TorqPlus™
Electric Valve Actuators and Controls
Introduction
For more than 40 years, Bettis Corporation has been recognized worldwide for providing industry with high performance pneumatic and hydraulic valve actuators. The addition of the Bettis line of TorqPlus electric actuators carries on the tradition of product quality, innovation and service reliability.

Bettis TorqPlus actuators are specifically designed for quarter-turn operating applications — ball, butterfly and plug valves; dampers; vents and similar uses. TorqPlus actuators are available in a wide range of output torques and operating speeds to fit your specific requirements.

The Bettis Engineered Solution
Most electric actuators in use today are designed to meet a range of torque and speed requirements for use in industrial applications. Controls and optional accessories are often available, added at the factory while being assembled. Heretofore, not much attention has been given to field upgrades, inventory modifications or parts replacement during servicing.

The Bettis TorqPlus actuators, instead, provide its users with a unique modular approach. The actuators are manufactured with pre-tapped holes in the base plate to accommodate a myriad of control and accessory components, available in more than 200 easy-to-install kits to fit virtually every requirement imaginable. Kits are available, depending on the actuator model, to add:

- Heaters and thermostats
- Potentiometers
- Servo controls
- Motor brakes
- Positioners and transmitters
- Control stations
- Multi-turn operation
- PLC interface

All of the components can be added inside the CSA type 4/4x weatherproof housing or the CSA type 4/4x, 7 and 9 weatherproof/explosion proof housings.

Advantages
The Bettis TorqPlus, and the modular concept, offers its users significant advantages:

- **Compact Design** – The actuators provide maximum torque output relative to its small design housing.
- **Custom Control Standards** – By offering an almost endless number of control and accessory combinations, Bettis electric actuators can effectively be designed to virtually any end use.
- **Modular Construction** – The modular design allows the actuators to be easily field modified and serviced. Accessory kits can be stored for future use without consuming a large amount of storage space.
- **High Strength Gearing** – We precision-machine our gears from hardened alloy steel, and run in needle bearings. The result is efficiency, smooth energy transfer, quiet operation and, best of all, long service life.
- **Low Maintenance** – Permanent lubrication reduces the need for scheduled maintenance. The actuators are supplied with low temperature lubricant, allowing the units to perform in temperatures to -40°F (-40°C). All operational parts are fully enclosed in the housing eliminating all contact with the environment.
- **Guaranteed Torques** – As with other Bettis actuators, we guarantee our published output torque values. If any Bettis TorqPlus actuator fails to meet its specified torque output under normal use, we will replace it.
- **Duty Cycle** – All Bettis actuators are rated for a duty cycle of at least 30% (one motor-on period followed by two motor-off periods). Higher duty cycles (up to 100%), which can allow for up to 1200 starts per hour, at normal ambient temperatures are available.
The following information may be used as a guide to compose specifications for Bettis TorqPlus Electric Actuators. Bettis supplies Electric Actuators that meet or exceed all of the specifications stated below except the Model EM-100 (which is not equipped with a manual override feature or dual conduit entrances).

1. General
The actuator shall consist of a sand cast CSA* Certified enclosure complete with an internal high-torque reversible electric motor, terminal block, heat-treated alloy steel gearing, a minimum of two (2) 1/2" NPT conduit connections and a two (2) year original manufacturer’s warranty.

2. Actuator Sizing
All actuator torques must be published and must be guaranteed, by the original manufacturer, as minimum values.

3. Ambient Temperature Range
The actuator shall be suitable for normal operation in ambient temperatures ranging from -40 to +140 °F (-40 to +60°C). For temperatures below 32°F (0°C), high-humidity environments or all outdoor applications the actuator shall be supplied with an electric heater and thermostat.

4. Electric Motors
The actuator motor shall be of the reversible, high-torque, open frame ventilated design with built-in automatic resetting thermal overload protection, a minimum 30% duty cycle rating and be UL* and CSA* Certified Motors of 1/4 hp or less with not more than 7 amps of locked rotor current draw. When single phase motors are selected, they shall be supplied as a permanent split capacitor type operating from a 1Ph/60Hz/115VAC supply.

5. Reduction Gearing
The actuator shall use exclusively cut alloy gearing. All power gearing shall be grease lubricated for long life.

6. Limit Switches
All limit switches shall be independently operated by adjustable cams in each direction of operation. Provisions shall be made for up to six (6) additional cam operated switches, each being capable of operation at any point of travel.

7. Torque Limit Switches
All actuators of 2,000 lb-in (226 Nm) output torque or greater, shall be supplied with two (2) mechanical torque limiting switches which shall be responsive to maximum torque encountered in both directions of travel.

8. Manual Override
Transfer to manual operation from motor operation shall not require the use of hand levers, solenoid shifters or handwheel depression and the transfer shall be positive and reliable.

Actuators of less than 1700 lb-in, except for the model 100, shall be supplied with a disengageable manual override mechanism. Disengagement of the motor drive shall permit the use of a wrench on the output shaft flats and shall by-pass the power gear drive and motor for manual operation.

Actuators of 2,000 lb-in (226 Nm) or greater output torque shall be supplied with a handwheel which will not rotate during motor operation, but must be operational at all times without danger of injury to operator. The handwheel shall not require more than 50 lbs. of rim force to operate under the most adverse conditions and be capable of assisting or opposing the motor without any form of declutching.

9. Enclosure
The actuator enclosure shall be a high-strength sand casting and must be certified by CSA*, or equal third party tester, as acceptable for use in the following locations:

9.1 Non-hazardous indoor or outdoor location to protect against wind-blown dust and rain, splashing water and hose-directed water (i.e. CSA Enclosure 4 – Weatherproof, conforms to IP-65).

9.2 Hazardous locations classified as Class I and II, Groups C, D, E, F and G as defined in the National Electrical Code plus non-hazardous locations to protect against wind-blown dust and rain, splashing water and hose-directed water (i.e. CSA Enclosure 4 and 7 – Explosion-proof and Weatherproof).  

*CSA is Canadian Standards Associations, Rexdale Ontario, Canada M9W 1R3
*UL is Underwriters Laboratories, Inc., Northbrook, IL 60062
*NEMA is National Electrical Manufacturers Association, Washington, D.C. 20037
These very rugged and versatile electric actuators take full benefit of precision-machining which allows every model to provide maximum torque output relative to its compact design configuration and contains a minimum of parts to reduce vibration, lessen noise and resist harsh service. Utilizing a combination of spur, worm and planetary power gearing reduction systems, the Bettis TorqPlus actuators incorporate the most efficient, powerful and appropriate drive design for service excellence.

1. **Motors.** Available in Single Phase, 3 Phase and DC voltages, all motors are custom built for high-torque, low current draw and the highest duty cycle ratings offered. Single phase motors are capacitor run type and three phase are squirrel cage induction type both having integral self resetting thermal cut-outs.

2. **Brakes.** Offered for all AC and DC motors, they are capable of a holding force equal to the output torque ratings of each actuator model.

3. **Heater and Thermostat.** Securely mounted and appropriately sized to insure ample protection even in the worst environments (not visible in photo).

4. **Terminal Strips.** Standard in all models and allow easy plus efficient actuator installation.

5. **Capacitors.** Used on all single phase AC units, each capacitor is peak voltage rated and of improved design for maximum service life.

6. **Potentiometers.** Precision mechanically linked to actuator output drive for continuous position signaling.

7. **Position Indicator.** Mechanically driven and easily viewed at top of actuator to insure or confirm actual actuator and driven device position at all times (not available on compact Model EM-100).

8. **Dual Conduit Connections.** Standard on all models, except EM-100, allows full electrical code access of all wiring through two NPT connections.

9. **Torque Limit Switches.** Standard for the high-torque 800-Series of Bettis TorqPlus actuators. These mechanical switches eliminate potential driven device damage due to over torque conditions in either direction of operation.

10. **Manual Override.** Standard in all models except the EM-100, manual override capability is offered in two forms; Declutchable and Direct Acting.
**Model EM-300 and the complete 500-Series** offer a Declutchable design which disengages the power gear drive from the output shaft. Manual operation is accomplished by rotating the exposed output shaft drive flats with an open end wrench after the position indicator knob is pulled up. Return to full automatic operation is as easy as removing the wrench and lowering the position indicator knob to allow the mechanism to re-engage upon application of power. Should power be applied during manual operation, the declutchable design will not allow the output shaft to rotate.

**The 800-Series** offers a Direct Acting handwheel design which allows completely safe operation at any time and with never more than 50 pounds of rim pull force. Operating independent of the motor but directly into the power gear drive, the handwheel does not rotate during automatic operation of the actuator, requires no engagement action for manual operation and may be rotated with or without power to the unit.

**11. Enclosures.** Made from high strength sand castings, enclosures are rated for applications in both Non-hazardous and Hazardous locations. As an option, the Bettis TorqPlus is also available with a CSA Certified combination Hazardous and Non-hazardous enclosure for indoor and outdoor protection in locations classified Class I and II, Groups C, D, E, F and G as defined in the National Electrical Code plus protects against wind-blown dust, wind-blown rain, splashing water and hose-directed water.

**12. Output Drives** are corrosion resistant. Female drives are available in a variety of DIN/ISO 8-point sizes. Male drives are also available on models 300 and 500. The EM-800 series is provided with bored drive sleeve with double keyways.

**13. Powder Coat Finish.** A polyester external coating developed to serve as both a high durability impact and chemical resistant finish. With up to 160 lb-in ASTM D2794 impact resistance, over 1000 hours ASTM B117 salt spray rating and 1000+ hours ASTM D2247 humidity resistance, this protective finish will stay in place and do the job.
TorqPlus™ Electric Actuators

**MODEL EM-100**

*Torque 100 IN/LB – 350 IN/LB*

**The Engineered Solution**

Bettis TorqPlus quality line of electric actuators are designed for quarter turn applications — ball, butterfly and plug valves; dampers; vents and similar uses. TorqPlus actuators are manufactured in a wide range of guaranteed output torques and operating speeds to fit your specific requirements.

The Model EM-100 actuators offer compactness with a rugged design to develop maximum torque in a small package.

- Single phase capacitor run motor with thermal overload protection and internal motor brake for 250 in/lb and 350 in/lb models
- Enclosure certified to weatherproof C.S.A. specifications that conform to Nema type 1, 2, 3, 3R, 4, 4X, & 12
- Two single pole double throw travel-stop limit switches with adjustable cams
- Female DIN/ISO output drive sleeve and DIN/ISO bolt pattern
- Operational in any mounting orientation
- Weight: 5 lbs
- Single 1/2-inch NPT conduit entrance

**STANDARD FEATURES**

- Two year warranty
- Permanently lubricated gear train
- Stainless steel output drive sleeve
- Operating temperatures:
  - -40°F with heater activated, to +140° F
- Unidirectional motor with thermal overload protection and mechanical brake for 100 in/lb model

**OPTIONAL FEATURES**

- Maximum of two additional single pole double throw auxiliary limit switches
- Heater and thermostat
- Canadian Standards Association general purpose for electrical certification available under file #LR90062
- Standard 1KΩ potentiometer. Other ranges provided upon request.
- Relay control
- Electronic proportional positioner for 4-20 mA, 1-5 VDC, or 0-10 VDC control input and 4-20mA output signal
- Optional voltages
  - 230 VAC 50/60 Hz single phase
  - 12/24 VDC
  - 24 VAC
**TorqPlus™ Electric Actuators**

**MODEL EM-100**

**Torque 100 IN/LB – 350 IN/LB**

![Image of TorqPlus™ Electric Actuator](image)

**Female DIN-ISO Mounting**

**MODEL EM-100 SERIES**

<table>
<thead>
<tr>
<th>TORQUE</th>
<th>SPEED 90°</th>
<th>LOCKED ROTOR AMP</th>
<th>MOTOR DUTY CYCLE @ 75°F AC</th>
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</thead>
<tbody>
<tr>
<td>IN/LB</td>
<td>NM</td>
<td>115VAC 220VAC 12VDC 24VDC</td>
<td>DC</td>
<td></td>
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<tr>
<td>100</td>
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<td>250</td>
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<tr>
<td>350</td>
<td>39</td>
<td>13 SEC 0.70 CF* N/A N/A</td>
<td>30% N/A</td>
<td></td>
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</table>

* Consult factory for 230VAC locked rotor current.

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**Bettis Electric**

2500 Park Avenue West
Mansfield, OH 44906 U.S.A.
T 419-529-4296
F 419-529-4484
Website: www.EmersonProcess.com/Bettis
E-Mail: Info.Bettis.Electric@EmersonProcess.com

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*Bulletin #85.10*
Torque 150 IN/LB – 600 IN/LB

The Engineered Solution

Bettis TorqPlus quality line of electric actuators are designed for quarter turn applications — ball, butterfly and plug valves; dampers; vents and similar uses. TorqPlus actuators are manufactured in a wide range of guaranteed output torques and operating speeds to fit your specific requirements.

The Model EM-300 actuators combine compactness with manual override capability and an extensive array of available options for a broad spectrum of applications.

STANDARD FEATURES

- Two year warranty
- Heater and thermostat installed in all actuators
- Case hardened steel spur gear train is permanently lubricated
- Hardened steel drive shaft
- Female DIN/ISO F04 output drive and bolt pattern or male output drive

OPTIONAL FEATURES

- 75% or 100% extended duty cycle motors
- Electromechanical brake for 15 second and 30 second units
- Standard 1KΩ potentiometer. Other ranges provided upon request.
- Relay control
- Electronic proportional positioner for 4-20 mA, 1-5 VDC, or 0-10 VDC control input and 4-20mA output signal
- Optional voltages
  - 230 VAC 50/60 Hz single phase
  - 12/24 VDC
  - 24 VAC
- Maximum of four additional auxiliary single pole double throw auxiliary limit switches with adjustable cams.
- Handwheel
- Canadian Standards Association general purpose for electrical certification available under file #LR90062
- Dual purpose weatherproof and explosion-proof enclosures are certified by Canadian Standards Association for services: Class I Groups C,D, Division I; Class II Groups E,F,G Division I that conform to NEMA type 7 and 9

- Operating temperatures:
  - -40° F with standard heater activated to +140° F
- Single phase capacitor run motor with thermal overload protection
- Internal motor brake on 4 and 10 second units
- Enclosure certified to weatherproof C.S.A. specifications that conform to NEMA type 1, 2, 3, 3R, 4, 4X & 12
- Two single pole double throw travel-stop limit switches with adjustable cams
- Declutchable manual override with position indicator
- Dual 1/2-inch NPT conduit entrance
- Operational in any mounting orientation.
- Weight: 11 to 12 lbs
TorqPlus™ Electric Actuators

Torque 150 IN/LB – 600 IN/LB

MODEL EM-300

TorqPlus™ Electric Actuators

MODEL EM-300 SERIES

Torque 150 IN/LB – 600 IN/LB

Position Indicator
Output Drive shaft
Motor and Brake
O-Ring Seal
Capacitor
Terminal Strip
Dual Conduit Connection
Travel-Stop Limit Switches

<table>
<thead>
<tr>
<th>TORQUE IN/LB</th>
<th>SPEED 90° NM</th>
<th>MODEL</th>
<th>LOCKED ROTOR AMP (115VAC</th>
<th>230VAC</th>
<th>12VDC</th>
<th>24VDC</th>
<th>MOTOR DUTY CYCLE @ 75°F AC</th>
<th>DC</th>
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<td>17</td>
<td>4 SEC</td>
<td>300-04</td>
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<td>19.2</td>
<td>8.8</td>
<td>**30% 100%</td>
</tr>
<tr>
<td>300</td>
<td>34</td>
<td>10 SEC</td>
<td>300-10</td>
<td>0.57 *</td>
<td>0.29</td>
<td>19.2</td>
<td>8.8</td>
<td>**30% 100%</td>
</tr>
<tr>
<td>400</td>
<td>45</td>
<td>15 SEC</td>
<td>300-15</td>
<td>0.56 *</td>
<td>0.25</td>
<td>19.2</td>
<td>8.8</td>
<td>**30% 100%</td>
</tr>
<tr>
<td>600</td>
<td>68</td>
<td>30 SEC</td>
<td>300-30</td>
<td>0.56 *</td>
<td>0.25</td>
<td>19.2</td>
<td>8.8</td>
<td>**30% 100%</td>
</tr>
</tbody>
</table>

* Locked rotor current for all 75% and 100% duty cycle motors is 0.50 amp

** 75% and 100% duty cycle motors are available for 115 VAC service

Bettis Electric
2500 Park Avenue West
Mansfield, OH 44906 U.S.A.
T 419-529-4296
F 419-529-4484
Website: www.EmersonProcess.com/Bettis
E-Mail: Info.Bettis.Electric@EmersonProcess.com

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TorqPlus™ Electric Actuators

**MODEL EM-500**

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**Torque 350 IN/LB – 1600 IN/LB**

**The Engineered Solution**

Bettis TorqPlus quality line of electric actuators are designed for quarter turn applications — ball, butterfly and plug valves; dampers; vents and similar uses. TorqPlus actuators are manufactured in a wide range of **guaranteed** output torques and operating speeds to fit your specific requirements.

The Model EM-500 Series are designed for the entire mid-range of torques and operating speeds, with a rugged versatility that is hard to beat.

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**STANDARD FEATURES**

- Two year warranty
- Heater and thermostat installed in all actuators
- Hardened steel spur gear train is permanently lubricated
- Hardened steel drive shaft
- Female DIN/ISO F07 output drive and F07/F10 bolt pattern or male output drive

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**OPTIONAL FEATURES**

- Electromechanical brake
- Standard 1KΩ potentiometer, other ranges provided upon request
- Electronic proportional positioner for 4-20mA, 1-5 VDC, or 0-10 VDC control input, and 4-20mA output signal
- Relay control
- Optional voltages: 220 VAC 50/60 Hz single phase, 12/24 VDC, 24 VAC
- Maximum of four additional single pole double throw auxiliary limit switches with adjustable cams
- Handwheel
- Dual purpose weatherproof and explosion-proof enclosures are certified by Canadian Standards Association for services: Class I Groups C,D, Division I; Class II Groups E,F,G Division I that conform to NEMA type 7 and 9
- Canadian Standards Association general purpose for electrical certification available under file #LR90062

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**Operating temperatures:**
- -40°F with standard heater activated, to +140°F
- Single phase capacitor run motor with thermal overload protection
- Enclosure certified to weatherproof C.S.A. specifications that conform to NEMA type 1, 2, 3, 3R, 4, 4X and 12
- Declutchable manual override with position indicator
- Dual 1/2-inch NPT machined conduit entrances
- Captive hex bolts on enclosure
- Operational in any mounting orientation
- Two single pole double throw end of travel stop limit switches with adjustable cams
- Weight: 17 to 18 lbs
Torque 350 IN/LB – 1600 IN/LB

**MODEL EM-500 SERIES**

<table>
<thead>
<tr>
<th>TORQUE IN/LB</th>
<th>SPEED 90°</th>
<th>MODEL</th>
<th>LOCKED ROTOR AMP 115VAC</th>
<th>230VAC</th>
<th>12VDC</th>
<th>24VDC</th>
<th>MOTOR DUTY CYCLE @ 75°F AC</th>
<th>DC</th>
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<tr>
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<td>39</td>
<td>5 SEC</td>
<td>500-05</td>
<td>0.69</td>
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<tr>
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<td>79</td>
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<td>500-10</td>
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<td>0.36</td>
<td>8.4</td>
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<td>100%</td>
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<td>15 SEC</td>
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<td>8.4</td>
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<td>5 SEC</td>
<td>510-05</td>
<td>1.57</td>
<td>0.80</td>
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<td>18.4</td>
<td>100%</td>
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<tr>
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<td>7 SEC</td>
<td>510-07</td>
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<td>18.4</td>
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<td>180</td>
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<td>520-05</td>
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<td>19.2</td>
<td>8.8</td>
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<td>51</td>
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*Heater and Thermostat not shown.*
Torque 2,000 IN/LB – 20,000 IN/LB

The Engineered Solution

Bettis TorqPlus quality line of electric actuators are designed for quarter turn applications — ball, butterfly and plug valves; dampers; vents and similar uses. TorqPlus actuators are manufactured in a wide range of guaranteed output torques and operating speeds to fit your specific requirements.

The EM-800 Series utilizes a highly effective planetary gearing system and a handwheel manual override to produce maximum torques in a compact package.

STANDARD FEATURES

- Two year warranty
- Heater and thermostat installed in all actuators
- Case hardened steel spur gear train is permanently lubricated
- Operating temperatures:
  - -40° F with standard heater activated, to +140° F
- Single phase capacitor run motor with thermal overload protection
- Enclosure certified to weatherproof C.S.A. specifications that conform to NEMA type 1, 2, 3, 3R, 4 and 12
- Handwheel manual operation
- Mechanical position indicator
- Captive hex bolts on enclosure
- Dual 3/4-inch NPT machined conduit entrances
- Two single pole double throw travel-stop limit switches with adjustable cams and 2 aux S.P.D.T.
- Female drive
- Weight: 65-70 lbs (type 4), 150-160 lbs (explosion-proof)
- Two mechanical torque limit switches

OPTIONAL FEATURES

- Dual purpose weatherproof and explosion-proof enclosures are certified by Canadian Standards Association for services: Class I Groups C,D, Division I; Class II Groups E,F,G Division I that conform to NEMA type 7 and 9
- Standard 1K potentiometer, other ranges provided upon request
- Electronic proportional positioner for 4-20 mA, 1-5 vDC, or 0-10 vDC control input and 4-20mA output signal
- Optional voltages
  - 220 VAC 50/60 Hz single phase
  - 220 VAC 50/60 Hz 3 phase
- Relay control
- Maximum of four additional single pole double throw auxiliary limit switches with adjustable cams
- Electromechanical brake
- Canadian Standards Association general purpose for electrical certification available under file #LR90062
**MODEL EM-800 SERIES**

<table>
<thead>
<tr>
<th>TORQUE</th>
<th>SPEED</th>
<th>MODEL</th>
<th>LOCKED ROTOR AMP</th>
<th>MOTOR DUTY</th>
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<tr>
<td>IN/LB</td>
<td>NM</td>
<td>90°</td>
<td>115VAC</td>
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<tr>
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<td>226</td>
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<td>72 SEC</td>
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The Engineered Solution

Bettis TorqPlus has taken the lead in offering compact, cost effective Spring Return Electric Actuator Packages. Three models offer a variety of solutions when one needs to protect a system upon loss of power. These actuators have been designed for dampers, small butterfly, ball and plug valves.

The Model EM-SR5 Series is designed for use in environments where automatic closing/opening is required upon loss of power, with a rugged versatility that is hard to beat.

When power is available, the device operates like a normal quarter turn, open/close or modulating actuator. Under powered operation, the spring pack travels with the movement of the actuator. Under powered stopped conditions, the actuator and spring are held in position via the electric mechanical brake. Upon loss of power, the spring is released and drives the actuator to the predesignated failsafe position. The failsafe positioning can be provided for either the CCW limit or to the CW limit.

STANDARD FEATURES

- Two year warranty
- Heater and thermostat
- Case hardened steel spur gear train is permanently lubricated
- Operating temperatures:
  - -40°F, with standard heater activated, to +140°F
- Thermally protected permanent split capacitor motor
- Electromechanical brake
- CW or CCW spring return
- Dual 1/2-inch NPT conduit entrances
- Captive hex bolts on enclosure
- Operational in any mounting orientation
- Limit switches with independent end of travel cams
- Male output drive on all models or female DIN/ISO F04 or F05 output drive on 10, 15 and 30 second models
- Adjustable mechanical stop at the fail safe position
- Visual position indicator
- Enclosure certified to weatherproof C.S.A. specifications that conform to NEMA type 1, 2, 3, 3R, 4, 4X and 12

OPTIONAL FEATURES

- Modulating service (separate enclosure)
- Standard 1KΩ potentiometer, other ranges provided upon request
- Optional 220 VAC 50/60 Hz motor
- Up to four auxiliary switches with adjustable cams
- Canadian Standard Association general purpose for electrical certification available under file #LR90062
- Dual purpose weatherproof and explosion-proof enclosures are certified by Canadian Standards Association for services: Class I Groups C,D, Division I; Class II Groups E,F,G Division I that conform to NEMA type 7 and 9

<table>
<thead>
<tr>
<th>MODEL EM-SR5 SERIES</th>
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<tr>
<td><strong>Model</strong></td>
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TorqPlus™ Electric Actuators

MODEL EM-SR5

Torque 300 IN/LB – 1,400 IN/LB

EM-SR5-90 with Gear Reduction Box


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F05 MOUNTING WITH

F04 MOUNTING WITH

F03 MOUNTING WITH

#8-32 PHIL.
1/2-14 NPT

.713 ACROSS CORNERS MIN.

.561 X .63 DEEP (TYP.)

1/4-20 TAP - .35 DEEP
(4) HOLES ON 1.97 DIA. BOLT CIRCLE

F05 MOUNTING WITH
F05 DRIVE SLEEVE

1/4-20 TAP - .35 DEEP
(4) HOLES ON 1.97 DIA. BOLT CIRCLE

F03 MOUNTING WITH
F03 DRIVE SLEEVE

#10-24 TAP - .35 DEEP
(4) HOLES ON 1.42 DIA. BOLT CIRCLE

F03 MOUNTING WITH
F03 DRIVE SLEEVE

#10-24 TAP - .35 DEEP
(4) HOLES ON 1.65 DIA. BOLT CIRCLE

F04 MOUNTING WITH
F04 DRIVE SLEEVE

#10-24 TAP - .35 DEEP
(4) HOLES ON 1.65 DIA. BOLT CIRCLE

F04 MOUNTING WITH
F04 DRIVE SLEEVE

5.00 CLEARANCE
FOR COVER REMOVAL

#8-32 PHIL.
PAN HEAD
(6) PLACES

1/2-14 NPT
CONDUIT ENTRY
SUPPLIED WITH
PLUG

.359 X .44 DEEP (TYP.)

.476 ACROSS CORNERS MIN.

.561 X .63 DEEP (TYP.)

.713 ACROSS CORNERS MIN.

.359 X .354

.501

1.002

.713 ACROSS CORNERS MIN.

.561 X .556

.696

1.392

.443 X .438

.554 ACROSS CORNERS MIN.

.169

.585

1.169

1.97

5.1/2

6 3/4
F05 MOUNTING WITH F05 DRIVE SLEEVE
1/4-20 TAP - .35 DEEP
(4) HOLES ON 1.97 DIA. BOLT CIRCLE
X .63 DEEP (TYP.)

F04 MOUNTING WITH F04 DRIVE SLEEVE
#10-24 TAP - .35 DEEP
(4) HOLES ON 1.65 DIA. BOLT CIRCLE
X .51 DEEP (TYP.)

F03 MOUNTING WITH F03 DRIVE SLEEVE
#10-24 TAP - .35 DEEP
(4) HOLES ON 1.42 DIA. BOLT CIRCLE
X .44 DEEP (TYP.)

5.00 CLEARANCE FOR COVER REMOVAL

TALL COVER
SHORT COVER

#8-32 PHIL.
PAN HEAD
(6) PLACES
1/2-14 NPT
CONDUIT ENTRY
SUPPLIED WITH PLUG

.713 ACROSS CORNERS MIN.
.561 X .63 DEEP (TYP.)
1.392
.696

.476 ACROSS CORNERS MIN.
.359 X .44 DEEP (TYP.)
1.002
.501

.554 ACROSS CORNERS MIN.
.443 X .51 DEEP (TYP.)
1.169
.585

501
.359
.354
1/4-20 S.S. CAPTIVE HEX SLOTTED SCREW (8 TOTAL)

6” MIN. CLEARANCE FOR COVER REMOVAL

1/2-14 NPT CONDUIT ENTRY WITH (2) PIPE PLUGS SUPPLIED

OPEN/CLOSE INDICATOR

FLANGE DIMENSIONS WITH MALE OUTPUTS

MODEL EM-500 EM-510 EM-520

Assembly Layout Drawings
1/2-13 TAPPED 3/4
8 Holes on
7.625 Dia. B.C.

2.315 / 2.321 Dia
X 1-3/4 Deep
1/4-20 X .50 TAP
(4) HOLES ON 1.650 DIA. BOLT CIRCLE

2.75 DIA.

FEMALE F04 OUTPUT MOUNTING

F04 OUTPUT ADAPTER
F04 FEMALE OUTPUT DRIVE

1/2 NPT CONDUIT ENTRANCES

SPRING RETURN PACK

1/4-20 X .50 TAP
(4) HOLES ON 1.850 DIA. BOLT CIRCLE

.746 DIA.

5/16-24 X .63 TAP
(4) HOLES ON 2.000 DIA. BOLT CIRCLE

.556 ACROSS CORNERS MIN.

F04 OUTPUT DRIVE VIEW

NOTE:
1) ADD 4.75 TO OVERALL DIMENSION FOR COVER REMOVAL

TorqPlus™ Electric Actuators

MODEL EM-SR5-10
EM-SR5-15

Bettis Electric
2500 Park Avenue West, Mansfield, OH 44906 U.S.A.  T 419-529-4296  F 419-529-4484

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NOTE:
1) ADD 4.75 TO OVERALL DIMENSION FOR COVER REMOVAL
NOTE:
1) ADD 4.75 TO OVERALL FOR COVER REMOVAL
INQUIRIES

Your inquiries for Bettis electric actuators can be processed efficiently when supplied with the information requested on this page. Please use this page as a guide or submittal. If you need assistance, just ask your Bettis sales representative.

**Customer**

Co. ________________________________________________  Job ________________________________________________

St. _________________________________________________  Item ____________ of ____________ Qty. _______________

City __________________________ State _______________  Mark/Tag ___________________________________________

Attn:  _______________________________________________

**Valve Information**

Mfg.: ____________________ Type: ___________________ Size: ____________________ Fig No. __________________

Rotation to CLOSE Position:  □ Clockwise  □ Counterclockwise as viewed from above (Std. is CW)
Maximum Sizing Torque, lb-in: ______________________________________________________________ (Safety factor included)

**Actuator Information**

Application:  
□ Open-Close, 2 position, Service  □ Spring Return
 □ Jogging Multi-position Service  □ Fail CW
 □ Automatic Modulating Service  □ Fail CCW

Ambient Temperature: From ______________________ °F to ______________________ °F (-40°F to +140°F standard)

Nominal Operating Speed: ______________________ seconds per 90° (min-max range)

Motor Voltage: ______________________ Ph/___________ Hz/___________ VAC or VDC ______________________

Control Voltage: 1Ph/ ______________________ Hz/ ______________________ VAC (3-phase motor only)

Motor Duty Cycle:  □ 30%  or  □ 100%

Total Number of Limit Switches: ______________________

Enclosure:
□ Type 4 CSA Certified for: non-hazardous indoor and outdoor locations to protect against wind-blown dust and rain, splashing water and hose-directed water.

□ Type 4 and 7 CSA Certified for: hazardous and non-hazardous indoor and outdoor locations to protect against wind-blown dust and rain, splashing water and hose-directed water plus locations classified as Class I and II, Groups C, D, E, F and G as defined in the National Electrical Code.

**Integral Control Items (as required)**

□ Motor Brake (standard on EM-100 in 1Ph/60Hz/115VAC and all 800-Series with torques of 6,000 lb-in or greater)

□ Multi-Turn Control: Set for: ______________________ output turns (maximum of 30)

□ Heater and Thermostat: 1Ph/____________________ Hz/____________________ VAC

□ Three Position Operation: Set for ______________________ °/____________________ °/____________________ ° Stops

□ Control Relay for:  □ normally clockwise or  □ normally counterclockwise

□ Single Feedback Potentiometer: ______________________ Ohm/4 Watt

□ Electronic Positioner: with  □ 4-20 mA or  □ 0-10v or  □ 1-5v input and set for minimum output at ______________

□ Electronic Position Transmitter: 4-20 mA output set for minimum output at ______________

**Separate Controls (as required)**

□ Manual Operating Station:  □ Type 4  or  □ Type 7 enclosure suitable for: wall mounting or close coupling

□ 1Ph/____________________ Hz/____________________ VAC to include:

□ (______) Position Selector Switch marked __________ / __________ / __________

□ (______) Push Buttons marked __________ / __________ / __________

□ (______) Lights marked and colored __________-_________ / __________-_________ / __________-_________

□ (______) Reversing Starter with 1 Ph/____________________ Hz/____________________ VAC control voltage

□ Other ___________________________________________________________________________________
PRODUCT IDENTIFICATION

All Bettis TorqPlus Electric Actuators are manufactured with a product descriptive nameplate to insure its proper application and continuing identification. The following represents the typical information included on the nameplate and the meaning.

Model: Model – Operating Speed – Enclosure Type – Motor Voltage – Configuration

Torque: Rated Output Torque (lb-in)

Speed Sec 90: Seconds Per 90 Degrees Operation

Voltage: Motor Voltage (Ph/Hz/V)

LR Amps: Locked Rotor Amp Draw

Duty Cycle %: Effective Motor Run Capability

Serial: Individual Unit Serial Number

Mfg MM-YY: Month & Year of Unit Manufacturer

Enclosure: Rated Enclosure Type

DEFINITIONS

A.C. – Alternating current/voltage flowing in both directions alternately.

Amphere (Amp) – The unit of electric current, defined in terms of the force between a pair of wires.

Auxiliary Switch – A switch used to energize or de-energize other equipment (such as lights or pumps). Supplied with its own cam to synchronize other equipment at any point of travel.

Capacitor – A device having the property of storing an electrical charge.

CSA – Canadian Standards Association

D.C. – Direct current/voltage which has a constant value rated to zero. Steady current in one direction.

Duty Cycle – A mathematical calculation, expressed as a percent, to indicate available motor-on (running) time without endangering an over heating condition which would terminate actuator operation.

Using an actuator with a 10 seconds/90° operating speed and rated for a 50% duty cycle as an example, safe, non-interrupting operational periods would be: One 10 second motor-on period followed by one 10 second motor-off period. Total calculation time is 20 seconds of which 50% is motor-on time.

Proper application of the duty cycle rating allows ample time for the motor to dissipate internal heat and thereby not cause a thermal overload cutoff.

Enclosure – The housing that surrounds the actuator’s operating parts. It can either be weatherproof or explosion proof. The enclosure generally protects the electrical equipment from the environment and/or prevents an explosion within the enclosure from causing an external explosion.

Hertz – Unit of frequency. Equal to one cycle per second.

NEMA – Acronym for National Electrical Manufacturers Association.

NEMA 4 – Rating designation for weatherproof enclosures. Pliable gaskets are used on all metal-mating parts to prevent moisture from entering.

NEMA 7 – Rating designation for enclosures suitable for containing internal explosion without rupturing the enclosure and without igniting surrounding gases in the atmosphere. Metal-to-metal sealing is required in these rated products.

Ohm – International unit of electrical resistance. The resistance in ohms between two points is defined by the DC voltage divided by the DC current flowing between the points.

Reversing Starter – Its purpose is to connect, disconnect and reverse electricity to the motor. Also called reversing contractor, reversing controller or integral starter.

Torque Limit Switches – Switches designed to monitor physical variables or operating states and to open circuits in the event of pre-set limits being exceeded.

Volt – Unit of potential difference or electrical potential. It represents the amount of work done per unit charge in moving a charge from one place to another.
Multi-Turn Operation
Option allows for multiple revolution on non-rising stem devices.

Electrical Mechanical Motor Brake
Available for all actuator models. Brakes are employed to eliminate motor run-on and to insure that the actuator and driven device maintain their position. Recommended applications include; all resilient seated valves, valves with high flow rates, all modulating services and any time in which increased position control is needed.

Three Position Control
Typically used for multiported valves, operation can be set for 0°-45°-90° or 0°-90°-180° with a stop at mid position from one extreme or both.

Potentiometers
Mechanically linked to the actuators output to provide a resistance signal proportional to the actuator’s and driven device’s position. Used to give continuous feedback to control panels, modulating position control and other closed loop devices.

Torque/Current Trip Module
(for DC Motors)
- Protects the valve and actuator from excessive torque conditions by comparing the motor current with a factory adjustable trip value.
- Provides dynamic braking, in order to improve positioning accuracy at both mid and end of travel stop points. (Caution: A mechanical brake should also be used in conjunction with the dynamic brake feature, for applications that require the valve to be held in place after stopping.)

Control Latching Relay
- Allows the actuator to run full travel upon receiving a non-maintained control signal, ranging from 0-240VAC or 0-110VDC.

Control Relay
- Provides a means of opening and closing a valve with a variety of standard AC or DC maintained control signals, such as 120 VAC, 24 VAC, 12 or 24 VDC.
- Can be used for a fail close (or open) application upon loss of the control signal. An internal coil (designed to be continuously energized) maintains the open signal to the actuator. When the signal is removed, the coil de-energizes, causing the actuator to close.

Additional Control Options
- Up to 6 SPDT aux. limit switches
- Electronic Transmitters (4-20mA output from a DC transmitter or 4-20mA, 0-10V output from an AC transmitter)
- Dual 1k ohm potentiometers
- Two speed operation (pulse timer package)
- Unidirectional controls (up to 30 rotations)
- Control stations including buttons, lights, selector switches
- 3-phase motor controls
- Three position operation (such as 0-45-90 or 0-90-180 degrees)
- Torque seating for multi-turn and quarter turn
- Torque switch trip indication
Typical Options

Timer packages, control relays, special labeling, LED lights, pad lockable switches, space heaters and Canadian Underwriter Laboratory labels.

Additional options for 3-phase wall-mounted CS’s include starters, control transformers, and overload relays.

Remote Signal Generator

The Remote Signal Generator (RSG) (supplied in a wall-mounted enclosure) produces a 4-20mA output signal, by manually rotating the dial. From a remote location, this output signal can then be used to position or throttle an actuator equipped with an integral modulating board.

The RSG can also be used in conjunction with a closed-coupled “CS” control station.

Control Stations are available in a variety of standard weatherproof wall-mounted and close-coupled configurations using the following 5-digit code system:

CS – 1st 2nd 3rd 4th 5th

1st indicates the number of pushbuttons
2nd indicates the number of lights
3rd indicates the number of positions on the first selector switch (such as Local-Remote)
4th indicates the number of positions on a second selector switch (such as Open-Stop-Close)
5th indicates close-coupled (C) or wall-mount (W)

CS-0223C would indicate 0-button, 2-lights, 2-position selector switch (usually Local-Remote), 3-position selector switch (usually Open-Stop-Close), Close-coupled to the actuator.

Standard configurations include:

CS-0003*  CS-0223*  and CS-3220*
CS-0023*  CS-0203*

(“C” for closed-coupled or “W” for wall-mount)
The Bettis Electric C1397 and C1415 Servo Positioners are proportional motor controllers for actuator modulating applications. The C1397 is for actuators with AC powered split phase motors. The C1415 is for use with 12 or 24VDC powered actuators. These controls are designed to proportionally position an actuator and the driven device by comparison of a varying external input command and a mechanically linked potentiometer. Input commands can be 0-10V, 1-5V, or 4-20mA. The servo also allows for three responses to command signal loss (1-5V and 4-20mA only); fail in place, fail to full clockwise (CW) position, or fail to full counterclockwise (CCW) position.

Features and Benefits

Digital micro-control allows:
- Pushbutton programming - eliminates Span and Zero pots
- 10-bit resolution
- Off-line calibration - eliminates the need for loop calibrators

Available in multiple power supply configurations: AC 120/230V; DC 12/24V

Onboard manual jog buttons

AC controller includes speed control

DC controller includes:
- Torque trip with relay output
- Dynamic braking for accurate stopping

Signal Wiring
**SPECIFICATIONS**

**Power Supply**
- C1397S 115VAC ± 10% 50/60Hz
- C1397D 230VAC ± 10% 50/60Hz
- C1415 12/24VDC Jumper configurable

**Motor Outputs**
C1397  When mounted in accordance with guidelines below, outputs will supply a maximum locked rotor load current (LRA) of 5A with less than 5/10mA (115/230VAC) of leakage current.
C1415  Continuous current 3A; Peak 5A.

**External Fuses**
- C1397  Employ fusing per actuator motor LRA to a maximum of 5A.
- C1415  Employ fusing per actuator motor LRA to a maximum of 5A. Consult factory for additional application details on DC powered units.

**Environmental**
- Operating temperature: +32°F to +158°F (0°C-70°C)
- Storage temperature: -40°F to +185°F (-40°C-85°C)
- Relative humidity: 0 to 90% non-condensing

**Signal Inputs**
All signal inputs are digitized to 10 bits of resolution.

**0-10 VDC Compound Input:** 200kohm input impedance.

**1-5 VDC Command Input:** 100kohm input impedance. Loss of signal threshold is 75% of low signal.

**4-20 mA Command Input:** 250ohm input impedance. Loss of signal threshold is 75% of low signal.

**Feedback Input:** 5 VDC excitation voltage. 1Mohm input impedance. Use with 1000ohm potentiometer.

**4-20mA Output**
300ohm maximum load impedance. 10-bit A/D.

**Function Details**

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**POWER & CONTROL CONNECTIONS**

---

**Control Interface**

---

**Configuration Ports**

---

**DIP Switches**

---

**Diagnostic LED**

---

**Manual CW**

---

**Manual CCW**

---

**Configuration Pots**

---

**Power Connections**

---

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### Performance Data – Open/Close and Modulating Configurations

**Available Torques, Operating Speeds, Motor Duty Cycles, Motor Voltagess and Locked Rotor Amp Draws**

Torque Expression: Inch-Pounds (in-lb) and Newton Meters (Nm).

Speed Expression: Seconds per 90° output rotation.

<table>
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<tr>
<th>Torque Output (in-lb)</th>
<th>Operating Speed (Sec/90°)</th>
<th>Motor Duty Cycle</th>
<th>Model</th>
<th>Locked Rotor Amp Draw</th>
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<tr>
<td>400</td>
<td>45</td>
<td>15</td>
<td>EM-SR5</td>
<td>100%</td>
</tr>
<tr>
<td>600</td>
<td>68</td>
<td>30</td>
<td>EM-SR5</td>
<td>100%</td>
</tr>
<tr>
<td>1,600</td>
<td>181</td>
<td>90</td>
<td>EM-SR5</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Notes:**
1. Operating speed is nominal at rated torques. Final operating speed may vary depending on actual service.
2. Actuators with 12VDC motors will have an operating speed of approximately 40% longer (slower) than that shown.
3. CF – Consult Factory
4. Bettis does not recommend the use of any actuator for any modulating application with an operating speed of 10 seconds or less.
# TorqPlus™ Product Matrix

<table>
<thead>
<tr>
<th>Feature</th>
<th>Model EM050</th>
<th>Model EM100</th>
<th>Model EM300</th>
<th>EM-500 Series</th>
<th>EM-800 Series</th>
<th>SRS Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Torque Range</td>
<td>n-lb</td>
<td>100 to 350</td>
<td>150 to 600</td>
<td>180 to 1,600</td>
<td>2,000 to 20,000</td>
<td>300 to 1,600</td>
</tr>
<tr>
<td></td>
<td>Nm</td>
<td>11</td>
<td>17 to 68</td>
<td>20 to 181</td>
<td>226 to 2,260</td>
<td>34 to 181</td>
</tr>
<tr>
<td>Operating Speeds (60Hz) Sec/90°</td>
<td>2 to 13</td>
<td>4 to 30</td>
<td>2 to 30</td>
<td>12 to 72</td>
<td>10 to 90</td>
<td></td>
</tr>
<tr>
<td>220VAC / 1 Ph /50-60Hz Motor Voltage</td>
<td>N.A.</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>12 or 24VDC Motor Voltage</td>
<td>N.A.</td>
<td>Optional</td>
<td>Optional</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>CSA Certified Enclosure 4&amp;7 (NEMA 4&amp;7) Note 4</td>
<td>N.A.</td>
<td>N.A.</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>CSA General Purpose Electrical Specification Note 3</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>Reversible Operation, Adjustable</td>
<td>0 – 180°</td>
<td>0 – 180°</td>
<td>0 – 180°</td>
<td>0 – 180°</td>
<td>0 – 90°</td>
<td></td>
</tr>
<tr>
<td>Multi-Turn Output Control</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>Optional</td>
<td>Optional</td>
<td>N.A.</td>
</tr>
<tr>
<td>(−40°F to +140°F (−40°C to +60°C)</td>
<td>Standard</td>
<td>Standard</td>
<td>Standard</td>
<td>Standard</td>
<td>Standard</td>
<td>Standard</td>
</tr>
<tr>
<td>Standard Manual Override Type</td>
<td>Direct</td>
<td>N.A.</td>
<td>Declutching</td>
<td>Declutching</td>
<td>Direct HW</td>
<td>N.A.</td>
</tr>
<tr>
<td>Standard Number of SPDT Switches</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Number of Optional SPDT Switches Note 1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dual Torque Limit Switches</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>Standard Conduit Entry, Number &amp; NPT Size</td>
<td>(1) 1/2&quot;</td>
<td>(1) 1/2&quot;</td>
<td>(2) 1/2&quot;</td>
<td>1/2&quot;</td>
<td>3/4&quot;</td>
<td>(2) 1/2&quot;</td>
</tr>
<tr>
<td>Standard Output Drive Configuration</td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>DIN/ISO</td>
<td>DIN/ISO</td>
<td>DIN/ISO or Male</td>
<td>DIN/ISO or Male</td>
<td>Bore &amp; Key</td>
<td>DIN/ISO or Male</td>
</tr>
<tr>
<td>Motor Brake</td>
<td>Standard</td>
<td>Standard</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>Note 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Brake</td>
<td></td>
<td></td>
<td>Optional for 15 &amp; 30 sec</td>
<td>Optional</td>
<td>6000 in-lb and above – std.</td>
<td>All others optional</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Standard for 4 &amp; 10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potentiometer 1k Ohm - 1/2%</td>
<td>N.A.</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>Electronic Proportional Positioner and/or</td>
<td>N.A.</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>Electronic Position Transmitter</td>
<td>N.A.</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
</tr>
</tbody>
</table>

(1) When actuator is to be supplied with potentiometer, reduce number of available optional switches by two (2) except for 100 series.
(2) Brake is part of motor rotor
(3) Actuators were subjected to an endurance test of 6000 complete cycles at maximum rated torque.
(4) Hazardous locations classified as Class I and II Groups C, D, E, F and G.

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Important: Due to Emerson's continuing commitment to engineered product advancement, data presented herein is subject to change. Certified dimensional drawings and wiring diagrams are available on request. Consult factory with model designation and serial number.

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