



# Redundant Control System

Safety instrumented system  
applications up to SIL 3

Process reliability

Process valve diagnostics



# RCS

COMPLETE FUNCTIONAL SAFETY WITH  
ENHANCED RELIABILITY



The Redundant Control System (RCS) is the only pilot valve system that has no single point of failure that could result in an unwanted closure of the process valve. The Redundant Control System is fit for use in **SIL3** applications with a spurious trip rate that is lower than Tri-Modular Redundant logic solvers. RCS achieves a higher level of process safety and reliability by using a redundant, fault tolerant architecture, high diagnostic coverage, and automated testing. A keyed bypass allows on-line maintenance of the RCS without process interruption.

The RCS is available in a variety of constructions that provide valve diagnostics through automated, partial stroke testing.

**The availability and reliability of RCS provides the most cost effective choice for process valve diagnostics and actuation.**

## ADVANTAGES

### NO NUISANCE TRIPS

### EASY ON-LINE MAINTENANCE

### HIGH AVAILABILITY

### AUTOMATED SOLENOID TESTING

### KNOWN TECHNOLOGY

### AUTOMATED PARTIAL STROKE TESTING

### LOWEST COST OPTION FOR

### VALVE ACTUATION AND AUTOMATED TESTING

## DIAGNOSTIC PROCESSOR

### WITHOUT ON-BOARD DIAGNOSTIC PROCESSOR

In its simplest form, the RCS can be implemented using one digital output from the controller shared by both solenoid operated valves and a single digital input back to the controller for a common alarm (series through all three pressure switches) to identify a solenoid operated valve failure or maintenance bypass of the unit. Manual testing can be facilitated through panel mounted pushbuttons (two) where each pushbutton is capable of cutting power to its associated solenoid operated valve. Testing is performed by actuating one pushbutton at a time. For automated operation, the RCS is provided with two digital outputs and three digital inputs. Using a system controller, the safety action of the RCS is entirely controlled through the operation of the two digital outputs. Any functional testing of the solenoid operated valves or partial stroke testing of the isolation valve is accomplished by programming the controller using IEC 61131 logic flow diagrams provided by ASCO.

### WITH ON-BOARD DIAGNOSTIC PROCESSOR

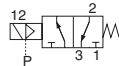
In order to reduce programming and I/O requirements in the user’s controller, RCS can be supplied with an on-board diagnostic processor (Siemens S7-200 series). This on-board processor controls the outputs to the individual solenoid operated valves and receives the diagnostic information from the pressure switch inputs. Power is supplied to the on-board PLC by user’s controller, which executes the safety action by de-energizing the output power to the on-board processor. Consequently, the user’s controller is always responsible for the safety action. The on-board processor provides diagnostic and testing information only and can be considered interference free and benign to the safety action. Watchdog relays are provided to prevent de-energizing the solenoid-operated valves due to a lack of on-board processor outputs. The watchdog relays maintain power to the solenoid-operated valves, avoiding inadvertent initiation of the safety action. The activation of the watchdog relays is detected and reported by the on-board processor. In the case of a total loss of the on-board processor, loss of communications from the on-board processor or loss of the pulse from the on-board processor, digital output is detected and annunciated.

**Two temperature ranges for the on-board processor are available:**

Standard: 0°C to 55°C (32°F to 131°F), Extended Temperature: -25°C to 70°C (-13°F to 158°F)

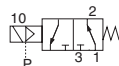
## CONFIGURATION

### NORMALLY CLOSED VERSION



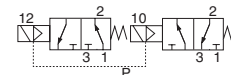
**Operation:** The normally closed RCS operates like a standard normally closed 3/2 solenoid operated valve.  
**Application:** The majority of emergency shut down valves are required to close in order to achieve the specified safe state for the process under control (i.e. shut off flow) and they are specified “fail safe” (spring to the safe state) which requires that the solenoid operated valves vent the process valve actuator allowing the process valve to move to a specified safe state on loss of power.

### NORMALLY OPEN VERSION



**Operation:** The normally open RCS operates like a standard normally open 3/2 solenoid operated valve.  
**Application:** The majority of emergency vent valves are required to open in order to achieve the specified safe state for the process under control (i.e. vent off pressure). In order to prevent opening of the process valve due to loss of instrument air, the user may choose to specify the process valve as air to open spring return closed. To move the process valve to the safe state requires the solenoid valves to apply air to the process valve actuator when they are de-energized. This configuration also fulfills the requirement that the process valve will move to the specified safe state on loss of power.

### DOUBLE ACTING VERSION (Available in 2oo2D operation.)



**Operation:** The double acting RCS operates like a 4/2 valve controlling air pressure to opposite sides of a piston type actuator.

**Application:** The user must determine the desired position (open or closed) for the process valve on loss of power (i.e. fail close/fail open). If the desired “fail” state for the valve is open, the normally open solenoid valve of the double acting RCS will control the air to the side of the process valve actuating cylinder that will drive the process valve shut and the normally closed solenoid operated valve of the double acting RCS will control the air to the side of the process valve actuating cylinder that will vent and allow the process valve to shut.

## OPERATIONAL MODES

### 2oo2D MODE

In the 2oo2D mode, both solenoids must de-energize for shutdown. Pressure switches are used to individually alarm if either solenoid valve goes to the vent state when not commanded, thereby reducing the potential for spurious trips. The pressure switches are also used for signaling during automatic, on-line testing.

### 1oo1HS MODE

In the 1oo1HS mode, only one solenoid valve is on-line during normal operation. Any spurious trip of the on-line solenoid valve is detected by the logic solver, due to a signal being sent from an associated pressure switch. The response to the trip is to energize the second solenoid valve thereby maintaining air supply to the block valve. For functional testing, both solenoid valves are energized. Each solenoid valve is de-energized individually with pressure switch confirmation of successful venting. No bypassing is required for functional testing. With this configuration, RCS achieves the safety availability of a single solenoid valve, the reliability of a two-out-of-two voted solenoid operated valve configuration and is SIL 3 capable.

## OPTIONAL FEATURES

ASCO offers many standard optional features. These features are available individually as well as in many different combinations. Special constructions containing customer specified features are also available. Please contact your ASCO representative for availability.

Some optional features automatically come with lights and/or push buttons located in pre-assigned locations for local initiation and local indication. They are as follows:

- Common alarm includes (1) green light
- Local initiation of SOV test includes (1) push button and (2) red lights
- Local initiation of partial stroke test includes (1) push button and (1) red light
- Local manual reset includes (1) red lighted push button
- Local initiation of bypass includes (1) red light

### Customer Selected Lights and Push Buttons

Space for up to (4) additional customer selected lights and/or push buttons is available. The location of these lights and push buttons can be identified by placing your computer cursor on an option. This will result in this option being displayed on the cabinet view.

## PRODUCT SPECIFICATIONS

### GENERAL SPECIFICATIONS

**Total weight:** Approx. 75 lbs

**Air Quality:** Dry instrument air, filtered to 50 microns (5 micron particulate and .3 micron coalescing filtration recommended)

**Ambient Temperatures:**

RCS-5R -23°C to 60°C (-9°F to 140°F)

RCS-5L 0°C to 55°C (32°F to 131°F)

RCS-5L (for extended temperatures) -25°C to 70°C (-13°F to 158°F)

**Wiring:** Maximum wiring size 14 awg

Cv: 2.0 Typical for NC

**Assembly Approvals: (without on-board diagnostic processor)**

ATEX II 2 G Ex d e mb IIC

### ENCLOSURE

304 or 316 Stainless Steel, Fiberglass - UL Type 4, 4X, IP56

### SOLENOID VALVE

**Solenoid Operators:** 1.4 watt (DC), 10.1 watt (AC), UL listed

Class I, Division 2, Groups A,B,C & D - Nonincendive,

Class I, Division 1, Groups A,B,C & D - Explosionproof AC & DC;

Continuous duty (CSA certified) - DC

### PRESSURE SWITCH (3 UNITS)

Stainless Steel Wetted Parts - FM, CSA, ATEX: EEx d IIC, CE

Electrical rating: Gold contacts (std) 1 amp suppressed resistive load; .5 amp inductive load @ 28 VDC

Silver contacts (opt) 5 amps suppressed resistive load; 3 amps inductive load @ 28 VDC

### ON-BOARD DIAGNOSTIC PROCESSOR (RCS-L)

European Community (CE) Low Voltage Directive 73/23/EEC

EN 61131-2: Programmable controllers - Equipment requirements

UL 508 Listed (Industrial Control Equipment) Registration number E75310

CSA C22.2 Number 142 Certified (Process Control Equipment)

FM Class I, Division 2, Groups A,B,C & D Hazardous Locations T4A and Class I, Zone 2 IIC, T4

### SIL 3 CAPABLE

RCS in 1oo1HS and 2oo2D configurations is fit for use in SIL 3 applications per IEC 61508 for low demand mode applications. For more information, consult the RCS safety manual.

### OPTIONS

Panel lights (Class I, Div. 2), and push button (Class I, Div. 2) up to a total of 12 lights and push buttons.

### PNEUMATIC CONNECTIONS

Recommended piping for the inlet and outlet pneumatic connections to the RCS is 1/2" stainless steel tubing. The length of tubing between the RCS and the process valve should be kept as short as possible for the fastest response of the process valve actuator.

**Normally Closed / Normally Open**

Inlet: 1/2" NPT, 3-150 psi max.

Pilot: 1/8" NPT, 40-150 psi max

Process: 1/2" NPT

Exhaust: 1/2" NPT

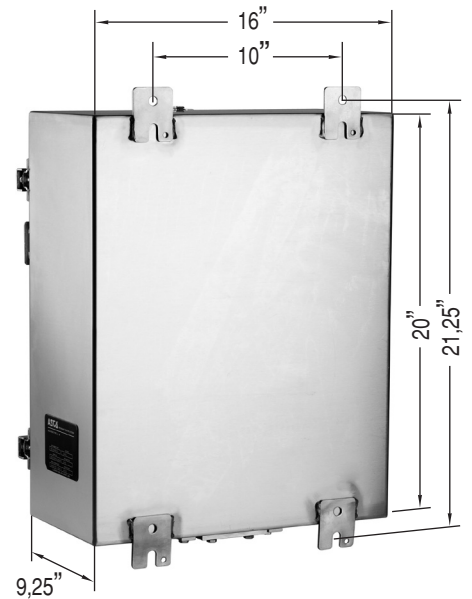
**Double Acting**

Inlet: 1/2" NPT, 3-150 psi max.

Pilot: 1/8" NPT, 40-150 psi max.

Process: (2) 1/2" NPT

Exhaust: 1/2" NPT



### OPERATIONAL RELATIONSHIP OF THE RCS TO THE PROCESS VALVE

De-energize to Trip			
	Normally Closed	Normally Open	Double Acting
Coils Energized (Normal)	Supplies air to PV	Exhaust PV	Supplies air to (C2), Exhaust (C1)
Coils De-energized (Trip)	Exhaust PV	Supplies air to PV	Exhaust (C2), Supplies air to (C1)
Bypass	Supplies air to PV	Exhaust PV	Supplies air to (C2), Exhaust (C1)
Energize to Trip			
	Normally Closed	Normally Open	Double Acting
Coils De-energized (Normal)	Supplies air to PV	Exhaust PV	Supplies air to (C2), Exhaust (C1)
Coils Energized (Trip)	Exhaust PV	Supplies air to PV	Exhaust (C2), Supplies air to (C1)
Bypass	Supplies air to PV	Exhaust PV	Supplies air to (C2), Exhaust (C1)

## RCS CONFIGURATOR

ASCO simplified the RCS product selection process with an online catalog number configurator. Once you have determined the features required, you can easily construct a catalog number by clicking on each feature required and then clicking the **View Details** button. A second screen appears providing the product catalog number, product attributes, and various drawings. The configurator is programmed to accept only valid constructions.

In addition to creating a catalog number, the configurator can also decipher a catalog number. Type a valid 5RC or 5LC catalog number into the window next to the **Enter Catalog Number** button (CAPs only). The configurator automatically highlights the appropriate construction features.

In order to use the online configurator go to: [www.ascovalve.com/RCSConfigurator](http://www.ascovalve.com/RCSConfigurator)

5RC027BFQ4E2Z0C

To ensure that you are familiar with the RCS product line, we recommend that you read the RCS catalog prior to designing a product.

**Design a Redundant Control System**

\* Indicates a required attribute

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**Optional Features**

Common Alarm	Full Stroke Limit Switch
Modbus 485 Communication	Dual Power Sources
Local Initiation of Sov Test	Analog Input Module
Local Initiation of Partial Stroke Test	Two Analog Input Modules
Local Manual Reset	Cabinet Heater
Bypass Indication	Lever Type Bypass
Midstroke Limit Switch	Shutoff for Modulated Control Valves
Silver Contacts for Relay Logic	No Bypass
SIL Certification	ATEX Certification

**Additional Lights and Push Buttons**

One Green Light	One Green & One Red Light	One Push Button
Two Green Lights	Two Green & One Red Light	Two Push Buttons
Three Green Lights	Three Green & One Red Light	Three Push Buttons
Four Green Lights	One Green & Two Red Lights	Four Push Buttons
One Red Light	One Green & Three Red Lights	
Two Red Lights	Two Green & Two Red Lights	
Three Red Lights		
Four Red Lights		

**Information**

