

RCx-xxxAx-8.09

(12-24 VDC; 4-20 mA Control)

CSA/IECEX Rated*

USER MANUAL

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***Only model numbers:
RCx-BxxAx w/ ex-proof
lid engraving (see p.11)**



INSTALLATION

Mounting

The holes indicated in the image are intended for a mounting bracket. They are threaded for 1/4-20 and are 0.4" deep.

The other two visible holes are threaded 10-32, 0.50" deep, and are intended to be used to lock the lid in position with screws.

For detailed dimensions see p.12.

Wiring

Wiring for Explosion Proof Actuators



The **RCx-BxxAx** Explosion-Proof 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 1/2" FNPT thread cable entry. See p.12 for location of 1/2" FNPT housing access. A cable with 5 wires is required; it is recommended to use 16-24 AWG for all wires.



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)

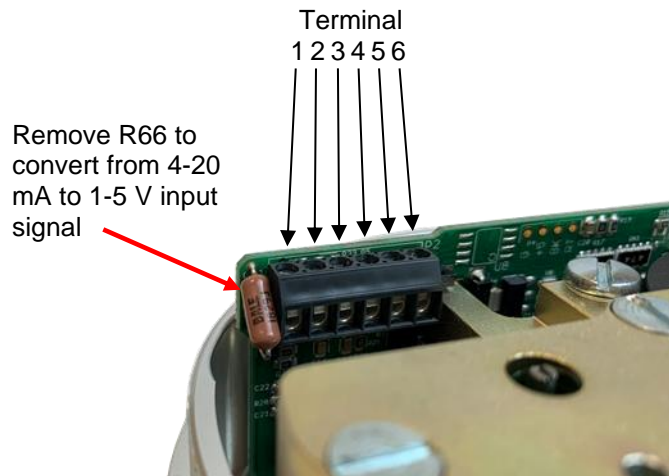
* In explosion-proof models, the FNPT thread is not intended for conduit connection. Cable gland only.

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

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

* "feedback" available in RCx-xxxAF version only

** "isolated" available in RCx-xxxAI and xxxAF versions only



If the sensing resistor R66 is removed, we recommend placing a 10K resistor between signal and signal GND, or simply using shielded cables (for noise reduction).

Wiring for Non-Explosion Proof Actuators

The actuator comes standard with a Turck 5-position connector and a 20' cable (5x 22 AWG) with plug. Cut the cable to the length required, then connect according to the following wire color schematic.

Pins indicate the connection of the cables to the terminal block on the PCB board within the actuator. These are pre-wired at the factory for non-explosion proof actuators.

Wire color schematic for "Turck 5" cable:

Pin	Colour	DC power supply only
6	White	+24VDC
5	Black	Power gnd.
4	Grey	Feedback signal (4-20 mA) *
3		<i>Not connected</i>
2	Brown	Isolated** input signal gnd.
1	Blue	Isolated** input signal (4-20 mA)

* "feedback" available in RCx-xxxAF version only

** "isolated" available in RCx-xxxAI and xxxAF versions only

Power Supply and Current Draw

The **RCx-xxxAx** may be connected to voltages ranging within 12-24 VDC.

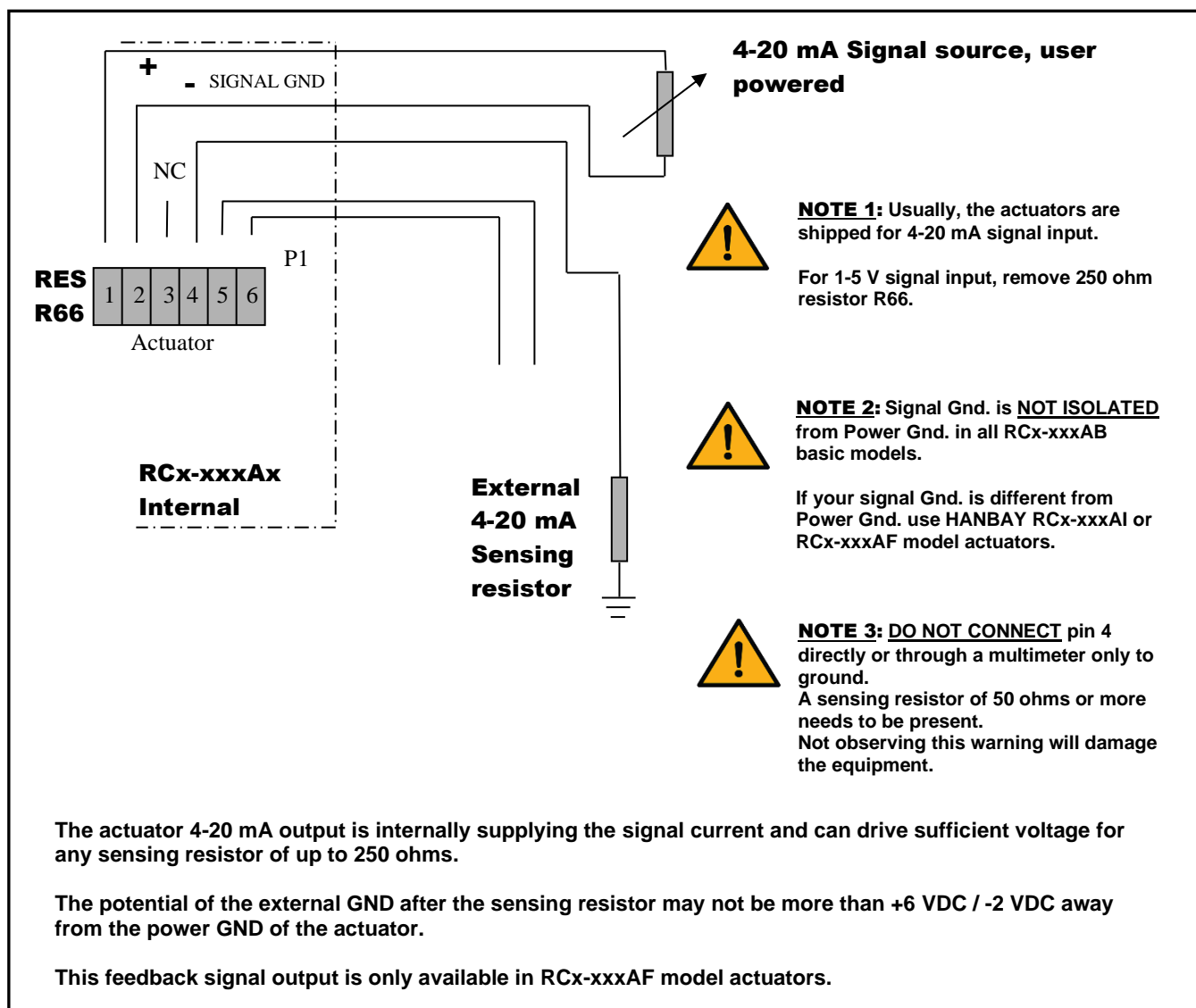
The current draw will range from minimum 100 mA to maximum 3 A while the actuator is active. When not moving, the actuator draws approx. 50 mA.



Note: Digital potentiometer functionality is disabled for supply voltages below 18 VDC, so the actuator position will not be retained on power-loss, on power-up the actuator will need to be re-zeroed every time.

Control Signal and Feedback

Locate the correct connection terminals/wires as shown on the previous page, 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 (grey wire).

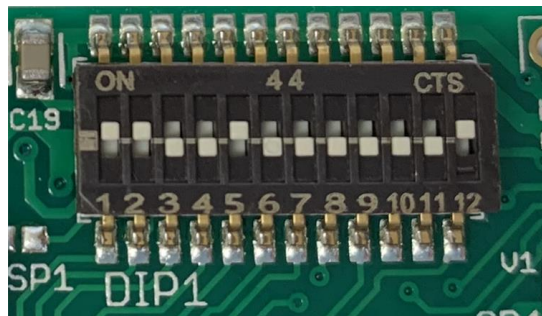


OPERATION

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	Speed: Choose how quickly the actuator will turn the valve. See p.7.
2	
3	Only in the ON position for actuator model RCH (with external gear stage).
4	Turns: The actuator usually ships from the factory with the recommended number of turns 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.
5	
6	See p.7 for relation between positions of the DIP switches and number of turns.
7	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.
8	
9	Signal loss: See p.9.
10	Seating torque: Set how much torque the actuator exerts on the valve lever during the calibration (finding valve seat) procedure. See p.7.
11	
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. See p.9.

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.

Controlling the Actuator

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

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: $(15-4)/16=0.6875 \Rightarrow 68.75\%$ of 2 turns $\Rightarrow 1.375$ turns from closed.

Changing the number of turns

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.

Torque Settings

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)

Speed and Torque Details

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:		
DIP 1	DIP 2	Time for 1 turn (sec)
OFF	OFF	7
OFF	ON	3
ON	OFF	2
ON	ON	1

RCM-xxxAx Actuators

Torque:				
DIP 10	DIP 11	Seating Torque (in-lbs)		Operating torque is 100%
		12 VDC	24 VDC	
OFF	OFF	6	12	
OFF	ON	10	20	
ON	OFF	19	38	
ON	ON	24	48	
NOTE: If actuator is RCJ-xxxAx, divide torque values by 3. To convert in-lbs to Nm, divide by 9				

Speed:		
DIP 1	DIP 2	Time for 1 turn (sec)
OFF	OFF	23
OFF	ON	11
ON	OFF	7
ON	ON	4

Torque:				
DIP 10	DIP 11	Seating Torque (in-lbs)		Operating torque is 100%
		12 VDC	24 VDC	
OFF	OFF	17	35	
OFF	ON	30	60	
ON	OFF	55	115	
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:		
DIP 1	DIP 2	Time for 1 turn (sec)
OFF	OFF	90
OFF	ON	45
ON	OFF	30
ON	ON	18

Torque:				
DIP 10	DIP 11	Seating Torque (in-lbs)		Operating torque is 100%
		12 VDC	24 VDC	
OFF	OFF	60	120	
OFF	ON	102	205	
ON	OFF	200	400	
ON	ON	248	497	
To convert in-lbs to Nm, divide by 9.				

RCF-xxxAx Actuators

Speed:		
DIP 1	DIP 2	Time for 1 turn (sec)
OFF	OFF	186
OFF	ON	94
ON	OFF	56
ON	ON	38

Torque:				
DIP 10	DIP 11	Seating Torque (in-lbs)		Operating torque is 100%
		12 VDC	24 VDC	
OFF	OFF	115	230	
OFF	ON	190	380	
ON	OFF	360	720	
ON	ON	457	915	
To convert in-lbs to Nm, divide by 9.				

Signal Loss and Calibration

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.

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.

Manual Override

The RCx-xxxAx actuator with manual override can also be certified for hazardous locations (CSA and/or IECEx). The additional manual override gear case and handle has no effective ignition sources and can therefore be used in all hazardous locations for which the actuator enclosure is certified for.

Operation 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.



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 Signal Loss and Calibration section).



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 Hanbay for technical support.

EXPLOSION PROOF CERTIFICATIONS

Actuator model number: RCx-**B**xxAx

IECEX

Standards & Editions:

IEC 60079-0:2017, 7th Edition

IEC 60079-1:2014, 7th Edition

*Serial number will be engraved on the lid.

CSA

Standards:

Class I, Div 1, Groups B, C, D (T6)

Class II, Groups E, F, G (T6)

CAN/CSA Std. C22.2 No. 0-M91 (R2001)

CSA Std C22.2 No. 25-1966 Locations

CSA Std C22.2 No. 30-M1986 Locations

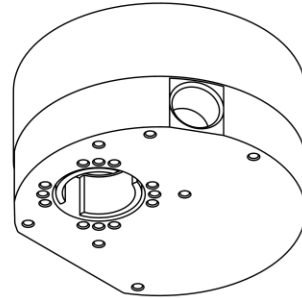
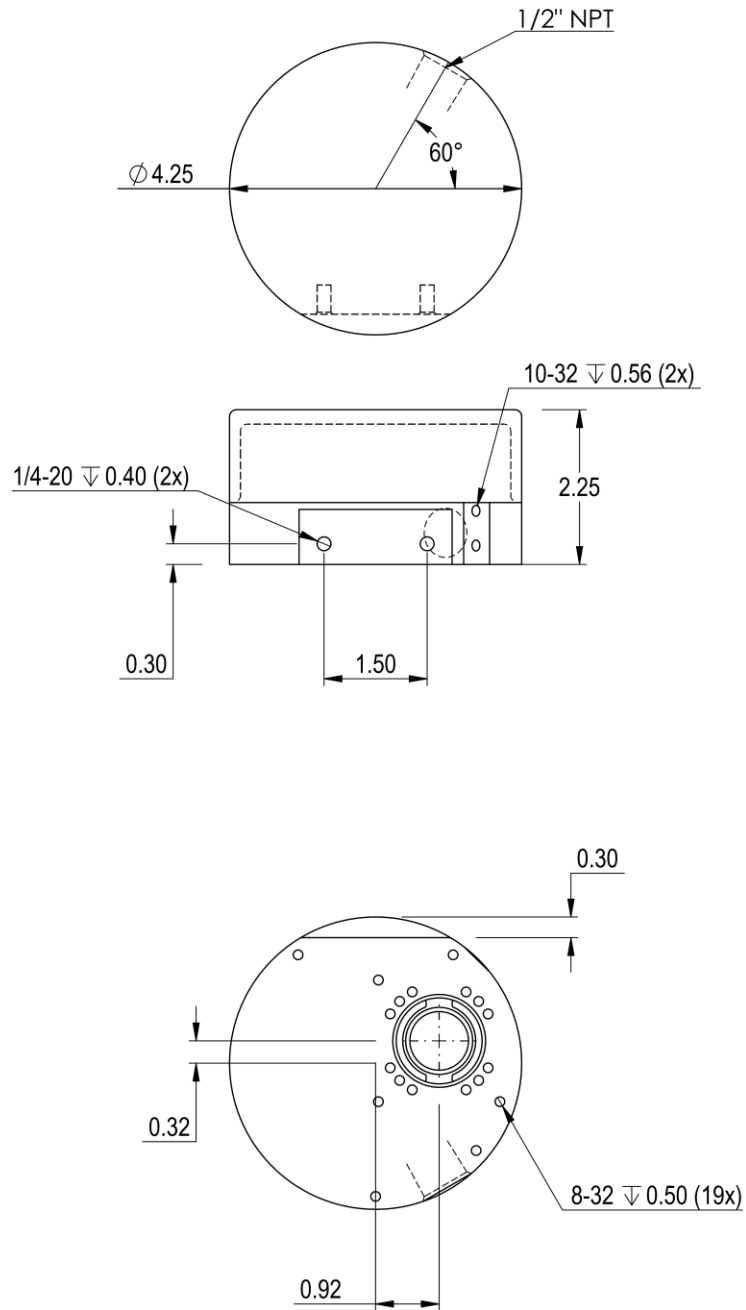
UL 1203-2006



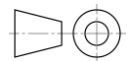
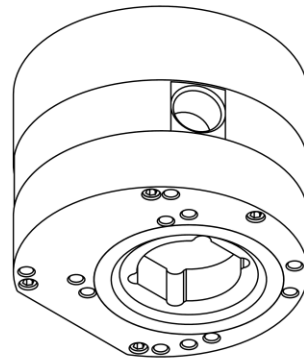
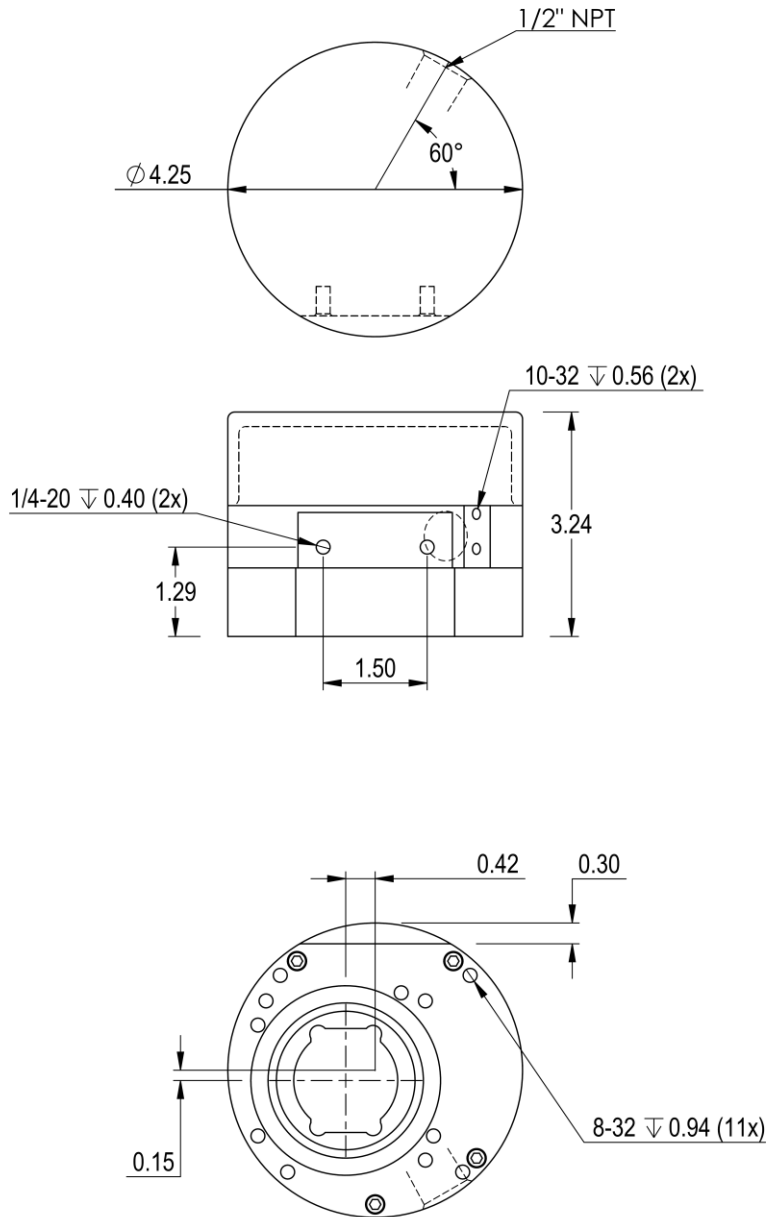
Lid engraving with CSA & IECEX certifications.

ACTUATOR DIMENSIONS

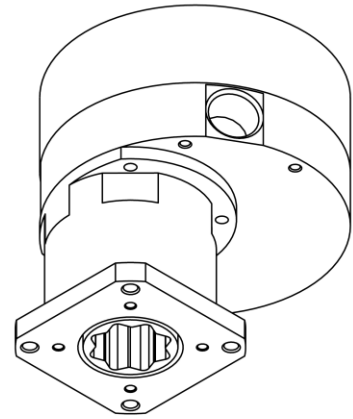
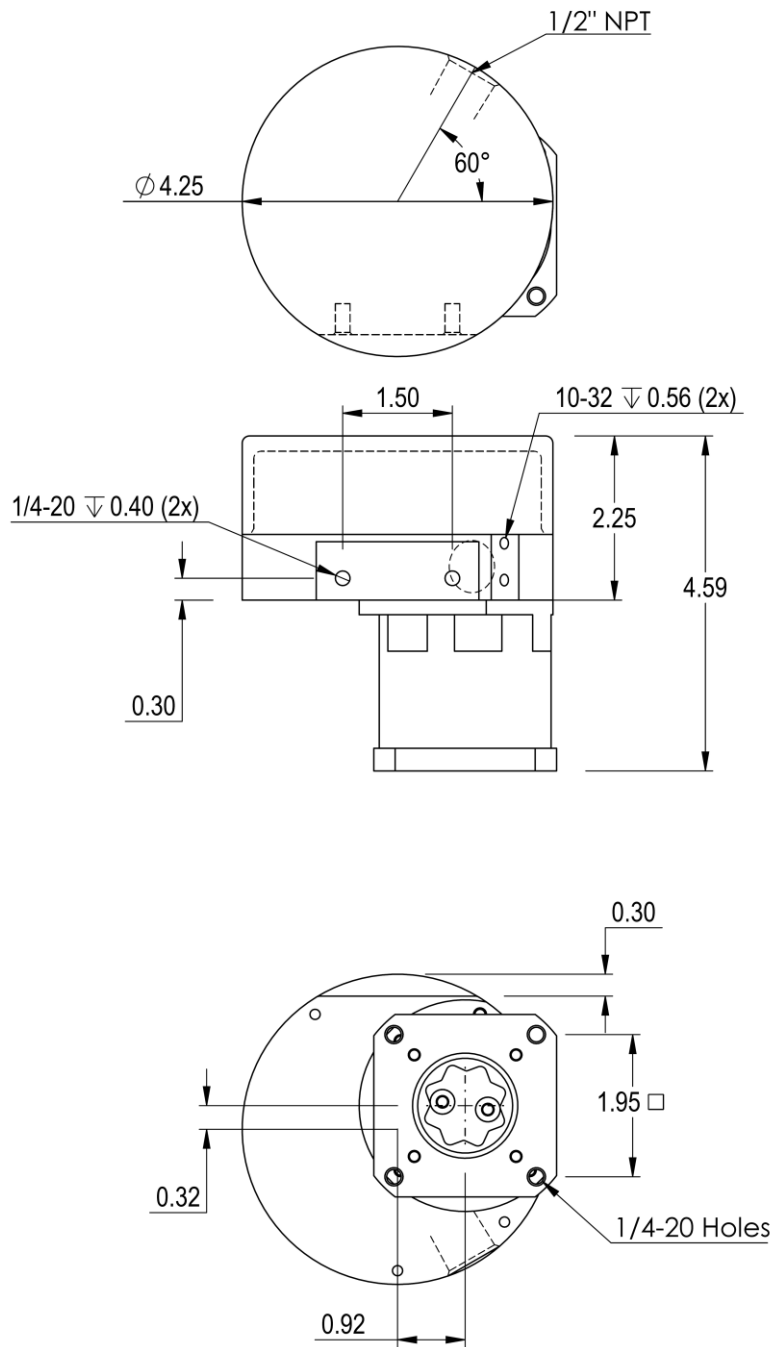
RCJ/ RCL/ RCM -xxxAx models



RCH-xxxAx models



RCF-xxxAx models



PART NUMBER BREAKDOWN

Full Hanbay Part Number: **R** **C** - - - **Ax** - -

Base Enclosure		Continuous or Discrete		Gear Train		Special Options		Enclosure Options		Wiring		Thermal Management		PCB		Mounting Kit		Valve Part Number	
R				-		-						-				-		Valve Manufacturers Part # / CU #	
R		R-Series																	
C		Continuous																	
D		Discrete																	
J		Extra Low Torque																	
L		Low Torque																	
M		Medium Torque																	
H		High Torque (Add. Gear Stage)																	
F		F-Gear Stage (Add. Gear Stage)																	
AB		Analog Signal Board																	
AI		Analog Signal Board Isolated Input																	
AF		Analog Signal Board Isolated with Feedback																	
DC		Continuous TTL Input Board																	
DT		TTL Input Board with 5 V Integrated Feedback (0 or 24 V output available)																	
AS		Modbus Control with Feedback																	
PT		Propane Board, Limit Switches, Thermal Cut Off																	
0		No Option																	
H		Internal Heater																	
F		External Fan																	
0		Cable Gland (Specify Cable & length at added cost) *If the actuator has an ex-proof enclosure, 0 indicates an NPT plug																	
4		Custom Dual Gauge Cable, 10ft.																	
5		TURCK 5 Position Connector w. 20' Cable and Plug																	
6		TURCK 6 Position Connector w. 20' Cable and Plug																	
7		TURCK 5 Position Connector Only																	
8		TURCK 8 Position Connector w. 20' Cable and Plug (Special)																	
0		Standard Anodised Alloy Enclosure																	
B		Explosion-Proof Rated Enclosure																	
S		Stainless Steel Enclosure																	
E		Stainless Steel Enclosure & Manual Override																	
M		Manual Override																	
U		Submersible																	
0		No Special Options																	
HT		High Temperature Kit																	
B		Battery Backup																	
G		G-Stage Gate Valve (with RCL or RCM)																	
L1		Linear 16 TPI																	
L2		Linear 8 TPI																	
M		Manual Override (When M in Enclosure Option is not usable)																	
AC		110-240 VAC Power																	
S		Spring Return																	
RS		Reverse Spring Return																	
BS		Bottom Stop																	

LABEL BREAKDOWN

Actuator Supply Voltage

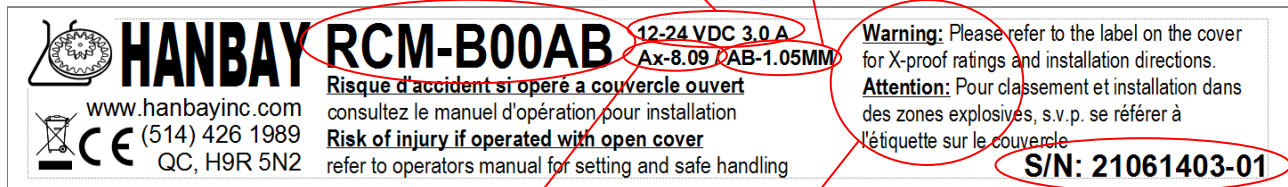
12-24 VDC @ 3.0 A or
110-240 VAC @ 1.5 A

Firmware Version

AF-1.05	[MM = Multiturn
AB-1.05		MML = Multiturn Low Torque
AS-1.05		MMUL = Multiturn Extra Low Torque
		QM = Quarter turn
		QM97 = Quarter turn 97°
DT-2.01		
DC-2.01		
DT-4.06 (Obsolete since 2019)		
M-Dx V2.31		

Actuator Part Number

Refer to part number breakdown for available options.



Ex-proof Certification

Info on ex-proof ratings and installation instructions.

Circuit Board Version

Ax-8.09
Dx-10.31
Dx-4.10 (Obsolete since 2019)
Px-10.3

Actuator Serial Number

This serial number is unique for each individual unit and is directly tied to your order/invoice number.