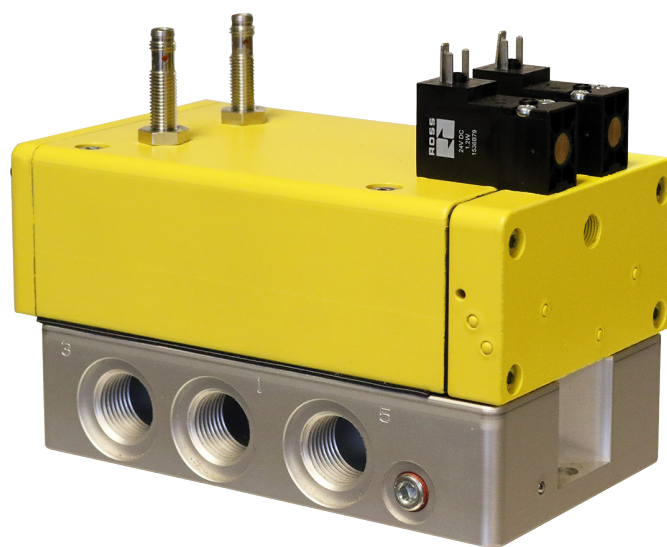




RSe SERIES DOUBLE VALVES FOR SAFE RETURN DUAL PRESSURE APPLICATIONS



INTEGRATION GUIDE

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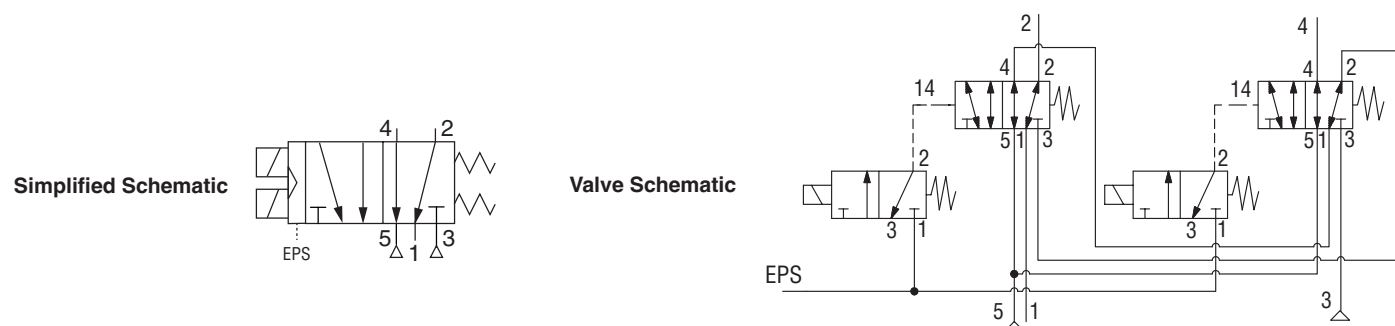
Disclaimer:

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 return, and safe load holding/stop. This document focuses specifically on ROSS CONTROLS' 5/2 RSe Series valves that are used for dual pressure safe cylinder return functions and utilize magnetic proximity sensors (PNP) to provide feedback to a safety control system for external monitoring.

The intent of this document is to provide guidance on how to connect, operate, and monitor the 5/2 RSe when used in Safe Return Dual Pressure applications. Using the 5/2 RSe as a Safe Return Dual Pressure control valve requires the valve to be converted to external pilot supply and the normal exhaust ports (3 and 5) will be used for pressure supply. Port 1 will be used as the exhaust port. The RSe valve will then be setup so as to supply a different pressure to extend than to retract. A test procedure is also provided for verification and validation of the user's external safety control monitoring system.



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 5/2 RSe 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 pulse period (cycle) of 400 ms to 600 ms and a pulse width of 0.4 ms to 0.8 ms. Pulse testing the outputs to the solenoids on the RSe 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.

Considerations for Safe Distance Calculations

In a dual pressure safe cylinder return application, the critical point of operation is that the valve, even if faulted, should reverse the condition of the work ports as quickly as possible. This means that when the valve is de-actuated or a fault occurs port 4 should begin to be pressurized and port 2 should begin to be exhausted as quickly as possible.

Increases in the time for this reversal to occur would be the worst-case scenario in this type of application. It would be expected that a difference in time to reverse these conditions would occur when the valve is faulted. Data indicates that of the three sizes of the 5/2 RSe valves there is an increase of at most 10 ms. This is only parts movement time based on the ISO 12238 standard for measuring valve response time.

There is also a corresponding reduction in Cv in both supplying port 4 and exhausting port 2 which will generate a net reduction in cylinder return speed. It is important to note that a precursor for safe cylinder return applications is that there should be no hazard in the reverse direction. Otherwise, a stop type solution (load holding) would have been required. Therefore, a slower retract may be desirable.

Safe Distance calculations should be validated by testing.

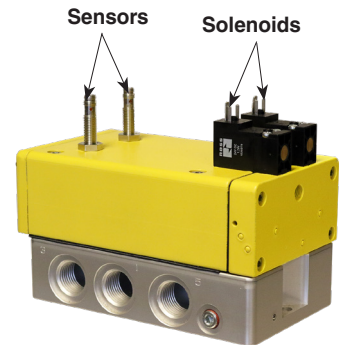
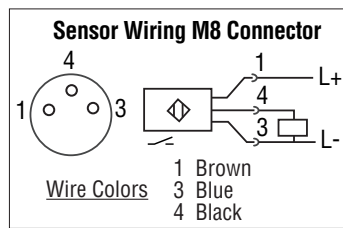
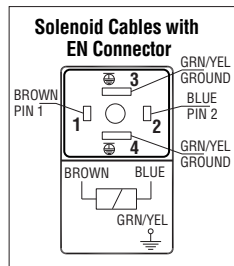
Cv Values				
Port Size	Normal		Faulted	
	1-2	4-5	1-2	4-5
1/8	0.82	0.87	0.64	0.63
1/4	1.09	1.14	0.83	0.69
1/2	3.83	3.48	1.54	1.39

De-actuation Time (time in ms from energized to valve in de-actuated position)		
Valve Basic Size	Normal Response	Faulted Response
1/8	50	51
1/4	86	95
1/2	209	227

RSe Wiring (Pinouts)

The RSe wiring connections are made via EN175301-803, Form C receptacles for the solenoids and male M8 receptacles on the sensors. Pinouts are shown below.

Solenoids & Position Sensors Pinouts



NOTE: The sensors must be wired with 24 volt (+) and 0 volt (-) connections in parallel with each other.

Pilot Supply Conversion

The RSe Series valve comes from the factory configured for internal pilot supply which sources pilot supply air pressure internally from port 1 in the valve sub-base. However, when used for dual pressure applications the valve **MUST** be converted in the field to operate with external pilot supply through the EPS port in the valve sub-base. When this conversion to external pilot supply is made, the valve solenoid pilots will get their supply air from a source that is independent of the supply 1 connected to port 5 and supply 2 connected to port 3.

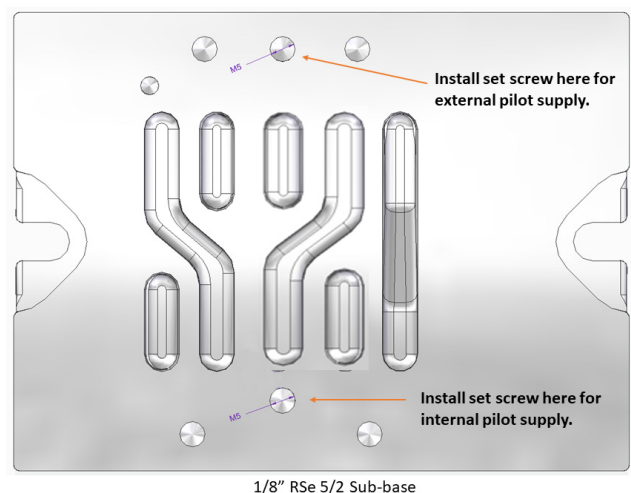
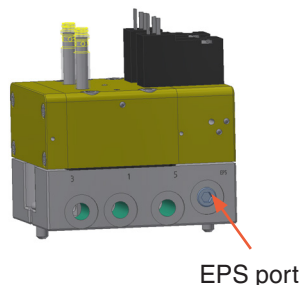
While external pilot supply is required when using the 5/2 RSE valve in a dual pressure application, caution should be taken to avoid unsafe situations. For example, when using external pilot supply, a loss of pressure in ports 3 and 5 while the valve is actuated could cause unexpected movement. In this situation, the valves will remain actuated by pressure from the external pilot source. This could allow both ports 2 and 4 to be exhausted, potentially causing unexpected motion. However, this situation can be detected through the addition of an upstream pressure switch or transducer in the main supply line to ports 3 and 5. Once a fault is detected, the safety control system should turn off the outputs to all the valve solenoids. See Loss of Supply Pressure While Actuated on page 7.

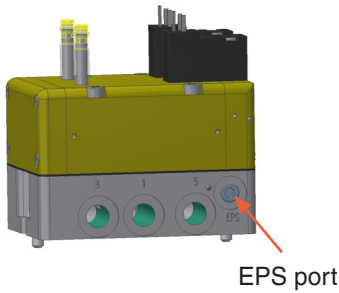
NOTE: A check valve can be installed in the RSe's supply lines to prevent loss of pressure in ports 2 and 4 of the valve in the event of loss of system pressure. This could prevent unexpected cylinder movement in this situation.

WARNING: Loss of supply pressure to the valve and cylinder could cause unexpected cylinder movement.

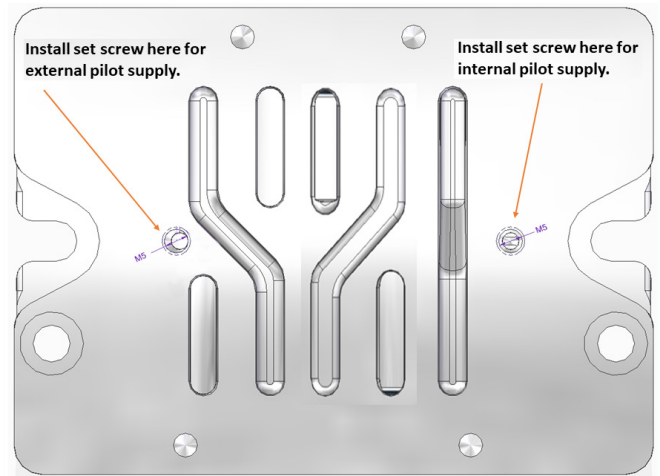
In order to convert the RSe valve to external pilot supply:

- Shut off and exhaust all pressure from the system and disconnect all electrical power from the valve.
- Remove the valve from the sub-base (4 screws). See photo below.
- Remove the set screw from the external pilot supply port in the top of the base. See figures below.
- Clean threads to remove any oil residue and apply a low or medium-strength thread-locking compound like Loctite 242. Install the set screw in the internal pilot supply flat with the base surface. Do not seat or tighten the set screw. Allow time for the compound to set and cure.
- Install an external pilot supply line into the EPS port in the side of the sub-base. The source for this external pilot supply should supply a constant supply of air with pressure greater than or equal to the supply pressure in Ports 3 and 5; 45 psig (3 bar) minimum.
- Re-install the valve on the sub-base (4 screws - max. torque 49 in-lbs (5.5 Nm)). See photo below.

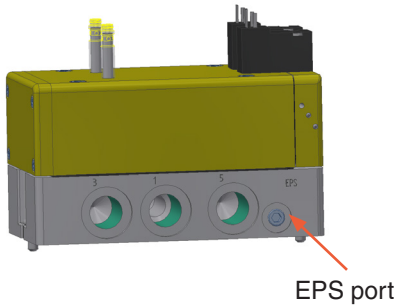




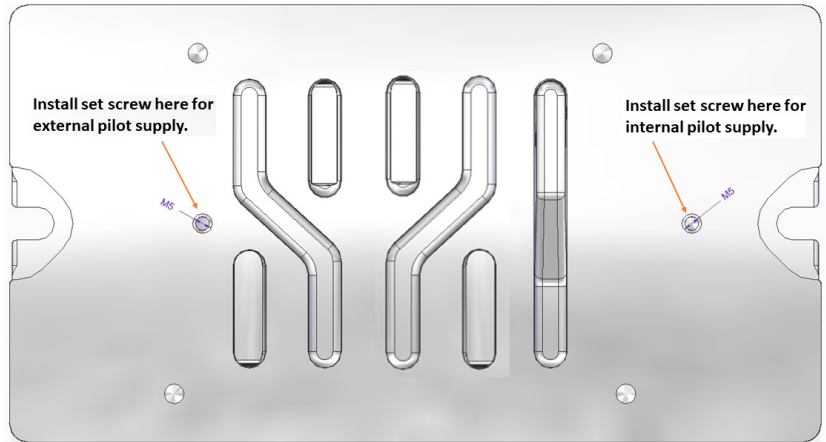
EPS port



1/4" RSe 5/2 Sub-base



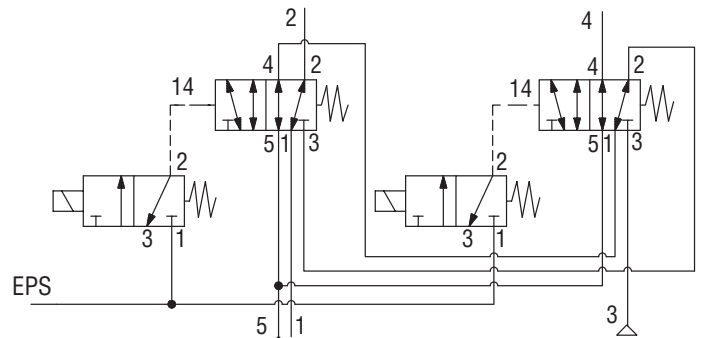
EPS port



1/2" RSe 5/2 Sub-base

Operation & Monitoring Requirements for 5/2 RSe Series Valves for Safe Return Dual Pressure Applications

Valve Schematic



Valve Operation

The 5/2 RSe valve used for safe return dual pressure applications is a redundant safe cylinder return valve. Its function is that of a 5/2, 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 proximity sensor that is wired as a PNP type sensor for position sensing. Actuating the valve will supply pressure from port 3 (supply 2) to port 2 (outlet) and open port 4 (outlet) to port 1 (exhaust). This also closes port 5 (supply 1).

De-actuating the valve will supply pressure from port 5 (supply 1) to port 4 (outlet) and open port 2 (outlet) to port 1 (exhaust). This also closes port 3 (supply 2). De-actuation of the valve is accomplished by turning off both solenoids simultaneously.

Normal operation occurs when both sets of valve internals shift within 250 msec of the change of the solenoid signals. For example, when both solenoids are signaled to energize, we would expect both proximity sensors to turn off within 250 msec of the application of the solenoid signals. 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 normally, as commanded, the valve will perform its safety function which is to default to supplying pressure from port 5 (supply 1) to port 4 (outlet) and open port 2 (outlet) to port 1 (exhaust). This also closes port 3 (supply 2).

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

Failure of the valve to shift normally leads to a fault in the 5/2 RSe dual pressure safe cylinder return 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 5/2 RSe valve is equipped with feedback proximity sensors that must be monitored by the user's external safety control & monitoring system to detect any fault condition within the valve. 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.

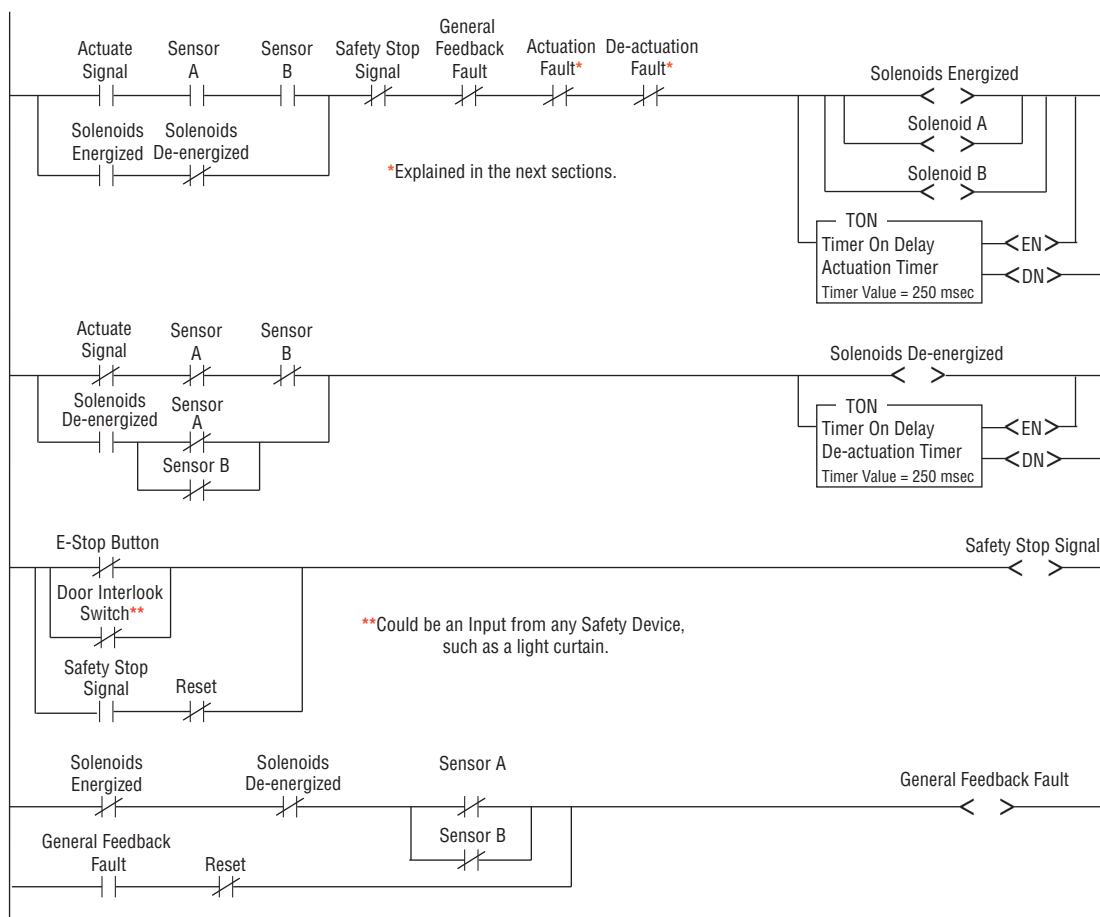
WARNING: It is possible to operate at a cycle rate that could result in non-monitored operation. To prevent exceeding this rate, ensure that the valve is de-actuated (both sensor outputs should be on) before attempting to energize the solenoids. Likewise, ensure that the valve is actuated (both sensor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

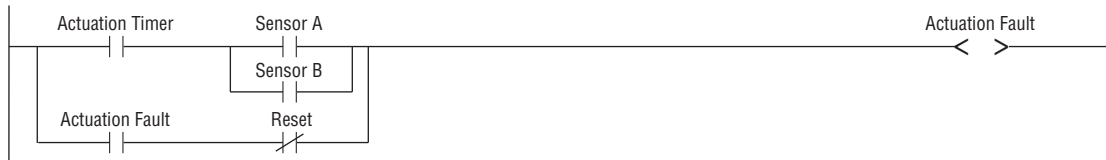
Valve Operation and General Feedback Monitoring Ladder Logic Example



Actuation Fault Monitoring

Actuation fault monitoring should check for actuation of both valves within 250 msec of the actuation signal. After the safety control system outputs provide simultaneous actuation signals to both solenoids, both sensor outputs should switch off within 250 msec. If both sensors have not changed state within the 250 msec timeframe, this should be registered as a valve fault.

Actuation Fault Monitoring Ladder Logic Example



De-Actuation Fault Monitoring

De-Actuation fault monitoring should check for de-actuation of both valves within 250 msec of the removal of the actuation signal. After the safety control system simultaneously removes the actuation signals from both solenoids, both sensor outputs should switch on within 250 msec. If both sensors have not changed state within the 250 msec timeframe, this should be registered as a valve fault.

De-actuation Fault Monitoring Ladder Logic Example



Loss of Supply Pressure While Actuated

The condition of loss of supply pressure to ports 3 or 5 while the valve is actuated must be detected by the safety control monitoring system if the loss of pressure creates a hazard.

WARNING: Loss of supply pressure to the valve will result in loss of downstream pressure.

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.

WARNING: Loss of supply pressure to the valve and cylinder could cause unexpected cylinder movement.

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



RSe (5/2) Safe Return Dual Pressure Application Validation Test Procedure for Valve Operation and External Monitoring Logic

NOTE 1:	This validation test procedure should only be performed with a 5/2 RSe 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 cables at the valve.
NOTE 3:	Supply pressure will need to be supplied to inlet ports 3 and 5. *Port 1 must remain open.
NOTE 4:	Outlet ports, 2 and 4, should be connected to a cylinder with a gauge or pressure sensor teed into each line. Or, just a gauge in each outlet port.
NOTE 5:	This procedure pertains to external pilot configuration only.
NOTE 6:	“-” indicates no change from previous step.
NOTE 7:	Actuate Signal is the signal to switch on the solenoids either from a physical input switch or a software signal.

Step	Action	Actuate Signal	Sol A	Sol B	Port Conditions	Outlet Pressure		Sensor Conditions		Cylinder Action	Fault ?	Pass/Fail
		Sol A & Sol B				Port 4	Port 2	Sensor A	Sensor B			(P/F)
1	Energize solenoids A & B	ON	ON	ON	3 to 2 4 to 1	None	Pressure	OFF	OFF	Extend	No	
2	De-energize solenoids A & B	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	ON	Retract	-	
3	Disconnect solenoid cable from solenoid B	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	ON	Retract	No	
4	Attempt to energize solenoids A & B	ON	-	-	-	-	-	-	-	-	Yes*	
5	Reconnect solenoid cable to solenoid B	-	-	-	-	-	-	-	-	-	-	
6	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
7	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	
8	Disconnect solenoid cable from solenoid A	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	ON	Retract	No	
9	Attempt to energize solenoids A & B	ON	-	-	-	-	-	-	-	-	Yes*	
10	Reconnect solenoid cable to solenoid A	-	-	-	-	-	-	-	-	-	-	
11	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
12	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	
13	Energize solenoids A & B	ON	ON	ON	3 to 2 4 to 1	None	Pressure	OFF	OFF	Extend	No	
14	Disconnect solenoid cable from solenoid A	-	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	ON	Retract	Yes**	
15	Reconnect solenoid cable to solenoid A	-	-	-	-	-	-	-	-	-	-	
16	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
17	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	
18	Energize solenoids A & B	ON	ON	ON	3 to 2 4 to 1	None	Pressure	OFF	OFF	Extend	No	
19	Disconnect solenoid cable from solenoid B	-	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	ON	Retract	Yes**	
20	Reconnect solenoid cable to solenoid B	-	-	-	-	-	-	-	-	-	-	
21	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
22	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	

* Fault should be detected within 250 msec.

** Fault should occur immediately.

Step	Action	Actuate Signal	Sol A	Sol B	Port Conditions	Outlet Pressure		Sensor Conditions		Cylinder Action	Fault ?	Pass/Fail
		Sol A & Sol B				Port 4	Port 2	Sensor A	Sensor B			(P/F)
23	Disconnect sensor cable from sensor A	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	OFF	ON	Retract	Yes**	
24	Attempt to energize solenoids A & B	ON	-	-	-	-	-	-	-	-	-	
25	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
26	Reconnect sensor cable to sensor A	-	-	-	-	-	-	ON	-	-	-	
27	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	
28	Disconnect sensor cable from sensor B	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	OFF	Retract	Yes**	
29	Attempt to energize solenoids A & B	ON	-	-	-	-	-	-	-	-	-	
30	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
31	Reconnect sensor cable to sensor B	-	-	-	-	-	-	-	ON	-	-	
32	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	
33	Energize solenoids A & B	ON	ON	ON	3 to 2 4 to 1	None	Pressure	OFF	OFF	Extend	No	
34	Disconnect sensor cable from sensor A	-	-	-	-	-	-	-	-	-	-	
35	De-energize solenoids A & B	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	-	ON	Retract	Yes*	
36	Reconnect sensor cable to sensor A	-	-	-	-	-	-	ON	-	-	-	
37	Attempt to energize solenoids A & B	ON	-	-	-	-	-	-	-	-	-	
38	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
39	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	
40	Energize solenoids A & B	ON	ON	ON	3 to 2 4 to 1	None	Pressure	OFF	OFF	Extend	No	
41	Disconnect sensor cable from sensor B	-	-	-	-	-	-	-	-	-	-	
42	De-energize solenoids A & B	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	-	Retract	Yes*	
43	Reconnect sensor cable to sensor B	-	-	-	-	-	-	-	ON	-	-	
44	Attempt to energize solenoids A & B	ON	-	-	-	-	-	-	-	-	-	
45	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
46	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	
47	Energize solenoids A & B	ON	ON	ON	3 to 2 4 to 1	None	Pressure	OFF	OFF	Extend	No	
WARNING: Loss of EPS pressure to the valve and actuator could cause unexpected cylinder movement.												
48	Remove supply air from EPS port	-	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	ON	Retract	Yes**	
WARNING: Re-application of EPS pressure to the valve and actuator could cause unexpected cylinder movement.												
49	Resupply air to EPS port	-	-	-	-	-	-	-	-	-	-	
50	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
51	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	

* Fault should be detected within 250 msec.

** Fault should occur immediately.

Step	Action	Actuate Signal	Sol A	Sol B	Port Conditions	Outlet Pressure		Sensor Conditions		Cylinder Action	Fault ?	Pass/Fail
		Sol A & Sol B				Port 4	Port 2	Sensor A	Sensor B			(P/F)
52	Disconnect sensor cable from sensor A	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	OFF	ON	Retract	Yes**	
53	Attempt to reset the safety control system	-	-	-	-	-	-	-	-	-	-	
54	Attempt to energize solenoids A & B	ON	-	-	-	-	-	-	-	-	-	
55	Reconnect the sensor cable to sensor A	-	-	-	-	-	-	ON	-	-	-	
56	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
57	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	
58	Energize solenoids A & B	ON	ON	ON	3 to 2 4 to 1	None	Pressure	OFF	OFF	Extend	-	
59	De-energize solenoids A & B	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	ON	Retract	-	
60	Disconnect sensor cable from sensor B	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	OFF	Retract	Yes**	
61	Attempt to reset the safety control system	-	-	-	-	-	-	-	-	-	-	
62	Attempt to energize solenoids A & B	ON	-	-	-	-	-	-	-	-	-	
63	Reconnect the sensor cable to sensor B	-	-	-	-	-	-	-	ON	-	-	
64	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
65	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	
66	Energize solenoids A & B	ON	ON	ON	3 to 2 4 to 1	None	Pressure	OFF	OFF	Extend	-	
67	De-energize solenoids A & B	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	ON	Retract	-	
Items 68 through 75 could also be done with Sensor B instead of Sensor A.												
68	Disconnect sensor cable from sensor A	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	OFF	ON	Retract	Yes**	
69	Reconnect the sensor cable to sensor A	-	-	-	-	-	-	ON	-	-	-	
70	Attempt to energize solenoids A & B	ON	-	-	-	-	-	-	-	-	-	
71	Attempt to reset the safety control system	-	-	-	-	-	-	-	-	-	-	
72	De-energize solenoids A & B	OFF	-	-	-	-	-	-	-	-	-	
73	Reset the safety control system	-	-	-	-	-	-	-	-	-	No	
74	Energize solenoids A & B	ON	ON	ON	3 to 2 4 to 1	None	Pressure	OFF	OFF	Extend	-	
75	De-energize solenoids A & B	OFF	OFF	OFF	5 to 4 2 to 1	Pressure	None	ON	ON	Retract	-	

** Fault should occur immediately.

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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