

Bray [®] SERIES 70

2ND GENERATION ELECTRIC ACTUATOR OPERATION AND MAINTENANCE MANUAL

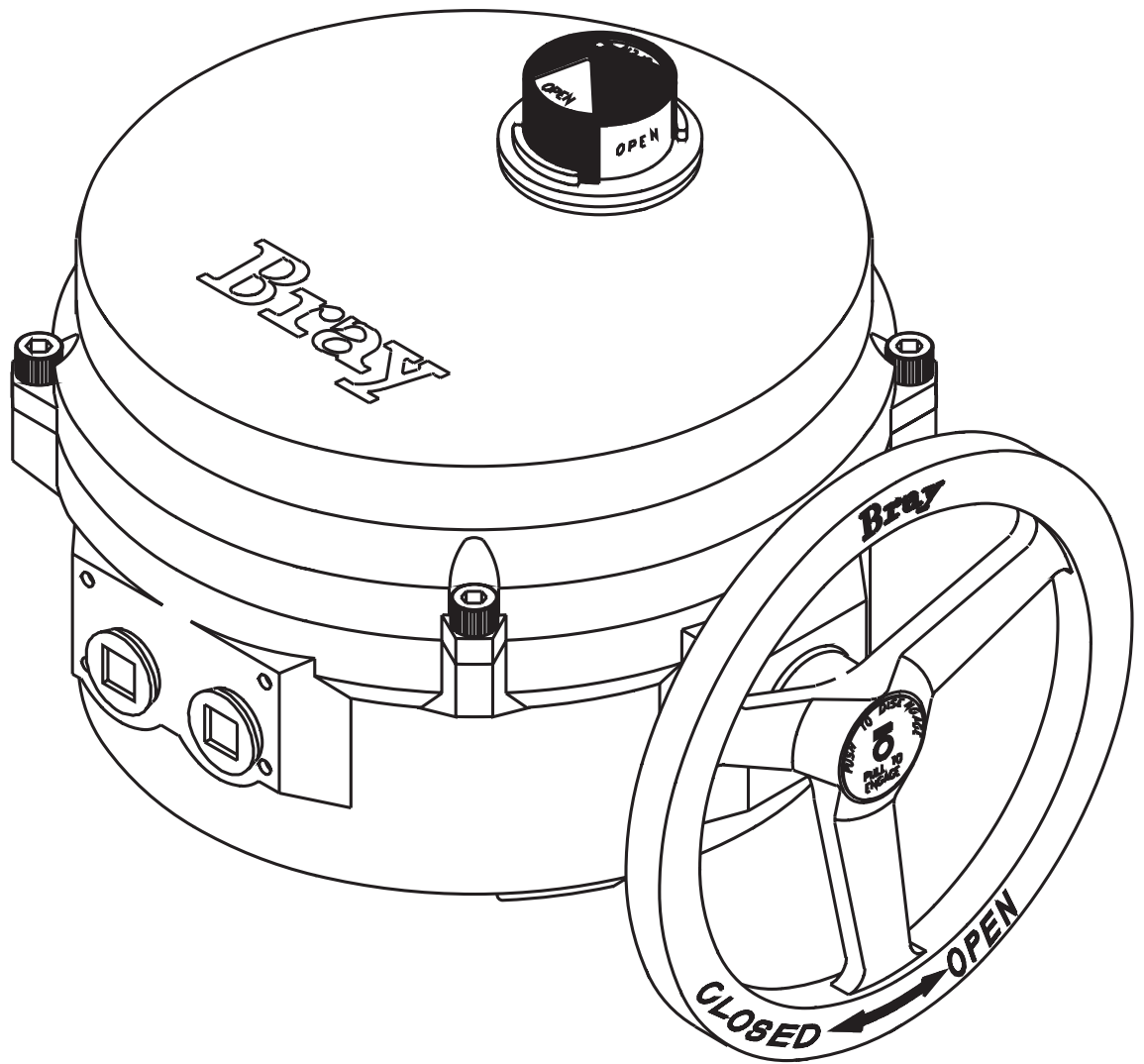


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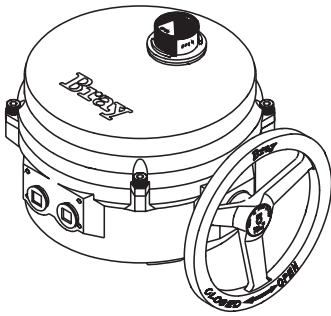
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BRAY Series 70 Electric Actuator Operation and Maintenance Manual

PART NUMBERING SYSTEM REFERENCE CHART



PART NUMBER	TORQUE (In.Lbs)	SPEED, 1/4 TURN (Seconds)	SUPPLY (Z Voltage)
70-003X-113yz-536	300	60/30/15	0/1/2/3/4
70-005X-113yz-536	500	60/30/15	0/1/2/3/4
70-008X-113yz-536	800	30/15/10/6	0/1/2/3/4/5/6/7/8
70-012X-113yz-536	1200	30/15/10/6	0/1/2/3/4/5/6/7/8
70-020X-113yz-536	2000	30/15	0/1/2/3/4/5/6/7/8
70-030X-113yz-536	3000	30/18	0/2/3/4/5/6/7/8
70-050X-113yz-536	5000	30/18	0/2/3/4/5/6/7/8
70-065X-113yz-536	6500	30	0/2/3/4/5/6/7/8

X - DESIGNATES THE SPEED	Y - DESIGNATES STYLE	Z - DESIGNATES THE VOLTAGE
X = 0 1 2 2 3 4	A= DECLUTCHABLE	Z= 0 1 2 3 4 5 6 7 8
SEC = 60 30 18 15 10 6	B = NON DECLUTCHABLE	VOLTAGE= 120VAC 12VDC 24VDC 24VAC 220VAC 380V 400V 440V 480V
		3-PH 3-PH 3-PH 3-PH

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

INTRODUCTION

The **Bray Series 70** is a quarter turn electric actuator with manual override for use on any quarter turn valve requiring up to 6500 in•lb of torque. Operating speeds vary between 6 to 60 seconds.

PRINCIPLE OF OPERATION

The Series 70 actuator is basically 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 final 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, torque switches, heater, and servo are all placed here for easy access. External to the unit are found adjustable mechanical travel stops, a large easy to read indicator, 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.

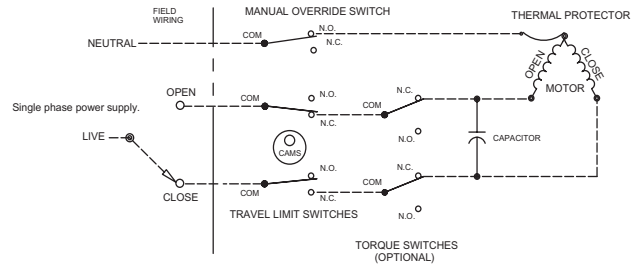
ELECTRICAL OPERATION

The motors used in the **Bray Series 70** are either permanent induction split capacitor design (single phase AC power), SCI (Three Phase AC Power) or PM (DC Power). Travel limit switches are mechanical form (SPDT) 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. Optional torque switches are avail-

able in all units to prevent the possibility of stalling the motor, thus reducing the necessity for an inoperable thermal cooldown period. Torque switches installed by Bray are factory adjusted to the output torque rating of the unit using electronic torque testing equipment. Field adjustment of the torque switches is not recommended.

General Electrical Schematic

(Note: this is only a reference. For the actual wiring diagram refer to the diagram placed inside the actuator cover.)



MECHANICAL OPERATION

Mechanically, the ratio of the gearmotor determines the speed of the unit. The gearmotor utilizes high efficiency spur gears with various ratios for the different speeds. 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 style the manual override drives the worm shaft when engaged.

MANUAL OVERRIDE OPERATION (DECLUTCHABLE STYLE)

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 (closed) direction and vice-versa.

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 will shear, thus preventing more serious internal gearing damage.

MANUAL OVERRIDE OPERATION (NON DECLUTCHABLE STYLE)

Removal of black plastic cap will reveal shaft stub with machined flats on it to allow a wrench to grip and rotate shaft. *NOTE: This shaft is directly connected to worm drive gear and electrical power must be isolated from unit prior to manually turning shaft.*

PRE-INSTALLATION STORAGE

Units are shipped with two metal screw-in plugs in order to prevent foreign matter from entering the unit. To prevent condensation from forming inside these units, maintain a near constant external temperature and supply power to the optional heater internal to the unit.

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. 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, use an intermediate position (i.e. valve disc/stem and actuator 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.

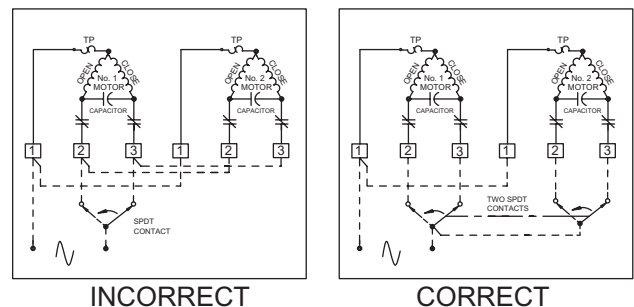
FIELD WIRING

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 (14 to 24 AWG for the servo). 18 AWG minimum is recommended. Note that the optional 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.
3. The conduit connections must be properly sealed to maintain the weatherproof integrity of the actuator enclosure.

MULTIPLE ACTUATOR (PARALLEL) WIRING

Do not connect more than one S70 actuator to a SPDT switch. A voltage is present on the opposite winding to the powered one. If this winding is connected to another as shown in the INCORRECT diagram it will interfere with the motor performance. Use a multiple pole switch as shown in the CORRECT diagram.*



WARNING:

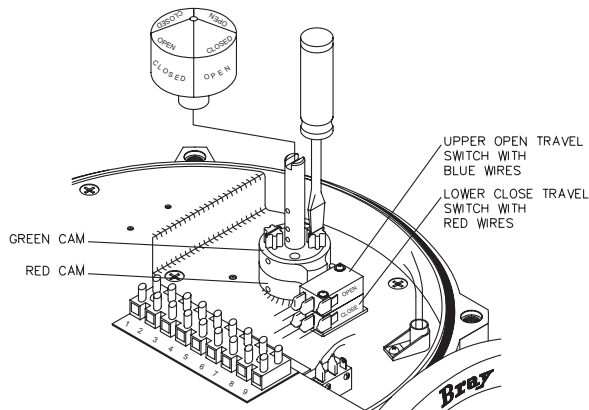
Do not reverse motor instantaneously when it is still running- Reversing direction to actuator motor when it is running can cause damage to motor, switches and gearing. Directional control switching can be done by PLC in 20ms or by a small relay in 45ms. Therefore time delay of .3s has to be incorporated into the control scheme to avoid damage.*

* Refer to Technical Bulletin 1176 for more details on Field Wiring.

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TRAVEL LIMIT SWITCH AND MECHANICAL TRAVEL STOP ADJUSTMENT

The electrical travel switches **must** be set to trigger prior to reaching the mechanical travel stops. The cams are color coded (green for open, red for closed). **NOTE:** *Manual travel stops are designed to prevent manual overtravel, not to stop the electric motor. The travel stops have an adjustment range of approximately 10-degrees.*



CLOSE ADJUSTMENT

1. Loosen the mechanical stop for the closed position and back it off so that it does not interfere with actuator travel (closed stop located on right when viewed from travel stop side of actuator).
2. Remove the indicator rotor, if not already done, by pulling up on it. This will expose the machined groove on the end of the cam shaft, which is the reference to the valve disc position.
3. Manually operate the actuator handwheel clockwise until the valve reaches the desired closed position.
4. Rotate the **red** adjusting knob by hand or with a flat head screwdriver until the cam lobe just trips the switch from a clockwise direction.

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 closed position, rotate the **handwheel** clockwise 1/4 to 1/2 a turn. Screw in the closed travel stop bolt until it bottoms against the output gear and lock in position with the locknut.
6. Replace indicator rotor, on completion of travel switch setting / adjustment.

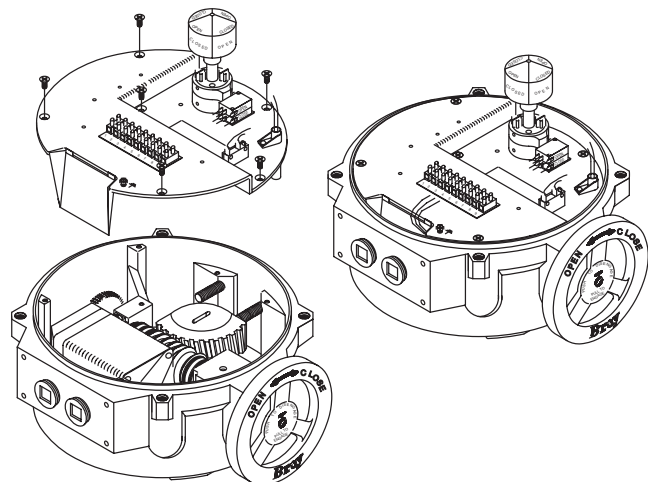
OPEN ADJUSTMENT

1. Loosen the mechanical stop for the open position and back it off, so that it does not interfere with actuator travel. The open stop is located on the left, when viewed from travel stop side of actuator.
2. Remove the indicator rotor, if it has not already been removed by pulling up on it. This will expose the machined groove on the end of the cam shaft, which is the reference to the valve disc position.
3. Manually operate the actuator handwheel counterclockwise until the valve reaches the desired open position.
4. Rotate the green adjusting knob until the cam lobe just trips the switch from a counterclockwise direction.
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 1/4 to 1/2 a turn. Screw in the open travel stop bolt until it bottoms against the output gear and lock in position with the locknut.
6. Replace indicator rotor, when travel switch adjustments are completed.

DISASSEMBLY AND ASSEMBLY

TOOLS REQUIRED:

See Appendix A for a complete list of basic tools

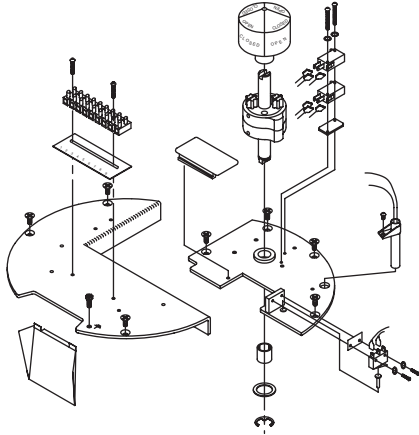


NOTE 1: *Assembly is the opposite of removal*

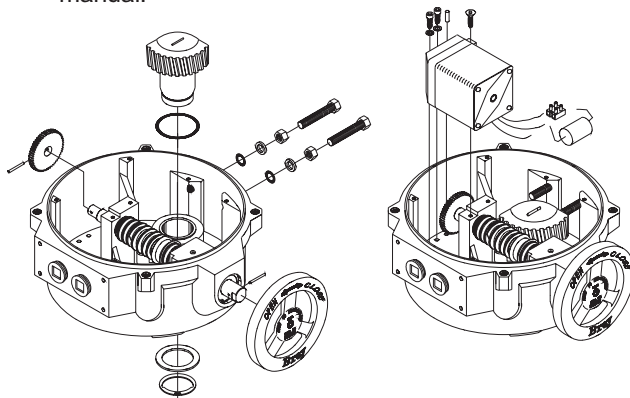
NOTE 2: *Pictures shown for size 003-005 are typical for all sizes*

PROCEDURE:

1. Disconnect all power from the unit.
2. Disconnect motor wires from the main terminal strip (motor neutral, open, and close).
3. Remove the switchplate by unscrewing the seven phillips head mounting screws. The switchplate should lift out as an assembly with the camshaft attached.
4. The switchplate can be independently disassembled.

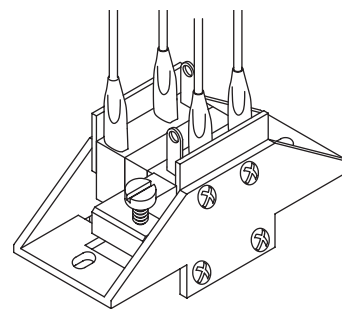


5. To remove the Gearmotor, first disconnect the motor leads which run to the capacitor, and unscrew the mounting screws for size 003-005 (two lower, one upper) for size 008-065 (four lower, one upper). The motor can now be removed vertically out of the unit. Note: do not misplace the alignment pin.
6. 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 size 003-020. Remove bowed E-clip retainer for size 030-065.
7. 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.
8. The handwheel is held by a spring pin.
9. Further disassembly of the unit requires special tools and procedures, and thus will not be covered in this manual.



FIELD OR FACTORY INSTALLABLE OPTIONS TORQUE SWITCHES

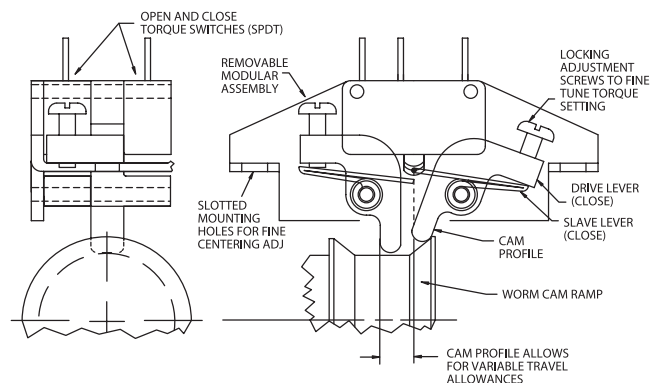
Torque switches are a factory installed and calibrated option available for all Series 70 units. Installation is simple, but due to the requirement for special calibration equipment, it is not recommended for field installation. In fact, modifying the factory torque setting voids the actuator warranty. The unique mechanism is extremely accurate and has excellent repeatability. The worm is pinned to the worm shaft, which is held in position with a stack of disc springs at both ends. The torque transmitted through the worm to the output worm gear acts directly against the disc springs, which compress proportionately. The worm and worm shaft shift longitudinally as a result. A specially designed cam is incorporated into the worm, providing the



ramp profile for the torque switching mechanism. A drive lever rides onto the cam surface, and in turn drives a slave lever through an adjusting screw. The slave lever then actuates its electrical switch, which interrupts the power to the

motor winding when the torque exceeds the setting. The motor can still be powered to run in the opposite direction, or if the torque diminishes, the switch will release automatically.

TORQUE SWITCH MECHANISM



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HEATER

To prevent condensation from forming inside the actuator, Bray offers an optional heater. 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

Caution: the heater surface can reach temperatures in excess of 200 degrees Celsius

HEATER KIT CONSISTS OF:

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

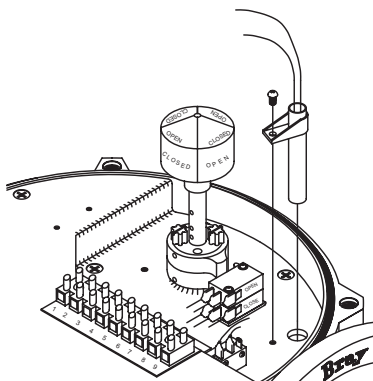
TOOLS REQUIRED:

- For terminal wiring: Screwdriver, $\frac{3}{16}$ tip flat blade
- For heater mounting screw: Screwdriver, No.1 phillips

INSTALLATION PROCEDURE:

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

- 1 Place the heater snugly into its mounting bracket until approx. $\frac{1}{2}$ 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.



SERVO-PLUS II MODULE

Servo kits can be field installed on any continuous duty actuator (30 or 60 sec. operation speed) to provide proportional positioning in response to a control signal. Intermittent duty actuators are not adaptable for servo control.

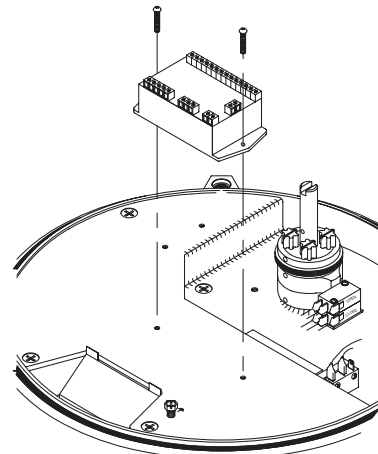
SERVO KIT CONSISTS OF:

- 1 One servo module
- 2 Four #6 cross drive pan head screw (two for servo, two for pot)
- 3 One potentiometer assembly
- 4 Two #6 type A internal lockwashers (for pot)
- 5 One wiring diagram sticker for attaching to inside of actuator s cover
- 6 One wiring diagram sticker for servo units with torque switches

TOOLS REQUIRED:

- For actuator terminals wiring Screwdriver, $\frac{3}{16}$ flat blade
- For servo terminals Screwdriver, No.1 phillips
- For servo and pot mounting screws Screwdriver, No.2 phillips

INSTALLATION PROCEDURE:



Remove the on/off duty, 9 point terminal strip and its marker

- 1 Disconnect all wiring to the terminal strip.
- 2 All wiring in the actuator is color coded to facilitate wiring, and does not need to be tagged or marked.
- 3 Field wiring should be marked if it is not already color coded.

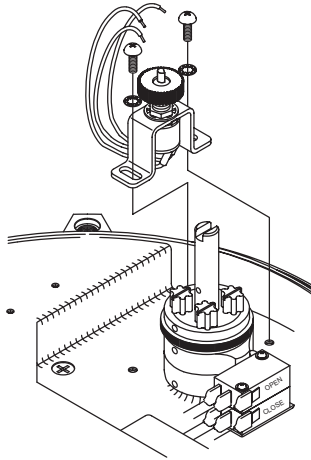
Mount the servo module

- 4 Secure the servo card module onto switchplate with the 2X #6 screws.

Install the potentiometer assembly

- 5 The potentiometer installs next to the camshaft where there are two threaded holes provided.

- 6 The potentiometer assembly must be mounted in the correct orientation with its gear. Simply center the pot, and orient it so the gears are meshing.
- 7 Push the assembly towards the cam to mesh the pot gears. Then tighten the mounting screws.



Wire the pot to the servo

- 8 Connect the pot wires into the terminal strip on the servo module.
- 9 Wire according to the wiring diagram provided.

Wire the servo to the actuator

- 10 Wire according to the wiring diagram provided.
- 11 See the servo calibration instructions.

SERVO CALIBRATION

The calibration procedure defines the limits of operation of the Series 70 Actuator between the fully open valve position and the fully closed valve position. The cams on the Series 70 Actuator define the fully open and closed positions of the valve and may be set at any degree of opening. The only requirement is that the open cam limit setting must set at a higher degree of opening than the closed cam limit setting. In other words, the Open position must be more open than the Closed position.

Calibration is performed as follows:

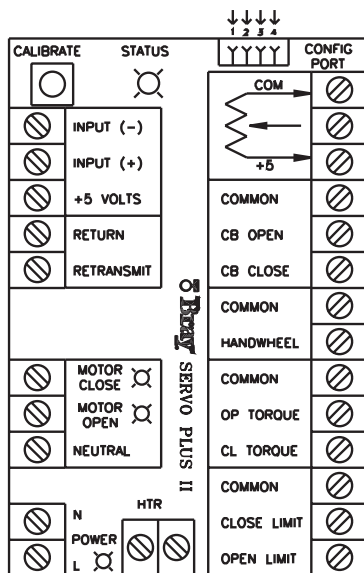
- 1 Adjust the Open and Closed limit switch cams on the Series 70 Actuator to the desired position.
- 2 Engage the handwheel and move the Series 70 Actuator until the closed limit switch cam is engaged.
- 3 Rotate the black potentiometer drive gear adjustment knob clockwise, so that potentiometer gear is at its max counter clockwise position.

NOTE:

- An analog signal source is not required for calibration.
- 4 Press and hold the Calibrate Set pushbutton for a minimum of 2 seconds. LED Status will light to signify the pushbutton is pressed. After 2 seconds, release pushbutton. This will cause the closed & open calibration data to be stored in the Servo Plus III non-volatile memory. If pushbutton is held for less than 2 seconds, such as an accidental touch, the calibration data will not be stored in the memory.

This completes the Self Calibration procedure.

After completing the calibration procedure, it is good practice to apply the fully closed and fully open Command Signals, and verify that the S70 Actuator moves to the proper positions.



BRAY Series 70 Electric Actuator

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EXTERNAL SIGNAL FEEDBACK POTENTIOMETER

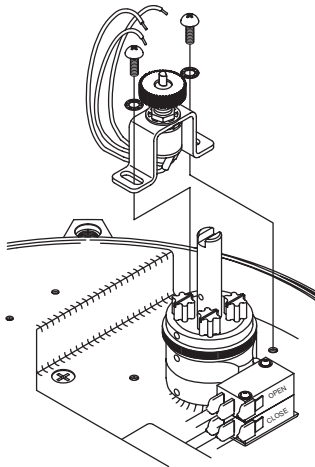
Potentiometers for external feedback can be field installed on all continuous duty actuators. Actuators which are not continuous duty do not have a pot gear fitted on their indicator shafts & must be fitted with a new shaft which has a pot drive gear for feedback pot (see Options: Auxiliary Switches).

FEEDBACK POTENTIOMETER KIT CONSISTS OF:

- 1 One potentiometer assembly
- 2 Two #6 cross drive pan head screws
- 3 Two #6 internal lockwashers
- 4 One 4 point terminal strip
- 5 One terminal strip marker for feedback pot
- 6 One small wiring diagram sticker for the additional potentiometer

TOOLS REQUIRED:

- For terminal wiring Screwdriver, $\frac{3}{16}$ tip flat blade
- For pot mounting screws Screwdriver, No.2 phillips



INSTALLATION PROCEDURE:

- 1 The potentiometer installs next to the camshaft where there are two threaded holes provided for it.
- 2 The potentiometer assembly must be mounted in the correct orientation, with the actuator in its Midtravel Position mate it onto approximate centered section of pot gear. The potentiometer has a over torque slip engagement and will self align after first cycle.
- 3 Push the assembly towards the cam to mesh the pot gears. Then tighten the mounting screws.
- 4 Fit the 4 point terminal strip and marker in the kit. Before laying down the marker, cut it to obtain a marker as illustrated: opposite
- 5 Wire the pot to the terminal strip using the small stick-on wiring diagram provided.
- 6 Adhere the wiring diagram sticker to the inside of the cover.

Set the Potentiometer:

- 1 Manually operate the actuator handwheel until the unit is in the fully closed position.
- 2 Rotate the black potentiometer drive gear adjustment knob, to engage the potentiometer gear at the closed position.
- 3 Manually operate the actuator to the fully open position.

AUXILIARY SWITCHES

Auxiliary switches are available / refer to chart on next page.

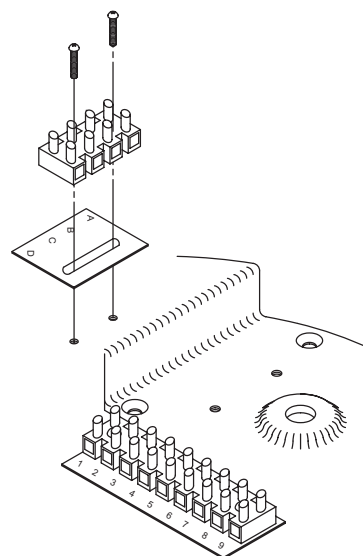
NOTES:

- 1 All auxiliary switches have voltage-free contacts.
- 2 Double-lobe cams are standard in all 2nd Generation units.
- 3 Main switches are one OPEN and one CLOSE switch.
- 4 Auxiliary switches are one OPEN and one CLOSE switch, which are fixed to activate 3... before the main switches.
- 5 Adjustable auxiliary switches are adjustable to any position.

INSTALLATION PROCEDURE

- 1 Cut terminal strip marker to length needed with letters facing up.
- 2 Mount terminal strip and marker to switchplate using two #4-40 screws.

Aux Terminal Strip

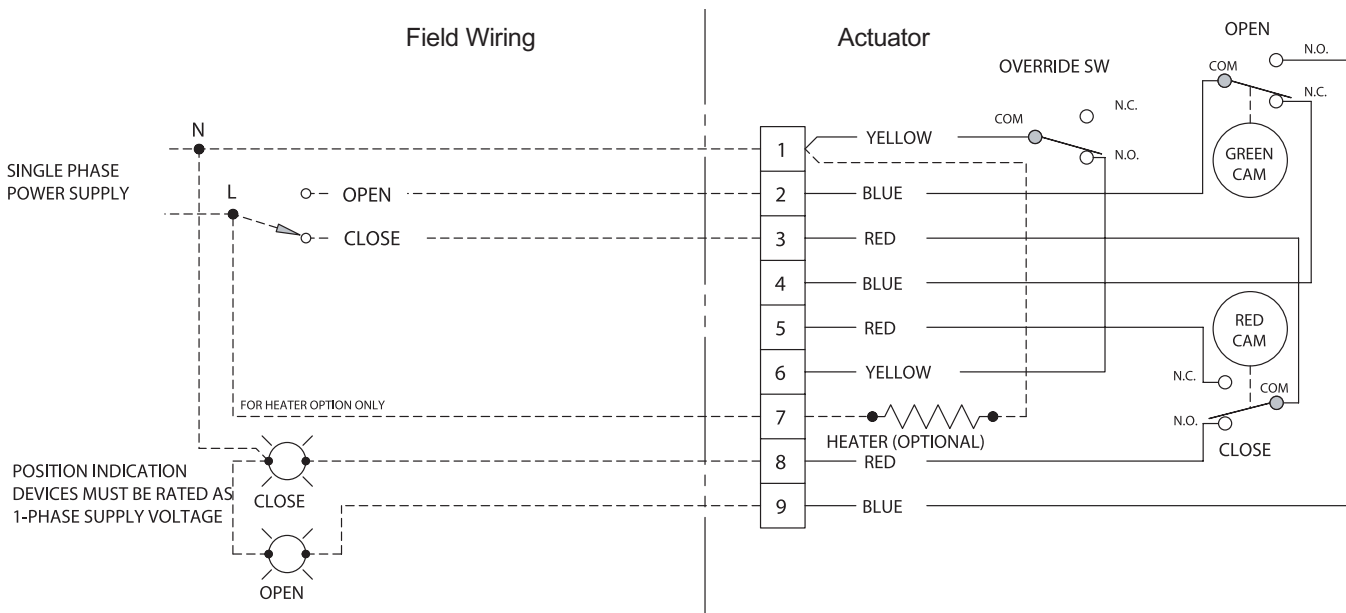


Cut marker as needed (4-way shown as example) and mount to switchplate as shown.

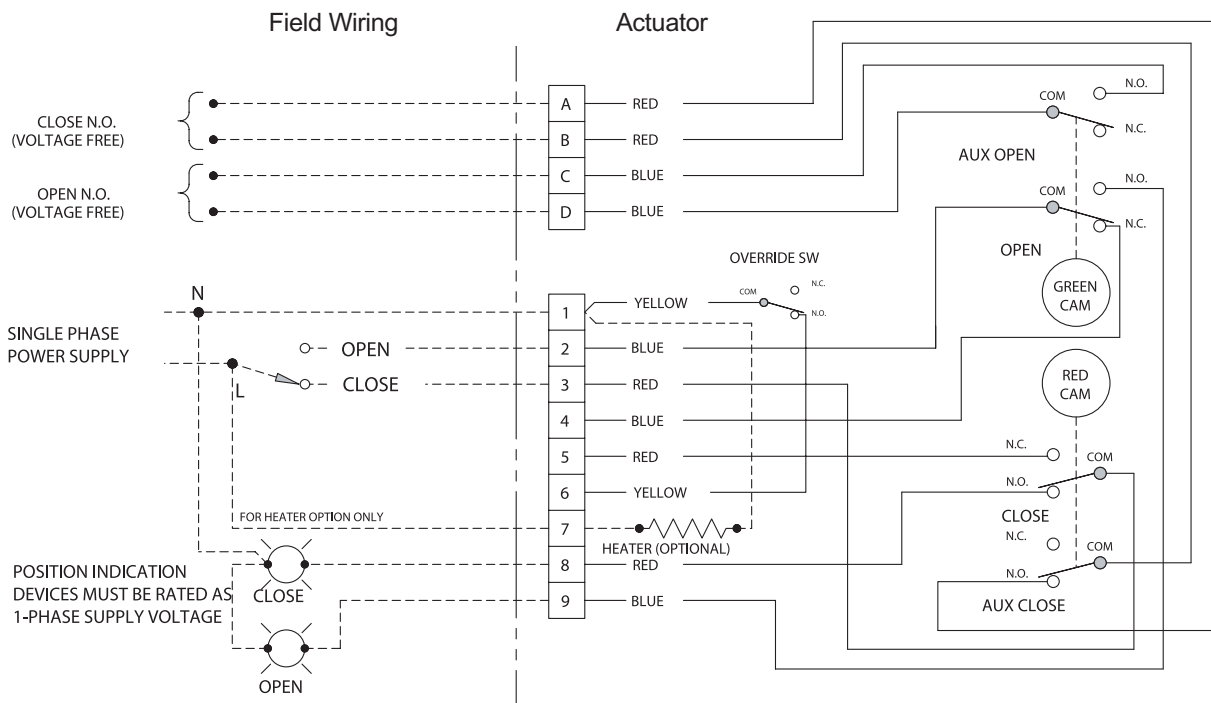
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CONFIGURATION	SIZE 6	SIZE 12 & 30
1 ON/OFF (Intermittent Duty Motor) with Main Switches (Standard OPEN and CLOSE switches)	2 Switch 2 Cams <i>Standard Assembly P/N</i>	2 Switch 2 Cams <i>Standard Assembly P/N</i>
2 ON/OFF (Continuous Duty Motor) with Main Switches (Standard OPEN and CLOSE switches)	2 Switch 2 Cams & Pot Gear <i>Standard Assembly P/N</i>	2 Switch 2 Cams & Pot Gear <i>Standard Assembly P/N</i>
3 ON/OFF (Intermittent Duty Motor) with Main and 1 set of Auxiliary Switches	4 Switch 2 Cams <i>Kit P/N 70-0006-22980-536</i>	4 Switch 2 Cams <i>Kit P/N 70-0012-22960-536</i>
4 ON/OFF (Continuous Duty Motor) with Main and 1 set of Auxiliary Switches	4 Switch 2 Cams & Pot Gear <i>Kit P/N 70-0006-22980-536</i>	4 Switch 2 Cams & Pot Gear <i>Kit P/N 70-0012-22960-536</i>
5 ON/OFF with Main, 1 set of Auxiliary, and 1 Adjustable Auxiliary Switches	5 Switch 3 Cams <i>Kit P/N 70-0006-22983-536</i>	5 Switch 3 Cams <i>Kit P/N 70-0012-22963-536</i>
6 ON/OFF with Main, 1 set of Auxiliary, and 1 set of Adjustable Auxiliary Switches	6 Switch 3 Cams <i>Kit P/N 70-0006-22984-536</i>	6 Switch 3 Cams <i>Kit P/N 70-0012-22964-536</i>
7 ON/OFF with Main, 1 set of Auxiliary, and 2 Adjustable Auxiliary Switches	N/A	6 Switch 4 Cams <i>Kit P/N 70-0012-22961-536</i>
8 ON/OFF with Main, 1 set of Auxiliary, and 2 sets of Adjustable Auxiliary Switches	N/A	8 Switch 4 Cams <i>Kit P/N 70-0012-22962-536</i>
9 Servo with Main, 1 set of Auxiliary, and 1 Adjustable Auxiliary Switches	N/A	5 Switch 3 Cams & 1 Pot Gear <i>Kit P/N 70-0012-22966-536</i>
10 Servo with Main, 1 set of Auxiliary, and 1 set of Adjustable Auxiliary Switches	N/A	6 Switch 3 Cams & 1 Pot Gear <i>Kit P/N 70-0012-22967-536</i>
11 ON/OFF with Main and 1 Adjustable Auxiliary Switches	3 Switch 3 Cams <i>Kit P/N 70-0006-22988-536</i>	3 Switch 3 Cams <i>Kit P/N 70-0012-22968-536</i>
12 Servo with Main and 1 Adjustable Auxiliary Switches	N/A	3 Switch 3 Cams & 1 Pot Gear <i>Kit P/N 70-0012-22971-536</i>

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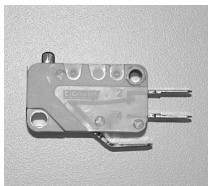
Wiring diagram for basic unit with C-Form (SPDT) travel switches.
(Drawn for actuator in its fully closed condition.)



Wiring diagram for unit with one set of Voltage Free C-Form (SPDT) open/close travel switches.
(Drawn for actuator in its fully closed condition.)

Actuator C-Form Switches, SPDT

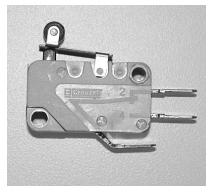
Size-6
V3-Sw



N.C.
N.O.

COM.

Size-12 & 30
V3-Sw with
Lever



N.C.
N.O.

COM.

RECEPTACLES (QUICK CONNECTORS)

Unless otherwise specified, power receptacles will be 5-pin mini style standard duty with a black anodized aluminum finish. They conform to ANSI B93.55M except in wire color. Euro receptacles will be used for low power instrument and signal cable since they can be supplied shielded. Wiring diagrams for plug-in receptacles for either the **Bray** Series 70 or the local control station will be provided as a separate diagram. Units ordered with pin connector receptacles factory installed are wired and tested. Cordsets which fit these receptacles may be ordered in several lengths.

RECEPTACLE KIT CONSISTS OF:

- 1) Receptacle(s), male pin and male thread $1/2$ -NPT, in the qty., style and number of pins ordered

- 2) Reducing bushing $3/4$ to $1/2$ NPT for installation in size 12 & 30 and control stations
- 3) Wiring diagram (SK-# below)

TOOLS REQUIRED:

- For terminal wiring Screwdriver, $3/16$ tip flat blade
- For Mini or Euro receptacle Wrench, 1

INSTALLATION PROCEDURE:

- 1) Screw the receptacle into the actuator conduit entry using teflon tape or similar.
- 2) Wire to the terminal strip according to the wiring diagram or the field wiring requirements.

WIRING SCHEMATIC FOR OPTIONAL PIN CONNECTOR RECEPTACLES

REQUIREMENTS				RECEPTACLES REQ D	NO L.C.S. ¹ DIAGRAM	WITH L.C.S. ¹ DIAGRAM
ON - OFF UNITS (INTERMITTENT OR CONTINUOUS)						
POWER	_____	_____	_____	ONE MINI _____	SK-960517	SK-960515
POWER	_____	POSITION INDICATION ²	_____	ONE MINI ONE EURO	SK-960717	SK-960513
POWER	_____	POSITION INDICATION ³	_____	ONE MINI ONE EURO	SK-960516	SK-960716 ⁵
POWER	_____	_____	FEEDBACK POTENTIOMETER	ONE MINI ONE EURO	SK-960718	SK-960720
POWER	_____	POSITION INDICATION ³	FEEDBACK POTENTIOMETER	ONE MINI 6-PIN EURO ⁴	SK-960719	N/A
MODULATING UNITS WITH A SERVO						
POWER	SIGNAL	_____	POSITION FEEDBACK SIGNAL	ONE MINI ONE EURO	SK-960512	SK-960734
POWER	SIGNAL	POSITION INDICATION ³	_____	ONE MINI ONE EURO	SK-960518	

Custom configurations are possible - consult the factory.

¹ L.C.S.: Local Control Station, WHICH implies mounted to the actuator

² Travel indication is wired to the supply voltage

³ Travel indication wiring is voltage free

⁴ A 6-pin EURO connector is required for this application, consult factory for price and availability.

⁵ The Local Control Station comes standard with 120 Volt lamp bulbs, for other voltages consult factory.

Note: the Control Station lights must be wired to the same voltage as the remote end of travel indication.

Euro receptacles use 22 AWG wire rated at 250V, 4 Amp. Pin configuration interfaces with European standards.

Mini receptacles use 18 AWG wire rated at 300 V, 9 Amp. Pin configuration conforms to ANSI B93.55M.

For requirements beyond these ratings consult the factory.

BRAY Series 70 Electric Actuator Operation and Maintenance Manual

SPINNER

A spinner is available to ease and speed the manual override of the **Bray** Series 70 actuator. The 300 and 500 in.lb. units mount the spinner on a lever which screws onto the back of the handwheel. The 800 through 6500 in.lb. units mount the spinner on the rim of the handwheel. Note that care should be exercised in the use of spinner equipped handwheels. Rapid operation of the handwheel to close the valve may cause water hammer. Also, rapid travel into a travel stop may cause damage.

SPINNER KIT CONSISTS OF:

For 300 and 500 in lb.

Spinner and lever assembly
Flat head socket cap screw,
#10-32UNF x 3/8

For 800 to 6500 in.lb. units

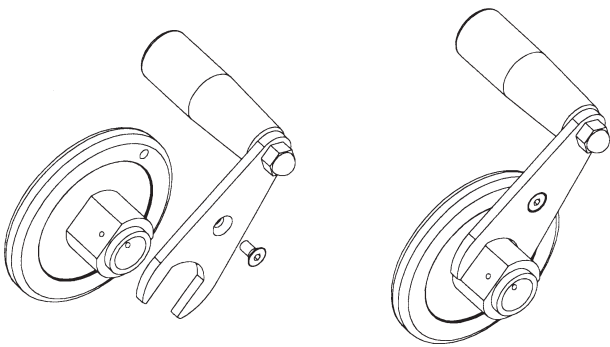
Socket head shoulder bolt,
1/4-20UNC x .75
Spinner handle

TOOLS REQUIRED:

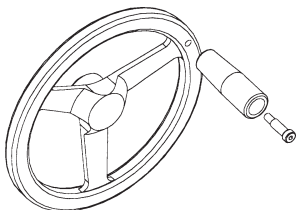
- For socket head shoulder bolt and flat head capscrew
Hex key, $\frac{1}{8}$

INSTALLATION PROCEDURE:

- For 300 and 500 in.lb. units simply position the lever onto the back of the handwheel then screw the flat head cap screw in to place from behind.



- For 800 up to 6500 in.lb. units, put the socket head shoulder bolt through the spinner handle and screw it firmly into the handwheel rim.



LOCAL CONTROL STATION (SINGLE PHASE POWERED ACTUATORS)

Bray's local control station gives the user the ability to locally override the actuator electrically. The station is equipped with a 3 position switch for remote / off / and local control. It includes a second 3 position switch for open / stop / close operation in the local control mode. Red and green end of travel indication lights are also provided. The control station can be used on both the on - off units as well as the servo controlled modulating units. Optional key operated locking switches are available.

LOCAL CONTROL STATION KIT CONSISTS OF:

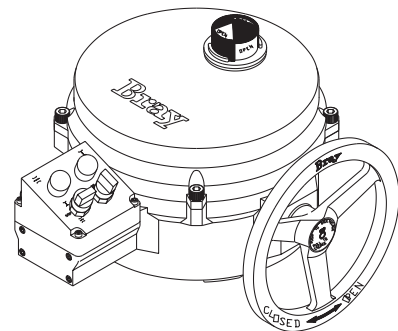
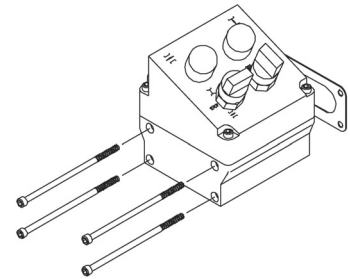
- 1 Local control station assembly
- 2 Four socket head cap screws, #10-24UNC x 4.50 long, for mounting the station to the actuator
- 3 A gasket for sealing the station to the actuator
- 4 Wiring diagram

TOOLS REQUIRED:

- For tapping control station mounting holes on actuator,
#10-24UNC Tap.
- For wiring Screwdriver, $\frac{3}{16}$ flat blade.
- For mounting and cover screws Hex key, $\frac{5}{32}$

INSTALLATION PROCEDURE:

1. Tap #10-24UNC holes using the cored holes on the side of actuator.
2. Adhere the gasket to the control box.
3. Mount the control box to the actuator using the 4 long socket head capscrews.
4. Wire the control box to the actuator in accordance to the wiring diagram provided. The local control station contains no terminal strips, and all wiring is direct to the switches and lights via $2 \times \frac{3}{4}$ pre trapped holes in bottom of housing. Ordering the control station with optional pin connector receptacles will eliminate the necessity of field wiring. The units will be completely factory wired and tested.



Note: the inclined cover of the local control station can be mounted in any of its four symmetrical positions. If field wiring is required, first mount the base to the actuator, then remove the cover to gain access for wiring.

APPENDIX A BASIC TOOLS

COMMON TO ALL UNITS

Terminal connections, cam adjustment
All switches, terminal strip, torque switch plate
Switchplate screws, capacitor
Servo trimmer pots

Screwdriver, 1/4" tip flat tip blade
Screwdriver, No.1 phillips
Screwdriver, No.2 phillips
Screwdriver, 1/8" flat tip for trim pots

300-500 IN•LB UNITS

Mounting nuts
Cover captivated capscrews
Travel stop adjusting studs
Travel stop jam nuts
Motor mount socket flat head capscrew
Motor mount socket head capscrew

Wrench, 1/2"
Hex key, 1/4"
Hex wrench, 1/8"
Wrench, 7/16"
Hex key, 3/32"
Hex key, 9/64"

800-1200 IN•LB UNITS

Mounting nuts (small pattern), travel stop jam nuts
Mounting nuts (large pattern)
Cover captivated capscrews
Travel stop adjusting studs
Motor mount socket head capscrew

Wrench, 1/2"
Wrench, 3/4"
Hex key, 5/16"
Hex key, 3/16"
Hex key, 5/32"

3000-6500 IN•LB UNITS

Mounting nuts, travel stop jam nuts
Cover captivated capscrews
Travel stop adjusting studs
Motor mount socket head shoulder bolt
Motor mount socket head cap screws

Wrench, 3/4"
Hex key, 3/8"
Hex key, 1/4"
Hex key, 5/32"
Hex key, 3/16"

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 valve (or open valve)	Limit switches are tripping	Readjust travel limit switches
	Mechanical travel stop is stopping actuator	Adjust mechanical travel stops
	Valve torque requirement is higher than actuator output	Manually override out of seat, try angle seating or larger actuator
	Optional torque switches are tripping	Valve torque exceeds actuator torque rating - consult factory
	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 trigger 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

SERVO PLUS II TROUBLESHOOTING CHART Refer to S.P. II Operation Manual for more information

Problem	Possible cause	Solutions
Actuator moves back and forth near setpoint (hunts)	Signal is fluctuating beyond deadband setting	Widen deadband
	Signal has interference	Shield signal from interference
Actuator does not travel fully open or fully closed	Travel limit switches are not set correctly	Set travel limit switches for 90° operation
	Servo is not set calibrated	Recalibrate servo
	Mechanical travel stops are not set correctly	Set mechanical travel stops for 90° operation
Actuator motor does not run and green servo power light is off	Power is disconnected	Reconnect power
Actuator motor does not run and green servo power light is on	Limit switches or torque switches are triggered	Test and ensure connections to servo from these switches are shorted
	Servo is not connected correctly	Check servo wiring to all points
	Override is engaged	Push handwheel in all the way
	Motor has thermally tripped	Allow motor to cool down
	Torque switch not fitted	Check program that torque switch option is not enabled
	Incorrect signal polarity	Correct polarity of wires
Actuator does not properly respond to command signal	Potentiometer gear is not engaged	Engage potentiometer gear
	Command signal is not the same as used on initial calibration	Repeat calibration procedure using signal that will be used to control unit
Actuator runs in one direction only	Wiring is incorrect	Inspect and correct wiring
	Potentiometer wired backwards	Reverse white and gray wires, See wiring diagram inside cover
	Limit switch or torque switch is triggered	Ensure connections to servo from these switches are shorted
	Command signal faulty & actuator runs to its fail safe position	Check polarity & value of control signal
Green/Red bicolor status lights indicating fault	I5 - different fault indications reported on	Refer to S.P. II manual for status light chart
Motor open & motor closed LED are on at same time (motor does not run/hums)	Both open & close motor output triacs are damaged	Replace servo
Analog position feedback signal failed	Signal receiving device has an impedance less than 100 ohms or greater than 1k ohm	Receiving device should have impedance of approx. 250 ohms
	Incorrectly a power source has been connected to the loop	Disconnect external signal power

BRAY Series 70 Electric Actuator Operation and Maintenance Manual

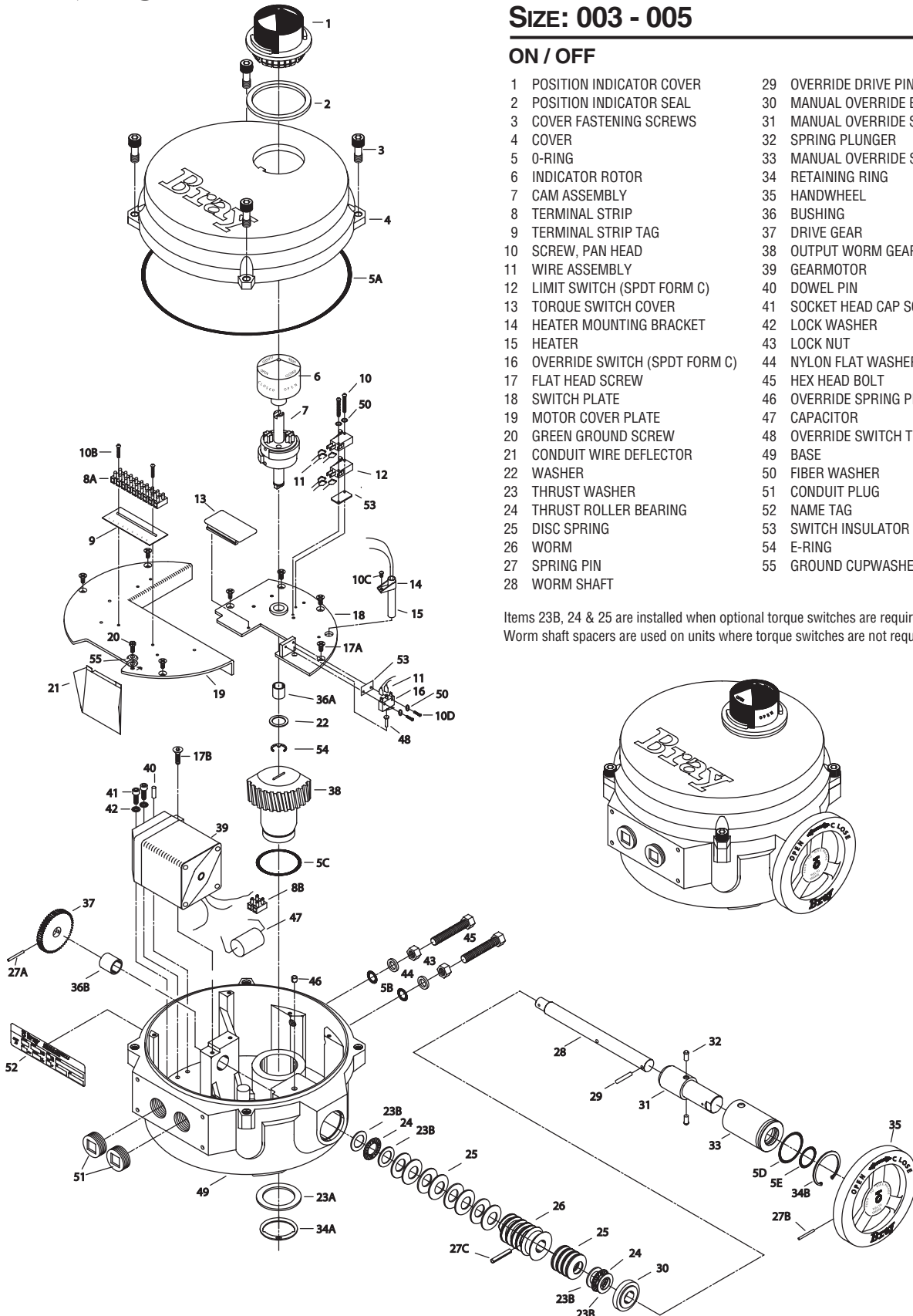
APPENDIX C

SERIES 70 SIZE: 003 - 005

ON / OFF

- | | |
|----------------------------------|--------------------------------|
| 1 POSITION INDICATOR COVER | 29 OVERRIDE DRIVE PIN |
| 2 POSITION INDICATOR SEAL | 30 MANUAL OVERRIDE BUSHING |
| 3 COVER FASTENING SCREWS | 31 MANUAL OVERRIDE SHAFT |
| 4 COVER | 32 SPRING PLUNGER |
| 5 O-RING | 33 MANUAL OVERRIDE SLEEVE |
| 6 INDICATOR ROTOR | 34 RETAINING RING |
| 7 CAM ASSEMBLY | 35 HANDWHEEL |
| 8 TERMINAL STRIP | 36 BUSHING |
| 9 TERMINAL STRIP TAG | 37 DRIVE GEAR |
| 10 SCREW, PAN HEAD | 38 OUTPUT WORM GEAR SEGMENT |
| 11 WIRE ASSEMBLY | 39 GEARMOTOR |
| 12 LIMIT SWITCH (SPDT FORM C) | 40 DOWEL PIN |
| 13 TORQUE SWITCH COVER | 41 SOCKET HEAD CAP SCREW |
| 14 HEATER MOUNTING BRACKET | 42 LOCK WASHER |
| 15 HEATER | 43 LOCK NUT |
| 16 OVERRIDE SWITCH (SPDT FORM C) | 44 NYLON FLAT WASHER |
| 17 FLAT HEAD SCREW | 45 HEX HEAD BOLT |
| 18 SWITCH PLATE | 46 OVERRIDE SPRING PIN |
| 19 MOTOR COVER PLATE | 47 CAPACITOR |
| 20 GREEN GROUND SCREW | 48 OVERRIDE SWITCH TRIGGER PIN |
| 21 CONDUIT WIRE DEFLECTOR | 49 BASE |
| 22 WASHER | 50 FIBER WASHER |
| 23 THRUST WASHER | 51 CONDUIT PLUG |
| 24 THRUST ROLLER BEARING | 52 NAME TAG |
| 25 DISC SPRING | 53 SWITCH INSULATOR |
| 26 WORM | 54 E-RING |
| 27 SPRING PIN | 55 GROUND CUPWASHER |
| 28 WORM SHAFT | |

Items 23B, 24 & 25 are installed when optional torque switches are required.
Worm shaft spacers are used on units where torque switches are not required.

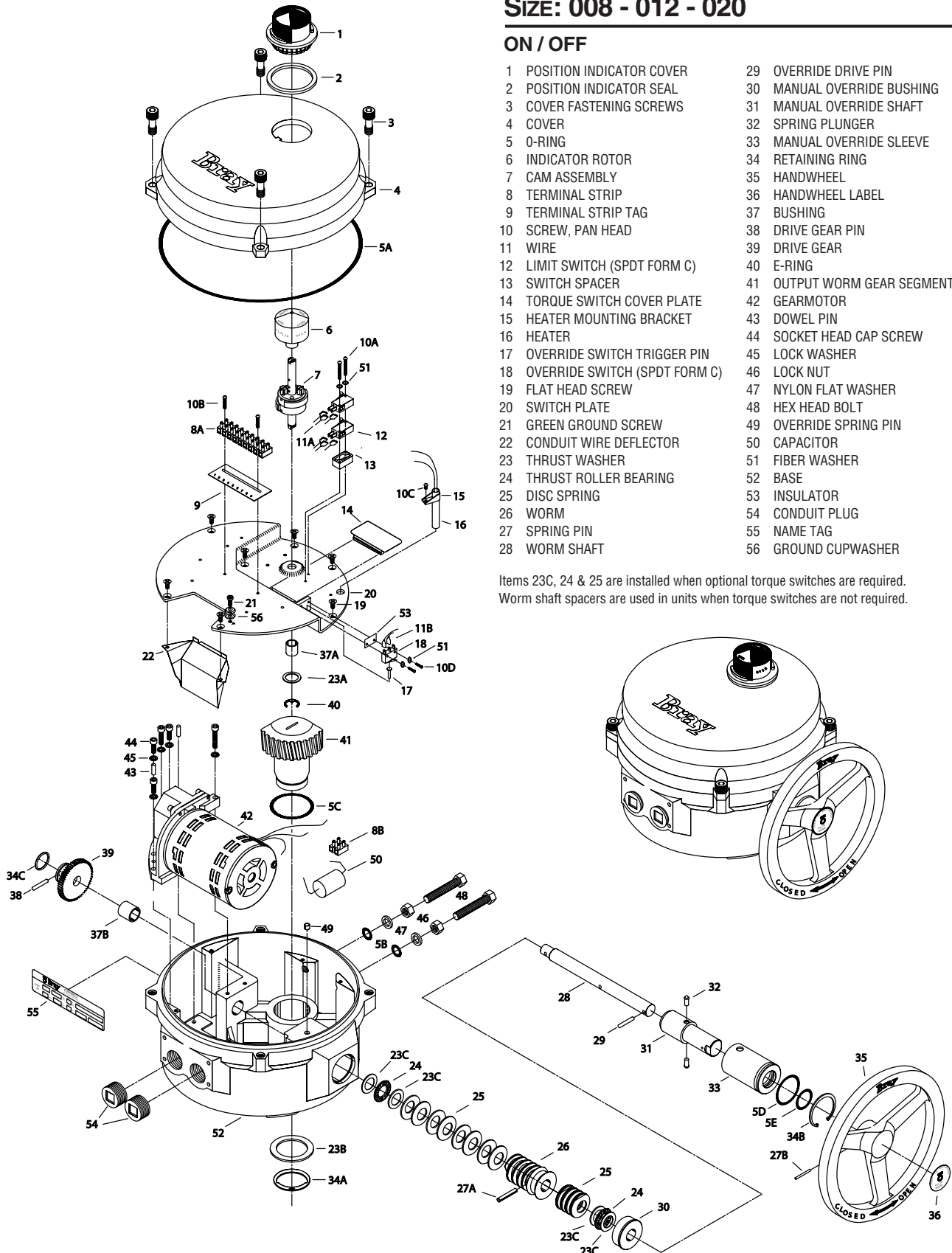


SERIES 70 SIZE: 008 - 012 - 020

ON / OFF

- | | |
|----------------------------------|-----------------------------|
| 1 POSITION INDICATOR COVER | 29 OVERRIDE DRIVE PIN |
| 2 POSITION INDICATOR SEAL | 30 MANUAL OVERRIDE BUSHING |
| 3 COVER FASTENING SCREWS | 31 MANUAL OVERRIDE SHAFT |
| 4 COVER | 32 SPRING PLUNGER |
| 5 O-RING | 33 MANUAL OVERRIDE SLEEVE |
| 6 INDICATOR ROTOR | 34 RETAINING RING |
| 7 CAM ASSEMBLY | 35 HANDWHEEL |
| 8 TERMINAL STRIP | 36 HANDWHEEL LABEL |
| 9 TERMINAL STRIP TAG | 37 BUSHING |
| 10 SCREW, PAN HEAD | 38 DRIVE GEAR PIN |
| 11 WIRE | 39 DRIVE GEAR |
| 12 LIMIT SWITCH (SPDT FORM C) | 40 E-RING |
| 13 SWITCH SPACER | 41 OUTPUT WORM GEAR SEGMENT |
| 14 TORQUE SWITCH COVER PLATE | 42 GEARMOTOR |
| 15 HEATER MOUNTING BRACKET | 43 DOWEL PIN |
| 16 HEATER | 44 SOCKET HEAD CAP SCREW |
| 17 OVERRIDE SWITCH TRIGGER PIN | 45 LOCK WASHER |
| 18 OVERRIDE SWITCH (SPDT FORM C) | 46 LOCK NUT |
| 19 FLAT HEAD SCREW | 47 NYLON FLAT WASHER |
| 20 SWITCH PLATE | 48 HEX HEAD BOLT |
| 21 GREEN GROUND SCREW | 49 OVERRIDE SPRING PIN |
| 22 CONDUIT WIRE DEFLECTOR | 50 CAPACITOR |
| 23 THRUST WASHER | 51 FIBER WASHER |
| 24 THRUST ROLLER BEARING | 52 BASE |
| 25 DISC SPRING | 53 INSULATOR |
| 26 WORM | 54 CONDUIT PLUG |
| 27 SPRING PIN | 55 NAME TAG |
| 28 WORM SHAFT | 56 GROUND CUPWASHER |

Items 23C, 24 & 25 are installed when optional torque switches are required. Worm shaft spacers are used in units when torque switches are not required.

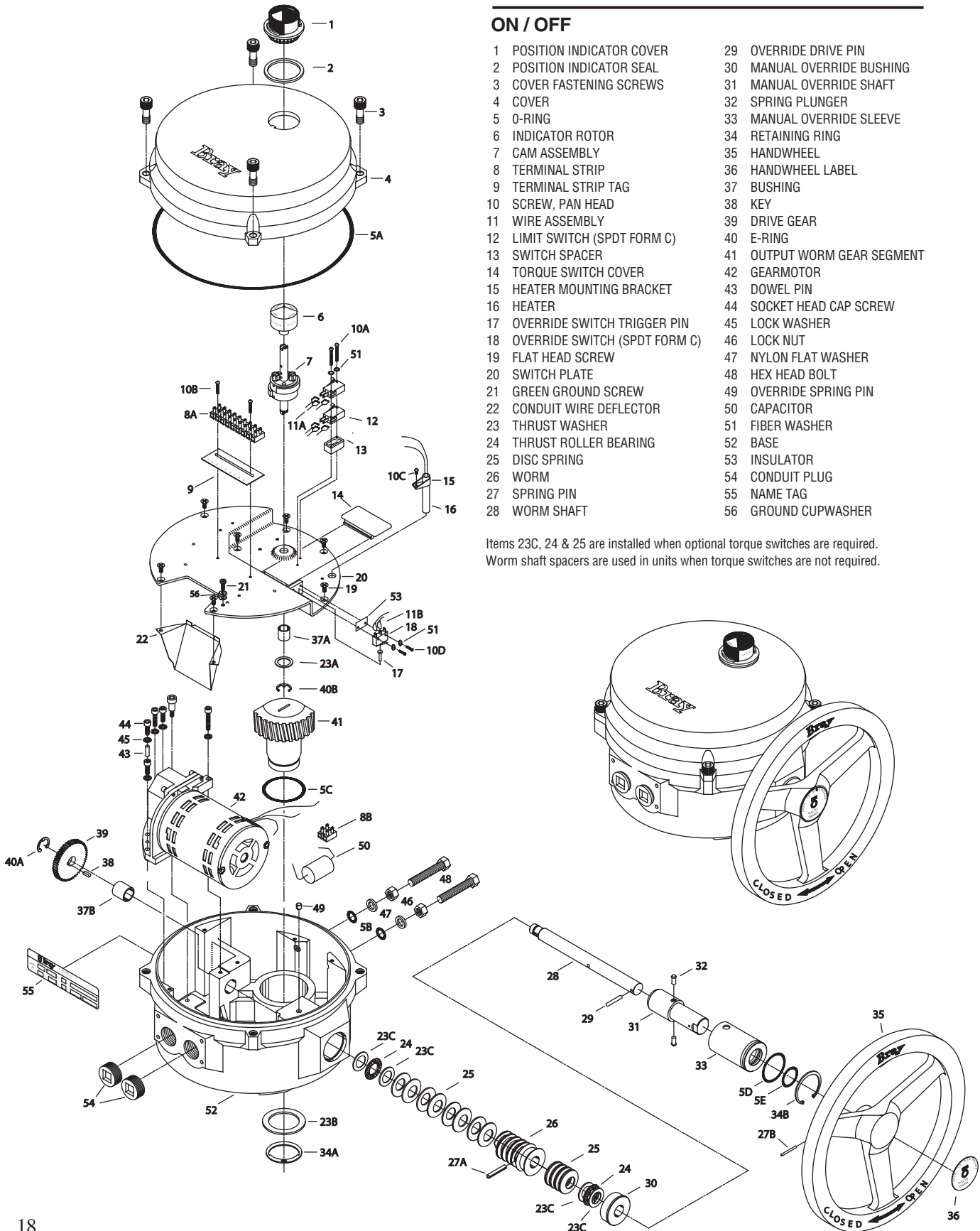


SERIES 70
SIZE: 030 - 050 - 065

ON / OFF

- | | |
|----------------------------------|-----------------------------|
| 1 POSITION INDICATOR COVER | 29 OVERRIDE DRIVE PIN |
| 2 POSITION INDICATOR SEAL | 30 MANUAL OVERRIDE BUSHING |
| 3 COVER FASTENING SCREWS | 31 MANUAL OVERRIDE SHAFT |
| 4 COVER | 32 SPRING PLUNGER |
| 5 O-RING | 33 MANUAL OVERRIDE SLEEVE |
| 6 INDICATOR ROTOR | 34 RETAINING RING |
| 7 CAM ASSEMBLY | 35 HANDWHEEL |
| 8 TERMINAL STRIP | 36 HANDWHEEL LABEL |
| 9 TERMINAL STRIP TAG | 37 BUSHING |
| 10 SCREW, PAN HEAD | 38 KEY |
| 11 WIRE ASSEMBLY | 39 DRIVE GEAR |
| 12 LIMIT SWITCH (SPDT FORM C) | 40 E-RING |
| 13 SWITCH SPACER | 41 OUTPUT WORM GEAR SEGMENT |
| 14 TORQUE SWITCH COVER | 42 GEARMOTOR |
| 15 HEATER MOUNTING BRACKET | 43 DOWEL PIN |
| 16 HEATER | 44 SOCKET HEAD CAP SCREW |
| 17 OVERRIDE SWITCH TRIGGER PIN | 45 LOCK WASHER |
| 18 OVERRIDE SWITCH (SPDT FORM C) | 46 LOCK NUT |
| 19 FLAT HEAD SCREW | 47 NYLON FLAT WASHER |
| 20 SWITCH PLATE | 48 HEX HEAD BOLT |
| 21 GREEN GROUND SCREW | 49 OVERRIDE SPRING PIN |
| 22 CONDUIT WIRE DEFLECTOR | 50 CAPACITOR |
| 23 THRUST WASHER | 51 FIBER WASHER |
| 24 THRUST ROLLER BEARING | 52 BASE |
| 25 DISC SPRING | 53 INSULATOR |
| 26 WORM | 54 CONDUIT PLUG |
| 27 SPRING PIN | 55 NAME TAG |
| 28 WORM SHAFT | 56 GROUND CUPWASHER |

Items 23C, 24 & 25 are installed when optional torque switches are required.
 Worm shaft spacers are used in units when torque switches are not required.



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Bray CONTROLS

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