RC-MCSE-OI 12.2019 EN

MCSE Series

Safety Exhaust (Dump)
Control Reliable Double Valves

Operating Instructions

Declaration of CE Conformity and Certifications available for download at www.rosscontrols.com

PRODUCT KEY IDENTIFICATION - VALVE

MCSE	A	40	G	A	I	X	AA	G	B
Series		Port Size		Voltage					Revision Level
		1/2		24 volts DC					

Version	
PP	A
NCNO	B
Start-Button NCNC	C
Start-Button PM	D

Thread	
BSPP	G
NPT	N

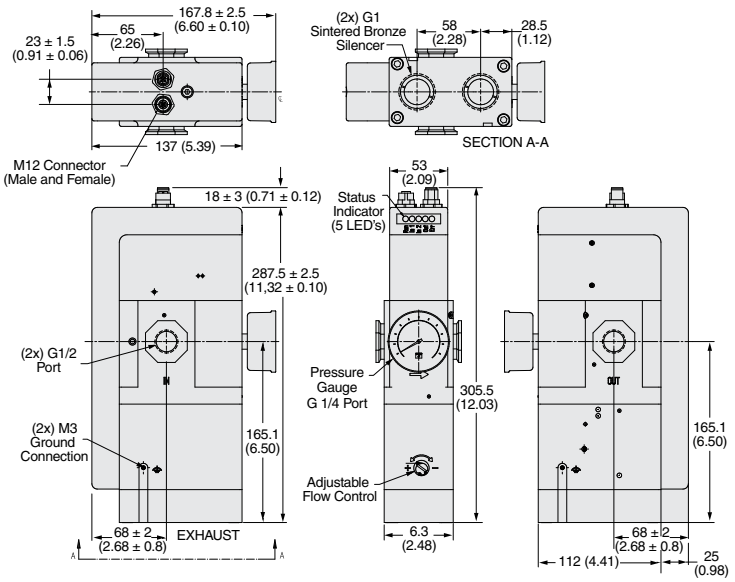
Monitoring
Internal

Communication
None

Pressure Measuring Device	
Gauge	G
Digital Transducer	T
None (plugged port)	X

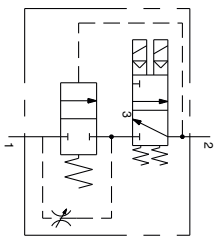
PIN Configuration Combination	
Solenoid	Sensor
A	A

DIMENSIONAL DRAWINGS - Dimension – Inches (mm)



PRODUCT LABEL IDENTIFICATION

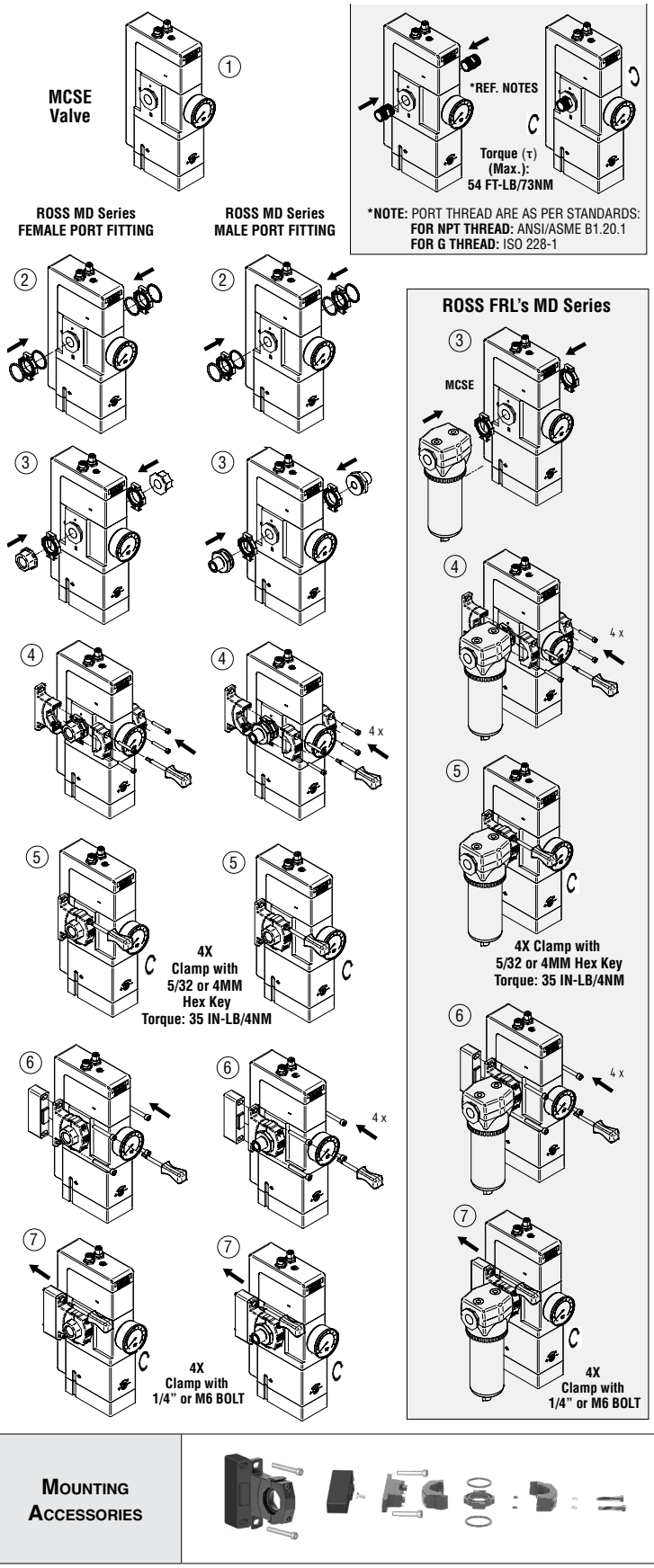
SCHEMATIC (Simplified)



Flow Rates	Port Size			C_v	
	Inlet	Outlet	Exhaust	1-2	2-3
	1/2	1/2	1/2	3.9	9.4

Weight lb (kg)	9.26 (4.2)

MOUNTING



*NOTE: PORT THREAD ARE AS PER STANDARDS:
FOR NPT THREAD: ANSI/ASME B1.20.1
FOR G THREAD: ISO 228-1

MOUNTING ACCESSORIES

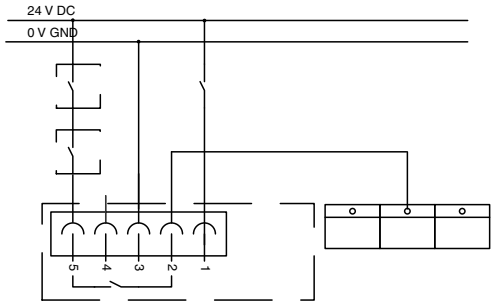


Figure 1.
Principle Use of the Signal Output

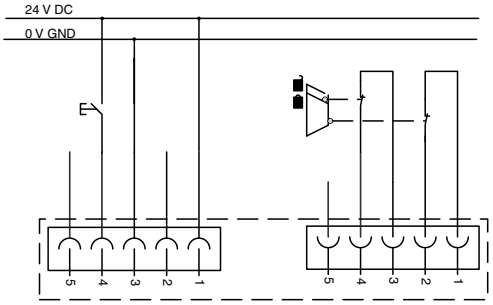


Figure 2.
Principle Wiring for NCNC Control

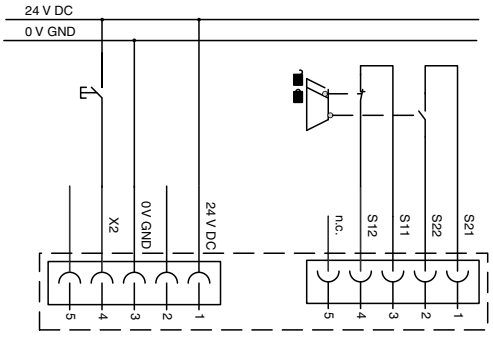


Figure 3.
Principle Wiring for NCNO Control

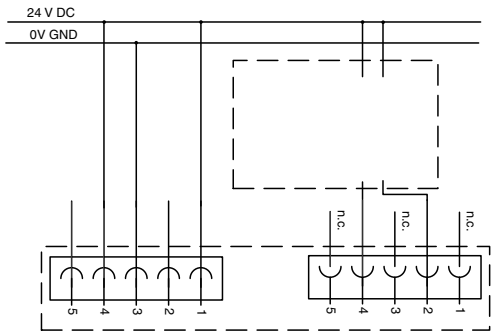


Figure 4.
Principle Wiring for PP Control

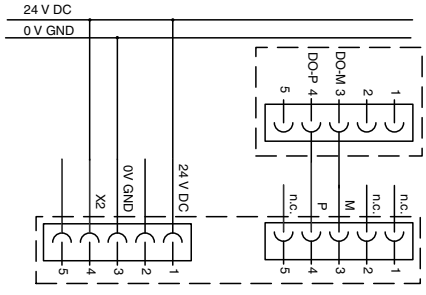


Figure 5.
Principle Wiring for PM Control

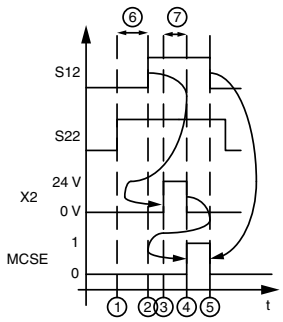


Figure 6.
Signal Sequence for NCNC Control

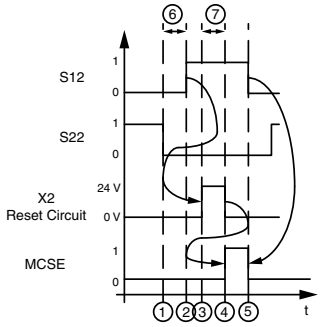


Figure 7.
Signal Sequence for NCNO Control

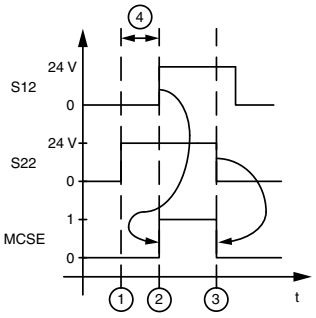


Figure 8.
Signal Sequence for PP Control

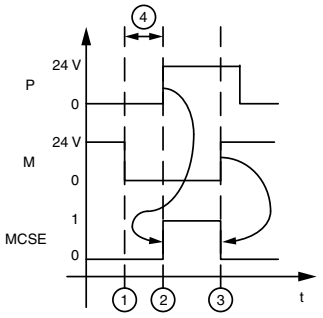


Figure 9.
Signal Sequence for PM Control

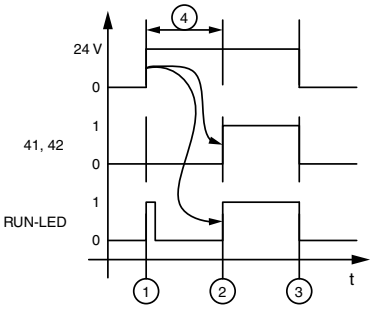


Figure 10.
Signal Sequence when Switching On

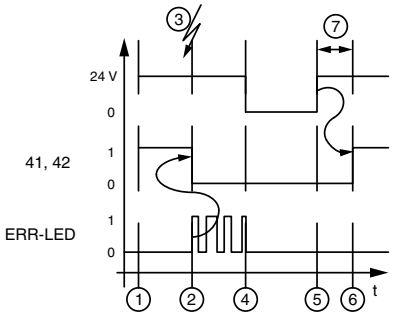


Figure 11.
Signal Sequence when a Fault Occurs

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Geschäftsführer: Ralf W. Dinkel

EU declaration of conformity

(Original Version)

Product: ROSS® double valve **MCSE**

This declaration of conformity is issued under the sole responsibility of the manufacturer

are in full accordance with the following Directive:

Machinery Directive	2006/42/EC
EMC Directive	2014/30/EC

Applied harmonized standards:

EN ISO 13849-1: 2015:	Safety of Machinery - Safety related parts of a control system -Part 1
EN ISO 13849-2: 2012:	Safety of Machinery - Safety related parts of a control system -Part 2
EN ISO 60204-1: 2014-10:	Safety of Machinery - Electrical equipment of machines -Part 1
DIN EN 61508-1-7: 2010/2011:	Functional Safety of electrical/ electronic/ programmable electronic safety-related systems Part 1-7 (as applicable)
DIN EN 62061: 2016-05:	Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems (as applicable)
EN 61000-6-2:2005:	Electromagnetic compatibility -: Generic standards - Immunity standard for industrial environments (IEC 77/488/CDV:2015)
EN 61000-6-4:2007+A1:2011:	Electromagnetic compatibility -: Generic standards - Emission standard for industrial environments
EN ISO 4414: 2010-11:	Pneumatic Fluid Power General Rules and Safety Requirements for Pneumatic Systems and their Components

Applied non-harmonized standards:

EN 61326-3-1: 2008:	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 3-1

Tested in accordance to: GS-IFA-M07:2017-04 (as applicable)

Authorized person for the compilation of technical documentation:

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Langen, 2019-06-16

Signed for and on behalf of

Dietrich Warmbier

Dietrich Warmbier
Global Safety Product Manager

1. About this Documentation

These instructions contain important information for the safe and appropriate assembly and commissioning of the product.

► Read these instructions all the way through, particularly section 2. “Notes on Safety”, before working with the product.

Additional documentation:

- SISTEMA libraries
- DGUV (formerly BG) certificate: German professional association
- Technical documents

For more information see last page for contact information, or visit www.rosscontrols.com.

► In addition, observe all applicable local and national regulations on accident prevention and on environmental protection.

1.1. Warning Notices in these Operating Instructions

In these operating instructions, warning notices precede sections with handling requirements which incur risks of personal injury or material damage.

Warnings are structured as follows:

⚠ SIGNAL WORD
Type or source of hazard! Consequences ► Measures to avert danger

- **Warning triangle:** Indicates a risk of fatal or severe injuries.
- **Signal word:** Indicates the severity of the danger.
- **Type or source of hazard:** States the type of danger or the source of the hazard.
- **Consequences:** Describes possible consequences of ignoring the warning.
- **Measures to avert danger:** Indicates how to avoid the danger. It is essential that the measures to avert danger are complied with.

⚠ DANGER	Indicates an imminent and serious danger that will result in severe or even fatal injury if you fail to avoid it.
⚠ WARNING	Indicates a possible danger that could result in severe or even fatal injury if you fail to avoid it.
⚠ CAUTION	Indicates a danger that may result in minor to moderate injuries if you fail to avoid it.
ATTENTION	Indicates potential property damage that may be incurred by the product or its surroundings if you fail to avoid it.

► 2. Notes on Safety

The product has been manufactured according to the accepted rules of current technology.

There is risk of injury or damage if the following safety instructions and warnings given in this instruction manual are not observed.

2.1. Intended Use

The MCSE Series double valves are safety components designed and manufactured in accordance with Machinery Directive 2006/42/EC. Its intended use is to control ventilation and exhaust in compressed air systems or similar applications, as well as to avoid unexpected switch-on and release of energy in pneumatic tubing systems and end devices in the industry.

The MCSE Series double valves are designed for safe, redundant operation and have internal monitoring. The valves consist of redundant 3/2 valves and have the overall function of an externally piloted valve with spring return.

► See section 10 “Technical Data” for the standards and test values complied with and adhered to by the product. See the declaration of conformity for product-relevant directives.

Intended use includes having read and understood this documentation, especially the chapter 2 “Notes on safety”

Soft Start

The MCSE Series double valves have a soft start function (soft start). The function of the soft start module is that the output pressure increases slower than normal during pressurization, until it reaches approx. 50% of the inlet pressure. The valve then opens fully at this point and fills the system with the full flow rate. This feature can be used to reduce the surge of a sudden, quick pressure application of cylinders. This function is particularly useful when inline flow controllers are placed in the cylinder control lines. By fully opening the soft start, the soft start function could be disabled if not needed.

⚠ WARNING
In contrast to the functions “safe exhaust” and “prevention of unexpected start-ups” of the MSCE valve, the “soft start” function does not fulfil the safety function according to ISO 13849.

2.1.1. Safety Function According to ISO 13849

The MCSE Series safety valve is a redundant system according to the requirements of ISO 13849-1 and -2, in which the pneumatic safety functions “safe exhaust” and “prevention of unexpected start-ups” are ensured, including in case of a safety valve fault (e.g., due to wear).

The safety function of the 3/2 valve from the MCSE Series is that the machine/system is only supplied with pneumatic energy (compressed air) when the redundant electrical control and therefore both valve elements are actuated simultaneously. The supply with compressed air is switched off and the system is exhausted if the redundant electrical control is not available.

The MCSE safety valve is designed in such a way so that the safe state (filling switch-off and exhausting the operating line) is always ensured, even in case of a fault within the valve (e.g., due to wear, contamination or similar situations). The control outputs of the electrical safety system must be designed and constructed in such a way that they fulfill the requirements of the category and the performance level (PL) of the safety system, which result from the machine’s risk assessment. With correct integration in the control system in accordance with ISO 13849-1 and -2, these products can be used in up to Category 3 and 4 and a performance level up to e can be achieved.

The product has been engineered and manufactured according to the fundamental and proven safety principles of ISO 13849-2.

2.1.2. Common Cause Failure – CCF

The product has been engineered and manufactured according to the fundamental and proven safety principles of ISO 13849-1 and -2 (e.g., measures for the software, diagnosis, against further CCF, against systematic failures etc.) and then evaluating whether the necessary performance level has been achieved.

Common Cause Failures (CCF) are failures of different components, resulting from a single event. CCF are not to be confused with cascading faults or common mode faults. Common cause failures can cause loss of the safety function, especially in dual channel circuits where both channels could fail simultaneously due to a single event.

- Maintain compressed air quality, i.e., filtration, pressure regulation, lubrication.
- Avoid compressor oils that can cause valve seals to swell, soften, or otherwise deteriorate.
- Conduct leakage tests of the load holding system, including the connecting lines, fittings, and actuator seals, on commissioning and periodically during use.
- Operate within prescribed temperature limits.
- Install the valve such that the normal stroke travel of the valve elements are perpendicular to the main direction of machine vibration and/or mechanical shock.
- Avoid external magnetic fields.
- Do not plug the valve exhaust port.
- Use only high-flow, non-clogging silencers, with similar or higher specifications as ROSS® silencers.

2.1.3. Diagnostic Coverage

A diagnostic coverage of 99% is achievable through appropriate integration of the MCSE Series valve into the safety control system.

2.1.4. Improper Use

⚠ WARNING
Risk of Injury! Misuse may result in injury or damage. ► The product must be used exclusively as intended.

The following applications are prohibited:

- Use outdoors
- Use in non-industrial applications/residential areas
- Use outside of the product limits defined in the technical data
- Unauthorized modifications
- Use as a press safety valve to control a clutch or brake
- Operation with a low demand rate (low demand mode) according to IEC 61508
- Bypassing the safety function or diagnostics
- Use in reverse operation (reversal of supply and exhaust air, reversal of output and supply)

  ROSS CONTROLS is not liable for any damages resulting from improper use. The user alone bears the risks of improper use of the product.

2.2. Responsibilities of the System Owner

- Observe the information on assembly and operating conditions listed in the operating instructions or the data sheet.
- Comply with the further requirements of ISO 13849 (e.g., CCF, DC, PLr, software) if you intend to use the product in higher categories (2, 3, or 4).
- Make sure that the maximum number of switching cycles (B_{10D}) within the service life T_m is not exceeded. If the expected number of switching cycles for a component exceeds the B_{10D} value during its period of use, suitable replacement intervals have to be specified.
- Switch the valve at least once a month to ensure its proper operation.

- Make sure that the fundamental and proven safety principles in accordance with ISO 13849 for implementation and operation of the component are complied with.
- Make sure that the permissible positive and negative test pulses for feedback-free operation of the pneumatic devices are observed (see chapter 11 “Technical Specifications“).

2.3. Safety Instructions

- When implementing surge suppression measures, be sure to check whether or not this extends the valve shut off response time which could extend the machine stopping time.
- In case of high levels of machine vibration, use appropriate vibration-reducing elements when installing the valve.
- Supply the proper voltage as overvoltage situations can result in solenoid burnout.
- Make sure that the silencer’s flow capacity is not restricted as this could affect system performance.
- If required, replace the silencer exclusively with a corresponding ROSS model.

3. Product Identification

Product label identification & product key identification example, see page 2.
See back page for ROSS addresses.

4. Prerequisites for Use of the Product

► Make these operating instructions available to the engineer and assembly technician of the machine/system in which the product will be used.
► Keep these operating instructions for the entire product life cycle.

4.1. Qualified Personnel

Assembly, installation, commissioning, maintenance, and decommissioning should only be carried out by qualified personnel that have the required knowledge of and experience in dealing with electrical and pneumatic control technology.

5. Package Contents

Items included:
- MCSE Series double valve
- Operating instructions

6. Service and Maintenance

► The MCSE valve is not repairable. Do not attempt to adjust or repair the valve. In case of technical problems or a required service, please contact your local ROSS representative. If used properly, the MCSE Series double valves will not require maintenance. Unless otherwise required, ROSS® recommends performing a functional test at least once a month (see 8.1 Test Procedure).

7. Assembly and Installation

⚠ CAUTIONS

Risk of injury due to installation while pressurized or with live parts!
Installation while pressurized or with electrical power switched on can result in injuries due to sudden pressure build-up or electric shock.
► De-energize and de-pressurize the relevant system parts before installing the valves.
► Secure the system to prevent it being switched back on again.

ATTENTION

Destruction of components!
Chemical substances can damage the surface, the markings and the seals of the device.
► Install the valve such that it is protected against the effects of chemicals.
Damage to the device through storage at incorrect temperatures!
The storage temperature represents the permissible ambient temperature and depends on the type of valve in question.
► Observe the temperature information in chapter 11 “Technical Specifications.“

7.1. Mechanical Installation

Prepare for assembly as follows:
1. Stop system operation and protect it against being switched on.
2. Return all suspended loads to a statically secure position or remove them from the system.
3. If required, exhaust stored compressed air from system parts in the immediate work area.
4. Make sure the relevant section of the system is not under pressure or voltage and protect it from being switched on.
5. Secure self-turning or other movable system parts before starting assembly.
6. Let the MCSE safety valve acclimatize itself for several hours before installation, otherwise water may condense in the housing.

Mount the Valve

To mount a single valve – See page 2.
To mount the valve as part of a maintenance unit – See page 2.
The valve must be mounted on both sides with one mounting element each on the mounting surface.

7.2. Pneumatic Installation

Mount the pressure sensor or pressure gauge (optional)

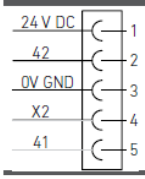
A pressure gauge or electronic pressure sensor can be connected to the thread connection(see page 3) once the blanking plug has been removed.
Observe the mounting instructions enclosed with the components.

7.3. Pneumatic and Electrical Connections

Pneumatic Connections
Requirement: The supply pressure must always be between 29 psig (2 bar) and up to 145 psig (10 bar).
Note: The correct function of the MSCE safety valve is not guaranteed if the supply pressure is lower than 29 psig (2 bar) and up to 145 psig (10 bar).
1. Connect the pressure line for the supply pressure to connection 1 (1, IN).
2. Connect the operating line to connection 2 (2, OUT).

Electrical Connections

1. Connect the supply voltage to plug XPS, the signal output, and, if applicable, start signal X2.
The assignment of the XPS plug is the same for all versions.
The contacts on the XPS plug, M12 male have the following pin assignment:



XPS	Pin	Function
	1	24 V DC supply voltage for the device
	2	Signal contact 42, potential-free
	3	0 V
	4	Input for start X2
	5	Signal contact 41, potential-free

2. Connect the safety signals to control the device to plug X2D. Observe the different assignment of plugs for different devices. The type of device can be taken from the name plate.

7.3.1. Connecting the Supply Voltage

⚠ WARNING

Risk of injury due to Electric shock due to incorrect power pack!
► Use a 24 V DC SELV or PELV circuit in accordance with DIN EN 60204-1 to connect the power supply for the valve.
► The PELV power source must be a safety isolation transformer in accordance with IEC 61558-1 or IEC 61558-2-6, or a power source offering the same degree of safety as a safety isolation transformer.
► Make sure that the power source for the SELV power pack adheres to DIN EN 60950.

We recommend using a type Z (max. 2 A) circuit breaker or a micro-fuse (max. 1 A, inactive) to protect the operating voltage.

7.3.2. Connect the Signal Contact

The device has a potential-free signal contact (41, 42). A loop covering all safety modules can be achieved with this signal contact, for example. The maximum voltage for the signal output is 24 V DC, and the maximum current is 0.2 A.

⚠ WARNING

Risk of injury due to valve malfunction!
A valve malfunction (e.g. failure to open the contact) may occur if you use signal outputs in safety circuits.
► Never use signal outputs in safety circuits.

Figure 1 on page 3 shows the principle use of the signal output.

7.3.3. Connect Start Input X2

⚠ WARNING

Risk of injury!

The use of the "automatic start" function is only permissible in terms of IEC/EN 60204-1 in conjunction with other appropriate measures for machine start-up!

- ► Make sure that the MCSE safety valve cannot be activated when using the "automatic start" function. For example, use an additional safety module with start button, which prevents immediate switch on after release of an emergency OFF button or after applying the operating voltage.

Start input X2 is not active during control with PP or PM. The MCSE safety valve performs an automatic start. Start input X2 must be connected with 24 V DC.

Start input X2 is active during control with NCNC or NCNO. Start input X2 can be connected with a button, for example. Activation of the MCSE safety valve starts when the button is released.

Actuation of the button is monitored. The button may have a maximum actuation time between 0.03 s and 3 s. Activation does not take place if the time is exceeded.

The contacts on the X2D plug, M12 female safety inputs have the following assignment:

X2D	Pin	Function
S21 — 1	1	S21 clock signal for S22
S22 — 2	2	S22 safety input 2
S11 — 3	3	S11 clock signal for S12
S12 — 4	4	S12 safety input 1
nc — 5	5	nc, not connected (not connect)

7.3.4. Principle Wiring for PP Control

When using the PP control, safety inputs 1 and 2 must each be connected with a safe output signal. The "automatic start" function is used in this operating mode. X2 is therefore connected with 24 V DC.
For principle wiring for PP control, see Figure 4 on page 3.

7.3.5. Principle Wiring for NCNC or NCNO Control

When using the NCNC or NCNO control, the safety switches are supplied by the clock signal (S21, S11). Safety input 1 (S12) is connected with S11 via the switch. Safety input 2 (S22) is connected with S21 via the switch. Cross-circuits on the safety inputs are monitored by the MCSE safety valve in this control. Start (pressurization) takes place using the start input X2 in this control.
For principle wiring for NCNC control, see Figure 2 on page 3.
For principle wiring for NCNO control, see Figure 3 on page 3.

7.3.6. Principle Wiring for PM Control

Input M of the MCSE safety valve must be connected with the safe negative output D0-M (e.g., safe output assembly) of a PLC. Input P of the MCSE safety valve must be connected with the safe positive output D0-P (e.g., safe output assembly) of a PLC. The "automatic start" function is used in this operating mode, therefore X2 must be connected with 24 V DC. The contacts have the following assignment for PM control:

X2D	Pin	Function
nc — 1	1	nc, not connected (not connect)
nc — 2	2	nc, not connected (not connect)
M — 3	3	M-input (safety input 2)
P — 4	4	P-input (safety input 1)
nc — 5	5	nc, not connected (not connect)

For principle wiring for PM control, see Figure 5 on page 3.

7.3.7. Connect Ground (FE, function potential compensation)

A ground connection is available on the device. To discharge EMC interferences, connect the FE connection to the MCSE safety valve via a low-impedance line to functional earth. Using the valve without FE connection is not allowed.

The line cross-section must be selected according to the application and implemented according to DIN EN 60204-1/IEC 60204-1.

8. Commissioning and Operation

⚠ CAUTIONS

Danger of injury while working on the system!

Working while the system is running can cause major injuries from moving machinery.

- ► Maintain a sufficient safety distance to moving machine components.
- ► Do not work on the system while it is running.

Before commissioning, the installation must be carefully inspected by a qualified, trained professional.

Make sure that the technical specifications match the operating criteria of the machine and/or the pneumatic system.
Make sure that all plugs are correctly connected. Always set the compressed air supply to a level that ensures that the minimum operating pressure is adhered to (see section 10 Technical Specifications).

8.1. Take the MCSE Safety Valve into Operation

Proceed as follows in order to take the MCSE safety valve into operation:
1. Switch on the pneumatic supply.
2. Switch on the 24 V DC supply voltage.

8.1.1. "Pressurization" Function

If the MCSE safety valve should pressurize the machines, you must switch both safety inputs 1 and 2 with the right signal sequence. If the signal sequence is not correct, the MCSE safety valve goes into the safe state. Exhausting of the operating line is the safe state.

8.1.2. "Exhaust" Function

If the MCSE safety valve should exhaust the machines, you must switch both safety inputs 1 and 2 with the right signal sequence. The MCSE safety valve goes into the safe state if the MCSE safety valve is isolated from the supply voltage or if a fault occurs during operation.
Exhausting of the operating line is the safe state.
Exhausting of the valve may not be restricted.

8.1.3. Signal Sequence when Switching On

The following signal sequence results when switching on the MCSE safety valve (see Figure 10 on page 3).

The MCSE safety valve is not supplied with 24 V DC before time 1. Signal output (41, 42) is open (41, 42=0) and the RUN-LED is off (0). The MCSE safety valve exhausts the operating line.

The MCSE safety valve is supplied with 24 V DC at time 1. The RUN LED and all other LEDs flash briefly when switched on. The device performs a self-test. This self-test takes a maximum of 1.5 s. After the self-test (4) has been successfully carried out, the MCSE safety valve is in the ready state (2). The RUN-LED (1) is illuminated in the ready state and the signal output is closed (41, 42=1). The MCSE safety valve is ready for control via both safety inputs.

If the device is disconnected from the supply voltage at time 4,

- The MCSE safety valve exhausts,
- the RUN LED is not illuminated and
- the signal output is open (41, 42=0).

8.1.4. Signal Sequence for PP Control

The following signal sequence results during PP control of the MCSE safety valve (see Figure 8 on page 3).
The MCSE safety valve is in the ready state before time 1, but is not activated. In this state (MCSE=0) the MCSE safety valve exhausts the operating line.
Signal input S22 is actuated with 24 V at time 1. If signal input S12 is also actuated with 24 V within synchronization time (4), the MCSE safety valve goes into the pressurized state (MCSE=1) at time 2. OUT LED illuminates and indicates the activated state.
The synchronization time for monitoring (4) is 0.5 s. The state of signal inputs 1 and 2 is displayed by the IN 1 LED and IN 2 LED.
If the interval between signal inputs 1 and 2 is longer than the synchronization time for monitoring, the MCSE safety valve remains in the non-activated state. In this state (MCSE=0) the MCSE safety valve exhausts the operating line and OUT LED is not illuminated. The IN 1 LED and IN 2 LED flash fast and indicate that signal inputs 1 and 2 have not been actuated synchronously. If signal input 1 and/or signal input 2 is actuated with 0 at time 3, the MCSE safety valve goes into the non-activated state (MSCE=0) and exhausts the operating line. OUT LED is off. Signal inputs 1 and 2 must be de-actuated before re-pressurize. The IN 1 and IN 2 LEDs are off in this state.

8.1.5. Signal Sequence for NCNC Control

The following signal sequence results during NCNC control of the MCSE safety valve (see Figure 6 on page 3).
The MCSE safety valve is in the ready state before time 1, but is not activated. In this state (MCSE=0) the MCSE safety valve exhausts the operating line.
Signal input S22 is connected with clock output S21 at time 1 via the switch. If signal input S12 is connected with clock output S11 via the second switch within synchronization time (6), the MCSE safety valve goes into the “wait for start” state at time 2. The MCSE safety valve remains in the non-activated state (MCSE=0) and the exhausts the operating line. OUT LED indicates this state by flashing slow.
The synchronization time for monitoring the signal inputs is 0.5 s. The state of signal inputs 1 and 2 is displayed by the IN 1 LED and IN 2 LED.
If the interval between signal inputs 1 and 2 is longer than the synchronization time for monitoring, the MCSE safety valve remains in the non-activated state. In this state (MCSE=0) the MCSE safety valve exhausts the operating line and OUT LED is not illuminated. The IN 1 LED and IN 2 LED flash fast and indicate that signal inputs 1 and 2 have not been actuated synchronously.
If start signal X2 is changed from 0 V to 24 V (positive flank) at time 3 and is changed back from 24 V to 0 V (negative flank) at time 4, the MCSE safety goes into the pressurized state (MCSE=1) at time 4. OUT LED illuminates and indicates the activated state. The time for monitoring signal X2 is between a minimum of 0.03 s and maximum 3 s. If X2 is not actuated within this monitoring time, the MCSE safety valve remains in the exhausted state (MCSE=0).
If the connection between S11 and S12 or between S21 and S22 is interrupted via the corresponding switch after time 4, the MCSE safety valve goes into the non-activated state (MCSE=0) and exhausts the operating line at time 5. OUT LED is off. Both signal inputs 1 and 2 must be open/interrupted to re-pressurize. The IN 1 and IN 2 LEDs are off in this state, and Start-Button X2 need to be pressed again.

8.1.6. Signal Sequence for NCNO Control

The following signal sequence results during NCNO control of the MCSE safety valve (see Figure 7 on page 3).
The MCSE safety valve is in the ready state before time 1, but is not activated. In this state (MCSE=0) the MCSE safety valve exhausts the operating line.
The switch opens the connection between signal input S22 and clock output S21 at time 1. If signal input S12 is connected with clock output S11 via the second switch within synchronization time (6), the MCSE safety valve goes into the “wait for start” state at time 2. The MCSE safety valve remains in the non-activated state (MCSE=0) and the exhausts the operating line. OUT LED indicates this state by flashing slow.
The synchronization time for monitoring the signal inputs is 0.5 s. The state of signal inputs 1 and 2 is displayed by the IN 1 LED and IN 2 LED.
If the interval between signal inputs 1 and 2 is longer than the synchronization time for monitoring, the MCSE safety valve remains in the non-activated state. In this state (MCSE=0) the MCSE safety valve exhausts the operating line and OUT LED is not illuminated. The IN 1 LED and IN 2 LED flash fast and indicate that signal inputs 1 and 2 have not been actuated synchronously.
If start signal X2 is changed from 0 V to 24 V (positive flank) at time 3 and is changed back from 24 V to 0 V (negative flank) at time 4, the MCSE safety goes into the pressurized state (MCSE=1) at time 4. OUT LED illuminates and indicates the activated state. The time for monitoring signal X2 is between a minimum of 0.03 s and maximum 3 s. If X2 is not actuated within this monitoring time, the MCSE safety valve remains in the exhausted state (MCSE=0).
If the connection between S11 and S12 is opened via the corresponding switch after time 4 or the connection between S21 and S22 is closed by the corresponding switch, the MCSE safety valve goes into the non-activated state (AS3-SOV=0) and exhausts the operating line at time 5.
OUT LED is off. Both signal inputs 1 and 2 must be open/closed to re-pressurize. LED IN 1 and IN 2 are off in this state and Start-Button X2 need to be pressed again.

8.1.7. Signal Sequence for PM Control

The following signal sequence results during PM control of the MCSE safety valve (see Figure 9 on page 3).
The MCSE safety valve is in the ready state but is not activated before time 1. In this state (MCSE=0) the MCSE safety valve exhausts the operating line.
Signal input M is actuated with 0 V at time 1. If signal input P is also actuated with 24 V within synchronization time (4), the MCSE safety valve goes into the pressurized state (MCSE=1) at time 2. OUT LED illuminates and indicates the activated state.
The synchronization time for monitoring (4) is 0.5 s. The state of signal inputs P and M is displayed by the IN 1 LED and IN 2 LED.
If the interval between signal inputs P and M is longer than the synchronization time for monitoring, the MCSE safety valve remains in the non-activated state. In this state (MCSE=0) the MCSE safety valve exhausts the operating line and OUT LED is not illuminated. The IN 1 LED and IN 2 LED flash fast and indicate that signal inputs 1 and 2 have not been actuated synchronously.
If signal input P is not actuated with 24 V or if signal input M is not actuated with 0 at time 3, the MCSE safety valve goes into the non-activated state (MCSE=0) and exhausts the operating line. OUT LED is off.
The signal input must be at 0 V and signal input M not at 0 V to re-pressurize. The IN 1 and IN 2 LEDs are off in this state.

8.1.8. Signal Sequence when a Fault Occurs

The MCSE safety valve goes into the safe state if a fault occurs during operation of the MCSE safety valve. Exhausting of the operating line is the safe state.
If an error occurs:

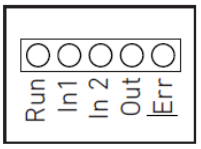
- The MCSE safety valve exhausts the operating line,
- opens the signal output and
- the red LED shows a flash code for the fault.

The following signal sequence results when a fault occurs (see Figure 11 on page 3).
The device works fault-free at time 1. The signal output (41, 42=0) opens at time 2 if a fault (3) occurs. The ERR LED shows a fault number via a flash consisting of long and short sequences.
You can analyze the error with the help of this error number. The device is switched off at time 4 and the fault is rectified. If the device is switched on at time 5 and the fault has been rectified, the device is ready to operate again at time 6 after the self-test (7, approx. 1.0s).
The following table shows an overview of flash codes with the corresponding cause of fault.

LED	Flashes		Error Cause
	Long	Short	
ERR	1	1	Supply voltage too low
	1	2	Supply voltage too high
	2	4	Cross-circuit between inputs S12 and S22
	4	3	Supply voltage is detected as an AC voltage
	3	8	Time monitoring during pressurization
	3	9	Time monitoring during exhaust
	4	1	Time monitoring during exhaust
	4	2	Time monitoring during exhaust
	3	4	Undefined level on input X2
	2	9	Undefined level on input S12
	3	1	Undefined level on input S22

8.2.1. LED Displays

The LEDs flash briefly if the MCSE safety valve is supplied with 24 V.



The normal non-activated operating state (exhaust) is:

- RUN: illuminated
- IN 1, IN 2, OUT, ERR: off

The normal activated operating state (pressurize) is:

- RUN, IN 1, IN 2, OUT: illuminated
- ERR: off

The following table shows an overview of LED displays with the corresponding function.

LED	Color	Display Type	Function
RUN	Green	Permanently illuminated	The MCSE safety valve is ready
IN 1	Green	Off	Safety input 1/P not actuated
IN 1	Green	Permanently illuminated	Safety input 1/P actuated
IN 1	Green	Flashes quickly	Time for synchronization exceeded
IN 1	Green	Flashes slowly	Second input S22 has not opened
IN 2	Green	Off	Safety input 2/M not actuated
IN 2	Green	Permanently illuminated	Safety input 2/M actuated
IN 2	Green	Flashes quickly	Time for synchronization exceeded
IN 2	Green	Flashes slowly	Second input S12 has not opened
Out	Green	Off	MCSE safety valve in the non-activated state, operating line is being exhausted
Out	Green	Permanently illuminated	MCSE safety valve in the activated state
Out	Green	Flashes slowly	The MCSE safety valve is waiting for start signal X2
ERR	Red	Off	No error
ERR	Red	Flashes slowly	See “Signal sequence when a fault occurs“
ERR	Red	Flashes quickly	See “Signal sequence when a fault occurs“

8.2.2. Soft Start

If the MCSE safety valve is activated, the operating line is pressurized. The time required for the output pressure to reach approx. 50% of the input pressure can be changed with the help of the “soft start function”. For this, you must turn the adjustment screw for the “soft start function” (see page 2).

If you turn the adjustment screw in a clockwise direction, the time required for the output pressure to reach approx. 50% of the input pressure is increased. Turn the adjustment screw in an anti-clockwise direction to reduce the time. By fully opening the soft start, the soft start function could be disabled if not needed.

Note: The time interval is directly influenced by the volumes of the system that is currently being filled. The time to reach 50% of the input pressure is longer in systems with larger volumes than in systems with smaller volumes.

9. Care and Maintenance

ATTENTION

Damage to the product due to the use of solvents and aggressive cleaning agents!

The product can be damaged if washed with a solvent or aggressive cleaning agent. The chemical resistance of the valve material to such products is not guaranteed. Solvents and aggressive detergents will destroy the surface, labeling and seals of the product.

- ► Make sure that no solvents and aggressive cleaning agents come into contact with the valve.

Damage to the product due to washing at high pressures and temperatures!

The product will be damaged if you clean it with high pressure and/or at a high temperature.

- ► Make sure that the product is not cleaned with high pressure and/or at a high temperature.

No special care is required for the MCSE safety valve. Note the following if you would like to clean the valve:

• Check that all seals and plugs for the plug connections are firmly seated so that no humidity can penetrate the MCSE safety valve during cleaning.

• Only clean the MCSE safety valve using a slightly damp cloth. Only use water to do this and, if necessary, a mild detergent.

⚠ WARNING

Risk of injury while working on a running system!

Working while the system is running can cause major injuries from moving machinery.

- ► Bring the system mode into a state in which working movements are no longer possible. Wait until all moving machine parts come to a standstill, and protect the system against being switched on.

In normal operation, the MCSE safety valve is maintenance-free. However to ensure proper function, the MCSE safety valve must be actuated at least once per month.

The MCSE safety valve seals may age faster in aggressive ambient conditions. A damaged seal can be recognized by parts of the seal visibly protruding from the housing gaps. Defective seals will lead to pneumatic leaks.

- Regularly check that the seals are in perfect order.
- Immediately exchange the MCSE safety valve if the seals are defective.
- Check regularly whether all plug connectors are firmly fitted.
- Establish the maintenance intervals according to your ambient conditions and enter them in the system-dependent maintenance plan.
- Observe the system-specific maintenance intervals.

In case of any maintenance requirements, it is advisable to replace the entire MCSE safety valve as this is the only way of ensuring a life cycle value for the entire valve.

Note: The operator is responsible for determining the maintenance intervals.

10. Disassembly and Exchange

⚠ WARNING

Risk of injury if disassembled under pressure or voltage!

Uncontrolled movement of the system components!

- ► Make sure that the system is not under pressure or voltage when you disassemble the MCSE safety valve.

ATTENTION

Contamination during disassembly!

During disassembly, greases or lubricant may escape from the MCSE safety valve.

- ► Make sure that the environment is not contaminated with greases or lubricant during disassembly.

Disassemble the MCSE

1. Stipulate a signal on safety inputs 1/2 to deactivate the MCSE safety valve and to exhaust the outlet line on outlet connection 2.
2. Switch off the 24 V DC supply.
3. Remove the connected plugs.
4. Switch-off the supply pressure and exhaust the supply line.
5. Remove the pneumatic lines.
6. Remove the valve fastening screws depending on the mounting type

This concludes the disassembly.

Exchange the MCSE

1. Disassemble the MCSE safety valve as described above.
2. Assemble a new MCSE safety valve as described in chapter “Assembly“.

11. Troubleshooting

⚠ WARNING

Risk of injury by dismantling the valve!

Pre-tensioned springs may suddenly be released when dismantling the valve.

- ► Never dismantle the valve.
- ► Do not attempt to perform any unauthorized repairs.

• Check the connections, operating voltage, and working pressure of the relevant system part if malfunctions occur.

Additional help for malfunctions can be found in the following table:

Malfunction	Possible cause	Remedy
Pressure/flow level is not reached or drops off slowly	Operating pressure is too low	Increase the operating pressure Check tubing diameter
	Leak on tubing	Check tubing and tubing connections
No output pressure on output 2 and LED display differs from the normal display (see below)	Incorrect control	Troubleshooting using the LED display (Normal state: RUN, IN 1, IN 2 and OUT illuminate, ERR is off)
RUN LED is OFF	Device is not supplied with a voltage	Supply a voltage to the device according to the instructions
LED IN 1, IN 2 OFF	The corresponding safety input does not have a signal	Check the wiring and control of safety inputs
The IN 1, IN 2 LEDs flash quickly	Control of signals IN 1 and IN 2 outside of the synchronization time	Check signal sequence on IN 1 and IN 2
OUT LED flashes slowly	No start signal on X2	Check the wiring and control of the start signal
ERR LED flashes	An error has occurred in the device	Establish the fault number using the flash code and carry out troubleshooting in accordance with “Signal sequence when a fault occurs“.

Additional help for malfunctions can be found in the following table:

If you are unable to troubleshoot the MCSE safety valve malfunction yourself:

• Disassemble the MCSE safety valve as described in chapter 10 “Disassembly and Exchange” and send it to ROSS CONTROLS. You can find the address on the back of the operating instructions.

ERR Error Number Flashes		Explanation of Errors	Remedy
Long	Short		
1	1	Supply voltage too low	Increase the power supply. Use a cable with a larger diameter
1	2	Supply voltage too high	Reduce the power supply
2	4	Cross-circuit between inputs S12 and S22	Check the wiring and correct if necessary
4	3	Supply voltage is detected as an AC voltage	Select a supply voltage according to the technical data
3	8	Time monitoring during pressurization	Check the compressed air supply. Change the soft start setting.
4	1	Time monitoring during exhaust	Silencer blocked, replace silencer
4	2	Time monitoring during exhaust	Silencer blocked, replace silencer
3	4	Undefined level on input X2	Check the signals on plug XPS and the wiring
2	9	Undefined level on input S12	Check the signals on plug X2D and the wiring
3	1	Undefined level on input S22	Check the signals on plug X2D and the wiring

11. Technical Specifications

Design: Redundant 3/2 Normally Closed double valve internally monitored.
Actuation: Electromagnetically externally piloted with air-assisted spring return. One magnet per valve element (2 in total) - both must be operated simultaneously.
Flow Media: Permissible medium Compressed air acc. to ISO 8573-1
Max. particle size 5-µm. Oil content of compressed air 0…1 mg/m^3.
The oil content of compressed air must remain constant during the life cycle.
Operating Pressure Range: 30 to 150 psig (2 to 10 bar).
Ambient/Media Temperature: 23° to 120°F (-5° to 50°C). For temperatures below 4°C, the compressed air must be dried according to ISO 8573-3, class 7.
Standard Voltage: 24 volts DC.

Electrical Data	
Supply voltage	Power pack/main supply SELV power pack in accordance with DIN EN 60950 for operation in a PELV circuit in accordance with EN/IEC 60204-1
Inputs S12, S22, X2	24 V DC, 8 mA
Clock output S11, 21	20 V DC, 10 mA per output
Cable length	1500 m at 1.5 mm² 2500 m at 2.5 mm²
Line resistance	max. 40 Ω
Power consumption	280 mA
Protection class according to IEC 60529/EN 60529	IP65 (only when assembled and with all plugs connected)
Electrical connections	1x plug and 1x socket, 5-pin, M12
Tightening delay	< 150 ms
Drop-out delay	In case of emergency stop: < 10 ms In case of power failure: < 10 ms
Override time in case of voltage drop	5 ms
Time until ready for operation after switch on	< 1.5 s
Switching capacity of signal outputs	41–42: 24 V DC, 0.2 A

SAFETY CLASSIFICATION:

Directives: 2006/42/EC (Machinery Directive) 2004/108/EC (EMC directive)
Standards: ISO 13849-1, IEC61508/IEC62061, DIN EN 61326-3-1.
Test Principle: GS-IFA-M07, April 2017.
Safety Functions: “Safe exhaust” and “protection against unexpected start-up”.
Vibration Resistance (DIN EN 60068-2-6): 0.35 mm ± 0.05 mm displacement at 10 Hz–55 Hz.
Shock Resistance (DIN EN 60068-2-27): 30 g with 18 ms duration.
Shock Wave Form: Sinus half-wave.
Safety Classification: Max. category 4, PL e, SIL 3.
Mean Time to Dangerous Failure: See B_{10D} from the ROSS SISTEMA library.
Common Cause Failure – CCF: > 65.
Diagnostic Coverage (DC): High, 99%.
Monitoring: Dynamic, cyclic, internal.
Noise Level [dB (A)]: The sound pressure level is influenced by the individual systems to reduce noise emissions. Exhausting of the valve may not be restricted. We do not recommend using the product without silencers.
Minimum Operation Frequency Recommended: 1 x per month, to ensure proper function.
Maximum Cycle Rate: 2 Hz.
Mounting Orientation: Any, preferably vertical.
Solenoids: Per VDE 0580. Rated for continuous duty. Electrical connection according to EN 175301-803 Form C. Enclosure rating according to DIN 400 50 IP 65.
Flow Rates: *See page 2.*

12. Disposal

Dispose of the valve in accordance with the applicable statutory regulations in your country.

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