rotork®

Keeping the World Flowing
for Future Generations

R Series

User manual

CE Ex

Contents

NOTE:

The R Series is referred to as 'R Range' in promotional material.

Contents

1. Intended Use

Rotork R-Series actuators are intended to be used in combination with any valve to regulate the flow automatically. The output of the actuator is rotary or linear,and is paired with the valve stem to achieve the desired flow control.

2. Manufacturer Details

Rotork manufactures the R-Series actuator at the following facilities:

Fairchild Industrial Products Company
3920 West Point Blvd.
Winston Salem, NC 27103
USA

Rotork Flow Technology (Suzhou)Co., Ltd.
Building A, No. 88, Yinhe Road,
Southeast Street, Changshu
Jiangsu 215558
China

3. Meaning of Symbols

The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product.

The Lightning Flash with arrowhead symbol within an equilateral triangle, is intended to alert the user to the presence of un-insulated "dangerous voltage" within the product enclosure that may be of sufficient magnitude to constitute a risk of shock to persons.

4. Applicable Sections

This manual covers the operation of the full range of R Series actuators.

Power Supply	DC or AC
Control	AB, HB, AF, HF, AS, HS, DC, DT, PT
Actuation	Linear, Rotary, Spring Return
Battery	YES or NO

Each section in the specifies which actuators it applies to, for example:

Applies to:	**Power**	**Control**	**Actuation**	**Battery**
	DC	AF	Any	NO

5. Understanding the Model Number

R Series actuators part numbers are of the format: RXX-Y-ZZZZZ-V

XX Denotes the positioning and gearing
Y Denotes special options
ZZZZZ Denotes the case, thermal management and electrical control
V Denotes the valve integration

Example part number: RCM-AC-B00AF-0

XX: Positioning and Gearing

The first character indicates the positioning. Options are:

C Continuous
D Discrete

The second character indicates the torque and gearing. Options are:

J Extra low torque
L Low torque
M Medium torque
H High torque
F Extra high torque

For example: RCM means Continuous Positioning with Medium Torque

Y: Special Options

If the special options field is 0, the actuator has no special options.

Actuators with AC power supply will have “AC” in the special options field. Otherwise the power supply is DC.

Actuators with Linear drive will have “L1” to “L6” in the special options field.

Actuators with Spring Return will have “S” or “RS” in the special options field.

Otherwise the actuation is standard rotary.

Special options may be combined, in alphabetical order.

For example: RCM-ACL1 means an RCM Actuator with AC power and L1 linear drive.

ZZZZZ: Case, Thermal Management and Electrical Control

The first character indicated the case type. Options are:

B Aluminum ATEX hazardous locations rated enclosure
E Stainless steel ATEX hazardous locations rated enclosure
M Aluminum CCC hazardous locations rated enclosure
P Stainless steel CCC hazardous locations rated enclosure
A Aluminum North America hazardous locations rated enclosure
N Stainless North America hazardous locations rated enclosure

The last two characters of the electrical control field show which control board is installed. The options are:

AB Analog without feedback
HB AB with 4x output resolution
AF Analog with feedback
HF AF with 4x output resolution
AS MODBUS with analog input
HS AS with 4x output resolution

5. Understanding the Model Number

DC Digital continuous positioning
DT Digital discrete positioning
PT Fail Safe Spring Return

For example: RCM-ACL1-E00AF means an RCM actuator with AC power and Linear drive, stainless steel hazardous locations enclosure and Analog control with feedback.

6. Installation

The safety of any system incorporating the equipment is the responsibility of the assembler of the system.

6.1 Environmental Conditions

The R-Series actuator has an IP67 rating and is recommended for outdoor use. The relative humidity of the environment has no effect on the R-Series.

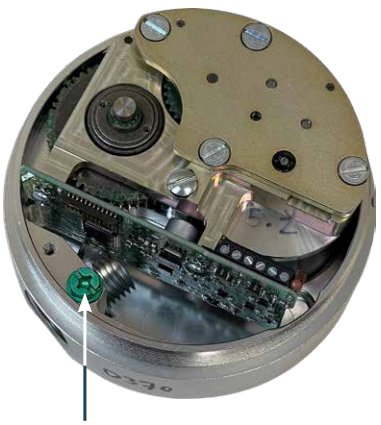
6.2 Mounting

The holes indicated in the image are intended for a mounting bracket. They are threaded for ¼-20 and are 0.3" deep.

6.3 Grounding and Securing

The other two visible holes are threaded 10-32, 0.50" deep, and are intended to be used to lock the lid in position (top) and as an external grounding connection (bottom) using supplied screws.

For detailed dimensions see Actuator Dimensions.



Additionally, there is a grounding connection supplied internally.

7. Wiring

The R Series Explosionproof actuator does not come with a pre-installed cable, nor cable gland. A cable gland that meets site specifications for the appropriate hazardous location rating is required for installation. The cable gland and the cable for hazardous location should be installed by qualified personnel in accordance with site and local requirements.

The actuator comes standard with a ½" FNPT thread cable entry. See the actuator dimension drawings for the location of ½" FNPT housing access.

Standards for cable gland and cable in hazardous locations:

Compliance Standards Required to be Met	Cable Types Permitted in Class I Division 1 Hazardous Locations
ANSI / UL 514B, ANSI / UL 1203, ANSI / UL 2225, C22.2	Non-Armored Extra Hard Usage Cord & TC-ER-HL
ANSI / UL 514B, ANSI / UL 1203, ANSI / UL 2225	Armored IEEE 45 & IEEE 1580 Marine Shipboard Cable
ANSI / UL 514B, ANSI / UL 1203, ANSI / UL 2225	MC-HI, ITC-HL
ANSI / UL 514B, ANSI / UL 1203, C22.2	Teck 90 (Canada Only)

* The FNPT thread is not intended for conduit connection. Cable gland only.

8. 24 VDC Powered Actuators

8.1 Power Supply and Current Draw

Applies to:	Power	Control	Actuation	Battery
	DC	Any	Any	Any

The **R Series** is intended for operation at 24 VDC, but it may be connected to voltages ranging within 12-24 VDC. The DC supply to the actuator must be limited by a 4 A fuse or circuit breaker; it is recommended to have this installed near the actuator.

The current draw will range from minimum 100 mA to maximum 3 A while the actuator is active. When not moving, the actuator draws approx. 50 mA.

Note: Position tracking on power down is disabled for supply voltages below 12 VDC, so the actuator position may not be retained on power-loss, on power-up the actuator will need to be re-zeroed every time.

Note: Actuator performance specifications are based on 24V operation. Speed and torque may be lower when operating from voltages below 24V.

Note: Actuators with optional battery backup must be powered with 24 VDC only.

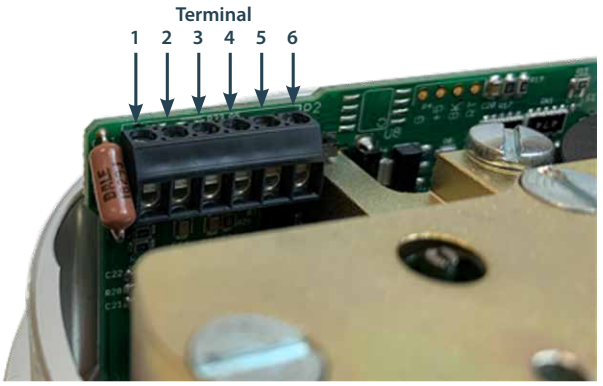
Note: All R Series actuators have the DC power ground electrically connected to the case.

8.2 Wiring 24 VDC AB Version

Applies to:	Power	Control	Actuation	Battery
	DC	AB	Any	NO

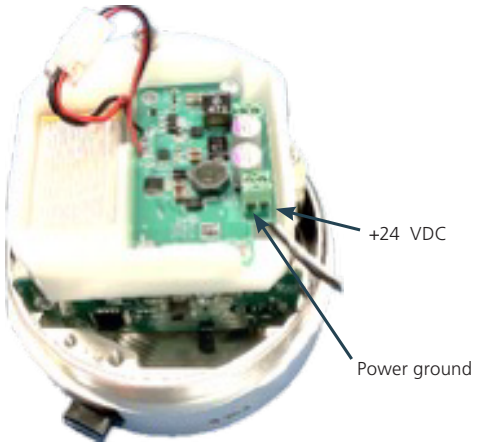
Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as indicated here:

Pin	Function
6	+24 VDC
5	Power ground
4	Not connected
3	Not connected
2	Ground (connected to pin 5)
1	Input signal (4-20 mA)



8.3 Wiring 24 VDC AB Version with Battery

Applies to:	Power	Control	Actuation	Battery
	DC	AB	Any	YES



The battery board holder (white plastic part, see image below) will have to be unscrewed to access the terminal block on the circuit board for wiring. When wiring is complete screw the battery board holder back into place.

Do not remove or change the existing **BLACK** and **WHITE** wires that connect the battery board to the processor board.

Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as shown.

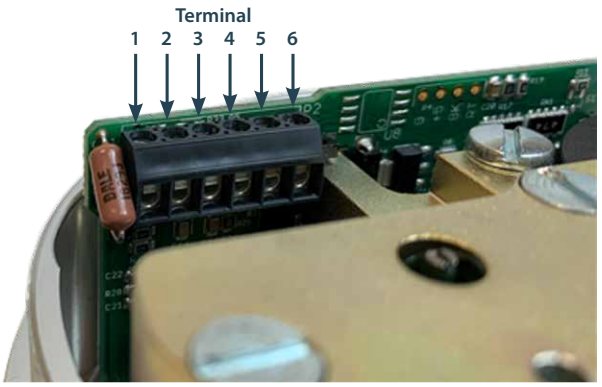
Pin	Function
6	Already Connected to battery board. Connect +24 VDC wire to the positive terminal on the battery board as shown.
5	Already Connected to battery board. Connect power ground wire to the ground terminal on the battery board as shown.
4	Not Connected
3	Not connected
2	Input signal gnd.
1	Input signal (4-20 mA)

8.4 Wiring 24 VDC AF Version

Applies to:	Power	Control	Actuation	Battery
	DC	AF	Any	NO

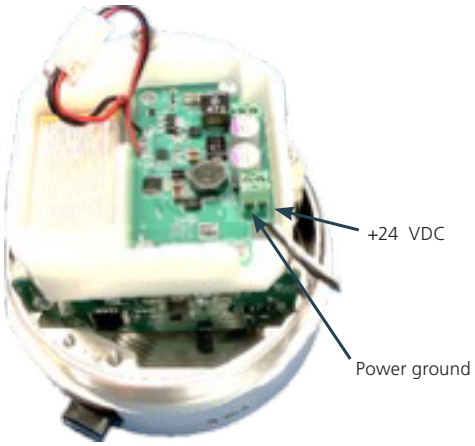
Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as indicated here:

Pin	Function
6	+24 VDC
5	Power ground
4	Feedback signal (4-20 mA)
3	Not connected
2	Isolated input signal gnd.
1	Isolated input signal (4-20 mA)



8.5 Wiring 24 VDC AF Version with Battery

Applies to:	Power	Control	Actuation	Battery
	DC	AF	Any	YES



The battery board holder (white plastic part, see image below) will have to be unscrewed to access the terminal block on the circuit board for wiring. When wiring is complete screw the battery board holder back into place.

Do not remove or change the existing **BLACK** and **WHITE** wires that connect the battery board to the processor board.

Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as shown.

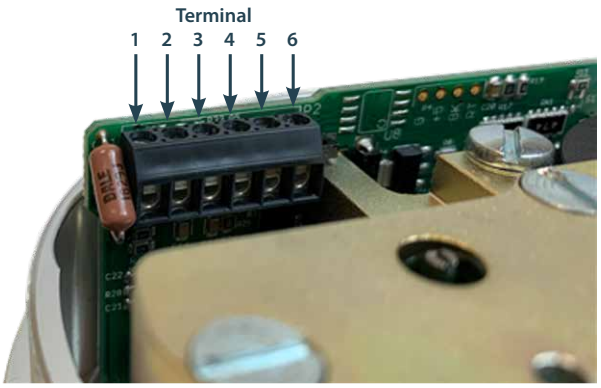
Pin	Function
6	Already Connected to battery board. Connect +24 VDC wire to the positive terminal on the battery board as shown.
5	Already Connected to battery board. Connect power ground wire to the ground terminal on the battery board as shown.
4	Feedback signal (4-20 mA)
3	Not connected
2	Isolated input signal gnd.
1	Isolated input signal (4-20 mA)

8.6 Wiring 24 VDC AS Version

Applies to:	Power	Control	Actuation	Battery
	DC	AS	Any	NO

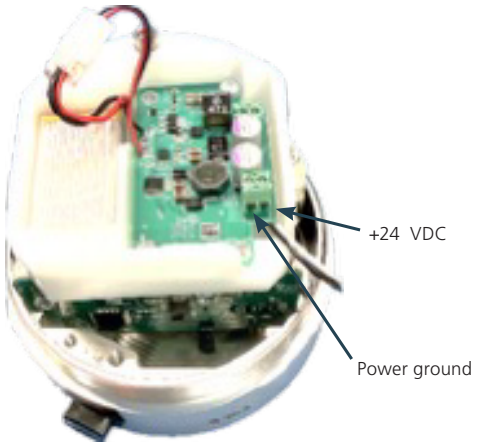
Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as indicated here:

Pin	Function
6	+24 VDC
5	Power gnd.
4	TD(A)
3	TD(B)
2	Isolated input signal gnd.
1	Isolated input signal (4-20 mA)



8.7 Wiring 24 VDC AS Version with Battery

Applies to:	Power	Control	Actuation	Battery
	DC	AS	Any	YES



The battery board holder (white plastic part, see image below) will have to be unscrewed to access the terminal block on the circuit board for wiring. When wiring is complete screw the battery board holder back into place.

Do not remove or change the existing **BLACK** and **WHITE** wires that connect the battery board to the processor board.

Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as shown.

Pin	Function
6	Already Connected to battery board. Connect +24 VDC wire to the positive terminal on the battery board as shown.
5	Already Connected to battery board. Connect power ground wire to the ground terminal on the battery board as shown.
4	TD(A)
3	TD(B)
2	Isolated input signal gnd.
1	Isolated input signal (4-20 mA)

8.8 Wiring 24 VDC DC/DT Version

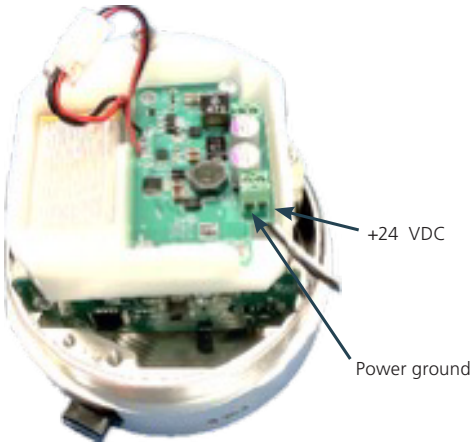
Applies to:	Power	Control	Actuation	Battery
	DC	DC/DT	Rotary	NO

Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as indicated here:

Pin	Function
6	+24 VDC
5	Power ground
4	Output TTL2
3	Output TTL1
2	Input TTL2
1	Input TTL1

8.9 Wiring 24 VDC DC/DT Version with Battery

Applies to:	Power	Control	Actuation	Battery
	DC	DC/DT	Rotary	YES



The battery board holder (white plastic part, see image below) will have to be unscrewed to access the terminal block on the circuit board for wiring. When wiring is complete screw the battery board holder back into place.

Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as indicated here:

Pin	Function
6	Already Connected to battery board Connect +24 VDC to the positive terminal on the battery board as shown.
5	Already Connected to battery board Connect power ground to the ground terminal on the battery board as shown.
4	Output TTL2
3	Output TTL1
2	Input TTL2
1	Input TTL1

Do not remove or change the existing **BLACK** and **WHITE** wires that connect the battery board to the processor board.

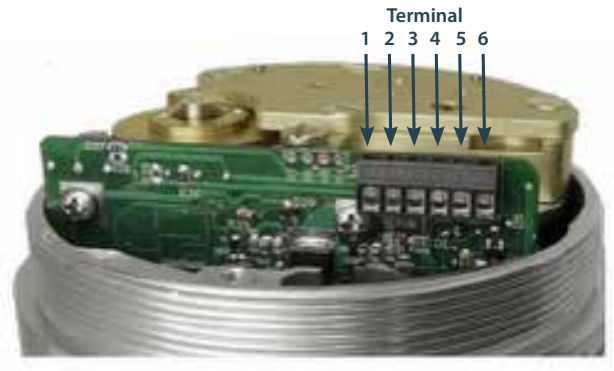
8. 24 VDC Powered Actuators

8.10 Wiring 24 VDC PT Version

Applies to:	Power	Control	Actuation	Battery
	DC	PT	Rotary	NO

Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as indicated here:

Pin	Function
6	+24 VDC (± 20%)
5	Power gnd
4	Signal (provide 24 V)
3	Limit Switch Common
2	Limit Switch – Zero Position
1	Limit Switch – Operate Position



9. 110-220 VAC Powered Actuators

AC Powered actuators use 110-220 VAC as the supply power, with low level analog or digital control signals.

Applies to:	Power	Control	Actuation	Battery
	AC	Any	Any	NO

9.1 Power Supply and Current Draw

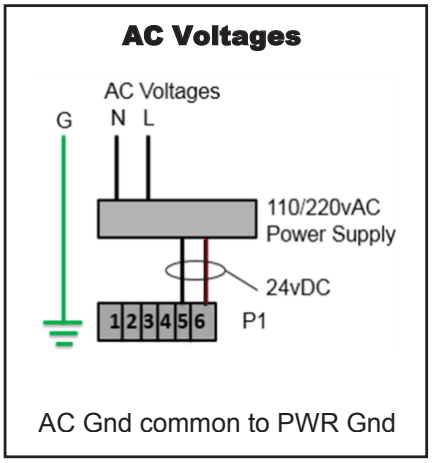
The **R series AC** actuator may be connected to voltages ranging within 110-240 VAC at 50/60 Hz. The AC supply to the actuator must be limited by a 2 A fuse or circuit breaker; it is recommended to have this installed near the actuator.

The current draw will range from minimum 10 mA to maximum 1.5 A while the actuator is active. When not moving, the actuator draws approx. 5 mA.

Wiring 110-220 VAC Versions

AC power is connected to the **WHITE & BLACK** wires with crimp connectors (WM18225-DN & WM18230-ND 18-22 AWG).

Ground is connected on the **GREEN** ground screw, shown below.



AC Input
Black: Live
White: Neutral

Ground connection

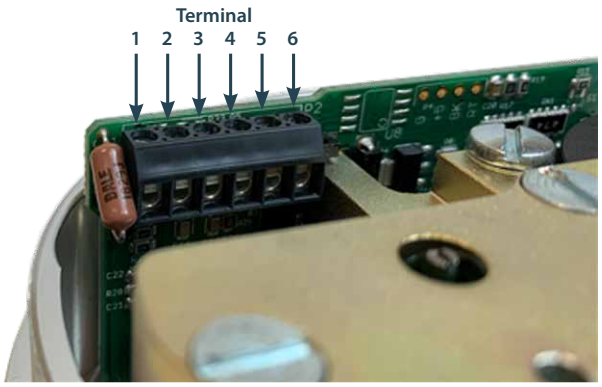
Internal Wires for 24 VDC
(Already Connected)
White: +24 VDC
Black: 0 VDC

9.2 Wiring 110-220 VAC AB Version

Applies to:	Power	Control	Actuation	Battery
	AC	AB	Any	NO

Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as indicated here:

Pin	Function
6	Already connected to +24 VDC
5	Already connected to DC ground
4	Not connected
3	Not connected
2	Input signal ground
1	Input signal (4-20 mA)

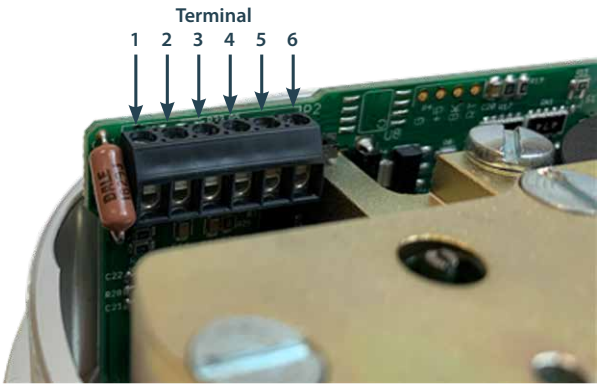


9.3 Wiring 110-220 VAC AF Version

Applies to:	Power	Control	Actuation	Battery
	AC	AF	Any	NO

Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as indicated here:

Pin	Function
6	Already connected to +24 VDC
5	Already connected to DC ground
4	Feedback signal (4-20 mA)
3	Not connected
2	Isolated input signal gnd.
1	Isolated input signal (4-20 mA)

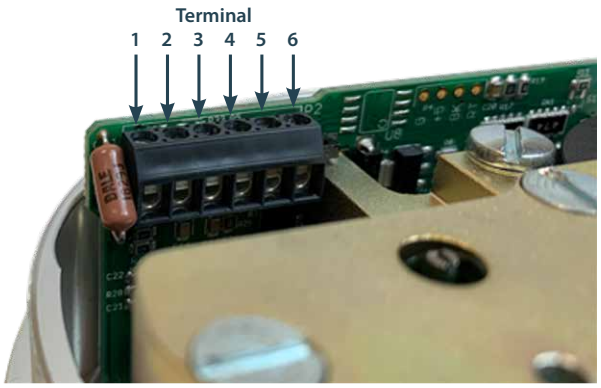


9.4 Wiring 110-220 VAC AS Version

Applies to:	Power	Control	Actuation	Battery
	AC	AS	Any	NO

Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as indicated here:

Pin	Function
6	Already connected to +24 VDC
5	Already connected to DC ground.
4	TD(A)
3	TD(B)
2	Isolated input signal gnd
1	Isolated input signal (4-20 mA)



9.5 Wiring 110-220 VAC DC/DT Version

Applies to:	Power	Control	Actuation	Battery
	AC	DC/DT	Rotary	NO

Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as indicated here. Note: the cables seen in the image below will not be present in explosionproof models.

Pin	Function
6	Already connected to power supply (connect live wire to the loose black cable with crimp connector).
5	Already connected to power supply (connect neutral wire to the loose white cable with crimp connector).
4	Output TTL2
3	Output TTL1
2	Input TTL2
1	Input TTL1

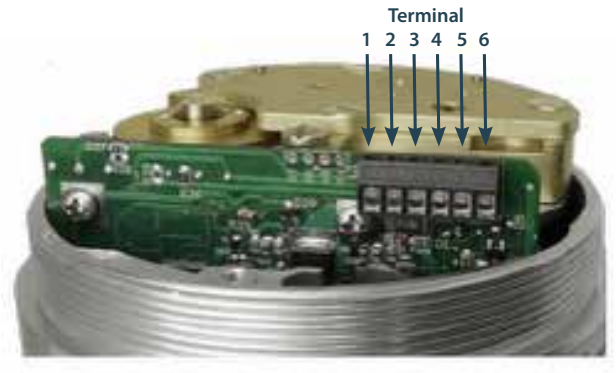
9. 110-220 VAC Powered Actuators

9.6 Wiring 110-220 VAC PT Version

Applies to:	Power	Control	Actuation	Battery
	AC	PT	Any	NO

Once the cable and cable gland are installed, connect the wires to the pins on the terminal block as indicated here:

Pin	Function
6	Already connected to power supply (connect live wire to loose black cable with crimp connector, see page 11
5	Already connected to power supply (connect neutral wire to loose white cable with crimp connector, see page 11
4	Signal (provide 24 V)
3	Limit Switch Common
2	Limit Switch – Zero Position
1	Limit Switch – Operate Position

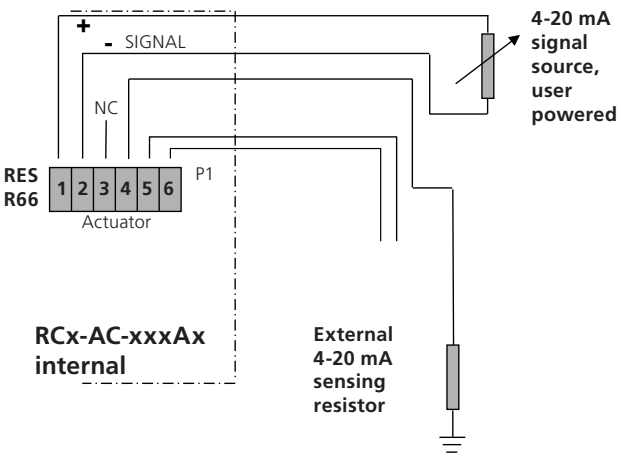


10. Control Signals

10.1 Control Signal and Feedback AF Version

Applies to:	Power	Control	Actuation	Battery
	Any	AF	Any	Any

Locate the correct connection terminals/wires as shown in [REF], then connect your input signal on positions 1 and 2 (blue and brown wires) as shown below. Feedback, if applicable is connected to position 4.



NOTE 1: Usually, the actuators are shipped for 4-20 mA signal input.

NOTE 2: Signal Gnd. Is ISOLATED from Power Gnd. in all RCx-xxxAF models and must be connected.

NOTE 3: DO NOT CONNECT pin 4 directly or through a multimeter only to ground.

A sensing resistor of 50 ohms or more needs to be present.

Not observing this warning will damage the equipment.

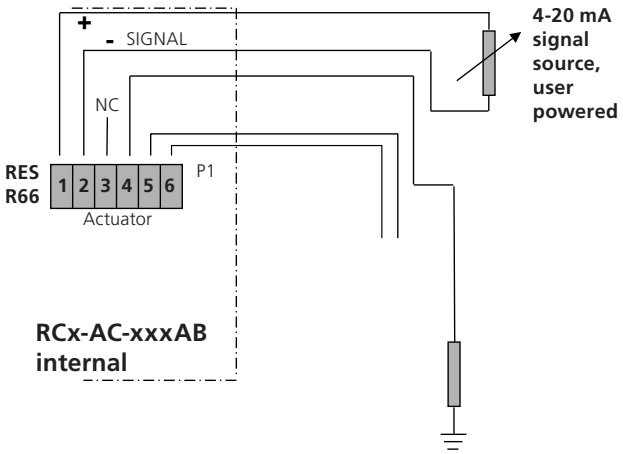
The actuator 4-20 mA output is internally supplying the signal current and can drive sufficient voltage for any sensing resistor of up to 250 ohms.

The potential of the external GND after the sensing resistor may not be more than +6 VDC / -2 VDC away from the power GND of the actuator.

10.2 Control Signal AB Version

Applies to:	Power	Control	Actuation	Battery
	Any	AB	Any	Any

Locate the correct connection terminals/wires as shown in [REF], then connect your input signal on positions 1 and 2 (blue and brown wires) as shown below. Feedback, if applicable is connected to position 4.



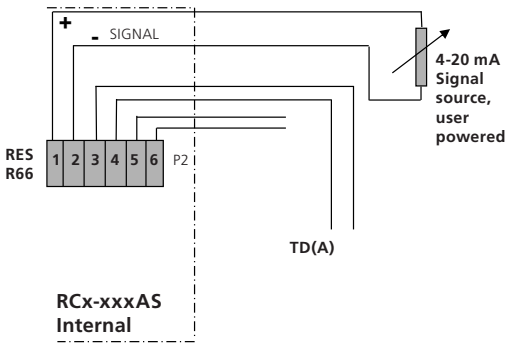
NOTE 1: Usually, the actuators are shipped for 4-20 mA signal input.

NOTE 2: Signal Gnd. Is CONNECTED to Power Gnd. in all RCx-xxxAB models.

10.3 Control and MODBUS Signal 24 VDC AS Version

Applies to:	Power	Control	Actuation	Battery
	Any	AS	Any	Any

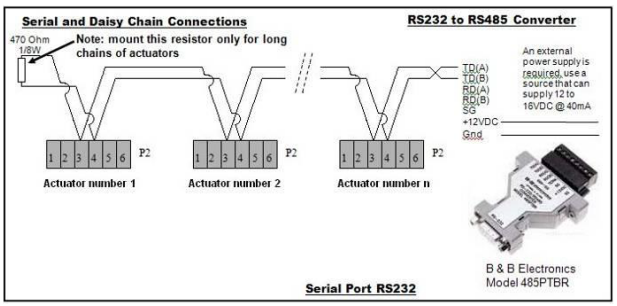
Locate the correct connection terminals as shown in figure then connect your communication wires to PIN 3 and PIN 4 (grey and pink wires) as shown below.



NOTE 1: Usually, the actuators are shipped for 4-20 mA signal input.

NOTE 2: Signal Gnd is ISOLATED from Power Gnd. in all RCx-xxxAS models.

10.3.1 Serial Port Connection

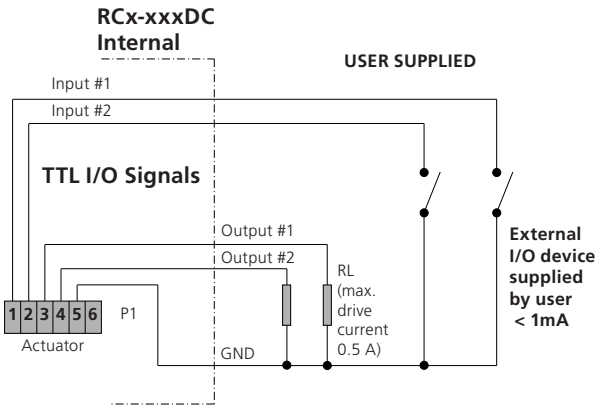


10.4 Control and Feedback Signal DC Version

Applies to:	Power	Control	Actuation	Battery
	Any	DC	Any	Any

Actuators with DC control have 5V pull to ground inputs, and 24 VDC and feedback signals. Locate the correct connection terminals/wires (as shown on the previous page), then set-up the PLC as shown below.

- Connect your input signal on positions 1 and 2 (brown and blue wires). **The input signals are high by default (5 V).** To change the value, send a low signal (0 V ⟷ pull to ground). See the section for details.
- Feedback is connected to positions 3 and 4. The maximum drive current is 0.5 A.

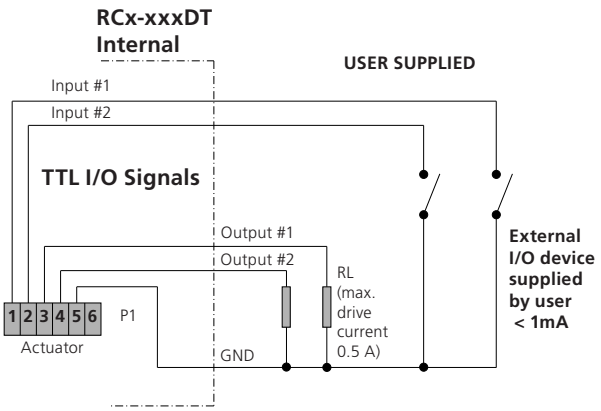


10.5 Control and Feedback Signal DT Version

Applies to:	Power	Control	Actuation	Battery
	Any	DT	Any	Any

Actuators with DT control have 5V pull to ground inputs, and 24 VDC and feedback signals. Locate the correct connection terminals/wires (as shown on the previous page), then set-up the PLC as shown below.

- Connect your input signal on positions 1 and 2 (brown and blue wires). **The input signals are high by default (5 V)**. To change the value, send a low signal (0 V ⟷ pull to ground). See the section for details.
- Feedback is connected to positions 3 and 4. The maximum drive current is 0.5 A.

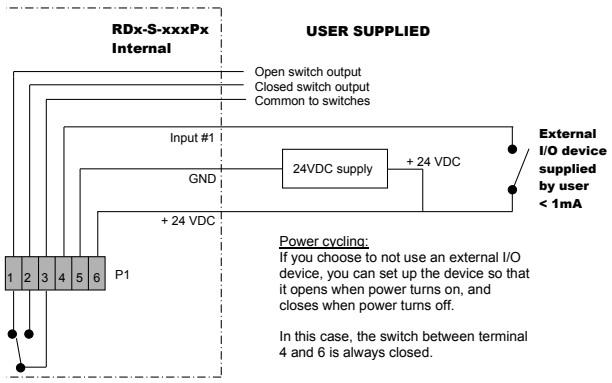


10. Control Signals

10.6 Control Signal 24 VDC PT Version

Applies to:	Power	Control	Actuation	Battery
	DC	PT	Any	Any

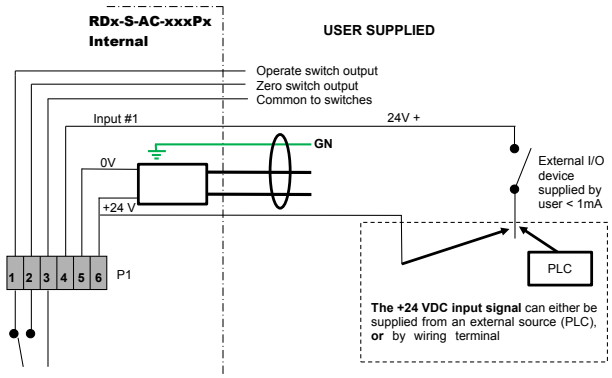
Locate the correct connection terminals/wires as shown on the previous page, then connect your input signal on terminal, as shown below.



10.7 Control Signal 110 VAC PT Version

Applies to:	Power	Control	Actuation	Battery
	AC	PT	Any	Any

Locate the correct connection terminals/wires, as shown on the previous page, then connect your input signal on position 4 (green wire), as shown below.



11. General specifications

Stall protection	Electronic position and motion detection
Gears & Bearings	Metal and bronze, oiled/greased for life
External fasteners	Stainless Steel
Life Expectance	250’000 cycles in specified conditions
Motor	Brushless DC motor, computer control
Positioning precision	Up to ± 0.25°
Positioning resolution	Up to ± 0.15° max.
End travel detection	By motion detection
Power setting	Adjustable
Mechanical Shock	Repeated ≤130 g-force, no effect Occasional ≤150g-force, no effect >150 g-force not tolerated
Mechanical Vibration	Random SAE J1211, Chassis, Exterior
Thermal Shock	-20 to +60 °C (-4 to 140 °F) in 10 min.
Weight	RxJ, RxL, RxM: 980 g RxH, RxF: 1700 g
Isolated Signals (AI & AF models only)	Optical isolation min. 1000 V

Applies to:	Power	Control	Actuation	Battery
	Any	AB/AF	Any	Any

12.1 DIP Switches (AB/AF)

The DIP switches allow you to change the settings on your actuator. To flip a switch, gently use a small flat-head screwdriver.

See the table below for DIP switch functionality.

In this example DIPs 1, 2, 5 and 12 are on.

DIP	Function
1 2	**Speed:** Choose how quickly the actuator will turn the valve.
3	Only in the ON position for actuator model RCH (with external gear stage).
4 5 6 7 8	**Turns/Stroke:** The actuator usually ships from the factory with the recommended number of turns or stroke for the valve. However, this number can be changed. Turning on a switch will add a specific number of turns to the actuator's movement. See p.38 for relation between positions of the DIP switches and number of turns. **Example:** Turning on DIP 6 adds four turns, turning on DIP 8 adds one turn. If both DIP 6 and 8 are on, then the total turns of the actuator would be five. (This sets stroke length for Linear actuators).
9	**Signal loss:** See signal loss section.
10 11	**Seating torque:** Set how much torque the actuator exerts on the valve lever during the calibration (finding valve seat) procedure. (Thrust for linear actuators).
12	**Direction/Calibration:** Toggle switch on and off while powered to re-calibrate actuator (find valve seat). Also sets direction in which the actuator will open and close. **Example:** The RCM model actuator turns clockwise when the signal is decreased with DIP 12 in the OFF position. Putting DIP 12 in the ON position will cause counter-clockwise turning for a decrease in signal. For changes in DIP 12 position to take effect, the power to the actuator must be cycled.

12.2 Controlling the AB/AF Actuator

The 4-20 mA (or 1-5 V / 1-10 V) input signal represents a total span of a number of turns or stroke length.

i.e.: If you set the number of turns to 2, then a signal of 12 mA will set the actuator to exactly 1 turn from the fully closed position. 15 mA will give: (15-4)/16=0.6875 ⇒ 68.75% of 2 turns ⇒ 1.375 turns from closed.

12.2.1 AB/AF Changing the Number of Turns (Rotary Versions)

Applies to:	Power	Control	Actuation	Battery
	Any	AB/AF	Rotary	Any

With the DIP switch settings, you can adjust anything between 1 and 31 turns to represent the full signal range of 4-20 mA. Check in the table below. (1 = "On", 0 = "Off").

Total Turns Dip4=0	DIP 5	DIP 6	DIP 7	DIP 8
reserved	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

For more turns, set DIP 4 to the ON position.

This will add 16 turns to the number set by DIPs 5 through 8, as shown in the table.

DIP 4=0	+0 turns
DIP 4=1	+16 turns

WARNING: Be sure that the number of turns the actuator is set for is **LESS** than the number of turns for the valve. The actuator should not stop itself on a fully opened valve. It can damage the valve, and the actuator will lose its position.

12.2.2 AB/AF Changing the Stroke Length (Linear Versions)

Applies to:	Power	Control	Actuation	Battery
	Any	AB/AF	Linear	Any

The standard linear actuator (RCx-**L1**-xxxAx models) has a maximal stroke of 1", and has 16 threads per inch (TPI). With the DIP switch settings, the actual stroke can be adjusted between 0.0625" and 1" in 1/16" increments, as indicated in the table below.

Non-standard RCx-**L2**-xxxAx models have 8 TPI instead. The stroke of these actuator models can be adjusted between 0.125" and 1" in 1/8" increments.

Additional non-standard models with a maximal stroke of 2" & 4" are also available. For such models, use the same DIP switch settings as indicated below, and multiply the stroke by 2 or 4 (for both 16 & 8 TPI models).

16 TPI (RCx-L1 models):				
Total Stroke (DIP 4 = 0)	**DIP 5**	**DIP 6**	**DIP 7**	**DIP 8**
reserved	0	0	0	0
0.0625"	0	0	0	1
0.1250"	0	0	1	0
0.1875"	0	0	1	1
0.2500"	0	1	0	0
0.3125"	0	1	0	1
0.3750"	0	1	1	0
0.4375"	0	1	1	1
0.5000"	1	0	0	0
0.5625"	1	0	0	1
0.6250"	1	0	1	0
0.6875"	1	0	1	1
0.7500"	1	1	0	0
0.8125"	1	1	0	1
0.8750"	1	1	1	0
0.9375"	1	1	1	1

* Turn on DIP 4 only for 1.000" stroke.

8 TPI (RCx-L2 models):				
Total Stroke (DIP 4 = 0)	**DIP 5**	**DIP 6**	**DIP 7**	**DIP 8**
reserved	0	0	0	0
0.125"	0	0	0	1
0.250"	0	0	1	0
0.375"	0	0	1	1
0.500"	0	1	0	0
0.625"	0	1	0	1
0.750"	0	1	1	0
0.875"	0	1	1	1
1.00"	1	0	0	0

WARNING: The stroke should not be set to exceed 1", otherwise the unit will stall. Also be sure that the stroke of the actuator is **LESS** than the stroke of the valve. The actuator should not stop itself on a fully opened valve. It can damage the valve, and the actuator will lose its position.

12.3 AB/AF Torque Settings (Rotary Actuators)

Applies to:	Power	Control	Actuation	Battery
	Any	AB/AF	Rotary	Any

To accommodate different valves and other applications with different torque requirements, the actuator can be set to apply different torque on the valve stem when in the seating mode.

During normal operation, the actuator will try to reach the speed set by DIP 1 and DIP 2. It will use 100% torque to try and reach the selected speed, regardless of the positions of DIP 10 and DIP 11. Current draw is limited to 3 A regardless of settings.

Please see the box to the right and the tables below to select the power setting that is right for your application.

Seating power settings:
(when operating at 24 VDC)

Dip 10	DIP 11	Power
OFF	OFF	16%
OFF	ON	33%
ON	OFF	66%
ON	ON	100%

To deal with sticking valves, at the beginning of the first reversing movement after the seating ("zeroing") of the valve, the actuator will apply double the power set by DIP 10 and DIP 11 (up to 100% power.). This "pull out" function is always enabled.

WARNING: High power settings can supply enough torque to damage your valve. Please be cautious, especially when using the 100% power setting.

Note: 66% setting and 100% setting require voltage supply minimum values as follows:

- Supply voltage needs to be min 14 VDC for 66% setting
- Supply voltage needs to be 16 VDC for 100% setting
- When operating above 20 VDC and 66% power, Duty cycle is reduced to 50% - 25% maximum. At these levels, the electronics produce more heat which must be dissipated (depending on environmental temperature)

12.3.1 AB/AF Speed and Torque Details

Applies to:	Power	Control	Actuation	Battery
	Any	AB/AF	Rotary	Any

The maximum speed of the actuator can be set by using the first two positions of the DIP switch selector.

As a result of this setting, the actuator will limit the maximum speed. The tables below show the time required to complete one turn.

The seating torque depends on the voltage provided in the power connection and on the seating power settings on DIP 10, 11 as shown below.

RCL-xxxAx Actuators

Speed:			Torque:				
DIP 1	DIP 2	Time for 1 turn (sec)	DIP 10	DIP 11	Seating Torque (in-lbs) 12 VDC	Seating Torque (in-lbs) 24 VDC	
OFF	OFF	7	OFF	OFF	6	12	Operating torque is 100%
OFF	ON	3	OFF	ON	10	20	
ON	OFF	2	ON	OFF	19	38	
ON	ON	1	ON	ON	24	48	

NOTE: If actuator is RCJ-xxxAx, divide torque values by 3.
To convert in-lbs to Nm, divide by 9.

RCM-xxxAx Actuators

Speed:			Torque:				
DIP 1	DIP 2	Time for 1 turn (sec)	DIP 10	DIP 11	Seating Torque (in-lbs) 12 VDC	Seating Torque (in-lbs) 24 VDC	
OFF	OFF	23	OFF	OFF	17	35	Operating torque is 100%
OFF	ON	11	OFF	ON	30	60	
ON	OFF	7	ON	OFF	55	115	
ON	ON	4	ON	ON	70	145	

NOTE: If actuator is RCK-xxxAx, divide torque values by 3.
To convert in-lbs to Nm, divide by 9.

RCH-xxxAx Actuators

Speed:			Torque:				
DIP 1	DIP 2	Time for 1 turn (sec)	DIP 10	DIP 11	Seating Torque (in-lbs) 12 VDC	Seating Torque (in-lbs) 24 VDC	
OFF	OFF	90	OFF	OFF	60	120	Operating torque is 100%
OFF	ON	45	OFF	ON	102	205	
ON	OFF	30	ON	OFF	200	400	
ON	ON	18	ON	ON	248	497	
			To convert in-lbs to Nm, divide by 9.				

RCF-xxxAx Actuators

Speed:			Torque:				
DIP 1	DIP 2	Time for 1 turn (sec)	DIP 10	DIP 11	Seating Torque (in-lbs) 12 VDC	Seating Torque (in-lbs) 24 VDC	
OFF	OFF	186	OFF	OFF	115	230	Operating torque is 100%
OFF	ON	94	OFF	ON	190	380	
ON	OFF	56	ON	OFF	360	720	
ON	ON	38	ON	ON	457	915	
			To convert in-lbs to Nm, divide by 9.				

12.4 AB/AF Thrust Settings (Linear Actuators)

Applies to:	Power	Control	Actuation	Battery
	Any	AB/AF	Linear	Any

To accommodate different valves and other applications with different thrust requirements, the actuator can be set to apply different amounts of force on the valve stem when in the seating mode.

During normal operation, the actuator will try to reach the speed set by DIP 1 and DIP 2. It will use 100% thrust to try and reach the selected speed, regardless of the positions of DIP 10 and DIP 11. Current draw is limited to 3 A regardless of settings.

Seating power settings:
(when operating at 24 VDC)

Dip 10	DIP 11	Power
OFF	OFF	16%
OFF	ON	33%
ON	OFF	66%
ON	ON	100%

To deal with sticking valves, at the beginning of the first reversing movement after the seating ("zeroing") of the valve, the actuator will apply double the power set by DIP 10 and DIP 11 (up to 100% power.) This "pull out" function is always enabled.

WARNING: High power settings can supply enough thrust to damage your valve. Please be cautious, especially when using the 100% power setting.

Note: 66% setting and 100% setting require voltage supply minimum values as follows:

- Supply voltage needs to be min 14 VDC for 66% setting
- Supply voltage needs to be 16 VDC for 100% setting
- When operating above 20 VDC and 66% power, Duty cycle is reduced to 50% - 25% maximum. At these levels, the electronics produce more heat which must be dissipated (depending on environmental temperature)

12.4.1 AB/AF Speed and Thrust Details (Linear Actuators)

Applies to:	Power	Control	Actuation	Battery
	Any	AB/AF	Linear	Any

The maximum speed of the actuator can be set by using the first two positions of the DIP switch selector.

As a result of this setting, the actuator will limit the maximum speed. The tables below show the time required for 1" of travel.

The seating thrust depends on the voltage provided in the power connection and on the seating power settings on DIP 10, 11 as shown below. The values shown are for a 24 VDC power connection.

RCL-Lx-xxxAx Actuators

Speed:			
DIP 1	DIP 2	Seconds per inch	
		8 TPI	16 TPI
OFF	OFF	63	120
OFF	ON	32	64
ON	OFF	20	38
ON	ON	13	26

Thrust:			
DIP 10	DIP 11	Seating Thrust (lbs)	
		8 TPI	16 TPI
OFF	OFF	37	13
OFF	ON	83	44
ON	OFF	149	88
ON	ON	180	138
Running Thrust		200	175

NOTE: If actuator is RCJ-Lx-xxxAx, divide thrust values by 3.
NOTE: If actuator is powered by 12 VDC, divide thrust values by 2.
To convert lbs to N, divide by 4.5.

RCM-Lx-xxxAx Actuators

Speed:			
DIP 1	DIP 2	Seconds per inch	
		8 TPI	16 TPI
OFF	OFF	189	360
OFF	ON	96	192
ON	OFF	60	114
ON	ON	40	78

Thrust:			
DIP 10	DIP 11	Seating Thrust (lbs)	
		8 TPI	16 TPI
OFF	OFF	110	35
OFF	ON	245	128
ON	OFF	445	256
ON	ON	535	400
Running Thrust		600	517

NOTE: If actuator is RCK-Lx-xxxAx, divide thrust values by 3.
NOTE: If actuator is powered by 12 VDC, divide thrust values by 2.
To convert lbs to N, divide by 4.5.

12.5 AB/AF Signal Loss and Calibration

Applies to:	Power	Control	Actuation	Battery
	Any	AB/AF	Any	Any

1. **For actuators that are not connected to a UPS** (Uninterruptible Power Supply), the loss of signal will be simultaneous with power loss. Consequently, the actuator will not be able to move anywhere. In the shutdown process, the actual position is automatically saved to the internal EEPROM. [This saving of the position only happens for min. 18 VDC supplies] When power is restored, the actuator will "know" its location and will simply start to follow the signal as received.

   IF YOU HAVE TO turn the actuator manually when its power is turned off, it will lose its position, and it will need to be re-zeroed (as described in sub-section 3).

2. **For actuators that are connected to a UPS** the behavior on signal loss can be set as follows:

   Normal position of DIP 9: OFF

   With DIP 9 in the off position, the actuator will ignore the signal if it is lost (i.e.: if the signal falls below 0.700 V or 2.80 mA) and simply remain in its current position.

   Note: if the sensing resistor R66 is removed (for 1-5 V input signals), we recommend placing a 10K resistor between signal and signal GND.

   Predetermined signal loss position DIP 9: ON

   With DIP 9 in the on position, the actuator will move to a predetermined position when the signal is lost (i.e.: if the signal falls below 2.80 mA or 0.700 V).

   Setting of the predetermined signal loss position:

   a. turn DIP 9 to the "off" position

   b. re-zero the actuator by sending and holding an input signal between 2.80 and 4.16 mA (0.700 and 1.04 V) wait until the device is re-zeroed, (i.e.: valve is closed).

   c. by varying the input signal, move the actuator to the position that is going to be the predetermined signal loss position.

   d. switch DIP 9 to the "on" position. The current actuator position will be saved as the default signal loss position. (The default signal position is an absolute actuator position, not a signal value.)

3. **Re-zeroing the actuator and initiating calibration routine:**

   The actuator will re-zero when the input signal is between 2.80 and 4.16 mA (0.700 and 1.04 V). It will turn clockwise until the actuator has reached the fully closed position of the valve.

12. AB/AF Operation

If the valve is removed for any reason, the calibration routine must be initiated on the actuator manually. This is done by toggling DIP 12 (switch position, then back to the original position) while the actuator is powered. This will prevent damage to the valve.

If you need to re-zero in the opposite direction (i.e.: for pressure regulators, which typically go to the "top" fully open position at 4 mA) change the setting of DIP 12 and cycle power.

4. **Feedback calibration: [RCx-xxxAF model actuators only]**

   The current feedback will be calibrated from the factory.

   To re-calibrate the feedback:

   a. Turn off the actuator and disconnect the feedback and input signals. If possible, remove the actuator from the valve.

   b. Connect the feedback signal to the signal input. Also connect the power and signal grounds.

   c. Power up the actuator with this "signal loop-back" setup.

   d. Short SP1. It will automatically run a special routine to calibrate the feedback signal to the signal input. The whole process takes about 1.5 seconds.

   e. turn off the power and reconnect the actuator as normal.

12.6 Troubleshooting

Upon noticing a problem, your first step should almost always be to recalibrate the actuator by toggling DIP 12 while the actuator is powered. This alone can solve basic problems. See sub-section 3 above for more details.

If the actuator does not move, try following these steps:

1. Re-calibrate the actuator. This will move the actuator regardless of what signal it is receiving.
2. A sticking valve may be the problem. Remove the valve from the actuator, and re-test the actuator.
3. Remove power. Re-check the wiring and the power/ signal apparatus. Power actuator and re-calibrate. If the problem persists, please call Rotork for technical support.

Any parts found to be defective should be examined and/or replaced by Rotork.

13. AS Actuator Operation

Applies to:	Power	Control	Actuation	Battery
	Any	AS	Any	Any

13.1 DIP Switches

The DIP switches allow you to change the settings on your actuator. To flip a switch, gently use a small flat-head screwdriver.

See the table below for DIP switch functionality.

In this example DIPs 1, 2, 5 and 12 are on.

DIP	Function
1 2	**Baud Rate:** Choose the rate at which information is transferred. See p.43.
3 4 5 6 7 8	**Actuator Address:** See p.44.
9 10 11	Deactivated
12	**Direction/Calibration:** Toggle while powered to re-calibrate actuator (find valve seat). Also sets direction in which the actuator will open and close. See p.52. **Example:** The RCM model actuator turns clockwise when the signal is decreased with DIP 12 in the OFF position. Putting DIP 12 in the ON position will cause counter-clockwise turning for a decrease in signal. For changes in DIP 12 position to take effect, the power to the actuator must be cycled.

13.1.1 Set the Communication Parameters

Data bits: 8

Parity: None

Stop bits: 1

Baud Rate: The communication baud rate can be set by using the first two positions of the **DIP switch selector**. Check the table below for settings.

To change the baud rate, turn off the actuator, change the setting of DIP switches and power it up again.

DIP 1	DIP 2	Baud rate
OFF	OFF	2400 bps
OFF	ON	4800 bps
ON	OFF	9600 bps
ON	ON	19200 bps

Response time: The response time is between 8ms to 35ms. This means, after sending a frame, you have to wait at least 35ms for the answer coming back from the actuator.

13.1.2 AS Set the Actuator Address

With the **DIP switch selector**, you can set any address between 1 and 63. (1 = "On" 0 = "Off").

To change the address, turn off the actuator, change the setting of DIP switches and power it up again.

Actuator Address	Dip3	Dip4	Dip5	Dip6	Dip7	Dip8
reserved	0	0	0	0	0	0
1	0	0	0	0	0	1
2	0	0	0	0	1	0
3	0	0	0	0	1	1
4	0	0	0	1	0	0
5	0	0	0	1	0	1
6	0	0	0	1	1	0
7	0	0	0	1	1	1
8	0	0	1	0	0	0
9	0	0	1	0	0	1
10	0	0	1	0	1	0
11	0	0	1	0	1	1
12	0	0	1	1	0	0
13	0	0	1	1	0	1
14	0	0	1	1	1	0
15	0	0	1	1	1	1
16	0	1	0	0	0	0
17	0	1	0	0	0	1
18	0	1	0	0	1	0
19	0	1	0	0	1	1
20	0	1	0	1	0	0
21	0	1	0	1	0	1
22	0	1	0	1	1	0
23	0	1	0	1	1	1
24	0	1	1	0	0	0
25	0	1	1	0	0	1
26	0	1	1	0	1	0
27	0	1	1	0	1	1
28	0	1	1	1	0	0
29	0	1	1	1	0	1
30	0	1	1	1	1	0
31	0	1	1	1	1	1
32	1	0	0	0	0	0
33	1	0	0	0	0	1
34	1	0	0	0	1	0
35	1	0	0	0	1	1
36	1	0	0	1	0	0
37	1	0	0	1	0	1
38	1	0	0	1	1	0
39	1	0	0	1	1	1
40	1	0	1	0	0	0
41	1	0	1	0	0	1
42	1	0	1	0	1	0
43	1	0	1	0	1	1
44	1	0	1	1	0	0
45	1	0	1	1	0	1
46	1	0	1	1	1	0
47	1	0	1	1	1	1
48	1	1	0	0	0	0
49	1	1	0	0	0	1
50	1	1	0	0	1	0
51	1	1	0	0	1	1
52	1	1	0	1	0	0
53	1	1	0	1	0	1
54	1	1	0	1	1	0
55	1	1	0	1	1	1
56	1	1	1	0	0	0
57	1	1	1	0	0	1
58	1	1	1	0	1	0
59	1	1	1	0	1	1
60	1	1	1	1	0	0
61	1	1	1	1	0	1
62	1	1	1	1	1	0
63	1	1	1	1	1	1

13.2 Modbus Protocol

Actuator parameters can be set by using the MODBUS (RTU) protocol.

Standard supported function codes:
02 (0x02) Read Discrete Inputs
03 (0x03) Read Holding Registers.
04 (0x04) Read Input Registers.
06 (0x06) Write Single Register.

Function codes: (see p.28 for examples)
100 (0x64) Re-zero the actuator.
101 (0x65) Close the valve.
102 (0x66) Open the valve.

If you try to use any other function code, the actuator will answer with the exception code 0x01 indicating that the attempted function code is not supported.

Actuator memory map:

Address (DEC)	Address (HEX)	Offset	Register Name	Type
0	0x0000	4001	MaximumSpeed	Holding registers. **READ** and **WRITE**
1	0x0001	4002	MaximumPower	
2	0x0002	4003	NumberOfTurns	
3	0x0003	4004	TargetFromRS485Flag	
4	0x0004	4005	InputRangeLow	
5	0x0005	4006	InputRangeHigh	
6	0x0006	4007	OutputRangeLow	
7	0x0007	4008	OutputRangeHigh	
8	0x0008	4009	TargetPosition	
9	0x0009	4010	SignalLostPosition	
10	0x000A	4011	Reserved	
11	0x000B	4012	Reserved	
12	0x000C	4013	Reserved	
13	0x000D	4014	Reserved	
14	0x000E	4015	Reserved	
15	0x000F	4016	Reserved	
16	0x0010	4017	Reserved	
17	0x0011	4018	Reserved	
18	0x0012	4019	Reserved	
19	0x0013	4020	Reserved	
20	0x0014	4021	CurrentPosition	Input registers. **READ** only
21	0x0015	4022	StatusRegister	

IMPORTANT: All the values sent to the actuator are "HEX" values

13.2.1 AS Speed and Torque Settings

During normal operation, the actuator will try to reach the speed set by "**MaximumSpeed**". If the torque required to reach this speed exceeds the actuator model's capability, the actuator will automatically slow down. Please refer to the tables in the Speed and Torque Details section for each actuator model's torque capability.

To accommodate different valves and other applications with different torque requirements, the actuator can be set to apply different torque on the valve stem when in the seating mode. Torque during normal operation is always 100% of the actuator's capability.

To deal with sticking valves, at the beginning of the first reversing movement after the seating ("zeroing") of the valve, the actuator will apply double the power set by "**MaximumPower**" (up to 100% power.) This "pull out" function is always enabled.

Register name	Address	Max	Min	Default
MaximumSpeed	**0x0000**	3	0	N/A
Example: Set Maximum speed to 0 in actuator number 8				
Actuator address	Function code	Register address	Register new value	CRC
0x08	0x06	0x0000	0x0000	0x----
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Possible values for the "**MaximumSpeed**" register are shown in the following table. To see how these values relate to physical speed, see the Speed and Torque Details section.

Maximum speed value	Speed level
0	16%
1	33%
2	66%
3	100%

Register name	Address	Max	Min	Default
MaximumPower	**0x0001**	3	0	N/A
Example: Set Maximum power to 3 in actuator number 9				
Actuator address	Function code	Register address	Register new value	CRC
0x09	0x06	0x0001	0x0003	0x----
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Possible values for the "**MaximumPower**" register are shown in the following table. To see how these values relate to physical torque values, see the Speed and Torque Details section.

Maximum speed value	Speed level
0	16%
1	33%
2	66%
3	100%

WARNING: High power settings can supply enough torque to damage your valve. Please be cautious, especially when using the 100% power setting.

Note: The 66% and 100% power settings have the following particularities:

- Supply voltage needs to be min. 14 VDC for 66% setting
- Supply voltage needs to be min. 16 VDC for 100% setting
- When operating above 20 VDC and 66% power, Duty cycle is reduced to 50% - 25% maximum. At these levels, the electronics produce more heat which must be dissipated (depending on environmental temperature)

13.2.2 Speed and Torque Details

RCL-xxxAS Actuators

Speed		Torque			
Max speed address 0x0000	Time for 1 turn (sec)	Torque address 0x0001	Seating Torque (in-lbs) 12 VDC	Seating Torque (in-lbs) 24 VDC	
0	7	0	6	12	Operating torque is 100%
1	3	1	10	20	
2	2	2	19	38	
3	1	3	24	48	
		NOTE: If actuator is RCJ-xxxAS, divide torque values by 3. To convert in-lbs to Nm, divide by 9.			

RCM-xxxAS Actuators

Speed		Torque			
Max speed address 0x0000	Time for 1 turn (sec)	Torque address 0x0001	Seating Torque (in-lbs) 12 VDC	Seating Torque (in-lbs) 24 VDC	
0	23	0	17	35	Operating torque is 100%
1	11	1	30	60	
2	7	2	55	115	
3	4	3	70	145	
		NOTE: If actuator is RCK-xxxAS, divide torque values by 3. To convert in-lbs to Nm, divide by 9.			

RCH-xxxAS Actuators

Speed		Torque			
Max speed address 0x0000	Time for 1 turn (sec)	Torque address 0x0001	Seating Torque (in-lbs) 12 VDC	Seating Torque (in-lbs) 24 VDC	
0	72	0	60	120	Operating torque is 100%
1	45	1	102	205	
2	30	2	200	400	
3	18	3	248	497	
		To convert in-lbs to Nm, divide by 9.			

RCF-xxxAS Actuators

Speed		Torque			
Max speed address 0x0000	Time for 1 turn (sec)	Torque address 0x0001	Seating Torque (in-lbs) 12 VDC	Seating Torque (in-lbs) 24 VDC	
0	197	0	115	230	Operating torque is 100%
1	99	1	190	380	
2	54	2	360	720	
3	38	3	457	915	
		To convert in-lbs to Nm, divide by 9.			

13.2.3 Writing to All Other Holding Registers

The "**NumberOfTurns**" register allows the user to set the number of turns the actuator performs in the full signal range.

Register name	Address	Max	Min	Default
NumberOfTurns	**0x0002**	100	1	N/A
Example: Set number of turns to 32 in actuator number 10				
Actuator address	Function code	Register address	Register new value	CRC
0x0A	0x06	0x0002	0x0020	0x----
1 byte	1 byte	2 bytes	2 bytes	2 bytes

The **"TargetFromRS485Flag"** register tells the actuator where to read its target position from. If the flag is set to 1, the actuator will take the value from a 4-20 mA input as its target position. If the flag is set to 0, the actuator will take the value from the **"TargetPosition"** register as its target position.

Remember: all values sent to actuator are HEX values.

Register name	Address	Max	Min	Default
TargetFromRS485Flag	**0x0003**	1	0	N/A
Example: Make actuator number 11 take the target position from the "TargetPosition" register				
Actuator address	Function code	Register address	Register new value	CRC
0x0B	0x06	0x0003	0x0000	0x----
1 byte	1 byte	2 bytes	2 bytes	2 bytes

The "**InputRangeLow**" register allows the user to set the lower limit of the input signal (i.e. the value of the input signal at which the actuator will move to the fully closed position).

Register name	Address	Max	Min	Default
InputRangeLow	**0x0004**	64900	0	0
Example: Set input range low to 4000 in actuator number 12				
Actuator address	Function code	Register address	Register new value	CRC
0x0C	0x06	0x0004	0x0FA0	0x----
1 byte	1 byte	2 bytes	2 bytes	2bytes

The "**InputRangeHigh**" register allows the user to set the upper limit of the input signal (i.e. the value of the input signal at which the actuator will open the valve to the number of turns specified in the "**NumberOfTurns**" register – fully open).

Register name	Address	Max	Min	Default
InputRangeHigh	**0x0005**	65000	100	10000
Example: Set input range high to 65000 in actuator number 23				
Actuator address	Function code	Register address	Register new value	CRC
0x17	0x06	0x0005	0xFDE8	0x----
1 byte	1 byte	2 bytes	2 bytes	2bytes

The value stored in the "**InputRangeLow**" register must always be lower than the value stored in the "**InputRangeHigh**" register. If you try to write an illogical range, the actuator will answer with exception code **0x03** indicating that the new value is not valid.

Remember: all values sent to actuator are HEX.

The "**OutputRangeLow**" register allows the user to set the lower limit of the feedback signal (i.e. the value of the feedback signal when the actuator is in the fully closed position).

Register name	Address	Max	Min	Default
OutputRangeLow	**0x0006**	64900	0	0
Example: Set input range low to 4000 in actuator number 12				
Actuator address	Function code	Register address	Register new value	CRC
0x0C	0x06	0x0006	0x0FA0	0x----
1 byte	1 byte	2 bytes	2 bytes	2bytes

The "**OutputRangeHigh**" register allows the user to set the upper limit of the feedback signal (i.e. the value of the feedback signal when the actuator is opened to the number of turns specified in the "**NumberOfTurns**" register – fully open).

Register name	Address	Max	Min	Default
OutputRangeHigh	**0x0007**	65000	100	10000
Example: Set input range high to 65000 in actuator number 23				
Actuator address	Function code	Register address	Register new value	CRC
0x17	0x06	0x0007	0xFDE8	0x----
1 byte	1 byte	2 bytes	2 bytes	2bytes

The value stored in the "**OutputRangeLow**" register must always be lower than the value stored in the "**OutputRangeHigh**" register. If you try to write an illogical range, the actuator will answer with exception code **0x03** indicating that the new value is not valid.

Remember: all values sent to actuator are HEX.

The "**TargetPosition**" is the input signal, which tells the actuator where to position the valve.

Register name	Address	Max	Min	Default
TargetPosition	**0x0008**	Input Range Low	Input Range High	N/A
Example: Set the target position to 3000 in actuator number 18				
Actuator address	Function code	Register address	Register new value	CRC
0x12	0x06	0x0008	0x0BB8	0x----
1 byte	1byte	2 bytes	2 bytes	2bytes

If the value in "**TargetPosition**" is the same as the value in "**InputRangeLow**" the actuator will re-zero, finding the valve seat and closing the valve completely. This enables a new fully closed position to be established based on normal wear of the valve seat.

If the value in "**TargetPosition**" is the same as the value in "**InputRangeHigh**" the valve will be opened to the maximum number of turns, as set by the "**NumberOfTurns**" register.

Example:

The actuator parameters are set to (decimal representation for simplicity):

NumberOfTurns = 10

InputRangeLow = 500

InputRangeHigh = 2500

- To close the valve, the "TargetPosition" register has to be set to 500.
- To open the valve 5 turns, the TargetPosition" register has to be set to 1500.

To have the actuator use "**TargetPosition**" as its target position, "**TargetFromRS485Flag**" must be 0.

The value stored in the "**TargetPosition**" register must always be lower or equal to "**OutputRangeHigh**" and greater or equal to "**OutputRangeLow**". If you try to write a value out of the range, the actuator will answer with exception code **0x03** indicating that the new value is not valid.

Signal Loss

Register name	Address	Max	Min	Default
SignalLostPosition	**0x0009**	Input Range Low	Input Range High	0xFFFF
Example: Set the signal lost position to 3000 in actuator number 19				
Actuator address	Function code	Register address	Register new value	CRC
0x13	0x06	0x0009	0x0BB8	0x----
1 byte	1byte	2 bytes	2 bytes	2bytes

The "**SignalLostPosition**" register can be used (optional) to set the position of the actuator upon signal loss. Signal loss can only occur when controlling the actuator with 4-20 mA (or 1-5 V) input signals, i.e. when "**TargetFromRS485Flag**" is set to 1. The signal is considered lost when it falls below 2.80 mA (or 0.700 V).

1. **For actuators that are not connected to a UPS** (Uninterruptible Power Supply), the loss of signal will be simultaneous with power loss. Consequently, the actuator will not be able to move anywhere. In the shutdown process, the actual position is automatically saved to the internal EEPROM. [This saving of the position only happens for min. 12 VDC supplies] When power is restored, the actuator will "know" where it's at and will simply start to follow the signal as received.

YOU HAVE TO turn the actuator manually when its power is turned off, it will lose its position, and it will need to be re-zeroed (as described in the Calibration section)

2. **For actuators that are connected to a UPS** the actuator will move to the position defined by the value in the "SignalLostPosition" register.

   The default value is 0xFFFF (DEC: 65535). The actuator will ignore the lost signal, and simply remain in its current position.

   If the value is between "InputRangeLow" and "InputRangeHigh", the actuator will move to the value in SignalLostPosition when the signal is lost

13.2.4 Reading the Input Registers

The physical meaning of the value in the **"CurrentPosition"** register depends on the values in the **"OutputRangeLow"** and **"OutputRangeHigh"** registers, as well as the **"NumberofTurns"** register.

Example:

The actuator parameters are set to (decimal representation for simplicity):

NumberOfTurns = 10

OutputRangeLow = 500

OutputRangeHigh = 2500

- If "CurrentPosition" equals to 500, that means the valve is closed
- If "CurrentPosition" equals to 1500, that means the valve is 5 turns opened

To read the value from the **"CurrentPosition"** register:

Register name	Address	Max	Min	Default
CurrentPosition	**0x0014**	N/A	N/A	N/A
Example: Read the current position in actuator number 31				
Actuator address	Function code	Register address	Register new value	CRC
0x1F	0x04	0x0014	0x0001	0x----
1 byte	1 byte	2 bytes	2 bytes	2 bytes

The meaning of the value in the **"StatusRegister"** is described below. Only Bits 0-4 are associated with a physical meaning.

Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5 to 15
Discrete input 1	Discrete input 2	Discrete input 3	Discrete input 4	Discrete input 5	Discrete input 6 to 16
Opened	**Closed**	**Stalled opening**	**Stalled closed**	**Signal lost**	**Reserved**
This bit will be '1' if the actuator is in the completely open position.	This bit will be '1' if the actuator is in the completely closed position.	This bit will be '1' if the actuator gets stalled while moving in the opening direction	This bit will be '1' if the actuator gets stalled while moving in the closing direction.	This bit will be '1' if the input signal falls below 2.80 mA or 0.700 V.	-

To read the value from the **"StatusRegister"** register:

Register name	Address	Max	Min	Default
StatusRegister	**0x0015**	N/A	N/A	N/A
Example: Read the status register in actuator number 32				
Actuator address	Function code	Register address	Qty of registers	CRC
0x20	0x04	0x0015	0x0001	0x----
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Alternatively, the Bits in **"StatusRegister"** can be read independently by using function code 2. In the PDU, Discrete Inputs are addressed starting at zero. Therefore, Discrete Inputs numbered 1-5 are addressed as 0-4.

Example 1

To read all discrete inputs in actuator number 33, the master needs to send:

Actuator address	Function code	Input address	Qty of inputs	CRC
0x21	0x02	0x0000	0x0005	0x----
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Example 2

To read the discrete inputs 1 and 2 (opened and closed) in actuator number 33, the master needs to send:

Actuator address	Function code	Input address	Qty of inputs	CRC
0x21	0x02	0x0000	0x0002	0x----
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Example 3

To read the discrete input 4 (stalled closed) in actuator number 33, the master needs to send:

Actuator address	Function code	Input address	Qty of inputs	CRC
0x21	0x02	0x0003	0x0001	0x----
1 byte	1 byte	2 bytes	2 bytes	2 bytes

13.2.5 Using Function Codes

Register name	Address	Max	Min	Default
N/A	**0x0064**	N/A	N/A	N/A
Example: Re-zero actuator number 1				
Actuator address	Function code	CRC		
0x01	0x64	0x----		
1 byte	1 byte	2 bytes		

13. AS Actuator Operation

Register name	Address	Max	Min	Default
N/A	**0x0065**	N/A	N/A	N/A
Example: Close the valve on actuator number 1				
Actuator address	Function code	CRC		
0x01	0x65	0x----		
1 byte	1 byte	2 bytes		

Register name	Address	Max	Min	Default
N/A	**0x0066**	N/A	N/A	N/A
Example: Open the valve on actuator number 1				
Actuator address	Function code	CRC		
0x01	0x66	0x----		
1 byte	1 byte	2 bytes		

13.3 Calibration

If the actuator is being controlled via 4-20 mA (resp. 1-5 V) input, i.e. the **"TargetFromRS485Flag"** register contains value 1, the actuator will re-zero when the input signal is between 2.80 and 4.16 mA (resp. 0.700 and 1.04 V). It will turn clockwise until the actuator has reached the fully closed position of the valve.

If the actuator is being controlled via Modbus protocol, i.e. **"TargetFromRS485Flag"** register contains value 0, the actuator will re-zero when the value in the **"TargetPosition"** register is the same as the value in the **"InputRangeLow"** register.

If the valve is removed for any reason, the calibration routine must be initiated on the actuator manually after re-mounting the valve. This is done by toggling DIP 12 (switch position, then back to the original position) while the actuator is powered. Alternatively, use command code 0x64 (refer also to the Modbus Protocol section). The valve will close very slowly, finding the seat and preventing any damage.

If you need to re-zero in the opposite direction (i.e.: for pressure regulators, which typically go to the "top" fully open position at 4 mA) change the setting of DIP 12 and cycle power.

WARNING: It is VERY important that you put DIP 12 back to its original setting. Failing to do so will make the actuator turn in the opposite direction next time you power it up.

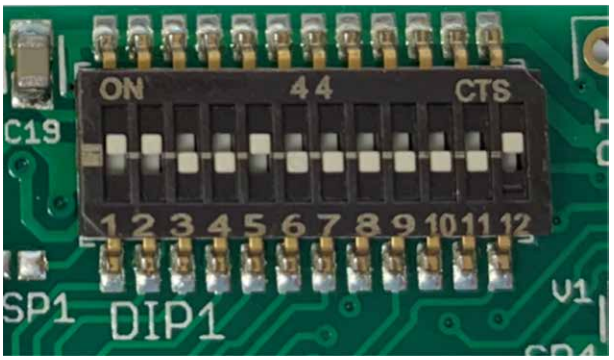
14. DC Operation

Applies to:	Power	Control	Actuation	Battery
	Any	DC	Any	Any

14.1 DIP Switches

The DIP switches allow you to change the settings on your actuator. To flip a switch, gently use a small flat-head screwdriver.

See the table below for DIP switch functionality.



In this example DIPs 1, 2, 5 and 12 are on.

DIP 1	DIP 2	Description	Recommended Use
Off	Off	Fastest settling	Use only for low torque valves
Off	On	Medium-fast	Typical setting
On	Off	Medium-slow	Typical setting
On	On	Slowest settling	Use for high torque valves

DIP switches 1 and 2 set the actuator position control parameters. High settling speed settings are suitable for fast positioning of light valves. Longer settling times will allow heavier valves to reach their target positions; trying to use a fast settling setting on a high torque valve will increase current consumption when holding position, and cause heating of the motor.

DIP 10	DIP 11	Torque description	Approx. stall current (A)	Approximate stall torque (in-lbs)			
				RCL-xxxDC	RCM-xxxDC	RCH-xxxDC	RCF-xxxDC
Off	Off	Low	1.0	63	212	430	715
Off	On	Medium-low	1.5	72	236	522	832
On	Off	Medium-high	2.0	77	243	525	949
On	On	High	3.0	83	247	532	1067

DIP switches 10 and 11 set the actuator torque. These settings are adapted to the valve at the factory. Worn-in valves may require a higher torque setting after some time. The actuator will use 100% of available torque to try and reach maximum speed.

Note: Medium-high and high settings require voltage supply minimum values as follows:

- Supply voltage needs to be min 14 VDC for medium-high
- Supply voltage needs to be 16 VDC for high
- When operating above 20 VDC and 66% power, Duty cycle is reduced to 50% - 25% maximum. At these levels, the electronics produce more heat which must be dissipated (depending on environmental temperature)

DIPs 3-8	Reserved for custom functions.
DIP 9	Run / Calibrate Setting DIP 9 into the off position will disable the actuator positioning control, and the motor will not move regardless of the input signals. When DIP 9 is moved back to the on position, the actuator will perform its homing routine, and then move to the position commanded by the input signals.
DIP 12	DIP 12 sets the direction of rotation

14.2 Functionality

The RCx-xxxDC operates as a continuous TTL. It can open or close to end positions or move to the center position.

Direction of rotation

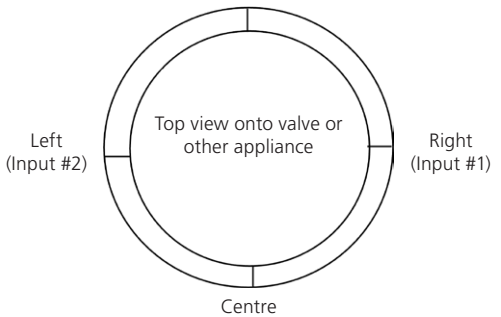
To change the direction of rotation on the actuator change the setting on DIP 12 and cycle power to the actuator.

Inputs 1 & 2 (pins 1 & 2) are HIGH by default – a LOW signal must be sent to change the value.

Low ≤ 0.8 VDC
High ≥ 4.5 VDC

Sending a signal of more than 24 VDC may be harmful to the internal circuit board.

Input #1 (Pin 1)	Input #2 (Pin 2)	Action taken
Low	High	Moves in clockwise [closes the valve]
High	Low	Moves in counterclockwise [opens the valve]
Low	Low	Moves to midpoint between fully open and fully closed
High	High	Does not move
The feedback is as follows		
Output #1 (Pin 3)	**Output #2 (Pin 4)**	**Meaning** High = 24 VDC Low = 0.8 VDC
High	High	Actuator is standing still or moving in its range
High	Low	Actuator has stopped moving because the valve is fully closed
Low	High	Actuator has stopped moving because the valve is fully open
Low	Low	Actuator has stopped moving because the valve is at the midpoint



Applies to:	Power	Control	Actuation	Battery
	Any	DT	Rotary	Any

DT Digital With Discrete Positioning

15.1 DIP Switches

The DIP switches allow you to change the settings on your actuator. To flip a switch, gently use a small flat-head screwdriver.

See the table below for DIP switch functionality.

In this example DIPs 1, 2, 5 and 12 are on.

DIP 1	DIP 2	Description	Recommended Use
Off	Off	Fastest settling	Use only for low torque valves
Off	On	Medium-fast	Typical setting
On	Off	Medium-slow	Typical setting
On	On	Slowest settling	Use for high torque valves

DIP switches 1 and 2 set the actuator position control parameters. High settling speed settings are suitable for fast positioning of light valves. Longer settling times will allow heavier valves to reach their target positions; trying to use a fast settling setting on a high torque valve will increase current consumption when holding position, and cause heating of the motor.

DIP 10	DIP 11	Torque description	Approx. stall current (A)	Approximate stall torque (in-lbs)			
				RCL-xxxDC	RCM-xxxDC	RCH-xxxDC	RCF-xxxDC
Off	Off	Low	1.0	63	212	430	715
Off	On	Medium-low	1.5	72	236	522	832
On	Off	Medium-high	2.0	77	243	525	949
On	On	High	3.0	83	247	532	1067

DIP switches 10 and 11 set the actuator torque. These settings are adapted to the valve at the factory. Worn-in valves may require a higher torque setting after some time. The actuator will use 100% of available torque to try and reach maximum speed.

Note: Medium-high and high settings require voltage supply minimum values as follows:

- Supply voltage needs to be min 14 VDC for medium-high
- Supply voltage needs to be 16 VDC for high
- When operating above 20 VDC and 66% power, Duty cycle is reduced to 50% - 25% maximum. At these levels, the electronics produce more heat which must be dissipated (depending on environmental temperature)

DIP 3	Reserved for custom functions.
DIP 4	Sets direction of offset (offset only required in RDH and RDF models).
DIP 5	Sets the highest amount of offset, typically 12°. **NOTE:** To set maximum offset DIPs 5,6, and 7 will need to be high for a total of 21°. The maximum offset can also be set differently at the factory (upon customer request).
DIP 6	Sets medium offset, typically 6°.
DIP 7	Sets the lowest amount of offset, typically 3°.
DIP 8	With DIP 8 in the ON position, the actuator will move to 4 positions. When DIP 8 is in the OFF position, the actuator is limited to three positions. DIP 8 also changes the function of the output signals. See p.56 for details.
DIP 9	Run / Calibrate Setting DIP 9 into the off position will disable the actuator positioning control, and the motor will not move regardless of the input signals. When DIP 9 is moved back into the on position, the actuator will perform its homing routine, and then move to the position commanded by the input signals.
DIP 12	DIP 12 sets the direction of rotation

15.2 Functionality

The RDx-xxxDT can operate as a 3-position or 4-position actuator. The 4th position is enabled by turning DIP 8 ON.

Direction of rotation and using input 1

To change the direction of rotation on the actuator change the setting on DIP 12 and cycle power to the actuator.

VERY IMPORTANT: Input 1 must always be used if only one input is used to operate the valve. When the actuator is operated using input 1 an automatic calibration is done every time the valve is actuated. This does not happen on input 2.

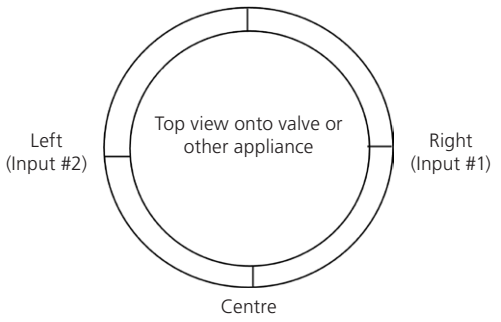
Inputs 1 & 2 (pins 1 & 2) are HIGH by default – a LOW signal must be sent to change the value.

Low ≤ 0.8 VDC
High ≥ 4.5 VDC

Sending a signal of more than 24 VDC may be harmful to the internal circuit board.

3-pos Functionality (DIP 8 OFF)

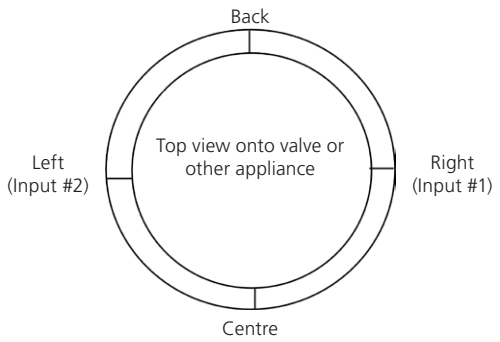
Input #1 (Pin 1)	Input #2 (Pin 2)	Action taken
High	High	Moves to or remains in centre position
Low	High	Moves to or remains in right position
High	Low	Moves to or remains in left position
Low	Low	Moves to or remains in left position (Input #2 has precedence over Input #1)
The feedback is as follows		
Output #1 (Pin 3)	**Output #2 (Pin 4)**	**Meaning**
High	High	Valve is in centre position
High	Low	Valve is in right position
Low	High	Valve is in left position
Low	Low	Actuator is moving or has stalled and given up trying to reach a requested position. You may retry to reach any position by cycling both inputs one after the other. Repeated failures to reach position will require troubleshooting.



15. DT Operation

4-pos Functionality (DIP 8 ON)

Input #1 (Pin 1)	Input #2 (Pin 2)	Action taken
High	High	Moves to or remains in centre position
Low	High	Moves to or remains in right position
High	Low	Moves to or remains in left position
Low	Low	Moves to or remains in back position
The feedback is as follows		
Output #1 (Pin 3)	**Output #2 (Pin 4)**	**Meaning**
Low	Low	Actuator is at requested position
High	Low	Actuator is moving
Low	High	Actuator has stalled. The stall can be cleared by making the actuator turn in the other direction. Repeated failures will require troubleshooting.



15.3 Calibration

The center position calibration routine can be initiated by switching DIP 9 momentarily “off” then “on”. This will cause the actuator to go through a series of movements to determine the proper center position. This function is useful if the actuator’s output gear gets manually rotated while the actuator is powered down and can’t properly realign to the center by itself.

16. PT Operation

Applies to:	Power	Control	Actuation	Battery
	Any	PT	Rotary	Any

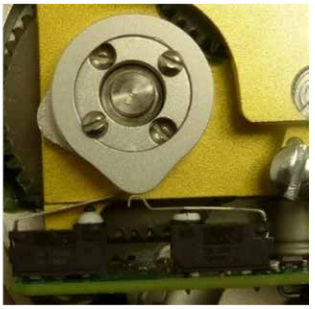
Input #1 (Terminal 4)	Action taken
Low (gnd.)	Moves to or remains in closed position
High (+24 VDC)	Moves to or remains in open position

16.1 Spring Return

The spring-return add-on closes the attached valve whenever power is turned off or lost for any reason.

16.2 Feedback via Limit Switches

Actuator Position	Action taken
Operate	Terminal 1 is connected to Terminal 3
Zero	Terminal 2 is connected to Terminal 3
In between	Nothing is connected to Terminal 3



Limit switches are triggered mechanically when the actuator is in the zero or operate positions.

IMPORTANT: The limit switches are rated for 3 A @ 125 VAC and 500 mA @ 12 VDC. Higher currents or voltages will damage the actuator.

16.3 Torque and Speed

Model	Torque [in-lbs]	Speed Range [time to open]	Speed Range [time to close]
RDM (internal valves)	140	4	2 (2 sec power loss)
RDM (ball valves)	40	4	2 (time upon power loss depends on valve)

Note: Opening and closing times are for the actuator. The valve may be fully open or closed before the actuator reaches these limits.

16. PT Operation

16.4 Safety Features

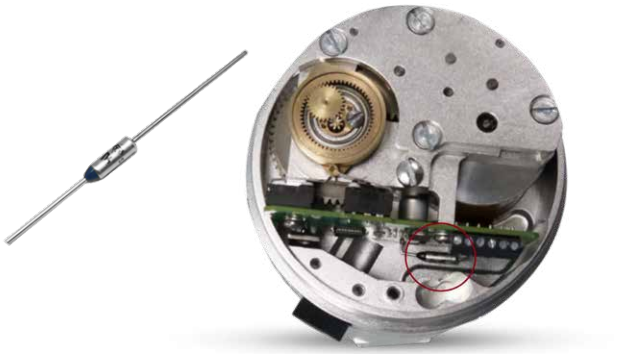
16.4.1 Fusible Link

This part is used only in combination with internal valves. It is UL approved and will fail mechanically at 100 °C (212 °F).

Upon failure, the valve becomes de-coupled from the actuator, allowing the valve to be shut by its own spring.

16.4.2 Thermal Cutoff

This part is used with all valves. It is UL approved and found on the PCB board within the actuator enclosure, as shown below. When a temperature of 128 °C (262 °F) is reached, it severs the electrical connection, making the actuator close itself via spring-return.



17. Special Features

17.1 Battery Backup

The R series actuator is available with battery backup. The battery allows the actuator to reposition when power is lost, returning it to a known position.

The power loss position is configured at the factory when the actuator is programmed.

17.2 Battery Backup Function

1. In the event of a loss of power or signal, the battery will maintain power to the processor and trigger the actuator to move the valve to its designated fail-safe position, using power from the battery.
2. Once the valve has reached its fail-safe position, and after about one minute, the processor will go into sleep mode to preserve the battery life.
3. The actuator will not respond to commands until the power supply is restored.

Note: The battery will maintain a charge for up to 2 months without power being applied.

During normal operation, from totally discharged, the batteries will take 2 hours to re-charge.

Battery function should be tested monthly.

17.2.1 Testing Battery Fail-Safe

- The batteries will be continuously on charge when power is available to the actuator.
- Regardless of application, the fail-safe function should be tested monthly by signaling the unit to the position opposite the fail position, removing the power to the actuator and observing whether the actuator reaches the desired fail position.
- The battery voltage can be measured with a multimeter set for DC volt measurement.

Measure battery voltage between the connector terminals.

Value should be:

7.9 ± 0.4 VDC

17.3 Manual Override

The R series actuator is available with optional manual override to allow positioning when the actuator is powered down.

Actuators with manual override are factory programmed to run the homing routine on every power up.

peration of the manual override when the actuator is powered will be difficult as the actuator will try to maintain the valve in the position it has been commanded to.

The manual override handle will move any time the actuator moves, and may move any time the actuator is powered, or at any time for actuators with battery backup. Care must be taken to avoid injury.

Manual override is not available for actuators with PT control.

Power should be removed if the valve is to be moved manually. If the valve is moved with the manual override when its power is turned off, it will lose its position, and it will need to be re-zeroed (as described in the AB/AF Signal Loss and Calibration section).

17.4 Internal Heater

The internal heater option lowered the minimum operating temperature of the actuator.

It will automatically switch on whenever internal temperatures below 0C are detected, and off once the internal temperature is at or above 4C.

While active, the heater will consume an additional 12 watts of power (0.5A for 24 VDC models, ~0.125A for 110 VAC models).

The internal heater is standard on actuators with PT control.

18.1 Hazardous Location Rating (Ex)

Actuator model number: Rxx-Bxxxx

Canada:

Class I, Division 1, Groups B, C, D (T5)
Class II, Division 1, Groups E, F, G (T5)

CSA C22.2 No. 30-M1986
CSA C22.2 No. 25-17

Ambient temperature range: -50°C to +40°C

* Serial number will be engraved on lid.

USA:

Class I, Division 1, Groups B, C, D (T5)
Class II, Division 1, Groups E, F, G (T5)

UL 1203 (Edition 5.0)

Ambient temperature range: -20°C to +40°C

* Serial number will be engraved on lid.

18.2 Hazardous Area Ratings (Ex)

USA:

Class I, Division 1, Groups B,C,D, (T5)
Class II, Division 1, Groups E,F,G, (T5)

UL 1203 (Edition 5.0)

Ambient temperature range -20 to +40 °C

Canada:

Class I, Division 1, Groups B,C,D, (T5)
Class II, Division 1, Groups E,F,G, (T5)

CSA C22.2 No. 3-M1986
CSA C22.2 No. 25-17

Ambient temperature range -40 to +40 °C

ATEX/IECEx:

Ex db IIB+H2 T6 Gb
Ex tb IIIC T85°C Db
Ⓔx II 2 GD
T6[T85°C]: Ta -40°C to +55°C,
IP66, IP67

IEC 60079-0:2017, 7th Edition
IEC 60079-0:2014, 7th Edition

Ambient temperature range -40 to +55 °C

CCC:

Ex db IIB+H2 T6 Gb
Ex tb IIIC T85°C Db

GB/T 3836.1-2021
GB/T 3836.2-2021
GB/T 3836.31-2021

Ambient temperature range -40 to +55 °C

18.3 Electrical Compliance (EC)

Canada & USA:

CSA.UL 61010-1

Europe:

EC Declaration of Conformity (CE)
UK Declaration of Conformity (UKCA)

18.4 Electromagnetic Compatibility (EMC)

USA:

FCC 47 CFR Part 15, Subpart B (Unintentional radiators), Class A

Canada:

ICES-001 Issue 5, July 2020, Class A

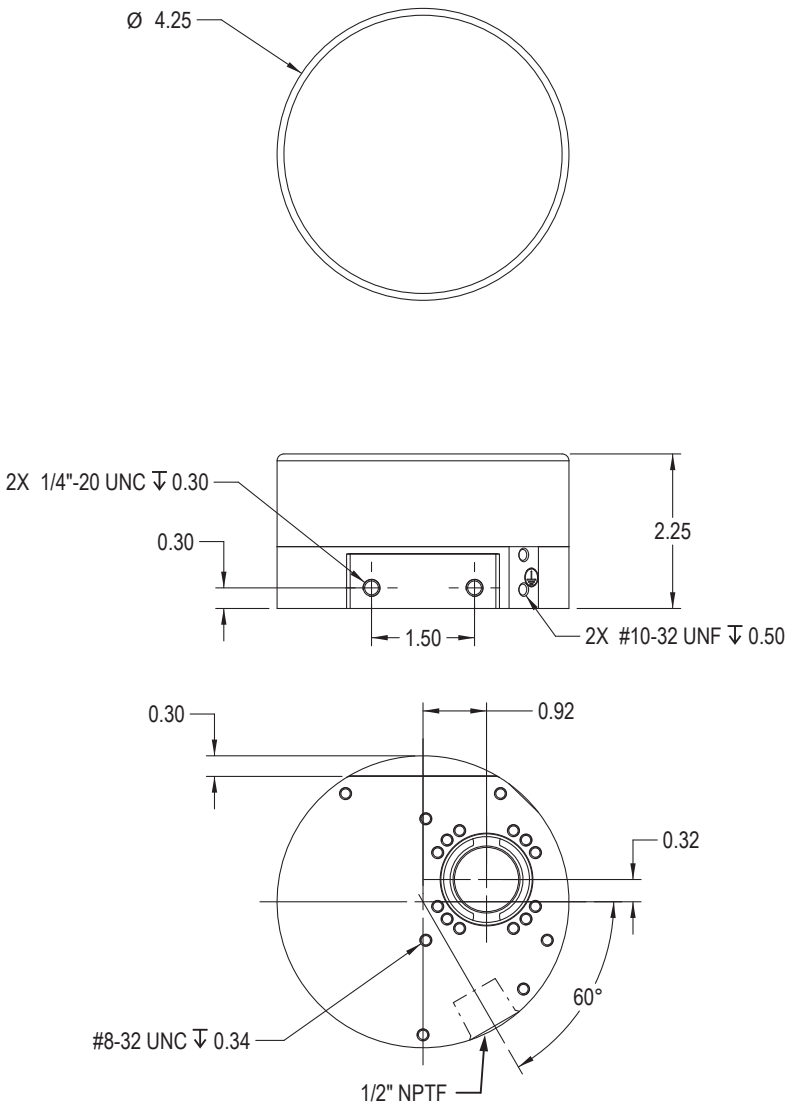
Europe:

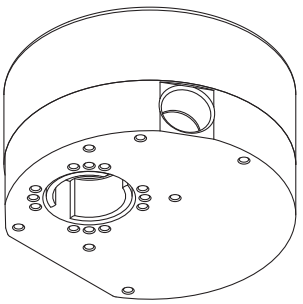
EN 61326-1:2013 (Group 1, Class A; Industrial electromagnetic environment)
IEC 61000-6-2:2016
IEC 61000-6-4:2018

18.5 Dust and Water Ingress Protection (IP)

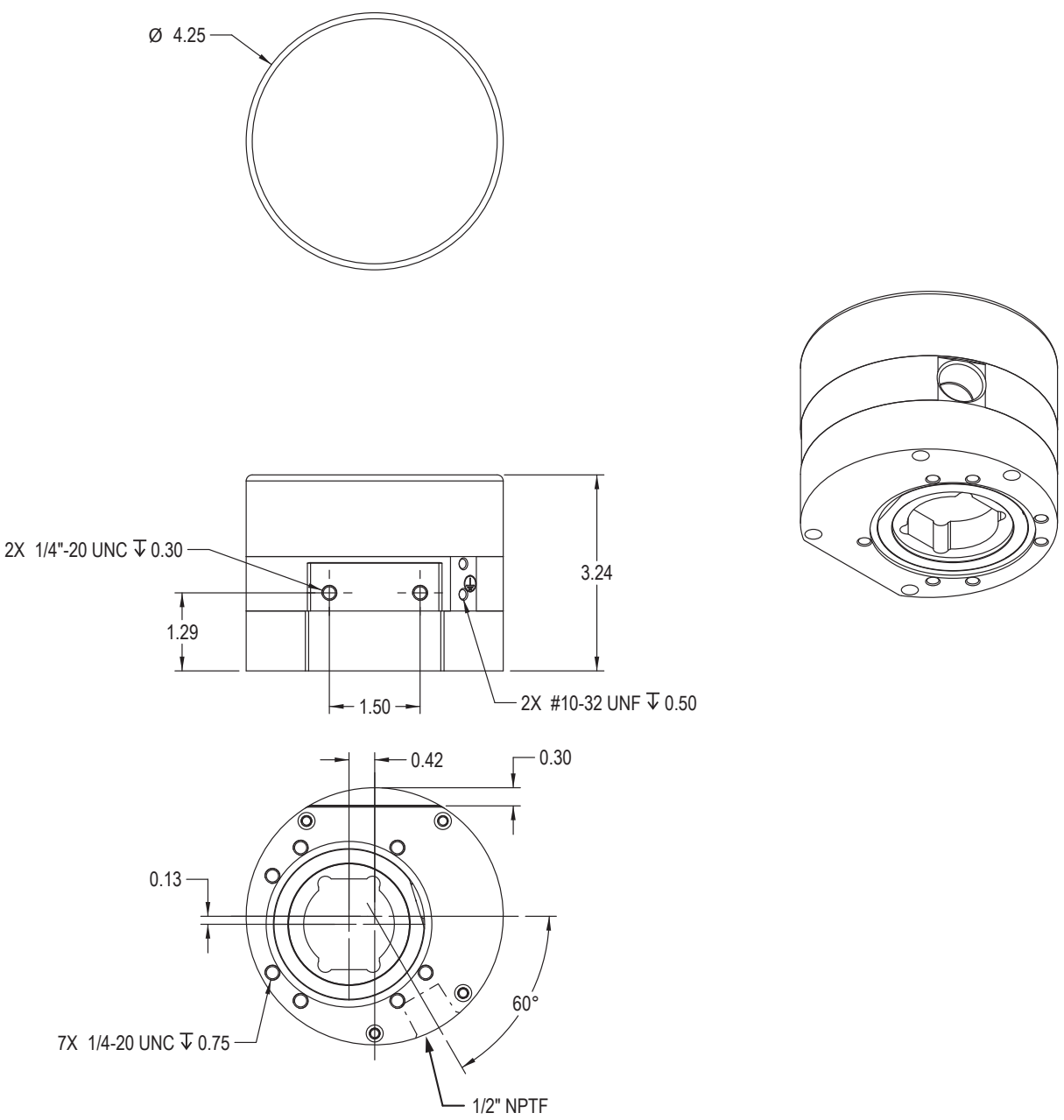
IP67 (30 minutes @ 1 meter) certified using standard IEC 60529:2013.

19.1 RxJ/ RxL/ RxM Models

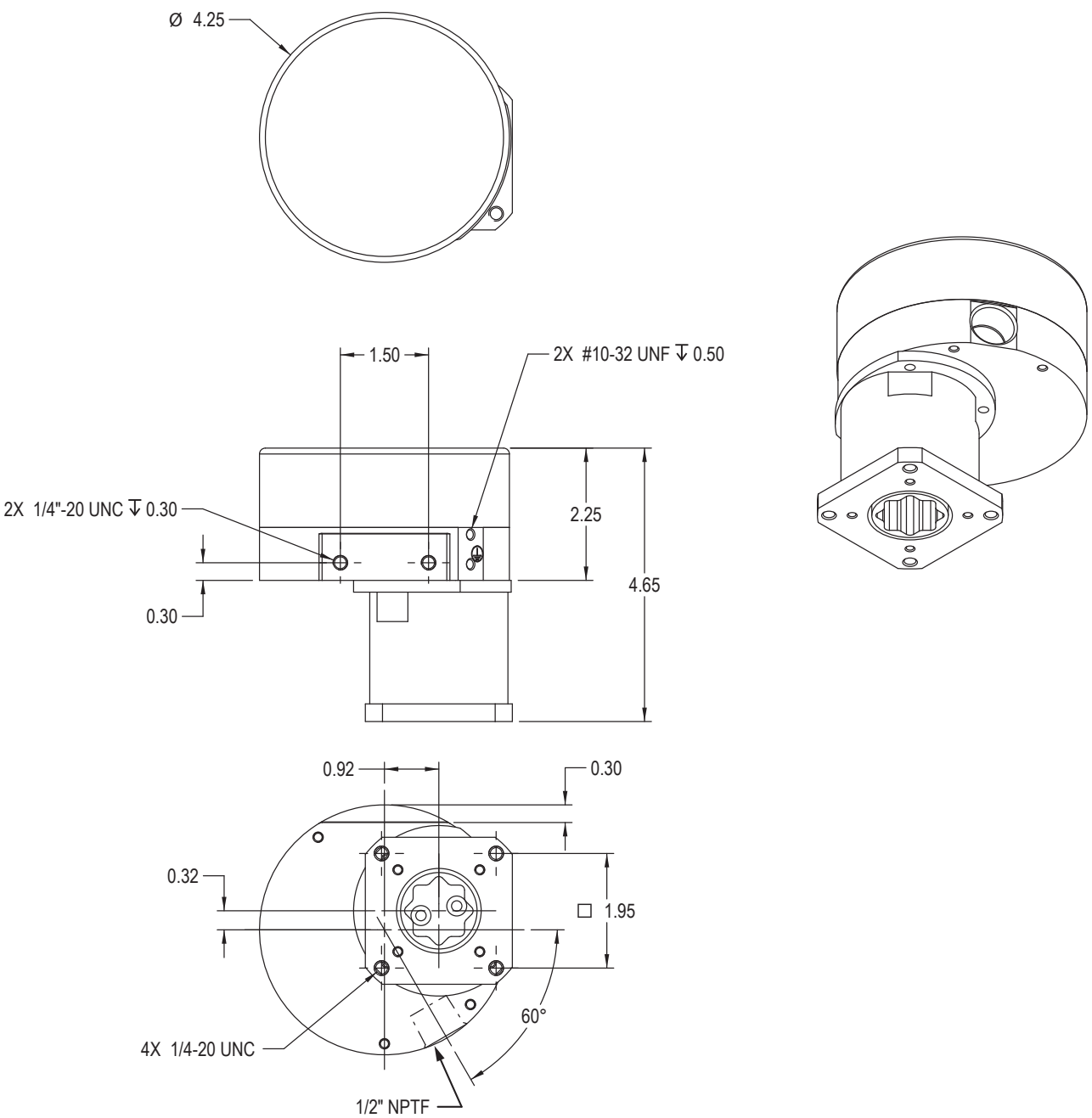




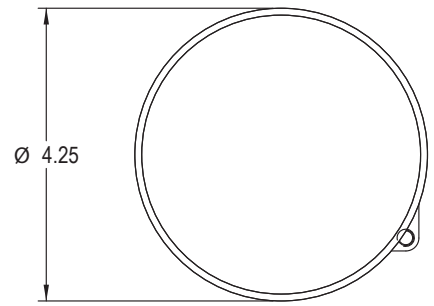
19.2 RxH Models

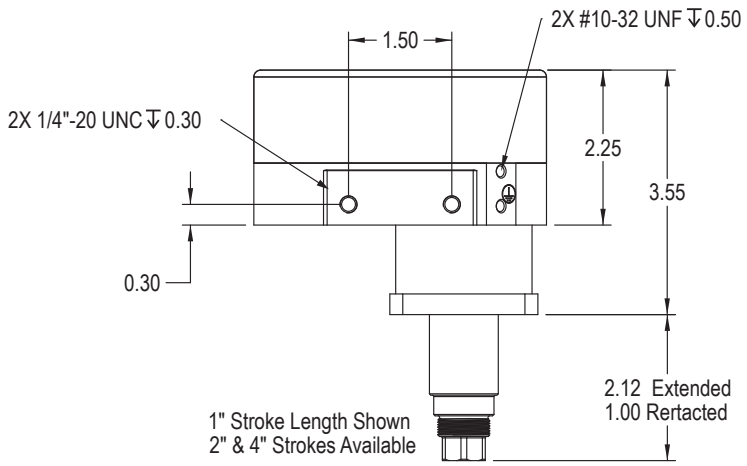


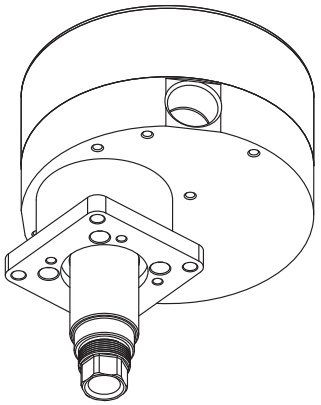
19.3 RxF Models

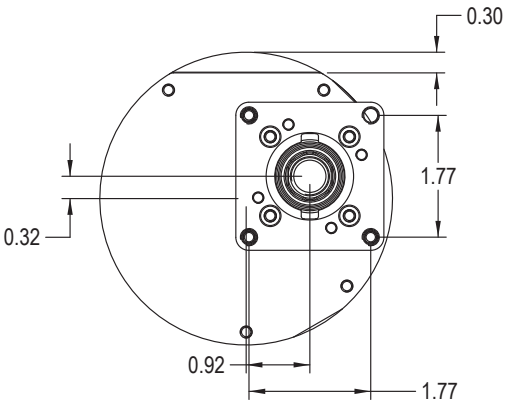


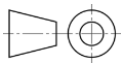
19.4 RCx-Lx Models



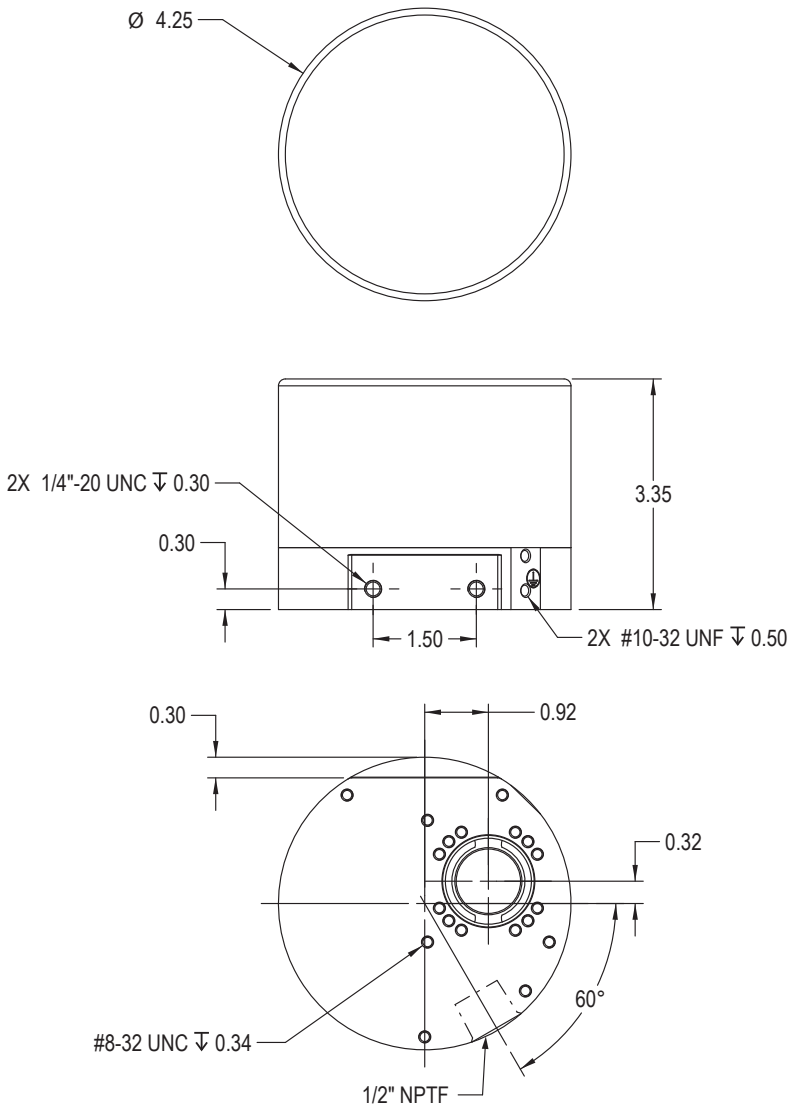


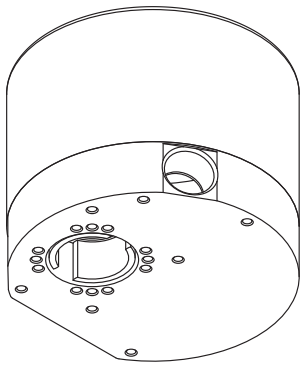




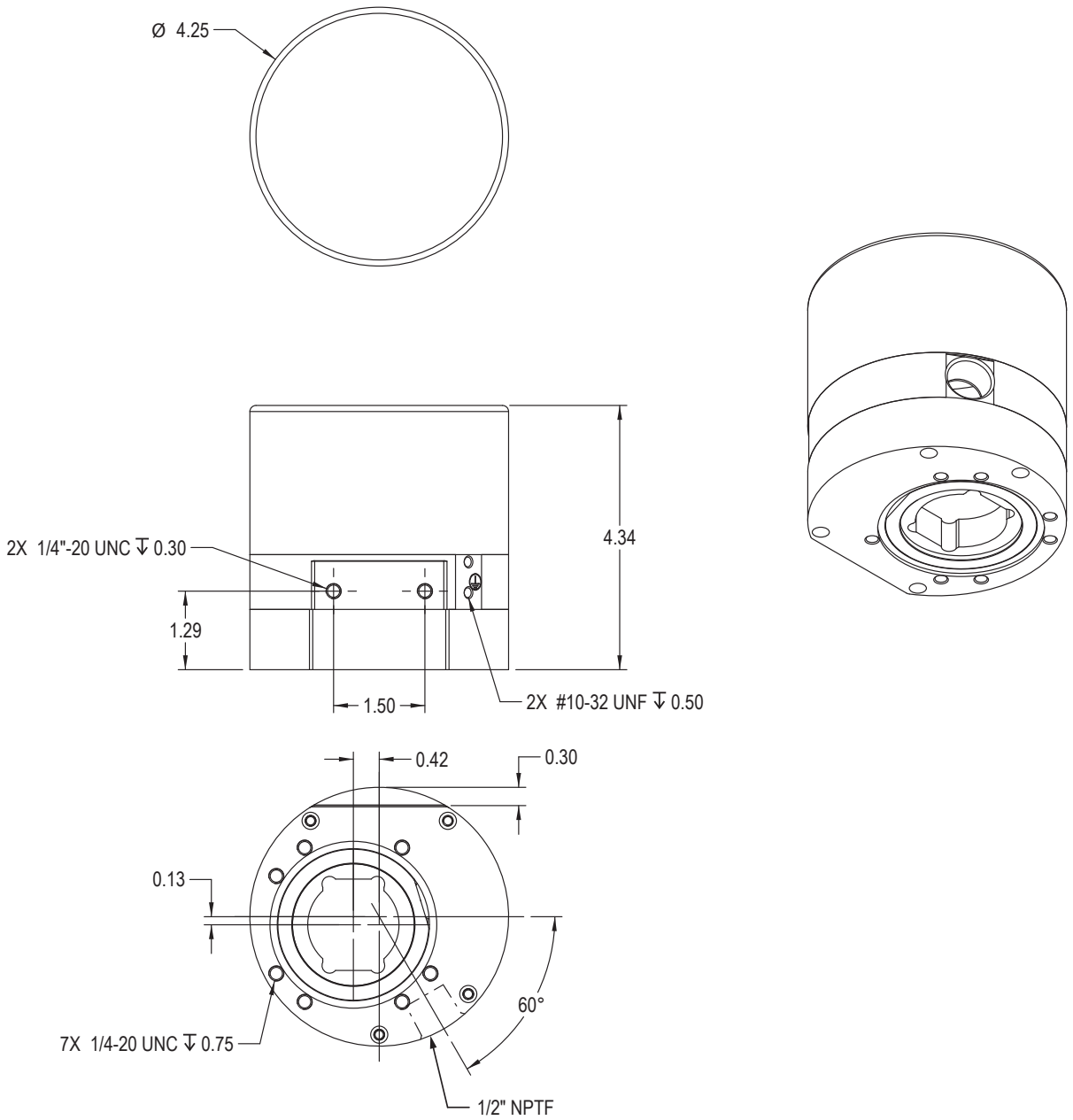


19.5 RxJ/ RxL/ RxM Models with Battery or AC Power

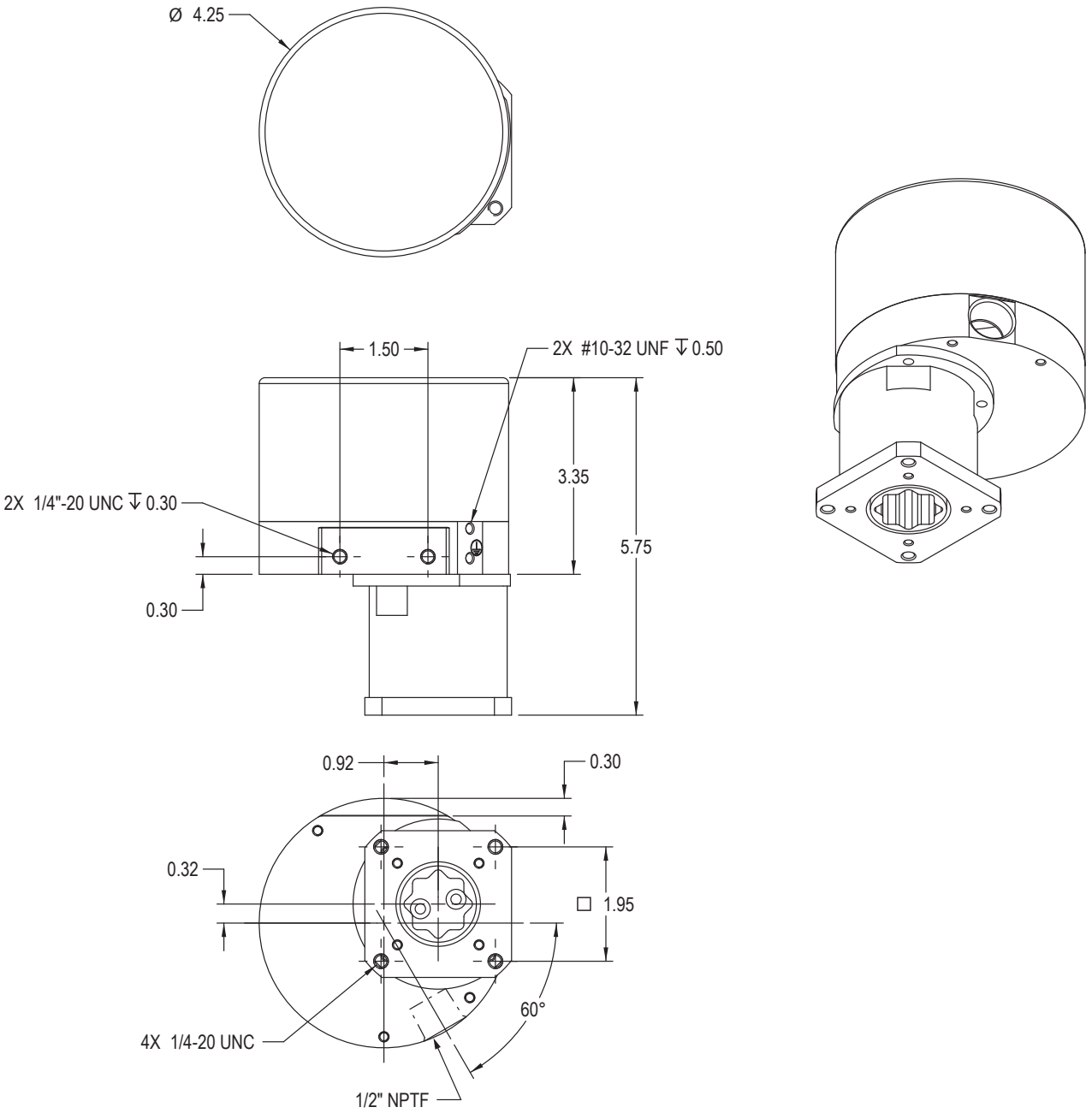




19.6 RxH Models with Battery or AC Power



19.7 RxF Models with Battery or AC Power

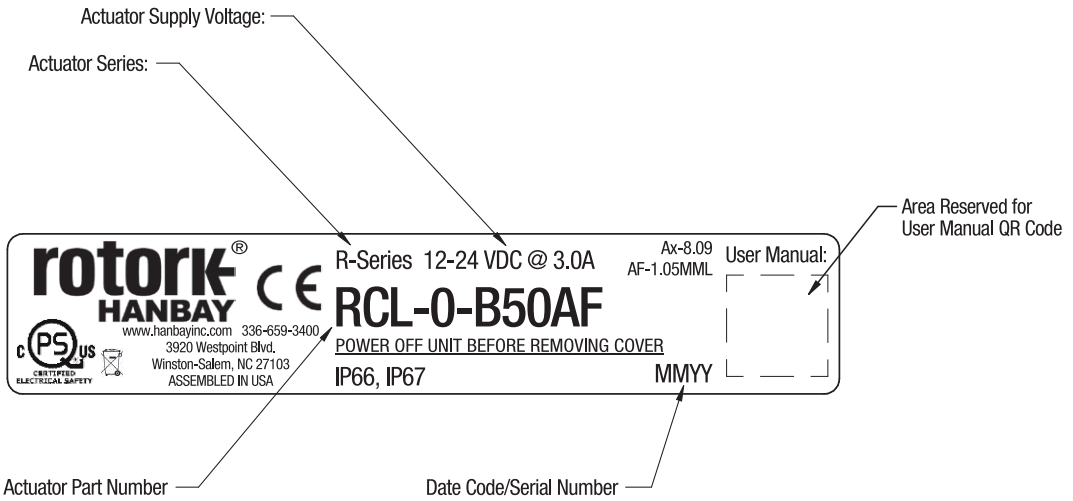


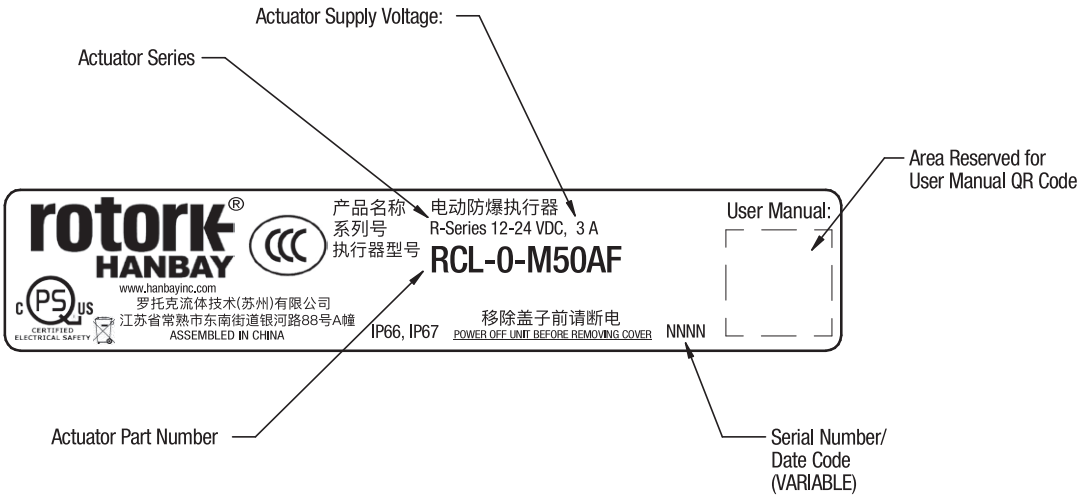
20. Part Number Breakdown

	BASE ENCLOSURE	POSITIONING	GEAR TRAIN	–	SPECIAL OPTIONS*	–	ENCLOSURE OPTIONS	WIRING	THERMAL MANAGEMENT	PCB	–	MOUNTING KIT	
R-Series	**R**											**0**	~½" Stroke Actuator Only
Continuous Positioning		**C**										**1**	~½" Stroke Actuator W/ Mounting Kit
Discrete Positioning		**D**										**2**	~½" Stroke Actuator on Customer Supplied Valve
Extra Low Torque			**J**									**3**	~½" Stroke Actuator on Rotork Supplied Valve
Low Torque			**L**									**4**	~1" Stroke Actuator Only
Medium Torque			**M**									**5**	~1" Stroke Actuator W/ Mounting Kit
High Torque (Add'L Gear Stage)			**H**									**6**	~1" Stroke Actuator on Customer Supplied Valve
F-Gear Stage (Add'L Gear Stage)			**F**	**–**								**7**	~1" Stroke Actuator on Rotork Supplied Valve
No Special Options					**0**							**8**	~1-½" Stroke Actuator Only
110-240 VAC Power Supply					**AC**							**9**	~1-½" Stroke Actuator W/ Mounting Kit
Battery Backup					**B**							**A**	~1-½" Stroke Actuator on Customer Supplied Valve
High Temp. Mounting Kit					**HT**						**–**	**B**	~1-½" Stroke Actuator on Rotork Supplied Valve
Linear 16 TPI ~ 1" Stroke					**L1**					**AB**			Analog Board
Linear 8 TPI ~ 1" Stroke					**L2**					**HB**			AB W/ 4x Output Resolution
Linear 16 TPI ~ 2" Stroke					**L3**					**AF**			Analog Board W/ Feedback
Linear 8 TPI ~ 2" Stroke					**L4**					**HF**			AF W/ 4x Output Resolution
Linear 16 TPI ~ 4" Stroke					**L5**					**AS**			Modbus Control W/ Feedback
Linear 8 TPI ~ 4" Stroke					**L6**					**HS**			AS W/ 4x Output Resolution
Manual Override					**M**					**DC**			24V Digital
Quarter Stop					**QS**					**DT**			24V TTL Board
Reverse Spring Return					**RS**					**PT**			Spring Return Board
Spring Return					**S**	**–**			**0**				No Thermal Management
Haz. Loc. Anodized Alloy (ATEX/IECEx)							**B**		**H**				Internal Heater
Haz. Loc. Stainless Steel (ATEX/IECEx)							**E**	**0**					No Cable
Haz. Loc. Anodized Alloy (CCC)							**M**	**4**					Dual Gauge Cable
Haz. Loc. Stainless Steel (CCC)							**P**						
Haz. Loc. Anodized Alloy (US/CAN)							**A**						
Haz. Loc. Stainless Steel (US/CAN)							**N**						

*Multiple special options listed in alphabetical order with no spaces or dashes between. Not all combinations are valid.

21. Label Breakdown





Notes

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