



M35 SERIES SAFE EXHAUST DOUBLE VALVES



INTEGRATION GUIDE

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Disclaimer:

Sample Logic and any and all related diagrams contained in ROSS Controls' Integration guide were developed and validated using dual channel electro-mechanical input signals in a laboratory environment and are provided to you for illustrative purposes only. Because of the many variables and unique requirements associated with any particular application, all persons responsible for installing and integrating ROSS products must satisfy themselves that the ROSS product is the correct product for the application and operates as intended. Because of the variability described above, ROSS Controls cannot assume responsibility or liability for actual use of its products based upon samples, examples and diagrams contained in its websites and documents.

Introduction

ROSS Controls offers a variety of safety valves for use in various safety functions such as safe exhaust, safe cylinder return, and safe load holding/stop. This document focuses specifically on ROSS Controls' M35 Series valves that are used for safe exhaust functions and utilize solid state pressure sensors to provide feedback to a safety control system for external monitoring.

Pulse Testing

In dual channel safety circuits, pulse testing is a method utilized to detect fault conditions that, otherwise, may be undetected. Pulse testing of the solenoids is required in dual channel circuits in order to reach performance level e (PL e). However, pulse testing of the feedback sensors is not required. Pulse testing of the solenoids will not affect the performance of the ROSS M35 valve.

There are two methods of pulse testing outputs. The most common method is to use the native pulse testing instruction embedded by the manufacturer in Safety PLCs and Safety Relays. The other method is to use custom programming code generated by the user. We recommend the use of native pulse testing instructions of the respective manufacturers' Safety PLCs or Safety Relays because these instructions are fixed and cannot be tampered with. These instructions typically have a frequency of 400ms to 600ms and a duration of 0.4ms to 0.8ms. Pulse testing the outputs to the solenoids on the M35 valve at this frequency and duration does not affect the performance of the valve, but does provide a method to monitor for the occurrence of wiring faults in the output portion of the safety circuit controlling the valve solenoids.

Exhaust Times and Faulted Flow Rates

When designing a safety circuit, the machine stopping time is a critical factor that determines the placement of guarding solutions. One factor in safe distance calculations is the exhaust time of the valve that is responsible for isolating and dumping the pneumatic energy from the machine. The faster your valve exhausts the quicker the machine can stop and the closer your safety devices may be placed to the hazardous area. This can improve overall operating efficiency, and possibly allow the footprint of the machine to be smaller.

Even more important than exhaust time is the "Faulted exhaust flow rate". Faulted exhaust flow rate is the exhaust rate of the valve in its worst state. Double valves (redundant valve systems used for safety applications) will not exhaust quite as quickly when there is an internal fault condition in the valve, such as when one of the redundant valve components is actuated and the other one is not actuated. For this reason, double valves used in safety circuits should always be sized using faulted flow rates as the worst case condition.

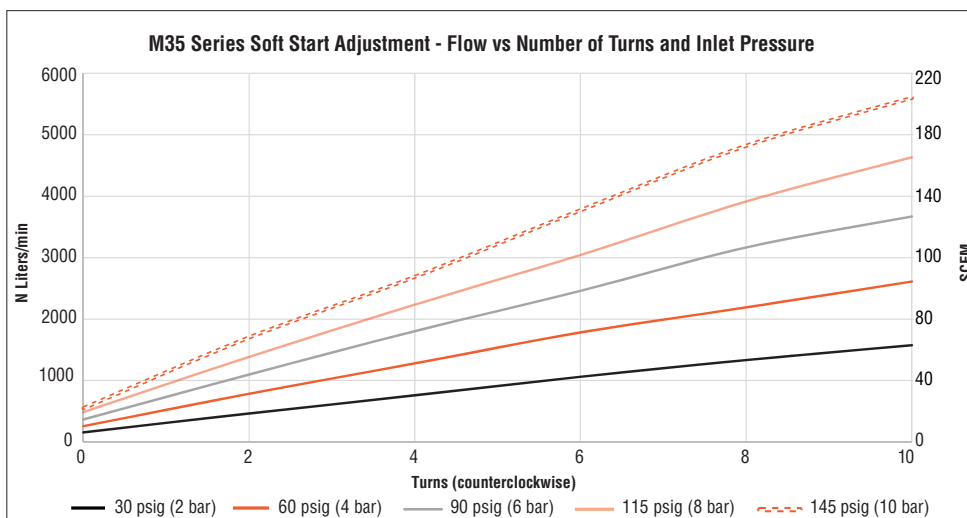
The chart below shows the M35 valve's very high-flow faulted exhaust flow times at various downstream volumes and operating pressures.

Exhaust Time – Normal and Faulted Conditions (s)							
Volume ft ³ (L)	Normal or Faulted	Operating Pressure					
		30 psig (2 bar)		90 psig (6 bar)		145 psig (10 bar)	
		to 15 psig (1 bar)	to 7 psig (0.5 bar)	to 15 psig (1 bar)	to 7 psig (0.5 bar)	to 15 psig (1 bar)	to 7 psig (0.5 bar)
0.071 (2)	N	0.055	0.071	0.094	0.112	0.120	0.135
	F	0.072	0.098	0.147	0.183	0.200	0.247
0.35 (10)	N	0.131	0.208	0.317	0.393	0.424	0.507
	F	0.185	0.301	0.533	0.710	0.789	1.024
0.71 (20)	N	0.226	0.379	0.597	0.746	0.804	0.971
	F	0.326	0.555	1.016	1.368	1.526	1.997
1.41 (40)	N	0.416	0.721	1.155	1.451	1.564	1.899
	F	0.608	1.063	1.983	2.685	3.000	3.941
5.30 (150)	N	1.462	2.604	4.227	5.326	5.743	7.006
	F	2.160	3.855	7.298	9.929	11.107	14.635

Soft Start Adjustment

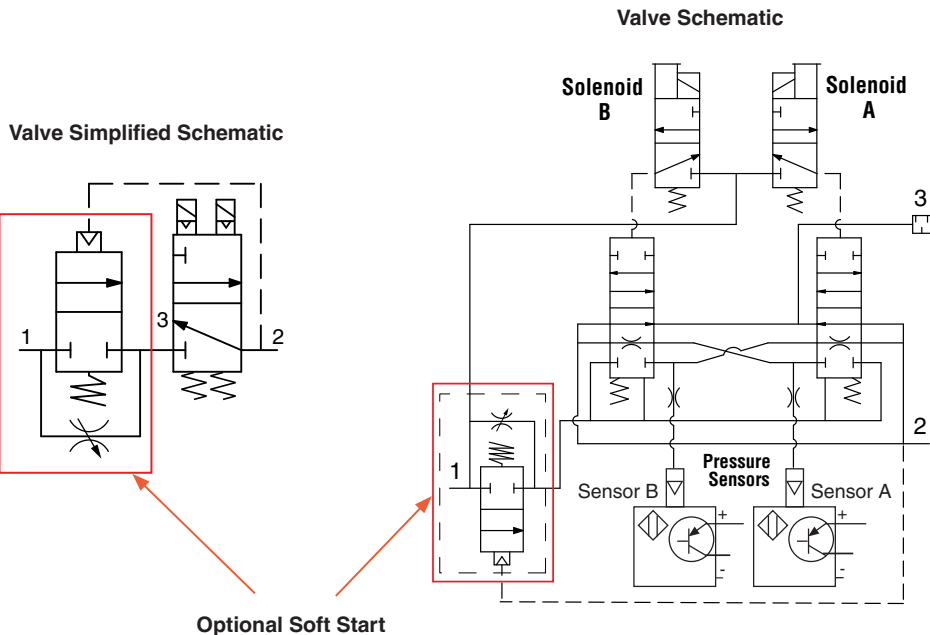
The function of the optional EEZ-ON® (soft start) module is to, on energization, allow outlet pressure to increase at a slower than normal rate until it reaches approximately 50% of inlet pressure, at which point the valve will then open fully to finish filling the system at full flow rate. This feature can be used to lessen the shock of sudden, rapid pressurization of cylinders, and to gradually refill the system.

The EEZ-ON® module has an adjusting screw that is used to control the rate of pressurization according to number of turns and inlet pressure. The chart below can be used to approximate the number of turns (clockwise from full open) it will take in order to adjust the soft start for your system. The necessary setting is dependent upon the number of turns, inlet pressure, and downstream volume to be filled by the valve.



Pneumatic Schematic

The ROSS M35 valve schematic shows patented cross flow technology and solid state pressure sensors for status feedback. The red box highlights the optional soft-start in the unit.



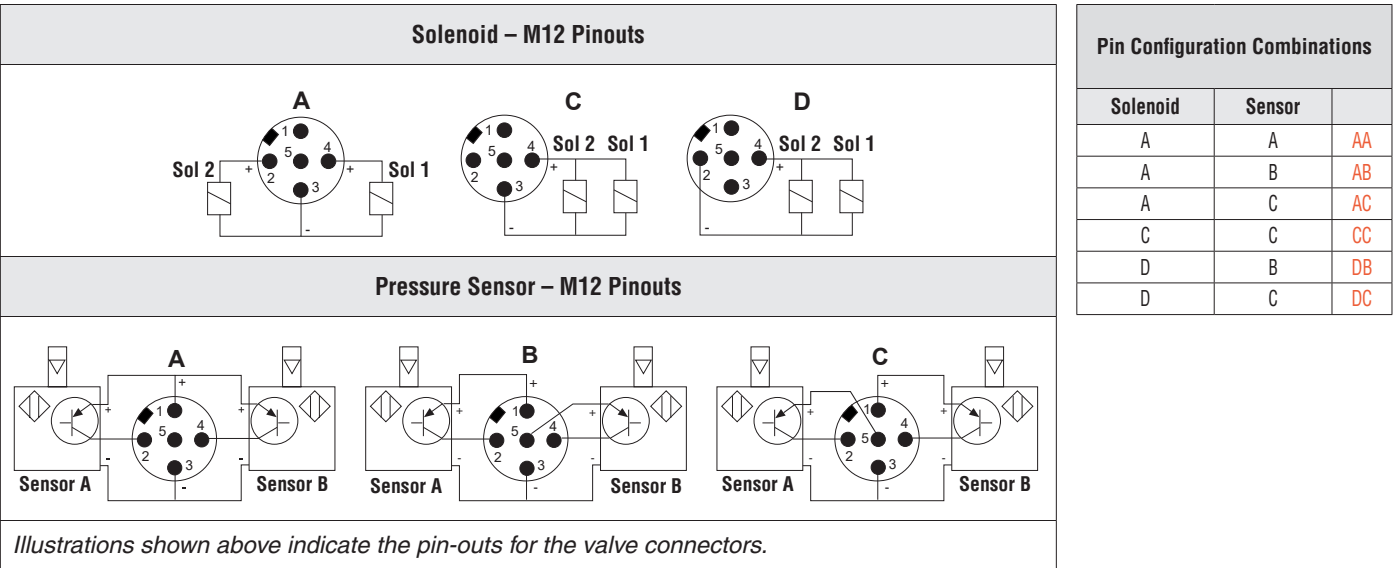
M35 Wiring (Pinouts)

The M35 valve is available with various wiring options for both the solenoid cable and the sensor cable. For example, the following model number is wired internally with the DB wiring option:

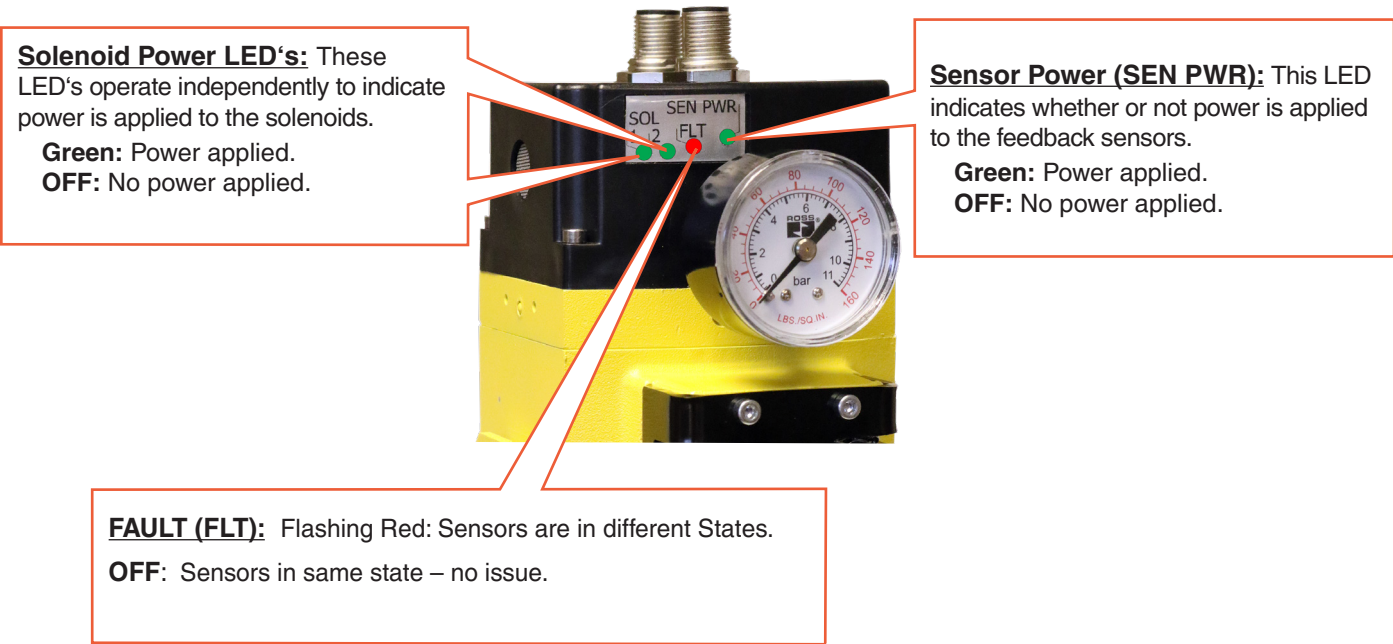
Model Number: M35S40GAEX**DB**GA

This means the valve in this example is wired with the D solenoid configuration and the B Sensor configuration. Use these diagrams to determine the proper pinouts for your valve.

NOTE: The sensors must be wired with 24 volt (+) and 0 volt (-) connections in parallel as shown below. See Pressure Sensor M12 pinouts below.



M35 LED Status Lights (Operation)



Operation & Monitoring Requirements for M35 Valves

The intent of this document is to provide guidance on how to operate and monitor the M35 valve for safe operation. A test procedure is also provided for verification and validation of the user's external safety control monitoring system.

Valve Operation

The M35 valve is a redundant safety exhaust (dump) valve. Its function is that of a 3/2, normally closed, single-solenoid valve. However, because the valve is redundant it has two operating solenoids that must be operated simultaneously in order to actuate the valve. In addition, each valve element has a single, pressure sensor that is wired as a PNP type sensor (each to be wired in parallel with the other sensor - not in series) to indicate position of each element.

Actuating the valve will supply pressure from port 1 (supply) to port 2 (outlet) and close port 3 (exhaust).

De-actuating the valve will close port 1 (supply) and open port 2 (outlet) to port 3 (exhaust). De-actuation of the valve is accomplished by turning off both solenoids simultaneously.

Normal operation occurs when both sets of valve internals shift within 50 msec of each other. For example, when both solenoids are signaled to energize, we would expect both pressure sensors to turn off within 50 msec of each other. Each sensor only reacts to its associated solenoid.

In the event of a valve fault where one of the redundant valve components does not operate synchronously as commanded, the valve will perform its safety function which is to shut off supply and exhaust downstream pressure to atmosphere.

The fault should be latched in by the safety monitoring system until a reset is performed.

Failure of the valve to shift synchronously leads to a fault in the M35 valve. This could happen for a variety of reasons, such as:

- Compromised piston seals
- Main valve elements experiencing a switching delay due to dirt, debris or resinous oil
- Insufficient electrical signals to valve solenoids; suitable voltage not available
- Receipt of signals at solenoids not synchronous
- Pilot valves experiencing a switching delay due to damaged components, dirt, debris or resinous oil
- Excessive water build-up in the valve

Feedback Monitoring (General)

The M35 valve is equipped with pressure sensors that must be monitored by the user's external safety control & monitoring system to detect any fault condition within the valve.

NOTE: The pressure sensors are transducers with a discrete pressure switch point that is factory set and non-adjustable.

A pressure sensor (wired as a PNP) is associated with each one of the redundant valve elements for valve position sensing. Sensor feedback should always be opposite the solenoid actuating signals. In other words, when the solenoids are energized, the sensor outputs should be off and when the solenoids are de-energized, the sensor outputs should be on.

This valve uses pressure-based feedback sensing technology. Downstream pressure build-up time is subject to several application parameters including, but not limited to supply pressure, outlet volume, pipe size, and soft-start setting. Additionally, downstream exhaust time is also subject to various factors such as downstream pressure, outlet volume, and pipe size. Therefore, reaction times of the feedback pressure sensors to actuation/de-actuation signals are application specific.

WARNING: It is possible to operate at a cycle rate that could result in non-monitored operation. To prevent exceeding this rate, ensure that the valve is de-actuated (both sensor outputs should be on) before attempting to energize the solenoids. Likewise, ensure that the valve is actuated (both sensor outputs should be off) before attempting to de-energize the solenoids.

NOTE: In the event of a stop signal from any safety system input, the safety system should immediately shut off the safety controller outputs to the valve solenoids (as required by the application) regardless of the condition of the feedback sensors.

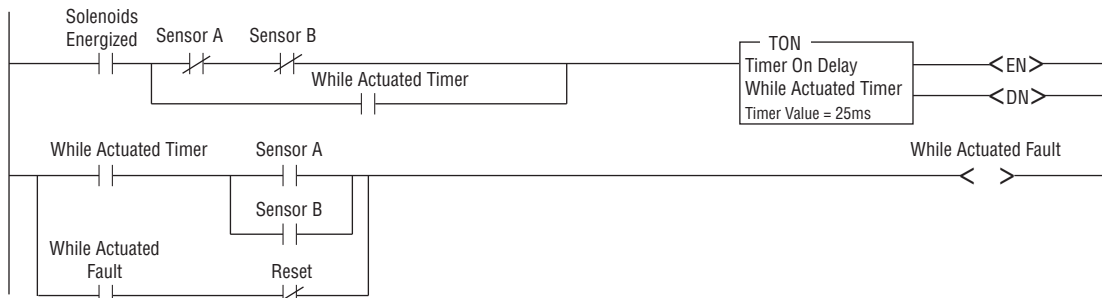
Refer to EN ISO13849-1 for Cat 3 vs Cat 4 monitoring.

Automatic RESET is not recommended by ROSS.

While Actuated

During normal actuation it is possible to see a momentary pressure spike in the sensing area (typically 10 msec duration or less) which causes the sensors to momentarily switch off, then back on before switching off again for the duration of the actuation signal. In order to consider the valve successfully actuated, both sensors should switch off and remain off for at least 25 msec. However, once the valve is successfully actuated, if either sensor switches from off to on, this should immediately be registered as a fault.

While Actuated Ladder Logic Example

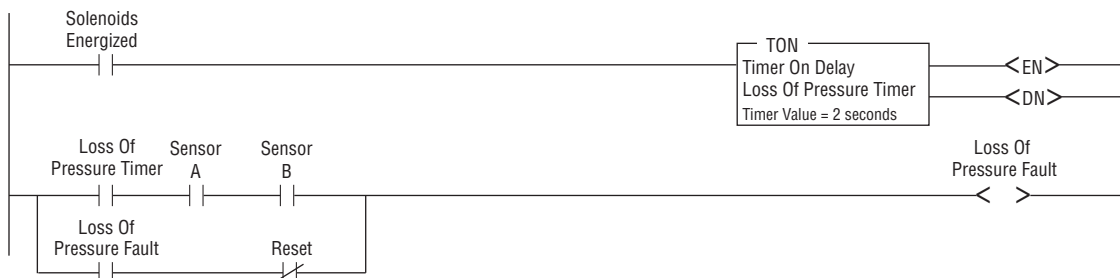


No Supply Pressure During Actuation / Loss of Supply Pressure While Actuated

The condition of no supply pressure during actuation should be detected by the safety control monitoring system and registered as a fault. No supply pressure present during actuation will cause the sensors to remain off (not sensing pressure) even though the solenoids are energized. However, during normal actuation, there is a reaction time that must be allowed for between energizing the solenoids and the sensors switching on (sensing pressure). This time will vary depending on supply pressure, outlet volume, pipe size, and soft-start setting. A 2-second delay to account for this reaction time can be used for most applications, but may need to be longer if necessary for your application parameters.

The condition of loss of supply pressure while the valve is actuated must be detected by the safety control monitoring system. Loss of supply pressure while actuated should cause both sensors to switch on due to lack of pressure in both valves' outlet port even though the valve is still energized. This fault can be detected when the solenoids are energized and one or both sensors go from off (sensing pressure) to on (not sensing pressure).

No Supply Pressure During Actuation / Loss of Supply Pressure While Actuated Ladder Logic Example



No Supply Pressure Applied Before Actuation

Monitoring of supply pressure may also be utilized if deemed beneficial for the application, but is not required. If you choose to detect this condition it would require the addition of an upstream pressure switch or transducer. The condition of the pressure switch or transducer should be monitored to prevent actuation of the valve when supply pressure is insufficient.

NOTE: No ladder logic example provided for additional equipment.

Valve Fault & Safety System Reset

Any detected fault in the valve system should cause the safety control system to de-actuate the valve by removing power from both solenoids. Any fault should be latched in by the safety monitoring system until a reset is performed. A reset of the safety control system should only be possible after the valve sensors indicate that the valve is in the de-actuated state (both sensor outputs are on). The valve solenoids must be de-energized during Reset.

Safety System Reset Ladder Logic Example



M35 Validation Test Procedure for Valve Operation and External Monitoring Logic

NOTE 1:	This validation test procedure should only be performed with an M35 valve that is known to be functioning properly. If basic valve function is in question please refer to Section 8 of the Product Operating Instructions for the Valve Test Procedure.
NOTE 2:	These procedures require fault simulation. It will be necessary to induce faults electrically by disabling a different solenoid or sensor at different times. This will be most easily done by disconnecting solenoid or sensor wires at the safety controller. Also, be aware that this would only be possible with solenoid wiring option A. See product data sheet.
NOTE 3:	Power for the sensor/LED board needs to be maintained throughout the entire procedure. Pins 1 and 3 must remain connected at all times during this validation test.
NOTE 4:	If FLT light is flashing and either or both solenoid lights are ON – it indicates the monitoring logic is not properly detecting this fault. The M35 unit should be powered down and monitoring logic reviewed and re-tested before putting into operation again.
NOTE 5:	If FLT light is flashing and both solenoid lights are OFF – it indicates the unit has an internal malfunction and should be replaced before continuing operation.
NOTE 6:	Port 2 should be connected to a small volume of approximately 20 cubic inches (~ 300 cubic centimeters) with a gauge or pressure sensor teed into the line.
NOTE 7:	Supply pressure will need to be supplied to inlet port 1. Insufficient supply flow and/or maximum soft-start settings (adjustment screw almost all the way in) could prevent detection of some induced faults during the validation test. Be sure not to restrict inlet flow with undersized piping/tubing. Also, begin testing with the soft start screw backed all the way out - counter-clockwise).
NOTE 8:	“-” Indicates no change from previous step.
NOTE 9:	Actuate Signal is the signal to switch on the solenoids either from a physical input switch or a software signal.

Step	Action	Sensor Power LED	Actuate Signal	Solenoid LEDs		Port Conditions	Outlet Pressure	Sensor Conditions		Safety System Fault	Valve Fault LED	Pass/Fail (P/F)
			Sol A & Sol B	Sol A	Sol B			Sensor A	Sensor B			
1	Energize solenoids A & B	Green	ON	Green	Green	1 to 2 3	Pressure	OFF	OFF	No	OFF	
2	De-energize solenoids A & B	Green	OFF	OFF	OFF	1 2 to 3	None	ON	ON	-	-	
3	Disconnect solenoid signal wire from solenoid B	Green	OFF	OFF	OFF	1 2 to 3	None	ON	ON	No	OFF	
4	Attempt to energize solenoids A & B	Green	ON	-	-	-	-	-	-	Yes*	-	
5	Reconnect solenoid B	Green	-	-	-	-	-	-	-	-	-	
6	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
7	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	
8	Disconnect solenoid signal wire from solenoid A	Green	OFF	OFF	OFF	1 2 to 3	None	ON	ON	No	OFF	
9	Attempt to energize solenoids A & B	Green	ON	-	-	-	-	-	-	Yes*	-	
10	Reconnect solenoid A	Green	-	-	-	-	-	-	-	-	-	
11	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
12	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	
13	Energize solenoids A & B	Green	ON	Green	Green	1 to 2 3	Pressure	OFF	OFF	No	OFF	
14	Disconnect solenoid signal wire from solenoid A	Green	-	OFF	OFF	1 2 to 3	None	ON	ON	Yes**	-	
15	Reconnect solenoid A	Green	-	-	-	-	-	-	-	-	-	
16	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
17	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	

* Fault should be detected within 50 msec.

** Fault should occur immediately.

Step	Action	Sensor Power LED	Actuate Signal	Solenoid LEDs		Port Conditions	Outlet Pressure	Sensor Conditions		Safety System Fault	Valve Fault LED	Pass/Fail (P/F)
			Sol A & Sol B	Sol A	Sol B			Sensor A	Sensor B			
18	Energize solenoids A & B	Green	ON	Green	Green	1 to 2 3	Pressure	OFF	OFF	No	OFF	
19	Disconnect solenoid signal wire from solenoid B	Green	-	OFF	OFF	1 2 to 3	None	ON	ON	Yes**	-	
20	Reconnect solenoid B	Green	-	-	-	-	-	-	-	-	-	
21	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
22	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	
23	Disconnect sensor output wire from sensor A	Green	OFF	OFF	OFF	1 2 to 3	None	OFF	ON	Yes*	OFF	
24	Attempt to energize solenoids A & B	Green	ON	-	-	-	-	-	-	-	-	
25	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
26	Reconnect sensor A	Green	-	-	-	-	-	ON	-	-	-	
27	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	
28	Disconnect sensor output wire from sensor B	Green	OFF	OFF	OFF	1 2 to 3	None	ON	OFF	Yes*	OFF	
29	Attempt to energize solenoids A & B	Green	ON	-	-	-	-	-	-	-	-	
30	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
31	Reconnect sensor B	Green	-	-	-	-	-	-	ON	-	-	
32	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	
33	Energize solenoids A & B	Green	ON	Green	Green	1 to 2 3	Pressure	OFF	OFF	No	OFF	
34	Disconnect sensor output wire from sensor A	Green	-	-	-	-	-	-	-	-	-	
35	De-energize solenoids A & B	Green	OFF	OFF	OFF	1 2 to 3	None	-	ON	Yes*	-	
36	Reconnect sensor A	Green	-	-	-	-	-	ON	-	-	-	
37	Attempt to energize solenoids A & B	Green	ON	-	-	-	-	-	-	-	-	
38	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
39	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	
40	Energize solenoids A & B	Green	ON	Green	Green	1 to 2 3	Pressure	OFF	OFF	No	OFF	
41	Disconnect sensor output wire from sensor B	Green	-	-	-	-	-	-	-	-	-	
42	De-energize solenoids A & B	Green	OFF	OFF	OFF	1 2 to 3	None	ON	-	Yes*	-	
43	Reconnect sensor B	Green	-	-	-	-	-	-	ON	-	-	
44	Attempt to energize solenoids A & B	Green	ON	-	-	-	-	-	-	-	-	
45	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
46	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	
47	Remove supply air from port 1	Green	OFF	OFF	OFF	1 2 to 3	None	ON	ON	No	OFF	
48	Energize solenoids A & B	Green	ON	-	-	-	-	-	-	Yes***	-	
49	Resupply air to port 1	Green	ON	-	-	-	-	-	-	-	-	
50	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
51	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	

* Fault should be detected within 50 msec.

** Fault should occur immediately.

*** Fault should occur after 2 seconds.

Step	Action	Sensor Power LED	Actuate Signal	Solenoid LEDs		Port Conditions	Outlet Pressure	Sensor Conditions		Safety System Fault	Valve Fault LED	Pass/Fail (P/F)
			Sol A & Sol B	Sol A	Sol B			Sensor A	Sensor B			
52	Energize solenoids A & B	Green	ON	Green	Green	1 to 2 3	Pressure	OFF	OFF	No	-	
53	Remove supply air from port 1	Green	-	OFF	OFF	1 2 to 3	None	ON	ON	Yes**	-	
54	Resupply air to port 1	Green	-	-	-	-	-	-	-	-	-	
55	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
56	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	
57	Disconnect sensor output wire from sensor A	Green	OFF	OFF	OFF	1 2 to 3	None	OFF	ON	Yes*	OFF	
58	Attempt to reset the safety control system	Green	-	-	-	-	-	-	-	-	-	
59	Attempt to energize solenoids A & B	Green	ON	-	-	-	-	-	-	-	-	
60	Reconnect sensor A	Green	-	-	-	-	-	ON	-	-	-	
61	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
62	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	
63	Energize solenoids A & B	Green	ON	Green	Green	1 to 2 3	Pressure	OFF	OFF	-	-	
64	De-energize solenoids A & B	Green	OFF	OFF	OFF	1 2 to 3	None	ON	ON	-	-	
65	Disconnect sensor output wire from sensor B	Green	OFF	OFF	OFF	1 2 to 3	None	ON	OFF	Yes*	OFF	
66	Attempt to reset the safety control system	Green	-	-	-	-	-	-	-	-	-	
67	Attempt to energize solenoids A & B	Green	ON	-	-	-	-	-	-	-	-	
68	Reconnect sensor B	Green	-	-	-	-	-	-	ON	-	-	
69	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
70	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	
71	Energize solenoids A & B	Green	ON	Green	Green	1 to 2 3	Pressure	OFF	OFF	-	-	
72	De-energize solenoids A & B	Green	OFF	OFF	OFF	1 2 to 3	None	ON	ON	-	-	
Items 73 through 80 could also be done with Sensor B instead of Sensor A.												
73	Disconnect sensor output wire from sensor A	Green	OFF	OFF	OFF	1 2 to 3	None	OFF	ON	Yes*	OFF	
74	Reconnect sensor A	Green	-	-	-	-	-	ON	-	-	-	
75	Attempt to energize solenoids A & B	Green	ON	-	-	-	-	-	-	-	-	
76	Attempt to reset the safety control system	Green	-	-	-	-	-	-	-	-	-	
77	De-energize solenoids A & B	Green	OFF	-	-	-	-	-	-	-	-	
78	Reset the safety control system	Green	-	-	-	-	-	-	-	No	-	
79	Energize solenoids A & B	Green	ON	Green	Green	1 to 2 3	Pressure	OFF	OFF	-	-	
80	De-energize solenoids A & B	Green	OFF	OFF	OFF	1 2 to 3	None	ON	ON	-	-	

* Fault should occur within 50 msec.

** Fault should occur immediately.

Notes



Notes

Notes



CAUTIONS, WARNINGS And STANDARD WARRANTY

ROSS OPERATING VALVE, ROSS CONTROLS®, ROSS DECCO®, and AUTOMATIC VALVE INDUSTRIAL, collectively the “ROSS Group”.

PRE-INSTALLATION or SERVICE

1. Before servicing a valve or other pneumatic component, be sure all sources of energy are turned off, the entire pneumatic system is shut down and exhausted, and all power sources are locked out (ref: OSHA 1910.147, EN 1037).
2. All ROSS Group Products, including service kits and parts, should be installed and/or serviced only by persons having training and experience with pneumatic equipment. Because any product can be tampered with and/or need servicing after installation, persons responsible for the safety of others or the care of equipment must check ROSS Group Products on a regular basis and perform all necessary maintenance to ensure safe operating conditions.
3. All applicable instructions should be read and complied with before using any fluid power system to prevent harm to persons or equipment. In addition, overhauled or serviced valves must be functionally tested prior to installation and use. If you have any questions, call your nearest ROSS Group location.
4. Each ROSS Group Product should be used within its specification limits. In addition, use only ROSS Group components to repair ROSS Group Products.

WARNINGS:

Failure to follow these instructions can result in personal injury and/or property damage.

FILTRATION and LUBRICATION

1. Dirt, scale, moisture, etc., are present in virtually every air system. Although some valves are more tolerant of these contaminants than others, best performance will be realized if a filter is installed to clean the air supply, thus preventing contaminants from interfering with the proper performance of the equipment. The ROSS Group recommends a filter with a 5-micron rating for normal applications.
2. All standard ROSS Group filters and lubricators with polycarbonate plastic bowls are designed for compressed air applications only. Use the metal bowl guard, where provided, to minimize danger from high pressure fragmentation in the event of bowl failure. Do not expose these products to certain fluids, such as alcohol or liquefied petroleum gas, as they can cause bowls to rupture, creating a combustible condition and hazardous leakage. Immediately replace crazed, cracked, or deteriorated bowls.
3. Only use lubricants which are compatible with materials used in the valves and other components in the system. Normally, compatible lubricants are petroleum base oils with oxidation inhibitors, an aniline point between 180°F (82°C) and 220°F (104°C), and an ISO 32, or lighter, viscosity. Avoid oils with phosphate

type additives which can harm polyurethane components, potentially leading to valve failure which risks personal injury, and/or damage to property.

WARNINGS:

Failure to follow these instructions can result in personal injury and/or property damage.

AVOID INTAKE/EXHAUST RESTRICTION

1. Do not restrict air flow in the supply line. To do so could reduce the pressure of the supply air below minimum requirements for the valve and thereby causing erratic action.
2. Do not restrict a valve's exhaust port as this can adversely affect its operation. Exhaust silencers must be resistant to clogging and must have flow capacities at least as great as the exhaust capacities of the valves. Contamination of the silencer can result in reduced flow and increased back pressure.

WARNINGS: ***Failure to follow these instructions can result in personal injury and/or property damage.***

SAFETY APPLICATIONS

1. Mechanical Power Presses and other potentially hazardous machinery using a pneumatically controlled clutch and brake mechanism must use a press control double valve with a monitoring device. A double valve without a self-contained monitoring device should be used only in conjunction with a control system which assures monitoring of the valve. All double valve installations involving hazardous applications should incorporate a monitoring system which inhibits further operation of the valve and machine in the event of a failure within the valve mechanism.
2. Safe Exhaust (dump) valves without a self-contained monitoring device should be used only in conjunction with a control system which assures monitoring of the valve. All Safe Exhaust valve installations should incorporate a monitoring system which inhibits further operation of the valve and machine in the event of a failure within the valve mechanism.
3. Per specifications and regulations, the ROSS L-O-X® and L-O-X® with EEZ-ON®, N06 and N16 Series operation products are defined as energy isolation devices, NOT AS EMERGENCY STOP DEVICES.

WARNINGS:

Failure to follow these instructions can result in personal injury and/or property damage.

STANDARD WARRANTY

All products sold by the ROSS Group are warranted for a one-year period [with the exception of Filters, Regulators and Lubricators (“FRLs”) which are warranted for a period of seven (7) years] from the date of purchase. All products are, during their respective warranty periods, warranted to be free of defects in material and workmanship. The ROSS Group's obligation under this warranty is limited to repair, replacement or refund of the purchase price paid for products which the ROSS Group has determined, in its sole discretion, are defective. All warranties become void if a product has been subject to misuse, misapplication, improper maintenance, modification or tampering. Products for which warranty protection is sought must be returned to the ROSS Group freight prepaid.

THE WARRANTY EXPRESSED ABOVE IS IN LIEU OF AND EXCLUSIVE OF ALL OTHER WARRANTIES AND THE ROSS GROUP EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES EITHER EXPRESSED OR IMPLIED WITH RESPECT TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THE ROSS GROUP MAKES NO WARRANTY WITH RESPECT TO ITS PRODUCTS MEETING THE PROVISIONS OF ANY GOVERNMENTAL OCCUPATIONAL SAFETY AND/OR HEALTH LAWS OR REGULATIONS. IN NO EVENT IS THE ROSS GROUP LIABLE TO PURCHASER, USER, THEIR EMPLOYEES OR OTHERS FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM A BREACH OF THE WARRANTY DESCRIBED ABOVE OR THE USE OR MISUSE OF THE PRODUCTS. NO STATEMENT OF ANY REPRESENTATIVE OR EMPLOYEE OF THE ROSS GROUP MAY EXTEND THE LIABILITY OF THE ROSS GROUP AS SET FORTH HEREIN.



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