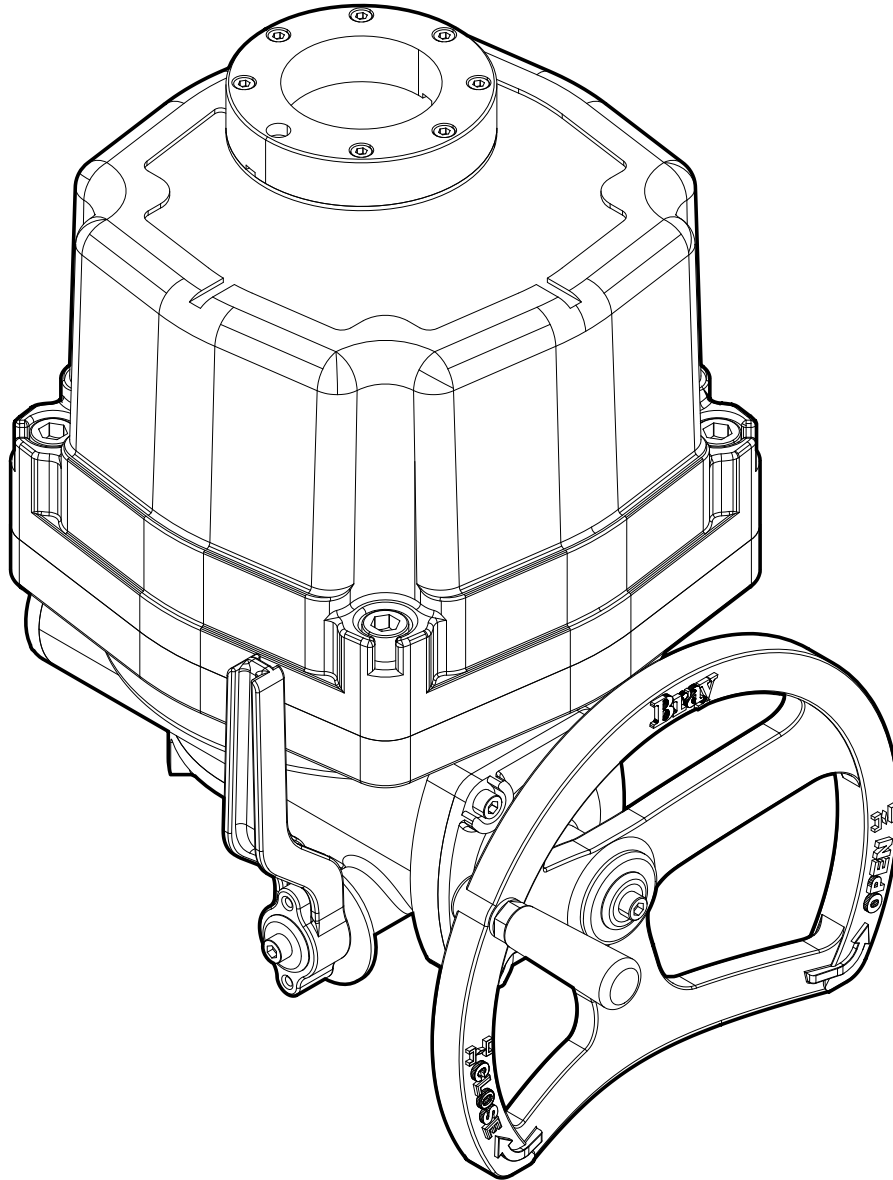


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**SERIES 76**

# INDUSTRIAL ELECTRIC ACTUATORS EXPLOSIONPROOF

Installation, Operation, and Maintenance Manual



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 **Bray**<sup>®</sup>

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**READ AND FOLLOW THESE INSTRUCTIONS CAREFULLY.  
SAVE THIS MANUAL FOR FUTURE USE.**

**0.0 DEFINITION OF TERMS**

All information within this manual is relevant to the safe operation and proper care of your Bray valve. Please understand the following examples of information used throughout this manual.

**0.0 IDENTIFIES CHAPTER HEADING**

**0.00** Identifies and explains sequential procedure to be performed.

**NOTE:** Provides important information related to a procedure.

**SAFETY STATEMENTS:** To prevent unwanted consequences. Standard symbols and classifications are:



**DANGER**

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



**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, could 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.

## 1.0 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 to ensure hazard-free operation of this device.

Configuration and setup procedures for this device are described in this manual. Proper configuration and setup are required for the safe operation of this device.

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

## 2.0 QUALIFIED PERSONNEL



### WARNING

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

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

As per this document, a qualified person is one who is trained in:

- > The operation and maintenance of electric equipment and systems in accordance with established safety practices.
- > Procedures to energize, de-energize, ground, tag and lock electrical circuits and equipment in accordance with established safety practices.
- > The proper use and care of personal protective equipment (PPE) in accordance with established safety practices.
- > 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

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

### 3.0 INTRODUCTION

The Bray Series 76 is a quarter-turn industrial electric actuator with manual override for use on any quarter-turn valve or damper requiring up to 26.6k in-lbs (3,000 Nm) of torque. Operating speeds vary between 17 to 130 seconds depending on torque, voltage, and frequency.



#### NOTICE

This document is specific to Series 76 models certified for use in hazardous locations. Additional product information (such as the IOM for weatherproof models, application data, engineering specifications, actuator selection, etc.) is available from your local Bray distributor, sales representative, or online at **BRAY.COM**.

For complete details on the latest product certifications, visit **BRAY.COM/Certifications**.

### 3.1 APPROVED LOCATIONS AND CERTIFICATIONS

The Bray Series 76 actuators are designed and certified to operate in the following hazardous locations when installed correctly by authorized personnel.



#### NOTICE

Each certification type contains limitations in model availability. See Appendix C for full listing of available models.

The Bray Series 76 is certified for use in North America.

**CSA Certificate:** 80179924

Approved Hazardous Locations

- Class I, Division 1, Groups C, D; T4 (USA, Canada)
- Ex d IIB T4 Gb (Canada)
- Class I, Zone 1, AEx d IIB T4 Gb (USA)
- $-20^{\circ}\text{C} \leq \text{Ta} \leq +60^{\circ}\text{C}$

The Bray Series 76 is certified for **ATEX** and **IECEX** hazardous locations.

**ATEX Certificate:** DEKRA 23ATEX0092 X

**IECEX Certificate:** IECEX DEK 23.0064X

Approved Hazardous Locations - ATEX:

- II 2G Ex db IIB T4 Gb
- II 2D Ex tb IIIC T135°C Db
- $-20^{\circ}\text{C} \leq \text{Ta} \leq +60^{\circ}\text{C}$

Approved Hazardous Locations - IECEX:

- Ex db IIB T4 Gb
- Ex tb IIIC T135°C Db
- $-20^{\circ}\text{C} \leq \text{Ta} \leq +60^{\circ}\text{C}$

The Bray Series 76 is also certified to the following environmental certificates.

- TYPE 4/4X/6
- IP 66/67

## **4.0 PRINCIPAL OF OPERATION**

The Series 76 actuator is divided into two internal sections. The mechanical gearing and override mechanism reside in a sealed mechanical compartment within the aluminum diecast base. The control center, including the motor, is mounted on top of the sealed base, underneath the cover.

The motor drives two sets of non-backdriveable worm gears within the sealed mechanical compartment. The control center is where user-required readily accessible components are placed. The indicator shaft assembly, limit switches, terminal strips, torque switches, heater, and electronic controllers are all placed here for easy access.

External to the unit are adjustable mechanical travel stops, a windowed indicator viewport, the manual override declutch lever, the handwheel with spinner, and dual conduit entry ports. The external coating is a high-quality polyester powder coat that has exceptional UV protection and chemical resistance.

## **4.1 ELECTRICAL OPERATION**

The motors used in the Bray Series 76 are either permanent split capacitor (PSC) single-phase AC induction motors, 3-phase AC induction motors, or permanent magnet (PM) DC motors. Travel limit switches are mechanical form (SPDT) with contacts rated at 16 Amp, 250 VAC.

In cases where the torque capacity of the unit is exceeded to the point where the motor stalls, a thermal protector switch, built into the induction motor windings, will automatically disconnect the motor power and prevent overheating. Once the motor cools sufficiently, the thermal protector switch will reset automatically.

Space heaters are installed inside the cover to prevent condensation from forming; space heaters operate at 5W for size 1 actuators and 10W for all other sizes. Torque switches are available in housing sizes 2 through 5 to prevent the possibility of stalling the motor, thus reducing the possibility of an inoperable thermal cool-down period. Torque switches, installed by Bray, are factory-adjusted to the output torque rating of the unit using electronic torque testing equipment. Additional limit and torque switches are available in most models.

## 4.2 MECHANICAL OPERATION

Mechanically, the ratio of the gearing determines the speed of the actuator. The motor drives two sets of worm gears in series. The final gear reduction and output is through a non-backdriveable gear set. Size 5 units are mounted to an additional gearbox with a 3:1 gear ratio. Positioning is determined by an indicator/camshaft, which is linked to the output shaft. In the declutchable condition, the manual override drives the secondary worm shaft when engaged.



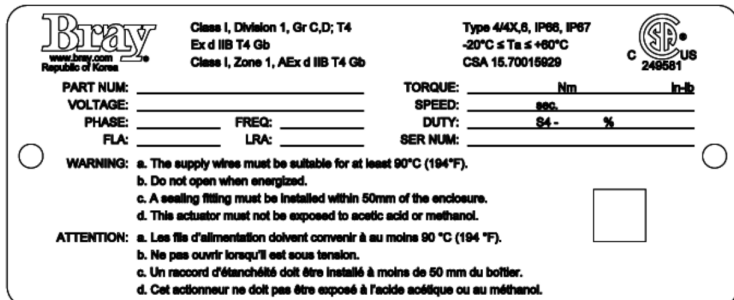
### NOTICE

The gearbox in size 5 models mechanically reverses the direction of operation with respect to the other model sizes. The control center is wired for reverse operation such that counter-clockwise open operation is achieved by the gearbox. The windowed indicator will rotate clockwise while opening and counter-clockwise while closing. The direction of manual operation will also be reversed when compared to the other model sizes.

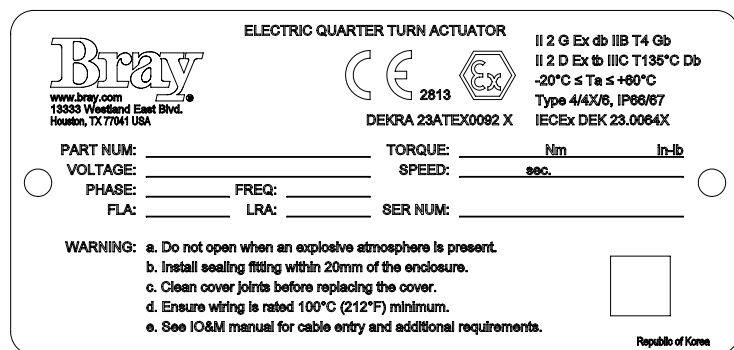
The Bray Series 76 XP electric actuators are supplied with a blank drive bushing and ISO 5211 or MSS SP-101 style bolt patterns for actuator mounting. The actuator drive bushing is removable for ease of machining and is made of S45C carbon steel. The factory can machine bushing for standard sizes or customize as required. Other bushing material options are available. See the factory for details.

**5.0 VALVE IDENTIFICATION**

The actuator nameplate is located on the enclosure body and is customized depending on the certification. Nameplate geometry may vary based on housing size, See **Figures 1 & 2**.



**Figure 1:** Example CSA-certified actuator nameplate



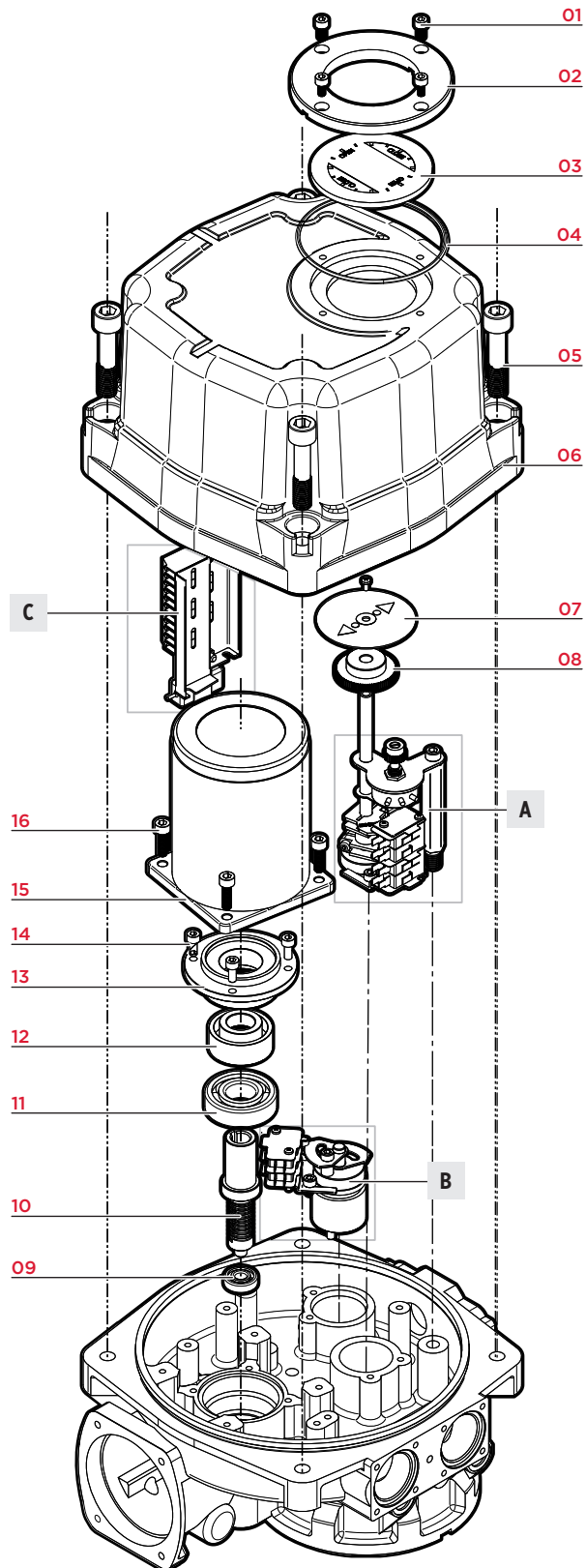
**Figure 2:** Example ATEX/IECEx certified actuator nameplate.



**6.0 PARTS IDENTIFICATION - EXPLODED VIEW UPPER**

**Figure 3:** Series 76 Upper

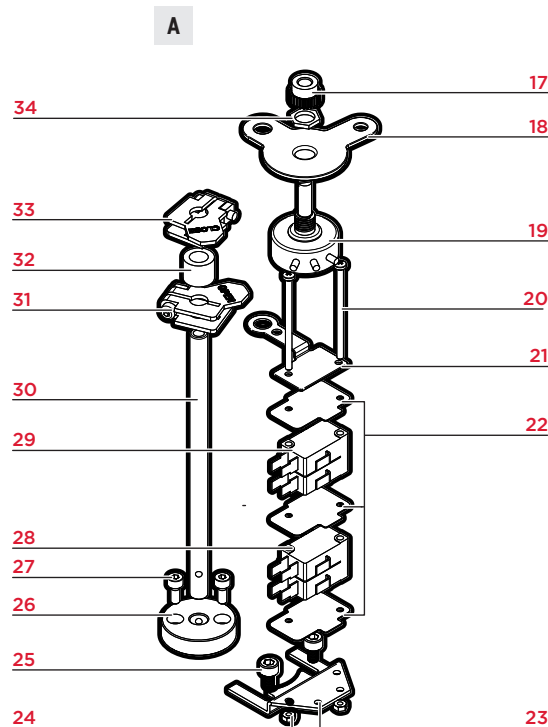
ITEM	DESCRIPTION	QTY
1	Window Mounting Bolt	4
2	Window Clamp	1
3	Indicator Window	1
4	Indicator O-ring	1
5	Cover Mounting Bolt	4
6	Cover	1
7	Indicator	1
8	Potentiometer Gear, Large	1
9	Motor Worm Bearing, Lower	1
10	Worm Gear, Motor	1
11	Motor Worm Bearing, Upper	1
12	Disc	1
13	Disc Cover	1
14	Disc Cover Mounting Bolts	4
15	Motor	1
16	Motor Mounting Bolts	4



**6.1 PARTS IDENTIFICATION - EXPLODED VIEW UPPER DETAIL**

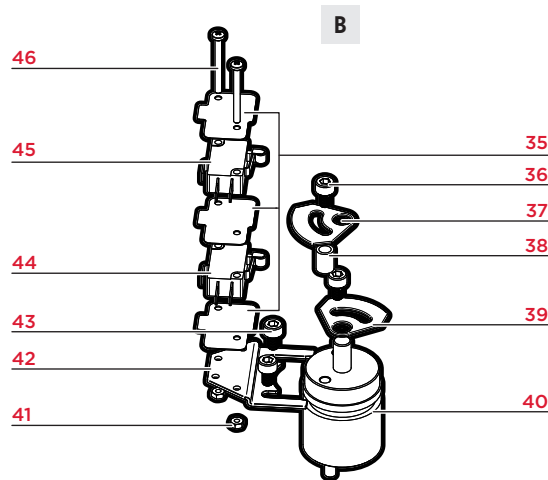
**Figure 4: Series 76 Upper-A**

ITEM	DESCRIPTION	QTY
17	Potentiometer Gear, Small	1
18	Potentiometer Holder	1
19	Potentiometer	1
20	Limit Switch Mount. Screw	2
21	Limit Switch Bracket	1
22	Switch Insulator	3
23	Limit Switch Mounting Plate	1
24	Limit Switch Mounting Nut	2
25	Mounting Plate Bolt	2
26	Point Shaft Block	1
27	Point Shaft Mounting Bolt	2
28	Open Limit/Aux Switch Stack	1
29	Closed Limit/Aux Switch Stack	1
30	Indicator Shaft	1
31	Open Limit Cam	1
32	Limit Cam Bushing	1
33	Closed Limit Cam	1
34	Potentiometer Mount. Nut	1



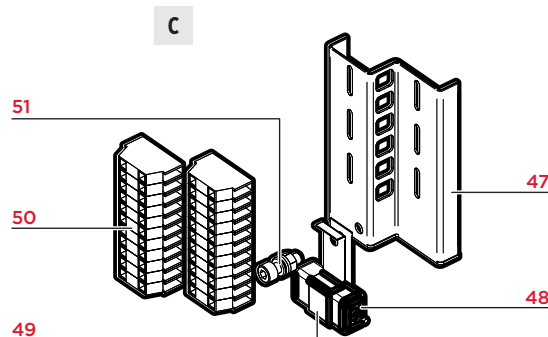
**Figure 5: Series 76 Upper-B 1**

ITEM	DESCRIPTION	QTY
35	Switch Insulator	3
36	Hex Socket Head Bolt	1
37	Open Torque Cam	1
38	Torque Cam Bushing	1
39	Close Torque Cam	1
40	Torque Shaft	1
41	Torque Switch Mount. Nut	2
42	Torque Switch Mount. Plate	1
43	Mounting Plate Bolt	2
44	Closed Torque Switch	1
45	Open Torque Switch	1
46	Torque Switch Moun. Screw	2



**Figure 6: Series 76 Upper-C**

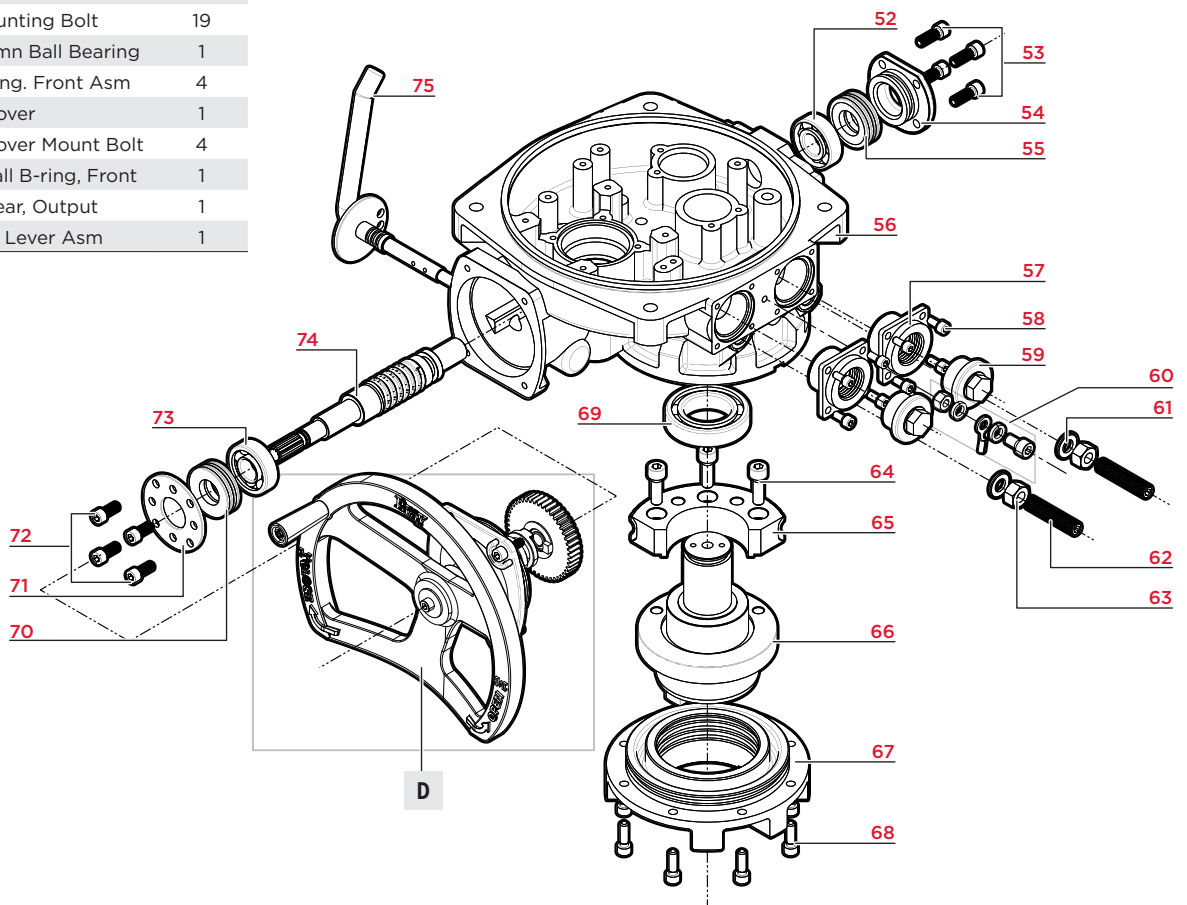
ITEM	DESCRIPTION	QTY
47	Terminal Bracket	1
48	Heater	1
49	Heater Bracket	1
50	Terminal Block	14-28
51	Heater Mounting Hardware	1



**6.2 PARTS IDENTIFICATION - EXPLODED VIEW LOWER**

**Figure 7:** Series 76 Lower

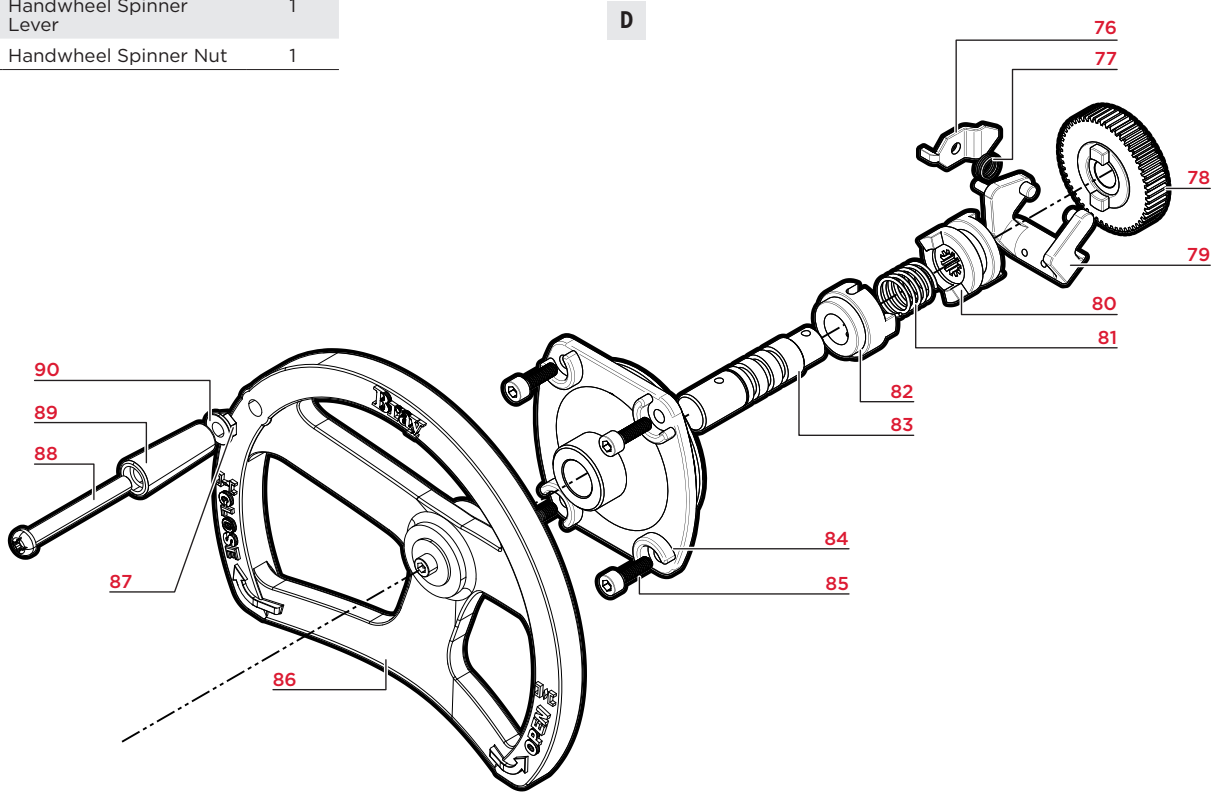
ITEM	DESCRIPTION	QTY
52	Worm Ball Bearing, Back	1
53	Worm Cover Mount. Bolt	4
54	Worm Cover Plate	1
55	Disc Spring, Back Asm	4
56	Body	1
57	Conduit Entry	2
58	Conduit Entry Mnt.Bolt	8
59	Conduit Entry Plug	2
60	External Ground Assembly	1
61	Travel Stop Bolt Washer	2
62	Travel Stop Bolt	2
63	Travel Stop Nut	2
64	Worm Wheel Mount. Bolt	3
65	Worm Wheel, Output	1
66	Center Column	1
67	Base	1
68	Base Mounting Bolt	19
69	Ctr Column Ball Bearing	1
70	Disc Spring. Front Asm	4
71	Thrust Cover	1
72	Thrust Cover Mount Bolt	4
73	Worm Ball B-ring, Front	1
74	Worm Gear, Output	1
75	Declutch Lever Asm	1



**6.3 PARTS IDENTIFICATION - EXPLODED VIEW LOWER**

**Figure 8:** Series 76 Lower - D

ITEM	DESCRIPTION	QTY
76	Declutch Lock Lever	1
77	Declutch Lever Spring	1
78	Worm Wheel, Motor	1
79	Auto Yoke	1
80	Clutch, Back	1
81	Yoke Spring	1
82	Clutch, Front	1
83	Handwheel Shaft	1
84	Handwheel Cover Plate	1
85	Handwheel Cover Mount Bolt	4
86	Handwheel	1
87	Handwheel Spinner Washer	1
88	Handwheel Spinner Bolt	1
89	Handwheel Spinner Lever	1
90	Handwheel Spinner Nut	1



## 7.0 STORAGE



### WARNING

Actuators are not weatherproof unless they are properly installed on the valve or prepared for storage. Bray cannot accept responsibility for deterioration caused on-site.

Bray Series 76 is not weatherproof until the unit is properly installed, or all conduits and applicable port connections are sealed off and prepared for storage. The units may be shipped with temporary covers to prevent foreign matter from entering through the conduit openings; however, the user is responsible for replacing them with the proper sealing plugs to support its NEMA/IP and hazardous locations certifications.



### NOTICE

Temporary shipping plugs may be used for short-term storage (< 1 year). If units are to be stored for a longer period (> 1 year), then temporary shipping plugs must be replaced and sealed with proper sealing plugs.

To prevent condensation from forming inside the unit, maintain a near-constant external temperature and store indoors in a well-ventilated, clean, dry room. The temperature shall be between 40°F (4°C) and 85°F (29°C), with a relative humidity less than 70%.

Store units away from vibration and direct sunlight exposure, and place units on a shelf or wooden pallet to protect against dampness. Keep units covered to protect against dust and dirt; if storing for the long term, placing the unit inside a plastic sealed bag may be preferred.



### CAUTION

Do not stack size 5 actuators or stack smaller-sized actuators on top of the size 5 actuators. Do not stack other sizes (1 through 4) higher than three high.



### NOTICE

If the units are expected to be stored long-term (over 1 year), power should be supplied to the heater via conduit entry with an appropriate sealing gland. Placing the unit inside a plastic sealed bag may be preferred. The silica gel should be periodically replaced.



### NOTICE

Long-term outdoor storage is not recommended. In addition to all indoor storage requirements, units must be stored off the ground, high enough to prevent them from being immersed in water or buried in snow. Periodically inspect the stored unit to check for damage.

Bray cannot accept responsibility for deterioration caused on-site once the cover is removed or due to improper storage.

**8.0 OPERATION MODES**

**8.1 MANUAL OPERATION**

To engage the manual override, pull the manual override lever towards the hand wheel until it locks into the forward position. Rotating the hand wheel in the clockwise direction will rotate the output shaft in the clockwise (closed) direction and vice-versa. See **Figure 9**. Electrically operate the actuator to disengage the manual override declutch mechanism. The manual override lever will automatically revert to its original position and allow remote operation to occur. See **Figure 10**.

The manual override lever may be padlocked to inhibit accidental activation of manual operation.



**NOTICE**

The direction of manual operation is reversed in size 5 models due to the gearbox.



**CAUTION**

Do not force the declutch lever back into its original position as this may damage the internal declutch components. Electrical operation via the motor will automatically re-engage the declutch mechanism and allow remote operation.



**CAUTION**

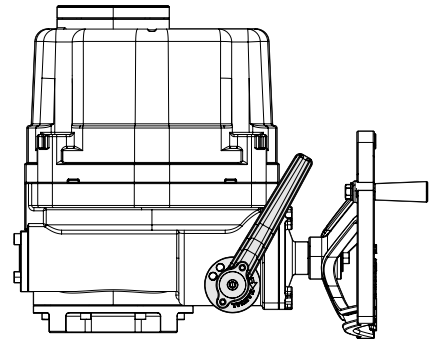
The internal electronics cannot sense the activation of the declutch mechanism. Therefore, if possible, electrical operation should be suspended during manual operation to ensure that the declutch is not disengaged by the motor. If it is not possible to suspend electrical operation, the operator may continuously hold the declutch lever in the forward position or pin the declutch handle in place using the locking holes.



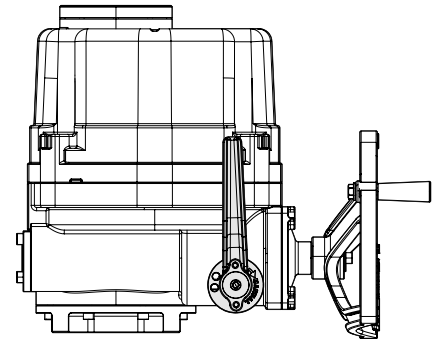
**CAUTION**

Do not exceed the specific 'rim pull' force for each size actuator. If the 'rim pull' force is exceeded, an internal roll pin may shear to protect the gearing. See the Technical Sales Manual for specific limits and contact factory for repair instructions.

**Figure 9:** Manual override lever engaged.



**Figure 10:** Manual override lever disengaged.



## 8.2 ON/OFF OPERATION



### **NOTICE**

3-Phase operation requires a motor starter to change direction. Bray configures all 3-phase actuators with a local control station which includes a built-in motor starter. See Local Control Station Operation for more details.

On/Off operation requires the customer to provide power to a specific terminal to control the direction of the actuator. A single-pole double-throw (SPDT) control relay is typically used to route power to the open or closed terminals to command direction.

Actuators configured for On/Off operation may have an optional potentiometer or a current transmitter installed by the factory. See Factory Installable Options for more details.



### **WARNING**

Do not apply power to both the open and closed direction control terminals at the same time.

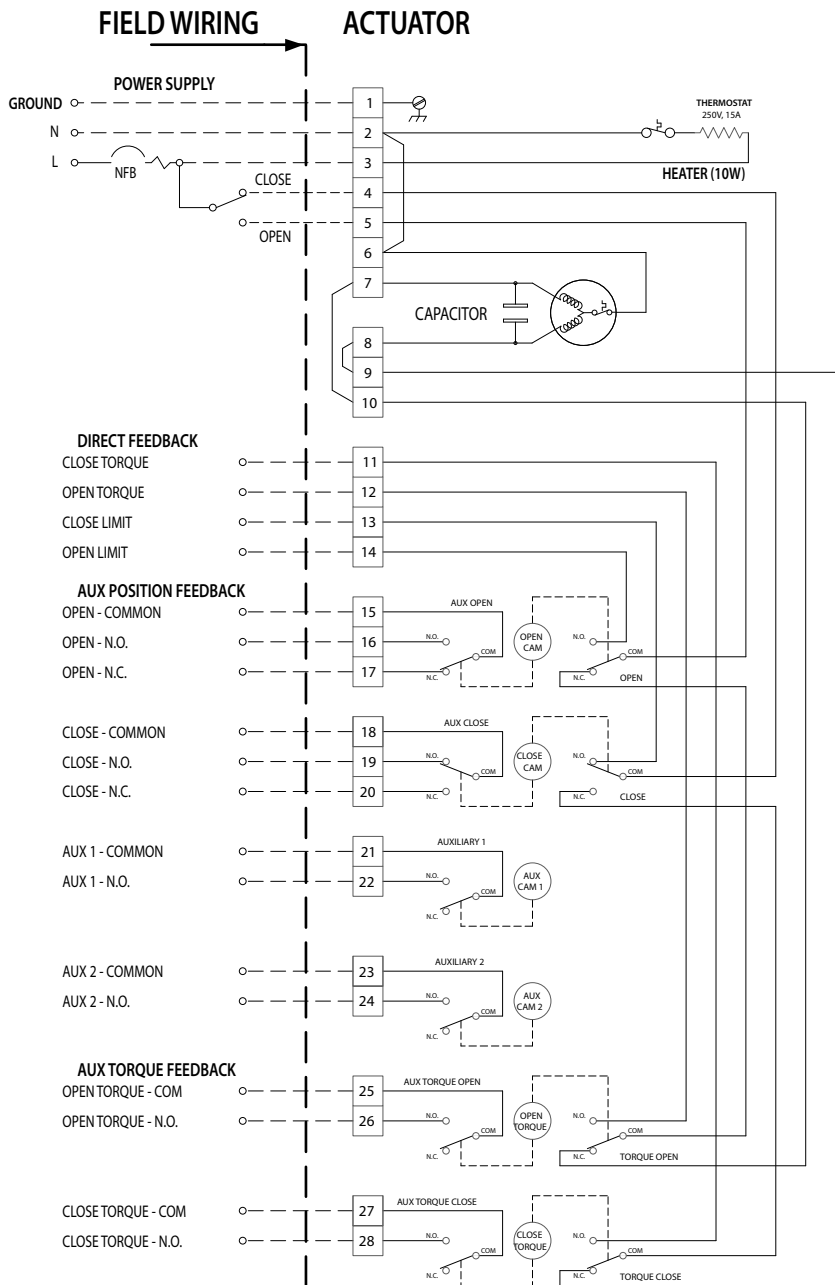


### **CAUTION**

Do not wire multiple actuators in parallel. Back-feeding of actuator power through parallel wiring may cause units to operate improperly. Use one control relay per actuator.

(Continued)

**Figure 11: Sample Wiring Diagram: WD-000658**



**FIELD WIRE RATINGS:**

14-28 AWG, Cu, 105°C  
300V MIN RATED WIRE

**SWITCH CONTACT RATINGS:**

250VAC, 10A MAX

**LEGEND:**

- C OM: COMMON CONTACT
- N .O.: NORMALLY OPEN CONTACT
- N .C.: NORMALLY CLOSED CONTACT
- L : POWER - LIVE
- N : POWER - NEUTRAL
- N FB: NO FUSE BREAKER

**NOTES:**

1. THE ACTUATOR IS SHOWN IN THE CLOSED POSITION.

**\*\* SWITCH CONTACT POSITIONS \*\***

SWITCH	TERM	VALVE OPENING (%)	
		0	100
AUX OPEN	15-16	ON	OFF
	15-17	OFF	ON
AUX CLOSE	18-19	ON	OFF
	18-20	OFF	ON

SWITCH	TERM	VALVE OPENING (%)	
		P1	P2
AUX LIMIT 1	21-22	ON	OFF
AUX LIMIT 2	23-24	ON	OFF

SWITCH	TERM	TORQUE (%)	
		100-125	
OPEN	25-26	ON	OFF
CLOSE	27-28	ON	OFF

— : CONTACT ON    - - - - : CONTACT OFF



**8.3 MODULATING OPERATION WITH MODULATING CONTROL CARD (MCC)**



**NOTICE**

The Bray Series 76 MCC is used when the application does not require a Local Control Station.



**NOTICE**

3-Phase operation requires a motor starter to change direction. Bray configures all 3-phase actuators with a local control station which includes a built-in motor starter.

See Local Control Station Operation for more details.

The Bray Series 76 MCC (modulating control card) provides complete modulating control and monitoring of the Bray Series 76 Electric Actuator. The Bray Series 76 MCC has two standard models: 24Vdc and 110/220Vac.

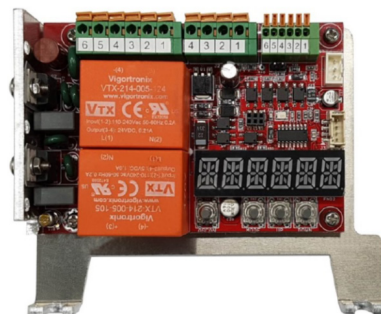
The MCC positions the Series 76 Electric Actuator in response to a command signal from a process controller. The process controller contains a desired process set point entered by the user and continually monitors the process variable (such as flow rate, tank level, etc.) through some type of sensor. Varying the command signal to the MCC will cause the actuator to change position, which will move the associated control valve to modify the process variable. The process controller continually calculates and transmits the appropriate command signal to the MCC to maintain the process at the desired set point.



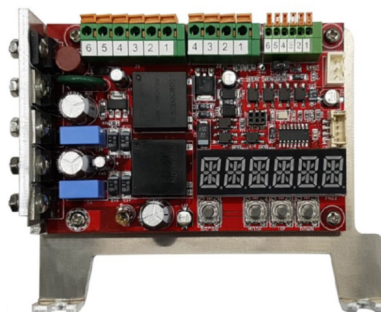
**NOTICE**

For more information, please refer to the Bray Series 76 Modulating Control Card IOM Manual. This manual is available on Bray's website, **BRAY.COM**.

**Figure 12:** 120V/230V Modulating CONTROL CARD

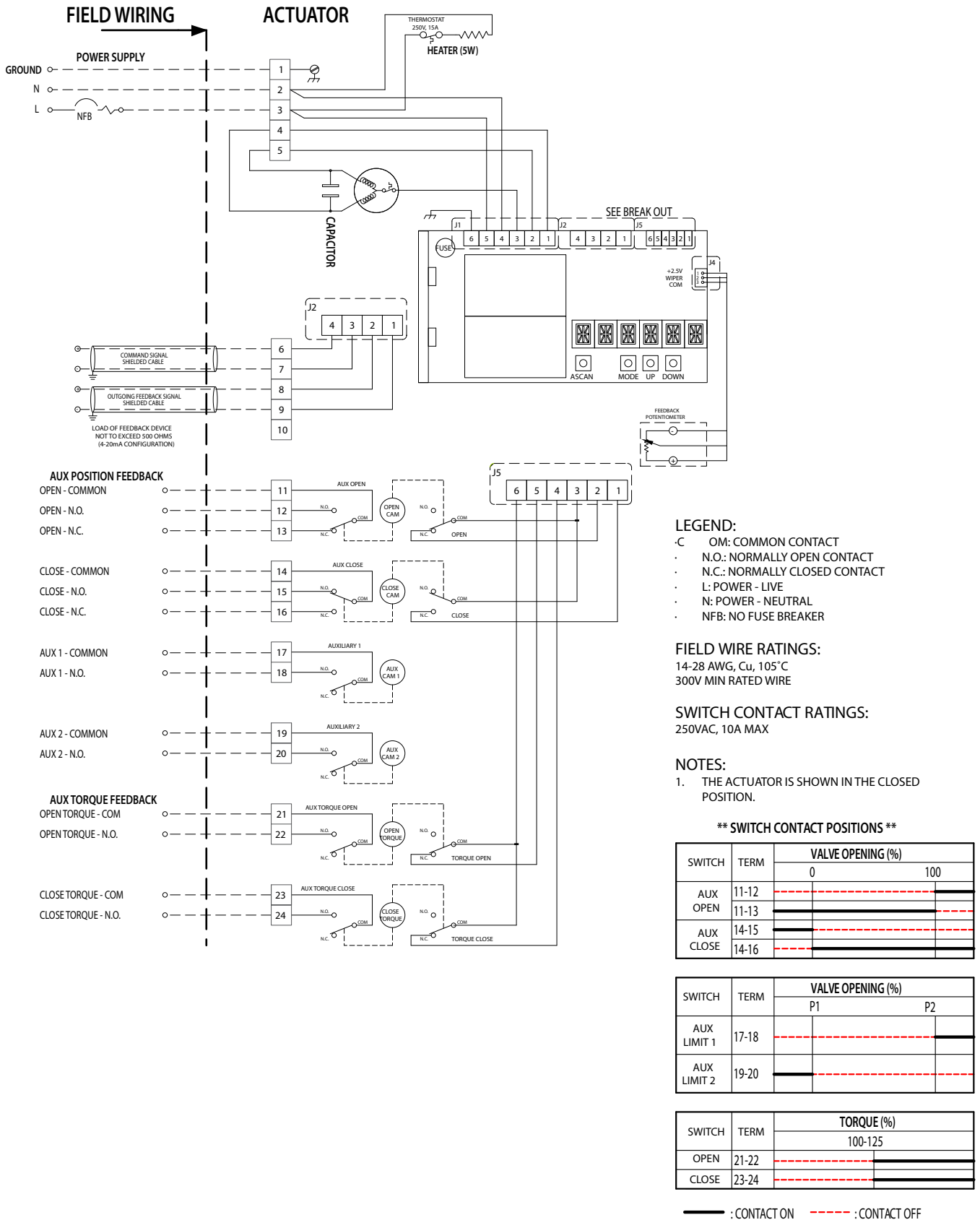


**Figure 13:** 24V DC MODULATING CONTROL CARD



(Continued)

**Figure 14:** Sample Wiring Diagram: WD-000677



### 8.4 LOCAL CONTROL STATION OPERATION

The Bray Series 76 Local Control Station (LCS) offers comprehensive control and monitoring capabilities for the Bray Series 76 Electric Actuator. A selector switch is provided (right side) to switch between operating modes: Stop, Local, and Remote. The operating mode selector switch is lockable to inhibit accidental changes to the operating mode. A toggle switch (left) is provided to control the direction of operation while set to the Local mode. Five LEDs are used to visually communicate operational mode, direction of operation, and faults.

The Series 76 LCS, for modulating applications, provides similar functionality as the MCC. However, the LCS also provides optional support for On/Off control via customer-supplied voltage-free single-pole single-throw (SPST) control relays. The LCS for On/Off applications features On/Off control via customer-supplied voltage-free SPST control relays. In both applications, dedicated power is provided by the customer to the actuator. Customer-supplied SPDT power control relays or 3-phase motor starters are not required.



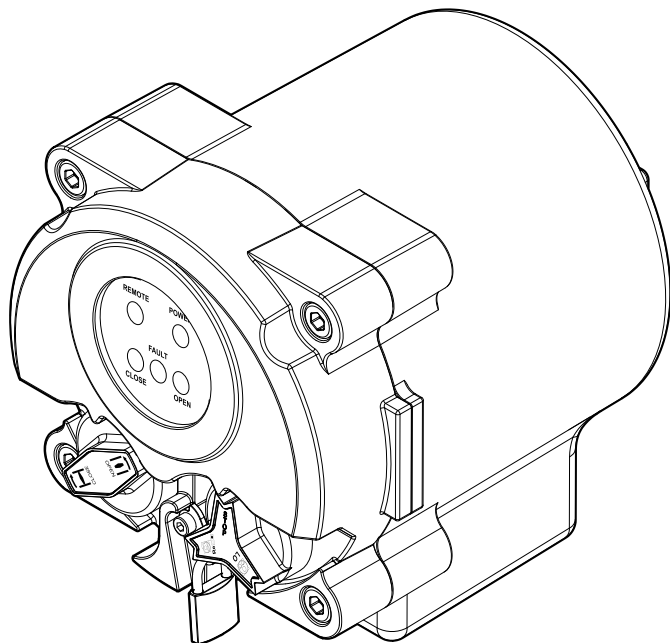
**NOTICE**

The Local Control Station electronics differ by control (On/Off versus Modulation) and by voltage. The LCS must be factory-configured to the application.



**WARNING**

Damage or lost hardware must be replaced by original spare parts. Hardware yield strength  $\geq 210\text{MPa}$ .



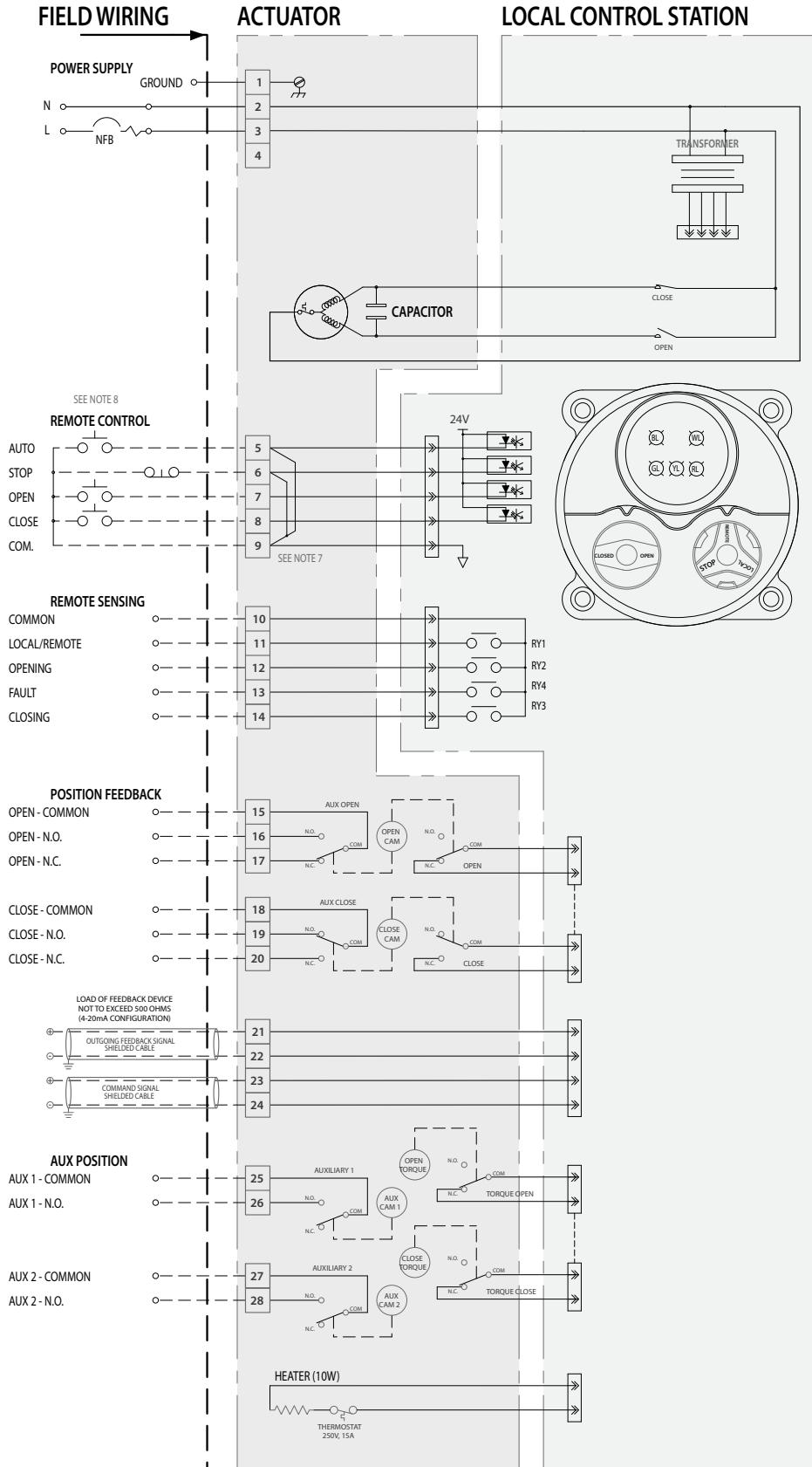
**Figure 15:** Series 76 LCS



**NOTICE**

For more information, please refer to the Bray Series 76 Modulating Control Card IOM Manual. This manual is available on the company website, BRAY.COM.

**Figure 16:** Sample Wiring Diagram for on/off LCS



**LEGEND:**

- BL: BLUE LAMP - REMOTE MODE ACTIVE
- WL: WHITE LAMP - POWER
- GL: GREEN LAMP - CLOSE/CLOSING
- Y: YELLOW LAMP - FAULT PRESENT
- RL: RED LAMP - OPEN/OPENING
- R: Y: RELAY
- C: OM: COMMON CONTACT
- N.O.: NORMALLY OPEN CONTACT
- N.C.: NORMALLY CLOSED CONTACT
- NFB: NO FUSE BREAKER

**NOTES:**

1. THE ACTUATOR IS SHOWN IN THE CLOSED POSITION.
2. THE OPEN/CLOSED SELECTOR SWITCH IS SPRING RETURNED TO THE NEUTRAL POSITION.
3. CONTROLLER IS DEFAULT 4-20mA.
4. DEFAULTS CAN BE MODIFIED USING SWITCHES INSIDE THE LOCAL CONTROL STATION. SEE THE IOM FOR WARNINGS, SETTINGS, AND CALIBRATION INSTRUCTIONS.
5. THE FEEDBACK LOOP IS POWERED BY THE CONTROLLER, DO NOT SUPPLY EXTERNAL POWER.
6. SIGNAL NOISE MITIGATION
  - 6.1. DO NOT GROUND/EARTH REFERENCE THE COMMON OF THE COMMAND SIGNAL WHEN USING 0-5VDC, 0-10VDC, 1-5VDC, OR 2-10VDC MODES.
  - 6.2. ISOLATE THE COMMAND SIGNAL AND FEEDBACK SIGNAL FROM EACH OTHER AND ANY OTHER CIRCUITS TO REDUCE THE POSSIBILITY OF NOISE AND GROUND LOOPS.
  - 6.3. COMMAND SIGNAL & FEEDBACK SIGNAL WIRES SHOULD BE SHIELDED PROPERLY & SHIELD SHOULD BE GROUNDED/EARTHED ON ONE END ONLY, PREFERABLY THE CONTROLLER END.
7. JUMPERS ARE PROVIDED BETWEEN TERMINALS (5 & 9) AND (6 & 9). REMOVE JUMPERS IF REMOTE CONTROL FUNCTIONALITY IS REQUIRED.
8. SWITCHES CONNECTED TO TERMINALS 5- 9 MUST BE VOLTAGE FREE. APPLYING POWER TO THESE TERMINALS MAY CAUSE DAMAGE TO THE ELECTRONICS.

**FIELD WIRE RATINGS:**

14-28 AWG, Cu, 105°C  
300V MIN RATED WIRE

**RELAY CONTACT RATINGS:**

250VAC, 5A MAX

**SWITCH CONTACT RATINGS:**

250VAC, 10A MAX

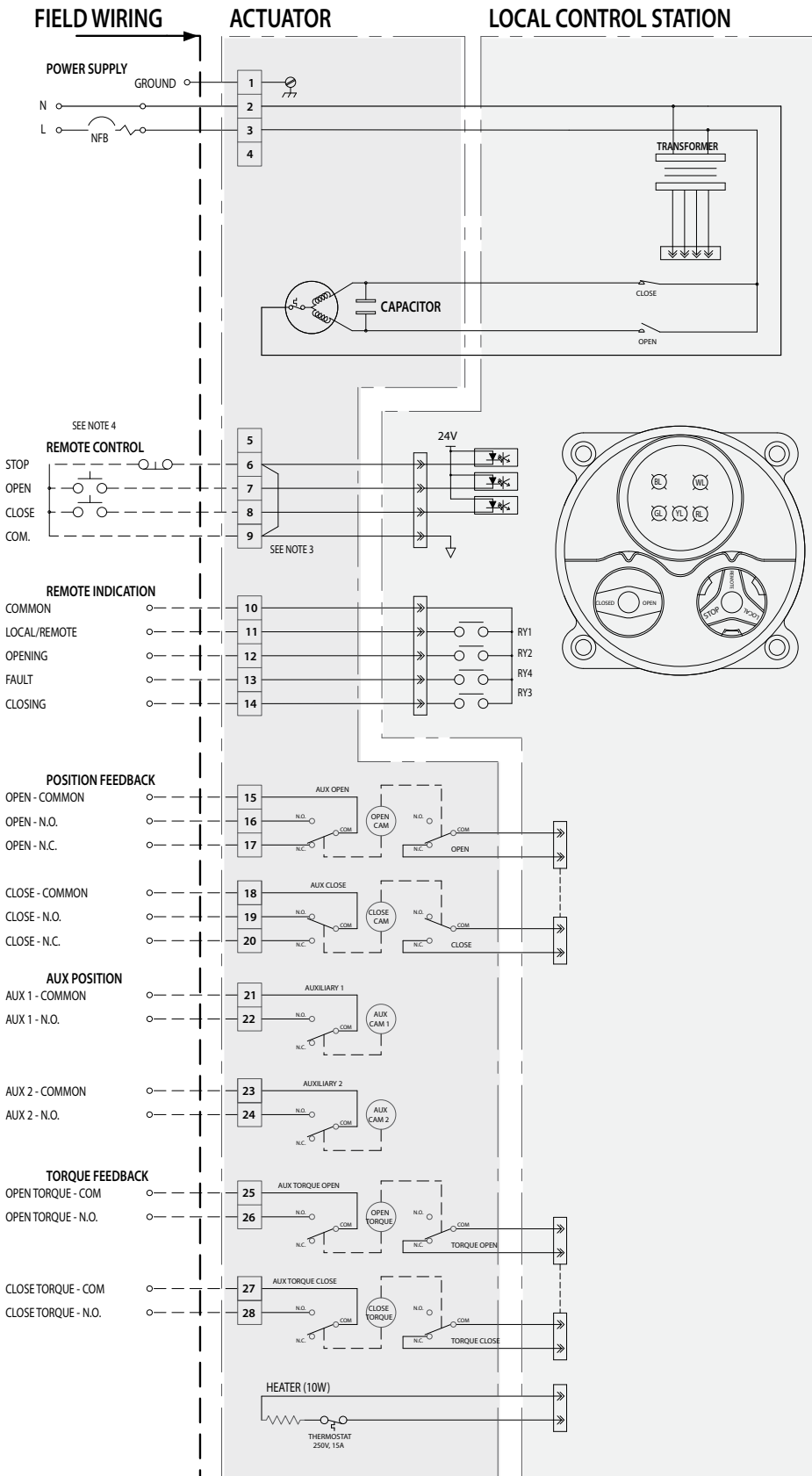
**\*\*SWITCH CONTACT POSITIONS\*\***

SWITCH	TERM	VALVE OPENING %	
		0	100
AUX OPEN	15-16	—	—
	15-17	—	—
AUX CLOSE	18-19	—	—
	18-20	—	—

SWITCH	TERM	VALVE OPENING %	
		P1	P2
AUX LIMIT 1	21-22	—	—
AUX LIMIT 2	22-24	—	—

— : CONTACT ON    - - - - : CONTACT OFF

**Figure 17:** Sample Wiring Diagram for Modulating LCS



**LEGEND:**

- B L: BLUE LAMP - REMOTE MODE ACTIVE
- W L: WHITE LAMP - POWER
- G L: GREEN LAMP - CLOSE/CLOSING
- Y L: YELLOW LAMP - FAULT PRESENT
- R L: RED LAMP - OPEN/OPENING
- R Y: RELAY
- C OM: COMMON CONTACT
- N .O.: NORMALLY OPEN CONTACT
- N .C.: NORMALLY CLOSED CONTACT
- L : POWER - LIVE
- N : POWER - NEUTRAL
- N FB: NO FUSE BREAKER

**NOTES:**

1. THE ACTUATOR IS SHOWN IN THE CLOSED POSITION.
2. THE OPEN/CLOSED SELECTOR SWITCH IS SPRING RETURNED TO THE NEUTRAL POSITION.
3. A JUMPER IS PROVIDED BETWEEN TERMINALS (6 & 9). REMOVE JUMPER IF REMOTE CONTROL FUNCTIONALITY IS REQUIRED.
4. SWITCHES CONNECTED TO TERMINALS 6 - 9 MUST BE VOLTAGE FREE. APPLYING POWER TO THESE TERMINALS MAY CAUSE DAMAGE TO THE ELECTRONICS.

**FIELD WIRE RATINGS:**

14-28 AWG, Cu, 105°C  
300V MIN RATED WIRE

**RELAY CONTACT RATINGS:**

250VAC, 5A MAX

**SWITCH CONTACT RATINGS:**

250VAC, 10A MAX

**\*\* SWITCH CONTACT POSITIONS \*\***

SWITCH	TERM	VALVE OPENING (%)	
		0	100
AUX OPEN	15-16	---	---
	15-17	---	---
AUX CLOSE	18-19	---	---
	18-20	---	---

SWITCH	TERM	VALVE OPENING (%)	
		P1	P2
AUX LIMIT 1	21-22	---	---
AUX LIMIT 2	22-24	---	---

SWITCH	TERM	TORQUE (%)	
		100-125	
OPEN	25-26	---	---
CLOSE	27-28	---	---

— : CONTACT ON    - - - - : CONTACT OFF

**9.0 COMMISSIONING**



**WARNING**

Read this manual carefully and completely before attempting to install, operate, or troubleshoot the Bray Series 76 electric actuator.



**WARNING**

Installation, commissioning, maintenance, repairs, and modification work must only be performed by qualified personnel with extensive knowledge of how to work on explosion-proof electrical equipment.

**9.1 INITIAL INSPECTION**

Before installation, verify the actuator nameplate to ensure the correct model number, torque output, operating speed, voltage, and enclosure type.

Check the Bray Series 76 for any damage.



**WARNING**

Damaged parts must be replaced by original spare parts.

**9.2 ACTUATOR MOUNTING**

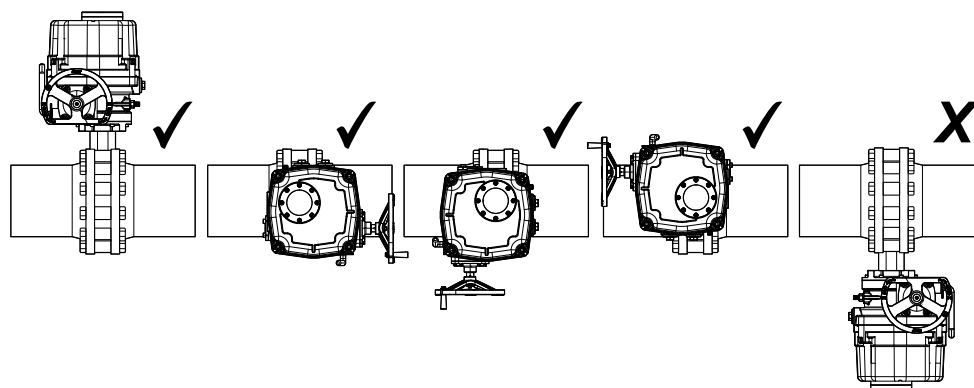


**WARNING**

Do not attempt to lift the actuator by tethering it to the hand wheel.

The valve output shaft must be aligned with the actuator output drive to avoid side-loading the shaft. The actuator must be firmly secured to a sturdy mounting bracket or directly mounted to the valves' mounting pad. To void backlash, the mounting must be able to support at least the rated torque of the actuator without loosening. High-tensile bolts or studs with spring locking washers must be used.

It is recommended to mount the actuator with the valve shaft pointing vertically upward, to ease commissioning and maintenance. Other orientations are permissible. **See Figure 18.**



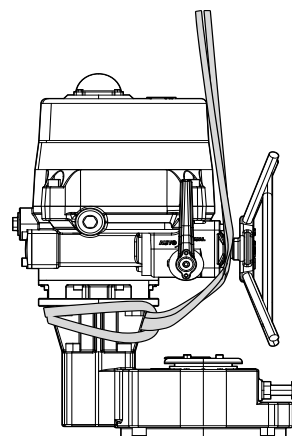
**Figure 18:** Proper mounting orientations.

(Continued)

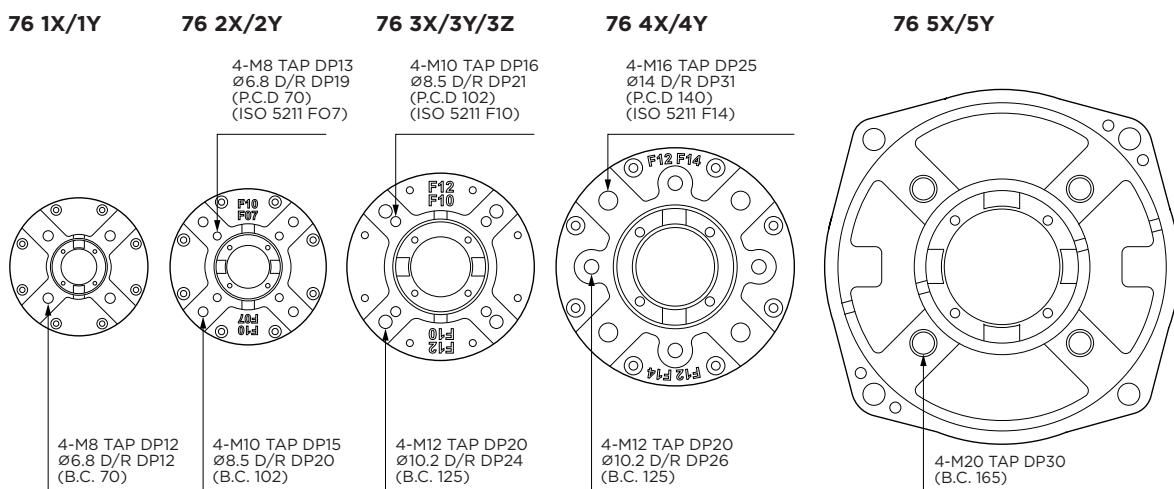
The size 5 actuator may be lifted with straps wrapped below the main body and the gearbox. See **Figure 19**.

**Figure 19:** Proper actuator lifting location.

The actuator must be firmly secured to a sturdy mounting bracket or directly mounted to the valves' mounting pad. To avoid backlash, the mounting must be able to support at least the rated torque of the actuator without loosening. High-tensile bolts or studs with spring locking washers must be used.



**9.3 ACTUATOR MOUNTING DETAILS - BASE (ISO 5211)**



**Figure 20:** Mounting Base Details (ISO 5211)

**Table 1:** ISO 5211 or MSS SP-101 bolt patterns are provided for actuator mounting.

Housing	ISO 5211			MSS SP-101			Thread Depth	
	Mounting	Hardware	Qty	Mounting	Hardware	Qty	In	mm
<b>1X/1Y</b>	F07	M8	4	FA07	5/16"-18	4	0.472	12
	F10	M10	4	FA10	3/8"-16	4	0.591	15
<b>2X/2Y</b>	F07	M8	4	FA07	5/16"-18	4	0.512	13
	F10	M10	4	FA10	3/8"-16	4	0.630	16
<b>3X/3Y/3Z</b>	F10	M10	4	FA10	3/8"-16	4	0.630	16
	F12	M12	4	FA12	1/2"-13	4	0.787	20
<b>4X/4Y</b>	F12	M12	4	FA12	1/2"-13	4	0.787	20
	F14	M16	4	FA14	5/8"-11	4	0.984	25
<b>5X/5Y</b>	F16	M20	4	FA14	3/4"-10	4	1.181	30

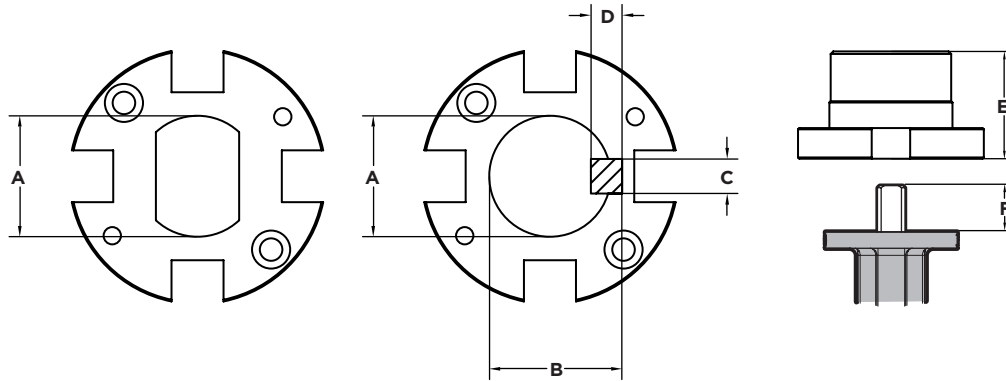
**9.4 ACTUATOR MOUNTING DETAILS - BUSHINGS**

The Bray Series 76 electric actuators are supplied with a removable blank drive bushing. The drive bushing may be machined by the factory on request.



**NOTICE**

See the Bray Series 76 Technical Manual for more information.



**Figure 21:** Machined Width Max

**Table 2: Machined Bushing Size**

Model	Bore Diameter - Max		Bore w/Keyway - Max		Key Size - Max		Bushing Height		Stem Engagement - Max	
	A	B	CxD	E	F					
	in	mm	in	mm	in	mm	in	mm	in	mm
<b>1X/1Y</b>	0.787	20	0.917	23.3	.28x.28	7x7	1.102	28	1.378	35
<b>2X/2Y</b>	0.866	22	0.976	24.8	.31x.28	8x7	1.378	35	1.772	45
<b>3X/3Y/3Z</b>	1.378	35	1.508	38.3	.39x.31	10x8	1.654	42	2.047	52
<b>4X/4Y</b>	1.772	45	1.921	48.8	.55x.35	14x9	2.008	51	2.362	60
<b>5X/5Y</b>	2.559	65	2.728	69.3	.79x.47	20x12	2.362	60	3.740	95



## 10.0 WIRING THE ACTUATOR



### **DANGER**

Do not operate the unit in the presence of an explosive atmosphere if commissioning has not been completed.



### **DANGER**

Do not operate the unit in the presence of an explosive atmosphere if the flamepath is damaged. Contact the factory for repair options.



### **WARNING**

Do not open the cover in the presence of an explosive atmosphere.



### **WARNING**

Treat the cover with care. The flamepath must not be damaged or dirtied in any way.



### **WARNING**

Do not allow the electronics to become wet.

Before wiring the actuator, ensure that the rated voltage of the actuator is the same as the supply voltage.

- > Loosen the bolts on the actuator cover and remove the cover.
- > Remove silica gel desiccants from the interior of the actuator.
- > Pass cables through the cable glands or conduit.
- > Connect the wiring according to the enclosed wiring diagram.

If cable glands are being used, the glands must be certified for use in the specific hazardous location in which it is being installed. Glands shall be certified as flameproof (Ex db) and/or dust ignition proof (Ex tb) if used in Zone 1 or Zone 21 applications.

It is recommended to use cable glands rated IP67 or higher. Ensure that cable glands are installed using the gland manufacturer's recommendations for torque to ensure proper sealing.

If a conduit is being used, a sealing fitting must be installed within 20mm of the conduit opening. The sealing fitting must be certified for use in the specific hazardous location in which it is being installed.

Any unused conduit entries must be fitted with a conduit blank certified for use in the specific hazardous location in which it is being installed.



### **WARNING**

Cables and wiring must be rated for at least 100°C operating temperature and the voltage rating must be equal to or greater than the nominal voltage. The wiring must be sized to limit self-heating due to current draw such that 100°C wire temperature is not exceeded.



### **NOTICE**

Terminals accept wires sized 28-14 AWG (0.2mm<sup>2</sup> - 2.5mm<sup>2</sup>).



**NOTICE**

Always ground the enclosure in accordance with local electric codes. The most effective enclosure grounding method is a direct connection to earth ground with minimal impedance. The internal ground is located at terminal block #1. An external ground lug is located near the conduit entries.

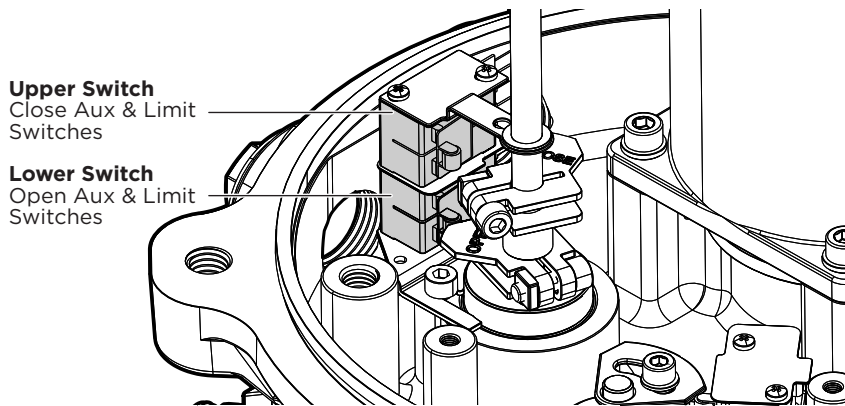


**NOTICE**

Each actuator may be rewired or configured for reverse action, counterclockwise to 'close'. Contact the factory for directions for reverse direction wiring configuration.

**10.1 SETTING TRAVEL LIMIT SWITCHES AND MECHANICAL STOPS**

The series 76 uses two metal cams along with SPDT mechanical switches to set the 'Open' and 'Closed' positions of the valve. The upper cam actuates the 'close' switch when the actuator reaches the 'closed' position. Similarly, the lower cam actuates the 'open' switch when the actuator reaches the 'open' position. In size 2 or larger, these cams also activate the associated auxiliary switch.



**Figure 22:** Travel Limit Switches

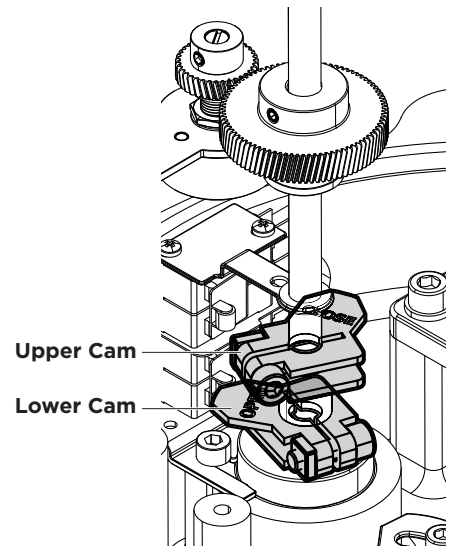
The limit switches and mechanical travel stops are calibrated at the factory to allow 90° of travel between the 'open' and 'closed' positions. Cams for each switch are adjustable for applications where less than 90° of travel is desired between the 'open' and 'closed' positions.



**WARNING**

Remove electrical power from the actuator before performing this procedure.

**Figure 23:** Limit switch cams.



(Continued)

**ADJUST THE ‘CLOSED’ CAM**

1. Manually operate the actuator clockwise until the valve reaches the desired ‘closed’ position.
2. Loosen the cam locking screw for the ‘closed’ cam.
3. Rotate the ‘closed’ cam clockwise until the limit switch activates.
4. Tighten the cam locking screw for the ‘closed’ cam.

**ADJUST THE ‘CLOSED’ TRAVEL STOP BOLT**

1. Loosen the ‘closed’ travel stop nut.
2. Tighten the ‘closed’ travel stop bolt until it hits the worm wheel.
3. Loosen the ‘closed’ travel stop bolt by one full turn.
4. Tighten the ‘closed’ travel stop nut.

**ADJUST THE VISUAL INDICATOR.**

1. Loosen the set screw holding the indicator in place.
2. Rotate the assembly until the indicator aligns with the full closed mark
3. Tighten the set screw.

**REPEAT STEPS 1 AND 2 FOR THE ‘OPEN’ DIRECTION**

For ‘close’ and ‘open’ travel stop bolt, see **Figures 24 & 25.**



**NOTICE**

Travel stop bolts for the size 5 actuator are located on the gearbox. See **Figure 26 & 27.** The standard location is plugged and must not be tampered with as this provides sealing.

**10.2**

**PRELIMINARY TEST**



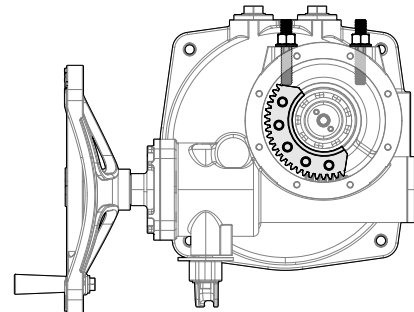
**DANGER**

Do not operate the unit in the presence of an explosive atmosphere when the cover is removed.

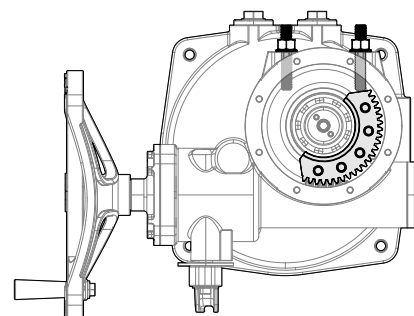
- > Manually actuate the valve to the mid-travel position.
- > Electrically command the actuator to the fully open position and check if the motor rotates in the correct direction; standard units are counterclockwise to open.
- > Ensure that the actuator open limit switch stops electrical operation.
- > Electrically command the actuator to the fully closed position and check if the motor rotates in the correct direction.
- > Ensure that the actuator closed limit switch stops electrical operation.
- > Refer to section **10.1** if additional modifications are required to the limit switch settings.

(Continued)

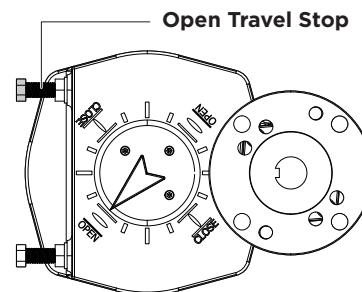
**Figure 24:** Travel stopper nut & bolt for **CLOSE.**



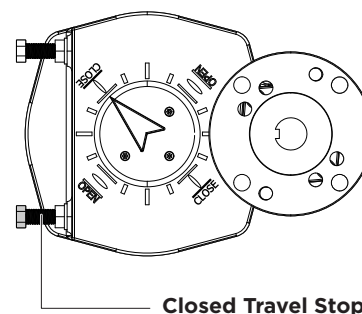
**Figure 25:** Travel stopper nut & bolt for **OPEN.**



**Figure 26:** Gear box **OPEN.**



**Figure 27:** Gear box **CLOSE.**



**10.3 COVER INSTALLATION**



**DANGER**

Carefully replace the cover. Do not jam the cover during fitting.



**DANGER**

Before performing this procedure, ensure that the flamepaths and o-ring seals are clean and undamaged.



**DANGER**

Damage or lost hardware must be replaced by original spare parts. Hardware yield strength  $\geq 210\text{MPa}$ .

Ensure that the indicator aligns with the window on the cover.

Gently lower the cover so that the flamepath flange does not jam or bind the cover.

Rotating the cover in small semi-circles while lowering it onto the base may help keep the cover from binding.

After the cover mates with the base, ensure that the indicator is visible through the window.

Gently hand-tighten the cover bolts to ensure that the bolts do not become cross-threaded.

Torque the cover bolts in a cross pattern to the required torque.

**Table 3: Cover Bolt Torque Requirements for Haz-Loc Models**


Model Size	Bolt Size	Cover Bolt Torque		Tolerance $\pm$	
		In-lbs	Nm	In-lbs	Nm
Size 1X/1Y	M8 x 35mm	110.6	12.5	22.1	2.5
Size 2X/2Y	M10 x 50mm	221.2	25.0	44.2	5.0
Sizes 3X to 5Y	M12 x 35mm	376.1	42.5	66.3	7.5

**Note:** Refer to tool list in **Appendix A**.

**11.0 STANDARD FEATURES AND FACTORY INSTALLABLE OPS**


**11.1 AUXILIARY SWITCHES**

In addition to the limit switches used to control the ‘open’ and ‘closed’ travel limits, actuators sized 2 through 5 have two auxiliary switches installed as part of the standard configuration. These auxiliary switches are assembled so that they are activated 3 degrees before their associated limit switch.

 **NOTICE**  
All actuators may be fitted with an optional set of stand-alone auxiliary limit switches. Auxiliary limit switches are SPDT and rated at 250 VAC, 16 A.

**Table 4:** Available Limit Switch Configurations

Size	Standard	Optional	Maximum
1	2	2	4
2 - 5	4	2	6

 **NOTICE**  
Models with Local Control Stations (LCS) in modulating applications are limited to 2 extra auxiliary limit switches or 2 extra torque switches due to restrictions in the maximum number of terminals that can be fit.

**11.2 TORQUE SWITCHES**




Mechanical Torque switches are a standard factory-installed and calibrated feature for series 76 actuators, sizes 2 through 5. Torque switches are not able to be installed in the size 1. Installation is simple, but due to the requirement for special calibration equipment, it is not available for field installation.

The worm 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 axially as a result.


A specially designed drive lever and pin are incorporated into a groove on the worm, providing the profile for the torque-switching mechanism. The pin rides in the worm gear torque sensor groove and, in turn, drives the cams. The cam actuates its electrical switch. When the torque exceeds the setting, the torque switch may directly interrupt the power to the motor winding or be sensed electronically, depending on the application. In either case, the motor can still be powered to run in the opposite direction. When powered in the opposite direction, the tripped torque switch will release automatically.

Torque switches are set by the factory to the rated torque of the actuator. If recalibration is necessary, contact Bray.


(Continued)

-  **NOTICE**  
Additional torque switches are optional for all sizes of actuators except for size 1. Torque switches are SPDT and rated at 250 VAC, 16 A.
-  **NOTICE**  
Torque switches are not field adjustable. Adjustment of torque switches in the field will void the warranty.
-  **NOTICE**  
Models with Local Control Stations (LCS) in modulating applications are limited to 2 extra auxiliary limit switches or 2 extra torque switches due to restrictions in the maximum number of terminals that can be fit.


**11.3 POTENTIOMETER**

 **NOTICE**  
On/off models have the option to include the same potentiometer that is available in modulating models for position feedback.

The potentiometer is rated  $1k\Omega \pm 5\%$  and is calibrated at the factory to the standard cam positions. If the 'closed' cam position is modified, then the following procedure must be performed when a potentiometer is installed.

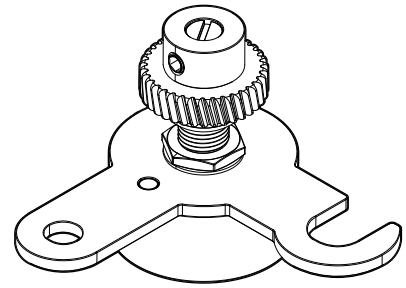
 **WARNING**  
Ensure that electrical power is removed from the potentiometer before performing this procedure.

1. Manually operate the actuator clockwise until the valve reaches the 'closed' position and the 'closed' limit switch activates.
2. Loosen the set screw on the gear mounted to the indicator shaft.
3. Adjust the potentiometer.
  - > Measure the resistance between the common terminal (P1) and the wiper terminal (P2) with a multimeter.
  - > Gently rotate the potentiometer gear until the multimeter measures  $100\Omega \pm 20\Omega$ .
4. Gently tighten the set screw on the indicator shaft gear.
5. Verify the potentiometer measurement before completely tightening the set screw.

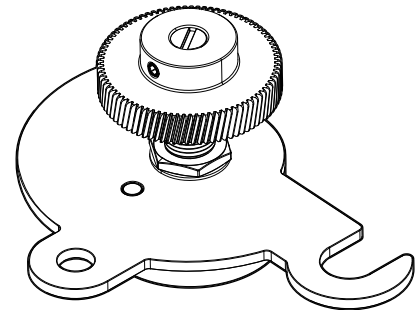
 **NOTICE**  
The potentiometer assemblies installed in size 5 units travel 270 degrees due to the installation of the 3:1 gearbox. Size 5 potentiometer assemblies use different gearing to account for the larger range of travel and cannot be used in other sized series 76 actuators.

(Continued)

**Figure 28:**  
Potentiometer for Sizes 1 - 4.



**Figure 29:**  
Potentiometer for Size 5.



**11.4 ANALOG POSITION TRANSMITTER**

An optional analog position transmitter may be installed in units configured for on/off applications. The analog position transmitter includes a standard potentiometer so that the transmitter can determine the actuator’s position. The transmitter converts feedback from the potentiometer into a 4 to 20mA analog current signal.



**NOTICE**

Refer to the Bray series 76 technical manual for detailed specifications.

A switch on the right of the analog position transmitter will allow the transmitter to be configured for 110VAC or 220V single-phase power.



**CAUTION**

Ensure that the power switch is set to the correct line voltage before powering.

The position transmitter and potentiometer are calibrated at the factory. However, if the cams are adjusted then the following procedure should be used to calibrate the position transmitter.

- > Perform the potentiometer calibration procedure.
- > Measure the mA current output signal from the analog position transmitter.
- > Manually or electrically operate the actuator to the ‘closed’ position.
- > Adjust the trim potentiometer labeled ‘ZERO’ until a reading of 4mA is achieved.
- > Manually or electrically operate the actuator to the ‘open’ position.
- > Adjust the trim potentiometer labeled ‘SPAN’ until a reading of 20mA is achieved.

**11.5 24VAC/DC ON/OFF CONTROL BOARD**

The 24VAC/DC on/off control board is installed in 24V series 76 when an on/off application is required. The 24V control board provides in-actuator direction control relays and rectification capability.



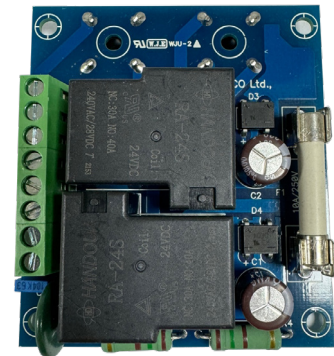
**NOTICE**

Refer to the wiring diagram for wiring details.

**Figure 30:** Analog position transmitter.



**Figure 31:** 24VAC/DC On/Off Control Board.



## 12.0 MAINTENANCE



### DANGER

Do not open the cover in the presence of an explosive atmosphere.



### WARNING

Turn off all power before attempting to perform maintenance on the actuator.



### WARNING

Treat the cover with care. The flamepath must not be damaged or dirtied in any way.



### WARNING

Do not operate the unit in the presence of an explosive atmosphere if the flamepath is damaged. Contact the factory.



### WARNING

Do not allow the electronics to become wet.



### WARNING

Carefully replace the cover. Do not jam the cover during fitting.



### WARNING

Avoid electrostatic discharge. Use a damp cloth when cleaning painted parts. Do not brush to dust.



### NOTICE

Test the operation of the actuator at least once per week.



### NOTICE

Maintain constant power to the actuator to ensure constant operation of the anti-condensation heater.



### NOTICE

Under normal conditions, maintenance should be performed every 6 months. Under more severe conditions, more frequent maintenance and inspection may be required.



### NOTICE

There is no need to lubricate the actuator during normal operation.



## 12.1 MAINTENANCE CHECKLIST

- Inspect the nameplate label for wear.**
  - > Contact the factory if a new label is required to maintain identification of the unit.
- Check the indicator window for damage.**
  - > Notify the factory if a new cover is required.
- Check that the actuator is properly aligned with the valve or other quarter-turn device.**
  - > Realign the actuator if necessary.
- Check the flamepath for damage, dirt, or debris.**
  - > Clean with a slightly damp towel and allow to dry if dirty.
  - > Do not introduce moisture or water into the enclosure.
  - > Contact the factory if the flamepath is damaged to determine if replacement is necessary.
- Check the wiring for damage and ensure that wires are connected properly at the terminals.**
  - > Repair all damaged wiring and reinstall wires in terminals.
- Check that all screws are present and tightened.**
  - > Tighten screws if loose.
- Check the cleanness of the internal electrical devices.**
  - > Wipe internal surfaces with a dry cloth.
- Check the cable connections are properly installed and dry.**
  - > Reinstall or tighten cable connections if necessary.
- Check for condensation.**
  - > Remove any apparent moisture.
  - > Check that cable glands are fit properly.
  - > Check that conduit sealing fittings are installed and sealed properly.
- Check the enclosure o-ring seals for damage (cut, pinched, etc.).**
  - > Replace o-ring seals if necessary.
- Check the operation of the declutch mechanism.**
  - > Notify the factory if repair is required.
- Check the operation of the internal heater.**
  - > Power must be applied to check the heater is functioning.
- Replace the cover, then electrically operate the actuator through a full open/close cycle.**

**12.2 APPENDIX A - BASIC TOOLS**

<b>Common To All Units</b>	
Terminal Connections	Flathead screwdriver up to 3mm
Cam Adjustment Bolts	4mm hex
Ground Screw	4mm hex
Handwheel Spinner	5mm hex
Conduit Blanks	18mm wrench

<b>Actuator Model</b>	<b>Cover Screws   Captivated - Hex Size</b>	<b>Travel Stop Adjustment</b>		<b>Bushing Mounting Bolts - Hex Size</b>
		<b>Bolts - Hex</b>	<b>Jam Nuts - Wrench</b>	
<b>1X, 1Y</b>	6mm	4mm	13mm	3mm
<b>2X, 2Y</b>	8mm	5mm	17mm	4mm
<b>3X, 3Y, 3Z</b>	10mm	5mm	17mm	5mm
<b>4X, 4Y</b>	10mm	6mm	19mm	6mm
<b>5X, 5Y</b>	10mm		24mm	6mm

**13.0 APPENDIX B - ACTUATOR TROUBLESHOOTING CHART**

PROBLEM	SOLUTION
The actuator does not respond to commands	<ul style="list-style-type: none"> <li>&gt; Visually inspect the actuator for physical damage.</li> <li>&gt; Verify that the line voltage supplied to the actuator matches the rating on the nameplate.</li> <li>&gt; Check the internal wiring against the supplied wiring diagram of the actuator.</li> <li>&gt; Check the limit switch cams.</li> </ul>
The actuator is supplied with voltage but does not operate	<ul style="list-style-type: none"> <li>&gt; Verify that the line voltage supplied to the actuator matches the rating on the nameplate.</li> <li>&gt; Ensure that the actuator output torque is greater than the required torque of the valve.</li> <li>&gt; Check the limit switch cams.</li> <li>&gt; Check that the torque switches have not been tripped.</li> <li>&gt; Check the mechanical travel stop adjustment.</li> <li>&gt; Verify the actuator's direction of operation against the position and required rotation of the valve (counterclockwise rotation to open is standard)</li> <li>&gt; Check the internal wiring against the supplied wiring diagram of the actuator.</li> <li>&gt; Check the electrical and mechanical components for contamination by corrosion and/or condensation.</li> <li>&gt; Verify that the coupler/bracket is correctly installed and is not causing the actuator to bind.</li> </ul>
Actuator runs erratically	<ul style="list-style-type: none"> <li>&gt; Verify that the ambient temperature is in the range -20°C to +60°C.</li> <li>&gt; Verify that the duty cycle has not been exceeded.</li> <li>&gt; Verify that the valve torque does not exceed the actuator torque limits.</li> <li>&gt; Check the position of the manual override lever.</li> </ul>
Potentiometer	<ul style="list-style-type: none"> <li>&gt; Visually inspect the potentiometer for damage.</li> <li>&gt; Check the wiring against the supplied actuator wiring diagram.</li> <li>&gt; Measure the resistance value and compare it to the specification.</li> <li>&gt; Check if the potentiometer gear is jammed.</li> <li>&gt; Perform the setup and calibration procedure and confirm that the wiper voltage is correct.</li> </ul>
Current position transmitter (optional)	<ul style="list-style-type: none"> <li>&gt; Visually inspect the electronics for damage.</li> <li>&gt; Check the wiring against the supplied actuator wiring diagram.</li> <li>&gt; Verify the setup and configuration of the DIP switches.</li> <li>&gt; Verify that the electronics is transmitting the correct feedback signal.</li> </ul>

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