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Keeping the World Flowing
for Future Generations

M series

MCx-B-xxxAx-8.09 user manual

HANBAY INC.
A rotork Brand

MCx-B-xxxAx-8.09

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

USER MANUAL

Contents

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.

INSTALLATION

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

Environmental Conditions

The M-Series actuator has an IP66 rating but is recommended for indoor use in environments with a relative humidity below 80%. For outdoor use, or for use in higher humidity environments, please consider the equivalent R-Series actuator with its IP68 rating.

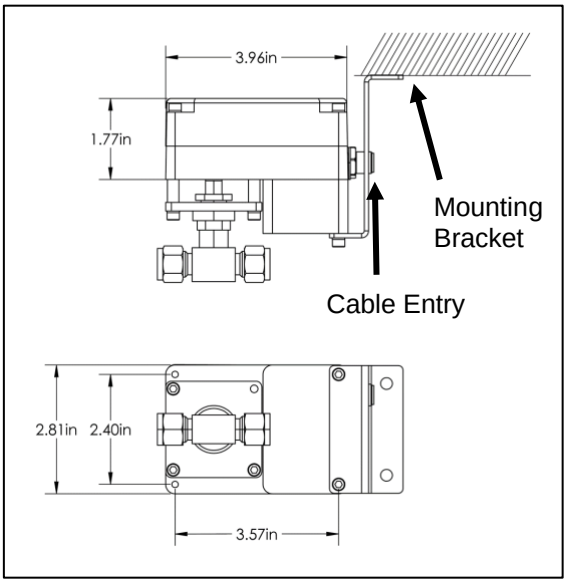
The ambient temperature range for the standard M-Series is -20 to 40 °C (-4 to 104 °F).
The internal heater option shifts the temperatures to a lower range of -40 to 40 °C (-40 to 104 °F).

The standard M-Series has been approved for use at altitudes of up to 2000 m.

Mounting

In most cases, the actuator must be mounted and supported as shown in the image to the right. The mounting bracket is not supplied by Rotork.

Exceptionally, the actuator may be suspended on the tubing itself but ONLY if the application is vibration free and the tubing is minimum ¼" dia. stainless.



Wiring

The actuator comes standard with a Turck 5 position connector and a 20' cable with plug. Cut the cable to the length required and then connect according to the following wire color schematic:

Wire color schematic for "Turck 5" cable:

Pin	Colour	Function
6	White	+24 VDC
5	Black	Power Gnd.
4	Grey	Output Signal (4-20 mA)*****
3		*Not connected*
2	Brown	Isolated****** Input Signal Gnd.
1	Blue	Isolated****** Input + Signal (4-20 mA)

* "feedback" available in MCx-Lx-xxxA**F** version of actuator only.
** "isolated" available in MCx-Lx-xxxA**I** and xxxA**F** versions of actuator only.

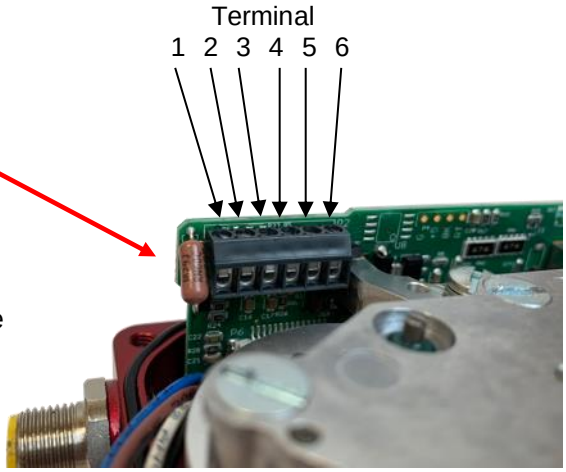
If the Turck cable is not included in your actuator, connect the wires to the corresponding pins on the terminal block as indicated in the table and schematic below:

Pin	Function
6	*Already Connected to battery board* Connect +24 VDC wire to loose red cable with crimp connector
5	*Already Connected to battery board* Connect power ground wire to loose black cable with crimp connector
4	Feedback signal (4-20 mA)*
3	*Not connected*
2	Isolated****** input signal gnd.
1	Isolated****** input signal (4-20 mA)

* "feedback" available in MCx-B-xxxA**F** version only.
** "isolated" available in MCx-B-xxxA**I** and xxxA**F** versions only.

Remove sensing resistor R66 to convert from 4-20 mA to 1-5 V control signal

Note: if R66 is removed, we recommend placing a 10K resistor between signal and signal GND or simply using shielded cable (for noise reduction).



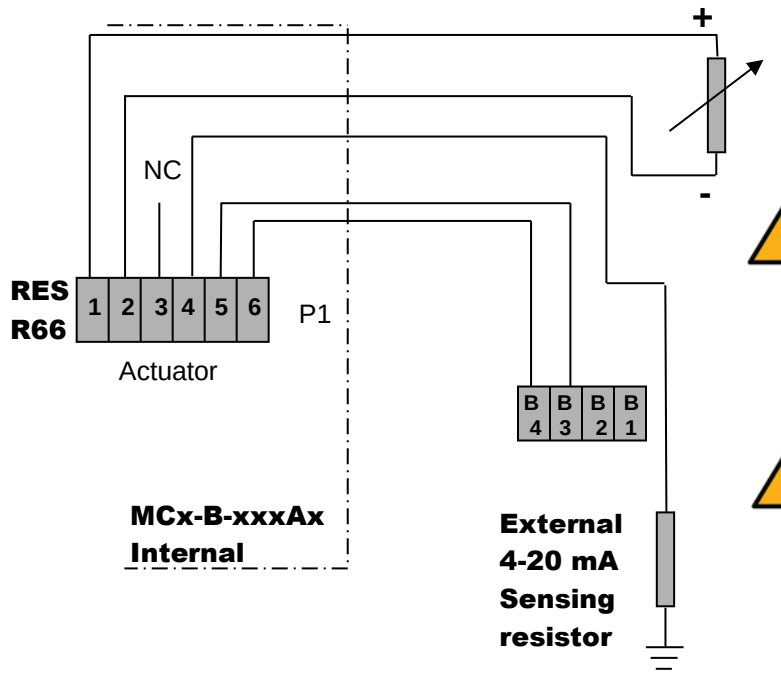
Power Supply and Current Draw

The **MCx-B-xxxAx** can **ONLY** be connected to 24 VDC +/-10%. 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 power consumption will range from minimum 100 mA to maximum 3 A while the actuator is active. When not moving, the actuator draws approx. 50 mA.

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).



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

For 1-5 V signal input, remove 250 ohm resistor R66.

NOTE 2: Signal Gnd. is NOT ISOLATED from Power Gnd. in all MCx-B-xxxAB basic models.
If your signal Gnd. is different from Power Gnd. use MCx-B-xxxAI or MCx-B-xxxAF model actuators.

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.

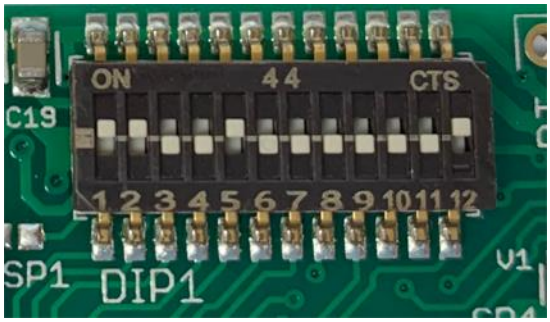
This feedback signal output is only available in MCx-B-xxxAF model actuators.

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 chart on next page 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 drive wheel. See p.8.
3	Defines fail-to position. ON = FAIL OPEN, OFF = FAIL CLOSED
4 5 6 7 8	**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. See p.7 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.
9	**Signal loss:** See p.9.
10 11	**Seating Torque:** Set how much torque the actuator exerts on the valve lever during the calibration (finding valve seat) procedure. See p.8.
12	**Direction/Calibration:** Toggle switch on and off while powered to re-calibrate actuator. Also sets direction in which the actuator will open and close. See p.9. Example: The MCM 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 counterclockwise turning for a decrease in signal. For changes in DIP 12 position to take effect, the power to the actuator must be cycled. When cycling the power, the power must be off for at least 2 minutes to ensure the battery has switched off.

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 ⇒ 68.75% of 2 turns ⇒ 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.

Seating power settings:

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

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

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: When operating at or above 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.

MC**L**-B-xxxAx Actuators

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

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

MC**M**-B-xxxAx Actuators

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%
OFF	OFF	35	
OFF	ON	60	
ON	OFF	115	
ON	ON	145	
NOTE: If actuator is MC**K**-B-xxxAx, divide torque values by 3. **To convert in-lbs to Nm, divide by 9.**			

MC**F**-B-xxxAx Actuators

Speed:		
DIP 1	**DIP 2**	**Time for 1 turn (sec)**
OFF	OFF	161
OFF	ON	77
ON	OFF	49
ON	ON	28

Torque:			
DIP 10	**DIP 11**	**Seating Torque (in-lbs)**	Operating torque is 100%
OFF	OFF	230	
OFF	ON	380	
ON	OFF	720	
ON	ON	915	
To convert in-lbs to Nm, divide by 9.			

The MCH model is not available with battery backup, please use the RDH model instead. Please see user manual RDx-B-xxxDT for more details.
If the M-Series housing with MDH torque range (120-497 in-lbs) is essential, contact us about MDF-L.

For reference, the torque and speed values for the RDH are given below:

RC**H**-B-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%
OFF	OFF	120	
OFF	ON	205	
ON	OFF	400	
ON	ON	497	
To convert in-lbs to Nm, divide by 9.			

Signal Loss and Calibration

1. In the event of a power loss, the **battery fail-safe** model will move to its designated fail-position. This position is programmed at the factory (based on user request) and cannot be changed in the field.

   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. 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.

   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. i.e.: 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.
   Remember to **wait 2 minutes before restoring the power**, to allow the battery board to shut down after moving to the fail-safe position.

4. **Feedback calibration:** [**RCx-B-xxxAF model actuators only]**
   The current feedback will be calibrated from the factory.

   To re-calibrate the feedback:
   a.- Turn off the actuator and **wait 2 minutes** to allow the battery board to shut down after moving to the fail-safe position. Then 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.

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.

Battery Fail Safe Function

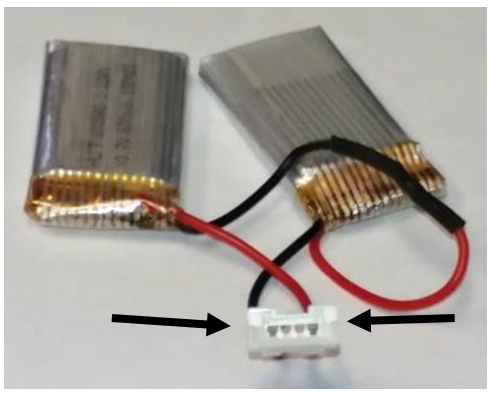
1. In the event of a loss of power or signal, the battery will maintain power to the P1 processor and trigger the actuator to move the valve to its designated fail-safe position, using power from the battery. The digital potentiometer will monitor the position of the valve during this fail-safe operation.
2. Once the valve has reached its fail-safe position, and after about one minute, the P1 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.
The fail-safe actuation can be performed for 30 cycles on the charge available in the battery.
During normal operation, from totally discharged, the batteries will take 2 hours to re-charge.

If in a critical fail-safe application, the battery function should be tested monthly.

Testing Battery Functionality

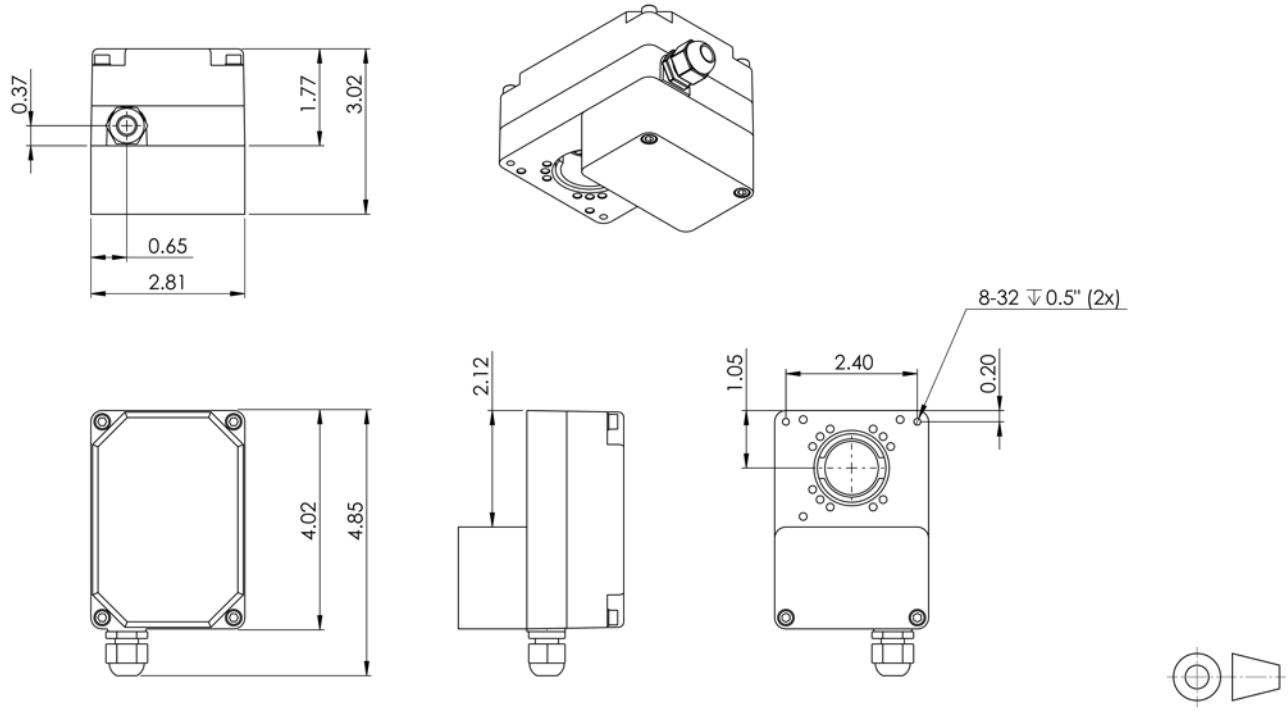
- The batteries will be continuously on charge when power is available to the actuator.
- Regardless of application, the fail-safe function should be tested monthly by signaling the unit to the position opposite the fail position, removing the power to the actuator and observing whether the actuator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



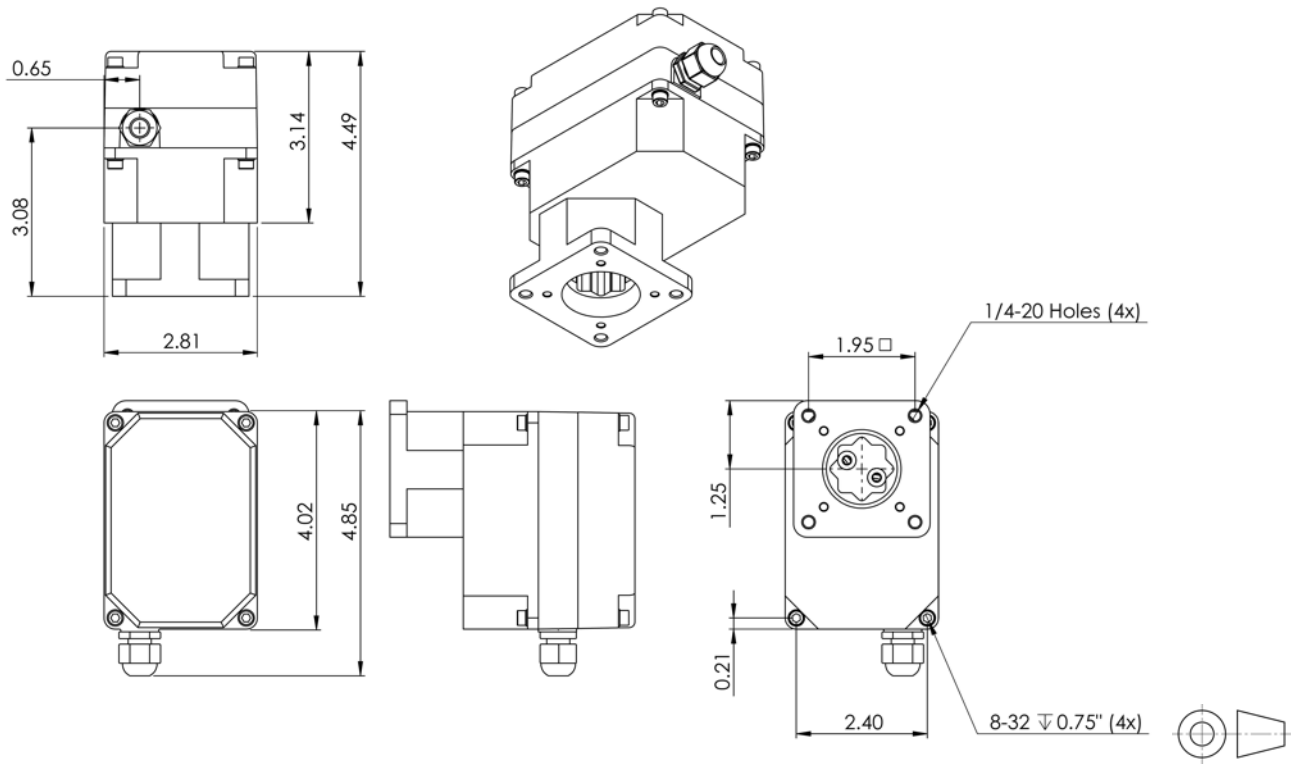
Measure battery voltage between the connector terminals. Value should be: 7.9 ± 0.5 VDC

ACTUATOR DIMENSIONS

MCJ/ MCL/ MCM -B-xxxAx models

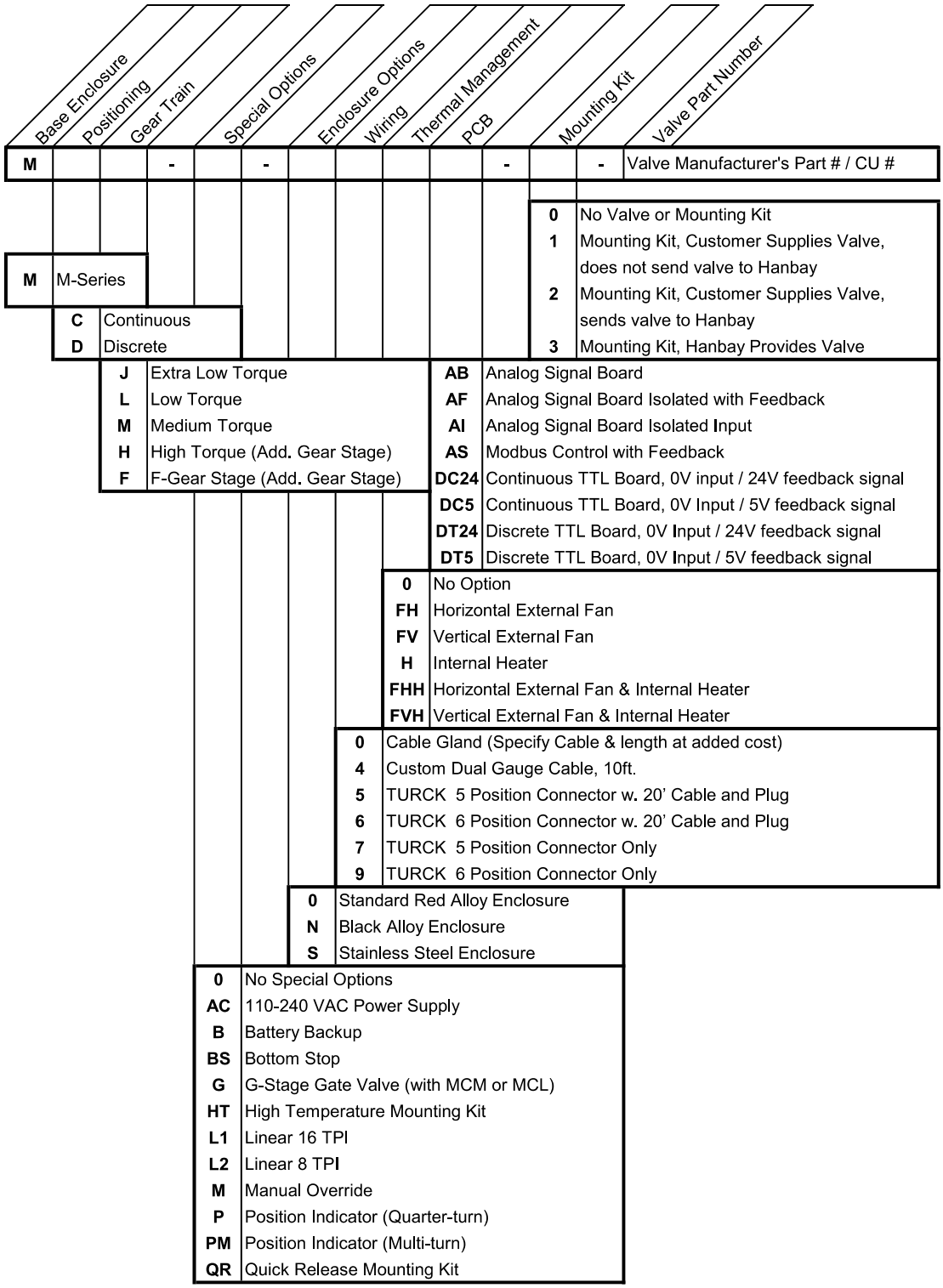


MCF-B-xxxAx models



PART NUMBER BREAKDOWN

Full Part Number: M C [ ] - B - [ ] [ ] [ ] Ax - [ ] - [ ]



LABEL BREAKDOWN

Firmware Version

AF-1.05
AB-1.05
AS-1.05

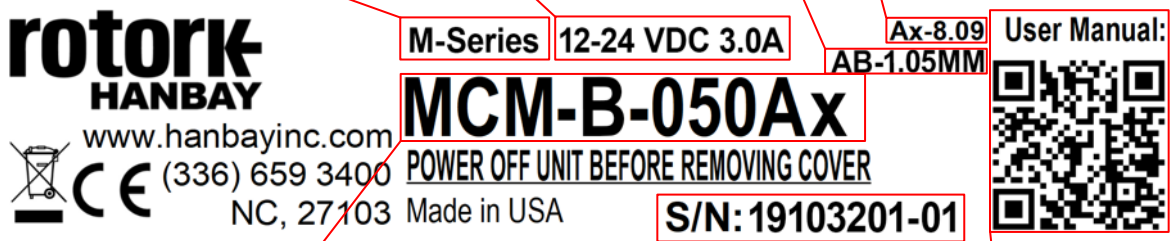
MM = Multiturn
MML = Multiturn Low Torque
MMUL = Multiturn Extra Low Torque
QM = Quarter turn
QM97 = Quarter turn 97°

DT-2.01
DC-2.01
M-Dx V2.34

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

Circuit Board Version
Ax-8.09
Dx-10.41
Px-10.3

Actuator Series
M-Series or R-Series



Actuator Part Number
Refer to part number breakdown for available options.

QR Code
Scan this QR code for a direct link to the user manual for your unit!

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