

Instruction Manual

Electric Actuated Ball Valve

For further assistance, please contact: service@ussolid.com

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1. PRODUCT OVERVIEW

U.S. SOLID is a specialized manufacturer dedicated to the research, development, and production of electric and pneumatic valve actuators for industrial automation. Our heavy-duty electric actuators are specifically engineered for demanding ball valve applications, featuring an integrated drive and transmission design that delivers exceptional torque in a compact, rugged housing. This series of products is ideal for industries such as electric power, food processing, industrial automation, and water treatment, our actuators provide reliable, precise performance in the most challenging environments.

⚠ WARNINGS

1. General Safety

- Read these instructions carefully before installing, operating, or servicing the actuator.
- Installation, commissioning, operation, and maintenance must be performed by qualified personnel only.
- Comply with all applicable local codes, standards, and safety regulations.
- Do not operate the actuator until all safety conditions described in this manual are satisfied.
- Failure to observe these instructions may result in personal injury, product damage, or operational failure, and will void any applicable warranties.
- Store these instructions near the product for future reference.

2. Electrical Safety

- **Disconnect Power:** Always disconnect electrical power before operating the manual override, removing covers, or performing any maintenance or service on the actuator.
- **Verify Voltage:** Before connecting power, confirm that the supplied voltage matches the actuator's rated voltage. Applying incorrect voltage may damage the actuator and void the warranty.
- **Dedicated Power Supply:** Each actuator must be connected to its own dedicated, fuse-protected, and isolated power circuit. Do not connect multiple actuators in parallel on the same circuit or use the same controller contact point to control more than one actuator. Parallel connection may cause loss of control, motor overheating, product damage, and reduced service life.
- **Control Device:** A suitable control device (e.g., three-way switch, control relay, PLC output) must be used to manage actuator operation. Ensure compatibility with actuator specifications.

3. Installation and Environmental Safety

- **Storage:** Store actuators in a clean, dry environment before installation.
- **Outdoor Installation:** If the actuator is installed outdoors, it is recommended to provide additional protective covering to prevent water ingress, ensure mechanical stability, and extend service life.
- **Temperature Limits:** Ensure the operating temperature does not exceed the specified limits of the actuator. Exceeding these limits may compromise performance.
- **Conduit Installation:** Use the correct diameter when installing cable or conduit to prevent damage to the actuator enclosure or internal components.

4. Maintenance and Operation

- **No User-Serviceable Parts:** Internal adjustments and component replacement are restricted to qualified personnel. Disconnect and lock out power before opening.
- **Annual Cycling:** To ensure proper operation, the actuator should be cycled at least once per year.
- **Coordination:** Coordinate any repair work with operating personnel and observe all relevant health and safety regulations.

WIRING INSTRUCTIONS

1. Verify Voltage

Before installation, verify that the voltage rating of the actuator matches the available power supply. Incorrect voltage may cause permanent damage and will void the warranty.

2. Access Terminal Block

- Remove the terminal box cover to access the terminal strip.
- Connect wiring according to the applicable wiring diagram provided inside the terminal box cover.
- Ensure all connections are secure and properly insulated.

3. Control Device

The installer must provide a suitable control device, such as a three-way switch, control relay, or PLC output, to manage actuator operation. Verify compatibility with actuator specifications before connection.

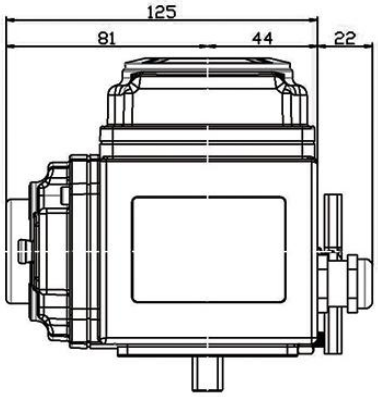
4. Dedicated Power Circuit

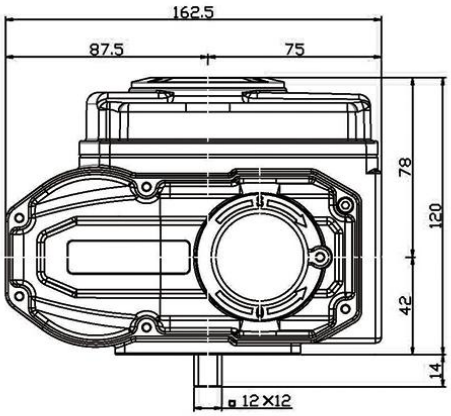
- Each actuator must be powered by its own dedicated, fuse-protected, and isolated power supply.
- Do not wire multiple actuators in parallel on the same circuit. Parallel connections may result in loss of control, motor overheating, and product damage.

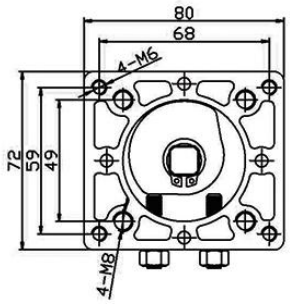
5. Final Voltage Check

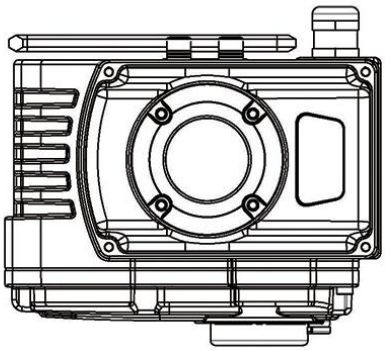
Before energizing the actuator, re-check that the applied voltage matches the actuator rating. Energizing with incorrect voltage will damage the actuator and void the warranty.

USS-Model 05

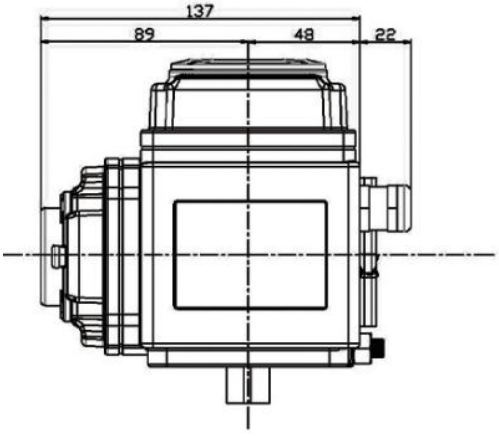


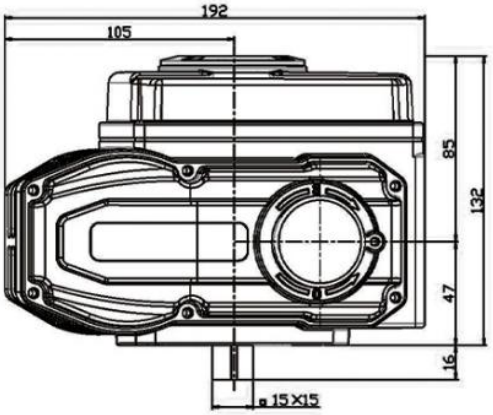


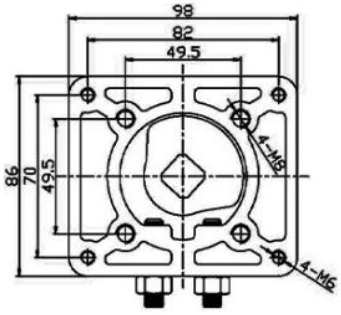


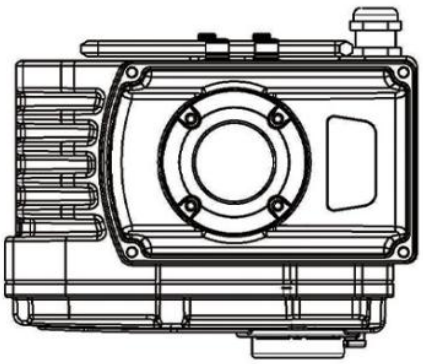


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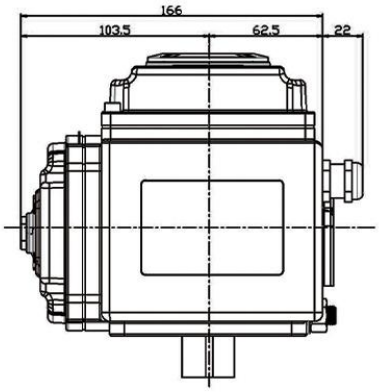


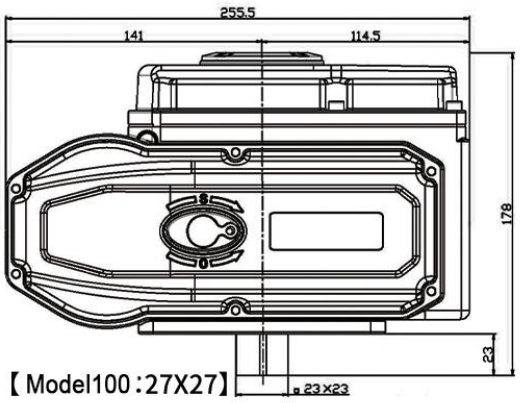




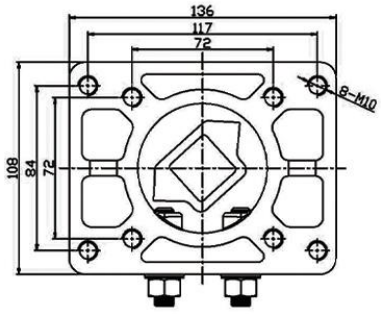


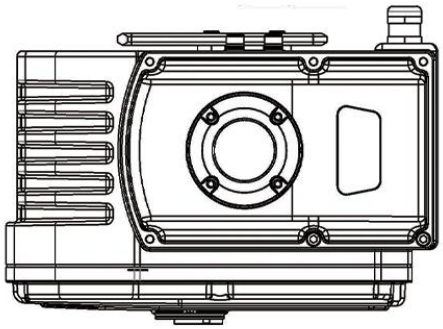
USS-Model 30/60



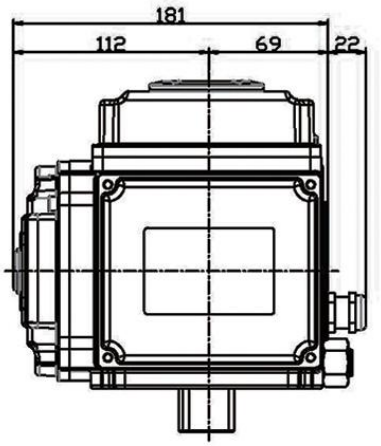


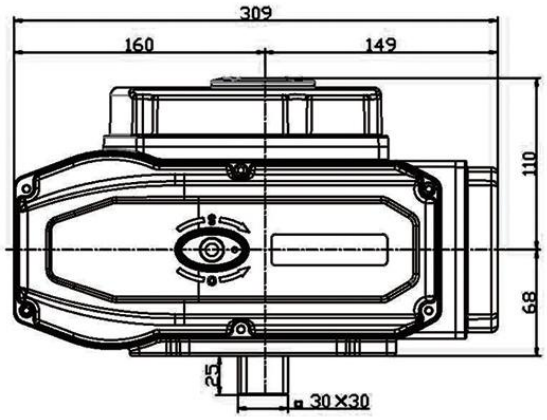
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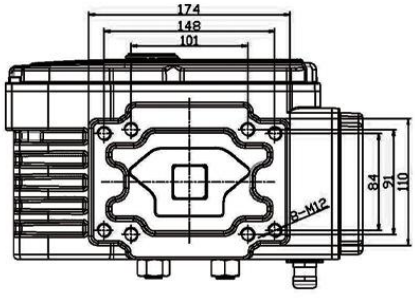


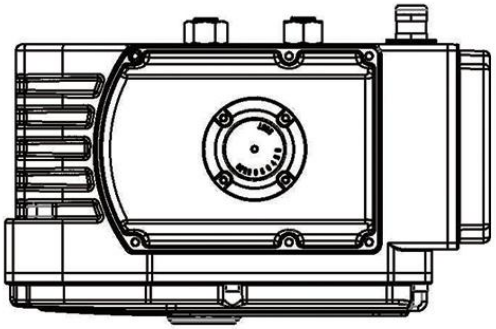


USS-Model 125/200









3.1 AC Electric Actuator Specifications （220V AC Data）

Parameter/Model	Model 05	Model 10	Model 16	Model 30	Model 60	Model 125	Model 250
Output Torque	50 Nm	100 Nm	160 Nm	300 Nm	600 Nm	1250 Nm	2200 Nm
Travel Time	10 / 20 / 60 s	15 / 30 / 60 s			30 / 60 s	70 s	70 s
Rotation Angle	0–90°						
No-Load Current	0.23 A	0.28 A	0.40 A	0.80 A	0.90 A	1.00 A	1.20 A
Current with Valve	0.27 A	0.35 A	0.46 A	1.22 A	1.60 A	1.82 A	2.30 A
Operating Power	55 W	60 W	80 W	170 W	190 W	200 W	230 W
Power with Valve	60 W	70 W	100 W	260 W	350 W	400 W	500 W
Stall Power	67 W	85 W	120 W	300 W	420 W	400 W	520 W
Actuator Weight	3 kg	5 kg	5.5 kg	8 kg	8.5 kg	15 kg	15.5 kg
Power Supply Options	**24 V AC / 110 V AC / 220 V AC**						
Insulation Resistance	100 MΩ at 500 V DC						
Dielectric Withstand	1500 V AC for 1 minute						
IP Rating	IP65						
Installation Position	Any mounting orientation						
Electrical Connection	Standard terminal block; G1/2 waterproof cable gland						
Relative Humidity	≤ 90% RH						
Operating Temperature	−30°C to +60°C						
Control Circuit Options	Type A: ON/OFF Type with Wet Contact Feedback Type B: ON/OFF Type with Dry Contact Feedback Type C: ON/OFF Type with Potentiometer Feedback Type D: ON/OFF Type with Potentiometer & Dry Contact Feedback				Type E: Modulating Type with Integrated Servo Controller Type K: ON/OFF Type with Dry Contact Feedback & Protective Earth Type L: ON/OFF Type with Dry Contact Feedback & Fault Output		
Optional Equipment	Stainless steel mounting bracket and coupling Bracket-free mounting adapter plate Inductive proximity switch Handwheel				Temperature control system Water flow control system Intelligent control module with RS-485 communication		

1. Electrical values are measured at 220 V AC under the stated load condition. Use the actuator nameplate or manufacturer data for other supply voltages.

2. Travel time refers to the time required for the actuator to complete its standard 0–90° stroke.

3. The actuator travel can be adjusted within the 0–90° rotation range.

4. Output torque tolerance: ±10%.

3.2 DC Electric Actuator Specifications（24V DC Data）

Parameter / Model	Model 05	Model 10	Model 16	Model 30	Model 60	Model 125	Model 250
Output Torque	50 Nm	100 Nm	160 Nm	300 Nm	600 Nm	1250 Nm	2200 Nm
Travel Time	8 s	11 s	11 s	9 s	35 s	32 s	35 s
Rotation Angle	0–90°						
No-Load Current	0.44 A	0.65 A	0.85 A	1.30 A	1.7 A	2.1 A	2.3 A
Current with Valve	3.20 A	4.60 A	8.0 A	14.7 A	19.0 A	23.5 A	27.5 A
No-Load Power	10 W	15 W	20 W	30 W	40 W	50 W	55 W
Power with Valve	75 W	110 W	190 W	350 W	450 W	550 W	650 W
Stall Power	112 W	150 W	204 W	600 W	600 W	600 W	-
Actuator Weight	3 kg	5 kg	5.5 kg	8 kg	8.5 kg	15 kg	15.5 kg
Power Supply Options	**12 V DC / 24 V DC / 110 V DC / 220 V DC**						
Insulation Resistance	100 MΩ at 500 V DC						
Dielectric Withstand	1500 V AC for 1 minute						
IP Rating	IP65						
Installation Position	Any mounting orientation						
Electrical Connection	Standard terminal block; G1/2 waterproof cable gland						
Relative Humidity	⩽ 90% RH						
Operating Temperature	−30°C to +60°C						
Control Circuit Options	Type F: ON/OFF Type, Standard DC Polarity Reversal Control Type I: ON/OFF Type, 3-Wire DC Control (Relay Integrated) Type J: ON/OFF Type, DC Control with Potentiometer Feedback						
Optional Equipment	Stainless steel mounting bracket and coupling Bracket-free mounting adapter plate Inductive proximity switch Handwheel			Temperature control system Water flow control system Intelligent control module with RS-485 communication			

1. Electrical values are measured at 24 V DC under the stated load condition. Use the actuator nameplate or manufacturer data for other supply voltages. '-' indicates data not provided.

2. Travel time refers to the time required for the actuator to complete a nominal 0–90° stroke.

3. The actuator's travel can be adjusted within the 0–90° range.

4. Output torque tolerance: ±10%.

3.3 Intelligent Modulating Actuator Specifications

Parameter / Model	Model 05	Model 10	Model 16	Model 30	Model 60	Model 125	Model 250
Output Torque	50 Nm	100 Nm	160 Nm	300 Nm	600 Nm	1250 Nm	2500 Nm
Travel Time	10 / 20 / 60 s	15 / 30 / 60 s			30 / 60 s	90 s	90 s
Rotation Angle	0–90°						
Working Current	0.15 A	0.20 A	0.23 A	0.36 A	0.45 A	0.9 A	1.15 A
Actuator Weight	3 kg	5 kg	5.5 kg	8 kg	8.5 kg	15 kg	15.5 kg
Power Supply Options	24 V AC / 110 V AC / 220 V AC / 380 V AC / 12 V DC / 24 V DC / 220 V DC						
Insulation Resistance	100 MΩ at 500 V DC						
Input Signal	1–5 V / 0–10 V / 4–20 mA						
Input Signal Error	⩽ ±0.1%						
Output Signal	1–5 V / 0–10 V / 4–20 mA						
Output Signal Error	⩽ ±0.1%						
Basic Error	⩽ (positioning error ±0.1%) + (module error ±0.1%)						
Deadband	0.0–25.0%						
Potentiometer Resistance	1–10 kΩ						
Temperature Drift	⩽ 20 ppm/°C						
Mechanical Repeatability Error	⩽ ±0.5%						
Optional Intelligent Module Features	ON/OFF control Analog signal control External pushbutton operation with remote control External digital touchscreen with remote control				Alarm indication Fully open and fully closed position indication Remote control / RS-485 communication		

1. The current and power values shown above were measured at the standard 220 V AC supply. For DC and 380 V AC actuators, refer to the specification table for the corresponding supply voltage.

2. Travel time refers to the time required for the actuator to complete its standard 0–90° stroke.

3. The actuator travel can be adjusted within the 0–90° rotation range.

4. Output torque tolerance: ±10%.

3.4 Three Phase AC380V Actuator Specifications

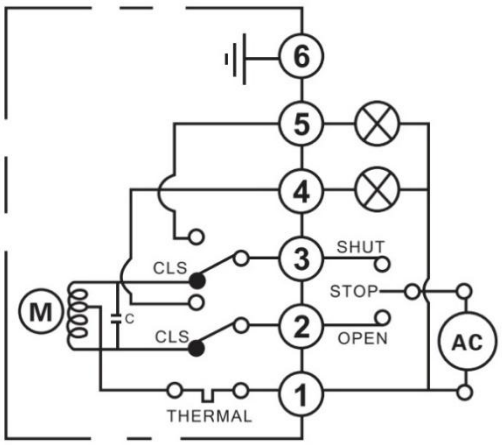
Actuator Model	Model 05	Model 10	Model 16	Model 30	Model 60	Model 125	Model 250
Power Supply	380 V AC, three-phase						
Output Torque	50 Nm	100 Nm	160 Nm	300 Nm	600 Nm	1250 Nm	2300 Nm
Travel Time	20 s	30 s	30 s	30 s	30 s	50 s	50 s
Rotation Angle	0–90°						
No-Load Current	0.16 A	0.26 A	0.33 A	0.50 A	0.55 A	0.54 A	0.82 A
Current with Valve	0.17 A	0.30 A	0.40 A	0.78 A	1.05 A	1.40 A	2.35 A
No-Load Power	50 W	83 W	95 W	80 W	87 W	100 W	100 W
Power with Valve	80 W	150 W	200 W	440 W	550 W	900 W	1400 W
Stall Power	96 W	170 W	250 W	480 W	620 W	1000 W	1550 W
Actuator Weight	3 kg	5 kg	5.5 kg	8 kg	8.5 kg	15 kg	15.5 kg
Insulation Resistance	100 MΩ at 500 V DC						
Dielectric Withstand	1500 V AC for 1 minute						
IP Rating	IP65						
Installation Position	Any mounting orientation						
Electrical Connection	Standard terminal block; G1/2 waterproof cable gland						
Relative Humidity	⩽ 90% RH						
Operating Temperature	−30°C to +60°C						
Output Torque Tolerance	±10%						
Control Option G	380 V AC three-wire control with dry-contact position signals						
Control Option H	380 V AC three-wire control with potentiometer feedback						
Control Option M	380 V AC with potentiometer feedback and dry-contact position signals						
Optional Equipment	Stainless steel bracket and coupling; bracket-free mounting adapter; inductive proximity switch; handwheel; temperature control system; water flow control system						

1. Electrical values are measured at 380 V AC, three-phase, under the stated load condition. Actual values may vary with supply voltage.

2. Travel time refers to the time required for the actuator to complete its standard 0–90° stroke.

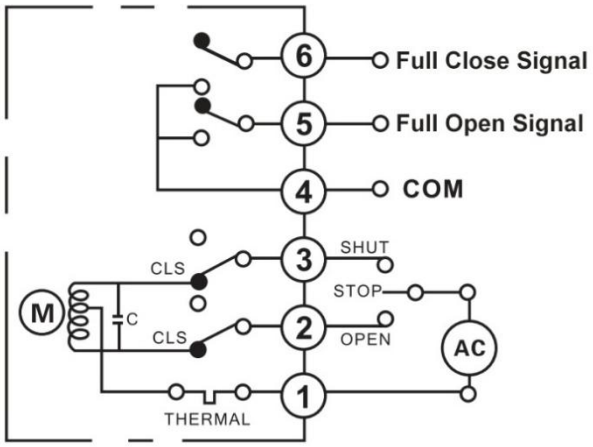
3. The actuator travel can be adjusted within the 0–90° rotation range.

4. Output torque tolerance: ±10%.



Type A: ON/OFF Type with Wet Contact Feedback

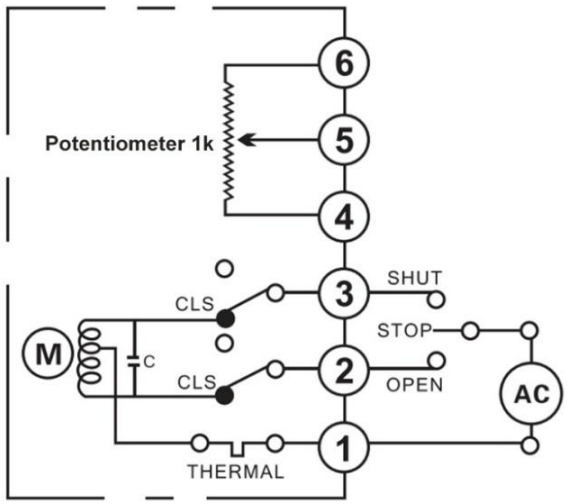
Function: The control circuit executes open/close operations, and it provides wet contact signals to indicate fully open/closed positions.



Type B: ON/OFF Type with Dry Contact Feedback

Function: Operates the valve to fully open or closed positions. It provides dry contact feedback to indicate fully open/closed positions.

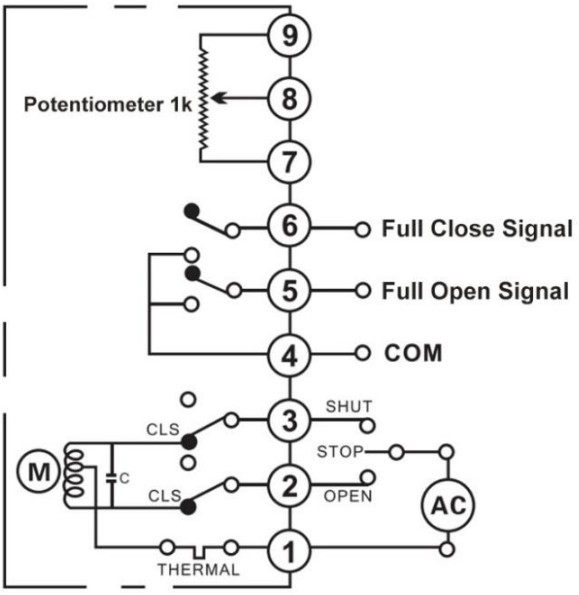
Structure: Equipped with two auxiliary limit switches for position signaling.



Type C: ON/OFF Type with Potentiometer Feedback

Function: Controls the valve position via the electrical circuit. Provides a proportional 0–1kΩ output corresponding to the actual valve stroke.

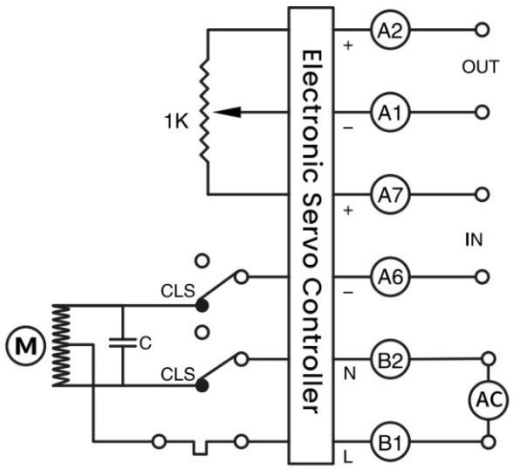
Structure: Equipped with a high-precision 1kΩ potentiometer for real-time position feedback.



Type D: ON/OFF Type with Potentiometer & Dry Contact Feedback

Function: Controls the valve position via the electrical circuit. Outputs a continuous 0–1kΩ signal corresponding to the valve stroke, plus dry contacts for the fully open/closed status.

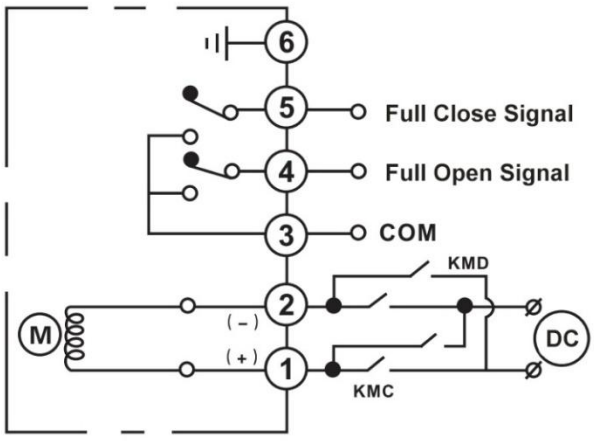
Structure: Dual-feedback system featuring a 1kΩ potentiometer and auxiliary limit switches.



Type E: Modulating Type with Integrated Servo Controller

Function: Modulates valve position based on input signals (4-20mA, 1-5V, or 0-10VDC) and provides a 4-20mA position feedback signal.

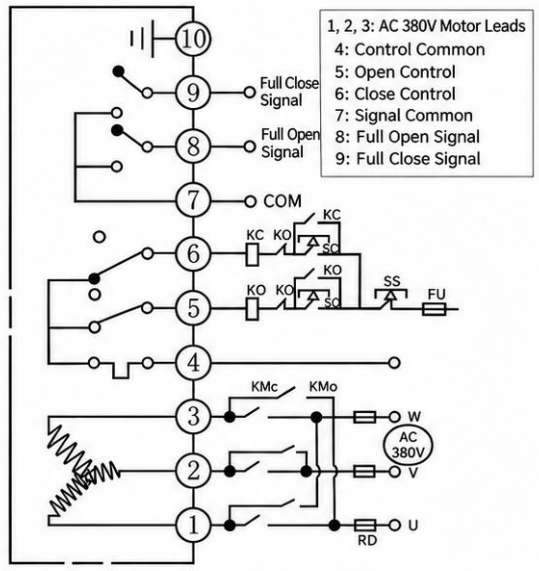
Structure: Includes an integrated servo control module and a 1kΩ potentiometer.



Type F: ON/OFF Type, Standard DC Polarity Reversal Control

Function: Operates via DC polarity reversal (switching +/-). The actuator provides dry contact feedback for "Full Open" and "Full Close" positions.

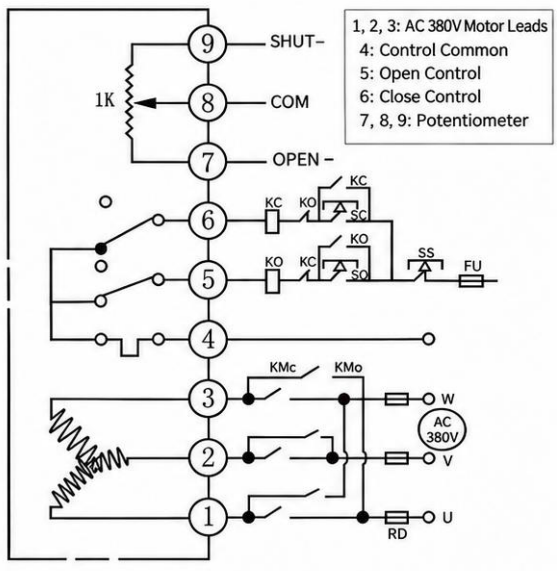
Structure: Equipped with two auxiliary limit switches for position signaling.



Type G: ON/OFF Type, 3-Phase AC 380V Control with Dry Contact Feedback

Function: Uses an external phase-reversing circuit for open/close operation. Dry contact feedback indicates fully open and fully closed positions.

Note: Verify the direction of rotation during commissioning. If reversed, disconnect power and swap any two supply phases.

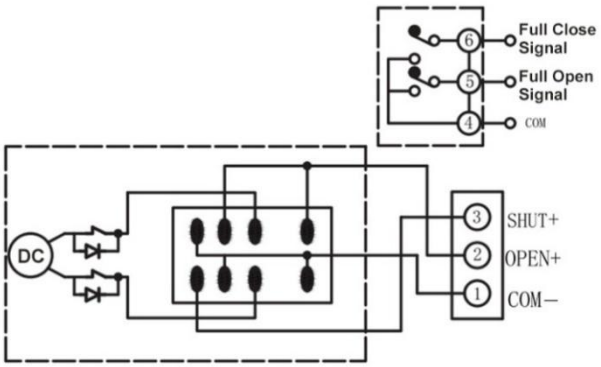


Type H: ON/OFF Type, 3-Phase AC 380V Control with Potentiometer Feedback

Function: Uses an external phase-reversing circuit for open/close operation. Potentiometer feedback provides a resistance signal corresponding to valve position.

Structure: Equipped with a 1 kΩ potentiometer.

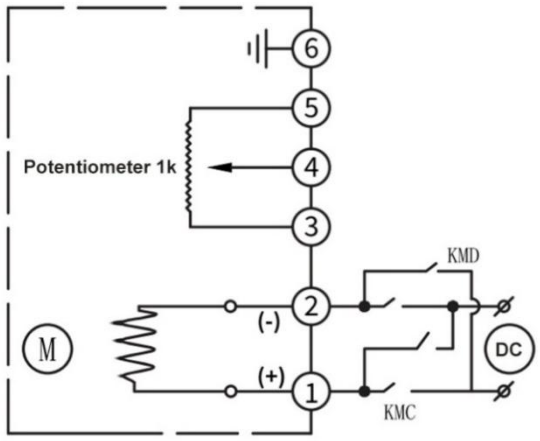
Note: Verify the direction of rotation during commissioning. If reversed, disconnect power and swap any two supply phases.



Type I: ON/OFF Type, 3-Wire DC Control (Relay Integrated)

Function: Uses an integrated relay to switch the DC polarity, enabling full open/close operations via a 3-wire control interface. The actuator provides dry contact signals for "Full Open" and "Full Close" position feedback.

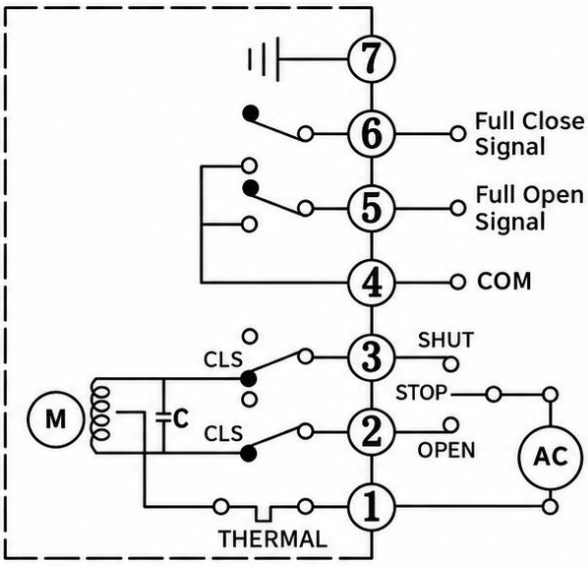
Structure: Equipped with an integrated relay for simplified external wiring.



Type J: ON/OFF Type, DC Control with Potentiometer Feedback

Function: Operates the valve's open/close functions via DC polarity reversal. Provides a proportional 0–1kΩ output corresponding to the actual valve stroke.

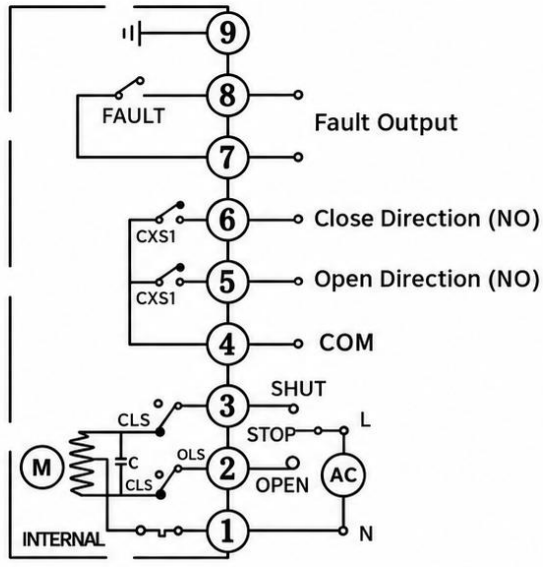
Structure: Equipped with a 1kΩ Potentiometer.



Type K: ON/OFF Type with Dry Contact Feedback & Protective Earth

Function: Provides open/close operation with dry contact feedback to indicate fully open and fully closed positions.

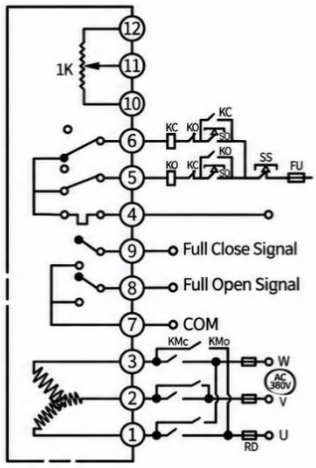
Structure: Includes a protective earth connection.



Type L: ON/OFF Type with Dry Contact Feedback & Fault Output

Function: Provides open/close operation with dry contact position feedback and a separate fault output for external monitoring.

Structure: Equipped with an additional fault switch.

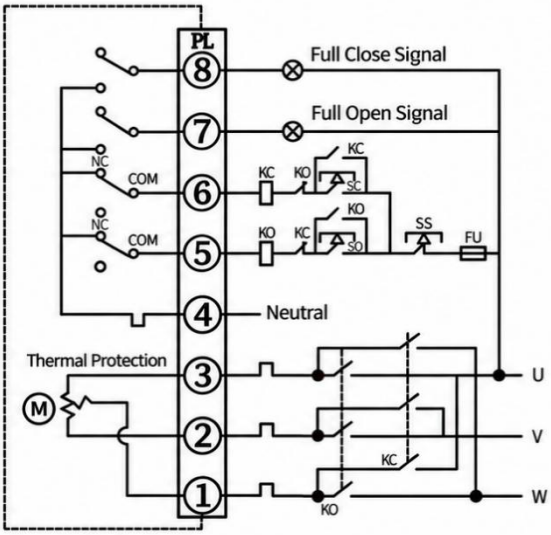


Type M: ON/OFF Type, 3-Phase AC 380V Control with Potentiometer & Dry Contact Feedback

Function: Uses an external phase-reversing circuit for open/close operation. Provides a resistance signal corresponding to valve position, plus dry contact feedback for fully open and fully closed positions.

Structure: Equipped with a 1 kΩ potentiometer.

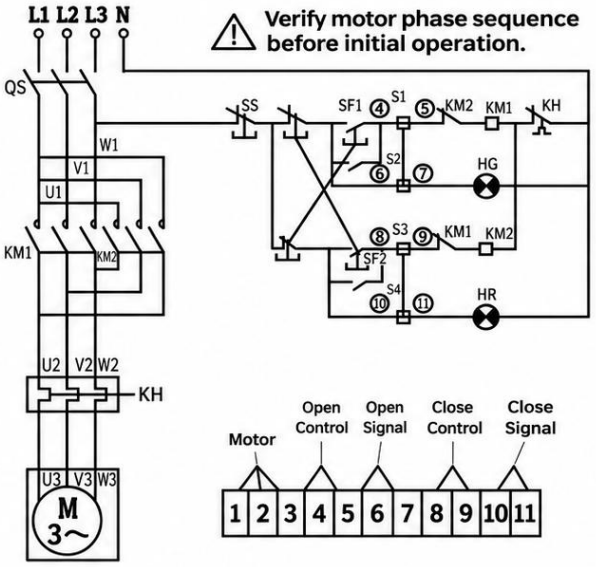
Note: Verify the direction of rotation during commissioning. If reversed, disconnect power and swap any two supply phases.



Type N: ON/OFF Type, 3-Phase AC 380V Control with Wet Contact Feedback

Function: Uses an external phase-reversing circuit for open/close operation. Wet contact feedback indicates fully open and fully closed positions.

Note: Verify the direction of rotation during commissioning. If reversed, disconnect power and swap any two supply phases.

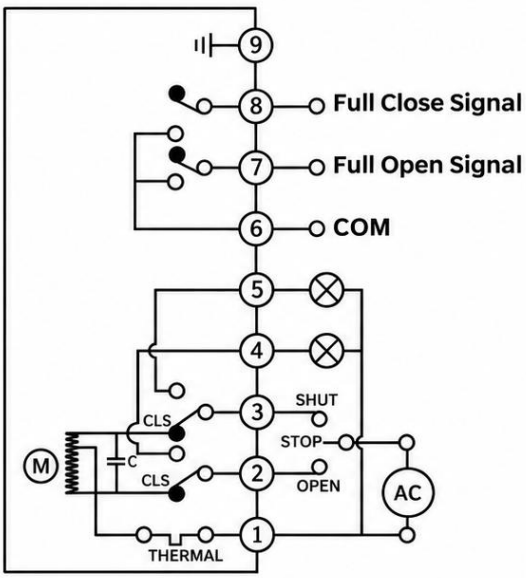


Type O: ON/OFF Type, 3-Phase AC 380V Control with NO/NC Contacts

Function: Uses an external phase-reversing circuit for open/close operation. Includes independent normally open (NO) and normally closed (NC) contacts.

Structure: Equipped with independent NO and NC contacts.

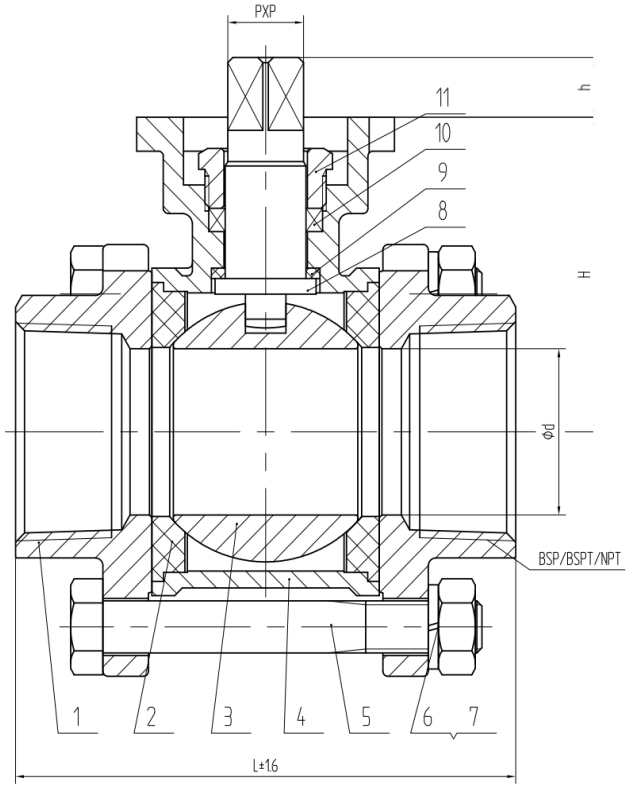
Note: Verify the direction of rotation during commissioning. If reversed, disconnect power and swap any two supply phases.

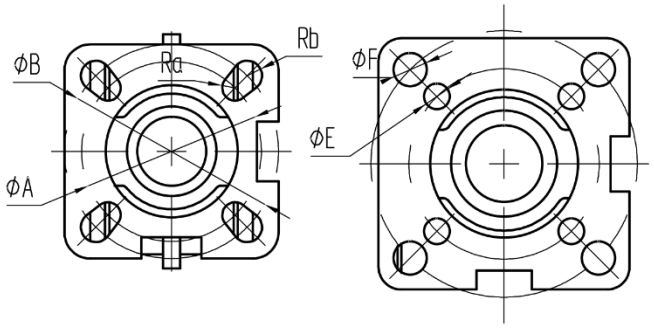


Type P: ON/OFF Type with Wet & Dry Contact Feedback

Function: Provides open/close operation with both wet contact and dry contact feedback for fully open and fully closed positions.

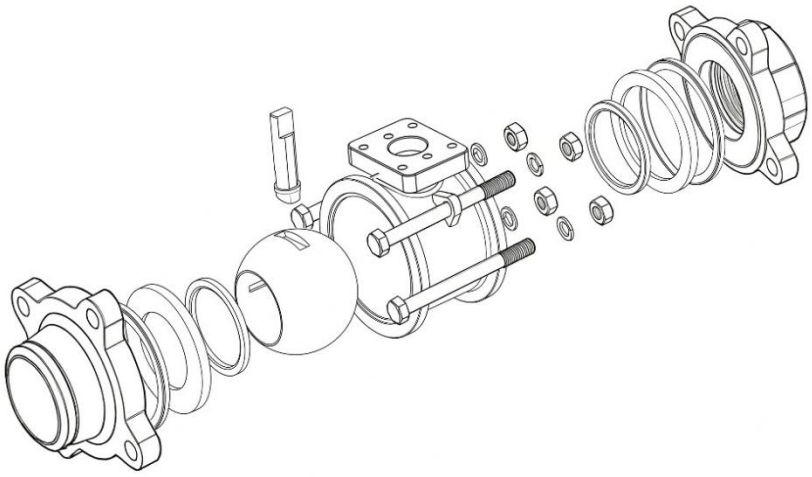
Structure: Includes a protective earth connection.





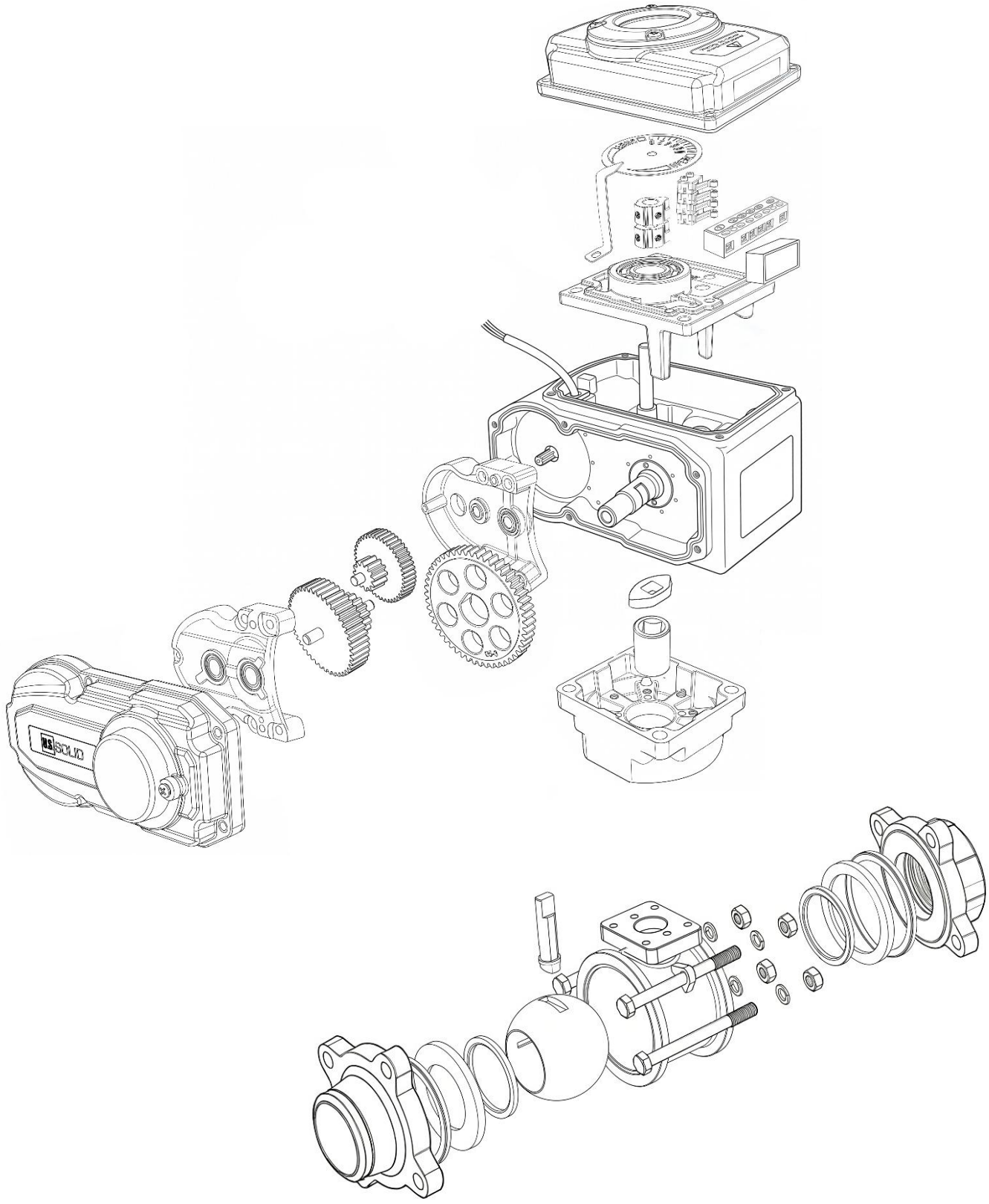
3-Piece High Platform Threaded Ball Valve





DN	in	Ød	L	BSP/BSPT /NPT	H≈	h	PXP	ØA	ØB	Ra	Rb	ØE	ØF
10	3/8"	12	69	3/8	38.5	6	9X9	36	42	3	3	-	-
15	1/2"	15	69	1/2	38.5	6	9X9	36	42	3	3	-	-
20	3/4"	20	79	3/4	46	8	9X9	36	42	3	3	-	-
25	1"	25	85	1	55.5	12	11X11	42	50	3	3.5	-	-
32	1 1/4"	32	100	1 1/4	60.5	14	11X11	42	50	3	3.5	-	-
40	1 1/2"	38	109	1 1/2	71	20	14X14	50	70	-	-	7	9
50	2"	49	129	2	78	17	14X14	50	70	-	-	7	9
65	2 1/2"	65	163	2 1/2	97.5	28	17X17	70	102	-	-	9	11
80	3"	79	190	3	108	28	17X17	70	102	-	-	9	11
100	4"	99	236	4	158	28	17X17	70	102	-	-	9	11

6. EXPLODED VIEW OF ELECTRIC BALL VALVE

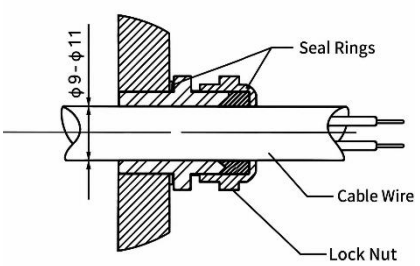


7. INSTALLATION INSTRUCTIONS

7.1 Installation & Environmental Guidelines

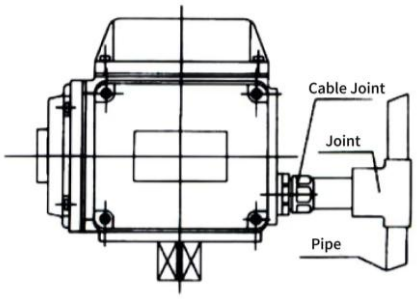
- Indoor & Outdoor Use: The product is suitable for both indoor and outdoor installation. The ambient operating temperature must remain within -30°C to +60°C (-22°F to 140°F).
- Non-Explosion Proof: This is a non-explosion-proof unit. Do NOT install in flammable, combustible, or explosive atmospheres.
- Environmental Protection: For installations exposed to prolonged rainfall, debris/material splashing, or direct sunlight, the actuator must be housed in a protective enclosure.
- Maintenance Clearance: Ensure adequate clearance space around the unit for wiring, controller access, and manual override operation.

7.2 Valve & Actuator Assembly



- **Manual Pre-Check:** Manually operate the actuator to drive the valve through its full stroke. Confirm smooth operation and ensure there are no obstructions or abnormalities. Turn the valve to the fully closed position.
- **Coupling Installation:** Fit one end of the coupling (adapter) onto the valve stem.
- **Actuator Alignment:** Ensure the electric actuator is in the **fully closed** position, then insert the actuator's output shaft into the square drive of the coupling.
- **Securing the Unit:** Install and tighten the mounting bolts between the electric actuator and the valve body.
- **Final Inspection:** Operate the actuator using a hex wrench. Ensure the movement is concentric and properly aligned without binding. Do not force beyond mechanical limits to avoid over-travel and gear damage.
- **NOTE**: Improper alignment between the actuator and valve stem may cause premature wear or failure of the drive nut.

7.3 Cable & Conduit Installation



- **Conduit Requirements:** Use conduit or cable glands with an outer diameter (OD) of φ9-11mm. Ensure all connections are properly sealed to maintain watertight integrity.
- **Water Ingress Prevention:** To prevent water from entering the actuator through the conduit, install the actuator higher than the conduit (using a drip loop).
- **Wiring Specifications:** Use cables with an OD of φ9-11mm. Ensure the cable gland is fully tightened to create a secure seal. Do not use undersized or damaged cables.
- **Signal Integrity:** Use shielded cable for signal lines. To avoid interference, do not run signal wires parallel to high-voltage power lines.

7.4 Power Supply Connection

- The connected power supply must remain within ±10% of the voltage marked on the electric actuator. Otherwise, the actuator may operate abnormally or fail.
- A fuse or circuit breaker must be used. Refer to the table below for the required rating. The table applies to AC 110 V; for other voltages, increase the fuse rating in proportion to the reduction in voltage.

Model	Fuse	Motor Power(AC 110V)
Type 05	6 A	20 W
Type 10/16	10 A	30/35W
Type 30/60	14 A	60/90 W
Type 200	20 A	250 W

8.1 System Calibration & Testing

Each actuator is factory-tested. Differences in valves, couplings, and assembly tolerances may require minor field adjustments. Refer to Section 7.2 for actuator-to-valve alignment, Section 8.2 for electrical travel limits, Section 8.4 for mechanical stops, and Section 8.3 for potentiometer calibration, where fitted.

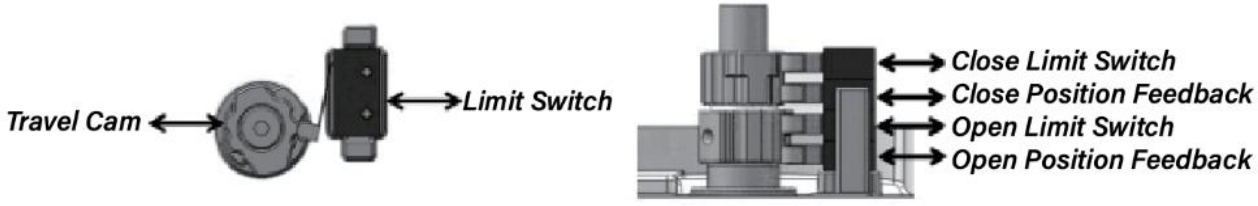
- **Manual Operation Check:** After mounting, disconnect power and manually cycle the valve through its full travel. Operation must be smooth and free of binding. Identify and correct any abnormal resistance before applying power.
- **Rotation Direction Check:** At initial startup, verify that rotation matches the OPEN and CLOSE commands, particularly on 380 V AC three-phase actuators. If rotation is reversed, stop operation and disconnect power immediately to prevent internal damage. Have qualified personnel correct the wiring before restarting.

8.2 Calibration & Limit Adjustment

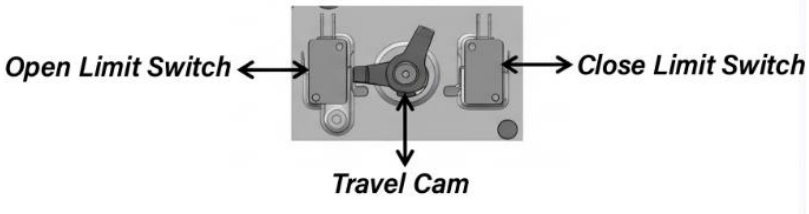
Electrical Limit Switch Adjustment

- **Closing Position:** Manually rotate the valve to the Fully Closed position. Check if the travel cam is precisely engaging the microswitch. The cam must not bypass or fail to reach the switch. If adjustment is needed, loosen the cam's set screw and reposition the cam until you hear a distinct "click" indicating switch activation. Secure the set screw and perform a powered test to verify the closing position; fine-tune if necessary.
- **Opening Position:** Manually rotate the valve to the Fully Open position and inspect the corresponding cam and microswitch. Follow the same adjustment procedure as the closing position.

Type 05/10/16 Switch Configuration

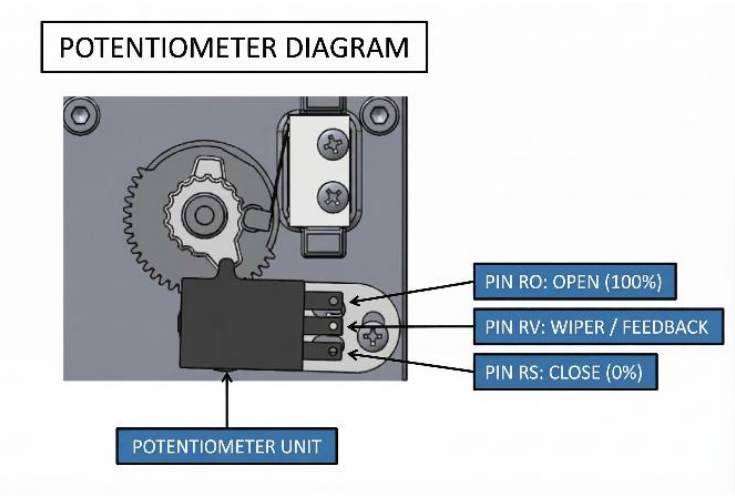


Type 30 Switch Configuration



⚠ **CAUTION:** Ensure the travel cams are accurately set to the valve's actual mechanical limits. Improper adjustment may cause over-travel, leading to permanent damage to the valve or actuator.

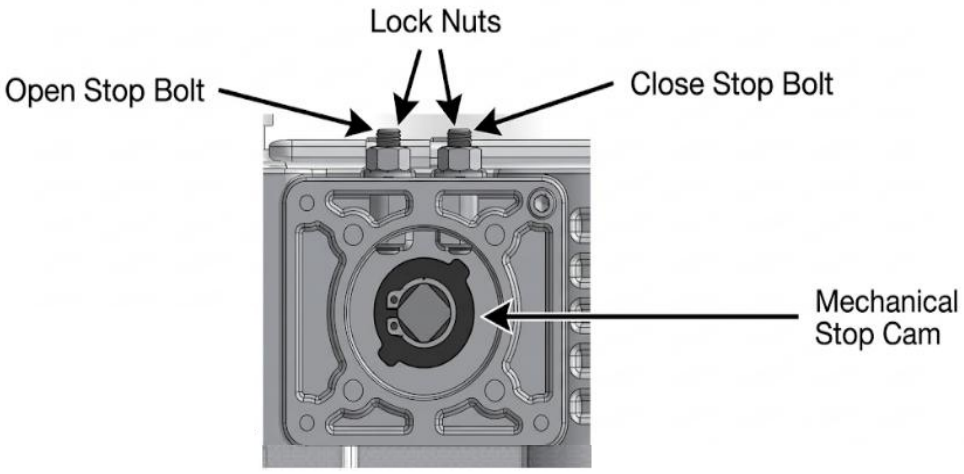
8.3 Potentiometer Calibration



- **Closed Position Resistance:** Drive the actuator electrically to the Fully Closed position until the motor stops via the limit switch. Using a multimeter (Ohm setting), measure the resistance between terminals RS and RV. The target value is approximately 80Ω. If the reading is outside this range, loosen the potentiometer mounting screws and rotate the drive gear until the resistance reaches 80Ω. Tighten the screws, ensuring the potentiometer gear meshes tightly with the drive gear without backlash.
- **Open Position Resistance:** Drive the actuator to the Fully Open position. Measure the resistance between terminals RO and RV. The value should be less than 1kΩ. If it exceeds 1kΩ, the valve opening angle must be re-adjusted.

8.4 Mechanical Travel Stop Adjustment

- **Close Direction:** Power the actuator to the Fully Closed position. Once the motor stops, loosen the lock nut on the Close Adjustment Bolt. Turn the bolt clockwise until it contacts the internal mechanical stop. Then, back off (rotate counter-clockwise) the bolt 2.5 turns and tighten the lock nut securely.
- **Open Direction:** Follow the same procedure to adjust the Open Adjustment Bolt at the fully open position.



⚠ **CAUTION:** Mechanical stops must be accurately calibrated to align with the electrical limit switches. Failure to do so may result in actuator motor overload, internal gear stripping, or permanent equipment damage.

9.1 Preventive Maintenance & Preservation

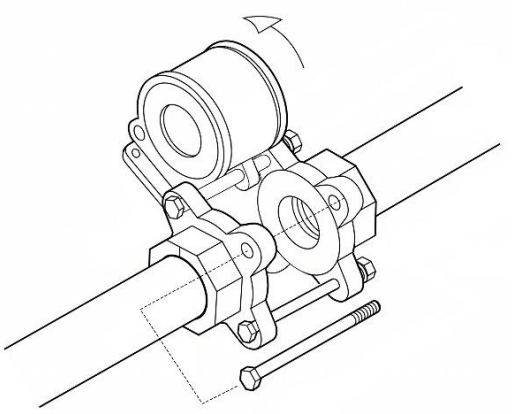
Follow these preventive maintenance practices to help ensure reliable actuator operation:

- **Manual Override Seal:** After installation and commissioning, securely reinstall the waterproof cap at the manual override port. Keep the port sealed to prevent moisture from entering the actuator housing.
- **Routine Inspection:** Periodically check the actuator for the following conditions:
  - Loose components or abnormal vibration
  - Overheating
  - Moisture or water ingress
  - *If an abnormal condition is found, stop operation as necessary and correct the cause promptly to prevent actuator failure.*
- **Outdoor Protection:** For outdoor installations, provide suitable weather protection to help prevent water ingress.

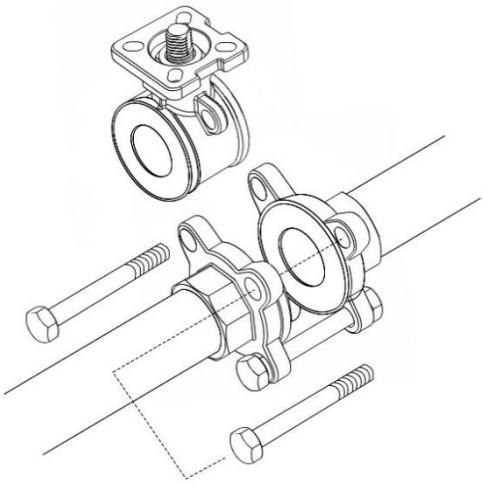
9.2 Maintenance & Service

WARNING: Before loosening any valve body bolts, disconnect and lock out actuator power, isolate the valve, fully depressurize the piping and valve cavity, and drain the process fluid. Support the valve body securely. Never disassemble a pressurized valve.

- **In-Line Maintenance (Swing-Out Design):** To perform on-site service without disturbing the threaded pipe connections, simply remove one of the two upper bolts passing through the body hinges. This allows the remaining bolt to function as a pivot, enabling the center body section to swing out to either side. In this position, the ball and seats are fully accessible for inspection or replacement while the end caps remain securely threaded to the pipeline.



- **Off-Line Maintenance (Center Body Removal):** For complete shop service or component replacement, extract both bolts from the body hinges and loosen the remaining two lower bolts (leaving them in place). This configuration allows the center body to be lifted out of the line while the end caps and remaining bolts maintain the original pipe alignment and spacing. Once serviced, the valve body can be reinstalled quickly without the need for cumbersome piping realignment.



10.1 Panel Overview and Status Indicators

The FC11A/FC11C controller provides local display, manual operation, automatic valve positioning, and parameter setup. The LED window can display actual valve position, the position setpoint or input indication, controller temperature, and setup values.

Ref.	Panel Label	Function and Indication
1	LED display	Displays valve position and operating or setup data. Use the front-panel keys to change the displayed value.
2	OPEN	Opening status: indicator on = actuator is opening; off = opening motion is stopped.
3	SHUT	Closing status: indicator on = actuator is closing; off = closing motion is stopped.
4	RVSA / DRTA	Control action: on = reverse action; off = direct action.
5	OPEN	Signal-loss response selection: drive to the fully open position.
6	STOP	Signal-loss response selection: stop and hold the current position.
7	SHUT	Signal-loss response selection: drive to the fully closed position.
8	AUTO	On = automatic operating mode is selected.
9	MANU	On = manual operating mode is selected.

Indicator convention: 1 means illuminated; 0 means off. For the three signal-loss indicators, illumination identifies the selected response. If OPEN, STOP, and SHUT are all off, signal-loss detection is disabled.

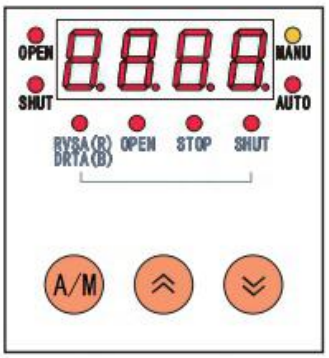
Controller Versions and Interfaces

Configuration: FC11A/FC11C units provide basic control functions. Additional special functions generally require a different controller version, such as FC11R or FC13A/FC13C.

Available supply versions: 220, 110, 24, or 380 V AC; 24 or 12 V DC. These are separate product versions. Use only the voltage specified for the installed module and actuator.

Signal options: 4–20 mA, 0–10 V, or 1–5 V; discrete signal options depend on the supplied configuration.

Connectors: Standard motor and potentiometer interfaces use 6-pin / 7-pin connectors on 2.54 mm centers.



FC11A / FC11C front panel

10.2 Front-Panel Controls and Quick Start

Key	During Operation	During Setup
A/M	Press briefly to switch between automatic and manual modes. Press and hold to enter setup.	Confirm the displayed setting and advance to the next parameter or function.
▲	Automatic: switch the displayed valve/input information. Manual: drive toward OPEN.	Increase the displayed value.
▼	Automatic: switch the displayed valve/input information. Manual: drive toward CLOSED.	Decrease the displayed value.

1. **Connect the actuator.** With power disconnected, connect the specified power supply and input signal. Connect the feedback output if required. Observe DC polarity exactly; reversed polarity can damage the module.

2. **Check manual operation.** Apply power and press A/M to select MANU. The MANU indicator flashes during manual operation. Press ▲ to check opening motion and ▼ to check closing motion. Confirm both directions before continuing.

3. **Calibrate valve travel.** While powered, hold A/M and press ▼. A circulating-segment indication shows that automatic calibration is in progress. When the display flashes 100.0, press A/M to confirm. If E2 appears, perform manual travel calibration as described in Section 10.5.

4. **Recover from incorrect settings.** If setup values have been changed incorrectly, enter the menu, select U5, set the code to 3888, and press A/M to restore factory settings. Repeat commissioning afterward.

5. **Unlock the display.** After an extended period without key input in automatic mode, the controller enters its screen-protection state. Hold A/M, use ▲ / ▼ to enter 6030, and press A/M to unlock. Manual mode does not enter this state.

6. **Adjust other parameters.** Press and hold A/M for approximately 5 seconds until the setup menu appears. Press A/M to advance to the next parameter, and use ▲ / ▼ to adjust values.

Important: Restoring factory settings is different from saving user settings. Code 3888 resets the module. After a reset, verify control action, signal-loss response, and travel calibration before returning the actuator to service.

10.3 Basic Setup Parameters U0–U4

Parameters are shown in the LED window. Press A/M to confirm and move to the next item; use ▲ / ▼ to change a value. In the X.X format below, the digit before the decimal point and the digit after it select separate functions.

Menu	Definition and Setting Range	Factory Value
U0 / X.X	Electronic braking: 0.x = disabled; 1.x = enabled. Input hardware selection: x.0 = standard 4–20 mA input; x.1 = discrete ON/OFF input; x.2 = RS-485 bus input priority. These selections require matching factory hardware. Do not change the input hardware selection without manufacturer approval.	1.0
U1 / X.X	Control action: 1.x = reverse action; 0.x = direct action. As defined in this controller manual, a 4 mA input commands fully CLOSED in reverse action and fully OPEN in direct action. Signal-loss response: x.0 = ignore (no alarm); x.1 = drive fully OPEN; x.2 = STOP / hold position; x.3 = drive fully CLOSED. The selected action is applied when the input signal is lost.	1.2
U2 / XX.X	Lower valve-position limit. Setting range: 0.0 to a value below U3.	0.0
U3 / XXX.X	Upper valve-position limit. Setting range: a value above U2 up to 100.0.	100.0
U4 / X.X	Positioning accuracy / allowable positioning error, expressed as x.x / 100 of full travel. Setting range: 0.1–9.9. A value that is too small may cause hunting; a value that is too large reduces positioning accuracy.	0.5 / 1.0

Use the control-action definition above when checking a 4–20 mA signal. A direct/reverse selection changes the relationship between the input signal and the commanded valve position; it is separate from correcting reversed motor or potentiometer wiring.

10.4 U5 Service Menu and Function Selection

U5 is the multifunction menu. Change the displayed code with ▲ / ▼, then press A/M to enter the selected function. The supplier lists -oh- as the factory U5 selection.

U5 Entry	Function
-oh-	Manual calibration of the fully closed and fully open valve positions.
-oA-	Automatic calibration of the closed and open travel endpoints.
288	Input-signal calibration at the closed and open reference points.
588	Feedback-output calibration at the closed and open reference points.
1888	Access additional settings: current temperature, stall-detection time, or valve address, depending on the supplied configuration.
3888	Restore factory settings. Recommission the actuator after resetting.
Other numeric entries	Save the current settings, as specified for the installed controller.

Menu Navigation

The basic setup sequence is U0 → U1 → U2 → U3 → U4 → U5. Press A/M to confirm each setting and advance to the next parameter. At U5, use ▲ / ▼ to select a function, then press A/M to enter it. Follow the save-and-exit instructions provided in the applicable calibration procedure.

Important: Code 3888 restores factory settings. Do not use it to save normal parameter changes.

Service Notes

Signal calibration and input hardware configuration should be performed by qualified personnel using equipment appropriate for the installed controller. Change the input hardware configuration only with manufacturer approval.

Some menu options and fault indications apply only to controllers equipped with the corresponding hardware. Confirm the installed configuration before using these functions.

10.5 Valve Position and Potentiometer Calibration

Manual Travel Calibration

Enter setup, select U5 = -oh-, and press A/M. This function calibrates the position potentiometer at the fully closed (U6) and fully open (U7) endpoints.

Parameter	Calibration Procedure	Reference Count Ranges
U6 — fully closed	Use ▼ to move the valve toward fully CLOSED. At the closed endpoint, press ▲ briefly to move back far enough to release the limit switch. Press A/M to confirm.	50–100 / 200–400
U7 — fully open	Use ▲ to move the valve toward fully OPEN. At the open endpoint, press ▼ briefly to move back far enough to release the limit switch. Press A/M to confirm.	800–1000 / 3200–4000

The two count ranges reflect different controller scales in the supplier documentation. Use the scale applicable to the installed unit. If you advance through U6 or U7 without pressing ▲ / ▼, that stored calibration value is retained.

Automatic Travel Calibration

1. Apply the correct power supply. Hold A/M and press ▼ once at the same time.

2. The circulating-segment indication shows that the controller is automatically learning the closed and open endpoints. Keep the valve travel path clear.

3. After successful calibration, the display flashes 100.0. Press A/M to confirm.

4. If E2 is reported, enter the setup menu and use manual calibration to inspect the endpoint counts and travel span. See Section 10.8 for position-feedback checks.

Calibration should leave a small amount of usable travel before the electrical limit switches actuate. Releasing the limit switch slightly at each learned endpoint helps prevent an endpoint from being interpreted as a stall.

10.6 Input and Feedback Signal Calibration

The examples below apply to 4–20 mA signals. Use the signal format specified for the installed controller. Confirm the service procedure and reference equipment before changing factory signal calibration.

Input Signal — U5 = 288

Enter setup, select U5 = 288, and press A/M. Use a suitable external current source to establish the two input reference points.

Parameter	Reference Point	Procedure
U8 / XXXX	Closed reference — 4 mA	Set the external current source to 4 mA, then press A/M to confirm.
U9 / XXXX	Open reference — 20 mA	Set the external current source to 20 mA, then press A/M to confirm.

After confirming both reference points, return to U5 = 288. Press ▲ to select U5 = 388, then press A/M to save and exit.

Feedback Output — U5 = 588

Enter setup, select U5 = 588, and press A/M. U10 and U11 define the closed and open feedback-output reference points.

Parameter	Feedback Reference	Service Adjustment
U10 / XXXX	Closed reference — 4 mA	Calibrate and confirm the 4 mA feedback reference using the verified procedure for this module.
U11 / XXXX	Open reference — 20 mA	Calibrate and confirm the 20 mA feedback reference using the verified procedure for this module.

After confirming both reference points, return to U5 = 588. Press ▲ to select U5 = 688, then press A/M to save and exit. Verify input calibration and feedback-output calibration independently.

Before Returning to Service

Check valve travel in manual mode, return to automatic mode, and verify the commanded and actual positions through the operating range. Confirm the configured direct/reverse action and the selected response to loss of the control signal.

10.7 Controller Fault Codes E0–E6

Use the displayed fault code to identify the condition. Perform inspection and corrective work in accordance with the electrical safety instructions in this manual.

Code / Condition	Possible Cause	Corrective Action
E0 — Overtemperature	Internal temperature exceeds the alarm threshold.	Reduce ambient temperature and opening/closing frequency. Review actuator sizing; use a higher-rated actuator if required by the load.
E1 — Input signal lost	Input is disconnected, incorrectly connected, or intentionally interrupted.	Check signal wiring and controller output settings. Review the selected signal-loss response. Use Ignore only where the application allows it.
E2 — Invalid position data	Closed/open endpoint data fall outside the accepted range.	Recalibrate travel with margin at both endpoints. Inspect the potentiometer mounting angle, wiring, and gear engagement.
E3 — Reversed position data	Position counts change in the wrong direction relative to valve travel.	Check motor direction and potentiometer end connections. Inspect for a feedback dead zone, short circuit, or loose connection.
E4 — Closing stall	Actuator cannot reach the commanded position while closing.	Check operation in manual mode. Inspect limit-switch operation, excessive operating torque, and a jammed valve.
E5 — Opening stall	Actuator cannot reach the commanded position while opening.	Check operation in manual mode. Inspect limit-switch operation, excessive operating torque, and a jammed valve.
E6 — ESD position command	An external ESD input is active, on configurations equipped with that feature.	Automatic control is interrupted; the actuator moves to the configured ESD position and reports an alarm. Investigate the external command before restoring normal operation.

10.8 Position Feedback and Stall Diagnostics

E1 — Signal-Loss Behavior

An absent or shorted 4–20 mA input can trigger E1. The actuator then applies the selected signal-loss response: ignore, fully open, stop/hold, or fully closed. E1 does not always indicate a damaged cable; signal interruption may be intentionally used by the control system.

E2 — Endpoint Data Validation

The controller checks the learned endpoint counts and their span. For FC11A/FC11C controllers, the recommended feedback readings are approximately U6 = 80 A/D counts at fully closed and U7 = 920 A/D counts at fully open. Other controller versions use approximately 300 and 3600 counts. These reference readings provide usable feedback range and margin for travel overshoot; they are not valve-opening percentages.

Validation Check	Larger-Count Scale	FC11A / FC11C
Closed endpoint rejected	U6 < 20 or U6 > 3000	U6 < 20 or U6 > 800
Open endpoint rejected	U7 > 4070 or U7 < 1000	U7 > 1000 or U7 < 100
Insufficient travel span	U7 − U6 < 153	U7 − U6 < 153

If E2 occurs, inspect loose potentiometer wiring, incorrect gear engagement, and an unsuitable gear ratio. Endpoint counts must leave adequate margin and change smoothly throughout travel.

E3 — Feedback Direction

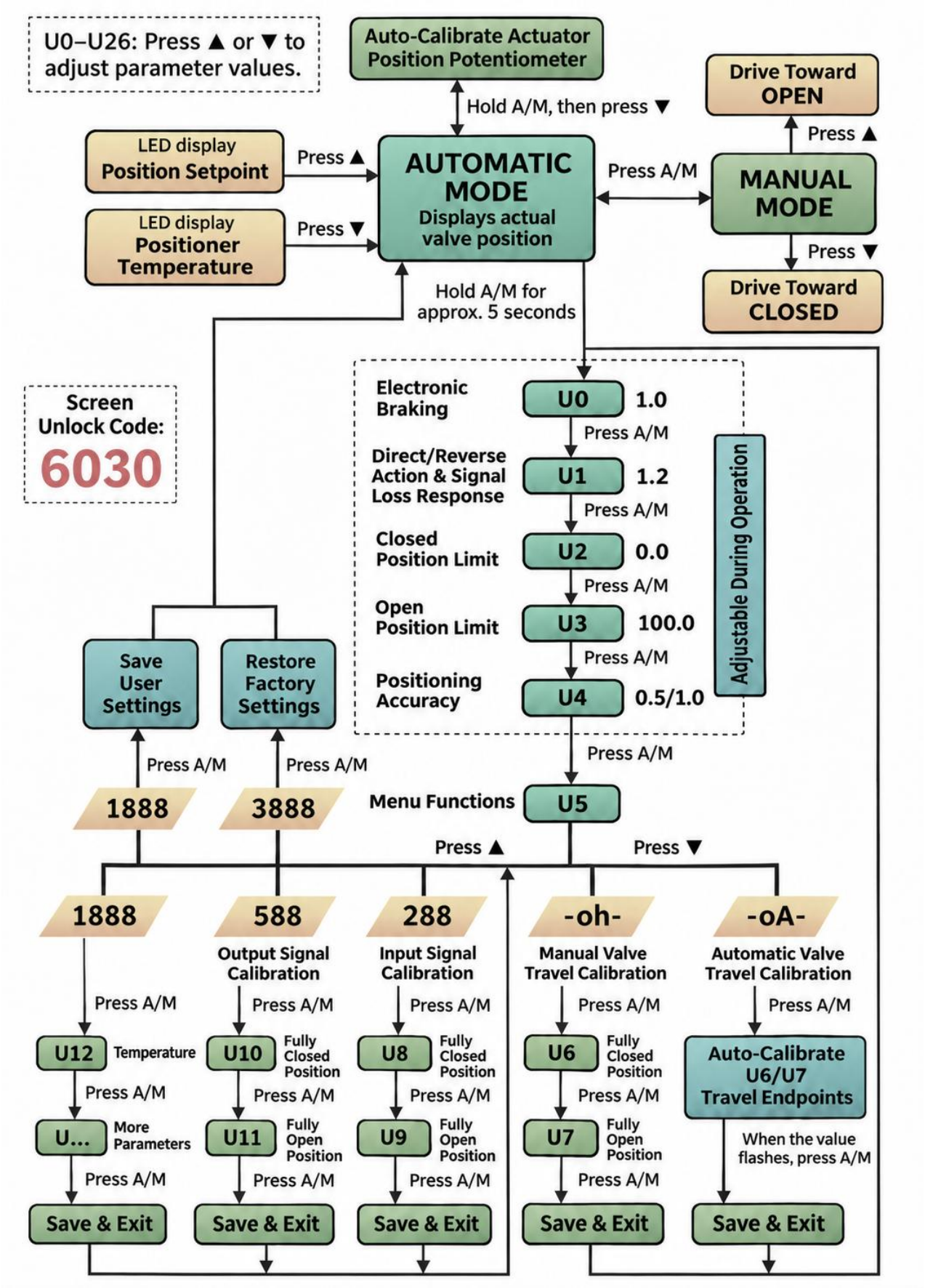
In manual mode, ▲ must open the valve and increase the position count; ▼ must close the valve and decrease it. If this relationship is reversed, check the motor OPEN/CLOSE connections and potentiometer RO/RS connections. Loose feedback wiring may also cause erratic or reversed readings.

E4 / E5 — Stall Detection and Recovery

During automatic/remote operation, including supported RS-485 or infrared control modes, a position reading that fails to change for 5 seconds while the valve is commanded to move triggers a directional stall alarm. The controller attempts up to three back-and-forth recovery movements. If travel passes the stalled point, the alarm clears; if recovery fails, motion in that direction stops.

An opposite-direction command allows a recovery attempt in the other direction. Successful reverse travel clears the alarm. If neither direction succeeds, the actuator remains stopped with an E4/E5 alarm.

Check whether a travel limit switch is causing the apparent stall. During U6/U7 calibration, move slightly away from each endpoint to release the switch. Confirm that feedback increases and decreases continuously; abrupt jumps, zero readings, or full-scale readings can indicate a faulty potentiometer.


U0–U26: Press ▲ or ▼ to adjust parameter values.
Auto-Calibrate Actuator Position Potentiometer
Hold A/M, then press ▼
Drive Toward OPEN
Press ▲
LED display Position Setpoint
Press ▲
AUTOMATIC MODE
Displays actual valve position
Press A/M
MANUAL MODE
LED display Positioner Temperature
Press ▼
Press ▼
Drive Toward CLOSED
Hold A/M for approx. 5 seconds
Screen Unlock Code:
6030
Electronic Braking
U0
1.0
Press A/M
Direct/Reverse Action & Signal Loss Response
U1
1.2
Press A/M
Closed Position Limit
U2
0.0
Press A/M
Open Position Limit
U3
100.0
Press A/M
Positioning Accuracy
U4
0.5/1.0
Adjustable During Operation
Save User Settings
Restore Factory Settings
Press A/M
Press A/M
Press A/M
1888
3888
Menu Functions
U5
Press ▲
Press ▼
1888
588
288
-oh-
-oA-
Output Signal Calibration
Input Signal Calibration
Manual Valve Travel Calibration
Automatic Valve Travel Calibration
Press A/M
U12
Temperature
U10
Fully Closed Position
U8
Fully Closed Position
U6
Fully Closed Position
Auto-Calibrate U6/U7 Travel Endpoints
U...
More Parameters
U11
Fully Open Position
U9
Fully Open Position
U7
Fully Open Position
When the value flashes, press A/M
Save & Exit
Save & Exit
Save & Exit
Save & Exit
Save & Exit

12. TROUBLESHOOTING & CORRECTIVE ACTION

Symptom	Possible Cause	Corrective Action
Motor does not start	No power supply.	Check the supply wiring and connect power.
	Broken wire or loose terminal connection.	Repair the damaged wire and secure loose terminal connections.
	Supply voltage does not match the actuator rating.	Check that the supply voltage matches the actuator nameplate.
	Thermal protection has tripped due to overheating.	Allow the actuator to cool. Reduce the ambient temperature or cycling frequency as needed.
	Faulty travel limit switch.	Replace the faulty limit switch.
	Failed or ruptured motor capacitor, where fitted.	Replace the capacitor and check the actuator operating temperature.
OPEN/CLOSED indicator does not illuminate	Faulty indicator lamp.	Replace the indicator lamp.
	Faulty position signal switch.	Replace the position signal switch.
Actuator hunts or repeatedly reverses direction	Travel stop is incorrectly adjusted.	Readjust the travel stop.
	Supply voltage is too low.	Check the supply voltage and restore it to the specified range.
	Electrical interference on the signal line.	Use shielded signal cable.
	Faulty intelligent control module.	Replace the intelligent control module.
	Potentiometer is loose or its gear is disengaged from the main drive gear.	Inspect and secure the potentiometer. Adjust the gear engagement.
Intelligent control module operates abnormally	No power supply to the module.	Check the wiring and confirm that the supply matches the module voltage rating.
	Module does not receive the control signal.	Check that a valid input signal is present.
	Module display changes, but the actuator position does not.	Check the actuator-to-module wiring. Manually operate the actuator to verify smooth travel and isolate the fault.
	Module signal-loss indication flashes.	Check the module input signal and ensure the signal wiring is securely connected.

Contact

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