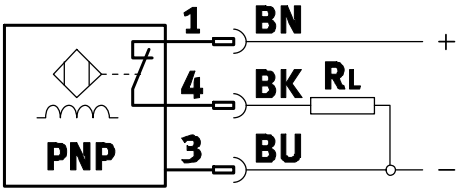

Fig. 16: Circuit symbol of the PNP proximity switch with solenoid valve variant ...-APP

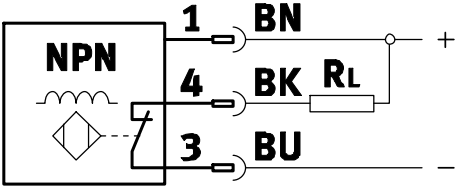

Fig. 17: Circuit symbol of the NPN proximity switch with solenoid valve variant ...-ANP

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