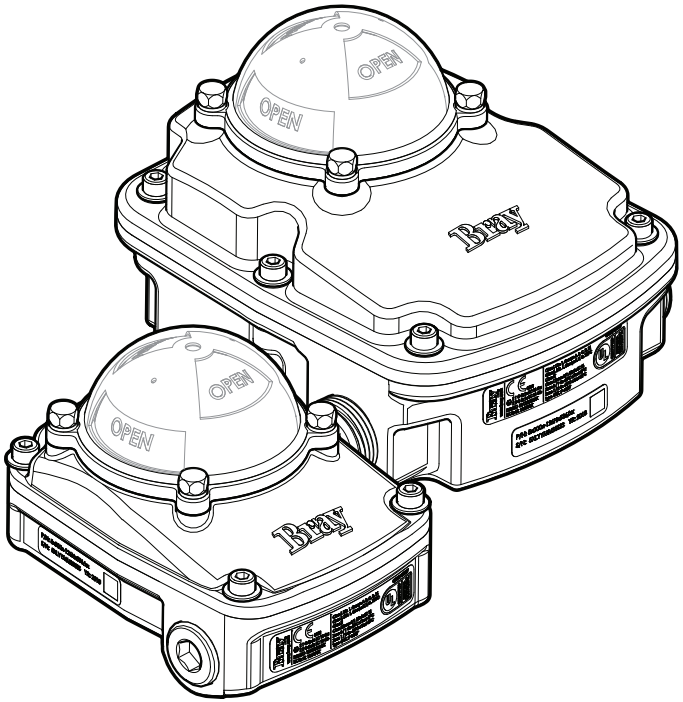
SERIES 5A AND 5B

INTRINSICALLY SAFE VALVE STATUS MONITOR

Installation, Operation and Maintenance Manual



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Read and Follow These Instructions
Save These Instructions

1. Safety Instructions - Definition of Terms

WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	Used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesirable result or state, including property damage.

2. Hazard-Free Use

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

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

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 failure of system components occur.

3. Qualified Personnel

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

- Is trained in the operation and maintenance of electric equipment and systems in accordance with established safety practices.
- Is trained or authorized to energize, de-energize, ground, tag and lock electrical circuits and equipment in accordance with established safety practices.
- Is trained in the proper use and care of personal protective equipment (PPE) in accordance with established safety practices.
- Is trained in first aid.
- In cases where the device is installed in a potentially explosive (hazardous) location - is trained in the operation, commissioning, operation and maintenance of equipment in hazardous locations.

WARNING

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

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

WARNING

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

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4. Part Numbering System Reference Chart

Series		Housing	Product	Switch	Configuration	Trim
5X	000	H	-126	S	C	T

5X – Designates Housing Size

5A	Type 4,4x, IP 66/67, Max 2 switches
5B	Type 4,4x, IP 66/67, Max 6 switches

H – Designates Housing Style

0	Imperial
5	Metric

S – Designates Switch Option

H	Intrinsically Safe, 2-wire, Proximity Switch

C – Designates Switch Configuration

2	2 Switches
3	3 Switches, Independent
4	4 Switches, Independent
5	4 Switches (2 Independent, 2 Auxiliary)
6	6 Switches (4 Independent, 2 Auxiliary)

T – Trim

536	Polyester coated aluminum
517	Resin

5. Introduction

The Bray Series 5A and 5B Intrinsically Safe Valve Status Monitors (VSMs) provide visual and electrical indication of position of any VDI/VDE 3845 compliant quarter-turn device. The S5A and S5B I.S. VSMs are designed to operate in multiple hazardous locations.

6. Principle of Operation

Bray Series 5A and 5B I.S. VSMs are comprised of a NEMA Type 4/4X, IP66/67 housing (resin housings are IP66/67/68 (1 meter, 1 hour) with external position indicator and two conduit entries, cam shaft with self-locking cams, elevated terminal block, internal grounding screw, and mounting bracket.

The VSM is coupled to the quarter turn device via the cam shaft. Rotation of the cam shaft, in turn, drives switch activation. The angular position in which the switches activate can be adjusted through the self-locking cams. Proximity activation of switches provides electrical feedback of achieved position through field wiring to a control network.

7. Hazardous Locations

The S5A and S5B I.S. (aluminum and resin trims) are designed and certified to operate in the following hazardous locations :

ATEX	CE 2813	II 1G Ex ia IIC Ga T6 II 2G Ex ia IIC Gb T6	DEMKO 18ATEX2062X
UKEX	UKEX 0518		UL22UKEX2734X
IECEx			IECEx UL 18.0073X
Ambient		1G: -25°C ≤ Ta ≤ 49°C 2G: -25°C ≤ Ta ≤ 65°C	
Elevation		2000m max	

The S5A (aluminum trim only) and S5B (aluminum and resin trims) I.S. are also certified to operate in the following hazardous locations :

NEC 500	Class I Division 1 Groups A, B, C, & D T6 Class II Division 1 Groups E, F, G T85°C	E202292 (UL)
NEC 505	Class I, Zone 0, AEx ia IIC T6 Class I, Zone 1, AEx ia IIC T6	
CEC	Ex ia IIC Gb T6	
Ambient	Zone 0: -25°C ≤ Ta ≤ 49°C Zone 1: -25°C ≤ Ta ≤ 65°C	
Elevation	2000m max	

CAUTION

For cULus applications, the S5B resin housing is only intended for use with flexible conduit.

WARNING

In addition to IO&M Manual instructions, it is required to follow all instructions specified in Control Drawing: WD-000393.

WARNING

S5A and S5B I.S. VSMs must be used in conjunction with a third party approved barrier that meets conditions specified in the control drawing: WD-000393.

WARNING

Enclosure may contain aluminum. Care must be taken to avoid hazard due to impact or friction

WARNING

Resin housings pose an electrostatic charging hazard. See Control Drawing: WD-000393

WARNING

Substitution of components may impair intrinsic safety.

NOTICE

The Bray Series 5A and 5B I.S. VSMs are compliant to the IEC/EN 60079-11 section 6.3.13 dielectric strength requirement.

8. Pre-Installation Storage

Bray Series 5A and 5B I.S. VSMs are 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 with the proper sealing plugs to support its NEMA/IP ratings.

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 in order to protect against dampness. Keep units covered to protect against dust and dirt; if storing for long term, placing the unit inside a plastic sealed bag may be preferred.

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

NOTICE

Units are shipped with two screw-in plugs or peel-off decal to prevent foreign matter from entering the unit through the conduit openings.

To prevent condensation from forming inside these units, maintain a near constant external temperature and store in a well-ventilated, clean, dry room away from vibration.

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

Keep units covered to protect against dust and dirt.

Storage Temperature should be maintained between -25°C and 65°C.

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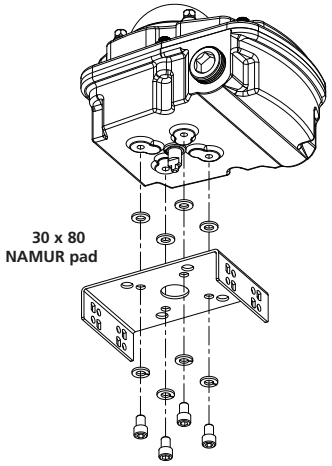
9. Mounting

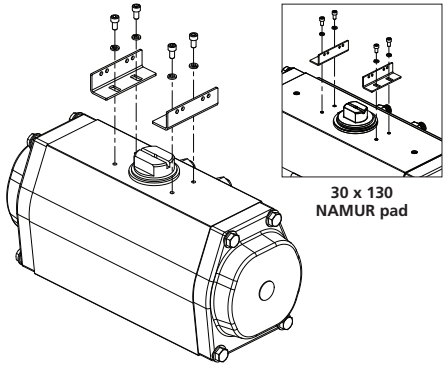
9.1 Adjustable Bracket

Bray's 3 piece adjustable bracket is designed to mount on both NAMUR 30x80 and 30x130 pads. Installation is as follows:

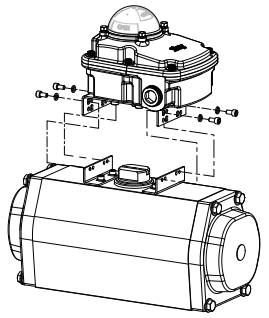
1. Disassemble two mounting bracket foot plates from top plate.
   a. Continue to Step 6 if the mounting bracket top plate was pre-installed.
2. Lightly coat mounting bracket bolt threads with grease.
3. Place lock washer onto bolts.
4. Place nylon washer in between mounting bracket and bottom of the VSM.
5. Attach mounting bracket and nylon washers to the VSM using mounting bracket bolts.
   a. Tighten mounting bolts in a cross pattern to 70.8 in-lbs. [8Nm]
   b. Ensure that the bracket remains aligned with the body of the VSM.



6. Place lock washers on foot plate mounting bolts.
7. Attach two mounting bracket foot plates to the quarter-turn device.
   a. Tighten mounting bracket foot plates to 44.3 in-lbs. [5Nm]



8. Attach coupler or adapter if provided.
9. Adjust the VSM cam shaft to align with the actuator shaft or coupler.
10. Connect the mounting bracket top plate to both bracket feet using bolts.
    a. Adjust height of the bracket by choosing mounting hole.
    b. Tighten bolts to 44.3 in-lbs. [5Nm]

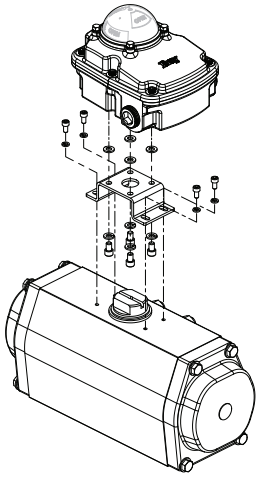


9.2 Fixed Bracket

9.2.1 Stainless Steel Bracket

Bray's single piece stainless steel bracket is used for NAMUR pattern 30 x 80. Installation is as follows:

1. Attach mounting bracket and nylon washers to the VSM using mounting bracket bolts.
   a. Tighten mounting bolts in a cross pattern to 70.8 in-lbs. [8Nm]
   b. Ensure that the bracket remains aligned with the body of the VSM.
2. Place VSM and bracket assembly on actuator. Ensure VSM shaft engages with actuator pinion.
3. Install bracket mounting bolts with lock washers as seen below.
   a. Tighten mounting bracket bolts to 44.3 in-lbs. [5Nm].



9.2.2 Resin Brackets

Bray's single piece resin brackets are available for NAMUR pattern 30 x 80 and 30 x 130 (based on actuator selection). Installation is as follows:

1. Attach mounting bracket to the VSM using mounting bracket bolts.
   a. Tighten mounting bolts in a cross pattern to 35 in-lbs. [4Nm]
   b. Ensure that the bracket remains aligned with the body of the VSM.
2. Place VSM and bracket assembly on actuator. Ensure VSM shaft engages with actuator pinion.
3. Install bracket mounting bolts with lock washers as seen below.
   a. Tighten mounting bracket bolts to 35 in-lbs. [4Nm].

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10. Accessing Internal Components

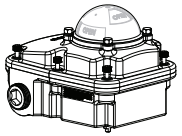
Access to the S5AB internals is done by removing the cover from the unit. The steps for removal are as follows:

WARNING

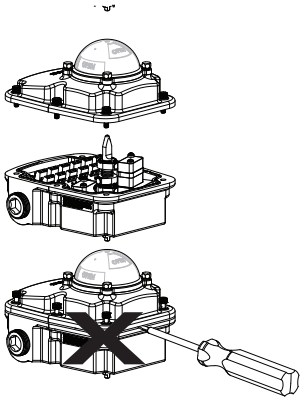
Do not open when energized or an explosive atmosphere is present.

10.1 Cover Removal

1. Loosen captive cover bolts. The S5A contains 4 bolts and the S5B contain 6 bolts located around the perimeter of the unit.



2. Pull the cover up and away from unit. Do not use a wedge device to remove cover.



3. Perform internal adjustment. Reference position adjustment section.

10.2 Cover Installation

1. Ensure o-ring is seated in the o-ring groove.
2. Press on cover ensuring captive bolts are aligned with the bolt holes.
3. Tighten cover bolts to 13-18 lb-in [1.5-2.0 Nm] in a cross pattern.

11. Field Wiring

Bray Series 5A and 5B I.S. are assembled with numbered terminal blocks on a printed circuit board designed to conform to Intrinsically Safe requirements. Bray Series 5A VSMs contain a 4-pole terminal block, while the Series 5B VSMs contain a 12-pole terminal block. All switches are pre-wired into the terminal block. Several features have been designed to help ease field wiring:

- Terminal blocks are angled towards the cover opening.
- Wiring diagram is attached to the inside of cover.
- Two side conduit entries are available for all models. Additional rear conduit entry available on S5B resin trim.

WARNING

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

Observe all applicable safety regulations for electrical equipment installed in potentially explosive (hazardous) locations.

NOTICE

- Do not re-machine the conduit entry threads or create any new holes in the enclosure.
- Do not remove the screw-in conduit plugs (aluminum housing) or peel-off decal (resin housing) until it is time to wire into the unit's terminal blocks.
- Do not tamper with or modify any exposed O-rings or gaskets.
- A minimum of 18 AWG wire is recommended for all field wiring.
- The terminals inside the VSM accept wire sizes ranging from 14 to 20 AWG.
- The conduit connections must be properly sealed to maintain the weatherproof integrity of the VSM enclosure.

Bray Series 5A and 5B I.S. VSMs should be wired as follows:

1. Remove the cover of the VSM.
2. Remove the conduit plugs (aluminum housing) or peel-off decal (resin housing).
3. Install appropriate cable or conduit fittings required to meet application needs, weatherproof requirements, and hazardous location requirements.
4. Terminate the field wiring per the wiring diagram attached to the inside of the cover.
5. Tighten wires in terminal block to 3.5 lb-in [0.4 Nm].
6. Re-attach VSM cover once position adjustment has been completed.
   a. Tighten cover bolts in a cross pattern to 80 lb-in [9 Nm] for aluminum housing or 17.7 lb-in [2 Nm] for resin housing. Reference Cover Installation.

WARNING

To ensure intrinsic safe operation, use cable ties to mount field wiring to the printed circuit board.

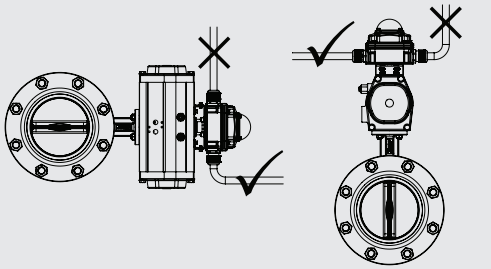
NOTICE
Do not use power tools to tighten the cover screws.

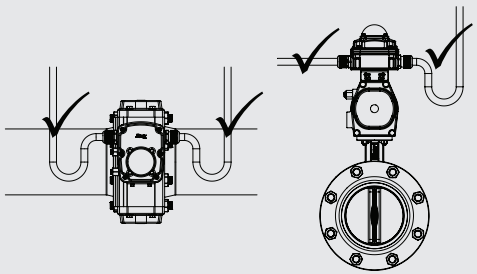
NOTICE

If the valve status monitor is 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 through the conduits.

In all cases, the conduit should be positioned to prevent drainage into the valve status monitor. In some cases the use of an "S" pipe can be used to prevent water ingress.

Refer to the figures on the right.





Side Conduit Entries		
VSM	Imperial	Metric
S5A	2 x 1/2" NPT	2 x M20
S5B	2 x 3/4" NPT	2 x M25
Rear Conduit Entry (Resin Only)		
S5B	1 x 1/2" NPT	1 x M20

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12. Reversal of Visual Indication

Visual indication can be reversed per application requirements without the need to re-mount the VSM. This may also be appropriate if the standard orientation of the VSM is not convenient for the application such as field wiring entry direction do not align with conduit entries.

WARNING

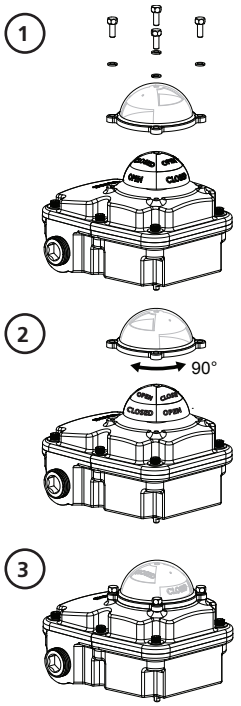
Observe all applicable safety regulations for electrical equipment installed in potentially explosive (hazardous) locations when making modifications to the assembly.

NOTICE
Ensure that open and close cams are properly set after any modification to visual indication.

Bray Series 5A and 5B I.S. VSM visual indication can be reversed as follows:

1. Remove all four Indicator dome bolts with lock washers.
2. Rotate the indicator dome 90° in either direction.
3. Remount the indicator dome bolts with lock washers.
   a. Tighten bolts in a cross pattern to 13-18 lb-in [1.5-2 Nm] for aluminum housing or 5.3-7.5 lb-in [0.6-0.85Nm] for resin housing.
   b. Ensure that o-ring is secure in indicator dome and is not pinched when dome is re-installed.

NOTE: The indicator dome of the 5A Resin VSM is part of the cover. Remove the cover for indication reversal.



13. Position Adjustment

A single or doubled lobed cam is provided for every independent/main switch. Double lobed cams are provided when the switch configuration could include an auxiliary switch. Double lobed cams will activate both main and auxiliary switches at the same time.

Cams are mounted to the indicator shaft, alternating between red and yellow and are independently adjustable by hand in 3.6° increments. No special tools are needed for this adjustment. The self-locking design ensures that cams will not slip position.

The bottom red cam is intended to indicate the close position while the bottom yellow cam is intended to indicate the open position. Both of the switches associated with these cams are labeled accordingly. An additional red and yellow cam may be installed for most switches and can be used for mid-travel position indication or to provide an additional auxiliary open and close indication. Mid-travel switches are unlabeled.

Closed Travel Indication Adjustment

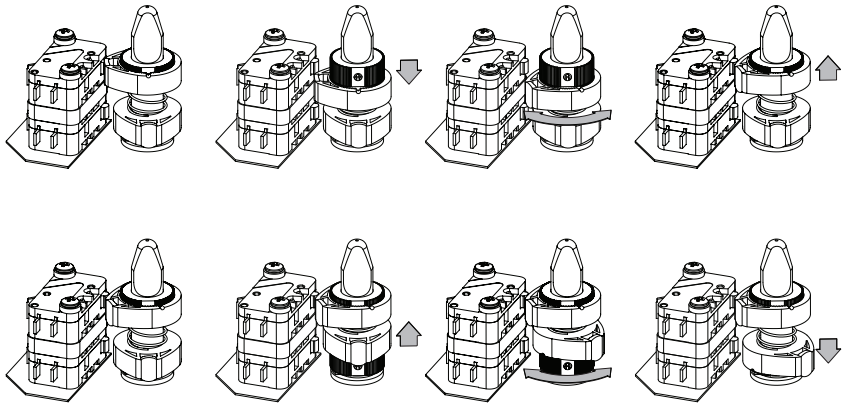
1. Operate the quarter turn device until it reaches the desired closed position.
2. Pull the bottom red close cam upwards towards the yellow cam to disengage the cam from the fixed cam holder.
3. While the cam is disengaged, rotate the cam to the position that will activate the close switch.
    a. NOTE: Do not attempt to adjust cams prior to disengaging the cam from the fixed cam holder.
4. Release the cam and allow the locking spring to re-engage the cam with the fixed cam holder.

Open Travel Indication Adjustment

1. Operate the quarter turn device until it reaches the desired open position.
2. Push the bottom yellow open cam towards the bottom red cam to disengage the cam from the fixed cam holder.
3. While the cam is disengaged, rotate the cam to the position that will activate the open switch.
    a. NOTE: Do not attempt to adjust cams prior to disengaging the cam from the fixed cam holder.
4. Release the cam and allow the locking spring to re-engage the cam with the fixed cam holder.

Mid-Travel Indication Adjustment

1. Operate the quarter turn device until it reaches the desired mid-travel position.
2. Disengage the cam from the cam holder.
    a. NOTE: Mid-travel cams are disengaged similarly to the open and close cams.
3. While the cam is disengaged, rotate the cam to the position that will activate the mid-travel switch.
    a. NOTE: Do not attempt to adjust cams prior to disengaging the cam from the fixed cam holder.
4. Release the cam and allow the locking spring to re-engage the cam with the fixed cam holder.



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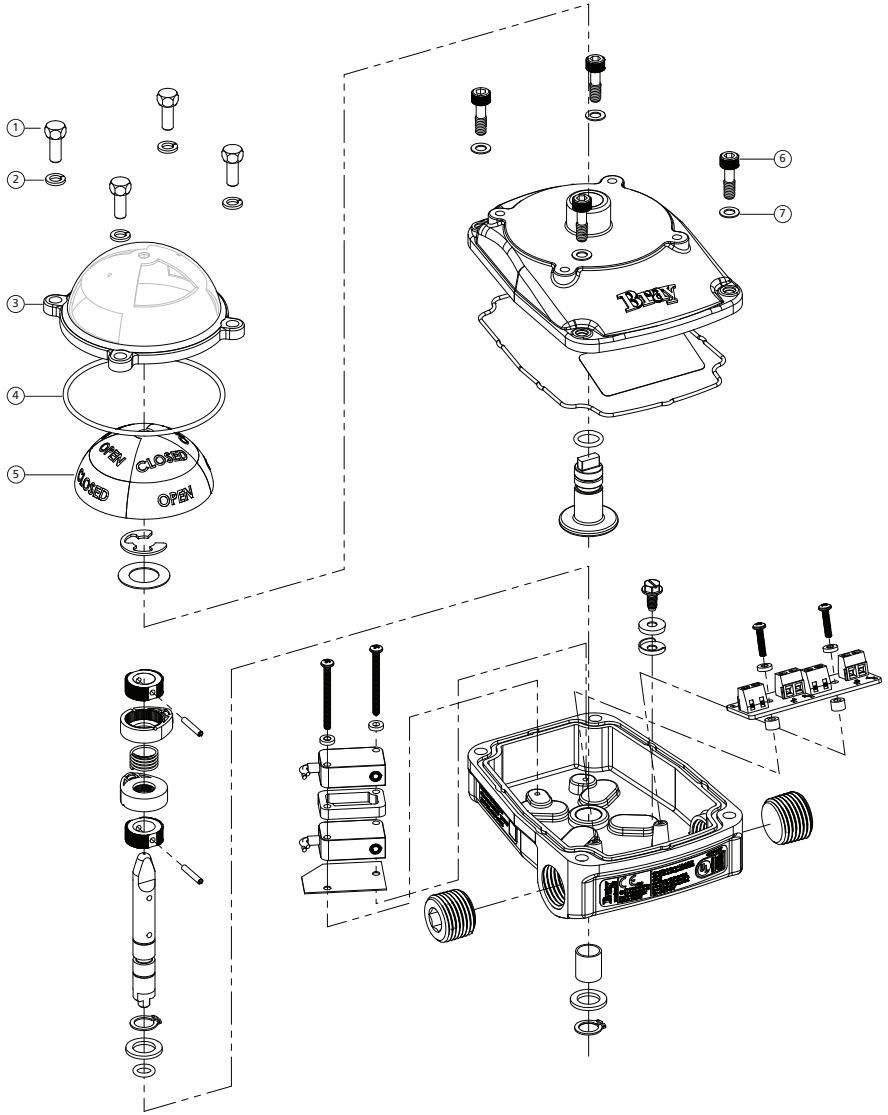
14. Troubleshooting Chart

Problem	Possible Cause	Solutions
Signal is not received	Wiring is not connected inside VSM	Rewire field wiring and check applied torque to terminal block
	Cams are set outside of actuator range	Adjust cam position
	Damage to switches	Check power ratings of switches versus application
Open signal is received in close position (or vice versa)	Field wiring is reversed	Rewire field wiring
Corrosion inside unit	Condensation forming	Seal conduit opening
	Water leaking in	Check all seals and possible water entry through conduit
Visual indication is opposite of actuator position	Visual indication was reversed or VSM was mounted 90°	Reverse visual indication or re-mount VSM.
VSM does not rotate	Bracket or adapter does not mate properly with actuator.	Check bracket and adapter for proper fit and adjust as needed.
	Actuator is not moving as commanded	Check troubleshooting chart in actuator IOM. Check field wiring.

15. Exploded Views

Exploded View - 5A - Aluminum Trim



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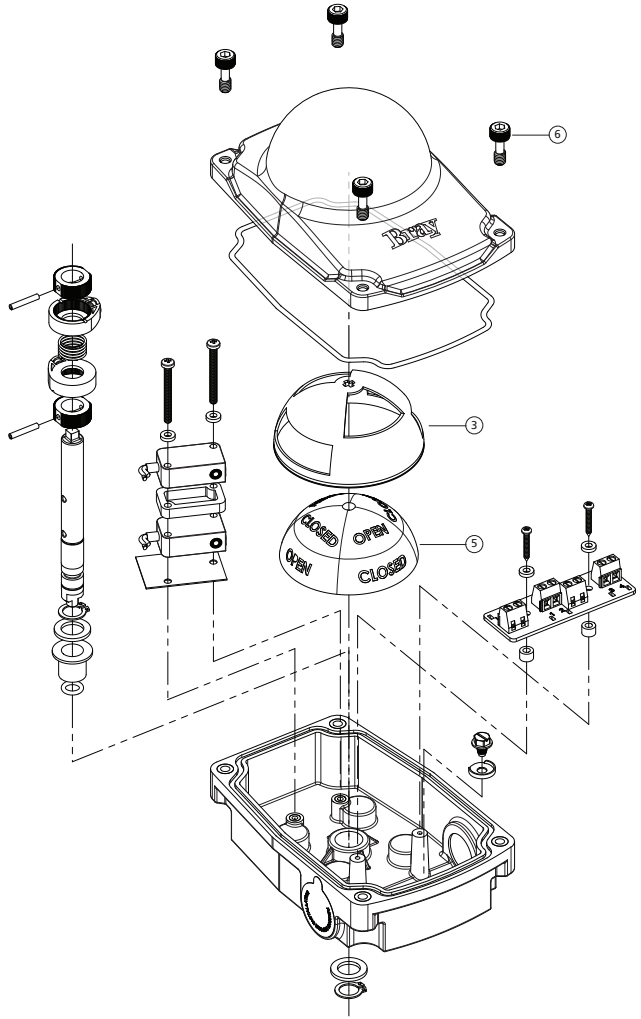
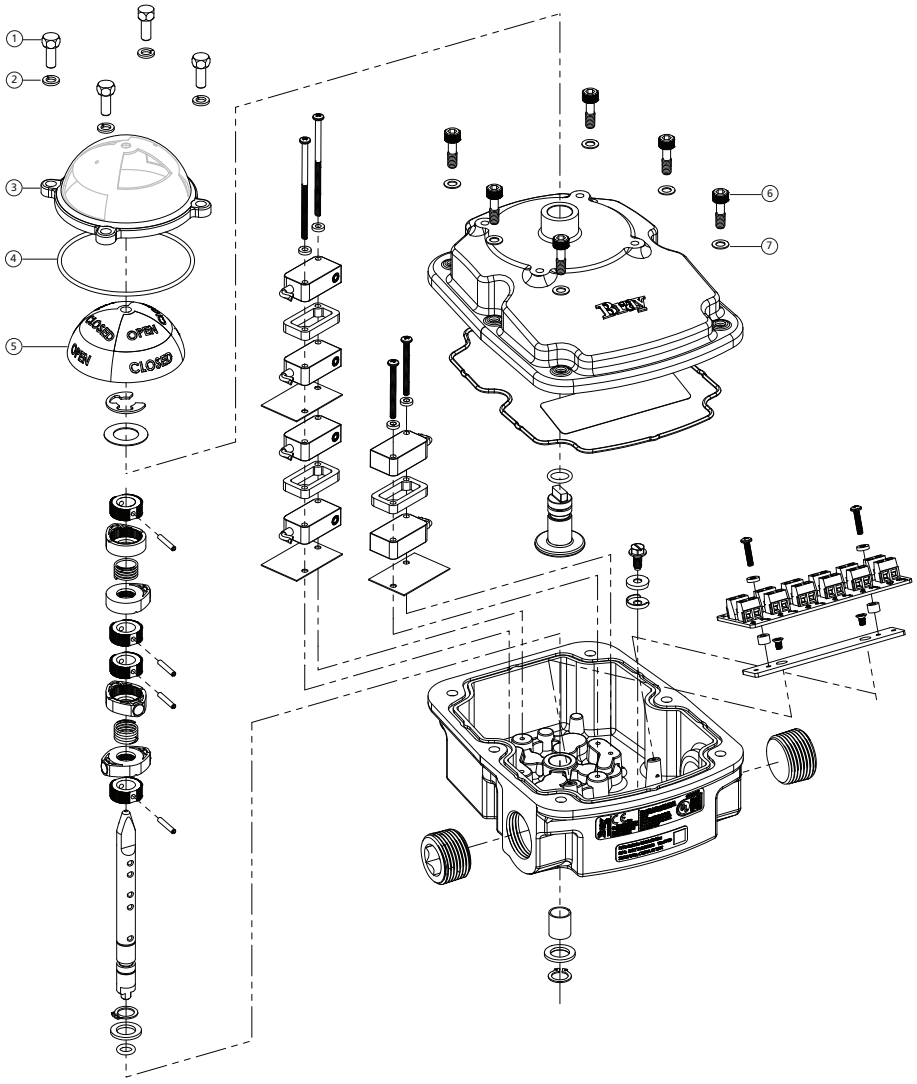
Exploded View - 5A - Resin Trim



Exploded View - 5B Aluminum Trim



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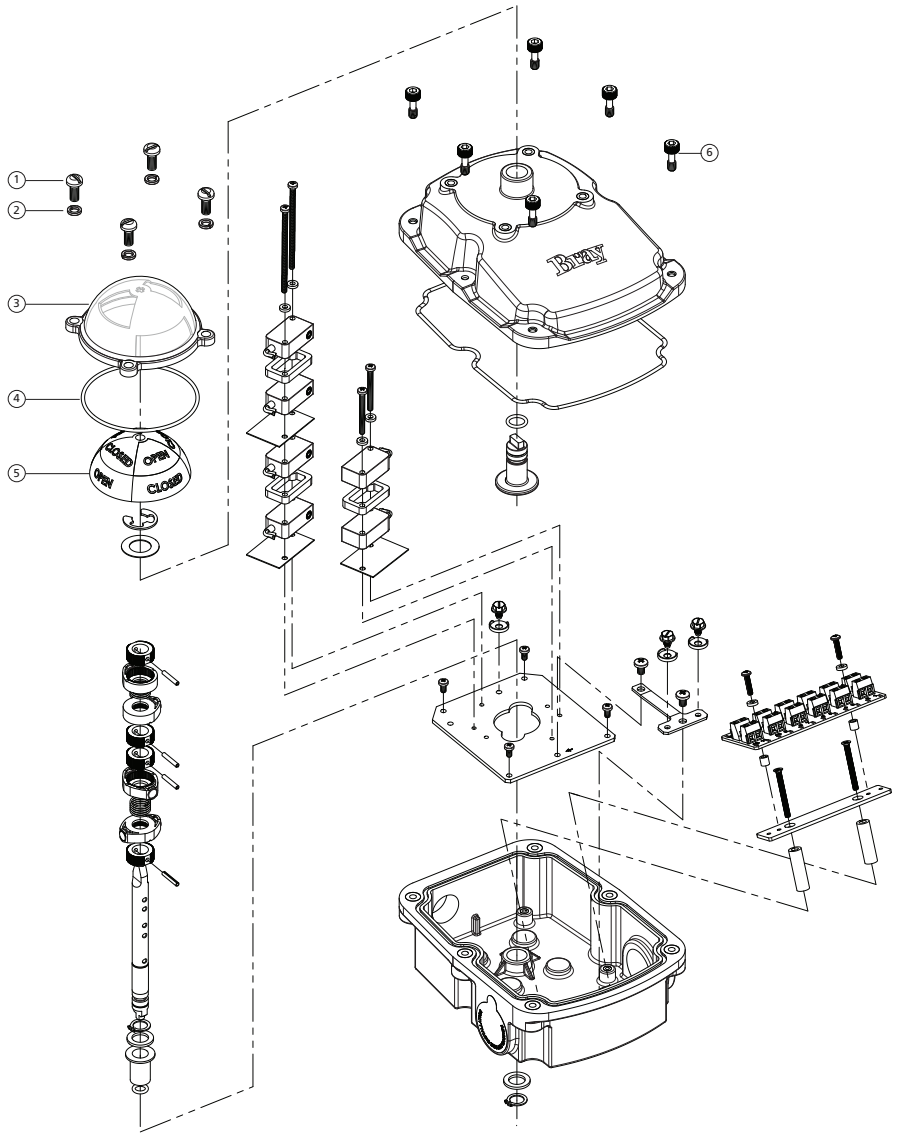
Exploded View - 5B Resin Trim



16. Replacement Parts

16.1 Replacement Parts Aluminum Housing

No.	Description	Imperial	Metric
1	Dome Bolts	5B0000-22900536	5B0000-22950536
2	Dome Washer		
3	Dome Assembly		
4	Dome Gasket		
5	Indicator Assembly		
6	Cover Bolt	5B0000-22901536	5B0000-22951536
7	Cover Bolt Washer		

16.2 Replacement Parts Resin Housing

No.	Description	Imperial and Metric
1	Dome Bolts	5B0000-22952536*
2	Dome Washer	
3	Dome Assembly	
4	Dome Gasket	
5	Indicator Assembly	
6	Cover Bolt	5A0000-72102534

**Dome repair kit only for S5B Resin*

17. Basic Tools

Common To All Units	
Terminal Connections	Screwdriver, ¼" tip flat blade
All switches, terminal strip	Screwdriver, No. 1 Phillips
Ground screw	Screwdriver, No. 2 Phillips
Imperial Style	
Indicator Dome	Wrench, 5/16"
Cover Bolt, Aluminum Housing	Hex Key, 5/32"
Cover Bolt, Resin Housing	Hex Key, 4mm
Conduit Entry – ½" NPT	Hex Key, 3/8"
Conduit Entry – ¾" NPT	Hex Key, 9/16"
Mounting Bracket Bolts	Wrench, 5/16" & 7/16"
Metric Style	
Indicator Dome	Wrench, 8mm
Cover Bolt	Hex Key, 4mm
Conduit Entry – M20	Screwdriver, No. 3 Phillips
Conduit Entry – M25	Screwdriver, No. 3 Phillips
Mounting Bracket Bolts	Wrench, 8mm & 10mm

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13333 Westland East Blvd.
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