

Valvcon™

ESR-series

electric actuators

Installation, maintenance and
operating instructions

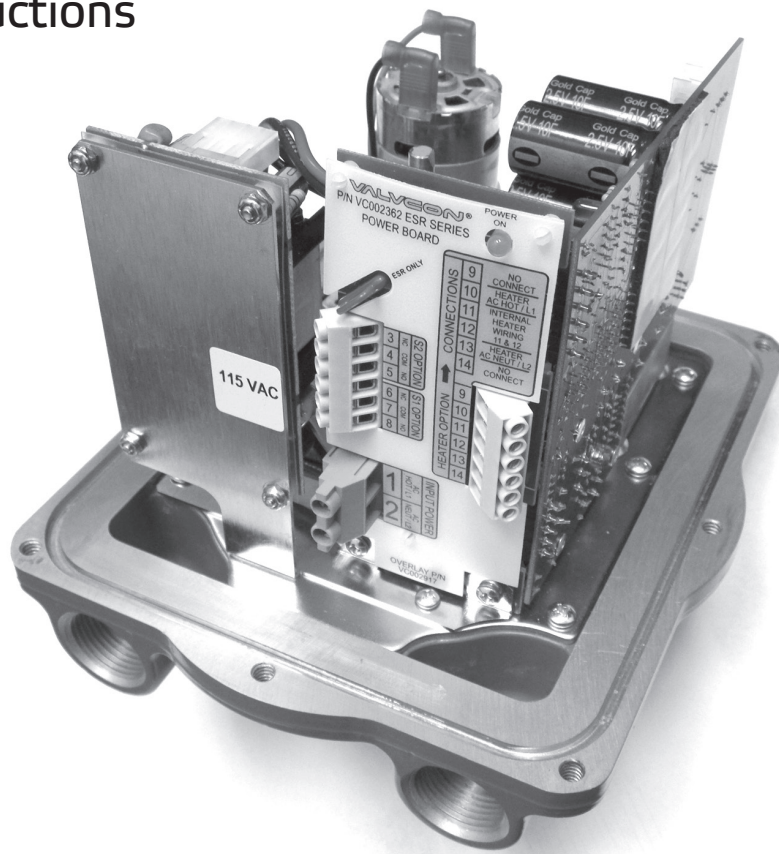


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READ THESE INSTRUCTIONS FIRST!

These instructions provide information about safe handling and operation of the valve.

If you require additional assistance, please contact the manufacturer or manufacturer's representative.

SAVE THESE INSTRUCTIONS!

Addresses and phone numbers are printed on the back cover.

1. GENERAL

1.1 ESR-SERIES ELECTRIC ACTUATORS

ESR-Series Electric Actuators are designed to provide reliable, efficient operation of final control elements, such as 1/4 turn valves, with torque requirements up to 600 inch pounds. An on-board high-energy storage module provides power to the actuator when user supplied power is removed. ESR-Series actuators are available in 115 VAC & 230 VAC.

2. OPERATION

The ESR-Series actuator is factory configured to drive CCW when power is applied, and to close drive CW when power is removed. This configuration is called Standard operation. In standard operation Full CCW is the power-on position. Full CW is the power-off position. The actuator can be configured to drive CW when power is applied, and to drive CCW when power is removed. This configuration is called Reverse operation. Standard and reverse operation is selected by the position of a jumper located on the ESR board. To set your desired function, place the jumper on the ESR board in it's designated position. See **Figure 2** for Standard/Reverse jumper location.

When power is applied to terminals 1 and 2, the ESR initiates a start-up routine. The actuator is held in the power- off position, and the energy level of the energy storage module is checked. If there is insufficient energy to drive the actuator through a complete cycle, the module is charged.

Note: The time between applying power and the actuator opening will vary depending on the initial charge level of the module -- it could be up to 180 seconds. Once the storage module is sufficiently charged, the actuator will travel to the power-on position. The ESR will remain in the power-on position until it detects a power loss at terminals 1 and 2. The energy stored in the storage module is then used to drive the actuator to the power-off position.

If the ESR actuator is left in the power-off position, all power will drain from the Storage module in less than one hour. The storage module will then recharge when the power-on condition exists.

For 150 in-lbs, there is only the ESR board. For other torque ranges, modular expansion boards are supplied.

2.1 LED INDICATORS

POWER BOARD

Power Indicator - This LED indicator shows that the user supplied power is present (See **Figure 1**)

ESR BOARD

CHG. - This LED indicator shows the charge of the storage module. When the modules are fully charged, this indicator will illuminate. When the module needs charging, this indicator is off. After power is disconnected the charge indicator remains lit until all power has been discharged from the module. (See **Figure 2**)

Power Indicator - This LED indicator shows that the user- supplied power is present. (See **Figure 2**)

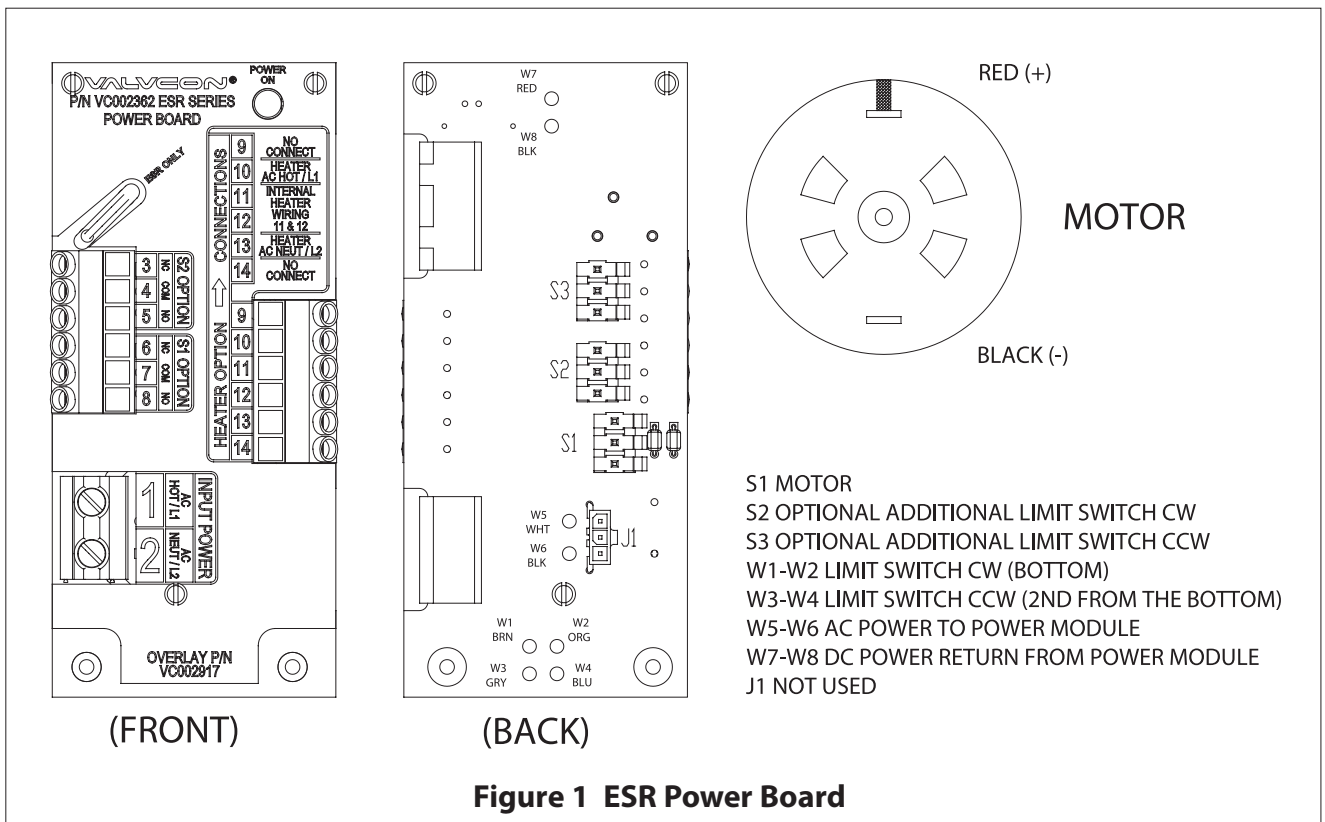


Figure 1 ESR Power Board

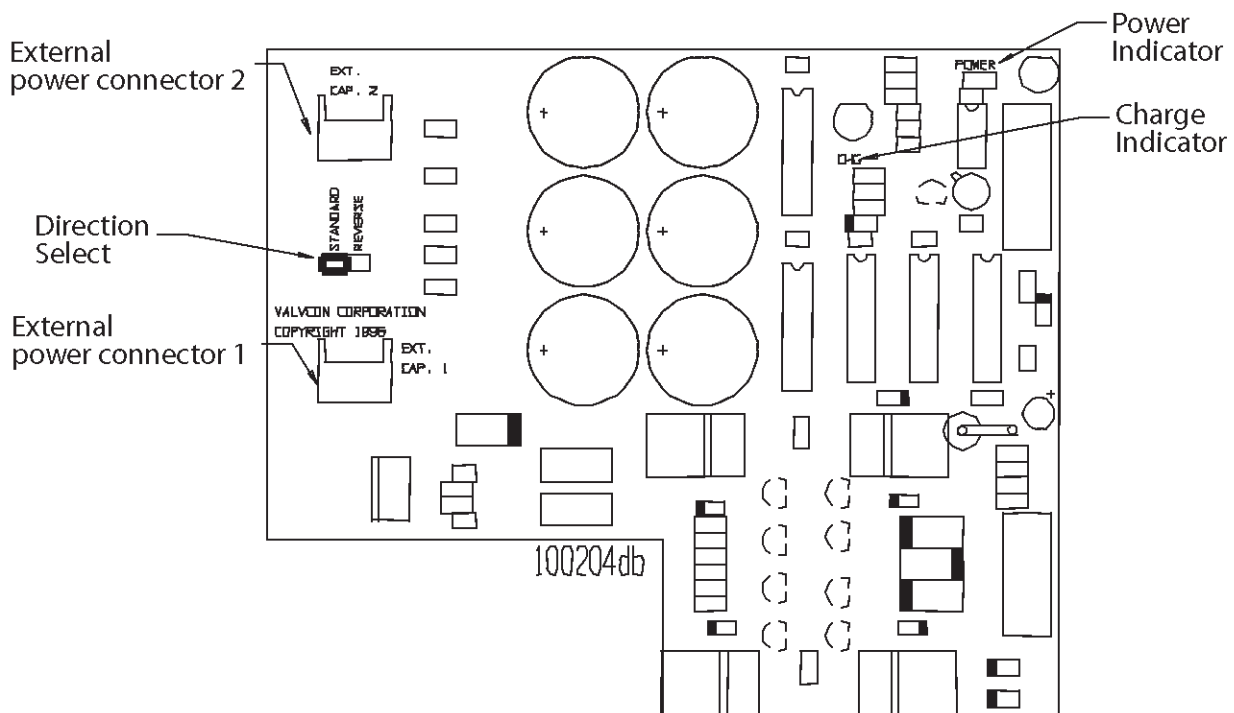


Figure 2 ESR Energy Storage Module

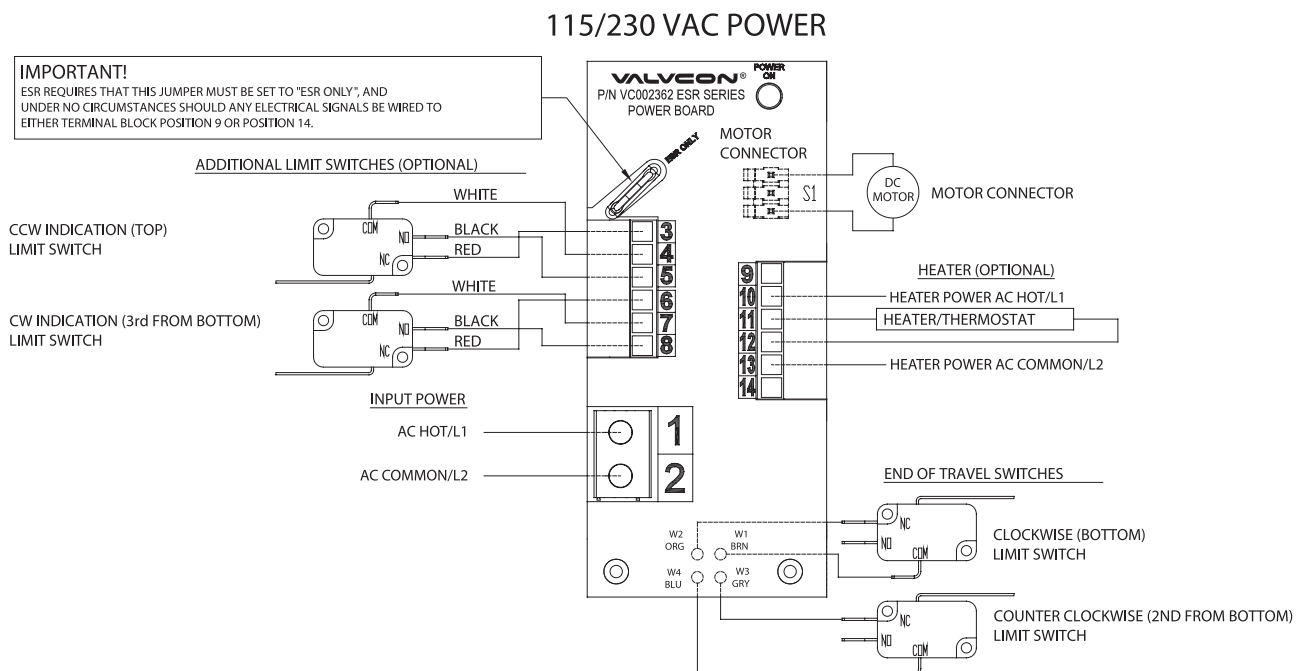


Figure 4 ESR Actuator Wiring for 115 AND 230 VAC

2.2 WIRING DIAGRAM

The ESR-Series actuator operates from the customer's supplied external power (HOT/L1 and NEUTRAL/L2 only). No other control signal or wiring is required. When power is applied to terminals 1 and 2 the actuator will drive to the power-on position. When power is removed the actuator will drive to the power-off position.

The identification label on each actuator specifies the voltage and current requirements for the actuator. Refer to **Figure 4** for the power and control wiring connections.

WIRING

The ESR-Series uses only two wires, HOT/L1 and NEUTRAL/L2. 18 or 20 gauge wire may be used for short runs. At least 16 gauge wire is recommended for longer runs. Be sure to follow local wiring codes.

To operate an ESR-Series electric actuator, power from the user is wired directly to the actuator's motor through a Switching Power Supply and two limit switches. Power may be 115 or 230 VAC dependent on the actuator - please match before wiring, as the wrong voltage could damage installed options such as a heater/thermostat. The power board is labeled with the correct voltage. The limit switches control the actuators mechanical travel limits, usually 90 degrees.

HEATER

If an optional heater is installed, wire the same voltage as the power to terminals 11 and 12. Separate power must be constantly maintained at terminals 10 and 13 to properly operate the heater.

2.3 ADJUSTMENT OF LIMIT SWITCHES

Two limit switches operated by cams on the output shaft determine the exact positions where the actuator will stop at the end of each cycle. The upper limit switch determines the CCW end-of-travel position. The lower limit switch determines the CW end-of-travel position. The limit switches can be adjusted from 5° to 270° of actuator rotation. If adjustment of the open or closed position is required, proceed as follows:

Caution: Disconnect power supply circuit before opening enclosure.

A. Remove the cover

Remove the actuator cover by removing the screws securing the cover to the base.

B. Drive the actuator to the full CCW position.

C. Adjust the CCW limit switch cam

1. Using a 1/16 inch hex wrench, loosen the set screw in the CCW limit switch cam (the second from the bottom).
2. Rotate the cam toward the limit switch arm until the switch just clicks closed.
3. Re-tighten the set screw on the limit switch cam (Be careful not to over-tighten the screw).

D. Drive the actuator to the full CW position.

E. Adjust the CW limit switch cam

4. Using a 1/16 inch hex wrench, loosen the set screw in the CW limit switch cam (the bottom one).
5. Rotate the cam toward the limit switch arm until the switch just clicks closed.
6. Re-tighten the set screw on the limit switch cam (Be careful not to over-tighten the screw).

F. Replace the cover

OPTIONAL ADDITIONAL LIMIT SWITCHES

Up to two additional limit switches may be installed in the actuator. When installed, they will use the following connectors on the mother board:

Extra Limit Switch 1 (#3) Connector S2

Extra Limit Switch 2 (#4) Connector S3

2.4 GENERAL TECHNICAL INFORMATION

The operation of the ESR-Series is very simple... power-on at terminals 1 & 2 will cycle the actuator counterclockwise, and power-off at terminals 1 & 2 will cycle the actuator clockwise (or vice-versa, depending on the position of a jumper on the board). The actuator uses a high-energy storage module (high capacity rechargeable devices) to charge during the open cycle, and when power is removed, the actuator uses this stored energy to close. The storage module is continuously trickle charged. There is a charge delay before each power-on cycle for charging, and a brief pause before each power-off cycle for brown-out protection. The actuator is designed for Open/Close two-position actuation only.

2.5 TEMPERATURE LIMITS

LOW AMBIENT TEMPERATURES

The minimum recommended ambient temperature is 32°F. A heater and thermostat can be used for ambient temperatures as low as -40°F, but the heater and thermostat must always be powered.

HIGH AMBIENT TEMPERATURES

The maximum recommended ambient operating temperature is 130°F. **Note:** Actuators mounted outdoors must be shaded from direct sunlight to keep the internal temperature below 130°F. Sustained exposure to temperatures over 130°F can damage the internal components.

HIGH MEDIA TEMPERATURES

For media temperatures between 200°F and 300°F, a shielding plate (about one inch larger than the actuator in each dimension, and at least a 1/16" thick) should be placed between the actuator and the mounting bracket. In addition, the actuator should not be mounted directly above the pipe. For media temperatures above 300°F, a valve with an extended shaft mounting arrangement should be used.

3. MOUNTING THE ACTUATOR

CAUTION: Dangerous voltages are present inside the actuator cover unless the power supply to the actuator has been shut off or disconnected. Use extreme caution whenever working on the actuator with the cover removed.

3.1 TOOLS REQUIRED

1/16 inch hex wrench (cam set screw wrench)
3/16 inch hex wrench (cover bolts)
Small flat blade screwdriver

3.2 ACTUATOR INSTALLATION

Verify that the output torque of the actuator is appropriate for the torque requirements of the valve. The output torque is listed on the actuator's base nameplate.

Actuator Drive Output - ESR-Series actuators are furnished with a female drive output. Two bolt hole patterns (ISO 5211) are provided for actuator mounting (See **Figure 7**).

Bracket requirements - It is mandatory that the actuator be firmly secured to a sturdy mounting bracket. A minimum of four bolts with lock-washers should be used to secure the actuator to the bracket. No flexibility in the bracket is allowed, and backlash, or "play", in the coupling should be minimized. The actuator output shaft must be inline (centered) with the valve shaft to avoid side-loading the shaft.

4. MANUAL OVERRIDE

ESR-Series actuators are not provided with a manual over-ride. This is because the ESR Storage Module cannot be disconnected -- when terminal strips 1 and 2 are not energized, the Storage Module will keep the actuator in the full clockwise position. Manually driving the actuator to a different position could damage the Storage Module or the motor gearbox.

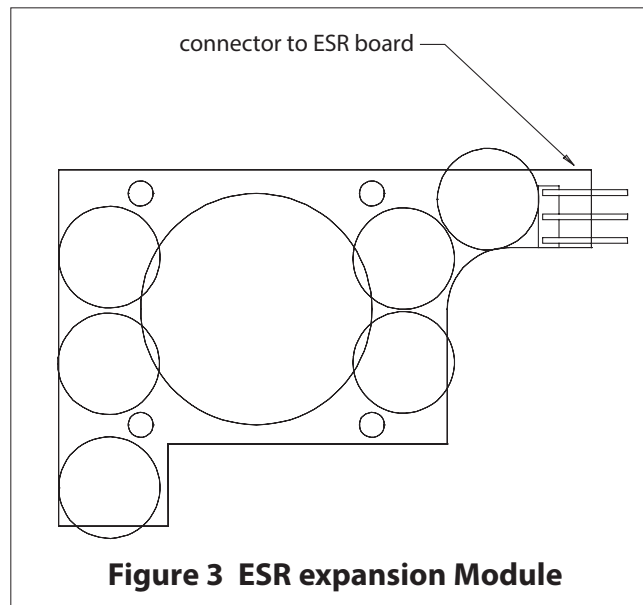
5. STORAGE MODULE

The ESR Storage Module is capable of supplying sufficient power to ensure one complete cycle of the actuator during power outages. The Module life is 3-4 years

6. TROUBLESHOOTING

If the actuator fails to operate:

- Check that the “Power On” indicator on the power board is lit.
- Check that the “Power” indicator on the ESR Storage Module is lit.
- Check that proper voltages are present at the actuator’s terminal connections.
- Check that all plug-in connections are properly made.
- Check that the limit switches are properly set.
- Check that the actuator has enough torque output for the application.



7. BOARD INSTALLATION

If a replacement board needs to be installed, insure that the jumper on the front of the power board is in the “ESR Only” location (refer to **Figure 1**).

Depending on the torque requirement of the actuator, the ESR will require up to 2 expansion modules. Actuators rated for 150 in-lbs use only the ESR board. Actuators rated for 300 in-lbs require one expansion module and actuators rated for 600 in-lbs require 2 ESR expansion modules.

Add the board bracket to the inside motor mounting hole with screw the #8-32 machine screw. Before installing the board select the desired operation direction by positioning the direction select jumper.

7.1 150 IN-LB MODELS

Place the 4-40 screw in from the back of the board bracket, and place the spacer over it from the front of the bracket. Plug the ESR board into the motherboard, and attach with the 4-40 nut.

7.2 300 IN-LB MODELS

Screw the #8-32, 3.5 inch threaded rod at least a 1/4" into the motor mounting holes. Place the 1 1/2 inch spacers over the threaded rod. Place a capacitor board 1641 over the threaded rod and secure with the 8-32 nuts. Place the #4-40 screw in from the back of the board bracket, and place the spacer over it from the front of the bracket. Plug the ESR board into the motherboard, and attach with the 4-40 nut.

7.3 600 IN-LB MODELS

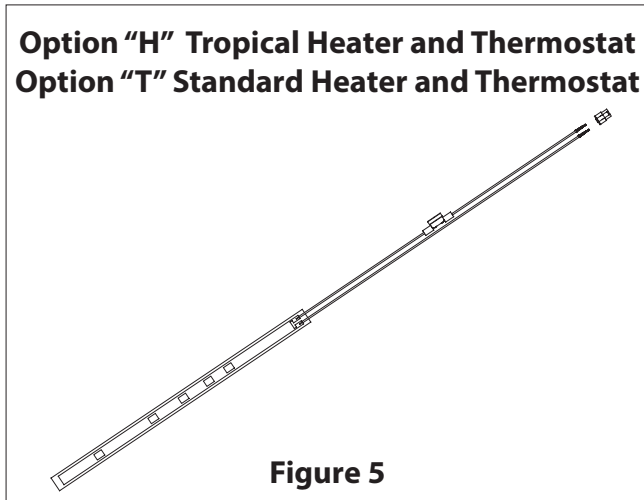
Screw the #8-32, 3.5 inch threaded rod at least a 1/4" into the motor mounting holes. Place the 1 1/2 inch spacers over the threaded rod. Place an ESR Expansion Module over the threaded rod. Place the 1 5/8 inch spacers over the threaded rod. Place a second ESR Expansion Module over the threaded rod, secure with the 8-32 nuts. Place the #4-40 screw in from the back of the board bracket, and place the spacer over it from the front of the bracket. Plug the ESR board into the motherboard, and into the ESR expansion Modules, attach with the 4-40 nut.

8. ESR-SERIES STANDARD OPTIONS

All ESR-Series options are designed to be easily installed in the field. Options for all standard ESR-Series actuators are universal and completely interchangeable with each enclosure size.

8.1 OPTION “H” – TROPICAL HEATER AND THERMOSTAT P/N VC099713, P/N VC099714

The tropical heater and thermostat option is a self-adhesive, resistant heater strip which is applied to primary gearbox. It installs with a plug-in connector and is recommended in high-humidity applications. The tropical heater option is also recommended installations that experience wide temperature swings in order to evaporate any condensation. Thermostat is pre-set to active at or below 90°F and deactivate at or above 110°F. The tropical heater draws 15 watts @ 115 VAC; 40 watts at 230 VAC. This option can be installed in the field; for 115 VAC applications, order kit **P/N VC099713**; for 230 VAC applications, order kit **P/N VC099714**. (See **Figure 5**)



8.2 OPTION “I” – ISO 5211 OUTPUT

150 – 600 in•lb models are supplied with a 3/4" female square output coupling; when the “I” option is selected they are supplied with a 14 mm female square.

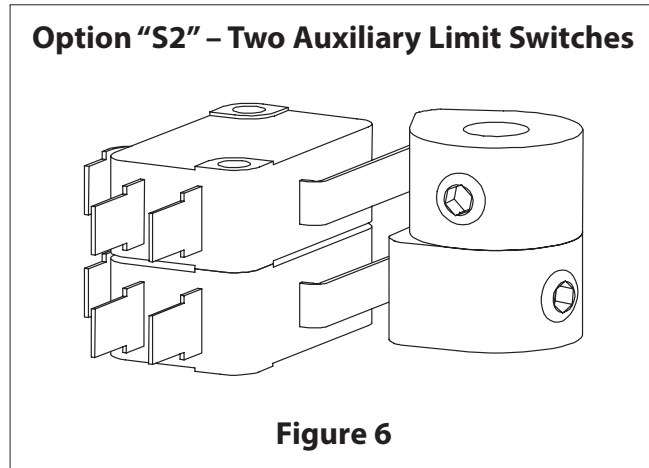
This option is factory installed only.

8.3 OPTION “K” – MECHANICAL BRAKE P/N VC092695

The highly efficient Valvcon hardened steel spur gear system requires that the brake option be installed on all butterfly valve and damper applications. It is also recommended on PVC ball valves and resilient seated valves. The brake will hold the valve in position against force as great as the torque rating of the actuator.

8.4 OPTION “S2” – TWO AUXILIARY LIMIT SWITCHES P/N VC099900

The extra switches and stainless steel cams provide dry contacts and are fully adjustable to trip at any position. They are often used for position indication or to interlock other devices (such as in sequencing operations). The switches are single pole, double throw switches rated for 1/2 HP, 11 amps @250 VAC, CSA certified. Auxiliary switch kit **P/N VC099900** is universal to all standard ESR-Series actuators. (See **Figure 6**)



8.5 OPTION “T” – HEATER AND THERMOSTAT P/N VC099513, P/N VC099514

The heater and thermostat option is a self-adhesive, resistance heater strip which is applied to the primary gearbox. It installs with a plug-in connector and is required in installations where the ambient temperatures drop below 32° F. The heater option is also recommended in installations that experience wide temperature swings in order to evaporate any condensation. The thermostat is pre-set to activate at or below 40°F and deactivate at or above 60°F. The heater draws 15 watt @115 VAC, 12 VDC and 24 V; 40 watts @ 230 VAC. This option can be installed in the field; for 115 VAC order kit **P/N VC099513**; for 230 VAC applications, order kit **P/N VC099514**. (See **Figure 5**)

8.6 OPTION “Y” - KEYED OUTPUT

150 – 600 in•lb actuators are supplied with a 3/4" female square output coupling; when the “Y” option is selected they are supplied with a 15mm female keyed output.

This option is factory installed only.

9. VOLTAGE

115 VAC & 230 VAC. ESR-Series actuators are rated for full torque at +/- 10% of the nominal voltage at 50Hz or 60 Hz. ESR-Series actuators are rated 80% duty. (**Note:** at 50Hz the cycle time will increase by approximately 20%)

10. GENERAL OPERATING INFORMATION

For enclosure specifications and dimensions, see (Tables 1-2 and Figure 7)

10.1 NEMA RATINGS

Neles manufactures two styles of Valvcon enclosures: the "W" enclosure is weathertight and designed to NEMA 4/4X standards the "WX" enclosure is "explosionproof" and designed to NEMA 4/4X/7&9 (Class 1, Division 1, Groups C and D, and Class 2, Division 1, Groups E, F and G) standards.

Use extreme care when removing the cover. Scratches or nicks on the flanges may cause the enclosure not to meet NEMA specifications.

10.2 DUTY CYCLE AND MOTOR PROTECTION

ESR-Series modulating actuators are equipped with a brushed DC motor and are rated for 80% duty cycle operation up to 104°F and for a maximum of 30 starts per minute. Higher temperature applications decrease the available duty cycle.

10.3 OPERATING TEMPERATURE LIMITS

ESR-Series actuators are designed to operate in ambient environments between 32°F, (0°C) and 130°F, (55°C). If the ambient temperature may drop below 32°F, (0°C), the heater and thermostat option must be installed. The actuator is rated to operate at -40°F, (-40°C) with the heater and thermostat option installed. In outdoor applications where ambient temperatures exceed 80°F, (27°C), actuators should be shielded from direct sunlight. In applications with high media temperatures, insulating blankets, heat shields and/or extended mounting shafts should be used to keep temperatures within normal operating limits.

Heaters and thermostats are required for all outdoor applications and may also be used to dry condensation in high humidity environments.

10.4 ACTUATOR MOUNTING

The actuator may be mounted in any position including upside-down. It must be firmly secured to a direct mount flange or sturdy mounting bracket. A minimum of four bolts with lock washers should be used to secure the actuator to the bracket. Flexibility in the bracket is not allowed, and backlash, or "play", in the coupling should be minimized. The actuator output shaft must be in line (centered) with the valve shaft to avoid side-loading the shaft. (**See Figure 7 for output drive dimensions and mounting hardware specifications.**)

10.5 LUBRICATION

All rotating power train components are permanently lubricated with multi-purpose Lithium grease suitable for the operating temperature range of the actuator. Additional lubrication is not required in normal operation.

10.6 PROBLEM PREVENTION

Most actuator problems result from improper installation.

Incorrect Wiring and Set Up - Make certain the actuator is wired correctly and travel stops are properly set before power is applied.

Coupling, Alignment, and Mounting - Do not add extra torque! Make certain that the mounting arrangement is sturdy, centered, properly aligned, and that all mounting hardware is secure and properly tightened.

Moisture - Replace the cover tightly and make certain conduit entry holes are sealed properly to prevent moisture infiltration.

Temperature - Excessive temperatures affect duty cycle, actuator performance and the condition of the internal power storage. ESR-Series actuators are designed to operate in environments below 130°F. In applications with high media temperatures, insulating blankets, heat shields, extended mounting shafts or off-set mounting may be used to maintain ambient temperatures at the actuator within normal operating limits.

10.7 WARRANTY

All ESR-Series actuators are backed by a 2 year warranty that covers materials and workmanship.

10.8 TECHNICAL ASSISTANCE, REPLACEMENT PARTS, OPTIONS AND REPAIRS

All replacement parts, plug-in options, accessories, and repair services for ESR-Series actuators are available through a network of qualified Neles Stocking Representatives.

For further technical information or to locate the Neles Stocking Representative closest to you, contact www.neles.com/valvcon.

11. SPECIFICATIONS & TECHNICAL INFORMATION

Table 1 - Specifications

Temperature Range	32°F to 130°F (0°C to 55°C) (without heater and thermostat) -40°F to 130°F (-40°C to 55°C) (with heater and thermostat)
Conduit Connections	(2) 3/4" NPT
Output	150 to 600 in-lbs: ISO 5211 F05 and F07 bolt circles, 3/4" female square (14mm female square w/ "I" Option; 15mm female keyed output w/ "Y" Option).
Voltage	115 VAC: 103.5 to 126.5 VAC, 50 or 60 Hz 230 VAC: 207 to 253 VAC, 50 or 60 Hz
Limit Switches	(2) Single pole, double throw switches rated for 1/3 HP, 11 amps @ 125/230 VAC, CSA certified, used for end of travel control only. Two additional switches may be added as dry contacts for pilot or position indication applications.
Motor	Brushed DC, sub-fractional horsepower
Lubrication	Permanently lubricated gear train and bearings
Gear Train	Hardened steel spur gears
Enclosure	Die cast aluminum
Approximate Weight	17 lbs
Electronic Spring Useful Life	8-10 years (at room temperature 72-80°F. Useful life decreases at higher ambient temperatures.)
Power Loss Position	Field settable fully clockwise or fully counter-clockwise
Brown Out Protection	To avoid actuating during brown-outs, the ESR-Series incorporates a two second delay after sensing a loss of power.

Table 2

Torque (in lbs)	Normal Operating Speed (per 90° rotation in seconds)	Power Loss Speed (90° rotation)	Maximum Charge Monitor Delay (before actuation begins)	Normal Operating Current Draw (in amps)		Duty Cycle*
				115VAC	230VAC	
150	5	10 seconds	1 minute	.2	.1	Continuous*
300	10	15 seconds	2 minute	.2	.1	Continuous*
600	15	20 seconds	3 minute	.2	.1	Continuous*

* Continuous up to 1 hour, after which duty cycle is 80%

DIMENSIONS

ESR-SERIES ENCLOSURE

Mounting Flange, ISO 5211 F05/F07

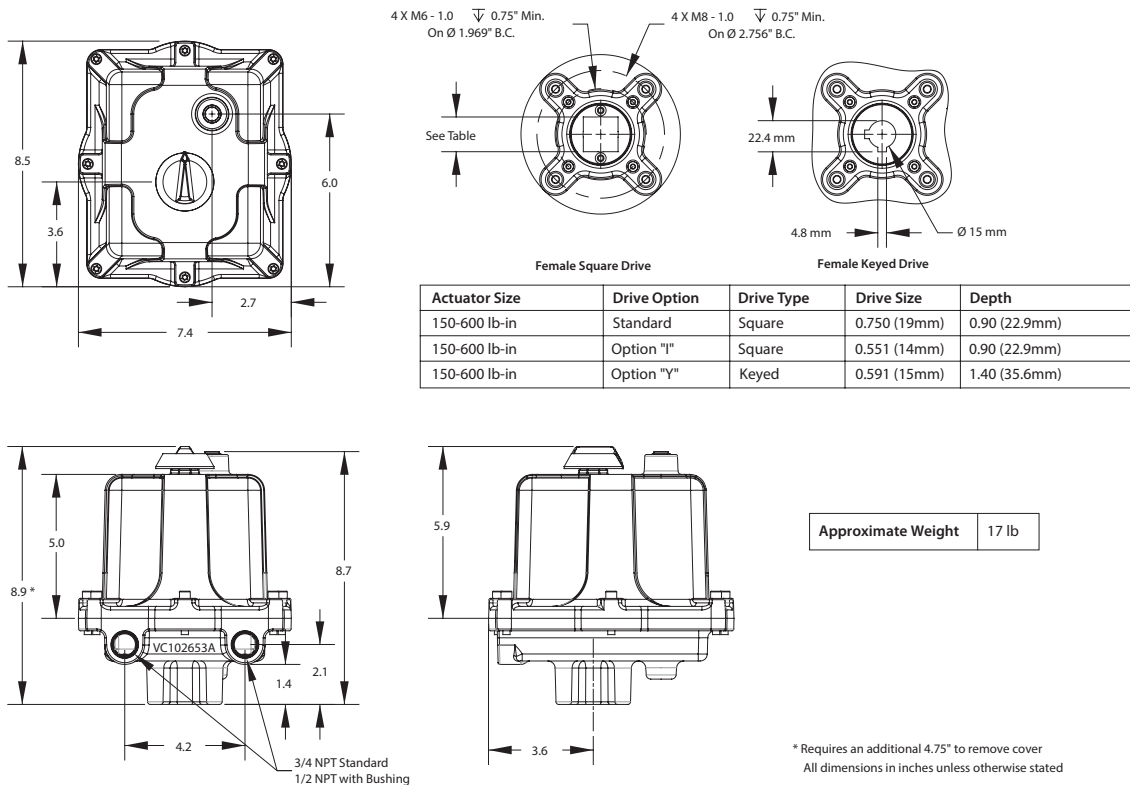


Figure 7

11.1 EXPLODED VIEW

PARTS LIST

- | | |
|-------------------------|-------------------------------|
| 1 - Cover | 11 - Switcher and Power Board |
| 2 - Cover bolts | 12 - Limit switches |
| 3 - Weather seal | 13 - ESR expansion module |
| 4 - Base | 14 - #8-32 nut |
| 5 - Output coupling | 15 - Spacer |
| 6 - Bull gear | 16 - #8-32 Stud |
| 7 - Snap ring | 17 - DC motor |
| 8 - Cam shaft | 18 - Base plate screws |
| 9 - Cams | 19 - Base plate |
| 10 - ESR daughter board | 20 - Pinion gear |

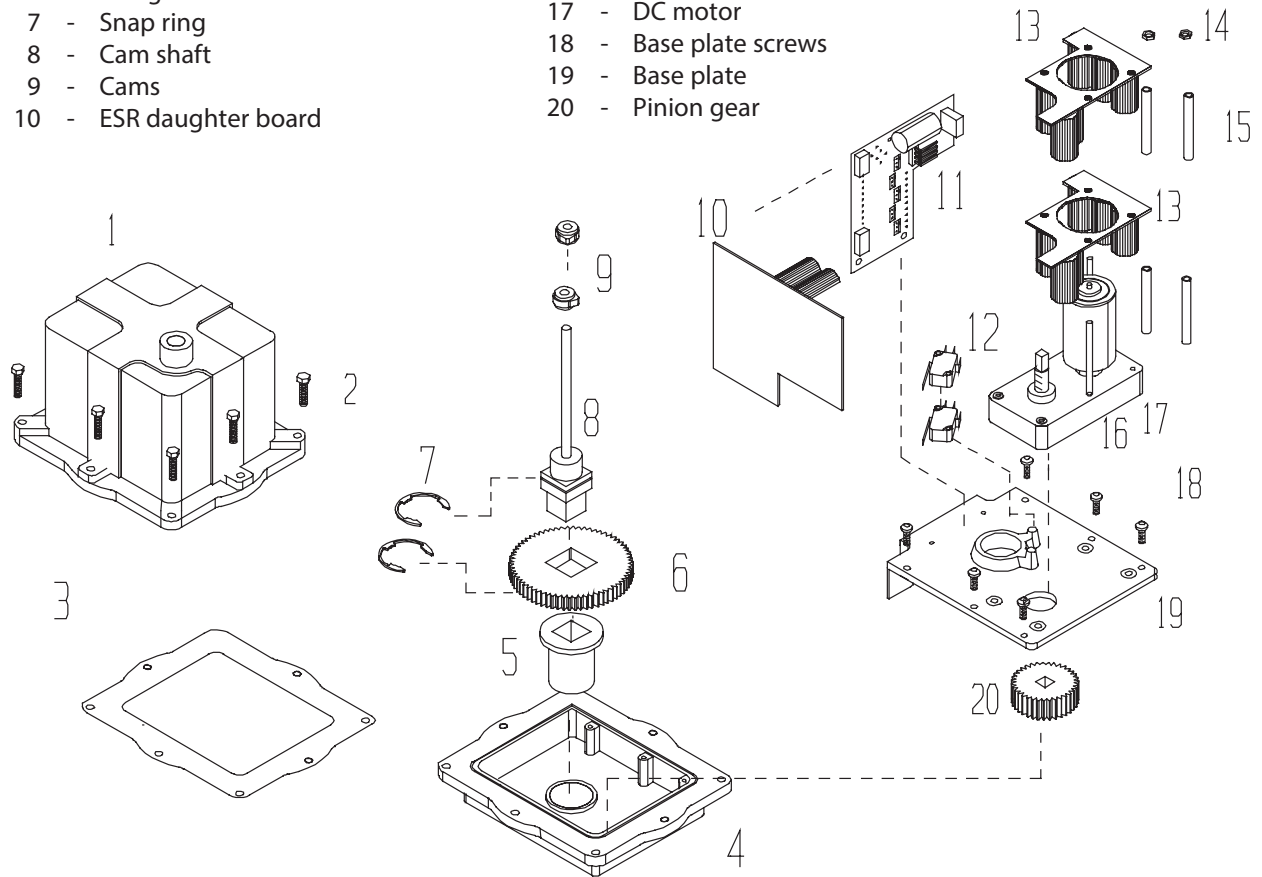


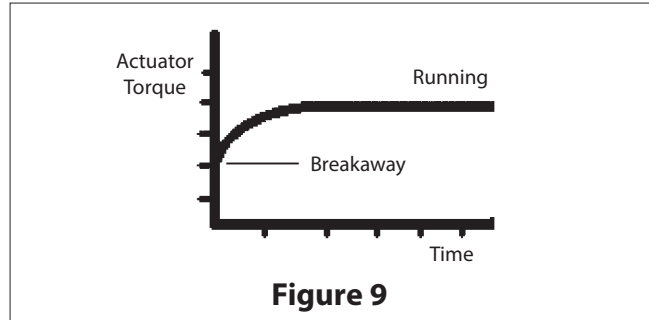
Figure 8 Parts Identification (Small Weatherproof Enclosure)

11.2 ENCLOSURE

- **Enclosure “W”** (weathertight) is designed to meet specifications for NEMA 4/4X for weathertight and dusttight, environments. It is intended for non-hazardous locations in indoor or outdoor use and provides a degree of protection against corrosion, windblown dust and rain, splashing water, hose-directed water, and damage from external ice formation. It is not designed to be submersible.
- **Enclosure “WX”** (explosionproof & weathertight) is designed to meet specifications for NEMA 7&9, explosionproof environments as well as to meet NEMA 4/4X specifications. Explosionproof means that an internal explosion will be contained, with no sparking that could ignite external atmospheric gases. The enclosure is rated for the following environments:
 - NEMA Class I, Division 1, Group C (Ethyl-ether vapors, ethylene or cyclopropane)
 - NEMA Class I, Division 1, Group D (Gasoline, hexane, naptha, benzene, butane, propane, alcohol, acetone, benzol, lacquer, solvent, vapors or natural gas)
 - NEMA Class II, Division 1, Group E (Metal dust, including aluminum, magnesium, their commercial alloys, and other metals of similarly hazardous characteristics)
 - NEMA Class II, Division 1, Group F (Carbon black, coal or coke dust)
 - NEMA Class II, Division 1, Group G (Flour, starch or grain dust)
 - NEMA Class III

(For enclosure specifications and dimensions see Table 1 & 2 and Figure 7).

- **Torque = Breakaway Torque** Valvcon actuators are rated at breakaway torque; the amount of torque the actuator will provide from a fully loaded stop upon immediate power-up. With running momentum and inertia, the amount of torque supplied by the actuator at full speed (running torque) or upon entering a stall condition (stall torque) always exceeds the minimum rated breakaway torque. Since valves require most torque at breakaway, only breakaway torque should be considered when sizing actuators.



12. ADDITIONAL ACTUATOR PRODUCTS AND ACCESSORIES FROM NELES

V-Series

- Up to 3000 inch pounds for On/Off, Modulating or Automatic Cycling applications
- 75% Duty Cycle
- 115VAC and 230VAC voltages
- NEMA 4/4X and NEMA 4/4X/7&9 enclosures
- CSA Certified (Canadian & U.S. Standards)
- Options include Modulating Control Board, Speed Control/TimerBoard, Iso/Readback Board, extra limit switches, heater/thermostats, motor brake, feedback potentiometer and handwheel override

ADC-Series

- Up to 3000 inch pounds for On/Off or Modulating applications
- Optional Internal Battery Back-Up
- Continuous Duty Cycle
- 115VAC, 230VAC, 24VAC, 12VDC and 24VDC voltages
- Options include extra limit switches, heater/thermostats and handwheel override

QX-Series

- Up to 3000 inch pounds for On/Off applications
- Economical NEMA 4/4X/7&9 solution
- 12VDC & 24VDC voltages
- 80% Duty Cycle
- CSA (C US) Certification

LC Series

- Up to 600 inch pounds
- Economical actuators for Reversing or Unidirectional applications
- 25% duty cycle
- NEMA 4/4X enclosures
- 115VAC, 230VAC, 24VAC, 12 VDC and 24VDC voltages
- Options include extra limit switches and heater/thermostats
- Male output (standard) or female output (optional)

I-Series Network Capable

- Modbus®
- AS-Interface
- DeviceNet™
- Foundation Fieldbus
- Other fieldbus protocols (consult factory)

Q6-Series for Remote Solar Applications

- 600 inch pounds
- 12VDC
- Low current draw

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