INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

HXBSN4 Series

Ex II 2 G Ex db IIB T4 Gb
Ex II 2 D Ex tb IIIC T85°C/T100°C/T135°C Db

Includes:
24VAC/VDC (LV)
120/230VAC (HV)
220/3~480/3 (3ph)

EU-Type Examination Certificate Number: **Presafe 19 ATEX 14746X** **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.

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.

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.***

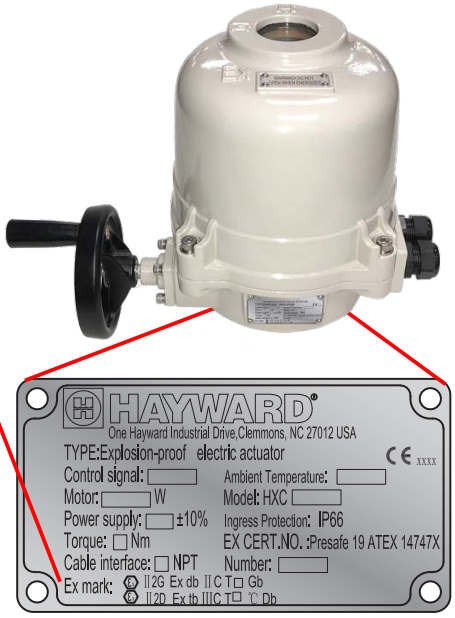
For servicing, DISCONNECT ALL POWER (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

IDENTIFYING HAZLOC PRODUCTS

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

- **II 2 G Ex db IIB T4 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		IIB
				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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Notice: HXBSN4 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 CW to fully 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 15-16 - Travel limits for CW (CLOSED) & CCW (OPEN) positions, HXBSN4 Series

Page 17 - Auxiliary switch cams for CW & CCW positions, HXBSN4 Series

3 Phase actuators require additional attention to detail and have two **Levels** of safety and control offered in the HXBSN 3 phase actuators.

Level 1 units, the most basic, have NO safeties, meaning the installer is fully responsible for connecting and immediately checking the motor rotation, and correcting if it is reversed, BEFORE damage can be done to the actuator, motor and connecting device.

Levels 3 units, have PHASE CORRECTION built-in. This means that these models will automatically correct phase discrepancies regardless of how the incoming power is landed on the main terminal strip.

It MUST be noted however, that installations with existing motor control centers may only be able to utilize level 1 actuators.

Contact Hayward Flow Control Technical Services for further information BEFORE placing orders if there is uncertainty of the Level of control required.

ACTUATOR OPERATIONAL CONCEPTS

Single phase actuators range in complexity from simple models with basic operability, to quite complicated models. The various models might seem to be easily adaptable across any site or design intent, but are actually very specific as to how they interface to existing or new installations.

3 phase actuators, while more efficient than single phase actuators, range in complexity from simple models with basic operability, to quite complicated models with full featured protection circuitry. The various levels of these actuators might seem to be easily adaptable across any site or design intent, but are actually very specific as to how they interface to existing or new installations.

It is important to FULLY UNDERSTAND what level of control is required prior to selecting one of these products. While it might make sense to opt for the most feature-laden solution in order to cover all the possibilities in a given application, that selection in fact would NOT function in an application that just required the most basic unit. For this reason, it is imperative to know the application completely BEFORE selecting a solution.

Notice: Read the project specifications and understand the application before making an actuator selection. If in doubt, consult with the project engineer to clarify what is actually required for a fully operational installation. We have provided in this document all the tools necessary to determine how the various levels interface to the outside world. If there are any questions, please contact Hayward Flow Control Technical Services.

CONVENTIONS USED IN THIS MANUAL

Below are Terms and Definitions used throughout this manual. Many are 3 Phase specific.

1. **TS** product manufactured with Torque Switches.
2. **XPC/PC** product manufactured without/with Phase Correction circuitry built-in.
3. **XREV/REV** product manufactured without/with Reversing Motor Starters built-in.
4. **XLCS** product manufactured without attached Local Control Station.
5. **MCC** is an industry definition for a Motor Control Center.
6. **CW** is Clockwise and **CCW** is Counterclockwise

Depending on the options required you can efficiently select the level of actuator and wiring diagram you require.

ACTUATOR OPTIONS

Control	Voltage	Torque Switches	Local Control Station	IOM	Wiring Diagram Page
On/Off	24VDC/VAC	TS	None	This IOM	38
Proportional	24VDC/VAC	TS	None	This IOM	38
On/Off	120VAC	TS	None	This IOM	39
Proportional	120VAC	TS	None	This IOM	39
On/Off	230VAC	TS	None	This IOM	40
Proportional	230VAC	TS	None	This IOM	40

3 PHASE ACTUATOR OPTIONS

Control	Torque Switches	Phase Correction	Motor Starter	Local Control	Level	Wiring Diagram Page
On/Off	TS	XPC	XREV	XLCS	L1	41
On/Off	TS	PC	REV	XLCS	L3	42
Proportional	TS	PC	REV	XLCS	L3	43

* There are no Level 2 Three Phase actuators.

TECHNICAL INFORMATION

	ACTUATOR SPECIFICATIONS		HXBSN4A	HXBSN4B	HXBSN4C	HXBSN4D
Supply	Torque Output (**in-lb** / Nm)		**3540 /** 400	**5310 /** 600	**7080 /** 800	**8850 /** 1000
24VAC - 24VDC	Current Draw (Start / Run / LRA)		7.0A / 5.8A / 15A	7.0A / 5.8A / 15A	7.0A / 5.8A / 15A	10.5A / 7.8A / 22A
	Speed (90°) DC-60Hz/50Hz, seconds		21 / 21	28 / 28	34 / 34	34 / 34
	Motor - 24V DC Perm Magnet 2 Pole Brush		40W	40W	40W	90W
	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)		3.0A / 1.8A / 3.5A	3.0A / 1.8A / 3.5A	3.0A / 1.8A / 3.5A	3.8A / 2.3A / 4.8A
	Speed (90°) 60Hz / 50Hz, seconds		24 / 29	33 / 39	39 / 47	39 / 47
	Motor - 120V Capacitor Run TENV		90W	90W	90W	120W
	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)		1.7A / 0.9A / 1.9A	1.7A / 0.9A / 1.9A	1.7A / 0.9A / 1.9A	2.2A / 1.1A / 2.4A
	Speed (90°) 60Hz / 50Hz, seconds		24 / 29	33 / 39	39 / 47	39 / 47
	Motor - 230V Capacitor Run TENV		90W	90W	90W	120W
	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			
220/3ph	Current Draw (Start / Run / LRA)		1.8A / 1.1A / 2.4A	1.8A / 1.1A / 2.4A	1.8A / 1.1A / 2.4A	2.8A / 1.1A / 2.1A
	Speed (90°) 60Hz / 50Hz, seconds		24 / 29	33 / 39	39 / 47	39 / 47
	Motor - 220v polyphase TENV		90W	90W	90W	120W
	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			
380/3ph	Current Draw (Start / Run / LRA)		1.1A / 0.6A / 1.4A	1.1A / 0.6A / 1.4A	1.1A / 0.6A / 1.4A	1.6A / 0.8A / 1.9A
	Speed (90°) 60Hz / 50Hz, seconds		24 / 29	33 / 39	39 / 47	39 / 47
	Motor - 380v polyphase TENV		90W	90W	90W	120W
	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			
480/3ph	Current Draw (Start / Run / LRA)		0.7A / 0.4A / 1.0A	0.7A / 0.4A / 1.0A	0.7A / 0.4A / 1.0A	0.9A / 0.5A / 1.1A
	Speed (90°) 60Hz / 50Hz, seconds		24 / 29	33 / 39	39 / 47	39 / 47
	Motor - 480v polyphase TENV		90W	90W	90W	120W
	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	Environmental Rating		NEMA 4/4X & IP66			
	Electrical Entry (2)		3/4" EMT, Polyamide threaded temporary blank plug			
	Control		On/Off, Proportional			
	Auxiliary Switch - End of Travel		(2) Form A Volt-Free, Rated 10A @ 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			

TECHNICAL INFORMATION

ACTUATOR SPECIFICATIONS			HXBSN4E	HXBSN4F
Supply	Torque Output (**in-lb** / Nm)		**15,040 /** 1700	**20,350 /** 2300
24VAC - 24VDC	Current Draw (Start / Run / LRA)		10.5A / 7.8A / 22A	-
	Speed (90°) DC-60Hz/50Hz, seconds		25 / 25	-
	Motor - 24V DC Perm Magnet 2 Pole Brush		90W	-
	On/Off / Proportional	Duty Cycle (IEC60034)	50% (S2-15 min) / **50% (S4-50%)**	-
		Motor Protection, Temp / Class	130°C / Class B	-
		Motor Starts, per hour, Max	600	-
120VAC	Current Draw (Start / Run / LRA)		7.2A / 4.5A / 9.4A	7.2A / 4.5A / 9.4A
	Speed (90°) 60Hz / 50Hz, seconds		28 / 34	39 / 47
	Motor - 120V Capacitor Run TENV		200W	200W
	On/Off - Ext Duty / Proportional	Duty Cycle (IEC60034)	50% (S2-30 min)	
		Motor Protection, Temp / Class	180°C / Class H	
		Motor Starts, per hour, Max	600	
230VAC	Current Draw (Start / Run / LRA)		4.1A / 2.2A / 4.5A	4.1A / 2.2A / 4.5A
	Speed (90°) 60Hz / 50Hz, seconds		28 / 34	39 / 47
	Motor - 230V Capacitor Run TENV		200W	200W
	On/Off - Ext Duty / Proportional	Duty Cycle (IEC60034)	50% (S2-30 min)	
		Motor Protection, Temp / Class	180°C / Class H	
		Motor Starts, per hour, Max	600	
220/3ph	Current Draw (Start / Run / LRA)		3.6A / 1.9A / 4.5A	3.6A / 1.9A / 4.5A
	Speed (90°) 60Hz / 50Hz, seconds		28 / 34	39 / 47
	Motor - 220v polyphase TENV		200W	200W
	On/Off - Ext Duty / Proportional	Duty Cycle (IEC60034)	50% (S2-30 min)	
		Motor Protection, Temp / Class	180°C / Class H	
		Motor Starts, per hour, Max	600	
380/3ph	Current Draw (Start / Run / LRA)		0.4A / 0.3A / 0.6A	0.4A / 0.3A / 0.6A
	Speed (90°) 60Hz / 50Hz, seconds		28 / 34	39 / 47
	Motor - 380v polyphase TENV		200W	200W
	On/Off - Ext Duty / Proportional	Duty Cycle (IEC60034)	50% (S2-30 min)	
		Motor Protection, Temp / Class	180°C / Class H	
		Motor Starts, per hour, Max	600	
480/3ph	Current Draw (Start / Run / LRA)		0.2A / 0.2A / 0.4A	0.2A / 0.2A / 0.4A
	Speed (90°) 60Hz / 50Hz, seconds		28 / 34	39 / 47
	Motor - 480v polyphase TENV		200W	200W
	On/Off - Ext Duty / Proportional	Duty Cycle (IEC60034)	50% (S2-30 min)	
		Motor Protection, Temp / Class	180°C / Class H	
		Motor Starts, per hour, Max	600	
All	Environmental Rating		NEMA 4/4X & IP66	
	Electrical Entry (2)		3/4" EMT, Polyamide threaded temporary blank plug	
	Control		On/Off, Proportional	
	Auxiliary Switch - End of Travel		(2) Form A Volt-Free, Rated 10A @ 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	

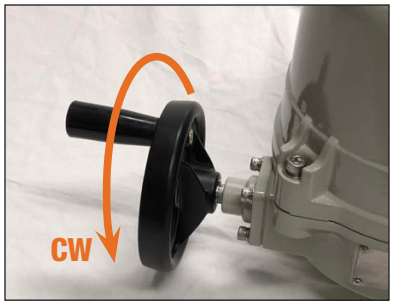
***WARNING* – Risk of Explosion.** *When this product is operating in a hazardous environment DO NOT remove any actuator covers while power is on this actuator.*

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

1. 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.
2. 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.
3. 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.
4. **Notice:** The HXBSN4 Series actuators have mechanical stops which limit rotation. Do not attempt to operate with a rotation greater than 95°.
5. **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 with or without power. Turning the handwheel CW makes the output drive move CW (when viewed from above). CCW is the reverse.

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).
- Mechanical travel stops are factory calibrated for 90 degree operation. These stops are NOT designed to adjust mechanical rotation by more than +/- 3 degrees, they are for positioning the handwheel only.
- Use the internal heater 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 12-18AWG 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 HXBSN4 Series actuators rotate CW to close the output shaft out the bottom of the actuator **when viewed from above.** On these models, the cam shaft and the indicator rotate CW to close as well.

1. Fully CLOSE the valve or damper to which the actuator is to be mounted.
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. HXBSN4 Series actuators utilize a removable terminal block to simplify field wiring and testing. *See page 41 for 3 Phase terminal block information.*
   - 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 RIGHT side of either terminal block (between the PCB mounting screws) is pulled out to the RIGHT.
   - 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.**

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.

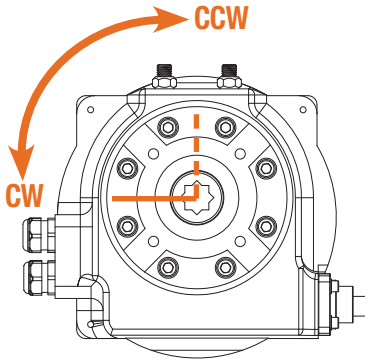
For servicing, DISCONNECT ALL POWER (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

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.

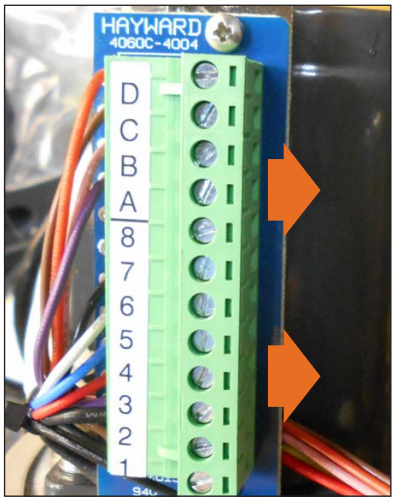
CAUTION – Be sure to make field connections to the proper terminal as identified by the LABEL and not the position!

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 (volt free) Form A contacts rated 250VAC @ 10A Max.
11. These actuators are equipped with torque switches which protect the actuator motor and gear train. Torque switches protect controlled valves or actuators from damage in the event of a high torque condition. More information can be found throughout this manual.

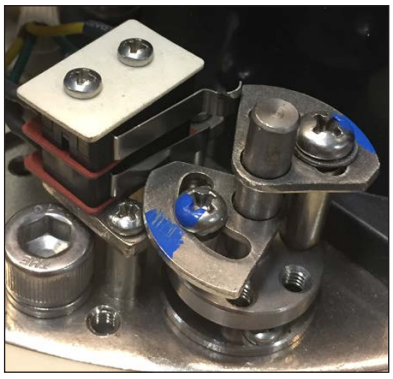
Notice: Torque switches are factory set and are not adjustable.



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



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.



Torque Switch (TS) equipped products have a secondary set of cams/ switches to protect the actuator, equipment and processes.

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.*

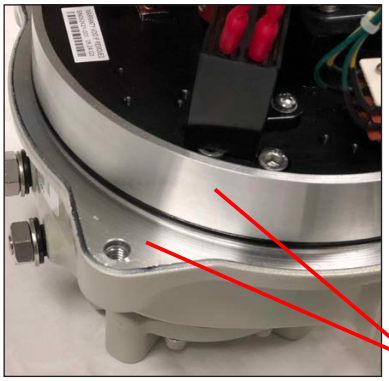
For servicing, DISCONNECT ALL POWER (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

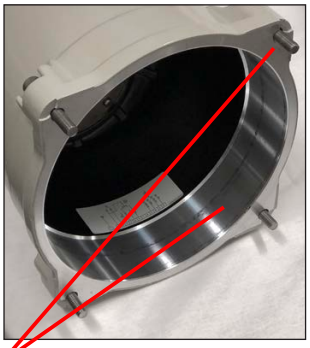
SURFACE HANDLING CONCERNS

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 –
Torque switches are factory set and are NOT ADJUSTABLE. Changing these settings will void the actuator 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!

Torque Switch Operation

HXBSN4 units have torque switches to protect the actuator and any attached equipment from possible damage which can occur in a high torque event. In such an event the valve or damper being driven encounters some blockage or impediment to travel. In the case of an actuator without torque switches, the actuator will attempt to drive until it either reaches the end of travel or (likely) the motor overworks and trips on a thermal overload. Units with torque switches will cease supplying power to the motor when a high torque event occurs.

Upper torque switch and cam for actuator drive CW rotation

Lower torque switch and cam for actuator drive CCW rotation

Torque Switch cams and switches are shown in the normal operating position.

Upper cam has rotated counter clockwise from its neutral position and has engaged the switch.

Torque Switch cams shown with the upper cam tripping the upper switch (Actuator was driving CW before this trip)

Lower cam has rotated clockwise from its neutral position (above) and has engaged the switch.

Torque Switch cams shown with the lower cam tripping the lower switch (Actuator was driving CCW before this trip)

Torque Switch (Normal Mode)

1. In normal operating mode, the torque switch and drive cam are in the neutral position shown in the photo.
2. Internal gearing in line with the output drive provide the rotational action for the cams.
3. Upper torque switch protects CW rotation.
4. Lower torque switch protects CCW rotation.

Torque Event (CW)

1. The photo at left shows a high torque event in the CW direction
2. The torque switch CW drive cam (upper) and switch are in the tripped position.
3. When the torque switch trips, it immediately cuts off power flow to the motor for that direction of travel.

Torque Event (CCW)

1. The photo at left shows a high torque event in the CCW direction
2. The torque switch CCW drive cam (lower) and switch are in the tripped position.
3. When the torque switch trips, it immediately cuts off power flow to the motor for that direction of travel.

3 PHASE THEORY OF OPERATION

Hayward offers several types of three phase actuators that are designed to fit applications ranging from basic controls to fully optioned solutions. These various strategies form the levels described below which allow product to fit functionally and economically into most three phase applications.

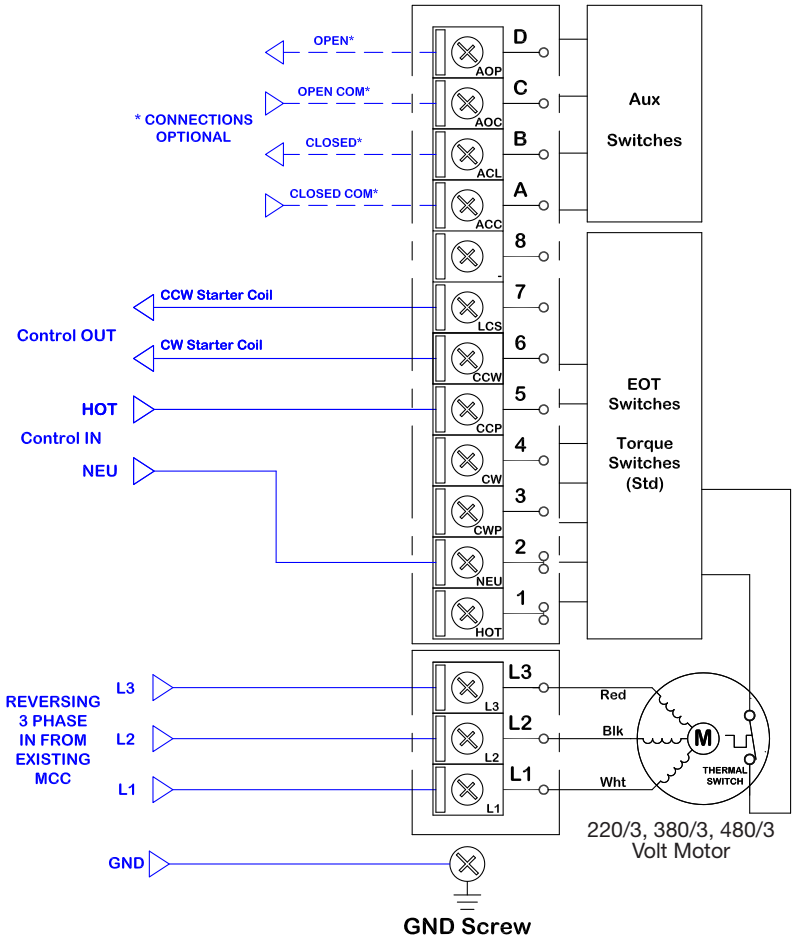
Background: Three phase motors, regardless of size or horsepower, MUST have a reversing starter / contactor in order to run in both directions as a result of some process control requirement. On single phase motors, they normally start and run in a fixed direction. Reversing the STARTING winding causes the motor to run in the opposite direction. In three phase motors, the direction of rotation is reversed by switching any two of the three phase lines into the motor. This is accomplished most commonly by utilizing a reversing motor starter. The reversing starter can be located inside the actuator, or in a completely separate enclosure remote from the actuator (e.g. switchgear "cabinet"), depending on site requirements and the actuator series chosen.

BASIC - ON/OFF ONLY

Starting with the most basic design are the Level 1 Series Actuators. These models are designed to be used in existing 3 phase installations where motor control centers are already established. A site-furnished control power circuit is required for this series.

Inside the actuator, there is:

1. No **Reversing Motor Starter**. This actuator will run in ONE direction only if the motor leads are not connected to a reversing starter. The required reversing motor starter must already be located in an existing switch gear cabinet.
2. No **Phase Monitor Circuitry**. If phasing is incorrect at the actuator, it will run in the wrong direction at start up. If phasing is incorrect, limit switches and torque switches are not necessarily in the correct circuit to protect the geartrain or actuator from damage. It should also be noted that a 3 phase service in a building may be perfectly functional and phased correctly for many years, and then a transformer goes out, the power company comes in to replace it, and it gets connected out of phase. The building still has power, but all three phase motors now run in the opposite direction. Proper phasing MUST be verified immediately at initial startup. Improper phasing may immediately damage the actuator. **Always perform start-up with actuator in MID stroke position, and have eyes on the actuator rotation at power-up.**
3. No **Local Control Device**. There is no way to operate the actuator locally. It can ONLY be operated by the existing Motor Control Center (MCC) and controls already on site. Without some type of MCC, there will be no way to drive the actuator in either direction.



* HXBSN4A~4F units with voltage codes M~T are all included in this group.

These Basic, Level 1 actuators require external controls for proper operation.

Torque switches are standard on these models.

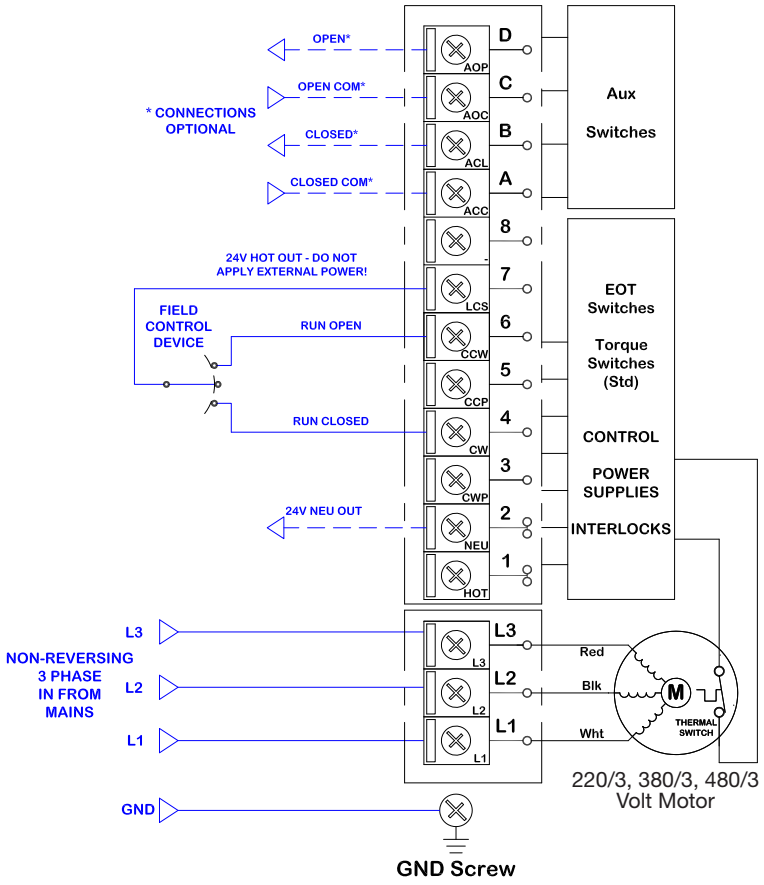
3 PHASE THEORY OF OPERATION

NON-LCS - ON/OFF

These models are designed to be used where there are NO existing Motor Control Centers (MCC). Typically these are used in new facilities or where additions to existing switch gear has limited available space or is otherwise just not feasible. The actuator generates a 24V control voltage to be utilized by the field control device, which switches that voltage between CW & CCW commands back to the actuator terminal block.

Inside the actuator, you will find:

1. **A Reversing Motor Starter**. This actuator is commanded to run CW (0°) or CCW (90°) as a function of received control signals. The required reversing motor starter is located inside the actuator.
2. **Phase Correction Circuitry**. If phasing is incorrect at the actuator, the protective circuitry will automatically reverse two of the three legs to allow the motor to drive in the correct direction. With this built-in protection device, improper phasing is non-existent. The installer need not worry about proper phasing being brought to the actuator nor possible phase reversal in the future. It is auto-correcting.
3. **No Local Control Device**. There is no way to operate the actuator locally. It can ONLY be operated by utilizing an external PLC, BAS or other automation controller. These units will require volt-free contacts (dry contacts) in one of the above mentioned devices which will switch the actuator's INTERNAL 24VAC power supply to generate commands to drive CW or CCW. Without some type of automation interface, there will be no way to command the actuator to move in either direction.



* HXBSN4A~4F units with voltage codes M~T are all included in this group.

These Level 3 actuators require an external control signal to drive in either direction.

These units have an integral reversing motor starter, phase monitoring and safety circuits and are equipped with torque switches as standard.

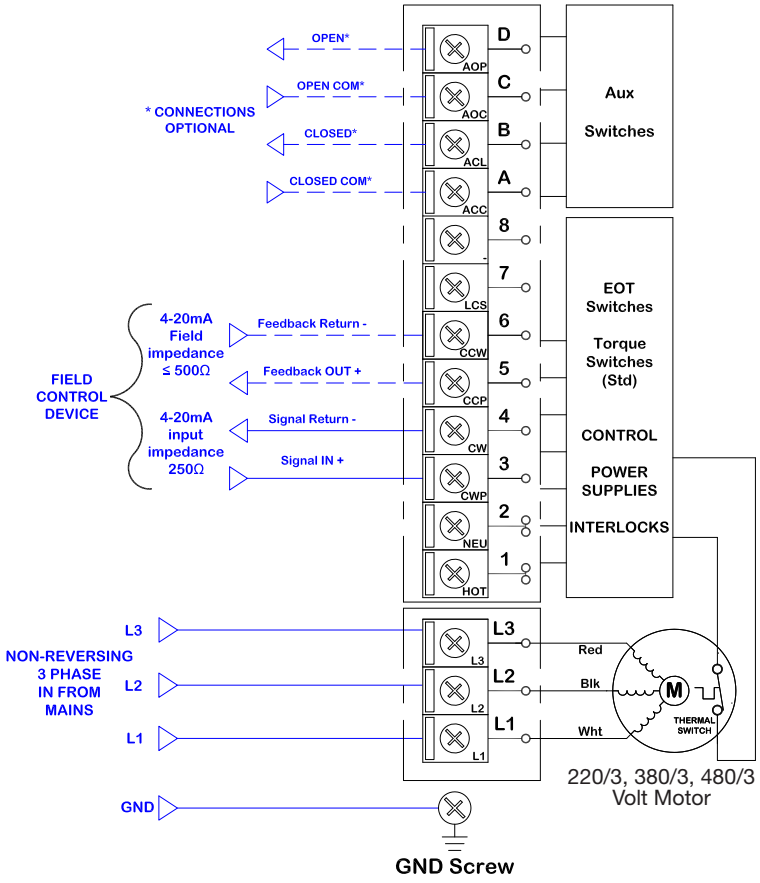
3 PHASE THEORY OF OPERATION

NON-LCS - PROPORTIONAL

These models are designed to be used where there are NO existing Motor Control Centers (MCC). Typically these are used in new facilities or where additions to existing switch gear has limited available space or is otherwise just not feasible. These units accept analog control signals (4-20mA or 2-10VDC) and process these incoming signals to position the actuator as a function of the incoming signal. Additionally, these units generate an analog feedback signal proportional to the position of the actuator and not directly related to the incoming signal. This feedback signal is designed to be used by automation devices or displays external to the actuator.

Inside the actuator, you will find:

1. **A Reversing Motor Starter**. This actuator is commanded to run CW (0°) or CCW (90°) as a function of received control signal compared to the actuator position. The required reversing motor starter is located inside the actuator.
2. **Phase Correction Circuitry**. If phasing is incorrect at the actuator, the protective circuitry will automatically reverse two of the three legs to allow the motor to drive in the correct direction. With this built-in protection device, improper phasing is non-existent. The installer need not worry about proper phasing being brought to the actuator nor possible phase reversal in the future. It is auto-correcting.
3. **No Local Control Device**. There is no way to operate the actuator locally. It can ONLY be operated by utilizing an external PLC, BAS or other automation controller generating 4-20mA or 2-10VDC analog signals to position the actuator between 0 and 90 degrees. Without some type of automation interface, there will be no way to command the actuator to move in either direction.
4. **Proportional Controller**. This analog processing Printed Circuit Board (PCB) accepts 4-20mA or 2-10VDC from the field and positions the actuator accordingly, utilizing the reversing motor starter.



* HXBSN4A~4F units with voltage codes M~T are all included in this group.

These Level 3 actuators require an external control signal to drive in either direction.

These units have an integral reversing motor starter, phase monitoring and safety circuits and are equipped with torque switches as standard.

ADJUSTING CW END OF TRAVEL

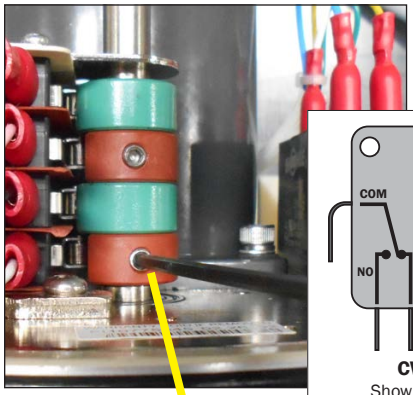
This actuator has been factory calibrated and tested to stop at 0 degrees for CW position and to stop at 90 degrees for CCW position. Most installations onto valves or dampers will likely not require changes to these settings.

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

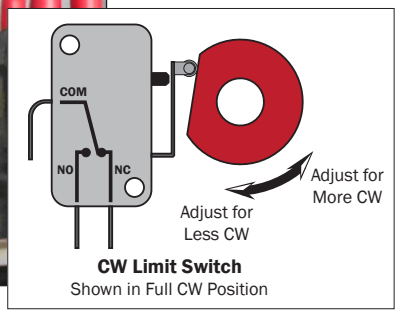
***WARNING* – Risk of Explosion.** *When this product is operating in a hazardous environment DO NOT remove any actuator covers while power is on this actuator.*

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!

CW Mechanical Stop



Cam 1 - CW Cam



CW Limit Switch
Shown in Full CW Position

CW Mechanical Stop

Reposition Mechanical Stop

Actuator mech. stop tools	Wrench	Hex Key
4A~4D	17mm	5mm
4E~4F	22mm	6mm

1. **Disconnect power.**
2. Loosen the RIGHT SIDE mechanical stop. This is the CW mechanical stop limit adjustment. Using a wrench and hex key, hold the jam nut and turn the stop screw 5-6 turns CCW so it clears the mechanical boss inside the actuator.
   - This will allow you to adjust the cam/switch stop position without running into the mechanical stop screw.
3. Use the manual override handwheel to position the actuator to your required CW position. Keep all changes within +/- 3 degrees of the factory setting.

Adjust CW Cam (Bottom)

4. Cam 1 is the bottom cam (red) 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 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. The click means correct adjustment has been achieved.
   - Tighten the cam set screw.
5. **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.Repeat the steps of item 4 if further adjustment is needed.

Tighten Mechanical Stop

1. With the actuator in the proper position. Hold the wrench on the RIGHT SIDE jam nut to prevent the jam nut from locking and turn the hex key CW until the end of the stop screw bottoms out against the internal stop boss.
2. Turn the hex key ONE FULL TURN CCW and lock this position with the jam nut. Now the actuator will reach its end of travel electrically before there is any interference from the mechanical stop.
3. CW position calibration is now complete.

CAUTION!* - *The mechanical stop screw limits handwheel operation ONLY and is NOT to be used as an electrical travel limiting device.

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 CCW END OF TRAVEL

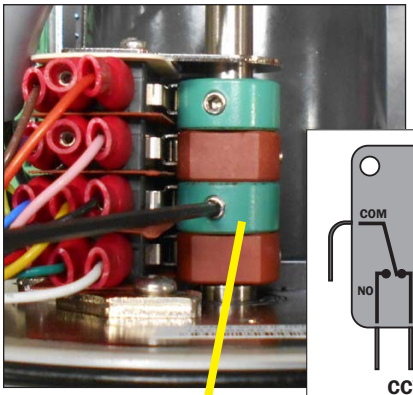
This actuator has been factory calibrated and tested to stop at 0 degrees for CW position and to stop at 90 degrees for CCW position. Most installations onto valves or dampers will likely not require changes to these settings.

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

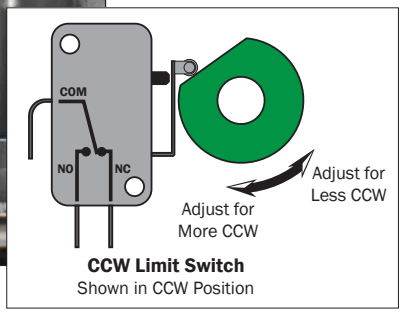
***WARNING* – Risk of Explosion.** *When this product is operating in a hazardous environment DO NOT remove any actuator covers while power is on this actuator.*

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!

CCW Mechanical Stop



Cam 2 - CCW Cam



CCW Limit Switch
Shown in CCW Position

CCW Mechanical Stop

Actuator mech. stop tools	Wrench	Hex Key
4A~4D	17mm	5mm
4E~4F	22mm	6mm

Reposition Mechanical Stop

1. **Disconnect power.**
2. Loosen the LEFT SIDE mechanical stop. This is the CCW mechanical stop limit adjustment. Using a wrench and hex key, hold the jam nut and turn the stop screw 5-6 turns CCW so it clears the mechanical boss inside the actuator.
   - This will allow you to adjust the cam/switch stop position without running into the mechanical stop screw.
3. Use the manual override handwheel to position the actuator to your required CCW position. Keep all changes within +/- 3 degrees of the factory setting.

Adjust CCW Cam (Second from Bottom)

4. Cam 2 is the second cam up from the bottom (green) 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 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.
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.Repeat the steps of item 4 if further adjustment is needed.

Tighten Mechanical Stop

1. With the actuator in the proper position, hold the wrench on the LEFT SIDE jam nut to prevent the jam nut from locking and turn the hex key CW until the end of the stop screw bottoms out against the internal stop boss.
2. Turn the hex key ONE FULL TURN CCW and lock this position with the jam nut. Now the actuator will reach its end of travel electrically before there is any interference from the mechanical stop.
3. CCW position calibration is now complete.

***CAUTION!* - The mechanical stop screw limits handwheel operation ONLY and is NOT to be used as an electrical travel limiting device.**

***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.**

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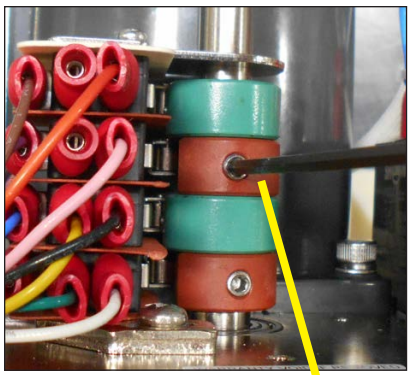
ADJUSTING AUXILIARY SWITCHES

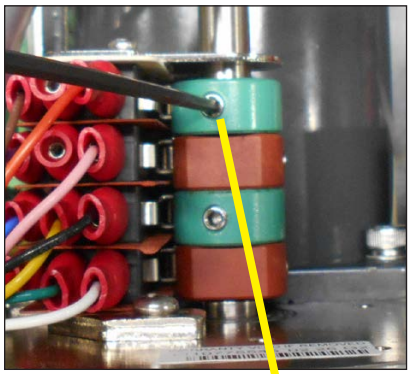
This actuator has been factory calibrated and tested to stop at 0 degrees for CW position and to stop at 90 degrees for CCW position. The Auxiliary Switch settings are based on those stops. Ideally the Auxiliary Switches are set a few degrees in advance of the respective stop switches.

***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



Cam 4 - CCW Auxiliary Cam

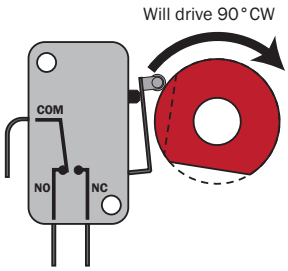
Adjust CW Auxiliary Cam

1. Cam 3 is the third cam up from the bottom (red) 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 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.

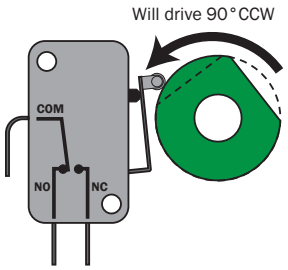
Adjust CCW Auxiliary Cam

1. Cam 4 is the fourth cam up from the bottom (green) 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 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.

CAM BEHAVIOR

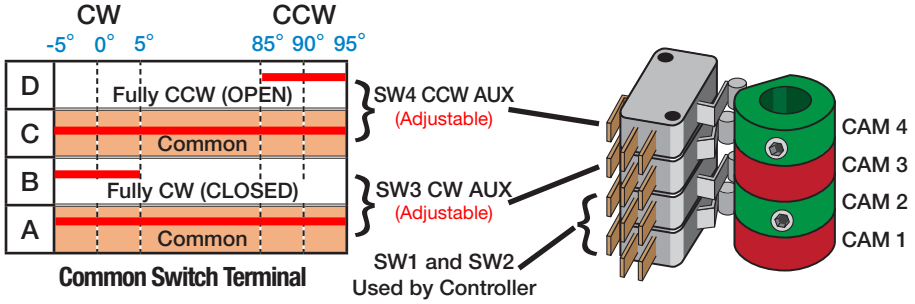


CW Limit Switch
Shown in CCW Position



CCW Limit Switch
Shown in Full CW Position

AUXILIARY SWITCH CAM MAPPING



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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 15~17 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 (CCW) travel position.

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 - On/Off Control

After the actuator and valve (damper) assembly have been installed with power and control connected, BEFORE applying power, **use the handwheel 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.
   - A. If it is NOT, there is a problem with the field logic or wiring, troubleshoot accordingly.
   - B. During CW travel movement, depress the lever on the UPPER torque switch to interrupt actuator movement as a check of the system.
   - C. 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. During CCW travel movement, depress the lever on the LOWER torque switch to interrupt actuator movement as a check of the system.
   - C. 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. **If the actuator stops at the correct positions, the actuator can be put into service and is fully 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 15~17 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 (CCW) travel position.

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 - Level 1 actuators - On/Off Control

1. After the actuator and valve (damper) assembly have been installed with power and control connected, BEFORE applying power, **use the handwheel to rotate the actuator to a mid-travel position.**
2. Be sure there are NO movement commands active, and apply 3 phase power to the external MCC.
   A. The actuator should NOT move.
      I. If it does move, **IMMEDIATELY remove 3 phase power from the external MCC to STOP movement.**
      II. Check control wiring to terminals 1~8 on the actuator. Correct if necessary and repeat step 2.
3. **Generate a CW move command** and verify that the DIRECTION of the position indicator is CW.
   A. If it is, proceed to step 3F.
   B. If it is NOT, **IMMEDIATELY remove 3 phase power from the external MCC to STOP movement.**
   C. Check and correct external MCC control wiring if necessary.
   D. With 3 phase power removed, reverse any two of the three connections to terminals L1, L2, or L3 AT THE ACTUATOR.
   E. Reapply 3 phase power and repeat step 3.
   F. During CW travel movement, depress the lever on the UPPER torque switch to interrupt actuator movement as a check of the system.
4. **Generate a CCW move command** and verify the DIRECTION of the position indicator is CCW.
   A. If it is NOT, **IMMEDIATELY remove 3 phase power from the actuator to STOP movement.**
   B. Check and correct external MCC control wiring if necessary.
   C. During CCW travel movement, depress the lever on the LOWER torque switch to interrupt actuator movement as a check of the system.
5. **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.
6. **If the actuator stops at the correct positions, the actuator can be put into service and is fully 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 15~17 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 (CCW) travel position.

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 - Non-LCS actuators - On/Off Control

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

1. Be sure there are NO movement commands active, and apply 3 phase power.
   - A. The actuator should NOT move.
     - I. If it does move, **IMMEDIATELY remove 3 phase 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 3 phase power. The actuator will move CW.
   - C. After confirmation, remove the jumper between terminals 4 & 7, and place a jumper between terminals 6 & 7.
   - D. The actuator will move CCW.
   - E. After confirmation, 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.
   - A. If it is NOT, there is a problem with the field logic or wiring, troubleshoot accordingly.
   - B. During CW travel movement, depress the lever on the UPPER torque switch to interrupt actuator movement as a check of the system.
   - C. 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. During CCW travel movement, depress the lever on the LOWER torque switch to interrupt actuator movement as a check of the system.
   - C. 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. **If the actuator stops at the correct positions, the actuator can be put into service and is fully 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 15~17 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 (CCW) travel position.

***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!

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

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.

Commissioning - Proportional Control (Default analog response is 4-20mA)

***WARNING* – LETHAL voltages may be present inside this actuator.**

1. After the actuator and valve (damper) assembly have been installed with power and control connected, BEFORE applying power, **use the handwheel 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. 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(-)).
   - C. During CW travel movement, depress the lever on the UPPER torque switch to interrupt actuator movement as a check of the system.

***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

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.
   B. 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.
   C. During CCW travel movement, depress the lever on the LOWER torque switch to interrupt actuator movement as a check of the system.

> *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. **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.**

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 15~17 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 (CCW) travel position.

***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!

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

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.

Commissioning - Non-LCS actuators - Proportional Control

1. After the actuator and valve (damper) assembly have been installed with power and control connected, BEFORE applying power, **use the handwheel 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 3 phase power.

   WARNING* – *LETHAL voltages may be present inside this actuator.

   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 3 phase power from the actuator to STOP movement.**
         a. Place a meter in series with terminal 3 (sig-in) and the wire coming from the field controller (+), 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. 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).
   C. During CW travel movement, depress the lever on the UPPER torque switch to interrupt actuator movement as a check of the system.

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

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.
   B. 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.
   C. During CCW travel movement, depress the lever on the LOWER torque switch to interrupt actuator movement as a check of the system.

> *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. **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.
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.**

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.*

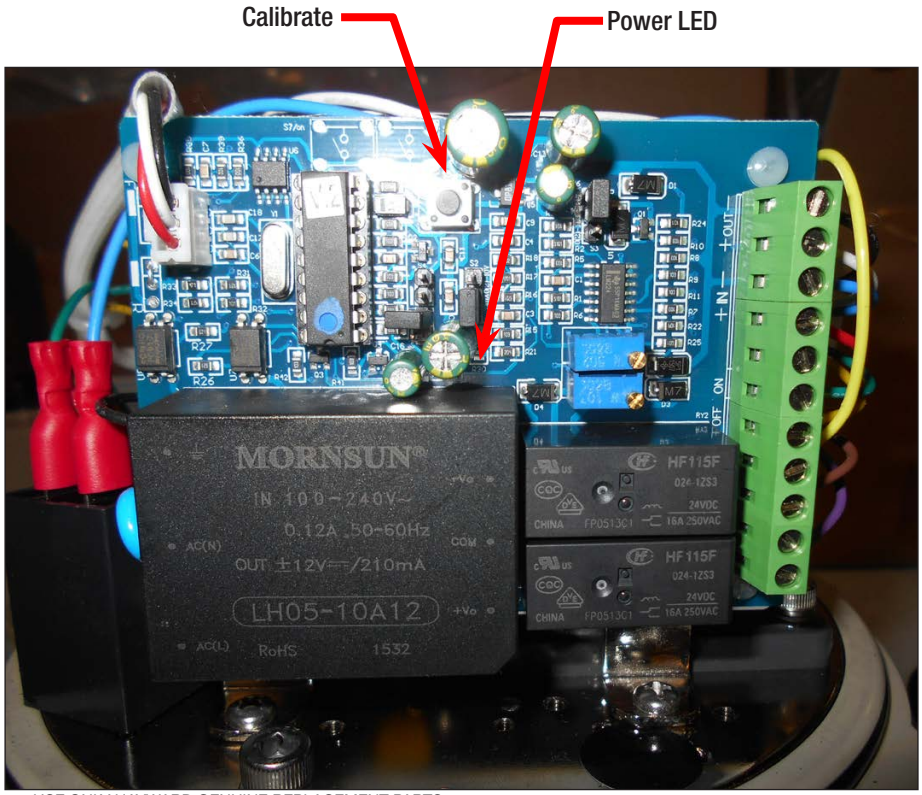
For servicing, DISCONNECT ALL POWER (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

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 PWR LED will turn on.
4. **Press the "Calibrate" black 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. 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.
5. Slight adjustments may be made to the 4mA and 20mA trimmers (see page 25) to affect accuracy on the feedback signal as a function of actuator position.
6. Unit is now calibrated and is ready to be put into service. No other calibration is necessary.
7. Note that upon loss of SIGNAL, the actuator response will be to go to the fully CW position until the SIGNAL is restored.

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



CALIBRATION - CONTINUED

Input Select (Jumpers)

4-20mA | 2-10vdc

DEFAULT

Feedback Select (Jumpers)

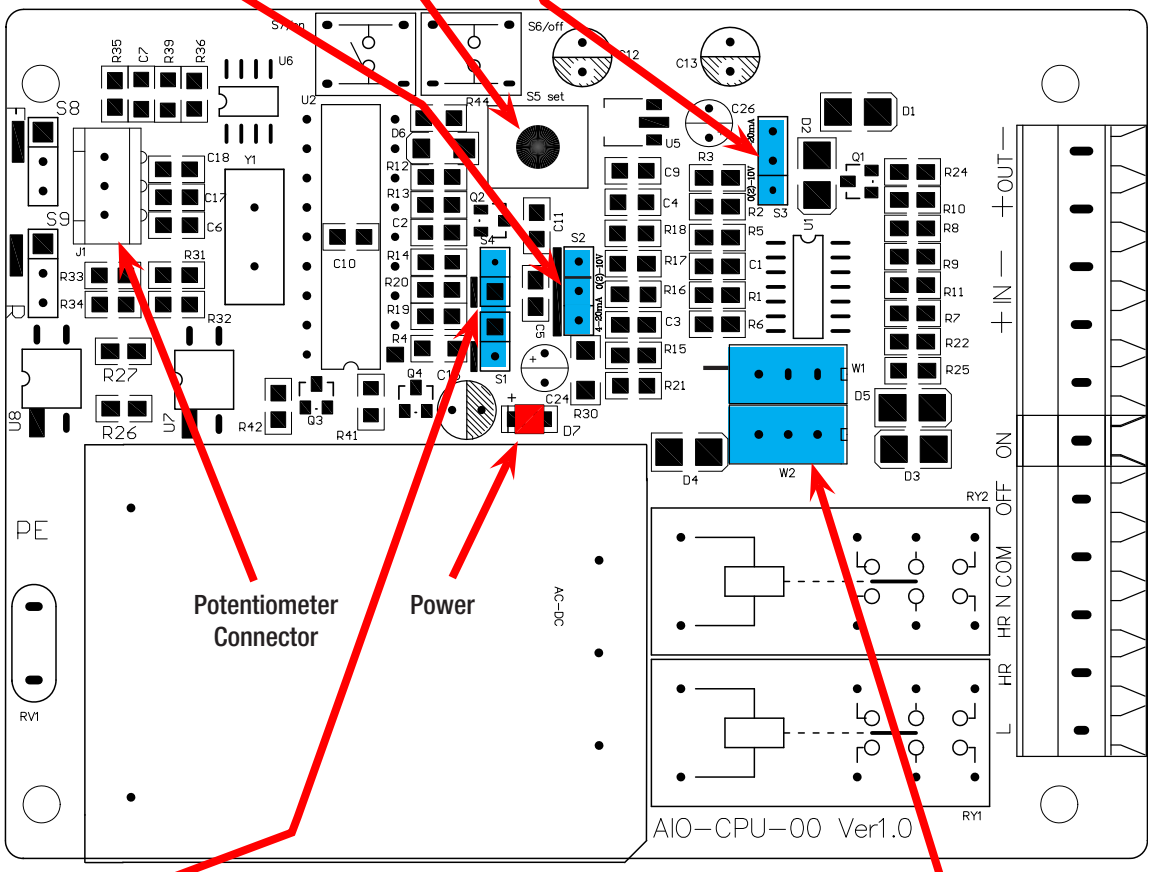
4-20mA | 2-10vdc

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!

Ex

Calibrate

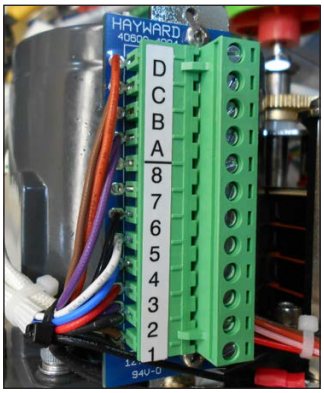


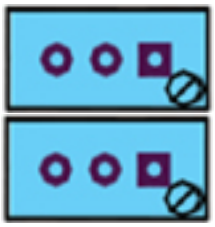
Range Select (Jumpers)

4-20mA | 2-10vdc | 0-10vdc

DEFAULT

Make all connections to the MAIN terminal blocks ONLY!





to DECREASE 20mA Feedback Output

to DECREASE 4mA Feedback Output

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.*

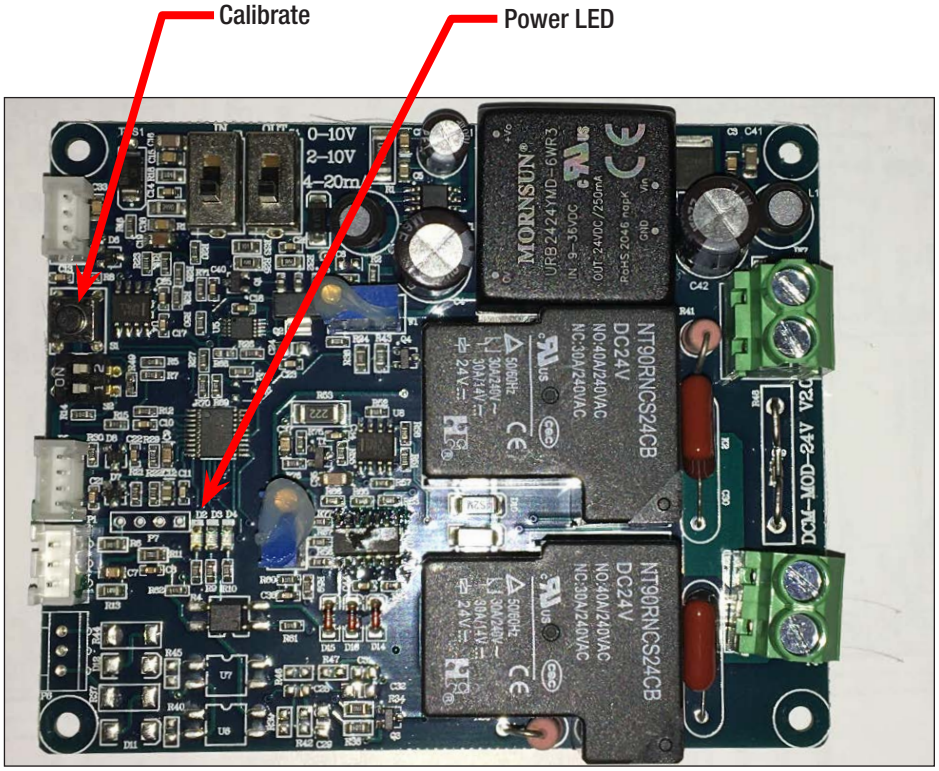
For servicing, DISCONNECT ALL POWER (supply as well as control) and ensure the area around the actuator is well ventilated and free of any explosive gases or dust before removing covers!

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 DIP switches for correct signal IN and feedback OUT and Response/ Feedback. (ref next page)
3. Apply correct power according to the actuator model.
   A. The blue Power LED will begin flashing.
4. **Press the "Calibrate" black 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. 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.
5. Slight adjustments may be made to the 20mA trimmer (W1) (see page 27) to affect accuracy on the feedback signal as a function of actuator position.
6. Unit is now calibrated and is ready to be put into service. No other calibration is necessary.
7. 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.

Alignment of the sector and potentiometer gear sets at actuator full CW 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!

Ex

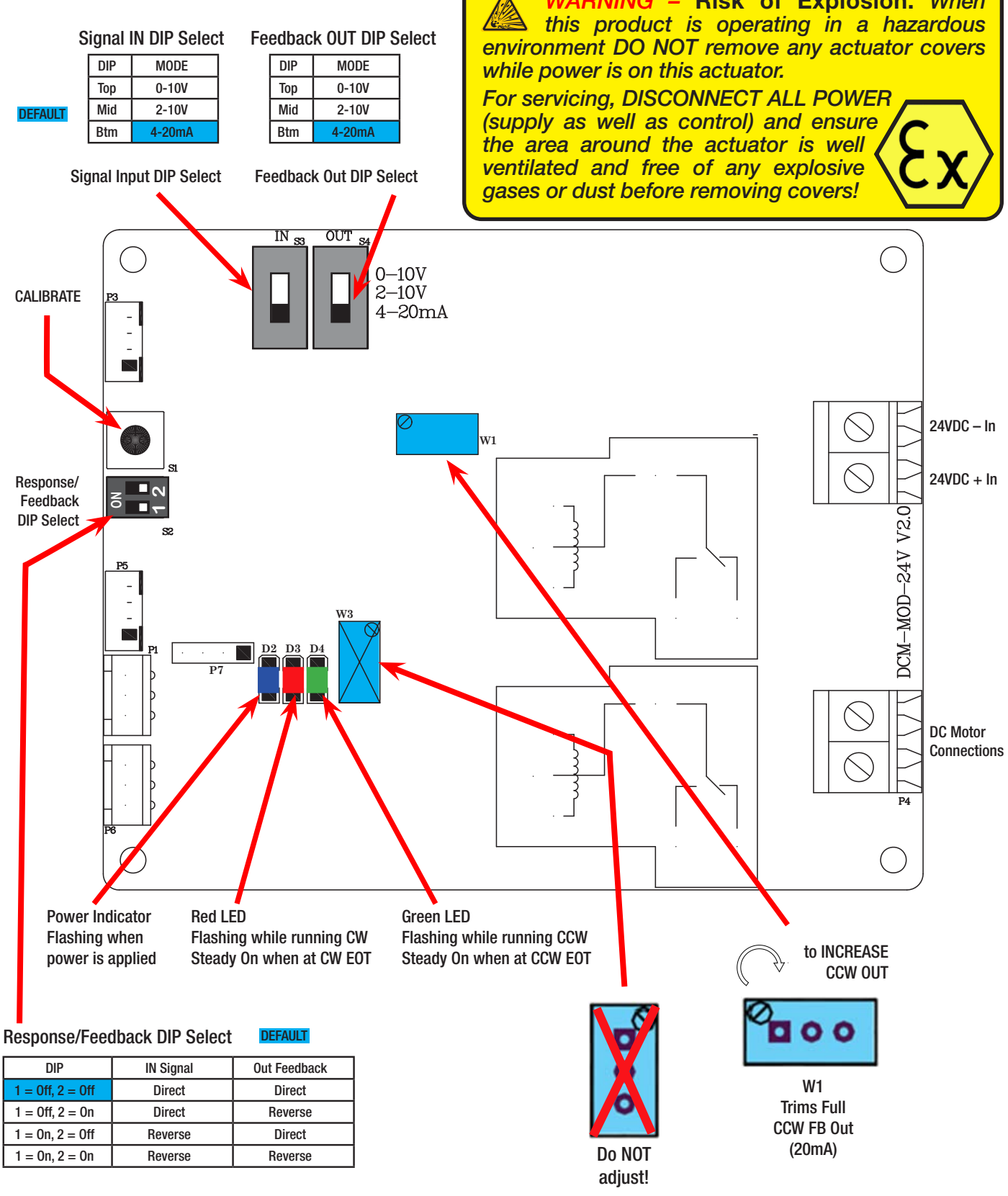
Signal IN DIP Select

DEFAULT

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

Feedback OUT DIP Select

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



Response/Feedback DIP Select DEFAULT

DIP	IN Signal	Out Feedback
1 = Off, 2 = Off	Direct	Direct
1 = Off, 2 = On	Direct	Reverse
1 = On, 2 = Off	Reverse	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%.
	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.
Motor is extremely hot to the touch.	Control “noise” or excessive duty cycle	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.
		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	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 blocks. Reference the correct wiring diagram.
	Control Problem	Generate move commands by the field device. Measure correct voltage changes between terminal #2 (24V NEU) and terminal #6 (CCW) and terminal #2 (24V NEU) 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 terminal #2 and terminal #7 WHILE commanding the actuator to move. Also measure voltage between terminals L1, L2, and L3. The measured voltage cannot drop more than 10% from rated voltage.
	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.
Motor is extremely hot to the touch.	Control “noise” or excessive duty cycle	Check for stray voltage fluctuations on the incoming control signals. Three phase on/off actuators have a maximum S-2 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	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%.
	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.
Motor is extremely hot to the touch.	Control “noise” or excessive duty cycle	Check for stray voltage fluctuations on the incoming control signals. Analog control signals are succeptable 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	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.*

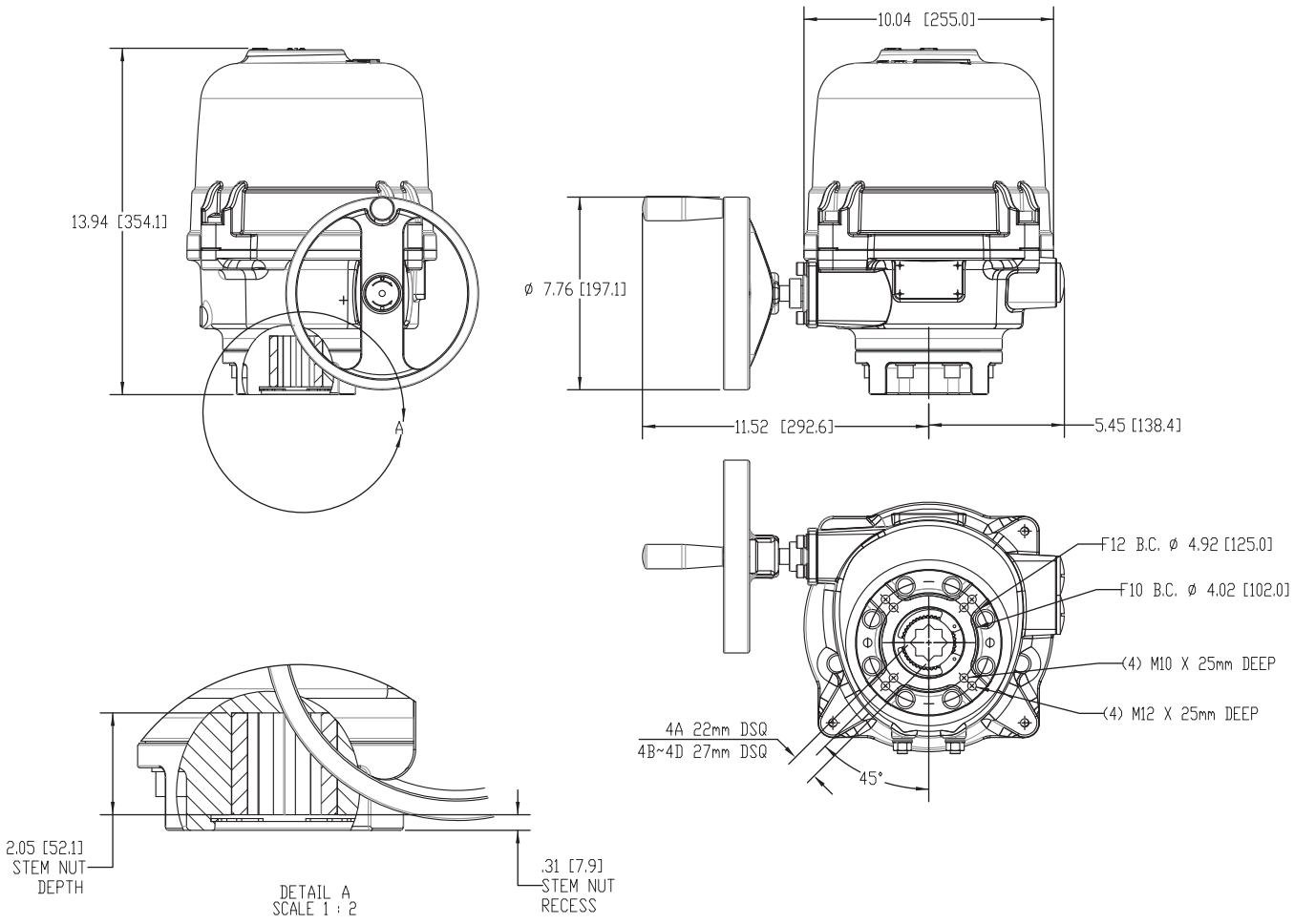
WARNING – **Risk of Explosion.** *When this product is operating in a hazardous environment DO NOT remove any actuator covers while power is on this actuator.*

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.

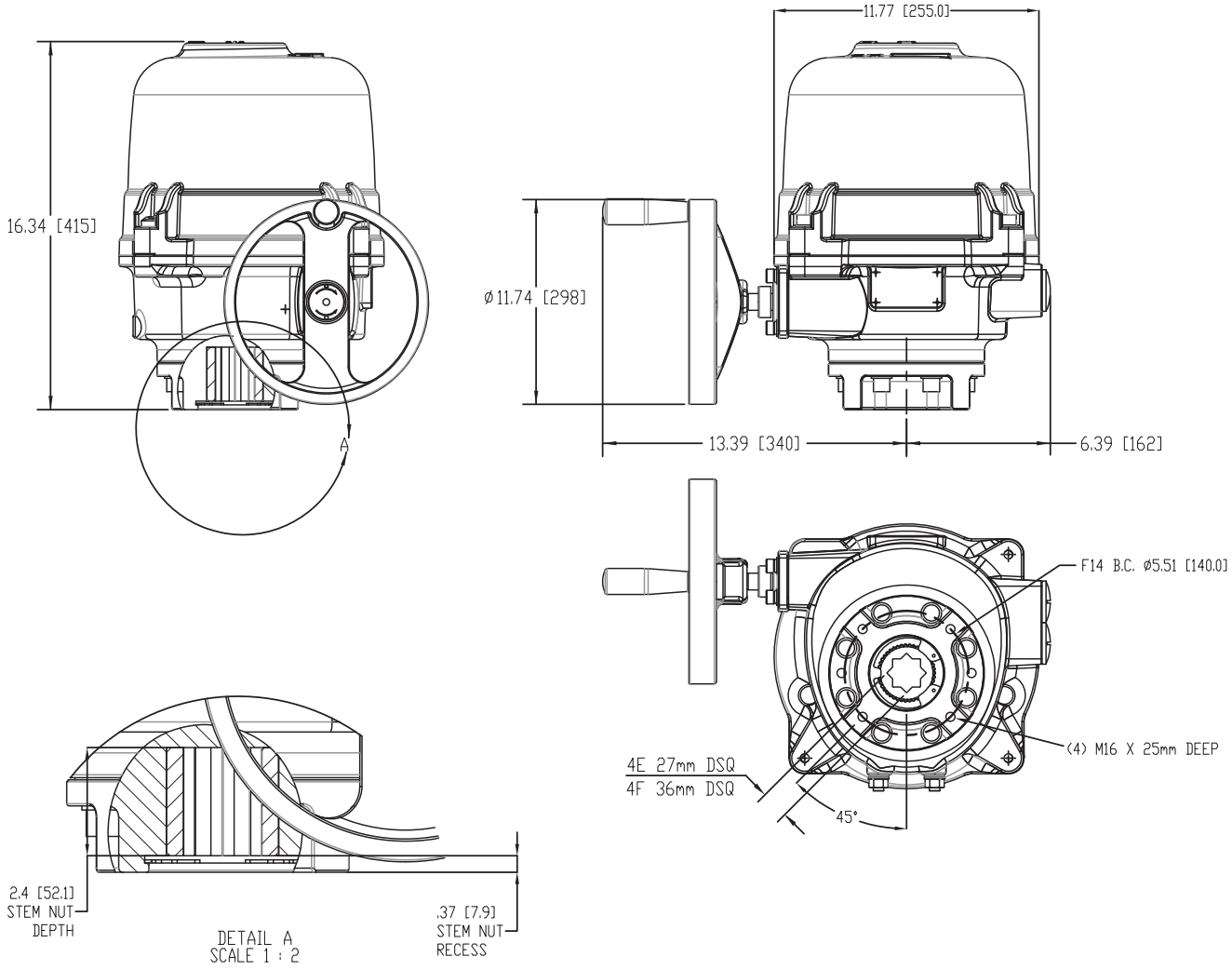
Symptom	Target	Action
Actuator does not move when commanded to do so.	Power Source	Measure incoming power AT the actuator terminal blocks. Reference the correct wiring diagram.
	Control Problem	Generate move commands by the field device. For most analog control systems, reversing the polarity will render 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 L1, L2, and L3. The measured voltage cannot drop more than 10% from rated voltage.
	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.
Motor is extremely hot to the touch.	Control “noise” or excessive duty cycle	Check for stray voltage fluctuations on the incoming control signals. Analog control signals are succeptable 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	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



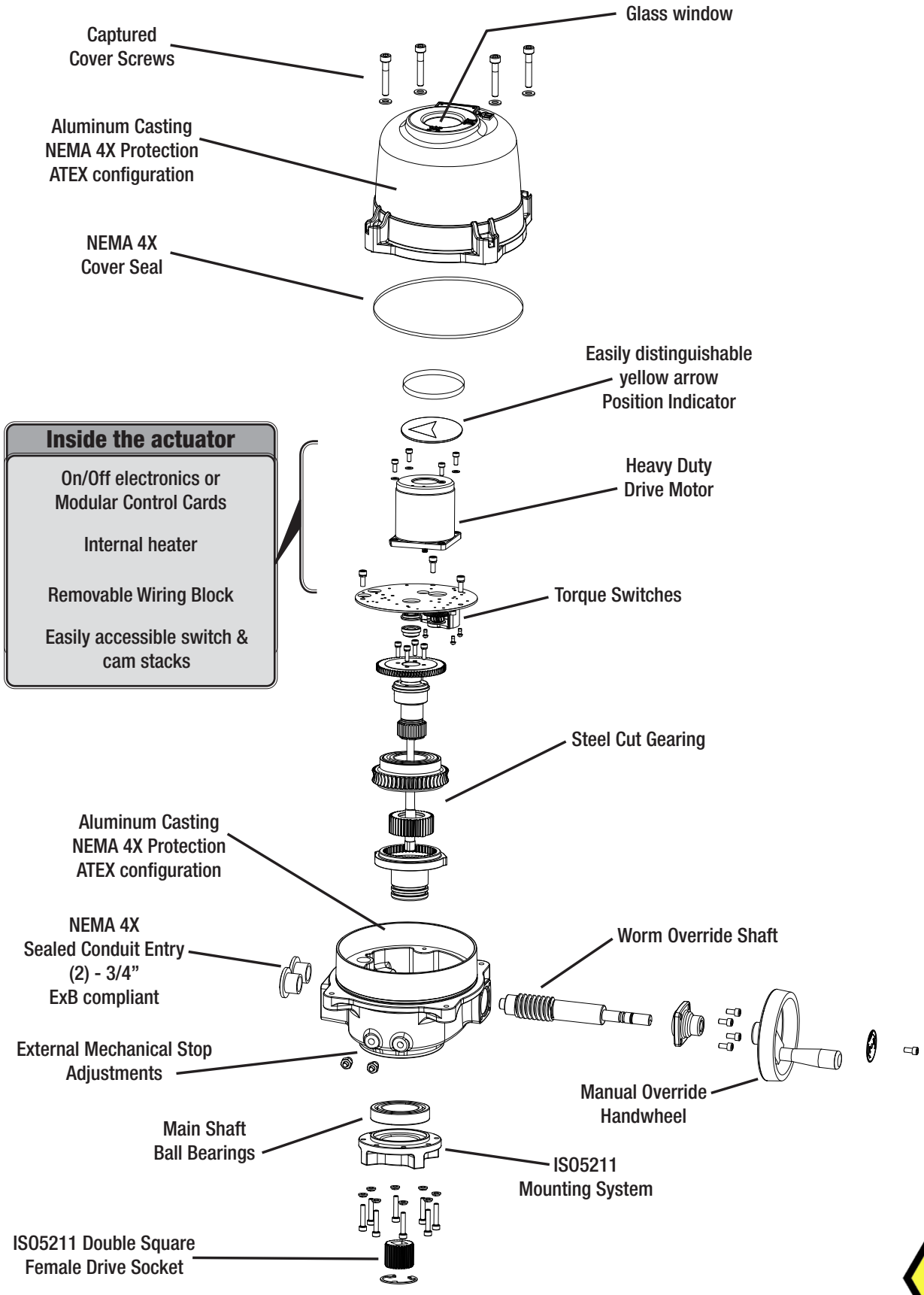
	COVER REMOVAL CLEARANCE	HANDWHEEL		WEIGHT
MODEL	IN/MM	IN/MM	# TURNS FOR 90°	LBS/KG
HXBSN4A	8 / 200	7.76 / 197	14.5 turns 90°	53.9 / 24.5
HXBSN4B	8 / 200	7.76 / 197	14.5 turns 90°	53.9 / 24.5
HXBSN4C	8 / 200	7.76 / 197	14.5 turns 90°	53.9 / 24.5
HXBSN4D	8 / 200	7.76 / 197	14.5 turns 90°	53.9 / 24.5

MECHANICAL DATA



	COVER REMOVAL CLEARANCE	HANDWHEEL		WEIGHT
MODEL	IN/MM	IN/MM	# TURNS FOR 90°	LBS/KG
HXBSN4E	9.84 / 250	11.42 / 290	16 turns 90°	81.4 / 37
HXBSN4F	9.84 / 250	11.42 / 290	16 turns 90°	81.4 / 37

EXPLODED VIEW
HXBSN4A~4F



WIRE SIZING CHART

Wire sizing data is provided in the table below to assist in the selection of the proper wire size for HXBSN4 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!

HV/LV PRODUCTS

Maximum distance between Actuator and Power Supply (ft)

ACTUATOR	HXBSN 4A~C	HXBSN 4D~E	HXBSN 4A~C	HXBSN 4D	HXBSN 4E~F	HXBSN 4A~C	HXBSN 4D	HXBSN 4E~F
Voltage	**24VAC/VDC**	**24VAC/VDC**	**120VAC**	**120VAC**	**120VAC**	**230VAC**	**230VAC**	**230VAC**
AWG \ Amps	7.0	10.5	3.0	3.8	7.2	1.7	2.2	4.1
18	–	–	285	225	–	963	744	399
16	–	–	453	357	–	1531	1183	635
14	62	–	720	568	300	2436	1882	1010
12	98	65	1145	904	477	3873	2992	1606
10	156	104	1820	1437	758	6156	4757	2552
8	248	165	2895	2286	1206	9793	7567	4060

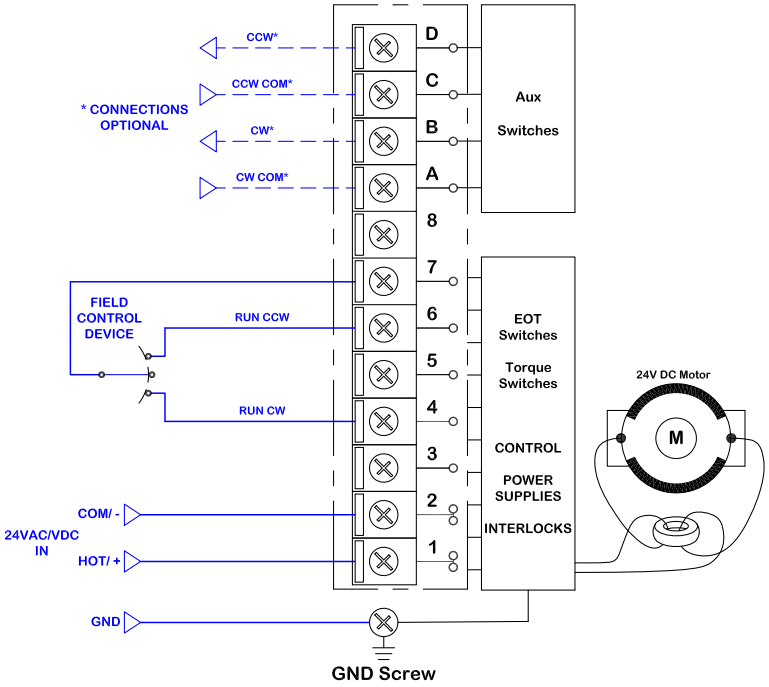
3 PHASE PRODUCTS

Maximum distance between Actuator and Power Supply (ft)

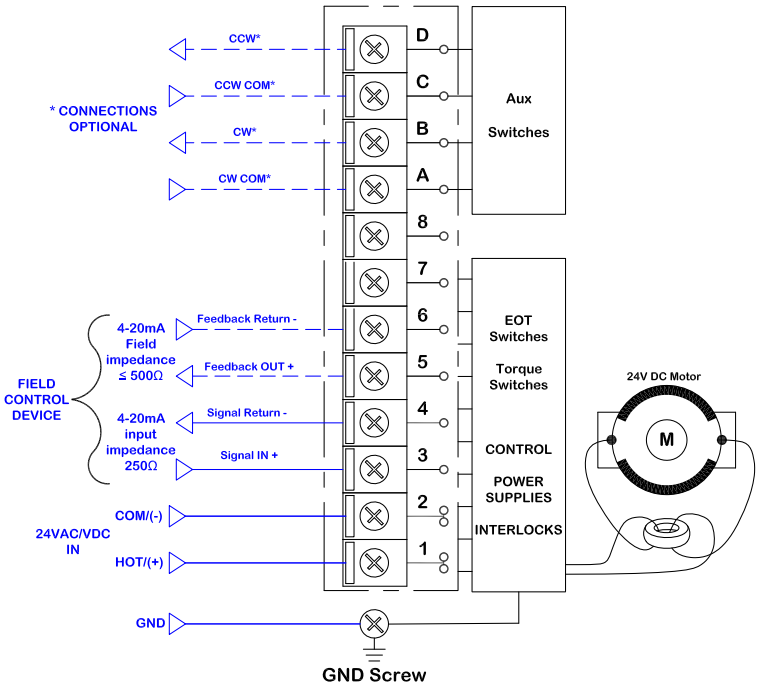
ACTUATOR	HXBSN 4A~4C	HXBSN 4D	HXBSN 4E~4F	HXBSN 4A~4C	HXBSN 4D	HXBSN 4E~4F	HXBSN 4A~4C	HXBSN 4D	HXBSN 4E~4F
Voltage	**220/3**	**220/3**	**220/3**	**380/3**	**380/3**	**380/3**	**480/3**	**480/3**	**480/3**
AWG \ Amps	1.8	2.8	3.6	1.1	1.6	2.1	0.7	0.9	1.2
16	648	416	324	3910	2688	2048	7325	5697	4273
14	1030	662	515	6219	4275	3257	11650	9061	6796
12	1638	1053	819	9888	6798	5180	18524	14407	10805
10	2604	1674	1302	15718	10806	8233	29445	22902	17176
8	4142	2663	2071	25004	17190	13097	46840	36431	27323

WIRING DIAGRAMS

HXBSN4A~4E 24vac/vdc On/Off

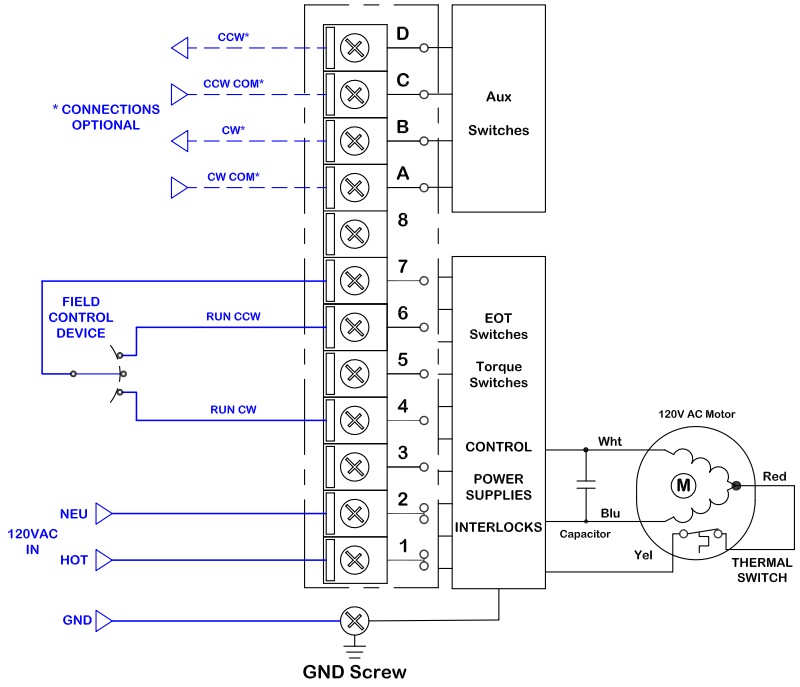


HXBSN4A~4E 24vac/vdc Proportional

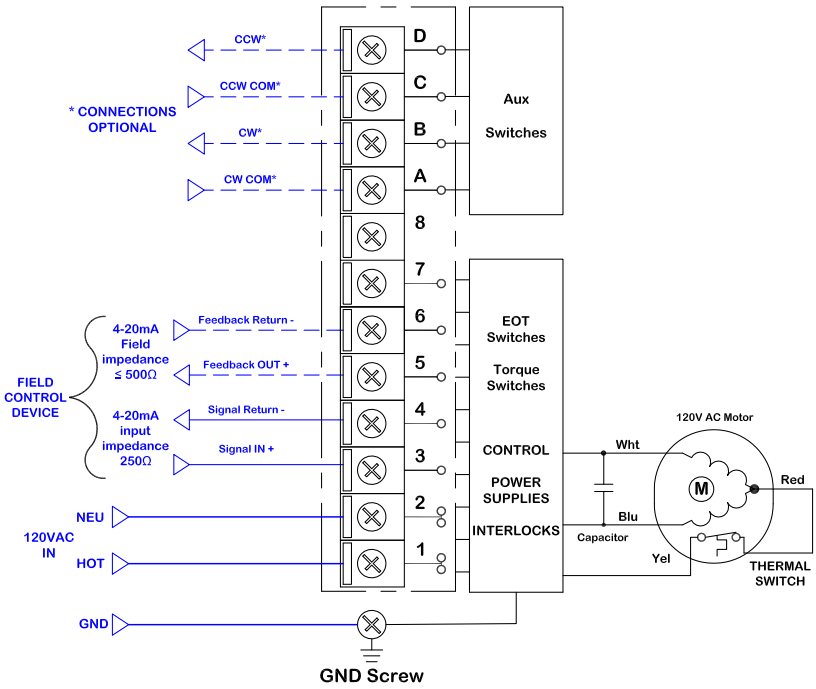


WIRING DIAGRAMS

HXBSN4A~4F 120vac On/Off

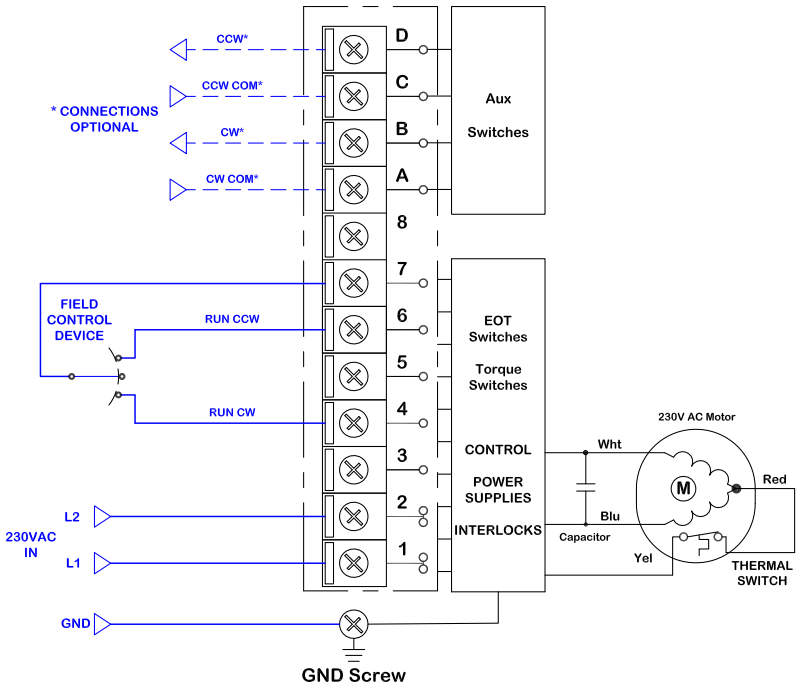


HXBSN4A~4F 120vac Proportional

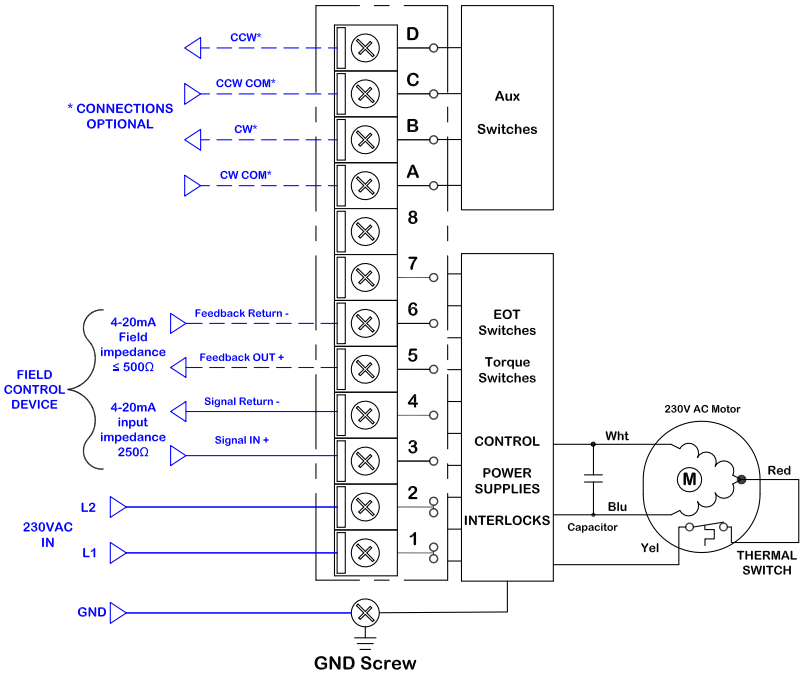


WIRING DIAGRAMS

HXBSN4A~4F 230vac On/Off



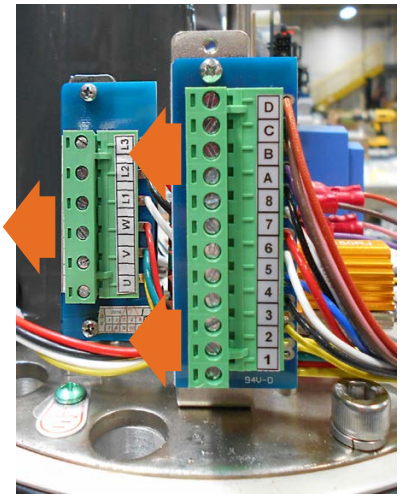
HXBSN4A~4F 230vac Proportional



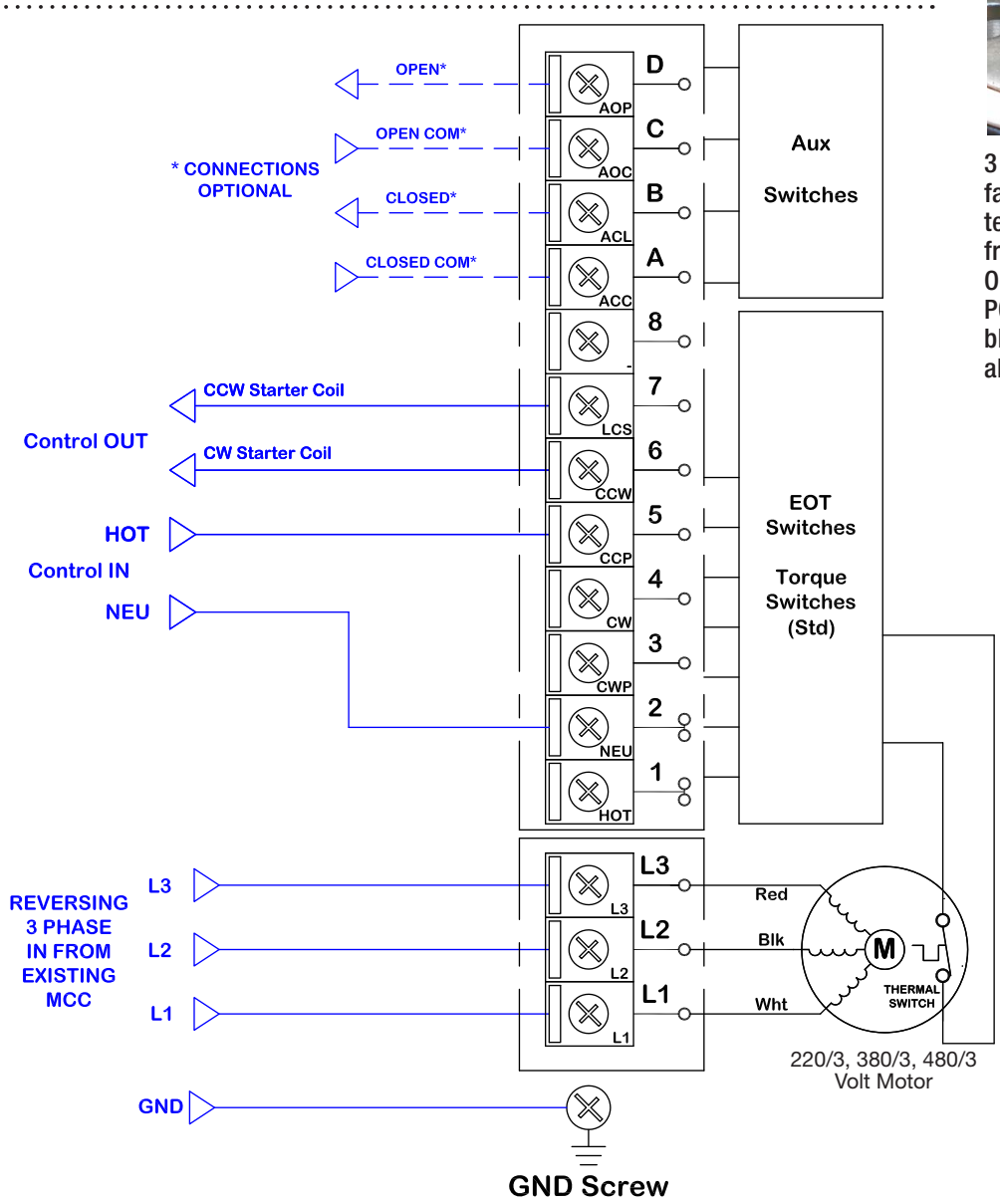
WIRING DIAGRAMS

HXBSN4A~4F 3ph Basic On/Off

1. HXBSN4 Series 3 Phase actuators utilize one or two removable terminal blocks to simplify field wiring and testing.
   - After wiring, reinsert the terminal strip into the receiver. This is a keyed pair and can only be inserted one way.
   - The low voltage terminal block (12 position) has **terminal number #1 at the bottom**. The high voltage terminal block (6 position) has **terminal letter U or L1 at the bottom**. (reference the correct wiring diagrams for numeric sequencing.
2. Note that although terminals are labeled as 1-8, A-D, U, V, W, L1, L2, L3 - not all terminals are used on all models.

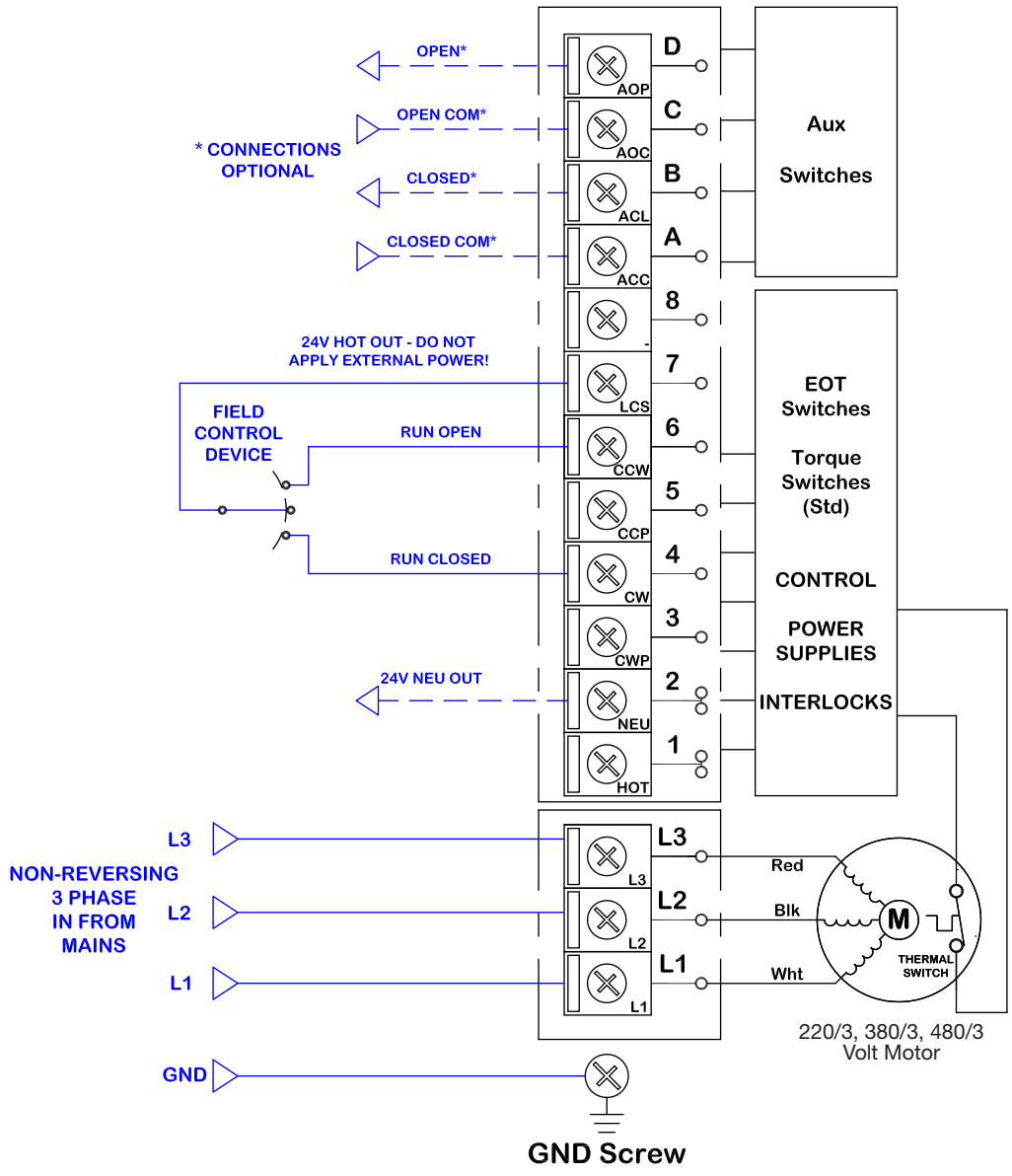


3 Phase removable terminal blocks facilitate ease of field wiring and testing. To remove a terminal block from the PCB receiver, pull straight OUT in a direction parallel to the PCB. Use caution when reinserting block - make sure all pins are aligned before seating.



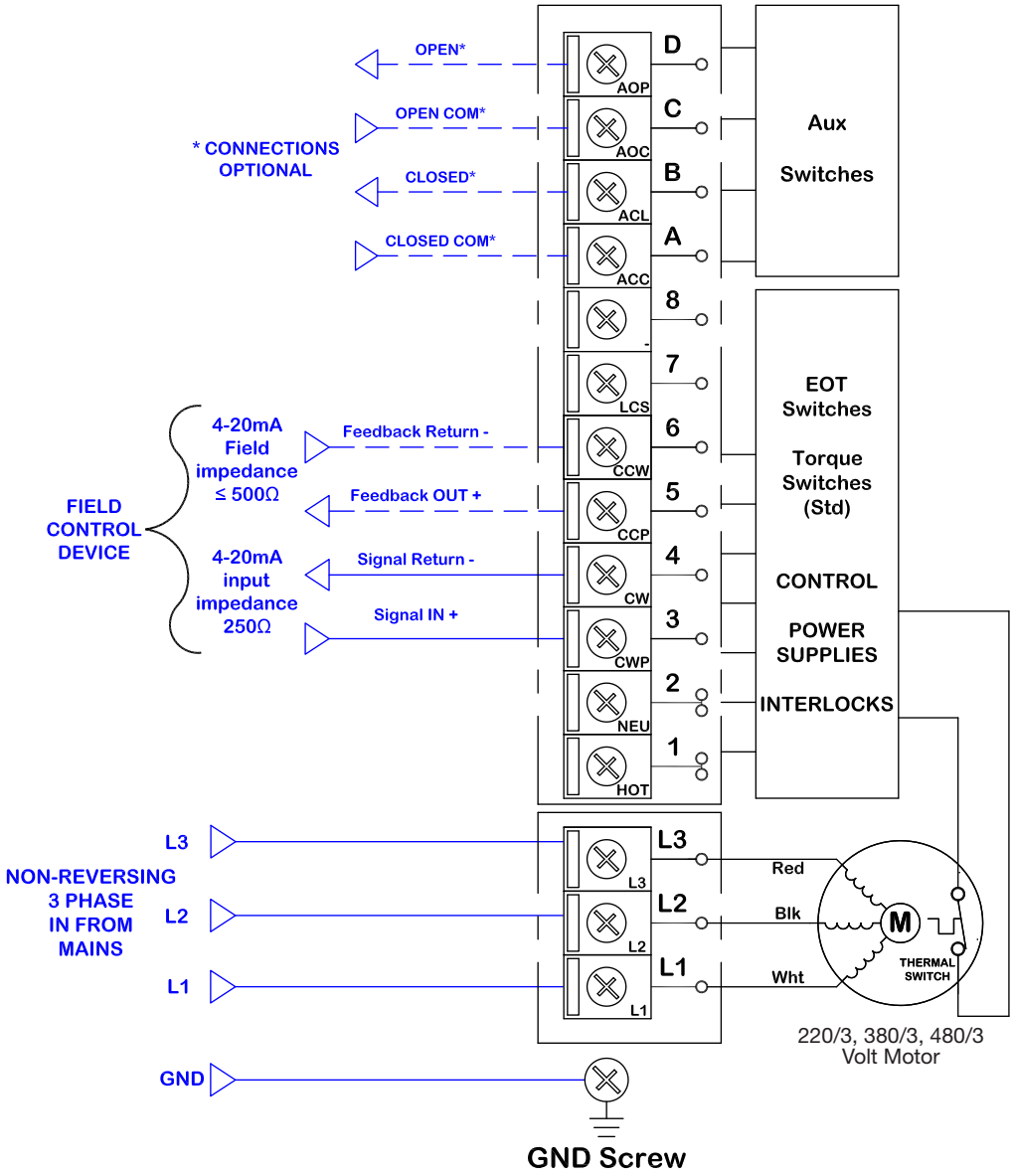
WIRING DIAGRAMS

HXBSN4A~4F 3ph On/Off



WIRING DIAGRAMS

HXBSN4A~4F 3ph Proportional



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