# MCx-Lx-xxxAx-8.09
## (12-24 VDC; Linear Drive; 4-20 mA Control)

# USER MANUAL

## *Contents*

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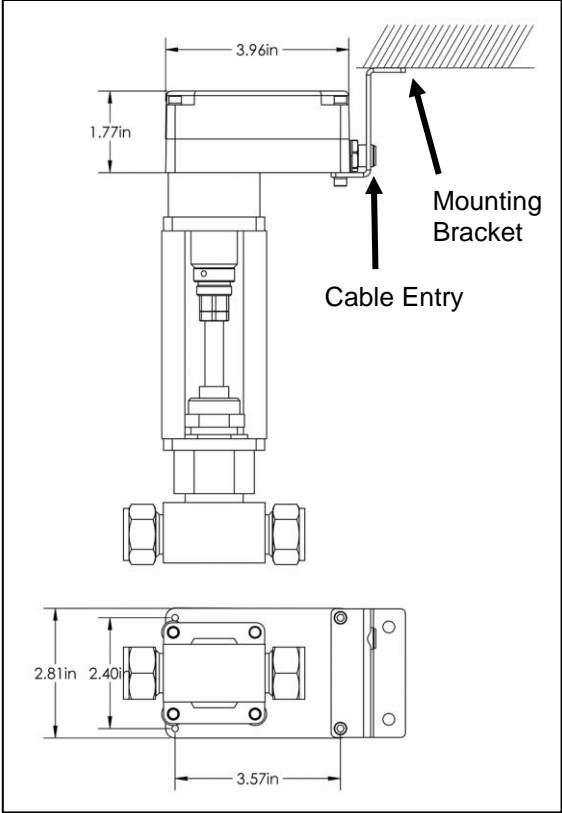hanbaysales@hanbayinc.com

# 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:

Terminal
1  2  3  4  5  6

Remove R66 to convert from 4-20 mA to 1-5 V input signal
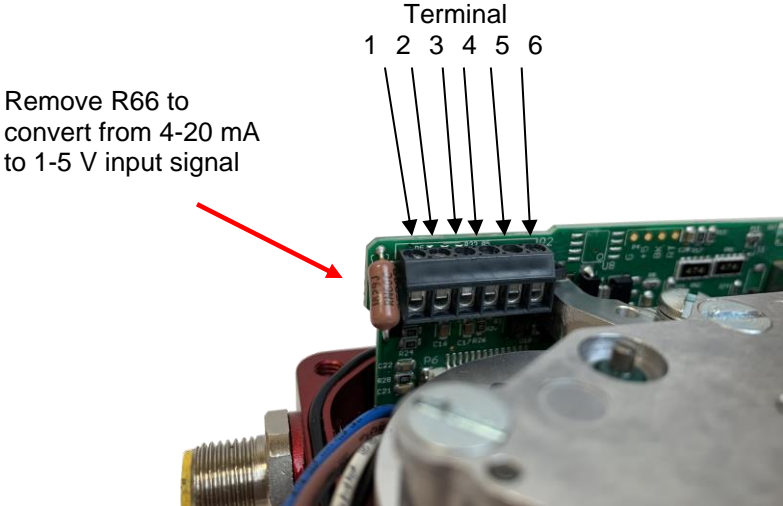
## Power Supply and Current Draw

The **MCx-Lx-xxxAx** may be connected to voltages ranging within 12-24 VDC.
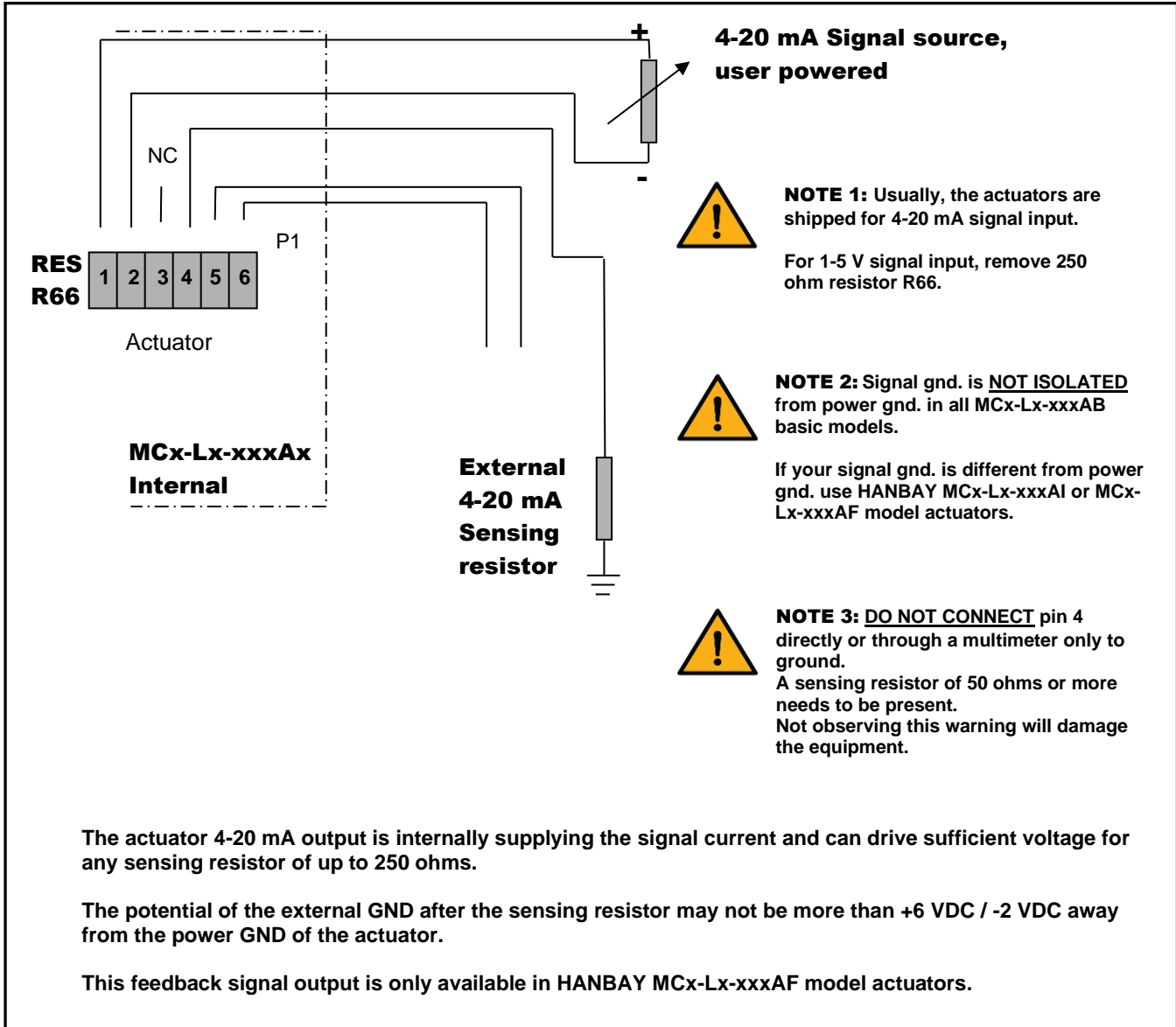
The current draw will range from minimum 100 mA to maximum 3 A while the actuator is active. When not moving, the actuator draws approx. 50 mA.

⚠️ **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).

**+**

**4-20 mA Signal source, user powered**

NC

**-**

P1

**RES R66**

| 1 | 2 | 3 | 4 | 5 | 6 |

Actuator

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

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

**MCx-Lx-xxxAx Internal**

**External 4-20 mA Sensing resistor**

**NOTE 2:** Signal gnd. is <u>NOT ISOLATED</u> from power gnd. in all MCx-Lx-xxxAB basic models.

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

**NOTE 3:** <u>DO NOT CONNECT</u> 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-Lx-xxxAF model actuators.
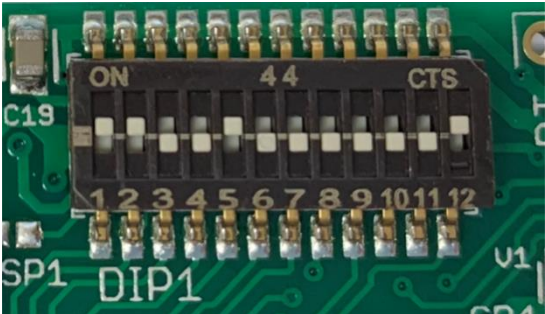
# OPERATION

## 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 | **Speed:** Choose how quickly the actuator will turn the drive wheel. See p.6. |
| 2 | |
| 3 | Not used. |
| 4 | **Stroke:** The actuator usually ships from the factory with the recommended stroke for the valve. |
| 5 | However, this value can be changed.  Turning on a switch will add a specific amount of travel to the |
| 6 | actuator's stroke. |
| 7 | See p.5 for relation between position of the DIP switches and stroke. |
| 8 | |
| 9 | **Signal loss:** See p.7. |
| 10 | **Seating thrust force:** Set how much torque the actuator exerts on the valve lever during the |
| 11 | 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. |
| | 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) input signal is proportional to the stroke of the valve.

*Example:*

You have an actuator with TPI=16 (standard). Valve stroke is 0.75". You wish to move the actuator so the valve's position is 0.122" above the closed position.

0.122/0.750=0.163              20mA-4mA= range of 16mA
0.163*16=2.608.                  2.608+4mA=**6.608mA**

To get 0.122" above the closed position, supply signal of 6.608mA to the actuator.

## Changing the stroke length

The standard HANBAY linear actuator (MCx-**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 MCx-**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** (MCx-**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 |

**8 TPI** (MCx-**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 |

* Turn on DIP 4 **only** for 1.000" stroke.

**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.

## Thrust Settings

To accommodate different valves and other applications with different torque 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 24V)**

| 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)

## Speed and Thrust 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 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.

MC**L**-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 MCJ-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.**

MC**M**-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 Torque (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 MC**K**-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.**

## 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-Lx-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 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.
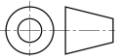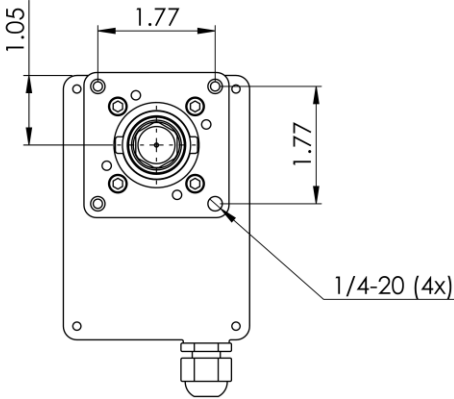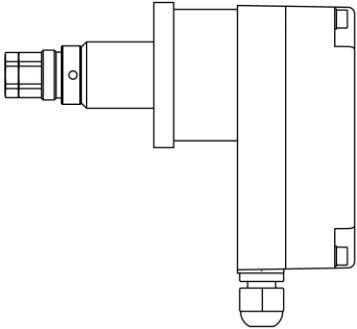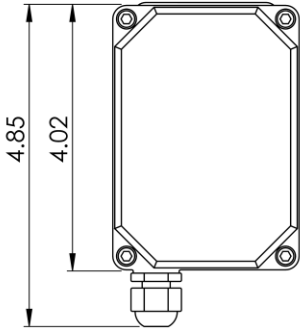
# ACTUATOR DIMENSIONS

## MCx-Lx-xxxAx models
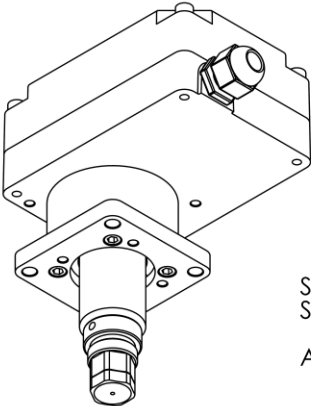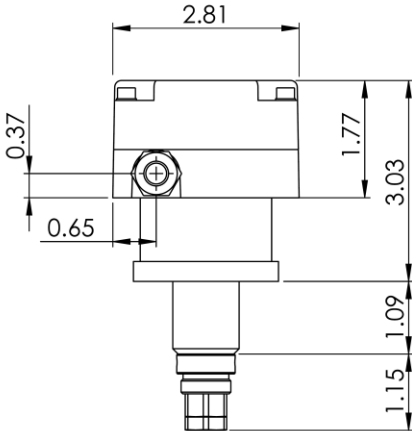
Stroke length 1"
Shown in extended position

Additional options: 2" & 4"

1/4-20 (4x)

# PART NUMBER BREAKDOWN

**Full Hanbay Part Number:** M C – Lx – Ax – – Valve Manufacturer's Part # / CU #

Labels (diagonal): Base Enclosure, Continuous or Discrete, Gear Train, Special Options, Enclosure Options, Wiring, Thermal Management, PCB, Mounting Kit, Valve Part Number

| | |
|---|---|
| **0** | No Valve or Mounting Kit |
| **1** | Mounting Kit, Customer Supplies Valve, does not send valve to Hanbay |
| **2** | Mounting Kit, Customer Supplies Valve, sends valve to Hanbay |
| **3** | Mounting Kit, Hanbay Provides Valve |

| | |
|---|---|
| **M** | M-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 |
| **DC5** | Continuous TTL Input Board, 5V input/feedback signals |
| **DC24** | Continuous TTL Input Board, 24V input/feedback signals |
| **DT5** | 5 V TTL Input Board with 5 V Integrated Feedback |
| **DT24** | 24 V TTL Input Board with 24 V Integrated Feedback |
| **AS** | Modbus Control with Feedback |

| | |
|---|---|
| **0** | No Option |
| **H** | Internal Heater |
| **F** | External Fan |

| | |
|---|---|
| **0** | Cable Gland (Specify Cable & length at added cost) |
| **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 Red Alloy Enclosure |
| **M** | Manual Override |
| **S** | Stainless Steel Enclosure |
| **N** | Black Alloy Enclosure |

| | |
|---|---|
| **0** | No Special Options |
| **HT** | High Temperature Kit |
| **B** | Battery Backup |
| **G** | G-Stage Gate Valve (with MCM or MCL) |
| **L1** | Linear 16 TPI |
| **L2** | Linear 8 TPI |
| **M** | Manual Override (When M in Enclosure Option is not usable) |
| **AC** | 110-240 VAC Power Supply |
| **BS** | Bottom Stop |

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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 @ 1.5 A

**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

HANBAY
www.hanbayinc.com
(514) 426 1989
QC, H9R 5N2
CE
M-Series 12-24 VDC
**MCL-050AF**
POWER OFF UNIT BEFORE REMOVING COVER
Made in Canada
Ax-8.09
AF-1.05MM
User Manual:
S/N: 21030350-02

**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.

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