



RC-MDC-01
EN

MDC Series

MDC1 & MDC2 Series – Safety Exhaust (Dump) Valves with EEZ-ON® (Soft-Start)

Operating Instructions



PRODUCT CREDENTIALS				
Performance Level Per ISO 13849-1:2015	Safety Integrity Level Per IEC 2061:2001	DGUV Certificate	Declaration of Conformity	Certificate of Compliance
Cat. 1 PL c Cat. 2 PL c	SIL 1 Functional Safety	DGUV Test HSM XXXX Sicherheitstechnik Pending	CE	CS® CETUS Pending

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

PRODUCT LABEL IDENTIFICATION

Valve with EEZ-ON® (Soft-Start)

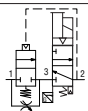
With Pressure Sensor

MDC2E131NAEXCGA

36-150 PSIG (2.5-10 BAR)

0223 FE

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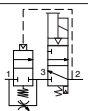
Without Pressure Sensor

MDC1E131NAEXCGA

36-150 PSIG (2.5-10 BAR)

0223 FE

www.rosscontrols.com



Valve without EEZ-ON® (Soft-Start)

With Pressure Sensor

MDC2X251NAEXCGA

36-150 PSIG (2.5-10 BAR)

0223 FE

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Without Pressure Sensor

MDC1X251NAEXCGA

36-150 PSIG (2.5-10 BAR)

0223 FE

www.rosscontrols.com



PRODUCT KEY IDENTIFICATION

MDC**1****E13****1****G****A****E****X****C****G****A**

Series

Voltage

24 V DC

Revision Level

Feedback Signal

Without Pressure Sensor	1
With Solid State Pressure Sensor	2

Monitoring

External

Pressure Measuring Device

Analog Gauge	G
Digital Transducer	T
None	X

Communication

None

Port Thread

NPT	N
G	G

Exhaust Silencer

With Silencer	1
Without Silencer	X

Solenoid Connection

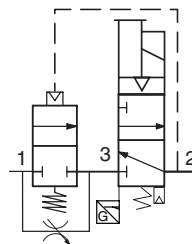
DIN EN 175301-803	C
M12	M

Soft Start	Body Size	Port Size		
		In-Out	Exhaust	
With	1/2	3/8	3/4	E13
		1/2	3/4	E14
		3/4	3/4	E15
Without	1	3/4	1-1/2	X25
		1	1-1/2	X26
		1-1/4	1-1/2	X27

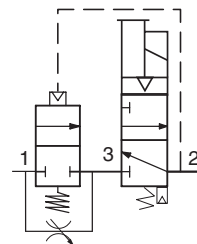
SCHEMATICS

Valve with EEZ-ON® (Soft-Start)

With Pressure Sensor

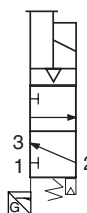


Without Pressure Sensor

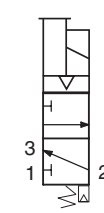


Valve without EEZ-ON® (Soft-Start)

With Pressure Sensor



Without Pressure Sensor



Body Size	Port Size	Flow* C _v (l/min)	
		1-2	2-3
1/2	3/8	3.1 (3100)	3.3 (3200)
	1/2	3.7 (3600)	4.0 (3900)
	3/4	4.0 (3900)	4.2 (4100)
1	3/4	14 (14000)	19 (19000)
	1	21 (21000)	27 (29000)
	1-1/4	23 (23000)	30 (30000)

* Flow test conducted without silencer at the exhaust port.

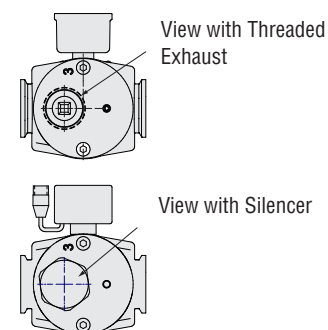
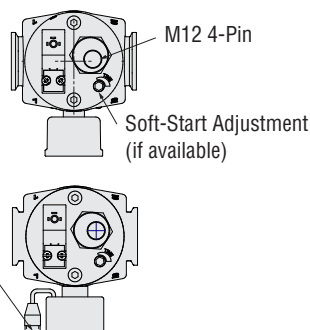
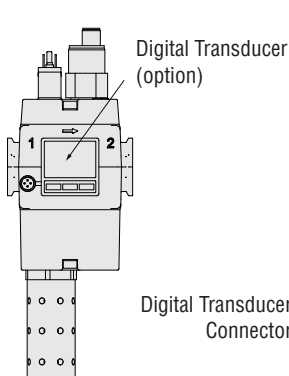
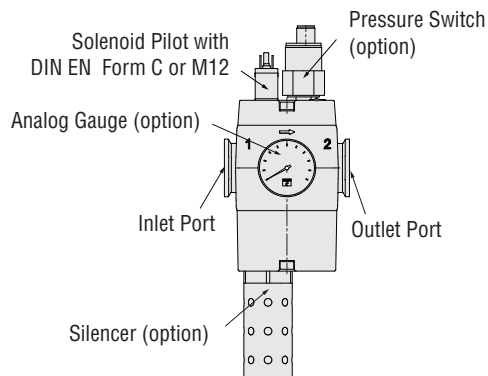
Body Size	Weight # lb (Kg)
1/2	2.05 (0.93)
1	9.35 (4.24)

Valve with Silencer, Pressure Sensor and Analog Gauge

MANUFACTURING INFORMATION	Manufacturing Site	Site Abbreviation	Valve Printing (example May 2022)
Date and site of manufacture	ROSS CONTROLS USA	(L)	(5 22 L)
		(FE)	(5 22 FE)
	ROSS EUROPA	(G)	(5 22 G)
	ROSS UK	(RB)	(5 22 RB)
	ROSS ASIA	(J)	(5 22 J)
See back page for ROSS addresses.	ROSS SOUTH AMERICA	(B)	(5 22 B)
	ROSS CONTROLS CHINA	(C)	(5 22 C)
	ROSS CONTROLS INDIA	(RCI)	(5 22 RCI)

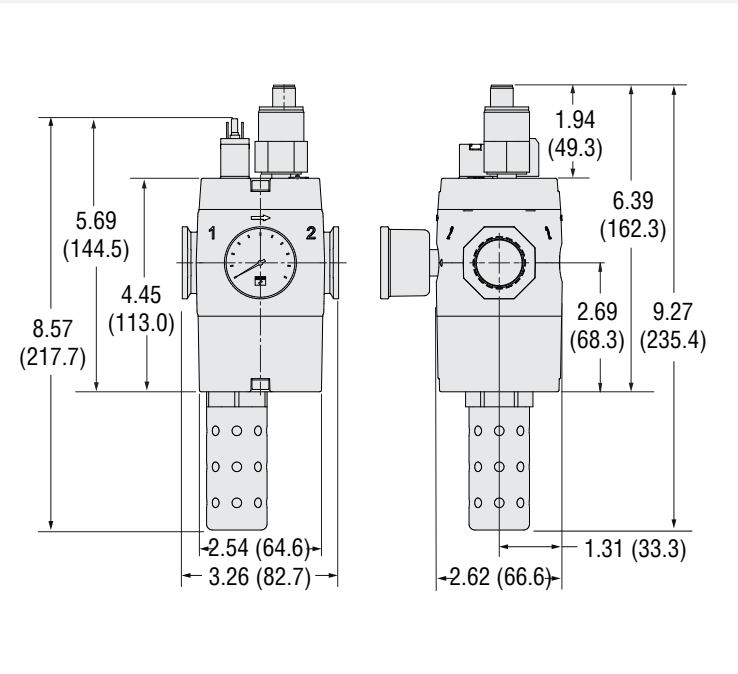
TOP VIEW

BOTTOM VIEW

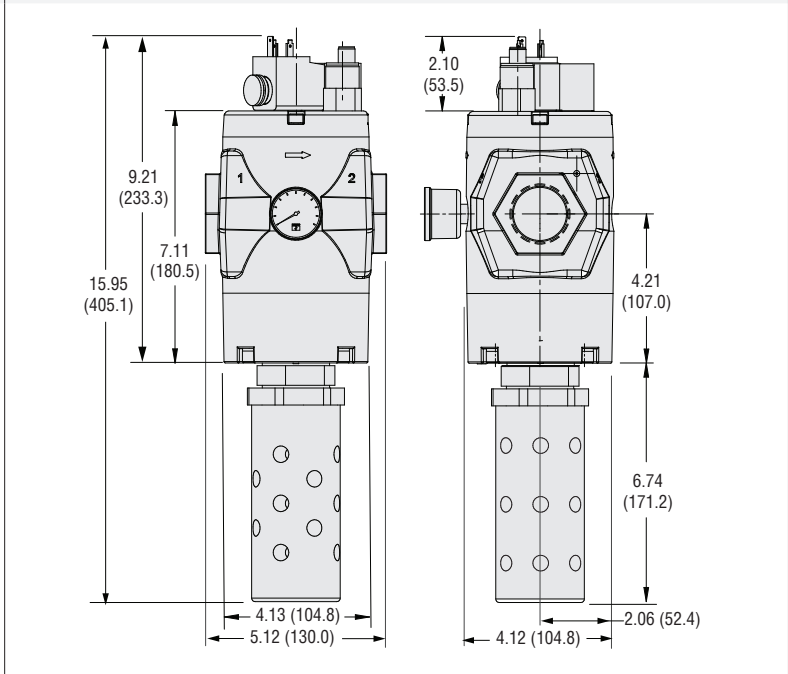


DIMENSIONAL DRAWINGS Inches (mm)

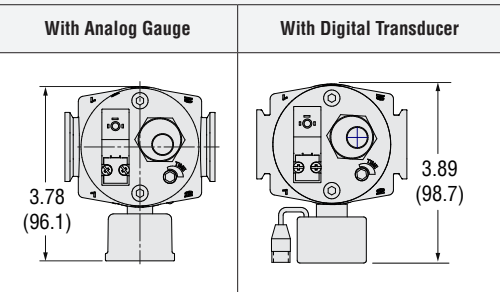
Valve Body Size 1/2



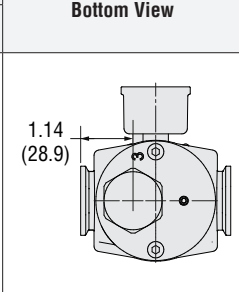
Valve Body Size 1



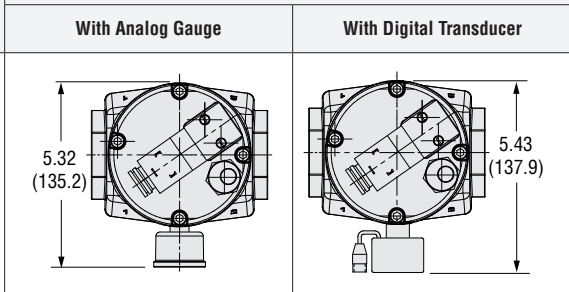
Top View



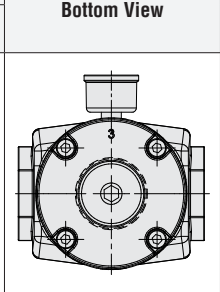
Bottom View



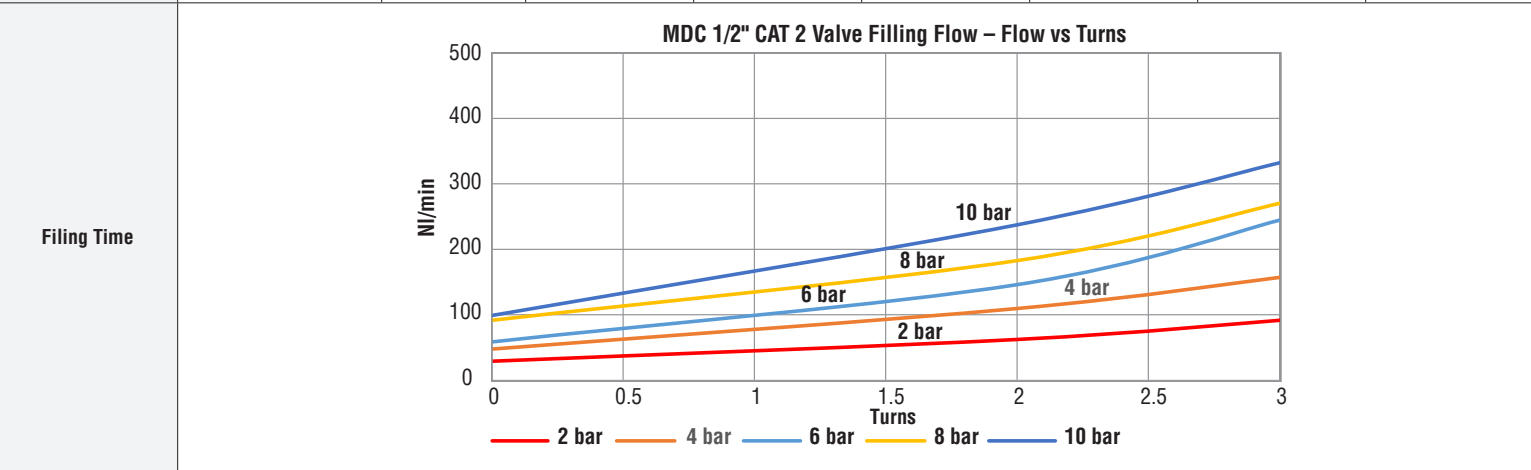
Top View



Bottom View



Exhaust Time	Operating Conditions	Volume ft³ (L)	Operating Pressure psig (bar)					
			30 (2)		90 (6)		145 (10)	
			to 15 (1)	to 7 (0.5)	to 15 (1)	to 7 (0.5)	to 15 (1)	to 7 (0.5)
			Normal					
	Normal	0.071 (2)	0.065	0.099	0.152	0.189	0.209	0.249
		0.35 (10)	0.203	0.359	0.615	0.800	0.898	1.084
		0.71 (20)	0.376	0.685	1.194	1.563	1.759	2.127
		1.41 (40)	0.721	1.336	2.351	3.091	3.480	4.213
		5.30 (150)	2.620	4.918	8.716	11.492	12.948	15.688



EU declaration of conformity

(Original Version)

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

ROSS® double valves series **MDC** is in full accordance with the following Directives:

Machinery Directive 2006/42/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
 DIN EN 62061: 2021: Safety of machinery – Functional safety of safety-related electrical, electronic, and programmable electronic control systems (as applicable)
 EN 60204-1: 2018: Safety of Machinery- Electrical equipment of machines -Part 1
 EN ISO 4414: 2010-11: Pneumatic Fluid Power
 General Rules and Safety Requirements for Pneumatic Systems and their Components

Authorized person for the compilation of technical documentation:

ROSS EUROPA GmbH, Dietrich Warmbier, Robert-Bosch-Straße 2, 63225 Langen / Germany

Ferndale, MI, 2023-03-01

Signed for and on behalf of ROSS®

Dietrich Warmbier
Global Safety Product Manager

subject to change, actual version on request

www.rosscontrols.com

ROSS CONTROLS®

950 Woodward Heights., Ferndale, MI, 48220
 Telephone: 248-764-1800

UKCA declaration of conformity

(Original Version)

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

ROSS® double valve series **MDC** is in full accordance with the following Directives:

SI 2008 No. 1597 Supply of Machinery (Safety) Regulations 2008

Applied harmonized standards:

BS EN ISO 13849-1: 2015: Safety of Machinery- Safety related parts of a control system -Part 1
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Authorized person for the compilation of technical documentation:

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Ferndale, MI, 2023-03-01

Signed for and on behalf of ROSS®

Dietrich Warmbier
Global Safety Product Manager

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Package Contents

Items included:

- MDC Series valve
- Silencer (if ordered)
- Operating instructions

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.
- ▶ 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.

Additional documentation:

- SISTEMA libraries
- DGUV certificate: German Social Accident Insurance
- Product catalog and other technical documents

For more information 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 MDC Series single valves are safety components designed and manufactured in accordance with Machinery Directive 2006/42/EC and bear the CE mark. The MDC Series valves are single 3/2 valves that are designed to meet the needs and requirements of safe air supply/exhaust applications for machinery with pneumatic controls. Typically, these valves are implemented to meet the Category 1 or 2 up to Performance Level c requirements of a machine's (or system's) safety circuit as determined by a risk assessment of the hazards and tasks required of employees that interact with the machine/system.

- See section 3 "Technical Data" for the standards and test values complied with and adhered to by the product. See the declaration of conformity for product-relevant CE directives.

The MDC Series valve is designed to supply air to a zone or entire machine/system until signaled to shut off and exhaust residual downstream pneumatic energy from the machine. Thus, reducing the hazards associated with the presence of residual energy during employee access and/or minor servicing. The safety function of the MDC Series valve is to shut off supply of pneumatic energy and to exhaust any pneumatic energy from downstream of the valve.

Note: The MDC Series valve cannot exhaust pneumatic energy from downstream of obstructions such as check valves and closed center function valves. Depending on the application, these devices may be detrimental or they may be beneficial to complete the needed safety function. Careful consideration of the required safety function and how to achieve that goal is absolutely necessary.

The MDC Series valves are designed for external monitoring for safe, single operation. The MDC Series valves are constructed of a single, pilot operated 3/2 poppet spring return type valve. The Cat-2 version (MDC2) of the MDC Series is equipped with a solid state pressure sensor. Monitoring the sensor on each actuation and de-actuation of the MDC2 Series valve provides a diagnostic coverage between 60% < 90%. Monitoring of the sensor is to be done by an external monitoring system.

The Cat-1 version (MDC1) w/o pressure sensor will have a diagnostic coverage <60%.

The 1/2" Body Size valves are equipped with EEZ-ON® (Soft-Start) function, while the 1" Body Size valves are not available with Soft-Start function.

The function of the EEZ-ON® (Soft-Start) is to, on energization, allow outlet pressure to increase at a slower than normal rate until it reaches approximately 50% of inlet pressure, at which point the valve will then open fully to finish filling the system at full flow rate.

This feature can be used to lessen the shock of sudden, rapid pressurization of double acting cylinders. This feature is especially useful where inline flow controls are placed into the cylinder control lines in the "meter out" mode. Flow controls mounted in this fashion do not operate sufficiently when the system is initially being refilled with compressed air after the system has been de-pressurized. This causes uncontrolled cylinder speed on the first actuation of the cylinder. The EEZ-ON® (Soft-Start) feature can remedy this situation by gradually refilling the system. Thus, allowing cylinders to ease into place instead of slamming. When using the EEZ-ON® (Soft-Start) feature, the time it takes for the outlet pressure to reach approximately 50% of inlet pressure can be changed by adjusting the flow control. Turning the flow control clockwise will increase the time it takes the outlet pressure to reach 50% of inlet pressure. Turning the flow control counter-clockwise will reduce this time. This time interval is directly affected by the volume of the system being filled. In larger volume systems the time to reach 50% will be longer than in systems with smaller volumes. It is important to note that the EEZ-ON® (Soft-Start) feature only works when switching the MDC Series valve on. By fully opening the EEZ-ON® (Soft-Start), the Soft-Start function could be disabled if not needed. The EEZ-ON® (Soft-Start) feature does not affect the exhaust (safety) function of the valve.

2.1.1. Safety Function According to ISO 13849

MDC Series valves are designed and manufactured in accordance with the requirements listed in ISO 13849-1 and -2.

Their "fail-to-safe" safety function is ensured as long as the poppet is able to go back into the start position. A single fault within the valve (e.g., caused by wear, contamination, or similar situations) can lead to the loss of the safety function.

The safety function of the 3/2 MDC Series valve is to only supply compressed air (pneumatic energy) to the machine/system when the single valve element is actuated, but to shut-off the supply and to exhaust any downstream compressed air when the valve is shut off.

Monitoring of the pressure sensor by the user's external safety monitoring system makes it possible to detect fault situations and to shut off and prevent further electrical energization of the solenoid.

The control output of the safety system must be designed and constructed to meet the Category and/or Performance Level requirements of the safety system, as determined by the risk assessment of the machine. Normally, the output to the solenoid is an output from a safety relay or safety PLC.

2.1.2. Common Cause Failure – CCF

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, e.g., filtration, pressure regulation, lubrication.
- Avoid oils that can cause valve seals to swell, soften, or otherwise deteriorate.
- 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, available from ROSS®.

2.1.3. Diagnostic Coverage

A diagnostic coverage of <60% w/o pressure sensor (MDC1, Cat 1) and 60% - <90% with pressure sensor (MDC2, Cat-2) is achievable through appropriate integration of the MDC Series valve into the safety control system. The monitoring system must check for the proper change of state of the valve pressure sensor with each change of state of the safety control system outputs to the valve solenoid.

Detection of a fault by the safety control system must trigger a shut-off of the safety controller's or relay output to the valve solenoid, see section 5.

2.1.4. Fault Modes

Note that normal operation requires energizing the solenoid for switching the MDC Series valve on, and de-energizing the solenoid for switching the MDC Series valve off. Faults that could occur during normal operation:

Fault mode shows the MDC2-version with pressure switch

Solenoid energized – Sensor ON

Solenoid de-energized – Sensor OFF

2.1.5. Foreseeable Misuse



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
- Bypassing the safety function or diagnostics
- Allowing continued operation of the valve when the shifted signal is not confirmed
- Use in reverse operation (reversal of supply and exhaust air)
- Operation in low-demand mode per IEC 61508
- Operation in hazardous locations.

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 to 4).
- Make sure that the maximum number of switching cycles (B_{100}) within the service life TM is not exceeded. If the expected number of switching cycles for a component exceeds the B_{100} 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.
- Only MDC2: Always monitor feedback signal with the monitoring system, do not operate unmonitored.
- If you operate the MDC Series valve together with an electric two-hand control, it must comply with the EN ISO 13851 standard. Selection and installation of this two-hand control must take place in accordance with the manufacturer's 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 with high-flow, non-clogging silencers, available from ROSS®.

3. Technical Specifications

Function	3/2 Valve		Normally Closed
Construction Design	Single Poppet		
Actuation	Solenoid pilot operated with air assisted spring return.		
Shock Resistance (based on DIN EN 60068-2-27)	Acceleration		30 G
	Shock Duration		16 ms
	Shock Waveform		1/2-sine
Mounting Type	Valve Basic Size	1/2	Inline/Modular
		1	Inline
Mounting Orientation	Any, preferably vertical		
Flow Media	Compressed (neutral gases) air according to ISO 8573-1 Class 7:4.4.		
Inlet Pressure	Valve Basic Size	1/2	30 to 150 psig (2 to 10.3 bar)
		1	36 to 150 psig (2.5 to 10.3 bar)
Temperature	Ambient	40° to 122°F (4° to 50°C)	
	Media	40° to 175°F (4° to 80°C)	
Standard Voltages	24 volts DC		
Supply Voltage	For CSA/UL compliance, in DC applications the valve must be connected to a NEC Class 2 power supply		
Pilot Solenoid	According to VDE 0580. Rated for continuous duty. Electrical connection according to DIN EN 175301-803 Form A, DIN EN 175301-803 Form C, or M12.		
Pilot Solenoid Power Consumption	Valve Basic Size	1/2	1.5 watts
		1	15 watts
Enclosure Rating	According to DIN 400 50 IP 65		
Pressure Sensor	PNP solid state		

Pressure Sensor Current Consumption	<4mA
B_{100} Pressure Sensor	5 Million
B_{100} Value	5 Million
Maximum Cycle Rate	3 Hz, measured without volume. The switching frequency decreases depending on pressure, load volume, pipe size, and soft start setting
Monitoring	Dynamic, cyclical, external with customer supplied equipment. Monitoring should check state of the valve pressure sensor with any and all changes in state of valve control signal
Sound Pressure Level [dB(A)]	Consult ROSS for value, maximum pulse sound pressure level at the loudest measuring point when exhausting the valve with a ROSS Controls silencer. The sound pressure level is influenced by the individual systems used for reduction of noise emissions. Do not restrict the valve exhaust. Use of the product without the silencer is not recommended.
Minimum Operation Frequency	Once per month, to ensure proper function.

4. Prerequisites for Use of the Product

ATTENTION

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. 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 ambient temperature represents the permissible storage temperature and depends on the type of valve in question.

- ▶ Observe the temperature information in chapter 3 "Technical Specifications."

5.1. Mechanical Installation

If attaching to an installed ROSS MD3™ or MD4™ Air Preparation Unit, use (2) ROSS connection clamps. If installing as a stand-alone unit, use either (2) ROSS connection clamp and bracket sets or install fittings directly into the inlet and outlet ports.

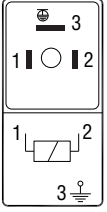
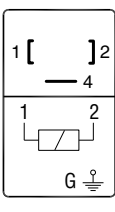
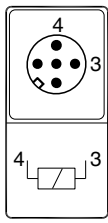
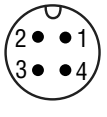
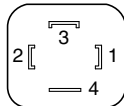
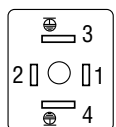
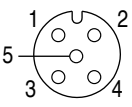
Visit www.rosscontrols.com for more information.

5.2. Pneumatic Installation

Connect the compressed air supply to port 1. Connect port 2 to the downstream portion of the circuit. Connect the silencer to port 3.

5.3. Electrical Connections

Electrical connections to the solenoid are made with DIN EN 175301-803 Form A, Form C or M12, and to sensor with female 5-pin M12 receptacles on the valve. Connectors and cables are sold separately. The cables and cable connections as well as the electrical control for the valve must comply with the applicable safety regulations.

Solenoid Pinouts	
DIN EN 175301-803 Form C	DIN EN 175301-803 Form A
 1 - Positive 2 - Negative 3 - Ground	 1 - Positive 2 - Negative 4 - Ground
M12	
 3 - Positive 4 - Negative	
Pressure Switch Pinout	
 1, 2, 3, 4 - Pin PNP - Switched Positive NO - Normally Open NC - Normally Closed	
Connector Pinouts	
DIN EN 175301-803 Form A	
 1 - Black 2 - Black 4 - Green/Yellow (Ground)	
DIN EN 175301-803 Form C	
 1 - Brown 2 - Blue 3 - Green/Yellow (Ground) 4 - Green/Yellow (Ground)	
M12	
 1 - Brown 2 - White 3 - Blue 4 - Black 5 - Grey	

6. Commissioning and Operation

CAUTIONS

Damage to health due to loud noise!

Levels above 70 dB(A) may lead to damage to health!

- ▶ Always wear ear protectors when working on the product.

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

Make sure that the technical specifications matches the operating criteria of the machine and/or the pneumatic system.

Always set the compressed air supply to a level that ensures that the minimum operating pressure is adhered to (see chapter 3 "Technical Specifications").

6.1. Test Procedure

(Sensor feedback only for valves equipped with pressure switch)

1. Solenoid de-energized.
Valve is off, supply is shut off, and downstream air is exhausted through port 3. Sensor is ON.
2. Solenoid energized.
Valve is on, air pressure is supplied downstream through port 2 and port 3 is shut off. Sensors is OFF.

Results from the test procedure other than those listed above could indicate a valve malfunction. See section 7 Maintenance, and section 8 Service & Repair.

Failure of the valve to shift leads to a fault in the MDC Series valve.

This could happen for a variety of reasons, such as:

- Defective piston seals
- Main valve element experiencing a switching delay due to dirt or resinous oil
- Insufficient electrical signal to valve solenoid and/or sensor; suitable voltage not available
- Pilot valve experiencing a switching delay due to damaged components, dirt, or resinous oil
- Excessive water build-up in the valve.

7. Maintenance

- ▶ Unless otherwise required, ROSS® recommends performing a functional test at least once a month.

8. Service & Repair

- ▶ In case of technical problems or a required repair, please contact your local ROSS representative. If used properly, the MDC Series valves will not require maintenance.

9. Disconnecting and Removal

CAUTIONS

Risk of injury due to disconnecting while pressurized or with live parts!

Disconnecting while pressurized or with electrical power switched on can result in injuries or death due to sudden pressure release, unexpected movement, or electric shock.

- ▶ De-energize and de-pressurize the relevant system parts before disconnecting the valve.
- ▶ Isolate and lock out the system to prevent it from being switched back on again before disconnecting the valve.

10. Disposal

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



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