

Bray *SERIES 70*

TUNNEL DAMPER MODEL ELECTRIC ACTUATOR
OPERATION AND MAINTENANCE MANUAL

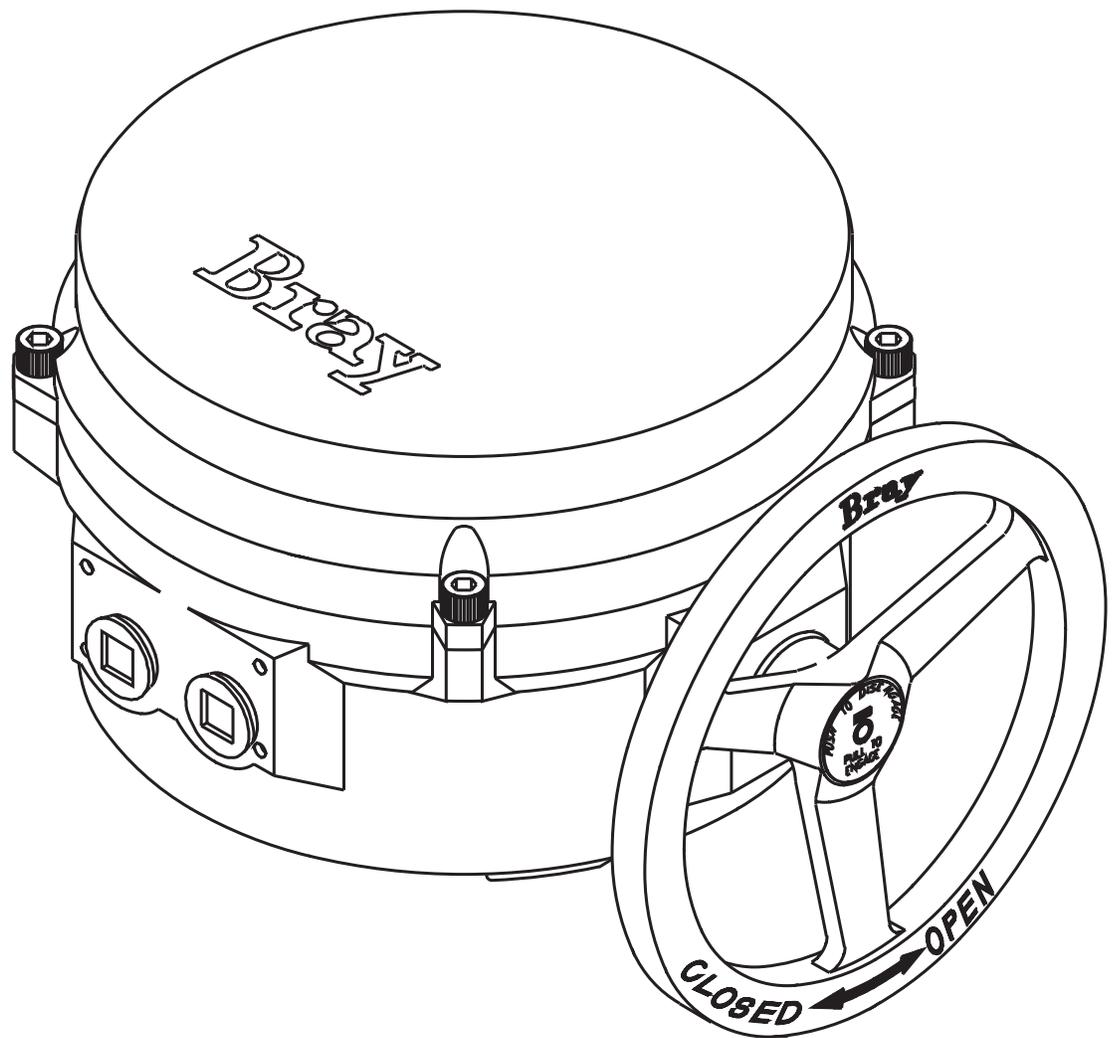


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SAFETY INSTRUCTIONS - DEFINITION OF TERMS

READ AND FOLLOW THESE INSTRUCTIONS
SAVE THESE INSTRUCTIONS



WARNING

indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



NOTICE

used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesirable result or state, including property damage.

1.1 HAZARD-FREE USE

This device left the factory in proper condition to be safely installed and operated in a hazard-free manner. The notes and warnings in this document must be observed by the user if this safe condition is to be maintained and hazard-free operation of the device assured.

Take all necessary precautions to prevent damage to the actuator due to rough handling, impact, or improper storage. Do not use abrasive compounds to clean the actuator, or scrape metal surfaces with any objects.

The control systems in which the actuator is installed must have proper safeguards to prevent injury to personnel, or damage to equipment, should failure of system components occur.

1.2 QUALIFIED PERSONNEL

A qualified person in terms of this document is one who is familiar with the installation, commissioning and operation of the device and who has appropriate qualifications, such as:

- Is trained in the operation and maintenance of electric equipment and systems in accordance with established safety practices
- Is trained or authorized to energize, de-energize, ground, tag and lock electrical circuits and equipment in accordance with established safety practices

- Is trained in the proper use and care of personal protective equipment (PPE) in accordance with established safety practices
- Is trained in first aid
- In cases where the device is installed in a potentially explosive (hazardous) location – is trained in the operation, commissioning, operation and maintenance of equipment in hazardous locations



WARNING

The actuator must only be installed, commissioned, operated and repaired by qualified personnel.

The device generates large mechanical force during normal operation.

All installation, commissioning, operation and maintenance must be performed under strict observation of all applicable codes, standards and safety regulations.

Reference is specifically made here to observe all applicable safety regulations for actuators installed in potentially explosive (hazardous) locations.

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PART NUMBERING SYSTEM REFERENCE CHART

SERIES	TORQUE CODE	SPEED	PRODUCT	STYLE	VOLTAGE	TRIM	DIR
70	AAA	W	113	X	Y	536	/Z

HOUSING SIZE	PART NUMBER	TORQUE (In.Lbs)	SPEED, ¼ TURN (Seconds)	SUPPLY (Voltage)
12	70-0122-113E0-536	1200	15	120 VAC
12	70-0202-113E0-536	2000	15	120 VAC
30	70-0302-113E0-536	3000	18	120 VAC
30	70-0502-113E0-536	5000	18	120 VAC

Use this chart as a guide to interpret the S70 Tunnel Damper electric actuator part number.

W - DESIGNATES THE SPEED

2	15/18 seconds
---	---------------

X - DESIGNATES STYLE

E	Basic Unit - Declutchable
---	---------------------------

Y - DESIGNATES THE VOLTAGE

0	120VAC
---	--------

/Z - DESIGNATES DIRECTION OF OPEN TRAVEL

/CW	Clockwise
/CCW	Counter-Clockwise

INTRODUCTION

The **Bray** Series 70 Tunnel Damper Electric Actuator is a quarter turn electric actuator with manual override for use on any quarter turn valve requiring up to 5000 in.lb of torque. Operating speeds vary between 15 to 18 seconds.

PRINCIPLE OF OPERATION

The Series 70 Tunnel Damper electric actuator is divided into two internal sections; the power center below the switchplate, and the control center above the switchplate. Below the switchplate the capacitor and gearmotor, with its spur geartrain, drive a non-backdriveable worm gear output. The override mechanism for manual operation is also housed here. Above the switchplate is where user required, readily accessible components are placed. The camshaft assembly, limit switches, terminal strips, and heater are all placed here for easy access. External to the unit are adjustable mechanical travel stops, the unique manual override handwheel, and dual conduit entry ports. The external coating is a high quality polyester powder coat which has exceptional UV as well as chemical resistance.

ELECTRICAL OPERATION

The motors used in the **Bray** Series 70 Tunnel Damper electric actuator are permanent induction split capacitor design (single phase AC power). Travel limit switches are mechanical form ZZ(DPDT-DB) with contacts rated at 10 amp (0.8 PF), 1/2 HP 125/250 VAC. In cases where the torque capacity of the unit is exceeded to the point where the motor stalls and overheats, a thermal protector switch built into the motor windings will automatically disconnect the motor power. Once the motor cools sufficiently the thermal protector switch will reset.

MECHANICAL OPERATION

Mechanically, the ratio of the gear motor determines the speed of the unit. The gear motor utilizes high efficiency spur gears. Initial gear reduction through the spur gears is then transferred to the worm shaft. The final gear reduction and output is through a non-backdriveable worm gear set. Positioning is determined by an indicator-cam shaft linked to the output shaft. In the declutchable condition the manual override drives the worm shaft when engaged.

CW VS CCW

Due to the fact that the Series 70 is a rotary actuator, there are two directions that it can turn to actuate a device: clockwise and counter-clockwise. Depending on the application the actuator is going into, and the physical constraints that application presents, it may be preferential to designate which direction the actuator turns to open and close. This is accomplished with the /Z designator, which assigns the open direction of the actuator: CW for clockwise and CCW for counter-clockwise. This can be easily determined locally by looking at which direction the open arrow is pointing on the actuator hand wheel, and should be kept in mind when mounting the actuator to the device. To ensure proper function, the direction of travel should always align with the arrows on the hand wheel and the /Z designator in actuator part number.

ELEVATED TEMPERATURE RATINGS

The Series 70 actuator is certified to meet NEMA type 4/4x specifications. The actuator utilizes a thermally protected, permanent split-capacitor (PSC) motor coupled to a gear train, allowing operation after experiencing elevated ambient temperatures. It has been tested to and complies with NYCTA Master Specification 15ID dated 7/16/12 – Dampers and Accessories for Tunnel Ventilation and Station Smoke Management, certifying it for use after soaking at an elevated ambient temperature of up to 302°F (150°C) for a minimum of 1 hour without the use of an insulated thermal blanket.

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MANUAL OVERRIDE OPERATION (DECLUTCHABLE)

The manual override operates similar to a watch adjusting knob. To engage the manual override, simply pull the handwheel to its outermost position. A yellow stripe is revealed for visual indication that the unit cannot run electrically. The two handwheel positions, engaged and disengaged, are held in place with the use of spring plungers. The handwheel remains in position until physically moved. Rotating the handwheel in the clockwise direction will rotate the output shaft in the same clockwise direction and vice-versa.



CAUTION

A label on the handwheel hub warns users not to exceed a specific rim pull force, for each size of actuator. If the rim pull force is exceeded, the roll pin securing the handwheel onto the manual override shaft is designed to shear, thus preventing more serious internal gearing damage.

PRE-INSTALLATION STORAGE

Actuators are not weatherproof until properly installed on the valve or prepared for storage. Bray cannot accept responsibility for deterioration caused on-site once the cover is removed.



NOTICE

Units are shipped with two metal screw-in plugs to prevent foreign matter from entering the unit. To prevent condensation from forming inside these units, maintain a near constant external temperature and store in a well-ventilated, clean, dry room away from vibration.

Power should be supplied to the heater via conduit entry and appropriate sealing gland.

Store units on a shelf or wooden pallet in order to protect against floor dampness.

Keep units covered to protect against dust and dirt.

INSTALLATION

MOUNTING TO A VALVE

All Bray Series 70 electric actuators are suitable for direct mounting on Bray butterfly valves. With proper mounting hardware, the S70 actuator can be installed onto other quarter-turn valves or devices, such as a damper.



NOTICE

The standard mounting position for the actuator is to orient the unit with its handwheel in a vertical plane and parallel to the pipeline. If the actuator is to be mounted on a vertical pipe, it is recommended that the unit be positioned with the conduit entries on the bottom to prevent condensation from entering the actuator by way of the conduit. In all cases, the conduit should be positioned to prevent drainage into the actuator.

The actuator should be mounted to the valve as follows:

1. Manually operate the actuator until the output shaft of the actuator is in line with the valve stem. If possible, select an intermediate position (i.e. valve disc/stem and actuator both half open).
2. Place the proper adapter, if required, onto the valve stem. It is recommended that a small amount of grease be applied to the adapter to ease assembly.
3. Mount the actuator onto the valve stem. It may be necessary to swing or manually override the actuator to align the bolt patterns.
4. Install the furnished mounting studs by threading them all the way into the actuator base.
5. Fasten in place with the furnished hex nuts and lock washers.

FIELD WIRING



WARNING

Turn off all power and lock out service panel before installing or modifying any electrical wiring.

Each actuator is provided with two (2) conduit entries (one for power and one for control).

1. The motor full load current is noted on the nameplate of the actuator. The terminal strip will accept wire sizes ranging from 14 to 22 AWG.



NOTICE

18 AWG minimum wire is recommended for all field wiring.

Note that heaters use approximately 0.5 amps at 110 volts.

2. **All actuators have their applicable wiring diagram attached to the inside of the cover.** Field wiring should be terminated at the actuator terminal strip in accordance with **this** wiring diagram.



NOTICE

The conduit connections must be properly sealed to maintain the weatherproof integrity of the actuator enclosure.



CAUTION

Do not reverse motor instantaneously when it is still running. Reversing direction to actuator motor when it is running can cause damage to motor, switches and gearing. Directional control switching can be done by PLC in 20ms or by a small relay in 46ms. Therefore time delay of 1s has to be incorporated into the control scheme to avoid damage.

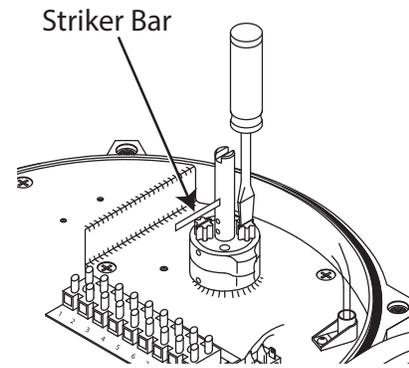
TRAVEL LIMIT SWITCH AND MECHANICAL TRAVEL STOP ADJUSTMENT



CAUTION

The electrical travel switches **must** be set to activate (depress) prior to reaching the mechanical travel stops. The cams are color coded (green for CCW, red for CW).

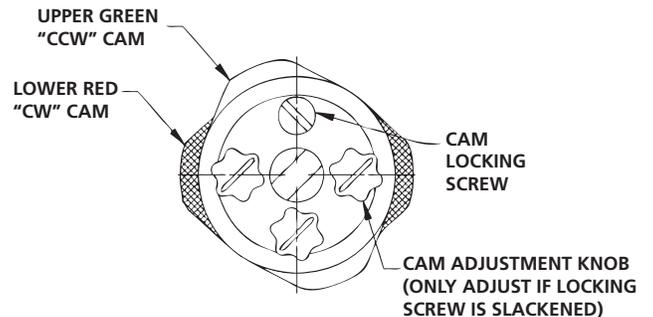
NOTE: Manual travel stops are designed to prevent manual overtravel from turning the handwheel, not to stop the electric motor. The travel stops have an adjustment range of approximately 10-degrees.



CLOCKWISE TRAVEL SWITCH ADJUSTMENT

1. Loosen the mechanical stop for the CW position and back it off so that it does not interfere with actuator travel (CW stop located on right when viewed from travel stop side of actuator).
2. Reference the striker bar for damper position.
3. Manually operate the actuator handwheel clockwise until the valve reaches the desired fully CW position.
4. Rotate the **red** adjusting knob by hand or with a flat head screwdriver until the cam lobe just activates (depresses) the switch from a clockwise direction.

NOTICE: All actuators have a cam locking screw. Cam locking screw must be slackened before cam adjustments and re-tightened after cam adjustments.



NOTE: It is possible that the rotation of one cam will move the other cam. If this occurs, hold the other knobs or cams during adjustment.

5. With the travel switch in the CW position, rotate the **handwheel** clockwise 1 turn for Housing Size 12 and ½ turn for Housing Size 30. Adjust the CW travel stop bolt until it bottoms against the output gear and lock it in position with the locknut.
6. After all travel switch adjustments have been completed, secure the actuator cover.

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COUNTER-CLOCKWISE TRAVEL SWITCH ADJUSTMENT

1. Loosen the mechanical stop for the CCW position and back it off, so that it does not interfere with actuator travel. The CCW stop is located on the left, when viewed from travel stop side of actuator.
2. Reference the striker bar for damper position.
3. Manually operate the actuator handwheel counter-clockwise until the valve reaches the desired CCW position.
4. Rotate the green adjusting knob until the cam lobe just activates (depresses) the switch from a counter-clockwise direction.

NOTICE: All actuators have a cam locking screw. Cam locking screw must be slackened before cam adjustments and re-tightened after cam adjustments.

NOTE: It is possible that the rotation of one cam will move the other cam. If this occurs, hold the other knobs or cams during adjustment.

5. With the travel switch in the open position, rotate the **handwheel** counterclockwise 1 turn for Housing Size 12 and ½ turn for Housing Size 30. Adjust the CCW travel stop bolt until it bottoms against the output gear and lock in position with the locknut.
6. After all travel stop adjustments have been completed, secure the actuator cover.

HEATER

To prevent condensation from forming inside the actuator, Bray offers a heater as standard in Series 70 Tunnel Damper models. The heater is a PTC (Positive Temperature Coefficient) style which has a unique temperature - resistance characteristic. The heater self-regulates by increasing its electrical resistance relative to its temperature. The heater does not require external thermostats or switches to control its heat output. It is constructed of a polycrystalline ceramic, sandwiched between two conductors, and wrapped inside a thermally conductive electrical insulator.

Connect the heater wires to the terminal strip as indicated on the wiring diagram.

NOTE: The heater must have a constant power supply to be effective.



WARNING

The heater surface can reach temperatures in excess of 200 degrees Celsius (392°F)

Heater Kit Consists of:

1. Heater with flying leads
2. Heater Mounting Bracket
3. #10 pan head screw, Phillips drive

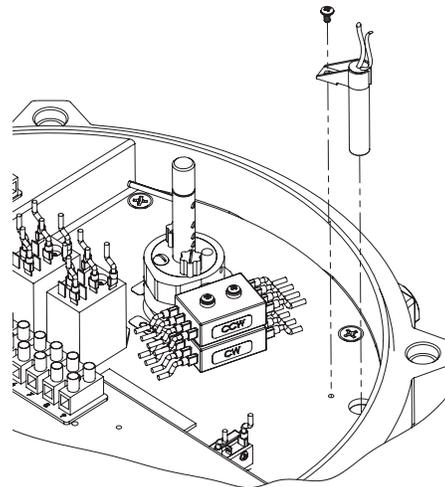
Tools required:

- For terminal wiring: Screwdriver, ¼" tip flat blade
- For heater mounting screw: Screwdriver, No.1 Phillips

Installation procedure:

The heater is mounted through a hole provided in the switchplate.

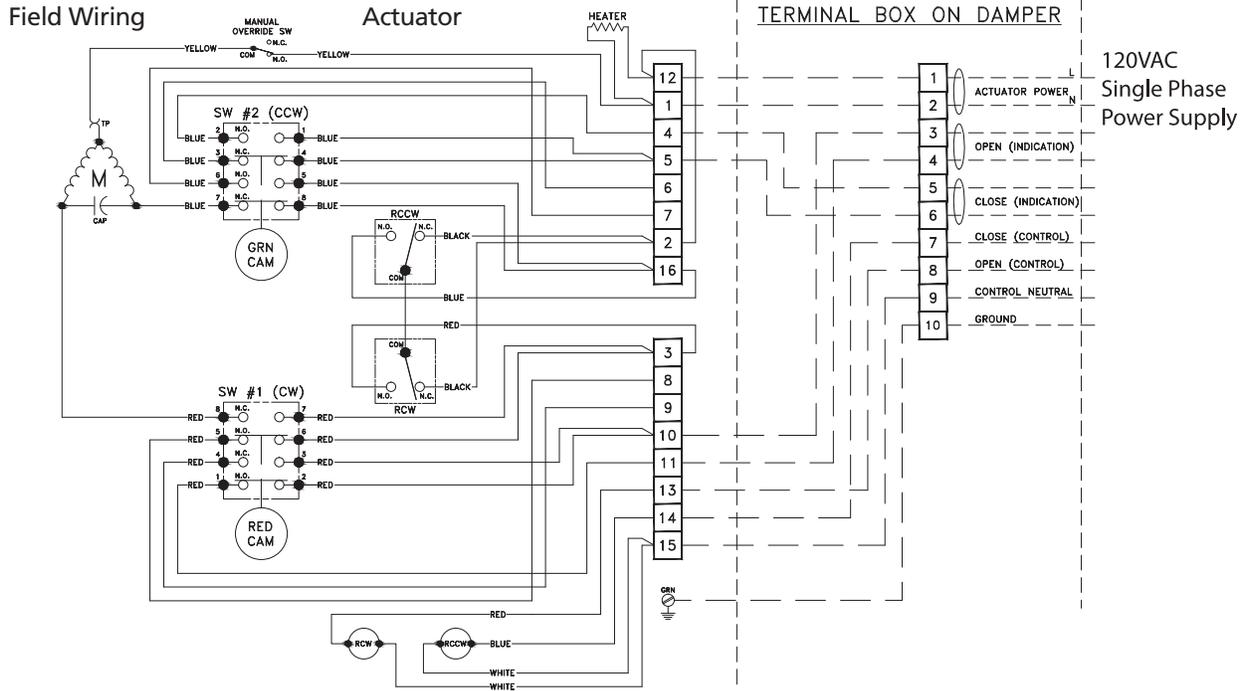
Before servicing unit, switch all power off at the service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.



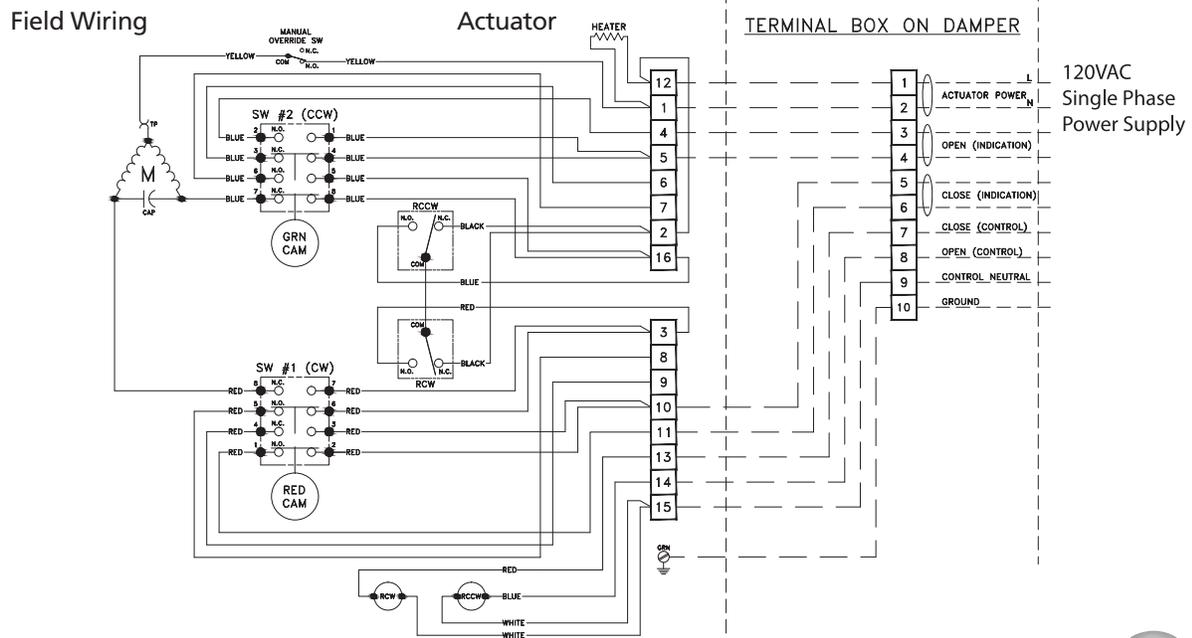
Disconnect all power to the unit.

1. Place the heater snugly into its mounting bracket until approx. 1/2 to 1" is left above the bracket as shown in diagram.
2. Slip the heater into its mounting hole.
3. Align the fastening hole in the bracket with the threaded screw hole in the plate. Fasten the heater to the switchplate.
4. Connect the heater wires to the terminal strip as indicated on the wiring diagram.

TYPICAL WIRING DIAGRAMS



Wiring diagram for CW OPEN unit with form-ZZ (DPDT-DB) travel switches. (Drawn for actuator in its fully open [CW] Condition.)



Wiring diagram for CCW Open Unit with form-ZZ (DPDT-DB) travel switches (Drawn for actuator in its fully closed [CW] condition)

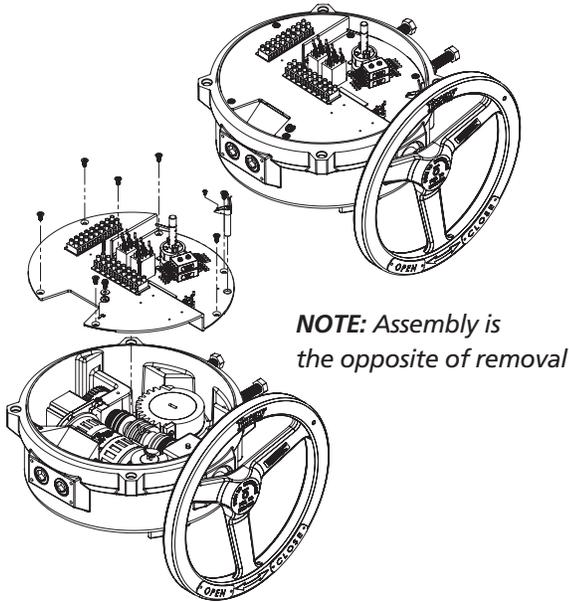
Note: Bray Series 70 Tunnel Damper electric actuator wiring is the same, regardless of CW or CWW application. Control is achieved through field wiring.



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DISASSEMBLY AND ASSEMBLY

Tools required:



2. Disconnect motor wires from the 3-terminal strip (motor neutral, open, and close).
3. The switchplate can be independently disassembled.
4. To remove the Gearmotor, first disconnect the motor leads which run to the capacitor, and unscrew the mounting screws (four lower, one upper). The motor can now be removed vertically out of the unit. Note: do not misplace the alignment pin.
5. To remove the worm shaft spur gear, remove the spring pin using a $\frac{3}{32}$ " punch, then slide the gear off the end of the worm shaft for Housing Size 12. Remove bowed E-clip retainer for Housing Size 30.
6. To remove the output drive worm gear, back off both mechanical travel stops. Remove the retaining ring and thrust washer, then lift the output drive worm gear out of its base.
7. The handwheel is held by a spring pin.

See Appendix A for a complete list of basic tools.

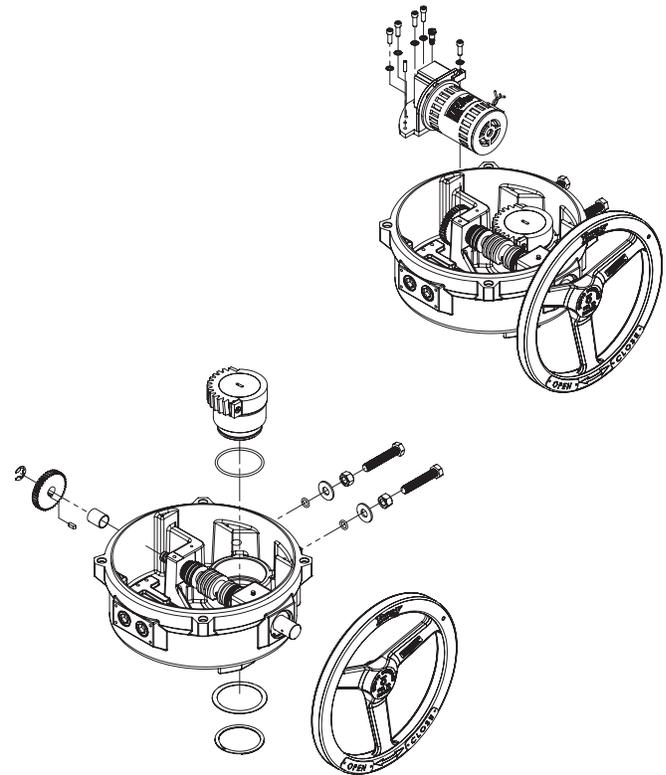
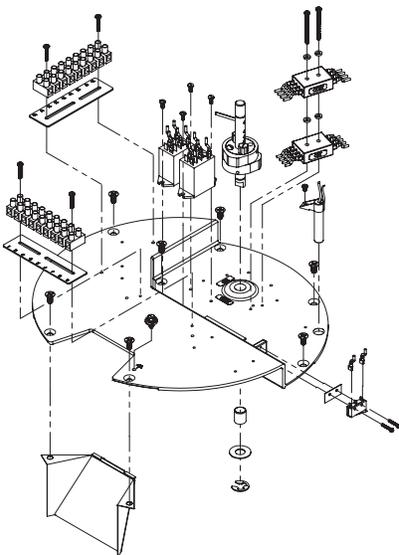
Procedure:



WARNING

Turn off all power and lock out service panel before installing or modifying any electrical wiring.

1. Remove the switchplate by unscrewing the seven Phillips head mounting screws. The switchplate should lift out as an assembly with the camshaft attached.



CAUTION

8. Further disassembly of the unit requires special tools and procedures, and thus will not be covered in this manual.

APPENDIX A - BASIC TOOLS

Common To All Units

Terminal connections, cam adjustment	Screwdriver, 1/4" tip flat tip blade
All switches, terminal strip, torque switch plate	Screwdriver, No.1 Phillips
Switchplate screws, capacitor	Screwdriver, No.2 Phillips

Housing Size 12

Mounting nuts (small pattern)	Wrench, 1/2"
Mounting nuts (large pattern)	Wrench, 3/4"
Cover captivated capscrews	Hex key, 5/16"
Travel stop adjusting bolts	Wrench, 9/16"
Travel stop nuts	Wrench, 9/16"
Motor mount socket head capscrew	Hex key, 5/32"
Conduit Entry Plug	Hex key, 9/16"

Housing Size 30

Mounting nuts, travel stop jam nuts	Wrench, 3/4"
Cover captivated capscrews	Hex key, 3/8"
Travel stop adjusting studs	Wrench, 3/4"
Motor mount socket head shoulder bolt	Hex key, 5/32"
Motor mount socket head cap screws	Hex key, 3/16"
Conduit Entry Plug	Hex key, 9/16"

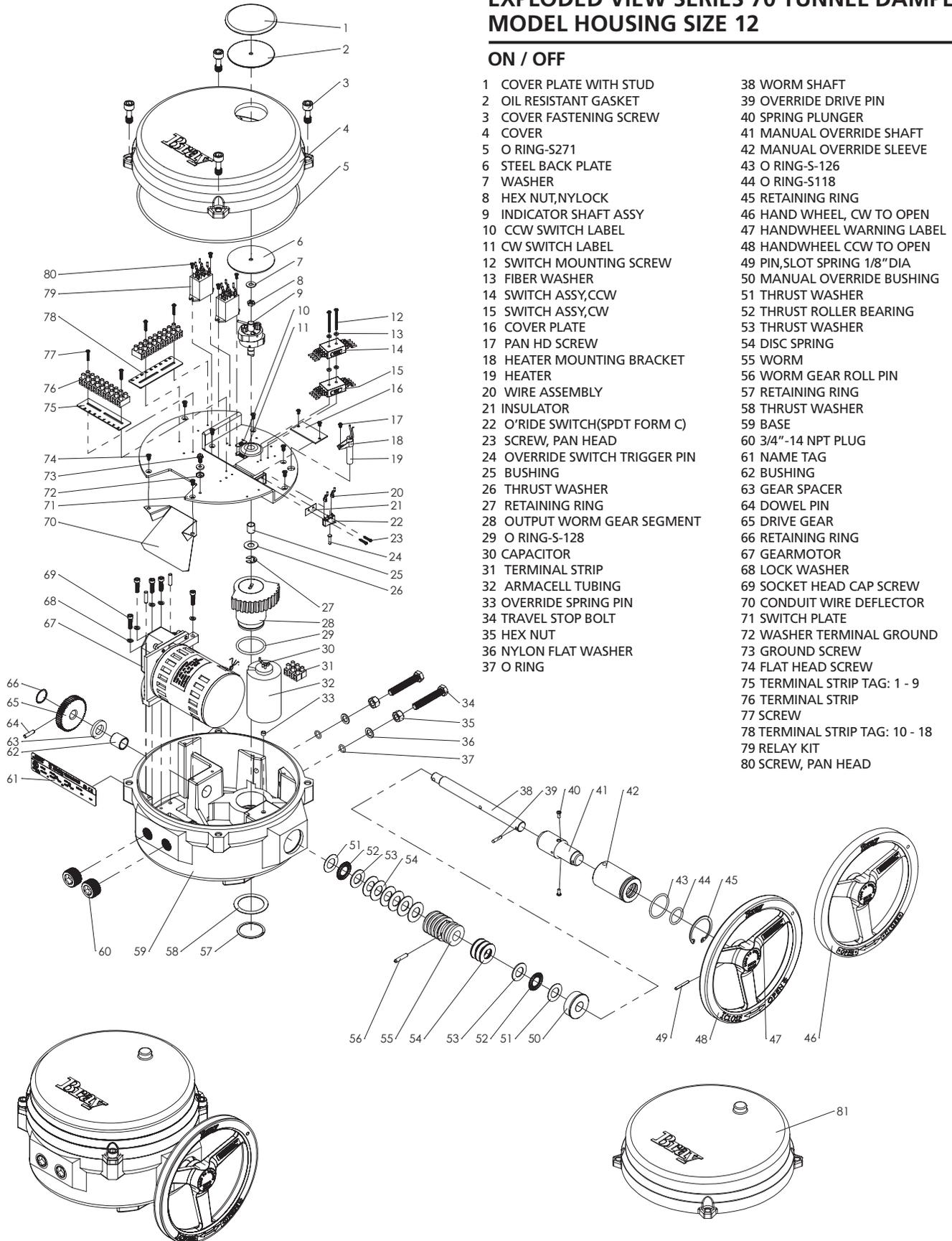
APPENDIX B - ACTUATOR TROUBLESHOOTING CHART

PROBLEM	POSSIBLE CAUSE	SOLUTIONS
Actuator does not operate	Override is engaged	Push handwheel in all the way
	Wiring is incorrect	Check wiring and power supply
	Actuator motor has reached its thermal shutdown temperature	Allow time to cool
Actuator operates in reverse directions	Field wiring is reversed	Rewire field wiring
Actuator does not fully close damper (or open damper)	Limit switches are depressed	Readjust travel limit switches
	Mechanical travel stop is stopping actuator	Adjust mechanical travel stops
	Damper torque requirement is higher than actuator output	Manually override out of seat, try angle seating or larger actuator
	Voltage power supply is low	Check power source.
Engaging override handwheel does not shut off motor	Override pin is corroded or damaged	Clean and check for smooth operation of the override switch pin
	Override switch is damaged	Replace switch
Disengaging override handwheel does not restart motor	Not completely disengaged	Push handwheel in as far as possible (no yellow showing)
	Override pin is damaged or and does not activate switch	Replace override pin
	Incorrect wiring of override switch	Check wiring
Motor runs but worm and gear segment do not	Worm gear segment is not meshing with worm	Remove switchplate and inspect, adjust travel stops to prevent gear disengaging
	Pin/Key on Worm/Motor drive gear sheared	Replace Pin/Key on drive gear
Corrosion inside unit	Condensation forming	Test heater wiring, should have constant power
	Water leaking in	Check all seals and possible water entry through conduit

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EXPLODED VIEW SERIES 70 TUNNEL DAMPER MODEL HOUSING SIZE 12

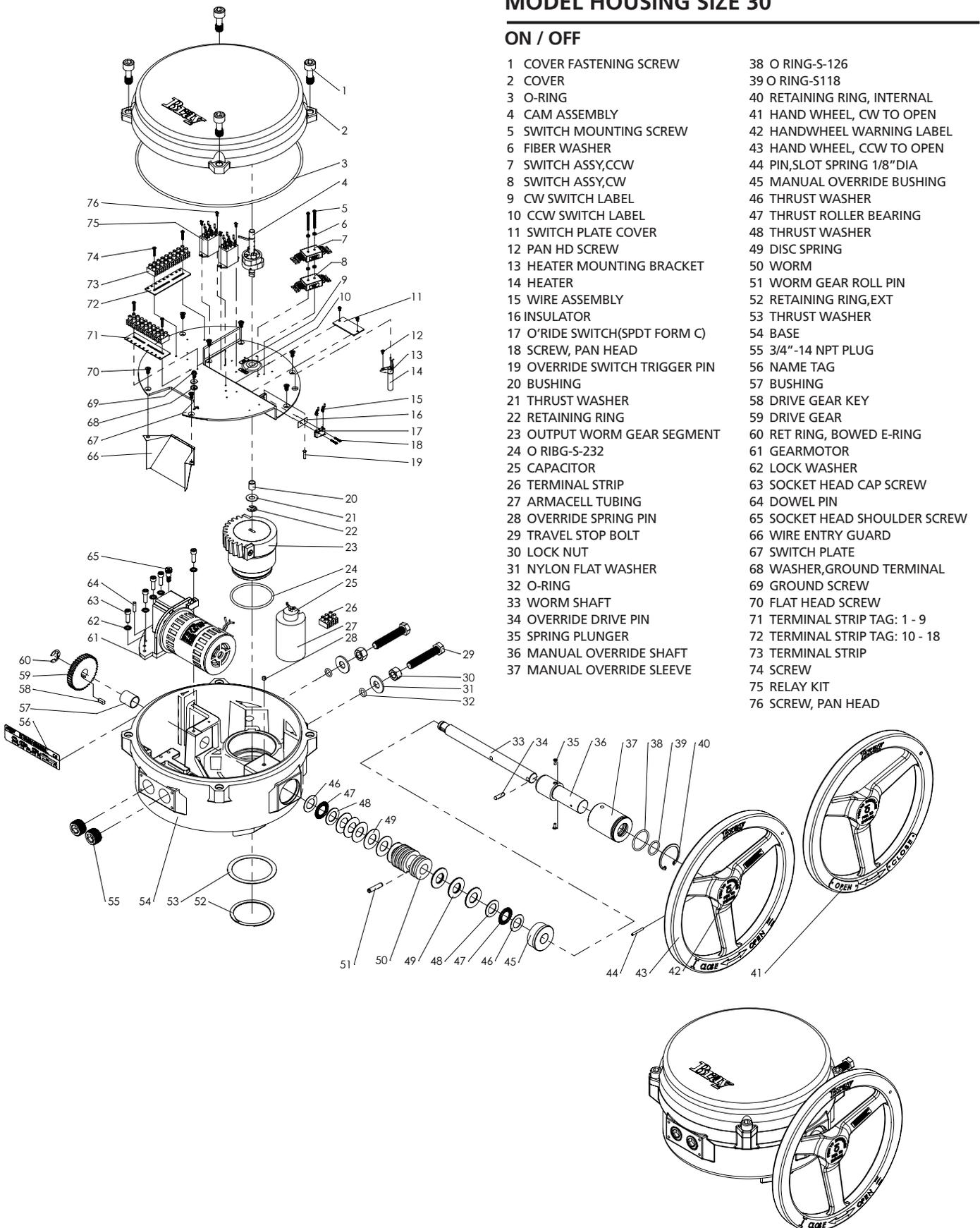
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EXPLODED VIEW SERIES 70 TUNNEL DAMPER MODEL HOUSING SIZE 30

ON / OFF



 **Bray** **CONTROLS**

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