# MCx-xxxAx-8.09

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

# USER MANUAL

## *Contents*







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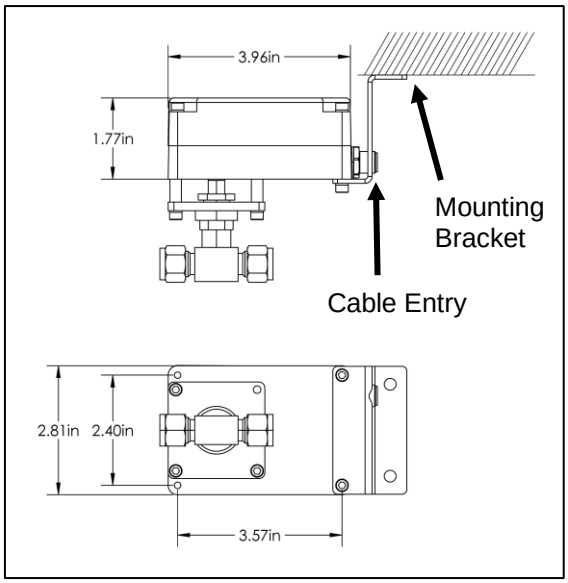
# INSTALLATION

## 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 Hanbay.

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

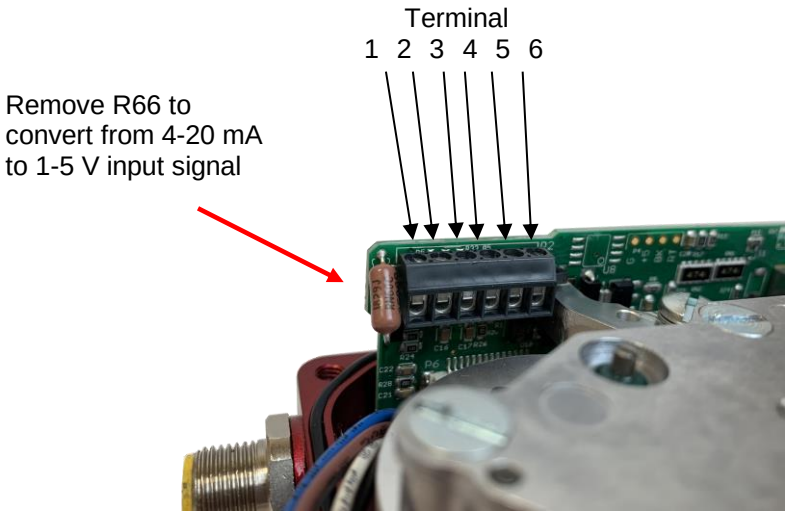
The actuator comes standard with a Turck 5 position connector and a 20' cable with plug. Cut the cable to the length required and then connect according to the following wire color schematic:

**Wire color schematic for "Turck5" 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 schematic:



## Power Supply and Current Draw

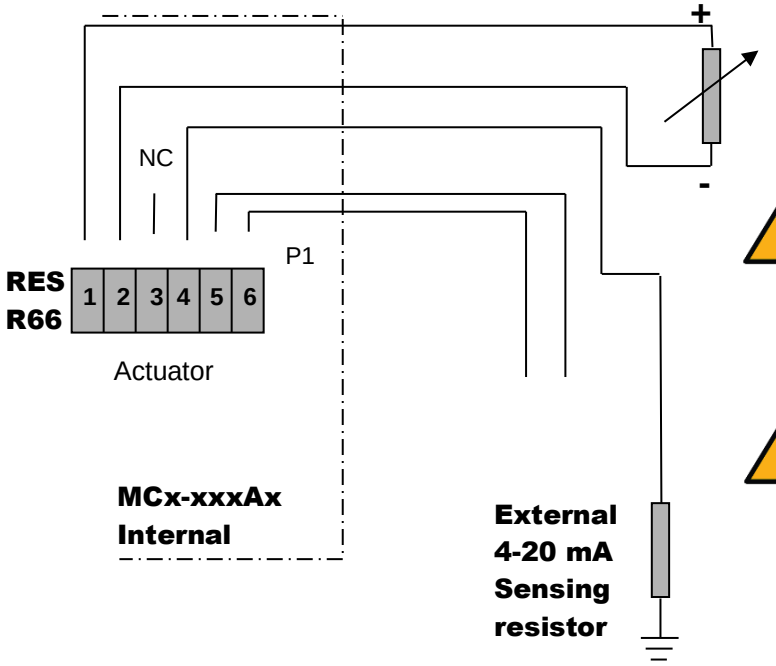
The **MCx-xxxAx** may be connected to voltages ranging within 12-24 VDC.

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).




**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-xxxAB basic models.

If your signal gnd. is different from power gnd. use HANBAY MCx-xxxAI or MCx-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 HANBAY MCx-xxxAF model actuators.**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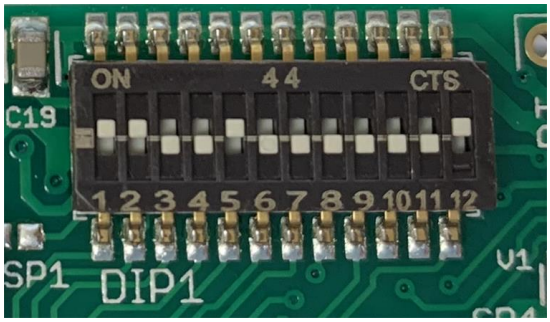
# OPERATION

## 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**<br>**2** | **Speed:** Choose how quickly the actuator will turn the drive wheel. See p.6. |
| **3** | Only in the ON position for actuator model MCH (with external gear stage). |
| **4**<br>**5**<br>**6**<br>**7**<br>**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.<br>See p.6 for relation between positions of the DIP switches and number of turns.<br>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.7 |
| **10**<br>**11** | **Seating torque:** Set how much torque the actuator exerts on the valve lever during the calibration (finding valve seat) procedure. See p.6 |
| **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.7<br><br>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. |

## 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.

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.

MC**L**-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% |
| | | **12VDC** | **24VDC** | |
| OFF | OFF | 6 | 12 | |
| OFF | ON | 10 | 20 | |
| ON | OFF | 19 | 38 | |
| ON | ON | 24 | 48 | |
| **NOTE**: If actuator is MC**J**-xxxAx, divide torque values by 3. **To convert in-lbs to Nm, divide by 9.** | | | | |

MC**M**-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% |
| | | **12VDC** | **24VDC** | |
| OFF | OFF | 17 | 35 | |
| OFF | ON | 30 | 60 | |
| ON | OFF | 55 | 115 | |
| ON | ON | 70 | 145 | |
| **NOTE**: If actuator is MC**K**-xxxAx, divide torque values by 3.<br>**To convert in-lbs to Nm, divide by 9.** | | | | |

MC**H**-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% |
| | | **12VDC** | **24VDC** | |
| 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.** | | | | |

MC**F**-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% |
| | | **12VDC** | **24VDC** | |
| 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.** | | | | |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## 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:** [**MCx-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.

## Troubleshooting

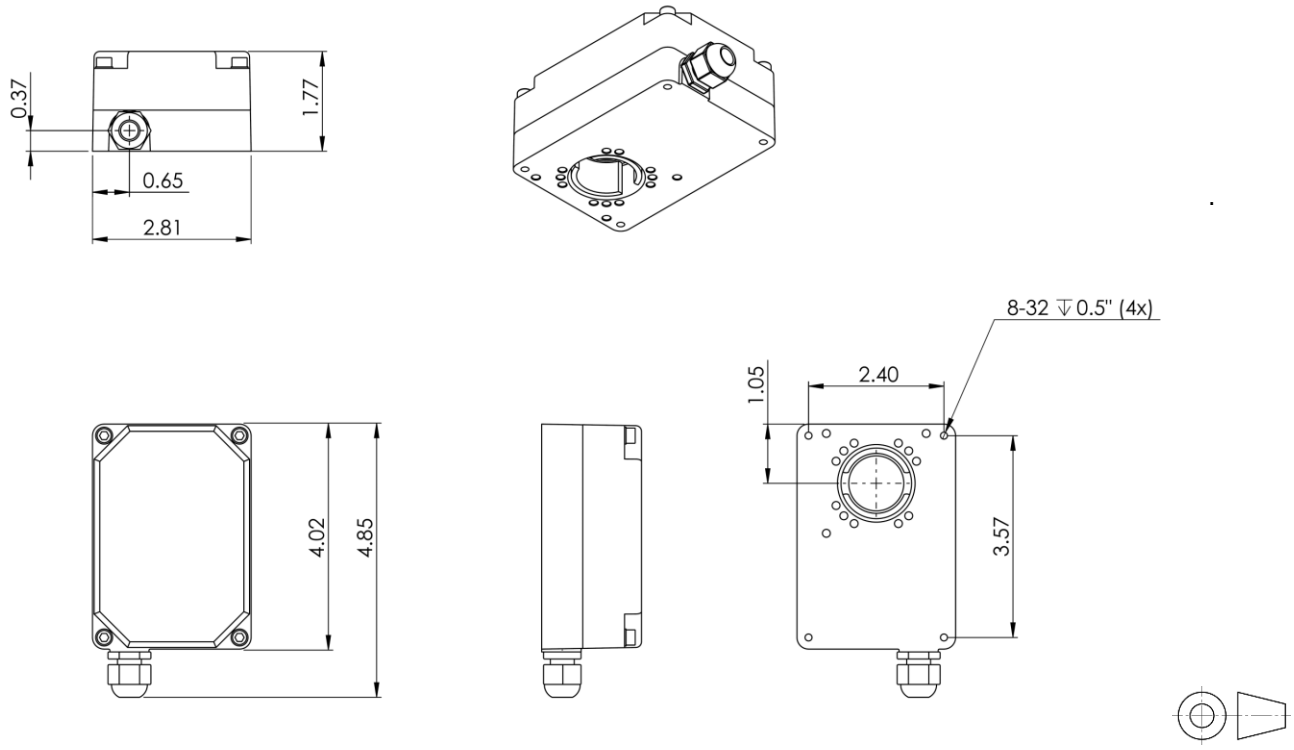
Upon noticing a problem, your first step should almost always be to recalibrate the actuator by toggling DIP 12 while the actuator is powered. This alone can solve the most basic problems. See sub-section 3 above for more details.

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

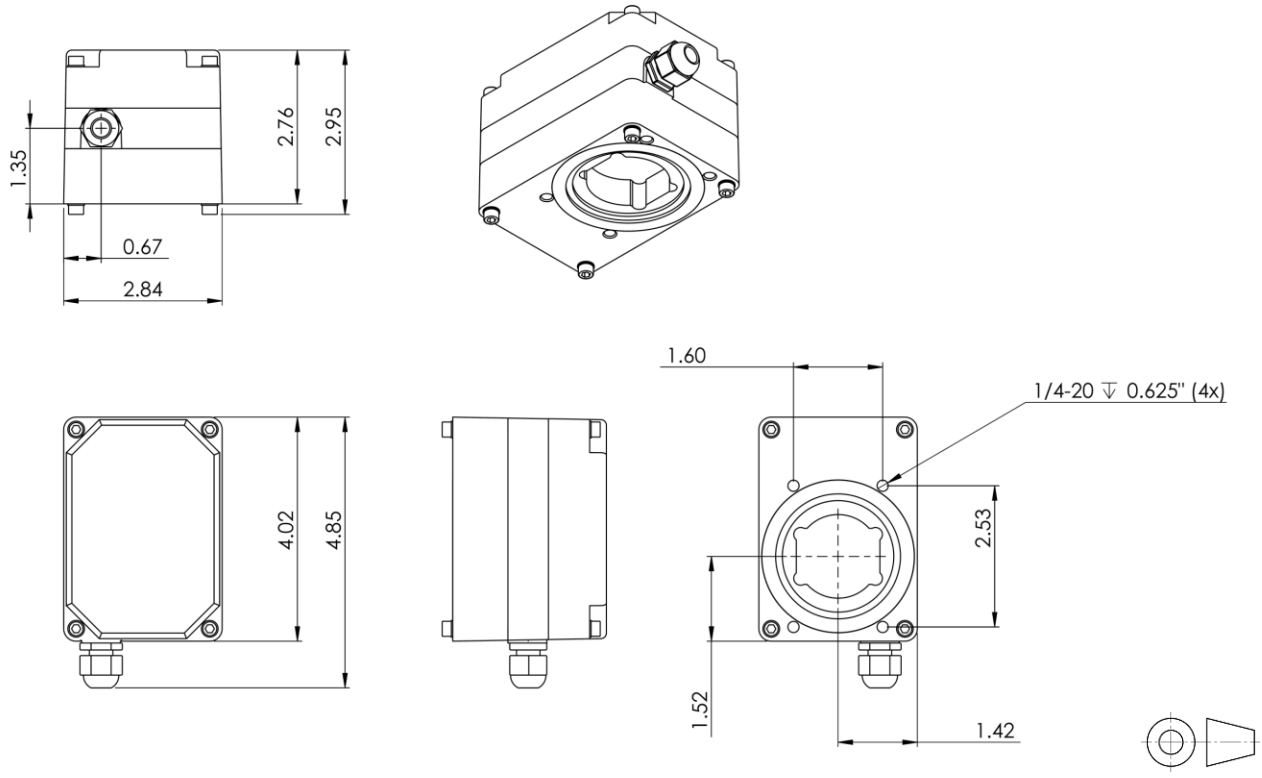
1) Re-calibrate the actuator. This will move the actuator regardless of what signal it is receiving.
2) A sticking valve may be the problem. Remove the valve from the actuator, and re-test the actuator.
3) Remove power. Re-check the wiring and the power/signal apparatus. Power actuator and re-calibrate.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

# ACTUATOR DIMENSIONS

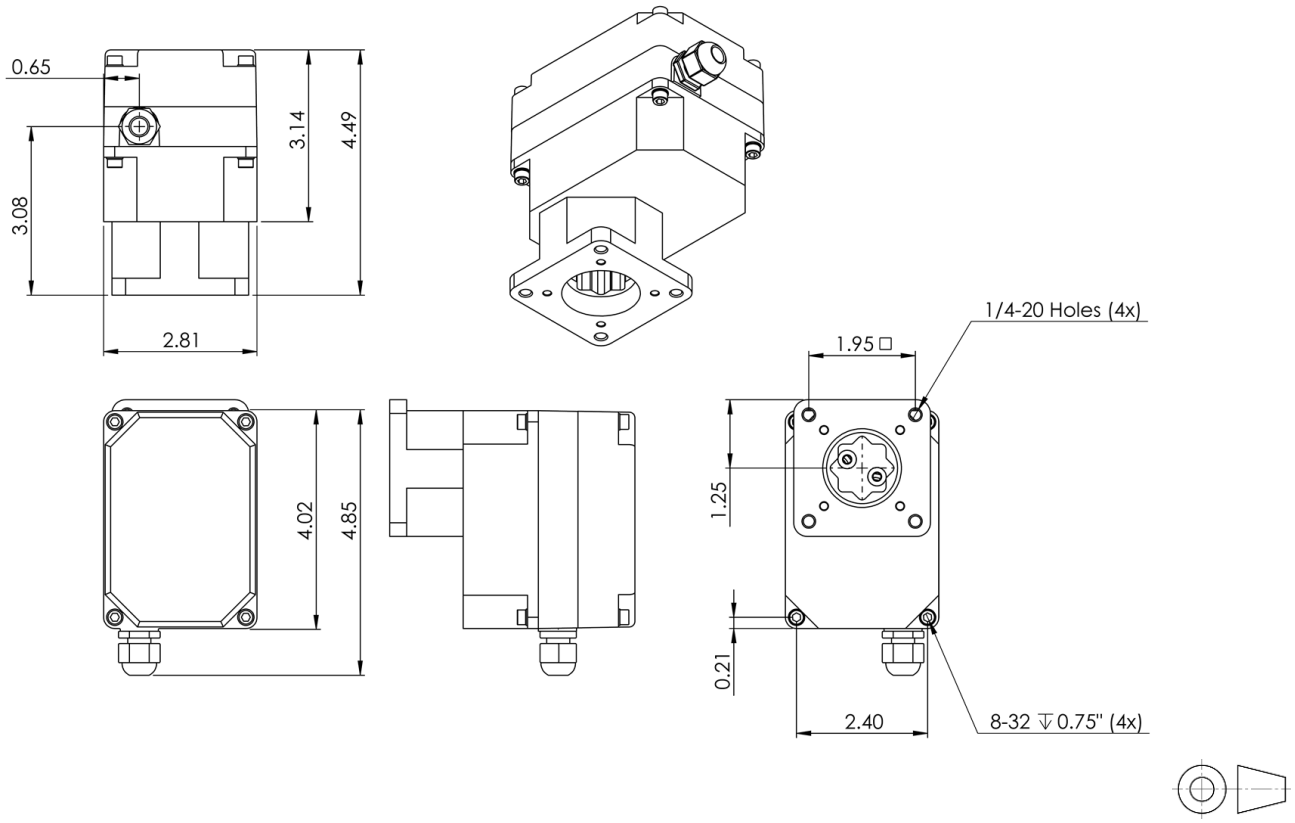
## MCJ, MCL & MCM -xxxAx models




## MCH-xxxAx models

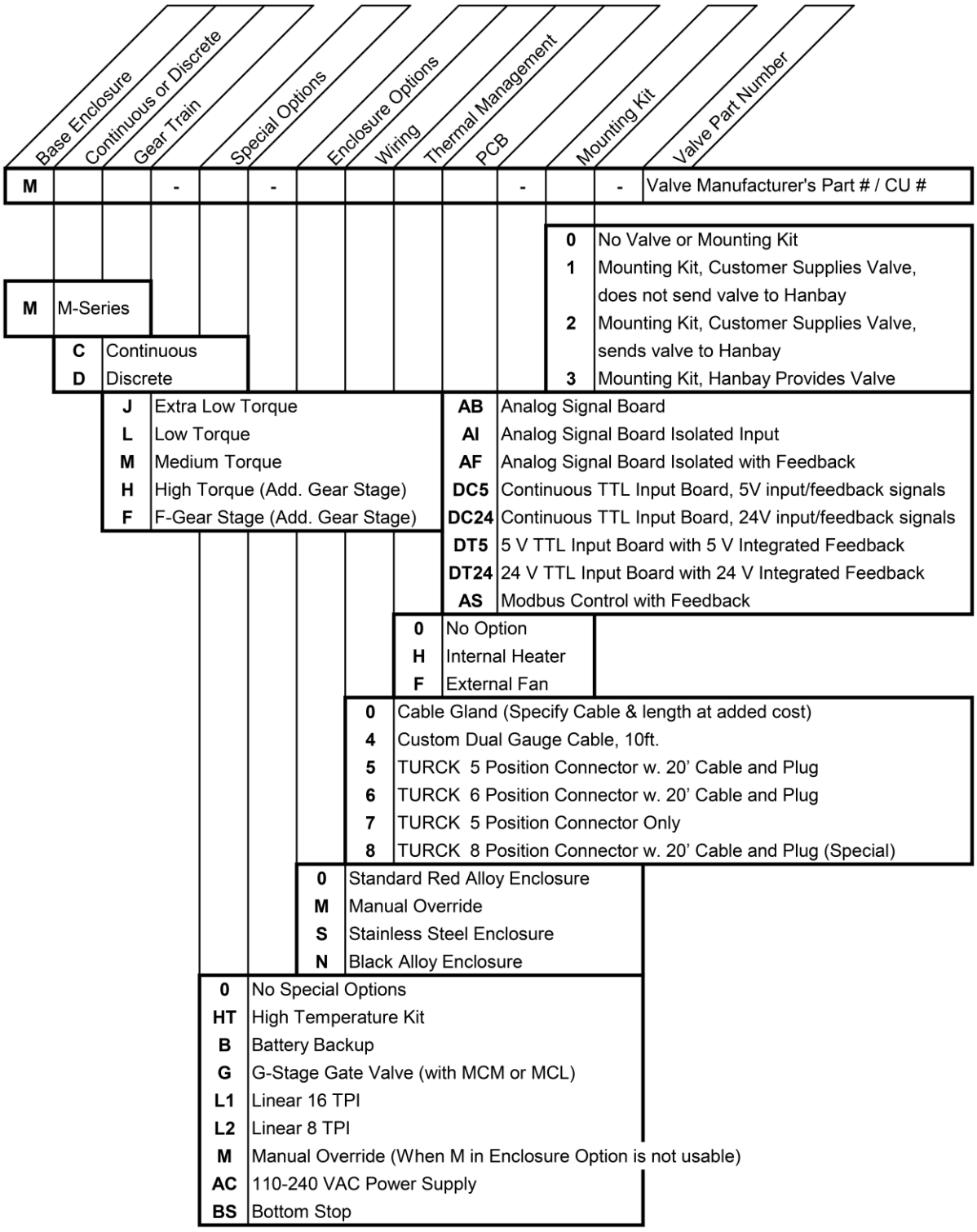


## MCF-xxxAx models



# PART NUMBER BREAKDOWN

**Full Hanbay Part Number:** | **M** | **C** | | - | | - | | | | **Ax** | - | | - | |





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# 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
DT-4.06 (Obsolete since 2019)
M-Dx V2.31

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

**Circuit Board Version**
Ax-8.09
Dx-10.31
Dx-4.10 (Obsolete since 2019)
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.