VA-6100 Series Electric Valve Actuators

Installation Instructions

VA-6100-xxx

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Applications

VA-6100 Series Electric Valve Actuators use a synchronous motor to accurately position Johnson Controls® VG2000 Series Cast Iron Flanged Globe Valves in Heating, Ventilating, and Air Conditioning (HVAC) and industrial applications. These non-spring return electric actuators provide a 1,350 lb (6,000 N) force output for on/off (floating) or proportional control. Integral auxiliary switches are available for indicating end stop position, or for performing switching functions. Position feedback is also available through an isolated 2,000 ohm potentiometer at a fixed stroke of 1-21/32 in., or a nominal 0 to 10 VDC feedback signal. All models feature a hand wheel for manual positioning of the valve, independent of a power supply.

IMPORTANT: Use this VA-6100 Series Electric Valve Actuator only as an operating control. Where failure or malfunction of the VA-6100 Series Actuator could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the VA-6100 Series Actuator.

Installation

Note the pre-installation details described in this section. Before installing a VA-6100 Series Electric Valve Actuator onto a VG2000 Series Cast Iron Flanged Globe Valve:

- install the actuator and valve assembly with the actuator at or above the centerline

IMPORTANT: Mount the actuator within 90° of the vertical position above the valve body. Failure to do so may permit water or moisture to travel down the valve stem, damaging the actuator and voiding the warranty.

- mount the actuator and valve assembly in an upright position, in a conveniently accessible location. When mounting the assembly horizontally, orient the yoke so that the yoke supports are positioned vertically, one above the other (as illustrated in Figure 1).

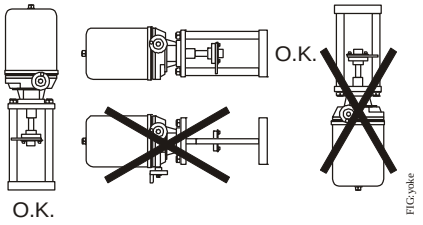


Figure 1: Proper Yoke Orientation

IMPORTANT: Protect the actuator from dripping water, condensation, and other moisture. Water or moisture could result in an electrical short, which may affect the operation of the actuator.

- allow sufficient clearance to remove the actuator (as illustrated in Figure 4)

IMPORTANT: Do not cover the actuator with thermal insulating material. High ambient temperatures may damage the actuator, and a hot water pipe, steam pipe, or other heat source may overheat it.

- pipe the valve with the flow in the direction of the arrow on the valve body, so that the plug seats against the flow

IMPORTANT: Take care to prevent foreign materials such as weld slag, thread burrs, metal chips, and scale from entering the piping system. This debris can damage or severely impede the operation of the valve by embedding itself in the seats, scoring the valve, and ultimately resulting in seat leakage. If the debris becomes embedded in the seats, subsequent flushing and filtering of the piping system with the valve installed does not remedy the problem.

Johnson Controls

Parts Included

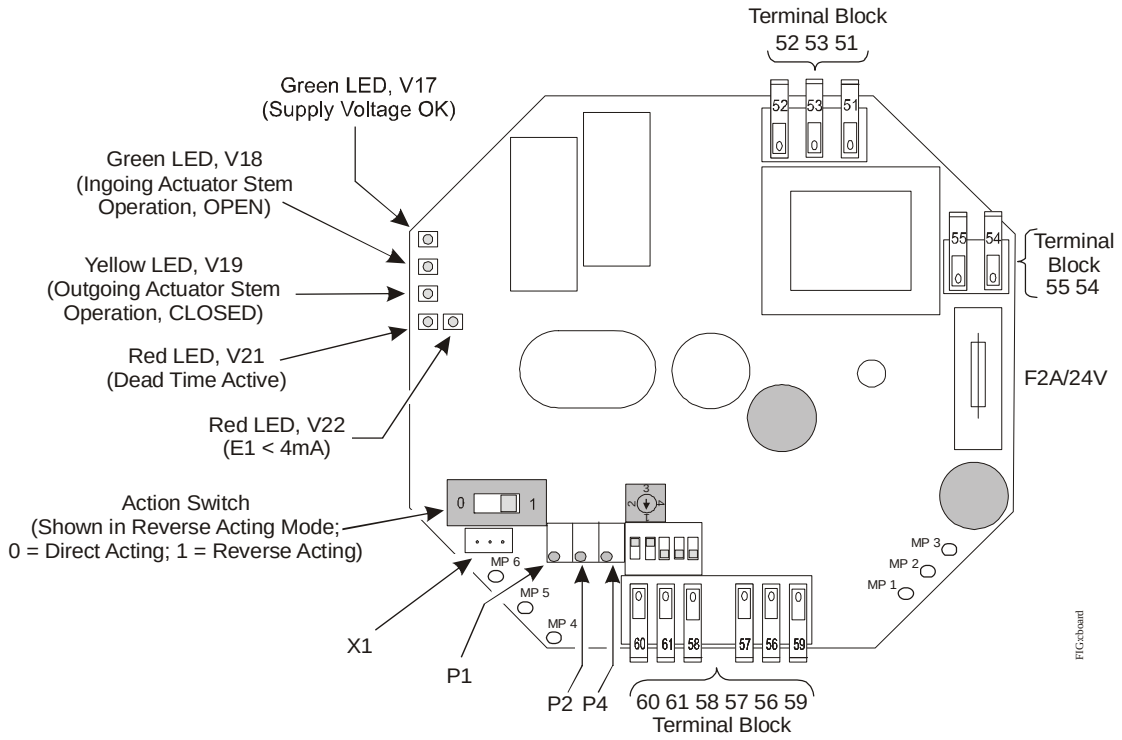


Figure 2: VA-6100-HGC Circuit Board Parts and Light-Emitting Diode (LED) Identification

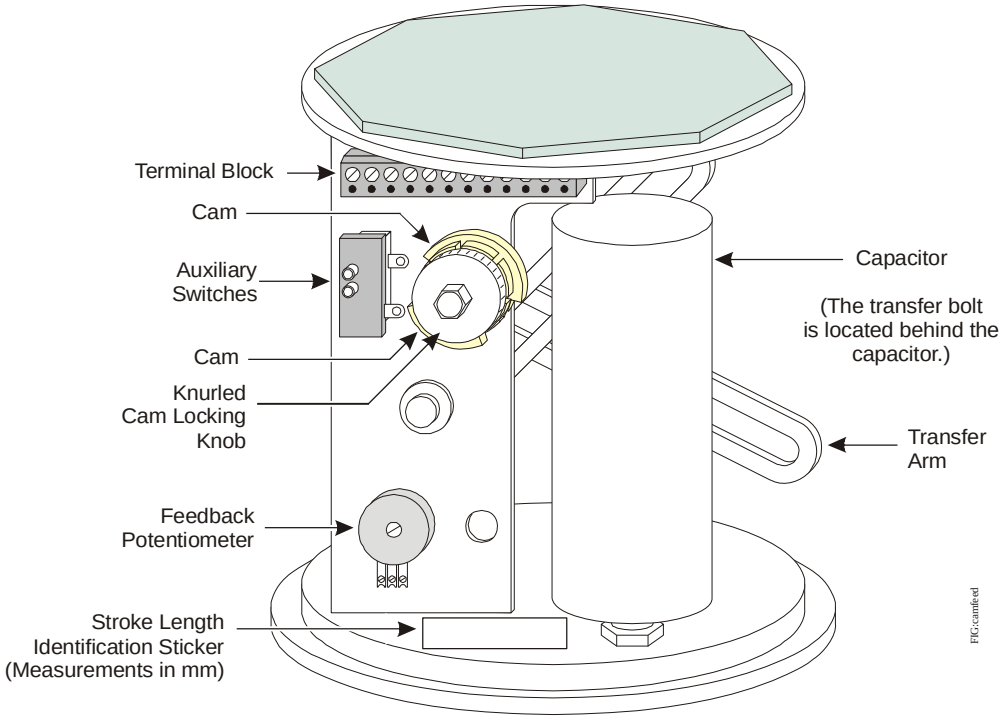


Figure 3: Cam and Feedback Potentiometer Identification

Special Tools Needed

Table 1: Special Tools Needed

Actuator/Valve Part	Recommended Actuator Mounting Tools
Packing Nut	1 in. Wrench for Valves with 1/2 in. Stem
	1-5/8 in. Wrench to Remove Old Packing Nut
Yoke Adaptor	1-7/8 in. Wrench
Stem Extender	7/8 in. Wrench for Valves with 1/2 in. Stem
Stem Nut	3/4 in. Wrench for Valves with 1/2 in. Stem
Actuator and Valve Stem Coupling Assembly Screws	5 mm Allen Wrench
Yoke Nut	Adjustable-Face, Pin-Style Spanner Wrench with Circle Diameter to 3 in.
Transfer Bolt Nut	10 mm Open End Wrench, Thin (Ignition Wrench Style)
Potentiometer P1 or P2	Jeweler's Screwdriver

Transfer Bolt Setting

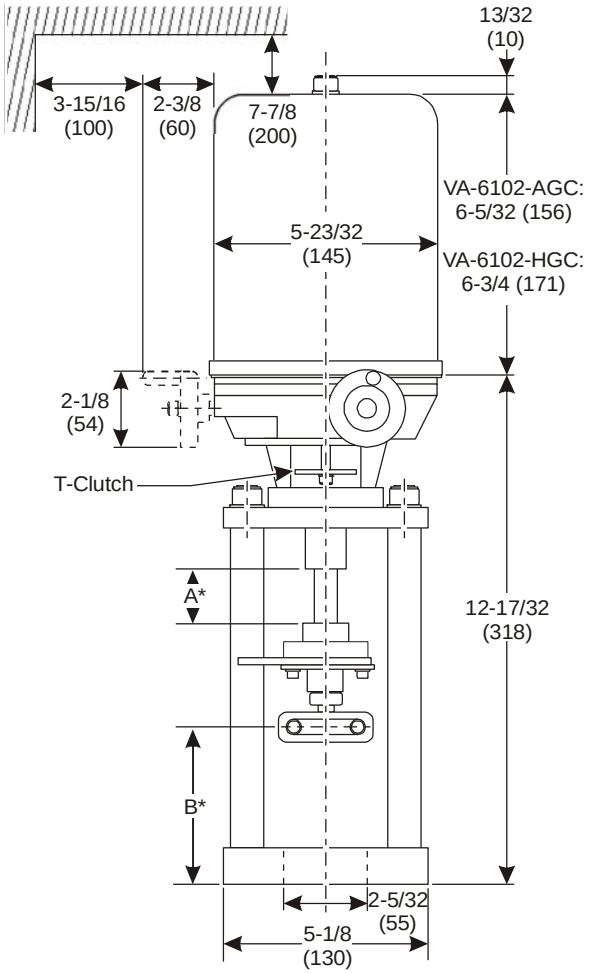
Prior to applying power to the VA-6100-HGC Electric Valve Actuator, check that the transfer bolt is set at the proper stroke length for the valve size as indicated in Table 2.

Table 2: Transfer Bolt Setting

Valve Size	Stroke Length	Transfer Bolt Setting
4 in.	1-1/8 in.	28 mm
5 in.	1-3/8 in.	35 mm
6 in.	1-1/2 in.	38 mm

See Figure 3 to locate the stroke length identification sticker to determine the transfer bolt setting and associated stroke length.

Dimensions



* The VA-6100 Series Actuator is shipped from the factory for proper mounting to the valve stem on 5 and 6 in. valves with the valve stem in the fully down position. Dimension B is 4-9/16 in. (116 mm), and dimension A is 1-13/16 in. (46 mm).

To mount the actuator on a 4 in. Valve with the valve stem in the fully down position, the actuator stem will need to be retracted 5/16 in. (8 mm). As a result, dimension B will then be 4-7/8 in. (124 mm), and dimension A will then be 1-1/2 in. (38 mm).

FIG.dimensions

Figure 4: VA-6100 Series Electric Valve Actuator Dimensions, in. (mm)

Mounting

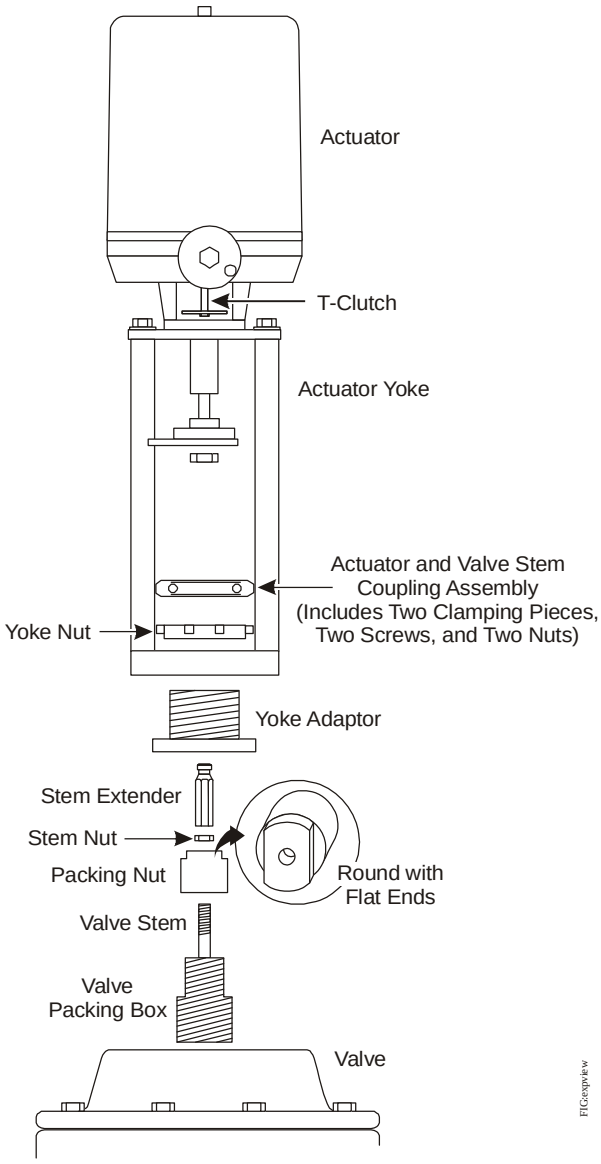


Figure 5: Exploded View of Actuator Mounting

To field mount a VA-6100 Series Electric Valve Actuator onto a VG2000 Series Cast Iron Flanged Globe Valve, see Figure 5 and proceed as follows:

Note: When mounting the actuator onto a 5 or 6 in. valve, proceed directly to Step 2.

1. When mounting the actuator onto a 4 in. valve, retract the actuator stem 5/16 in. (8 mm) as illustrated in Figure 4 using the integral manual hand wheel. To use the manual hand wheel, pull down on the T-clutch and rotate the hand wheel counterclockwise to retract the actuator stem.
2. Remove the hex packing nut from the valve and discard.
3. Thread the yoke adaptor onto the valve packing box and tighten to a torque of 25 lb·ft (34 N·m).
4. Push the valve stem fully down into the valve body.
5. Thread the replacement packing nut (round with flat ends, included with the mounting kit) onto the valve packing box and tighten to a torque of 4 lb·ft (5.4 N·m).
6. Thread the stem nut and the appropriate stem extender onto the valve stem down to the packing nut, without tightening either securely in place.
7. Remove the actuator and valve stem coupling assembly from the actuator, without rotating the actuator stem.
8. Mount the actuator and yoke nut onto the yoke adaptor, making sure that the side of the yoke nut with the small lip and standoff is facing downward.
9. Thread the yoke nut onto the yoke adaptor and tighten to a torque of 20 lb·ft (27.2 N·m).
10. Unscrew the stem extender to the point where it barely touches the actuator stem, being careful not to apply any force to the actuator stem.
11. Secure the position of the stem extender by tightening the stem nut to a torque of 9 lb·ft (12.2 N·m).
12. Secure the actuator stem to the stem extender using the clamping pieces, two screws, and two nuts of the actuator and valve stem coupling assembly. Position the actuator stem so that its flat ends are parallel to the actuator yoke. The clamping assembly is designed to securely hold the actuator stem without rotating.

    When properly aligned, the actuator stem and stem extender will fit perfectly into the cutouts on the inside of the clamping pieces. Tighten the two clamping assembly screws to a torque of 4 lb·ft (5.4 N·m).
13. Proceed to the *Setup and Adjustments* section to complete the installation.

Wiring

WARNING: Risk of Electric Shock. Disconnect or isolate all power supplies before making electrical connections. More than one disconnect or isolation may be required to completely de-energize equipment. Contact with components carrying hazardous voltage can cause electric shock and may result in severe personal injury or death.

CAUTION: Risk of Property Damage. Do not apply power to the system before checking all wiring connections. Short circuited or improperly connected wires may result in permanent damage to the equipment.

IMPORTANT: Make all wiring connections in accordance with the National Electrical Code and local regulations. Use proper Electrostatic Discharge (ESD) precautions during installation and servicing to avoid damaging the electronic circuits.

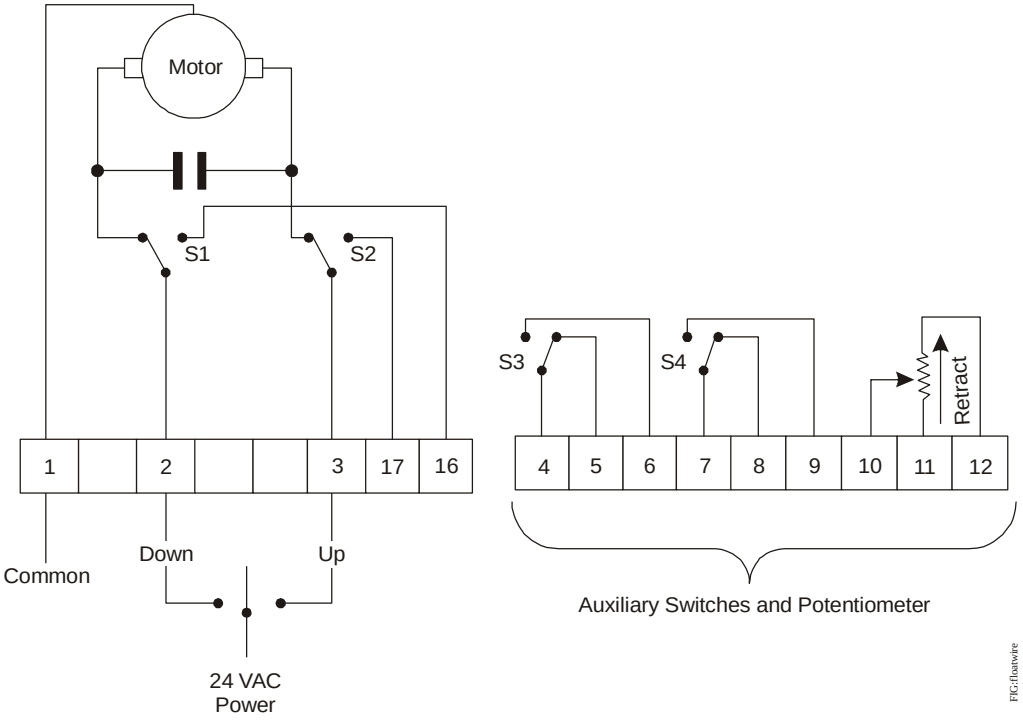


Figure 6: VA-6100-AGC Wiring Diagram for On/Off (Floating) Control

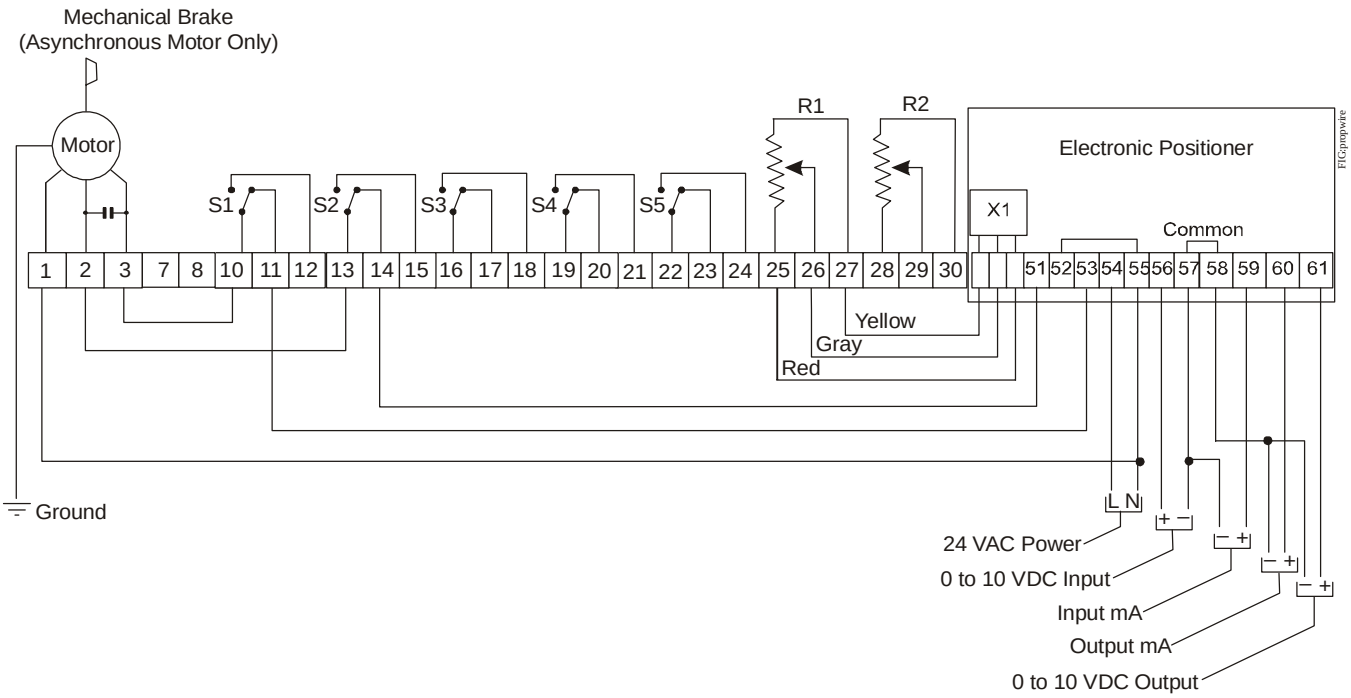


Figure 7: VA-6100-HGC Wiring Diagram for Proportional Control

Setup and Adjustments

IMPORTANT: Do not power VA-6100 Series Electric Valve Actuators using the Johnson Controls M9000-200 Commissioning Tool. The M9000-200 provides a maximum power of 25 VA. The VA-6100-AGC Electric Valve Actuator requires 37 VA and the VA-6100-HGC requires 42 VA. If the M9000-200 is used to power either valve actuator, the commissioning tool could become damaged.

VA-6100-AGC Electric Valve Actuator

To adjust the potentiometer on the VA-6100-AGC Electric Valve Actuator, proceed as follows:

1. Connect an ohmmeter to Terminals 10 and 11.
2. Rotate the feedback potentiometer clockwise to its stop. The ohmmeter should display a resistance of less than 10 ohms.
3. Apply 24 VAC power to Terminals 1 and 3 (Figure 6) to drive the valve stem fully up. The ohmmeter should display a resistance of 1,300 to 1,500 ohms for a 4 in. valve; 1,600 to 1,800 ohms for a 5 in. valve; and 1,700 to 1,900 ohms for a 6 in. valve.

To adjust the auxiliary switches, proceed as follows:

1. Use Figure 3 to locate the auxiliary switches, cams, and terminal block.
2. Loosen the knurled cam locking knob by turning it counterclockwise.
3. Adjust the actuator to the desired down position where the inner auxiliary switch is to be tripped.
4. Adjust the inner cam so that it just trips the inner auxiliary switch.
5. Adjust the actuator to the desired up position where the outer auxiliary switch is to be tripped.
6. Adjust the outer cam so that it just trips the outer auxiliary switch.
7. Tighten the knurled cam locking knob by turning it clockwise.

To use the manual hand wheel to control the valve, proceed as follows:

1. Disconnect the power.
2. Pull down on the T-clutch. The T-clutch is located below the manual hand wheel.
3. Rotate the manual hand wheel clockwise to extend the actuator stem and lower the valve stem. Rotate the manual hand wheel counterclockwise to retract the actuator stem and raise the valve stem.

VA-6100-HGC Electric Valve Actuator

The actuator action for the VA-6100-HGC Electric Valve Actuator is as follows:

Direct Acting: As the control signal increases, the actuator stem fully extends and the valve stem moves to the fully down position. With no control signal, the actuator moves to the fully retracted position.

Reverse Acting: As the control signal increases, the actuator stem retracts and the valve stem moves to the fully up position. With no control signal, the actuator moves to the fully extended position.

To switch from direct acting to reverse acting or vice versa, proceed as follows:

1. Apply 24 VAC power to Terminals 54 and 55 (Figure 7) and determine if the actuator is set for direct acting or reverse acting.
2. Disconnect the 24 VAC power if the actuator is not set for the desired action. Skip Step 3 and Step 4 if the actuator is set for the desired action.
3. Set the action switch on the actuator circuit board from the 0 (direct acting) position to the 1 (reverse acting) position (Figure 2).
4. Apply 24 VAC power to Terminals 54 and 55 (Figure 7) and check for the desired action.

To adjust the operating range of the VA-6100-HGC Electric Valve Actuator, see Figure 2 and proceed as follows:

1. Apply 24 VAC power to Terminals 54 and 55 (Figure 7).
2. Note the location of the green and red LEDs on either end of the terminal block (Figure 2). The green LED illuminates when the actuator motor is running, and the red LED illuminates when the actuator motor is stopped.
3. **For direct action**, proceed as follows:
   a. Input the desired minimum control signal between 0 and 8 VDC to Terminals 56 and 57 (Figure 7) for voltage applications, or input the desired minimum control signal between 0 and 16 mA to Terminals 58 and 59 (Figure 7) for current applications. The actuator motor may run, illuminating the green LED (see Figure 2). If so, wait until the actuator motor stops and the red LED is illuminated before proceeding.
   b. Connect a voltmeter to Terminals 57 and 61 or a current meter to Terminals 58 and 60 (Figure 7). The voltmeter should be on the 10 V range or the current meter should be on the 20 mA range.
   c. Rotate the feedback potentiometer clockwise to its stop (Figure 3).
   d. Locate Potentiometer P1 on the actuator circuit board (Figure 2) and adjust it until the voltmeter reads 0.35 V above the minimum control signal or the current meter reads 0.7 mA above the minimum control signal. The actuator should fully retract.
   e. Check that the feedback potentiometer is fully clockwise and readjust it, if necessary. The motor may operate when the feedback potentiometer is adjusted. After the motor stops, readjust Potentiometer P1 until the voltmeter reads 0.35 V above the minimum control signal or the current meter reads 0.7 mA above the minimum control signal.
   f. Input the desired maximum control signal between 2 and 10 VDC to Terminals 56 and 57 (Figure 7) for voltage applications, or input the desired maximum control signal between 4 and 20 mA to Terminals 58 and 59 (Figure 7) for current applications. The maximum control signal must always exceed the minimum control signal by at least 2 VDC or 4 mA.
   g. Locate Potentiometer P2 on the actuator circuit board (as illustrated in Figure 2) and adjust it until the voltmeter reads 0.35 V below the maximum control signal or the current meter reads 0.7 mA below the maximum control signal. The actuator should fully extend.

Note: If Potentiometer P2 adjustment is insufficient, adjust the transfer bolt. The transfer bolt is located behind the capacitor (Figure 3). For reference purposes, a scale with numbers that correspond to notches on the transfer lever is located on the surface just below the feedback potentiometer.

Loosening the transfer bolt nut and moving the transfer bolt location changes the span of the actuator operating range. If the voltage span from Step 3, Step c through Step g is insufficient, the center of the transfer bolt needs to be adjusted to a smaller number (as indicated on the scale). If the voltage span is too great, the center of the transfer bolt needs to be adjusted to a larger number (as indicated on the scale). Regardless of which way the transfer bolt is moved, direct action Step c through Step g must be repeated.

4. **For reverse action**, proceed as follows:

   a. Input the desired maximum control signal between 2 and 10 VDC to Terminals 56 and 57 (Figure 7) for voltage applications, or input the desired maximum control signal between 4 and 20 mA to Terminals 58 and 59 (Figure 7) for current applications. The actuator motor may run, illuminating the green LED (see Figure 2). If so, wait until the actuator motor stops and the red LED is illuminated before proceeding.

   b. Connect a voltmeter to Terminals 57 and 61 or a current meter to Terminals 58 and 60 (Figure 7). The voltmeter should be on the 10 V range or the current meter should be on the 20 mA range.

   c. Rotate the feedback potentiometer clockwise to its stop (Figure 3).

   d. Locate Potentiometer P2 on the actuator circuit board (Figure 2) and adjust it until the voltmeter reads 0.35 V below the maximum control signal or the current meter reads 0.7 mA below the maximum control signal. The actuator should fully retract.

   e. Check that the feedback potentiometer is fully clockwise and readjust it, if necessary. The motor may operate when the feedback potentiometer is adjusted. After the motor stops, readjust Potentiometer P2 until the voltmeter reads 0.35 V below the maximum control signal or the current meter reads 0.7 mA below the maximum control signal.

   f. Input the desired minimum control signal between 0 and 8 VDC to Terminals 56 and 57 (Figure 7) for voltage applications, or input the desired minimum control signal between 0 and 16 mA to Terminals 58 and 59 (Figure 7) for current applications. The minimum control signal must always be at least 2 VDC or 4 mA less than the maximum control signal.

   g. Locate Potentiometer P1 on the actuator circuit board (Figure 2) and adjust it until the voltmeter reads 0.35 V above the minimum control signal or the current meter reads 0.7 mA above the minimum control signal. The actuator should fully extend.

Note: If Potentiometer P1 adjustment is insufficient, adjust the transfer bolt. The transfer bolt is located behind the capacitor (Figure 3). For reference purposes, a scale with numbers that correspond to notches on the transfer lever is located on the surface just below the feedback potentiometer.

Loosening the transfer bolt nut and moving the transfer bolt location changes the span of the actuator operating range. If the voltage span from Step 4, Step c through Step g is insufficient, the center of the transfer bolt needs to be adjusted to a smaller number (as indicated on the scale). If the voltage span is too great, the center of the transfer bolt needs to be adjusted to a larger number (as indicated on the scale). Regardless of which way the transfer bolt is moved, reverse action Step c through Step g must be repeated.

To adjust the auxiliary switches on the VA-6100-HGC Electric Valve Actuator, proceed as follows:

1. Use Figure 3 to locate the auxiliary switches, cams, and terminal block.
2. Loosen the knurled cam locking knob by turning it counterclockwise.
3. Adjust the actuator to the desired down position where the inner auxiliary switch is to be tripped.
4. Adjust the inner cam so that it just trips the inner auxiliary switch.
5. Adjust the actuator to the desired up position where the outer auxiliary switch is to be tripped.
6. Adjust the outer cam so that it just trips the outer auxiliary switch.
7. Tighten the knurled cam locking knob by turning it clockwise.

To use the manual hand wheel to control the valve, proceed as follows:

1. Disconnect the power.
2. Pull down on the T-clutch. The T-clutch is located below the manual hand wheel.
3. To extend the actuator stem and lower the valve stem, rotate the manual hand wheel clockwise. To retract the actuator stem and raise the valve stem, rotate the manual hand wheel counterclockwise.

Repair Information

If the VA-6100 Series Electric Valve Actuator fails to operate within its specifications, replace the unit. For a replacement VA-6100 Actuator, contact the nearest Johnson Controls® representative.

Technical Specifications

VA-6100 Series Electric Valve Actuators

Force Output		1,350 lb (6,000 N)
Power Requirements	**VA-6100-AGC Only**	20 to 28 VAC, 60 Hz; 37 VA Minimum
	VA-6100-HGC Only	20 to 28 VAC, 60 Hz; 42 VA Minimum
Input Signal	**VA-6100-AGC Only**	20 to 28 VAC, 60 Hz
	VA-6100-HGC Only	0 to 10 VDC or 0 to 20 mA; Minimum Control Signal Adjustable 0 to 8 VDC or 0 to 16 mA; Maximum Control Signal Adjustable 2 to 10 VDC or 4 to 20 mA[1]
Input Impedance	**VA-6100-HGC Only**	10,000 ohms with 0 to 10 VDC Input; 500 ohms with 0 to 20 mA Input
Feedback Signal	**VA-6100-AGC Only**	0 to 2,000 ohms
	VA-6100-HGC Only	0.35 to 9.65 VDC or 0.7 to 19.3 mA
Switch Contact Rating		5A, 24 VAC
Maximum Stroke		1-21/32 in. (42 mm)
Nominal Timing for 1-1/2 in. Stroke		111 Seconds
Ambient Operating Temperature Limits (Limited by the Actuator)		-4 to 140°F (-20 to 60°C)
Enclosure Rating		NEMA 4, IP 65
Shipping Weight		16.5 lb (7.5 kg)
Compliance	**United States**	UL Listed, File E27734, CCN XAPX, UL 873
	Canada	UL Listed, File E27734, CCN XAPX7. CAN/CSA C22.2 No. 24-93

1. The maximum control signal must always exceed the minimum control signal by at least 2 VDC or 4 mA.

The performance specifications are nominal and conform to acceptable industry standard. For application at conditions beyond these specifications, consult the local Johnson Controls® office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

Building Efficiency
507 E. Michigan Street, Milwaukee, WI 53202

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