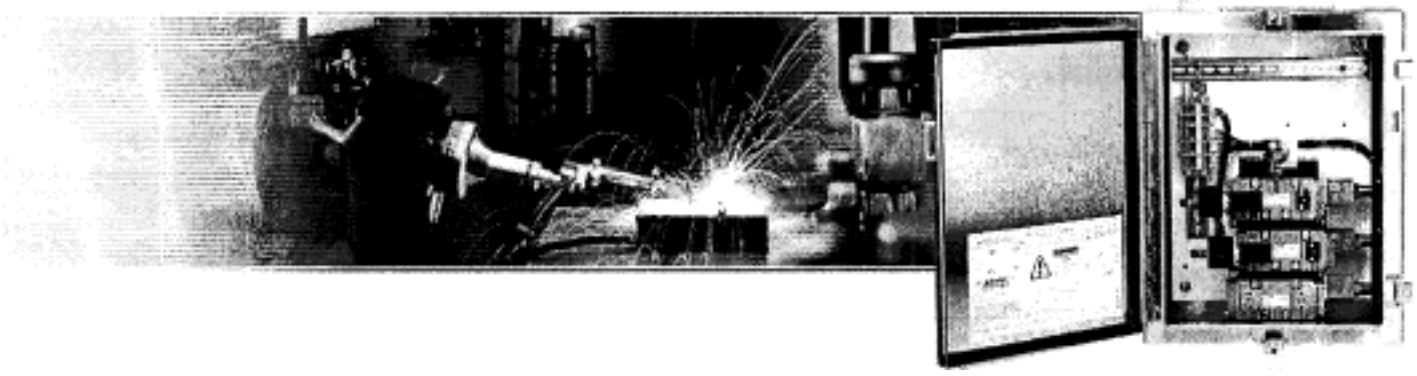
ASCO Redundant Control System

2oo2D Enclosure with Proximity Sensor Diagnostics

Operation & Maintenance Guide

exida® SIL 3 Capable



Operation & Maintenance Guide
Redundant Control System

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Documentation Conventions

This guide uses the following typographic conventions:

EXAMPLE	*Description*
NOTE	***Notes containing supplementary information.***
⚠	***This symbol precedes information about potential equipment damage.***
⚠	***This symbol precedes information about potential personnel hazards.***

User Experience Prerequisites

To effectively use the Pneumatic RCS, users should have some experience with pneumatic systems.

Warnings!

READ THIS ENTIRE MANUAL AND ALL RELATED PUBLICATIONS PERTAINING TO THE WORK TO BE PERFORMED BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT.

- *Follow all appropriate safety codes* and standards.
- *Failure to follow instructions may result in personal injury and/or property damage.*
- *Use extreme caution when working around power-input cables. These cables may have potentially lethal or dangerous voltages.*
- *Prior to energizing the equipment, have qualified personnel verify all wiring and connections against vendor drawings. Incorrect wiring and/or connections can result in equipment damage or serious system failure. If you have questions or need more information on installing and operating ASCO equipment,* contact ASCO.

Avertissements!

LISEZ LE MANUEL COMPLET AINSI QUE LES PUBLICATIONS RELATIVE AU TRAVAIL À EFFECTUER AVANT D'INSTALLER, D'UTILISER OU DE MAINTENIR CET ÉQUIPEMENT.

- *Suivez toutes les procédures et normes relatives à la sécurité* appropriées.
- *Le non-respect des instructions peut entrainer des blessures corporelles et/ou des dommages matériels*
- *Travaillez avec une extrême précaution à proximité des câbles de puissance. Ces câbles peuvent présenter potentiellement des tensions mortelles ou dangereuses.*
- *Avant de mettre l'équipement sous tension, faites vérifier le câblage et les connexions par du personnel qualifié par rapport aux plans du fournisseur. Un câblage et/ou des connexions erronée peuvent endommager l'équipement et provoquer une grave défaillance du système. Si vous aves des questions ou avez besoin de plus d'informations sur l'installation et l'utilisation des équipements ASCO, contactez ASCO.*

PRODUCT DESCRIPTION

The RCS is a two-out-of-two (2oo2) or one-out-of-one hot standby (1oo1 HS) voting, solenoid-operated valve system designed for use as a component in safety instrumented systems. It functions as a redundant pneumatic tripping device to control the pilot air signal to a process valve actuator. The RCS uses 2oo2 or 1oo1 HS voting solenoids to enhance the reliability of the circuit. The RCS consists of two electrically actuated solenoid valves (SOV1, SOV2) and a pneumatically operated (Manually Controlled) bypass valve, and three proximity sensors. The proximity sensors provide solenoid state feedback and are used during on-line testing of the RCS unit. The bypass valve allows for maintenance of the solenoid valves without having to shut down the process valve. The use of the Maintenance Bypass Valve is not required for functional testing of the RCS unit. The type of operation (2oo2 NC, 2oo2 NO, 2oo2 DA, 1oo1HS NC, 1oo1HS NO) must be specified by the customer at the time of order.

Under normal operating conditions:

The RCS allows for periodic testing of the solenoids by cycling one solenoid valve and then the other either manually or automatically therefore attaining the desired safety availability. This testing is performed online without the need for bypassing of the safety action and without interruption of the process.

For all constructions, three proximity sensors are included to provide indication of each solenoid-operated valve and bypass valve position.

Normally Closed Construction: The RCS supplies air to the process valve actuator through the "Process" port when energized.

Normally Open Construction: the RCS blocks the incoming pneumatic signal and connects the "Process" port to the "Exhaust" port when energized.

Double Acting Construction: the incoming pneumatic control signal passes through the RCS to one side (C2) of the process valve actuator while the other side (C1) of the process valve actuator is vented through the RCS when energized. **The 1oo1 HS mode cannot be used with the double acting construction.**

When a trip occurs:

Normally Closed Construction: the RCS blocks the incoming pneumatic signal and connects the "Process" port to the "Exhaust" port. This vents the air signal from the process valve actuator and allows the actuator return spring to move the process to its fail-safe position.

Normally Open Construction: the RCS supplies air to the process valve actuator through the "Process" port. This allows the actuator to move the process to its fail-safe position.

Double Acting Construction: (C2) of the process valve actuator is vented through the RCS while the pneumatic control signal is applied to (C1) of the process valve actuator. This causes the process valve actuator to move from its normal operating position to its fail-safe position.

HARDWARE

For proper operation, a pneumatic pressure of 0-150 PSI must be supplied to the RCS [process connection] while a pressure of 40-150 PSI must be supplied to the [pilot connection]. It is housed in a 20" x 16" x 8" enclosure. The primary components include:

- Hard anodized aluminum manifold body
- Two low power solenoid-operated ISO-3 valves
- A key-actuated bypass valve. (Lever Optional)
- Three proximity sensors/switches
- An electrical terminal block for wiring termination (ATEX rated Ex e IIC)
- Associated wiring.

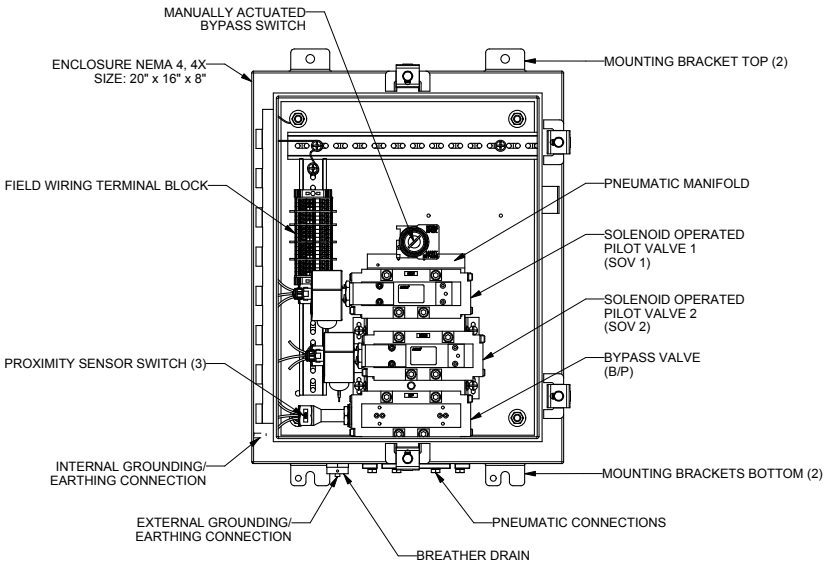

Figure 1. RCS 2oo2D With Enclosure Components, Approx. Weight 28.1 kg (62 lbs)

GENERAL SPECIFICATIONS

Solenoid Operator:
12, 24, 48 or 120 Volt DC Low Power, Class F coil-1.4 watts.
120/60-110/50 or 230/50-240/50 AC 10.1 Watts, Class H Coil.

Pneumatic Valve:
ISO-3; 5/2 air-spring valve; solenoid operated/ Requires external pilot air supply.

Bypass Valve:
ISO-3; 5/2 air-spring valve; manually operated/Requires external pilot air supply.

Manifold:
3 - station ISO base; unique pneumatic circuit design.

Proximity Sensor/Switch:
3 each

Switch Type:
SPDT switches, hermetically sealed, Stainless Steel

Switch Contact Rating:
Silver Contacts
Resistive Load
4 amps @ 120 VAC
2 amps @ 240 VAC
3 amps @ 24 VDC
1.25 amps @ 12 VDC

Pneumatic Connections:
Pilot:
1/8" NPTF

Pilot Pressure:
40-150 psi

Inlet & Process:
1/2" NPTF

Exhaust Port:
1/2" NPTF

Inlet Pressure Range:
0 psi to 150 psi

Air Quality:
Instrument air per ANSI/ISA 7.0.01-1996
Particle size ≤ 40 microns.

Materials:

Enclosure:
Stainless Steel (304 SS, 316SS) or Fiberglass

Size:
20"x 16"x 8"

Weight:
Approximately 28.1 kg(62 lbs)

Mounting Panel
Painted Steel

Manifold:
Anodized aluminum.

Valves:
Body – Die-cast Aluminum alloy, Sealing- Nitrile (NBR) and Polyurethane (PUR), Spool - Stainless Steel.

Solenoid Coil:
Epoxy encapsulated.

Proximity Sensors/Switches:
316 Stainless Steel

Environmental:

Ambient temperature range:
Consult panel nameplate to verify.
- -40 °F to 140 °F (-40 °C to 60 °C)
- With local manual reset option = -4 °F to 140 °F (-20 °C to 60 °C)

Approvals:

Exida
Certified SIL 3 capable (Standard Normally Open and Normally Closed constructions, see SIL certificate for special constructions).

INSTALLATION

This section provides the information needed to install the RCS.

Unpacking:
Upon receipt of the RCS, unpack it carefully and visually check for damage. The packing list shows the complete model number and describes the features of the unit.
1. If the unit is damaged, immediately contact ASCO.
2. If everything is in order, proceed to the instructions in the following sections.

Mounting Location Considerations:
The RCS is designed to be field mounted near the process valve to be actuated. The following factors should be considered when selecting a mounting location:

- **Accessibility**: Allow ample space for door operation, and for wiring and tubing runs.
- **Temperature**: Consider the amount of heat generated by equipment in the mounting area. The RCS is intended for operation in ambient temperatures from - 40 °C to 60 °C (-20 °C to 60 °C with local manual reset option).
- **Environment**: Ensure that RCS unit is compatible with respect to water ingress and corrosion resistance.

⚠ WARNING: Explosion Hazard! Do not remove or replace any component while circuit is live unless the area is known to be non-hazardous.

⚠ AVERTISSEMENT: Risque d'explosion! Ne pas retirer ou remplacer les composants lorsque le circuit est sous tension sauf en atmosphère non explosible.

ASCO components are intended to be used only within the technical characteristics as specified on the nameplate. Changes to the equipment are only allowed after consulting the manufacturer or its representative. The surface temperature classification depends on the voltage, wattage and ambient temperature which are stated on the nameplate. Depending on the ambient/operation temperature heat resistant cabling capable for the temperature as indicated on the nameplate must be used.

Mounting:
The RCS is designed to be mounted using the four mounting brackets provided as shown in the figure below. It is recommended that four 3/8" or 10 mm diameter bolts be used.

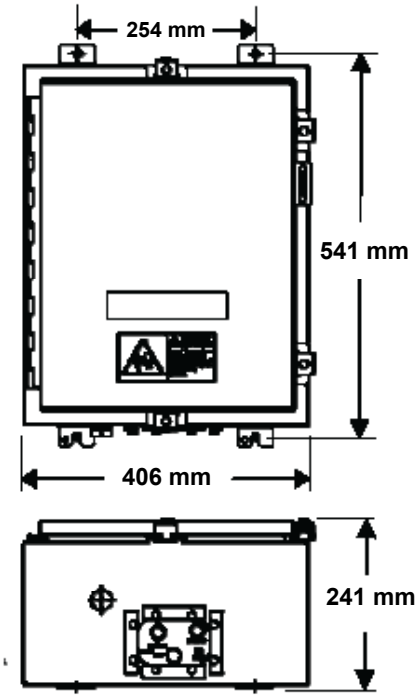

Figure 2. Mounting Dimensions

Field Connections:
Pneumatic Connections (Figure 3A)

⚠ WARNING: Explosion Hazard! Do not remove or replace any component while circuit is live unless the area is known to be non-hazardous.

⚠ AVERTISSEMENT: Risque d'explosion! Ne pas retirer ou remplacer les composants lorsque le circuit est sous tension sauf en atmosphère non explosible.

The RCS should be mounted as closely to the process valve as possible. In order to insure proper operation of the process valve, tubing runs should be as straight and short as possible. Recommended piping for the inlet and outlet pneumatic connections to the RCS is ½" stainless steel tubing. Recommended piping for pilot supply is 1/8" stainless steel tubing.

Wiring Guidelines
The following general guidelines apply to all wiring discussed in this document.

⚠ WARNING: Circuit power must be removed from the device prior to disconnecting the wiring on either the field or internal side of the terminal strip.

⚠ AVERTISSEMENT: L'alimentation électrique du circuit doit être coupée avant de déconnecter le câblage ou le bornier interne de l'équipement.

- Wiring shall be according to the National Electrical Code (ANSI-NFPA 70), Zone 1 ATEX requirements or other applicable codes.

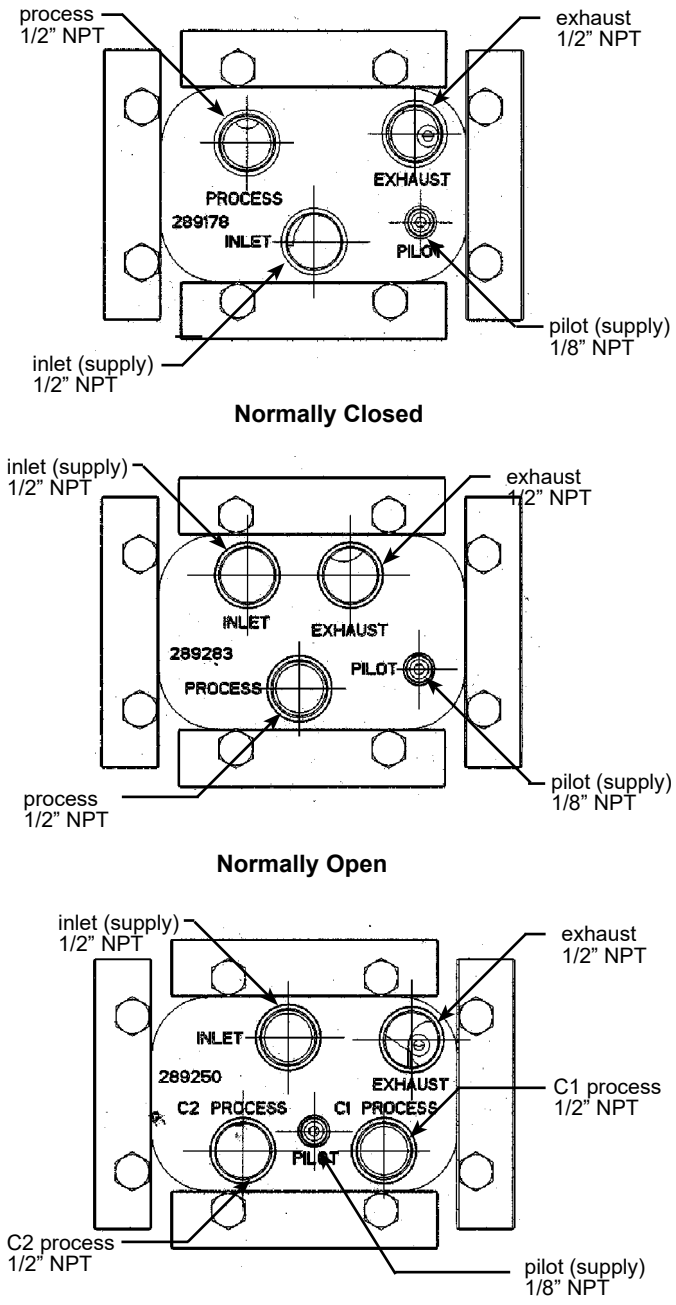

Figure 3A. Pneumatic Connections

- Wire size: stranded 16 and 18 AWG.
- The terminal clamps are designed for one wire only; DO NOT attempt to terminate multiple wires into one terminal.
- Use care when running signal wiring near to or crossing conduit or wiring that supplies power to motors, solenoids, lighting, horns, bells, etc.
- AC power wiring should be run in a separate conduit from DC power. All power wiring to and from the RCS should be in grounded conduit.
- The RCS should be connected to a high quality instrument grade ground with #14 AWG or heavier wire. A grounding stud is provided both inside and outside the enclosure.

Electrical Connection (Customer Responsibility):
General (Figure 3B)

1. In all cases follow local and national electrical codes and confirm compliance with Zone 1 ATEX requirements.
2. Placement of the conduit connection is up to the customer, in compliance with Zone 1, ATEX requirements, based on location

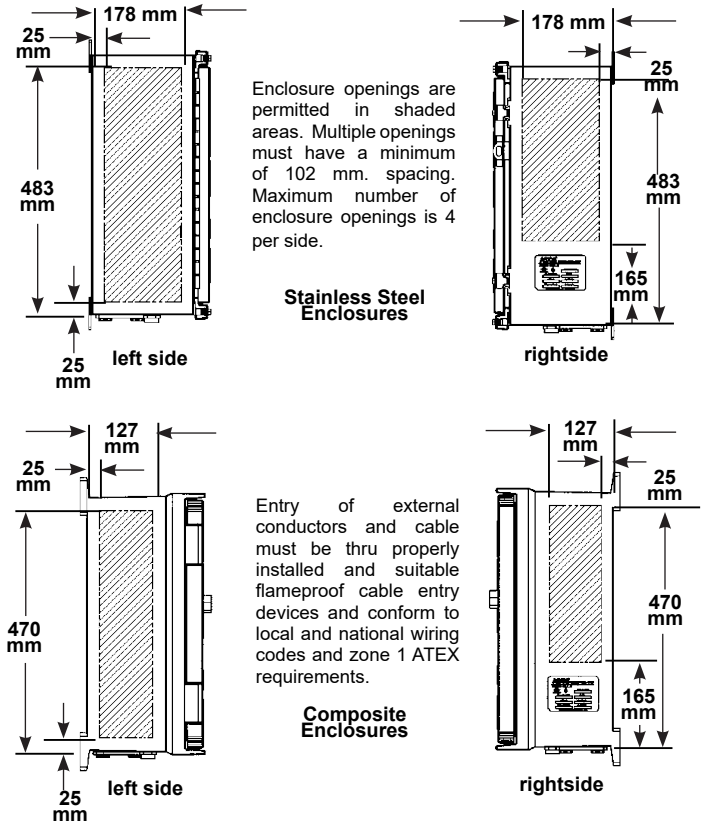

Figure 3B. Enclosure Openings

and ease of installation. The upper or lower left side of the box will give the shortest run to the wire terminal.

3. Cable/conduit connections can be added in location as shown on Figure 3B. Entry of external conductors and cables must be through properly installed and suitable certified flameproof cable entry devices and in accordance with ATEX Zone 1 increased safety requirements. Assemble and install cable glands per manufacturer's instructions. Connect cable ground connections to the grounding/ earthing terminal blocks or grounding / earth studs provided internally and externally.
4. It is recommended that standard industry practices are followed to prevent condensation from entering the enclosure and, in some cases of Class I, Div 2 or ATEX Zone 1 conditions, to prevent hazardous gasses and vapours from migrating through the conduit to the control room or open ignition source.

Grounding and Earthing. (Figure 3C)

Internal and external grounding studs are provided on the RCS product. Ground/earth the product in accordance with local and national electric codes as well as ATEX Zone 1 requirements. Green earthing terminal blocks are provided for easy installation of conductor up to 4 mm sq. Only insert one conductor per terminal block. Grounding studs are provided inside and outside of the enclosure for additional grounding/ earthing requirements. (see Figure 3C)

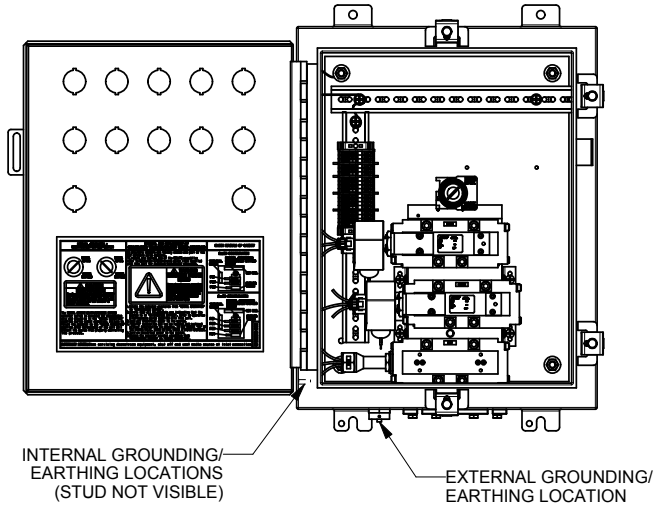

Figure 3C. Grounding Connections

RCS-R Base Unit

1. Connect the power source to the designated terminals (SOV1, SOV2) as per wiring diagram provided with the RCS unit. Wiring diagrams are available on the Internet at: **www.ascovalve.com/ rcsconfigurator**
2. Wire the three proximity sensors switches (PS1, PS2 & PS3) as per wiring diagram.
3. Wire optional accessories.

Section 1. - Normally Closed

1. General Operation

The RCS is a two-out-of-two (2oo2) or one-out-of-one hot standby (1oo1 HS) voting, solenoid-operated valve system designed for use as a component in safety instrumented systems. It functions as a redundant pneumatic tripping device to control the pilot air signal to a process valve actuator. Both solenoids must be de-energized (De-Energize-To-Trip Version) prior to moving the process to its fail-safe position. Three proximity sensors are included to provide indication of each solenoid-operated valve and bypass valve position.

The RCS allows for periodic testing of the solenoids by cycling one solenoid valve and then the other either manually (when ordered with a local initiation of SOV test option) or automatically by the system DCS, therefore maintaining the desired safety availability. This testing is performed online without the need for bypassing of the safety action and without interruption of the system process.

Under normal operating conditions, the RCS supplies pilot air to the process valve actuator through the "process" port. When a trip occurs, the RCS blocks the incoming pneumatic signal and connects the "process" port to the "exhaust" port. This vents the air signal from the process valve actuator and allows the actuator return spring to move the process valve actuator to its fail-safe position.

Proximity sensors report solenoid valve positions as shown in Table 1.

RUN MODE: De-Energized to Trip

- If either or both solenoid valves SOV1 and SOV2 are in the energized position, INLET pressure is directed to the PROCESS port.
- If both solenoid valves SOV1 and SOV2 are in the de-energized position, INLET pressure is blocked and pressure from the PROCESS port is vented to the EXHAUST port.
- Reference Table 1 for the various states of solenoid energization, and the resulting status of the PROCESS/Outlet port and PS proximity sensor contact state.

BYPASS MODE: De-Energized to Trip

Manually Actuated Maintenance Bypass valve operation:

The manually actuated bypass switch has two positions. NORMAL for system run and MAINTENANCE BYPASS for the maintenance of the solenoid valves. To change positions simply rotate the key to desired position, indicated on the switch. (A lever option is available in the place of the key)

- The manually operated bypass switch is used to isolate and depressurize the solenoid valves during maintenance. The maintenance bypass valve position is indicated by proximity sensor No. 3 contacts (PS3).
- In bypass mode, the RCS INLET port is directly connected to the PROCESS port. The solenoid valves are vented to the EXHAUST port.
- In the bypass mode, the Normally Open contacts of PS1 and PS2 are closed and PS3 is open, indicating that no pressure is on solenoid valves.
- Reference Table 1 for the various states of SOV solenoid valve energization, and the resulting status of PS proximity sensor contact state.

2. Testing and Maintenance:

Testing:

Solenoid-operated valve testing

The solenoid-operated valves and their associated proximity sensors can be tested online without interruption to the process. This testing is

Table 1 - RCS States, Normally Closed, De-Energize to Trip							
State	SOV1	SOV2	Bypass Valve	Normally Open Contact State			Process/Outlet
				PS1	PS2	PS3	
1	Energized	Energized	Normal Operation	Open	Open	Closed	Air Supply
2	De-Energized	De-Energized	Normal Operation	Closed	Closed	Closed	Vented
3	De-Energized	Energized	Normal Operation	Closed	Open	Closed	Air Supply
4	Energized	De-Energized	Normal Operation	Open	Closed	Closed	Air Supply
5	*	*	Maintenance Bypass	Closed	Closed	Open	Air Supply
* - SOV valves are vented to exhaust when in Maintenance Bypass mode.							

implemented by cycling each solenoid-operated valve and comparing the associated proximity sensor contact reading to the test table 1.

Partial Stroke testing

A partial stroke of the process valve can be performed online without interruption to the process. This testing is implemented by performing solenoid-operated valve testing, then moving the process valve toward the safe state for a predetermined time. At the end of the predetermined time, the process valve is returned to the normal position.
Testing can be automated using a programmable logic controller (PLC) or a distributed control system (DCS).

⚠CAUTION: (De - Energize - To - Trip Version) De - energizing two solenoid valves at the same time will initiate a shutdown.

⚠ATTENTION: (version « De-Energize-To-Trip ») la coupure électrique de deux électrovannes simultanément déclenchera un arrêt.

1. At all times during testing, one out of the two solenoid-operated valves must be in the energized position (De-Energize-To-Trip Version).
2. IF, during the test process, the proximity sensors do not indicate what is expected according to the test table 1, the second solenoid-operated valve must not be de-energized.

Maintenance:

⚠WARNING: Potential Electrostatic Charging Hazard. Use wet or damp cloth when cleaning any non-metallic/ painted surfaces.

⚠AVERTISSEMENT: Risque potentiel de décharge électrostatique. Utilisez un chiffon humide quand vous nettoyez toutes les surfaces non métalliques ou peintes.

The Pneumatic RCS requires no routine maintenance except periodic inspections for loose wires and fittings. The enclosure should be opened occasionally and the components checked to make sure they are tight, clean, and dry. The Breather/Drain shall be inspected for obstruction and that it is free of debris during routine maintenance cycles and during manual proof testing.

Manually-Actuated Bypass Valve

If it is necessary to replace a solenoid-operated valve or coil during normal operation, the manually-operated bypass valve is used.
This valve is used to isolate and depressurize the solenoid valves, for maintenance only.
When the switch is rotated to the bypass position, the RCS manifold channels the inlet pressure directly to the process port. Pressure to the solenoid valves is vented to “exhaust”. The NORMALLY OPEN contacts of PS1 and PS2 are closed, and PS3 is open, which signals the PLC/DCS that the RCS is in bypass and not in shut down.

Manual Bypass Valve Operation (for maintenance only)

⚠WARNING: Explosion Hazard. Do not open the enclosure unless area is known to be non-hazardous.

⚠AVERTISSEMENT: Risque d’explosion. Ne pas ouvrir le boitier dans une atmosphère explosible.

1. Turn the key clockwise from “Normal” to “Maintenance Bypass”. The system pressure is now bypassed directly from “inlet” to “process” so that the process valve position is maintained.
2. Verify that all 3 proximity sensor contacts are indicating the RCS is in Bypass. Refer to table 1.

⚠WARNING: Remove the maintenance bypass key from the switch and place the key in the bottom of the enclosure until maintenance has been completed.

⚠AVERTISSEMENT: Retirez la clé de dérivation de maintenance du commutateur et placez là au bas du boitier jusqu’à ce que la maintenance soit terminée.

⚠WARNING: Explosion Hazard. Do not remove or replace any component while circuit is live unless area is known to be non - hazardous.

⚠AVERTISSEMENT: Risque d’explosion. Ne pas retirer ou remplacer les composants lorsque le circuit est sous tension sauf en atmosphère non explosible.

3. Turn off power to the RCS; disconnect appropriate wires from terminal block.
4. Remove device (coil, solenoid valve) and install the new device following instructions supplied. If replacing a solenoid valve, apply a small amount of anti-seize to the bolt threads and torque to 160-175 in-lbs in a crisscross pattern. Reconnect wires to appropriate terminal, (see wiring diagrams).
5. Turn on power to the RCS. Verify that each device has power and is in the correct state. (See Table 1).
6. Replace key in the Maintenance Bypass and rotate counter-clockwise to the “Normal” position.
7. Have the control room run through the programmed test to be sure the system is operating properly.

Section 2. - Normally Open

1. General Operation and Testing

The RCS is a two-out-of-two (2oo2) or one-out-of-one hot standby (1oo1 HS) voting, solenoid-operated valve system designed for use as a component in safety instrumented systems. It functions as a redundant pneumatic tripping device to control the air signal to a process valve actuator. Both solenoids must be de-energized (De-Energize-To-Trip) prior to moving the process to its fail-safe position.
Three proximity sensors are included to provide indication of each solenoid-operated valve and bypass valve position. The RCS allows for periodic testing of the solenoids by cycling one solenoid valve and then the other either manually (when ordered with a local initiation of SOV test option) or automatically (by the system DCS) therefore attaining the desired safety availability. This testing is performed online without the need for bypassing of the safety action and without interruption of the system process.
Under normal operating conditions, the RCS blocks the pilot air supply from the process valve and connects the “process” port to the “exhaust” port. When a trip occurs, the RCS supplies pilot air to the process valve actuator through the “process” port. This allows the actuator to move the process valve actuator to its fail-safe position.
The Proximity Sensors report solenoid valve positions as shown in Table 2.

RUN MODE: De-Energized to Trip

- If both solenoid valves SOVl and SOV2 are in the de-energized position, INLET pressure is directed to the PROCESS port.
- If either or both solenoid valves SOVl and SOV2 are in the energized position, INLET pressure is blocked and pressure from the PROCESS port is vented to the EXHAUST port.

- Reference Table 2 for the various states of solenoid energization, and the resulting status of the PROCESS/Outlet port and PS proximity sensor contact state.

BYPASS MODE: De-Energized to Trip

Manually Actuated Maintenance Bypass valve operation:
The manually actuated bypass switch has two positions. NORMAL for system run and MAINTENANCE BYPASS for maintenance of the solenoid valves. To change positions simply rotate the key to the desired position, indicated on the switch. (A lever option is available in place of the key)

- The manually operated bypass switch is used to isolate and depressurize the solenoid valves during maintenance. The maintenance bypass valve position is indicated by proximity sensor No. 3 contacts (PS3).
- In bypass mode, the RCS INLET port is blocked and the PROCESS port and solenoid valves are vented to the EXHAUST port.
- In the bypass mode, the NORMALLY OPEN contacts of PSl and PS2 are closed, and PS3 is open, indicating that no pressure is on the solenoid valves.
- Reference Table 2 for the various states of solenoid energization, and the resulting status of PS proximity sensor contact state.

2. Testing and Maintenance:

Testing:

Solenoid-operated valve testing
The solenoid-operated valves and their associated proximity sensors/ switches can be tested online without interruption of the process. This testing is implemented by cycling each solenoid-operated valve and comparing the associated proximity sensor contact to the test table 2.

Partial Stroke testing
A partial stroke of the process valve can be performed online without interruption of the process. This testing is implemented by performing a solenoid-operated valve testing, then moving the process valve toward the safe state for a predetermined time. At the end of the predetermined time, the process valve is returned to the normal position. Testing can be automated using a programmable logic controller (PLC) or a distributed control system (DCS).

⚠CAUTION: (De - Energize - To - Trip Version) De - energizing two solenoid valves at the same time will initiate a shutdown.

⚠ATTENTION: (version « De-Energize-To-Trip ») la coupure électrique de deux électrovannes simultanément déclenchera un arrêt.

1. At all times during testing, one out of the two solenoid-operated valves must be in the energized position (De-Energize-To-Trip Version).
2. IF, during the test process, the proximity sensors do not indicate what is expected according to the test table 2, the a second solenoid-operated valve must not be de-energized.

Maintenance:

⚠WARNING: Potential Electrostatic Charging Hazard. Use wet or damp cloth when cleaning any non-metallic/ painted surfaces.

⚠AVERTISSEMENT: Risque potentiel de décharge électrostatique. Utilisez un chiffon humide quand vous nettoyez toutes les surfaces non métalliques ou peintes.

The Pneumatic RCS requires no routine maintenance except periodic inspections for loose wires and fittings. The enclosure should be opened occasionally and the components checked to make sure they are tight, clean, and dry. The Breather/Drain shall be inspected for obstruction and that it is free of debris during routine maintenance cycles and during manual proof testing.

Manually-Actuated Bypass Valve

If it is necessary to replace a solenoid-operated valve or coil during normal operation, the manually operated bypass valve is used.
This valve is used to isolate and depressurize the solenoid valves for maintenance only.
When the switch is rotated to the bypass position, the “inlet” air to the RCS is blocked. The “process” port is connected to the “exhaust”. Pressure to the solenoid valves is vented to “exhaust”. The NORMALLY OPEN contacts of PS1 and PS2 are closed, and PS3 is open which signals the PLC/DCS that the RCS is in bypass and not in shut down.

Manual Bypass Valve Operation (for maintenance only)

⚠WARNING: Explosion Hazard. Do not open the enclosure unless area is known to be non-hazardous.

⚠AVERTISSEMENT: Risque d’explosion. Ne pas ouvrir le boitier dans une atmosphère explosible.

1. Turn the key clockwise from “Normal” to “Bypass”. The system pressure is now blocked by the RCS, “process” is connected to “exhaust”.
2. Verify that all 3 proximity sensors contacts are indicating the RCS is in Bypass. Refer to Table 2.

⚠WARNING: Remove the maintenance bypass key from the switch and place the key in the bottom of the enclosure until maintenance has been completed.

⚠AVERTISSEMENT: Retirez la clé de dérivation de maintenance du commutateur et placez là au bas du boitier jusqu’à ce que la maintenance soit terminée.

⚠WARNING: Explosion Hazard. Do not remove or replace any component while circuit is live unless area is known to be non - hazardous.

⚠AVERTISSEMENT: Risque d’explosion. Ne pas retirer ou remplacer les composants lorsque le circuit est sous tension sauf en atmosphère non explosible.

3. Turn off power to the RCS; disconnect appropriate wires from terminal block.
4. Remove device (coil, solenoid valve) and install the new device following instructions supplied. If replacing a solenoid valve, apply a small amount of anti-seize to the bolt threads and torque to 160-175 in-lbs in a crisscross pattern. Reconnect wires to appropriate terminal (see wiring diagrams provided with unit). Wiring diagrams are available on the internet at: **www.ascovalve.com/rcsconfigurator**.
5. Turn on power to the RCS. Verify that each device has power and is in the correct state. (See Table 2).
6. Replace key in the Bypass and rotate counter-clockwise to the “Normal” position.
7. Have the control room run through the programmed test to be sure the system is operating properly.

Table 2 - RCS States, Normally Open, De-Energize to Trip

State	SOV1	SOV2	Bypass Valve	Normally Open Contact State			Process/Outlet
				PS1	PS2	PS3	
1	Energized	Energized	Normal Operation	Open	Open	Closed	Vented
2	De-Energized	De-Energized	Normal Operation	Closed	Closed	Closed	Air Supply
3	De-Energized	Energized	Normal Operation	Closed	Open	Closed	Vented
4	Energized	De-Energized	Normal Operation	Open	Closed	Closed	Vented
5	*	*	Maintenance Bypass	Closed	Closed	Open	Vented
* - SOV valves are vented to exhaust when in Maintenance Bypass mode.							

Section 3. - Double Acting

NOTE: One-out-of-one hot standby (1oo1HS) mode cannot be used with the Double Acting RCS- L.

1. General Operation

The RCS is a two-out-of-two (2oo2) or one-out-of-one hot standby (1oo1 HS) voting, solenoid-operated valve system designed for use as a component in safety instrumented systems. Double acting RCS units are only available in 2oo2. It functions as a redundant pneumatic tripping device to control the air signal to a process valve actuator. Both solenoids must be de-energized (De-Energize-To-Trip) prior to moving the process to its fail-safe position.

Three proximity sensors are included to provide indication of each solenoid-operated valve and bypass valve position. The RCS allows for periodic testing of the solenoids by cycling one solenoid valve and then the other either manually (when ordered with a local initiation of SOV test option) or automatically (by the system DCS) therefore attaining the desired safety availability. This testing is performed online without the need for bypassing of the safety action and without interruption of the system process.

Under normal operating conditions, the incoming pilot air supply for the process valve actuator passes through the RCS to one side (C2) of the process valve actuator while the other side (C1) of the process valve actuator is vented through the RCS.

When a trip occurs, (C2) of the process valve actuator is vented through the RCS while the pneumatic control signal is applied to (C1) of the process valve actuator. This forces the process valve actuator to move from its normal operating position to its fail-safe position.

The Proximity Sensors report solenoid valve positions as follows:

RUN MODE: De-Energized to Trip

- If both solenoid valves SOVl and SOV2 are in the energized position, INLET pressure is directed to the C2 PROCESS port, and C1 PROCESS port is vented to the EXHAUST port.
- If both solenoid valves SOVl and SOV2 are in the de-energized position, INLET pressure is directed to the C1 PROCESS port, and C2 PROCESS port is vented to the EXHAUST port.
- Reference Table 3 for the various states of solenoid energization, and the resulting status of the PROCESS/Outlet port and PS proximity sensor contact state.

BYPASS MODE: De-Energized to Trip

Manually Actuated Maintenance Bypass valve operation:

The manually actuated bypass switch has two positions. NORMAL for system run and MAINTENANCE BYPASS for maintenance of the solenoid valves. To change positions simply rotate the key to the desired position, indicated on the switch. (A lever option is available in place of the key)

- The manually operated bypass switch is used to isolate and depressurize the solenoid valves during maintenance. The maintenance bypass valve position is indicated by proximity sensor No. 3 contacts (PS3).
- In bypass mode, the RCS INLET port is directed to C2 PROCESS port and C1 PROCESS port and solenoid valves are vented to the EXHAUST port.
- In the bypass mode, the normally open contacts of PSl and PS2 are closed, and PS3 is open, indicating that no pressure is on the solenoid valves.
- Reference Table 3 for the various states of solenoid energization, and the resulting status of PS proximity sensor contact state.

2. Testing and Maintenance:

Testing:

Solenoid-operated valve testing

The solenoid-operated valves and their associated proximity sensors can be tested online without interruption to the process. This testing is implemented by cycling each solenoid-operated valve and comparing the associated proximity sensor contact to the test table 3.

Partial Stroke testing

A partial stroke of the process valve can be performed online without interruption to the process. This testing is implemented by performing a solenoid-operated valve testing, then moving the process valve toward the safe state for a predetermined time. At the end of the predetermined time, the process valve is returned to the normal position. Testing can be automated using a programmable logic controller (PLC) or a distributed control system (DCS).

⚠CAUTION: (De - Energize - To - Trip Version) De - energizing two solenoid valves at the same time will initiate a shutdown.

⚠ATTENTION: (version « De-Energize-To-Trip ») la coupure électrique de deux électrovannes simultanément déclenchera un arrêt.

1. At all times during testing, one out of the two solenoid-operated valves must be in the energized position (De-Energize-To-Trip Version).
2. IF, during the test process, the pressure switches do not indicate what is expected according to the test table 3, the second solenoid-operated valve must not be de-energized (DE-Energize-To-Trip Version).

Maintenance

⚠WARNING: Potential Electrostatic Charging Hazard. Use wet or damp cloth when cleaning any non-metallic/ painted surfaces.

⚠AVERTISSEMENT: Risque potentiel de décharge électrostatique. Utilisez un chiffon humide quand vous nettoyez toutes les surfaces non métalliques ou peintes.

The Pneumatic RCS requires no routine maintenance except periodic inspections for loose wires and fittings. The enclosure should be opened occasionally and the components checked to make sure they are tight, clean, and dry. The Breather/Drain shall be inspected for obstruction and that it is free of debris during routine maintenance cycles and during manual proof testing.

Manually-Actuated Bypass Valve

If it is necessary to replace a solenoid valve or coil during normal operation, the manually operated bypass is used. The valve is used to isolate and depressurize the solenoid valves for maintenance only.

When the maintenance bypass valve is in its maintenance bypass position, the RCS “inlet” port is directly connected to the “process” port (C2), and “process” port C1 is connected to the “exhaust” port. In the Maintenance Bypass mode the NORMALLY OPEN contacts of pressure sensor PS1 and PS2 are closed, and PS3 is open.

Manual Bypass Valve Operation (for maintenance only)

⚠WARNING: Explosion Hazard. Do not open the enclosure unless area is known to be non-hazardous.

Table 3 - RCS States Double Acting

State	SOV1	SOV2	Bypass Valve	Normally Open Contact State			Process Outlet C1	Process Outlet C2
				PS1	PS2	PS3		
1	Energized	Energized	Normal Operation	Open	Open	Closed	Vented	Air Supply
2	De-Energized	De-Energized	Normal Operation	Closed	Closed	Closed	Air Supply	Vented
3	De-Energized	Energized	Normal Operation	Closed	Open	Closed	Air Supply	Air Supply
4	Energized	De-Energized	Normal Operation	Open	Closed	Closed	Vented	Vented
5	*	*	Maintenance Bypass	Closed	Closed	Open	Vented	Air Supply
* - SOV valves are vented to exhaust when in Maintenance Bypass mode.								

⚠ AVERTISSEMENT: Risque d'explosion. Ne pas ouvrir le boitier dans une atmosphère explosible.

1. Turn the key clockwise from "Normal" to "Maintenance Bypass". The system pressure is now bypassed directly from "inlet" to "process" port (C2) so that the process valve position is maintained (a lever option is available in place of the key).
2. Verify that all three proximity sensor contacts are indicating the RCS is in bypass. Refer to Table 3.

⚠ WARNING: Remove the maintenance bypass key from the switch and place the key in the bottom of the enclosure until maintenance has been completed.

⚠ AVERTISSEMENT: Retirez la clé de dérivation de maintenance du commutateur et placez là au bas du boitier jusqu'à ce que la maintenance soit terminée.

⚠ WARNING: Explosion Hazard. Do not remove or replace any component while circuit is live unless area is known to be non - hazardous.

⚠ AVERTISSEMENT: Risque d'explosion. Ne pas retirer ou remplacer les composants lorsque le circuit est sous tension sauf en atmosphère non explosible.

3. Turn off power to the RCS; disconnect appropriate wires from terminal block.
4. Remove device (coil, solenoid valve) and install the new device following instructions supplied. If replacing a solenoid valve, apply a small amount of anti-seize to the bolt threads and torque to 160-175 in-lbs in a crisscross pattern. Reconnect wires to appropriate terminal, (see wiring diagrams provided with the RCS unit).
5. Turn on power to the RCS. Verify that each device has power and is in the correct state. (See Table 3).
6. Replace key in the Maintenance Bypass and rotate counter-clockwise to the "Normal" position.
7. Have the control room run through the programmed test to be sure the system is operating properly.

Section 4.

1. Functional Test Certification

Once assembled and inspected the RCS is cycled through a generic program to validate two-out-of-two (2oo2) or one-out-of-one hot standby (1oo1 HS); shut down function; solenoid valve status and pressure switch indication and manual bypass function.

2. Spare Parts

⚠ WARNING: Replacement parts are only to be obtained from ASCO or an authorized distributor or the certifications may be invalidated or there may be a risk of explosion.

⚠ AVERTISSEMENT: Le pièces de rechange doivent uniquement être approvisionnées auprès d'ASCO ou d'un de ses distributeurs agréés, sinon les certificats pourraient être invalidés et il pourrait y avoir un risque d'explosion.

VALVES AND COILS			
APPLICATION	VOLTAGE	VALVE includes proximity sensor/switch	COIL
De-Energize-To-Trip	12/DC	326424	238714-903-D
De-Energize-To-Trip	24/DC	325909	238714-902-D
De-Energize-To-Trip	48DC	326425	238714-912-D
De-Energize-To-Trip	120/DC	326426	238714-904-D
De-Energize-To-Trip	120/60–110/50	326427	238814-032-D
De-Energize-To-Trip	230/50–240/50	326428	238814-059-D
Bypass	ALL	323493	None

Packaging

While the package for RCS is designed to handle the weight of the unit, there are always hazards in shipping. Upon receipt of product, unpack and check the product against the packing slip. If there is damage to the product, immediately contact the Authorized ASCO sales representative.

4. Disclaimer

Because of the variety of uses for the ASCO Redundant Control System (RCS), the user and those responsible for applying this equipment must satisfy themselves as to the acceptability of the RCS for each application.

The illustrations in this manual are solely intended to illustrate the text of this manual. Because of the many variables and requirements associated with this particular installation, ASCO cannot assume responsibility or liability for actual use based upon the illustrative uses and applications.

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