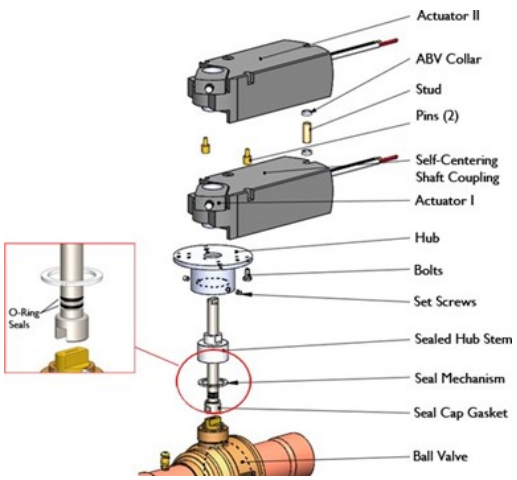
CYCLEMASTER® BALL VALVES

SERIES IV ACTUATOR AND WEATHERPROOF ENCLOSURE INSTALLATION INSTRUCTIONS

ACTUATOR/HUB REMOVAL

1. Disconnect both the tandem Actuators on Actuated Ball Valve (ABV) from all electrical sources.
2. Remove Actuator from Sealed Hub Stem by:
   a) Loosening the screw on the Shaft Couplings
   b) Slide the Actuator off the Sealed Hub Stem.
3. Remove Hub Assembly from Ball Valve by
   a) Loosening the Set-Screws on Hub
   b) Remove Hub by placing wrench on flats of the Sealing Mechanism and turn counter-clockwise.
   c) Unscrew Hub Assembly from valve.
   d) Confirm that the Seal Cap Gasket remains with the Hub Assembly.

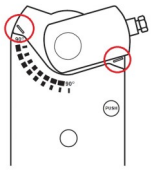


HUB INSTALLATION

1. Remove Remove Seal Mechanism from Hub Assembly. Sealed Hub Stem should remain partially installed in the Seal Mechanism. Ensure Stem and O-Ring Seals are well lubricated.
2. Reinstall the Seal Mechanism into the Hub, hand-tight. Apply a small amount of lubricant to the threads if necessary.
3. Assemble the hex-head Bolts onto the Hub to go into actuator. Align Bolts with holes on underside of Actuator.4
4. Partially install the Set-Screws into the Hub.
5. Make sure the brass sealing surface on top of the Ball Valve is clean and free of debris.
6. Confirm that the PTFE Seal is in place, then install the entire Hub Assembly onto the valve neck, taking care that the slot in the Stem aligns properly with the valve stem and the Seal is in place between the Seal Mechanism and the top of the valve neck.
7. Thread the Hub over the Seal Mechanism and onto the valve as far as possible, stopping just short of bottoming out.
8. Align the Hub so that the Actuator orientation will be as desired. With an Allen wrench, tighten the Set Screws (Torque: 60-65 lb. – in.) on either side of the Hub so that Set Screws secure the Hub against the ball valve body.
9. While holding the larger diameter, tighten the Seal Mechanism portion with a wrench approximately 1/4 to 1/2 turn until secure.
10. Pull Stem upward away from Ball Valve to remove slack.

ACTUATOR INSTALLATION (No Enclosure)

1. Get the Actuator, Self-Centering Shaft Coupling and Locking Clips required for installation.
2. Assemble the Shaft Coupling (9) onto the Actuator as shown in Figures 1 & 2. Depress the manual override button on top of the Actuator and manually cycle the Shaft Coupling back-and-forth through the full 90° cycle to confirm that each actuator operates within the full range between the left and right raised stops. Reposition if necessary.



3. Attach Locking Clip to the underside of the Shaft Coupling to secure it in the Actuator as shown in Fig 3.
4. Depress the manual override button on top of the Actuator and match the full counter-clockwise position of the Shaft Coupling to the full counter-clockwise rotation of the Ball Valve.
5. Insert the ABV Collar into the slot on both the Actuators as shown in Figures 4 & 5, in topside on the bottom Actuator and the underside of the top Actuator. Insert stud into the Collar and Pins into the slots of Bottom Actuator, as shown in Figure 6 on each side of the actuator. Align the Pins and the Stud to underside of top Actuator and mate both Actuators together with matching surfaces touching.
6. Pull Stem upward, away from Ball Valve until no additional space is between the Hub Assembly's Stem and Seal Mechanism within Hub Assembly.
7. Place Actuator Assembly against the Hub, over the Stem taking care that the flange Bolts align with the holes on the underside of the Actuator housing. Bottom of Actuator should be flush against the top of the Hub.
8. Tighten screws on both Self-Centering Shaft Couplings against the Stem – (Torque – 100-130 lb.-in / 12-15 N-m) – see standard Commissioning Instructions.

Notes:

1. Do not over-tighten the screw on the Shaft Couplings.
2. Hub is tightened to Seal Mechanism, not to bottom of the valve neck. Seal Cap Gasket should be tight enough to seal valve surface.
3. The direction of rotation switches must be identically set on both actuators according to the clockwise or counterclockwise rotation of the valve stem. The factory setting is clockwise – this means that a 10Vdc signal will move the Actuator clockwise.

Figure 1 Shaft Coupling

Figure 2 Shaft Coupling

Figure 3 Locking Clip

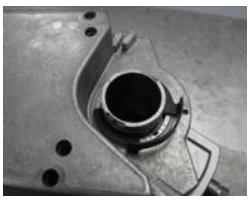


Figure 4

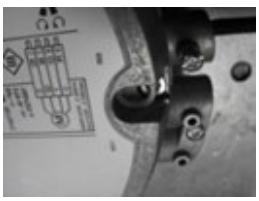


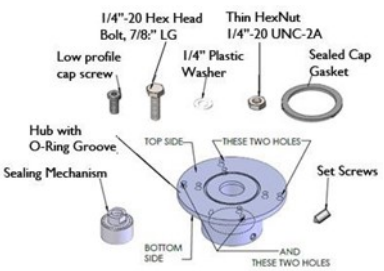
Figure 5

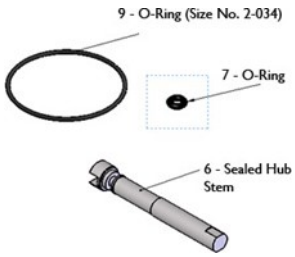
Figure 6

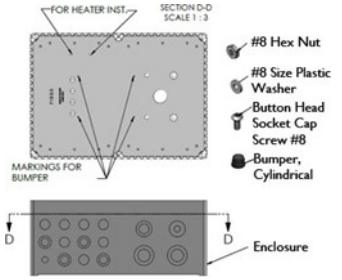
Figure 7

Figure 8

Figure 9 Illustration for installing Shaft Coupling on the underside







ACTUATOR INSTALLATION (with Enclosure)

1. Take the Enclosure and accessories out of the kit (In case of Act.- BV-Hub-Encl. kit, the kit includes the Ball Valve and the Two Actuators as well).
2. Disassemble cover by loosening plastic screws on enclosure.
3. Follow steps 4 through 10 of "HUB INSTALLATION". DO NOT REMOVE SEAL MECHANISM (already installed) or thread sealant between Hub and Seal Mechanism will be damaged.
4. Install O-Ring into Hub Groove. (Figure 7) If Hub does not have groove, use Hub from the new Enclosure Kit. Apply small amount of lubricant to O-Ring, if necessary.
5. Assemble **two** of the hex-head bolts onto the Hub (Figure 8). Align Bolts with holes on underside of Enclosure and Actuator.
6. Place enclosure over Stem and on Hub. Align flange bolts with holes on the underside of Enclosure. Tighten Enclosure onto the flange bolts (onto the Hub) using the two thin hex nuts and two plastic washers (Assembly Torque ≈ 44-50 lb. –in). Bottom of Enclosure should be flush against top of Hub.
7. From top of Enclosure, assemble the two Low Profile Cap Screws (using the plastic washer) in the remaining 2 holes and tighten down the Enclosure onto the hub. (The heads of the bolts should be on the topside and the shaft of the body of the bolt protruding out of the underside of the hub.
8. Before installing the actuator into the enclosure, follow steps 1-6 of the "Actuator (Motor) Installation" stated above.

NOTE: When installed in a Weatherproof Enclosure, the Shaft Coupling of the Actuator needs to be installed on the bottom side of the Actuator (Figure 9) instead of the top side (as mentioned in Step 2 – Figure 2).

9. Place Actuator against Enclosure, over the Stem. Align Flange Bolts with the holes on the underside of the Actuator housing. Bottom of Actuator should be flush against top of Enclosure.
10. While holding manual override switch on Actuator, align both the Shaft Couplings and tighten against the Stem. Series IV, Torque ≈ 100-130 lb. – in (12-15 N-m) – see standard Commissioning Instructions.
11. Install Enclosure using cover screws. (Torque ≈ 10 lb.-in/1.2 N-m)

Actuator Features:

- Synchronous motor technology with stall protection
- Unique self-centering Shaft Coupling
- Modulating Control
- Built-in Feedback
- Manual override
- cUL and UL Listed, CE Certified
- Independently adjustable dual auxiliary switches available

Service Warnings/Cautions	
⚠	DO NOT OPEN THE ACTUATOR. IF THE ACTUATOR IS INOPERATIVE, REPLACE THE UNIT.
⚠	Do not wire different types of actuators in parallel with these models.
⚠	All six outputs of the dual auxiliary switch (A and B) must only be connected to: Class 2 voltage (UL/CSA), Separated Extra-Low Voltage (SELV) or Protective Extra Low Voltage (PELV) (according to HD384-4-41) for installations requiring CE conformance. You must use a CE certified plenum actuator.
⚠	Installations requiring CE Conformance: All wiring for CE certified actuators must only be separated extra low voltage (SELV) or protective extra low voltage (PELV) per HD384-4-41. Use safety isolating transformers (Class III transformer) per EN61558. They must be rated for 100% duty cycle. Overcurrent protection for supply lines is maximum 10A.
⚠	Mixed Switching operation is not permitted to the switching outputs of both auxiliary switches (A and B)
⚠	Personal injury/loss of life may occur if a procedure is not performed as specified.
⚠	Not for use in condensing or wet applications.
⚠	Equipment damage or loss of data may occur if the user does not follow a procedure as specified.
⚠	To avoid injury or loss of life, pay attention to any hazardous voltage when performing checks.

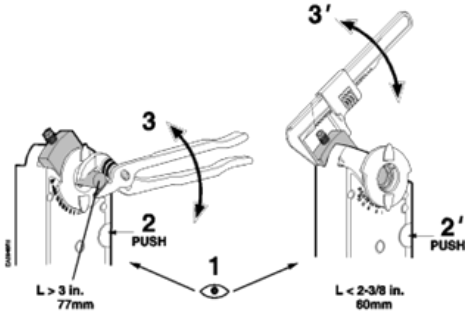
Manual Override

To move the valve and lock the position with no power present:

1. Hold down the PUSH button.
2. Make adjustments to the valve position.
3. Release the PUSH button.

NOTE:

1. For Tandem motor application top motor may need to be removed in order to access manual override for bottom motor.
2. If there is no load, the actuator will hold the new position. If load conditions exist, the actuator might not be able to hold. Once power is restored, the actuator returns to the automatic control.



Wiring

All wiring must conform to NEC and local codes and regulations.

Use earth ground isolating step-down Class 2 transformers. Do not use auto transformers.

The sum of the VA ratings of all actuators and all other components powered by one transformer must not exceed the rating of the transformer. It is recommended that one transformer power no more than 10 actuators.

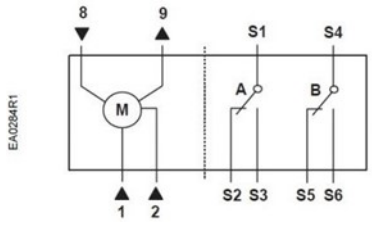


Figure 1 Wiring Designations

Standard Symbol	Function	Terminal Designation	Series I & III Color
1	Supply (SP)	G	Red
2	Neutral (SN)	G0	Black
8	Control Signal: 0 to 10 Vdc	Y	Gray
9	Output for 0 to 10 Vdc position indication	U	Pink
S1	Switch A Common	Q11	Gray/Red
S2	Switch A N.C.	Q12	Gray/Blue
S3	Switch A N.O.	Q14	Gray/Pink
S4	Switch B Common	Q21	Black/Red
S5	Switch B N.C.	Q22	Black/Blue
S6	Switch B N.O.	Q24	Black/Pink

START UP/COMMISSIONING

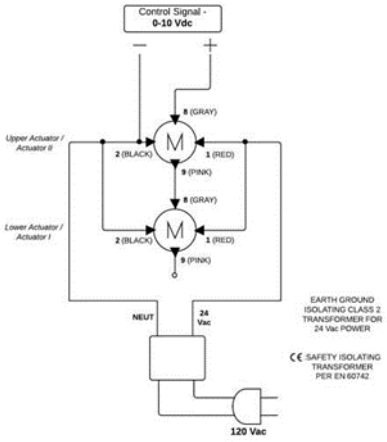
1. Check that the direction of the rotation switch matches the rotation of the valve shaft.
2. Check that the wires are connected correctly.
3. Connect wires 1 (red) and 2 (black) to the actuator. Apply a drive voltage of 24 Vac to wires 1 and 2 and with the help of a Digital Multimeter (DMM) and dial set at Vac, verify that the operating voltage is within range.
4. Check that the direction of the rotation switch matches the rotation of the valve ball.
5. Check the operation.
   a) Connect wire 1 (red) and 2 (black) to the actuator.
   b) Set the DMM dial to Vdc
   c) Connect wires 2 (black) and 8 (gray) to a Digital Multimeter (DMM).
   d) Apply a full scale input signal (10 Vdc) to wire 8 (gray).
   e) Allow the actuator Shaft Coupling to rotate from 0° to 90°.
   f) Disconnect the wire 8 (gray) and the Shaft Coupling returns to the "0" position.
6. Check the Feedback
   a) Set the DMM dial to Vdc.
   b) Attach wires 2 (black) and 9 (pink) to the DMM.
   c) Apply a full scale input signal to the wire 8 (gray). The DMM reading should increase.
   d) Remove the signal from wire 8 (gray). The reading at the DMM should decrease and the actuator Shaft Coupling returns to the "0" position.
7. Check the Auxiliary Switch A.
   a) Set the DMM dial to Ohms (resistance) or continuity check.
   b) Connect wires S1 and S3 to the DMM. The DMM should indicate an open circuit or no resistance.
   c) Apply a full scale input signal (10 Vdc) to wire 8 (gray). The DMM should indicate contact closure as the actuator Shaft Coupling reaches the setting of switch A.
   d) Connect wires S1 and S2 to the DMM. The DMM should indicate an open circuit or no resistance.
   e) Stop applying a control signal to wire 8 (gray). The DMM should indicate contact closure as the actuator Shaft Coupling reaches the setting of switch A.
8. Check the Auxiliary Switch B.
   a) Set the DMM dial to Ohms (resistance) or continuity check.
   b) Connect wires S4 and S6 to the DMM. The DMM should indicate an open circuit or no resistance.
   c) Apply a full scale input signal (20 Vdc) to wire 8 (gray). The DMM should indicate contact closure as the actuator Shaft Coupling reaches the setting of switch B.
   d) Connect wires S4 and S5 to the DMM. The DMM should indicate an open circuit or no resistance.
   e) Stop applying a control signal to wire 8 (gray). The DMM should indicate contact closure as the actuator Shaft Coupling reaches the setting of switch B.

Wiring Description—Tandem Actuator

The largest Mueller Ball Valves (2-5/8" and 3-1/8" Full Flow) requires two (2) 310 in-lb. actuators acting in tandem to move the valve. In order to keep them working together, a Master-Slave needs to be setup between the two actuators. The operation is as follows:

- Each actuator has 4 wires, red, black, gray, and pink. The 3 "drive" wires (red, black and gray) on the Master should be used to position the actuator properly.
- Check that the modulation input moves the actuator in the desired direction, and that both actuator drive directions are set to move the same direction with a given input.
- Use the feedback from the Master (pink) to drive the position of the Slave (gray). If the actuators run one way, but not the other – check for grounding.

NOTE: Master = Actuator II; Slave = Actuator 1



Wiring Instructions:

1. Tie both red wires together (24Vac).
2. Tie both black wires together (Neutral).
3. Master gray is the drive voltage (0-10 Vdc). Cross the DC ground from the input board to the Black. The actuators are electrically isolated inside the housing, and the DC requires some way to ground.
4. Master pink is tied to slave gray.
5. Slave pink is stubbed off, or used to drive some other function (i.e. indicator on a control panel).

Additional Notes:

The valve should only be used in the "full closed" or "full open" position.

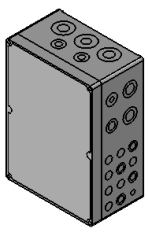
Any voltage above 10VDC is interpreted as 10VDC, as long as it isn't more than ~30VDC. So, if the incoming voltage is 24VAC (AC drive voltage), and it is rectified to DC to use as a signal for modulation, then the actuator would use 0VDC-10VDC for modulation, and any signal it received between 10VDC and 24VDC would be interpreted as 10VDC.

The tandem actuator pair should be joined with appropriate hardware and cycled fully clockwise and counterclockwise before the clamps are tightened onto the stem extension. Confirm that both clamps have the same alignment, and that both touch the hard-stop at either end of the cycle at approximately the same time when cycling.

If the actuators run one way, but not the other – check for grounding. An ungrounded DC signal will be interpreted as 0VDC (nil). This can be confirmed by simply reversing the input signal rotation direction with the small switch on top of the actuator (lower-left). If reversing this switch causes the actuator to move all the way in the other direction, then it is most likely receiving 0VDC input. In most cases, the DC ground from the input board can be tied to the Black (Neutral).

Weatherproof Enclosure Kits

Includes Enclosure, Hub Kit, O-Ring, Bolts (2), Cap Screws (2), Hex Nuts (2), Gaskets (4)



PRODUCT HAS BEEN MANUFACTURED TO BE CONSISTENT WITH NEMA 3R SPECIFICATIONS.

Assemble the kit in compliance with the Installation instructions provided, in order for the enclosure to perform its function.

Notes

The conduit hubs are to be connected to the conduit before being connected to the enclosure. Selected location must provide adequate wire bending space.

Weatherproof Enclosure Features:

All the Enclosures have drilled holes to accommodate the Heater kit except the Series I Enclosure.
Enclosure has Metric Knockouts for easy wiring.
Encl. Material: Polycarbonate (PC); Screw Cover; Opaque

NON-METALLIC ENCLOSURE DOES NOT PROVIDE GROUNDING BETWEEN CONDUIT CONNECTIONS. USE GROUNDING BUSHINGS AND JUMPING WIRES.

AMBIENT TEMPERATURE: -25°F to 125°F (-40°F TO 125°F, IF USED WITH A HEATER KIT)

Specifications		Series IV Actuator
Sizes		2-5/8" Full Flow thru 4-1/8" Reduced Port
Power Supply	Operating Voltage	25 Vac ±20%
	Frequency	50/60 Hz
	Power Consumption	8 VA, 8 W (Running); 1.1 W (Holding); 12 VA (Tandem Application)
Control Signal	Input signal (Voltage	0 to 10 Vdc
	Input Resistance	>100K ohms
Feedback Signal	Position Output Signal (Voltage)	0 to 10 Vdc
	Maximum Output Current	DC 1 mA
Equipment Rating	Rating	Class 2 according to UL, CSA
		Class III per EN60730
Auxiliary Features	Dual Auxiliary Switch Contact Rating	6A resistive, 2A general purpose
	Dual Auxiliary Switch Voltage Rating	24 Vac / 12 to 30 Vdc
	Switch Range	
	Switch A	0 to 90° with 5° intervals
	Recommended Range Usage	0 to 45°
	Factory Setting	5°
	Switch B	0 to 90° with 5° intervals
	Recommended Range Usage	45 to 90°
	Factory Setting	85°
	Switching Hysteresis	2°
Function	Torque	310 lb.-in (35 Nm) per Actuator
	Runtime for 90° Opening or Closing	125 sec. @ 60 Hz 150 sec. @ 50 Hz
	Nominal Angle of Rotation	90°
	Maximum Angular Rotation	95°
Housing	Enclosure	NEMA 2 in vertical position to 90° to the left and right of vertical
		IP54 according to EN60529
	Material	Die Cast Aluminum Alloy
	Gear Lubrication	Silicone Free
Ambient Conditions	**Ambient Temperature**	
	Operation	-25°F to 130°F (-32°C to 55°C)
	Storage and Transport	-40°F to 158°F (-40°C to 70°C)
	Ambient Humidity (non-condensing)	95% rh
Agency Certification	UL Listing	UL listed to UL873
	Canadian Conformance	C-UL certified to Canadian Standard C2.2 No. 24-93
Conformity	**In accordance with the directive set forth by the European Union for**	
	Electromagnetic Compatibility (EMC)	2004/108/EC
	Low Voltage Directive (LVD)	2006/95/EC
Miscellaneous	Pre-Cabled Connection	18 AWG
	Cable Length	3 feet (0.9 m)
	Life Cycle	50,000 Full Strokes at rated torque and temperature.
	Dimensions	11 13/16 x 3 15/16 x 2 11/16 (300mm x 100mm x 68mm)
	Weight	4.4 lbs. (2 kg.)
Operation **(Floating Control)**	A floating control signal controls the actuator. The actuator's angle of rotation is proportional to the length of time the signal is applied. A 24 Vac control signal to wires 1 and 6 (G-Y1) causes the actuator coupling to rotate clockwise. A 24 Vac control signal to wires 1 and 7 (G-Y2) causes the actuator coupling to rotate counterclockwise. To reverse the direction of rotation, the wires 6 and 7 (Y1 and Y2) can be interchanged. In the event of a power failure or with no control voltage, the actuator holds its position.	
Operation **(Modulating Control)**	A continuous 0 to 10 Vdc signal from a controller to wire 8 (Y) operates the damper actuator. The angle of rotation is proportional to the control signal. A 0 to 10 Vdc position feedback output signal is available between wire 9 (U) and wire 2 (G0) to monitor the position of the damper motor. In the event of a power failure, the actuator holds its position. In the event that only the control signal is lost, the actuator returns to the "0" position.	
Overload Protection	In the event of a blockage in the damper, the actuator is overload protected over the full range to prevent damage to the actuator.	
Life Expectancy	An improperly tuned loop will cause excessive repositioning that will shorten the life of the actuator.	