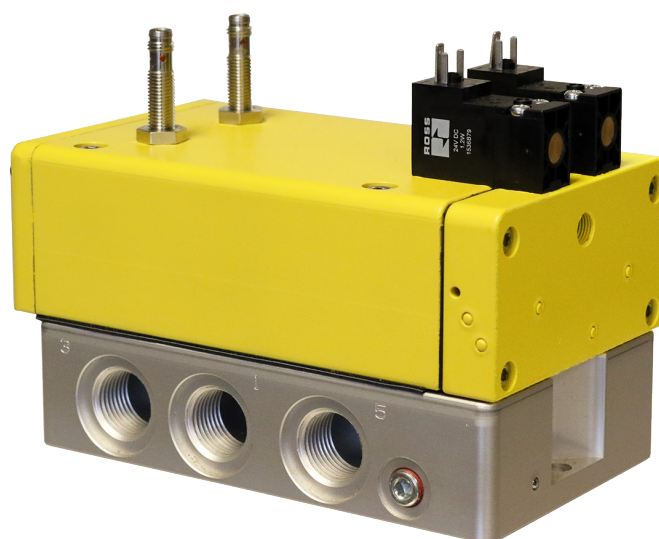




## **RSe SERIES DOUBLE VALVES FOR SAFE PRESSURE SELECT APPLICATIONS**

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## **INTEGRATION GUIDE**

## Table of Contents

| RSe Series 5/2 Double Valves For Safe Pressure Select Applications                             |        |
|------------------------------------------------------------------------------------------------|--------|
|                                                                                                | Page   |
| <b>General Information</b>                                                                     |        |
| Introduction                                                                                   | 3      |
| Pulse Testing                                                                                  |        |
| Considerations for Safe Distance Calculations                                                  |        |
| RSe Wiring (Pinouts)                                                                           | 4 - 5  |
| Pilot Supply Conversion                                                                        |        |
| <b>Operation &amp; Monitoring Requirements for 5/2 RSe Series Pressure Select Applications</b> | 5      |
| Valve Operation                                                                                | 5-6    |
| Feedback Monitoring (General)                                                                  |        |
| Actuation Fault Monitoring                                                                     | 7      |
| De-Actuation Fault Monitoring                                                                  |        |
| Loss of Supply Pressure While Actuated                                                         |        |
| No Supply Pressure Applied Before Actuation                                                    |        |
| Valve Fault & Safety System Reset                                                              |        |
| <b>RSe (5/2) Validation Test Procedure for Valve Operation and External Monitoring Logic</b>   | 8 - 10 |
| <b>Cautions, Warnings and Standard Warranty</b>                                                | Cover  |
| <b>Global Locations</b>                                                                        |        |

### Disclaimer:

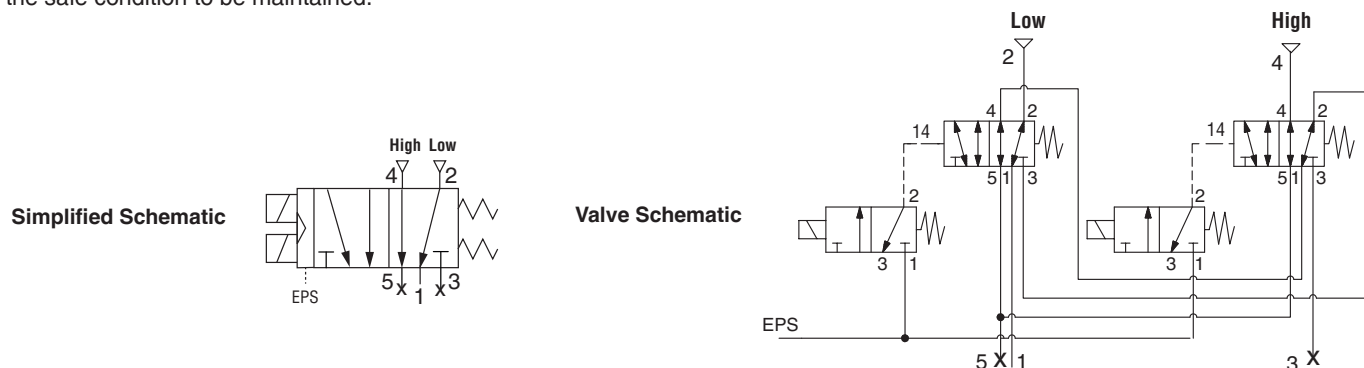
Sample Logic and any and all related diagrams contained in ROSS Controls' Integration guide were developed and validated using dual channel electro-mechanical input signals in a laboratory environment and are provided to you for illustrative purposes only. Because of the many variables and unique requirements 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' 5/2 RSe Series valves when used for safe pressure select 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 Pressure Select applications. Using the 5/2 RSe as a Safe Pressure Select control valve requires the valve to be converted to external pilot supply and the normal exhaust ports (3 and 5) must be plugged. Also, the normal work ports will become the new inlets with high pressure on port 4 and low pressure on port 2. Port 1 will be used as the outlet port. The RSe valve will then be setup so as to switch between supplying a lower (safe) pressure and a higher (non-safe) pressure. This may require a self relieving regulator to be used on the low pressure supply on port 2. A test procedure is also provided for verification and validation of the user's external safety control monitoring system.

This applies to typical pressure select applications while ROSS acknowledges there may be applications that require higher pressure for the safe condition to be maintained.



## 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 any safety application involving safety-rated valves, the critical point of operation is that the valve (and the rest of the safety system), even if faulted, should react quickly and appropriately for the application. In a Pressure Select type application, this means that when the valve is de-actuated or a fault occurs the valve should shift so that the "safe" pressure is applied to the outlet of the valve.

Port 1 is the Pressure Select outlet, and Ports 2 and 4 are the inlets to the valve in this application. Typically, the "safe" pressure is the lower pressure and is supplied to Port 2 of the valve, whereas, the higher pressure is supplied to Port 4. One of the inlets is always connected to the outlet depending on which position the valve is in. In the Off or Faulted condition, Port 2 will be connected to Port 1 and in the actuated condition Port 4 is connected to Port 1. However, you may have an application where the higher pressure is considered "safe". In this case, the higher pressure would be supplied to Port 2 as the default and the lower pressure supplied to Port 4.

Safe Distance calculations should be based on the normal and faulted response times of the system, including the safety valve. There are many factors that could affect how long it takes the pressure in the outlet of the Pressure Select valve to switch to the "safe" mode, including actual valve response time, volume of the system, difference in pressure between the two sources (delta P), actuator size, relative position in the actuator's stroke when the valve shifts or faults, as well as if the regulators are of the relieving or non-relieving type.

Data indicates that, of the three sizes of the RSe valve, there is an increase of at most 10 msec when the valve is faulted. This is only considering valve response time (parts movement) based on the ISO 12238 standard for measuring valve response time. See the table below for valve response times.

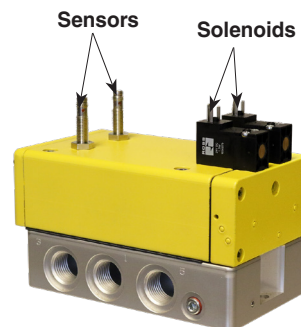
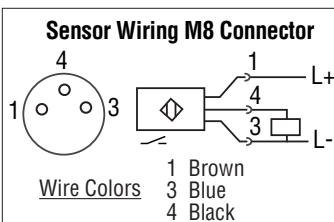
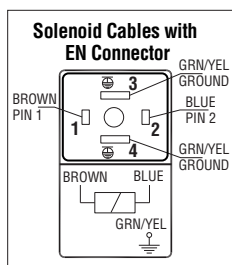
Safe Distance calculations should be validated by testing.

| Cv Values |        |         | De-actuation Time<br>(time in ms from energized to valve in de-actuated position) |                     |                  |
|-----------|--------|---------|-----------------------------------------------------------------------------------|---------------------|------------------|
| Port Size | Normal | Faulted | Port Size                                                                         | Time (milliseconds) |                  |
|           | 1-2    | 1-2     |                                                                                   | Normal Response     | Faulted Response |
| 1/8       | 0.87   | 0.63    | 1/8                                                                               | 50                  | 51               |
| 1/4       | 1.14   | 0.69    | 1/4                                                                               | 86                  | 95               |
| 1/2       | 3.48   | 1.39    | 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 pressure select 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 lines connected to Ports 2 and 4. This external pilot supply must be set at a pressure equal to or higher than the the pressure being supplied to port 4.

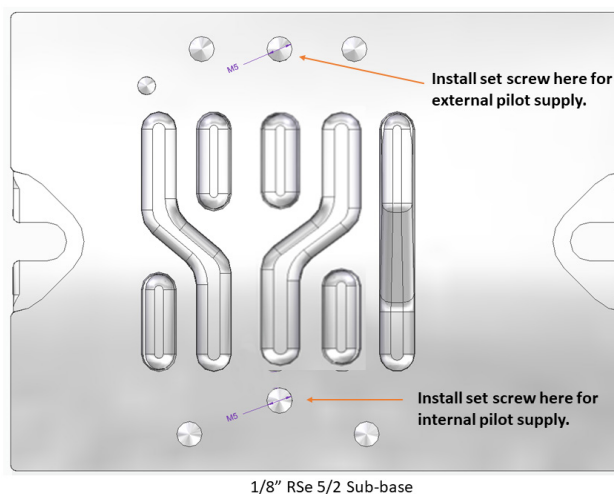
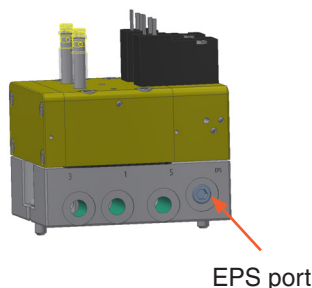
While external pilot supply is required when using the 5/2 RSe valve in a pressure select application, caution should be taken to avoid unsafe situations. For example, when using external pilot supply, a loss of pressure in ports 2 and 4 while the valve is actuated could cause unexpected movement. In this situation, the valves will remain in the selected position by pressure from the external pilot source. This would allow port 1 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 2 and 4. 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.

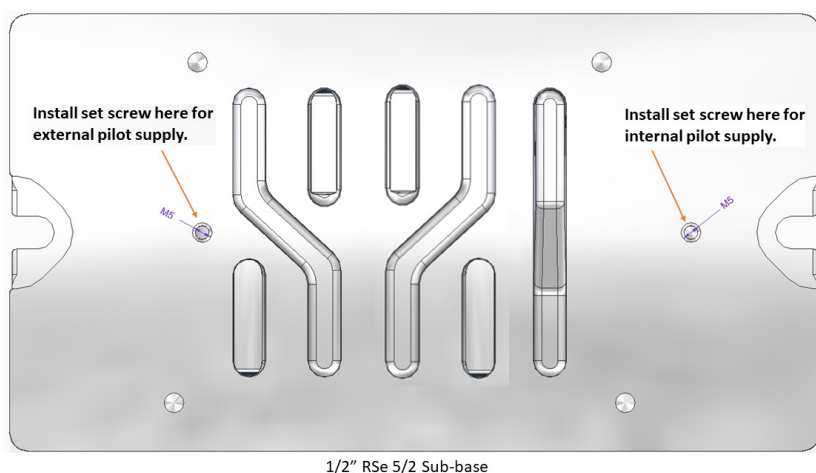
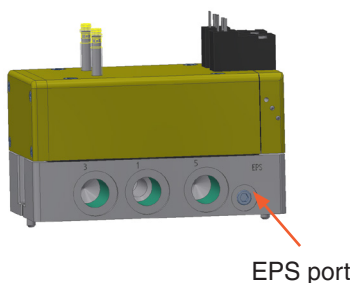
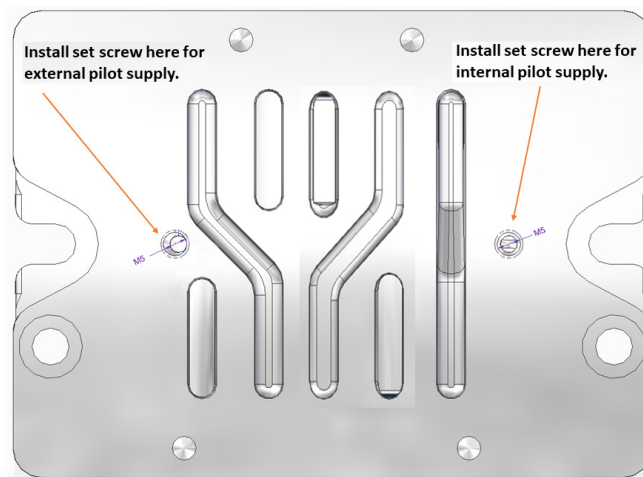
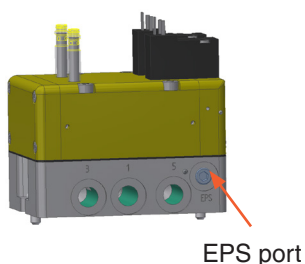
**NOTE:** A check valve can be installed in the RSe's supply lines to prevent loss of pressure in ports 2 and 4.

**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:

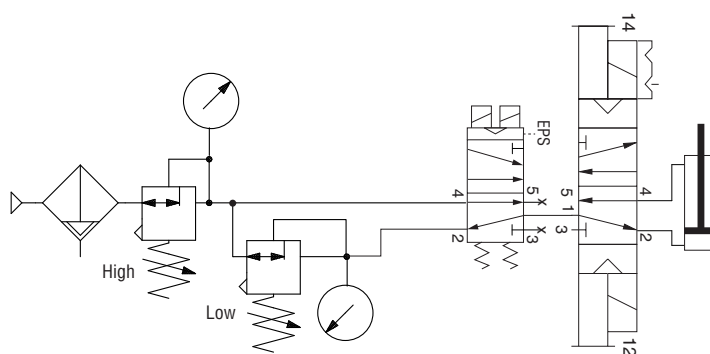
- Shut off and exhaust all pressure from the system and disconnect all electrical power from the valve.
- Remove the valve from the sub-base (4 screws). See photo below.
- Remove the set screw from the external pilot supply port in the top of the base. See figures below.
- Clean threads to remove any 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 Port 4; 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.





## Operation & Monitoring Requirements for 5/2 RSe Series Valves used in Safe Pressure Select Applications

Typical Application Schematic



### Valve Operation

The 5/2 RSe valve used for safe pressure select applications is a redundant valve that selects between two pressures to be supplied downstream. 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 4 to port 1 (outlet) and close port 2.

De-actuating the valve will supply pressure from port 2 to port 1 (outlet) and close port 4. Although a lower pressure may be supplied to port 1, the active pressure at port 1 will be dependent on the relief of the higher pressure that may currently be present. Using a self relieving regulator on the supply to port 2 or consuming the air within the application are two ways to reach the lower pressure.

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 2 to port 1 (outlet) and close port 4.

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 pressure select 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.

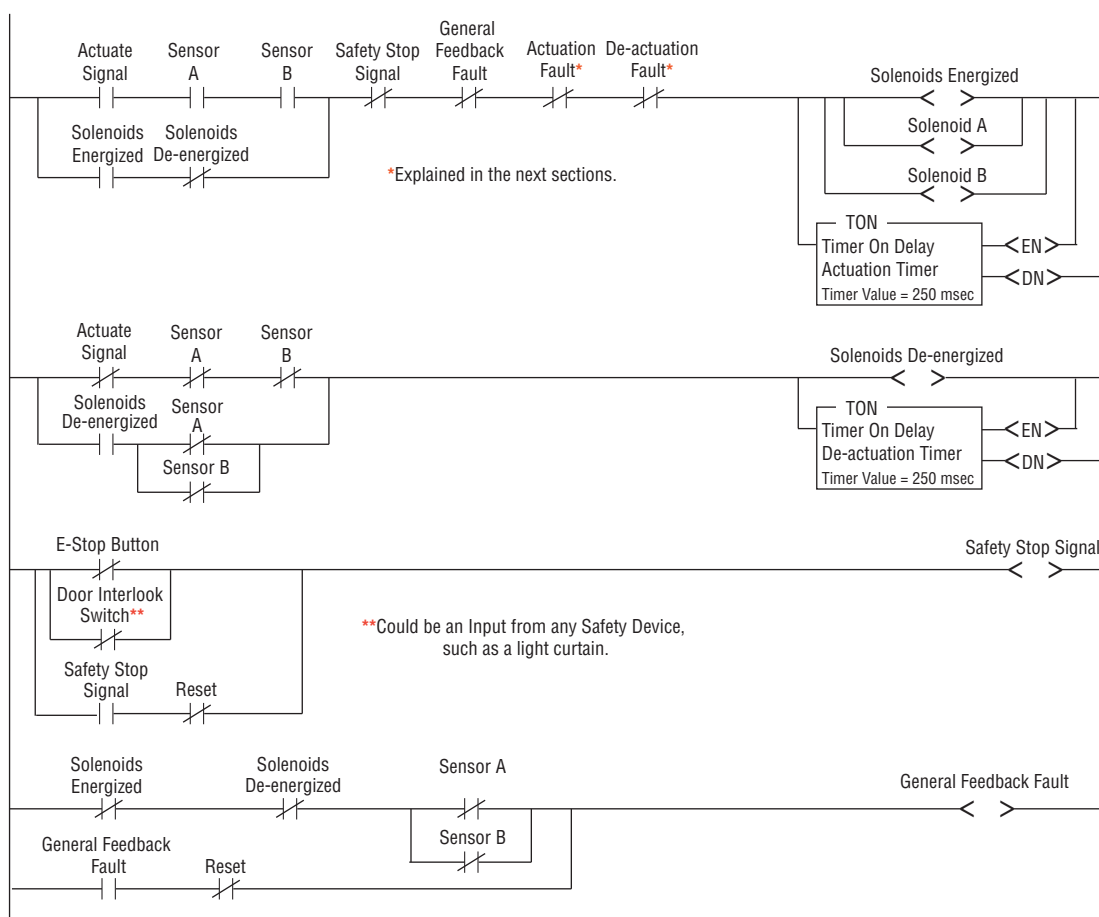
**WARNING:** It is possible to operate at a cycle rate that could result in non-monitored operation. To prevent exceeding this rate, ensure that the valve is de-actuated (both sensor outputs should be on) before attempting to energize the solenoids. Likewise, ensure that the valve is actuated (both sensor 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 2 and 4 while the valve is actuated must be detected by the safety control monitoring system if the loss of pressure creates a hazard. Detecting this condition is not possible when using external pilot supply without the addition of pressure sensing device(s) in the air supplies to ports 2 and 4.

**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. Detection of the loss of supply pressure requires 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 Pressure Select Application Validation Test Procedure for Valve Operation and External Monitoring Logic

|                |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NOTE 1:</b> | 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. |                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>NOTE 2:</b> | 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.         |                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>NOTE 3:</b> | This validation test procedure is only for applications where the 5/2 RSe is used as a Pressure Select valve.                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>NOTE 4:</b> | The 5/2 RSe valve should be plumbed such that:                                                                                                                                                                                                               | <ol style="list-style-type: none"> <li>1. Ports 2 and 4 are inlets with higher pressure supplied to port 4.</li> <li>2. Ports 3 and 5 are blocked (plugged).</li> <li>3. Port 1 is the outlet.</li> <li>4. The valve is converted to external pilot supply.</li> <li>5. Supply regulators should be of the self-relieving type. Non-relieving regulators are not recommended.</li> </ol> |
| <b>NOTE 5:</b> | Outlet port 1 should be connected to gauge or pressure sensor.                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>NOTE 6:</b> | This procedure pertains to external pilot configuration only.                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>NOTE 7:</b> | “-” indicates no change from previous step.                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>NOTE 8:</b> | 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 |          | Fault ? | Pass/Fail |
|------|-------------------------------------------|----------------|-------|-------|-----------------|-----------------|-------------------|----------|---------|-----------|
|      |                                           | Sol A & Sol B  |       |       |                 |                 | Sensor A          | Sensor B |         | (P/F)     |
| 1    | Energize solenoids A & B                  | ON             | ON    | ON    | 4 to 1          | High Pressure   | OFF               | OFF      | No      |           |
| 2    | De-energize solenoids A & B               | OFF            | OFF   | OFF   | 2 to 1          | Low Pressure    | ON                | ON       | -       |           |
| 3    | Disconnect solenoid cable from solenoid B | OFF            | OFF   | OFF   | 2 to 1          | Low Pressure    | ON                | ON       | 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   | 2 to 1          | Low Pressure    | ON                | ON       | 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    | 4 to 1          | High Pressure   | OFF               | OFF      | No      |           |
| 14   | Disconnect solenoid cable from solenoid A | -              | OFF   | OFF   | 2 to 1          | Low Pressure    | ON                | ON       | 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    | 4 to 1          | High Pressure   | OFF               | OFF      | No      |           |
| 19   | Disconnect solenoid cable from solenoid B | -              | OFF   | OFF   | 2 to 1          | Low Pressure    | ON                | ON       | 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 |          | Fault ? | Pass/Fail |
|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------|-------|-------|-----------------|-----------------|-------------------|----------|---------|-----------|
|                                                                                                                    |                                            | Sol A & Sol B  |       |       |                 | Port 1          | Sensor A          | Sensor B |         | (P/F)     |
| 23                                                                                                                 | Disconnect sensor cable from sensor A      | OFF            | OFF   | OFF   | 2 to 1          | Low Pressure    | OFF               | ON       | 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   | 2 to 1          | Low Pressure    | ON                | OFF      | 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    | 4 to 1          | High Pressure   | OFF               | OFF      | No      |           |
| 34                                                                                                                 | Disconnect sensor cable from sensor A      | -              | -     | -     | -               | -               | -                 | -        | -       |           |
| 35                                                                                                                 | De-energize solenoids A & B                | OFF            | OFF   | OFF   | 2 to 1          | Low Pressure    | -                 | ON       | 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    | 4 to 1          | High Pressure   | OFF               | OFF      | No      |           |
| 41                                                                                                                 | Disconnect sensor cable from sensor B      | -              | -     | -     | -               | -               | -                 | -        | -       |           |
| 42                                                                                                                 | De-energize solenoids A & B                | OFF            | OFF   | OFF   | 2 to 1          | Low Pressure    | ON                | -        | 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    | 4 to 1          | High Pressure   | OFF               | OFF      | No      |           |
| <b>WARNING:</b> Loss of EPS pressure to the valve and actuator could cause unexpected cylinder movement.           |                                            |                |       |       |                 |                 |                   |          |         |           |
| 48                                                                                                                 | Remove pressure from external pilot supply | -              | OFF   | OFF   | 2 to 1          | Low Pressure    | ON                | ON       | Yes**   |           |
| <b>WARNING:</b> Re-application of EPS pressure to the valve and actuator could cause unexpected cylinder movement. |                                            |                |       |       |                 |                 |                   |          |         |           |
| 49                                                                                                                 | Resupply air to the EPS port               | -              | -     | -     | -               | Low Pressure    | -                 | -        | -       |           |
| 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 |          | Fault ? | Pass/Fail |
|------|--------------------------------------------|----------------|-------|-------|-----------------|-----------------|-------------------|----------|---------|-----------|
|      |                                            | Sol A & Sol B  |       |       |                 |                 | Sensor A          | Sensor B |         | (P/F)     |
| 52   | Disconnect sensor cable from sensor A      | OFF            | OFF   | OFF   | 2 to 1          | Low Pressure    | OFF               | ON       | 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    | 4 to 1          | High Pressure   | OFF               | OFF      | -       |           |
| 59   | De-energize solenoids A & B                | OFF            | OFF   | OFF   | 2 to 1          | Low Pressure    | ON                | ON       | -       |           |

|    |                                            |     |     |     |        |               |     |     |       |  |
|----|--------------------------------------------|-----|-----|-----|--------|---------------|-----|-----|-------|--|
| 60 | Disconnect sensor cable from sensor B      | OFF | OFF | OFF | 2 to 1 | Low Pressure  | ON  | OFF | 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  | 4 to 1 | High Pressure | OFF | OFF | -     |  |
| 67 | De-energize solenoids A & B                | OFF | OFF | OFF | 2 to 1 | Low Pressure  | ON  | ON  | -     |  |

**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 | 2 to 1 | Low Pressure  | OFF | ON  | 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  | 4 to 1 | High Pressure | OFF | OFF | -     |  |
| 75 | De-energize solenoids A & B                | OFF | OFF | OFF | 2 to 1 | Low Pressure  | ON  | ON  | -     |  |

**\*\* 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.

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