

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS



HXCSN2 Series

 II 2 G Ex db IIC T6 Gb

 II 2 D Ex tb IIIC T85°C/T100°C/T135°C Db

Includes:

24VAC/VDC (LV)
120/230VAC (HV)

EU-Type Examination Certificate Number:

Presafe 19 ATEX 14747X

Issue 0

DNV GL Presafe AS, notified body number 2460, in accordance with Article 17 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014, certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.

Compliance with the Essential Health and Safety Requirements has been assured by compliance with: **EN IEC 60079-0:2018, EN 60079-1:2014 and EN 60079-31:2014.**



WARNING – This product is designed for use in hazardous locations. See warnings throughout this document regarding special considerations during handling, installation and operation.

TO PREVENT POTENTIAL INJURY OR DAMAGE TO PROPERTY, READ THIS MANUAL CAREFULLY AND COMPLETELY.

USE ONLY HAYWARD GENUINE REPLACEMENT PARTS

IMPORTANT SAFETY INSTRUCTIONS

Basic safety precautions should always be followed, including the following: Failure to follow instructions can cause severe injury and/or death.

 This is the safety-alert symbol. When you see this symbol on your equipment or in this manual, look for one of the following signal words and be alert to the potential for personal injury.

 **WARNING** warns about hazards that could cause serious personal injury, death or major property damage and if ignored presents a potential hazard.

 **CAUTION** warns about hazards that will or can cause minor or moderate personal injury and/or property damage and if ignored presents a potential hazard. It can also make consumers aware of actions that are unpredictable and unsafe.

Notice: A notice indicates special instructions that are important but not related to hazards.



 **WARNING** - Read and follow all instructions in this IOM manual and on the equipment. Failure to follow instructions can cause severe injury and/or death.



 **WARNING** - Risk of Explosion. Read and follow all instructions in this IOM manual and on the equipment. Failure to follow instructions can cause severe injury and/or death and severe property damage.

Before removing any actuator covers or working on any electrical equipment, turn off any power supply (main and control power) to the equipment.



 **WARNING** – Risk of Electric Shock. All electrical wiring MUST be in conformance with applicable local codes, regulations, and the National Electric Code (NEC). Hazardous voltage can shock, burn, and cause death or serious property damage. To reduce the risk of electric shock, do NOT use an extension cord to connect unit to electric supply. Provide a properly located electrical receptacle. **Before working on any electrical equipment, turn off power supply to the equipment.**

 **WARNING** – Follow all national, state, and local government and site specific safety and installation procedures when installing and working with this product.

 **WARNING** – To reduce the risk of electric shock replace damaged wiring immediately.

 **WARNING** – Ground all electrical equipment before connecting to electrical power supply. Failure to ground all electrical equipment can cause serious or fatal electrical shock hazard.

 **WARNING** – Do NOT ground to a gas supply line.

 **WARNING** – To avoid dangerous or fatal electrical shock, turn OFF power to all electrical equipment before removing any covers or working on electrical connections.

 **WARNING** – Failure to bond all electrical equipment to system structure will increase risk for electrocution and could result in injury or death. To reduce the risk of electric shock, see installation instructions and consult a professional electrician on how to bond all electrical equipment. Also, contact a licensed electrician for information on local electrical codes for bonding requirements.

 **WARNING** – To avoid damage to critical smooth mating surfaces, take great care to prevent damage to actuator mating surfaces. All these surfaces create seals which must remain intact for the actuator to work as designed in hazardous environments.



 **CAUTION** – Potential pinch point. Equipment connected to or driven by this device may start unexpectedly and may cause personal injury or entrapment in linkage systems.

HAZARDOUS ENVIRONMENT ACTUATORS



WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

IDENTIFYING HAZLOC PRODUCTS

This product is manufactured and certified specifically for use in the following hazardous locations:

 **II 2 G Ex db IIC T6 Gb**

 **II 2 D Ex tb IIIC T85°C/T100°C/T135°C Db**

Certified hazardous location products can be identified by distinct markings and warnings on the actuator body.



Permanently attached engraved stainless tag with all pertinent certifications and codes displayed for field reference.

PRODUCT HAZARDOUS LOCATION MARKINGS

ATEX	Equipment Group		ATEX Equipment Category		Environment		IEC/EN EPL (Explosion Protection Level)		Level of Protection		Presence or Duration of Explosive Atmosphere			Correlation with Hazardous Areas				
	II		2		G-Gas D-Dust		Gb (for gas) Db (for dust)		High		Likely to occur			Zone 1 (Gas/Vapor) Zone 21 (Dust)				
IECEX	Protection Method / IEC/EN EPL Explosion Protection Level						Max Surface Temperature (w/ 30°C temp rise)						Explosive Environment Grouping					
	Gas	Flame-Proof	Ex db	EU	Category 2G	EN 60079-1	T4 - 135°C		T5 - 100°C		T6 - 85°C		IIC					
				IEC	EPL Gb	IEC 60079-1	Max Ambient	100°C	Max Ambient	65°C	Max Ambient	50°C						
	Dust	Protection by Enclosure	Ex tb	EU	Category 2D	EN 60079-31							IIIC					
				IEC	EPL Db	IEC 60079-31												

Notice: Due to certification regulations and traceability requirements, this product is non-returnable and non-cancellable. Verify the product and certifications are approved for the project prior to ordering.

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ACTUATOR OPERATIONAL CONCEPTS

Notice: The HXCSN2 Series is produced with a manual hand wheel on the side of the actuator (HXCSN2B & 2S).

Notice: ALL HXCSN2 Series actuators rotate CW to CLOSE the output shaft (out the bottom of the actuator) when viewed from ABOVE, however, **the cam shaft and the indicator rotate CCW (opposite the output shaft).**

Notice: The calibration procedures are specific to each model. Please be sure to follow the correct sequence for your model.

Notice: HXCSN2 Series actuators are fully assembled, calibrated and tested prior to leaving our factory. In most cases, after you have mounted the actuator to your device, you should be able to operate the actuator from fully CLOSED (CW) to fully OPEN (CCW) and back again, and find that no adjustments are needed. The assembly can be put into service immediately. However, should it be necessary to make adjustments to the end-of-travel positions to overcome any device related issues (e.g. valve shaft incorrectly timed to the drive stem), the procedures outlined below should be followed to put the assembly into service. Note that there is a maximum adjustment range of +/- 3° at each end of travel.

[Pages 10-11](#) - Travel limits and Auxiliary switch cams, HXCSN2B, 2S Series

TECHNICAL INFORMATION

ACTUATOR SPECIFICATIONS			HXCSN2B	HXCSN2S
24VAC - 24VDC	Torque Output (in-lb / Nm)		310 / 35	440 / 50
	Current Draw (Start / Run / LRA)		2.1A / 1.2A / 2.3A	2.1A / 1.2A / 2.3A
	Speed (90°) DC-60Hz/50Hz, seconds		8 / 8	10 / 10
	Motor - 24V DC Perm Magnet 2 Pole Brush		6W	6W
	On/Off / Proportional	Duty Cycle (IEC60034)	75% (S2-30 min)	
		Motor Protection, Temp / Class	All - 130°C / Class B	
		Motor Starts, per hour, Max	600	
120VAC	Current Draw (Start / Run / LRA)		0.4A / 0.4A / 0.5A	0.4A / 0.4A / 0.5A
	Speed (90°) 60Hz / 50Hz, seconds		9 / 11	13 / 15
	Motor - 120V Capacitor Run TENV		10W	10W
	On/Off - Ext Duty / Proportional	Duty Cycle (IEC60034)	75% (S2-30 min)	
		Motor Protection, Temp / Class	180°C / Class H	
		Motor Starts, per hour, Max	600	
230VAC	Current Draw (Start / Run / LRA)		0.2A / 0.2A / 0.3A	0.2A / 0.2A / 0.3A
	Speed (90°) 60Hz / 50Hz, seconds		9 / 11	13 / 15
	Motor - 230V Capacitor Run TENV		10W	10W
	On/Off - Ext Duty / Proportional	Duty Cycle (IEC60034)	75% (S2-30 min)	
		Motor Protection, Temp / Class	180°C / Class H	
		Motor Starts, per hour, Max	600	
All	Manual Override		Hand Wheel	Hand Wheel
	Environmental Rating		NEMA 4/4X & IP66	
	Electrical Entry (2)		1/2" EMT, Polyamide threaded temporary blank plug	
	Control		On/Off, Proportional	
	Auxiliary Switch - End of Travel		(2) Form A Volt-Free, Rated 3A @ 250vac	
	Ambient Operating Range		-40°F to +149°F (-40°C to +65°C)	
	Humidity Range		0-95% RH	
	Altitude Limit		9850 ft / 3000 m	

CONVENTIONS USED IN THIS MANUAL

Below are Terms and Definitions used throughout this manual.

1. CW is Clockwise and CCW is Counterclockwise.
2. **Note:** HXCSN2 models are NOT available with Torque Switches (TS).
3. **Note:** HXCSN2 models are not available with Local Control Stations (LCS).
4. **Note:** HXCSN2 models are not available with Fail-Safe (FS).



Use this table to efficiently select the actuator and wiring diagram you require.

ACTUATOR OPTIONS

Control	Voltage	Torque Switches	Fail Safe	Local Control Station	IOM	Wiring Diagram Page
On/Off	24VDC/VAC	XTS	XFS	None	This IOM	25
Proportional	24VDC/VAC	XTS	XFS	None	This IOM	25
On/Off	120VAC	XTS	XFS	None	This IOM	26
Proportional	120VAC	XTS	XFS	None	This IOM	27
On/Off	230VAC	XTS	XFS	None	This IOM	26
Proportional	230VAC	XTS	XFS	None	This IOM	27

ACTUATOR HANDLING AND INSTALLATION



WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

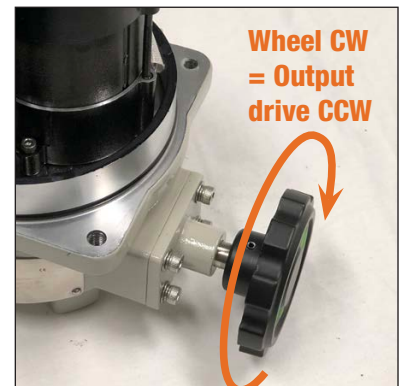
For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

SHIPPING AND HANDLING

- Position on arrival:
 - A separate actuator arrives in the FULLY CLOSED (CW) position. The yellow arrow shaped position indicator (see photo) points at the CW symbol cast into the actuator lid.
 - A 2 way ball valve assembly arrives in the FULLY OPEN (CCW) position and the position indicator points at the CCW symbol.
 - A 2 way butterfly valve assembly arrives nearly CLOSED (5°) position and the position indicator points just short of the CW symbol.
- Storage: This unit should not be stored outside unless it is powered up and has proper conduit terminations* (see Installation Notes). When not powered up, it should be stored in a clean, dry environment at all times.
- This quarter-turn actuator has been factory tested and calibrated to operate between 0° and 90°. Most products will not require recalibration of these settings. If any travel adjustment is necessary, please refer to the Adjusting CW/CCW End of Travel section for instructions.
- Notice:** The HXCSN2 Series actuators do not have adjustable mechanical stops. Use caution when operating the manual override. Do not attempt to operate with a rotation greater than 95°.
- Notice:** Protect the actuator from moisture at all times** (see Installation Notes).



The actuator has a position indicator beneath the glass window. The yellow arrow of the indicator will move to point to the symbols on the actuator lid.



The manual override handwheel allows a user to position the valve or damper. Turn the handwheel CW to make the output drive move CCW (when viewed from above). CCW is the reverse. Ref Page 9.

INSTALLATION NOTES



WARNING – To avoid dangerous or fatal electrical shock, turn OFF power to all electrical equipment before working on electrical connections.



CAUTION – Please follow the following guidelines for proper installation.

- These actuators are designed to be used between a horizontal and upright position. Do NOT mount the assembly with the actuator top below a horizontal position (e.g. upside down).
- The internal heater is to be used in ALL applications.
- Do NOT install the actuator outdoors or in humid environments unless it is powered up and the heater is functioning.
- Use proper wire size to prevent actuator failure (see Wire Sizing Chart for proper wire sizing).
- All terminals accept 14-18AWG solid / stranded wire.
- Notice:** Do NOT parallel wire multiple on/off actuators together without utilizing isolation relays. If this is your intention, please contact HAYWARD FLOW CONTROL for a multiple actuator parallel wiring diagram.



WARNING – Protect the actuator from moisture by installing it with EMT fittings and proper conduit drainage using fittings, conduit, and hardware designed for use in and which comply with the hazardous location requirements.

When safe to do so, supply power to the properly installed unit to keep the internal heater warm at the time of installation.

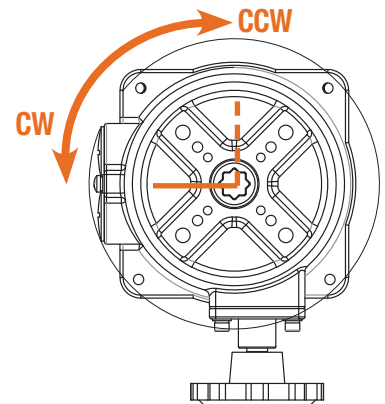
When installing conduit, use proper techniques for entry into the actuator. Use drip loops to prevent conduit condensate from entering the actuator.

PRODUCT MOUNTING AND SETUP



Notice: All HXCSN2 Series actuators rotate CW to close the output shaft out the bottom of the actuator **when viewed from above**. On HXCSN2B & 2S models, the cam shaft and the indicator rotate CCW to close.

1. Fully CLOSE the valve or damper to which the actuator is to be mounted.
 - Keep in mind the OUTPUT SHAFT rotates CW (as viewed from above the unit) when driving CLOSED.
2. Assemble necessary linkage hardware and attach the actuator to the valve or damper.
3. Center the actuator on the valve or damper drive shaft and tighten all hardware.
4. **Before applying power to the unit**, rotate the manual override handwheel from the fully CW to the fully CCW position to check for unobstructed manual operation of the valve or damper.
5. HXCSN2 Series actuators utilize a removable terminal block to simplify field wiring and testing.
 - To remove a terminal block from the PCB receiver, pull straight out in a direction parallel to the PCB.
 - In the photo at right, the LEFT side of the terminal block (between the PCB mounting screws) is pulled out to the LEFT.
 - After wiring, reinsert the terminal strip into the receiver. This is a keyed pair and can only be inserted one way.
 - Screw terminals are rated to accept 14AWG down to 18AWG solid or stranded wire. **TERMINAL NUMBERING HAS #1 AT THE BOTTOM.**



Note that the rotation seen from below is a mirror of the direction viewed from above.



WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

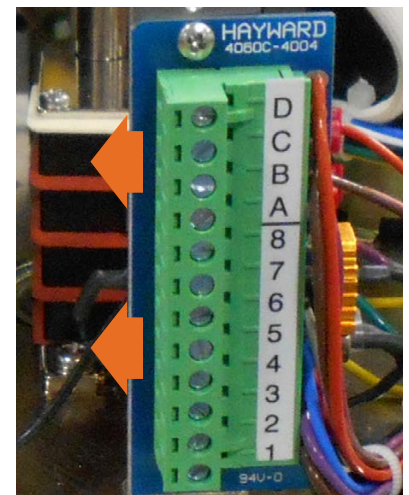
For servicing, DISCONNECT ALL POWER (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

6. Refer to your product part number to determine which wiring diagram to follow when wiring up the actuator.
7. Note that although terminals are labeled as 1-8 and A-D, not all terminals are used on all models.



CAUTION – Be sure to make field connections to the proper terminal as identified by the LABEL and not the position!

8. Make the electrical connections per the appropriate Wiring Diagram for your actuator.
9. Connect POWER and CONTROL to the correct terminals.
10. Terminals A~D on each actuator are for the (adjustable) auxiliary switches. These are dry type (voltage free) Form A contacts rated 250VAC @ 3A Max.



Removable terminal blocks facilitate ease of field wiring and testing. To remove a terminal block from the PCB receiver, pull straight OUT in a direction parallel to the PCB. Use caution when reinserting block - make sure all pins are aligned before seating.

DESIGN SPECIFIC CONCERNS



WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

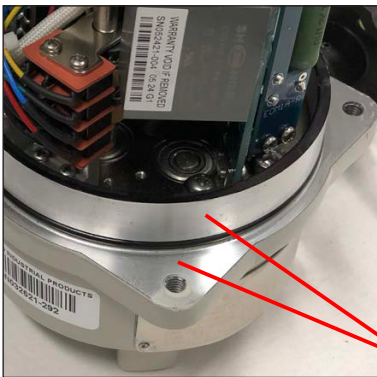
SURFACE HANDLING CONCERNS

The product is designed to prevent the progression of internal flame to the exterior of the actuator and propagating a potentially explosive event. The design is based on flame-path protection and all removable covers consist of precision machined surfaces.



WARNING - Risk of Explosion. Care **MUST** be taken **NOT** to damage those surfaces during handling, installation and servicing of the product.

Due to the critical nature of the integrity of the housing envelope (castings, covers, view-ports), any impact of the product during transportation, movement, handling or servicing **MUST** be identified and tagged as possible damage to the product which may make the unit unfit for its intended use.



Prevent damage to these mating surfaces!



Do NOT nick or scratch glass!



CAUTION – Use Caution when removing the cover from these actuators.

After releasing the four captured cover screws, use a non-metallic wedge to slightly raise the cover from its seat on the base. Keep the cover straight and level while raising it up and away from the base completely. Prevent binding of the cover during the removal and installation process. Take care **NOT** to mark, scratch or otherwise damage the mating surfaces of either the cover or the base during handling.



WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

Output drive rotation

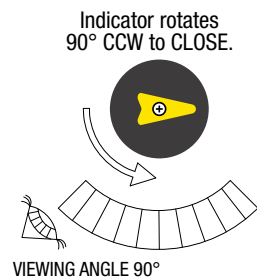
ALL HXCSN2 Series actuators rotate CW to CLOSE. This means that when viewed from above, the OUTPUT shaft (out the bottom of the actuator) will drive CW to CLOSE when commanded to do so.

Note: For all the HXCSN2 Series actuators, the OUTPUT shaft rotates in the same direction, but the camshaft (position indicator and end-of-travel cams) for HXCSN2B & 2S models rotates opposite from the OUTPUT shaft.

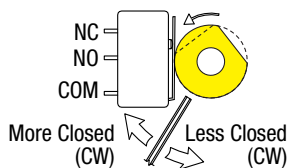
Component rotation

It is often helpful to describe the rotation of components from one fixed point of view, as such, we give **all descriptions of rotation "as viewed from above"**.

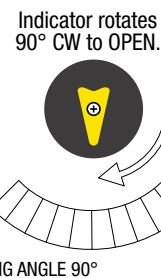
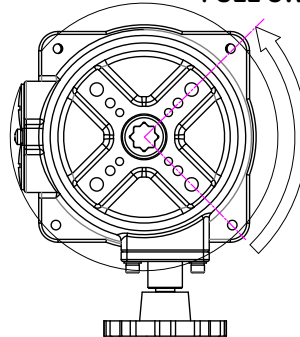
Component	CW (CLOSE) Command	CCW (OPEN) Command
Visual Indicator	Rotates CCW	Rotates CW
Cam 1-2 Behavior	Cam 1 Engages Switch 1 from the rear	Cam 2 Engages Switch 2 from the front
Output Drive	Drive CW (CLOSE)	Drive CCW (OPEN)



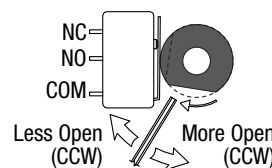
Cam approaches switch from the BACK side of the switch.



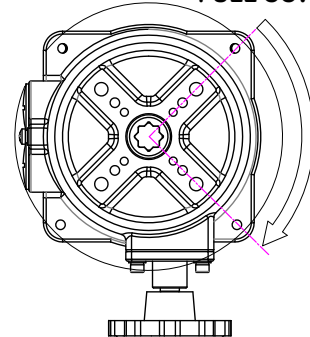
2B, 2S FULL CW



Cam approaches switch from the FRONT side of the switch.



2B, 2S FULL CCW



Manual Override - when powered off ONLY

HXCSN2B & 2S feature a side mounted engageable handwheel (see photo at right).

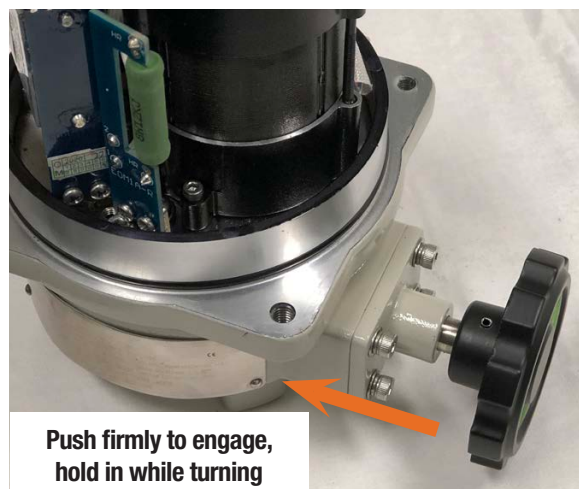
- Engage the manual override by pressing the handwheel in firmly before rotating it.
- CW rotation of the handwheel will OPEN the actuator and CCW rotation of the handwheel will CLOSE the actuator.

Notice: The handwheel on HXCSN2B & 2S models is disengaged from the drive system during normal operation.

Also, the HXCSN2B & 2S models have LIMITED rotation angles of less than 105°. There are HARD mechanical stops in the geartrain which prevent the manual or automatic operation of the actuator beyond those limitations.



WARNING – Attempts to use the hand wheel system to move the geartrain beyond the 105° rotation limits will void the product warranty.



Engageable Handwheel Manual Override, HXCSN2B, 2S models

ADJUSTING END OF TRAVEL CAMS

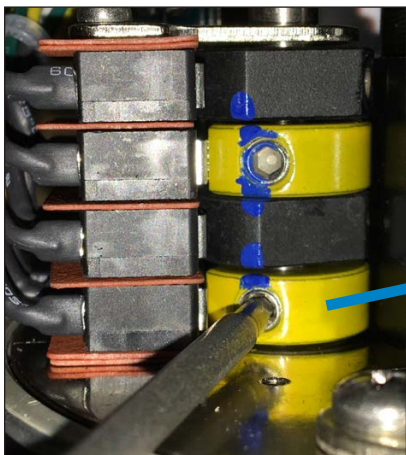
This actuator has been factory calibrated and tested to stop at 0 degrees for CW position and to stop at 90 degrees for CCW position. Most installations onto valves or dampers will likely not require changes to these settings.

Please mount the valve or damper and proceed on these pages **only** if adjustments are required.

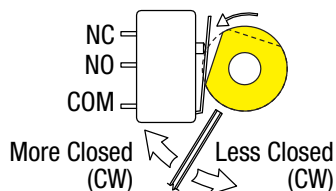


WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!



Cam approaches switch from the BACK side of the switch.



Adjust CW Cam (Bottom)

1. Cam 1 is the bottom cam and is the end-of-travel adjustment for the actuator CW position. With POWER OFF and the actuator at its required CW position, use a sharp 2.5mm hex key to free up the cam set screw. **Take care not to let the hex key slip at this stage, it can easily strip out.** Once it is free adjust it as described below:
 - Rotate the hex key to the LEFT 10-15 degrees until you hear a click. This will reset the switch roller arm.
 - Gently tighten (CW) the set screw only until slight pressure is felt. Ideally the set screw rides along the camshaft.
 - Now SLOWLY rotate the hex key to the RIGHT, pushing the cam, until you hear the “click” on the bottom switch. The click means correct adjustment has been achieved.
 - Tighten the cam set screw.

2. Apply power and test for the correct CW position:

- Drive the actuator CCW at least 15-20 degrees.
- Drive the actuator CW until the cam stops the electrical travel.
- Check to be sure this is the correct CW position you require

3. Repeat the steps of item 1 if further adjustment is needed.

Adjust CCW Cam (Second from Bottom)

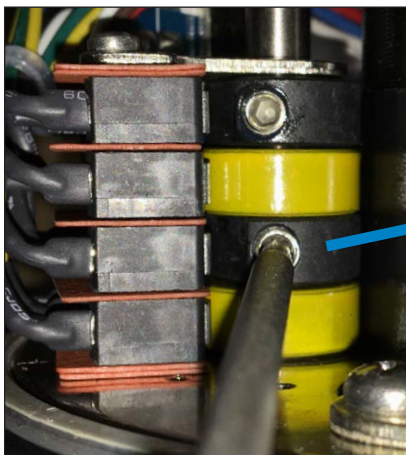
4. Cam 2 is the second cam up from the bottom and is the end-of-travel adjustment for the actuator CCW position. With POWER OFF and the actuator at its required CCW position, use a 2.5mm hex key to free up the cam set screw. Once it is free adjust it as described below:

- Rotate the hex key to the RIGHT 10-15 degrees until you hear a click. This will reset the switch roller arm.
- Gently tighten (CW) the set screw only until slight pressure is felt. Ideally the set screw rides along the camshaft.
- Now SLOWLY rotate the hex key to the LEFT, pushing the cam, until you hear the “click” on the second switch. The click means correct adjustment has been achieved.
- Tighten the cam set screw.

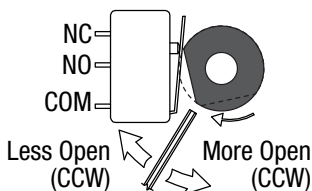
5. Apply power and test for the correct CCW position:

- Drive the actuator CW at least 15-20 degrees.
- Drive the actuator CCW until the cam stops the electrical travel.
- Check to be sure this is the correct CCW position you require

6. Repeat the steps of item 4 if further adjustment is needed.



Cam approaches switch from the FRONT side of the switch.



WARNING – Serious Damage to the actuator will result if the motor is allowed to drive the gear train into the mechanical stop! Remove power from this device BEFORE making any travel adjustments.

ADJUSTING AUXILIARY SWITCH CAMS

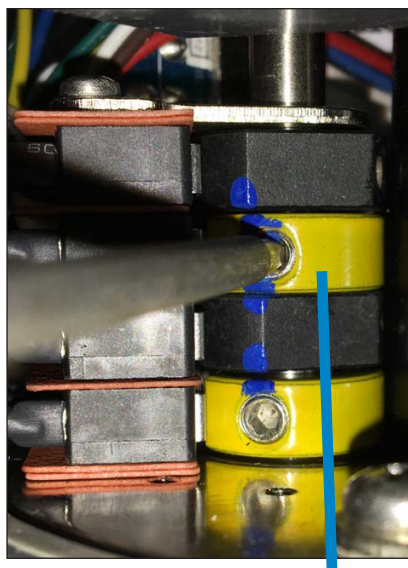
This actuator has been factory calibrated and tested to stop at 0 degrees for CW position and to stop at 90 degrees for CCW position. Most installations onto valves or dampers will likely not require changes to these settings.

Please mount the valve or damper and proceed on these pages **only** if adjustments are required.



WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!



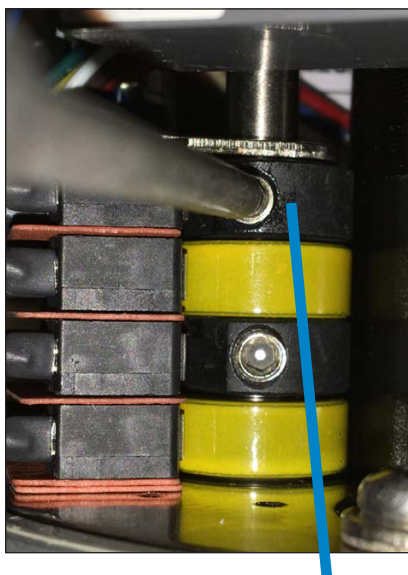
Cam 3 - CW Auxiliary Cam

Adjust CW Auxiliary Cam

1. Cam 3 is the third cam up from the bottom and is the CW auxiliary switch adjustment, an optional switch typically used to indicate the actuator reached its CW position.
2. Drive the actuator to its CW position. Use a sharp 2.5mm hex key to free up the cam set screw. **Take care not to let the hex key slip at this stage, it can easily strip out.** Once it is free adjust it as described below:
 - Rotate the hex key to the **LEFT** 10-15 degrees until you hear a click. This will reset the switch roller arm.
 - Gently tighten (CW) the set screw only until slight pressure is felt. Ideally the set screw rides along the camshaft.
 - Now **SLOWLY** rotate the hex key to the **RIGHT**, pushing the cam, until you hear the “click” on the bottom switch.
 - Continue to rotate the cam between 3 and 5 degrees to the **RIGHT** to make sure the auxiliary cam switch changes state before the actuator reaches its end of travel electrically.
 - Tighten the cam set screw.
3. An easy indicator of correct CW Aux cam setting is to look at the setscrew on the #3 cam. It should be about one-half the setscrew diameter to the **RIGHT** of the #1 cam setscrew.

Adjust CCW Auxiliary Cam

1. Cam 4 is the fourth cam up from the bottom and is the CCW auxiliary switch adjustment, an optional switch typically used to indicate the actuator reached its CCW position.
2. Drive the actuator to its CCW position. Use a 2.5mm hex key to free up the cam set screw. Once it is free adjust it as described below:
 - Rotate the hex key to the **RIGHT** 10-15 degrees until you hear a click. This will reset the switch roller arm.
 - Gently tighten (CW) the set screw only until slight pressure is felt. Ideally the set screw rides along the camshaft.
 - Now **SLOWLY** rotate the hex key to the **LEFT**, pushing the cam, until you hear the “click” on the bottom switch.
 - Continue to rotate the cam between 3 and 5 degrees to the **LEFT** to make sure the auxiliary cam switch changes state before the actuator reaches its end of travel electrically.
 - Tighten the cam set screw.
3. An easy indicator of correct CCW Aux cam setting is to look at the setscrew on the #4 cam. It should be about one-half the setscrew diameter to the **LEFT** of the #2 cam setscrew.



Cam 4 - CCW Auxiliary Cam



WARNING – Serious Damage to the actuator will result if the motor is allowed to drive the gear train into the mechanical stop! Remove power from this device BEFORE making any travel adjustments.

PROPORTIONAL CONTROL SETUP

The process of setting the potentiometer correctly is a function of the model of the actuator. Be sure to use the photo reference for the correct actuator model to prevent damage to the potentiometer.

Loosen Gear Setscrews:

During the initial setup, BEFORE changing actuator rotation, be sure the sector gear setscrews (2) are loose enough to allow the sector gear / potentiometer pinion gear to rotate freely by hand. This will prevent damage to the potentiometer if initial settings are incorrect.

Check to be sure:

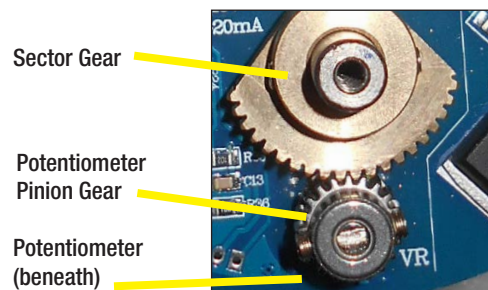
- Two (2) setscrews, **loose**, in the sector gear.
- Two (2) setscrews, **tight**, in the potentiometer pinion gear.

Notice: This page is for visual reference ONLY.
Contact Hayward before making changes.



WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!



Proper Sector Gear/Potentiometer Pinion Gear Behavior:

HXCSN2B, 2S Models, normal operation:

When viewed from ABOVE the actuator, when it is driving to the full CW (closed) position:

- The sector gear rotates CCW.
- The potentiometer pinion gear rotates CW.

When viewed from ABOVE the actuator, when it is driving to the full CCW (open) position:

- The sector gear will rotate CW.
- The potentiometer pinion gear rotates CCW until the actuator reaches its full CCW position.
- **Note: If the setting of this procedure is incorrect, the sector gear will overdrive and damage the potentiometer.**

HXCSN2B, 2S: initial gear mesh setup:

Because the potentiometer itself has a limited angle of rotation and can be easily

damaged by overdriving its limits, take care to initially set it up.

- With the sector gear setscrews loosened as described, lift the sector gear so it is not meshed with the pinion gear.
- Place the actuator geartrain in the full CW position.
- Rotate the potentiometer pinion gear to its full CW direction, then back one to two teeth.
- Rotate the sector gear and place it where the second or third tooth from the end meshes with the pre-positioned potentiometer gear.
- The goal is that the sector gear is always meshed with the pinion gear from CW position to CCW position and never hits the potentiometer end stops.
- Tighten the two M3 setscrews on the sector gear.



Photo shows the correct alignment of sector gear and pinion gear when the actuator is in its FULL CW position (CW cam tripped).

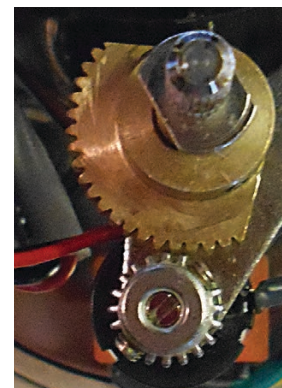


Photo shows the correct alignment of sector gear and pinion gear when the actuator is in its FULL CCW position (CCW cam tripped).

HXCSN2B, 2S Model Notes:

- Photos show the correct alignments of sector gear to potentiometer pinion gear when the actuator is in its FULL CW position (CW cam tripped) and FULL CCW position (CCW cam tripped), respectively.
- Note that the sector gear rotates CCW, and the pinion gear rotates CW as the actuator drives CCW (Open).
- Be sure the potentiometer pinion gear is rotated fully CCW before aligning the two gear sets.
- During any movements, pull the sector gear UP on the camshaft to clear the pinion gear teeth. This will allow proper rotation and alignment of components. (disregard shaft top deviation from correct model in the photos).

COMMISSIONING

The end stop travel (cams) of this actuator have been factory set and tested to respond between 0° and 90° degrees rotation. If NO changes to end stops are required, this unit is ready to be put into service immediately using this procedure. IF changes to the cam positions are required, refer to pages 10~11 before proceeding.

Conceptually this procedure first establishes correct direction and control; these **MUST** be verified in order to proceed. Any actuator must drive CW when commanded to do so, and **STOP** when the actuator reaches the full CW travel position. The same applies for the CCW operation.

⚠ WARNING – Follow these directions carefully and in order. Actuator damage due to improper testing and commissioning will NOT be covered under warranty.

Commissioning - On/Off Control

After the actuator and valve (damper) assembly have been installed with power and control connected, **BEFORE** applying power, use the manual override to rotate the actuator to a mid-travel position.

1. Be sure there are NO movement commands active, and apply power.
 - A. The actuator should NOT move.
 - I. If it does move, **IMMEDIATELY remove power from the actuator to STOP movement.**
 - a. Proceed to step 2.
 - II. If it does NOT move, proceed to step 3.
2. Check control wiring to terminals 1~8 on the actuator.
 - A. Remove field wiring from terminals 4, 6 & 7, then place a jumper between terminals 4 & 7. Do NOT apply external power to any of these terminals.
 - B. Re-apply power. The actuator will move CW.
 - C. After confirmation, remove power, then remove the jumper between terminals 4 & 7, and place a jumper between terminals 6 & 7.
 - D. Re-apply power, and the actuator will move CCW.
 - E. After confirmation, remove power, then remove the jumper between terminals 6 & 7, and replace the field wiring to terminals 4, 6 & 7.
 - F. Repeat step 1.
3. **Generate a remote CW move command** and verify the DIRECTION of the position indicator is CW.



WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!



Notice: This procedure has many sections with the text “**IMMEDIATELY remove power from the actuator to STOP movement**”. Quick action is necessary in case of any unexpected or uncontrolled movement to keep the actuator from possibly driving into the mechanical stops, past the limits of the valve or damper attached, and to simply keep the actuator in a known position for a quick, efficient installation.



WARNING – LETHAL voltages may be present inside this actuator.

- A. If it is NOT, there is a problem with the field logic or wiring, troubleshoot accordingly.
 - B. If it is, proceed to step 4.
4. **Generate a remote CCW move command** and verify the DIRECTION of the position indicator is CCW.
 - A. If it is NOT, there is a problem with the field logic or wiring, troubleshoot accordingly.
 - B. If it is, proceed to step 5.
5. **If the actuator does NOT stop at the correct positions**, fails to move in the correct directions, or on fails to stop movement when the respective torque switch levers are depressed, **IMMEDIATELY STOP the operation of the actuator** and refer to the Table of Contents for the section to reference for the corrective action needed.
6. **Return Field control to automatic mode. Actuator is now commissioned and operational.**



WARNING – Serious Damage to the actuator will result if the motor is allowed to drive the gear train into the mechanical stop! Remove power from this device BEFORE making any travel adjustments.

COMMISSIONING

The end stop travel (cams) of this actuator have been factory set and tested to respond between 0° and 90° degrees rotation. If NO changes to end stops are required, this unit is ready to be put into service immediately using this procedure. IF changes to the cam positions are required, refer to pages 10~11 before proceeding.

Conceptually this procedure first establishes correct direction and control; these **MUST** be verified in order to proceed. Any actuator must drive CW when commanded to do so, and **STOP** when the actuator reaches the full CW travel position. The same applies for the CCW operation.

 **WARNING – Follow these directions carefully and in order. Actuator damage due to improper testing and commissioning will NOT be covered under warranty.**



WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!



Notice: This procedure has many sections with the text “**IMMEDIATELY remove power from the actuator to STOP movement**”. Quick action is necessary in case of any unexpected or uncontrolled movement to keep the actuator from possibly driving into the mechanical stops, past the limits of the valve or damper attached, and to simply keep the actuator in a known position for a quick, efficient installation.



WARNING – LETHAL voltages may be present inside this actuator.

Commissioning - Proportional Control

1. After the actuator and valve (damper) assembly have been installed with power and control connected, **BEFORE** applying power, use the manual override to rotate the actuator to a mid-travel position.
2. Set the control signal selection jumpers, refer to the Proportional PCB detail page.
3. **Generate a mid-travel command** (12mA) and apply power.
 - A. The actuator should move only to match the incoming signal, if at all.
 - I. If the actuator moves and continues to move **away** from midpoint, **IMMEDIATELY remove power from the actuator to STOP movement**.
 - a. Place a meter in series with terminal 3 (sig-in) (– lead) and the wire coming from the field controller (+ lead), it **MUST** read +12mA (with power ON).
 - i. If it does NOT, check the polarity of the incoming analog signal to make sure it is (+)12mA.
 - ii. Return to step 3.
 - II. If the actuator moves momentarily and then **STOPS** at the mid stroke position, proceed to step 4.
 - III. If the actuator does not move at all, rotate the handwheel slightly in either direction to offset the controller.
 - a. The actuator should move back to the midpoint position and then **STOP**.
 - b. Proceed to step 4.
4. **Generate a CW move command** (4mA) and verify the **DIRECTION** of the position indicator is CW.
 - A. The actuator should run CW and run until it reaches its CW end of travel position.
 - B. Measure terminals 5 (+) and 6 (–) to read 4mA (2vdc).
 - C. While power is on, an analog feedback signal OUT provides an electronic position of the actuator... i.e. 4mA = full CW and 20mA = full CCW positions (reference actuator terminals #5 (+) and #6(–)).
5. **Generate a CCW move command** (20mA) and verify the **DIRECTION** of the position indicator is CCW.
 - A. The actuator should run CCW and run until it reaches its CW end of travel position.



WARNING – Serious Damage to the actuator will result if the motor is allowed to drive the gear train into the mechanical stop! Remove power from this device BEFORE making any travel adjustments.

COMMISSIONING - CONTINUED

- B. Measure terminals 5 (+) and 6 (-) to read 20mA (10vdc).
 - C. While power is on, an analog feedback signal OUT provides an electronic position of the actuator... i.e. 4mA = full CW and 20mA = full CCW positions.
6. **If the actuator does NOT stop at the correct positions**, fails to move in the correct directions, or fails to stop movement when the respective torque switch levers are depressed, **IMMEDIATELY STOP the operation of the actuator** and refer to the Table of Contents for the section to reference for the corrective action needed.
7. Check the full scale response of the analog signals into and out of the actuator by referring to the section: Calibration - Proportional Control for the proper voltage of the actuator.
8. **If the actuator stops at the correct positions and generates a feedback signal representative of the position of the actuator, the actuator can be put into service and is fully operational.**



WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!



PROPORTIONAL CALIBRATION

⚠ WARNING – Follow these directions carefully and in order. Actuator damage due to improper calibration will NOT be covered under warranty.

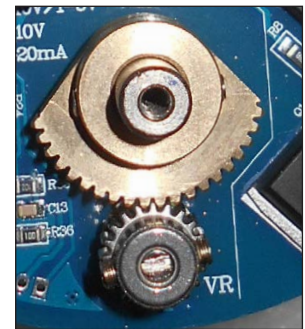
⚠ WARNING – Risk of Explosion. When this product is operating in a hazardous environment DO NOT remove any actuator covers while power is on this actuator. For servicing, DISCONNECT ALL POWER (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!



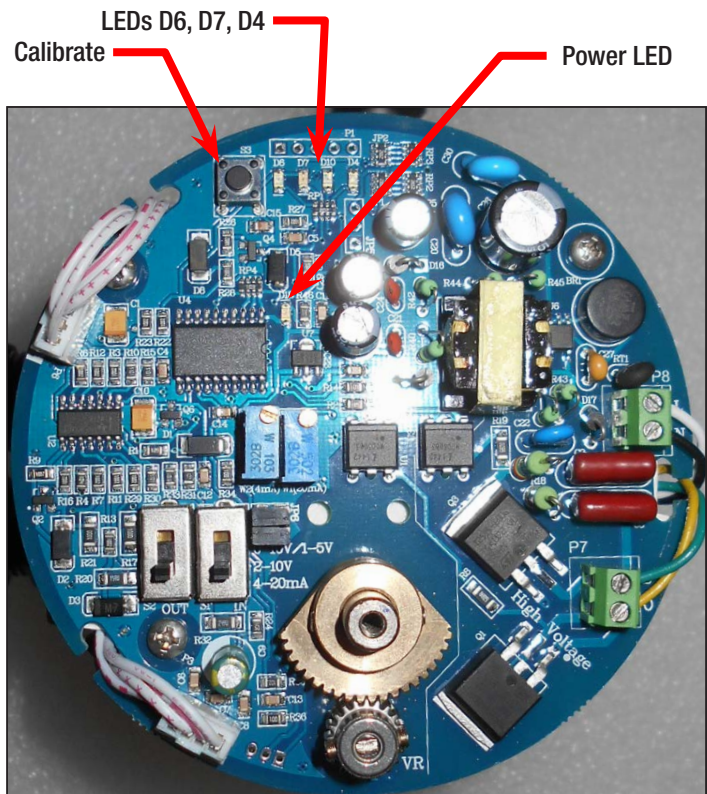
Calibration Procedure - Proportional Control

After completing all mounting and wiring procedures and the commissioning has been performed, it is now possible to calibrate the analog response of the actuator.

1. Before applying power or making any wiring connections:
2. Set the jumper headers for correct signal IN and OUT. (ref next page)
3. Apply correct power according to the actuator model.
 - A. The red LED D18 will turn on, and blue LED D4 will start to flash.
4. **Press the black "S3" pushbutton** on the Mod control board and hold it down for about three seconds, then release.
 - A. The unit will run to its full CCW position, stop for a few seconds, then run back to its full CW position.
 - B. This procedure reads and saves the potentiometer readings into microcontroller EEPROM.
 - C. Loss of power does not erase these settings.
 - D. During the CCW drive process, the grn LED D6 will be ON, and turns off when CCW end of travel is reached.
 - E. During the CW drive process, the red LED D7 will be ON, and turns off when CW end of travel is reached.
5. Upon completion of this procedure, the blu LED D4 will resume flashing approximately once every four seconds to indicate normal CPU activity.
6. The unit will start to respond to the incoming 4-20mA control signal being sent to the actuator.
7. Slight adjustments may be made to the 4mA and 20mA trimmers (see page 17) to affect accuracy on the feedback signal as a function of the actuator position.
8. **Unit is now calibrated and is ready to be put into service. No other calibration is necessary.**



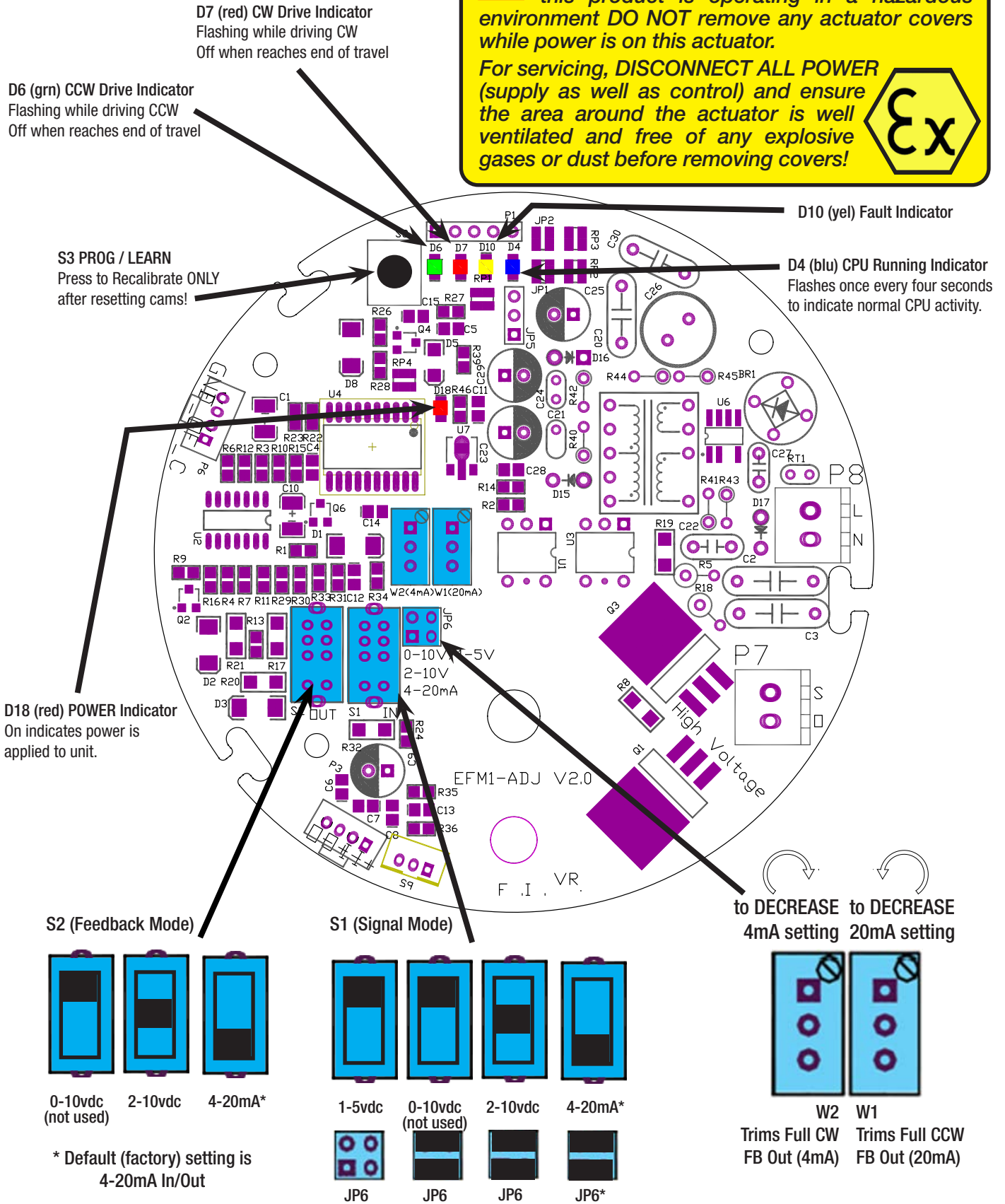
Alignment of the sector and potentiometer gear sets at actuator midpoint position. (reference only).



CALIBRATION - CONTINUED


WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!


[Back to TOC](#)

PROPORTIONAL CALIBRATION

⚠ WARNING – Follow these directions carefully and in order. Actuator damage due to improper calibration will NOT be covered under warranty.

⚠ WARNING – Risk of Explosion. When this product is operating in a hazardous environment DO NOT remove any actuator covers while power is on this actuator.

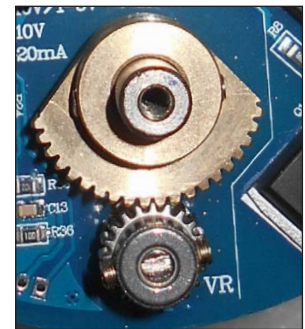
For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!



Calibration Procedure - Proportional Control

After completing all mounting and wiring procedures and the commissioning has been performed, it is now possible to calibrate the analog response of the actuator.

- Before applying power or making any wiring connections:
- Set the DIP switches for correct signal IN and feedback OUT and Response/Feedback. (ref next page)
- Apply correct power according to the actuator model.
 - The blue Power LED D2 will begin flashing.
- Press the “Calibrate” black pushbutton** on the Mod control board and hold it down for about three seconds, then release.
 - The unit will run to its full CCW position, stop for a few seconds, then run back to its full CW position.
 - Wait 20 seconds, the unit will complete the calibration routine and will return to active operation mode by responding to the incoming 4-20mA control signals being sent to the actuator.
 - During the CCW drive process, the grn LED D4 will be ON, and turns off when CCW end of travel is reached.
 - During the CW drive process, the red LED D3 will be ON, and turns off when CW end of travel is reached.
- Slight adjustments may be made to the 20mA trimmer (W1) (see page 19) to affect accuracy on the feedback signal as a function of actuator position.
- Unit is now calibrated and is ready to be put into service. No other calibration is necessary.**
- Note that upon loss of SIGNAL, the actuator response will be as follows:
 - DIP1 = OFF, the unit will go to the fully CW position, until the SIGNAL is restored.
 - DIP 1 = ON, the unit will go to the fully CCW position until the SIGNAL is restored.



and potentiometer gear sets at actuator midpoint position. (reference only).

Calibrate

LEDs D2, D3, D4



CALIBRATION - CONTINUED



WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.

For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!



Signal IN DIP Select

DIP	MODE
Top	0-10V
Mid	2-10V
Btm	4-20mA

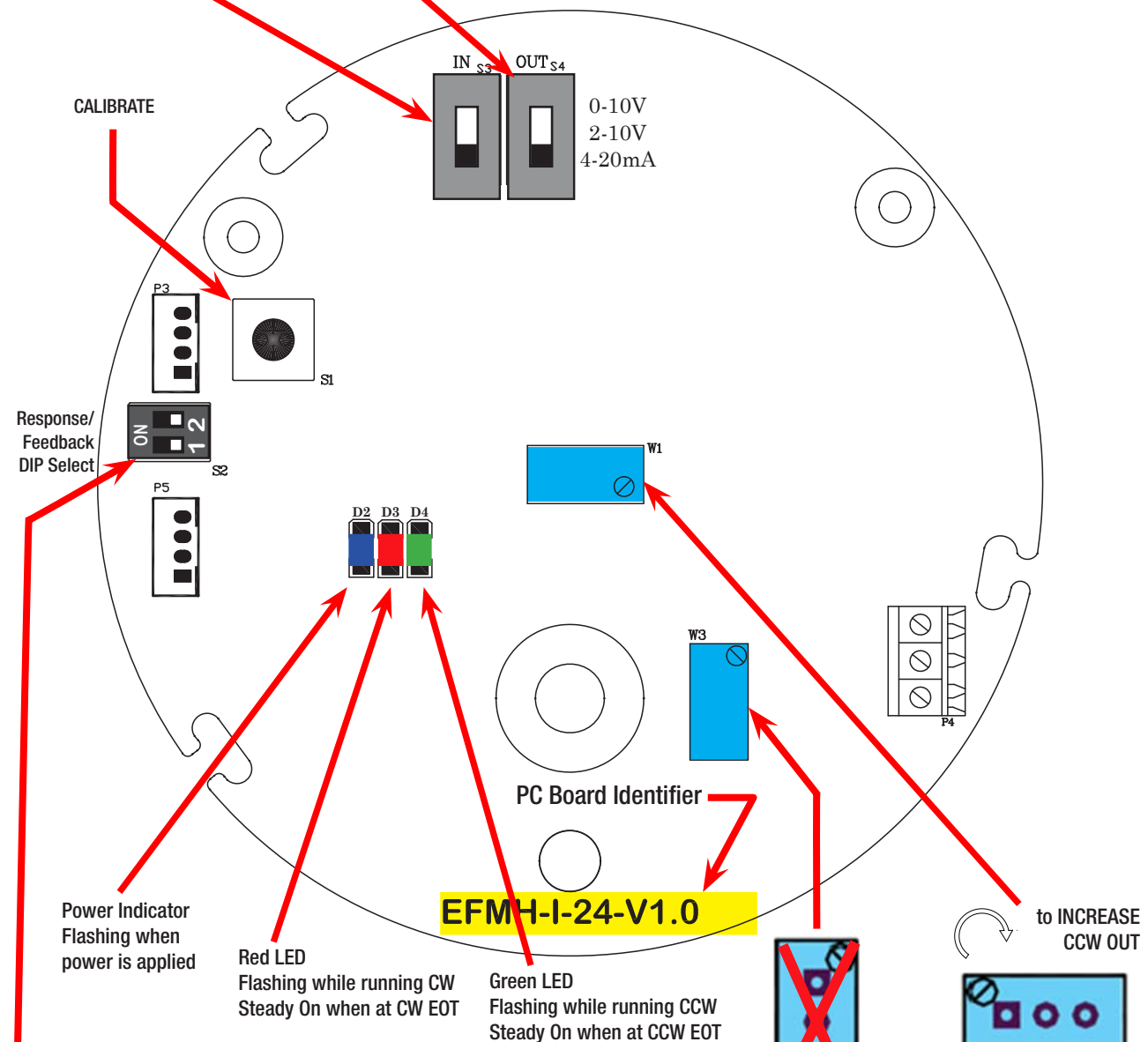
DEFAULT

Feedback OUT DIP Select

DIP	MODE
Top	0-10V
Mid	2-10V
Btm	4-20mA

Signal Input DIP Select

Feedback Out DIP Select



Response/Feedback DIP Select

DEFAULT

DIP	IN Signal	Out Feedback
1 = Off, 2 = Off	Direct	Direct
1 = On, 2 = On	Reverse	Reverse

⚠ WARNING – To avoid dangerous or fatal electrical shock, turn OFF power to all electrical equipment before working on electrical connections. If it is necessary to troubleshoot with live power to the actuator, please use **EXTREME CAUTION**, and follow your company's safety protocols and procedures at all times.

⚠ WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator.
For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

After completing all mounting and wiring procedures and main power is available, if the actuator does NOT respond as expected, the following procedure(s) may help in identifying the problem.

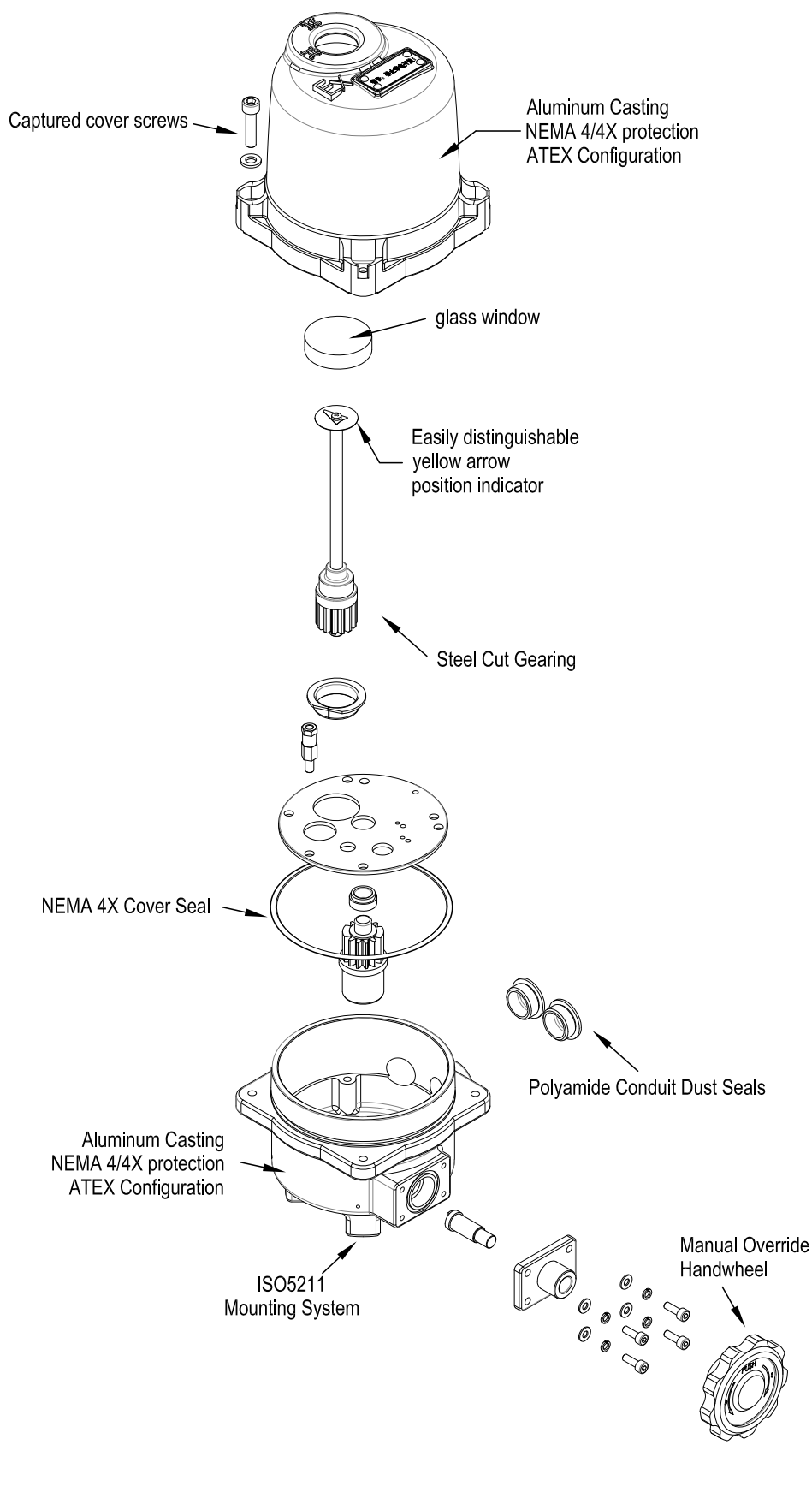
Symptom	Target	Action
Actuator does not move when commanded to do so.	Power Source	Measure incoming power AT the actuator terminal block. Reference the correct wiring diagram.
	Control Problem	Generate move commands by the field device. Measure correct voltage changes between HOT and terminal #6 (CCW) and HOT and terminal #4 (CW).
	Wire Sizing	Check for correct wire size per Wire Sizing Chart.
Supply and controls are measured to be correct, but actuator still does not move.	Overtorque	Remove the actuator from the driven device. If the actuator now moves, the torque required by the mechanical device exceeds that of the actuator. Increase actuator size.
		With the actuator removed from the mechanical equipment, manually rotate the valve or damper through its intended range of travel to check for mechanical problems.
	Insufficient power supply and/or incorrect wire size during installation.	Measure the voltage between terminals 1 & 2 WHILE commanding the actuator to move. The measured voltage cannot drop more than 10%.
Motor is extremely hot to the touch.	Cams improperly set.	REMOVE POWER. Check to see if cams rotate freely on the cam shaft using your finger. Cams MUST be secure and set according to the procedures in the Adjusting CW/CCW End of Travel section.
		Check for stray voltage fluctuations on the incoming control signals. The on/off line voltage actuators have a maximum 25% duty cycle. While the low voltage models have a 75% duty cycle.
	Control “noise” or excessive duty cycle	Check for parallel wiring of multiple on/off actuators. Review the site as-built wiring diagrams to verify.
Actuator does not stop at correct position at either end of travel	Actuator is out of quadrant	The manual override system has been employed to rotate the actuator beyond its intended angle of rotation. Use the manual override to rotate the actuator back into its correct quadrant of operation.
	Travel cams and/or mechanical stops not positioned correctly	Reset end-of-travel cams and/or mechanical stops as detailed in the Adjusting CW/CCW End of Travel section.

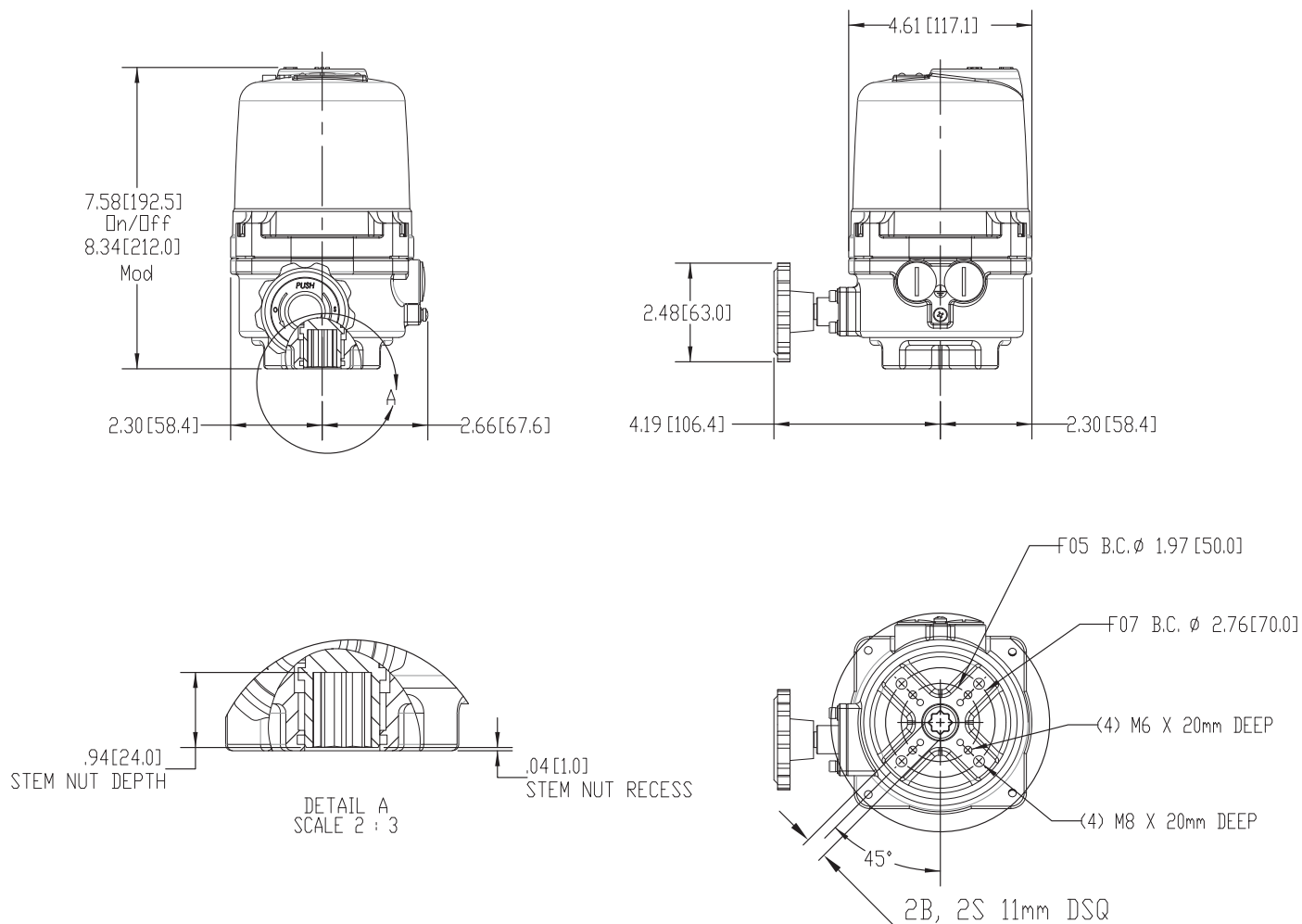
⚠ WARNING – To avoid dangerous or fatal electrical shock, turn OFF power to all electrical equipment before working on electrical connections. If it is necessary to troubleshoot with live power to the actuator, please use **EXTREME CAUTION**, and follow your company's safety protocols and procedures at all times.

⚠ WARNING – Risk of Explosion. When this product is operating in a hazardous environment **DO NOT** remove any actuator covers while power is on this actuator. For servicing, **DISCONNECT ALL POWER** (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

After completing all mounting and wiring procedures and main power is available, if the actuator does NOT respond as expected, the following procedure(s) may help in identifying the problem.

Symptom	Target	Action
Actuator does not move when commanded to do so.	Power Source	Measure incoming power AT the actuator terminal block. Reference the correct wiring diagram.
	Control Problem	Generate move commands by the field device. For most analog control systems, reversing the polarity will render the control system output as invalid. Check the polarity of the analog control signals as they are connected to the actuator. The actuator will NOT respond to inverted control signals.
	Wire Sizing	Check for correct wire size per Wire Sizing Chart.
Supply and controls are measured to be correct, but actuator still does not move.	Overtorque	Remove the actuator from the driven device. If the actuator now moves, the torque required by the mechanical device exceeds that of the actuator. Increase actuator size.
		With the actuator removed from the mechanical equipment, manually rotate the valve or damper through its intended range of travel to check for mechanical problems.
	Insufficient power supply and/or incorrect wire size during installation.	Measure the voltage between terminals 1 & 2 WHILE commanding the actuator to move. The measured voltage cannot drop more than 10%.
Motor is extremely hot to the touch.	Cams improperly set.	REMOVE POWER. Check to see if cams rotate freely on the cam shaft using your finger. Cams MUST be secure and set according to the procedures in the Adjusting CW/CCW End of Travel section.
	Control “noise” or excessive duty cycle	Check for stray voltage fluctuations on the incoming control signals. Analog control signals are susceptible to “noise” and send unstable control data to the actuator. This results in a never-ending motor drive scenario with the usual result being thermal overload of the drive motor. Check for parallel wiring of multiple on/off actuators. Review the site as-built wiring diagrams to verify.
Actuator does not stop at correct position at either end of travel	Actuator is out of quadrant	The manual override system has been employed to rotate the actuator beyond its intended angle of rotation. Use the manual override to rotate the actuator back into its correct quadrant of operation.
	Travel cams and/or mechanical stops not positioned correctly	Reset end-of-travel cams and/or mechanical stops as detailed in the Adjusting CW/CCW End of Travel section.



MECHANICAL DATA


COVER REMOVAL CLEARANCE		HANDWHEEL		WEIGHT
MODEL	TYPE	IN/MM	IN/MM # TURNS FOR 90°	LBS/KG
HXCSN2B	on/off - All	4.93 / 125	2.46 / 62.5	7.0 / 3.2
	Mod - HV		12 turns 90°	9.3 / 4.2
HXCSN2S	on/off - All	4.93 / 125	2.46 / 62.5	7.0 / 3.2
	Mod - HV		12 turns 90°	9.3 / 4.2



WIRE SIZING CHART

Wire sizing data is provided in the table below to assist in the selection of the proper wire size for HXCSN2 Series actuators using various wire sizes over distance. Be sure to reference the correct voltage and do not exceed the indicated length of the wire run for each model.

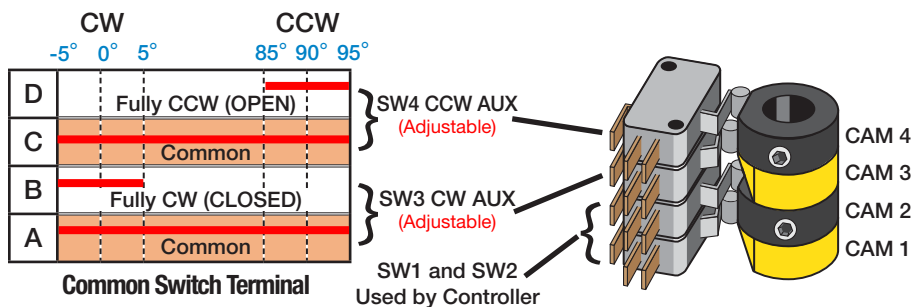
⚠ WARNING – To avoid dangerous or fatal electrical shock, turn OFF power to all electrical equipment before working on electrical connections. If it is necessary to troubleshoot with live power to the actuator, please use EXTREME CAUTION, and follow your company's safety protocols and procedures at all times.

⚠ WARNING – Risk of Explosion. When this product is operating in a hazardous environment DO NOT remove any actuator covers while power is on this actuator. For servicing, DISCONNECT ALL POWER (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

Maximum distance between Actuator and Power Supply (ft)

ACTUATOR	HXCSN2	HXCSN2	HXCSN2
Voltage	24VAC/VDC	120VAC	230VAC
AWG \ Amps	2.1	0.4	0.2
18	81	2136	8187
16	129	3396	13016
14	206	5401	20702
12	327	8587	32917
10	520	13650	52325
8	827	21714	83237

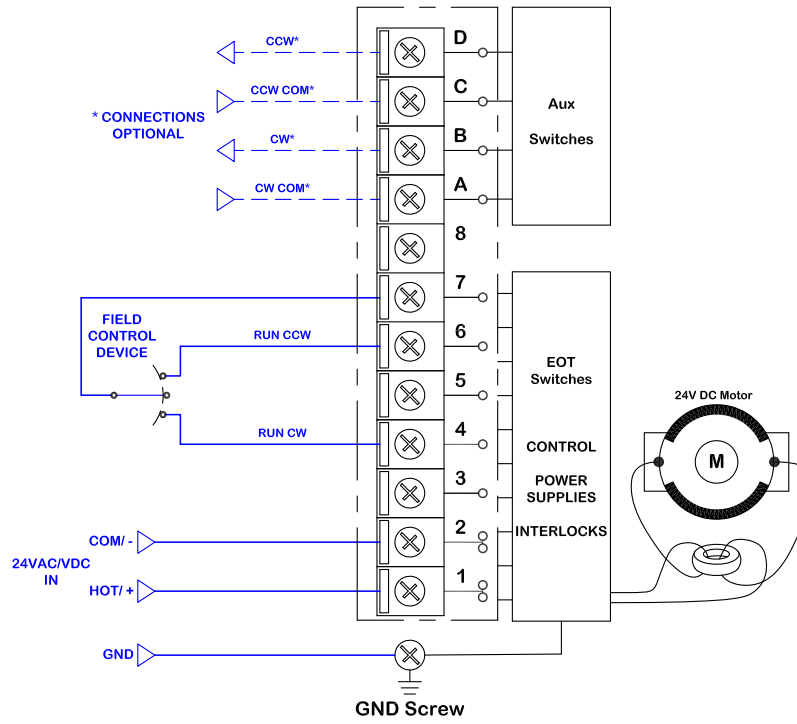
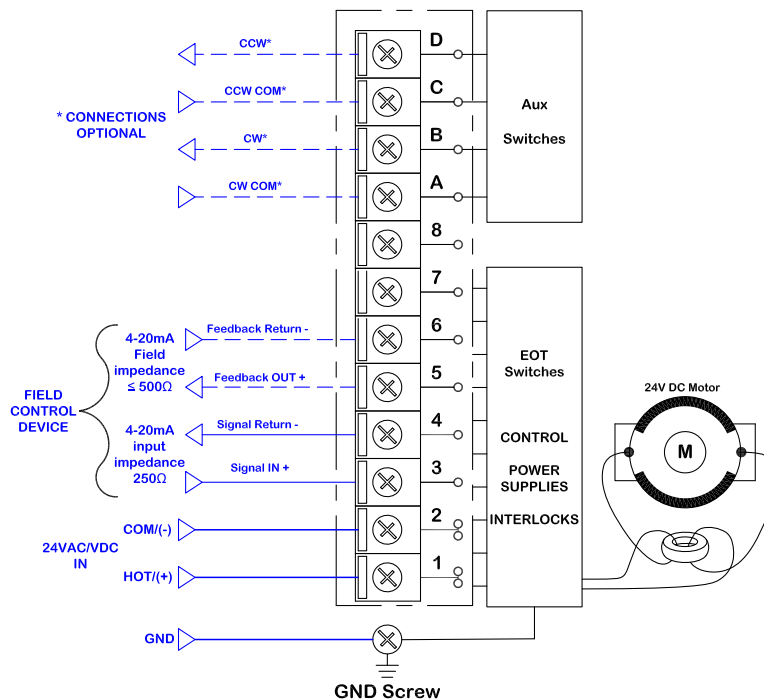
AUXILIARY SWITCH CAM MAPPING

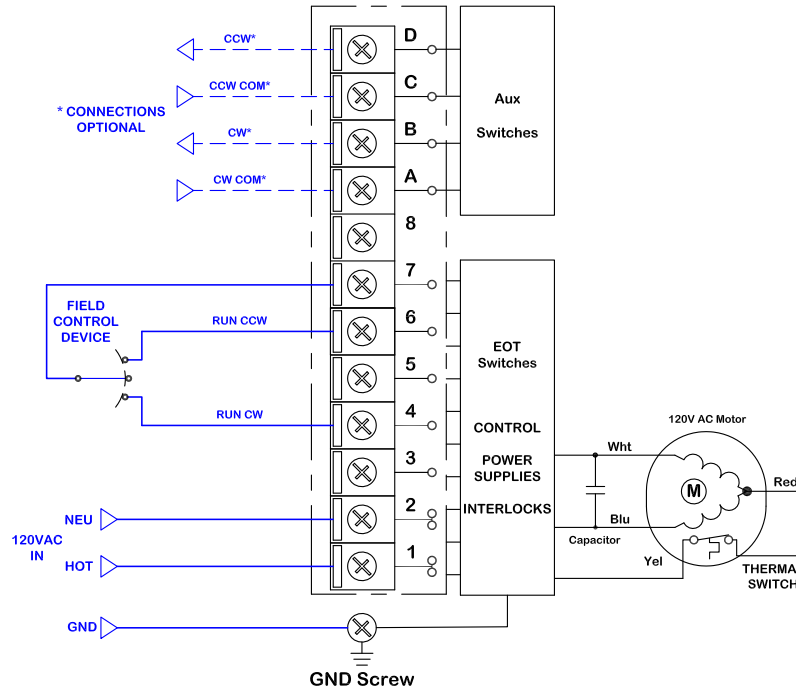
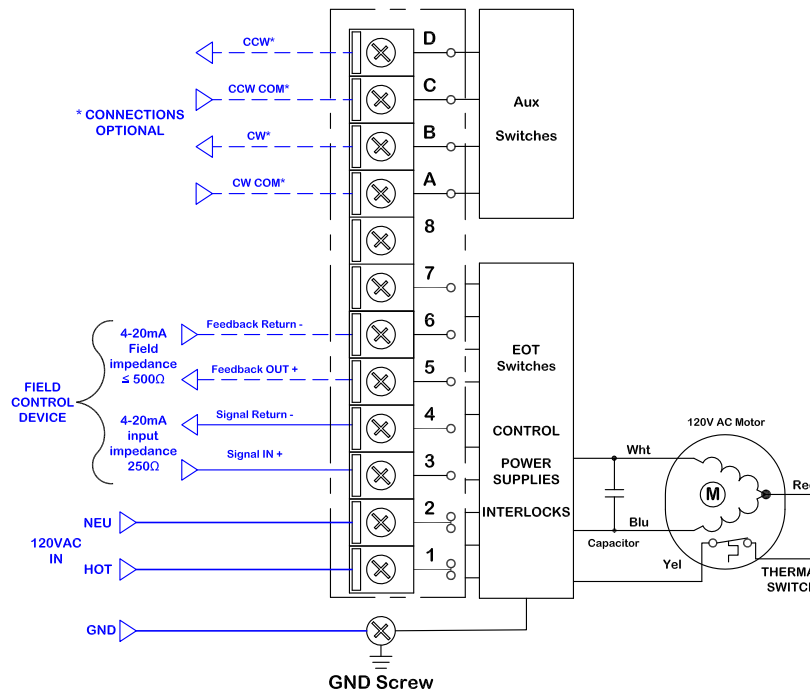


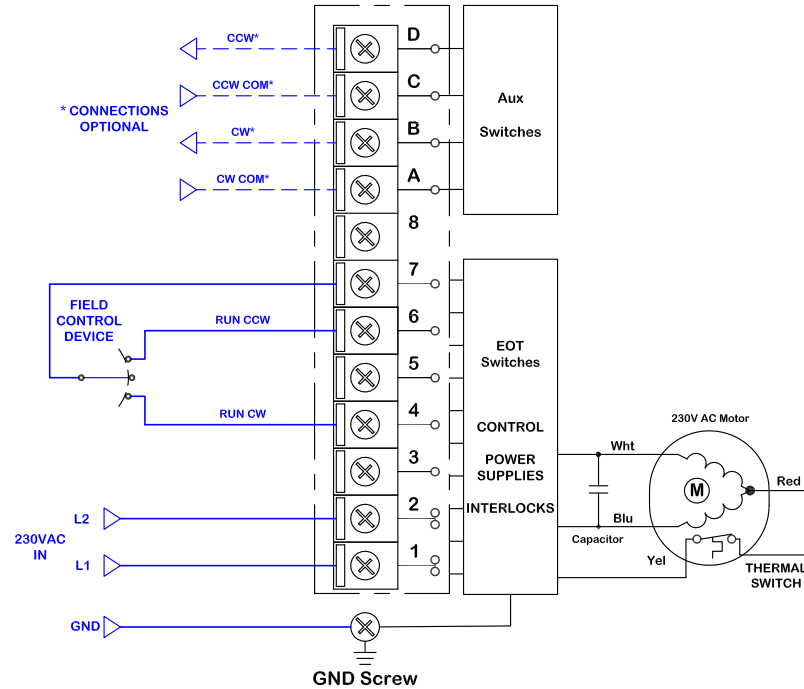
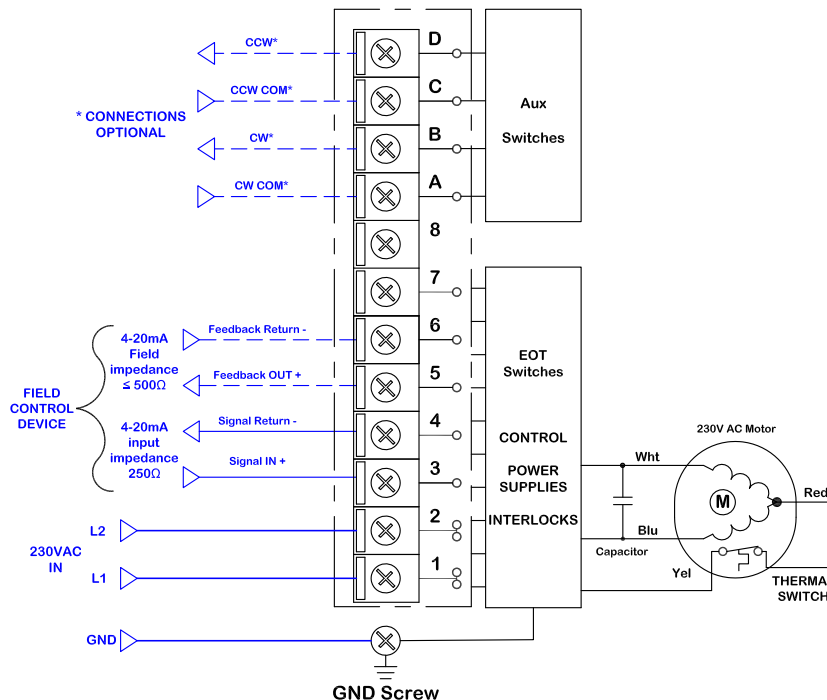
Auxiliary Switch Function

The illustration above describes how the rotation of the actuator drive shaft activates either auxiliary switch depending on the position, CW or CCW. The auxiliary switches allow a signal current to flow along different paths and ultimately allows the actuator position to be known by reading the electrical outputs of B or D. Reference the proper wiring diagram for your actuator as needed.



WIRING DIAGRAMS
HXCSN2B, 2S 24vac/vdc On/Off

HXCN2B, 2S 24vac/vdc Proportional


WIRING DIAGRAMS
HXCSN2B, 2S 120vac On/Off

HXCSN2B, 2S 120vac Proportional


WIRING DIAGRAMS
HXCSN2B, 2S 230vac On/Off

HXCSN2B, 2S 230vac Proportional


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