



Installation & Operation Manual

REXA Electraulic™ Actuators and





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Fundamental Safety Information

REXA Actuators produce extremely high forces, have hydraulic lines under pressure and have dangerous electrical power input levels. In addition to these standard characteristics, optional actuator constructions possess other hazards such as coil and disk springs under compression and high-pressure accumulator bottles.

Warnings

Based on these hazards, the following could occur if this safety information is not observed:

- Serious physical injury
- Death
- Damage to actuator or other equipment

NOTE: Always observe the safety information listed in this documentation.

Warning Labels



Hazardous Voltage

Turn Off and Lock Out system power before servicing. Do Not Operate this equipment from any power source that does not match the voltage rating stamped on the equipment. Refer to the manufacturer's identification nameplate for operational requirements.



General Warning

Refer to Installation Manual before servicing.



Attention

Important information provided. Do No Use this equipment for any purpose not described in this manual.



Crush or Pinch Point Hazard

Turn Off and Lock Out system power before servicing. Warn of actuator movement if Spring Fail Unit.



Guard Warning

All Guards **MUST** be in place before operation. Failure to do so may result in injury or damage to equipment.



Tripping, Slipping and Falling Hazards

These hazards can be avoided by cleaning spilled hydraulic oil in a timely manner.

- Airborne noise greater than 80 dB, ear protection suggested.
- Using the actuator for uses other than what it is intended may result in injury or death. Use the actuator for its intended purpose **ONLY**.
- Do not use the actuator should it be damaged in shipping or installation. Contact REXA.

Residual Risks

This section is to help identify the risks associated with the Actuator System. These items are identified as:



Actuator & Driven Device Connection:

The point at which the actuator couples to the driven device poses the risk of injury due to pinch or crush point. Use appropriate Lock-Out/Tag-Out procedures when connecting Actuator to the driven device.



Manual Override Handwheel Assembly:

The Manual Override Handwheel Assembly is to remain declutched until it is required. The Motor Shaft Cover **MUST** be in place during normal operation. Failure to do so poses a risk of injury.



Manual Override Handwheel Assembly:

When the Manual Override, Handwheel Assembly is used, adhere to proper Lock-Out/Tag-Out procedures.



Feedback Cover:

Feedback Cover **MUST** be in place during operation. Failure to do so may result in injury. Use proper Lock-Out/Tag-Out procedures before accessing feedback housing.



Shock Hazard:

Wire Cover must be in place during operation. Use proper Lock-Out/Tag-Out procedures before removing the cover.



Shock Hazard:

Control Enclosure Cover must be closed during normal operation. Failure to do so may result in injury. Use proper Lock-Out/Tag-Out procedures before accessing Control Enclosure.



Shock Hazard:

Hazardous voltage levels are present in the actuator. Only qualified service and installation personnel should install or adjust this device.



Alignment:

Ensure that the actuator shaft is in line with the valve plug stem. Misalignment could damage the actuator and driven device or cause injury to installation personnel.



Avoid Accidental Starting:

When installing the actuator, ensure that line power to the unit is shut off. When power is applied, the actuator may immediately respond to the control signal. Inadvertent motion could damage the actuator and driven device or cause injury to installation personnel.



Important:

When machining the control enclosure, thoroughly clean any metal chips or residue from the enclosure before applying power.

**Hydraulic Oil:**

The standard oil used in REXA Actuators or drives is 5W-50 motor oil. The introduction of other fluids may cause damage to the unit.

**Spring Under Tension:**

REXA Actuators, denoted by an E, R or U as the last character in the model number, contain a spring under tension. Failure to properly remove this force before disassembly can cause serious injury to maintenance personnel. Contact REXA for disassembly instructions.

**Relieving Internal Pressure:**

When the electric power is off or the motor is not turning, hydraulic pressure remains locked within the cylinder and/or accumulator. This internal pressure must be relieved before disconnecting any hydraulic fitting. Open the bypass valve (3/16" hex) located on the power module for fail in place units and manually override all solenoid valves that are closed.

NOTE: External thermal expansion chamber or accumulator collection bottle lines may contain up to 60 psi (4 bar) that cannot be relieved.

NOTE: Accumulators will still contain up to 2000 psi (138 bar) of nitrogen gas that cannot be relieved.

**Accumulator Fail Option:**

REXA Actuators denoted by an A as the last character in the model number contain an accumulator charged with high-pressure nitrogen. These actuators also have an automatic recharging cycle for the accumulator. Failure to properly follow installation instructions may cause serious injury to maintenance personnel and/or damage to equipment.

**NPT Plug and Conduit Connections:**

During assembly, Loctite® 567 compound—or its equivalent—must be used on threads of all NPT plug and conduit connections to ensure a watertight seal.

**When to Lock-Out/Tag-Out:**

Lock-out/Tag-out before servicing.

Most equipment is installed along with safe switches allowing the equipment to be disabled for minor repair. In general, these switches provide adequate protection for minor repairs, which is routine, repetitive, and necessary to the normal use of the equipment. Lock-Out/Tag-Out procedures should be used for the following situations.

- Major repairs or overhaul.
- When working alone, out of visual contact of the controlling switch.
- Anytime there is danger of injury from an unexpected release of energy.
- Any situation that threatens an employee's safety.

NOTE: Always follow local & plant procedures.



Procedures: Lock-Out/Tag-Out

The following are minimum recommended procedures to be followed for Lock-Out/Tag-Out:

1. Notify all affected areas and employees of the impending Lock-Out situation, the reason for it, and estimated start and duration times.
2. Equipment shutdown and isolation: Place all switches in the “off” or “safe” position. Disconnect sources of power, ensuring all sources of both primary and secondary power to the equipment are interrupted.
3. Dissipate residual energy. Shutting down equipment does not mean there is no energy left in it. Check for trapped pressure, compressed spring or residual electricity in the system.
4. Lock-Out or Tag-Out all in-line points of control. In most cases, there may be more than one place, or more than one lock, if several people are working on the equipment.
5. Lock-Out verification: Take nothing for granted. Verify that the locked-out switch or control cannot be overridden. Test the equipment to be certain that the locked-out switch is de-energized, and not simply malfunctioning. Test all control points and modes to be sure that the equipment does not start.
6. Perform the work scheduled. Try to foresee all possible hazards. Ensure the new/repair work does not bypass the Lock-Out and reactivate the system.
7. Lock and/or tag removal. All locks and tags are to be left in place until all work is finished. This is especially true when more than one employee is working on the equipment. A lock is never to be removed except by the person who placed it there.
8. Equipment start-up. Make a final safety check before restarting equipment; to be certain it is safe to operate. Make sure of the following:
 - a. All tools and other items have been removed.
 - b. All machine guards are returned to their proper position. All electric, hydraulic, pneumatic or other systems are properly reconnected.
 - c. All employees are clear of equipment.

Many of the Lock-Out/Tag-Out procedures appear to be common sense, and they are. Following them will ensure safe operation calibration, maintenance and repair of equipment and/or processes, without dangerous surprises or injury.

Education and Discipline

The key to worker safety is education. The purpose of this document is for everyone to understand the importance of Lock-Out/ Tag-Out and how to recognize when it is in use. By educating all employees about the importance of following proper safety procedures, we ensure a safer working environment. As with all safety procedures, a fair uniform enforcement of discipline must be in place. Employees are responsible for their own safety, the safety of their fellow employees and the safety of the facility.



General Information

1.0 Factory Support

REXA's primary manufacturing facility is located in Middleborough, Massachusetts, USA with sales service and distribution centers located in Tomball Texas, and Austell Georgia. Customer support is our top priority at REXA. Please contact the factory if this manual fails to provide you with the level of support you are looking for. We have a fully staffed customer support group and aftermarket service department with trained and certified personnel. For on-site repair, service, sales, warranty, or parts orders, you may contact the factory at the following:

REXA, Inc.

Address: 200 Canopy Drive

Middleborough, MA 02346

Phone: (508) 584-1199

Website: www.rexa.com

24-Hour Service Line: +1 (281) 675- 6086

NOTE: It is important to have the serial number for both the electronic control enclosure and the actuator so we can provide better service.

This information can be found on the metal tags on the actuator and on the front panel of the electronic control enclosure. Reference the sections below on Actuator Identification for more detailed explanation.

1.1 Actuator Identification

The model number, mechanical build number, electronic build number and serial numbers are all used to identify the individual construction of each actuator. The model number will provide a general description of the actuator and electronic control enclosure as a set. These numbers also provide the information required to correctly define what sections of this manual applies to a particular actuator. The build number provides more detailed information of the components used in the construction of the actuator. Finally, the serial number will allow the factory to determine any special considerations or custom features your actuator may have.



Customer support requires the serial number to ensure the quickest and most accurate response to your request. The serial numbers can be found on the ID tags located on the actuator or electronic control enclosure. Figure 1 shows a typical ID tag.

REXA, Inc.
USA (508) 584 - 1199

MADE IN USA

200 Canopy Drive
Middleborough, MA

MODEL

MODEL NUMBER DESCRIPTION

SERIAL

SERIAL NUMBER BUILD BUILD CODE

INPUT

VOLTAGE

AMPS

PHASE

HERTZ

☐

☐

CUSTOMER SPECIFIC TAG INFO

NEMA 4X

☐

AREA CLASSIFICATION
HAZLOC TEMPERATURE RATINGS
MECHANICAL OUTPUT
MECHANICAL TRAVEL

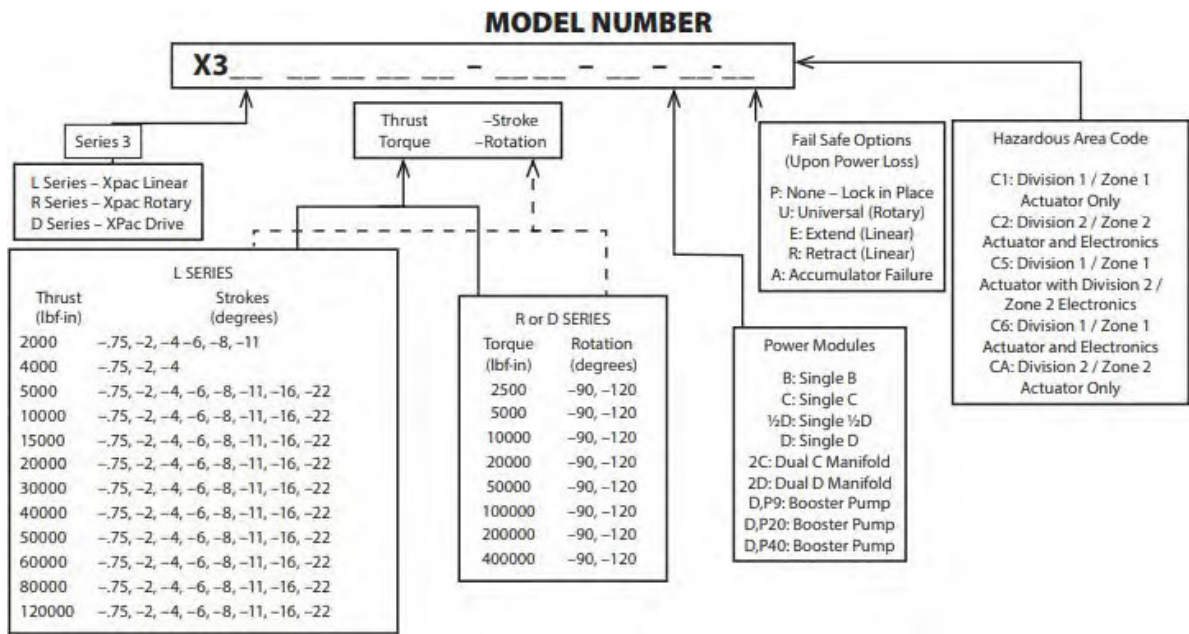
MULTIPLE RATED EQUIPMENT,
REFER TO INSTALLATION &
OPERATION MANUAL

AREA CLASSIFICATIONS AND/OR WARNINGS

Figure 1: ID Tag

1.1.1 Model Number

The basic model number is a generic description of the actuator. Not all examples are covered in this tree but can be inquired about. The table below shows a breakdown of the model number tree and how it works.



Model Numbers — Examples:

X3L4000-4-C-P

Is a Linear L Xpac Series 3 with 4000 lb of thrust, stroke adjustable up to 4 inches, and C size power module. Lock in position upon loss of power.

X3R2500-90-B-U

A Rotary R Xpac Series 3 with 2500 lbf-in of torque, rotation adjustable to 90 degrees, and B size Power module. Spring failure upon loss of power.



1.1.2 Serial Number

Serial numbers are assigned to every REXA actuator. Project specific details as well as sales and engineering information are stored under a specific serial number. A typical serial number will look like: RC2400000. The 24 indicates the year of manufacture as 2024, and the next five digits correspond to the unique order number.

1.1.3 Build Number

The build number is a configuration number we use to detail the construction of the actuator. There are two different categories of build numbers; one is for the mechanical actuator, and the second is for its corresponding electronic control enclosure.

1.2 Actuator System Components

1.2.1 Overview

The REXA Xpac is a microprocessor controlled, self-contained, Electraulic™ (electro-hydraulic) actuator designed specifically for modulating service. Hydraulic, electronic, and mechanical technologies are combined to achieve REXA's state-of-the-art line of actuators.

The patented Flow Match System is simply described as a highly efficient method of pumping hydraulic fluid (motor oil 5W-50) from one side of a double acting cylinder to the other. Once the correct position is reached, the motor shuts off and power consumption drops down to an idle level. The hydraulic system is controlled by a dedicated microprocessor contained within the control enclosure.

The Xpac consists of two major components, the hydraulic actuator (cylinder, feedback and Electraulic power module) and the control enclosure. The actuator is installed on the driven device, while the enclosure is remotely mounted.

1.2.2 Hydraulic Actuator

The heart of the actuator is the Electraulic Pumping system called the power module. Consisting of a motor, gear pump, flow match valve (FMV), make-up oil thermal expansion chamber, heater, thermostat, output limiting valves, and bypass solenoid (spring fail units only). The Power module delivers oil at the required pressure to overcome the load that the actuator is driving, the actuator is at its nominal output rating when the power module is delivering 2000 psi to the hydraulic cylinder. Four different size modules, B, C, ½ D and D. The major functional difference between these sizes is the pumping volume and thus, the maximum stroking speed of an actuator.

1.2.3 Module Identification

The B and C modules shown in Figure 2 are the two sizes of stepping motor modules. They can be identified by the cylindrical motor cases.

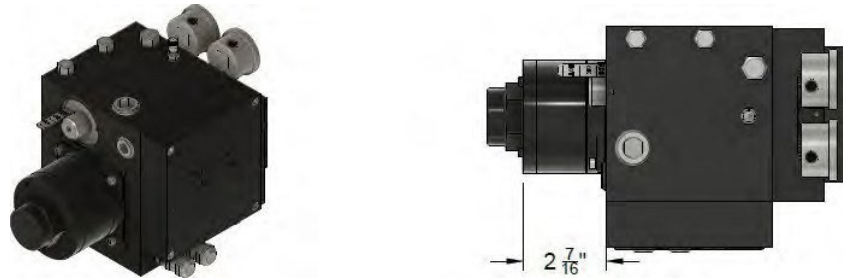
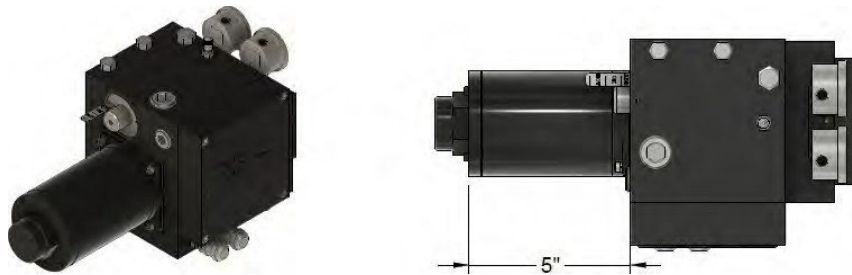


Figure 2: B Module (Above) vs C Module (Below)



The $\frac{1}{2}$ D and D modules shown in Figure 3 are the two sizes of servo motor modules. They both have square case motors.

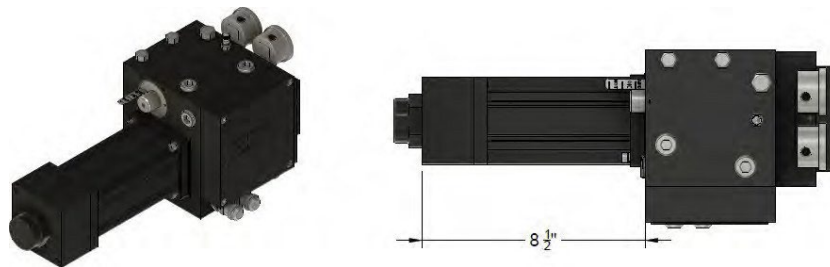
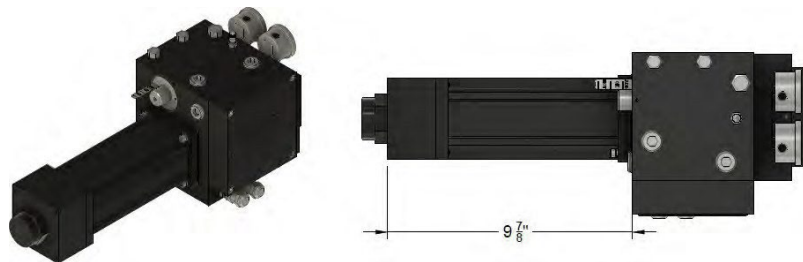


Figure 3: $\frac{1}{2}$ D Module (Above) vs D Module (Below)



If the actuator is going to be installed in a hazardous gas environment, classified as Division 1 or Zone 1, a C or D explosion proof module, shown in Figure 4, will be supplied.

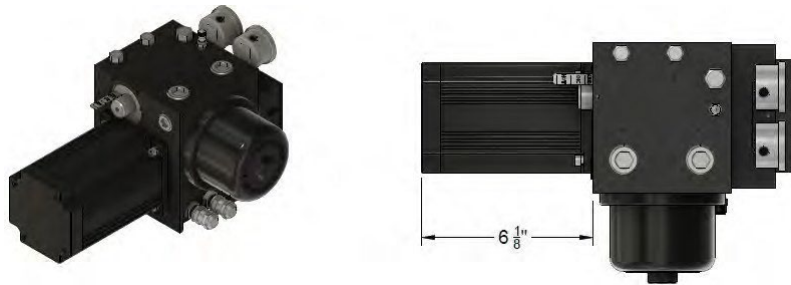
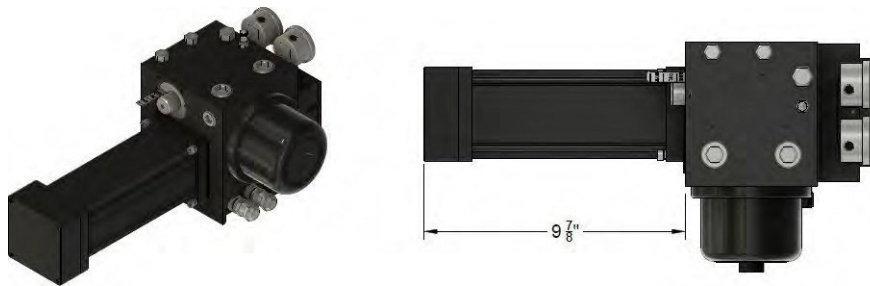


Figure 4: C Module (Above) vs D Module (Below)



1.2.4 Electronic Control Enclosure

The electronic control enclosure consists of the enclosure, power supply, motor drivers, main Power Transient Suppression, control board assembly and a termination area.

The electronic control enclosure also provides the user interface. The enclosure mounted 4-line x 20 character/line Vacuum Fluorescent Display (VFD) with Limited Graphics and a 5-button keypad will be the point for setup and calibration of the actuator as well as visual feedback of actuator status. See Figure 5 for details. The Keypad and Display can be optionally mounted inside the electronic control enclosure should the installation warrant it.

The motor driver is the component that supplies power to the motor. It can either be a DC Stepper Motor Driver or an AC Servo Motor Driver, depending on the model actuator. The motor driver accepts command signals from the actuator and provides DC Step Pulses (Stepper Motor) or Pulse Width Modulated (PWM) DC Voltage (Servo Motor) to the module mounted motor to drive it in one direction or the other. There is one motor driver for each power module.



316 Stainless-Steel Electronic Control Enclosure Specifications for Single Module Actuators:

- Complies with NEMA Type 12 and 4X
- IEC 529, IP66 Construction

Figure 5: Electronic Control Enclosure



Delivery

2.0 Receipt

REXA makes every effort to package products to avoid damage in shipping. Upon receipt, inspect the crate and make note of any physical damage. If severe damage is present, then consideration should be given to rejecting the shipment and contacting the shipping company concerning in-transit damage claims.

2.0.1 Relative Humidity

The equipment will operate correctly within an environment at 50% RH, +40 °C (+104 °F). Higher RH may be allowed at lower temperatures. Measures shall be taken by the Purchaser to avoid the harmful effects of occasional condensation.

2.1 Storage

If the actuator and control enclosure sub-assemblies are not immediately installed, provisions for storage must be made. The equipment should not be removed from the original containers and should be protected from the elements. The recommended ambient environment must be indoors in a clean and dry area that meets the following requirements:

- Clean- no airborne particles or contaminants.
- Non-Corrosive- minute quantities of gases can concentrate in a confined area.
- Dry- relative humidity must be sufficiently low to prevent moisture condensation on chilled metal components.
- Temperature- recommended storage temperature is between -13 °F to 131 °F (–25°C to 55 °C).

2.1.1 Extended Storage

NOTE: It is not recommended that the oil be drained from the system as the oil will act as a corrosion preventative for the internal components during long term storage.

Instructions:

- Put the actuator into **Setup** mode – *This will ensure when power is returned the actuators do not attempt to operate.*
- Record any previous fault history and clear all the existing error codes (Refer to Section 6.7) – *This will allow the system history to start fresh upon re-commissioning.*
- The power to the system should be left on, if possible, to prevent condensation, if the power cannot be left on then desiccant should be added to prevent condensation and moisture from building up in the electronic control enclosure.



- Open the manual bypass valve (externally plumbed solenoid S09930 Series) all the way, this will allow the actuator to find its neutral position where it is no longer supporting any outside loads. If the actuator is holding a load up this step will lower the load. – *This will relieve all internal system pressure.*
- Place moisture protecting desiccant bags, which are appropriate for the environmental conditions on site and length of storage that is being specified, over the conduit entrances in the electronic control enclosure. – *This will minimize air flow through these conduit openings and will absorb any moisture that makes it into the electronic control enclosure.*
- Place moisture protecting desiccant bags, which are appropriate for the environmental conditions on site and length of storage that is being specified, over the conduit entrances under the feedback housing for both cylinders and inside the motor junction box. *This will minimize air flow through these conduit openings and will absorb any moisture that makes it into these housings.*
- Close the electronic control enclosure making sure the latch is tight. – *This will prevent any moisture from entering the system.*

2.1.2 Long Term Storage (Greater than 12 months)

Inspect the electronic control enclosure, feedback housing, solenoid coils and all junction boxes for indication of water ingress or corrosion.

After long term storage, lubrication on rotating and reciprocating shaft seals significantly decreases. It is important to slowly break in the seals or pre-lubricate contact surfaces. The following procedures should be used.

Warehouse Storage

- a. Warehouse to be fully enclosed with a solid floor.
- b. Cartons, crates should not be stacked.
- c. Humidity levels to be sufficiently low enough to prevent condensation on metal surfaces.
- d. Maintain temperatures between -13 °F to 131 °F (–25°C to 55 °C).

Outside Storage

- a. Store crates on high ground above and away from water runoff / flood prone areas. If this is not possible, crate should be elevated off ground using non water absorbing materials like cement blocks or bricks.
- b. Cartons, crates should not be stacked.
- c. Cover crates / cartons with a minimum of two layers of 4 mil thick plastic sheet or a weather resistant tarp. Cover in a manner to prevent pockets where water and ice can collect.
- d. Secure covering / tarp using rope.

2.2 Unpacking

CAUTION: Use care when removing and handling equipment.

CAUTION: Lifting lugs are for lifting actuators only.

The REXA Xpac Actuator is shipped filled with oil and ready to be installed. It has been operated, tested, and thoroughly inspected. After removing the actuator from the packaging, inspect it for any signs of mechanical damage that may have occurred during shipping. Immediately report any damage to the factory.

Compare the contents to the packing list included with every shipment. Immediately report any discrepancies to the factory.

2.2.1 Unpacking System & Lifting

If a piece of the system weighs between 40 – 79 lb (18 –36 kg), a two-man lift is required.

If a piece of the system weighs between 80 lb and 129 lb (36 kg – 59 kg), a machine assist must be used (forklift or crane)

2.3 Pre-Installation Preparation

2.3.1 Accumulator Fail-Safe Nitrogen Fill

NOTE: Typically, REXA actuators are filled and are ready to operate. However, some actuators have reduced oil levels to comply with shipping regulations. The below sections only apply to actuators with these regulations.

NITROGEN NEEDS TO BE ADDED
TO THIS ACTUATOR
PER INCLUDED INSTRUCTION DOC134

Figure 6: Shipment Label

CAUTION: Carefully read and perform this procedure before powering on your REXA actuator.

Prior to shipment, the accumulator nitrogen pressure was lowered to 20 psi (1.38 bar). The accumulator nitrogen pressure must be restored to normal levels before the actuator can be powered on. Shipment should be labeled appropriately and include a label and instructions (DOC 134). See Figure 6 for details.

2.3.2 Accumulator Fail-Safe Nitrogen Fill Procedure:

1. Determine accumulator bottle oil capacity by tag. See Figure 7 and the table below for details. Use the Accumulator Capacity table to determine nitrogen volume value.

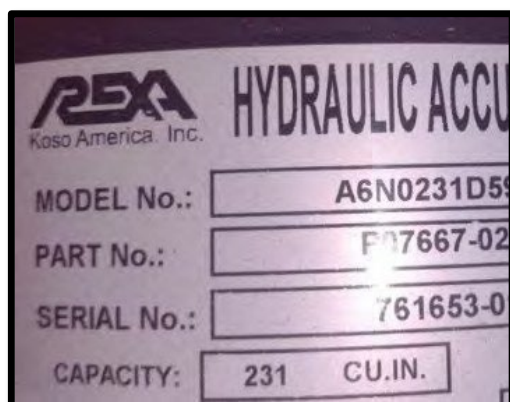


Figure 7: Accumulator Bottle Oil Capacity Tag

Accumulator Capacity	Nitrogen Volume@ 3000 psi (206 bar)	Nitrogen Volume@ 4000 psi (275 bar)
116	500 cu. in (8.19L)	375 cu. in (6.14L)
231	1048 cu. in (17.1L)	786 cu. in (12.9L)
578	2436 cu. in (39.9L)	1824 cu. in (29.9L)
1155	4832 cu. in (79.1L)	3624 cu. in (59.4L)
1733	7144 cu. in (117L)	5358 cu. in (87.8L)
2310	9452 cu. in (155L)	7089 cu. in (116L)

2. Locate and remove the gas valve protective strap. See Figure 8 below.



Figure 8: Nitrogen Gas Valve Cap and Protective Strap

3. Add nitrogen using appropriate charge kit (REXA part number K09851-3000). See Figure 9 below. Using the Pre-Charging Procedure, DOC134, add nitrogen until the pressure reaches what is shown on the bottle tag (typically 1900 psi) shown in Figure 10.

NOTE: The nitrogen needs to be added slowly to allow the temperature to stabilize. After the full amount is added, wait one hour, and recheck the pressure.

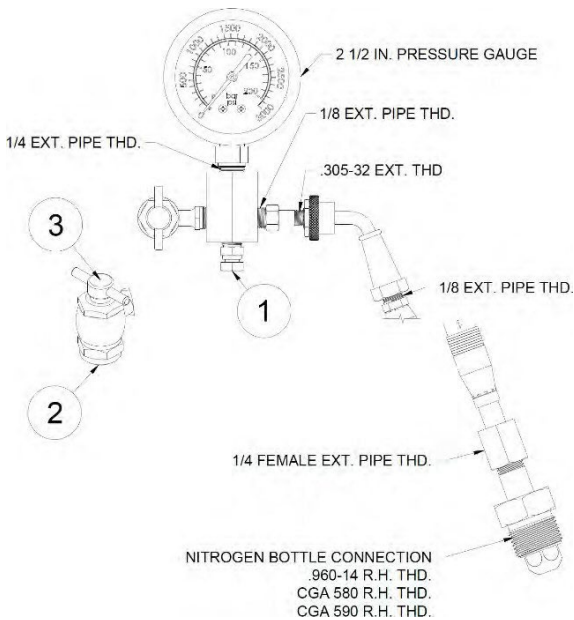


Figure 9: Charging Kit

REXA HYDRAULIC ACCUMULATOR	
MODEL No.:	012345678910
PART No.:	P07667-0578
SERIAL No.:	123456
CAPACITY:	231 CU.IN.
MAX. OPERATING PRESSURE:	3000 PSI
ACCUMULATOR IS PRECHARGED TO:	1900 PSI

Figure 10: Bottle Pressure Tag

2.3.3 Pre-charging Procedure:

Remove gas valve protective strap and gas valve cap (Figure 8).

Back out the gas chuck "T" handle (Figure 9: Item 3) all the way (counterclockwise) before attaching charging assembly to accumulator gas valve.

Close the bleed valve using a 7/16" wrench (Figure 9: Item 1).

Attach swivel nut to gas valve (Figure 9: Item 2) and tighten to 11-16 in-lbs. using an 11/16" wrench. Make sure not to loop or twist the hose.

Turn the gas chuck "T" handle until the gauge starts showing the pressure in the accumulator. Do not turn the "T" handle all the way down, as it will damage the valve core, shown in Figure 11A.

For the gas valve shown in Figure 11B, hold the gas valve at point "C" with one wrench while unscrewing the hex nut at point "D" with a second wrench. This will open the poppet inside the gas valve.

NOTE: Three turns will fully open the valve.



Figure 11A: Gas Valve Core Locator

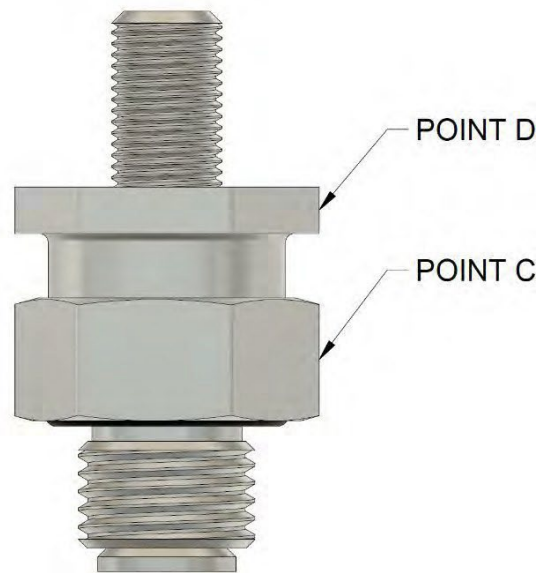


Figure 11B: Gas Valve Core

Open the nitrogen bottle valve and slowly fill accumulator. Shut off when gauge indicates desired pre-charge.

Let the pre-charge set for one hour. This will allow the gas temperature to stabilize. If the desired pre-charge is exceeded, close nitrogen bottle valve, then slowly open bleed valve. Do not reduce pre-charge by depressing valve core with a foreign object. High pressure may rupture the rubber valve seat.

When finished pre-charging the accumulator, turn “T” handle all the way out on the gas chuck (Figure 9: Item 3), then open the bleed valve (Figure 9: Item 1).

For the gas valve shown in Figure 11B, use a $\frac{3}{4}$ ” wrench to tighten hex nut and gas valve to 5-8 ft-lbs. at point “D” to close internal poppet.

Hold the gas valve to keep it from turning, loosen swivel nut, and remove charge kit assembly. Check for pre-charge leak using a common leak reactant.

Put the gas valve cap, shown in Figure 8 and tighten to 10-15 in-lbs. Put the valve guard back on the gas valve cap. (The gas valve cap serves as a secondary seal.)

2.4 Fail In Place Oil Fill

NOTE: Typically, REXA actuators are filled and are ready to operate. However, some actuators have reduced oil levels to comply with shipping regulations. The below sections only apply to actuators with these regulations.

The internal thermal expansion tank pressure was decreased to 20 psi. This needs to be filled back up to 75 psi using REXA's standard oil, 5W-50 motor oil. If 5W-50 motor oil is not available, other oils of fully synthetic quality may be substituted*. Refer to Section 1.4 for details on recommended fluids. However, using other oils may result in a derating of the actuator low and/or high temp rating. Shipment should be labeled appropriately and include a label and instructions (DOC 133). Refer to the table below and Figure 12 for details:

Oil Grade	Low Temp Limit Derating	High Temp Limit Derating
5W-50	None	None
5W-40	None	170°F (76°C)
10W-30	25°F (-4°C)	135°F (57°C)
15W-40	30°F (-1°C)	170°F (76°C)

**For actuators using specialty oil other than 5W-50 motor oil no substitutes are allowed.*

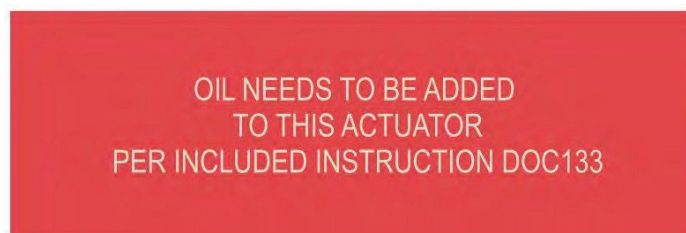


Figure 12

2.4.1 Fail In Place Oil Fill Procedure:

1. Locate and remove the oil fill valve cover highlighted in blue below.



Figure 13

2. Fill the oil gun with the appropriate oil, taking care to pour along the sides of the tube to reduce entrapped air.
 - a. Remove plunger and cap assembly if using the REXA provided S03082.
 - b. Assembly of this kit is required, the P04088 flex hose needs to be threaded into the oil gun.

NOTE: Any oil-gun may be utilized; so long as the tube has a cap that is removable to allow for adding oil.



Figure 14

3. Purge any air out of the oil gun, line and fitting by pumping the handle several times until the lever feels firm.

NOTE: Ensure the Schrader fitting adapter at the end of the oil gun is placed over an oil absorbent mat or container for disposed oil.



Figure 15

4. Pump the handle until clean, air free oil is observed from the Schrader valve fitting.



Figure 16

5. Back out the Schrader valve fitting “T” Handle all the way counterclockwise before attaching to the oil fill valve.



Figure 17

6. Attach the oil gun fitting to the actuator oil fill valve by tightening the swivel nut.
7. Once the connection is secured, the “T” handle may be rotated clockwise no more than 2.5 turns.

CAUTION: Do NOT pump the oil gun with low/no oil as this will introduce air into the system which is detrimental to the performance of the REXA.

NOTE: Do not overfill the thermal expansion chamber. While overfilling will not harm the actuator, overfilling will force oil from the thermal expansion chamber. Overfilling will also cause oil weeping from the overfill protection due to thermal expansion.

*NOTE: Do **NOT** bottom out “T” Handle as damage to the Oil Fill Valve may occur.*

8. Add oil until the thermal expansion chamber gauge reads within 70 psi to 80 psi or within the range specified by labeling.



Figure 18

9. Remove the oil gun fitting from the actuators oil fill valve.
10. Reinstall the oil fill valve cover on the actuator.
11. Drain and store the oil gun in a clean location.

2.5 Thermal Expansion Chamber Purging

NOTE: Typically, REXA actuators are filled and are ready to operate. However, some actuators have reduced oil levels to comply with shipping regulations. The below sections only apply to actuators with these regulations.

NOTE: Be aware of external thermal expansion chambers or additional modules; press evenly on all indicators to check for entrapped air.

NOTE: Some modules will have external thermal expansion chambers attached and the plugged ports may be the highest points.

NOTE: Some actuator orientations will not allow for proper purging and the actuator may need to be removed and re-orientated for purging, then re-installed. The best position for purging is with purge port 1 facing up.



Figure 19: Purge Ports Locator

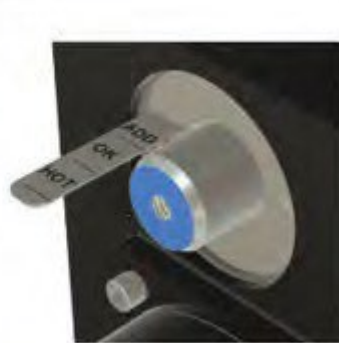


Figure 20: Oil Level Indicator "OK"

1. It is important to first identify if the chamber has entrapped air. This can be done by pressing in on the oil level indicator(s), highlighted in blue. If the indicator does not feel "stiff," there is air in the chamber. See Figure 19 and Figure 20 for details.
2. Depending on the orientation of the actuator the highest purge point on the module must be identified, as any entrapped air will migrate to the highest point. Purge Port 1 and Purge Port 2 in Figure 19 are both at corners of the thermal expansion chamber volume and most likely will be the highest points.
3. Slowly unthread the highest purge point fastener and have an oil catch pan ready. It may not be necessary to fully remove these plugs as air will purge out with a few threads still installed. This should only be done if the port has a plug installed and **NOT** a tube fitting.
4. Retighten the plug before proceeding.
5. Refill to the correct oil level.



2.5.1 Hydraulic System Purging

NOTE: Take off any load or pressure on the cylinder before starting this procedure.

NOTE: Do not let the chamber run dry, or you will need to purge the chamber and start over.

NOTE: To purge the actuator of air, it is recommended that you use the REXA bleed kit. See Figure 21 for details.

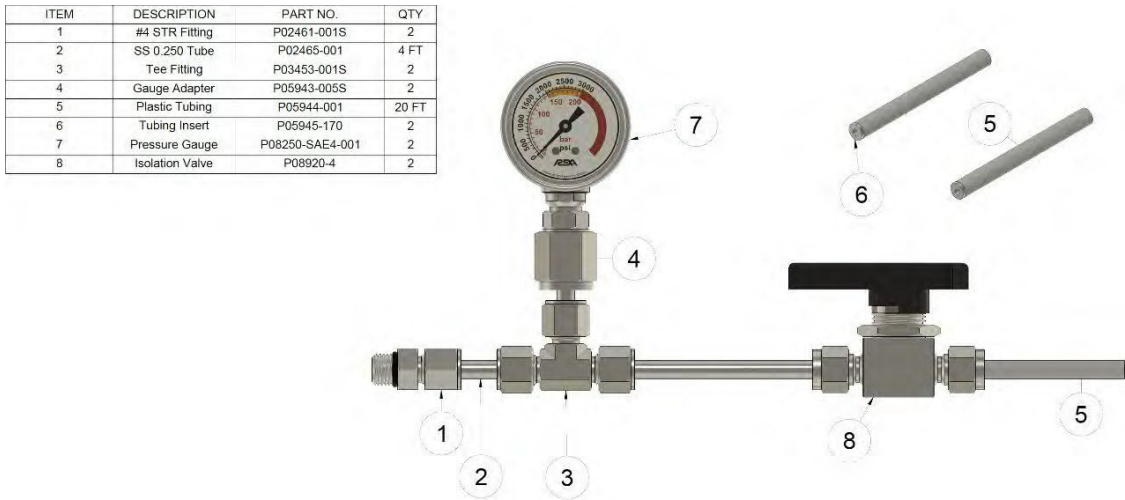


Figure 21: Bleed Kit (PN: K09275)

1. Change the Max Man Spd to 30% or less. Refer to Section 6.1 and Section 6.3 for more details.
2. Open the manual bypass valve to relieve internal pressure. See Figure 22 for details.

NOTE: Some units can have a solenoid instead of a manual bypass; ensure that the solenoid is open before proceeding.

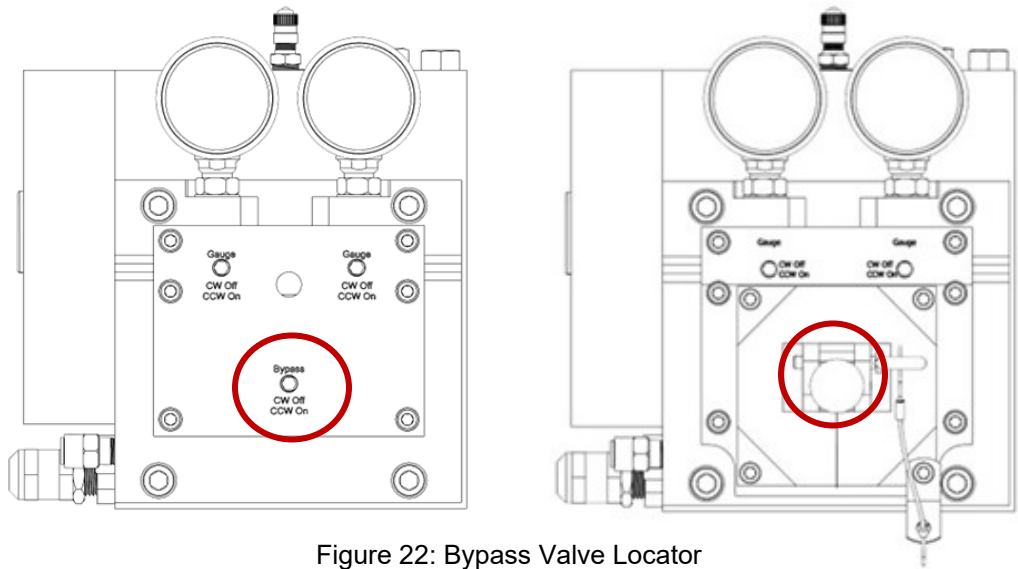


Figure 22: Bypass Valve Locator

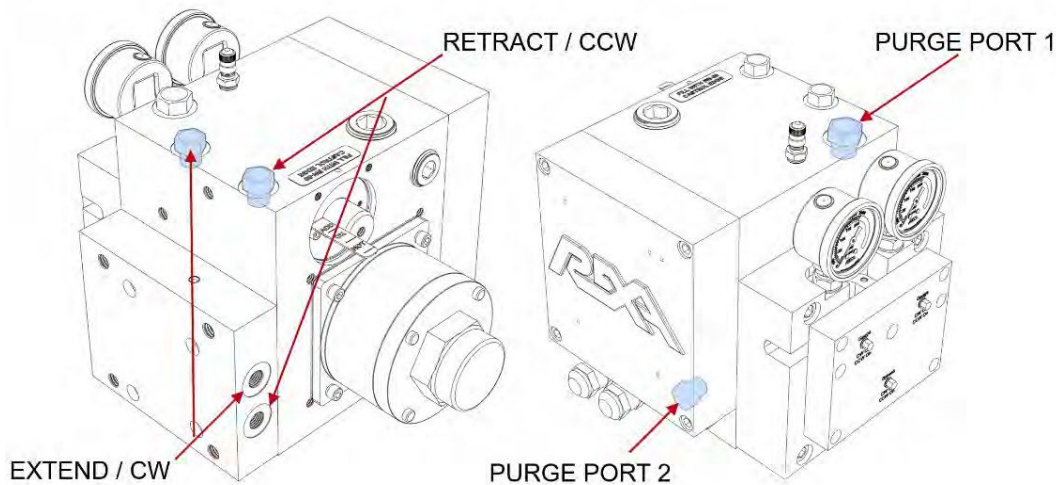


Figure 23: Extend/CW (clockwise) and Retract/CCW (counterclockwise) Ports

3. Locate the best available pressure ports to bleed air from the system. The best position is the highest point that is accessible and will allow air to escape the system. Keep in mind that the porting may be located on the module, cylinder, manual hydraulic pump, or Seat Load Cylinder (SLC), etc.
4. Attach the REXA bleed kit in Figure 21 to the open ports Extend/CW (clockwise) and Retract/CCW (counterclockwise) in Figure 23. Follow the hydraulic lines to differentiate between pressure directions.
5. Run the actuator through its full stroke constantly pumping oil into the thermal expansion chamber. The unit should be cycled until air is no longer visible in the lines.
 - a) Run the module's motor in both directions with both isolation valves, highlighted in blue in Figure 24, open. Run it until there are no more air bubbles seen in the clear return lines.

NOTE: Always maintain the power module thermal expansion chamber level.

- b) Close the isolation valve shown in Figure 24 (Extend or Retract) that corresponds to the port that will move the cylinder away from the closest end stop.

CAUTION: Use EXTREME caution, in the event the following is done mounted to a driven device, damage, death or injury may occur.

- c) Run the module in that direction until the end stop of the cylinder is hit and the pressure relief recirculates the oil (approx. 1800 psi). Continue to run for 3 to 5 seconds until no more air is seen coming from the clear bleed lines.

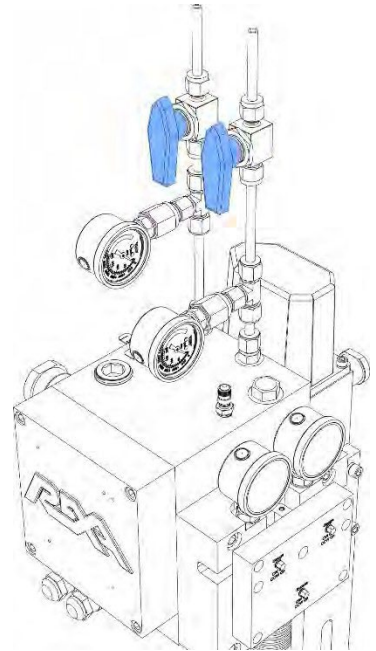


Figure 24: Isolation Valves



- d) Open the isolation valve that is closed and close isolation valve that is open and run the module in the opposite direction until the end stop of the cylinder is hit and the pressure relief opens (approx. 1800 psi). Continue to run for 3 to 5 seconds until no more air is seen coming from the clear bleed lines.
- e) Repeat Step D several times (each direction) until no more air bubbles can be seen purging out of the actuator through the clear bleed lines.
- f) Take off any load or pressure on the cylinder.
- g) Remove the bleed kit and do not allow oil to escape.
- h) Put the SAE plugs back making sure to add oil on the inside of the plugs using the oil bottles provided. Also top off the ports if any oil escaped.
- i) Reinstall the oil fill valve cover.

Electrical Installation

3.0 Electronic Control Enclosure Overview

The electrical installation block diagram, shown in Figure 25 below, gives a general overview of the electronic control enclosure and actuator installation.

NOTE: Not all actuators will have all the options shown in Figure 25.

3.1 Electronic Control Enclosure Installation

The electronic control enclosure must be mounted in a location conducive to its operation. Ideally, it should be mounted in a control room environment.

NOTE: It is necessary to verify the enclosure door is closed tightly and any openings added are sealed to comply with ratings.

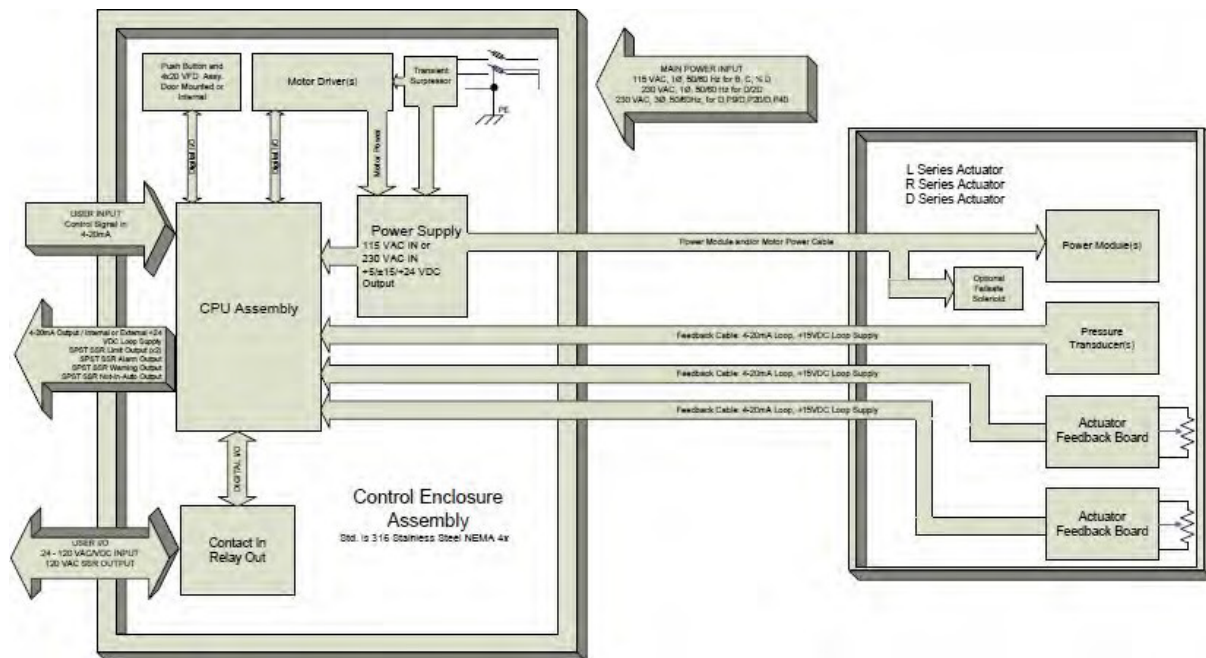


Figure 25: Electrical Installation Block Diagram

3.2 Main Power

The main power requirements for the electronic control enclosure and actuator vary according to model. The main power requirements are given as part of the nameplate information attached to the lower left corner of the electronic control enclosure as shown in Figure 26. If no electronic control enclosure is used, the nameplate will be attached to the backplane on which the electronic control enclosure is mounted.

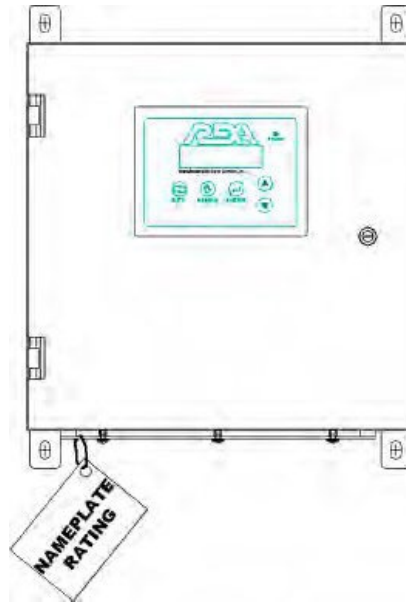


Figure 26: Electronic Control Enclosure

3.3 Supply Disconnect Device

To comply with IEC 61010-1, safety requirements for electrical equipment for measurement, control and laboratory use, a supply disconnect device with the proper rating **MUST** be installed. The supply disconnecting device:

- Shall disconnect (isolate) the electronic control enclosure and actuator from the supply when required.
- Shall be included in the building installation.
- Shall be in close proximity and within easy reach of the electronic control enclosure.
- Shall be marked as the disconnecting device for the equipment.

Refer to the nameplate rating of the electronic control enclosure for proper sizing of the required disconnect device.

NOTE: It is the responsibility of the installer of this equipment to provide a suitable disconnect for the control panel supplying power to this equipment.

This disconnect must:

- Be suitable for the voltage and full load ampere rating of all downstream equipment supplied by the panel.
- The supply disconnecting device shall be one of the following types:

Switch disconnecter with fuses, in accordance with IEC 60947-3, utilization category AC-23B or DC-23B.

- a. As above, except one that has an auxiliary contact that in all cases causes switching devices to break the load circuit before the opening of the main contacts of the disconnecter.
 - b. A circuit breaker suitable as an isolation device per IEC 60947-2.
 - c. Any other switching device in accordance with an IEC product standard that also meets the isolation requirements of IEC 60947-1 and is appropriate for on-load switching of the largest motor or other inductive loads.
- Be approved for use as a disconnect for the country in which this equipment is installed.
 - Be provided with a Lock-Out/ Tag-Out capability in the Off (Down) position.
 - The handle must be red in color to indicate it is suitable as an emergency stop device.

3.4 Grounding

Protective Earth Ground:

A dedicated protective bonding conductor (Protective Earth, PE) must be provided. The conductor must be connected to the terminal labeled PE or . Protective bonding provides protection against electrical shock and provides a path for used energy to leave the electronic control enclosure. A PE ground should be provided at both electronic control enclosure and actuator.

3.4.1 Grounding Symbols

PE	Protective Earthing
	Safety Earth Ground
	Noise Free (EMI) Ground
	Frame/Chassis Ground



3.5 Main Power Supply Wiring

It is the responsibility of the installer of this equipment to supply suitable main power supply wiring. Consult the manufacturer's identification nameplate on the actuator to determine voltage and amperage requirements when determining the wiring size (mm²).

A separate bi-color ground wire that is green in color with a yellow stripe must be run in the hard-pipe conduit along with the supply wiring.

The conduit must be grounded in accordance with the National Electrical Code (NEC) of the country where installed.

The fittings installed where the service wiring enters the body of the panel must not reduce the panel ingress protection rating.

Main power supply wiring must use wire type with a temperature rating $\geq 90^{\circ}\text{C}$.

3.6 Interconnect Cables

It is the responsibility of the installer of this equipment to supply a suitable length of heavy-duty supply cables. It should meet the following requirements:

- The maximum length of the interconnect cables should not exceed the values established by the NEC of the country in which it is installed.
- The outer jacketing of the interconnect cables should be rated for exposure to water, oil, and other similar substances.
- The voltage and ampere rating of this equipment, as noted on the manufacturer's identification nameplate, should be consulted when selecting the proper size (mm²) of the interconnect cables.
- A suitable industrial style attachment plug should be selected for connecting to the branch circuit. As an alternative, the end that terminates at the building supply source may be permanently connected in accordance with local wiring rules.
- The supply cable should be routed to the electronic control enclosure in a manner that does not allow it to be stepped on, pinched, subject to abrasion, excessive bending, become a trip hazard or subject to other abuse.

Refer to REXA interconnect drawings and Technical Product Bulletin #10.0: Interconnect Cables for details on interconnect cable requirements.

3.7 Fuse Identification / Replacement

CSA /General Locations Fuse Replacement / Identification						
REXA Actuator Input Voltage	Phase (~)	REXA Power Module Size	Standard Fuse (A)	Alternate Configuration with 1/3C OAR Fuse (A)	Alternate Configuration with Full D OAR Fuse (A)	Fuse Type
115 VAC	1	B	5	15	N/A	Type CC 600 VAC IR 200kA 10mm x 38mm
		C	10	20	N/A	
		Dual C	15	20	N/A	
		1/2D	10	20	25	
		Dual 1/2D	20	30	30	
230 VAC	1	B	3	8	10	
		C	5	10	12	
		Dual C	8	15	15	
		1/2D	5	10	12	
		Dual 1/2D	10	15	20	
		D	10	15	20	
		Dual D	20	25	30	
	3	D,P9	20	25	25	
		D,P20*	30	N/A	30	
		D,P40	50	N/A	60	Type J 600 VAC IR 200kA 27mm x 60mm
24 VDC	N/A	D,2P40	100	N/A	N/A	Type CC
		1/3C	20	40	N/A	Type J
		Dual 1/3C	40	N/A	N/A	
		C	50	N/A	N/A	

*D,P20 is not CSA certified.

ATEX /IECEX Locations Fuse Replacement / Identification

REXA Actuator Input Voltage	Phase (~)	REXA Power Module Size	Standard Fuse (A)	Alternate Configuration with 1/3C OAR Fuse(A)	Alternate Configuration with Full D OAR Fuse (A)	Fuse Type
115 VAC	1	B	6	12	N/A	Type aM 500V IR 120kA 10mm x 38mm
		C	10	16	N/A	
		Dual C	16	N/A	N/A	
		1/2D	10	20	25	
		Dual 1/2D	20	N/A	N/A	
230 VAC	1	B	4	8	10	
		C	6	10	12	
		Dual C	8	N/A	N/A	
		1/2D	6	10	16	
		Dual 1/2D	10	N/A	20	
		D	10	16	20	
		Dual D	20	N/A	32	
230 VAC	3	D,P9	20	N/A	25	Type aM 690V IR 80kA 22mm x 58mm
		D,P40	50	N/A	N/A	

Power Supply Identification

Power Supply	Fuse Location	Description	Voltage (V)	Amperage (A)	SCI/R (A)	Type	Size
230 V Power Supply	F1	Heater	250	2.0	35	S500	5 × 20mm
	F2	Trip / Fail Solenoid	250	2.0	35	S500	5 × 20mm
	F3	Trip / Fail Solenoid	250	2.0	35	S500	5 × 20mm
	F4	Heater	250	2.0	35	S500	5 × 20mm
	F5	Position Transmitter	250	1/4	35	S506	5 × 20mm
	F8	Line	250	1/4	35	5ST	5 × 20mm
115 V Power Supply	F1	Trip / Fail Solenoid	250	2.0	35	S500	5 × 20mm
	F2	Heater	250	3.15	35	S500	5 × 20mm
	F3	Line	250	1/2	35	S506	5 × 20mm
	F4	Position Transmitter	250	1/2	35	S506	5 × 20mm



3.8 Conduit and Conduit Fittings

- Conduit and conduit fittings suitable for the environment must be used. Failure to do so may cause ingress of contaminants or water into the electronic control enclosure.
- A removable gland plate is provided on the bottom of the electronic control enclosure. The gland plate can be removed to machine the appropriate conduit openings. Be sure to reattach the gland plate securely with its gasket in place.
- Seal all conduit threads with Loctite 567™ or equivalent to prevent ingress of moisture.
- Be sure fittings are tightened securely.
- Must maintain IP66 for steel, IP67 for stainless and 316SS for electronic control enclosures, as well as actuator assembly.
- For applications requiring hazardous and explosion proof systems, conduit and conduit fittings must be properly installed to the appropriate local standards to meet the area classifications:
 - CSA Class I Division 1, Groups C and D; -40C to 60C; T3
 - ATEX II 2G EX db [Ia IIC] IIB T3, -40C≤Tamb≤60C
- Follow appropriate local codes for installation of industrial equipment.



Rotary Mechanical Installation

These instructions apply to any device that may be controlled by the Xpac Series 3.

4.R Pre-Installation Checklist

Before installation of the actuator, check for the following:

- Ensure that the equipment was not damaged during shipping.
- Confirm that the electronic control enclosure and actuator serial number tags match.
- Verify that there is sufficient clearance for installation.
- Ensure that interconnect cables are present and are the proper length.
- Confirm that all the necessary equipment, tools and personnel are present for installation.
- Ensure all hydraulic tube fittings are tight.

NOTE: If your rotary actuator is equipped with an accumulator fail-safe option refer to Technical Product Bulletin #17.1: Accumulator Fail-Safe Option. If your rotary actuator is equipped with a spring fail-safe option refer to Technical Product Bulletin #17.2: Spring Fail-Safe Option.

4.R.1. Rotary Actuator Mounting (Fail in Place)

This operation requires the unit to be in the closed position. Refer to Technical Product Bulletins #16.1, #16.2, #16.3 and #16.4 for manual operator information, if equipped. If the unit is not supplied with a manual operator, it must be connected to the electronic control enclosure and driven to the closed position, in Manual Mode. Refer to Manual Mode in Section 6.

- a. With the actuator separated from its mounting, rotate the driven device to the closed position.

NOTE: Be aware that not all bolt patterns are square; refer to layout drawing for reference.

- b. Place the mounting bracket on the driven device.
- c. Hand tighten fasteners.
- d. Install the shaft coupling if applicable. Confirm the correct position of the shaft key on both actuator and driven device.

NOTE: Be sure to use anti-seize compounds on mating surfaces.

- e. Carefully install actuator to the assembly; hand tighten fasteners.

NOTE: If a discrepancy exists between mating connections, check orientation of assembly components.

- f. Check alignment of assembly. Ensure that the actuator face and mounting bracket are parallel, with no gaps.
- g. Tighten fasteners in a star pattern.

4.R.2 Rotary Actuator Mounting (Spring Fail-Safe)

The rotary spring fail-safe option is a bolt on addition to the Xpac Series 3 rotary actuator. The unit may rotate in either a clockwise or counterclockwise direction upon power loss or trip. A solenoid valve is internal or external to the power module, depending on the configuration, and wired to the input power and/or trip signal. Please refer to Technical Product Bulletin #17.2: Spring Fail-Safe Option, for additional information.

If the unit has an internal solenoid valve it will have the toggle lever shown in Figure 27A. Toggling this lever will override the function of the solenoid. If the unit has no power and you need to use a manual operator, the lever must be in the solenoid override position as shown in Figure 27B.

CAUTION: Make sure the toggle lever is returned to its normal position when solenoid power is returned, or the spring fail-safe function will not operate.

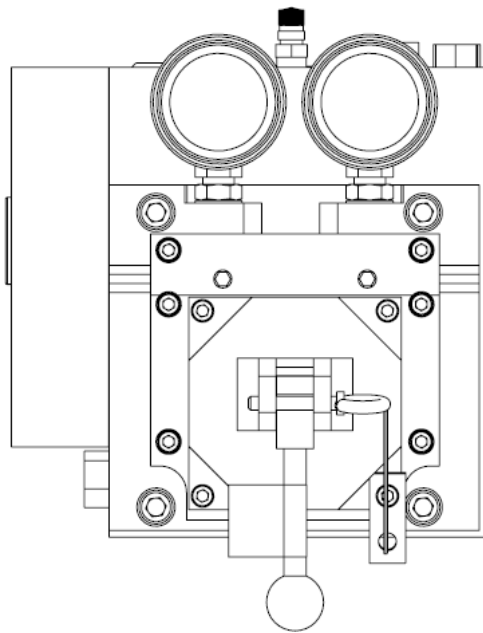


Figure 27A: Internal Solenoid

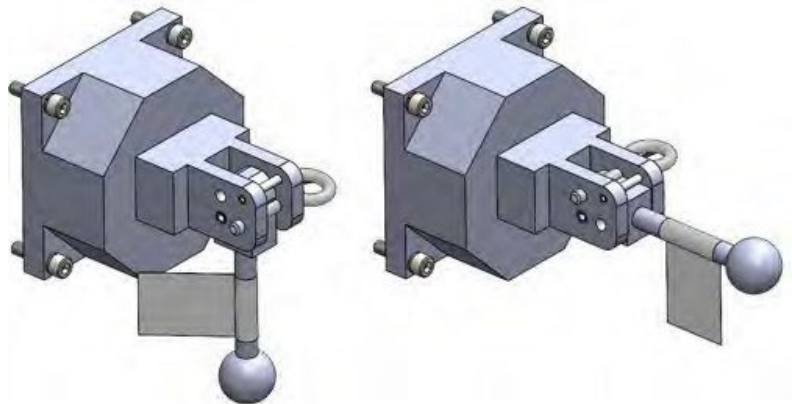


Figure 27B: Internal Solenoid Normal Operation (Left) vs Override Position (Right)

The spring package will be pre-loaded (compressed) to a specified torque as indicated on the order.

CAUTION: REXA actuators, denoted by an E, R or U in the model number, contain a spring under tension.

- a. With the actuator separated from its mounting, rotate the driven device to the fail-safe position.

NOTE: Be aware that not all bolt patterns are square; refer to layout drawing for reference.

- b. Place the mounting bracket on the driven device.
- c. Hand tighten fasteners.
- d. Install the shaft coupling if applicable. Confirm the correct position of the shaft key on both actuator and driven device.



NOTE: Be sure to use anti-seize compound on mating surfaces.

- e. Carefully install actuator to the assembly; hand tighten fasteners.

NOTE: If a discrepancy exists between mating connections, check orientation of assembly components.

- f. Check alignment of assembly. Ensure that the actuator face and mounting bracket are parallel, with no gaps.
- g. Tighten fasteners in a star pattern.

4.R.3 Rotary Actuator Mounting Accumulator Fail-Safe

Fail-safe operation uses a piston type accumulator with nitrogen gas on one side of the piston and oil on the other. The accumulator is sized to provide full rated output at end of stroke during fail-safe.

The following operation requires the unit to be in the closed position. If the unit is not supplied with a manual operator, the unit must be connected to the electronic control enclosure and driven to the closed position, in Manual Mode. Refer to Manual Mode in Section 6.

- a. With the actuator separated from its mounting, rotate the driven device to the closed position.

NOTE: Be aware that not all bolt patterns are square; refer to layout drawing for reference.

- b. Place the mounting bracket on the driven device.
- c. Hand tighten fasteners.
- d. Install the shaft coupling if applicable. Confirm the correct position of the shaft key on both actuator and driven device.

NOTE: Be sure to use an anti-seize compound on mating surfaces.

- e. Carefully install actuator to the assembly; hand tighten fasteners.

NOTE: If a discrepancy exists between mating connections, check orientation of assembly components.

- f. Check alignment of assembly. Ensure that the actuator face and mounting bracket are parallel, with no gaps.
- g. Tighten fasteners in a star pattern.



Linear Mechanical Installation

These instructions apply to any device that may be controlled by the Xpac Series 3.

4.L Pre-Installation Checklist

Before installation of the actuator, check for the following:

- Ensure that the equipment was not damaged during shipping.
- Confirm that the electronic control enclosure and actuator serial number tags match.
- Verify that there is sufficient clearance for installation.
- Ensure that interconnect cables are present and are the proper length.
- Confirm that all the necessary equipment, tools and personnel are present for installation.
- Ensure all hydraulic tube fittings are tight.

NOTE: If your linear actuator is equipped with an accumulator fail-safe option refer to Technical Product Bulletin #17.1: Accumulator Fail-Safe Option. If your linear actuator is equipped with a spring fail-safe option refer to Technical Product Bulletin #17.2: Spring Fail-Safe Option.

4.L.1 Linear Actuator Mounting (Fail in Place)

Linear actuators are usually shipped in the retracted position. Refer to Technical Product Bulletin #18.0 for information on Stem Connection and Seat Loading Methods.

CAUTION: When mounting linear actuators, take care to avoid mechanical misalignment that would cause side-load to the actuator output shaft. Be sure that the driven device is straight and true. Severe side-load will cause excessive wear to both the actuator and driven device.

- a. With the actuator separated from its mounting, move the driven device to the retracted position.
- b. Retract the actuator output shaft to a position that will allow mounting the actuator without contacting the valve stem. If a manual operator is not available, the unit must be connected to the electronic control enclosure and driven to the retracted position in Manual Mode. Refer to Manual Mode in Section 6.
- c. Place the actuator onto the driven device's mating surface and loosely install the mounting hardware.

NOTE: Loose set up allows for float and self-alignment.

- d. Extend the actuator output shaft until the coupling contacts the valve stem.
- e. Connect the actuator stem to the driven device.
- f. If the actuator is installed in a vertical position, manually stroke it to allow the stem connection to self-align.
- g. Securely tighten the mounting connection. Visually inspect the stem for any noticeable indication of bending. For all other orientations, support the actuator in a manner that prevents any noticeable indication of stem bending. Manually stroke the actuator and carefully observe the stem for any evidence of lateral (side-to-side) misalignment.

- h. For verification, once the mounting hardware is tight and the actuator is installed, decouple the actuator output shaft. If any movement of the actuator output shaft can be seen during the process, loosen the mounting hardware, realign the actuator, and repeat steps f, g, and h.

4.L.2 Linear Actuator Mounting (Spring Fail-Safe)

The spring fail-safe option for linear actuators consists of a spring mounted underneath the hydraulic cylinder and a normally de-energized solenoid valve that is internal or external to the power module and wired to the input power and/or trip signal. The spring can be specified to extend or retract the stem upon power loss.

If the unit has an internal solenoid valve it will have the toggle lever shown in Figure 28A. Toggling this lever will override the function of the solenoid. If the unit has no power and you need to use a manual operator, the lever must be in the solenoid override position as shown in Figure 28B.

CAUTION: Make sure the toggle lever is returned to its normal position when solenoid power is returned, or the spring fail-safe function will not operate.

CAUTION: REXA actuators denoted by an E, R or U in the model number, contain a spring under tension.

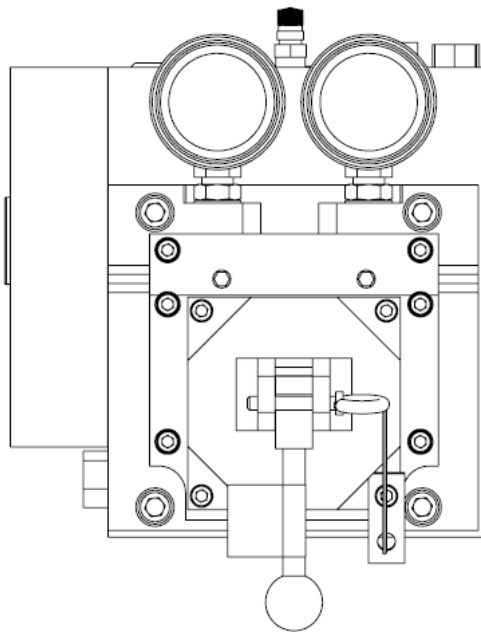


Figure 28A: Internal Solenoid

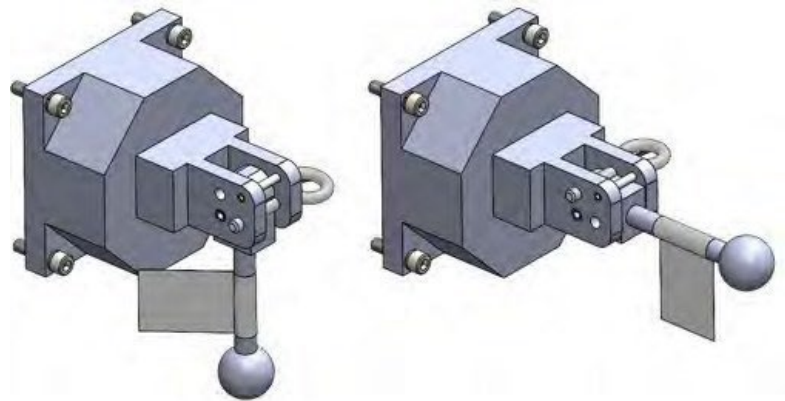


Figure 28B: Internal Solenoid Normal Operation (Left) vs Override Position (Right)



4.L.3 Linear Actuator Mounting Accumulator

Fail-safe operation uses a piston type accumulator with nitrogen gas on one side of the piston and oil on the other. The accumulator is sized to provide full rated output at end of stroke during fail-safe.

CAUTION: When mounting linear actuators, take care to avoid mechanical misalignment that would cause side-load to the actuator output shaft. Be sure that the driven device is straight and true. Severe side-load will cause excessive wear to both the actuator and driven device.

- a. With the actuator separated from its mounting, stroke the driven device to the retracted position.
- b. Retract the actuator output shaft to a position that will allow mounting the actuator without contacting the valve stem. If a manual operator is not available, the unit must be connected to the electronic control enclosure and driven to the closed position in MANUAL mode. Refer to Manual Mode in Section 6.
- c. Place the actuator onto the driven device's mating surface and loosely install the mounting hardware.

NOTE: Loose set up allows for float and self-alignment.

- d. Extend the actuator output shaft until the coupling contacts the valve stem.
- e. Thread the driven device stem into the coupling for a distance of at least one and a half times the stem diameter and use a lock nut against the coupling to prevent the stem from rotating out.
- f. If the actuator is installed in a vertical position, manually stroke it to allow the stem connection to self-align.
- g. Securely tighten the mounting connection. Visually inspect the stem for any noticeable indication of bending. For all other orientations, support the actuator in a manner that prevents any noticeable indication of stem bending. Manually stroke the actuator and carefully observe the stem for any evidence of lateral (side to side) misalignment.
- h. For verification, once the mounting hardware is tight and the actuator is installed, decouple the actuator output shaft. If any movement of the actuator output shaft can be seen during the process, loosen the mounting hardware, realign the actuator, and repeat steps f, g, and h.



Drive Mechanical Installation

These instructions apply to any device that may be controlled by the Xpac Series 3.

4.D Pre-Installation Checklist

Before installation of the actuator, check for the following:

- Ensure that the equipment was not damaged during shipping.
- Confirm that the electronic control enclosure and actuator serial number tags match.
- Verify that there is sufficient clearance for installation.
- Ensure that interconnect cables are present and are the proper length.
- Confirm that all the necessary equipment, tools and personnel are present for installation.
- Ensure all hydraulic tube fittings are tight.

4.D.1 Drive Series

By the addition of a rugged L-shaped mounting base, a lateral load bushing and a lever arm, the rotary actuator series becomes a damper drive. Applications requiring long strokes or non-axial loaded rotary motion are effectively solved by this unit.

4.D.2 Drive Mounting

The base of a REXA Drive contains a four-hole mounting pattern. These holes have been sized to accept the appropriate diameter bolt for the imposed load. The Drive Base Bolting table lists the base hole, minimum bolt diameter, and recommended bolt torques. Standard bolting or threaded studs are acceptable, but material strength must be SAE Grade 8. Hardened load washers and lock washers must be used.

Drive Base Bolting				
Model	Hole Diameter	Min. Bolt Diameter	Recommended Bolt Torque	
			Minimum	Max
D2 500/ 5 000	.56"	1/2"	20 ft-lbs.	30 ft-lbs.
D10 000/ 20 000	.81"	3/4"	200 ft-lbs.	250 ft-lbs.
D50 000/ 100 000	1.00"	1"	650 ft-lbs.	700 ft-lbs.
D200 000	1.3"	1 1/4"	1300 ft-lbs.	1400 ft-lbs.

NOTE: Bolting to be SAE Grade 8.



Start-Up Considerations

5.0 Start-Up Checklist

At this time the actuator and the electronic control enclosure should be installed. The following should be considered before applying power and calibrating the actuator.

5.0.1 Inspection of Electronic Control Enclosure:

- Inspect incoming voltage connection.
- Test for correct incoming voltage.
- Ensure control signal and outgoing signal (I/O) connections are secure.
- Confirm interconnection cable wiring is correct at electronic control enclosure, actuator junction boxes and terminal blocks.
- Verify feedback cables are connected and shielded properly at actuator/electronic control enclosure.
- Confirm all ground wires are secured.
- Confirm all electrical connections are tightened properly.
- Ensure conduit connections are secure and watertight with thread sealant.
- Clear the electronic control enclosure of tools and debris.
- Notify proper personnel for lock out/ tag out procedures.

5.0.2 Inspection of Actuator:

- Inspect oil level.
- Confirm motor and feedback wires are connected properly and securely.
- Confirm actuator mounting fasteners are tight.
- Ensure coupling/split clamp installed properly.
- Ensure all conduit connections are secure and watertight with thread sealant.
- Clear all tools and equipment of operating area.
- Confirm safety related covers and labels are installed and clearly marked.
- Notify proper personnel for lock-out/tag-out procedures.

NOTE: Refer to the certified electronic control enclosure and actuator drawings included with each system for specific connection details.

5.1 Terminal Blocks – Low Power

Connection Description: CPU connections/ Resolver/ Solenoids/ Heater/ Stepper Motor Power. IS box torques correspond with low power terminal block torques. See Figure 29A for details.

Physical:

- Single level, feed-thru connector
- Operating Temperature: -40°F to 221°F (-40°C to 105°C)
- Insulating Material: PA (polyamide)
- Inflammability Rating: UL94V0
- Color 1: Gray (standard terminal)
- Color 2: Green/Yellow (ground terminal)



Figure 29A: Mini Low Power Terminal Block

Connections:

- Screw Thread: M3
- Wire Range: 26 to 10 AWG (0.14mm² to 6.0mm²)
- Tightening Torque: 5.31 in-lbs. to 7.08 in-lbs. (0.6Nm to 0.8Nm)
- Stripping Length: 0.35" (9mm)

Electrical:

- Voltage Rating: 600V
- Current Rating: 30A

Connection Description: Solenoids/ Heater/ Stepper Motor Power. See Figure 29B for details.

Physical:

- Single level, feed-thru connector
- Operating Temperature: -40°F to 221°F (-40°C to 105°C)
- Insulating Material: PA (polyamide)
- Inflammability Rating: UL94V0
- Color 1: Gray (standard terminal)
- Color 2: Green/Yellow (ground terminal)



Figure 29B: Standard Low Power Terminal Block

Connections:

- Screw Thread: M3
- Wire Range: 26 to 10 AWG (0.14mm² to 6.0mm²)
- Tightening Torque: 5.31 in-lbs. to 7.08 in-lbs. (0.6Nm to 0.8Nm)
- Stripping Length: 0.35" (9mm)

Electrical:

- Voltage Rating: 600V
- Current Rating: 30A

5.2 Terminal Blocks - Medium Power

Connection Description: Servo Motor and P9, P20 Booster Motor Power. IS box torques correspond with low power terminal block torques. Refer to "Connections" in Section 5.1 Terminal Blocks – Low Power. See Figure 30A for details.

Physical:

- Single level, feed-thru connector
- Operating Temperature: -40°F to 221°F (-40°C to 105°C)
- Insulating Material: PA (polyamide)
- Inflammability Rating: UL94V0
- Color 1: Gray (standard terminal)
- Color 2: Blue (neutral terminal)
- Color 3: Green/Yellow (ground terminal)



Figure 30A: Medium Power Terminal Block

Connections:

- Screw Thread: M4
- Wire Range: 24 to 8 AWG (0.2mm² to 10.0mm²)
- Tightening Torque: 13.27 in-lbs. to 15.93 in-lbs. (1.5Nm to 1.8Nm)
- Stripping Length: 0.39" (10mm)

Electrical:

- Voltage Rating: 600V
- Current Rating: 50A

Connection Description: Standard Main Power input. See Figure 30B for details.

Physical:

- Single level, feed-thru connector
- Operating Temperature: -40°F to 221°F (-40°C to 105°C)
- Insulating Material: PA (polyamide)
- Inflammability Rating: UL94V0
- Color 1: Gray (standard terminal)
- Color 2: Blue (neutral terminal)
- Color 3: Green/Yellow (ground terminal)



Figure 30B: Standard Main Power Terminal Block

Connections:

- Screw Thread: M4
- Wire Range: 20 to 6 AWG (0.5mm² to 10.0mm²)
- Tightening Torque: 13.28 in-lbs. to 15.93 in-lbs. (1.5Nm to 1.8Nm)
- Stripping Length: 0.39" (10mm)

Electrical:

- Voltage Rating: 600V
- Current Rating: 65A

5.3 High Power Terminal Block

Connection Description: High Power Main Input & P40 Booster Motor Power. IS box torques correspond with low power terminal block torques. Refer to "Connections" in Section 5.1 Terminal Blocks – Low Power. See Figure 31 for details.

Physical:

- Single level, feed-thru connector
- Operating Temperature: -40°F to 221°F (-40°C to 105°C)
- Insulating Material: PA (polyamide)
- Inflammability Rating: UL94V0
- Color 1: Gray (standard terminal)
- Color 2: Green/Yellow (ground terminal)

Connections:

- Screw Thread: M6
- Wire Range: 18 to 1/0 AWG (0.75mm² to 50.0mm²)
- Tightening Torque: 28.32 in-lbs. to 33.63 in-lbs. (3.2Nm to 3.7Nm)
- Stripping Length: 0.63" (16mm)

Electrical:

- Voltage Rating: 600V
- Current Rating: 150A



Figure 31: High Power Terminal Block

5.4 Initial Calibration

NOTE: Refer to Section 5.6, Rotary and Drive Spring Stops, and Section 5.7, Cylinder End Stops, prior to calibrating rotary or drive units with spring or accumulator fail-safe option. See Figure 32 for details.

1. Apply incoming power.
Line 2 will display the **CALIBRATE** menu header.
2. If not already in **CALIBRATE**, simultaneously press **AUTO** and **MANUAL** keys for 5 seconds.
3. Scroll down to **Position Lo** with the down arrow key.
4. Press the **ENTER** key. = will begin to flash. The value will change to current actuator position.
5. Move the actuator to the position that corresponds to 4.0 mA.

Refer to Technical Product Bulletin #18.0, Stem Connection and Seat Loading Methods.

6. Press the **ENTER** key to lock in that value.

CAUTION: The end point should not be set against a mechanical stop on linear actuators without an elastic coupling or damage will occur.

*NOTE: If the actuator is stroked beyond the factory set cylinder limit, the display will show **CylEnd** while the down key is held. If the enter key is pressed, the display will show **TooLow**. **Position Lo** needs to be set higher to make this warning go away.*

7. Scroll down to **Position Hi** with the down arrow key.
8. Press the **ENTER** key. = will begin to flash. The value will change to current actuator position.
9. Move the actuator to the position that corresponds to 20.0 mA.
10. Press the **ENTER** key to lock in that value.

CAUTION: The end point should not be set against a mechanical stop on linear actuators without an elastic coupling or damage will occur.

*NOTE: If the actuator is stroked beyond the factory set cylinder limit, the display will show **CylEnd** while the up key is held. If the **ENTER** key is pressed, the display will show **TooHi**. **Position Hi** needs to be set lower to make this warning go away.*

11. Scroll down to **Signal Lo** with the down arrow key.
12. Press the **ENTER** key. = will begin to flash.
13. Apply the actual 4.0 mA control signal from the Distributed Control System (DCS). The value in the display will change; showing what is being read from the DCS.
14. Press the **ENTER** key to lock in that value.
15. Scroll down to **Signal Hi** with the down arrow key.
16. Press the **ENTER** key. = will begin to flash.



Figure 32: Initial Calibration

17. Apply the actual 20.0 mA control signal from the Distributed Control System (DCS). The value in the display will change; showing what is being read from the DCS.
18. Press the **ENTER** key to lock in that value.
19. Scroll down to **TIME** with the down arrow key.
20. Press the **ENTER** key. = will begin to flash. Change current hours, minutes, and seconds using the up or down arrow key. Press the **ENTER** key to advance between hours, minutes, and seconds.
21. Press the **ENTER** key to lock in each value.
22. Scroll down to **DATE** with the down arrow key.
23. Press the **ENTER** key. = will begin to flash. Change current year, month, and day using the up or down arrow key. Press the **ENTER** key to advance between year, month, and day.
24. Press the **ENTER** key to lock in each value.

The actuator is now calibrated. It is recommended at this point that all **Current Status** be reset to 0. Refer to **Current Status** menu section for procedure.

CAUTION: Unit may move as soon as placed in Auto Mode.

To enter the **Auto** mode:

25. Simultaneously press **AUTO** and **ENTER** keys. Line 1 of the display will change to **Auto** followed by the **Current Status**. See Figure 33 for details.
26. When the keys are released Line 2 will display the current position.



Figure 33: Auto Mode

5.5 Rotary and Drive Spring Stops

Spring stops provide the actuator the means to prevent over-travel during a fail-safe condition. If the driven device does not limit over-rotation or over-travel, spring stops can be utilized. Turning the spring stop adjustment screw in or out will modify the actuator's final fail-safe position. See Figure 34 for details.

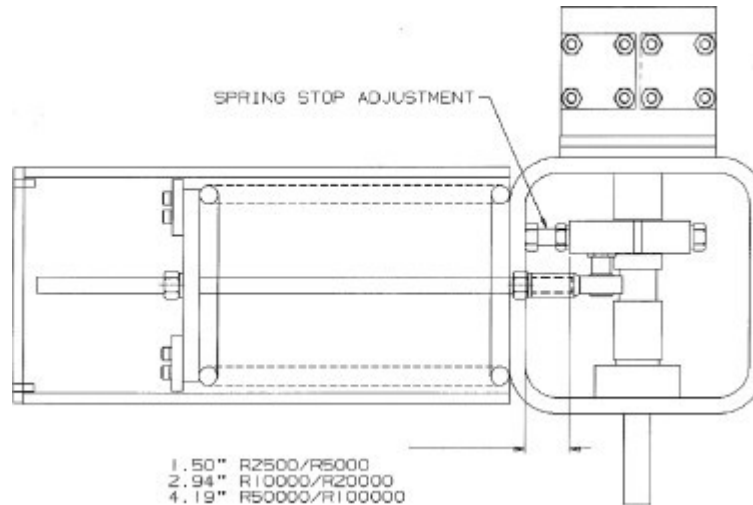


Figure 34: Spring Stop

5.6 Actuator Stroke Adjustment

Actuator stroke adjusters prevent the actuator from over-traveling during a fail-safe condition. If the driven device does not limit over-rotation or over-travel, stroke adjusters can be utilized for this purpose. These stroke adjusters can reduce cylinder rotation by 0° to 5°. See Figure 35 for details.

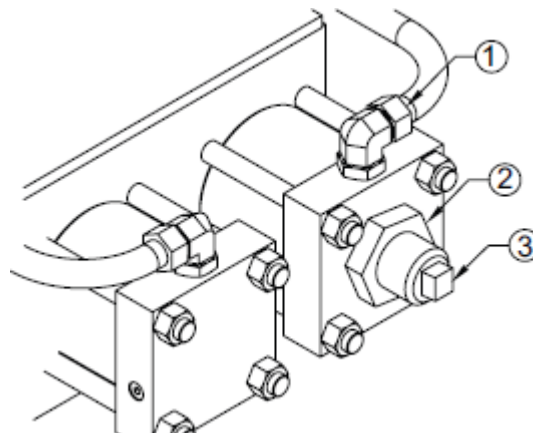


Figure 35: Stroke Adjustment

CAUTION: Ensure that there is no hydraulic pressure in the system prior to opening any hydraulic lines. All pressure gauges should read 0 psi/bar.

5.6.1 Stroke Adjustment

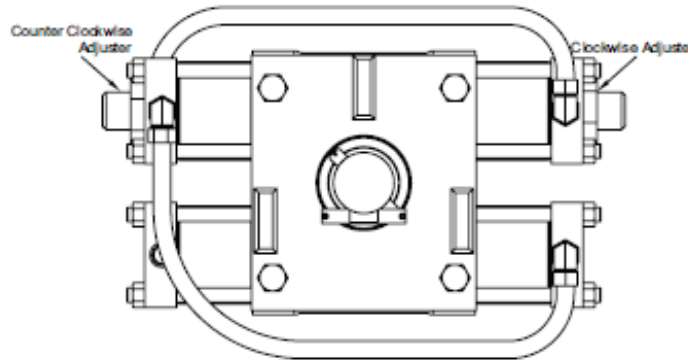


Figure 36A: Stroke Adjusters

WARNING: The calibrated end points **Position Lo** and **Position Hi** must **NOT** be set with the actuator against the actuator stroke adjuster.

1. Position the actuator in the desired final fail-safe position slightly beyond the calibrated stroke adjuster. This can be done when calibrating **Position Lo** and **Position Hi**. See Figure 36A for details.

NOTE: Failure to follow this step may cause the electronic control enclosure to drive the actuator beyond its physical limit and stall the actuator.

2. Turn off the power breaker in the electronic control enclosure.
3. Locate the correct stroke adjuster. See Figure 36A for details.
4. Locate the hydraulic fitting (1) connected directly to the stroke adjuster cylinder cap as shown in Figure 35. Loosen this fitting to allow oil to escape during this adjustment process. Ensure to capture any oil that escapes.

NOTE: For R200,000 and up, skip to Step 8.

5. Loosen the jam nut (2), shown in Figure 35, by turning counterclockwise. Back off this jam nut 4 to 5 turns and move the countersunk washer away from the thread seal and against the repositioned jam nut.
6. Using light oil and a small brush or squirt can, generously lubricate the thread seal rubber and the threads of the adjustment screw.
7. Carefully pry the thread seal washer away from the end cap and then pull and twist it back and forth to carefully slide it along the adjustment screw threads to gain adjustment clearance.
8. The actuator stroke adjustment can now be made using the threaded adjustment rod (3), shown in Figure 35.

WARNING: As the stroke adjusters are turned in, displaced fluid will purge from the system. Failure to purge fluid will damage internal components of the actuator.

9. The actuator is shipped from the factory with the adjustment rod (3) extended out to the end of travel to give the maximum rotation of the actuator. The adjustment screw can only be rotated clockwise (inward) from this shipped position. Doing so will restrict rotation of the actuator.

CAUTION: A mechanical lock at the end of the threads restricts inadvertent disassembly outward. Rotating the adjustment screw counterclockwise (outward) from this end position may cause damage to the hardware.

10. Rotate clockwise to decrease the stroke of the actuator. Each stroke adjuster provides a minimum of 5° of actuator rotation adjustment.

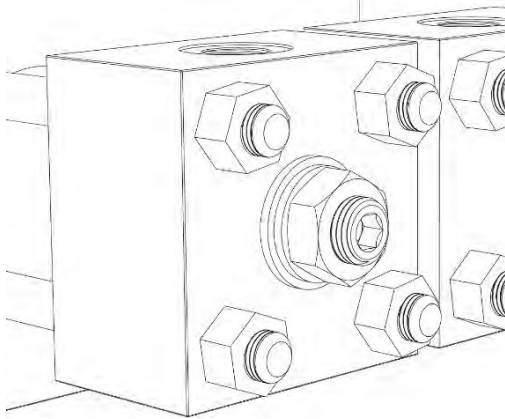


Figure 36B: 20,000 in-lbs. and Lower Stroke Adjuster

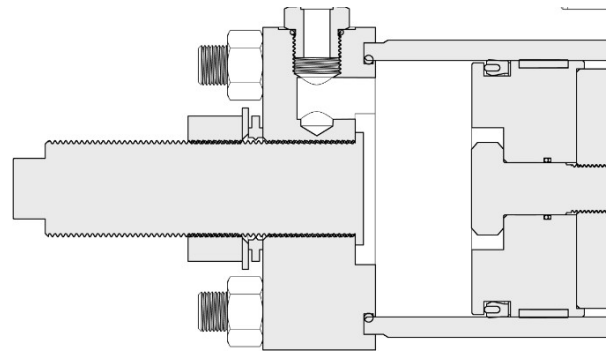


Figure 36C: 50,000 in-lbs. and Up Stroke Adjuster

11. The number of adjustment screw rotations needed to achieve the 5° rotational adjustment of the actuator depends on the size (model) of the actuator and the pitch of the adjustment thread on the adjustment screw. The Stroke Adjuster table shows this relationship.

NOTE: For R200,000 and up, skip to Step 14.

12. After final positioning of the adjustment screw to achieve the desired actuator rotation, readjust the position of the thread seal along the adjustment screw threads to contact the end cap.

CAUTION: use generous lubrication during this step to assure no damage to the rubber seal by the threads.

13. Reposition the countersunk washer and the jam nut and torque the jam nut to the requirements of the table.
14. Tighten the hydraulic fitting that was loosened in step 4.

Stroke Adjuster				
Model	R2,500/R5,000	R10,000/R20,000	R50,000/R100,000	R200,000/R400,000
One Turn Adjustment (degrees)	3.3	2.0	2.0	1.2
Jam Nut Final Torque (ft-lbs.)	50	150	300	375
Adjuster Wrench Size & Type	Allen Wrench	Allen Wrench	1" Standard Wrench	1.5" Standard Wrench

5.6.2 R200,000/R400,000 Actuator Stroke Adjustments

R200 000/R400 000 actuators do not use an external thread seal arrangement. The seal is contained internally while the jam nut and adjustment screw drive are located externally. Refer to Figure 37 below for details. An external drive square is provided on the adjustment screw end and can be driven by using a standard wrench. No special lubrication of the threads is needed during adjustment.

The unit is shipped from the factory with the stroke adjuster positioned at the full outward position as described above. Adjustment is made by disconnecting the hydraulic line to vent out any displaced fluid, loosening the jam nut several turns counterclockwise and then using the square drive to position the adjuster to provide the desired actuator stop position. The total adjustment range is 5° minimum. The stroke adjuster table shows the adjustment achieved from one turn of the adjuster.

The jam nut is repositioned after adjustment is complete and torqued to the final tightness value specified in the table above.

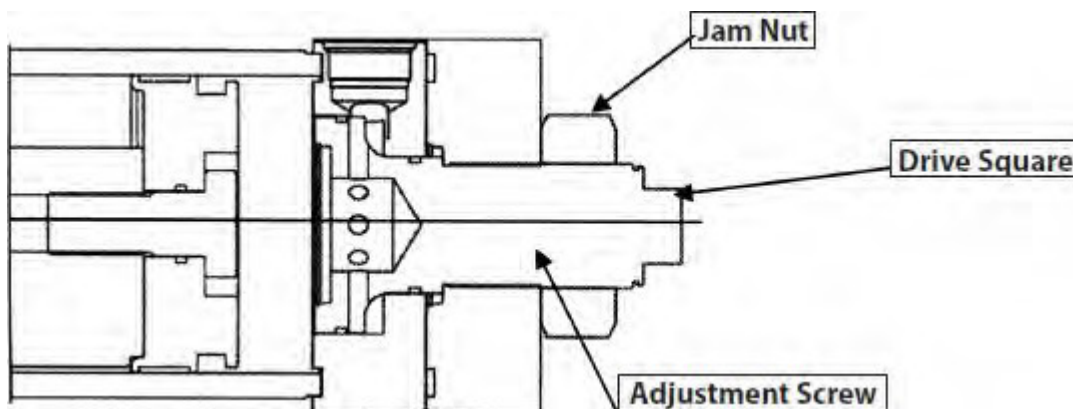


Figure 37: R200 000/R400 000 Stroke Adjuster

Modes of Operation and Control Parameters

6.0 User Interface & Modes of Operation

The user interface is a four-line display with a five-button keypad. The display dims after five minutes without keypad usage. After ten minutes, the display turns off completely. Pressing any of the five keys will wake up the display. A single key press will not affect this process. Refer to Figure 38.

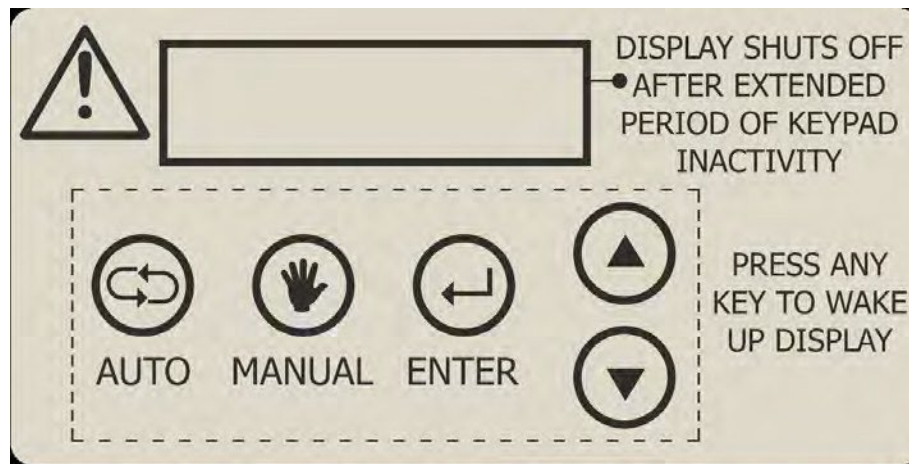


Figure 38: Display Label Inside Flip Cover

The REXA electronic control enclosure has three different operating modes:

- Setup – Calibration Mode
- Auto – Remote Mode
- Local Man – Local Mode

Enter each operating mode as shown below in Figure 39:



Figure 39: Modes of Operation

6.1 Setup Mode Control Parameters

6.1.1 Setup Mode

Setup mode is used to set the control and calibration parameters of the actuator. Most control parameters are factory set and provide excellent actuator performance. Some applications may require fine tuning.

The eight main menus and accompanying control parameters are covered in the following sections. Refer to Figure 40 to access **Setup** mode and change the parameters.

Setup mode can be password protected. The default password value is 00000. This indicates that no password is set. If any other value is set, the user will be prompted to enter the password to access the **Setup** mode.



Figure 40: Setup Mode Display

6.1.2 Menu Navigation

To enter **Setup** mode, simultaneously press and hold the **AUTO** and **MANUAL** keys for 5 seconds. See Figure 40 for details.

*NOTE: While in **Setup** mode the actuator will not follow a control signal.*

The menu tree of the control parameters can be found in the tables on the following pages.

Pressing **ENTER** will scroll left to right from **CALIBRATE** through **HISTORIC STATS** and then repeat in a circular path.

Pressing the up or down arrow key will scroll up and down each menu column.

6.1.3 Changing a Parameter

To access and change a parameter value, the parameter must be visible on the display (i.e. **Position Lo**).

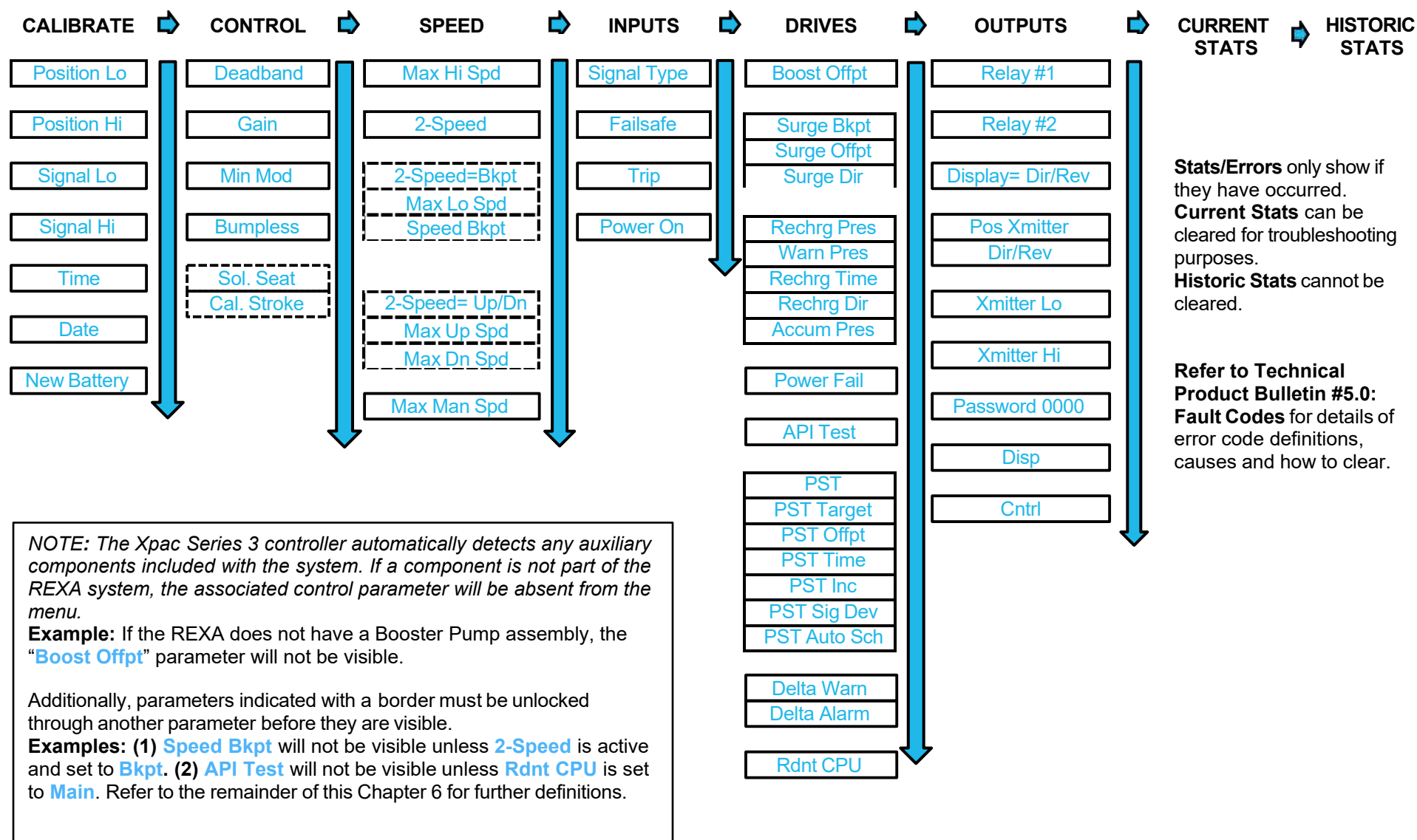
Pressing the **ENTER** key will cause the equal sign to flash. This symbolizes that the system is ready for the user to input a change in value.

Pressing the up or down arrow keys will change the parameter value.

To enter and accept the newly selected value, press the **ENTER** key. The equal sign will stop flashing.



Menu- Xpac Actuator



6.2 CALIBRATE Menu

The **CALIBRATE** menu consists of the following parameters:

Position Lo defines the actuator position corresponding to the Signal Lo setting. If the Signal Type is set to Contact Input, Position Lo defines the actuator position corresponding to the closed input.

Position Hi defines the actuator position corresponding to the Signal Hi setting. If the Signal Type is set to Contact Input, Position Hi defines the actuator position corresponding to open input.

*NOTE: The actuator will move when changing **Position Lo** and **Position Hi**. The total span between each parameter must be greater than 10%.*

Signal Lo is the analog signal input at 4 mA that corresponds to **Position Lo**.

Signal Hi is the analog input signal at 20 mA that corresponds to **Position Hi**.

Range: **0.0** to **25.0** mA

*NOTE: **Signal Lo** and **Signal Hi** are only visible if **Signal Type** is set to **Analog**. These parameters cannot be set by pressing the arrows. An active 4-20 mA must be applied. The actual signal in milliamps will display.*

*NOTE: **Unknwn** will appear if a control signal failure occurs while calibrating. **Error** appears briefly if an unacceptable value is entered. The unacceptable value is rejected, and previous value is retained. Input signal must be greater than 2.5 mA if fail-safe does not equal Off. If fail-safe does equal off, Input signal can be less than 2.5 mA. The span from Signal Lo to Signal Hi must be greater than 3.8 mA regardless of the fail-safe setting.*

Time: HH/MM/SS sets local time

Date: MM/DD/YY sets local date

New Battery is a prompt to inform the user that the lithium-ion clock battery, used to maintain time and date, has expired. Changing the parameter to **Yes** will reset the battery life timer and clear the display warning.

6.2.1 CONTROL Menu

The CONTROL menu consists of the following parameters:

Deadband sets the maximum deviation allowed between the input signal and actuator position before a corrective movement is made.

Range: **0.05%** to **5.00%** of calibrated stroke/rotation

Deadband should be set to a value appropriate for the process being controlled. Ensure that the actuator is reacting to actual signal changes as required and not just reacting to noise in the control signal itself.

Gain determines how motor speed is adjusted as the actuator approaches the target position. The higher the **Gain** setting, the closer the actuator will get to the target position before decelerating. With a lower **Gain** setting, the actuator will begin decelerating further away from the target position. This parameter is factory set to an ideal value for the actuator model configuration. It may be changed if the application warrants it. See Figure 41 for more information.

Range: **1** to **999**

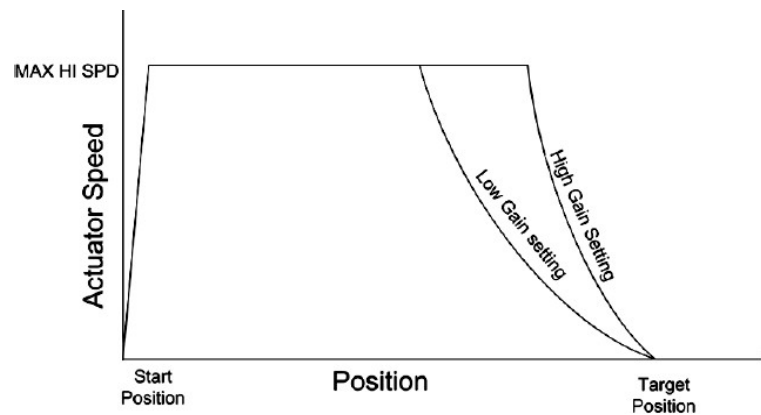


Figure 41: Gain

Min Mod (minimum modulation) defines a position value in the stroke/rotation below which the actuator will not modulate.

Min Mod sets the upper limit of a non-modulating span with respect to **Position Lo**. The actuator will move to **Position Lo** if any control signal input falls within this span. This parameter may be used to minimize valve seat wear.

Range: **Off** or **0.1%** to **99.9%** of calibrated stroke/rotation

*NOTE: If set, this parameter will function in **Auto** and **Local Man** mode. It is not visible in the menu if **Signal Type** is set to **1 Cont.** or **2 Cont.** or if **Rdnt CPU = Main** or **Backup**.*

Bumpless (Bumpless Transfer) is a safeguard to prevent unwanted actuator movement when returning from **Local Man** or **Setup** mode into **Auto** mode. When entering **Auto** mode, if the deviation is greater than the Deadband and Bumpless Transfer is active, **Auto-BT** will appear in the Mode field. With the **Bumpless** parameter turned on, the actuator will wait for operator intervention before following the control signal if the actuator position was moved manually or the control signal changed. To clear **Bumpless**, the operator must move the actuator to within the deadband of the new control signal or change the control signal to be within the deadband of the new actuator position. The adjustment must be made within the set **Deadband** and maintained for a minimum of 1 second for the actuator to return to following the control signal.

This parameter only appears in the menu if the **Signal Type** is set to **Analog**. See **INPUTS** and **DRIVES** menu.

Sol. Seat (Solenoid Seating) uses software to allow the stored energy of the fail-safe spring or accumulator (if equipped) to seat the valve. This feature is only available on fail-safe actuators where the fail-safe direction is the same as the valve seating direction. In such applications, this feature eliminates the need for an elastic coupling or a seat load cylinder.

NOTE: Solenoid Seat is not visible in the menu if seat load cylinder is configured.

Cal. Stroke (Calibrated Stroke) is used when configuring the **Sol. Seat** function. Calibrated Stroke defines the valve/driven device stroke so the system can determine when to open the fail-safe solenoid and allow the spring or accumulator to seat the valve.

Range: **0.3 to 99.9 in**



For Rotary and Damper applications, the standard Cal. Stroke setting is 4" which will open the solenoid at 1% from the calibrated end point. The following formula may be used to translate linear stroke to Rotary Percentage.

$$\text{Rotary seat \%} = (4.5 / \text{"Cal. Stroke"} \times .05\%)$$

6.3 SPEED Menu

The SPEED menu consists of the following parameters:

Max Hi Spd (Maximum High Speed) defines the maximum motor speed when operating in **Auto** mode.

Range: **5% to 125%** of maximum specified motor speed

2-Speed defines use of option two speed operation.

Select: **Off, Up/Dn, Bkpt**. Default = **Off**

When **2-Speed** is off, Maximum High Speed defines the maximum motor speed when in **Auto** mode.

When **2-Speed** is set to **Bkpt**, **Max Lo Spd** and **Speed Bkpt** are added to the menu.

Max Lo Spd (Maximum Low Speed) defines the maximum speed between **Position Lo** and the **Spd Bkpt**.

Range: **5% to 125%** of maximum specified motor speed. Cannot be greater than **Max Hi Spd**

Spd Bkpt (Speed Breakpoint) defines a break point to determine when to use **Max Lo Spd** or **Max Hi Spd**

Range: **0.1% to 99.9%** of calibrated stroke/rotation

When **2-Speed** = **Up/Dn**, **MaxHi Spd** is changed to **Max Up Spd** and **Max Dn Spd** is introduced to the menu. and defines maximum motor speed as the actuator moves toward **Position Hi** or **Position Lo**.

Max Up Spd (Maximum Up Speed defines the maximum motor speed when moving toward **Position Hi**.

Range: **5% to 125%** of maximum specified motor speed

Max Dn Spd (Maximum Down Speed defines the maximum motor speed when moving toward **Position Lo**.

Range: **5% to 125%** of maximum specified motor speed

Max Man Spd (Maximum Manual Speed) defines the maximum motor speed when operating in **SETUP** mode or **LOCAL MANUAL** mode.

6.4 INPUTS Menu

The **INPUTS** menu consists of the following parameters:

Signal Type defines the control signal the actuator will respond to in **Auto** mode.

Select: **Analog, 1 Cont, 2 Cont**

*NOTE: **1 Cont** and **2 Cont** are only included in the **INPUTS** menu if a contact board is installed.*

When **Signal Type** = **Analog**, the main control signal is the 4-20 mA analog input. This selection provides the full modulating capability of the actuator.

When **Signal Type** = **1 Cont** (one contact), two position on/closed operation—open/closed is selected. The applied signal defines actuator position. If the open input is active (powered), the actuator goes to **Position Hi**. If the open input is not active (un-powered), the actuator goes to **Position Lo**.

When **Signal Type** = **2 Cont** (two contacts), MANUAL modulation operation is selected. The main input signals are the contacts open and close of the contact input board. If both inputs are active or inactive, the actuator remains in position. If only the open input is active, the actuator moves toward **Position Hi**. If only the close input is active, the actuator moves toward **Position Lo**.

NOTE: The actuator will continue to move in the desired direction as long as a signal is present or until the target position is reached.

Failsafe defines the position the actuator moved to, via the motor, if the analog control signal falls below 2.5 mA. Only if **Signal Type** – **Analog**.

Select:

Inplac: The actuator remains in current position.

CAUTION: If set incorrectly, CS Bad will not be reported.

Off: Used for zero based control signal, i.e, 0-20 mA. Actuator will run to Position Lo.

0-100%: Actuator goes to set position value.

*NOTE: Fail-safe function only affects **Auto** mode operation. Is not an available option if **Rdnt CPU** = **Main** or **Backup**.*

Trip defines the active state of the trip signal input on the interconnect board. This input is used to override the control signal input to cause actuator movement via the spring or accumulator. This fail-safe mechanism is factory configured to either end of stroke or rotation. It is not field reversible.

When **Trip** = **Off**, trip function is not used

When **Trip** = **UnpwrPL**, the trip direction is to **Position Lo** and is active when no power is present on the input signal.

When **Trip** = **UnpwrPH**, the trip direction is to **Position Hi** and is active when no power is present on the input signal.

When **Trip** = **PwrPL**, the trip direction is **Position Lo** and is active when power is present on the input signal.

When **Trip** = **PwrPH**, the trip direction is **Position Hi** and is active when power is present on the input signal.



When **Trip = UMotPL**, the trip direction is **Position Lo** and is active when no power is present on the input signal. This is motor operated trip. No solenoid needed.

When **Trip = UMotPH**, the trip direction is **Position Hi** and is active when no power is present on the input signal. This is motor operated trip. No solenoid needed.

When **Trip = PMotPL**, the trip direction is **Position Lo** and is active when power is present on the input signal. This is motor operated trip. No solenoid needed.

When **Trip = PMotPH**, the trip direction is **Position Hi** and is active when power is present on the input signal. This is a motor operated trip. No solenoid needed.

Power On parameter defines the mode the electronic control enclosure will be in when the main power is applied.

When **Power On = Last**, on power up or reset, the actuator will return to its previous operating mode (**Auto**, **Local Man** or **Setup**).

When **Power On = Local**, on power up or reset, if the previous mode was **Auto**, the actuator will enter Manual (**Local Man**) mode.

6.5 DRIVES Menu

The **DRIVES** menu consists of the following parameters:

Boost Offpt is the deviation between current position and control signal for the booster pump to turn off or on. It can be set between **0.1% to 75%** of calibrated span.

Surge Bkpt {Surge Breakpoint} defines minimum deviation (in % of calibrated span) between current position and the new target position where a surge solenoid will operate. When the deviation exceeds the set value, the surge relay output is activated and kept active until the current position matches the current control signal. Surge breakpoint has a settable range of: OFF, 99.9% to 0.5%.

Surge Offpt {Surge Offpoint} defines the distance away from the new target position in which the surge solenoid is reenergized during a surge event – effectively stopping the actuator movement. On systems with high speed Solenoids this allows the REXA electronic control enclosure to change states of the solenoid to anticipate hitting the new target position and eliminate overshoot during a surge event.

Surge Offpt has a settable range of: OFF, 0.1% to 94.9%. (5% minimum from Surge Bkpt.)

If an actuator is equipped with an Online Accumulator Recharge (OAR) or a spring fail-safe, the following five parameters are in the menu:

Surge Dir {Surge Direction} is displayed whenever **Surge Bkpt** is set to any value other than off. Surge Direction is settable to either to **PL** (**Position Lo**), or **PH** (**Position Hi**) which specifies the direction of action. **PLPH** is used for bi-directional accumulator surge control.

Rechrg Pres {Recharge Pressure} adjusts the pressure level at which an accumulator recharge cycle will end. Factory set in # (psi), from **Warn Pres + 200** up to **3000 psi**.

*NOTE: The warning relay deactivates, and the status display will indicate **Pres Low** when the accumulator pressure drops below the value set in **Warn Pres**.*

Warn Pres {Warning Pressure} adjusts the pressure at which an accumulator low pressure warning is issued. Factory set from **1000** psi up to **2800** psi.



Rechrg Time {Recharge Time} adjusts the maximum time allowed for a recharge cycle to complete. A recharge cycle ends when either the **Rechrg Pres** setting is reached or the **Rechrg Time** expires. In either case, the actuator resumes tracking the control signal.

Power Fail defines what the accumulator will do on loss of power.

The parameter can be set to:

Accum- Unit will fail on loss of power.

Inplace- Unit will not fail on loss of power, only trip input.

Recharge Dir (Accumulator Recharge Direction) defines the direction the modulating motor runs toward during a recharge cycle after a trip.

POS_Hi = Recharge Direction

POS_Lo = Recharge Direction

OFF = Modulating motor will not run during recharge cycle. (Only Online Accumulator Motor will run during recharge.)

NOTE: If Rdnt CPU = Main or Backup this setting will default to OFF.

Accum Pres (Accumulator Pressure): This parameter cannot be set. It is the “live” pressure reading from the accumulator pressure transducer.

Units: **#** (psi)

Range: **0 to 3000 psi**

Unknwn if “pressure bad” error

If an actuator is configured for PST, the following parameters are in the menu:

PST defines an actuator use of partial stroke testing. **PST** cannot operate while in LOCAL Mode.

The parameter can be set to: **Off, CntPwr, CntUnp, Signal, Auto, ConPAu, CUnpAu**

Off – PST option not enabled

CntPwr – PST event will activate on energizing the PST input

CntUnp – PST event will activate on de-energizing the PST input

Signal – PST event will activate based on the set control signal deviation. This deviation is defined in the PST Signal Deviation parameter.

Auto – PST event will run automatically after a certain period of time. Period of time between **Auto** PST events is defined in the **PST Auto Sch**.

ConPAu – PST event will run automatically after a certain period of time or as soon as the PST input is energized

CUnpAu - PST event will run automatically after a certain period of time or as soon as the PST input is de-energized.



PST Target is added to the drives menu if **PST** is set to anything other than 'Off'. Options are position from **95.0% to 50.1%**, incremented by .1%. Cannot be set less than **PST Off Point**.

PST Offpt is added to the drives menu if PST is set to anything other than 'off'. Options are "Off" or 95.1% to 50.2%. Value must be higher than "PST Target". **PST Time** is added to the drives menu if PST is set to anything other than "off". Options 1 to 150 seconds.

PST Time is added to the drives menu if PST is set to anything other than "off." Options 1 - 150 seconds. **PST Inc** {PST Increment} is added to the drives menu if PST is set to anything other than "off". Options are "off" 0.1% to 1%.

PST Signal Deviation Signal deviation from 100% to a new PST target position. This allows the analog control line to control the actuator and avoids running a second PST command cable. Control signal deviation is used to initiate a PST cycle.

PST Auto Sch is only viewable if the **Auto** schedule is powered on. Settable from 24 to 999 hours... PST will run automatically on schedule from every 24hr. to 999hr.

Delta Warn is active when pressure exceeds the setting value. When it is active **Warn Relay** is active, the actuator will still modulate normally.

Units: # (psi)

Range: **500 psi to 2900 psi**

Delta Alarm is active when the pressure exceeds setting value. When it is active **Alarm Relay** is active, motor(s) are stopped, the actuator can only move in the direction that relieves the alarm pressure.

Units: # (psi)

Range: **600 psi to 3000 psi**

Rdnt CPU defines if the REXA system is equipped with redundant electronic control enclosure.

The parameter can be set to: **Off, Main, Backup**.

Off indicates that the system is not redundant.

Main indicates the primary electronic control enclosure that will control all moves < 5% deviation. Operational modes are displayed as defined in the earlier section.

Backup indicates the backup electronics will assist control moves ≥ 5% deviation. Operational modes are appended with "**-Bkup**" to indicate CPU is acting as backup only. If the main electronic control enclosure is in an alarm state, the backup electronics will take over the role of the main electronic control enclosure and reduces its deadband to the parameter setting in **CONTROL** menu. When acting as the main the "**-Bkup**" is removed and the standard operational modes are displayed.

When **Backup** is selected in the menu a new parameter is available in the Calibration menu called "**Linearize**".

The linearized range can be set between -5% to 5% in .1% increments.



Calibration process:

1. Calibrate **Position Lo** and **Position Hi** for both electronic control enclosures.
2. Move the actuator to 50% and record the delta between the position read outs on the two electronic displays.
3. Go to **CALIBRATE** menu in the backup electronics and enter the delta recorded into the **Linearize** parameter. The backup electronics will drop the decimal place on the position/feedback display when it's acting as a redundant system. When the redundant actuator changes to the primary the decimal digit will return to the display.

API Test = Off / On is added to the **DRIVES** menu only if **Rdnt CPU** = Main. Setting defines an actuator use of the solenoid test feature. When set to On all solenoid test functionality will be enabled. See Technical Product Bulletin #20.0: Automated Online Solenoid Testing for further definition of the solenoid test functionality.

6.6 Outputs Menu

Relay #1 defines the point in % of calibrated stroke at which relay output 1 is active. The relay will be active when the actuator position is = or < the value set in Relay #1.

Relay #2 defines the point in % of calibrated stroke at which relay output 2 is active. The relay will be active when the actuator position is = or > the value set in Relay #2.

Display = Dir/Rev allows the position display to be reverse acting with position open and position closed (i.e. 100%=closed instead of 100%=open).

Pos Xmitter {Position Transmitter} defines the action of the position transmitter output as being direct acting, **Dir** or reverse acting, **Rev**.

When set to direct acting, a 4 mA output corresponds to **Position Lo**. When

set to reverse acting, a 4 mA output corresponds to **Position Hi**.

Xmitter Low (Transmitter Low) is the parameter to calibrate the output of the 4-20 mA Position Transmitter.

To calibrate the 4mA Zero, Set a digital multi-meter, DMM, to read milliamps (mA) DC. Connect the DMM to the Position Transmitter Output. Connect through a 250Ω load resistor the Red lead of the DMM to the "LOOP –" terminal block. Connect the Black lead of the DMM to connector P13 Pin 3 of the S99051 interconnect board. If the position transmitter is configured for Active connect the Red and Black lead of the DMM to the "LOOP +" & "LOOP –" terminal blocks respectively. Press ENTER to access this setting. The value displayed on the REXA display corresponds to Digital bits. Each increment or decrement of 4 bits and will increment or decrement the current output by one micro-amp (1 μA). The acceptable range for Xmitter Lo is 3.9 to 4.1 mA.

NOTE: The Position Transmitter will output the mA signal that corresponds to the actuator's current position until the ENTER button is pressed and the "=" sign is flashing. When the "=" sign is flashing, the output will change to the "Zero" or Lo Calibration value.

Xmitter Hi (Transmitter Hi) is the parameter to calibrate the Output span of the 4-20 mA Position Transmitter.



To calibrate the 20 mA Span, Set a digital multi-meter, DMM, to read milliamps (mA) DC. Connect the DMM to the Position Transmitter Output. Connect through a 250Ω load resistor the Red lead of the DMM to the "LOOP –" terminal block. Connect the Black lead of the DMM to connector P13 Pin 3 of the S99051 interconnect board. If the position transmitter is configured for Active connect the Red and Black lead of the DMM to the "LOOP +" & "LOOP –" terminal blocks respectively. Press **ENTER** to access this setting. The value displayed on the REXA display corresponds to Digital bits. Each increment or decrement is steps of 4 bits and will increment or decrement the current output by one micro-amp (1 mA).

*NOTE: The Position Transmitter will output the mA signal that corresponds to the actuator's current position until the **ENTER** button is pressed and the "=" sign is flashing. When the "=" sign is flashing, the output will change to the "Span" or Hi Calibration value.*

Once the position transmitter calibration is complete, there is no need to re-calibrate the transmitter for changes in actuator span. Changing the actuator span will cause the transmitter span to automatically re-calibrate its output.

Password defines the password required to enter the **Setup** mode to change any control parameters. The default value of **00000** indicates no password is required. If a value is entered into Password other than the default value, future entry into **Setup** mode will require that the user enter the Password value prior to gaining access to the **Setup** menus.

Disp displays the version of display software. Example: **Disp AA_02.8.2220**

Cntrl displays the version of control (CPU) software. Example: **AA_12.5.81318**

6.7 CURRENT STATS Menu and HISTORIC STATS Menu

The **CURRENT STATS** and **HISTORIC STATS** menus provide error counters and usage indicators. They offer identical information; **CURRENT STATS** parameters can be cleared/zeroed whereas the **HISTORIC STATS** cannot.

The error counters are provided as an aid to diagnosing a problem. They are particularly useful in identifying intermittent problems since they record ALL instances of detected errors, rather than just those which result in an "alarmed" condition. They are also useful in identifying problems associated with actuator "tuning".

Error counters generally operate only in **Auto** mode. Errors detected in **Setup** are not recorded. Usage indicators only record in **Auto** mode.

The **CURRENT STATS** error counters and usage indicators may be reset to zero by doing the following;

While in SETUP and the counter/indicator to be reset is on display:

1. Press **ENTER** key– the equals sign begins blinking.
2. Press Down Arrow key – the value field resets to zero.
3. Press **ENTER key**– the new count is now zero.

*NOTE: If the up arrow key is pressed prior to step 3, the old count is returned to the display and will be retained if the **ENTER** key is then pressed. See Technical Product Bulletin #5.0: Fault Codes for more information.*

Messages in CPU Display Error Status:	Motor Errors:	Servo Primary Booster Faults:
CS bad:	PSrv_Flt:	SBstFlt:
MFB bad:	PSrvReset:	SBstRest:
Rdnt_FB bad:	P MTRTemp:	SBstMTRTemp:
Fb Offset:	PResCable:	SBstResCable:
Slc Fb bad:	P DRV Temp:	SBstDRV Temp:
Slc stop:	P Replc DRV:	SBstReplc DRV:
APres_Low:	P MTR Cable:	SBstMTR Cable:
APres_Bad:	P MTR Short:	SBstMTR Short:
Accum_Time:	Dual Servo Faults:	Dual Servo Booster Faults:
Accumulator Conflict: (A_Conflict)	DSrvFlt:	DSBstFlt:
Stall:	DSrvReset:	DSBstReset:
Dir error:	D MTRTemp:	Primary Induction Drive Faults:
Inval PST:	DResCable:	PInducFlt:
PSTTimELP:	D DRV Temp:	PIndReset:
OpPresbad or CIPresbad:	D Replc DRV:	Induction Booster Drive Faults:
Clock Bat:	D MTR Cable:	IBstFlt:
Delta Alarm:	D MTR Short:	IBstReset:
Delta Warn:	Accumulator Servo Faults:	Primary Stepper Drive Faults:
Power Supply Errors:	ASrv Fault:	PStpFlt:
-5Bad:	ASrvReset:	PStpReset:
AC High	AMTRTemp:	Dual Stepper Drive Faults:
AC Low	AResCable:	DStpFlt:
+15Bad:	A DRV Temp:	DStpReset:
System Configuration Errors:	A Replc DRV:	Accumulator Stepper Drive Faults:
No inp bd:	A MTR Cable:	AStpFlt:



Inval HW:	A MTR Short:	AStpReset:
Inval SC:		
PConflict:		
No PMotor:		

6.7.1 Auto Mode

Auto is the mode in which the actuator will automatically follow the control signal. When the deviation between current position and control signal is greater than the dead band setting, the actuator will move to decrease that error. See Figure 42 for details.

6.7.2 Display Fields in Auto

Field 1 displays the operating mode.

Field 2 displays the unit status.

Field 3 displays the parameter.

Field 4 separates fields 3 and 5 with “=”.

Field 5 shows the value for the parameter.

Field 6 shows the local time.

Field 7 shows the date.

Field 8 shows Bluetooth.

Field 9 shows motor on/off.

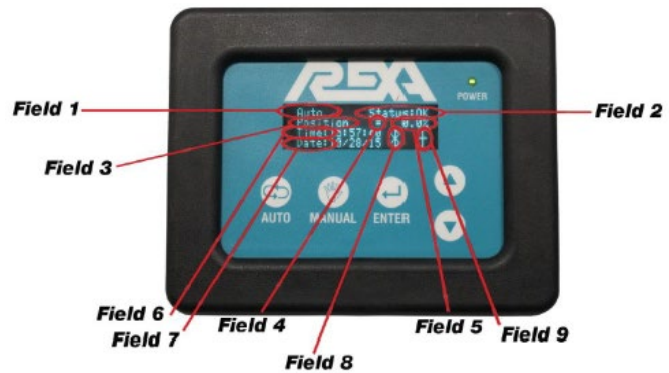


Figure 42: Current Stats and Historic Stats Menu

6.7.3 Display Information

AUTO (Field 1) indicates the unit is in **Auto** mode, standard operation.

Auto – Bt (Field 1) indicates **Auto** mode with bumpless transfer in progress. Refer to the **CONTROL** menu.

Auto – mm (Field 1) refers to **Auto** mode with minimum modulating active. Refer to the **CONTROL** menu.

Auto – Rchg (Field 1) indicates the unit is in **Auto** mode with accumulator recharge cycle in progress. Refer to the **DRIVES** menu.

Auto – Trip (Field 1) indicates the unit is in **Auto** mode with the Trip input active. Refer to the **INPUTS** menu.

Auto-Bkup (Field 1) indicates **Auto** mode of the backup electronics. Refer to the **DRIVES** menu for more information.

Auto-PST (Field 1) indicates a PST test cycle is currently in process. Refer to the **DRIVES** menu for more information.

Auto-API (Field 1) indicates the unit is in **Auto** mode while the solenoid test is active. Refer to Technical Product Bulletin #20.0: Automated Online Solenoid Testing for solenoid test information.

Status:OK (Field 2) or an error/warning message indicates the status of the unit. Refer to the **Current Stats** menu.

Position (Field 3) identifies the value displayed in Field 5.

Value (Field 5): **Low** if current position is more than 0.5% below **Position Lo**.

0.0 to **100.0** if current position is between **Position Lo** and **Position Hi**.

High if current position is more than 0.5% above **Position Hi**.

NOTE: **Low** or **High** indicates overtravel past **Position Hi** or **Position Lo** setting due to spring/accumulator driven operation.

NOTE: To move actuator, put actuator in **Local Man** mode and press the **ENTER** key. A flashing “=” sign will be displayed on the screen. Push the up and down arrow keys to move the actuator in open/closed position. To exit **Local Man** mode, press the **ENTER** key again. See Figure 43 for details.



Figure 43: How to Enter Local Manual Mode

If set up for Reverse Acting: Value (Field 5): **Low** if current position is more than 0.5% above **Position Lo**

0.0 to **100.0** if current position is between **Position Lo** and **Position Hi**

High if current position is more than 0.5% below **Position Hi**

Position value may display the following in the situations stated:

Unknown (Field 5) if the feedback signal from the actuator to the electronic control enclosure is not present.

Seated (Field 5) if the seat load cylinder is at the “seated” position.

6.7.4 Parameter Viewing

In **Auto** mode the control parameters may be viewed (but not altered) by using the Up or Down keys. Pressing the Down key once displays the “Live Control Signal”.

The next 2 presses of the Down key display the “Live **OPEN PRES**” (Open Pressure Transducer) and “Live **CLOSE PRES**”

(Close Pressure Transducer) values in psi. Successive presses of the Down key step the display through the **Setup** menus.

The Up key pressed displays the current “Live Deviation”.



Successive presses of the Up-key step the display through the **Setup** menu from **CURRENT STATS**. A 5-second timer reverts the display back to current position parameter if no keys presses are detected. Holding the ENTER key depressed displays the current parameter indefinitely.

Control Sig {Live Control Signal} (Field 4) identifies the value of the analog control signal. The display is 0 -100 % for easy comparison with the Position display.

Control Sig = 'None' (Field 5): when parameter signal TYPE does not equal analog.

Low when the current signal is more than 0.5% below Signal Lo.

0-100% Active 4-20 mA signal is applied and is in between Signal Lo and Signal Hi.

High when the current signal is more than 0.5% above Signal Hi.

Unknwn when control signal is not applied.



General Maintenance

7.0 Maintenance Schedule

Although REXA actuators are designed to be low maintenance, there are some preventative maintenance steps recommended to maximize the service life of the actuator. A vast variety of maintenance strategies are deployed globally around the valve automation and process control industry. These strategies are categorized and can be selected based on evaluating automated valve failures against process safety, process down time and cost to protect expensive assets. Advanced actuator technologies and proper maintenance strategy planning can have a significant ROI. The most successfully implemented maintenance strategy is always application dependent, and it balances down time versus cost.

- Reactive Maintenance (“Run to Fail”, “Corrective Maintenance”)
 - Maintenance strategy where assets are operated until a functional failure occurs.
 - REXA does not recommend this approach but due to the relatively low required maintenance REXA actuators perform exceptionally even when not maintained.
- Preventative Maintenance (“PM”)
 - Maintenance based on component replacement and overhauls at fixed intervals regardless of the equipment's condition.
 - REXA typically recommends the quarterly inspection below and replacing the soft goods and seals every 2 million full strokes or every 10 million dither strokes. This is considered a general guideline as specific operating pressure and ambient conditions will cause variation in maintenance intervals.
- Condition-Based Maintenance (“CM”, “CBM”)
 - Maintenance is deployed based on the condition of the asset by defined condition thresholds, potentially from sensors and data trends.
- Predictive Maintenance (“PdM”)
 - Utilizes sensors and data trends to determine the condition and deterioration rate of an asset so maintenance is performed at an optimal time.

7.0.1 Quarterly

Perform a visual inspection of the actuators for damage, correct oil level, obstruction, and hazards. Repair items found damaged during this inspection in accordance with company procedures. During this inspection, check the following items at a minimum:

- Visual inspection for damage
- Oil level is correct

NOTE: Ambient temperature swings will affect the oil indicator position.

- Tubing and fittings are tight, not touching or rubbing
- Mounting hardware and fasteners are tight
- Record system stats (strokes, fault codes and gauge pressures)
- Actuator can hold position without recorrecting



- Check for moisture ingress or contaminants under the feedback housing, wire cover, and in the electronic control enclosure.
- Check control signal surge suppressor indicator color. The indicator will turn red if the power has experienced a surge event and the suppressor is no longer protecting the circuit.” (red = bad, green = good). See Figure 44 for details.



Figure 44: Indicator Color

7.1 General Specifications

Recommended Fluids and Lubricants

Intended Use	Specifications
Operating fluid, all REXA Actuators	5W-50 Motor Oil
Anti-Seize Compound	Bostik Never-Seez® or equivalent
O-ring Lubricant	Parker Super-O-Lube or equivalent
Thermal Grease	Thermalcote™ or equivalent
Molybdenum Disulfide Grease	Mobilgrease® XHP 222 or equivalent
Parts Cleaner	ZEP® BRAKE WASH or equivalent

NOTE: For actuators using specialty oil other than 5W-50 motor oil no substitutes are allowed.

7.2 Tool Requirements

All these common tools may be required during installation and maintenance:

- Flashlight
- Standard Set of Allen Wrenches
- 3/16 " Nut Driver
- Soft Blow Hammer
- Set of Flat Tip Screwdriver
- Set of Combination Wrenches
- 12 " Channel Lock Pliers
- Double end hydraulic purge coupling – Remote hydraulic skid actuators with hydraulic hoses
- Wire Strippers
- Oil Gun with Schrader fill assembly
- 3/8 " Nut Driver
- Needle Nose Pliers
- Wire Cutter
- Digital Multimeter
- Torque Wrench for connecting valve mounting hardware

7.3 General Specifications

7.3.1 Servo and Stepper Operating Temperatures*

Linear Actuators					
Temperature Range ¹	Actuator Construction	Standard			High Temp.
	Type L Linear Cylinder	-5°F to +200°F	-30°F to +200°F	-76°F to +200°F	-5°F to +250°F
		(-20°C to +93°C)	(-34°C to +93°C)	(-60°C to +93°C)	(-20°C to 121°C)
	Type C Linear Cylinder	+10°F to +200°F	-10°F to +200°F	-76°F to +200°F	-5°F to +250°F
		(-12°C to +93°C)	(-23°C to +93°C)	(-60°C to +93°C)	(-20°C to 121°C)
	Installation Requirements	None	1-inch thermal insulation ²	Heat tracing & 1-inch thermal insulation ²	None

1. High ambient temperatures affect oil viscosity which may affect actuator rated output.

2. These items are not supplied by REXA.

Rotary Actuators and Drives					
Temperature Range ¹	Actuator Construction	Standard			High Temp.
	Type R Rotary or D Drive Cylinder	+10°F to +200°F (-12°C to +93°C)	-10°F to +200°F (-23°C to + 93°C)	-76°F to +200°F (-60°C to +93°C)	-5°F to +250°F (-20°C to 121°C)
	Installation Requirements	Standard oil & cartridge heater	1-inch thermal insulation ²	Heat tracing & 1-inch thermal insulation ²	Optional High Temp. Construction

1. High ambient temperatures affect oil viscosity which may affect actuator rated output.
2. These items are not supplied by REXA.

Electronics Temperature Range
Separate Electronic Control Enclosure with CPU, motor driver, power supply, transient protection and termination.
-40F to 131F (-40C to 55C)

*Temperature limits may be further restricted due to hazardous areas. See Technical Product Bulletin #2.0: Hazardous Area Approvals for additional information.

7.4 Oil Level Inspection

The REXA Actuator is a sealed, self-contained, hydraulic positioning system in which oil is pumped from one side of a double acting cylinder to the other. A thermal expansion chamber provides a source of makeup oil and is an integral component within the module. As the size of the actuator cylinders increases so does the need for additional make up oil, therefore larger systems will have external auxiliary expansion chambers in addition to the standard internal thermal expansions chamber.

The thermal expansion chamber is pressurized above atmosphere and air purged. This eliminates oxygen from contacting the oil and ensures there is no potential for ingress or contamination into the thermal expansion chamber. This design provides the maximum protection against oil breakdown. Since the hydraulic system is sealed and spring-loaded, it is also unaffected by the orientation in which the actuator is installed.

A periodic, visual inspection of the REXA Xpac Actuator is required to verify that the hydraulic system has not been compromised for any reason. Any external signs of a major oil leak or repeated refilling of the unit will indicate damage to the actuator that will require servicing of the unit and investigation for a cause.

7.4.1 Oil Indicator

There is an oil level indicator on the actuator body located on the same face as the motor shown in Figure 45A, Figure 45B, and Figure 45C. It is used to display the oil level within the actuator. The indicator is a silver rod with a scale beside it reading “Hot”, “Ok” and “Add”. As the unit cools down and heats up the indicator will move in and out. At 70 °F the indicators ideal position will be in the middle of the “Ok” region. The unit may be indicating near the “Add” limit if the ambient temperature is lower and will indicate in the “Hot” region if the ambient temperature is elevated. The thermal expansion chamber volume has been sized for 110 °F temperature swings.



Figure 45A: Add Oil



Figure 45B: OK



Figure 45C: Hot

Larger units will require additional make up oil and an external thermal expansion chamber will be plumbed in series with the internal thermal expansion chamber. There are two designs of external auxiliary expansion chamber: (A) spring loaded legacy external thermal expansion with oil level indicator; (B) nitrogen precharge external thermal expansion chamber.

7.4.2 Nitrogen Charged External Thermal Expansion Chamber & Accumulator Fail-Safe Units

The bottle style nitrogen charged external thermal expansion chamber, as illustrated in Figure 46, is used in large actuator units and on accumulator fail-safe unit.

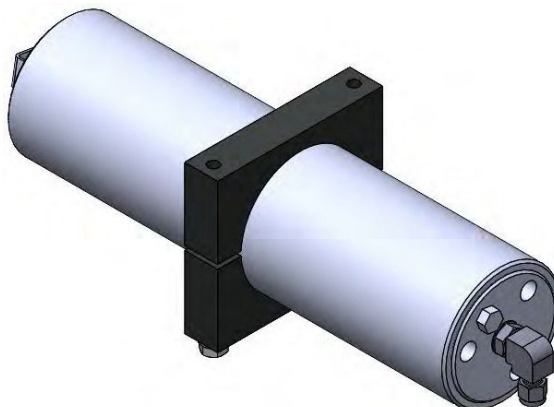


Figure 46: External Thermal Expansion Chamber



Figure 47A: Pressure Gauge

The nitrogen charged external expansion chamber provides make up oil volume for non-accumulator fail-safe systems and provides both make up oil volume as well as oil volume for the Online Accumulator Recharge (OAR) module to charge high pressure oil in the accumulator bottle on accumulator fail-safe and/or accumulator surge systems. There are two different oil level indications on these types of system. Visual oil level indication can be seen on the PM oil level indicator rod as shown in Figure 45A, Figure 45B, and Figure 45C. Typically, the PM oil level indicator is fully extended as in Figure 45C during normal operation of these systems.

Another visual indicator of oil level within the system is by reading the pressure gauge on either the power module or in line with the nitrogen charged external expansion chamber. On typical non-accumulator systems with the nitrogen charged external expansion chamber, the pressure gauge should read between 70 psi to 80 psi. See Figure 47A for details. On typical accumulator fail-safe systems with the nitrogen charged external expansion chamber, the pressure gauge should read between 20 psi to 40 psi. See Figure 47B for details.



Figure 47B: Pressure Gauge

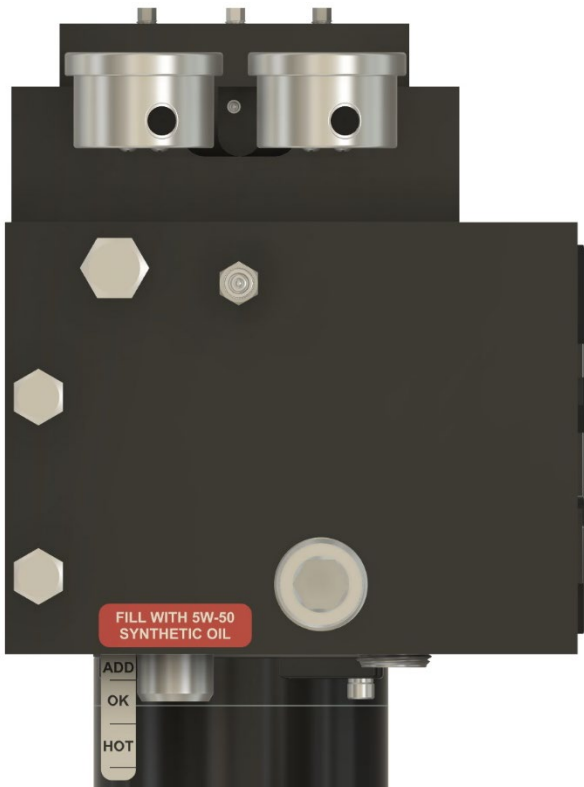


Figure 48: Oil Fill Sticker Locator

7.4.3 Oil Fill Requirements

NOTE: 5W-50 motor oil is recommended as it has the widest viscosity range, but other motor oil of fully synthetic quality may be used.

If the addition of oil is required, it should be filled with 5W-50 motor oil. See the oil fill sticker shown in Figure 48 for more details. Special applications may require different types of oil such as biodegradable / environmentally friendly types of oils or oils suitable in pure oxygen environments. The actuator does not need to be taken out of service when adding oil.

REXA actuators are filled through a standard Schrader-style fill valve located on the power module. Refer to Figure 13 in Section 2.4.1 for locator details. Use any oil gun equipped with an adapter Schrader-style fitting. REXA offers several oil fill and bleed kits to simplify this process.

See Chapter 2: Delivery for details on how to successfully fill a REXA actuator with oil.

Thermal Expansion Chamber Settings

With the accumulator fully discharged, the accumulator pressure gauge must read 0 PSI. Fill until thermal expansion chamber pressure is

XXX $\pm$ 5 PSI

WARNING: Adding oil to the unit without verifying the accumulator is at 0 PSI before filling will cause damage and potential injury or death.

When the accumulator is full @ XXX PSI. The thermal expansion pressure should be @ XXX $\pm$ 5 PSI

7.4.3 Overfilling, Oil Weeping, and Thermal Expansion Chamber

NOTE: Do not overfill the thermal expansion chamber. While overfilling will not harm the actuator on non-accumulator units, overfilling will force oil from the thermal expansion chamber via the overfill protection. All REXA Xpac Actuators contain a thermal expansion relief valve located next to the output limiting valves. If slightly overfilled, simply wipe off excess purged oil.

WARNING: Overfilling WILL harm an accumulator unit. If an accumulator unit is overfilled, the external thermal expansion chamber can be over pressurized and catastrophic seal damage can occur.



Figure 49: Thermal Expansion Relief Valve

The thermal expansion relief valve, shown in Figure 49, is built into every REXA Xpac Actuator to allow the actuator to relieve the thermal expansion chamber of excess oil pressure due to thermal expansion. Excess oil pressure is 150 psi. Thermal expansion refers to the volumetric changes a fluid, such as oil, experiences given changes in environmental temperature.



It is not uncommon to discover trace amounts of residual oil collected around the thermal expansion chamber of a valve if the unit has been overfilled. This residual oil is typically the result of oil weeping from the overfill protection as the ambient temperature increases causing the oil to expand. As previously mentioned, the actuator is a closed-loop hydraulic system, and any increase in oil volume will be purged. On large oil volume actuators REXA adds an external auxiliary expansion chamber to compensate for the greater volume of oil that may expand due to increases in ambient temperature.

If the temperature is lowered, the auxiliary expansion chamber indicator will retract as the oil volume decreases. Oftentimes, users will mistake the indicator retraction as a sign that the actuator has lost oil due to a service issue. If a user adds oil to the actuator at this time, oil will likely purge out of the thermal expansion valve upon an eventual rise in ambient temperature. It is when oil is evidently leaking, or collected in large amounts somewhere on, or dripping off, a REXA Xpac Actuator that a service-related issue is likely, and oil filling is needed. For this reason, we ask users to perform periodic inspections with ambient temperature changes in mind.

NOTE: Refer to Troubleshooting section in TS&R manual for weeping oil from thermal expansion module.

Product Compliance

INFORMATION

Inclusion of the following symbols indicates that the supplied REXA actuator complies with applicable standards:



For the U.S. and Canada: A CSA mark with the indicators “C” and “US” means that the product is certified for both the U.S. and Canadian markets, to the applicable U.S. and Canadian standards.

CLASS I DIVISION 2 GROUPS A,B,C and D

CLASS I DIVISION 1 GROUPS C AND D



IECEx scheme is a single globally accepted certification framework based on ISO and IEC International Standards relating to Equipment, Services and Persons in areas relating to Explosive Atmospheres.

ZONE 1: Ex db [ia IIC Ga] IIB T3 Gb

ZONE 2: Ex ec IIC T3 Gc and Ex ec [ia Gb] IIC T3 Gc*

**NOTE: For Zone 2, [ia] is optional when the actuator assembly is located in Zone 1.*



The ATEX Directive 2014/34/EU covers equipment and protective systems intended for use in potentially explosive atmospheres. The Directive defines the essential health and safety requirements and conformity assessment procedures, to be applied before products are placed on the EU market.

ZONE 1:  II 2(1)G Ex db [ia IIC Ga] IIB T3 Gb

ZONE 2:  II 3G Ex ec IIC T3 Gc and  II 3(1)G Ex ec [ia Ga] IIC T3 Gc

NOTE: For IECEx and ATEX, the ‘X’ marking following the certificate number is used as a means of identifying that essential information for the installation, use and maintenance of the equipment must be followed as detailed in the following sections.



Ordinance No. 115 From INMETRO establishes the criteria and procedures for assessing the conformity of electrical equipment for explosive atmospheres in Brazil

ZONE 1: Ex db [ia IIC] IIB T3

ZONE 2: Ex ec IIC T3 Gc



This mark indicates that the product is certified for European markets and complies with the applicable Directives for hazardous protection concepts as well as the Essential Health & Safety Requirements.



KCS mark for South Korea indicating compliance for Zone 1 explosion proof electrical equipment.
Ex db [ia IIC] IIB T3 -40°C ≤ Ta ≤ 65°C for Actuator and -40°C ≤ Ta ≤ 60°C for Electronics

**KTL 21-KA4BO-0161X
KTL 21-KA4BO-0163X**

**KTL 21-KA4BO-0162X
KTL 21-KA4BO-0164X**



Applicable Standards: 고용노동부고시 제2020-33호

잘못된 설치, 사용 및 유지보수로 인한 위험이 초래하지 않도록 방폭기기 설치는

KS C IEC 60079-14를 따라야 함



SPECIFIC CONDITIONS OF USE (Zone 1)
IECEX CSA 16.0041X and SIRA 17ATEX1231X

General

1. The design and construction of the systems shall be strictly in accordance with the description, condition and drawings as mentioned in the Test Reports.
2. Ambient Temperatures below -10°C: use field wiring suitable for minimum ambient temperature
3. Cable entry devices and blanking elements shall be certified for protection type “d”; suitable for IP ratings and correctly installed.
4. Unused apertures shall be closed with suitable blanking elements.
5. End User shall ensure adequate earthing or equipotential bonding is suitable for the installation of the metallic conduit.
6. Flamepath joints are not for repair

X3 Electronic Assembly

7. Electronic enclosures shall be positioned such that the risk of impact to the window is low.
8. CONDUIT ENTRY SEALS: When conduit is used, end user shall seal all Electronic Enclosure ½” NPT and ¾” NPT conduit ports within 50.8mm [2.0”] of entry using listed fittings and sealing compounds.
9. FASTENERS: only M16X2.0X60MM Stainless Steel hex bolts are to be used. 6g/6H with min yield strength 450Mpa.
10. FUSE REPLACEMENT table is as follows:

FUSE REPLACEMENT TABLE

System Description	Standard Fuse (A)	Alternate Configuration with 1/3C OAR Fuse (A)	Alternate Configuration with Full DOAR Fuse (A)	Fuse Type
D Module, 230 VAC	10	15	20	TypeaM 500V IR 120kA 10mm x 38mm
B Module, 115 VAC	6	12	N/A	
C Module, 115 VAC	10	16	N/A	
2C Module, 115 VAC	16	NA	N/A	
1/2D Module, 230 VAC	6	10	15	
1/2D Module, 115 VAC	10	20	25	
B Module, 230 VAC	4	8	10	
C Module, 230 VAC	6	10	12	
2C Module, 230 VAC	8	NA	NA	



X2 or X3 Actuator Assembly

11. CONDUIT ENTRY SEALS: When conduit is used, end user shall seal all Actuator ½" NPT and ¾" NPT conduit ports within 457mm [18.0"] of entry using listed fittings and sealing compounds.
12. SURFACE CLEANING: Actuator Assembly includes a non-metallic outer protective coating which may be cleaned with a damp cloth.
13. FASTENERS: shall be replaced only with the corresponding grade of fastener as follows:

ACTUATOR FASTENERS REPLACEMENT TABLE

Stepper Motor Mounting Screws (secures motor to power module) • US SHCS 1/4-20UNC-2A X 0.875 • Material is 316SS • Min Yield Strength =207 Mpa [30ksi], Min Tensile Strength=517MPa [75ksi]
Servo Motor Mounting Screws(secures motor to power module) • US SHCS 1/4-20UNC-2A X 1.25 • Material is 316SS • Min Yield Strength =207 Mpa [30ksi], Min Tensile Strength=517MPa [75ksi]
Latch Cover Hex Bolt (secures threaded cover onto power module) • US SHCS 1/4-20UNC-2A X 5/8 • Material is 316SS • Min Yield Strength =207 Mpa [30ksi], Min Tensile Strength=517MPa [75ksi]

14. Flamepath joints are not intended for repair.

Conditions when installed with the 70 Series GO Switch with Connection Head:

15. All terminal screws, used and unused, shall be fully tightened down by the end user
16. No more than one single or multi-stranded lead shall be connected to the terminal unless multiple conductors have been joined in a suitable manner, e.g. two conductors into a single insulated bootlace ferrule, or any method indicated on the terminal certificate
17. All terminals, and accessories such as cross-connectors, shall be installed in accordance with the terminal manufactures instructions. Topworx Incorporated will supply the relevant terminal manufacturer's instructions with each assembly covered by this certificate.
18. The maximum voltage and current shown on the rating label must not be exceeded.
19. When connecting conductors of cross section below the maximum 2.5mm² allowed for the terminal then the maximum amps per pole must be reduced inline with the maximum amps permitted for a terminal equivalent to the conductor size fitted.



SPECIFIC CONDITIONS OF USE (Zone 2)
IECEX CSA 17.0013X and SIRA 17ATEX4360X

General

1. Ambient Temperatures below -10°C: use field wiring suitable for minimum ambient temperature.
2. Cable glands, blanking elements, adaptors and conduits shall match the equipment marking to maintain the type of protection and ingress rating.
3. End User shall ensure adequate earthing or equipotential bonding is suitable for the installation of the metallic conduit.

X3 Electronic Assembly

4. SUPPLY DISCONNECT DEVICE: End User shall provide a Supply Disconnect Device with the proper rating to comply with IEC61010. The supply disconnecting device shall disconnect (isolate) the Electronic Enclosure / Actuator from the power supply source when engaged.
5. TRANSIENT SUPPRESSION DEVICE: End user shall provide transient suppression of the supply terminals limiting to 140% of the rated supply.
6. Electronic enclosures shall be positioned such that the risk of impact to the window is low.
7. LITHIUM CELL: shall be replaced by certified REXA service personnel using only the following type of cell:
 - a. Panasonic BR2330, Lithium Poly-Carbon Monofluoride (BR) Coin Cell. Rated 255mAh @ 3.0V.
Operating Ambient: -30°C to 85°C.
8. GO LIMIT SWITCH OPTION shall not be connected to a circuit with a maximum available short circuit current > 10kA.
 - a. An external earth bonding connection may be maintained using a grounding bushing with external lug.
9. FUSE REPLACEMENT table is as follows:



ATEX /IECEX Locations Fuse Replacement / Identification						
REXA Actuator Input Voltage	Phase (~)	REXA Power Module Size	Standard Fuse (A)	Alternate Configuration with 1/3C OAR Fuse(A)	Alternate Configuration with Full D OAR Fuse (A)	Fuse Type
115 VAC	1	B	6	12	N/A	Type aM 500V IR 120kA 10mm x 38mm
		C	10	16	N/A	
		Dual C	16	N/A	N/A	
		1/2D	10	20	25	
		Dual 1/2D	20	N/A	N/A	
230 VAC	1	B	4	8	10	
		C	6	10	12	
		Dual C	8	N/A	N/A	
		1/2D	6	10	16	
		Dual 1/2D	10	N/A	20	
		D	10	16	20	
		Dual D	20	N/A	32	
230 VAC	3	D,P9	20	N/A	25	Type aM 690V IR 80kA 22mm x 58mm
		D,P40	50	N/A	N/A	

X2 or X3 Actuator Assembly

10. SURFACE CLEANING: Actuator Assembly includes a non-metallic outer protective coating which may be cleaned with a damp cloth.
11. THERMAL INSULATION: End user shall supply 1.0" (25.4mm) thick insulation below operating temperatures of -12°C for the Valve Position Monitor (VPM) used on the Rotary Actuators



12. FASTENERS: shall be replaced only with the corresponding grade of fastener as follows:

Stepper Motor Mounting Screws (secures motor to power module) • US SHCS 1/4-20UNC-2A X 0.875 • Material is 316SS • Min Yield Strength =207 Mpa [30ksi], Min Tensile Strength=517MPa [75ksi]
Servo Motor Mounting Screws (secures motor to power module) • US SHCS 1/4-20UNC-2A X 1.25 • Material is 316SS • Min Yield Strength =207 Mpa [30ksi], Min Tensile Strength=517MPa [75ksi]
Latch Cover Hex Bolt (secures threaded cover onto power module) • US SHCS 1/4-20UNC-2A X 5/8 • Material is 316SS • Min Yield Strength =207 Mpa [30ksi], Min Tensile Strength=517MPa [75ksi]



SPECIFIC CONDITIONS OF USE (Zone 2 Electronics paired with Zone 1 Actuator)
CSANe 23ATEX1094X

General

1. Ambient temperatures below -10°C: use field wiring suitable for minimum ambient temperature
2. Cable glands, blanking elements, adaptors and conduits shall match the equipment marking to maintain the type of protection and ingress rating.
3. End User shall ensure adequate earthing or equipotential bonding is suitable for the installation of the metallic conduit

X3 Electronic Assembly (Zone 2)

4. SUPPLY DISCONNECT DEVICE: End User shall provide a Supply Disconnect Device with the proper rating to comply with IEC61010. The supply disconnecting device shall disconnect (isolate) the Electronic Enclosure / Actuator from the power supply source when engaged.
5. TRANSIENT SUPPRESSION DEVICE: End user shall provide transient suppression of the supply terminals limiting to 140% of the rated supply.
6. Electronic enclosure shall be positioned such that the risk of impact to the window is low.
7. Cable glands, blanking elements, adaptors and conduits shall match the equipment marking to maintain the type of protection and ingress rating.
8. For the optional "Go Limit Switch" an external earth bonding connection may be maintained using a grounding bushing with external lug.
9. LITHIUM CELL: shall be replaced by certified REXA service personnel using only the following type of cell:
 - a. Panasonic BR2330, Lithium Poly-Carbon Monofluoride (BR) Coin Cell. Rated 255mAh @ 3.0V. Operating Ambient: -30°C to 85°C.
10. FUSE REPLACEMENT table is the same table used in the section above per Zone 2 certificate IECEx CSA 17.0013X.



EU Declaration of Conformity

We, REXA Inc.,

Hereby declare under our sole responsibility, the following products to be in compliance by design according to the relevant essential health and safety requirements and harmonized standards mentioned. The Technical File may be produced by our EU representative below. In case of alteration of the product, not agreed upon by us, this declaration will lose its validity.

Manufactured: 200 Canopy Drive
Middleborough, MA 02346 USA

EU Authorized Representative: Koso Parcol Via Isonzo, 2 - 20039 Canegrate (Milan) Italy
Contact: Stefano Conti (Engineering Manager)
Telephone: +39 033141311 Fax: +39 0331404215

Brand Name:



Product Description: X-Pac, X2 and X3 Series Electraulic (Self-Contained Electro-Hydraulic) Actuator and Drive Systems

Models: Linear, Rotary and Drive Units
Servo or Stepper Units

Applicable Directives: Machinery Directive 2006/42/EC including Low Voltage Directive (LVD) 2014/35/EU

Electromagnetic Compatibility Directive (EMC) 2014/30/EU

Pressure Equipment Directive (PED) 2014/68/EU; applies where applicable, to accumulator systems

Radio Equipment Directive (RED) 2014/53/EU; applicable to optional Bluetooth feature

RoHS Directive EU 2015/863; met by design, by exclusion of hazardous / restricted substances

Applicable Harmonized Standards:

Health/Safety: Machinery Directive 2006/42/EC Annex I, EN60204-1:2018, EN ISO 12100:2010

EMC: EN61326-1:2013, EN61000-6 Part -2:2005 and -4:2007+A1:2011; EN55011:2016+A1:2017

PED: Directive 2014/68/EU; designed as 'Sound Engineering Practice' Equipment

**EU Declaration of Conformity**
According to: Directive 2014/34/EU

We, REXA Inc.,

Hereby declare under our sole responsibility, the following products to be in compliance by design according to the relevant essential health and safety requirements and harmonized standards mentioned. The Technical File may be produced by our EU representative below. In the event of alteration of the product, not agreed upon by us, this declaration will lose its validity.

Manufactured: 200 Canopy Drive
Middleborough, MA 02346 USA

Brand Name: 

Product Description: Electrohydraulic (Self-Contained Electro-Hydraulic) Actuator and Drive Systems;
X3 Electronic Assembly and X2 or X3 Actuator Assembly

Models: Linear, Rotary and Drive Units
Servo or Stepper Units

Designation:   II (2)1G Ex db [ia IIC Ga] IIB T3 Gb -40C ≤ Ta ≤ 65C

Certificate: Sira 17ATEX1231X issued by CSA Group NB #2813

Applicable Directives: Machinery Directive 2006/42/EC including,
Low Voltage Directive (LVD) 2014/35/EU
Electromagnetic Compatibility Directive (EMC) 2014/30/EU
Equipment for use in potentially explosive atmospheres,
(ATEX) Directive 2014/34/EU
Pressure Equipment Directive (PED) 2014/68/EU; applies where applicable, to
accumulator systems
Radio Equipment Directive (RED) 2014/53/EU; applicable to optional
Bluetooth feature
RoHS Directive EU 2015/863; met by design, by exclusion of hazardous /
restricted substances

Applicable Harmonized Standards:

Health/Safety:	Machinery Directive 2006/42/EC Annex I, EN60204-1:2018, EN ISO 12100:2010
EMC:	EN61326-1:2013, EN61000-6 Part -2:2005 and -4:2007+A1:2011; EN55011:2016+A1:2017
ATEX:	EN IEC 60079-0:2018; EN 60079-1:2014; EN 60079-11:2011
PED:	Directive 2014/68/EU; designed as 'Sound Engineering Practice' Equipment

**EU Declaration of Conformity**
According to: Directive 2014/34/EU

We, REXA Inc.,

Hereby declare under our sole responsibility, the following products to be in compliance by design according to the relevant essential health and safety requirements and harmonized standards mentioned. The Technical File may be produced by our EU representative below. In the event of alteration of the product, not agreed upon by us, this declaration will lose its validity.

Manufactured: 200 Canopy Drive
Middleborough, MA 02346 USA

Brand Name: 

Product Description: X2 and X3 Series Electrolic (Self-Contained Electro-Hydraulic) Actuator and Drive Systems

Models: Linear, Rotary and Drive Units
Servo or Stepper Units

Designation:   II 3G Ex ec IIC T3 Gc -40C ≤ Ta ≤ 65C

Certificate: SIRA 17ATEX4360X issued by CSA Group NB #2813

  II 3(1)G Ex ec [ia Ga] IIC T3 Gc -40C ≤ Ta ≤ 55C

Certificate: CSANe 23ATEX1094X issued by CSA Group NB #2813

Applicable Directives: Machinery Directive 2006/42/EC including,
Low Voltage Directive (LVD) 2014/35/EU

Electromagnetic Compatibility Directive (EMC) 2014/30/EU

Equipment for use in potentially explosive atmospheres,
(ATEX) Directive 2014/34/EU

Pressure Equipment Directive (PED) 2014/68/EU; applies where applicable, to accumulator systems

Radio Equipment Directive (RED) 2014/53/EU; applicable to optional Bluetooth feature

RoHS Directive EU 2015/863; met by design, by exclusion of hazardous / restricted substances

Applicable Harmonized Standards:

Health/Safety: Machinery Directive 2006/42/EC Annex I, EN60204-1:2018, EN ISO 12100:2010

EMC: EN61326-1:2013, EN61000-6 Part -2:2005 and -4:2007+A1:2011;
EN55011:2016+A1:2017

ATEX: EN IEC 60079-0:2018, EN 60079-11:2012, EN 60079-15:2010

PED: Directive 2014/68/EU; designed as 'Sound Engineering Practice' Equipment



Declaration of Noise Emission

The REXA inc., Model REXA Electraulic™ Actuator System Sound Pressure Levels per EN ISO 11202 is as follows:

Model No: As above	Serial No: On Nameplate	Year of Construction: 2017	
		Operating	Idle
L_{pAm} (Operator Position)		81 dB (A)	66 dB (A)
L_{pAm} (Bystander Position)		84 dB (A)	67 dB (A)
Peak C-weighted instantaneous SPL in the Operator's position $L_{pC peak}$		88 dB (c)	---
Sound power emitted where the equivalent continuous A-weighted SPL exceeds 80 dB (A).		8.8 Bel	---
The average difference between the extraneous noise level and the sound intensity level at each measuring point is:		$L_{pAm} \Delta = 16 \text{ dB (A)}$	
Ambient Correction Factor K3A calculated according to EN ISO 11204 Appendix A.		4 dB(A)	
Measurements were made at a height of 1.5 m and 1 m from the Operator Position and all four sides of the equipment.			
The figures quoted are emission levels and are not necessarily safe working levels. While there is a correlation between the emission and exposure levels this cannot be used reliably to determine whether or not further precautions are required. Factors that influence the actual level of exposure of the workforce include characteristics of the work room, the other sources of noise, etc. such as the number of machines and other adjacent processes. Also, the permissible level of exposure can vary from country to country. This information, however, will enable the user of the machine to make a better evaluation of the hazard and risk.			
		REXA Inc. 200 Canopy Drive Middleborough, MA USA	
			



Waiver Of Translations Agreement

We, REXA Inc.,

Hereby declare exclusion of the responsibility at the time of sale to provide translated documentation of REXA products. This includes and is not limited to the following documents:

Installation and Operation Manual (IOM)

Interconnect, layout and wiring schematics and drawings.

Technical Service and Repair Manual

This document also waives the responsibility of translations of the following system components and markings:

Human Machine Interface (HMI Keypad Display) textual read-out of system parameters and status display

Modification of keypad display symbols to ISO characters

Internal labeling and identification symbols and statements

Individual wire and component marking identification is not required. The fully assembled factory wired panel is only serviced by REXA personnel and not the end user. However, end - user terminations are readily identified.

Translations of the above mentioned may be made by the end user and/or the authorized representative listed on this document. Any of which may be translated must bear the statement 'Translation of Original Instructions' within the document(s) header or footer.

EU Authorized Representative: Koso Parcol Via Isonzo, 2 - 20039 Canegrate (Milan) Italy
Contact: Stefano Conti (Engineering Manager)
Telephone: +39 033141311 Fax: +39 0331404215



Waiver of Main Supply Disconnect/Emergency Stop Agreement



We, REXA Inc.,

Hereby declare it the responsibility of the installer of this equipment to provide a suitable disconnect for the Control Panel supplying power to the system.

The disconnect must:

- 1) Be suitable for the Voltage and Full Load Ampere Rating of all downstream equipment supplied by the Panel.
- 2) The supply disconnecting device shall be one of the following types:
 - a. Switch-disconnector with fuses, in accordance with IEC 60947-3, utilization category AC-23B or DC-23B.
 - b. As above, except one that has an auxiliary contact that in all cases causes switching devices to break the load circuit before the opening of the main contacts of the disconnector.
 - c. A circuit breaker suitable as an isolation device per IEC 60947-2
 - d. Any other switching device in accordance with an IEC product standard that also meets the isolation requirements of IEC 60947-1 and is appropriate for on-load switching of the largest motor or other inductive loads.
- 3) Be approved for use as a disconnect for the country in which the system is installed.
- 4) Be provided with a Lock Out Tag Out capability in the Off (Down) position.
- 5) The Handle must be RED in color to indicate it is suitable as an E-Stop device.

If assistance is required in specifying an appropriate device, please contact our engineering department for recommendations.



Hazardous Area Approvals

CSA (Canadian Standards Approval) for North America Hazardous Areas

Class 1 Division 2 Groups A, B, C, and D

Available units: All units in Table 1

Protection method: Non-incendive (non-sparking), limitations of surface temperatures

Class 1 Division 1 Groups C and D

Available units: C, 2C, D, and Dual D in Table 1

Protection Method: Explosion proof and intrinsically safe (feedback)

CSA Operating Temperature Ranges

REXA Power Module	Electronic Control Enclosure Temperature ¹	Actuator Assembly Temperature	Duty Cycle	T-Code Actuator
B Stepper – 115 VAC	-40F to 131F (-40C to 55C)	-40F to 150F (-40C to 65C)	100%	T4
B Stepper – 230 VAC				
Dual B Stepper – 115 VAC				
Dual B Stepper – 230 VAC				
C Stepper – 115 VAC				T3 ²
C Stepper – 230 VAC				
Dual C Stepper – 115 VAC				
Dual C Stepper – 230 VAC				
1/3C Stepper – 24 VDC		-40F to 176F (-40C to 80C)	100%	T4
Dual 1/3C Stepper – 24 VDC				
1/2D Servo – 115 VAC				
1/2D Servo – 230 VAC				
Dual 1/2D Servo – 115 VAC				
Dual 1/2D Servo – 230 VAC				
D Servo – 115 VAC				
D Servo – 230 VAC				
Dual D Servo – 230 VAC				
D,P9 Servo – 230 VAC	-40F to 121F (-40C to 50C)	-40F to 140F (-40C to 60C)	D = 100% P9 & P40 Booster = 31.8%	T3C
D,P40 Servo – 230 VAC				
D,2P40 – 230 VAC				

1. Electronic control enclosure rated T3C except 1/3C which is rated T3.

2. Alternatively rated T5 with -40C to 50C and 60% duty cycle



IECEx and ATEX Hazardous Areas

Ex II 3G Ex ec IIC T3

Available units: All units in Table 2

Protection method: Ex ec (non-sparking), limitations of surface temperatures

Ex II 2(1)G Ex db [ia IIC Ga] IIB T3 Gb

Available units: C, 2C, D, and Dual D in Table 2

Protection Method: Ex d Flameproof and Ex ia intrinsically safe (feedback)

IECEx and ATEX Operating Temperature Ranges

REXA Power Module	Electronic Control Enclosure Temperature	Actuator Assembly Temperature	Duty Cycle	T-Code Actuator and Electronic Control Enclosure
B Stepper – 115 VAC	-40C to 55C	-40C to 65C	100%	T3
B Stepper – 230 VAC				
Dual B Stepper – 115 VAC				
Dual B Stepper – 230 VAC				
C Stepper – 115 VAC				
C Stepper – 230 VAC				
Dual C Stepper – 115 VAC				
Dual C Stepper – 230 VAC				
1/3C Stepper – 24 VDC				
Dual 1/3C Stepper – 24 VDC				
1/2D Servo – 115 VAC				
1/2D Servo – 230 VAC				
Dual 1/2D Servo – 115 VAC				
Dual 1/2D Servo – 230 VAC				
D Servo – 115 VAC				
D Servo – 230 VAC				
Dual D Servo – 230 VAC				
D, P9 Servo – 230 VAC	-40C to 50C	-40C to 60C	D = 100% P9 & P40 Booster = 31.8%	
D, P40 Servo – 230 VAC				



Hazardous Location Model Designations

(Ex: X3L2000-2-B-P-C2)

C1 = Zone 1 or Class 1 Division 1, Groups C, D, Explosion protected actuator only.

C5 = Zone 1 or Class 1 Division 1, Groups C, D, Explosion protected actuator and Zone 2 or Class 1 Division 2, Groups A, B, C, D electronics

C6 = Zone 1 or Class 1 Division 1, Groups C & D Explosion protected actuator and electronics

C2 = Zone 2 or Class 1 Division 2, Groups A, B, C, D actuator and electronics

CA = Zone 2 or Class 1 Division 2, Groups A, B, C, D actuator only

CE Marking:

REXA product lines are available optionally CE marked indicating compliance with the applicable European Directives and the applicable Harmonized Standards.

IECEX Marking:

REXA quality systems and products have been evaluated by a notified body for compliance with the relevant IEC standards. Product can be optionally marked for Zone 1(Ex d) or Zone 2 (Ex ec) and backed by a notified body certificate.

ATEX (European Explosive Atmospheres):

REXA product lines have been evaluated in accordance with the ATEX Directive. Products can be supplied for Zone 1 or Zone 2 and backed by a notified body certificate.

INMETRO:

REXA product can be optionally marked for Brazil markets for either Zone 1 or Zone 2 making use of the IECEX certificates and alternately can be built using the CSA Division 2 certificates.

KCS Mark:

By leveraging the REXA IECEX Zone 1 certificates REXA can also optionally mark the following products for South Korea:

Full D, 230V Linear or Rotary and C Stepper 115V or 230V Linear or Rotary.

Linear Mechanical Limit Switches

The mechanical limit switches are independent devices installed on the yoke of the linear units. Electrical connections are made directly to the switches independent of REXA electronic control enclosure. Position will be indicated regardless of actuator power status.

Linear Series

Quantity: 2 or 4

Type: Single Pole, Double Throw (SPDT), Form C.

Rating: 5 amp @ 24 VDC, 0.5 amp @ 125 VDC,

10 amp @ 110 VAC - resistive

Differential Travel (Hysteresis): 5/16"

Environmental: NEMA 4, FM/CSA CL.I, DIV.1 & 2, GRP. A, B, C & D.

Connection: 1/2"-14 NPT, screw terminals

Optional DPDT Limit Switches

Quantity: 2 or 4

Type: Double Pole Double Throw (DPDT), Form CC

Rating: 3 amp @ 24 VDC, 0.5 amp @ 125 VDC,

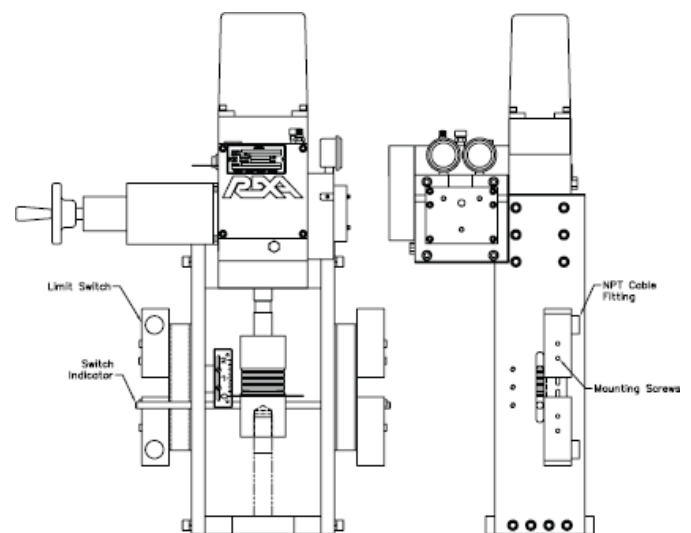
10 amp @ 110 VAC - resistive

Differential Travel (Hysteresis): 1/4"

Environmental: NEMA 4, FM/CSA CL.I, DIV.1 & 2,

GRP. A, B, C & D.

Connection: 1/2"-14 NPT, screw terminals



Linear Limit Switches

Limit Switch Wiring

Remove the access plate by unscrewing the four slotted screws on the bottom of the unit. Thread the cable through the 1/2" NPT fitting and connect to the appropriate Normally Open (NO), Normally Closed (NC) and Common (C) screw terminals. The cable should be grounded in accordance with Local and National Electrical Code. Make sure that the gasket is in place and tightly seal the cavity.

Limit Switch Adjustment

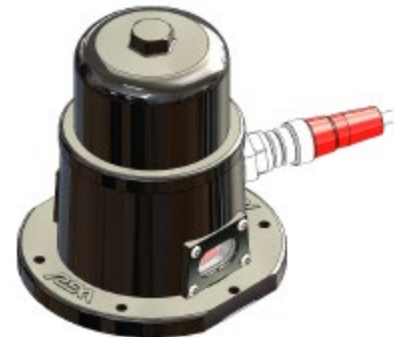
Loosen the two mounting screws approximately 1 1/2 to 2 turns and slide the entire switch to the required position. Securely retighten the screws.

Rotary Mechanical Limit Switches

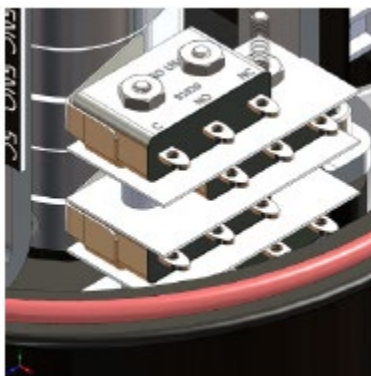
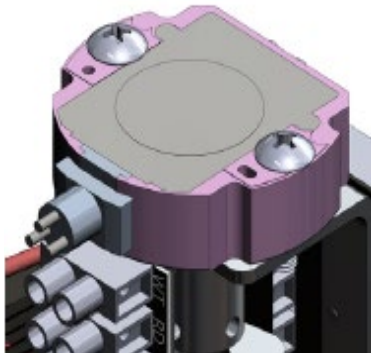
Rotary Valve Position Monitor (VPM)

The Rotary Valve Position Monitor (VPM) or Feedback assembly consists of an Aluminum housing containing a non-contacting (Touchless) analog sensor. The sensor is coupled to the rotary cylinder by means of a magnetic induction and transmits the actuator position to the actuator.

The Rotary Valve Position Monitor (VPM) has one (1) sensor and up to four (4) optional SPDT Rotary Limit Switches:



Rotary Valve Position Monitor (VPM)



Rotary Limit Sensor and Switches

Sensor

The touchless sensor, mounted on a bracket, has 3 wires; Blue/white for output, Black for ground and Red for supply, all connected to a terminal block.

Input: 14.8 – 30 VDC Output: 4-20 mA

NOTE: Mechanical hysteresis of switches will be ~5%.

Switches

Type: Hermetically Sealed, Single Pole, Double

Throw (SPDT)

Rating: 3.0 AMPS @ 28 VDC, 1.0 AMP @ 115 VAC

Environmental: CSA/IEC, Class1, Div.2 or Zone 2,

IP66 (NEMA 4),

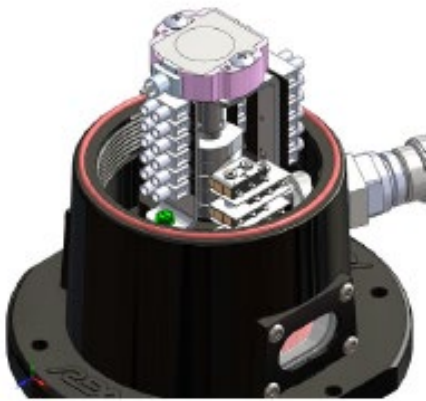
Connection: Directly via terminal Blocks

Rotary Valve Position Monitor Adjustment

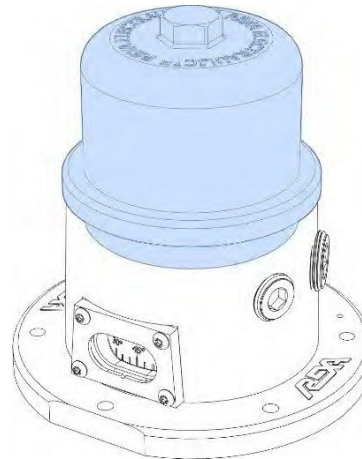
Any adjustment to the Rotary sensor will require removing the unit from service. Tag-out and lock-out the unit for repair in accordance with local procedures. If the actuator has a spring fail-safe option, take note of the actuator display when the actuator is in the fail position.

Rotary Wiring

The VPM will have two (2) ports- one (1) $\frac{1}{2}$ " NPT and one (1) $\frac{3}{4}$ " NPT Feedback Wiring for Sensor, Limit Switch Wiring, and Limit Switch Cams. Remove the cylinder feedback cover (over the cylinder pinion) by unscrewing. Take care to keep the threads clean and free from damage. Thread the cable through the $\frac{3}{4}$ " NPT fitting and make connections directly to the micro switch terminal strips. The cable should be grounded in accordance with the Local and National Electrical Code.



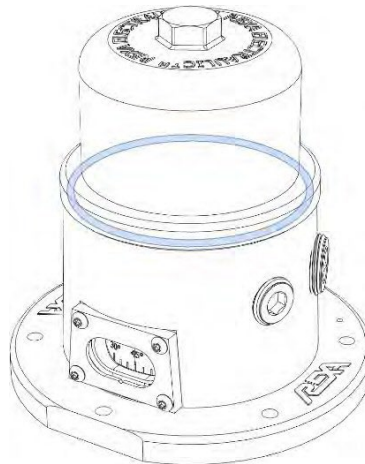
Rotary Wiring



Feedback Cover

Rotary Adjustment

For adjustment, the Switch Cam can be relocated by loosening the set screw and repositioning. Torque set screw to 4 in-lbs. using a $\frac{3}{32}$ " wrench. Make sure that the O-ring gasket is in place and tightly seal the cavity.



O-Ring Gasket

Electronic Relays

All REXA X3 series actuators have five standard electronic relays:

Relay #	Description	Function	Active State	Active Condition
1	Relay 1	Low Limit	Closed	Position $\leq$ Relay 1 Param
2	Relay 2	High Limit	Closed	Position $\geq$ Relay 2 Param
3	Alarm	System Fault Status	Open	Active Alarm Fault
4	Warning	System Fault Status	Open	Active Warning Fault
5	Not in Auto	System Mode	Open	Mode = SETUP or LOCAL
	PST Confirm	PST Completion Status	Closed	PST successful

NOTE: Relay 5 can only be set to one of the two functions defined.

Limit Switch Relays

Relay 1 is active; indicating the actuator position is at, or below, the value set in parameter Relay 1. Relay 2 is active; indicating the actuator position is at, or above, the value set in parameter Relay 2. Both parameters can be configured in [Setup](#) mode via the [Outputs](#) menu.

Alarm and Warning Relay

The Alarm and Warning relays are always in-active (closed) when the actuator operates normally without any faults and is following the control signal. Once the actuator detects a fault, the Alarm and Warning Relays open.

When the REXA electronic control enclosure detects a fault but can still operate (i.e. will respond to Control Signal and trip) the Warning Relay only will open.

If the REXA electronic control enclosure detects a fault but cannot operate (i.e. will not respond to Control Signal and trip) the Alarm Relay will open. During an Alarm event both the Alarm and Warning relays will open. Refer to Technical Product Bulletin #5.0: Fault Codes for detailed Warning and Alarm details and the methods for clearing these Relay states.

Not in Auto/ PST Confirm Relay

This relay output can be configured for either function via the Bluetooth GUI, but by default is set to not in [Auto](#) mode. In this mode when the system is put into [Local Man](#) or [Setup](#) mode this Relay will open.

NOTE: The Alarm and Warning relay will open during this same mode change event as well.

If this relay is configured for PST Confirm the relay will remain open until a successful PST (Partial Stroke Time) has been completed. Once a PST test has been started this relay will maintain its last state until the PST target parameter position has been reached. After reaching this target the PST Confirm relay will open and remain open until the actuator has motored back to the 100% position. Once this target is achieved the relay will Close to indicate that the test was successful and will remain closed until the next PST test is executed or the system is reset.



General Specifications	
Quantity:	5 (2 Limit, 1 Warning, 1 Alarm, & 1 Not-In-Auto/ PST Confirm)
Type:	Solid State Relay
Rating:	1 amp @ 200 VAC/VDC - Resistive
Turn On Time:	<4 mS
Differential Travel (Hysteresis):	0.1%
Connection:	Terminal Block

Fault Codes

The following are the error messages which appear on line 1 of the display in place of **Status:OK** when one or more errors are detected. If more than one error is active, each is displayed at 1 second intervals rotating and repeating until cleared. Clearing error codes is accomplished as identified in the “Cleared by” sections which follow below. To fix some of these errors, it may be necessary to refer to the Trouble Shooting and Repair manual or contact REXA for support.

NOTE: The list below is a general summary of all REXA error codes. Error codes are configuration dependent and will only occur if your actuator is equipped with the associated hardware.

Display Messages and Meanings:

CS Bad:

Cause: The analog Control Signal is below 2.5 mA; either the (+) or (-) **15 fail** is set, or **A/D fail** is set.

Indicators: Alarm and Warning relays open. **CS Bad** is displayed. Actuator will move to fail-safe position, if configured to do so.

Cleared by: Self clearing when Control Signal > 2.5 mA, or when **15 fail** or **A/D fail** clears.

MFB_Bad:

Cause: The actuator's main Feedback is below 2 mA or above 20mA; (+) **15_fail** is set, or **A/D fail** is set.

Indicators: Alarm and Warning opens. **MFB_Bad** is displayed. The actuator will not move.

Cleared by: Self clearing when Feedback > 2 mA or ≤ 20mA, or when **15 fail** or **A/D fail** clears.

Rdnt_FB bad:

Cause: The actuator's redundant feedback is below 2 mA or above 20mA.

Indicators: Warning Relays open. **Rdnt_FB Bad** is displayed. Actuator will move. (Only warning if Redundant Feedback Bad only. Alarm when both **MFB Bad** and **Rdnt FB Bad** have failed. Actuator will not move if **MFB_Bad** also).

Cleared by: Self clearing when Feedback > 2 mA or ≤ 20mA.

FB_Offset:

Cause: The actuator's main Feedback and **Rdnt FB** have a > 10% difference.

Indicators: **FB_Offset** is displayed. Actuator will move.

Cleared by: Self clearing when Feedback offset < 7%.

APres_Low:

Cause: The accumulator pressure is below the value set in parameter Warn Pres.

Indicators: Warning relay opens. **APres_Low** is displayed. Actuator continues to operate normally.

Cleared by: Successful Accumulator recharge cycle (**Accum Pres > Warn Pres**)

APres_Bad:

Cause: The accumulator's pressure transducer is out of range if the 4 - 20 mA signal is less than 3 mA or greater than 21mA.

Indicators: Warning relay opens, **APres_Bad** is displayed. Actuator continues to operate normally, but has lost the ability to maintain its fail-safe or trip function.

Cleared by: Cleared when transducer signal is greater than 3 mA or less than 21 mA.

Accum_Time:

Cause: The accumulator did not complete a full recharge in time set by **Rechrg_Time** of 10-999 sec.

Indicators: Warning relay opens. **Accum_Time** is displayed and stops the recharge of the accumulator bottle. Actuator continues to operate normally, but has lost the ability to maintain its fail-safe or trip function.

Cleared by: Cleared by cycling main power on, by pushing the CPU reset switch or activating the trip input and then completing a successful Recharge cycle.

OpPres_Bad or CLPres bad:

Cause: The open or close pressure transducer is out of range if the 4 - 20 mA signal is less than 3 mA or greater than 21mA.

Indicators: Warning relay opens, **OpPres_Bad or CLPres_Bad** is displayed. The actuator continues to operate normally.

Cleared by: Cleared when transducer signal is greater than 3 mA or less than 21 mA.

Stall:

Cause: After five attempts the actuator was unable to move .1% of stroke within 5 seconds. (Total time of 25 seconds)

Indicators: Alarm and Warning relays open. **Stall** is displayed. The actuator will not move.

Cleared by: Cycling main power on, by pushing the CPU reset switch or any control signal change which effects movement in the opposite direction of the stall will clear the stall error.

Dir Error:

Cause: The actuator was detected moving in the wrong direction.

Indicators: Alarm and Warning relays open. Dir error is displayed. Actuator will not move.

Cleared by: Cleared by cycling main power on, by pushing the reset switch, or entering **Setup** mode.

SLC Fb_Bad:

Cause: The Feedback signal from the Seat Load Cylinder is below 2 mA; (+) 15_fail is set, or A/D fail is set.

Indicators: Alarm and Warning opens. **SLC FB_Bad** is displayed. The actuator will not move.

Cleared by: Self clearing when the SLC Feedback > 2 mA, or when **15 fail** or **A/D fail** clears.

SLC_STOP:

Cause: The “Seated” position was reached on the Seat Load Cylinder while the position of the main cylinder was greater than 1% above **Position Lo**.

Indicators: Warning relay opens, and **SLC_STOP** is displayed. The actuator continues with normal operation; however, the main cylinder may not seat properly.

Cleared by: Cycling main power on, by pushing the CPU reset switch or any control signal change which affects movement in the opposite direction of the stop will clear the stall error.

Delta Alarm:

Cause: Indicates delta pressure exceeded alarm limit.

Indicators: Alarm and warning relays open. (Pressure Output is displayed on the Bluetooth GUI).

Cleared by: CPU Reset or any control signal change which effects movement in the opposite direction of the **Delta Alarm**. Actuator output returning to below warning range.

Delta Warn:

Cause: Indicates delta pressure exceeded warning limit.

Indicators: Warning relay open. (Pressure Output is displayed on Bluetooth GUI).

Cleared by: CPU Reset or any control signal change which affects movement in the opposite direction of the **Delta Warn**. Actuator output returning to below alarm range.

NOTE: Not applicable if pressure transducers are powered by and wired directly to the DCS.

Clock Bat:

Cause: Indicates 8-year timer has expired.

Indicators: **Clock Bat** displays.

Cleared by: Replace clock battery (located on power board) and reset battery timer in the **CALIBRATE** menu by setting New Battery = Yes.

Invalid PST:

- Cause:** The actuator was not at 100% when a PST command was initiated.
- Indicators:** Warning relay open. **Invalid PST** is displayed.
- Cleared by:** A power cycle, CPU reset, successful subsequent PST event.

PST TimeEsp:

- Cause:** The time for the actuator to go from 100% to the PST target and back to full open exceeded the PST time.
- Indicators:** Warning relay open. **PST Time Elp** is displayed.
- Cleared by:** A power cycle, CPU reset, successful subsequent PST event.

Power Supply Errors:**-5Bad:**

- Cause:** The (-)5-volt power supply is out of range if it exceeds a (+) or (-) 10% error band.
- Indicators:** Alarm and Warning relays open. **-5V_Bad**. Actuator will not move.
- Cleared by:** CPU will attempt to clear fail error until fault condition is corrected. If condition is not cleared, refer to TS&R.

+15Bad:

- Cause:** The (+)15-volt power supply is out of range if it exceeds a (+) or (-) 10% error band.
- Indicators:** Alarm and Warning relays open. **+15V_Bad** is displayed. Actuator will not move.
- Cleared by:** CPU will attempt to clear fail error until fault condition is corrected. If condition is not cleared, replace Power Board. See TS&R for details.

System Configuration Errors:**Accumulator Conflict: (A_Conflict)**

- Cause:** Sys_Config has a Stepper or Servo already for Online Accumulator.
- Indicators:** **Invalid_Hardware** is displayed.
- Cleared by:** Correct hardware configuration installation, and successful Sys_Config.

No inp bd:

- Cause:** Signal Type is set to **1 Cont**, **2 Cont**, or **Rdnt CPU = Main** or **Backup** and the contact input board is not installed or is faulty.
- Indicators:** Alarm and Warning relays open. **No input bd** is displayed.
- Cleared by:** Changing the **Signals** or **Rdnt CPU** menu parameter(s), or (with power off) installing the required board.

Inval_HW:

Cause: Sys_Config has hardware connected that is not a valid configuration.

Indicators: **Inval_HW** is displayed

Cleared by: Correct hardware configuration installation, and successful Sys_Config.

Inval_SC:

Cause: Sys_Config has hardware, Motor Drivers and Analog Inputs connected that are not a valid configuration for the System Software installed.

Indicators: **Inval_SC** is displayed

Cleared by: Correct hardware configuration installed, and successful Sys_Config. Cleared by cycling main power on or by pushing the CPU reset switch.

PConflict:

Cause: Sys_Config has discovered 2 Primary Motor Drivers connected, only 1 Primary Motor Driver allowed.

Indicators: **PConflict** (Primary Motor Driver Conflict) is displayed

Cleared by: Correct hardware configuration installed, and successful Sys_Config. Cleared by cycling main power on or by pushing the CPU reset switch.

No_PMotor:

Cause: Sys_Config has discovered no Primary Motor Driver connected.

Indicators: **No_PMotor** (No Primary Motor Driver Installed) is displayed

Cleared by: Correct hardware configuration installed, and successful Sys_Config. Cleared by cycling main power on or by pushing the CPU reset switch.

Motor Errors:**PSrv_Flt:**

Cause: Fault line active from Primary Servo Driver indicating the drive is in a fault state.

Indicators: **PSrv_Flt** is displayed. Warning relay opens. Alarm relay opens if no additional positioning motors are available or operational. The actuator may or may not continue normal operation depending on actuator construction.

Setup Mode: Actuator will move only if additional positioning motors are available.

Local Man Mode: Actuator will move only if additional positioning motors are available.

Auto Mode: Actuator will move only if additional positioning motors are available.

Cleared by: Depending on the fault the CPU will attempt to reset the drive (**PSrvReset**) fault error until fault condition is corrected. Cleared by cycling main power on, pushing the CPU reset switch or by holding down the **ENTER** key while in **AUTO** mode to reset the driver only.

P_MTRTemp:

Cause: The Primary Servo Motor is over temperature.

Indicators: **P_MTRTemp** is displayed. Warning relay opens.

Cleared by: Self clearing once the Primary Servo Motor has returned to normal temperature.

PResCable:

Cause: The Primary Servo Motor Resolver cable has a short or an open.

Indicators: **PResCable** is displayed. Warning relay opens. Alarm relay opens if no additional positioning motors are available or operational.

Cleared by: The Primary Servo Motor Resolver cable short or open corrected and power is cycled to the system or the CPU reset key is pressed. Driver can also be reset by holding down the **ENTER** key while in **Auto** mode.

P_DRV_Temp:

Cause: The Primary Servo Motor Driver is over temperature.

Indicators: **P_DRV_Temp** is displayed. Warning relay opens.

Cleared by: Self clearing once the Primary Servo Driver has returned to normal temperature.

P_Replc_DRV

Cause: The Primary Servo Motor Driver has a short.

Indicators: **P_Replc_DRV** is displayed. Warning relay opens. Alarm relay opens if no additional positioning motors are available or operational.

Cleared by: The Primary Servo Motor Driver has been replaced.

P MTR-Cable:

Cause: The Primary Servo Motor Power cable has a short or an open.

Indicators: **P_MTR-Cable** is displayed. Warning relay opens. Alarm relay opens if no additional positioning motors are available or operational.

Cleared by: The Primary Servo Motor Power cable short or open corrected. Cleared by cycling main power on, by pushing the CPU reset switch or by holding down the **ENTER** key while in **AUTO** mode to reset the driver only.

P_MTR-Short:

Cause: The Primary Servo Motor has a short.

Indicators: **P_MTR-Short** is displayed. Warning relay opens. Alarm relay opens if no additional positioning motors are available or operational.

Cleared by: The Primary Servo Motor has been replaced.

Dual Servo Faults:

DSrvFlt:

Cause: Fault line from Dual Servo Motor indicating fault state.

Indicators: **DSrvFlt** is displayed. Warning relay opens. Alarm relay opens if no additional positioning motors are operational. The actuator may or may not continue normal operation depending on actuator construction.

Setup Mode: Actuator will move only if additional positioning motors are available.

Local Man Mode: Actuator will move only if additional positioning motors are available.

Auto Mode: Actuator will move only if additional positioning motors are available.

Cleared by: Depending on the fault the CPU will attempt to reset the drive (**DSrvReset**) fault error until fault condition is corrected. Cleared by cycling main power on, pushing the CPU reset switch or by holding down the **ENTER** key while in **AUTO** mode to reset the driver only.

DSrvReset:

Cause: At least one motor drive has detected a problem and asserted Drive Fault.

Indicators: **DSrvReset** is displayed. Warning relay opens.

Cleared by: End of Reset Signal generation by CPU.

DMTRTemp:

Cause: The Dual Servo motor is over temperature.

Indicators: **DMTRTemp** is displayed. Warning relay opens.

Cleared by: Self clearing once the Dual Servo motor has returned to normal temperature.

DResCable:

Cause: The Dual Servo Motor Resolver cable has a short or an open.

Indicators: **DResCable** is displayed. Warning relay opens. Alarm relay opens if no additional positioning motors are operational.

Cleared by: The Dual servo Motor Resolver cable short or open corrected and power is cycled to the system or the CPU reset button is pressed. Driver can also be reset by holding down the **ENTER** key while in **Auto** mode.

D_DRV_Temp:

Cause: The Dual Servo Motor Driver is over temperature.

Indicators: **D_DRV_Temp** is displayed. Warning relay opens.

Cleared by: Self clearing once the Dual Servo Motor Driver has returned to normal temperature.

D_Replc_DRV:

Cause: The Dual Servo Motor Driver has a shorted output.

Indicators: **D_Replc_DRV** is displayed. Warning relay opens. Alarm relay opens if no additional positioning motors are available or operational.

Cleared by: The Dual Servo Motor Driver has been replaced.

D_MTR-Cable:

Cause: The Dual Servo Motor Power cable has a short or an open.

Indicators: **D_MTR-Cable** is displayed. Warning relay opens. Alarm relay opens if no additional positioning motors are operational.

Cleared by: The Dual Servo Motor Power cable short or open corrected. Cleared by cycling main power on, by pushing the CPU reset switch or by holding down the **ENTER** key while in **AUTO** mode to reset the driver only.

D_MTR-Short:

Cause: The Dual Servo Motor has a short.

Indicators: **D_MTR-Short** is displayed. Warning relay opens. Alarm relay opens if no additional positioning motors are operational.

Cleared by: The Dual Servo Motor has been replaced.

Accumulator Servo Faults:**AServoFit:**

Cause: Fault line from Accumulator Servo Motor Drive indicating fault state.

Indicator: Warning relay opens display: **AServoFit**. Actuator has lost its ability to maintain its fail-safe or trip function.

Cleared by: Depending on the fault the CPU will attempt to reset the drive (**ASrvReset**) fault error until fault condition is corrected. Cleared by cycling main power on, pushing the CPU reset switch or by holding down the **ENTER** key while in **AUTO** mode to reset the driver only.

Option Feature: Turned on only when a Secondary Servo Booster motor is present when running system configuration in Setup Mode, and it is configured to be an "Accumulator".

ASrvReset:

Cause: The Accumulator Servo Motor drive has detected a problem and asserted Drive Fault.

Indicators: **ASrvReset** is displayed. Warning relay opens.

Cleared by: End of Reset Signal generation by CPU.

AMTRTemp:

Cause: The Accumulator Servo motor is over temperature.

Indicators: **AMTRTemp** is displayed. Warning relay opens.

Cleared by: The Accumulator Servo Motor has returned to normal temperature

AResCable:

Cause: The Accumulator Servo Motor Resolver cable has a short or an open.

Indicators: **AResCable** is displayed. Warning relay opens. Actuator has lost its ability to maintain its fail-safe or trip function.

Cleared by: The Accumulator Servo Motor Resolver cable short or open corrected and power is cycled to the system or the CPU reset button is pressed. Driver can also be reset by holding down the **ENTER** key while in **AUTO** mode.

A_DRV_Temp:

Cause: The Accumulator Servo Motor Driver is over temperature.

Indicators: **A_DRV_Temp** is displayed. Warning relay opens.

Cleared by: The Accumulator Servo Motor Driver has returned to normal temperature.

A_Replc_DRV:

Cause: The Accumulator Servo Motor Driver has a shorted output.

Indicators: **A_Replc_DRV** is displayed. Warning relay opens. Actuator has lost its ability to maintain its fail-safe or trip function.

Cleared by: The Accumulator Servo Motor Driver has been replaced.

A_MTR-Cable:

Cause: The Accumulator Servo Motor Power cable has a short or an open.

Indicators: **A_MTR-Cable** is displayed. Warning relay opens. Actuator has lost its ability to maintain its fail-safe or trip function.

Cleared by: The Accumulator Servo Motor Power cable short or open corrected. Cleared by cycling main power on, by pushing the CPU reset switch or by holding down the **ENTER** key while in **AUTO** mode to reset the driver only.

A_MTR-Short:

Cause: The Accumulator Servo Motor has a short.

Indicators: **A_MTR-Short** is displayed. Warning relay opens. Actuator has lost its ability to maintain its fail-safe or trip function.

Cleared by: The Accumulator Servo Motor has been replaced.

Servo Primary Booster Faults:

SBstFlt:

Cause: The Primary Servo Booster Drive has detected a problem.

Indicators: Warning relay opens. **SBstFlt** is displayed. The actuator will continue operation with Primary Servo Motor, with increased stroke time.

Cleared by: CPU will attempt to clear Drv fault error until fault condition is corrected. Cleared by cycling main power on, pushing the CPU reset switch or by holding down the **ENTER** key while in **Auto** mode to reset the driver only.

SBstRest:

Cause: The Servo Booster Motor drive has detected a problem and asserted Drive Fault.

Indicators: **SBstRest** is displayed. Warning relay opens.

Cleared by: End of Reset Signal generation by CPU.

SBstMTRTemp:

Cause: The Servo Booster Motor is over temperature.

Indicators: **SBstMTRTemp** is displayed. Warning relay opens.

Cleared by: Self clearing once the Servo Booster Motor has returned to normal temperature.

SBstResCable:

Cause: The Servo Booster Motor Resolver cable has a short or an open.

Indicators: **SBstResCable** is displayed. Warning relay opens. The actuator will continue operation with Primary Servo Motor, with increased stroke time.

Cleared by: The Servo Booster Motor Resolver cable short or open corrected and power is cycled to the system or the CPU reset button is pressed. Driver can also be reset by holding down the **ENTER** key while in **Auto** mode.

SBstDRV_Temp:

Cause: The Servo Booster Motor Driver is over temperature.

Indicators: **SBstDRV_Temp** is displayed. Warning relay opens.

Cleared by: Self clearing once the Servo Booster Motor Driver has returned to normal temperature.

SBstReplc_DRV:

Cause: The Servo Booster Motor Driver has a short.

Indicators: **SBstReplc_DRV** is displayed. Warning relay opens. The actuator will continue operation with Primary Servo Motor, with increased stroke time.

Cleared by: The Servo Booster Motor Driver has been replaced.

SBstMTR-Cable:

Cause: The Servo Booster Motor Power cable has a short or an open.

Indicators: **SBstMTR-Cable** is displayed. Warning relay opens. The actuator will continue operation with Primary Servo Motor, with increase stroke time.

Cleared by: The Servo Booster Motor Power cable short or open corrected. Cleared by cycling main power on, by pushing the CPU reset switch or by holding down the **ENTER** key while in **Auto** mode to reset the driver only.

SBstMTR-Short:

Cause: The Servo Booster Motor has a short.

Indicators: **SBstMTR-Short** is displayed. Warning relay opens. The actuator will continue operation with Primary Servo Motor, with increase stroke time.

Cleared by: The Servo Booster Motor has been replaced.

Dual Servo Booster Faults:**DSbstFlt:**

Cause: The Dual Booster Servo Motor drive has detected a problem.

Indicators: Warning relay opens. **DSbstFlt** is displayed. The actuator will continue operation with Primary Servo and Primary Booster Motor, with reduced stroke time.

Cleared by: CPU will attempt to clear Dual Servo Booster fault error until fault condition is corrected. Cleared by cycling main power on, pushing the CPU reset switch or by holding down the **ENTER** key while in **Auto** mode to reset the driver only.

DSbstReset:

Cause: The Dual Servo Booster Motor drive has detected a problem and asserted Drive Fault.

Indicators: **DSbstReset** is displayed. Warning relay opens.

Cleared by: End of Reset Signal generation by CPU. No RS232 Error Codes for Dual Booster (only 2 connections available).

Primary Induction Drive Faults:**PInducFlt:**

Cause: Primary Induction Motor Drive has detected a problem.

Indicators: Warning relay opens. Alarm relay opens if no additional induction motors are available or operational. **PInducFlt** is displayed the actuator may or may not continue normal operation depending on actuator construction.

Cleared by: CPU will attempt to clear the Primary Induction Drive fault error until fault condition is corrected.

PIndReset:

Cause: The Primary Induction Booster Motor drive has detected a problem and asserted Drive Fault.

Indicators: **PIndReset** is displayed. Warning relay opens.

Cleared by: End of Reset Signal generation by actuator.

Induction Booster Drive Faults:**IBstFlt:**

Cause: Induction Booster Motor Drive has detected a problem.

Indicators: Warning relay opens. **IBstFlt** is displayed. The actuator may or may not continue normal operation depending on actuator construction.

Cleared by: CPU will attempt to clear Induction Booster Drive fault error until fault condition is corrected.

IBstReset:

Cause: The Induction Booster Motor drive has detected a problem and asserted Drive Fault.

Indicators: **IBstReset** is displayed. Warning relay opens.

Cleared by: End of Reset Signal generation by CPU.

Primary Stepper Drive Faults:**PStpFlt:**

Cause: Fault line active from the Primary Stepper Drive.

Indicators: Warning relay opens. **PStpFlt** is displayed. The actuator may or may not continue normal operation depending on actuator construction.

Cleared by: CPU will attempt to clear reset the drive (**PStpReset**) until fault condition is corrected.

PStpReset:

Cause: The Primary Stepper Motor drive has detected a problem and asserted Drive Fault.

Indicators: **PStpRst** is displayed. Warning relay opens.

Cleared by: End of Reset Signal generation by CPU.

Dual Stepper Drive Faults:**DStpFlt:**

Cause: At least one motor drive has detected a problem.

Indicators: Warning relay opens. **DStpFlt** The actuator may or may not continue normal operation depending on actuator construction.

Cleared by: CPU will attempt to clear **DStpFlt** error until fault condition is corrected.

DStpReset:

- Cause:** The Dual Stepper Motor drive has detected a problem and asserted Drive Fault.
- Indicators:** **DStpRst** is displayed. Warning relay opens.
- Cleared by:** End of Reset Signal generation by CPU.

Accumulator Stepper Drive Faults:**AStpFlt:**

- Cause:** At least one motor drive has detected a problem.
- Indicators:** Warning relay opens. **AStpFlt** is displayed. Actuator has lost its ability to maintain its fail-safe or trip function.
- Cleared by:** CPU will attempt to clear **AStpFlt** error until fault condition is corrected.

AStpReset:

- Cause:** The Accumulator Stepper Motor drive has detected a problem and asserted Drive Fault.
- Indicators:** **AStpReset** is displayed. Warning relay opens.
- Cleared by:** End of Reset Signal generation by CPU.

Solenoid Test Faults:**TstPs1Bad or TstPs2Bad:**

- Cause:** The Test Pressure 1 or Test Pressure 2 transducer is out of range. The transducer is Considered out of range if the 4-20 mA signal is less than 3 mA.
- Indicators:** Warning relay opens. **TstPs1** or **TstPs1 bad** is displayed. Actuator continues to operate normally in **Auto** mode.
- Cleared by:** Transducer signal being greater than 3 mA.

TRIP DIS:

- Cause:** An operator has manually overridden any one of the isolation valves on the trip block manifold which would prevent the actuator from tripping.
- Indicators:** **TRIP DIS** will display in the REXA display and the red trip disabled LED will illuminate. Warning and Alarm relays open and will not follow changes in control setpoint. If Redundant Electronics, **TRIP DIS** will display in the REXA Main and Backup display and the Main red trip disabled LED will illuminate. The Main electronics Warning and Alarm relays will open and will no longer follow control setpoint but will recharge the accumulator. The Backup electronics Warning and Alarm relays will remain closed. It will take over as the Main and follow changes in control setpoint.
- Cleared by:** Returning the isolation valves to their fully open position.

HYD Bypass:

Cause: An operator has manually overridden the bypass valve for manual operation. The actuator will no longer follow control setpoint.

Indicators: **HYD Bypass** will display in the REXA display. Warning and Alarm relays open.

Cleared by: Returning the bypass valve to its fully closed position.

T1 Fail:

Cause: The automated solenoid test sequence number 1 has failed (T1, Open or T2 pressure < API Press 1).

Indicators: **T1 Fail** will display in the REXA display. Warning relay opens. See Technical Product Bulletin #20.0: Automated Online Solenoid Testing for solenoid test details.

Cleared by: After correcting the cause of the failure, repeating the solenoid testing will reset the previous testing failures. Resetting the CPU or cycling power will also eliminate the active warning.

T2 Fail:

Cause: The automated solenoid test sequence number 2 has failed (T1, Open or T2 pressure > API Press 2).

Indicators: **T2 Fail** will display in the REXA display. Warning relay opens. See Technical Product Bulletin #20.0: Automated Online Solenoid Testing for solenoid test details.

Cleared by: After correcting the cause of the failure, repeating the solenoid testing will reset the previous testing failures. Resetting the CPU or cycling power will also eliminate the active warning.

T3 Fail:

Cause: The automated solenoid test sequence number 3 has failed (T1, Open or T2 pressure < API Press 1).

Indicators: **T3 Fail** will display in the REXA display. Warning relay opens. See Technical Product Bulletin #20.0: Automated Online Solenoid Testing for solenoid test details.

Cleared by: After correcting the cause of the failure, repeating the solenoid testing will reset the previous testing failures. Resetting the CPU or cycling power will also eliminate the active warning.

T4 Fail:

Cause: The automated solenoid test sequence number 4 has failed (Open pressure > API Press 2).

Indicators: **T4 Fail** will display in the REXA display. Warning relay opens. See Technical Product Bulletin #20.0: Automated Online Solenoid Testing for solenoid test details.

Cleared by: After correcting the cause of the failure, repeating the solenoid testing will reset the previous testing failures. Resetting the CPU or cycling power will also eliminate the active warning.

T5 Fail:

Cause: The automated solenoid test sequence number 5 has failed (Close pressure > API Press 2).

Indicators: **T5 Fail** will display in the REXA display. Warning relay opens. See Technical Product Bulletin #20.0: Automated Online Solenoid Testing for solenoid test details.

Cleared by: After correcting the cause of the failure, repeating the solenoid testing will reset the previous testing failures. Resetting the CPU or cycling power will also eliminate the active warning.

T6 Fail:

Cause: The automated solenoid test sequence number 6 has failed (T1 pressure > API Press 2).

Indicators: **T6 Fail** will display in the REXA display. Warning relay opens. See Technical Product Bulletin #20.0: Automated Online Solenoid Testing for Solenoid Test details.

Cleared by: After correcting the cause of the failure, repeating the solenoid testing will reset the previous testing failures. Resetting the CPU or cycling power will also eliminate the active warning.

API Drift:

Cause: During a solenoid test sequence, the actuator moved >5% below its current position.

Indicators: **API Drift** will display in the REXA display. Warning relay opens.

Cleared by: After correcting the cause of the failure, repeating the solenoid testing will reset the previous testing failures. Resetting the CPU or cycling power will also eliminate the active warning.

Inv. API:

Cause: In **Auto** mode an online solenoid trip block test was initiated, but the actuator was not at 100% +0/- 1%+DB, the test was initiated while there was already another active fault, hydraulic bypass valve open, Isolation Valve #2 or Valve #4 was not closed, or Isolation Valve #1 or Valve #3 were closed.

NOTE: When in LOCAL mode, the actuator can be at any position to run the solenoid trip block test.

Indicators: **INV API** will display in the REXA display. Warning relay opens.

Cleared by: After correcting the cause of the failure, repeating the solenoid testing will reset the previous testing failures. Resetting the CPU or cycling power will also eliminate the active warning.



HART® Field Device Setup and Specification

Device Identification and Capability

Manufacturer Name:	<u>REXA</u>	Model Name(s):	<u>X3</u>
Manufacture ID Code:	<u>222 (DE Hex)</u>	Device Type Code:	<u>56961(DE81 Hex)</u>
HART Protocol Revision:	<u>7.6</u>	Device Revision:	<u>1</u>
Number of Device Variables:	<u>6</u>		
Physical Layers Supported:	<u>FSK</u>		
Physical Device Category:	<u>Actuator</u>		

Capability Checklist

Manufacturer, model, and revision	REXA, Xpac Series X3
Device type	Actuator
HART revision	7.6
Device Description available	Yes
Number and type of sensors	2 available from HART
Number and type of actuators	Electrohydraulic
Number and type of host side signals	1: 4 - 20mA analog
Number of Device Variables	6
Number of Dynamic Variables	4
Mappable Dynamic Variables?	Yes
Number of common-practice commands	3
Number of device-specific commands	53
Bits of additional device status	19
Alternative operating modes?	Yes
Burst mode?	No
Write-protection?	Yes, not in Setup mode

Terms and Definitions

HART DTM	Device Type Manager for HART devices
Device Type Manager (DTM)	Software component (device driver) for configuring, diagnosing, forcing, displaying the measured variables, and so on of a field device. It is compatible with the device and supplies device-specific documentation.
Highway addressable remote transducer (HART)	Digital communication protocol developed for industrial process application.
GUI	Graphical Unser Interface
Device Descriptor (DD)	Software component (device driver) for configuring, diagnosing, forcing, displaying the measured variables, and so on of a field device. It is compatible with the device and supplies device-specific documentation.

Product Scope

REXA provides device setup, monitoring and diagnostic information about the actuator through HART technology over the analog control signal input to the actuator. The following functions are supported:

Identification

- Display general actuator information such as actuator model, tag identification, actuator serial number and software/
hardware/HART version information.

Configuration

- View and update the actuator configuration parameters. *

Monitor

- View dynamic variables in real time such as Control Signal, Position, Torque / Thrust and Accumulator Pressure

Status

- View real time status and specific warning or alarm details.

Diagnosis

- View the alarm and warning current and historic counters.
- Display actuator Start / Stroke counters.

Mode

- Display device operational modes such as **Setup**, **Local Man**, and **Auto** modes.

*NOTE: No parameters can be written into the actuator unless that actuator is in **Setup** mode.*

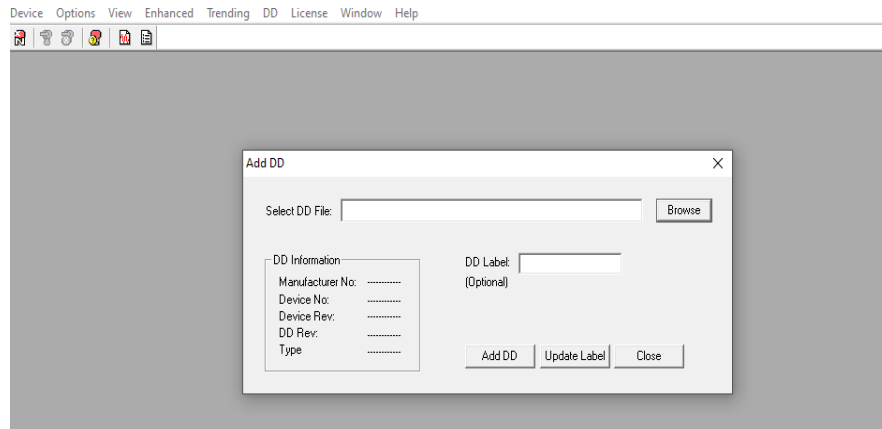
Product Interfaces

Host Interface

Through DD (Device Descriptor) technology, REXA provides users rich menu contents through host HART application. Each host application PLC, Field Communicator and Asset Management Software application will have its own look, feel, and screen navigation however the content shown in this manual should all be available. Some of host software platforms utilize iDTM or DTM frame technology to organize the DD information into their applications format. These systems typically have a built-in translation function however the HOST system support team will be responsible for handling the DD integration. REXA does not supply a vendor specific DTM file. This manual shows examples of numerous host applications to illustrate examples of the functionality, however the host system has final control of the way in which the information is displayed and controlled on the console screen.

Install/Update REXA DD

All host HART applications have a way to set up a new device onto the network which allows users to install/update/upload device descriptor “DD” files. The “DD” files consist of two separate files, an “xxxx.fm8” and “xxxx.sym” file. Below is an example screen capture.

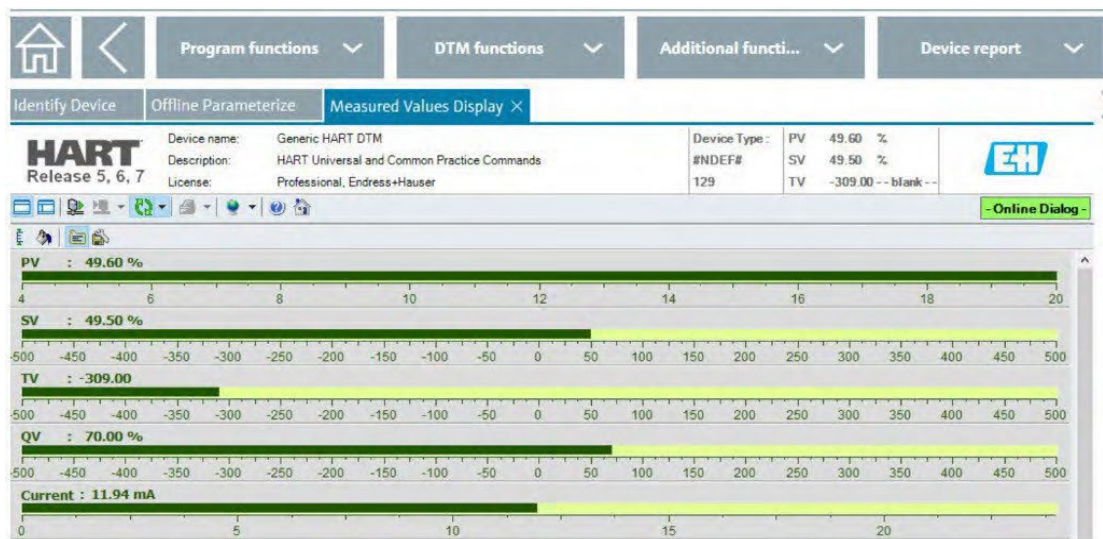


Install/Update REXA DD

There are multiple ways Host programs can handle the integration of a field device (REXA Actuator).

Basic HART Commands / Generic DTM Option

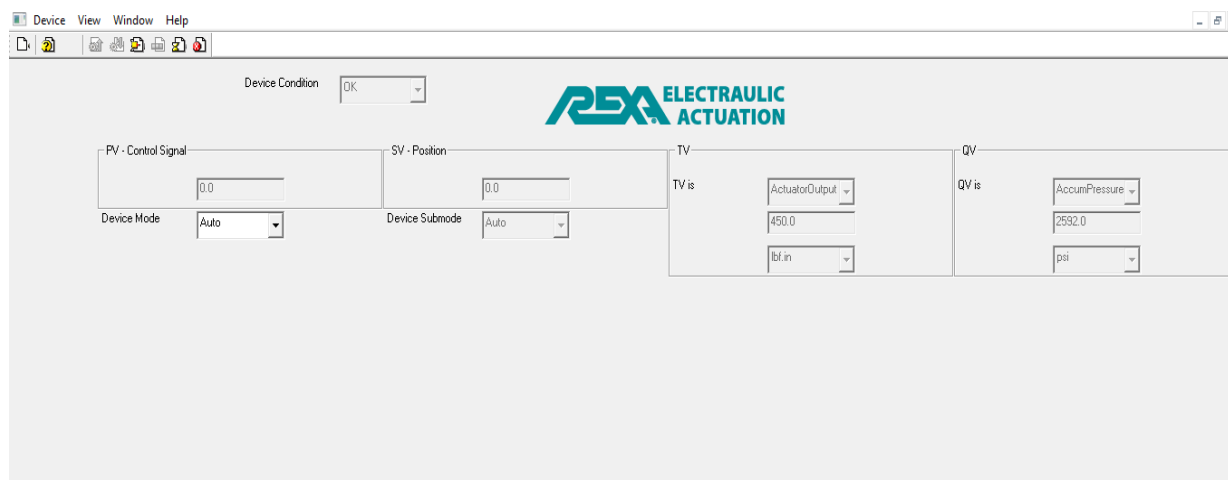
When a field device is connected to a HART Host and there are no device driver files installed the Host system will communicate using HART “Universal” and “Common Practice Commands”. The screenshot below provides an example. Variables are listed as “PV” – Primary variable, “SV” Secondary Variable, “TV” – Tertiary Variable, “QV” Quaternary Variable.



Basic HART Commands / Generic DTM Option

DD & Advanced iDTM Translators

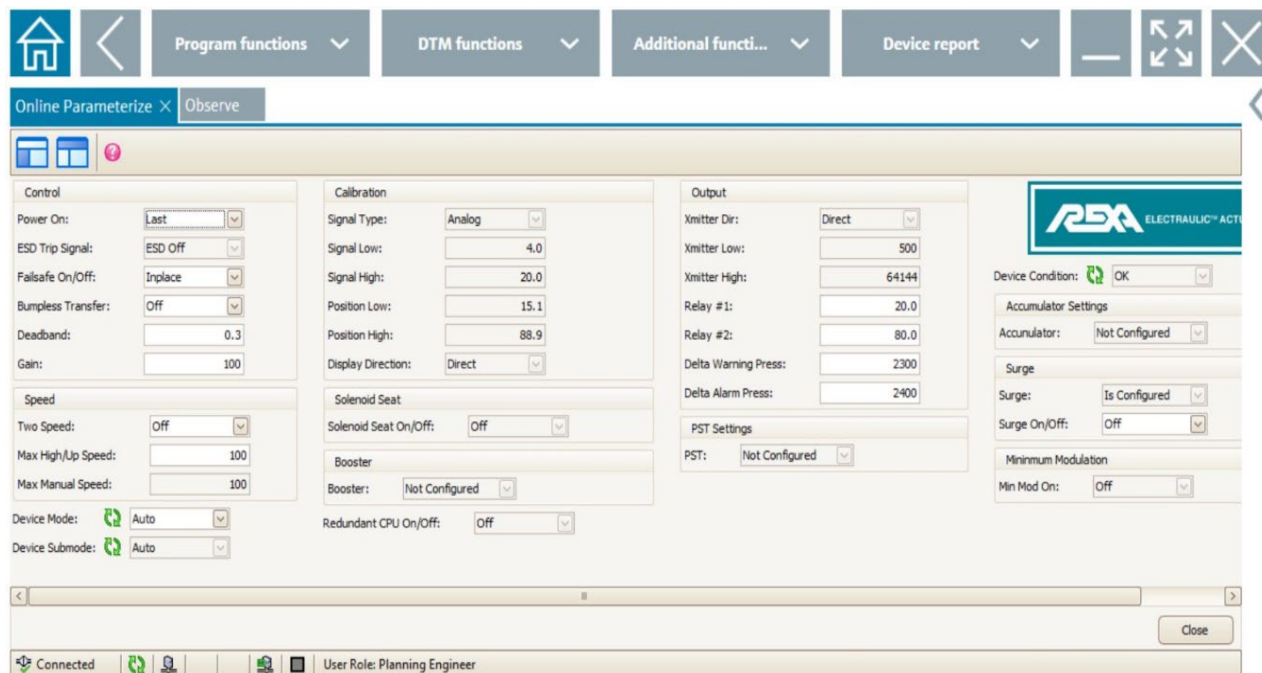
When a field device is connected to a HART Host and there are “DD” files installed the Host system will communicate using device specific Commands. The screen shots below provide an example of how the information will be presented in a GUI format with the correct variable labels and units.



The screenshot displays the 'DD & Advanced iDTM Translators' GUI. The interface includes the following elements:

- Device Condition:** OK
- REXA ELECTRAULIC ACTUATION** logo
- PV - Control Signal:** 0.0
- SV - Position:** 0.0
- TV:**
 - TV is: ActuatorOutput
 - 450.0
 - lbf.in
- QV:**
 - QV is: AccumPressure
 - 2592.0
 - psi
- Device Mode:** Auto
- Device Submode:** Auto

DD & Advanced iDTM Translators



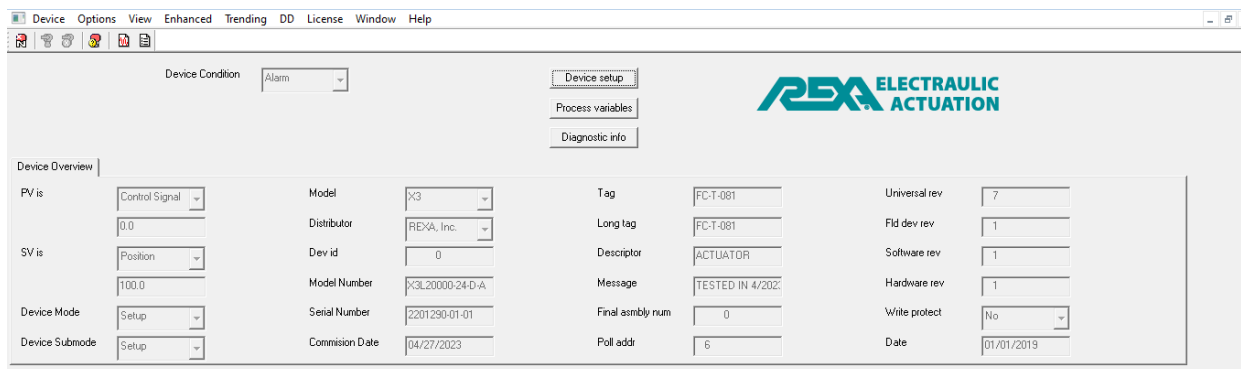
The screenshot shows the REXA GUI with the following configuration details:

- Control:** Power On: Last, ESD Trip Signal: ESD Off, Failsafe On/Off: Inplace, Bumpless Transfer: Off, Deadband: 0.3, Gain: 100.
- Speed:** Two Speed: Off, Max High/Up Speed: 100, Max Manual Speed: 100.
- Calibration:** Signal Type: Analog, Signal Low: 4.0, Signal High: 20.0, Position Low: 15.1, Position High: 88.9, Display Direction: Direct.
- Output:** Xmitter Dir: Direct, Xmitter Low: 500, Xmitter High: 64144, Relay #1: 20.0, Relay #2: 80.0, Delta Warning Press: 2300, Delta Alarm Press: 2400.
- PST Settings:** PST: Not Configured.
- Device Mode:** Auto.
- Device Submode:** Auto.
- Accumulator Settings:** Accumulator: Not Configured.
- Surge:** Surge: Is Configured, Surge On/Off: Off.
- Minimum Modulation:** Min Mod On: Off.

GUI Screens

Setup Device Polling Address Search Range

REXA is configured with the polling address 0 (can be updated as needed to 64).



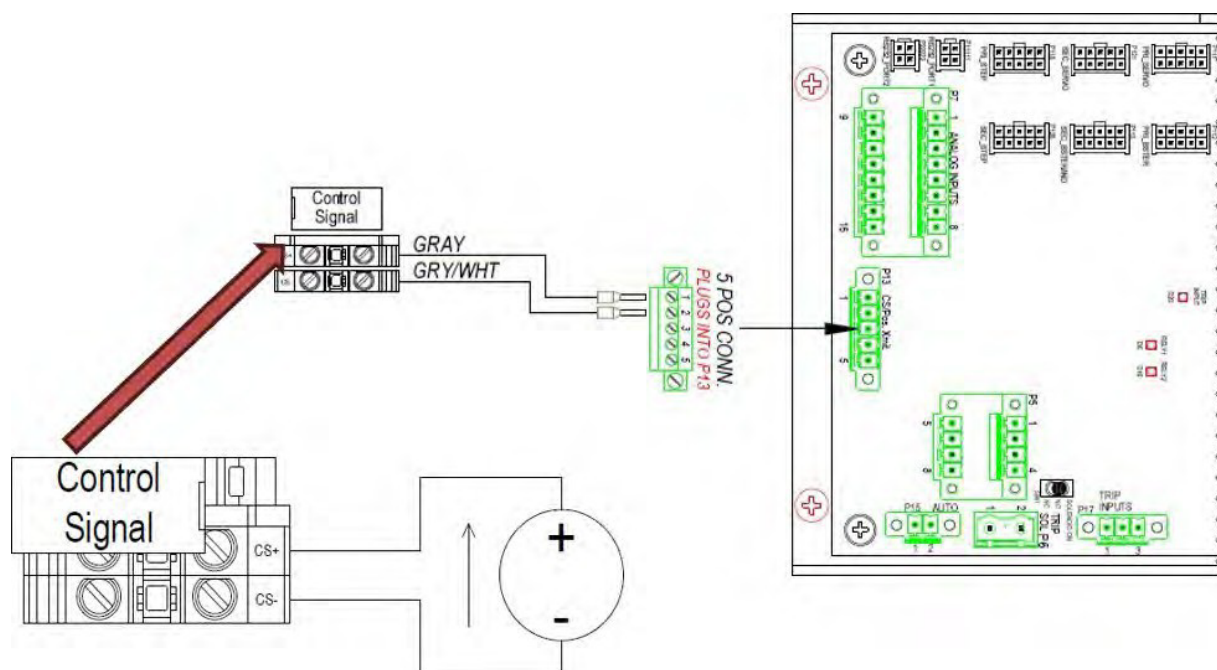
The screenshot shows the REXA GUI with the following configuration details:

- Device Overview:**
 - PV is: Control Signal, 0.0
 - SV is: Position, 100.0
 - Device Mode: Setup
 - Device Submode: Setup
 - Model: X3
 - Distributor: REXA, Inc.
 - Dev id: 0
 - Model Number: X3L20000-24-D-A
 - Serial Number: 2201290-01-01
 - Commission Date: 04/27/2023
 - Tag: FC-T-081
 - Long tag: FC-T-081
 - Descriptor: ACTUATOR
 - Message: TESTED IN 4/2022
 - Final assembly num: 0
 - Poll addr: 6
 - Universal rev: 7
 - Fid dev rev: 1
 - Software rev: 1
 - Hardware rev: 1
 - Write protect: No
 - Date: 01/01/2019

Setup Device Polling Address Search Range

Connect to Actuator

Connect two-wire 4-20mA loop to actuator from a HART compatible HOST card as illustrated below.



Control Signal Factory Connection

It is recommended to use high quality cable meeting the following requirements as a minimum:

Cable Type	1 Pair 24 AWG
Shield	Bi-Laminate (Alum+Poly) 100% Coverage
Nom. Conductor DCR	24.1 Ohm/1000ft
UL Voltage Rating	300 V (CMP)
Max Current	2.2 Amps per Conductor at 25 C

Device Online Menu

****Not available on all models.**

Host HART application allows user to get an overview of the device through online menus or navigation windows provided in the host application. While the device is online the parameters are greyed out and cannot be modified.

Write Protection

'Write' is only allowed when the actuator is put into **Setup** mode locally at REXA electronic control enclosure. To write a parameter, the value of the parameter needs to be modified and may also need to be highlighted. Once the parameter is selected and modified, a send or apply button must be clicked to send its value to the device.

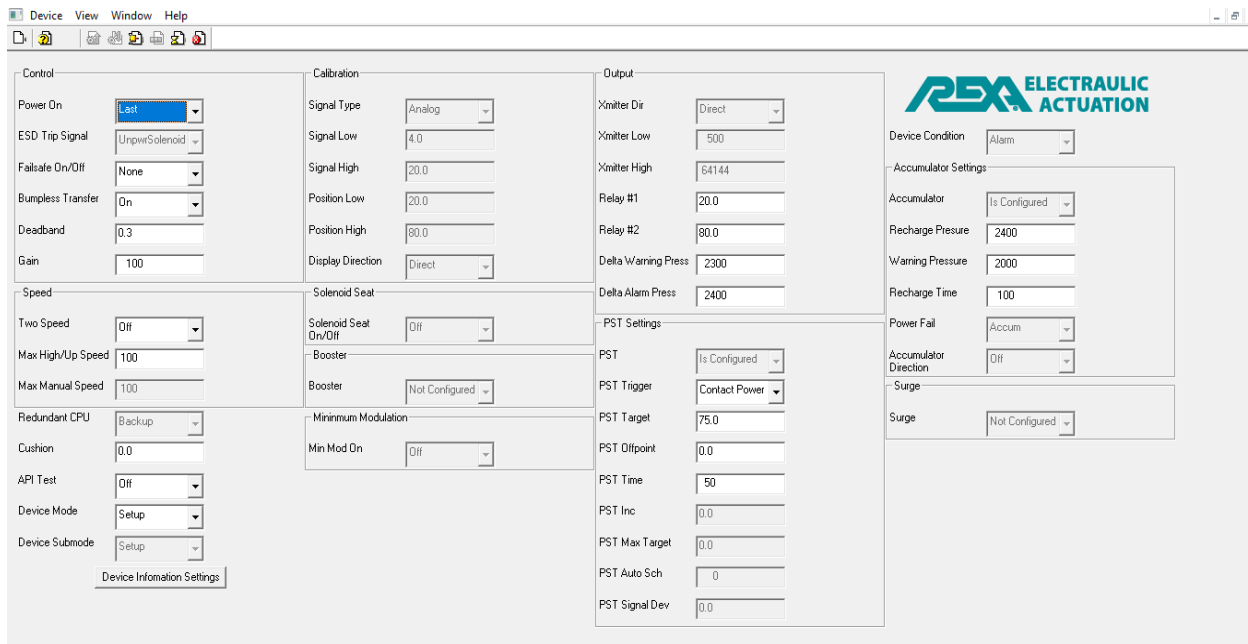
Host HART application allows user to get an overview of the device through online menus or navigation windows provided in the host application. While the device is online the parameters are greyed out and cannot be modified. To modify parameters, the device must be put into **Setup** mode.



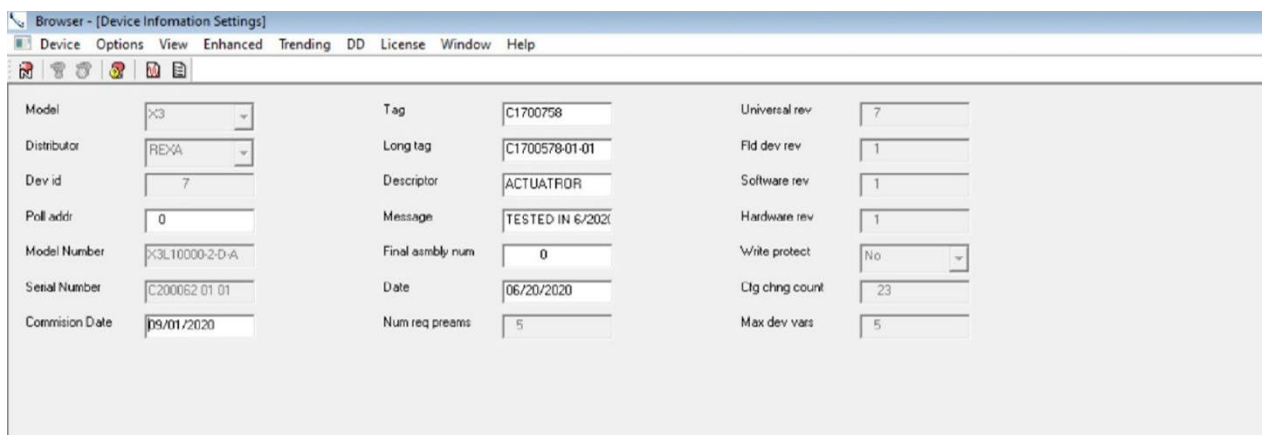
Write Protection

Device Settings

Navigate the online menu through host HART application, user can find the device **Setup** menu.



Online Menu Navigation

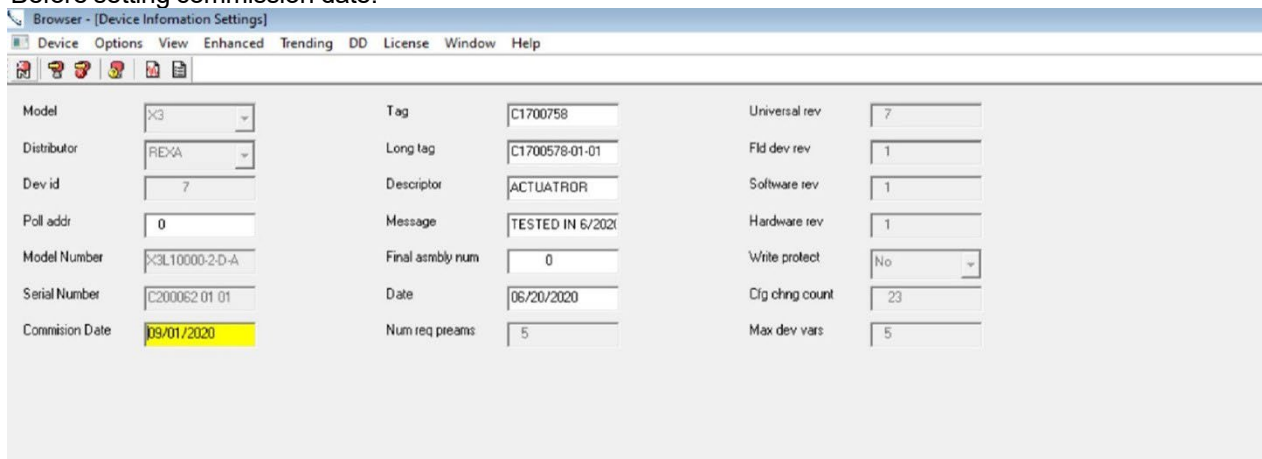


Browser - [Device Information Settings]			
Device Options View Enhanced Trending DD License Window Help			
Model	X3	Tag	C1700758
Distributor	REXA	Long tag	C1700578-01-01
Dev id	7	Descriptor	ACTUATOR
Poll addr	0	Message	TESTED IN 6/2020
Model Number	X3L10000-2-D-A	Final assembly num	0
Serial Number	C200062 01 01	Date	06/20/2020
Commission Date	09/01/2020	Num req preams	5
		Universal rev	7
		Fld dev rev	1
		Software rev	1
		Hardware rev	1
		Write protect	No
		Cfg chng count	23
		Max dev vars	5

Device Identification Settings

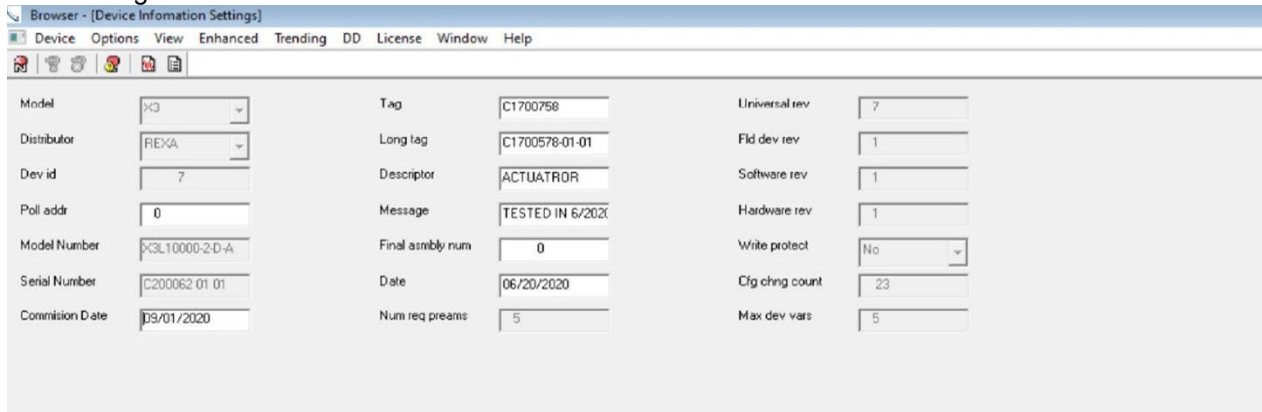
At the setup page, the parameters in white are writable while the ones in grey are read-only. Below is an example of setting commission date.

Before setting commission date:



Browser - [Device Information Settings]			
Device Options View Enhanced Trending DD License Window Help			
Model	X3	Tag	C1700758
Distributor	REXA	Long tag	C1700578-01-01
Dev id	7	Descriptor	ACTUATOR
Poll addr	0	Message	TESTED IN 6/2020
Model Number	X3L10000-2-D-A	Final assembly num	0
Serial Number	C200062 01 01	Date	06/20/2020
Commission Date	09/01/2020	Num req preams	5
		Universal rev	7
		Fld dev rev	1
		Software rev	1
		Hardware rev	1
		Write protect	No
		Cfg chng count	23
		Max dev vars	5

After setting commission date:

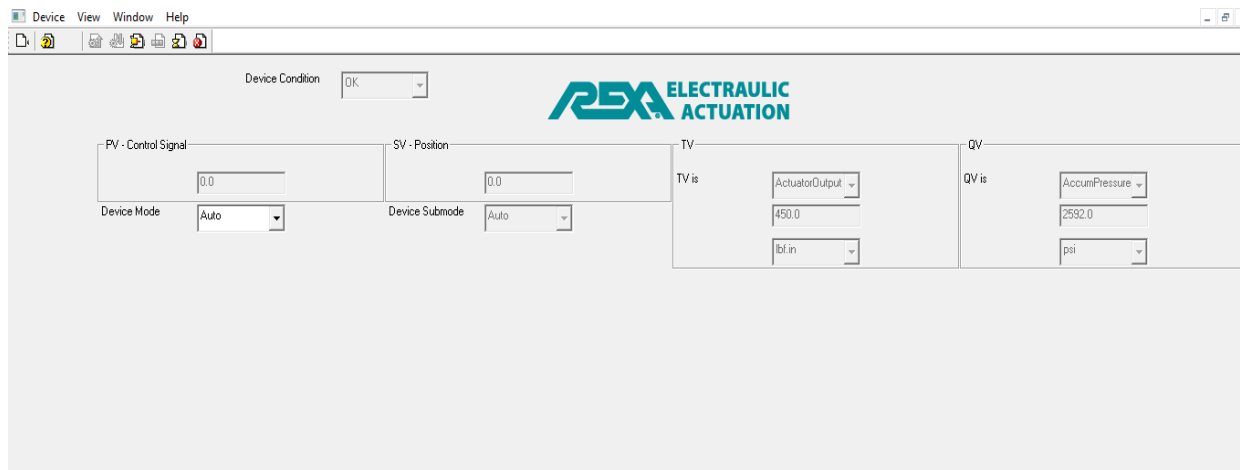


Browser - [Device Information Settings]			
Device Options View Enhanced Trending DD License Window Help			
Model	X3	Tag	C1700758
Distributor	REXA	Long tag	C1700578-01-01
Dev id	7	Descriptor	ACTUATOR
Poll addr	0	Message	TESTED IN 6/2020
Model Number	X3L10000-2-D-A	Final assembly num	0
Serial Number	C200062 01 01	Date	06/20/2020
Commission Date	09/01/2020	Num req preams	5
		Universal rev	7
		Fld dev rev	1
		Software rev	1
		Hardware rev	1
		Write protect	No
		Cfg chng count	23
		Max dev vars	5

****To satisfy the user's convenience, REXA treats short tag as a part of the long tag.**

Monitor X3 Device's Operation Process

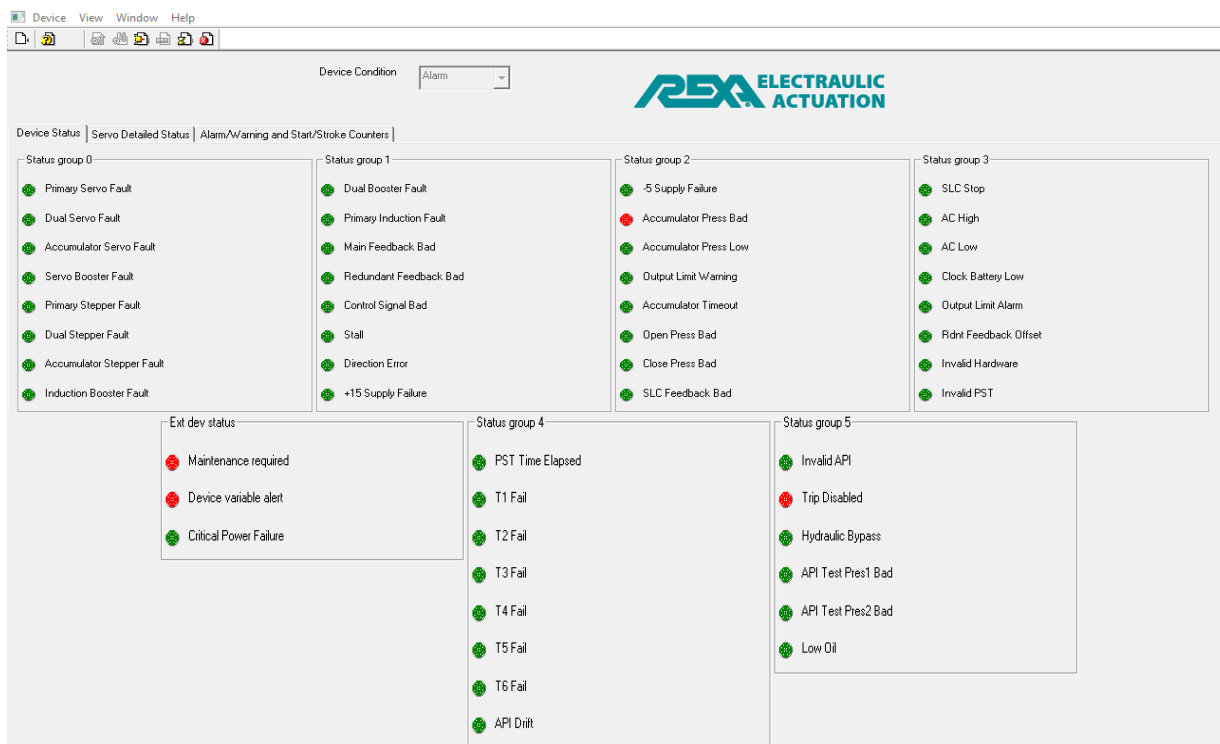
Host HART application can monitor X3 device in real time through process variables.



The screenshot shows the 'Device' window of the Rexa HART application. The 'Device Condition' is set to 'OK'. The interface displays several process variables and their current values:

- PV - Control Signal:** 0.0
- SV - Position:** 0.0
- Device Mode:** Auto
- Device Submode:** Auto
- TV is:** ActuatorOutput (450.0, lb/in)
- QV is:** AccumPressure (2532.0, psi)

Monitor X3 Device's Operation Process

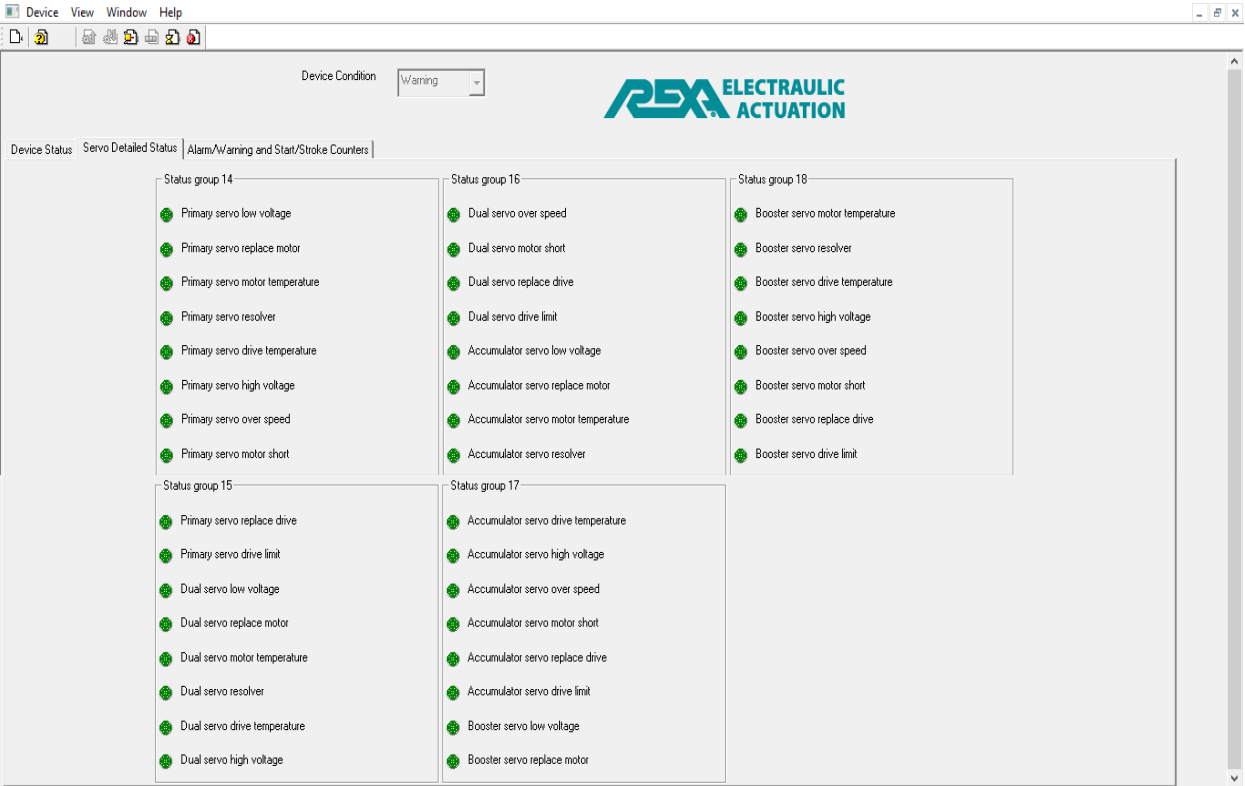


The screenshot shows the 'Device' window of the Rexa HART application with the 'Device Condition' set to 'Alarm'. The 'Device Status' tab is selected, displaying a list of faults categorized into status groups:

- Status group 0:**
 - Primary Servo Fault
 - Dual Servo Fault
 - Accumulator Servo Fault
 - Servo Booster Fault
 - Primary Stepper Fault
 - Dual Stepper Fault
 - Accumulator Stepper Fault
 - Induction Booster Fault
- Status group 1:**
 - Dual Booster Fault
 - Primary Induction Fault
 - Main Feedback Bad
 - Redundant Feedback Bad
 - Control Signal Bad
 - Stall
 - Direction Error
 - +15 Supply Failure
- Status group 2:**
 - 5 Supply Failure
 - Accumulator Press Bad
 - Accumulator Press Low
 - Output Limit Warning
 - Accumulator Timeout
 - Open Press Bad
 - Close Press Bad
 - SLC Feedback Bad
- Status group 3:**
 - SLC Stop
 - AC High
 - AC Low
 - Clock Battery Low
 - Output Limit Alarm
 - Rdnt Feedback Offset
 - Invalid Hardware
 - Invalid PST
- Ext dev status:**
 - Maintenance required
 - Device variable alert
 - Critical Power Failure
- Status group 4:**
 - PST Time Elapsed
 - T1 Fail
 - T2 Fail
 - T3 Fail
 - T4 Fail
 - T5 Fail
 - T6 Fail
 - API Drift
- Status group 5:**
 - Invalid API
 - Trip Disabled
 - Hydraulic Bypass
 - API Test Pres1 Bad
 - API Test Pres2 Bad
 - Low Oil

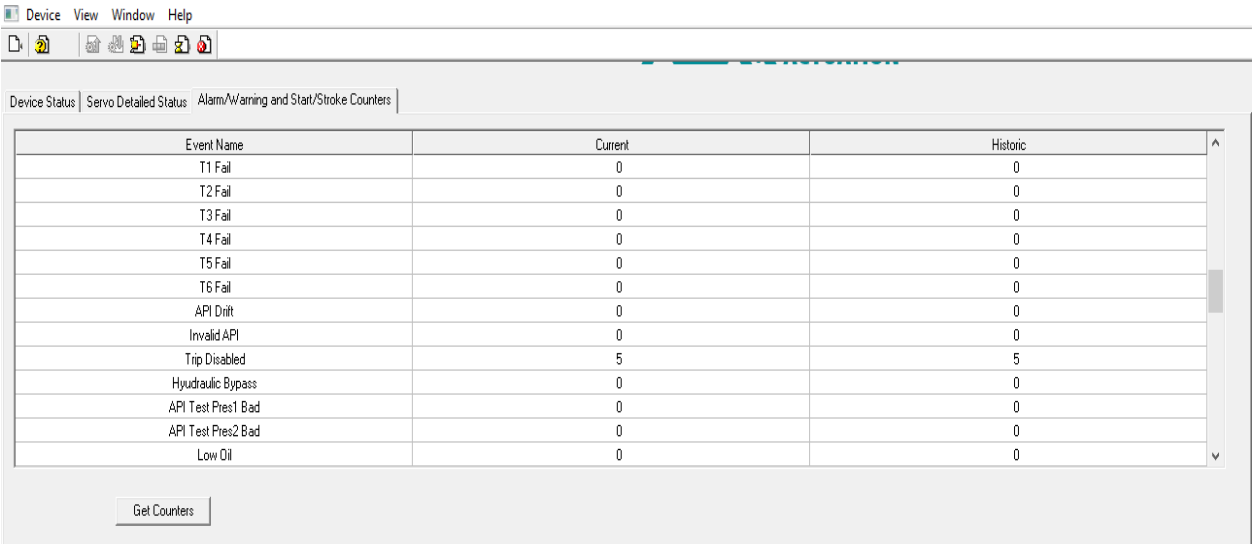
X3 Device Fault Information

Clicking on “Servo Detailed Status” on diagnostics page, user can get additional Motor Status information:



Diagnostics Page

Clicking on “Alarm/Warning and Start/Stroke Counters” on the diagnostic page, user can navigate to the counter page:



Counter Page

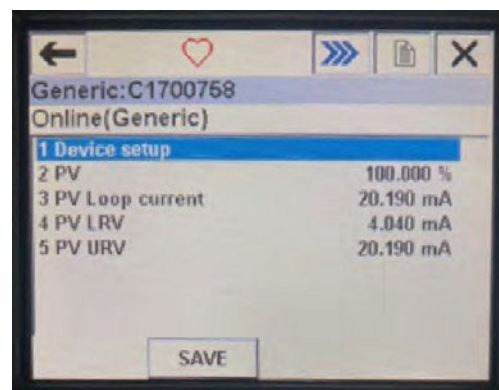
To get updated counters, user can click on the “Get Counters” button, and further click on “OK” on the question of “Read All The Counters Now?”

Possible Trouble Shooting Methods

HART Secondary Master Device

A HART secondary master device, such as the Emerson 475, Trex, or laptop running a HART application is a valid method to confirm that the REXA is properly communicating HART data.

For example, the HART probes of Emerson 475 can be connected to 4-20mA control signal wires. The screen below indicates a solid red HART symbol confirming that the REXA is sending the proper HART information and that the secondary master device is receiving the data. Also shown below the four real time variables will show up and they will continuously update further confirming the REXA is configured properly.



HART Secondary Master Device

Dynamic Variables

This device uses dynamic variable mapping based on system configurations. In X3 device, the following mapping is typical. When torque/thrust and/or accumulator are not available, position 2 and/or pressure 2 can be mapped to dynamic variables. Position 2 and pressure 2 can be a fixed value used for testing purposes.

Dynamic Variable	Device Variable Number	Name	UNIT
PV	0	Control Signal (Setpoint)	%
SV	1	Position	%
TV	2	**Torque/ Thrust	lbf.in/lbf
QV	3	**Accumulator Pressure	psi

****Not available on all models.**

Control Signal

4~20mA input signal as the setpoint of the position control. This variable is displayed in percentages.

Position

This variable is the current position of the actuator and is displayed in percentage of the actuators calibrated span.

Torque/ Thrust

The actuator differential pressure (close pressure – open pressure) is used for calculating its torque or thrust based on the device’s model number. A positive value indicates extending/CW (clockwise), and a negative value indicates retracting/CCW (counterclockwise).

Accumulator

4~20mA accumulator pressure signal represents the pressure from 0 psi to 3000 psi.

Status Information

Device Status

Bit 4 (“More Status Available”) is contained in each communication package being sent from the actuator to the host. This is set to 1 whenever any status bit is detected. Command #48 gives further detail.

Extended Device Status

Command 48 warning status is the prediction of device maintenance needed. Command 48 alarm status means the variables are in alert status.

Additional Device Status (Command #48)

Command #48 returns 19 bytes of status data, with the following status information:

Byte	Bit	Meaning	Class	Device Status Bits Set
0	0	Primary servo fault	Warning	4
	1**	Dual servo fault	Warning	4
	2**	Accumulator servo fault	Warning	4
	3**	Servo booster fault	Warning	4
	4	Primary stepper fault	Warning	4
	5**	Dual stepper fault	Warning	4
	6**	Accumulator stepper fault	Warning	4
	7**	Induction boost fault	Warning	4
1	0**	Dual boost fault	Warning	4
	1**	Primary induction fault	Warning	4
	2	Main feedback bad	Alarm	4, 7
	3**	Redundant feedback bad	Warning	4
	4	Control signal failure	Alarm	4, 7
	5	Stall	Alarm	4, 7
	6	Direction error	Alarm	4, 7
	7	15v supply failure	Alarm	4, 7
2	0	-5v supply failure	Alarm	4, 7
	1**	Accumulator pressure bad	Warning	4
	2**	Accumulator pressure low	Warning	4
	3**	Output Limit Warning	Warning	4
	4**	Accumulator timeout	Warning	4
	5**	Open pressure bad	Warning	4
	6**	Close pressure bad	Warning	4
	7**	SLC Feedback Bad	Alarm	4, 7
3	0**	SLC Stop	Warning	4
	1	AC High	Warning	4
	2	AC Low	Warning	4
	3	Clock Battery Low	Warning	4
	4**	Output Limit Alarm	Alarm	4, 7



	5**	Redundant Feedback Offset	Warning	4
	6	Invalid Hardware	Warning	4
	7**	Invalid PST	Warning	4
4	0**	PST Time Elapsed	Warning	4
	1**	T1 Fail	Warning	4
	2**	T2 Fail	Warning	4
	3**	T3 Fail	Warning	4
	4**	T4 Fail	Warning	4
	5**	T5 Fail	Warning	4
	6**	T6 Fail	Warning	4
	7**	API Drift	Warning	4
5	0**	Invalid API	Warning	4
	1**	Trip Disabled	Alarm	4, 7
	2**	Hydraulic Bypass	Alarm	4, 7
	3**	API Test Pres1 Bad	Warning	4
	4**	API Test Pres2 Bad	Warning	4
	5**	Low Oil	Warning	4
6	0	Set whenever warning bit is set	Warning	
	1	Set whenever alarm bit is set	Alarm	
14	0**	Primary servo low voltage	Warning	4
	1**	Primary servo replace motor	Warning	4
	2**	Primary servo motor temperature	Warning	4
	3**	Primary servo resolver	Warning	4
	4**	Primary servo drive temperature	Warning	4
	5**	Primary servo high voltage	Warning	4
	6**	Primary servo over speed	Warning	4
	7**	Primary servo motor short	Warning	4
15	0**	Primary servo replace drive	Warning	4
	1**	Primary servo drive limit	Warning	4
	2**	Dual servo low voltage	Warning	4
	3**	Dual servo replace motor	Warning	4
	4**	Dual servo motor temperature	Warning	4
	5**	Dual servo resolver	Warning	4
	6**	Dual servo drive temperature	Warning	4
	7**	Dual servo high voltage	Warning	4
16	0**	Dual servo over speed	Warning	4
	1**	Dual servo motor short	Warning	4
	2**	Dual servo replace drive	Warning	4
	3**	Dual servo drive limit	Warning	4
	4**	Accumulator servo low voltage	Warning	4

	5**	Accumulator servo replace motor	Warning	4
	6**	Accumulator servo motor temperature	Warning	4
	7**	Accumulator servo resolver	Warning	4
17	0**	Accumulator servo drive temperature	Warning	4
	1**	Accumulator servo high voltage	Warning	4
	2**	Accumulator servo over speed	Warning	4
	3**	Accumulator servo motor short	Warning	4
	4**	Accumulator servo replace drive	Warning	4
	5**	Accumulator servo drive limit	Warning	4
	6**	Booster servo low voltage	Warning	4
	7**	Booster servo replace motor	Warning	4
18	0**	Booster servo motor temperature	Warning	4
	1**	Booster servo resolver	Warning	4
	2**	Booster servo drive temperature	Warning	4
	3**	Booster servo high voltage	Warning	4
	4**	Booster servo over speed	Warning	4
	5**	Booster servo motor short	Warning	4
	6**	Booster servo replace drive	Warning	4
	7**	Booster servo drive limit	Warning	4

****Not available on all models.**

These bits are set or cleared by the self-test executed at power up or following a reset command. They are also set (but not cleared) by any failure detected during continuous background self-testing.

Universal Commands

Universal Commands	0, 1, 2, 3, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22
---------------------------	--

Common Practice Commands

Common Practice Commands	33, 50, 54
---------------------------------	------------

Device-Specific Commands

The host system communicates with the REXA Device through Device EDD. It is Device EDD that uses Device Specific Commands as needed.

Tables

Unit Codes

Name	Unit Code	Unit
Torque Unit	240	lbf.in

Unsupported Modes

Burst Mode

This Field Device does not support Burst Mode.

Catch Device Variable

This Field Device does not support Catch Device Variable.

Connecting Emerson AMS Device Manager with REXA HART DD

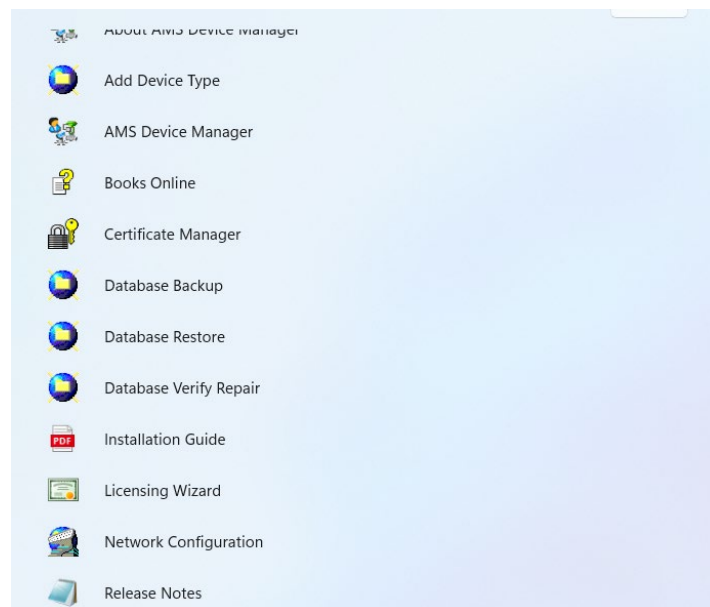
1. Establish REXA DD file directory on the host device.

- Create a Device DD directory, name it REXA DD.
- Save the REXA DD files named 0107.sym and 0107.fm8 into this new directory

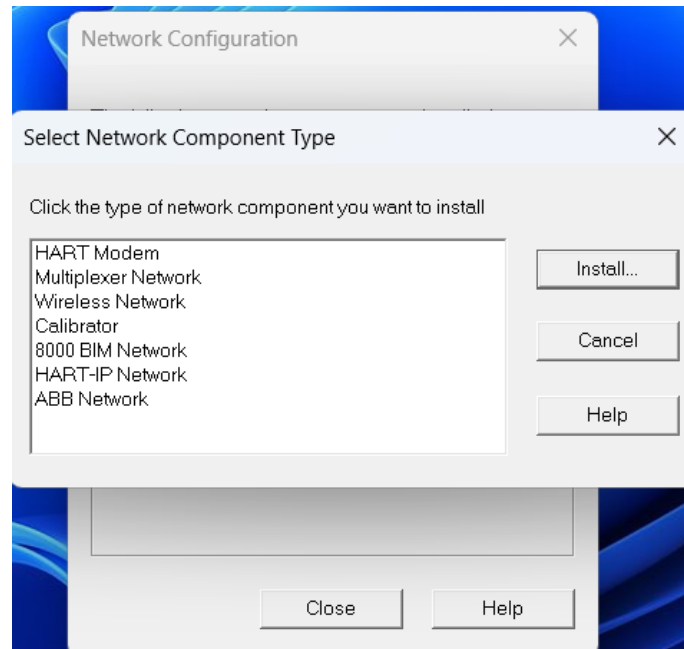
NOTE: DD file name "0107" is used as an example throughout this procedure. Please replace this file name with the actual file name in use.

2. Connect with AMS Device Manager

- Check if the HART network is properly configured.
- If not, launch AMS Network Configuration by clicking Start -> AMS Device Manager Folder-> Network Configuration

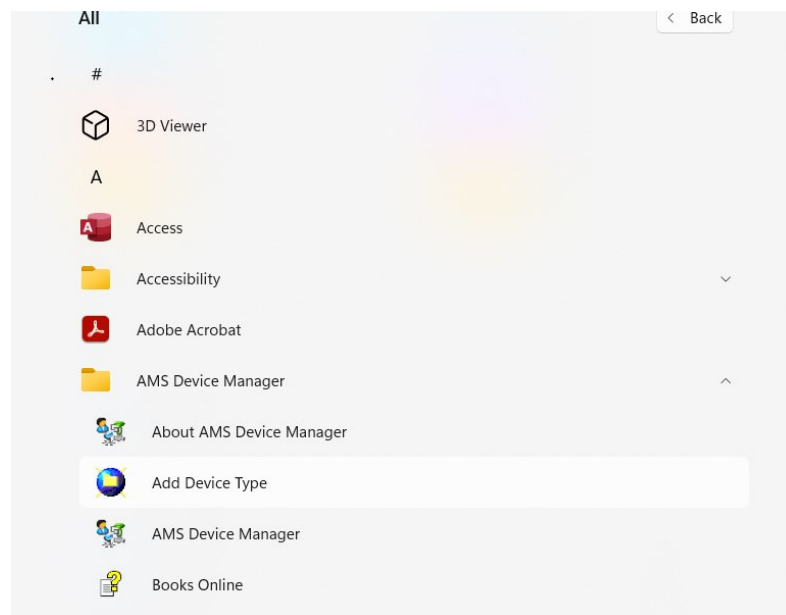


- Add the proper network interface->Click on Install.

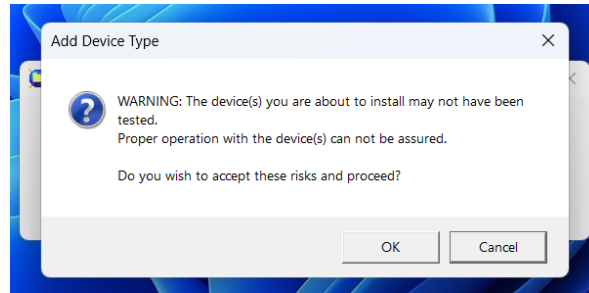


3. Install REXA DD into AMS Device Manager

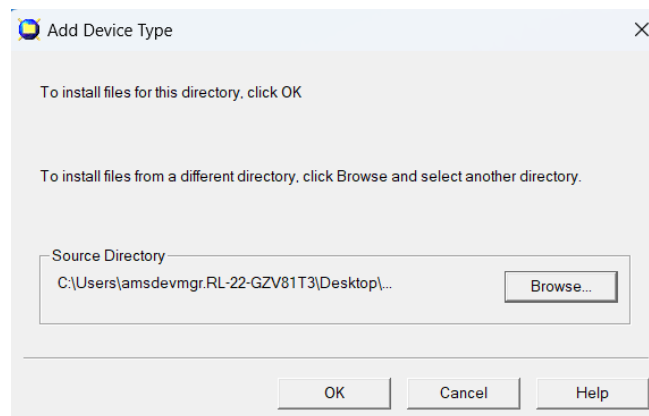
- Start the program “Add Device Type” by clicking “Start”->AMS Device Manager folder-> “Add Device Type”



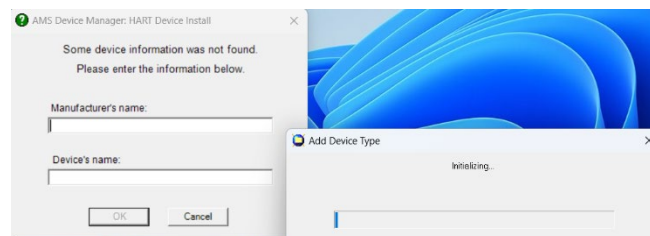
- Click “OK” at Warning



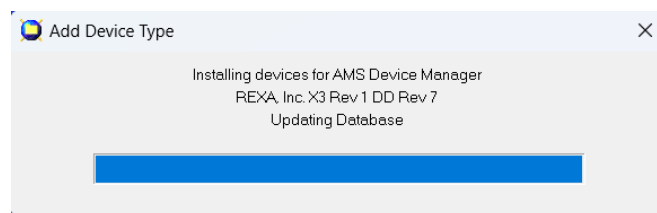
- Browse to the directory that contains DD files 0107.fm8 and 0107.sym. i.e. the directory “REXA DD” created at step 1-> click OK.



- Enter “REXA, Inc.” at the box “Manufacturer’s name” and “X3” at the box “Device’s name”, click “OK”



- The device will begin installing.



- Click OK at “Add Device Type completed successfully”



4. Update DDInstal.ini

- Go to the base AMS directory on the host system and open the devices folder AMS\Devices. Open the file ddinstal.ini.
- Find the total manufacturer number NumOfMfg under [General]. Increase this NumOfMfg by 1.

For example, if the original ddinstal.ini file contains the following:

```
[General]
NumOfMfg=299
UseDeviceFileSubDirs=Yes
```

Change it to contain the following:

```
[General]
NumOfMfg=300
UseDeviceFileSubDirs=Yes
```



NOTE: The number highlighted in yellow is the REXA DD version number in the name of DD file. 07 reflects the DD file named 0107.fm8. If DD file 0108.fm8 is in use, use 08 to replace 07 in yellow background.

NOTE: The number highlighted in purple is the total number of REXA Devices in the network.

NOTE: The number highlighted in blue is the device number.

At the end of ddinstal.ini, add the following:

[Mfg (NumOfMfg + 1)] or [Mfg300] for example

Protocol=HART

Name =REXA, Inc.

ID=0000de

NumOfDev=1

[0000de.1]

DevType=de81

DevTypeDesc=X3

DevTypeRevDesc=Rev 1

DevTypeRev=0

DDRevDesc=DD Rev 7

FMS=0107.fm8

SYM=0107.sym

FHX=0000de_de81_01.fhx

ALM=0000de_de81_01.alm

MAP=

DeviceHelp=

DeviceDLL=

Template=0000dede810107.mrg

HART Protocol Rev 7

AmsVersionSupport= 14.5

(14.5 is the version number of ASM Device Manager in use.)

Save this ddinstal.ini file.

5. Update .fhx file

*NOTE: The number highlighted in yellow = (DD version number * 100) + 1*

In the AMS directory :\\AMS\\Devices\\HART\\0000de\\de81 open file 0000de_de81_01.fhx
Under section HART_DEVICE_TYPE, add a line DDREV=**701**
below the line: DESCRIPTION="REXA, Inc., X3 H7 Rev 1"

NOTE: "DDREV=701" is calculated based on the example "DD file name 0107" used throughout this procedure. Please replace this file name with the actual file name in use.

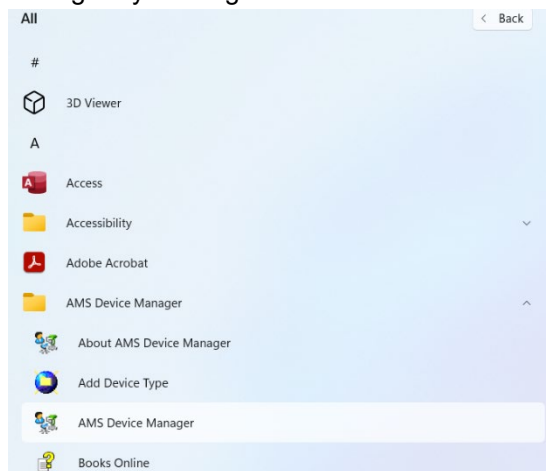
For example,

```
HART_DEVICE_REVISION REVISION="1" DEVICE_REVISION_ID=1 MANUFACTURER="REXA, Inc.." HART_DEVICE_TYPE="X3 H7"
{
  DESCRIPTION="REXA, Inc.. X3 H7 Rev 1"
  DDREV=701
  RESOURCE_PATH="0000de\\de81\\"
  FACEPLATE_DISPLAY_NAME=""
  ALARMS_ENABLED=T
}
```

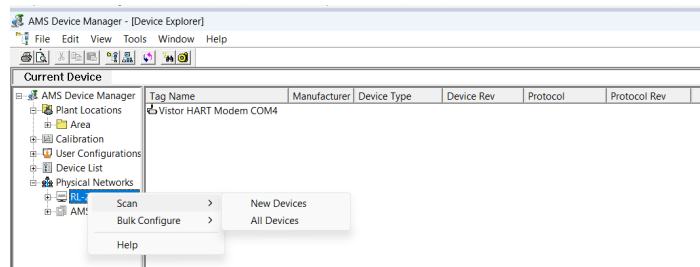
Save this .fhx file.

6. HART DD Operation:

- Launch AMS Device Manager by clicking Start->AMS Device Manager folder-> AMS Device Manager



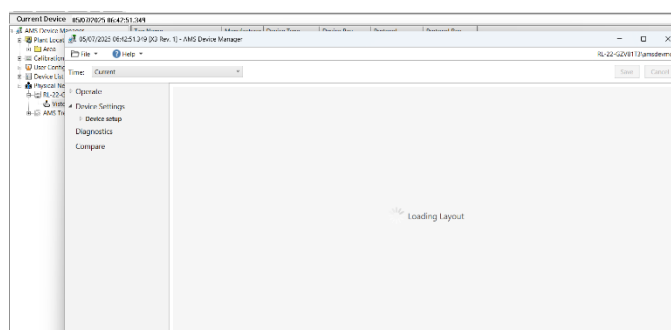
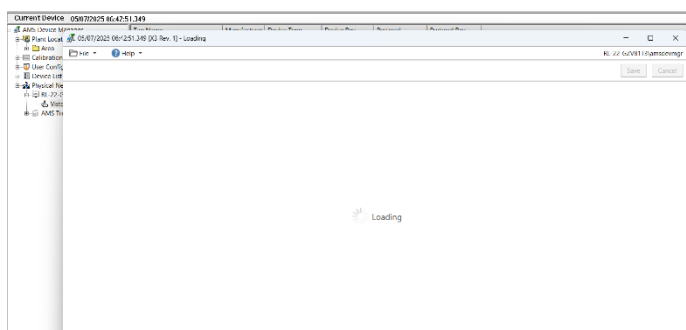
- At AMS Device Manager navigator on the left of the AMS Screen, expand Physical Networks->right click on the name of the host system->scan.



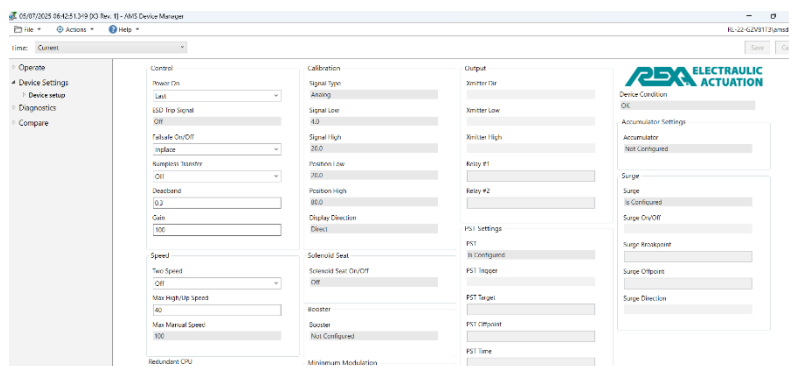
- REXA, Inc. HART Device shows up at the center of the screen with Tag Name equals the time stamp that device was added, Manufacturer=REXA, Inc., Device Type = X3, Device Rev = 1, Protocol = HART, Protocol Rev = 7

Current Device							
Tag Name	Manufacturer	Device Type	Device Rev	Protocol	Protocol Rev		
05/07/2025 06:42:51.349	REXA, Inc.	X3	1	HART	7		

- Change the time stamp to be the device tag name.
- Double click the tag name-> device will be loading



- REXA DD Menu shows up

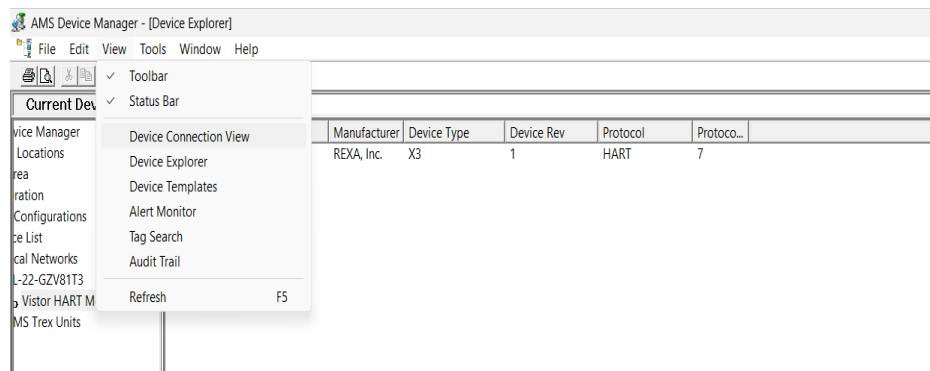


- Navigate through the menu on the left of the screen to control/monitor REXA X3 device.

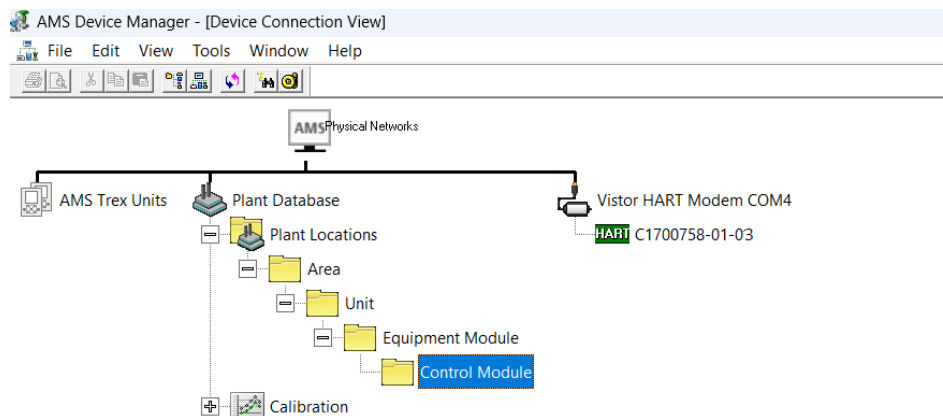
NOTE: For details see the Product Interfaces section of Technical Product Bulletin #6.0: HART® Field Device Setup and Specification in Xpac 3 IOM.

7. Configure AMS Device Manager Alert Monitor

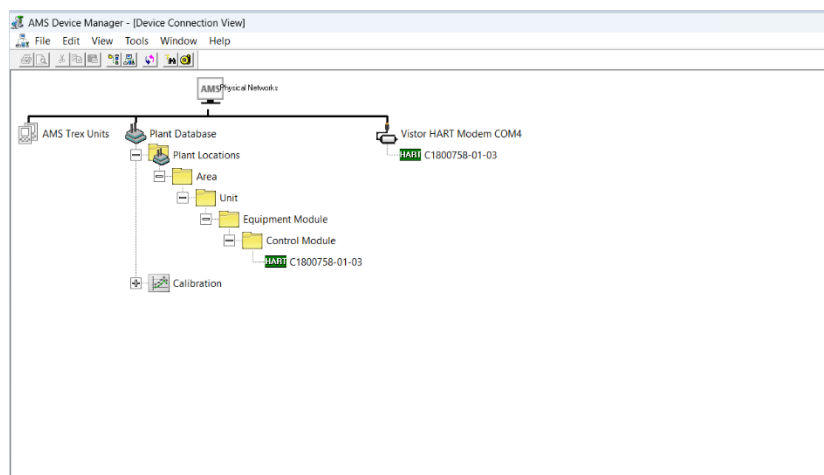
- Click View -> Device Connection View



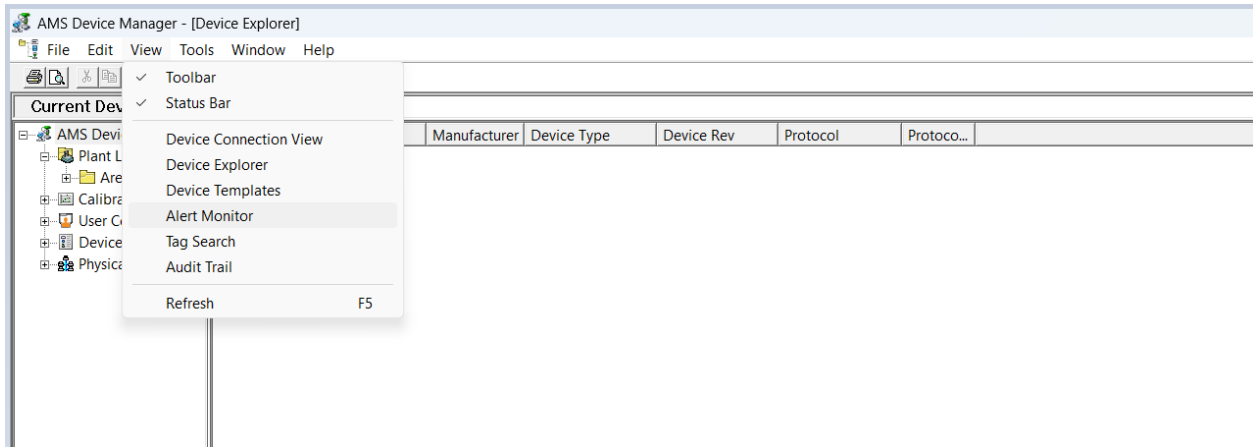
- Expand the Plant Database.



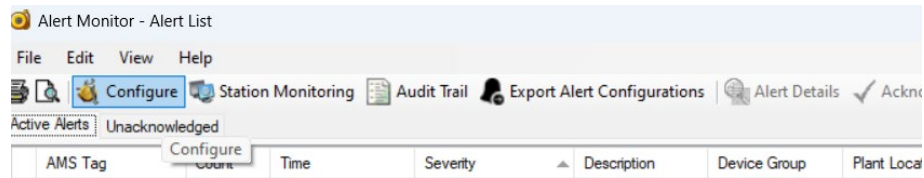
- Drag REXA Inc. Device (in this example, tag name C1700758-01-03) under the Network Interface on the right into Control Module under Plant Database. Save and close it.



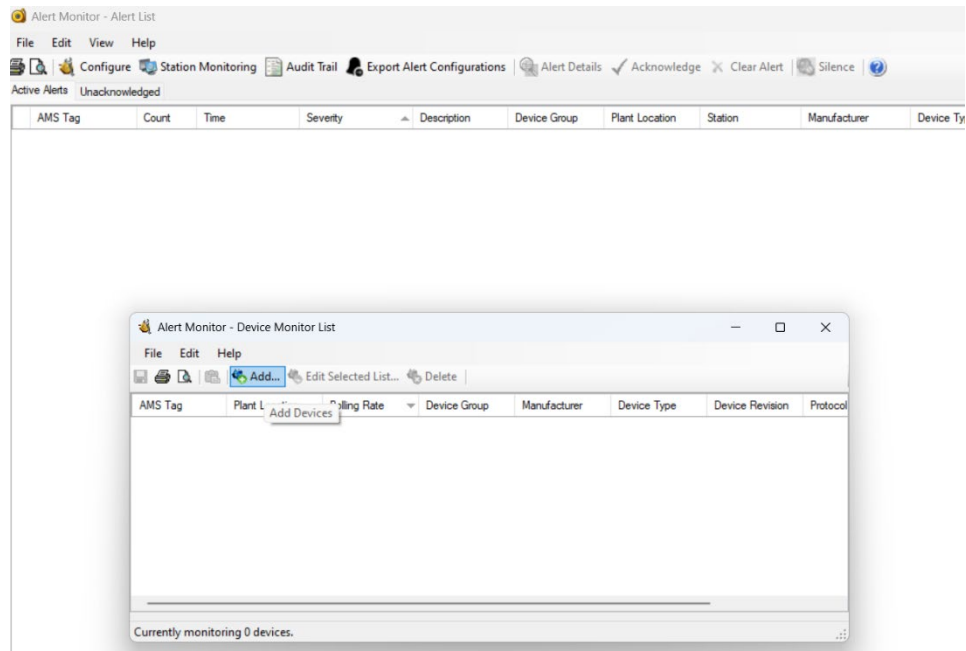
- Click View->Alert Monitor



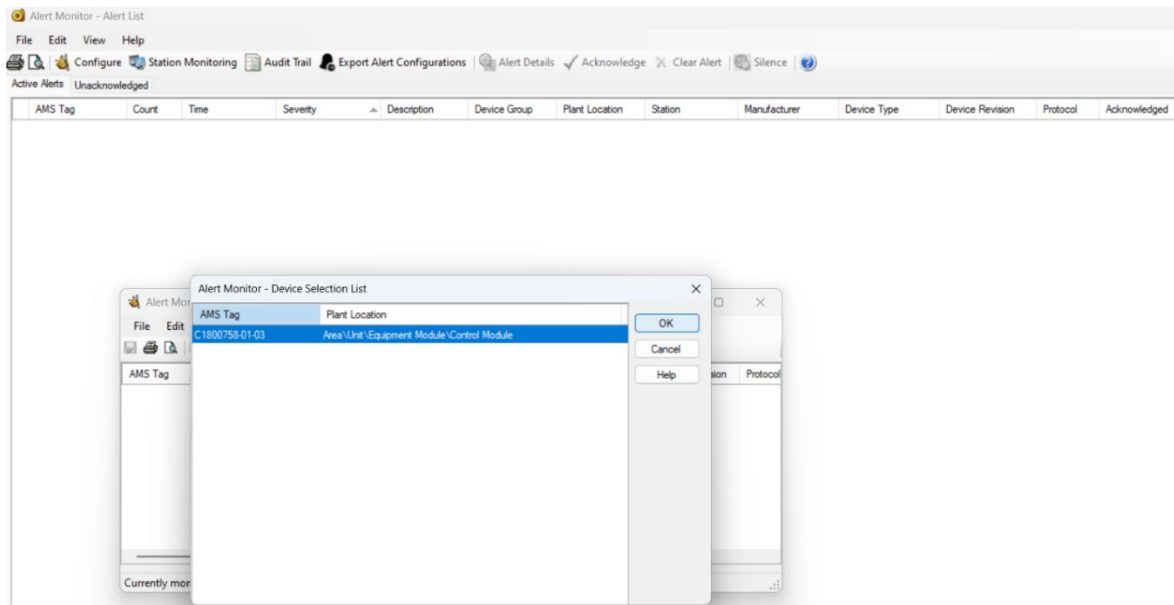
- Click Configure



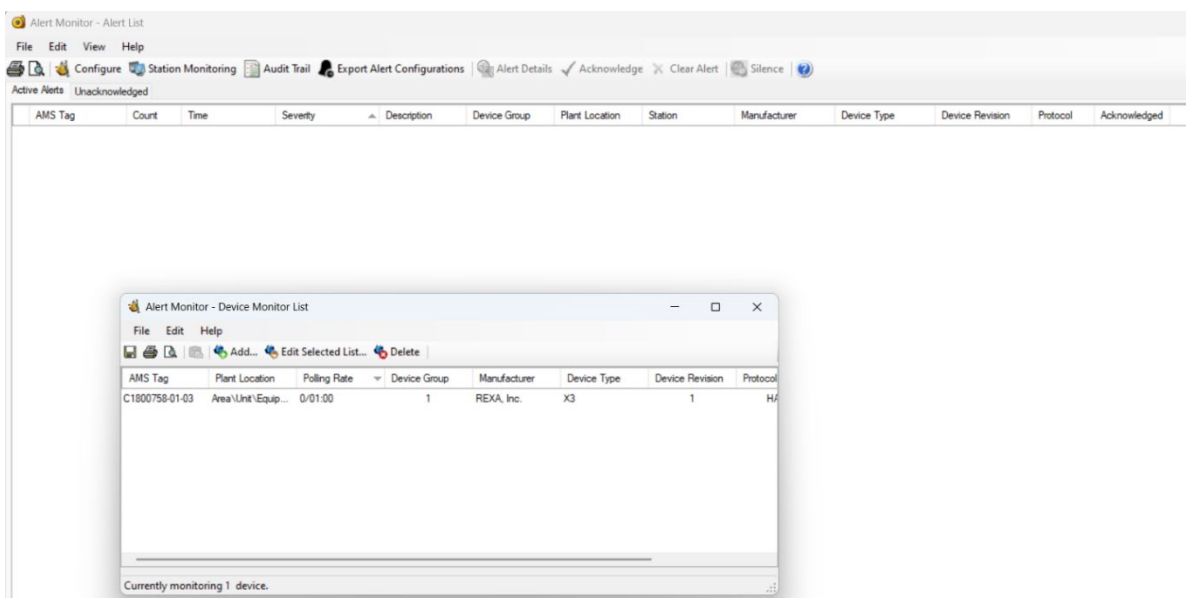
- Click Add



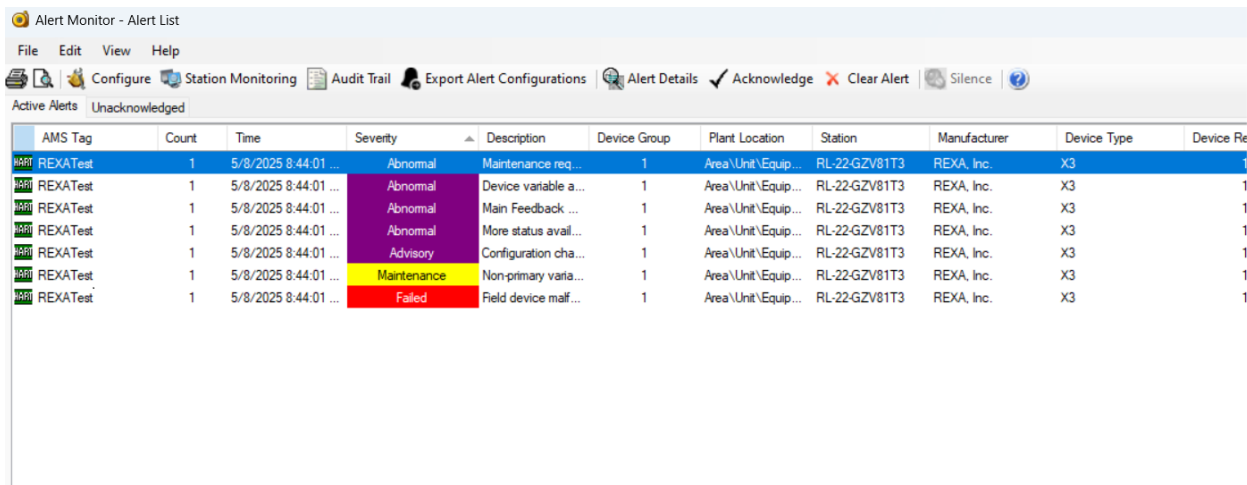
- Choose REXA Device and click OK.



- REXA Device has been added. Save and close the window.



- When Alert occurs or Maintenance is needed, the information shows up at Alert Monitor.



Alert Monitor - Alert List

File Edit View Help

Configure Station Monitoring Audit Trail Export Alert Configurations Alert Details Acknowledge Clear Alert Silence

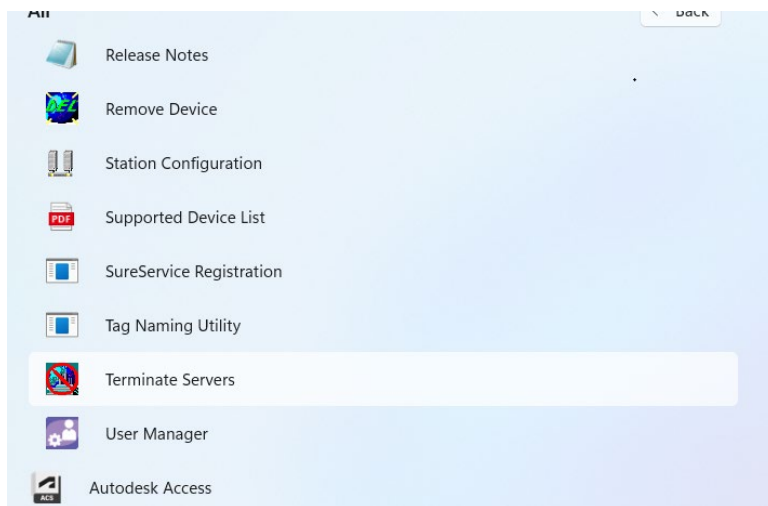
Active Alerts Unacknowledged

AMS Tag	Count	Time	Severity	Description	Device Group	Plant Location	Station	Manufacturer	Device Type	Device Re
REXATest	1	5/8/2025 8:44:01 ...	Abnormal	Maintenance req...	1	Area\Unit\Equip...	RL-22-GZV81T3	REXA, Inc.	X3	1
REXATest	1	5/8/2025 8:44:01 ...	Abnormal	Device variable a...	1	Area\Unit\Equip...	RL-22-GZV81T3	REXA, Inc.	X3	1
REXATest	1	5/8/2025 8:44:01 ...	Abnormal	Main Feedback ...	1	Area\Unit\Equip...	RL-22-GZV81T3	REXA, Inc.	X3	1
REXATest	1	5/8/2025 8:44:01 ...	Abnormal	More status avail...	1	Area\Unit\Equip...	RL-22-GZV81T3	REXA, Inc.	X3	1
REXATest	1	5/8/2025 8:44:01 ...	Advisory	Configuration cha...	1	Area\Unit\Equip...	RL-22-GZV81T3	REXA, Inc.	X3	1
REXATest	1	5/8/2025 8:44:01 ...	Maintenance	Non-primary varia...	1	Area\Unit\Equip...	RL-22-GZV81T3	REXA, Inc.	X3	1
REXATest	1	5/8/2025 8:44:01 ...	Failed	Field device malf...	1	Area\Unit\Equip...	RL-22-GZV81T3	REXA, Inc.	X3	1

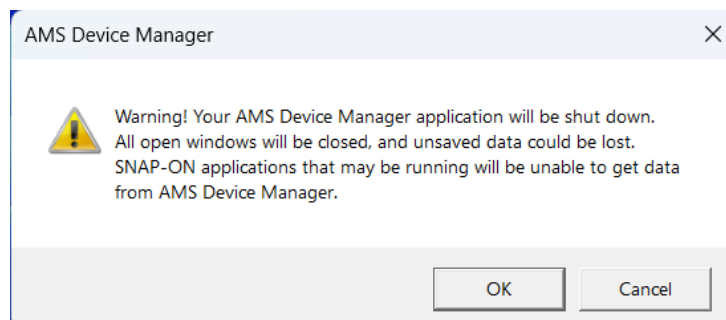
Removing a HART Device

1. Terminate the servers

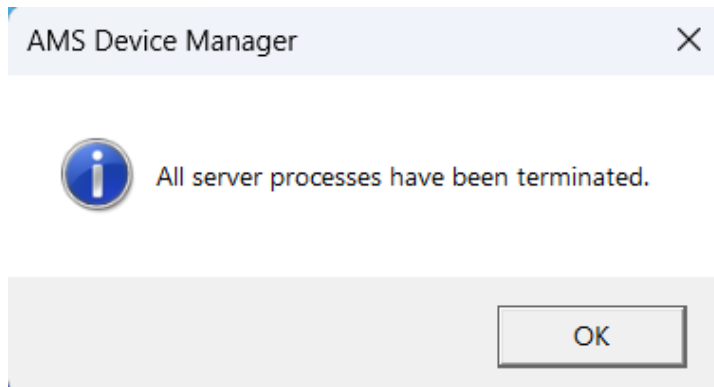
- Terminate servers by clicking Start->AMS Device Manager Folder-> "Terminate Servers"



- Click OK at Warning. Wait until all servers are terminated.

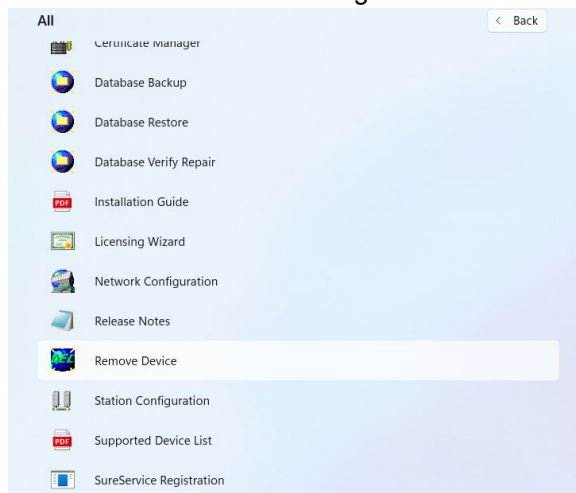


- Click OK to complete.

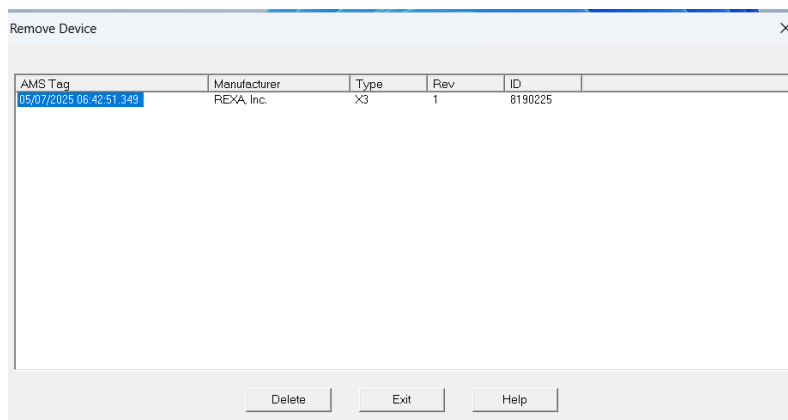


2. Remove the device

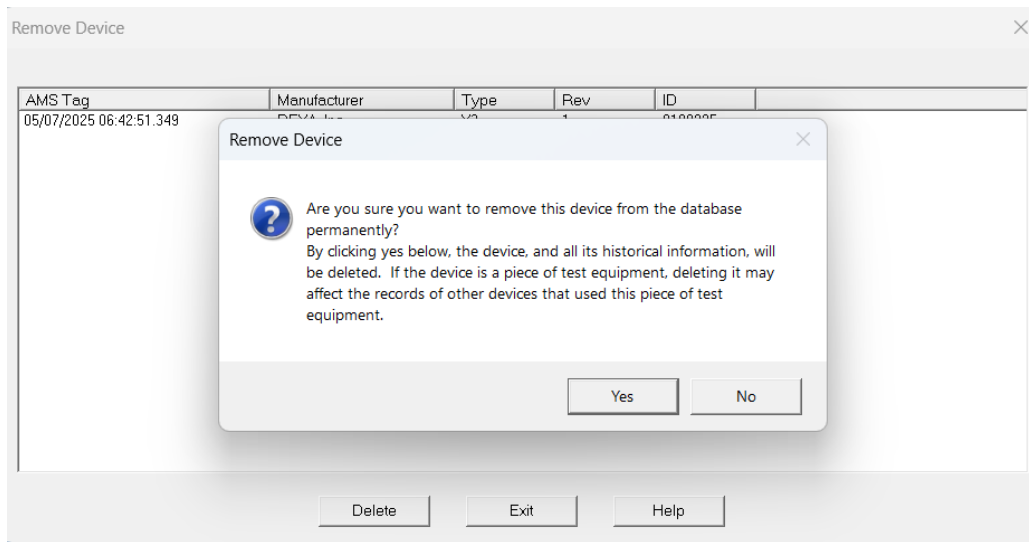
- Start->AMS Device Manager folder->Remove Device



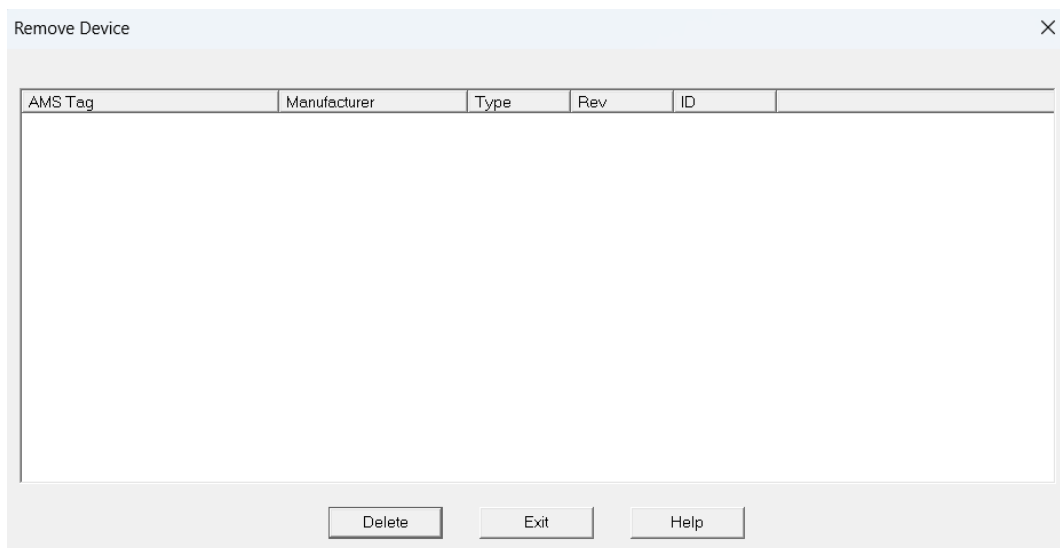
- Highlight the HART Device to be removed-> click "Delete"



- Click Yes at Warning

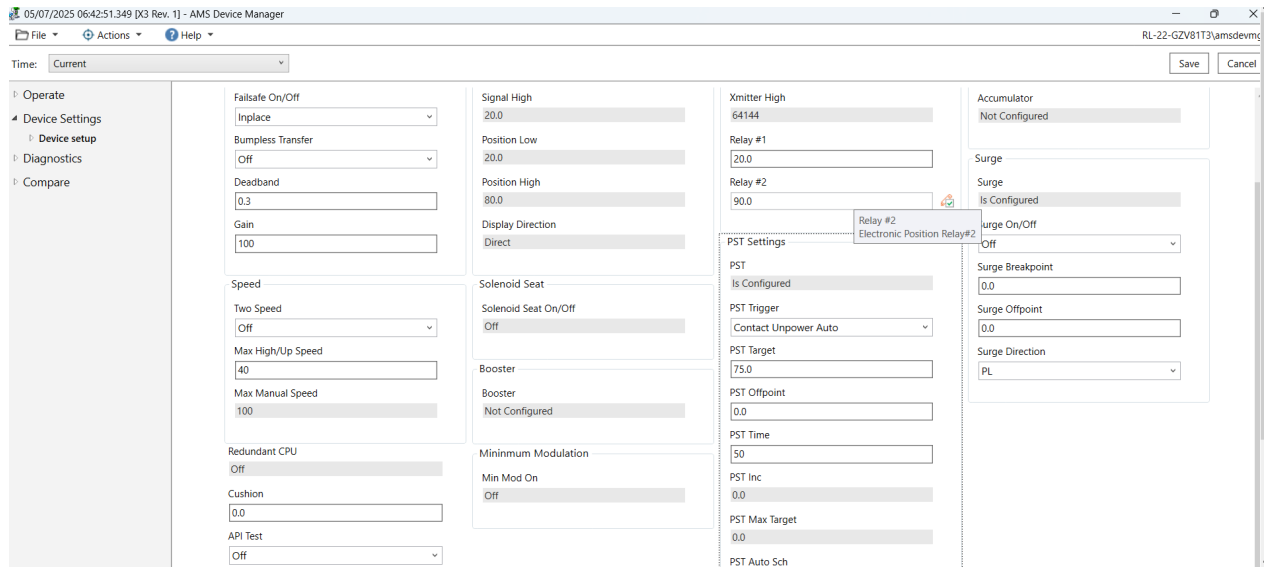


- Click Exit to complete



3. Change Parameters in Setup Page

- In Device Setup page, to change parameters, edit the value of the parameter, then click “Save” on top right of the page.



05/07/2025 06:42:51.349 [X3 Rev. 1] - AMS Device Manager

File Actions Help

Time: Current

Save Cancel

RL-22-GZV81T3\amsdevm

Operate

Device Settings

Device setup

Diagnostics

Compare

Failsafe On/Off
Inplace

Bumpless Transfer
Off

Deadband
0.3

Gain
100

Speed

Two Speed
Off

Max High/Up Speed
40

Max Manual Speed
100

Redundant CPU
Off

Cushion
0.0

API Test
Off

Signal High
20.0

Position Low
20.0

Position High
80.0

Display Direction
Direct

Solenoid Seat

Solenoid Seat On/Off
Off

Booster

Booster
Not Configured

Minimum Modulation

Min Mod On
Off

Xmitter High
64144

Relay #1
20.0

Relay #2
90.0

Relay #2
Electronic Position Relay#2

PST Settings

PST
Is Configured

PST Trigger
Contact Unpower Auto

PST Target
75.0

PST Offpoint
0.0

PST Time
50

PST Inc
0.0

PST Max Target
0.0

PST Auto Sch

Accumulator
Not Configured

Surge

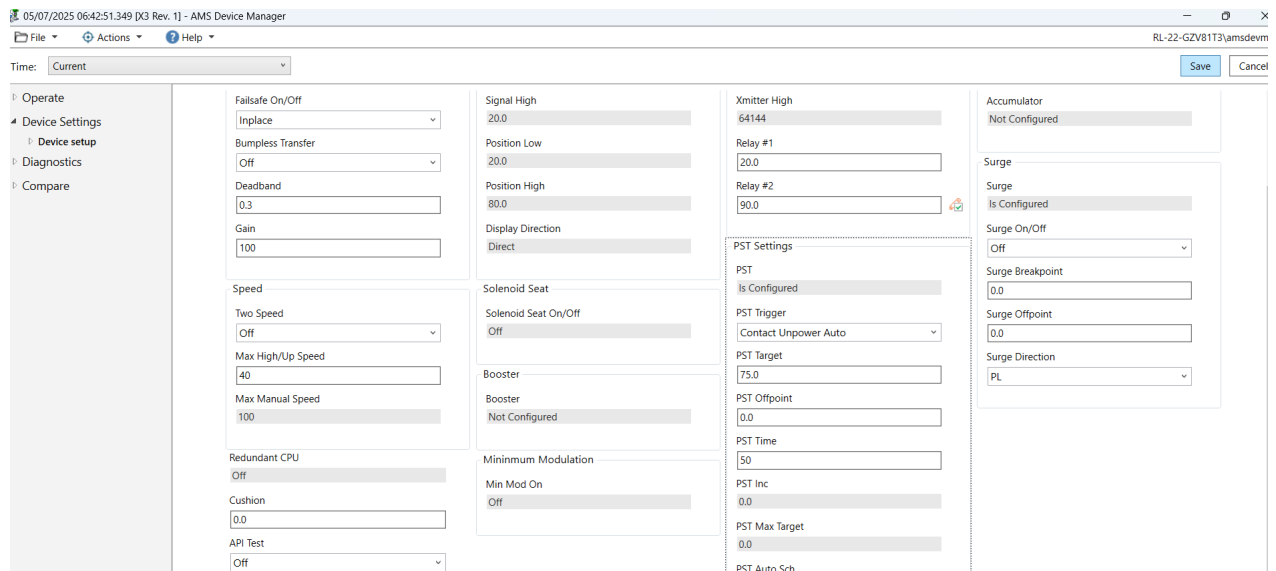
Surge
Is Configured

Surge On/Off
Off

Surge Breakpoint
0.0

Surge Offpoint
0.0

Surge Direction
PL



05/07/2025 06:42:51.349 [X3 Rev. 1] - AMS Device Manager

File Actions Help

Time: Current

Save Cancel

RL-22-GZV81T3\amsdevm

Operate

Device Settings

Device setup

Diagnostics

Compare

Failsafe On/Off
Inplace

Bumpless Transfer
Off

Deadband
0.3

Gain
100

Speed

Two Speed
Off

Max High/Up Speed
40

Max Manual Speed
100

Redundant CPU
Off

Cushion
0.0

API Test
Off

Signal High
20.0

Position Low
20.0

Position High
80.0

Display Direction
Direct

Solenoid Seat

Solenoid Seat On/Off
Off

Booster

Booster
Not Configured

Minimum Modulation

Min Mod On
Off

Xmitter High
64144

Relay #1
20.0

Relay #2
90.0

PST Settings

PST
Is Configured

PST Trigger
Contact Unpower Auto

PST Target
75.0

PST Offpoint
0.0

PST Time
50

PST Inc
0.0

PST Max Target
0.0

PST Auto Sch

Accumulator
Not Configured

Surge

Surge
Is Configured

Surge On/Off
Off

Surge Breakpoint
0.0

Surge Offpoint
0.0

Surge Direction
PL

Output Load Protection

Operation

Each Xpac power module is equipped with two pressure limiting cartridges that provide output load protection to the device the actuator is attached to. These valves are located under the wire cover on the power module body.



Xpac Power Module

Identification

Each valve has a pressure label sticker indicating its range of adjustment. The range corresponds to the spring installed under the adjustment cap as noted in the table below.

Adjustment Range (psi)	Spring Color
50-350	Blue
350-750	Yellow
750-1500	Purple
1500-2250	Orange
2250-3000	Brown (Std)

NOTE: When using standard relief springs, each $\frac{1}{4}$ turn is approximately a 300 psi change.

NOTE: Valves with lower spring rates can be used to limit the output of the actuator due to the MAST (Maximum Actuator Stem Torque/Thrust). Modified or custom springs are color coded. See table above for more information.

Standard springs are 2,250 psi to 3,000 psi unless specified otherwise. The limiting cartridge is then factory set to 2,600 psi for fail in place and spring fail-safe configurations and set to 3,000 psi for accumulator fail-safe configurations. To translate pressure into actuator output, use the following formula:

$$\left(\frac{\text{Pressure Gauge Reading}}{2,000 \text{ psi}} \right) \times \left(\text{Actuator Rated Output} \right) = \left[\text{Actual Output} \right]$$

The pressure gauge reading can be obtained from the corresponding pressure gauge shown in the Adjustment Range table above. This value should be the delta between the two gauges when calculating actual output.

Adjustment:

- Loosen the lock nut while holding the adjustment cap in place.
- While running the actuator into a hard stop, read the corresponding gauge to the valve that is being adjusted.
- Turn the adjustment cap CW (clockwise) to increase the relief pressure and CCW (counterclockwise) to decrease the relief pressure.

NOTE: The adjustment cap does not have a hard stop and will unthread.

- Tighten lock nut against the cap to 100 in-lbs (11 N·m) and test set pressure.

Spring Change:

- Loosen the lock nut.
- Unthread the adjustment cap.
- Replace the spring.
- Replace the adjustment cap.
- Follow the adjustment procedure above.

Safety Manual for ESD SIL Compliance

General

This REXA Actuator is a Type A device with a hardware fault tolerance (HFT) of 0. It has a safety trip function designed to meet or exceed IEC 61508 requirements for a SIL 3 capable designed process. The actuator is verified to withstand the worst expected environmental conditions listed in the IOM and specification sheet. This chapter covers the operating requirements for the end user to ensure their system operates safely in accordance with the rated SIL level.

The time in which an actuator will transition into a safe state is defined as the time required to trip on the REXA data sheet. This transition time must be reviewed against the process safety time to ensure this product is appropriate for the application.

Any deviation to installation, operation or maintenance will void the IEC61508 SIL certification and may impact the actuator's ability to operate safely. All product failures should be reported to REXA. The FMEDA report for failure rates, failure modes, and proof test information can be provided upon request.

System Setup

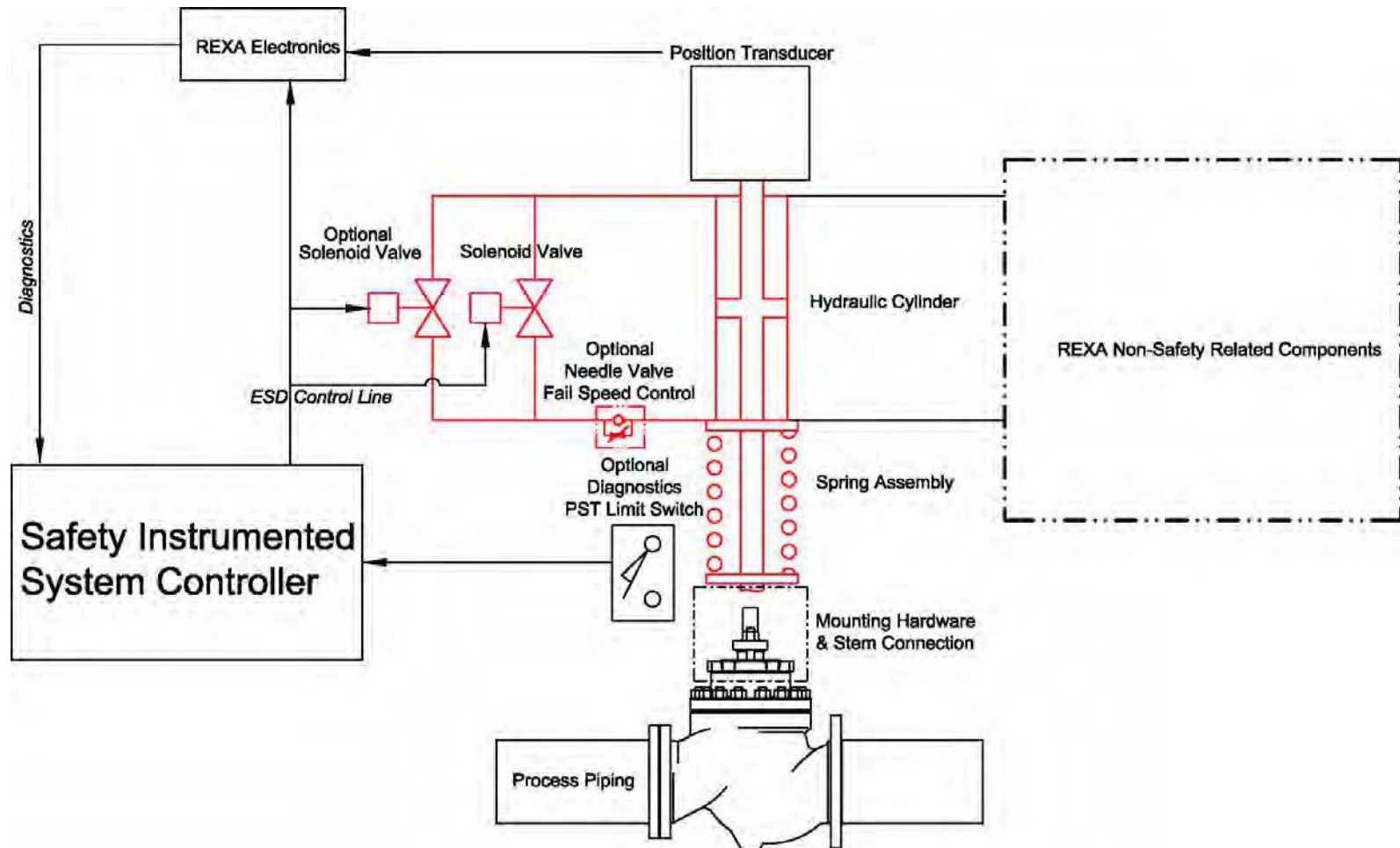
To properly set up the ESD control system the following measures must be taken:

1. The actuator must be calibrated to the driven device; refer to the Mechanical and Electrical installation section of this manual.
2. The actuator end points need to be set. Reference the section of this IOM on setting mechanical end stops.

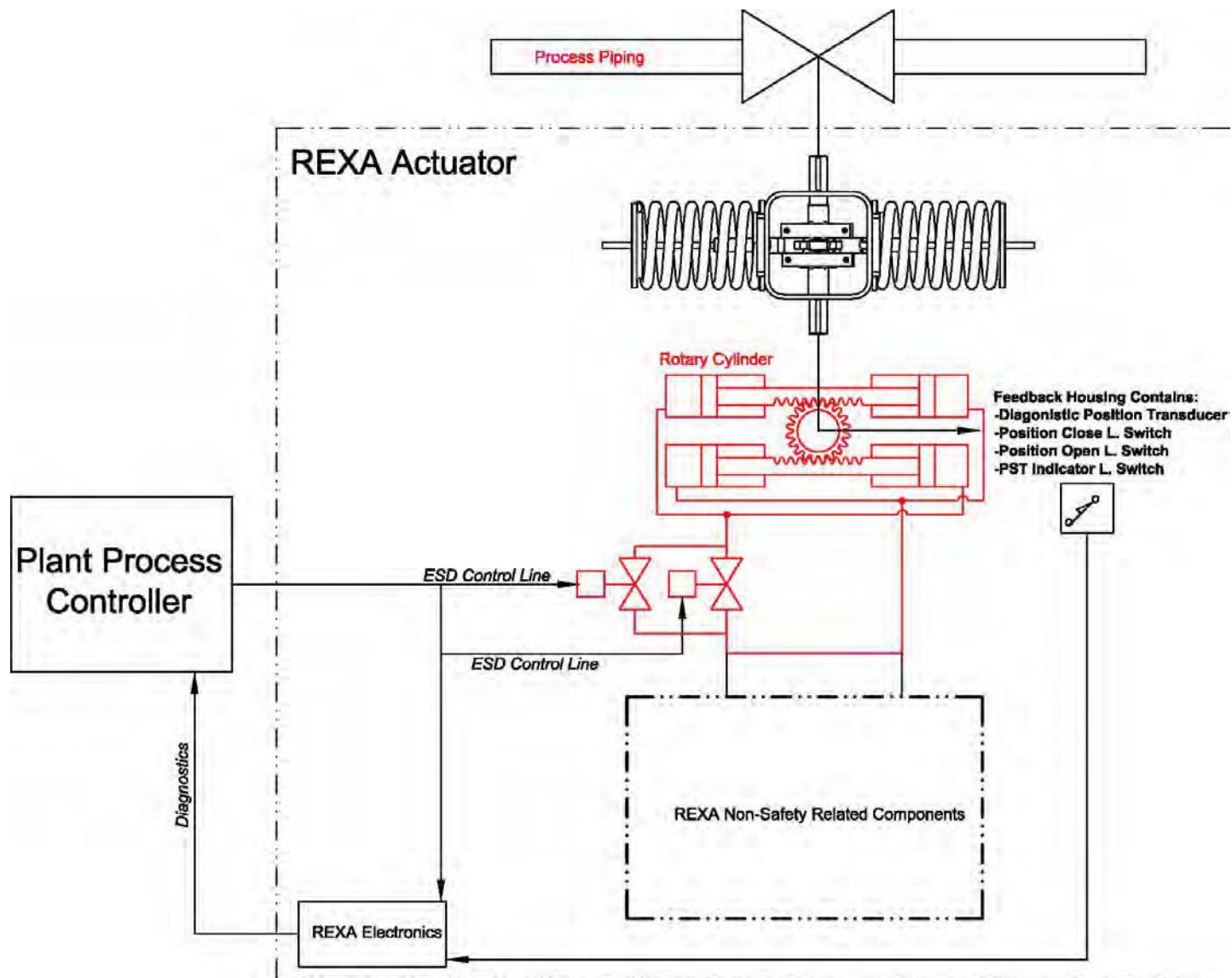
System Operation

The primary safety function of the actuator is to place the driven device in the process safe position when input to the actuator's solenoid valves is de-energized. The safety function that carries the SIL certification is an ESD trip function. This trip function is designed to ensure the actuator can be stroked in one direction to either the full open or the full closed position. This function needs to be controlled directly from the user's SIS and not through the REXA control box. The ESD is certified for low demand fail safe applications.

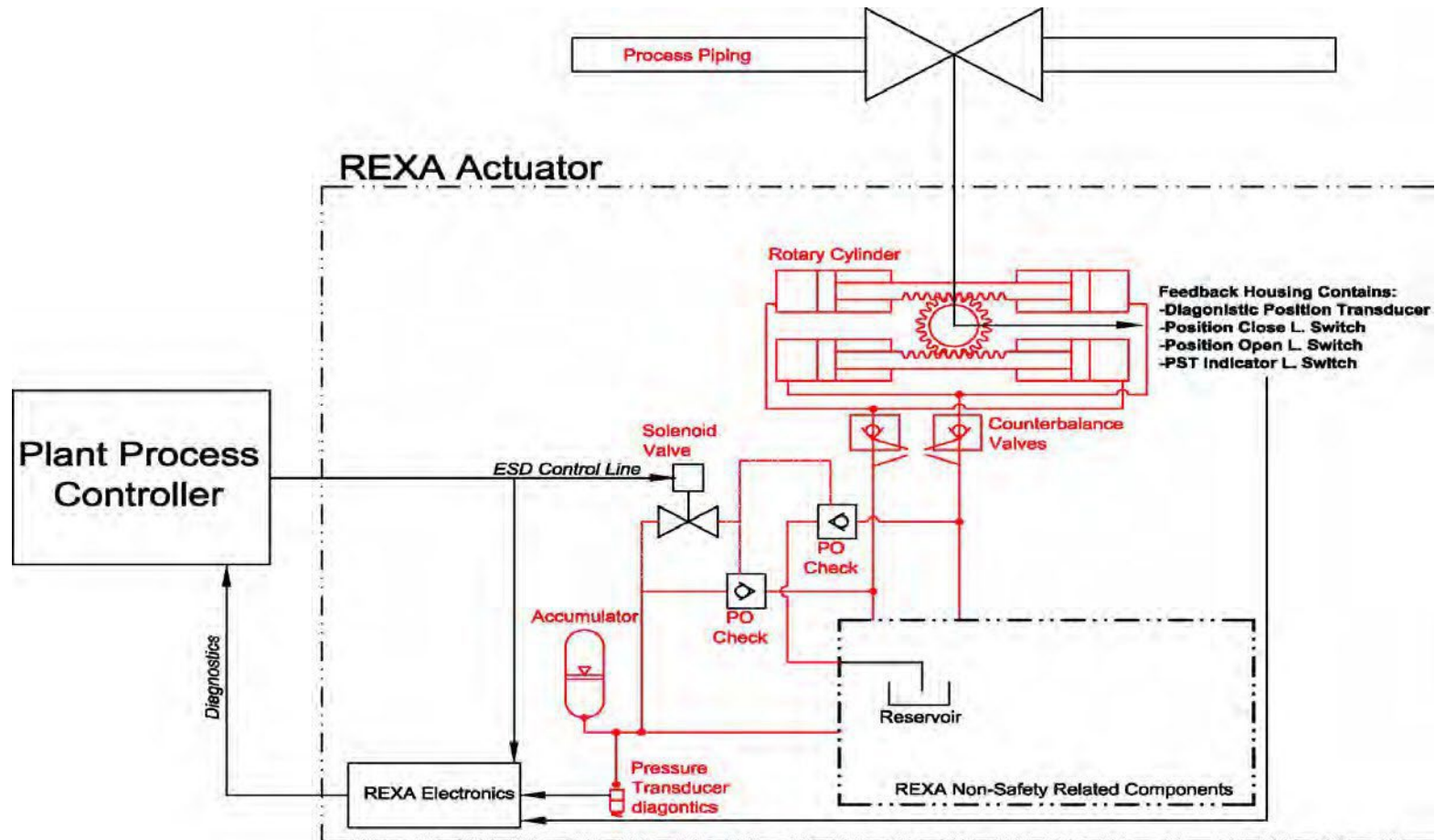
1. The solenoid valve shown on the block diagram below must be powered from the SIS system. It is possible for the REXA controller to control these solenoids for systems with online testing capabilities.
2. Since the safety solenoids are controlled directly by the safety system a trip relay must be installed to disable the REXA electronic control enclosure during a safety event. This relay will ensure the REXA electronic control enclosure cannot react to the safety system taking control of the actuator.



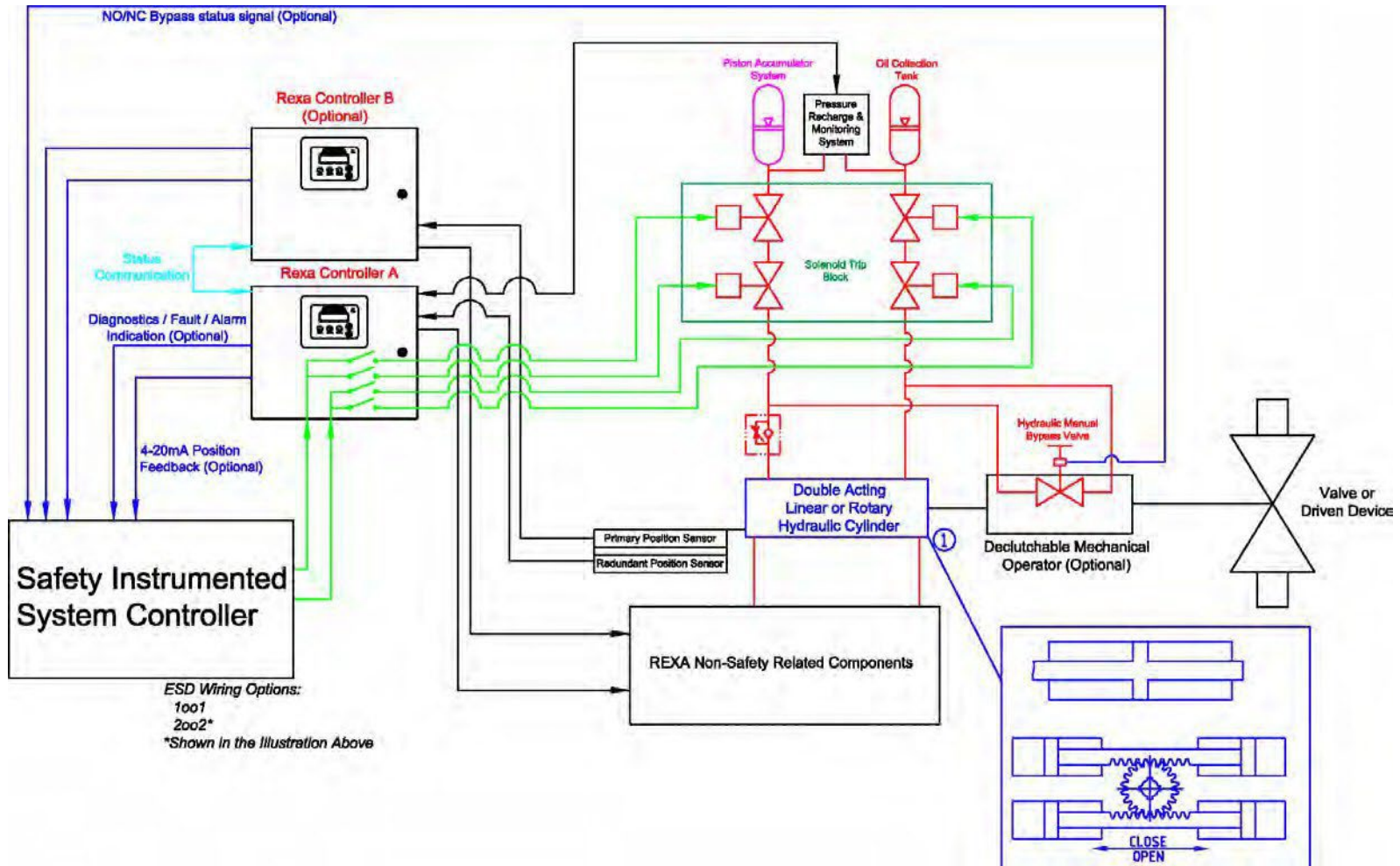
Example Safety Instrumented Function (Linear Spring Fail-Safe)



Example Safety Instrumented Function (Rotary Spring Fail-Safe)



Example Safety Instrumented Function (Rotary Accumulator Fail-Safe)



Example Safety Instrumented Function (Accumulator Fail-Safe with Solenoid Testing)

3. This system is designed to full stroke at the rate shown on the provided actuator data sheet provided for this specific order.
4. The actuator's useful life is 10 years based on the provided duty cycle. After recommended seal maintenance the actuators' useful life is 20 years.
5. The REXA Actuator is available in normally open or normally closed ESD configurations.
6. A 24-hour meantime to repair should be assumed for safety availability calculations.

Safety Critical Components

Definition - Some of the components on this actuator are identified as safety critical. If the failure of any component inhibits the safety function of this REXA actuator, it is deemed a Safety critical component.

1. Only OEM supplied replacement parts can be used as suitable replacement parts for any component identified as Safety critical.
2. This actuator was supplied to meet a strict specification and may not be modified in the field.

System Diagnostics

Built into the REXA actuator are numerous diagnostics that can be found in the error codes section of this IOM. These error codes must be monitored by the safety system through an alarm relay. The only critical alarming feature that would indicate the system may not perform its intended trip function is the stall alarm or low accumulator pressure.

1. Stall Alarm – While positioning: if the actuator fails to move 0.1% within the allowed stall time, the alarm relay will open indicating an alarm event. See Technical Product Bulletin #5.0: Fault Codes for additional information.
2. Partial stroke testing is performed to verify the actuator can perform its intended safety function. The actuator shall be designed to support proof test intervals of 1 year or greater while consuming less than 40% of the allowable PFDavg for SIL 2 SIF applications when PST is implemented. The control and design of this test should be in the scope of the control system. The REXA Actuator will only follow the requested change in position as defined by the control loop. This PST percentage to activate needs to be calibrated within the scope of the plants SIS system. During a partial stroke test the control system must monitor the position transmitter to ensure the actuator successfully performed this function. The control room supervisor needs to review and sign off on the results of the proof tests. This PST should be sufficient to achieve a greater than 65% SFF (Safe Failure Fraction). Key points to review during this test:
3. Verification from the REXA position transmitter that the actuator followed the change in the control position and performed its PST function.
4. Redundant verification from an optional PST limit switch can be provided, this limit switch needs to be wired directly into the SIS system.
5. Module Status (Used to determine if A or B electronic control enclosure is "Off")

The test results are to be recorded and stored for the life of the product.

Strict adherence to this manual will ensure this system will function as designed.



Site Acceptance Test Procedures

A cognizant engineer supporting the operation of the system is responsible for assigning individuals to conduct and record automated testing and proof testing of the equipment. The cognizant engineer is then responsible for reviewing the results.

1. Run the actuator to OPEN and verify stroking times meet the specification sheet.
2. Run the actuator to CLOSE and verify stroking time meet the specification sheet.
3. Perform an ESD trip and verify stroking time meet the specification sheet.
4. Run the actuator to the PST position to verify position feedback and the optional PST limit switch is functioning properly.
5. Run the solenoid testing function.

Environmental Requirements

The actuator has been designed and verified to withstand the worst-case environmental conditions in this IOM.

Position Transmitter

The position transmitter provides a two-wire 4-20 mA signal that is proportional to actuator position. The output is optically isolated from the electronic control enclosure to minimize electrical noise. Both an active and passive transmitter are available. A passive position transmitter is like other two-wire transmitters in that an external DC power source is required to power the loop. When wired to the active two-wire transmitter the loop power will be provided via the electronic control enclosures 24 VDC power supply. Refer to DOC150 for more information.

NOTE: When using the Passive transmitter if system power is lost this output will maintain the last position prior to power loss.

NOTE: If you have feedback bad alarm the position transmitter will drop below 4mA.

Specification		
	Passive	Active
Resolution	<0.1% of full stroke	
Maximum External Load	1000 ohms @ 36 VDC	700 ohms @24 VDC
Minimum Supply Voltage	$10 + (0.02 \times \text{RLOAD}) \text{ VDC}$	24 Vdc (internal supply)
Maximum Supply Voltage	$36 + (0.004 \times \text{RLOAD}) \text{ VDC}$	

NOTE: See section 6.6 to calibrate the end points and signal levels of the position transmitter output.

Interconnect Cables

The REXA actuation system consists of the electro-hydraulic actuator and its electronic control enclosure. The actuator is mounted on the driven device, while the electronic control enclosure is remote mounted away from extreme environmental conditions in an ideal location for operators to interact with the controller's user interface. The actuators incoming main power supply and all user I/O is wired to and from the electronic control enclosure. Connecting the two sub-assemblies is a series of REXA specified interconnect cables which vary depending on actuator configuration details. This document outlines the different cables used, their purpose, construction, length limits, installation guidelines and wire termination options available.

Cable Description and Purpose

Position & Pressure Signal Cables:

The position and pressure cables provide an analog position and pressure signal to the electronic control enclosure. The cable consists of 3 conductors per signal, a tinned copper drain wire and overall foil shielding. Multiple signals may be combined into a single cable depending on the actuator's configuration and options. The feedback cable is a low voltage signal level cable.

Stepper Motor, Heater Solenoid Power Cable:

The stepper motor power cable provides the electrical current needed to operate the actuator's stepper motor(s). These cables also provide power module heater and solenoid wiring. The cable consists of 4 twisted pairs, a twisted triad, a 16 AWG drain wire and an overall foil shield. The motor power cable is a high voltage cable.

Servo Motor Power Cable:

The servo motor power cable provides the electrical current needed to operate the actuator's servo motor. The cable consists of four 14 AWG wires, a tinned copper drain wire and overall foil shield. This cable is a high voltage cable.

Servo Resolver Cable:

The servo resolver cable provides velocity and temperature information from the servo motor to the servo motor driver located in the electronic control enclosure. The cable consists of eight 20 AWG wires, a tinned copper drain wire and overall foil shield. This is a low voltage signal level cable.

Servo Heater Solenoid Cable:

The heater solenoid cable provides power to the power module's integral heater and solenoid assembly (if equipped). The cable consists of five 16 AWG conductors. This is a high voltage cable.

Booster Motor Power Cable:

The booster motor power cable provides the electrical current needed to operate the actuator's booster motor. The P9 and P20 booster motor cable consists of four 10 AWG wires (P40 uses 8 AWG), a tinned copper drain wire overall foil shield and overall braided shield. The booster motor power cable is a high voltage cable.

Cable Separation and Installation

Proper separation of high voltage cables and low voltage signal level cables is necessary to ensure correct actuator operation. Failure to maintain proper cable separation may result in the introduction of noise within the REXA system or surrounding instrumentation. The recommended safe separation distance for REXA high and lower power cables is 1 meter (39.4 inches). However, this distance can be reduced when certain installation practices are applied. Refer to the tables below:

Table 1 – Separation Distance for Power and Signal Level Cables

Electrical Input	Power and Signal in same tray without barrier.	Power in steel conduit and Signal in separate tray, or same tray with divider.	Power and Signal run in separate steel conduits.	Power and Signal using Armored cable.
24 VDC / 115 VAC / 230 VAC	39.3" (1.0M)	15.0" (0.38M)	8.0" (0.2M)	8.0" (0.2M)

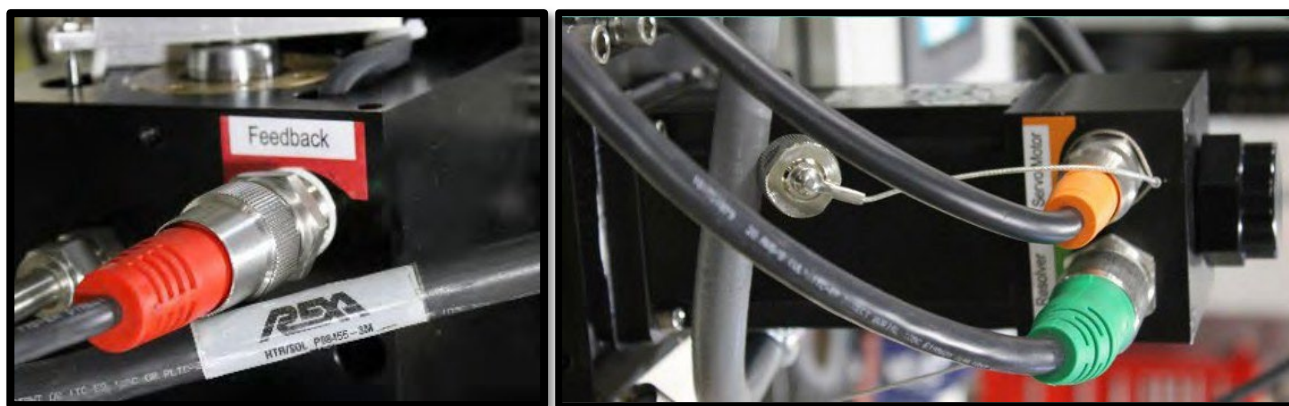
Table 2 – REXA Equipment and wiring in proximity to magnetic fields

Separation between REXA equipment and wiring in proximity to strong magnetic fields*.	If steel conduit is used, then clearances may be reduced by half.
5.0' (1.5M)	2.5' (0.75M)

*Generators, large motors, transformers, electric furnaces, etc.

Quick Release Connectors

Quick release connectors (QRC) provide ease of plug and play design. This simplifies the installation procedure, eliminates wiring errors, ensures proper environmental sealing and reduces time and cost. Actuators equipped with quick release connectors come with a cable kit assembly that is pre-cut to a specified length with molded connectors on the actuator cable end. The molded ends of the cable and the receptacles on the actuator are color coded and print labeled to ensure proper identification.



Quick Release Connectors and Cables

REXA quick release connector cables are rated for direct burial and do not require the use of conduit but can be pulled through conduit if the installation site requires.

Cold shrink tubing shall be applied in the field over each quick disconnect connector to create a moisture and UV proof seal that extends the life of the Quick Disconnect cable ends.

Installation of Cold Shrink Tubing:

1. Verify exterior of the Cordset molding, metal nut / receptacle & cable are clean and dry.
2. Before connecting the cordset to the receptacle, slip the tubing over the cordset down to the cable jacket. Tubing **must** be oriented as shown in the Figures below.
3. Twist the metal spinning nut clockwise to engage the threads hand tight. Our electrical connectors are designed to be able to be connected by hand and meet the rated ingress protection for the product. We do recommend the use of a torque wrench with the proper torque setting. **Recommended connector torque: 18 in*lb (2 Nm).**
4. Position the shrink tubing exactly as shown in the Figures below.

5.  Gloves recommended 

After positioning, pull the rip cord to remove the spiral wrap completely from the tubing.

NOTE: once shrinking begins, the starting position of the shrink must be as shown in the Figures below, positioned against the metal hex nut of the receptacle, but not over it.

Twist and push the shrink tightly against the hex nut keeping it in place as the rip cord is pulled.

6. Continue pulling the rip cord until it is completely removed from the cold shrink.

Large Tubing Actuator Terminations: Stepper or Resolver Cordsets

Figure 1 - Orientation of Large Tubing



The loose end of the plastic spiral must face toward the bottom (cable) end

Figure 2A – Large Tubing Position as shrinking begins



Tubing starting position must be tightly up against the large hex nut feature of the receptacle.

Figure 2B – Large Tubing after shrinking



DO NOT APPLY TUBING OVER THE HEX NUT

Tubing extends down to cable jacket, completely covering the color molded portion of the cordset.

Figure 2C – LockFast secured (Large)



Position the LockFast over the shrink as shown and click closed. Push and twist the LockFast up the body of the shrink until it is tightly in place.

Small Tubing Actuator Terminations:

Servo Motor, Feedback, Heater / Solenoid Cordsets

Figure 3A – Orientation of Small Tubing



The loose end of the plastic spiral must face toward the bottom (cable) end

Figure 3B – Small Tubing Position as shrinking begins



Tubing starting position must be tightly up against the large hex nut feature of the receptacle.

**Figure 3C – Small Tubing
after shrinking**



**DO NOT APPLY TUBING OVER THE HEX
NUT**

Tubing extends down to cable jacket,
completely covering the color molded
portion of the cordset.

**Figure 3D – LockFast secured
(Small)**



Position the LockFast over the shrink as
shown and click closed. Push and twist
the LockFast up the body of the shrink
until it is tightly in place.

Electronic Control Enclosure Terminations

Figure 4A – Orientation of Tubing



Tubing starting position
must be tightly up
against the large hex
nut feature of the
receptacle.

The loose end of the
plastic spiral must face
toward the bottom
(cable) end

**Figure 4B – Tubing Position
as shrinking begins**



Figure 4C – Tubing after shrinking



DO NOT APPLY TUBING OVER THE HEX NUT

Tubing extends down to cable jacket, completely covering the color molded portion of the cordset.

Figure 4D – LockFast secured



Position the LockFast over the shrink as shown and click closed. Push and twist the LockFast up the body of the shrink until it is tightly in place.

Removal of Cold Shrink Tubing

Removal of cold shrink tubing can be easily achieved by using a razor blade or knife to score the cold shrink tubing. It can then be pulled away from the cordset.

NOTE: Use caution not to cut too deep when reaching the cable jacket so as not to compromise it.

Figure 5A – Remove shrink only from metal nut so cordset can be un-mated from receptacle



Figure 5B – Continue scoring all the way down to cable jacket to completely remove shrink



Flying Lead Cables with Terminal Strip

REXA actuators not supplied with quick release connectors are provided flying lead style cable. Interconnect cable connections for such systems are made at the actuator terminal strip located under the square wire cover on the power module.

Cable Specifications

REXA provides four different cable solutions depending on the ambient environmental requirements. Quick disconnect cables are the standard offering but are not allowed in environments over 221F(105C) or in hazardous gas areas classified under Division 1, Zone 1 or Zone 2. High temperature and low temperature cable package are used for environments below -21F(-29C) or above 221F(105C) and a standard temperature package is available for Division 1, Zone 1 or Zone 2 applications.

Quick Disconnect Cable Specifications:

Class 1 Division 2 Approved

UL Type TC -ER, ITC/PLTC-ER

NEMA 4X and 6P, IP67

316 Passivated Stainless Steel

Direct Burial Rated

Temperature rating -40°F to 221°F (-40°C to 105°C)

All connectors in Division 2 locations must be secured with a “Lokfast” guard and require a flathead screwdriver to disconnect:

**Standard Temp Cable Specifications:**

Approved for use in all hazardous gas locations

UL Type TC -ER, ITC/PLTC-ER

Direct Burial Rated

Temperature rating -20°F to 221°F (-28°C to 105°C)

High Temp Cable Specifications:

Approved for use in all hazardous gas locations

UL Type TC -ER, ITC/PLTC-ER

Direct Burial Rated

Temperature rating -40°F to 250°F (-40°C to 122°C)

Low Temp Cable Specifications:

Approved for use in all hazardous gas locations

UL Type TC -ER, ITC/PLTC-ER

Direct Burial Rated

Temperature rating -40°F to 221°F (-40°C to 105°C)

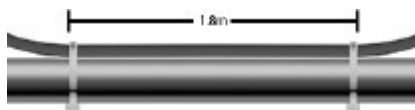
Installation Cable Length Limits

Actuator Product	Voltage	Quick Disconnect & High Temperature Cable Installation Length Limits	Standard Temperature Non-Quick Disconnect Length Limits
B or 1/3C Stepper Actuators	24 VDC	400' (122M)	500' (152M)
	115 VAC	500' (152M)	700' (213M)
	230 VAC	300' (92M)	400' (122M)
C Stepper Actuators	24 VDC	200' (61M)	300' (92M)
	115 VAC	500' (152M)	700' (213M)
	230 VAC	300' (92M)	400' (122M)
1/2D Servo Actuators	115 VAC	700' (213M)	700' (213M)
	230 VAC		
D Servo Actuators	230 VAC	700' (213M)	700' (213M)

*Dual power module systems require two of these cables.

Cable Support

Cables should be supported to prevent movement of the equipment. Ideally the cable should be supported in a distance not to exceed 1.8m (6ft) without continuous support. The cable should also be supported at any connection points or terminations so that tension is not transmitted to joints or terminals.



Proper Bend Radius

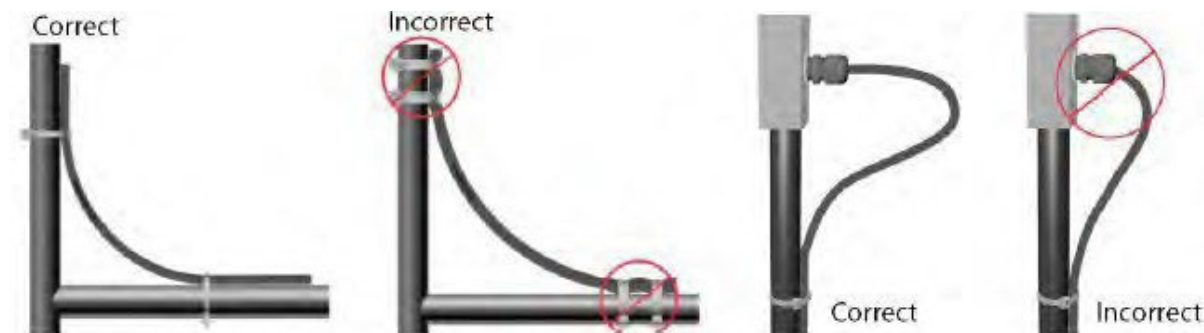
Minimum bend radius for Fixed Applications: Standard cable - 10x cable diameter

Tying Cables with Cable Ties

When tying the cable with self-locking cable ties, always leave the ties loose enough for the cables to slide freely under the tie. Over tightening will create stress concentrations that can cause the conductors to fail prematurely. Never tighten the tie to the point where the cable jacket becomes deformed.

Eliminating Stress Points in Cable Dress

Installing cables to allow for adequate stress loops and freedom of motion increases the life of the cables.





Basis Weight Control Option

Control Overview

24 VDC increases input, when active the actuator moves in one direction. 24

VDC decreases input, when active the actuator moves in the other direction.

These 24 VDC signals are issued in pulses and pulse time duration corresponding to the magnitude of the actuator's movement.

Typical Pulse Response

Based on field testing REXA has validated the following typical % of actuator movement based on the total time the 24 VDC pulse is active for small setpoint changes.

REXA Menu Parameters

1. Deadband – This is a read only parameter in this version of software and cannot be adjusted directly. It is represented based on the Abs Deadb value below.

2. Abs Deadb – Range 8-500; default 10

NOTE: When you change these values the actual read only deadband value will adjust. This parameter gives you more resolution than you can see by incrementing the true deadband.

a. Set to 8 as a default

3. Pulse Width – range 100ms -10000ms; default 300ms

a. This is the pulse duration time that will achieve a 1% movement.

$(\text{Actual pulse time} / \text{Pulse Width}) \times 1\% = \text{Actual movement}$

b. Adjusting Pulse Width higher results in the actuator making a smaller move for a fixed pulse duration.

c. Set to 2500 as a default

4. Filter – Total number of control loop cycles that the actuator is out of deadband before the actuator will move.

a. Increasing this value filters out noise but makes the actuator's response slower.

b. Set to 12 as a default

5. Normal parameters that still work in this custom code that should be used if the unit is overshooting

a. Gain

i. Set to 50 as a default

b. High speed

i. Set to 100%

GUI Bluetooth

About

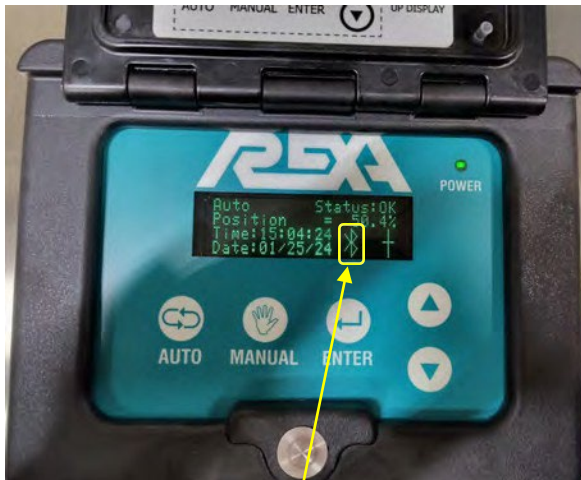
All X3 systems are provided with Bluetooth functionality standard. Paired with the REXA Bluetooth GUI you can access troubleshooting and diagnostic data not available on the standard display.

To ensure maximum security of the wireless connection the following precautions have been implemented:

- Bluetooth radio has limited range of 100ft maximum (line of sight)
- Wireless communication interpreted by the display processor, which then communicates to the main control processor. Isolation ensures no direct wireless access to the processor controlling the actuator.
- Industry standard 128-bit AES encryption of the Bluetooth signal
- Password protected. The same password set in the electronic control enclosure at time of install is required to connect to the electronic control enclosure.
- Actuator position cannot be manipulated via the Bluetooth GUI
- Non-critical parameters can be changed via the GUI if the electronic control enclosure is in **Setup** mode only.

To determine if Bluetooth is enabled power on the electronic control enclosure and confirm if the Bluetooth symbol is shown on the display.

Bluetooth Enabled



Symbol indicates the Bluetooth functionality is enabled.

Bluetooth Connection Active

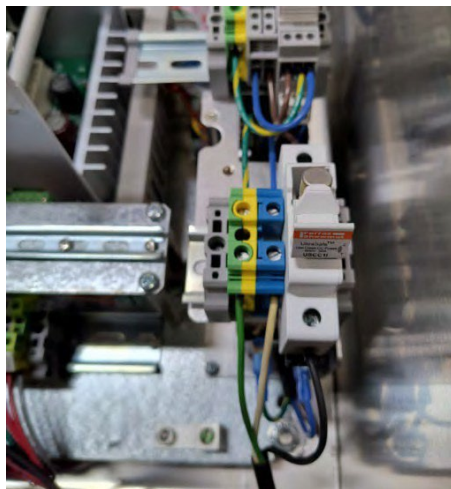


The bars indicate the current signal strength with the connected device.

NOTE: If the display is in sleep mode it can be woken up by pressing any of the display keys.

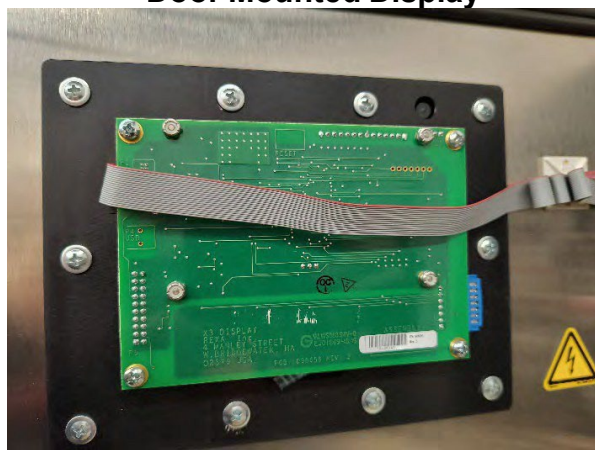
If Bluetooth functionality is not desired this feature can be easily disabled following the steps below:

1. Open the electronic control enclosure and disable the main power fuse holder.

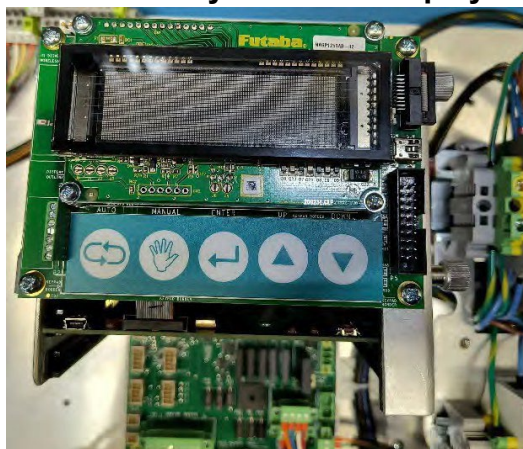


2. Locate the display board on the inside of the enclosure door or attached to the Interconnect board assembly.

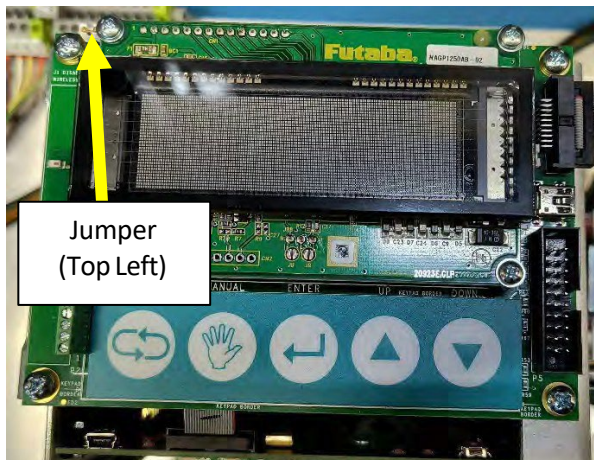
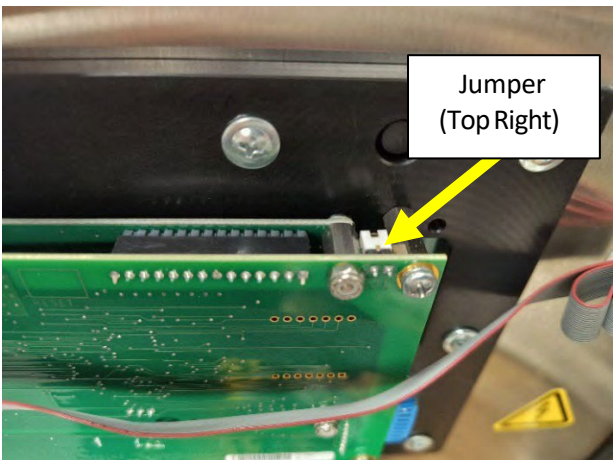
Door Mounted Display



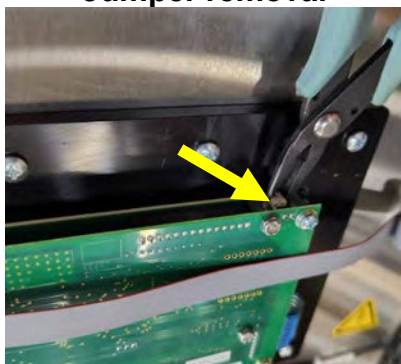
Internally Mounted Display



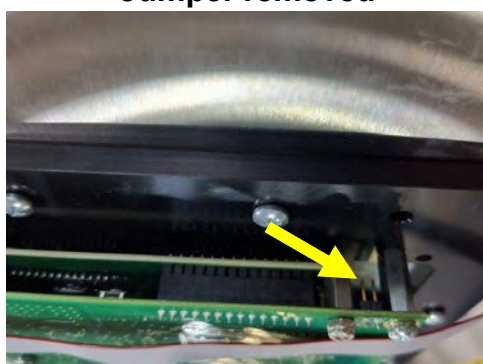
3. Use a small pair of pliers to remove the suitcase jumper located at the top corner of the board.



Jumper removal

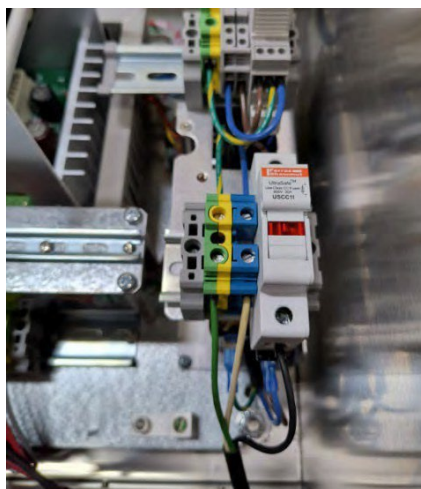


Jumper removed



NOTE: Use caution during removal to not drop the jumper onto any of the board assemblies and potentially cause an electrical short.

4. Re-enable the main power fuse holder.



5. Close the electronic control enclosure door and verify that the Bluetooth symbol is no longer shown on the display.



No Bluetooth symbol in the typical location.

6. Bluetooth has been successfully disabled on the X3 electronic control enclosure.

NOTE: Bluetooth can be re-enabled by just re-installing the suitcase jumper in the location outlined in the steps above.

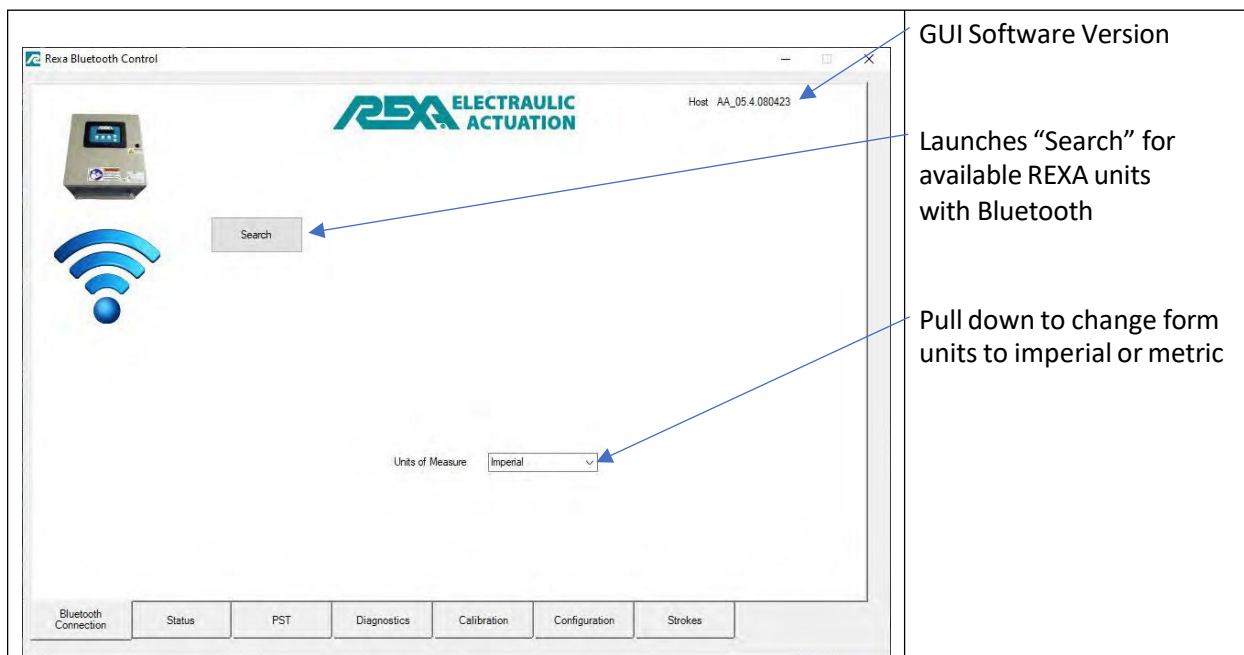
Bluetooth Connection

Complete installation utilizing the installation wizard. The Desktop Icon will launch GUI.



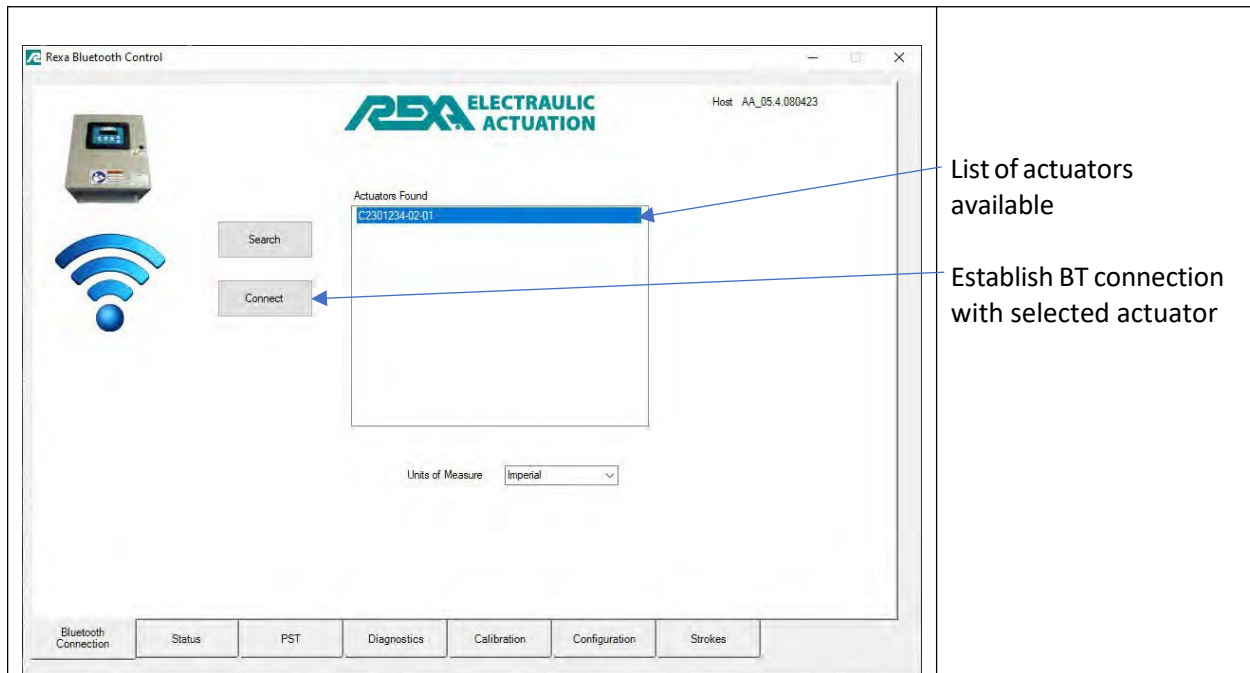
Desktop Icon

When the Bluetooth program launches you will first see the “Bluetooth Connection” screen and signal strength will be indicated on the left-hand side of the screen. Clicking the “Search” button will scan the area for Available Bluetooth signals from REXA units.



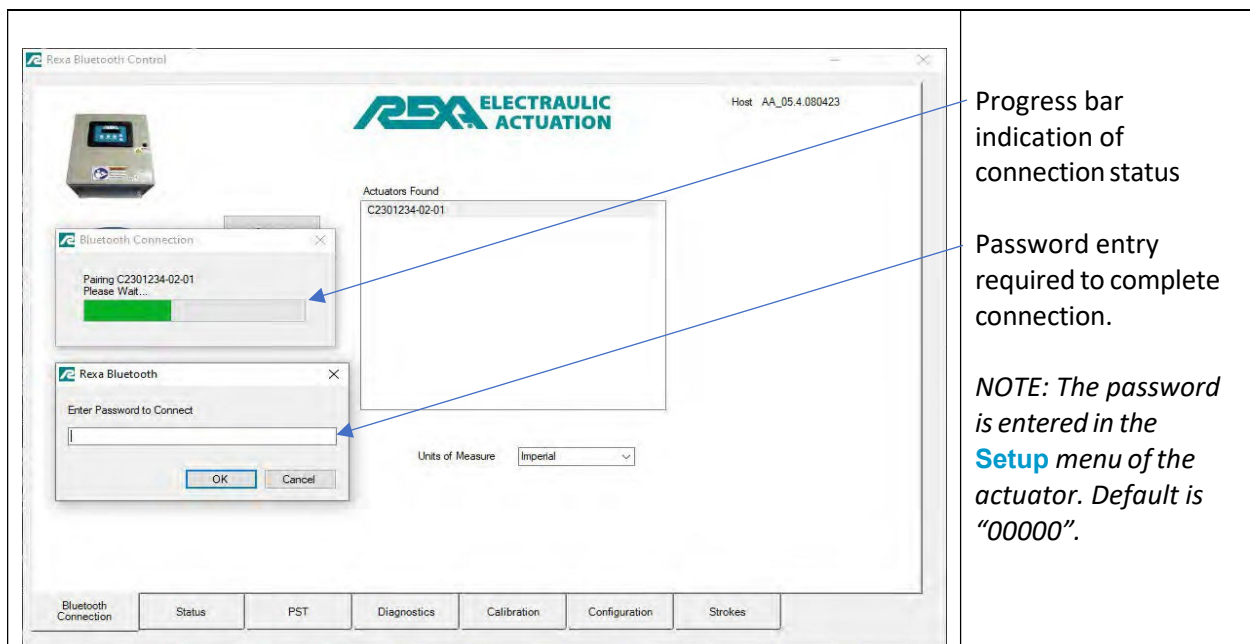
Initial Screen

When the search is complete GUI will show the actuators found. Actuators will be identified by REXA serial number. Select the actuator you wish to connect to and click the “Connect” button.



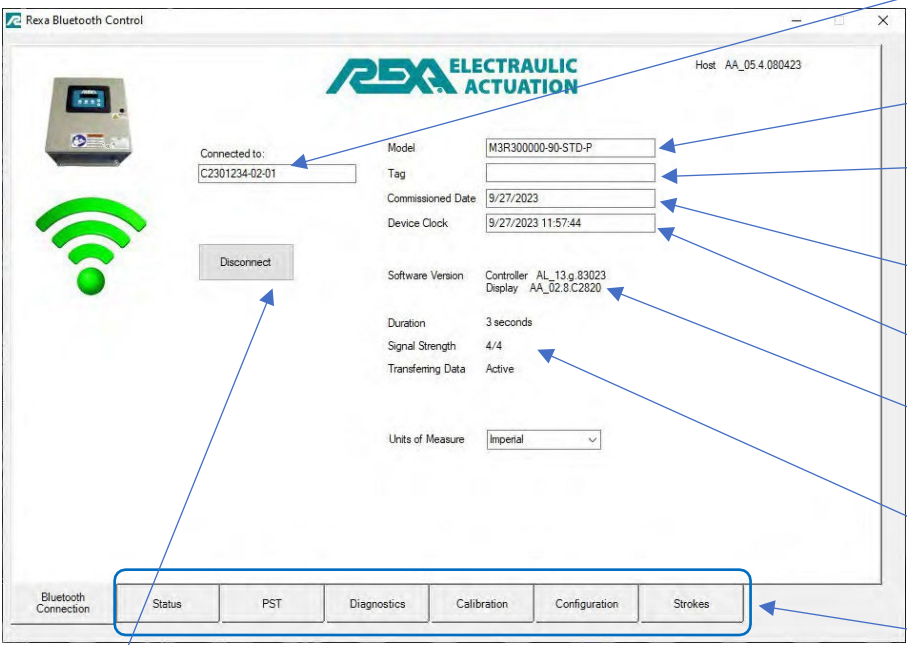
Search for Actuators

The connection process will begin, and the program will prompt you to enter the password to connect. Enter password and click “Ok”.



Connect to Actuator

Once connected the GUI will display all pertinent information related to the selected actuator. Details shown are: model number, tag number, commission date, device clock, software version, duration and signal strength.



The screenshot shows the 'Rexa Bluetooth Control' window. On the left, there's a 'Bluetooth Connection' section with a 'Disconnect' button. The main area displays actuator information: Model (M3R300000-90-STD-P), Tag (C2301234-02-01), Commissioned Date (9/27/2023), Device Clock (9/27/2023 11:57:44), Software Version (Controller: AL_13.g.83023, Display: AA_02.8.C2820), Duration (3 seconds), Signal Strength (4/4), and Transferring Data (Active). At the bottom, there are tabs for Status, PST, Diagnostics, Calibration, Configuration, and Strokes. A 'Host' label shows 'AA_05.4.080423'.

Serial number of the connected actuator

Actuator model Info

Customer tag number (if provided)

Date actuator commissioned.

Current device time

Current control and display software versions

BT signal strength info and stats

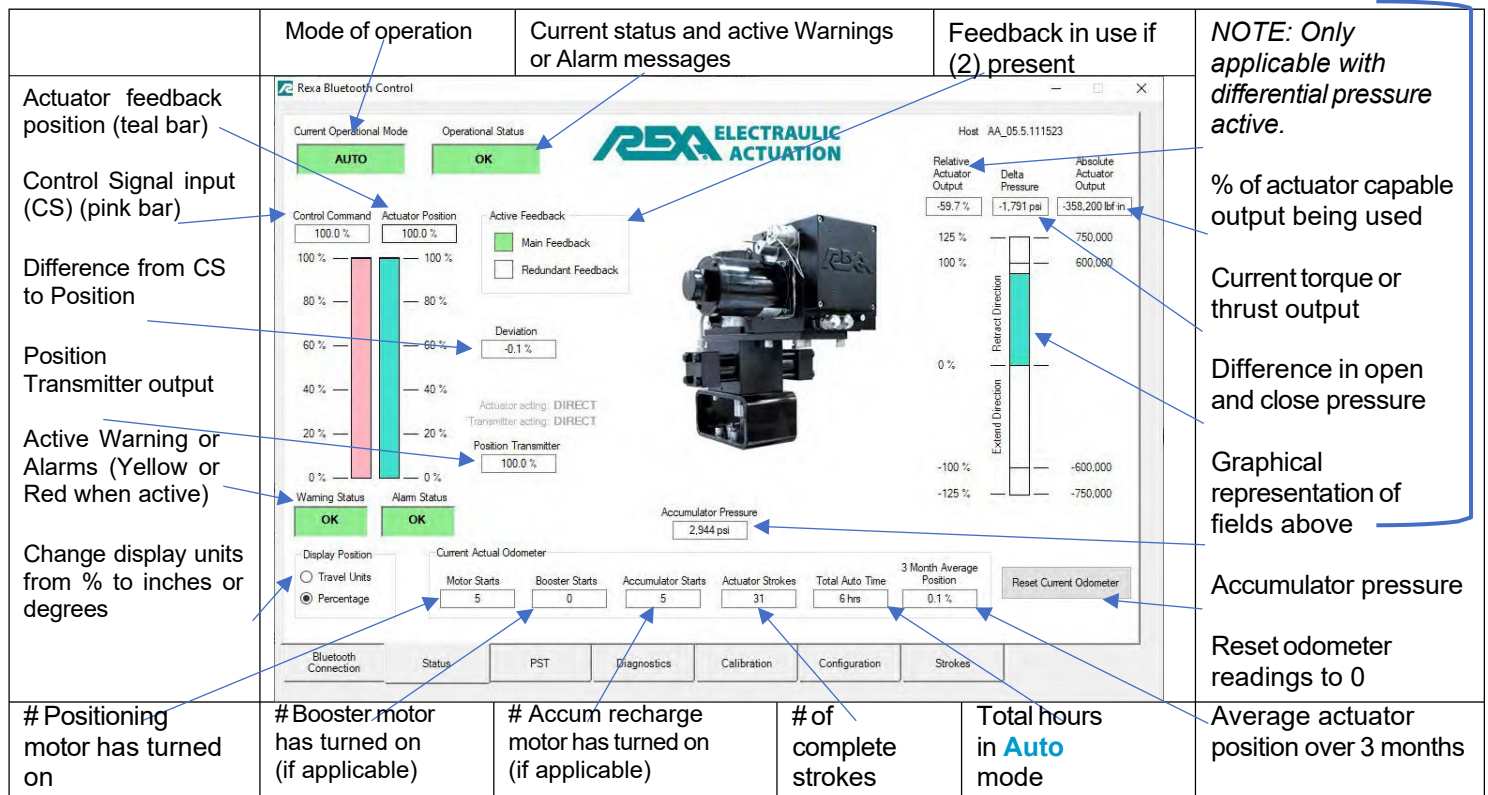
Form tab options to change displayed content (Detailed in subsequent sections)

Will disconnect from current actuator

Bluetooth Connection

Status

The “Status” screen indicates the current status of the connected actuator. Current operation mode, operational status, control signal, actuator position, active feedback loop, warning status, alarm status, motor starts, actuator strokes, total **Auto** time, 3-month average position. Displaying actuator output thrust or torque is an available option, if equipped.



Status

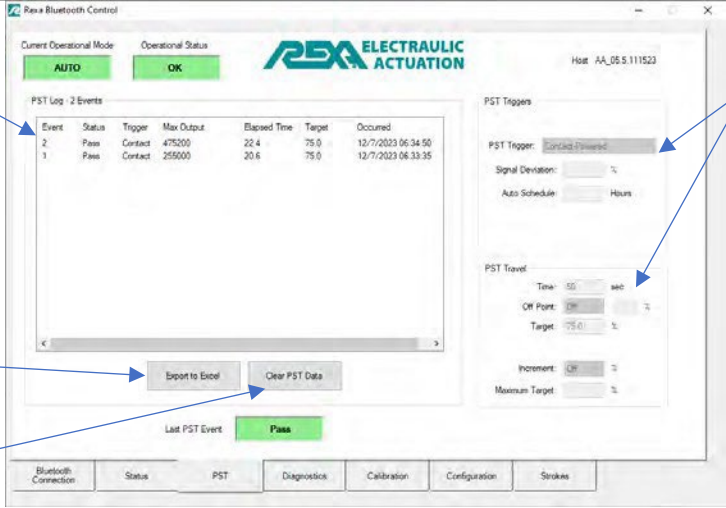
PST

The “Partial Stroke Test (PST) screen tracks any partial stroke tests that may have been performed and their corresponding time stamp. PST related settings are also viewable in this form.

Log of the following PST event stats:
 Pass/Fail status of the test
 Max torque during event
 Total time to complete
 Travel target
 Date / Time event took place

Export log data to an Excel file

Clears the PST event log



The screenshot shows the 'R&A Bluetooth Control' window. At the top, it indicates 'Current Operational Mode: AUTO' and 'Operational Status: OK'. The main section is titled 'PST Log - 2 Events' and contains a table with the following data:

Event	Status	Trigger	Max Output	Elapsed Time	Target	Occurred
2	Pass	Contact	475200	22.4	75.0	12/7/2023 06:34:50
1	Pass	Contact	255000	20.6	75.0	12/7/2023 06:33:35

Below the table are buttons for 'Export to Excel' and 'Clear PST Data'. A 'Last PST Event' section shows a 'Pass' status. On the right side of the window, there are 'PST Triggers' and 'PST Travel' settings. The 'PST Triggers' section includes 'PST Trigger: Contact Forwarded', 'Signal Deviation: 1%', and 'Auto Schedule: Hours'. The 'PST Travel' section includes 'Time: 10.0', 'Off Point: 0.0', 'Target: 75.0', 'Increment: 0.0', and 'Maximum Target: 1.0'. At the bottom of the window is a navigation bar with buttons for 'Bluetooth Connection', 'Status', 'PST', 'Diagnostics', 'Calibration', 'Configuration', and 'Strokes'.

PST control parameters.

NOTE: Settings can be changed Locally via the electronic control enclosure display.

Pass / Fail status of the last PST event

Patril Stroke Test Screen

Diagnostics

The “Diagnostics” screen indicates the occurrence of error related events (Example: CS Bad). Each error is recorded with a time stamp that shows when the error occurred and when the error was cleared. Adjustable warning and alarm status is also viewable. These include: accumulator warning pressure, accumulator recharge pressure, delta pressure output warning, and delta pressure output alarm.

Log of time stamped errors (Occurred and Cleared)

Log of error counters

Settable Warning & Alarm parameters

NOTE: Can be changed when the actuator is in Setup mode.

Last recorded system error

Clears running error log and current totals (Historic totals not impacted)

Tab highlighted yellow when active

Warning or Alarm

Diagnostics

Enter notes in this location

Save note changes to the X3

Read existing notes from X3

Close the note editing form

Calibration

The “Calibration” screen allows the user to view calibrated parameters of the REXA actuator via Bluetooth control.

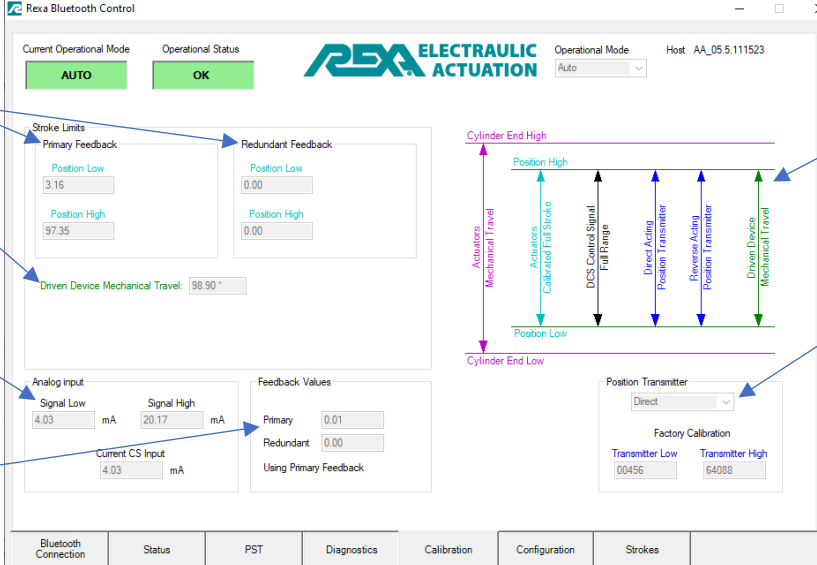
NOTE: All other calibration values can only be changed Locally via the electronic control enclosure display.

Calibration limits of the feedback pots

Actual mechanical travel based on calibrated limits

Calibrated range of the control signal input

Current feedback position



Graphical reference of the calibrated ranges

Position transmitter calibration settings.

NOTE: Can be changed when the actuator is in Setup mode.

Calibration

Configuration

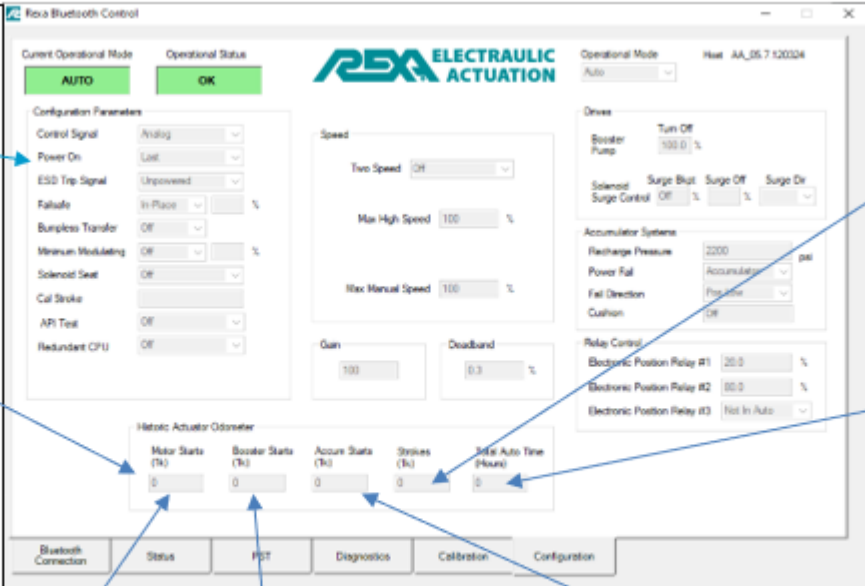
The "Configuration" screen allows the user to view all pertinent values that the actuator is currently programmed to.

Current configuration settings

NOTE: Can be changed when the actuator is in Setup mode.

Historic actuator counters

NOTE: For accurate lower counts refer to the status page.



of complete strokes

Total hours in Auto mode.

x 1k Positioning motor has turned on.

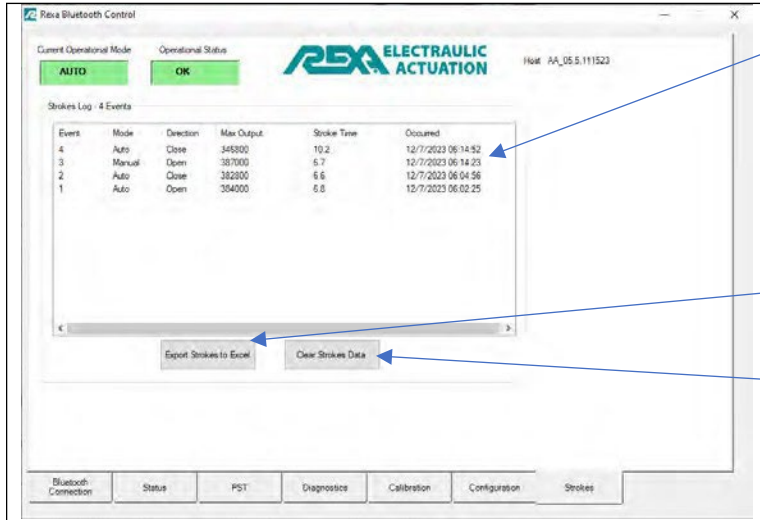
x 1k Booster motor has turned on (if applicable).

x 1k Accum recharge motor has turned on (if applicable).

Configuration

Strokes

The “Strokes” page provides detailed information about each stroke that has taken place on the system. During each position change from fully open to fully closed or vice versa the event is captured along with the direction of motion, max recorded torque, total stroke time and the date & time the event occurred. The buttons located directly below the event log can be utilized to either export this event data to an excel file or clear the existing stroke counters.



Log of the stroke events, direction of travel, Max output during stroke, stroke time and the date & time of event occurrence

NOTE: See below for Max output during stroke details.

Saves event log to Excel

Clears the current stroke event log

Event	Mode	Direction	Max Output	Stroke Time	Occurred
4	Auto	Close	345000	10.2	12/7/2023 06:14:52
3	Manual	Open	387000	6.7	12/7/2023 06:14:23
2	Auto	Close	382000	6.6	12/7/2023 06:04:56
1	Auto	Open	354000	6.8	12/7/2023 06:02:25

Strokes



Remote Manual Control

Configuration And Local Operation

Configuration and operation of the actuator is accomplished by means of the five-button keypad which is located outside the electronic control enclosure. Manual operation without access to the electronic control enclosure is provided by either the external or remote option.

Remote Man allows the actuator to operate manually from a remote location or the external local controls. Once the **Remote Man** mode is entered, the current status will be displayed along with Position.

The **Remote Man** mode will be entered when the MANUAL input of the Remote AUTO/MANUAL inputs is activated. The actuator is then controlled by activating the open or close inputs of the Remote AUTO/MANUAL input.

External Control Option

Installed in the cover of the electronic control enclosure, the external control option consists of a window to view the VFD position display, a two-position rotary switch and three-position center return rotary switch. The two-position switch is used to alternate between **Auto** and **Remote Man** (Remote Manual) modes. In **Remote Man** mode, turning the momentary switch to Open or Close will move the actuator in the OPEN or CLOSE direction. The spring-return-to-center (off) will stop the actuator at the position when the switch is released. When in **Remote Man**, the Not in Auto Relay will open to indicate the mode change.

Remote Manual Station

The actuator may be equipped to connect to a remotely located MANUAL station. The basic station includes one Remote/Auto: two-position maintained switch, and one Open/Off/Close: momentary spring-return-to-center switch. The two-position switch is used to alternate between **Auto** and **Remote Man** (Remote Manual) modes. In **Remote Man** mode, turning the momentary switch to open or close will move the actuator in the OPEN or CLOSE direction. The spring-return-to-center (off) will stop the actuator at the position when the switch is released. As an additional option, a seven segment LED digital display may be connected to the standard position transmitter to display actuator position at the Remote Manual station. When in **Remote Man**, the Not in Auto Relay will open to indicate the mode change.

The user may provide the MANUAL station, or two types of NEMA 4X manual stations are available from REXA:

BB: Material: 316SS

- (1) Remote/Auto switch, two position
- (1) Open/Off/Close Switch, three position, spring return

Dx: Material: 316SS

- (1) Remote/Auto switch, two position
- (1) Open/Off/Close Switch, three position, spring return Position indicator, 0-100%, includes Active Position Transmitter
- (see Technical Product Bulletin #9.0: Position Transmitter for more details)

Booster Pump Options

About Booster Pumps

The bi-directional gear displacement pumps utilized in REXA power modules are custom designed and manufactured. These pumps also play an integral role in our ability to provide the precise, reliable, and compact self-contained actuation that REXA is famous for. As Electraulic™ actuation continued to prove itself in the industry's most demanding applications, the demand for larger and faster actuators developed. To meet this demand, REXA designed supplementary booster pump packages that are used in conjunction with our D size power module.

Theory Of Operation

Booster Pump Configurations utilize an Xpac power module and a large capacity "Booster Pump." The power module provides fine positioning, while a booster pump provides the speed for large or coarse position changes. This dual pump operation allows REXA to extend its unique capabilities to very high thrust or torque units and high-speed operation without sacrificing position accuracy.

Boost Pump: {Booster Pump Breakpoint} defines the minimum deviation, 5.0 to 99.9% of calibrated stroke or Off, between current position and Control Signal for the booster pump to turn on.

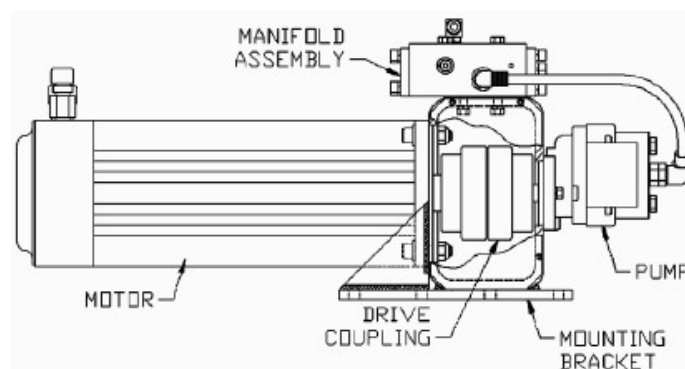
Three sizes of BOOSTER PUMPS are available: the D,P9, Dp20, and the D,P40.

- The D,P9 provide 5 times the capacity of a D size power module or 2.5 GPM.
- The D,P20 provides 12 times the capacity of a D size power module or 6 GPM.
- The D,P40 has a pumping capacity of 11 GPM or 22 times a D size power module.

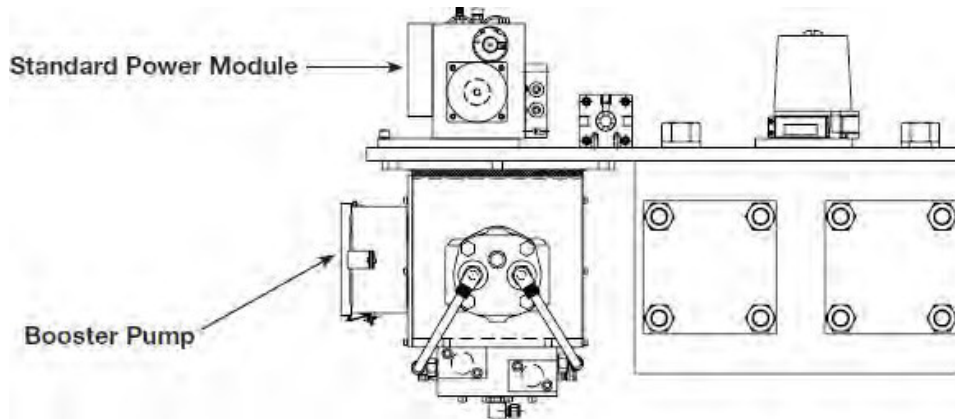
CAUTION: Motor power and motor resolver cables for the power module and booster pump motors must be shielded! The shield of each is connected to the green ground screw on the back panel of the control enclosure only. Failure to follow may inhibit the proper operation of the actuator.

CAUTION: The motor resolver signals are low level voltages. The motor resolver cables must be kept separate from the motor power cables or any other high-power wiring. Failure to follow the above may inhibit the proper operation of the actuator.

NOTE: Resolver cables may be run with the feedback cable or other low power conductors.



Booster Pump Assembly (Side View)



Booster Pump Assembly (Top View)

Mechanical Installation

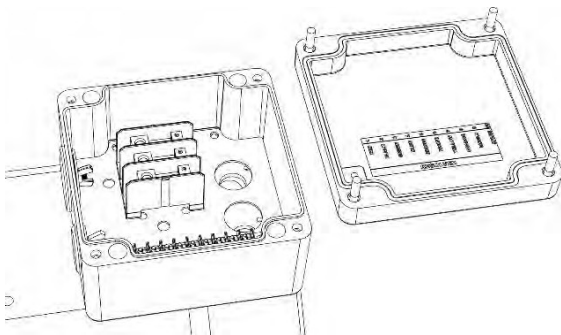
An Xpac Series 3 with the Booster Pump Configuration has no special installation procedure. Therefore, the standard installation should be followed.

Control Enclosure

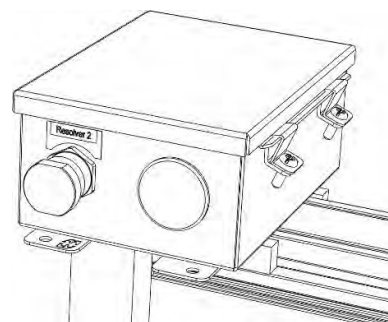
The major electrical components are located in a NEMA 4X enclosure. They have a wide temperature range¹ (-40 °F to 120 °F [-40 °C to +49 °C]) and can be field installed at a convenient location. Avoid areas subject to excessive vibration or heat. To reduce the possibility of water incursion, we recommend that any fitting be pointed downward. There is an enclosure "Junction Box" on the booster assemblies.

¹Ambient temperature only. Direct solar heat load must be avoided.

Typical P,40 Junction Box:



Typical P,9 Junction Box:





Electrical Installation

The Xpac Series 3 consists of two major components, the Electrohydraulic actuator (cylinder and power module) and the control enclosure. The actuator is installed on the driven device, while the enclosure is remotely mounted. Connecting them are the motor power, resolver, feedback, and module cables. Some cables may not be run within the same conduit or Sealtite flex hose. Preferred wiring procedures recommend that power voltages (motor power and module cables) be kept separate from low level signal lines (resolver and feedback cables). User connections of electric power and control signals are made at the enclosure.

Contact Input Options

For applications where precision control is not required a simple 1 Contact or 2 Contact control scheme may be utilized. Based on the input that is active the actuator will run in that OPEN or CLOSE direction.

NOTE: See the Inputs menu, Signal Type parameter in Chapter 6: Modes of Operation & Control Parameters in Xpac 3 Manual.

'On' State:

Most AC and DC solid state switching devices require a minimum current flow to remain in the closed state. If this minimum current exceeds the input signal current at the activation voltage, the current flow may be increased by adding a shunt resistor across the input signal terminals of the inputs board.

'Off' State:

The 'OFF' state leakage current must be less than 1 mA. Diode clamps or RC snubber networks placed across mechanical relays and the semiconductor junctions of solid-state switches will pass some current in the 'OFF' state. If this leakage exceeds 1 mA, a resistor added across the input signal terminals will bypass the current.

1 Contact

The single contact (1 Cont) option for controlling the actuator is for on/off applications. A live voltage is applied to the Contact Inputs Board.

When **Signal Type = 1 Cont** (one contact), "two position" operation—OPEN/CLOSED position—is selected. The applied signal defines actuator position. If the open input is active (powered), the actuator goes to **Position Hi**. If the open input is not active (un-powered), the actuator goes to **Position Lo**.

2 Contact

The dual contact (2 Cont) option for controlling the actuator is for manual modulation control, using two signals. Two live voltages are applied to the Contact Inputs Board.

When **Signal Type = 2 Cont** (two contacts), "manual modulation" operation is selected. The main input signals are the main contacts open and close inputs of the Contact Input Board. If both inputs are active or inactive, the actuator remains in its current position. If only the open input is active, the actuator travels towards **Position Hi**. If only the close input is active, the actuator travels towards **Position Lo**.

NOTE: Actuator will continue to move to its target location if an input signal is present or until the target position is reached.

Refer to certified drawing for wiring details and input requirements.



General Specifications	
Voltage:	OFF: < 8 volts, AC or DC ON: 22 to 120 volts, AC or DC
Current:	OFF: < 1 mA ON: 1.8 mA to 10 mA; proportional to voltage
Impedance:	12K Ω
Connection:	Terminal Block
Dry Contact Input:	24 VDC provided from REXA electronic control enclosure to bias customer control contact to activate input
Wet Contact Input:	Voltage provided by customer to activate input (See Voltage for input range)

Manual Operators: Handwheel/ Drill Drive

Handwheel/ Drill Drive for Fail in Place Configuration

CAUTION: Before attempting to operate any manual override feature, make sure that the electric power is OFF.

CAUTION: The motor cap should always be installed when the handwheel is not being used to manually operate a unit. Failure to remove the handwheel can allow a path for water to ingress into the motor over time.

NOTE: Handwheel/drill drive option is not available for Division 1 or Zone 1 explosion proof environments.

NOTE: The actuator's drive train and cylinder must be in proper working order to operate handwheel/drill drive.



Motor Cap

Linear Handwheel

The handwheel is mounted to the motor output end of the actuator. To operate, depress and turn the handwheel. One half-revolution may be required before proper engagement, as the inside of the handwheel must engage with the motor shaft. The handwheel will declutch by moving outwards when released. Clockwise (CW) rotation of the manual operator will retract the stem on a linear unit and CW rotate the shaft (looking at the feedback housing) on a rotary unit.



Linear Handwheel

Handwheel Revolutions			
Power Module	B	C, Half D	D
Linear (to move one inch per 1,000 lb. of rated thrust)	~75	~25	~13
Rotary (90° of rotation/ 1,000 in. lb. of rated torque)	~200	~65	~33

Drill Drive

CAUTION: Care must be taken to ensure the drill gun is limited to 2,000 rpm. Running into a mechanical stop using a drill may damage the actuator and potentially the equipment it is attached to. As the actuator nears the end point, decrease drill speed so damage doesn't occur.

The drill drive is part of the handwheel assembly that can be used on standard power modules to drive the unit.

To operate, pull off the handle of the handwheel and expose the 5/16" Hex, connect an appropriate drill to the 5/16" Hex. Push the drive in and turn. One half-revolution may be required before proper engagement since the drill drive must contact a slot on the end of the motor shaft. Clockwise rotation of the drill drive will retract the stem on a linear unit and rotate the shaft clockwise (looking at the feedback housing) on a rotary unit. The drive will declutch by moving outwards when released.



Drill Drive

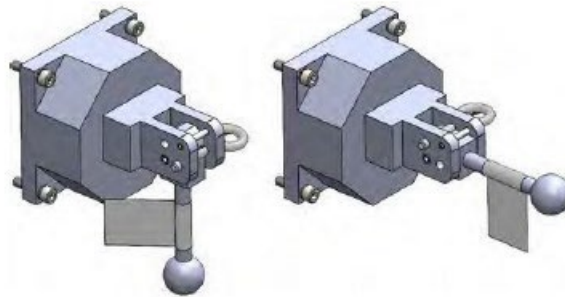
Handwheel/Drill Drive for Spring Fail-Safe Configuration

CAUTION: Spring fail-safe systems contain high pressure; inappropriate identification and service of the system may result in system malfunction, inadvertent system trips or severe personal injury.

In the event of power loss or system malfunction, all X3 spring fail-safe actuator systems with a manual override option can be engaged to manually move the actuator to the required position.

Handwheel/ Drill Drive (Internal Solenoid Procedure)

If the unit has an internal solenoid valve it will have the toggle lever shown in Figure 1. Toggling this lever will override the function of the solenoid.



Internal Solenoid Normal Operation (Left) vs Override Position (Right)

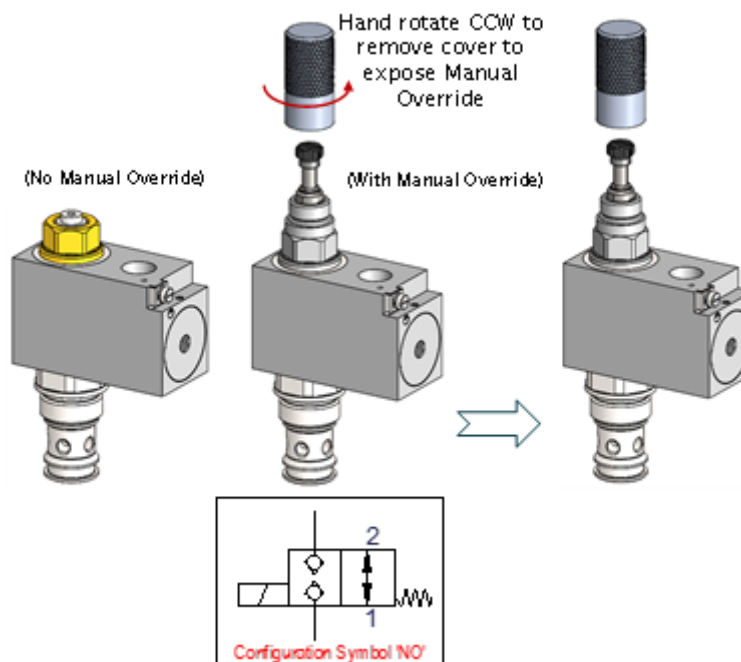
Procedure

This procedure details the steps for manually operating REXA actuators with the spring fail-safe option. On loss of power or module malfunction, the following procedures must be followed to manually operate the actuator.

NOTE: All solenoids that are energized during normal operation will have solenoid overrides that must be engaged.

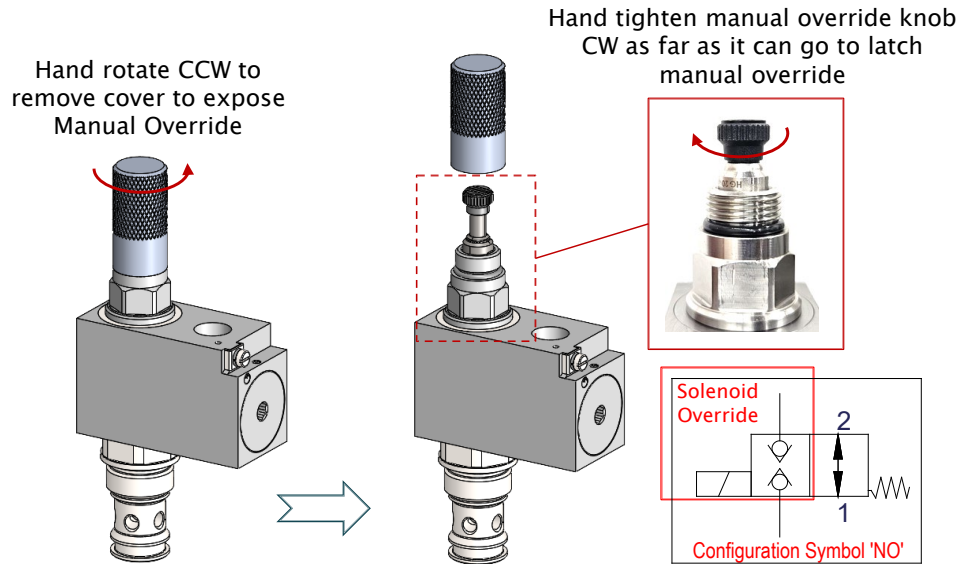
1. If manual operation of the system is required, manually override **Sol 1** (Item 2). The figure below shows the solenoid with and without the override.

NOTE: If power is available to Sol 1, proceed to step 2.



2-Way-2 Position Solenoid

- a. Remove the manual override cover by turning the knob Counterclockwise (CCW), lifting up the cover to expose the manual override. The manual override design is a threaded lock-in-place design.
- b. The solenoid override can be engaged by rotating the manual override all the way CW as illustrated in the figure below. In doing so, ports 1 and 2 of the solenoid are isolated.



2. Remove the motor cap and attach a declutchable drill drive to the primary motor to move the actuator to the desired position.
3. To reconfigure the system back in the pre-manual override condition, reverse **steps 1-3**, starting with **step 3** and working your way back to **step 1**. Open up all shutoff valves if applicable.

Handwheel/ Drill Drive for Accumulator Fail-Safe Configuration

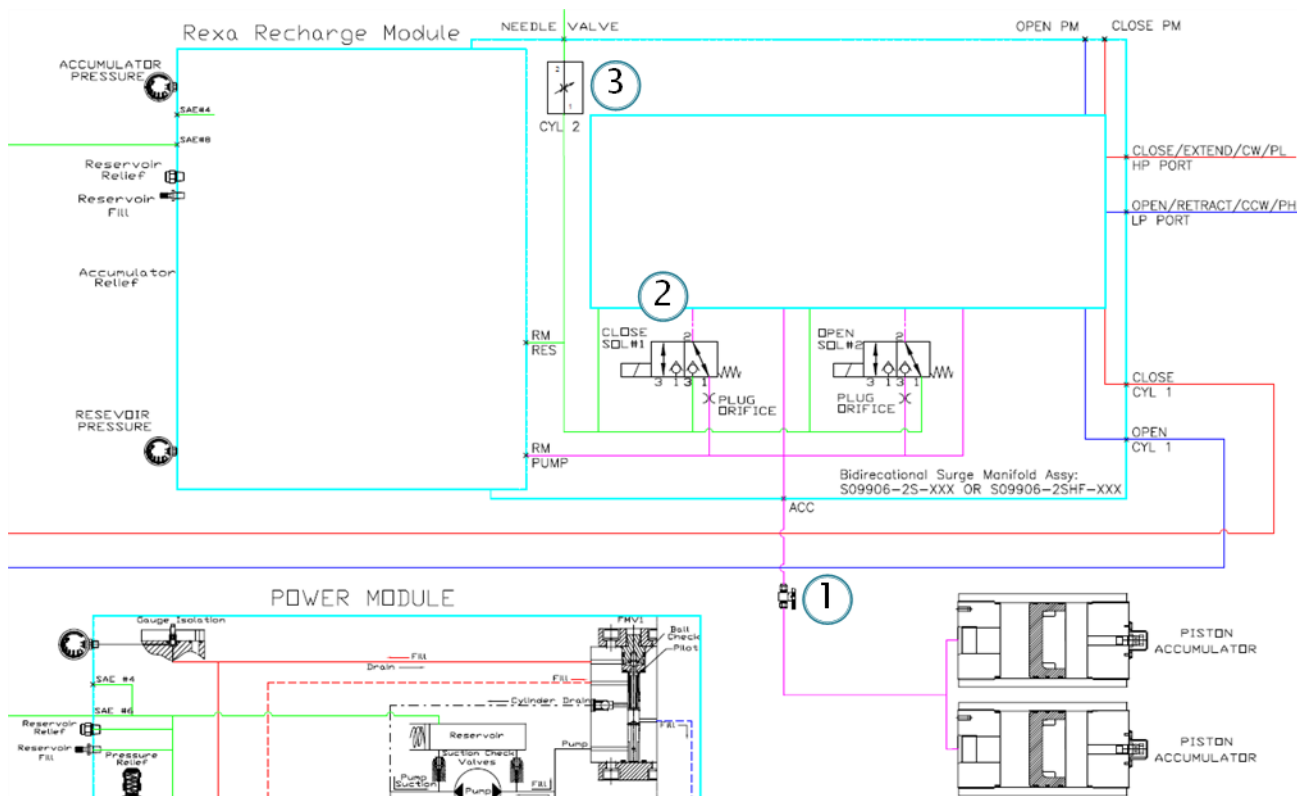
CAUTION: Accumulator fail-safe systems contain high pressure; inappropriate identification and service of the system may result in system malfunction, inadvertent system trips or severe personal injury.

In the event of power loss or system malfunction, all X3 accumulator fail/surge actuator systems with a manual override option can be engaged to manually move the actuator to the required position.

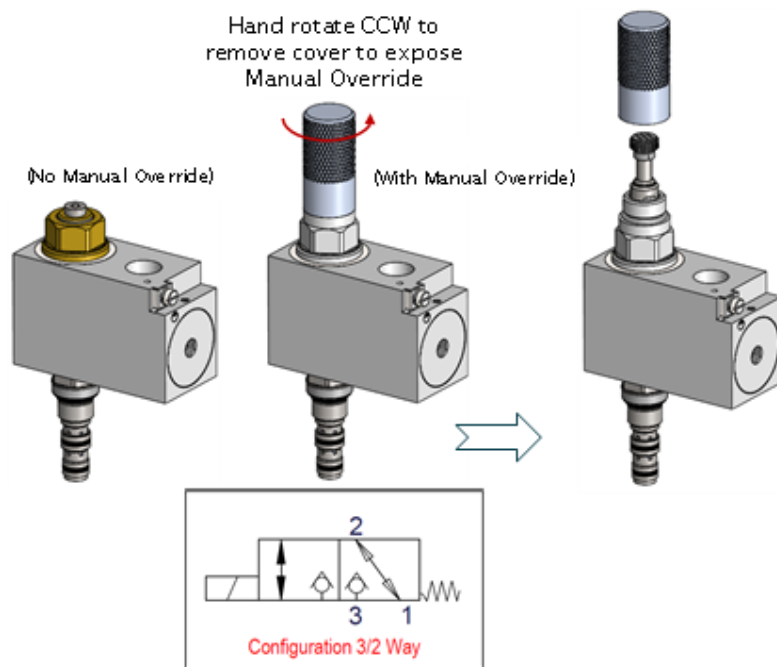
Procedure

This procedure details the steps for manually operating REXA actuators with the online accumulator fail-safe and/or surge option. On loss of power, online recharge module malfunction, or accumulator bottle N2 pre-charge leaks, the following procedures must be followed to manually operate the actuator. The example hydraulic schematic below is of a bidirectional surge manifold assembly with the relevant components ballooned for reference; however, the procedure can be applied to any online accumulator fail-safe system with a dedicated recharge module.

NOTE: Online accumulator fail-safe systems with the fail in place option will not require the solenoid override. Solenoids on these systems are normally deenergized and step 2 can be skipped.



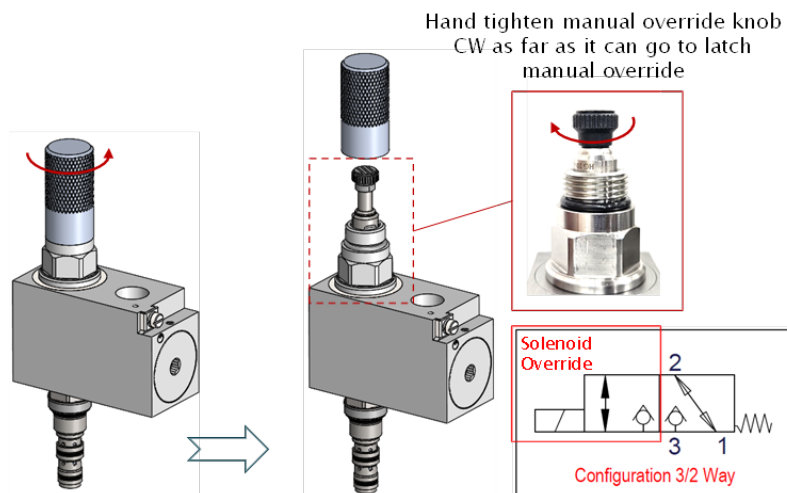
1. If manual operation of the system is required, close off ball valve (Item 1). This is to prevent oil from backflowing into the accumulator bottle when operating the manual override.
2. **Sol 1** (Item 2) is energized during normal operation and therefore needs to be either powered or must have the solenoid override engaged to ensure that the oil does not recirculate within the recharge module lines when operating the manual override. The figure below shows the solenoid with and without the override.



3-Way 2-Position Solenoid

3. If power is available to **Sol 1**, skip this section. If not, proceed to the section below:
 - a. Remove the manual override cover by turning the knob Counterclockwise (CCW), lifting the cover to expose the manual override. The manual override design is a threaded lock-in-place design.
 - b. The solenoid override can be engaged by rotating the manual override all the way CW, as illustrated in the figure below. In doing so, ports 1 and 2 of the solenoid are isolated.

NOTE: All Solenoids that are energized during normal operation will have solenoid overrides that must be engaged.



3-Way 2-Position Solenoid Valve Override



4. Remove the motor cap and attach a declutchable drill drive to the primary motor to move the actuator to the desired position.
5. To reconfigure the system back in the pre-manual override condition, reverse **steps 1-4**, starting with **step 4** and working your way back to **step 1**. Open up all shutoff valves if applicable.

Manual Operators: Hydraulic Hand Pump

CAUTION: Before attempting to operate ANY manual override feature, make sure that electrical power is turned OFF.

The hydraulic hand pump manifold assembly can be installed on any REXA actuator and needs only the cylinder side of the hydraulic circuit and the Flow Match Valve (FMV) check valves to be in working order. The manual hydraulic pump operates at the following speeds.

Manual Hydraulic Hand Pump Speeds (Number of Pumps)		
Linear	To move one inch/1,000 lb. of rated thrust.	~1
Rotary	90° of rotation/ 1,000 in-lbs. of rated torque.	~2.5

1. To operate the hydraulic pump:
 - a. Remove the DCV (Directional Control Valve) cover to expose the DCV by manually turning the cover Counterclockwise (CCW) .
 - b. Referring to the Indicator Disc in Figure 1, turn the DCV all the way CCW or Clockwise (CW) to open or close the actuator.

NOTE: Close/Open is application dependent and is noted by the indicator disc on the DCV cover of the unit.

 - c. Remove Lock-Out pin from pump lever locking bracket. See Figure 2 for details.
 - d. Operate the hydraulic pump lever to stroke actuator.
 - e. To reverse the actuator's direction, rotate the DCV all the way CW or CCW.

To lock out the hydraulic hand pump:

- a. Hold DCV at middle position between detents, allowing handle to lower into the pump lever locking bracket.

*NOTE: This step **DOES NOT** affect actuator positioning*

- b. Remove and store lever arm then replace pin into lever locking bracket
- c. Replace the DCV Cover by turning the cover clockwise when done.

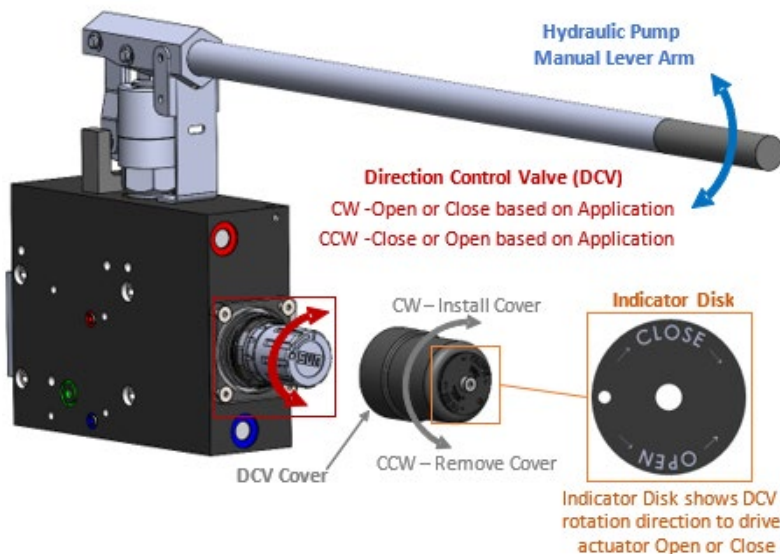


Figure 1: Indicator Disc Locator

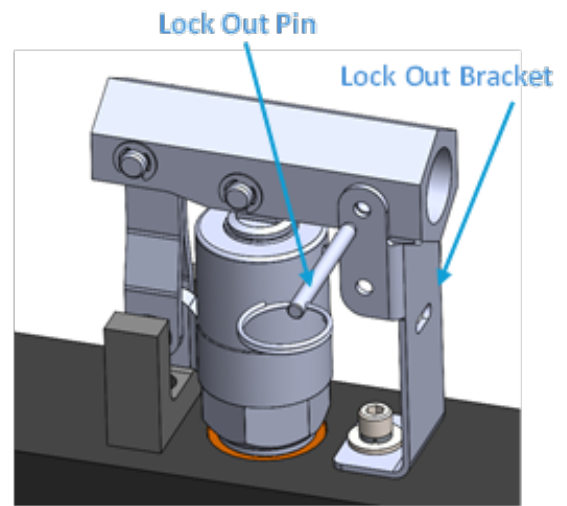


Figure 2: Lock-Out Pin Locator

Hydraulic Hand Pump for Spring Fail-Safe Configuration

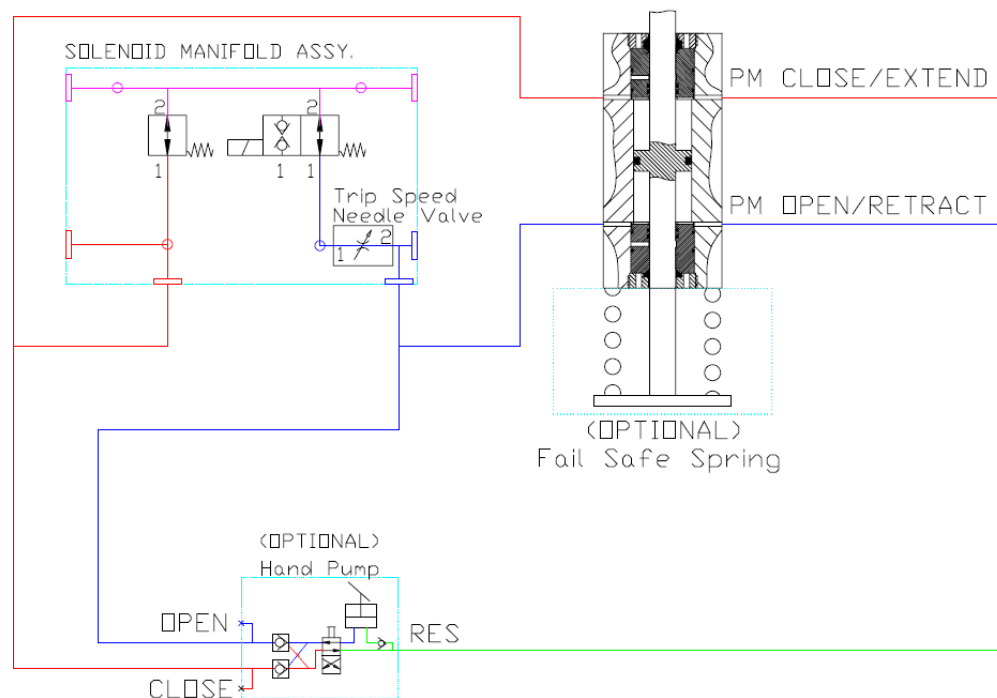
CAUTION: Spring fail-safe systems contain high pressure; inappropriate identification and service of the system may result in system malfunction, inadvertent system trips or severe personal injury.

In the event of power loss or system malfunction, all X3 spring fail-safe actuator systems with a manual override option can be engaged to manually move the actuator to the required position.

Procedure

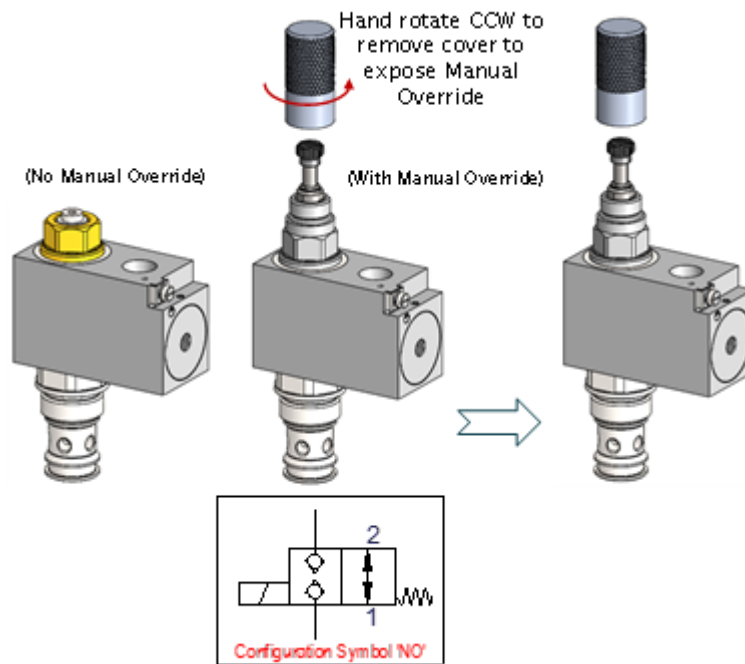
This procedure details the steps for manually operating REXA actuators with the spring fail-safe option. On loss of power or module malfunction, the following procedures must be followed to manually operate the actuator. The example hydraulic schematic below is of a linear Spring Fail-Safe system with the relevant components ballooned for reference; however, the procedure is applicable to any spring fail-safe system with one or more solenoids.

NOTE: All Solenoids that are energized during normal operation will have Solenoid overrides that must be engaged.



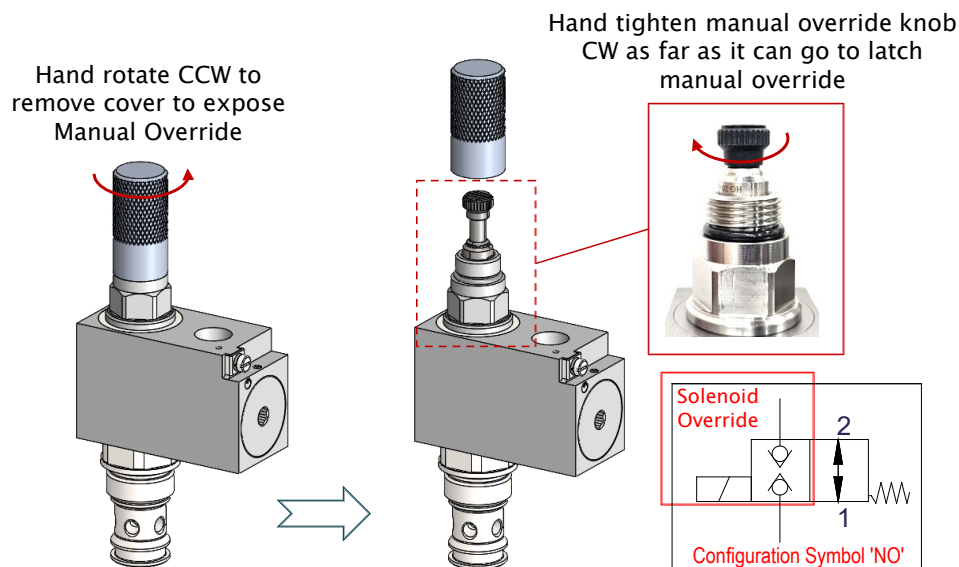
1. If manual operation of the system is required, manually override **Sol 1** (Item 2). The figure below shows the solenoid with and without the override.

NOTE: If power is available to Sol 1, proceed to Step 2.

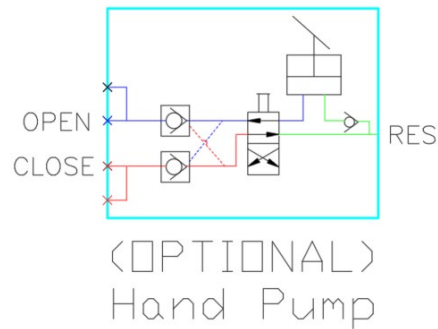


2-Way-2 Position Solenoid

- Remove the manual override cover by turning the knob Counterclockwise (CCW), lifting up the cover to expose the manual override. The manual override design is a threaded lock-in-place design.
- The solenoid override can be engaged by rotating the manual override all the way Clockwise (CW), as shown in the figure below. In doing so, ports 1 and 2 of the solenoid are isolated.



2. If the system is configured with a hand pump, the hydraulic hand pump manifold assembly will either be mounted directly onto a REXA power module or as a standalone modular assembly with hydraulic connections to the OPEN, CLOSE, and RES hydraulic lines without shutoffs. Use the hydraulic pump to move the actuator to the desired position.



Hydraulic Hand Pump Manifold Assembly

3. To reconfigure the system back in the pre-manual override condition, reverse **steps 1-3**, starting with **step 3** and working your way back to **step 1**. Open up all shutoff valves if applicable.

Hydraulic Hand Pump for Accumulator Fail-Safe Configuration

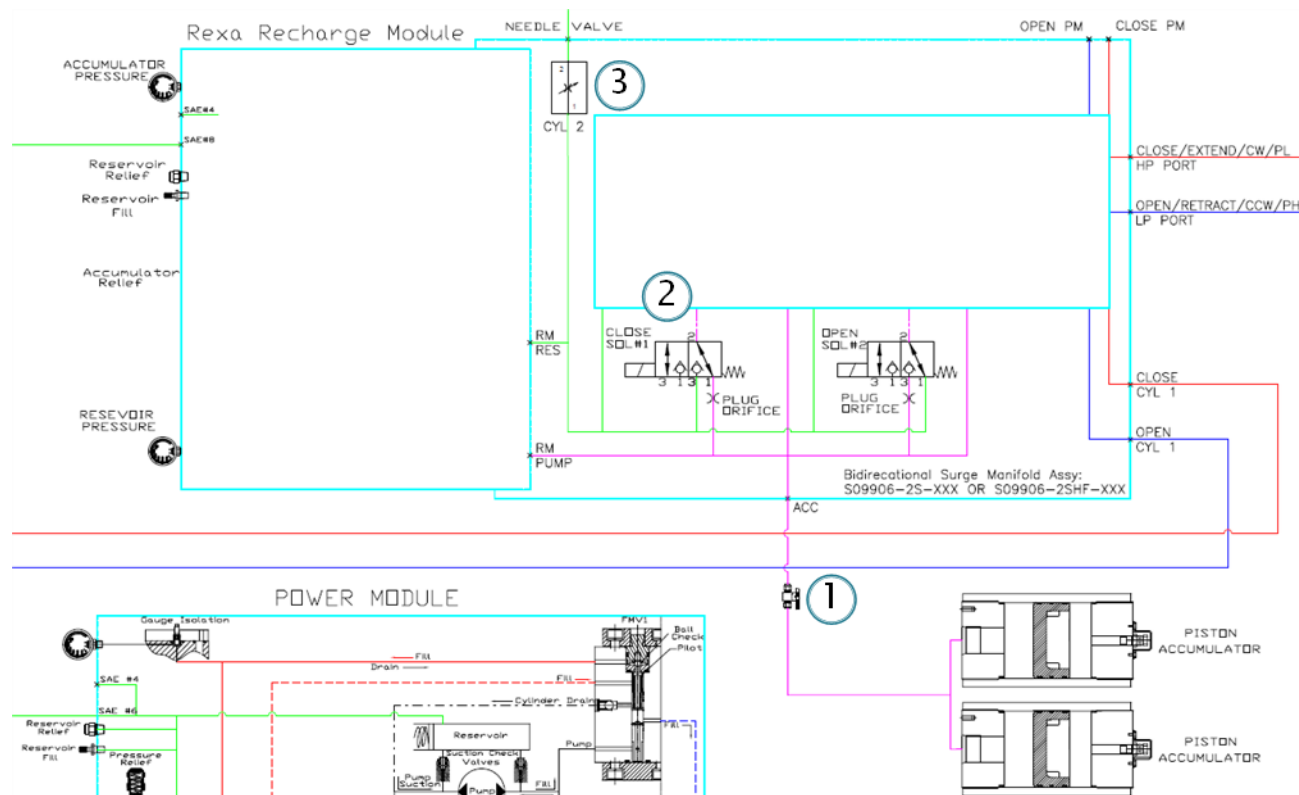
CAUTION: Accumulator fail-safe systems contain high pressure; inappropriate identification and service of the system may result in system malfunction, inadvertent system trips or severe personal injury.

In the event of power loss or system malfunction, all X3 accumulator fail/surge actuator systems with a manual override option can be engaged to manually move the actuator to the required position.

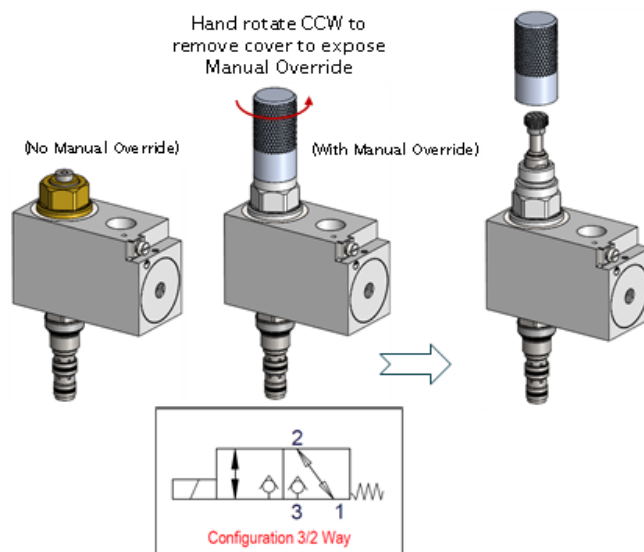
Procedure

This procedure details the steps for manually operating REXA actuators with the online accumulator fail-safe and/or surge option. On loss of power, online recharge module malfunction, or accumulator bottle N2 pre-charge leaks, the following procedures must be followed to manually operate the actuator. The example hydraulic schematic below is of a bidirectional surge manifold assembly with the relevant components ballooned for reference; however, the procedure can be applied to any online accumulator fail-safe system with a dedicated recharge module.

NOTE: Online accumulator fail-safe systems with the fail in place option will not require the Solenoid override. Solenoids on these systems are normally deenergized, and step 2 can be skipped.



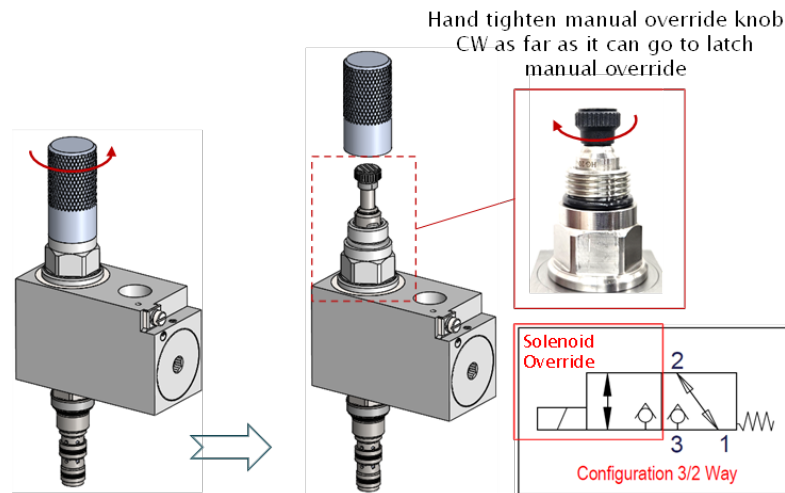
4. If manual operation of the system is required, close off ball valve (Item 1). This is to prevent oil backflow into the accumulator bottle when operating the manual override.
5. **Sol 1** (Item 2) is energized during normal operation and therefore needs to be either powered or must have the solenoid override engaged to ensure that the oil does not recirculate within the recharge module lines when operating the manual override. The figure below shows the solenoid with and without the override.



3-Way 2-Position Solenoid

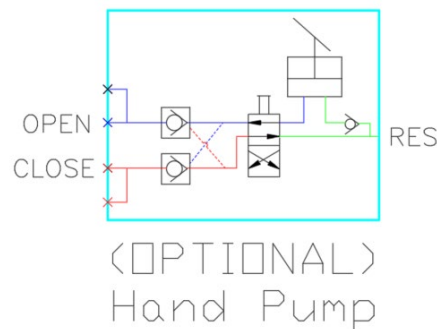
6. If power is available to **Sol 1**, skip this section. If not, proceed to the section below:
 - a. Remove the manual override cover by turning the knob Counterclockwise (CCW), lifting up the cover to expose the manual override. The manual override design is a threaded lock-in-place design.
 - b. The solenoid override can be engaged by rotating the manual override all the way Clockwise (CW) as shown in the figure below. In doing so, ports 1 and 2 of the solenoid are isolated.

NOTE: All Solenoids that are energized during normal operation will have solenoid overrides that must be engaged.



3-Way 2-Position Solenoid Valve Override

7. If the system is configured with a hand pump, the hydraulic hand pump manifold assembly will either be mounted directly onto a REXA power module or as a standalone modular assembly with hydraulic connections to the OPEN, CLOSE, and RES hydraulic lines without shutoffs. Use the hydraulic pump to move the actuator to the desired position.



Hand Pump Manifold Assembly (No Ball Valves)

8. To reconfigure the system back in the pre-manual override condition, reverse **steps 1-4**, starting with **step 4** and working your way back to **step 1**. Open up all shutoff valves if applicable.

Manual Operators: Linear Mechanical Gear Drive

CAUTION: Before attempting to operate ANY manual override feature, make sure that electrical power is turned OFF and all trip signals have been removed.

REXA linear actuators can be designed with a mechanical override to allow for manual operation of the actuator in the event of a power outage or failure. Each linear actuator equipped with a linear mechanical gear drive consists of two main sub-assemblies: (1) the linear hydraulic cylinder with either on-board power module(s) or remote power module(s) and (2) the linear mechanical gear drive sub-assembly. Figure 1 illustrates an actuator system with mechanical override design mounted onto (3) and example end user valve assembly:

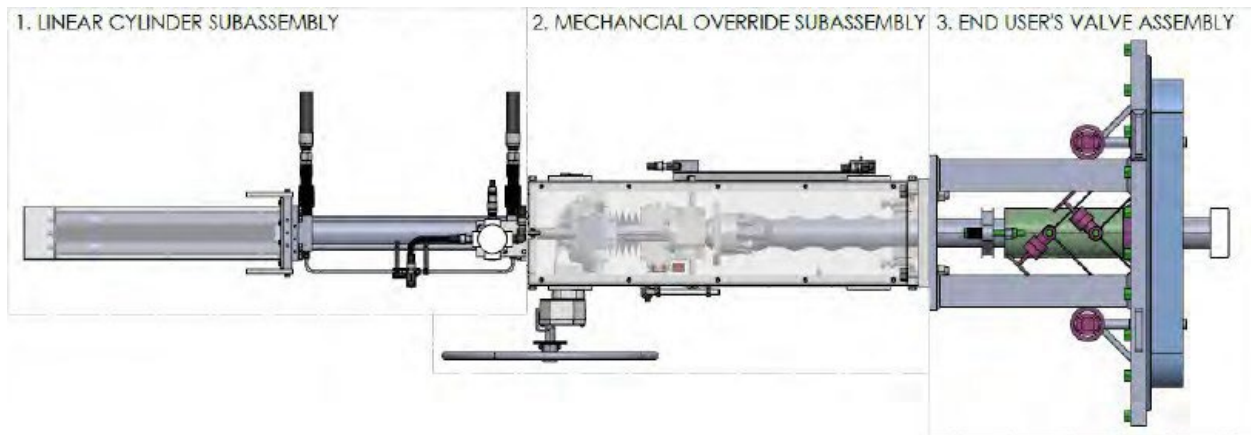


Figure 1: Linear Mechanical Gear Drive

Optional accessories such as Lock Out Tag Out (LOTO) lock features, override bypass sensing, mechanical stop adjustments, and limit switches can be added onto the mechanical override configuration.

Theory of Operation

The REXA mechanical override assembly consists of a linear lead screw, lead screw clutching mechanism, and a gearbox and handwheel drive mechanism. Opening the hydraulic bypass and engaging the clutching mechanism onto the leadscrew will allow the gearbox and handwheel drive mechanism to linearly traverse the valve stem. It is also possible to completely remove the linear electro-hydraulic actuator completely (i.e., for service) and operate the mechanical override subassembly independently as illustrated below.

Engaging Mechanical Override

To engage the manual override to the drive shaft for hand wheel or pneumatic drive operation.

The operation of REXA's linear mechanical override system is the same. the differences are in the optional accessories.

1. Ensure proper lock out and tag out procedures to ensure power is removed from the actuator and the hydraulic system is disabled. see figure 2 for details.
2. Operate handwheel until the mechanical override carriage trunnion aligns to the split clamp carriage trunnion, shown in figure 3.
3. Remove mechanical override pin from pin holder by pressing release button and insert through both trunnions.
4. Open the bypass illustrated in figure 4 (handle inline with tubing).
5. The handwheel or pneumatic drive can now be used to position the actuator.

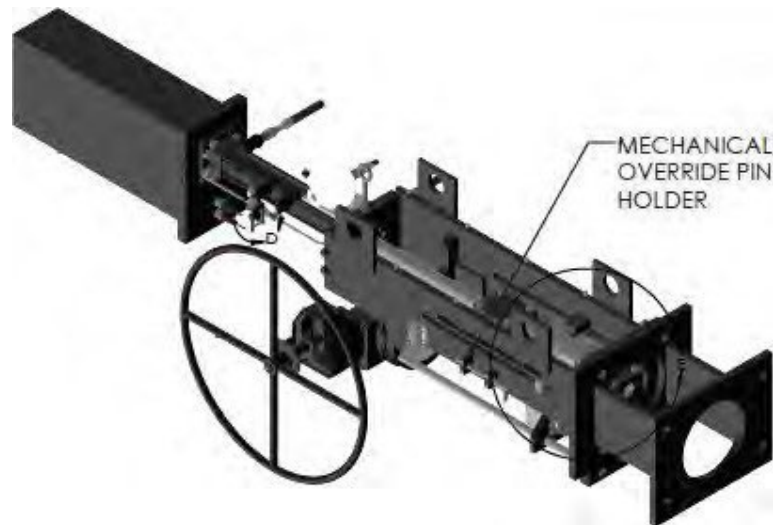


Figure 2

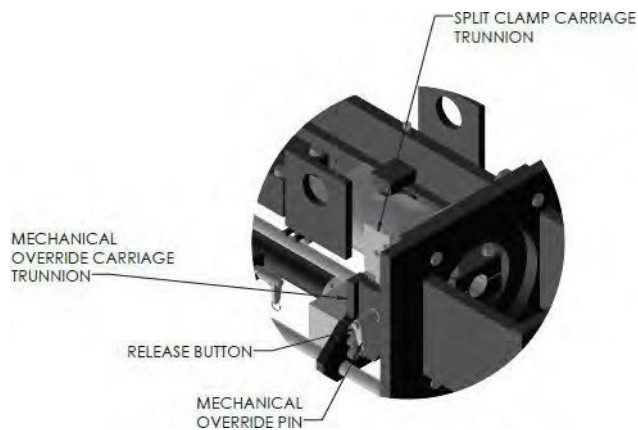


Figure 3

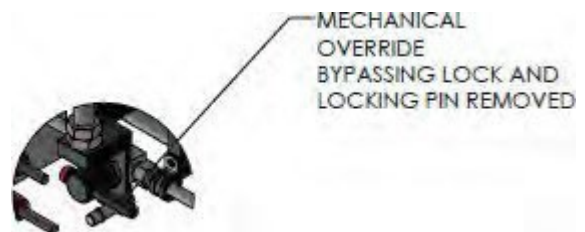


Figure 4

Disengage Mechanical Override

To disengage the manual override from the drive shaft and run the unit with the actuator.

1. Turn mechanical override bypass (Figure 5) clockwise (handle perpendicular with tubing).
2. Push the pin release button to remove the pin (Figure 3) and place the pin back into the holder (Figure 2) (small rotations of the handwheel may be needed to relieve tension on pin).
3. Reapply power to unit to resume electronic control of actuator.

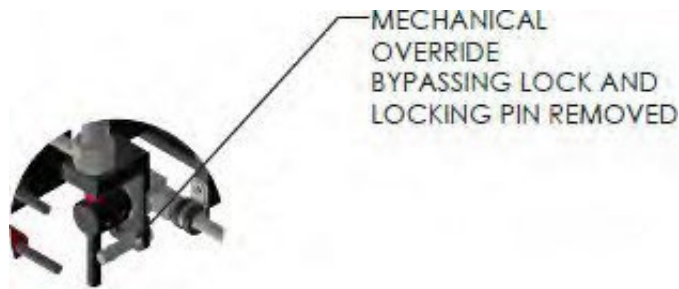
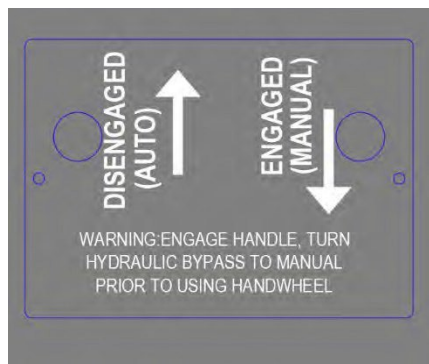


Figure 5

Manual Operators: Rotary Mechanical Gear Drive

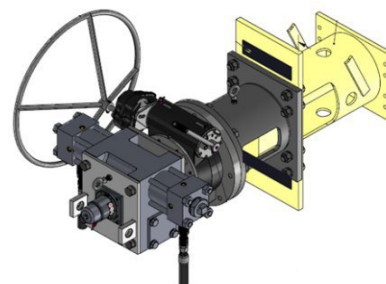
CAUTION: Before attempting to operate ANY manual override feature, make sure that electrical power is turned OFF and all trip signals have been removed.



Hydraulic Bypass Warning

NOTE: Hydraulic Bypass valve MUST be opened, and the electronic control enclosure must be in manual mode, or the incoming electrical power must be turned off to the control enclosure before attempting to use the manual override.

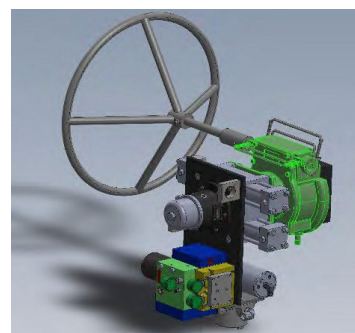
NOTE: If the actuator is equipped with hydraulic bypass sensor, this will disable normal actuator function when the bypass is open.



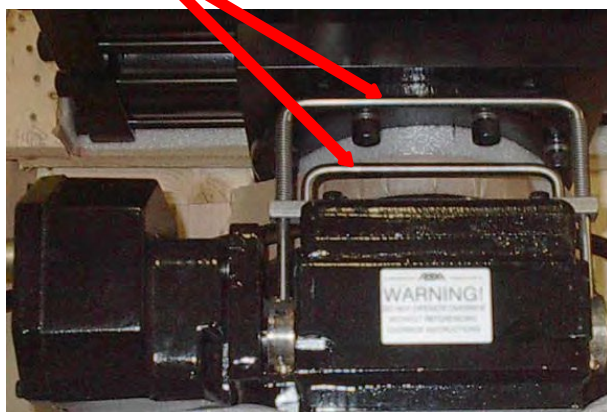
Rotary Mechanical Override

Manual Operation:

1. Turn off power to the actuator or put the electronics in manual mode so it will not try and re-correct the mechanical overrides positioning.
2. Engaging the manual operator for actuators up to 100,000 in-lbs.:
 - a. Using one hand, grab the override engagement handle shown below, squeezing the bottom and top handle together.

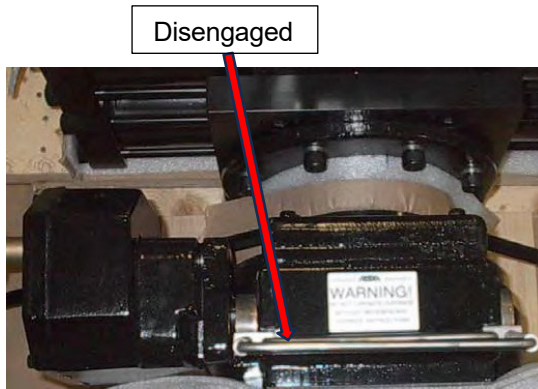


Squeeze the two bars together to unlock

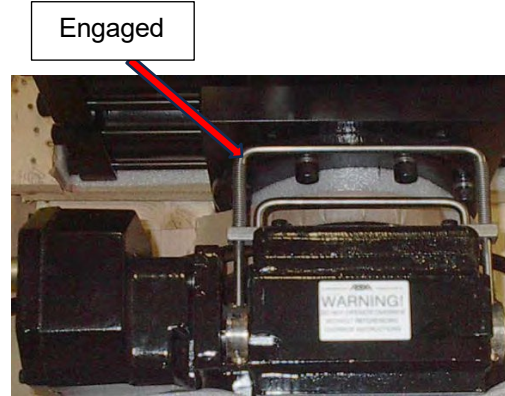


Override Handle Locator

- b. With the handles still squeezed together, rotate the handle from its declutched (Disengaged) position upward toward the hydraulic cylinder actuator mounting flange until the handle locking tabs are in line with their locking positions.



Override Handle - Disengaged



Override Handle - Engaged

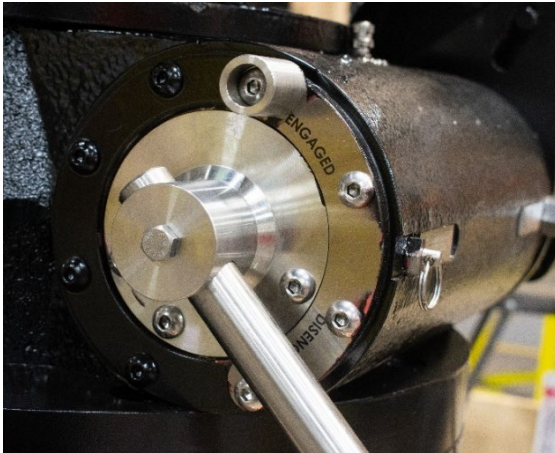
NOTE: In some cases, the override gear teeth will not mesh correctly when rotating the handle upward. If this occurs, rotate the override wheel slightly to mesh the gears and then rotate the declutch handle upward.

- c. Release the handle and allow the override engagement handle to lock in the override position.
3. Engaging the manual operator for actuators over 100,000 in-lbs.:
 - a. Using two hands, pull the two spring pins located on the housing shown below and turn them so that the pins remain pulled out.

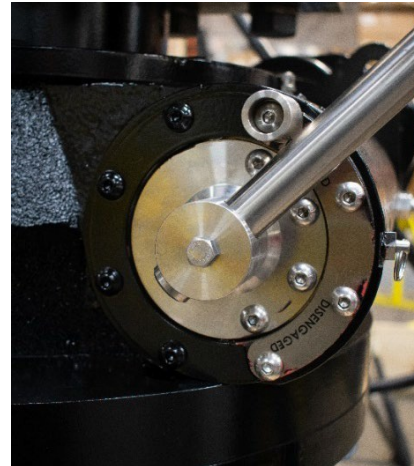


String Pins Locator

- b. Rotate the declutching lever shown below to the ENGAGED position.



Override Handle - Disengaged



Override Handle - Engaged

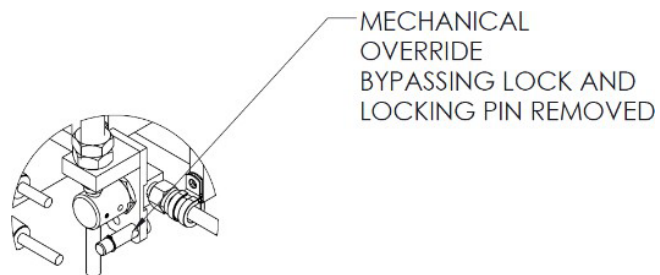
NOTE: In some cases, the override gear teeth will not mesh correctly when rotating the handle upward. If this occurs, rotate the override wheel slightly to mesh the gears and then rotate the declutch handle upward.

4. Once the override lever is fully engaged, the override is ready to be used.
5. Open the hydraulic bypass valve by turning it counterclockwise to the MANUAL position shown below.

NOTE: Some overrides may have a locking pin which would need to be removed.



Hydraulic Bypass Valve



6. Once the override handle is in its locked position, the override is ready to be used. A clockwise rotation of the override handwheel will produce either clockwise or counterclockwise rotation of the override output, reference the direction label on the handwheel.



Manual Operation Completed – Return to Actuator Control:

1. Close the hydraulic bypass valve referenced in step 5 above.
2. Reversing steps 3 and 2 above disengage the manual operator.
3. Turn on the power to the actuator.

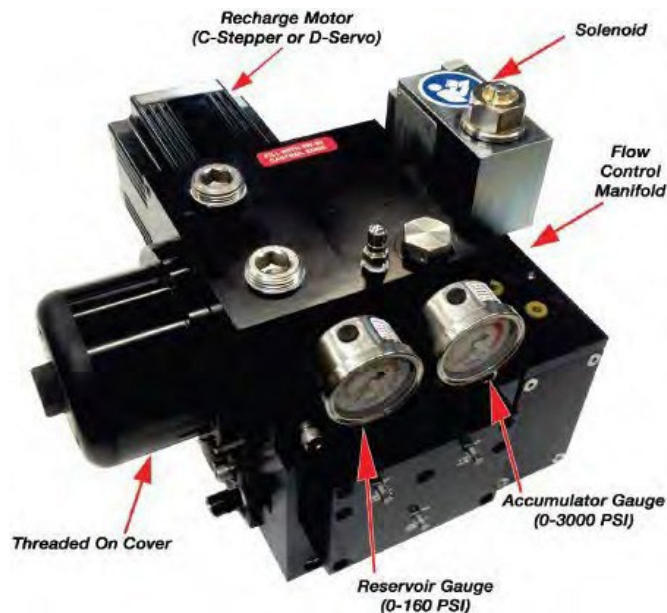
Accumulator Fail-Safe Option

The basic design of REXA Electraulic™ actuation will inherently lock-in-last place upon loss of power. However, it is easily adapted to provide end of travel fail-safe operation. One common method of accomplishing fail-safe positioning is with a solenoid and spring design. This type of device is limited to smaller actuators for physical and economic reasons. It should also be noted that since the spring is directly coupled to the cylinder, much of the actuators hydraulic force is consumed to compress the spring with each stroke. As a result, “spring-fail” actuators require a larger cylinder to accomplish the required net output force.

For larger actuation needs, where spring packages become very large and impractical, an accumulator fail option is offered. The accumulator system is isolated from the main hydraulic circuit during normal actuator operation removing the need to “oversize” the actuator. Our unique accumulator technology uses the power module to recharge the accumulator, eliminating the need for a separate re-charge pump and associated plumbing. A fail-safe event may be initiated by loss of electrical power or an independent trip signal. After a fail-safe event the accumulator is re-charged by the actuator’s power module prior to resuming normal operation.

Accumulator Operation

System operation is based on a piston type accumulator with nitrogen gas on one side of the piston and oil on the other.



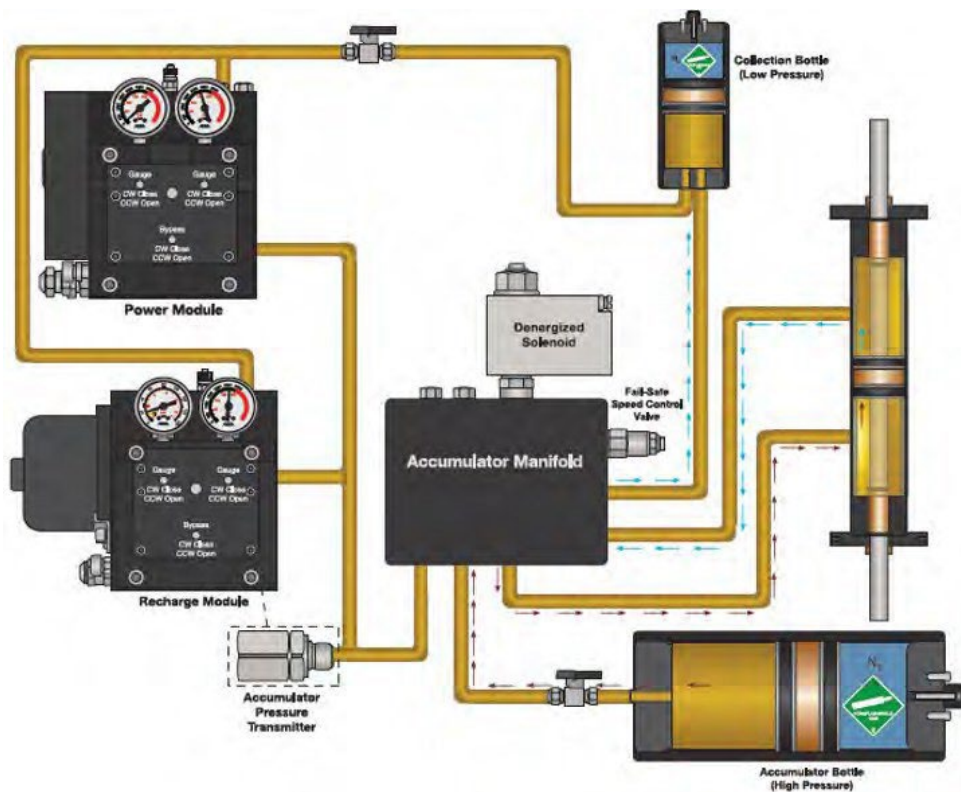
Online Accumulator Fail-Safe

Power Fail Trip

The accumulator system maintains an acceptable pressure range defined by the setpoint. During a fail-safe event, the solenoid valve changes state, allowing the accumulator pressure to drive the actuator cylinder to the fail-safe position (open or closed). The stored pressure within the accumulator bottle is released into the actuator cylinder. System oil that was already present in the actuator cylinder is displaced into a pressurized collection bottle. It remains there until the recharge sequence is initiated.

A needle valve is integrated into the accumulator manifold to adjust the fail-safe speed to meet application requirements. The arrows in these figures indicate the oil flow path during a loss of power or trip condition.

Maximum Fail Speed	
R Series	Approximate Fail Time* (seconds)
R2 500	<1
R5 000	<1
R10 000	<1
R20 000	<1
R50 000	<1.5
R100 000	3
R200 000	6
R400 000	12

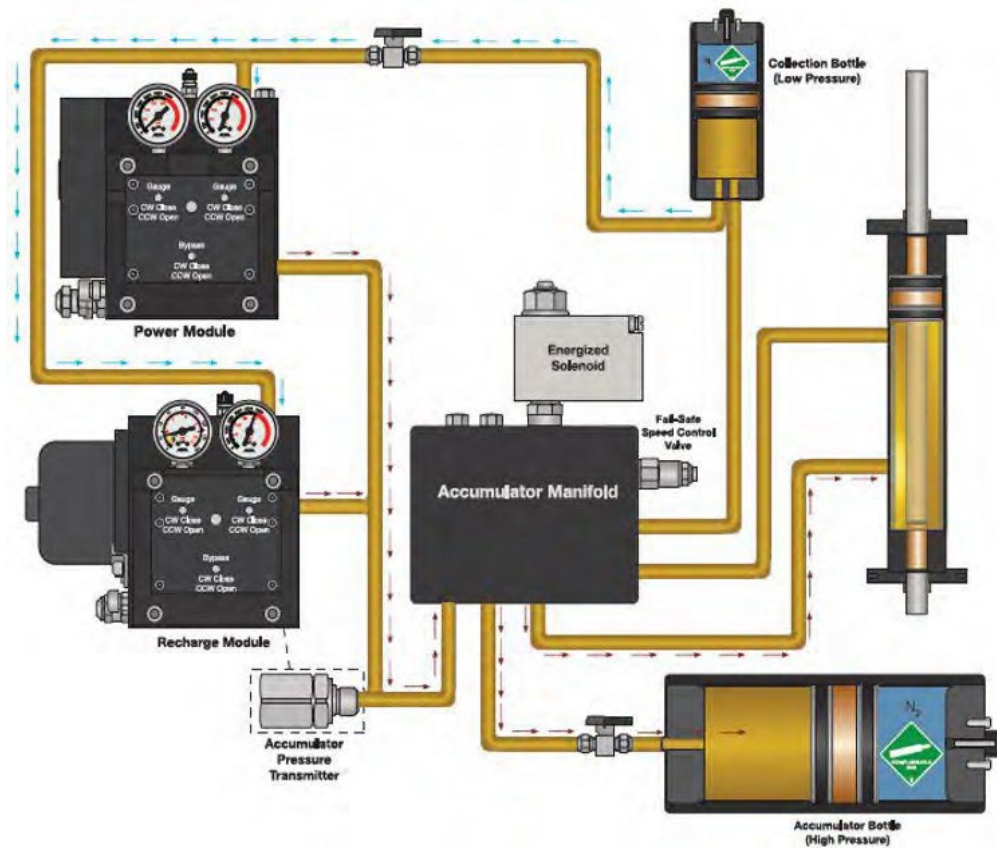


Fail-Safe Trip

Recharge After Fail-Safe

When the fail-safe condition is removed, a pressure transducer signals that there is low pressure in the accumulator system. All pumping modules then run to quickly recharge the accumulator system, transferring oil from the collection bottle to the accumulator bottle. When the required pressure is reached, the pumping modules stop, and the solenoids are re-energizing the solenoid locking the pressure in the accumulator system. Normal operation is resumed, and the actuator will travel to the control signal target position.

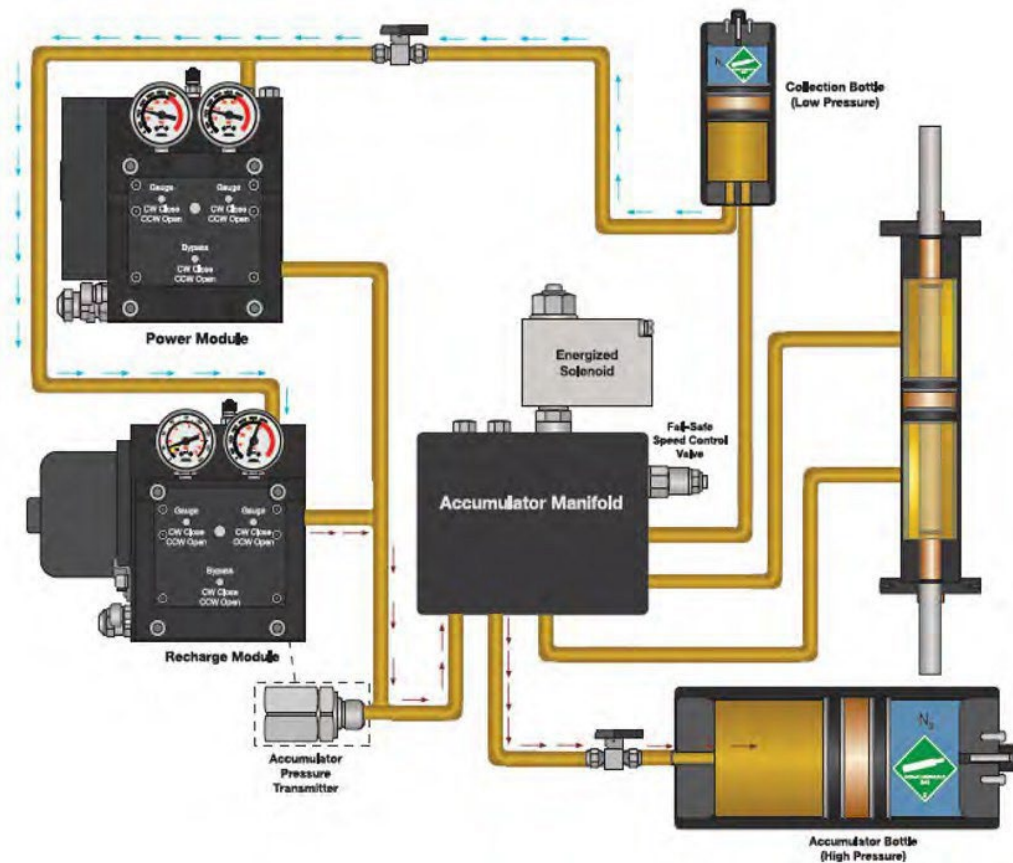
If the fail-safe condition is initiated with a trip signal and power is still available, the dedicated recharge module will begin charging the accumulator system as soon as the actuator has reached its trip position. This allows the system to readily modulate after removal of the trip signal. The figure below indicates the oil flow path during a recharge after power loss and the flow path any time the pressure is detected below the recharge threshold.



Recharge Post Fail-Safe

Recharge (Top-Off)

If the accumulator pressure falls 100 psi below the programmed setpoint during a normal operation, the recharge module pumps oil from the pressurized collection bottle into the accumulator system. This sequence can occur simultaneously while the actuator is modulating. The figure below illustrates this recharge sequence.



Recharge (Top-Off)

Spring Fail-Safe Option

Theory of Operation

The springs used on REXA actuators are “pre-loaded” so they will apply a minimum force in each case. This pre-loading is done by deflecting the spring to a specific amount during assembly. This initial deflection is based on the spring rate and results in the spring end force. Each spring is also designed with a maximum output force at maximum compression height (end of travel); this is referred to as the spring start force.

As the cylinder moves in the direction to compress the spring, an increasing amount of the cylinder’s force is required to compress the spring. This spring force is calculated by multiplying the spring rate by the travel (additional deflection) plus the spring end force.

$$\text{Spring Force} = (\text{Spring Rate} \times \text{Cylinder Travel}) + \text{Spring End}$$

The net output force of an actuator at any point is the cylinder force plus or minus the spring force, depending upon force direction.

When calculating the force in the direction that compresses the spring, we subtract the spring force from the cylinder force.

$$\text{Actuator Net Output Force} = \text{Cylinder Force} - \text{Spring Force}$$

When calculating the force in the direction that extends the spring, we can add the spring force to the cylinder force.

$$\text{Actuator Net Output Force} = \text{Cylinder Force} + \text{Spring Force}$$

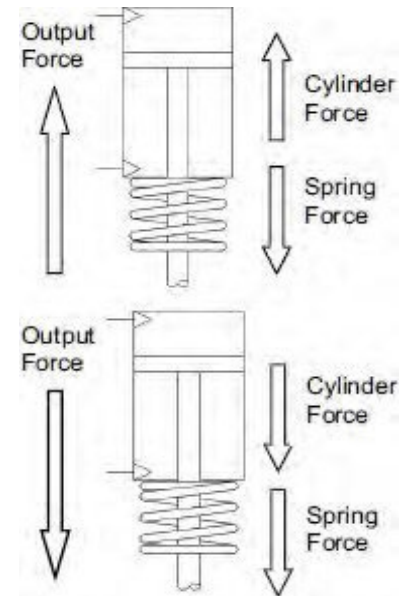


Figure 1: Spring Function

Solenoid Valves

Internal Solenoid

If the unit has an internal solenoid valve it will have the toggle lever shown in Figure 2. Toggling this lever will override the function of the solenoid. If the unit has no power and you need to use a manual operator, the lever must be in the solenoid override position as shown in Figure 3.

CAUTION: Make sure the toggle lever is returned to its normal position when solenoid power is returned, or the spring fail-safe function will not operate.

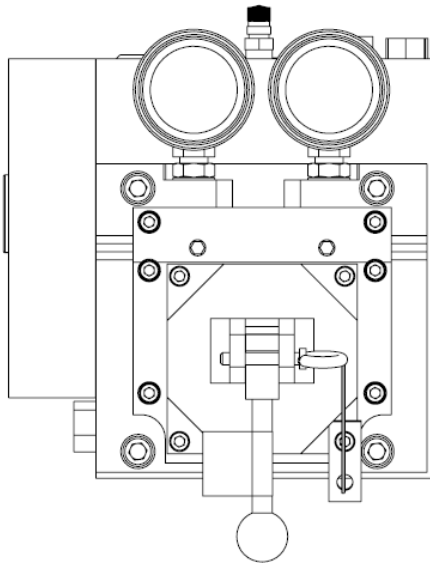


Figure 2: Internal Solenoid

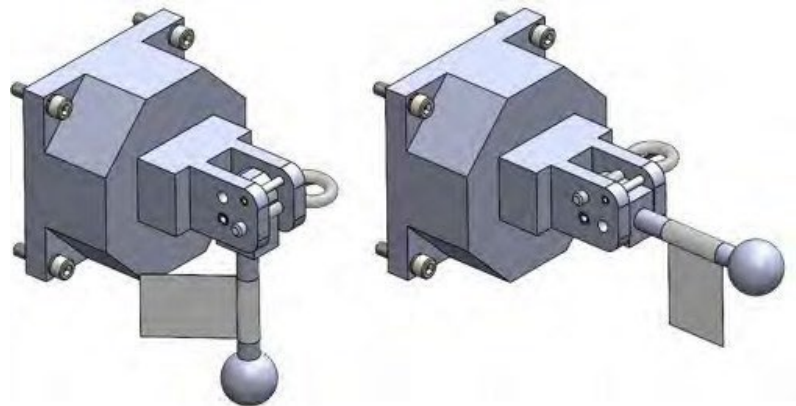


Figure 3: Internal Solenoid Normal Operation (Left) vs Override Position (Right)

External Solenoid

If the unit has an external solenoid, then the speed and override function is controlled by the needle valve as shown in Figure 4. To adjust the needle valve, to increase the fail-safe/ trip speed, loosen the jam nut then rotate the screw counterclockwise. To slow the fail-safe/ trip speed, turn screw clockwise. To use the override function, tighten the screw clockwise until it no longer turns.

CAUTION: Do NOT over tighten screw or damage to the screw seat will occur.

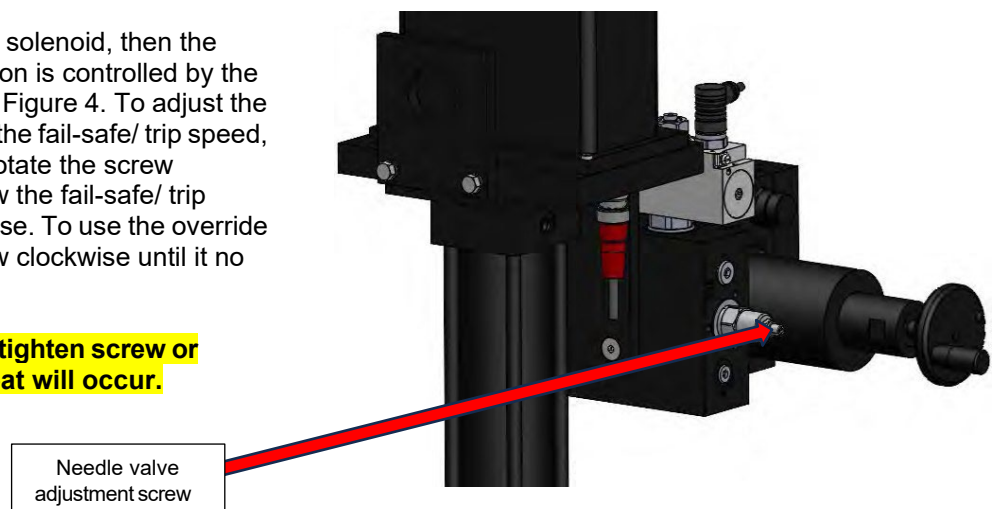


Figure 4: Needle Valve Adjustment Screw Locator

Linear Short-Stroking

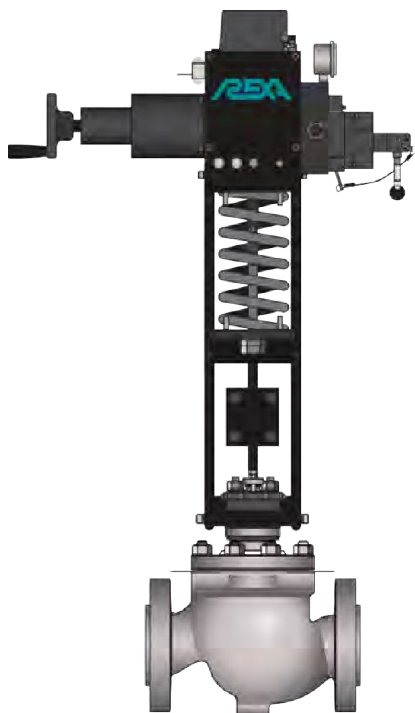
On linear actuators, the full rated stroke of the cylinder and spring may not be required in the application. This allows us to adjust the “spring end” by further pre-loading or additionally pre-compressing the spring and in turn derive more force out of the spring than the standard chart suggests. This allows us to get more force out of the spring than the standard chart suggests.

The spring rate is used to determine how much additional force is available in a particular unit. Spring rates are constant for each spring. This means the “rate” does not change with stroke. The force will always be rate multiplied by distance. In other words, it would require 600 pounds of force to compress a 300 pounds/inch spring 2 inches. When pre-compressing a linear actuator, make sure sufficient stroke remains for the intended application.

SPRING VALUES CHART		ACTUAL	PRESSURE GAGE READING
SPRING VALUES	INITIAL	4500 LBS	875 PSI
	FINAL	2000 LBS	389 PSI

Example: 1” Stroke Application That Requires 800 Lbf

Assume an L2000-2. The Spring End is 700 ft-lbs. However, if we set the seated position, such that the spring is pre-compressed ½” more, we get an additional 150 ft-lbs. (300 ft-lbs./inch of stroke × ½” of stroke = 150 ft-lbs.) for a total of 850 ft-lbs.

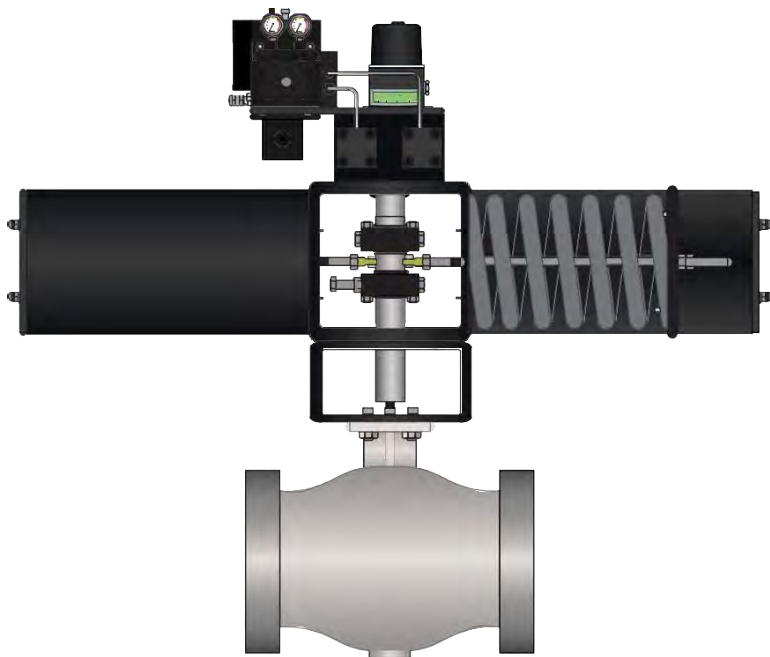


Linear Spring Fail-Safe		
Thrust	Time (seconds per inch)	
	Standard Solenoid	High Speed Solenoid
2000 lb (8896 N)	0.6s	<1s*
4000 lb (17792 N)	1s	<1s*
5000 lb (22241 N)	1.25s	<1s*
10000 lb (44482 N)	2.5s	<1s*
15000 lb (66723 N)	Consult Factory	<1s*
20000 lb (88964 N)	Consult Factory	<1s*

Rotary Spring Selection

The table below provides the Spring Rate, Spring End and Spring Start torques in inch-pounds for each spring matched to its' appropriate rotary cylinders. Spring Start torque is at a full 90-degree travel. Use the three steps below the table to select the proper spring for each application.

1. Using **Spring End**, determine the smallest cylinder/spring combo that will meet the fail-safe shut-off requirement.
2. Subtract the **Spring End** from the **Cylinder Torque** to make sure there is sufficient torque to initiate travel (break-away-torque).
3. Subtract the Spring Start from the Cylinder Torque to make sure there is sufficient actuator torque to fully stroke the application.



Rotary Spring Fail-Safe		
Torque	Time (seconds per 90° rotation)	
	Standard Solenoid	High Speed Solenoid
2500 lb•in (282 N•m)	1.25s	<1s*
5000 lb•in (565 N•m)	2.5s	<1s*
10000 lb•in (1130 N•m)	5s	<1s*
20000 lb•in (2260 N•m)	10s	<1s*
50000 lb•in (5650 N•m)	NA	1.5s*
100000 lb•in (11300 N•m)	NA	3s*

Torque or Thrust Seating Methods

Theory Of Operation

Actuators which are required to hold a seating thrust or torque require a spring-loaded element between the actuator and driven device or means to control the actuator's seating pressure. On smaller linear actuators a spring-loaded element referred to as an elastic coupling is used. On larger fail in place actuators a spring-loaded hydraulic cylinder referred to as a seat loading cylinder is used to control the operating pressure in the actuator. For actuators which have a fail-safe spring or accumulator the spring or accumulator is used to maintain the seating torque or thrust.

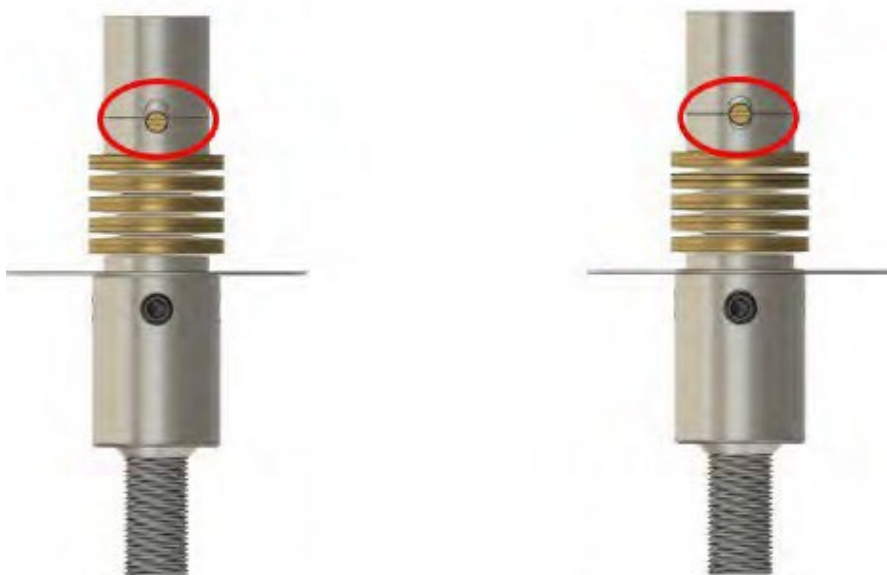
Elastic Coupling

The elastic coupling maintains a constant spring-loaded seating thrust and compensates for thermal expansion of a valve stem.

For applications that extend or retract against a seat, linear REXA actuators are provided with an "elastic coupling" for connecting the driven device to the actuator. The elastic coupling contains a set of disc springs which are pre-compressed to approximately 80% of the rated thrust of the actuator. When the actuator is driving into the driven device the spring will compress from 80% to 100% of the actuator's output creating a spring-loaded seating thrust.

The coupling also provides a visual indication of compression (seat load) and should be compressed to its rated mark when the driven device is at the seat. When seated the load on the driven device is approximately the rated output of the actuator.

The force indicator on the elastic coupling is a pin captured in a slot on the side of the coupling. As the coupling compresses, the pin slides in the slot. A scribed line marks the rated output position.



Preloaded Coupling (Left) vs Rated Load Coupling (Right)

NOTE: When calibrating Position Lo or Position Hi corresponding to the end position (seated position) the pin must be aligned with the scribe mark.

NOTE: To translate pressure gauge readings into actuator output, use the following formula:

$$(\text{Pressure Gauge reading} \div 2,000 \text{ psi}) \times \text{actuator rated output} = [\text{actual output}]$$

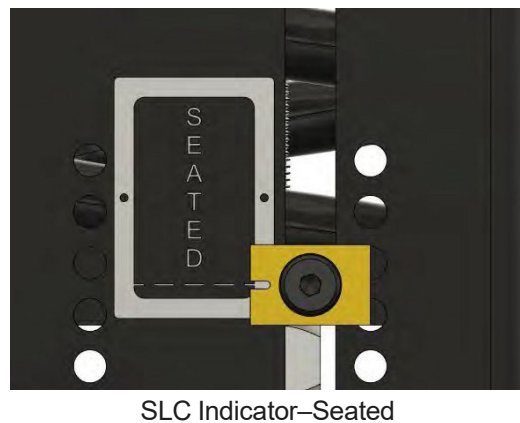
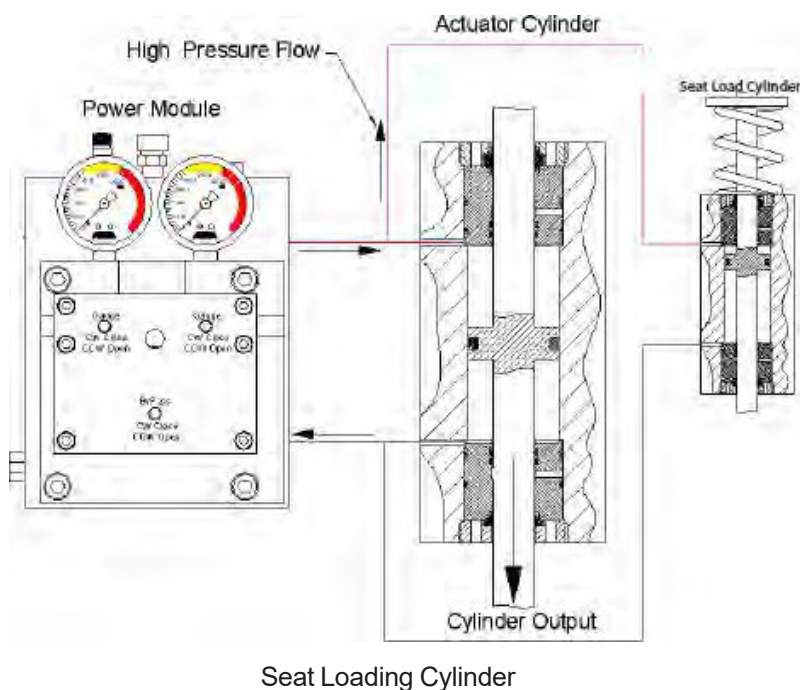
Seat Loading Cylinder

On larger size actuators the forces are too great to use a mechanical elastic coupling. Instead, a smaller Seat Loading Cylinder (SLC) with a spring load is hydraulically connected to the actuator cylinder. This SLC acts as a pressure switch to maintain the necessary torque or thrust on the seat and compensates for thermal expansion of the valve stem.

The Seat Loading Cylinder utilizes a pre-compressed load equivalent to 80% (1600 psi) of the nominal working pressure (2000 psi). As the power module pumps hydraulic fluid into the actuator cylinder, the actuator will drive into the seat and the internal pressure will increase. Once the force on the extension shaft reaches the preset 80% of the actuator's rated output, the pressure in the top of the actuator cylinder begin to compress the spring on the seat load cylinder. This will occur when the driven device reaches its end of stroke (valve seat).

As the pressure builds within the actuator cylinder, oil flows into the SLC, designated by the high-pressure flow arrow and retracts the SLC shaft. When the spring is compressed to the full nominal working pressure, the position feedback of the SLC will trigger the power module to shut off. The rated actuator output is now applied to the driven device and retained within the cylinders. When calibrating [Position Lo](#) or [Position Hi](#) corresponding to the end position (seated position) the SLC indicator notch shown below must align to the dashed line on the Seated label.

NOTE: The delta pressure between the two power module gauges should be 2000 psi indicating full actuator output when setting the seated position.



Solenoid Auto-Seating

For actuators that require fail-safe in the same direction as the torque or thrust seated position, the elastic coupling and seat load cylinder are redundant and unnecessary. The fail-safe spring or accumulator system is used to maintain the torque or thrust seated position. The REXA electronic control enclosure automatically controls the solenoid operation as the actuator positions approaches the seat. A control menu parameter, called Solenoid Seat ([Sol. Seat](#)), sets the percentage away from the seat that the solenoids will open. Rather than using the motor to drive to the seat once the actuator reaches a position close to the seat the solenoid valve(s) open and the remaining travel is accomplished by using the stored energy (spring or accumulator) to drive the valve into the seat.



Power Consumption

Total actuator power consumption will vary depending on actuator model and configured optional features. Idle power consumption, actuator heater, and power module motor apply to every model. Spring Fail-Safe and accumulator models have additional components that add to the total actuator power consumption. Refer to Figure 1 to determine how your system is configured based on model number. See the list and table below for details.

Idle Power Consumption

The electrical power requirement of the actuator is based on the power module size; however, each electronic control enclosure has minimum power consumption for when the actuator is idle. Refer to column 4 for idle power consumption.

Actuator Heater

Each actuator contains a cartridge heater to maintain a constant oil viscosity. The heater turns on at 60°F (15.5°C) and turns off at 80°F (26.7°C).

Heater Power Consumption, 150VA per Power Module - *only when heater is on.*

Power Module Motor

The power module motor operates when the actuator is instructed to move to its target position. Various size power modules have differing electrical power requirements as shown below:

Spring Fail-Safe Solenoids

Actuators featuring the Spring Fail-Safe option contain at least one solenoid.

Internal Solenoid: 30 VA, *continuous.*

External Solenoid: 10 VA, *per solenoid.*

Accumulator Recharge Module and Solenoids

Actuators featuring the Accumulator Fail-Safe option contain at least one recharge module with external solenoid.

Accumulator Recharge Module (Stepper): 700 VA total, *during recharge.*

Accumulator Recharge Module (Servo): 1400 VA total, *during recharge.*

Fail In Place or Spring Fail-Safe Actuator: Fail-Safe Position Letter P, E, R or U

1	2	3	4	6
REXA Actuator Input Voltage	Phase (~)	REXA Power Module Size	Idle (Without Heaters) Draw VA	Max/Start Up VA
115 VAC	1	B	56	550
		C	56	850
		Dual C	56	1,550
		1/2D	56	1,000
		Dual 1/2D	56	2,000
230 VAC	1	B	56	550
		C	56	850
		Dual C	56	1,550
		1/2D	56	1,000
		Dual 1/2D	56	2,000
		D	56	1,800
		Dual D	56	3,500
230 VAC	3	D,P9	56	6,000
		D,P20	56	9,000
		D,P40	56	15,000
		D,2P40	56	30,000
24 VDC	N/A	1/3C	13	370
		Dual 1/3C	22	750
		C	42	650

Accumulator Fail-Safe Actuator: Fail-Safe Position Letter A

For accumulator fail-safe actuators configured with a stepper recharge module add **700 VA** to Max VA

For accumulator fail-safe actuators configured with a servo recharge module add **1400 VA** to Max VA

Automated Online Solenoid Testing

The REXA accumulator trip block assembly offers the ability to initiate a local partial stroke valve test or a local solenoid trip block test. The user interface located on the front of the main control enclosure will consist of the REXA display under a protective flip up cover as well as two test buttons and three status light indicators. Refer to Figure 1 below.

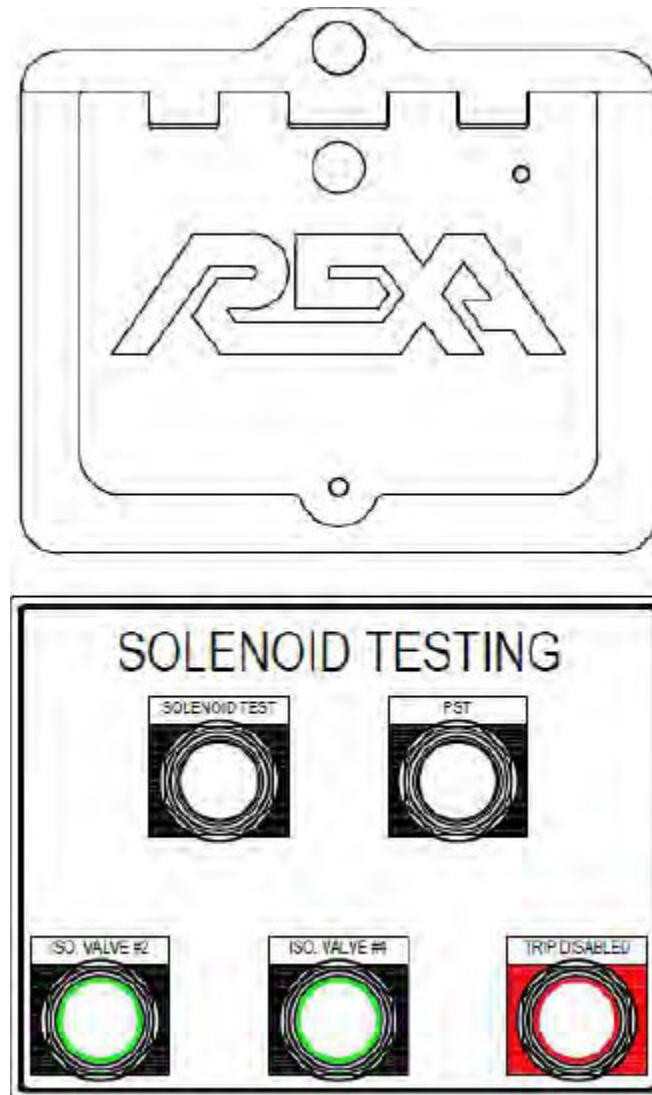


Figure 1: User Interface

Electronic Control Enclosure

The standard functionality of the REXA display is detailed in Chapter 6 of this operations manual. All new features associated with the trip block testing are documented below.

Indication Lights

- TRIP DISABLED – Red LED light illuminates to indicate an operator has manually disabled the trip function. Trip is disabled upon closing any of the four isolation valves and the limit switches indicate a closure when the valves are not in their fully open state.
- ISO. Valve #2 – Green LED light illuminates when isolation valve 2 is in its full open state.
- ISO Valve #4 - Green LED light illuminates when isolation valve 4 is in its full open state.

Push Buttons

- PST – Black push button that will initiate a valve partial stroke test.
- SOLENOID TEST - Black push button that will initiate an online solenoid valve test.

Trip Block Manifold

The trip block manifold shown in figure 2 is used to control the accumulator trip function and facilitates the online testing of the individual trip valves. Contained in the trip block are four solenoid valves (2A-1, 2A-2, 2A-3 and 2A-4) and four pilot to close check valves (2B-1, 2B-2, 2B-3 and 2B-4) that control the trip function. The combined function of a solenoid valve and its pilot to close check valve will be referred to as the “Trip Valves”. The four trip valves can be online tested to ensure they are operationally ready to perform their trip function on demand. The trip block contains four manual isolation valves (1-1, 1-2, 1-3 and 1-4) to isolate the manifold during trip valve testing. These isolation valves also facilitate the ability to isolate and replace any of the trip valves while the actuator is still able to position in remote mode. Five pressure transducers (T-Open, T-Close, T-ACC, T1 and T2) are mounted on the trip block manifold and are used to monitor thrust of the actuator (T-Close/TE and T-Open/TR), accumulator pressure (T-ACC) and internal manifold pressure (T1 and T2) to facilitate the online testing of the trip valves.

[Refer to Figures 2 and 3 on next pages]

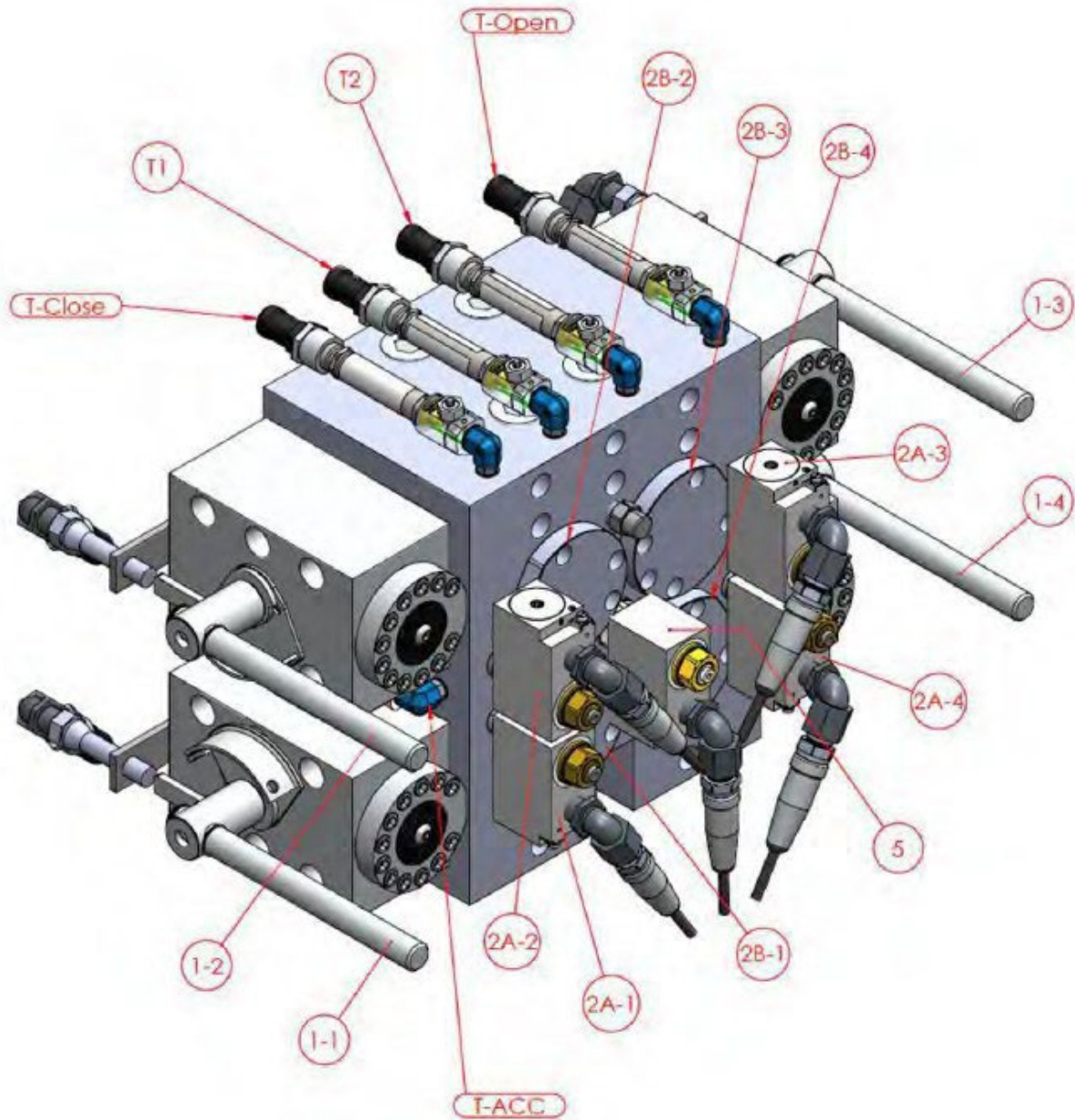


Figure 2: Trip Block Assembly

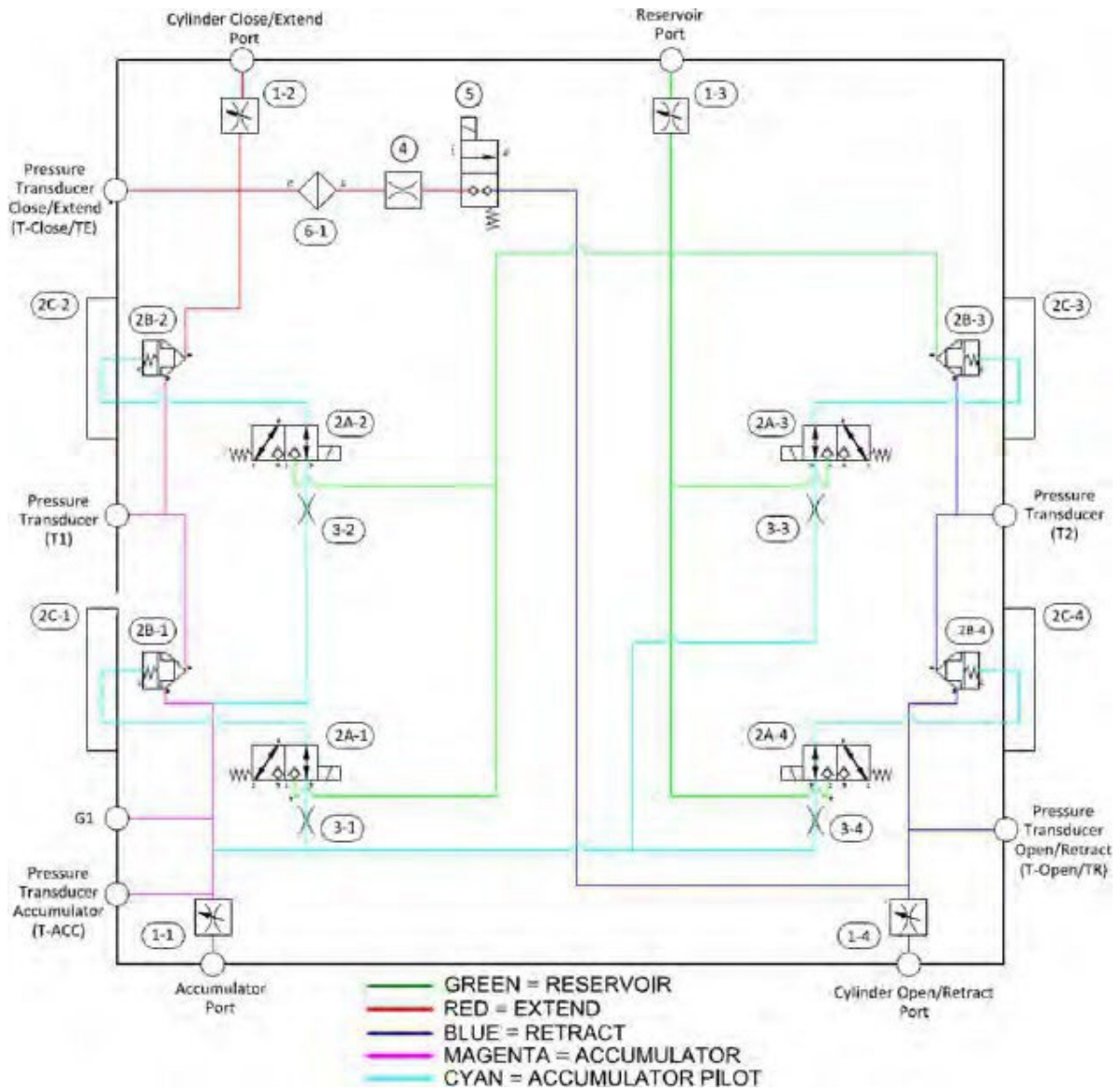


Figure 3: Trip Block Hydraulic Schematic

Operation

- **Trip Function**
 - Site wiring shall provide two independent trip signals (Trip Input #1 & Trip Input #2) from the SIS system, the actuator can only trip when both signals lose 24 VDC power.
- **PST**
 - The actuator will move to a pre-programmed menu defined position and return to the original position when the PST button is pressed. Additional information on PST can be found in Chapter 6, Technical Product Bulletin #12.0: GUI Bluetooth, and Technical Product Bulletin #5.0: Fault Codes.

NOTE: PST can only be deployed when the actuator is at 100% open and will be aborted if there is a control signal change during the PST event.

Solenoid Testing Operational Sequence

NOTES:

- Solenoids 2A-1 (Sol 1), 2A-2 (Sol 2), 2A-3 (Sol 3) and 2A-4 (Sol 4) are energized during normal operation mode.
 - Solenoid 5 is de-energized during normal operation mode.
 - During the API test, the actuator will maintain current position.
 - If the cylinder drifts more than 5% closed during an API test the testing sequence will stop and the display will read "API DRIFT"
 - If a PST input is initiated during an API test the PST input will be ignored.
 - Solenoid Test pressure criteria: API Pres 1 = Recharge Press – 500 psi & API Pres 2 = 150 psi. API Press 2 is not adjustable via a menu parameter.
1. Make sure the actuator is in Remote (**Auto**) mode and at 100% open or in Manual (**Local Man**) mode at any position.
 2. Close isolation valve 2 (1-2) by pushing/rotating the handle up and close isolation valve 4 (1-4) by pulling/rotating the handle down as shown below. This will disable the trip function and isolates the cylinder from the trip manifold. The ISO Valve #2 and ISO Valve #4 green LEDs will go out and the trip disabled red LED will turn on.

NOTES:

Warning and Alarm relays will open.

TRIP DIS will display as an Alarm in the REXA LED display. See Trip Dis Fault in Technical Product Bulletin #5.0: Fault Codes for functional details.

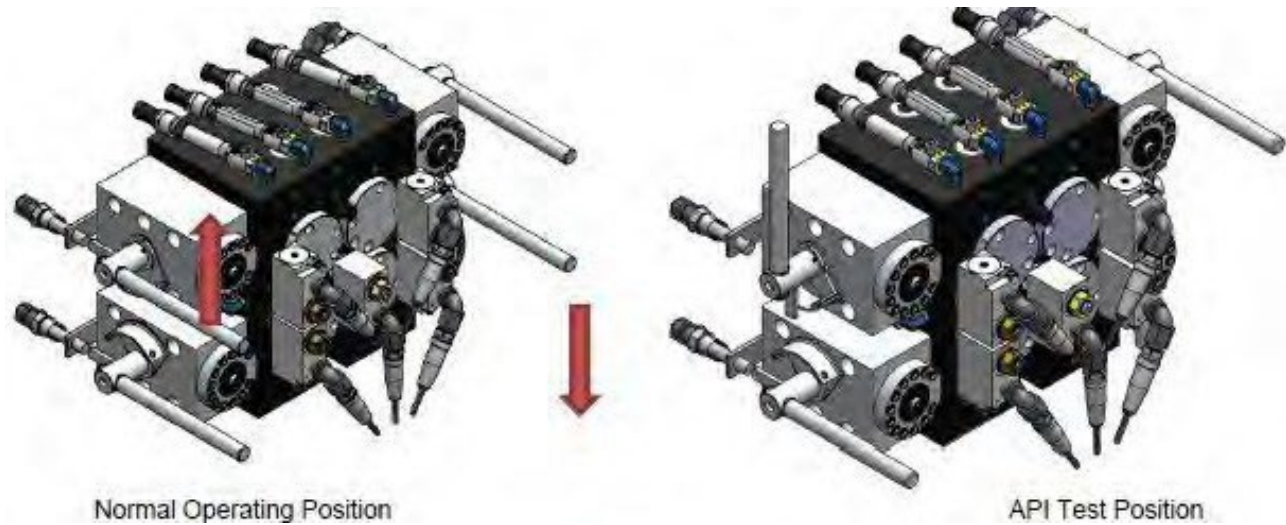


Figure 4: Isolation Valve Positions

3. Press the push button labeled “Solenoid TEST”, the operation mode will change from **Auto** to **Auto API** or if in **Local Man** mode **Manual API**.

NOTES:

Pressure transducer (T1) reading will replace the position value in the display.

Pressure transducer (T-Open) reading will replace the time in the display for all tests 1-6 except for test 5; T-Close will display for test 5.

Pressure transducer (T2) will replace the date value in the display.

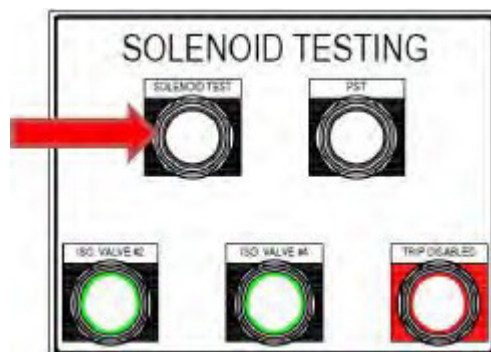


Figure 5: Solenoid Test Button Locator

4. Upon successful completion of the API Test sequence the mode will change back to **Auto** or **Local Man** and report an API Pass in the display for ~2 minutes. If a failure occurs the corresponding test failure will be displayed. See Automated test sequence reference below and Appendix F for failure details. The automated testing sequence provided for reference below. Valve identification numbers are shown in Figure 2 and Figure 3.

Test 1 (Reference Figure 6)

- System de-energizes trip solenoids 2A-1, 2A-2 and 2A-4 and reads pressure transducer (T1), pressure transducer retract (T-Open) and pressure transducer (T2).
 - If all three inputs are > “API Pres1” proceed to the next step
 - If any of the three inputs are < “API Pres1”
 - Warning “T1 FAIL” is displayed and the testing sequence is stopped.
 - Trip solenoids 2A-1, 2A-2, and 2A-4 are re-energized and solenoid 5 is de-energized.
 - “T1 FAIL” is cleared upon successful completion of a subsequent API test.

Test 2 (Reference Figure 6)

- System energizes trip solenoid 2A-1, de-energize trip solenoid 2A-3 and reads pressure transducer (T1), retract (T-Open) and pressure transducer (T2).
 - If all three inputs are < 150 psi (API Pres 2) proceed to the next step
 - If any of the three inputs are > 150 psi (API Pres 2)
 - Warning “T2 FAIL” is displayed and the testing sequence is stopped.
 - Trip solenoids 2A-2, 2A-3, and 2A-4 are re-energized and solenoid 5 is de-energized.
 - “T2 FAIL” is cleared upon successful completion of a subsequent API test.

Test 3 (Reference Figure 6)

- System Energizes trip solenoid 2A-3, de-energize solenoid 2A-1 and reads pressure transducer T1, Retract (T-Open) and T2
 - If all three inputs are > “API Pres1” proceed to the next step
 - If any of the three inputs are < the menu set parameter for “API Pres1”
 - Warning “T3 FAIL” is displayed and the testing sequence is stopped.
 - Trip solenoids 2A-1, 2A-2, 2A-4 are re-energized and solenoid 5 is de-energized.
 - “T3 FAIL” is cleared upon successful completion of a subsequent API solenoid.

Test 4 (Reference Figure 6)

- System Energizes trip solenoid 2A-4, de-energizes solenoid 2A-3 and reads pressure transducer retract (T-Open)
 - If T-Open is > 150 psi (API Pres 2) proceed to the next step
 - If T-Open is < 150 psi (API Pres 2)
 - Warning “T4 FAIL” is displayed and the testing sequence is stopped.
 - Trip solenoids 2A-1, 2A-2, and 2A-3 are re-energized and solenoid 5 is de-energized.
 - “T4 FAIL” is cleared upon successful completion of a subsequent API test.

Test 5 (Reference Figure 6)

- System energizes solenoid 2A-2, de-energizes solenoid 2A-4 and reads pressure transducer extend (TClose)
 - If T-Close is < 150 psi (API Pres 2) proceed to the next step
 - If T-Close is > 150 psi (API Pres 2)
 - Warning “T5 FAIL” is displayed and the testing sequence is stopped.
 - Trip solenoids 2A-1, 2A-3 & 2A-4 are re-energized and solenoid 5 is de-energized.
 - “T5 FAIL” is cleared upon successful completion of a subsequent API test.

Test 6 (Reference Figure 6)

- System energizes solenoid 2A-1, de-energizes solenoid 2A-2 and reads pressure transducer T1
 - If T1 is < 150 psi (API Pres 2) proceed to the next step
 - If T1 is > 150 psi (API Pres 2)
 - Warning “T6 FAIL” is displayed and the testing sequence is stopped.
 - Trip solenoids 2A-2, 2A-3, and 2A-4 are re-energized and solenoid 5 is de-energized.
 - “T6 FAIL” is cleared upon successful completion of a subsequent API test.
- “API Test Pass” will be displayed for 2 minutes then the display will return to normal operation mode.

Post API Test

If any tests fail test sequence test 1 through test 6, all solenoid voltages are returned to normal operating conditions, and the appropriate warning is displayed. Successful completion of API testing validates that solenoids 2A-1, 2A-2, 2A-3, and 2A-4 are properly functioning.

- After API testing, re-energize solenoids 2A-1, 2A-2, 2A-3, 2A-4 and de-energize solenoid 5.
- Display “APITstPas”
- Actuator mode changes from **Auto API** to **Auto** or **Manual API** to **Manual**.
- “APITstPas” displays for 2 minutes while mode is **Auto** or **Local Man**.

After completion of API test, return trip block assembly to normal operation mode as illustrated in Figure 2.

- Open isolation valve (1-2) by pulling/rotating down the handle.
- Open isolation valve (1-4) by pulling/rotating up the handle.

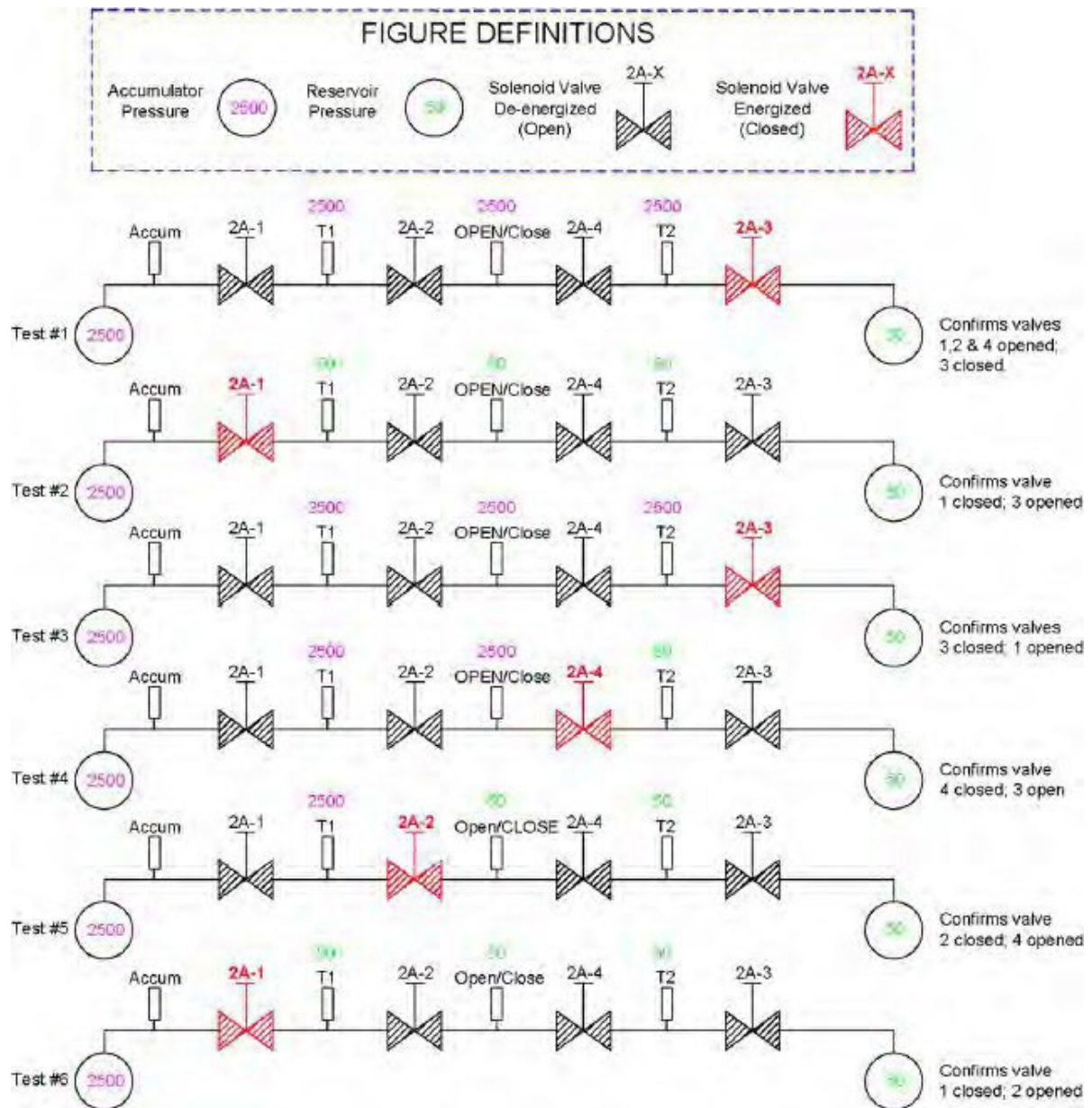


Figure 6: Simplified Solenoids Testing Sequence



Stroke and Rotation Times

REXA Standard Linear Double Rod Extend & Retract Stroke Time - Seconds per Linear Inch of Travel

Thrust lbf (N)	Power Module & Booster Pump Sizes										
	B & 1/3C	Dual 1/3C	C	Dual C & 1/2D	Dual 1/2D & D	Dual D	D,P9	D,P20	D,P40	D, Dual P-40	
2000 (8896.4)	5.88	2.94	1.96	0.98	0.49	Consult Factory					
3000 (13344.7)	9.86	4.93	3.29	1.65	0.82						
4000 (17792.9)	11.76	5.88	3.93	1.96	0.98						0.49
5000 (22241.1)	14.99	7.50	5.01	2.50	1.25						0.63
10000 (44482.2)	30.86	15.43	10.31	5.15	2.58	1.29	0.57				
15000 (66723.3)	45.85	22.93	15.32	7.66	3.83	1.91	0.85				
20000 (88964.4)	60.84	30.42	20.32	10.16	5.08	2.54	1.13	0.56			
30000 (133446.7)	88.18	44.09	29.45	14.73	7.36	3.68	1.64	0.82			
40000 (177928.9)	126.98	63.49	42.41	21.21	10.60	5.30	2.36	1.18	0.56		
60000 (266893.3)	Consult Factory	94.06	62.83	31.42	15.71	7.85	3.49	1.75	0.83		
80000 (355857.7)		121.69	81.29	40.64	20.32	10.16	4.52	2.26	1.07	0.55	
120000 (533786.6)				125.27	62.64	31.32	15.66	6.96	3.48	1.65	0.85
275000 (1223260.9)					137.44	68.72	34.36	15.27	7.64	3.62	1.86

Rotary Rack & Pinion Rotation Time - Seconds per 90°

Torque in-lbf (N-m)	Power Module & Booster Pump Sizes											
	B & 1/3C	Dual 1/3C	C	Dual C & 1/2D	Dual 1/2D & D	Dual D	D,P9	D,P20	D,P40	D, Dual P-40		
2500 (282)	14.6	7.3	4.9	2.4	1.2	0.6	Consult Factory					
5000 (565)	29.1	14.6	9.7	4.9	2.4	1.2						
10000 (1130)	53.3	26.6	17.8	8.9	4.5	2.2					1.1	
20000 (2260)	106.6	53.3	35.6	17.8	8.9	4.5	2	1				
50000 (5649)	275.4	137.7	92	46	23	11.5	5.1	2.6			1.2	
100000 (11298)	Consult Factory	275.4	184	92	46	23	10.2	5.1			2.4	1.2
200000 (22597)					178	89	44.5	19.8	9.9	4.7	2.4	
400000 (45194)						178	88.8	39.4	20	9.3	4.8	
566000 (63949)						250	125	55.6	28	13	6.8	
766000 (86546)						340.5	170	75.7	38	18	9.2	
1016000 (114793)						550	275	122	61	29	15	
1330000 (150270)								312	139	69	33	17
2000000 (225969)								432	192	96	45	23

**Single Rod Linear EXTEND Stroke Time - Seconds per Linear Inch of Travel**

Thrust lbf (N)	Power Module & Booster Pump Sizes									
	B & 1/3C	Dual 1/3C	C	Dual C & 1/2D	Dual 1/2D & D	Dual D	D,P9	D,P20	D,P40	D, Dual P40
2000 (8896.4)	10.58	5.29	3.53	1.77	0.88					
3000 (13344.7)	18.81	9.41	6.28	3.14	1.57	0.79				
5000 (22241.1)	29.39	14.70	9.82	4.91	2.45	1.23	0.55			
10000 (44482.2)	49.68	24.84	16.59	8.30	4.15	2.07	0.92			
15000 (66723.3)	75.25	37.62	25.13	12.57	6.28	3.14	1.40	0.70		
20000 (88964.4)	75.25	37.62	25.13	12.57	6.28	3.14	1.40	0.70		
30000 (133446.7)	117.57	58.79	39.27	19.63	9.82	4.91	2.18	1.09	0.52	
40000 (177928.9)		84.65	56.55	28.27	14.14	7.07	3.14	1.57	0.74	
60000 (266893.3)		115.22	76.97	38.48	19.24	9.62	4.28	2.14	1.01	0.52
80000 (355857.7)			100.53	50.27	25.13	12.57	5.59	2.79	1.32	0.68
120000 (533786.6)				78.54	39.27	19.63	8.73	4.36	2.07	1.06
275000 (1223260.9)					100.53	50.27	22.34	11.17	5.29	2.72

Single Rod Linear RETRACT Stroke Time - Seconds per Linear Inch of Travel

Thrust lbf (N)	Power Module & Booster Pump Sizes									
	B & 1/3C	Dual 1/3C	C	Dual C & 1/2D	Dual 1/2D & D	Dual D	D,P9	D,P20	D,P40	D, Dual P40
2000 (8896.4)	5.88	2.94	1.96	0.98	0.49					
3000 (13344.7)	9.86	4.93	3.29	1.65	0.82					
5000 (22241.1)	14.99	7.50	5.01	2.50	1.25	0.63				
10000 (44482.2)	30.86	15.43	10.31	5.15	2.58	1.29	0.57			
15000 (66723.3)	45.85	22.93	15.32	7.66	3.83	1.91	0.85			
20000 (88964.4)	60.84	30.42	20.32	10.16	5.08	2.54	1.13	0.56		
30000 (133446.7)	88.18	44.09	29.45	14.73	7.36	3.68	1.64	0.82		
40000 (177928.9)	126.98	63.49	42.41	21.21	10.60	5.30	2.36	1.18	0.56	
60000 (266893.3)		94.06	62.83	31.42	15.71	7.85	3.49	1.75	0.83	
80000 (355857.7)		121.69	81.29	40.64	20.32	10.16	4.52	2.26	1.07	0.55
120000 (533786.6)			125.27	62.64	31.32	15.66	6.96	3.48	1.65	0.85
275000 (1223260.9)				137.44	68.72	34.36	15.27	7.64	3.62	1.86

Consult Factory Notes:

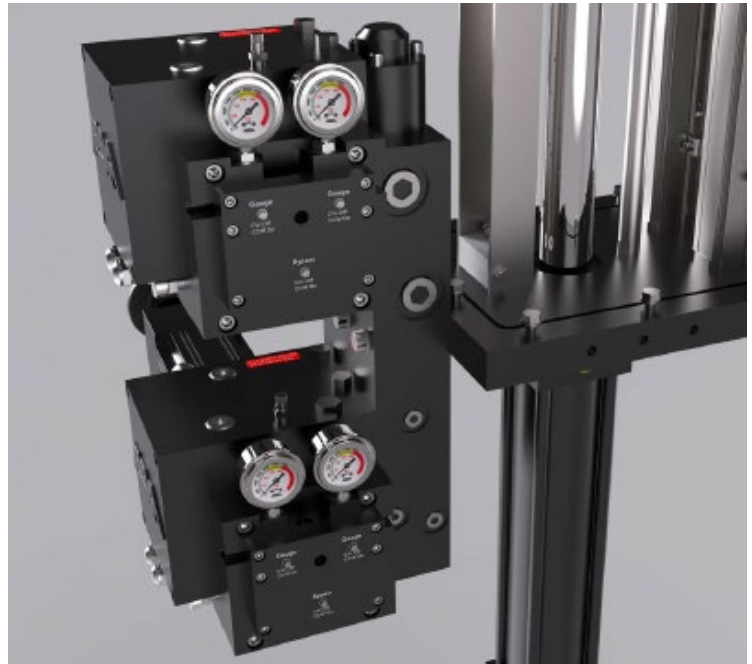
- Engineering review is required for anything faster than 1/2 second per inch/90°.
- B, 1/3C and C motors should never be sized to run for more than 5 minutes per direction.
- DP9, D20 & DP40 stroke and rotation rates assume 230V 3Ø motor power. Operating at 208V reduces actuator speed.
- Stroke and rotation rates specify the maximum operating speed and are calculated at 100% speed setting and 70°F (21°C). Temperature and actuator load fluctuations may affect speed.

Redundant Construction

About

For a controls application there are three core elements of the REXA actuator, the power module (motor and pump assembly), the position feedback sensor system and the electronic controller.

Redundant power module assemblies are mounted on an isolation manifold which connects them to the rest of the hydraulic system. In the unlikely event of a component failure within the power modules the power module assembly can be hydraulically isolated and replaced without impacting the control of the actuator. In this case the actuator will continue its operation using only the working module.



Redundant Power Module Example



Redundant Position Feedback Example

Redundant feedback position sensor systems connect two independent sensors directly to the actuator's main hydraulic cylinder. They are physically connected to the end of the hydraulic cylinder and provide an analog signal back to the actuator controllers. Shown below is an illustration of the linear solution and a similar concept is available for rotary actuators as well. In the unlikely event of a feedback sensor failure, power to the corresponding controller can be removed, allowing for the sensor to be replaced online without impacting the control of the actuator. In this case, the actuator will continue its operation using only the working feedback until the failed feedback is replaced.

Redundant electronic controllers are two independent controllers, each dedicated to driving their own power module pumping system and each receiving an independent analog position signal from a redundant position feedback assembly. Each controller would also have its own dedicated electrical power feed and dedicated I/O. The two controllers are optimized to work together by monitoring each other's current state of health. Should one controller have a fault, lose power, or be taken offline, the other controller will continue to operate uninterrupted. In the unlikely event of a controller failure, power can be removed without impacting the control of the actuator. In this case, the actuator will continue its operation using the working controller until the failed controller element is repaired.



Redundant Electrical Control Enclosure Example

For an Electrostatic Discharge (ESD) or control application with a critical trip function, there are additional elements of the REXA actuator that create redundancy associated with the trip function. The trip function is driven by stored energy, either in the form of a compressed coil spring or a pressurized accumulator system. In these systems, the redundant construction associated with performing a trip function is in the solenoid trip assembly.

For a spring-driven trip actuator, the coil spring is compressed, and a solenoid arrangement is used to release the hydraulic pressure that is holding the spring in a compressed state. An example of a redundant solenoid configuration is shown below. These solenoids are typically powered by a trip signal, often coming from an SIS controller. The REXA ESD safety manual, covered in Technical Product Bulletin #8.0: Safety Manual for ESD SIL Compliance, covers the SIL compliance operation and diagnostics of different redundant solenoid configurations. Depending on the operational requirements of the system, trip block assemblies controlling the actuators' fail-safe function can be configured in 1oo2, 2oo2, 2oo3, 2oo4 for spring fail units or 1oo2, 2oo2, and 2oo4 for accumulator units.

1002 Solenoid Block



Theory Of Operation

All REXA actuators are designed and constructed with components that are suited for the most severe and demanding applications. Through several product generations spanning over 40 years and ongoing continuous improvements, REXA actuators have an exceptionally low mean time between failure. Even with industry-leading reliability, some critical applications and industries require no single point failures for process equipment. For these applications, REXA has a fully redundant actuator solution that comprises redundancy for all critical components except for the main hydraulic cylinder.

Operational Summary

Redundant REXA actuators act as two independently controlled hydraulic pumping systems, each with its own power module, feedback, and controller. Both systems drive the same hydraulic cylinder and operate together at the same time. The controllers of these two systems are optimized to make sure they are never in conflict. This optimization will designate the controller labeled A as the main system set by default and the controller labeled B as the backup system set by default.

During normal operation, both the main and backup systems operate together and perform the same function, with one exception. To ensure optimized control and prevent the two systems from conflicting with each other, the backup system has a deadband equal to five times the deadband of the main system. This will reduce the duty cycle of the backup system and optimize the overall tuning of the system. The main and backup controllers monitor each other's system status. Should the main controller have an operational alarm fault, the backup controller automatically shifts from its backup role to the role of the main controller while the main controller is out of service. The operational mode of both systems will always be available on the front display of the actuator as well as over any digital communication protocols.

The table below outlines some examples of how the redundant controllers will respond to different events. Note the cases where the backup controller changes from Auto-Bkup to Auto, indicating it is now operating as the main system:

Case #	Event	Main (Elec A)	Backup (Elec B)	Operational State
1	None	Status: OK Mode: Auto	Status: OK Mode: Auto-Bkup	Operational
2	Main – Feedback Bad	Status: Alarm Mode: Auto	Status: OK Mode: Auto	Operational
3	Case 2 Alarm Resolved	Status: OK Mode: Auto	Status: OK Mode: Auto-Bkup	Operational
4	Backup – Feedback Bad or Power Fail	Status: OK Mode: Auto	Status: Alarm Mode: Auto-Bkup	Operational
5	Case 4 Alarm Resolved	Status: OK Mode: Auto	Status: OK Mode: Auto-Bkup	Operational
6	Main & Backup – CS Bad (example: Loss of control signal)	Status: Alarm Mode: Auto	Status: Alarm Mode: Auto	Performs Required Fail Safe Function
7	Main – Power Fail	Module 1 Status Relay Open Mode: N/A	Module 2 Status Relay Closed Mode: Auto	Operational
8	Backup – Power Fail	Module 1 Status Relay Closed Mode: Auto	Module 2 Status Relay Open Mode: N/A	Operational
9	Main & Backup – Power Fail	Module 1 Status Relay Open Mode: N/A	Module 2 Status Relay Open Mode: N/A	Performs Required Fail Safe Function

Notes:

- 1) After any main alarm is cleared, the main will re-take primary control automatically, and the Backup will return to backup operation.
- 2) If both the main and backup lose power or are faulted, they will perform the required fail-safe function, such as lock-in-last, fail Open, or fail Closed.
- 3) A system state of operational means the actuator is in control and following the setpoint with either the main system only, the backup system only, or both systems.

Local Manual Mode

When running in Local Manual mode, both main (Elec A) and backup (Elec B) must be in Local Manual mode. If not, the system, still in Auto mode, will try to correct any position changes attempting to be made by the system in Local Manual mode.

Auto Mode

While operating in Auto mode, the system will behave as a standard system and follow any control signal target changes. The benefit of the redundancy resides in the system's ability to continue operation if one of the controllers is in a fault condition.

REXA Menu Parameters

Menu parameters corresponding to redundant functionality are as follows:

CALIBRATION Menu

Linearize allows for calibration of the display and the position feedback of the backup electronics to calibrate out any deviation between the main controller and backup controller.

Range: **-5.0** to **5.0%** in 0.1% increments.

*NOTE: The **Linearize** parameter only becomes available if **Backup** is selected in **Rdnt CPU** parameter of the Drives menu.*

When calibrating the **Linearize** parameter, the following steps should be taken:

1. Calibrate Position Low and Position High for both electronic control enclosures.
2. Move the actuator to 50% and record the delta between the position readouts on the two electronic displays.
3. Go to the CALIBRATION menu in the backup electronics and enter the delta recorded into the **Linearize** parameter. The backup electronics will drop the decimal place on the position/feedback display when it's acting as a redundant system. When the redundant actuator changes to the primary, the decimal digit will return to the display.

DRIVES Menu

Rdnt CPU defines if the REXA system is equipped with a redundant electronic control enclosure.

The parameter can be set to: **Off, Main, or Backup**.

Off indicates that the system is not redundant.

Main indicates the primary electronic control enclosure (Electronics A) that will control all moves based on its deadband setting. Operational modes are displayed as defined in Chapter 6 of the Xpac 3 IOM, Modes of Operation and Control Parameters.

Backup indicates the backup electronics control enclosure (Electronics B) that will assist control moves $\geq$ 5 times its deadband. Operational modes are appended with "**-Bkup**" to indicate that the CPU is acting as a backup **only** and will drop the decimal place on the position/feedback display when it's acting as a backup system.

If the main electronic control enclosure is in an alarm state, the backup electronics will take over the role of the main electronic control enclosure and reduce its deadband to the parameter setting in the **CONTROL** menu. When acting as the main, the "**-Bkup**" is removed, and the standard operational modes are displayed. The primary decimal digit will then return to the position/feedback display.

When **Backup** is selected in the menu, a new parameter is available in the CALIBRATION menu called **Linearize**. See System Setup -> Calibration section below for additional details on setting up the **Linearize** parameter.

The following parameters/features outlined in Chapter 6 are not supported by this option:

- **Min Mod**
- **Fail-safe** (loss of control signal)
- Primary Recharge (**Recharge Dir = Off** only)

System Setup

Calibration

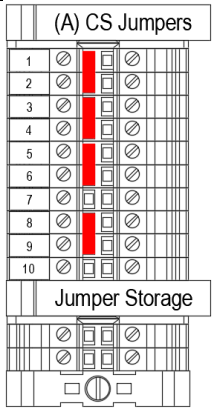
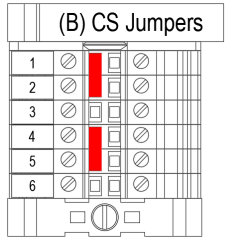
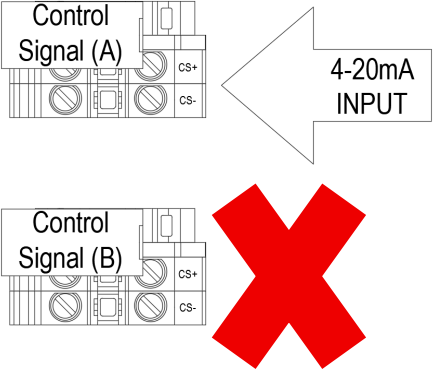
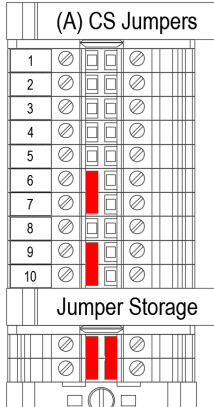
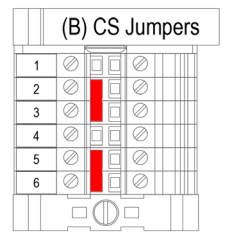
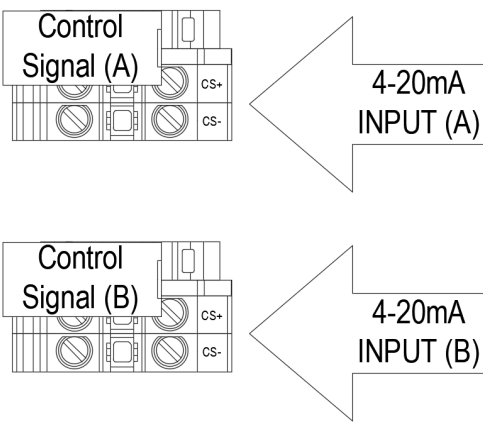
When initially calibrating the system to the valve, the following steps should be followed:

1. Put both electronics A & B into Setup mode.
2. Go into the Calibrate menu, scroll down to the Position Lo parameter, and press the ENTER button. Repeat this process on both displays.
3. Press the up or down arrow on electronics A to run to the Closed position. Once complete, press the ENTER button on both displays to commit this setting.
4. While still in the Calibrate menu, scroll down to the Position Hi parameter and press the ENTER button. Repeat this process on both displays.
5. Press the up or down arrow on electronics A to run to the Open position. Once complete, press the ENTER button on both displays to commit this setting.
6. Put both electronics A & B into Local mode and with the position showing, press the ENTER button.
7. With the '=' sign flashing, move the actuator to the 50% position via the up or down buttons.
8. Record the difference between the position readings on the two electronic displays.
Ex. Main (Elec A) = 50.0%, Backup (Elec B) = 50.2%
 $\Delta = \text{Elec A} - \text{Elec B} = 50.0 - 50.2 = -0.2\%$
9. Go to the Calibrate menu in the backup electronics (Electronics B), scroll down to the **Linearize** parameter, and enter the delta recorded in step 8.

Controls Signal Options

Jumper Configuration

Terminal block jumpers are provided in the electronic control enclosure to allow for the system to be easily used with one or two independent control signal inputs. All systems ship from the factory configured for one control signal unless indicated otherwise by the table on the following page.

Configuration	Main (Elec A) Jumpers	Backup (Elec B) Jumpers	Signal Inputs
One Control Signal	 (A) CS Jumpers	 (B) CS Jumpers	
	<i>Jumpers between 1&2, 3&4, 5&6, 8&9</i>	<i>Jumpers between 1&2, 4&5</i>	
Two Control Signals	 (A) CS Jumpers	 (B) CS Jumpers	
	<i>Jumpers between 6&7, 9&10</i>	<i>Jumpers between 2&3, 5&6</i>	

NOTE: When using two control signals Input B must be kept within 5x the actuator's deadband setting from Input A to avoid contradicting control inputs while positioning.

Timed Actuator Travel Software Five Position Relay Option

About

For applications requiring slow opening and closing times, typically found in the Water and Wastewater Industry, special time stroke software can be used. In most cases, the required stroking times can be achieved by decreasing the motor speed, but if the projected motor speed needs to be decreased below 30% of the actuator's rated maximum stroking speed, this option must be utilized. This ensures the motor speed is adequate to meet the required opening & closing torques while still achieving the desired stroke time. Refer to Technical Product Bulletin #21.0: Stroke and Rotation Time for detailed information on speeds to determine if this option is required.

In addition to the standard two-position relays (Open & Close), three additional relays have been provided for position granularity. This additional hardware is not included in the standard time stroke construction and needs to be explicitly requested.

Theory Of Operation

The total stroke time that the application requires for full stroke in the open, close, or both open and close directions shall be entered into the actuator's Speed menu. The actuator will then regulate its speed by making a series of 1% moves with small pauses until the new position is reached. The total time between the 1% move and the rest period shall be equivalent to the total stroke time divided by 99 moves.

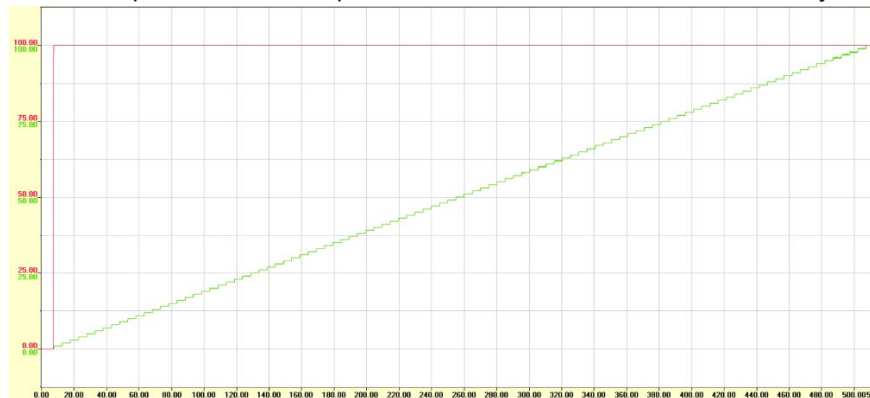


Figure 1 – Sample 500sec Time Stroke Plot (Red trace – Control Signal, Green Trace – Actuator Position)

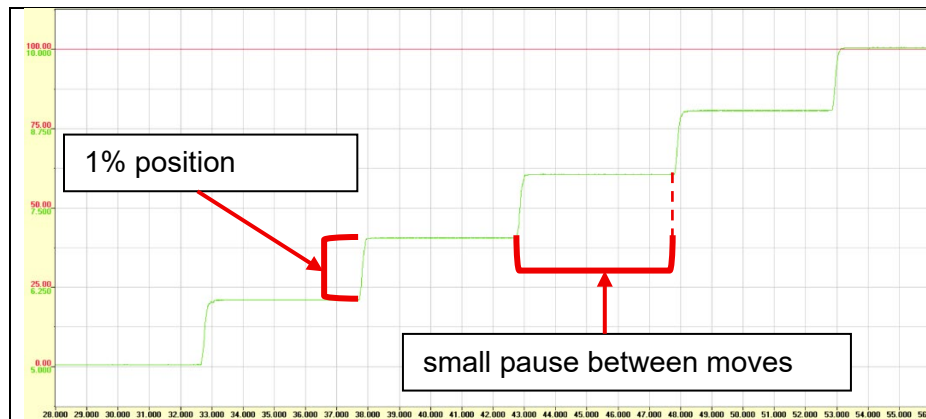


Figure 2 – Zoom 500sec Time Stroke Plot (5-10%)

500sec stroke time example:
Open Time = 500,
Pause between 1% moves
= $500 / 99 = 5.05$ sec

This will translate to a 500sec travel time in the Open and Closed direction as shown above.

Optional Outputs - Five Position Relays

Three additional programmable position indicating relays can be added to the standard open and close relays with additional hardware. These three additional relays provide programmable set point changes. Whenever the current position is = or < then the setting the relay becomes active. All five relays can switch loads up to 200VAC/VDC at 1A and provide Normally Open and Normally Closed dry contacts.

The table below outlines the various relay states:

Output	Relay State						Notes
	Power Loss		Position ≤ Setting		Position ≥ Setting		
	COM to NO	COM to NC	COM to NO	COM to NC	COM to NO	COM to NC	
Relay 1	OPEN	CLOSED	CLOSED	OPEN	OPEN	CLOSED	NO relay provided standard.
Relay 2	OPEN	CLOSED	OPEN	CLOSED	CLOSED	OPEN	
Relay 3	OPEN	CLOSED	CLOSED	OPEN	OPEN	CLOSED	Provided standard with (5) relay specials option.
Relay 4	OPEN	CLOSED	CLOSED	OPEN	OPEN	CLOSED	
Relay 5	OPEN	CLOSED	CLOSED	OPEN	OPEN	CLOSED	

Table 1 – Position Relay States

Rexa Menu Parameters

Menu parameters that were added or deviate from what is already outlined in Chapter 6 are outlined below:

Control Menu

Deadband sets the maximum deviation allowed between the input signal and actuator position before a corrective movement is made.

Range: **0.05** to **0.9%** percent of calibrated stroke/rotation The range was reduced for this option to ensure the **Deadband** cannot be set greater than the 1% step size.

Speed Menu

2-Speed defines use of option two speed operation.

Select: **Off**, **TimeOp**, **TimeCl**, **TimeOC** Default = **Off**

When **2-Speed** is off, Maximum High Speed defines the maximum motor speed when in **Auto** mode.

When **2-Speed** is set to **TimeOp** and **Open Time** is added to the menu.

Open Time defines the stroking time in seconds in the open direction.

Range: **10** to **990** seconds (16.5 minutes) and is adjustable in 10sec increments.

When **2-Speed** is set to **TimeCl** and **Close Time** is added to the menu.

Close Time defines the stroking time in seconds in the close direction.

Range: **10** to **990** seconds (16.5 minutes) and is adjustable in 10sec increments.

When **2-Speed** is set to **TimeOC** and **Open Time & Close Time** is added to the menu.

Both **Open Time & Close Time** parameters can be set as outlined above.

NOTES:

1. *If the desired Open and Close time can be achieved without setting the Max Hi. Spd. lower than 30% then time stroke software should not be used.*
2. *When operating if no notable delay can be seen between the time stroke steps this may cause steps to be missed and the final stroke time to be shorter than expected. To accommodate for this the Max Hi. Spd setting should be decreased until proper operation is achieved.*

Outputs Menu

Relay #3 defines the point in % of calibrated stroke at which relay output 3 is active. The relay will be active when the actuator position is = or < the value set in **Relay #3**.

Range: **0.1 to 99.9%**, Default: **Relay#3** = 35%

Relay #4 defines the point in % of calibrated stroke at which relay output 4 is active. The relay will be active when the actuator position is = or < the value set in **Relay #4**.

Range: **0.1 to 99.9%**, Default: **Relay#4** = 50%

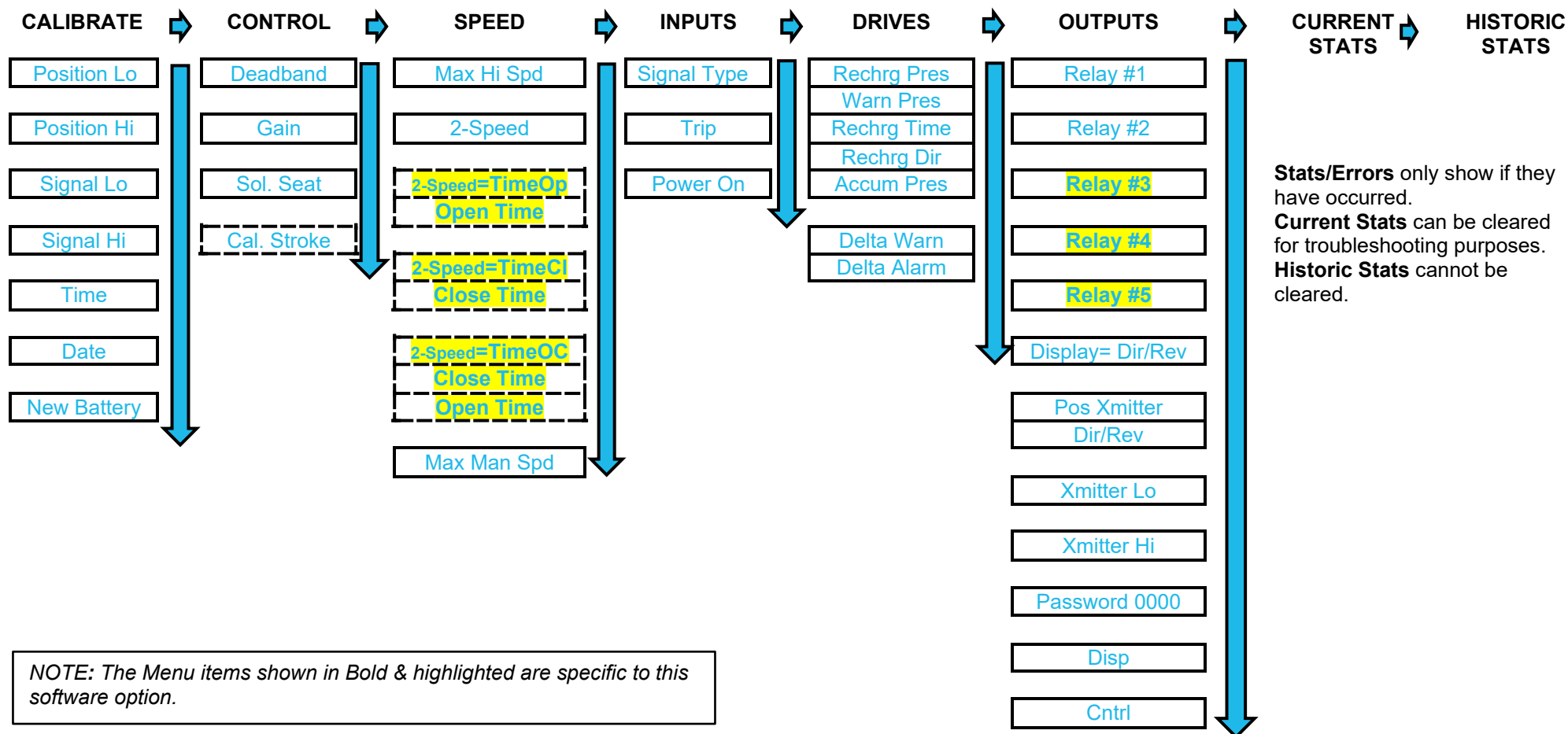
Relay #5 defines the point in % of calibrated stroke at which relay output 5 is active. The relay will be active when the actuator position is = or < the value set in **Relay #5**.

Range: **0.1 to 99.9%**, Default: **Relay#5** = 65%

The following parameters / features outlined in Chapter 6 are not supported by this option:

- **Min Mod**
- **Bumpless**
- **Failsafe** (loss of control signal)
- Partial Stroke Test (PST) - **PST, PST Target, PST Offpt, PST Time, PST Inc, PST Signal Deviation, PST Auto Sch**
- Redundant electronics - **Rdnt CPU**
- Motor-controlled trip - **Trip = UMotPL, UMotPH, PMotPL, PMotPH,**
- Solenoid surge - **Surge Bkpt, Surge Offpt, Surge Dir**
- Booster pumps - **Boost Offpt**
- Redundant feedback
- Seat load cylinder

Menu- X3 Timed Actuator Travel Softwar

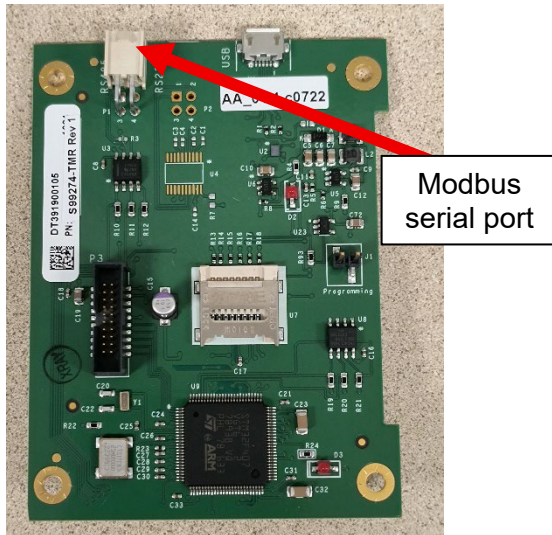


Modbus RTU

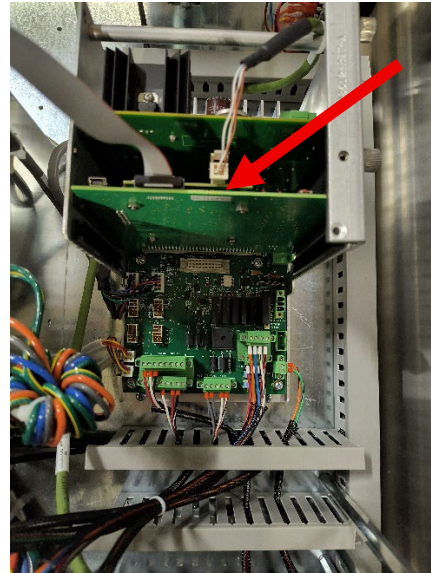
Theory Of Operation

To support this protocol, a Modbus interface board is required.

S99274 – Modbus Interface Board



Modbus Board Installed in Actuator



The REXA protocol follows the standard Modbus implementation with a poll rate of 100ms (depending on the amount of data requested). We support reading/writing to holding registers and reading coil registers. Coil registers are utilized for fault status variables and holding registers for any remaining data. Additional holding registers are also designated for writing of control inputs and actuator date/time.

The following Modbus function codes are supported:

Function Code	Description
01 (0x01)	Read Coil Registers
03 (0x03)	Read Holding Registers
16 (0x10)	Write Multiple Registers

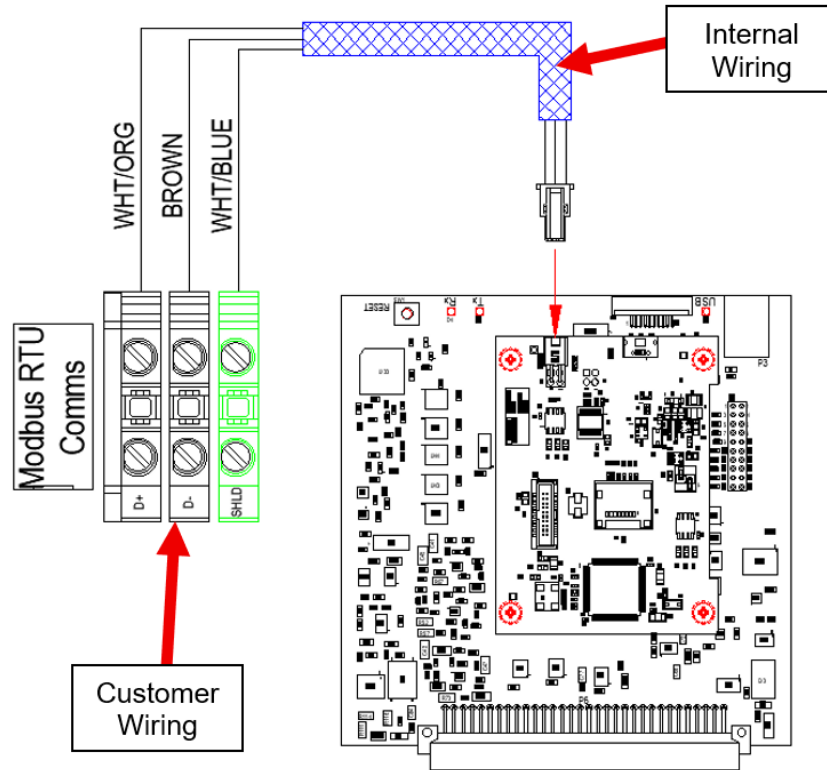
An RS-485 connection scheme is utilized to support this network and is capable of supporting connections up to ~1200ft (400 meters). The communication parameters and wiring are as follows:

Wiring

Baud Rate: 115.2 Kbits/s
Data Bits: 8
Stop Bits: 1
Parity: None
Flow Control: None
Termination: 120Ω

4Pin Conn (J2)	Wire Color	Terminal Block	RS-485 Signal
1	Brown	D -	D(B)-
2	Wht/Org	D +	D(A)+
3	Wht/Blue	SHIELD	GND

Customer Terminations:

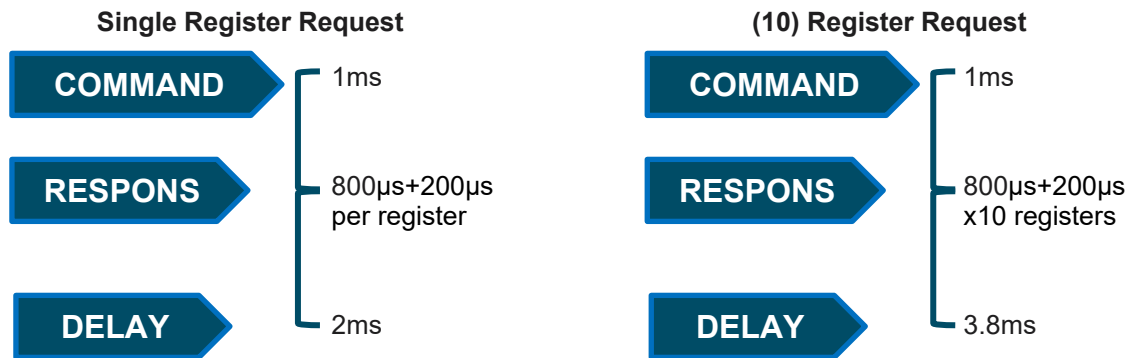


Modbus Polling Considerations

To ensure optimal data acquisition and actuator responsiveness, follow these guidelines:

1. **Group Register Requests:** When requesting multiple registers, consolidate them into a single request rather than polling individually. The maximum allowable group size is 125 registers per request.

Example



NOTE: To request these same (10) registers individually would take ~20ms.

2. **Communication Rate:** This rate should never exceed 100ms, this interval may be increased based on the process requirements.
3. **Control Command Timing:** Schedule read commands to avoid interference with write commands. Interleaved reads will introduce delays in the subsequent writes.
4. **Control Response Delay:** When Control over Modbus the response will be ~25ms slower than standard Analog 4-20mA control.
5. **Control Response Delay:** In the event of a **Comm Loss** or **CS Bad fault** (CS bad if Signal Type = **NetWrk**), Modbus communication will be non-responsive. The current data will only be representative of the actuator state before the **Comm Loss** and any new control commands will not be processed.

Practice Commands

During initial actuator installation some basic commands can be used to validate proper communication has been established.

1. **Up Counter:** Read register 40567 – An increasing value should be seen each time this register is read.
2. **Actuator Mode:** Read register 40014 – Using the keypad on the front of the REXA control enclosure, put the actuator in Auto Mode and a decimal 1 will be populated in register 40014. Putting the actuator in Local Mode will change this register value to a decimal 5.

The following can also be tested if configured for **NetWrk** control:

3. **Actuator Control:** Write into register 40569 (Host Write Enable) a decimal 1 and write to register 40570 a hex 4248 & 40571 a hex 0000 (Host Write target) – Verify that the actuator moves to the 50% position.

Recommended Polling Routines

When considering registers to read during normal operation the following is suggested:

1. **Actuator Control:** When using **NetWrk** control after setting the new target the position should be monitored to verify a proper response.

Control Command Sequence			
Step	1	2	3
Command	Write	Write	Read
Address	40569 Host Write Enable	40570 & 40571 Host Write Target	40003 & 40004 Position
Value	True	Target in %	Position in %
Comms Delay	2ms	2ms	2ms

2. **Live Status Variables:** Monitoring these registers will provide real time operation data.
Communication Rate – 100ms Max, 1 sec nominal

Address	Description	Address	Description	Total Read Time
40001 - 40002	Control Signal	40013	Accumulator Pressure	1ms (Request) + 4ms (Response) = 5ms
40003 - 40004	Position	40014	Actuator Mode	
40007 - 40008	*Torque/Thrust	40015	Last Event	
40012	*PST Status	40016	Actuator Status	

Note: (*) If these features are not available on your actuator then these registers can be removed from the list above.

3. **Fault Verification:** If the Actuator Status comes back indicating an active Alarm or Warning the details of the specific fault can be determined by polling the following addresses.

Fault Details		
Address	Description	Total Read Time
1 - 100	Active Warnings (Coils)	1ms (Request) + 4ms (Response) = 5ms
101 - 200	Active Alarms (Coils)	
40018 - 40021	Active Warnings (Bit Mask)	1ms (Request) + 4ms (Response) = 5ms
40022 - 40025	Active Alarms (Bit Mask)	

To determine if the fault is a one time event or something that has been ongoing there are counters that can be further polled.

Extended Fault Details			
Address	Description	Total Read Time	Notes
40419 - 40488	Current Fault Counters	~16ms	Counters provide insight into re-occurring failures
40489 - 40558	Historic Fault Counters	~16ms	
40319 - 40328	Last 10 fault events	~4ms	Event tracking allows failure trends to be determined.
40330 - 40368	Last 10 fault time stamps	~10ms	

Operational Modes

Data from the actuator can be retrieved over the Modbus connection while the actuator is in any mode. There are some limits in the data that need to be taken into account:

Local Mode

- Host write commands will not be accepted

Setup Mode

- Host write commands will not be accepted
- Changes in parameters will not be updated until the actuator is changed out of Setup Mode.

Auto Mode

- With INPUT = Comms the actuator will only change position according to Host Write commands over Modbus.

Menu Parameters

New menu parameters corresponding with Modbus functionality are as follows:

CONTROL Menu

Digital defines if the REXA actuator is equipped with a Modbus communication daughter board.

The parameter can be set to: **Off** or **Modbus**.

Off indicates that the actuator does not support Modbus communication.

ModBus ID defines the Modbus address that the REXA actuator will communicate over.

Range: **1** to **247**, Default: **10**

NOTE: The REXA actuator is a slave device on the Modbus network.

Poll Rate defines the rate that the communication daughter board will update its polled registers.

Units: ms

Range: **48** to **60,000**, settable in 4ms increments

INPUTS Menu

Signal Type defines the control signal the actuator will respond to in Auto mode.

The parameter can be set to: **Analog**, **1 Cont**, **2 Cont** or **NetWrk**.

NOTE: The **NetWrk** option is only settable if the **Digital** parameter is set to **ModBus**.

When **Signal Type** = **NetWrk**, the actuator will only respond to ModBus target commands provided via the Host Write Target register. If communication is lost (Comm loss) between the Daughter Board and the CPU this will be reported as a **CS Bad** fault.

NOTE: Refer to Section 6.4 Inputs Menu for additional information on the other signal type options. Refer to Actuator Status section Host Write Enable and Host Write Target registers for additional details on use of the control registers.

Fault Codes

New faults corresponding with the Modbus functionality are as follows:

Com Loss:

Cause: The communication between the Modbus board and CPU board has become interrupted for longer than 120ms.

NOTE: For this fault to occur parameter **Digital** must be set to **MODBUS**.

Indicators: Warning relay opens and **Com Loss** is displayed.

Cleared by: Self clearing when the Modbus board and CPU board communication is restored.

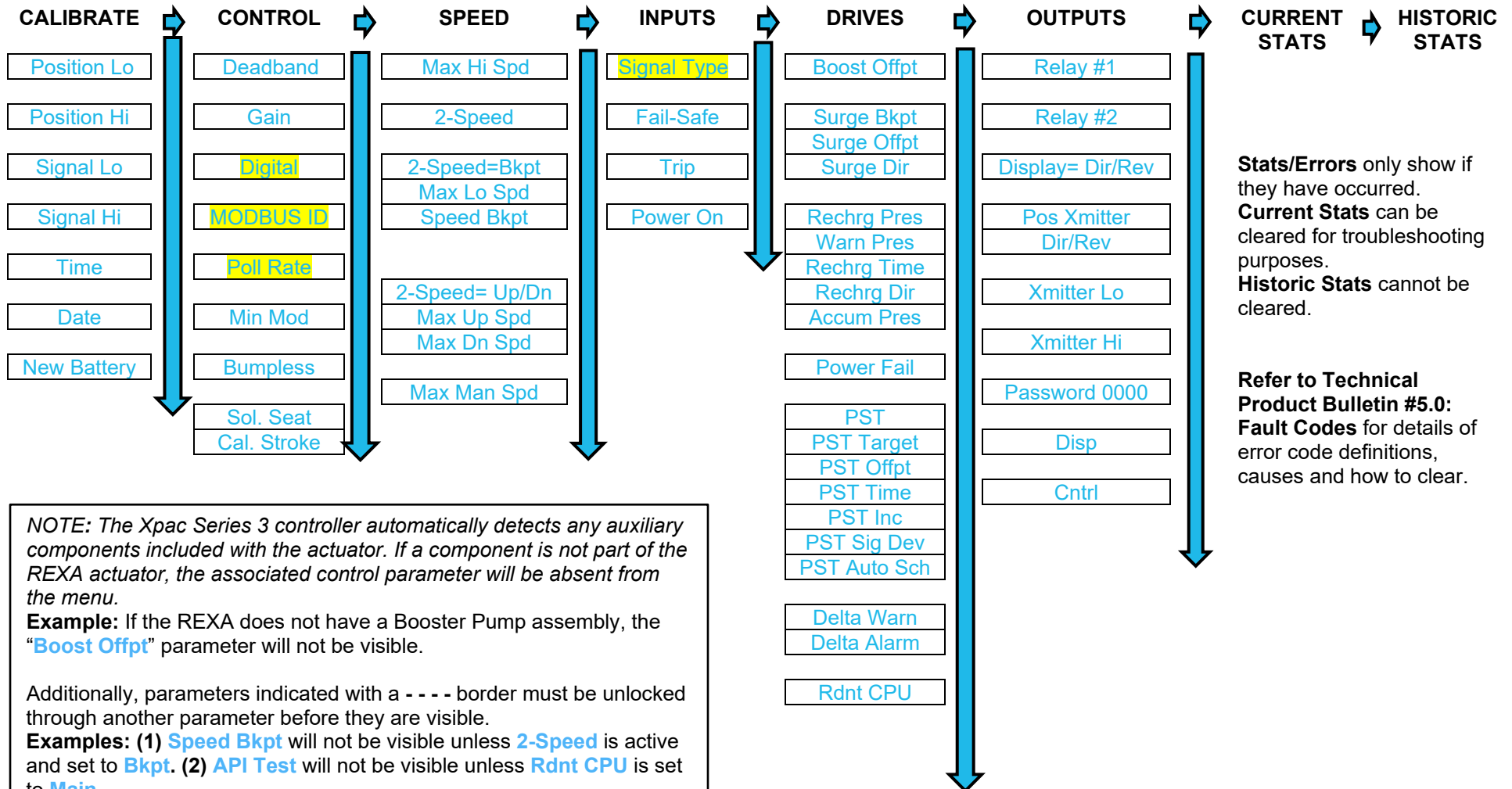
CS Bad:

Cause: The communication between the Modbus board and CPU board has become interrupted for longer than 120ms.

NOTE: This is equivalent to the **Comm Loss** fault, but since the actuator is configured for **NetWrk** control the priority is elevated. For this fault to occur parameters **Digital** must be set to **MODBUS** and **Signal Type** must be set to **NetWrk**.

Indicators: Alarm and Warning relays open. **CS Bad** is displayed. The actuator **will not** travel to the failsafe position due to a **NetWrk CS Bad**.

Cleared by: Self clearing when the Modbus board and CPU board communication is restored.

Menu- Xpac Actuator

Stats/Errors only show if they have occurred.
Current Stats can be cleared for troubleshooting purposes.
Historic Stats cannot be cleared.

Refer to **Technical Product Bulletin #5.0: Fault Codes** for details of error code definitions, causes and how to clear.

NOTE: The Xpac Series 3 controller automatically detects any auxiliary components included with the actuator. If a component is not part of the REXA actuator, the associated control parameter will be absent from the menu.

Example: If the REXA does not have a Booster Pump assembly, the "Boost Offpt" parameter will not be visible.

Additionally, parameters indicated with a - - - - border must be unlocked through another parameter before they are visible.

Examples: (1) **Speed Bkpt** will not be visible unless **2-Speed** is active and set to **Bkpt**. (2) **API Test** will not be visible unless **Rdnt CPU** is set to **Main**.

Refer to the remainder of this Chapter 6 for further definitions.

Modbus Register Details

This section provides detailed information on each of the registers and the corresponding data provided. They are broken up by relevant data categories and importance.

Register Summary			
TPB Section	Register Group (Type)	Address(es)	Importance Factor
1	ACTUATOR STATUS (Read)	40001 to 40004, 40007 to 40008, 40012 to 40017 & 40577	High
1	CONTROL (Read/Write)	40569 to 40571	High
2	WARNINGS & ALARMS (Read)	1 to 200, 40018 to 40025	Moderate
2	FAULT COUNTERS (Read)	40419 to 40558	Low
3	LAST 10 FAULT EVENTS (Read)	40319 to 40368	Low
4	PREDICTIVE DIAGNOSTICS (Read)	40028 to 40031, 40559 to 40560, 40563 to 40567, 40578 to 40581	Low
5	ACTUATOR SETTINGS (Read)	40118 to 40205, 40305 to 40313	Low
5	ACTUATOR TIME (Read/Write)	40572 to 40575	Low
6	ACTUATOR IDENTIFICATION (Read)	40206 to 40304, 40314 to 40318	Low

Overall Register Notes

1. All data is big endian
2. ASCII characters are stored (1) character per register
3. The data type definitions are as follows:

Data Type	Definition
Word	Unsigned 16-bit
Real	32bit float
DWord	32bit Integer
QWord	Unsigned 64bit

1. ACTUATOR

STATUS

These registers provide current status of the actuator. At a minimum these registers should be monitored at a regular interval.

Control Signal

Description:	Series of (2) registers each containing 2 Bytes of the floating point value representing the active 4-20mA signal provided to the actuator for the setpoint position control. When both registers are combined the current control signal can be determined.
Address:	40001 to 40002
Register Data:	Real
Register Type:	Read
Units:	-25.00% to 125.00% (Ex. 4mA = 0%, 20mA = 100%)
Notes:	Value can only be changed via the Analog input or the host write command and the current input can be monitored on the display. Refer to Section 6.4 for setting details, Section 6.7.4 for live reading details.

Actuator Control - Host Write Enable

Description:	Acts as a latching mechanism to ensure incorrect control targets are not used. This must be set to "True" before the Host Write Target will be accepted as a new target position.
Address:	40569
Register Data:	Boolean
Register Type:	Write
Units:	Boolean (0 = False, 1 = True)
Notes:	If this value is "False" no new Host Write Target changes will be accepted. After the actuator is powered up or reset this register defaults back to fault. To ensure proper control this register should always be set "True" before issuing a Host Write Target command.

Actuator Control - Host Write Target

Description:	Series of (2) registers each containing 2 Bytes of the floating point value representing the new 0 to 100% setpoint point of the position control. When both registers are combined the new target position can be determined.
Address:	40570 to 40571
Register Data:	Real
Register Type:	Write
Units:	0.00% to 100.00%
Notes:	The actuator will only respond to changes in this register if the following is met: actuator parameter Inputs -> Signal Type = NetWrk , Host Write Enable = True Actuator Mode = Auto and Actuator Status ≠ Alarm. Once this parameter is written the Control Signal register will update to this new value. The actuator will hold the last set target until a new target is received. There is a ~25ms delay before the actuator will receive and fully process any new target changes.
Example:	<u>Writing a new target position -</u>

Actuator Control - Host Write Target

Current Actuator Position = 50.0%
New Target Position = 95.1%

New Target Position (decimal) = 95.2
Converted to floating point (Hex): 0x42be3333

This value should be entered into the registers as follows:

Register	Description	Value
40570	Host Write Target MS2B	0x42be
40571	Host Write Target LS2B	0x3333

To execute the command registers should be entered in the below sequence:

Control Command Sequence

Step	1	2
Command	Write	Write
Address	40569 Host Write Enable	40570 & 40571 Host Write Target
Value	1 (True)	42be & 3333
Delay	2ms	~25ms before actuator response

Note: Any additional reads in between control writes will result in delays in the subsequent write.

Position

Description:	Series of (2) registers each containing 2 Bytes of the floating point value representing the current actuator position. When both registers are combined the current actuator position can be determined.
Address:	40003 to 40004
Register Data:	Real
Register Type:	Read
Units:	0.00% to 100.00%
Note:	This information can also be derived from the display or the position transmitter output. Refer to Sections 6.7.3 & 6.6 for further details.

Torque / Thrust

Description:	A series of (2) registers each containing 2 Bytes of the signed 32 bit value representing the current actuator torque or thrust output force. When both registers are combined the current actuator torque or thrust can be determined. A positive value indicates extending/CW (clockwise), and a negative value indicates retracting/CCW (counterclockwise). The device's model number is utilized to calculate this value.
Address:	40007 to 40008
Register Data:	DWord (Signed)
Register Type:	Read
Units:	lbf or in'lbs
Note:	Only applicable for actuators with differential pressure sensors equipped. This information can also be derived via the Bluetooth GUI. Refer to TPB #12 Status page for more details.

PST Status

Description:	When an activation signal is received the actuator will move to a pre programmed menu defined position and return to the original position. The hex enumeration value indicates the current status of the PST (Partial Stroke Test) event.																				
Address:	40012																				
Register Data:	Word (enumeration)																				
Register Type:	Read																				
Units:	N/A																				
Note:	PST can only be deployed when the actuator is at 100% open and will be aborted if there is a control signal change during the PST event. This will cause the event to report as Invalid PST. Refer to TPB #12.0 for GUI PST page details, TPB #5.0 for PST faults and Section 6.5 for details pertaining to setting parameters.																				
Enumeration Table:	<table><tr><th>Position Relay Status</th><th>Description</th><th>Value</th></tr><tr><td>PST has not run</td><td>Test has not been executed</td><td>0x00</td></tr><tr><td>PST Running</td><td>Test is currently in process. Does not complete until PST target reached</td><td>0x01</td></tr><tr><td>PST ran & Failed</td><td>Test was run, but could not reach PST target within the PST Time setting.</td><td>0x02</td></tr><tr><td>PST ran & Passed</td><td>Test was run and could reach PST target within the PST Time setting.</td><td>0x03</td></tr><tr><td>PST not applicable</td><td>Not applicable for this configuration</td><td>0x04</td></tr></table>			Position Relay Status	Description	Value	PST has not run	Test has not been executed	0x00	PST Running	Test is currently in process. Does not complete until PST target reached	0x01	PST ran & Failed	Test was run, but could not reach PST target within the PST Time setting.	0x02	PST ran & Passed	Test was run and could reach PST target within the PST Time setting.	0x03	PST not applicable	Not applicable for this configuration	0x04
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PST ran & Passed	Test was run and could reach PST target within the PST Time setting.	0x03																			
PST not applicable	Not applicable for this configuration	0x04																			

Accumulator Pressure

Description:	Contains 16 bit value representing the current pressure stored in the accumulator bottle.
Address:	40013
Register Data:	Unsigned 16 bit
Register Type:	Read
Units:	0 – 3000 PSI
Note:	Only applicable for actuators with accumulator failsafe actuators equipped. This information can also be derived via the display or the Bluetooth GUI. Refer Section 6.5 for parameter settings & live pressure and TPB #12 for the BT Status page for further details.

Operational Mode

Description:	Contains 16 bit decimal enumeration value where each value represents a different actuator operational mode.																																																											
Address:	40014																																																											
Register Data:	Word																																																											
Register Type:	Read																																																											
Units:	N/A																																																											
Note:	Refer to Sections 6.0 & 6.7.3 for details on the modes of operation.																																																											
Enumeration Table:	<table><tr><th>Actuator Mode</th><th>Value</th><th>Actuator Mode</th><th>Value</th></tr><tr><td>Auto Mode</td><td>1</td><td>Remote Test Mode</td><td>21</td></tr><tr><td>Setup Mode</td><td>2</td><td>*Remote Recharge Mode</td><td>22</td></tr><tr><td>Manual Mode</td><td>5</td><td>*Remote Trip Mode</td><td>23</td></tr><tr><td>Auto Test Mode</td><td>11</td><td>*Remote Seat Mode</td><td>24</td></tr><tr><td>*Auto Remote Mode</td><td>12</td><td>Remote MM Mode</td><td>25</td></tr><tr><td>*Auto Recharge Mode</td><td>13</td><td>Remote BT Mode</td><td>26</td></tr><tr><td>*Auto Trip Mode</td><td>14</td><td>*Remote PST Mode</td><td>27</td></tr><tr><td>*Auto Seat Mode</td><td>15</td><td>*Remote Backup Mode</td><td>28</td></tr><tr><td>Auto MM Mode</td><td>16</td><td>*Manual Trip Mode</td><td>29</td></tr><tr><td>Auto BT Mode</td><td>17</td><td>*Manual Backup Mode</td><td>30</td></tr><tr><td>*Auto PST Mode</td><td>18</td><td>*Auto API Mode</td><td>31</td></tr><tr><td>*Manual PST Mode</td><td>19</td><td>*Manual API Mode</td><td>32</td></tr><tr><td>*Auto Backup Mode</td><td>20</td><td>Invalid Values</td><td>0,3,4,6 - 10</td></tr></table>				Actuator Mode	Value	Actuator Mode	Value	Auto Mode	1	Remote Test Mode	21	Setup Mode	2	*Remote Recharge Mode	22	Manual Mode	5	*Remote Trip Mode	23	Auto Test Mode	11	*Remote Seat Mode	24	*Auto Remote Mode	12	Remote MM Mode	25	*Auto Recharge Mode	13	Remote BT Mode	26	*Auto Trip Mode	14	*Remote PST Mode	27	*Auto Seat Mode	15	*Remote Backup Mode	28	Auto MM Mode	16	*Manual Trip Mode	29	Auto BT Mode	17	*Manual Backup Mode	30	*Auto PST Mode	18	*Auto API Mode	31	*Manual PST Mode	19	*Manual API Mode	32	*Auto Backup Mode	20	Invalid Values	0,3,4,6 - 10
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(*) These outputs are only populated for certain configurations where that feature is available.

Last Event

Description:	Contains 16 bit hex enumeration value where each value represents a different Alarm or Warning fault that has taken place on the actuator.
Address:	40015
Register Data:	Word
Register Type:	Read
Units:	N/A
Note:	A fault recorded here does not indicate that the fault is still active. The current fault state should be derived from the System Status register and the active Warning & Alarm registers (see Section 2 of this TPB for the possible faults and the definitions)

Enumeration Table:

Last Event/Fault	Value	Last Event/Fault	Value
NO_EVENT	0x00	Primary Servo Resolver Fault Event	0x25
Primary Servo Fault Event	0x01	Primary Servo Driver Temp. Event	0x26
Dual Servo Fault Event	0x02	Primary Servo Hi Volt Event	0x27
Accum Servo Fault Event	0x03	Primary Servo Overspeed Event	0x28
Booster Servo Fault Event	0x04	Primary Servo Mtr Short Event	0x29
Primary Stepper Fault Event	0x05	Primary Servo Driver Replace Event	0x2A
Dual Stepper Fault Event	0x06	Primary Servo Unused Event	0x2B
Accum Stepper Fault Event	0x07	Dual Servo Low Volt Event	0x2C
Booster Ind. Fault Event	0x08	Dual Servo Mtr Replace Event	0x2D
Dual Ind. Fault Event	0x09	Dual Servo Mtr Temp. Event	0x2E
Primary Ind. Fault Event	0x0A	Dual Servo Resolver Fault Event	0x2F
Main Feedback Bad Event	0x0B	Dual Servo Driver Temp. Event	0x30
Redundant Feedback Bad Event	0x0C	Dual Servo Hi Volt Event	0x31
Control Signal Bad Event	0x0D	Dual Servo Overspeed Event	0x32
Stall Event	0x0E	Dual Servo Mtr Short Event	0x33
Direction Error Event	0x0F	Dual Servo Driver Replace Event	0x34
Plus 15V Bad Event	0x10	Dual Servo Unused Event	0x35
Neg. 5V Bad Event	0x11	Accum Servo Low Volt Event	0x36
Accum Press Bad Event	0x12	Accum Servo Mtr Replace Event	0x37
Accum Press Low Event	0x13	Accum Servo Mtr Temp.	0x38

Last Event

		Event	
Output (Delta) Warning Event	0x14	Accum Servo Resolver Fault Event	0x39
Accum Timeout Event	0x15	Accum Servo Driver Temp. Event	0x3A
Open Pressure Bad Event	0x16	Accum Servo Hi Volt Event	0x3B
Close Pressure Bad Event	0x17	Accum Servo Overspeed Event	0x3C
Seat Load Cyl. Feedback Bad Event	0x18	Accum Servo Mtr Short Event	0x3D
Seat Load Cyl. Stop Event	0x19	Accum Servo Driver Replace Event	0x3E
AC High Event	0x1A	Accum Servo Unused Event	0x3F
AC Low Event	0x1B	Booster Servo Low Volt Event	0x40
Clock Battery Low Event	0x1C	Booster Servo Mtr Replace Event	0x41
Output (Delta) Alarm Event	0x1D	Booster Servo Mtr Temp. Event	0x42
Feedback Offset Event	0x1E	Booster Servo Resolver Fault Event	0x43
Invalid Hardware Event	0x1F	Booster Servo Driver Temp. Event	0x44
Invalid PST Event	0x20	Booster Servo Hi Volt Event	0x45
PST Time Elapsed Event	0x21	Booster Servo Overspeed Event	0x46
Primary Servo Low Volt Event	0x22	Booster Servo Mtr Short Event	0x47
Primary Servo Mtr Replace Event	0x23	Booster Servo Driver Replace Event	0x48
Primary Servo Mtr Temp. Event	0x24	Booster Servo Unused Event	0x49
		Comm Loss Event	0x4A

(*) These outputs are only populated for certain configurations where that feature is available.

Actuator Status

Description:	Contains 16 bit hex enumeration value where each value indicates the current functional status of the actuator
Address:	40016
Register Data:	Word (bit mask)

Actuator Status

Register Type:	Read																					
Units:	N/A																					
Note:	Refer to Section 6.7.3 to see where this information is shown on the display. The Warning, Alarm & Not in Auto mirror the individual discrete relay outputs. See TPB 4.0 for additional details.																					
Bit Mask Definition:	<table><tr><th>Actuator Status</th><th>Description</th><th>Bit Mask</th></tr><tr><td>ACTUATOR_OK</td><td>No faults, actuator functional</td><td>0x00</td></tr><tr><td>ACTUATOR_WARNING</td><td>Active Warning fault, actuator can still operate (ie. Will follow control signal or Trip)</td><td>0x01</td></tr><tr><td>ACTUATOR_ALARM</td><td>Active Alarm fault, actuator cannot operate (ie. Will not follow control signal or Trip)</td><td>0x02</td></tr><tr><td>ACTUATOR_NOT_IN_AUTO (NIA)</td><td>Electronics put in Local or Setup mode. Will not follow control signal changes or Trip.</td><td>0x04</td></tr><tr><td>*ACTUATOR_TRIPPED</td><td>Trip input active and actuator is in the fail position. Will not follow control signal until trip is in-active.</td><td>0x08</td></tr></table> (*) This status will only populate if Trip is an active feature on your actuator.	Actuator Status	Description	Bit Mask	ACTUATOR_OK	No faults, actuator functional	0x00	ACTUATOR_WARNING	Active Warning fault, actuator can still operate (ie. Will follow control signal or Trip)	0x01	ACTUATOR_ALARM	Active Alarm fault, actuator cannot operate (ie. Will not follow control signal or Trip)	0x02	ACTUATOR_NOT_IN_AUTO (NIA)	Electronics put in Local or Setup mode. Will not follow control signal changes or Trip.	0x04	*ACTUATOR_TRIPPED	Trip input active and actuator is in the fail position. Will not follow control signal until trip is in-active.	0x08			
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ACTUATOR_OK	No faults, actuator functional	0x00																				
ACTUATOR_WARNING	Active Warning fault, actuator can still operate (ie. Will follow control signal or Trip)	0x01																				
ACTUATOR_ALARM	Active Alarm fault, actuator cannot operate (ie. Will not follow control signal or Trip)	0x02																				
ACTUATOR_NOT_IN_AUTO (NIA)	Electronics put in Local or Setup mode. Will not follow control signal changes or Trip.	0x04																				
*ACTUATOR_TRIPPED	Trip input active and actuator is in the fail position. Will not follow control signal until trip is in-active.	0x08																				
Example:	<u>Reading Actuator Status Bit Mask</u> - Active Faults – Main Feedback Bad (Alarm) Actuator Mode – Local Mode Other – Actuator not tripped and no active warnings Corresponding binary values for these conditions: <table><tr><td>Bit #</td><td>7 - 5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>Definition</td><td>None</td><td>Trip</td><td>NIA</td><td>Alarm</td><td>Warning</td><td>OK</td></tr><tr><td>Bit Value</td><td>000</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr></table> Binary = 0000 1100 Register value (Hex) = 0x0c	Bit #	7 - 5	4	3	2	1	0	Definition	None	Trip	NIA	Alarm	Warning	OK	Bit Value	000	0	1	1	0	0
Bit #	7 - 5	4	3	2	1	0																
Definition	None	Trip	NIA	Alarm	Warning	OK																
Bit Value	000	0	1	1	0	0																

Active Feedback

Description:	Contains 16 bit hex enumeration value where each value indicates which actuator feedback is currently acting as the primary positioning feedback.
Address:	40017
Register Data:	Word (enumeration)
Register Type:	Read
Units:	N/A
Note:	For configurations with redundant feedback this could be used to determine which feedback is active. Refer to TPB #12.0 for GUI PST page details, TPB #5.0 for PST faults and Section 6.5 for details pertaining to setting parameters.

Enumeration Table:

Position Relay Status	Description	Value
Main Feedback Active	Main feedback acting as primary and Redundant feedback acting as backup (if present).	0x00
*Redundant Feedback Active	Main feedback is faulted and the Redundant feedback acting as primary.	0x01

(*) Only applicable for actuator configurations with Redundant feedback.

Position Relay Status

Description:	Contains 16 bit hex enumeration value where each value indicates the current active status of the position relays.
Address:	40577
Register Data:	Word (bit mask)
Register Type:	Read
Units:	N/A
Note:	The register mirrors the discrete Relay 1 & Relay 2 outputs and both relays cannot be active at the same time. See TPB 4.0 for additional relay functional details. Refer to Section 6.6 for details pertaining to configuring the activation thresholds.

Enumeration Table:

Position Relay Status	Description	Value
Relay 1 & 2 Open	Both relays in-active	0x00
Relay 1 Closed	Relay 1 Active, position $\leq$ Relay 1 parameter setting	0x01
Relay 2 Closed	Relay 2 Active, position $\geq$ Relay 2 parameter setting	0x02

These registers provide current status of the actuator. At a minimum these registers should be monitored at a regular interval.

2. WARNINGS & ALARMS

Warning - Primary Servo Fault

Description:	Indicates that a problem exists in the Servo primary positioning motor. Since the Actuator is Dual construction, flagged as a warning since the Dual can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000001
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	

Warning - Primary Servo Fault

Register Data:	bit
Address:	00001
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40419, Data: Word
Lifetime:	Register: 40489, Data: Word
Note:	Refer to TPB #5 Motor Errors – PSrv_Flt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning - Dual Servo Fault

Description:	Indicates that a problem exists in the Servo secondary positioning motor. Since the Actuator is Dual construction, flagged as a warning since the Primary can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000002
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00002
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40420, Data: Word
Lifetime:	Register: 40490, Data: Word
Note:	Refer to TPB #5 Motor Errors – DSrvFIt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning - Accumulator Servo Fault

Description:	Indicates that a problem exists in the Accumulator Servo Motor Drive. Flagged as a warning since this does not affect positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000004
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00003
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	

Current:	Register: 40421, Data: Word
Lifetime:	Register: 40491, Data: Word
Note:	Refer to TPB #5 Motor Errors – AServoFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning - Booster Servo Fault

Description:	Indicates that a problem exists in the Servo Booster Motor Drive. Flagged as a warning since the actuator can still position with the Primary motor.. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A

Holding Register

Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000008
Bit Value:	1 (fault active), 0 (fault inactive)

Coil

Register Data:	bit
Address:	00004
Bit Value:	1 (fault active), 0 (fault inactive)

Counters

Current:	Register: 40422, Data: Word
Lifetime:	Register: 40492, Data: Word
Note:	Refer to TPB #5 Motor Errors – SBstFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning - Primary Stepper Fault

Description:	Indicates that a problem exists in the Stepper primary positioning motor. Since the actuator is Dual construction, flagged as a warning since the Dual can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A

Holding Register

Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000010
Bit Value:	1 (fault active), 0 (fault inactive)

Coil

Register Data:	bit
Address:	00005
Bit Value:	1 (fault active), 0 (fault inactive)

Counters

Current:	Register: 40423, Data: Word
Lifetime:	Register: 40493, Data: Word
Note:	Refer to TPB #5 Motor Errors – PStpFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning - Dual Stepper Fault

Description:	Indicates that a problem exists in the Stepper secondary positioning motor. Since the actuator is Dual construction, flagged as a warning since the Primary can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord
Bit Mask:	0x0000000000000020
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00006
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40424, Data: Word
Lifetime:	Register: 40494, Data: Word
Note:	Refer to TPB #5 Motor Errors – DStpFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning - Accumulator Stepper Fault

Description:	Indicates that a problem exists in the Accumulator Stepper Motor Drive. Flagged as a warning since this does not affect positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000040
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00007
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40425, Data: Word
Lifetime:	Register: 40495, Data: Word
Note:	Refer to TPB #5 Motor Errors – AStpFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Induction Booster Fault

Description:	Indicates that a problem exists in the Induction Booster Motor Drive. Flagged as a warning since the Primary motor can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000080
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00008
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40426, Data: Word
Lifetime:	Register: 40496, Data: Word
Note:	Refer to TPB #5 Motor Errors – IBstFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Dual Induction Booster Fault

Description:	Indicates that a problem exists in the Dual Induction Booster Motor Drive. Flagged as a warning since the Primary motor can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000100
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00009
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40427, Data: Word
Lifetime:	Register: 40497, Data: Word
Note:	Refer to TPB #5 Motor Errors – IBstFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Primary Induction Fault

Description:	Indicates that a problem exists in the Primary Induction Motor Drive. With a
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	Dual construction, flagged as a warning since the Dual can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000200
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00010
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40428, Data: Word
Lifetime:	Register: 40498, Data: Word
Note:	Refer to TPB #5 Motor Errors – PInducFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Main Feedback Bad Fault

Description:	Indicates that the actuator's main Feedback is below 2 mA or above 20mA. With a redundant Feedback, flagged as warning since the redundant Feedback can be used as the main. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000400
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00011
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40429, Data: Word
Lifetime:	Register: 40499, Data: Word
Note:	Refer to TPB #5 Fault Codes – MFB_Bad for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Redundant Feedback Bad Fault

Description:	Indicates that the actuator's redundant Feedback is below 2 mA or above
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Warning – Redundant Feedback Bad Fault

	20mA. Flagged as warning since the main Feedback can still be used. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000800
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00012
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40430, Data: Word
Lifetime:	Register: 40500, Data: Word
Note:	Refer to TPB #5 Fault Codes – Rdnt_FB bad for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Accumulator Pressure Bad Fault

Description:	Indicates that the accumulator's pressure transducer is out of range if the 4 - 20 mA signal is less than 3 mA or greater than 21mA. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000100
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00013
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40436, Data: Word
Lifetime:	Register: 40506, Data: Word
Note:	Refer to TPB #5 Fault Codes – APres_Bad for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Accumulator Pressure Low Fault

Warning – Accumulator Pressure Low Fault

Description:	Indicates that the accumulator pressure is below the value set in Warn Pres parameter. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000002000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00014
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40437, Data: Word
Lifetime:	Register: 40507, Data: Word
Note:	Refer to TPB #5 Fault Codes – APres_Low for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Open Pressure Bad Fault

Description:	Indicates that the pressure transducer in the Open direction is out of range if the 4 - 20 mA signal is less than 3 mA or greater than 21mA. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000004000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00015
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40440, Data: Word
Lifetime:	Register: 40510, Data: Word
Note:	Refer to TPB #5 Fault Codes – OpPres_Bad for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Close Pressure Bad Fault

Description:	Indicates that the pressure transducer in the Close direction is out of range if the 4 - 20 mA signal is less than 3 mA or greater than 21mA. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000008000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00016
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40441, Data: Word
Lifetime:	Register: 40511, Data: Word
Note:	Refer to TPB #5 Fault Codes – CIPres_Bad for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Seat Load Cylinder Stop Fault

Description:	Indicates that the “Seated” position was reached by the Seat Load Cylinder while the position of the main cylinder was greater than 1% above Position Lo. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000010000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00017
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40443, Data: Word
Lifetime:	Register: 40513, Data: Word
Note:	Refer to TPB #5 Fault Codes – SLC_STOP for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – AC Voltage High Fault

Description:	Indicates that the actuator AC voltage is above the rated input range. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000020000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00018
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40444, Data: Word
Lifetime:	Register: 40514, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – AC Voltage Low Fault

Description:	Indicates that the system AC voltage is below the rated input range. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000040000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00019
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40445, Data: Word
Lifetime:	Register: 40515, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Output (Delta) Warning Fault

Description:	Indicates that delta pressure exceeded Delta Warn parameter limit. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000080000



Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00020
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40438, Data: Word
Lifetime:	Register: 40508, Data: Word
Note:	Refer to TPB #5 Fault Codes – Delta Warn for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Clock Battery Low Fault

Description:	Indicates that the 8-year timer on the clock battery has expired and needs to be replaced. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000100000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00021
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40446, Data: Word
Lifetime:	Register: 40516, Data: Word
Note:	Refer to TPB #5 Fault Codes – Clock Bat for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Invalid Hardware Fault

Description:	Indicates that Sys_Config detected that the connected hardware is not a valid configuration. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000200000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00022
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40449, Data: Word
Lifetime:	Register: 40519, Data: Word

Warning – Invalid Hardware Fault

Note:	Refer to TPB #5 Fault Codes – Inval_HW for details on the fault and how it is cleared and Section 6.7 for Fault counter details.
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Warning – Primary Servo Low Voltage Fault

Description:	Indicates that the Primary Servo input voltage is below the rated input range. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000400000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00023
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40452, Data: Word
Lifetime:	Register: 40522, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Primary Servo Replace Motor Fault

Description:	Indicates that the Primary Servo Motor should be replaced. When the actuator is Dual construction, flagged as a warning since the Dual can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000800000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00024
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40453, Data: Word
Lifetime:	Register: 40523, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Primary Servo Motor Temperature Fault

Description:	Indicates that the Primary Servo Motor has exceeded its rated temperature. Data can be derived from either the holding register or the coil.
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Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000001000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00025
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40454, Data: Word
Lifetime:	Register: 40524, Data: Word
Note:	Refer to TPB #5 Fault Codes – P_MTRTemp for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Primary Servo Resolver Fault

Description:	Indicates that the Primary Servo Motor Resolver cable has a short or an open. When the actuator is Dual construction, flagged as a warning since the Dual can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000002000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00026
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40455, Data: Word
Lifetime:	Register: 40525, Data: Word
Note:	Refer to TPB #5 Fault Codes – PResCable for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Primary Servo Drive Temperature Fault

Description:	Indicates that the Primary Servo Motor Driver has exceeded its rated temperature. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)

Bit Mask:	0x0000000004000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00027
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40456, Data: Word
Lifetime:	Register: 40526, Data: Word
Note:	Refer to TPB #5 Fault Codes – P_DRV_Temp for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Primary Servo High Voltage Fault

Description:	Indicates that the Primary Servo Motor input voltage is above the rated input. When the actuator is in Dual construction, flagged as a warning since the Dual can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A

Holding Register

Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000008000000
Bit Value:	1 (fault active), 0 (fault inactive)

Coil

Register Data:	bit
Address:	00028
Bit Value:	1 (fault active), 0 (fault inactive)

Counters

Current:	Register: 40457, Data: Word
Lifetime:	Register: 40527, Data: Word
Note:	Refer to Section 6.7 for Fault counter details..

Warning – Primary Servo Overspeed Fault

Description:	Indicates that the Primary Servo Motor speed is too high. When the actuator is in Dual construction, flagged as a warning since the Dual can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A

Holding Register

Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000010000000
Bit Value:	1 (fault active), 0 (fault inactive)

Coil

Register Data:	bit
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Address:	00029
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40458, Data: Word
Lifetime:	Register: 40528, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Primary Servo Motor Short Fault

Description:	Indicates that the Primary Servo Motor has a short. When the actuator is in Dual construction, flagged as a warning since the Dual can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000020000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00030
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40459, Data: Word
Lifetime:	Register: 40529, Data: Word
Note:	N/A Refer to TPB #5 Fault Codes – P_MTR-Short for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Primary Servo Replace Drive Fault

Description:	Indicates that the Primary Servo Motor Driver has a shorted output. When the actuator is in Dual construction, flagged as a warning since the Dual can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000040000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00031
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40460, Data: Word
Lifetime:	Register: 40530, Data: Word



Note:	Refer to TPB #5 Fault Codes – P_Replc_DRV for details on the fault and how it is cleared and Section 6.7 for Fault counter details.
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Warning – Dual Servo Low Voltage Fault

Description:	Indicates that the Dual Servo input voltage is below the rated input range. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000080000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00032
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40461, Data: Word
Lifetime:	Register: 40531, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Dual Servo Replace Motor Fault

Description:	Indicates that the Dual Servo Motor should be replaced. When the actuator is in Dual construction, flagged as a warning since the Primary can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000010000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00033
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40462, Data: Word
Lifetime:	Register: 40532, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Dual Servo Motor Temperature Fault

Description:	Indicates that the Dual Servo Motor has exceeded its rated temperature. Data can be derived from either the holding register or the coil.
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Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000200000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00034
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40463, Data: Word
Lifetime:	Register: 40533, Data: Word
Note:	Refer to TPB #5 Fault Codes – DMTRTemp for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Dual Servo Resolver Fault

Description:	Indicates that the Dual Servo Motor Resolver cable has a short or an open. When the actuator is Dual construction, flagged as a warning since the Primary can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000400000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00035
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40464, Data: Word
Lifetime:	Register: 40534, Data: Word
Note:	Refer to TPB #5 Fault Codes – DResCable for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Dual Servo Drive Temperature Fault

Description:	Indicates that the Dual Servo Motor Driver has exceeded its rated temperature. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)



Bit Mask:	0x0000000800000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00036
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40465, Data: Word
Lifetime:	Register: 40535, Data: Word
Note:	Refer to TPB #5 Fault Codes – D_DRV_Temp for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Dual Servo High Voltage Fault

Description:	Indicates that the Dual Servo Motor input voltage is above the rated input. When the actuator is in Dual construction, flagged as a warning since the Primary can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000001000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00037
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40466, Data: Word
Lifetime:	Register: 40536, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Dual Servo Overspeed Fault

Description:	Indicates that the Dual Servo Motor speed is too high. When the actuator is in Dual construction, flagged as a warning since the Primary can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000002000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	

Register Data:	bit
Address:	00038
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40467, Data: Word
Lifetime:	Register: 40537, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Dual Servo Motor Short Fault

Description:	Indicates that the Dual Servo Motor has a short. When the actuator is in Dual construction, flagged as a warning since the Primary can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000004000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00039
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40468, Data: Word
Lifetime:	Register: 40538, Data: Word
Note:	Refer to TPB #5 Fault Codes – D_MTR-Short for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Dual Servo Replace Drive Fault

Description:	Indicates that the Dual Servo Motor Driver has a shorted output. When the actuator is in Dual construction, flagged as a warning since the Primary can still be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000008000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00040
Bit Value:	1 (fault active), 0 (fault inactive)

Counters

Current:	Register: 40469, Data: Word
Lifetime:	Register: 40539, Data: Word
Note:	Refer to TPB #5 Fault Codes – D_Replc_DRV for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Accumulator Servo Low Voltage Fault

Description:	Indicates that the Accumulator Servo input voltage is below the rated input range. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A

Holding Register

Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000010000000000
Bit Value:	1 (fault active), 0 (fault inactive)

Coil

Register Data:	bit
Address:	00041
Bit Value:	1 (fault active), 0 (fault inactive)

Counters

Current:	Register: 40470, Data: Word
Lifetime:	Register: 40540, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Accumulator Servo Replace Motor Fault

Description:	Indicates that the Accumulator Servo Motor should be replaced. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A

Holding Register

Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000020000000000
Bit Value:	1 (fault active), 0 (fault inactive)

Coil

Register Data:	bit
Address:	00042
Bit Value:	1 (fault active), 0 (fault inactive)

Counters

Current:	Register: 40471, Data: Word
Lifetime:	Register: 40541, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Accumulator Servo Motor Temperature Fault

Warning – Accumulator Servo Motor Temperature Fault

Description:	Indicates that the Accumulator Servo Motor has exceeded its rated temperature. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000040000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00043
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40472, Data: Word
Lifetime:	Register: 40542, Data: Word
Note:	Refer to TPB #5 Fault Codes – AMTRTemp for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Accumulator Servo Resolver Fault

Description:	Indicates that the Accumulator Servo Motor Resolver cable has a short or an open. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000080000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00044
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40473, Data: Word
Lifetime:	Register: 40543, Data: Word
Note:	Refer to TPB #5 Fault Codes – AResCable for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Accumulator Servo Drive Temperature Fault

Description:	Indicates that the Accumulator Servo Motor Driver has exceeded its rated temperature. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021

Warning – Accumulator Servo Drive Temperature Fault

Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000100000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00045
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40474, Data: Word
Lifetime:	Register: 40544, Data: Word
Note:	Refer to TPB #5 Fault Codes – A_DRV_Temp for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Accumulator Servo High Voltage Fault

Description:	Indicates that the Accumulator Servo Motor input voltage is above the rated input. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000200000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00046
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40475, Data: Word
Lifetime:	Register: 40545, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Accumulator Servo Overspeed Fault

Description:	Indicates that the Accumulator Servo Motor speed is too high. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000400000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00047
Bit Value:	1 (fault active), 0 (fault inactive)

Warning – Accumulator Servo Overspeed Fault

Counters	
Current:	Register: 40476, Data: Word
Lifetime:	Register: 40546, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Accumulator Servo Motor Short Fault

Description:	Indicates that the Accumulator Servo Motor has a short. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000800000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00048
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40477, Data: Word
Lifetime:	Register: 40547, Data: Word
Note:	Refer to TPB #5 Fault Codes – A_MTR-Short for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Accumulator Servo Replace Drive Fault

Description:	Indicates that the Accumulator Servo Motor Driver has a shorted output. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0001000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00049
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40478, Data: Word
Lifetime:	Register: 40548, Data: Word
Note:	Refer to TPB #5 Fault Codes – A_Replc_DRV for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Booster Servo Low Voltage Fault

Description:	Indicates that the Booster Servo input voltage is below the rated input range. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0002000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00050
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40479, Data: Word
Lifetime:	Register: 40549, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Booster Servo Replace Motor Fault

Description:	Indicates that the Servo Booster Motor should be replaced. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0004000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00051
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40480, Data: Word
Lifetime:	Register: 40550, Data: Word
Note:	Refer to Section 6.7 for Fault counter details

Warning – Booster Servo Motor Temperature Fault

Description:	Indicates that the Servo Booster Motor has exceeded its rated temperature. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0008000000000000

Warning – Booster Servo Motor Temperature Fault

Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00052
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40481, Data: Word
Lifetime:	Register: 40551, Data: Word
Note:	Refer to TPB #5 Fault Codes – SBstMTRTemp for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Booster Servo Resolver Fault

Description:	Indicates that the Servo Booster Motor Resolver cable has a short or an open. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0010000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00053
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40482, Data: Word
Lifetime:	Register: 40552, Data: Word
Note:	Refer to TPB #5 Fault Codes – SBstResCable for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Booster Servo Drive Temperature Fault

Description:	Indicates that the Servo Booster Motor Driver has exceeded its rated temperature. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0020000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00054
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	

Warning – Booster Servo Drive Temperature Fault

Current:	Register: 40483, Data: Word
Lifetime:	Register: 40553, Data: Word
Note:	Refer to TPB #5 Fault Codes – SBstDRV_Temp for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Booster Servo High Voltage Fault

Description:	Indicates that the Servo Booster Motor input voltage is above the rated input. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0040000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00055
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40484, Data: Word
Lifetime:	Register: 40554, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Booster Servo Overspeed Fault

Description:	Indicates that the Servo Booster Motor speed is too high. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0080000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00056
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40485, Data: Word
Lifetime:	Register: 40555, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Warning – Booster Servo Motor Short Fault

Description:	Indicates that the Servo Booster Motor has a short. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0100000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00057
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40486, Data: Word
Lifetime:	Register: 40556, Data: Word
Note:	N/A Refer to TPB #5 Fault Codes – SBstMTR-Short for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Booster Servo Replace Drive Fault

Description:	Indicates that the Servo Booster Motor Driver has a shorted output. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0200000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00058
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40487, Data: Word
Lifetime:	Register: 40557, Data: Word
Note:	Refer to TPB #5 Fault Codes – SBstReplc_DRV for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Comm Loss Fault

Description:	Indicates that communications was lost between the CPU Board and the Modbus Board. Data can be derived from either the holding register or the coil.
Register Type:	Read



Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0400000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00059
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40488, Data: Word
Lifetime:	Register: 40558, Data: Word
Note:	See Fault Codes section of this TPB for additional details about this Warning. Refer to Section 6.7 for Fault counter details.

Warning – PST Time Elapsed Fault

Description:	Indicates that the time for the actuator to go from 100% to the PST Target and back to the full Open position exceeded the PST Time. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0800000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00060
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40451, Data: Word
Lifetime:	Register: 40521, Data: Word
Note:	Refer to TPB #5 Fault Codes – PST Time Elp for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Invalid PST Fault

Description:	Indicates that the actuator was not at the 100% position when a PST command was initiated. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	



Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x1000000000000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00061
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40450, Data: Word
Lifetime:	Register: 40520, Data: Word
Note:	Refer to TPB #5 Fault Codes – Inval PST for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Feedback Offset Fault

Description:	Indicates that the actuator's main Feedback and redundant Feedback have a greater than 10% difference. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A

Holding Register

Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x2000000000000000
Bit Value:	1 (fault active), 0 (fault inactive)

Coil

Register Data:	bit
Address:	00062
Bit Value:	1 (fault active), 0 (fault inactive)

Counters

Current:	Register: 40448, Data: Word
Lifetime:	Register: 40518, Data: Word
Note:	Refer to TPB #5 Fault Codes – FB_Offset for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Warning – Accumulator Timeout Fault

Description:	Indicates that the accumulator did not complete a full recharge in time set in Rechrgr_Time parameter. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A

Holding Register

Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x4000000000000000
Bit Value:	1 (fault active), 0 (fault inactive)

Coil

Register Data:	bit
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Warning – Accumulator Timeout Fault

Address:	00063
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40439, Data: Word
Lifetime:	Register: 40509, Data: Word
Note:	Refer to TPB #5 Fault Codes – Accum_Time for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm – Primary Servo Fault

Description:	Indicates that a problem exists in the Servo primary positioning motor. Since the actuator is not Dual construction, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000001
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00101
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40419, Data: Word
Lifetime:	Register: 40489, Data: Word
Note:	Refer to TPB #5 Fault Codes – PSrv_Flt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm - Dual Servo Fault

Description:	Indicates that a problem exists in the Servo secondary positioning motor. When in Dual construction and the Primary Motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000002
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00102
Bit Value:	1 (fault active), 0 (fault inactive)

Alarm - Dual Servo Fault

Counters	
Current:	Register: 40420, Data: Word
Lifetime:	Register: 40490, Data: Word
Note:	Refer to TPB #5 Motor Errors – DSrvFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm - Primary Stepper Fault

Description:	Indicates that a problem exists in the Stepper primary positioning motor. Since the actuator is not Dual construction, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000004
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00103
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40423, Data: Word
Lifetime:	Register: 40493, Data: Word
Note:	Refer to TPB #5 Motor Errors – PStpFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm - Dual Stepper Fault

Description:	Indicates that a problem exists in the Stepper secondary positioning motor. When in Dual construction and Primary Motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000008
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00104
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40424, Data: Word
Lifetime:	Register: 40494, Data: Word

Alarm - Dual Stepper Fault

Note:	Refer to TPB #5 Motor Errors – DStpFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.
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Alarm – Dual Induction Booster Fault

Description:	Indicates that a problem exists in the Dual Induction Booster Motor Drive. When in Dual construction and Primary Motor is in a bad state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000010
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00105
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40427, Data: Word
Lifetime:	Register: 40497, Data: Word
Note:	Refer to TPB #5 Motor Errors – IBstFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm – Primary Induction Fault

Description:	Indicates that a problem exists in the Primary Induction Motor Drive. Since the actuator is not Dual construction, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000020
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00106
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40428, Data: Word
Lifetime:	Register: 40498, Data: Word
Note:	Refer to TPB #5 Motor Errors – PInducFlt for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm – Main Feedback Bad Fault

Description:	Indicates that the actuator's main Feedback is below 2 mA or above 20mA. When constructed without a redundant Feedback or when the redundant Feedback is in a faulted state, flagged as an alarm since no Feedback can be used. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000040
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00107
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40429, Data: Word
Lifetime:	Register: 40499, Data: Word
Note:	Refer to TPB #5 Fault Codes – MFB_Bad for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm – Redundant Feedback Bad Fault

Description:	Indicates that the actuator's redundant Feedback is below 2 mA or above 20mA. When the main Feedback is also in a faulted state, flagged as an alarm since no Feedback can be used. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000000080
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00108
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40430, Data: Word
Lifetime:	Register: 40500, Data: Word
Note:	Refer to TPB #5 Fault Codes – Rdnt_FB bad for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm – Control Signal Bad Fault

Description:	Indicates that the analog Control Signal is below 2.5 mA or that communications has been lost between the CPU Board and the Modbus Board. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000000100
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00109
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40431, Data: Word
Lifetime:	Register: 40501, Data: Word
Note:	Refer to TPB #5 Fault Codes – Analog CS Bad for details on the fault and how it is cleared or if Netwrk control see the Fault Codes section of this TPB for equivalent details. Refer to Section 6.7 for Fault counter details.

Alarm – Stall Fault

Description:	Indicates that after five attempts the actuator was unable to move 0.1% of stroke within 5 seconds. (Total time of 25 seconds). Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000000200
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00110
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40432, Data: Word
Lifetime:	Register: 40502, Data: Word
Note:	Refer to TPB #5 Fault Codes – Stall for details on the fault and how it is cleared and Section 6.7 for Fault counter details

Alarm – Direction Error Fault

Description:	Indicates that the actuator was detected moving in the wrong direction. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000000400
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00111
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40433, Data: Word
Lifetime:	Register: 40503, Data: Word
Note:	Refer to TPB #5 Fault Codes – Dir Error for details on the fault and how it is cleared and Section 6.7 for Fault counter details

Alarm – Seat Load Cylinder Feedback Bad Fault

Description:	Indicates that the Feedback signal from the Seat Load Cylinder is below 2 mA. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000001000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00113
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40442, Data: Word
Lifetime:	Register: 40512, Data: Word
Note:	Refer to TPB #5 Fault Codes – SLC Fb_Bad for details on the fault and how it is cleared and Section 6.7 for Fault counter details

Alarm – Output (Delta) Alarm Fault

Description:	Indicates that delta pressure exceeded the Delta Alarm parameter limit. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40018 to 40021
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000002000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00114
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40447, Data: Word
Lifetime:	Register: 40517, Data: Word
Note:	Refer to TPB #5 Fault Codes – Delta Alarm for details on the fault and how it is cleared and Section 6.7 for Fault counter details

Alarm – Primary Servo Replace Motor Fault

Description:	Indicates that the Primary Servo Motor should be replaced. When the actuator is not in Dual construction or the Dual motor is in bad state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000008000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00116
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40453, Data: Word
Lifetime:	Register: 40523, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Alarm – Primary Servo Resolver Fault

Description:	Indicates that the Primary Servo Motor Resolver cable has a short or an open. Since the actuator is not Dual construction or the Dual motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000020000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00118
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40455, Data: Word
Lifetime:	Register: 40525, Data: Word
Note:	Refer to TPB #5 Fault Codes – PResCable for details on the fault and how it is cleared and Section 6.7 for Fault counter details

Alarm – Primary Servo High Voltage Fault

Description:	Indicates that the Primary Servo Motor input voltage is above the rated input. Since the actuator is not a Dual construction or the Dual motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000080000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00120
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40457, Data: Word
Lifetime:	Register: 40527, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Alarm – Primary Servo Overspeed Fault

Description:	Indicates that the Primary Servo Motor speed is too high. Since the actuator is not a Dual construction or the Dual motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000100000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00121
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40458, Data: Word
Lifetime:	Register: 40528, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Alarm – Primary Servo Motor Short Fault

Description:	Indicates that the Primary Servo Motor has a short. Since the actuator is not a Dual construction or the Dual motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000000200000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00122
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40459, Data: Word
Lifetime:	Register: 40529, Data: Word
Note:	Refer to TPB #5 Fault Codes – P_MTR-Short for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm – Primary Servo Replace Drive Fault

Description:	Indicates that the Primary Servo Motor Driver has a shorted output. Since the actuator is not a Dual construction or the Dual motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000000400000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00123
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40460, Data: Word
Lifetime:	Register: 40530, Data: Word
Note:	Refer to TPB #5 Fault Codes – P_Replc_DRV for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm – Dual Servo Replace Motor Fault

Description:	Indicates that the Dual Servo Motor should be replaced. Since the Primary motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000001000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00125
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40462, Data: Word
Lifetime:	Register: 40532, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Alarm – Dual Servo Resolver Fault

Description:	Indicates that the Dual Servo Motor Resolver cable has a short or an open. When the Primary motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000004000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00127
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40464, Data: Word
Lifetime:	Register: 40534, Data: Word
Note:	Refer to TPB #5 Fault Codes – DResCable for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm – Dual Servo High Voltage Fault

Description:	Indicates that the Dual Servo Motor input voltage is above the rated input. When the Primary motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000010000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00129
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40466, Data: Word
Lifetime:	Register: 40536, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Alarm – Dual Servo Overspeed Fault

Description:	Indicates that the Dual Servo Motor speed is too high. When the Primary motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000020000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00130
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40467, Data: Word
Lifetime:	Register: 40537, Data: Word
Note:	Refer to Section 6.7 for Fault counter details.

Alarm – Dual Servo Motor Short Fault

Description:	Indicates that the Dual Servo Motor has a short. When the Primary motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000040000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00131
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40468, Data: Word
Lifetime:	Register: 40538, Data: Word
Note:	Refer to TPB #5 Fault Codes – D_MTR-Short for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm – Dual Servo Replace Drive Fault

Description:	Indicates that the Dual Servo Motor Driver has a shorted output. When the Primary motor is in a faulted state, flagged as an alarm since no other motor can be used for positioning. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000080000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00132
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40469, Data: Word
Lifetime:	Register: 40539, Data: Word
Note:	Refer to TPB #5 Fault Codes – D_Replc_DRV for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm – Plus 15V Fault

Description:	Indicates that the (+)15-volt power supply is out of range if it exceeds a $\pm 10\%$ error band. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x0000000010000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00133
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40434, Data: Word
Lifetime:	Register: 40504, Data: Word
Note:	Refer to TPB #5 Fault Codes – +15Bad for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

Alarm – Neg 5V Fault

Description:	Indicates that the (-) 5-volt power supply is out of range if it exceeds a $\pm 10\%$ error band. Data can be derived from either the holding register or the coil.
Register Type:	Read
Units:	N/A
Holding Register	
Address:	40022 to 40025
Register Data:	QWord (Bit Mask)
Bit Mask:	0x00000000200000000
Bit Value:	1 (fault active), 0 (fault inactive)
Coil	
Register Data:	bit
Address:	00134
Bit Value:	1 (fault active), 0 (fault inactive)
Counters	
Current:	Register: 40435, Data: Word
Lifetime:	Register: 40505, Data: Word
Note:	Refer to TPB #5 Fault Codes – -5Bad for details on the fault and how it is cleared and Section 6.7 for Fault counter details.

3. LAST 10 FAULT EVENTS

Last (10) Fault Events

Description:	Any fault event that is captured in the “Last Event” register is recorded in one of the (10) Last Fault Event registers.													
Address:	40319 to 40328 (#1 to #10)													
Register Data:	Word (enumeration)													
Register Type:	Read													
Units:	N/A													
Note:	Once the 10 th register has been filled the 1 st register will be overwritten with any new fault event data.													
Enumeration Table:	Refer to the Last Event register for enumeration table details.													
Example:	<u>Fault Event Tracking</u> - The following Last Events took place on the actuator in this particular order: 1. Main FB Bad 2. CS Bad 3. PSrvo Fault The last (10) fault event registers would be populated as follows: <table border="1"> <thead> <tr> <th>Fault Event Register</th><th>#1 40319</th><th>#2 40320</th><th>#3 40321</th><th>#4 - #10 40322 - 40328</th></tr> </thead> <tbody> <tr> <td>Definition</td><td>MAIN_FB_BAD</td><td>CS BAD EVENT</td><td>PSrvo Fault</td><td>Will populate</td></tr> </tbody> </table>				Fault Event Register	#1 40319	#2 40320	#3 40321	#4 - #10 40322 - 40328	Definition	MAIN_FB_BAD	CS BAD EVENT	PSrvo Fault	Will populate
Fault Event Register	#1 40319	#2 40320	#3 40321	#4 - #10 40322 - 40328										
Definition	MAIN_FB_BAD	CS BAD EVENT	PSrvo Fault	Will populate										

**Last (10) Fault Events**

		EVENT		Event	once fault occurs
	Hex Value	0x0b	0x0d	0x01	0x00

Last (10) Fault Event Time Stamps

Description:	Any fault event that is captured in the Last (10) Fault Event registers the time stamp for when that event occurs is recorded in the corresponding Fault Event Time Stamp register. The series of (4) registers each containing 2 Bytes combine to derive the Epoch time stamp.																																
Address(es):	40329 to 40368 (Distributed as follows: #1 - 40329 to 40332, *****, #10 – 40365 to 40368)																																
Register Data:	QWord																																
Register Type:	Read																																
Units:	Epoch (Hex)																																
Note:	Once the 10 th register has been filled the 1 st register will be overwritten with any new fault event time stamp data.																																
Example:	<u><i>Fault Event Time Stamps</i></u> - The following Last Events took place on the actuator in this particular order: 1. Main FB Bad, Time – 11/3/25 @ 8:00:00 (8:00 AM) 2. CS Bad, Time – 11/10/25 @ 13:30:00 (1:30 PM) 3. PSrvo Fault – 11/17/25 @ 9:15:00 (9:15 AM) The last (10) fault event registers and time stamps would be populated as follows: <table><tr><th>Event #</th><th></th><th>Fault Event</th><th>Fault Time Stamp</th></tr><tr><td rowspan="2">1</td><td>Register</td><td>40319</td><td>40329 - 40332</td></tr><tr><td>Value</td><td>0x0b</td><td>0x000000006908a750</td></tr><tr><td rowspan="2">2</td><td>Register</td><td>40320</td><td>40333 - 40336</td></tr><tr><td>Value</td><td>0x0d</td><td>0x0000000069122f28</td></tr><tr><td rowspan="2">3</td><td>Register</td><td>40321</td><td>40337 - 40340</td></tr><tr><td>Value</td><td>0x01</td><td>0x00000000691b2de4</td></tr><tr><td rowspan="2">4 - 10</td><td>Register</td><td>40322 - 40328</td><td>40341 - 40368</td></tr><tr><td>Value</td><td>0x00</td><td>0x0000000000000000</td></tr></table>	Event #		Fault Event	Fault Time Stamp	1	Register	40319	40329 - 40332	Value	0x0b	0x000000006908a750	2	Register	40320	40333 - 40336	Value	0x0d	0x0000000069122f28	3	Register	40321	40337 - 40340	Value	0x01	0x00000000691b2de4	4 - 10	Register	40322 - 40328	40341 - 40368	Value	0x00	0x0000000000000000
Event #		Fault Event	Fault Time Stamp																														
1	Register	40319	40329 - 40332																														
	Value	0x0b	0x000000006908a750																														
2	Register	40320	40333 - 40336																														
	Value	0x0d	0x0000000069122f28																														
3	Register	40321	40337 - 40340																														
	Value	0x01	0x00000000691b2de4																														
4 - 10	Register	40322 - 40328	40341 - 40368																														
	Value	0x00	0x0000000000000000																														

4. PREDICTIVE DIAGNOSTICS

Max Torque / Thrust Per Poll

Description:	Torque / Thrust data is updated at the rate defined in the Poll Rate parameter. A series of (2) registers each containing 2 Bytes of the 32 bit value representing the maximum actuator torque or thrust output force. When both registers are combined the max actuator torque or thrust can be determined. As the actuator moves this value will be updated with any reading that is greater than the current value.
Address:	40028 to 40029
Register Data:	DWord (Signed)
Register Type:	Read
Units:	lbf or in'lbs
Note:	Only applicable for actuators with differential pressure sensors equipped.

Min Torque / Thrust Per Poll

Description:	Torque / Thrust data is updated at the rate defined in the Poll Rate parameter. A series of (2) registers each containing 2 Bytes of the 32 bit value representing the minimum actuator torque or thrust output force. When both registers are combined the min actuator torque or thrust can be determined. As the actuator moves this value will be updated with any reading that is less than the current value.
Address:	40030 to 40031
Register Data:	DWord (Signed)
Register Type:	Read
Units:	lbf or in'lbs
Note:	Only applicable for actuators with differential pressure sensors equipped.

Current Strokes 1K

Description:	Counter that tracks the number of times the actuator has completed a full stroke. One full stroke is defined as travelling from the fully open, to fully closed and back to the fully open position (or vice versa).
Address:	40559 to 40560
Register Data:	DWord
Register Type:	Read
Units:	counts
Note:	Counter restarts to 0 after an actuator power cycle or if manually cleared, but the count is maintained in the Lifetime counters. The value is x1000 the current count. (Ex. Current Stokes 1k = 10, actual strokes = 10x1000 = 10,000 strokes) Refer to Section 6.7 for information on the Current Stats counters, section 7.0 for Maintenance recommendations.

Lifetime Strokes 1K

Description:	Counter that tracks the number of times the actuator has completed a full stroke since the actuator has been in operation or since its last maintenance cycle. One full stroke is defined as travelling from the fully open, to fully closed and back to the fully open position (or vice versa).
Address:	40561 to 40562
Register Data:	DWord
Register Type:	Read
Units:	counts
Note:	Counter only restarts if it is manually cleared via the display. The value is x1000 the current count. (Ex. Lifetime Stokes 1k = 10, actual strokes = 10x1000 = 10,000 strokes) Refer to Section 6.7 for information on the Historic Stats counters, Section 7.0 for Maintenance recommendations.

Current Starts 1K

Description:	Counter that tracks each time the primary positioning motor turns on.
Address:	40563 to 40564
Register Data:	DWord
Register Type:	Read
Units:	counts
Note:	Counter restarts to 0 after a actuator power cycle or if manually cleared, but the count is maintained in the Lifetime counters. The value is x1000 the current count. (Ex. Current Starts 1k = 10, actual starts = 10x1000 = 10,000 strokes) Refer to Section 6.7 for information on the Current Stats counters, Section 7.0 for Maintenance recommendations.

Lifetime Starts 1K

Description:	Counter that tracks each time the primary positioning motor turns on since the actuator has been in operation or since its last maintenance cycle.
Address:	40565 to 40566
Register Data:	DWord
Register Type:	Read
Units:	counts
Note:	Counter only restarts if it is manually cleared via the display. The value is x1000 the current count. (Ex. Lifetime Starts 1k = 10, actual starts = 10x1000 = 10,000 strokes) Refer to Section 6.7 for information on the Historic Stats counters, Section 7.0 for Maintenance recommendations.

Up Counter

Description:	Counter that increments each second to provide positive indication that communication is still active.
Address:	40567
Register Data:	Unsigned 16 bit
Register Type:	Read
Units:	Time (sec)
Note:	Once the maximum count (65535 sec) has been reached the counter will reset back to 0 and continue incrementing.

Current Booster Starts 1K

Description:	Counter that tracks each time the booster motor turns on.
Address:	40578 to 40579
Register Data:	DWord
Register Type:	Read
Units:	counts
Note:	Only applicable for actuators with Booster motors. Counter restarts to 0 after a actuator power cycle or if manually cleared and this count is not maintained in the Lifetime counters. The value is x1000 the current count. (Ex. Current Booster Starts 1k = 10, actual booster starts = 10x1000 = 10,000 strokes) Refer to Section 6.7 for information on the Current Stats counters, Section 7.0 for Maintenance recommendations.

Current Online Recharge Starts 1K

Description:	Counter that tracks each time the online recharge motor turns on.
Address:	40580 to 40581
Register Data:	DWord
Register Type:	Read
Units:	counts
Note:	Only applicable for actuators with Online Recharge motors. Counter restarts to 0 after a actuator power cycle or if manually cleared and this count is not maintained in the Lifetime counters. The value is x1000 the current count. (Ex. Current Booster Starts 1k = 10, actual booster starts = 10x1000 = 10,000 strokes) Refer to Section 6.7 for information on the Current Stats counters, Section 7.0 for Maintenance recommendations.

5. ACTUATOR SETTINGS

Position Lo

Description:	Parameter that defines the actuator position corresponding to the Signal Lo setting as interpreted by the main Feedback. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the current actuator position. When both registers are combined the Position Lo setting can be determined.
Address:	40118 to 40119
Register Data:	Real
Register Type:	Read
Units:	0.00% to 100.00%
Note:	This setting can only be updated through the CALIBRATE Menu in the display. Refer to Sections 6.1 & 6.2 of the X3 IOM for details pertaining to setting parameter.

Position Hi

Description:	Parameter that defines the actuator position corresponding to the Signal Hi setting as interpreted by the main Feedback. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the current actuator position. When both registers are combined the Position Hi setting can be determined.
Address:	40120 to 40121
Register Data:	Real
Register Type:	Read
Units:	0.00% to 100.00%
Note:	This setting can only be updated through the CALIBRATE Menu in the display. Refer to Sections 6.1 & 6.2 of the X3 IOM for details pertaining to setting parameter.

Redundant Position Lo

Description:	Parameter that defines the actuator position corresponding to the Signal Lo setting as interpreted by the redundant Feedback (if constructed with one). Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the current actuator position. When both registers are combined the Redundant Position Lo setting can be determined.
Address:	40122 to 40123
Register Data:	Real
Register Type:	Read
Units:	0.00% to 100.00%
Note:	This setting can only be updated through the CALIBRATE Menu in the display. Refer to Sections 6.1 & 6.2 of the X3 IOM for details pertaining to setting parameter.

Redundant Position Hi

Description:	Parameter that defines the actuator position corresponding to the Signal Hi setting as interpreted by the redundant Feedback (if constructed with one). Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the current actuator position. When both registers are combined the Redundant Position Hi setting can be determined.
Address(es):	40124 to 40125
Register Data:	Real
Register Type:	Read
Units:	0.00% to 100.00%
Note:	This setting can only be updated through the CALIBRATE Menu in the display. Refer to Sections 6.1 & 6.2 of the X3 IOM for details pertaining to setting parameter.

Signal Lo

Description:	Parameter that defines the analog input signal that corresponds to Position Lo. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing Signal Lo. When both registers are combined the Signal Lo setting can be determined.
Address(es):	40126 to 40127
Register Data:	Real
Register Type:	Read
Units:	0.0 mA to 21.1 mA
Note:	This setting can only be updated through the CALIBRATE Menu in the display. Refer to Sections 6.1 & 6.2 of the X3 IOM for details pertaining to setting parameter.

Signal Hi

Description:	Parameter that defines the analog input signal that corresponds to Position Hi. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing Signal Hi. When both registers are combined the Signal Hi setting can be determined.
Address(es):	40128 to 40129
Register Data:	Real
Register Type:	Read
Units:	3.9 mA to 25.0 mA
Note:	This setting can only be updated through the CALIBRATE Menu in the display. Refer to Sections 6.1 & 6.2 of the X3 IOM for details pertaining to setting parameter.

Fail-Safe Position

Description:	Parameter that defines the position the actuator is moved to, via the motor, if the analog control signal falls below 2.5 mA. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing Failsafe Position. When both registers are combined the Failsafe Position setting can be determined.
Address(es):	40130 to 40131
Register Data:	Real
Register Type:	Read
Units:	0.0% to 100.0%
Note:	Failsafe Position is only valid when Register 40181 (Failsafe Position Enabled) is True. This setting can only be updated through the INPUTS Menu in the display with parameter: Failsafe. Refer to Sections 6.1 & 6.4 of the X3 IOM for details pertaining to setting parameter.

Min. Mod. Position

Description:	Parameter that defines the position value in the stroke/rotation below which the actuator will move to Position Lo. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing Min. Mod. Position. When both registers are combined the Min. Mod. Position setting can be determined.
Address(es):	40132 to 40133
Register Data:	Real
Register Type:	Read
Units:	0.1% to 99.9%
Note:	Min. Mod. Position is only valid when Register 40184 (Min. Mod. Enabled) is True. This setting can only be updated through the CONTROL Menu in the display with parameter: Min Mod. Refer to Sections 6.1 & 6.2.1 of the X3 IOM for details pertaining to setting parameter.

Calibrated Stroke

Description:	Parameter that defines the valve/driven device stroke so the actuator can determine when to open the fail-safe solenoid and allow the spring or accumulator to seat the valve. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the stroke. When both registers are combined the Calibrated Stroke setting can be determined.
Address(es):	40134 to 40135
Register Data:	Real
Register Type:	Read
Units:	0.3 inches to 99.9 inches
Note:	Calibrated Stroke is only valid when Register 40185 (Solenoid Seating Enabled) is True. This setting can only be updated through the CONTROL Menu in the display. Refer to Sections 6.1 & 6.2.1 of the X3 IOM for details



Calibrated Stroke

pertaining to setting parameter.

Booster Offpt

Description:	Parameter that defines the deviation between current position and control signal for the booster pump to turn off or on. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the deviation. When both registers are combined the Booster Offpoint setting can be determined.
Address(es):	40136 to 40137
Register Data:	Real
Register Type:	Read
Units:	0.1% to 75.0%
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

Deadband

Description:	Parameter that defines the maximum deviation allowed between the input signal and actuator position before a corrective movement is made. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the deviation. When both registers are combined the Deadband setting can be determined.
Address(es):	40138 to 40139
Register Data:	Real
Register Type:	Read
Units:	0.05% to 5.00%
Note:	This setting can only be updated through the CONTROL Menu in the display. Refer to Sections 6.1 & 6.2.1 of the X3 IOM for details pertaining to setting parameter.

Speed Breakpoint

Description:	Parameter that defines a break point to determine when to use Max Lo Spd or Max Hi Spd. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the break point. When both registers are combined the Speed Breakpoint setting can be determined.
Address(es):	40142 to 40143
Register Data:	Real
Register Type:	Read
Units:	0.1% to 99.9%
Note:	Speed Breakpoint is only valid when Register 40193 (Two Speed Breakpoint Mode) is True. This setting can only be updated through the SPEED Menu in the display. Refer to Sections 6.1 & 6.3 of the X3 IOM for details pertaining to setting parameter.

Surge Offpoint

Description:	Parameter that defines the distance away from the new target position in which the surge solenoid is reenergized during a surge event – effectively stopping the actuator movement. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the distance. When both registers are combined the Surge Offpoint setting can be determined.
Address(es):	40144 to 40145
Register Data:	Real
Register Type:	Read
Units:	0.1% to 94.9%
Note:	Surge Offpoint is only valid when Register 40194 (Surge Enabled) is True. This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

Relay #1

Description:	Parameter that defines the point in % of position at which Relay Output #1 is active. The relay will be active when the actuator position is = or < the value set in Relay #1. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the position. When both registers are combined the Relay #1 setting can be determined.
Address(es):	40146 to 40147
Register Data:	Real
Register Type:	Read
Units:	0.1% to 99.9%
Note:	This setting can only be updated through the OUTPUTS Menu in the display. Refer to Sections 6.1 & 6.6 of the X3 IOM for details pertaining to setting parameter and TPB #4 for details on Electronic Relays.

Relay #2

Description:	Parameter that defines the point in % of position at which Relay Output #2 is active. The relay will be active when the actuator position is = or > the value set in Relay #2. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the position. When both registers are combined the Relay #2 setting can be determined.
Address(es):	40148 to 40149
Register Data:	Real
Register Type:	Read
Units:	0.1% to 99.9%
Note:	This setting can only be updated through the OUTPUTS Menu in the display. Refer to Sections 6.1 & 6.6 of the X3 IOM for details pertaining to setting parameter and TPB #4 for details on Electronic Relays.

PST Increment

Description:	Parameter that defines the percentage change that will be subtracted from PST Target after every run. This will continue on each PST routine until PST Target is at PST Max Target. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the change. When both registers are combined the PST Increment setting can be determined.
Address(es):	40150 to 40151
Register Data:	Real
Register Type:	Read
Units:	0.0% to 1.0%
Note:	PST Increment is only valid when one of: Register 40202 (PST Mode Contact Power), Register 40203 (PST Mode Signal Deviation), Register 40204 (PST Mode Scheduled/Auto), or Register 40205 (PST Mode Contact Unpowered) is True. This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

PST Large Increment

Description:	Parameter that defines the percentage change that will be subtracted from PST Target after every run. This will continue on each PST routine until PST Target is at PST Max Target. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the change. When both registers are combined the PST Large Increment setting can be determined.
Address(es):	40152 to 40153
Register Data:	Real
Register Type:	Read
Units:	0.0% to 1.0%
Note:	PST Large Increment is only valid when one of: Register 40202 (PST Mode Contact Power), Register 40203 (PST Mode Signal Deviation), Register 40204 (PST Mode Scheduled/Auto), or Register 40205 (PST Mode Contact Unpowered) is True. This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

PST Signal Deviation

Description:	Parameter that defines the deviation in position from 100% at which PST will initiate. To initiate, must start from 100% position and set the analog control signal to 100% minus the deviation. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the deviation. When both registers are combined the PST Signal Deviation setting can be determined.
Address(es):	40154 to 40155
Register Data:	Real
Register Type:	Read
Units:	0.5% to 50.0%

Note:	PST Signal Deviation is only valid when register 40203 (PST Mode Signal Deviation) is True. This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter and Appendix X for details on converting from a 32bit float.
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PST Offpoint

Description:	Parameter that defines the deviation from PST Target at which the solenoid deactivates. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the deviation. When both registers are combined the PST Offpoint setting can be determined.
Address(es):	40156 to 40157
Register Data:	Real
Register Type:	Read
Units:	50.2% to 95.1%
Note:	PST Offpoint is only valid when one of: Register 40202 (PST Mode Contact Power), Register 40203 (PST Mode Signal Deviation), Register 40204 (PST Mode Scheduled/Auto), or Register 40205 (PST Mode Contact Unpowered) is True. This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

PST Target

Description:	Parameter that defines the target that is trying to be reached during a PST routine. When the target is hit, the actuator will modulate back to 100% position. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the target. When both registers are combined the PST Target setting can be determined.
Address(es):	40158 to 40159
Register Data:	Real
Register Type:	Read
Units:	50.1% to 95.0%
Note:	PST Offpoint is only valid when one of: Register 40202 (PST Mode Contact Power), Register 40203 (PST Mode Signal Deviation), Register 40204 (PST Mode Scheduled/Auto), or Register 40205 (PST Mode Contact Unpowered) is True. This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

PST Max Target

Description:	Parameter that defines the target that is trying to be reached when PST Increment is set. After every PST routine, PST Target is subtracted by PST Increment until PST Max Target is reached. Consists of a series of (2) registers each containing 2 Bytes of the Floating point value representing the target. When both registers are combined the PST Max Target setting can be determined.
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Address(es):	40160 to 40161
Register Data:	Real
Register Type:	Read
Units:	50.1% to 90.0%
Note:	PST Max Target is only valid when one of: Register 40202 (PST Mode Contact Power), Register 40203 (PST Mode Signal Deviation), Register 40204 (PST Mode Scheduled/Auto), or Register 40205 (PST Mode Contact Unpowered) is True. This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

Transmitter Low

Description:	Contains 16 bit value that represents the calibrated low A/D setting for the analog 4-20mA position transmitter output.
Address(es):	40162
Register Data:	Word
Register Type:	Read
Units:	4 to 1200 counts
Note:	This setting can only be updated through the OUTPUTS Menu in the display. Refer to Sections 6.1 & 6.6 of the X3 IOM for details pertaining to setting parameter.

Transmitter High

Description:	Contains 16 bit value that represents the calibrated high A/D setting for the analog 4-20mA position transmitter output.
Address(es):	40163
Register Data:	Word
Register Type:	Read
Units:	63000 to 65000 counts
Note:	This setting can only be updated through the OUTPUTS Menu in the display. Refer to Sections 6.1 & 6.6 of the X3 IOM for details pertaining to setting parameter.

Recharge Time

Description:	Contains 16 bit value that represents the maximum time allowed for a recharge cycle to complete, after which, the actuator resumes tracking the control signal.
Address(es):	40164
Register Data:	Word
Register Type:	Read
Units:	10 seconds to 2500 seconds
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.



Warning Pressure

Description:	Contains 16 bit value that represents the pressure at which an accumulator low pressure warning is issued.
Address(es):	40165
Register Data:	Word
Register Type:	Read
Units:	1000 psi to 2800 psi
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

Recharge Pressure

Description:	Contains 16 bit value that represents the pressure level at which an accumulator recharge cycle will end.
Address(es):	40166
Register Data:	Word
Register Type:	Read
Units:	1200 psi to 3000 psi
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

Gain

Description:	Contains 16 bit value that determines how motor speed is adjusted as the actuator approaches the target position. The higher the setting, the closer the actuator will get to the target position before decelerating.
Address(es):	40167
Register Data:	Word
Register Type:	Read
Units:	1 to 999
Note:	This setting can only be updated through the CONTROL Menu in the display. Refer to Sections 6.1 & 6.2.1 of the X3 IOM for details pertaining to setting parameter.

Max Down Speed

Description:	Contains 16 bit value that represents the maximum motor speed when moving toward Position Lo.
Address(es):	40168
Register Data:	Word
Register Type:	Read
Units:	5% to 125%
Note:	Max Down Speed is only valid when Register 40192 (Two Speed Up/Down Mode) is True. This setting can only be updated through the SPEED Menu in the display. Refer to Sections 6.1 & 6.3 of the X3 IOM for details pertaining to setting parameter.



Max Up Speed

Description:	Contains 16 bit value that represents the maximum motor speed when moving toward Position Hi.
Address(es):	40169
Register Data:	Word
Register Type:	Read
Units:	5% to 125%
Note:	Max Up Speed is only valid when Register 40192 (Two Speed Up/Down Mode) is True. This setting can only be updated through the SPEED Menu in the display. Refer to Sections 6.1 & 6.3 of the X3 IOM for details pertaining to setting parameter.

Max Manual Speed

Description:	Contains 16 bit value that represents the maximum motor speed when operating in SETUP mode or LOCAL MANUAL mode.
Address(es):	40170
Register Data:	Word
Register Type:	Read
Units:	5% to 125%
Note:	This setting can only be updated through the SPEED Menu in the display. Refer to Sections 6.1 & 6.3 of the X3 IOM for details pertaining to setting parameter.

Delta Alarm

Description:	Contains 16 bit value that represents the point that if pressure exceeds, the actuator gets into an alarm state. When Delta Alarm is active, the actuator can only move in the direction that relieves the alarm pressure.
Address(es):	40171
Register Data:	Word
Register Type:	Read
Units:	600 psi to 3000 psi
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

Delta Warn

Description:	Contains 16 bit value that represents the point that if pressure exceeds, the actuator gets into a warning state. When Delta Alarm is active, the actuator can modulate normally.
Address(es):	40172
Register Data:	Word
Register Type:	Read
Units:	500 psi to 2900 psi
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

PST Schedule Time

Description:	Contains 16 bit value that represents the schedule in which a PST routine will run automatically.
Address(es):	40173
Register Data:	Word
Register Type:	Read
Units:	24 hours to 999 hours
Note:	This setting can only be updated through the DRIVES Menu in the display with parameter: PST AutoTm. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

PST Max Runtime

Description:	Contains 16 bit value that represents the maximum time that a PST routine will run before getting Invalid_PST.
Address(es):	40174
Register Data:	Word
Register Type:	Read
Units:	24 hours to 999 hours
Note:	This setting can only be updated through the DRIVES Menu in the display with parameter: PST Time. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

Trip Mode

Description:	When an activation signal is received, the actuator will move to a fail-safe end via the spring or accumulator. The hex enumeration value indicates the activation process of the Trip event.																							
Address:	40175																							
Register Data:	Word (enumeration)																							
Register Type:	Read																							
Units:	N/A																							
Note:	Refer to TPB #8.0 for safety details and Section 6.4 for details pertaining to setting parameters.																							
Enumeration Table:	<table><tr><th>Trip Type</th><th>Description</th><th>Value</th></tr><tr><td>TRIP_OFF</td><td>Trip not configured.</td><td>0x00</td></tr><tr><td>TRIP_UNPOWERED_SOL</td><td>Solenoid Trip activated when there is no power at Trip Input.</td><td>0x01</td></tr><tr><td>TRIP_POWERED_SOL</td><td>Solenoid Trip activated when there is power at Trip Input.</td><td>0x02</td></tr><tr><td>TRIP_UNPOWERED_MOTOR_PL</td><td>Motor Trip activated and runs to Position Lo when there is no power at Trip Input.</td><td>0x03</td></tr><tr><td>TRIP_POWERED_MOTOR_PL</td><td>Motor Trip activated and runs to Position Lo when there is power at Trip Input.</td><td>0x04</td></tr><tr><td>TRIP_UNPOWERED_MOTOR_PH</td><td>Motor Trip activated and runs</td><td>0x05</td></tr></table>			Trip Type	Description	Value	TRIP_OFF	Trip not configured.	0x00	TRIP_UNPOWERED_SOL	Solenoid Trip activated when there is no power at Trip Input.	0x01	TRIP_POWERED_SOL	Solenoid Trip activated when there is power at Trip Input.	0x02	TRIP_UNPOWERED_MOTOR_PL	Motor Trip activated and runs to Position Lo when there is no power at Trip Input.	0x03	TRIP_POWERED_MOTOR_PL	Motor Trip activated and runs to Position Lo when there is power at Trip Input.	0x04	TRIP_UNPOWERED_MOTOR_PH	Motor Trip activated and runs	0x05
Trip Type	Description	Value																						
TRIP_OFF	Trip not configured.	0x00																						
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TRIP_POWERED_MOTOR_PL	Motor Trip activated and runs to Position Lo when there is power at Trip Input.	0x04																						
TRIP_UNPOWERED_MOTOR_PH	Motor Trip activated and runs	0x05																						

		to Position Hi when there is no power at Trip Input.	
TRIP_POWERED_MOTOR_PH		Motor Trip activated and runs to Position Lo when there is power at Trip Input.	0x06

Signal Type

Description:	Group of mutually exclusive Booleans that defines the control signal the actuator will respond to in AUTO mode.
Address:	40176 (Boolean) to 40178 (Boolean)
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the INPUTS Menu in the display. Refer to Sections 6.1 & 6.4 of the X3 IOM for details pertaining to setting parameter.

Enumeration Table:

Register	Bit Values			
40176: Analog CS Enabled	0	0	0	1
40177: One-Contact Enabled	0	0	1	0
40178: Two-Contact Enabled	0	1	0	0
Signal Type Mode	NetWrk	One-Contact	Two-Contact	Analog

Power-up Mode

Description:	Group of mutually exclusive Booleans that defines the mode the electronic control enclosure will be in when the main power is applied.
Address:	40179 (Boolean) to 40180 (Boolean)
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the INPUTS Menu in the display. Refer to Sections 6.1 & 6.4 of the X3 IOM for details pertaining to setting parameter.

Enumeration Table:

Register	Bit Values	
40179: Power-up Last Enabled	1	0
40180: Power-up Local Enabled	0	1
Power-Up Mode	Last	Local

Fail-Safe Mode

Description:	Group of mutually exclusive Booleans that defines the position the actuator moved to, via the motor, if the analog control signal falls below 2.5 mA.																		
Address:	40181 (Boolean) to 40182 (Boolean)																		
Register Data:	Boolean																		
Register Type:	Read																		
Units:	0 (False) or 1 (True)																		
Note:	This setting can only be updated through the INPUTS Menu in the display. Refer to Sections 6.1 & 6.4 of the X3 IOM for details pertaining to setting parameter.																		
Enumeration Table:	<table border="1"> <thead> <tr> <th>Register</th><th colspan="3">Bit Values</th></tr> </thead> <tbody> <tr> <td>40181: Failsafe Position Enabled</td><td>0</td><td>1</td><td>0</td></tr> <tr> <td>40182: Failsafe In-Place Enabled</td><td>0</td><td>0</td><td>1</td></tr> <tr> <td>Failsafe Mode</td><td>Off</td><td>Position</td><td>In-Place</td></tr> </tbody> </table>			Register	Bit Values			40181: Failsafe Position Enabled	0	1	0	40182: Failsafe In-Place Enabled	0	0	1	Failsafe Mode	Off	Position	In-Place
Register	Bit Values																		
40181: Failsafe Position Enabled	0	1	0																
40182: Failsafe In-Place Enabled	0	0	1																
Failsafe Mode	Off	Position	In-Place																

Bumpless Transfer

Description:	Boolean that defines whether a safeguard to prevent unwanted actuator movement when returning from MANUAL or SETUP mode into AUTO mode is in place. If deviation is greater than Deadband when going to AUTO mode with Bumpless Transfer, the mode will be Auto-BT and the actuator will not modulate unless the analog control signal is within Deadband.
Address:	40183
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the CONTROL Menu in the display. Refer to Sections 6.1 & 6.2.1 of the X3 IOM for details pertaining to setting parameter.

Min. Mod.

Description:	Boolean that defines whether there is a position (Min. Mod. Position) in the stroke/rotation below which the actuator will move to Position Lo.
Address:	40184
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the CONTROL Menu in the display. Refer to Sections 6.1 & 6.2.1 of the X3 IOM for details pertaining to setting parameter.

Solenoid Seating

Description:	Boolean that defines whether the software is being used to allow the stored energy of the fail-safe spring or accumulator (if equipped) to seat the valve. This feature is only available on fail-safe actuators where the fail-safe direction is the same as the valve seating direction.
Address:	40185
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the CONTROL Menu in the display. Refer to Sections 6.1 & 6.2.1 of the X3 IOM for details pertaining to setting parameter.

Contact Board Present

Description:	Boolean that defines whether there is a Digital Input board on the actuator.
Address:	40186
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	Refer to TPB #15.0 for details on Contact Input Options.

Booster Motor

Description:	Boolean that defines whether there is a Booster Motor on the actuator.
Address:	40187
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	Refer to TPB #5 for details on Booster Faults.

Power Fail Mode

Description:	Group of mutually exclusive Booleans that defines what the accumulator will do on loss of power.
Address:	40188 (Boolean) to 40189 (Boolean)
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter and TPB #17.1 for details on Power Fail Accumulator speed.



Power Fail Mode

Enumeration Table:

Register	Bit	Values
40188: Power Fail Accumulator Mode	1	0
40189: Power Fail In-Place Mode	0	1
Power Fail Mode	Accumulator	In-Place

Recharge Direction

Description:	Group of mutually exclusive Booleans that defines the direction the modulating motor runs toward during a recharge cycle after a trip.
Address:	40190 (Boolean) to 40191 (Boolean)
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

Enumeration Table:

Register	Bit	Values
40190: Recharge Direction PL	1	0
40191: Recharge Direction PH	0	1
Recharge Direction	Position Lo	Position Hi

Two Speed Mode

Description:	Group of mutually exclusive Booleans that defines which mode the actuator is in pertaining to modulating at two different speeds.
Address:	40192 (Boolean) to 40193 (Boolean)
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the SPEED Menu in the display. Refer to Sections 6.1 & 6.3 of the X3 IOM for details pertaining to setting parameter.

Two Speed Mode

Enumeration Table:

Register	Bit Values		
40192: Two Speed Up/Down Mode	0	1	0
40193: Two Speed Breakpoint Mode	0	0	1
Two Speed Mode	Off	Up/Down	Bkpt

Surge Enabled

Description:	Boolean that defines whether Surge is configured on the actuator. When the deviation between current position and target position exceeds the Surge Offpoint, the surge relay output is activated and kept active until the current position matches the current control signal.
Address:	40194
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

Surge Direction

Description:	Group of mutually exclusive Booleans that defines the direction of action that surge operates in.
Address:	40195 (Boolean) to 40197 (Boolean)
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.

Enumeration Table:

Register	Bit Values		
40195: Surge Direction PL	1	0	0
40196: Surge Direction PH	0	1	0
40197: Surge Direction PL/PH	0	0	1
Surge Direction	Position Lo	Position Hi	Both

Midpoint Relay Enabled

Description:	Boolean that defines whether Relay #3 will function as a Midpoint relay or Not_In_Auto relay.
Address:	40198
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	Refer to TPB #4.0 of the X3 IOM for details pertaining to Electronic Relays.

Redundant CPU Mode

Description:	Some REXA actuators are equipped with redundant electronic control enclosures. The hex enumeration value indicates whether the electronics are in this state.																	
Address:	40199																	
Register Data:	Word (enumeration)																	
Register Type:	Read																	
Units:	N/A																	
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.																	
Enumeration Table:	<table><tr><th>CPU Redundancy Mode</th><th>Description</th><th>Value</th></tr><tr><td>CPU_REDUNDANCY_OFF</td><td>Actuator not redundant.</td><td>0x00</td></tr><tr><td>CPU_REDUNDANCY_RESERVED_VALUE</td><td>Reserved value.</td><td>0x01</td></tr><tr><td>CPU_REDUNDANCY_BACKUP_ROLE</td><td>Indicates actuator is the redundant electronics that will control all moves > or = 5% deviation.</td><td>0x02</td></tr><tr><td>CPU_REDUNDANCY_MAIN_ROLE</td><td>Indicates actuator is the main electronics that will control all moves < 5% deviation.</td><td>0x03</td></tr></table>			CPU Redundancy Mode	Description	Value	CPU_REDUNDANCY_OFF	Actuator not redundant.	0x00	CPU_REDUNDANCY_RESERVED_VALUE	Reserved value.	0x01	CPU_REDUNDANCY_BACKUP_ROLE	Indicates actuator is the redundant electronics that will control all moves > or = 5% deviation.	0x02	CPU_REDUNDANCY_MAIN_ROLE	Indicates actuator is the main electronics that will control all moves < 5% deviation.	0x03
CPU Redundancy Mode	Description	Value																
CPU_REDUNDANCY_OFF	Actuator not redundant.	0x00																
CPU_REDUNDANCY_RESERVED_VALUE	Reserved value.	0x01																
CPU_REDUNDANCY_BACKUP_ROLE	Indicates actuator is the redundant electronics that will control all moves > or = 5% deviation.	0x02																
CPU_REDUNDANCY_MAIN_ROLE	Indicates actuator is the main electronics that will control all moves < 5% deviation.	0x03																

Reverse Acting Display

Description:	Boolean that defines whether the position display is in reverse acting with position OPEN and position CLOSED (i.e. 100%=CLOSED instead of 100%=OPEN).
Address:	40200
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the OUTPUTS Menu in the display. Refer to Sections 6.1 & 6.6 of the X3 IOM for details pertaining to setting parameter.

Reverse Acting Transmitter

Description:	Boolean that defines whether the position transmitter is set to reverse acting, in which, a 4 mA output corresponds to Position Hi.
Address:	40201
Register Data:	Boolean
Register Type:	Read
Units:	0 (False) or 1 (True)
Note:	This setting can only be updated through the OUTPUTS Menu in the display. Refer to Sections 6.1 & 6.6 of the X3 IOM for details pertaining to setting parameter.

PST Activation Mode

Description:	Group of mutually exclusive Booleans that defines an actuator's use of partial stroke testing.																																		
Address:	40202 (Boolean) to 40205 (Boolean)																																		
Register Data:	Boolean																																		
Register Type:	Read																																		
Units:	0 (False) or 1 (True)																																		
Note:	This setting can only be updated through the DRIVES Menu in the display. Refer to Sections 6.1 & 6.5 of the X3 IOM for details pertaining to setting parameter.																																		
Enumeration Table:	<table><tr><th>Register</th><th colspan="4">Bit Values</th></tr><tr><td>40202: PST Mode Contact Power</td><td>1</td><td>0</td><td>0</td><td>0</td></tr><tr><td>40203: PST Mode Signal Deviation</td><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>40204: PST Mode Scheduled/Auto</td><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>40205: PST Mode Contact Unpowered</td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>PST Activation Mode</td><td>Contact Power</td><td>Signal Deviation</td><td>Auto Schedule</td><td>Contact Unpowered</td></tr></table>					Register	Bit Values				40202: PST Mode Contact Power	1	0	0	0	40203: PST Mode Signal Deviation	0	1	0	0	40204: PST Mode Scheduled/Auto	0	0	1	0	40205: PST Mode Contact Unpowered	0	0	0	1	PST Activation Mode	Contact Power	Signal Deviation	Auto Schedule	Contact Unpowered
Register	Bit Values																																		
40202: PST Mode Contact Power	1	0	0	0																															
40203: PST Mode Signal Deviation	0	1	0	0																															
40204: PST Mode Scheduled/Auto	0	0	1	0																															
40205: PST Mode Contact Unpowered	0	0	0	1																															
PST Activation Mode	Contact Power	Signal Deviation	Auto Schedule	Contact Unpowered																															

Current Day Current Month Current Year

Description:	Actuator day	Actuator month	Actuator year
Address:	40305	40306	40307
Register Data:	Word	Word	Word
Register Type:	Read	Read	Read
Units:	Day (1 to 31)	Month (1 to 12)	Year (2020 to XXXX)
Note:	Settable via display, Bluetooth GUI or via the Host Write time registers. Refer to Section 6.2 – Date to set via the display.		

	Current Hour	Current Minute	Current Second
Description:	Actuator hour	Actuator Minute	Actuator seconds
Address:	40308	40309	40310
Register Data:	Word	Word	Word
Register Type:	Read	Read	Read
Units:	Hour (0 to 24)	Minute (0 to 59)	Second (0 to 59)
Note:	Settable via display, Bluetooth GUI or via the Host Write time registers. Refer to Section 6.2 – Time to set via the display.		

Commission Day Commission Month Commission Year

Description:	Series of registers that comprise of the date that the actuator was commissioned in the field.		
Address:	40311	40312	40313
Register Data:	Word	Word	Word
Register Type:	Read	Read	Read
Units:	Day (1 to 31)	Month (1 to 12)	Year (2020 to XXXX)
Note:	Settable only via the Bluetooth GUI. Refer to TPB #12.0 Bluetooth Connection tab for the Commission Date field location.		

Actuator Time - Host Write Time

Description:	Series of (4) registers each containing 2 Bytes of the desired Epoch time setting.
Address:	40572 to 40575
Register Data:	QWord
Register Type:	Write
Units:	Epoch (Hex)
Notes:	Setting the date and time via Modbus ensures that the actuator time and network time are in sync. Refer to Section 6.2 – time and date to view via the display.

Actuator Time - Host Write Time

Example:

Updating Actuator Date & Time -

Update the actuator date & time to the following:

Day	Month	Year	Hour	Minute	Seconds
30	5	2024	10	30	00

Converted to Epoch (Hex): 0x0000000066588d68

Register	Description	Value
40572	Host Write Time MS2B	0x0000
40573	Host Write Time next 2B	0x0000
40574	Host Write Time next 2B	0x6658
40575	Host Write Time LS2B	0x8d68

Once the Host Write Time is sent the values in the Date & Time registers (40305 to 40310) and the display will now be updated to reflect these changes.

6. ACTUATOR IDENTIFICATION

Actuator Model Number

Description:	Series of (25) registers each containing one character of the actuator model. When all (25) registers are combined the actuator model can be determined.																																
Address(es):	40206 (Model Character 1) to 40230 (Model Character 25)																																
Register Data:	ASCII																																
Register Type:	Read																																
Units:	N/A																																
Note:	This value is set at the factory and cannot be edited. This information can be found on the actuator tag or the Bluetooth GUI. Refer to Section 1.1 for model number details and TPB #12.0 Bluetooth Connection tab.																																
Example:	<u>Reading Model Number</u> - The current character values stored in this range are as follows: <table><tr><th>Register</th><th>40206</th><th>40207</th><th>40208</th><th>40209</th><th>40210</th><th>40211</th><th>40212</th></tr><tr><td>Value</td><td>X</td><td>3</td><td>L</td><td>2</td><td>0</td><td>0</td><td>0</td></tr></table> <table><tr><th>Register</th><th>40213</th><th>40214</th><th>40215</th><th>40216</th><th>40217</th><th>40218</th><th>40219 - 40230</th></tr><tr><td>Value</td><td>-</td><td>4</td><td>-</td><td>C</td><td>-</td><td>P</td><td>0</td></tr></table> After combining the registers & removing the trailing '0' register values the following model number is derived: X3L2000-4-C-P	Register	40206	40207	40208	40209	40210	40211	40212	Value	X	3	L	2	0	0	0	Register	40213	40214	40215	40216	40217	40218	40219 - 40230	Value	-	4	-	C	-	P	0
Register	40206	40207	40208	40209	40210	40211	40212																										
Value	X	3	L	2	0	0	0																										
Register	40213	40214	40215	40216	40217	40218	40219 - 40230																										
Value	-	4	-	C	-	P	0																										

Actuator Tag Number

Description:	Series of (32) registers each containing one character of the actuator tag number. When all (32) registers are combined the actuator tag number can be determined.																														
Address(es):	40231 (Tag Character 1) to 40262 (Tag Character 32)																														
Register Data:	ASCII																														
Register Type:	Read																														
Units:	N/A																														
Note:	This value is set at the factory and can be edited via the Bluetooth GUI. The Tag is set per customer information provided and if this is not provided this value is set to match the actuator serial number. This information can also be found on the actuator tag. Refer to Section 1.1 for tag number location details and TPB #12.0 Bluetooth Connection tab.																														
Example:	<u>Reading Tag Number</u> - The current character values stored in this range are as follows: <table><tr><td>Register</td><td>40231</td><td>40232</td><td>40233</td><td>40234</td><td>40235</td><td>40236</td><td>40237</td></tr><tr><td>Value</td><td>P</td><td>C</td><td>V</td><td>-</td><td>1</td><td>2</td><td>3</td></tr></table> <table><tr><td>Register</td><td>40238</td><td>40239</td><td>40240</td><td>40241</td><td>40242</td><td>40243 - 40262</td></tr><tr><td>Value</td><td>-</td><td>V</td><td>C</td><td>2</td><td>A</td><td>0</td></tr></table> After combining the registers & removing the trailing '0' register values the following tag number is derived: PCV-123-VC2A	Register	40231	40232	40233	40234	40235	40236	40237	Value	P	C	V	-	1	2	3	Register	40238	40239	40240	40241	40242	40243 - 40262	Value	-	V	C	2	A	0
Register	40231	40232	40233	40234	40235	40236	40237																								
Value	P	C	V	-	1	2	3																								
Register	40238	40239	40240	40241	40242	40243 - 40262																									
Value	-	V	C	2	A	0																									

Actuator Serial Number

Description:	Series of (14) registers each containing one character of the actuator serial number. When all (14) registers are combined the actuator serial number can be determined.																																
Address(es):	40263 (Serial Number Character 1) to 40276 (Serial Number Character 14)																																
Register Data:	ASCII																																
Register Type:	Read																																
Units:	N/A																																
Note:	This value is set at the factory and cannot be edited. This information can be found on the actuator tag or the Bluetooth GUI. Refer to Section 1.1 for serial number details and TPB #12.0 Bluetooth Connection tab.																																
Example:	<u>Reading Serial Number</u> - The current character values stored in this range are as follows: <table><tr><th>Register</th><th>40263</th><th>40264</th><th>40265</th><th>40266</th><th>40267</th><th>40268</th><th>40269</th></tr><tr><td>Value</td><td>C</td><td>2</td><td>5</td><td>0</td><td>1</td><td>2</td><td>3</td></tr></table> <table><tr><th>Register</th><th>40270</th><th>40271</th><th>40272</th><th>40273</th><th>40274</th><th>40275</th><th>40276</th></tr><tr><td>Value</td><td>4</td><td>-</td><td>0</td><td>1</td><td>-</td><td>0</td><td>1</td></tr></table> After combining the registers the following serial number is derived: C2501234-01-01	Register	40263	40264	40265	40266	40267	40268	40269	Value	C	2	5	0	1	2	3	Register	40270	40271	40272	40273	40274	40275	40276	Value	4	-	0	1	-	0	1
Register	40263	40264	40265	40266	40267	40268	40269																										
Value	C	2	5	0	1	2	3																										
Register	40270	40271	40272	40273	40274	40275	40276																										
Value	4	-	0	1	-	0	1																										

CPU Software Version

Description:	Series of (14) registers each containing one character of the CPU software version. When all (14) registers are combined the CPU software version can be determined.																																
Address(es):	40277 (Software Version Character 1) to 40290 (Software Version Character 14)																																
Register Data:	ASCII																																
Register Type:	Read																																
Units:	N/A																																
Note:	This information can be found in the display Setup -> Outputs menu or the Bluetooth GUI. Refer to Section 6.6 for software version details and TPB #12.0 Bluetooth Connection tab.																																
Example:	<u>Reading CPU Software Version</u> - The current character values stored in this range are as follows: <table><tr><th>Register</th><th>40277</th><th>40278</th><th>40279</th><th>40280</th><th>40281</th><th>40282</th><th>40283</th></tr><tr><td>Value</td><td>A</td><td>A</td><td>_</td><td>1</td><td>3</td><td>.</td><td>r</td></tr></table> <table><tr><th>Register</th><th>40284</th><th>40285</th><th>40286</th><th>40287</th><th>40288</th><th>40289</th><th>40290</th></tr><tr><td>Value</td><td>.</td><td>5</td><td>0</td><td>2</td><td>2</td><td>5</td><td>0</td></tr></table> After combining the registers & removing the trailing zero the following CPU software version is derived: AA_13.r.50225	Register	40277	40278	40279	40280	40281	40282	40283	Value	A	A	_	1	3	.	r	Register	40284	40285	40286	40287	40288	40289	40290	Value	.	5	0	2	2	5	0
Register	40277	40278	40279	40280	40281	40282	40283																										
Value	A	A	_	1	3	.	r																										
Register	40284	40285	40286	40287	40288	40289	40290																										
Value	.	5	0	2	2	5	0																										

Display Software Version

Description:	Series of (14) registers each containing one character of the Display software version. When all (14) registers are combined the Display software version can be determined.																																
Address(es):	40291 (Software Version Character 1) to 40304 (Software Version Character 14)																																
Register Data:	ASCII																																
Register Type:	Read																																
Units:	N/A																																
Note:	This information can be found in the display Setup -> Outputs menu or the Bluetooth GUI. Refer to Section 6.6 for software version details and TPB #12.0 Bluetooth Connection tab.																																
Example:	<u>Reading Display Software Version</u> - The current character values stored in this range are as follows: <table><tr><td>Register</td><td>40291</td><td>40292</td><td>40293</td><td>40294</td><td>40295</td><td>40296</td><td>40297</td></tr><tr><td>Value</td><td>A</td><td>A</td><td>_</td><td>0</td><td>4</td><td>.</td><td>0</td></tr></table> <table><tr><td>Register</td><td>40298</td><td>40299</td><td>40300</td><td>40301</td><td>40302</td><td>40303</td><td>40304</td></tr><tr><td>Value</td><td>.</td><td>2</td><td>2</td><td>7</td><td>2</td><td>5</td><td>0</td></tr></table> After combining the registers & removing the trailing zero the following Display software version is derived: AA_04.0.22725	Register	40291	40292	40293	40294	40295	40296	40297	Value	A	A	_	0	4	.	0	Register	40298	40299	40300	40301	40302	40303	40304	Value	.	2	2	7	2	5	0
Register	40291	40292	40293	40294	40295	40296	40297																										
Value	A	A	_	0	4	.	0																										
Register	40298	40299	40300	40301	40302	40303	40304																										
Value	.	2	2	7	2	5	0																										

Rated Rotation or Length

Description:	The rated rotation or length is derived based on the actuator model number and the current calibrated stroke. The series of (2) registers each contain 2 Bytes of the floating point value representing the rated stroke. When both registers are combined the rated rotation or length can be determined.
Address:	40314 to 40315
Register Data:	Real
Register Type:	Read
Units:	Linear: inches, Rotary: degrees
Note:	This value is calculated by the actuator and not user settable. The current value can also be viewed in the Bluetooth GUI. Refer to TPB # 12.0 Calibration for GUI details.

Rated Output

Description:	The rated output is derived from the actuator model number. The series of (2) registers each contain 2 Bytes of the unsigned 32 bit value representing the rated output. When both registers are combined the rated output can be determined.
Address:	40316 to 40317
Register Data:	DWord
Register Type:	Read
Units:	lbf or in'lbs
Note:	Refer to TPB # 12.0 Calibration for GUI details.

Torque or Thrust

Description:	Each different hex enumeration value indicates whether the output force is torque or thrust. The output force type is derived from the actuator model number.											
Address:	40318											
Register Data:	Word											
Register Type:	Read											
Units:	N/A											
Enumeration Table:	<table><tr><th>Force Type</th><th>Description</th><th>Value</th></tr><tr><td>Torque</td><td>Rotary / Drive actuator, output units (lbs/in)</td><td>0x00</td></tr><tr><td>Thrust</td><td>Linear actuator, output units (lbs force)</td><td>0x01</td></tr></table>			Force Type	Description	Value	Torque	Rotary / Drive actuator, output units (lbs/in)	0x00	Thrust	Linear actuator, output units (lbs force)	0x01
Force Type	Description	Value										
Torque	Rotary / Drive actuator, output units (lbs/in)	0x00										
Thrust	Linear actuator, output units (lbs force)	0x01										

**Appendix F – Modbus Table**

Coil Address	Coil Number	Description	Type	Data Type	Definition (Big Endian)	Group
1	0	Primary Servo Fault Warning	Read	Bit	Bit	Warnings & Alarms
2	1	Dual Servo Fault Warning	Read	Bit	Bit	Warnings & Alarms
3	2	Accum Servo Fault Warning	Read	Bit	Bit	Warnings & Alarms
4	3	Booster Servo Fault Warning	Read	Bit	Bit	Warnings & Alarms
5	4	Primary Stepper Fault Warning	Read	Bit	Bit	Warnings & Alarms
6	5	Dual Stepper Fault Warning	Read	Bit	Bit	Warnings & Alarms
7	6	Accum Stepper Fault Warning	Read	Bit	Bit	Warnings & Alarms
8	7	Booster Ind. Fault Warning	Read	Bit	Bit	Warnings & Alarms
9	8	Dual Ind. Fault Warning	Read	Bit	Bit	Warnings & Alarms
10	9	Primary Ind. Fault Warning	Read	Bit	Bit	Warnings & Alarms
11	10	Main Feedback Bad Warning	Read	Bit	Bit	Warnings & Alarms
12	11	Redundant Feedback Bad Warning	Read	Bit	Bit	Warnings & Alarms
13	12	Accum Press Bad Warning	Read	Bit	Bit	Warnings & Alarms
14	13	Accum Press Low Warning	Read	Bit	Bit	Warnings & Alarms
15	14	Open Pressure Bad Warning	Read	Bit	Bit	Warnings & Alarms
16	15	Close Pressure Bad Warning	Read	Bit	Bit	Warnings & Alarms
17	16	Seat Load Cyl. Stop Warning	Read	Bit	Bit	Warnings & Alarms
18	17	AC High Warning	Read	Bit	Bit	Warnings & Alarms
19	18	AC Low Warning	Read	Bit	Bit	Warnings & Alarms
20	19	Output (Delta) Warning	Read	Bit	Bit	Warnings & Alarms
21	20	Clock Battery Low Warning	Read	Bit	Bit	Warnings & Alarms
22	21	Invalid Hardware Warning	Read	Bit	Bit	Warnings & Alarms
23	22	Primary Servo Low Volt Warning	Read	Bit	Bit	Warnings & Alarms
24	23	Primary Servo Mtr Replace Warning	Read	Bit	Bit	Warnings & Alarms
25	24	Primary Servo Mtr Temp. Warning	Read	Bit	Bit	Warnings & Alarms
26	25	Primary Servo Resolver Fault Warning	Read	Bit	Bit	Warnings & Alarms
27	26	Primary Servo Driver Temp. Warning	Read	Bit	Bit	Warnings & Alarms
28	27	Primary Servo Hi Volt Warning	Read	Bit	Bit	Warnings & Alarms
29	28	Primary Servo Overspeed Warning	Read	Bit	Bit	Warnings & Alarms
30	29	Primary Servo Mtr Short Warning	Read	Bit	Bit	Warnings & Alarms
31	30	Primary Servo Driver Replace Warning	Read	Bit	Bit	Warnings & Alarms
32	31	Dual Servo Low Volt Warning	Read	Bit	Bit	Warnings & Alarms
33	32	Dual Servo Mtr Replace Warning	Read	Bit	Bit	Warnings & Alarms
34	33	Dual Servo Mtr Temp. Warning	Read	Bit	Bit	Warnings & Alarms



Coil Address	Coil Number	Description	Type	Data Type	Definition (Big Endian)	Group
35	34	Dual Servo Resolver Fault Warning	Read	Bit	Bit	Warnings & Alarms
36	35	Dual Servo Driver Temp. Warning	Read	Bit	Bit	Warnings & Alarms
37	36	Dual Servo Hi Volt Warning	Read	Bit	Bit	Warnings & Alarms
38	37	Dual Servo Overspeed Warning	Read	Bit	Bit	Warnings & Alarms
39	38	Dual Servo Mtr Short Warning	Read	Bit	Bit	Warnings & Alarms
40	39	Dual Servo Driver Replace Warning	Read	Bit	Bit	Warnings & Alarms
41	40	Accum Servo Low Volt Warning	Read	Bit	Bit	Warnings & Alarms
42	41	Accum Servo Mtr Replace Warning	Read	Bit	Bit	Warnings & Alarms
43	42	Accum Servo Mtr Temp. Warning	Read	Bit	Bit	Warnings & Alarms
44	43	Accum Servo Resolver Fault Warning	Read	Bit	Bit	Warnings & Alarms
45	44	Accum Servo Driver Temp. Warning	Read	Bit	Bit	Warnings & Alarms
46	45	Accum Servo Hi Volt Warning	Read	Bit	Bit	Warnings & Alarms
47	46	Accum Servo Overspeed Warning	Read	Bit	Bit	Warnings & Alarms
48	47	Accum Servo Mtr Short Warning	Read	Bit	Bit	Warnings & Alarms
49	48	Accum Servo Driver Replace Warning	Read	Bit	Bit	Warnings & Alarms
50	49	Booster Servo Low Volt Warning	Read	Bit	Bit	Warnings & Alarms
51	50	Booster Servo Mtr Replace Warning	Read	Bit	Bit	Warnings & Alarms
52	51	Booster Servo Mtr Temp. Warning	Read	Bit	Bit	Warnings & Alarms
53	52	Booster Servo Resolver Fault Warning	Read	Bit	Bit	Warnings & Alarms
54	53	Booster Servo Driver Temp. Warning	Read	Bit	Bit	Warnings & Alarms
55	54	Booster Servo Hi Volt Warning	Read	Bit	Bit	Warnings & Alarms
56	55	Booster Servo Overspeed Warning	Read	Bit	Bit	Warnings & Alarms
57	56	Booster Servo Mtr Short Warning	Read	Bit	Bit	Warnings & Alarms
58	57	Booster Servo Driver Replace Warning	Read	Bit	Bit	Warnings & Alarms
59	58	Comm Loss Warning	Read	Bit	Bit	Warnings & Alarms
60	59	PST Time Elapsed Warning	Read	Bit	Bit	Warnings & Alarms
61	60	Invalid PST Warning	Read	Bit	Bit	Warnings & Alarms
62	61	Feedback Offset Warning	Read	Bit	Bit	Warnings & Alarms
63	62	Accum Timeout Warning	Read	Bit	Bit	Warnings & Alarms
101	100	Primary Servo Fault Alarm	Read	Bit	Bit	Warnings & Alarms
102	101	Dual Servo Fault Alarm	Read	Bit	Bit	Warnings & Alarms
103	102	Primary Stepper Fault Alarm	Read	Bit	Bit	Warnings & Alarms
104	103	Dual Stepper Fault Alarm	Read	Bit	Bit	Warnings & Alarms
105	104	Dual Ind. Fault Alarm	Read	Bit	Bit	Warnings & Alarms
106	105	Primary Ind. Fault Alarm	Read	Bit	Bit	Warnings & Alarms
107	106	Main Feedback Bad Alarm	Read	Bit	Bit	Warnings & Alarms



<i>Coil Address</i>	<i>Coil Number</i>	<i>Description</i>	<i>Type</i>	<i>Data Type</i>	<i>Definition (Big Endian)</i>	<i>Group</i>
108	107	Redundant Feedback Bad Alarm	Read	Bit	Bit	Warnings & Alarms
109	108	Control Signal Bad Alarm	Read	Bit	Bit	Warnings & Alarms
110	109	Stall Alarm	Read	Bit	Bit	Warnings & Alarms
111	110	Direction Error Alarm	Read	Bit	Bit	Warnings & Alarms
113	112	Seat Load Cyl. Feedback Bad Alarm	Read	Bit	Bit	Warnings & Alarms
114	113	Output (Delta) Alarm	Read	Bit	Bit	Warnings & Alarms
116	115	Primary Servo Mtr Replace Alarm	Read	Bit	Bit	Warnings & Alarms
118	117	Primary Servo Resolver Fault Alarm	Read	Bit	Bit	Warnings & Alarms
120	119	Primary Servo Hi Volt Alarm	Read	Bit	Bit	Warnings & Alarms
121	120	Primary Servo Overspeed Alarm	Read	Bit	Bit	Warnings & Alarms
122	121	Primary Servo Mtr Short Alarm	Read	Bit	Bit	Warnings & Alarms
123	122	Primary Servo Driver Replace Alarm	Read	Bit	Bit	Warnings & Alarms
125	124	Dual Servo Mtr Replace Alarm	Read	Bit	Bit	Warnings & Alarms
127	126	Dual Servo Hi Volt Alarm	Read	Bit	Bit	Warnings & Alarms
129	128	Dual Servo Overspeed Alarm	Read	Bit	Bit	Warnings & Alarms
130	129	Dual Servo Mtr Short Alarm	Read	Bit	Bit	Warnings & Alarms
131	130	Dual Servo Driver Replace Alarm	Read	Bit	Bit	Warnings & Alarms
132	131	Plus 15V Bad Alarm	Read	Bit	Bit	Warnings & Alarms
133	132	Neg. 5V Bad Alarm	Read	Bit	Bit	Warnings & Alarms
134	133	Dual Servo Hi Volt Alarm	Read	Bit	Bit	Warnings & Alarms



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40001	0	Control Signal	Read	Real	Float MS2B	Actuator Status
40002	1				Float LS2B	Actuator Status
40003	2	Position	Read	Real	Float MS2B	Actuator Status
40004	3				Float LS2B	Actuator Status
40007	6	Torque/Thrust	Read	DWord (S)	Signed 32-bit MS2B	Actuator Status
40008	7				Signed 32-bit LS2B	Actuator Status
40012	11	PST Status	Read	Word	Enumeration Refer to Appendix F1	Actuator Status
40013	12	Accumulator Pressure	Read	Word	Unsigned 16 bit	Actuator Status
40014	13	Operational Mode	Read	Word	Enumeration Refer to Appendix F2	Actuator Status
40015	14	Last Event	Read	Word	Enumeration Refer to Appendix F3	Actuator Status
40016	15	Actuator Status	Read	Word	Bit Mask (16bit) Refer to Appendix F4	Actuator Status
40017	16	Active Feedback	Read	Word	Enumeration Refer to Appendix F5	Actuator Status
40018	17	Active Warnings	Read	QWord	Bit Mask (64bit) Refer to Appendix F6	Warnings & Alarms
40019	18					
40020	19					
40021	20					
40022	21	Active Alarms	Read	QWord	Bit Mask (64bit) Refer to Appendix F7	Warnings & Alarms
40023	22					
40024	23					
40025	24					
40028	27	Max Torque/Thrust Per Poll	Read	DWord (S)	Signed 32-bit MS2B	Predictive Diagnostics
40029	28				Signed 32-bit LS2B	Predictive Diagnostics
40030	29	Min Torque/Thrust Per Poll	Read	DWord (S)	Signed 32-bit MS2B	Predictive Diagnostics
40031	30				Signed 32-bit LS2B	Predictive Diagnostics
40118	117	Position Lo	Read	Real	Float MS2B	Actuator Settings
40119	118				Float LS2B	Actuator Settings



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40120	119	Position Hi	Read	Real	Float MS2B	Actuator Settings
40121	120				Float LS2B	Actuator Settings
40122	121	Redundant Position Lo	Read	Real	Float MS2B	Actuator Settings
40123	122				Float LS2B	Actuator Settings
40124	123	Redundant Position Hi	Read	Real	Float MS2B	Actuator Settings
40125	124				Float LS2B	Actuator Settings
40126	125	Signal Lo	Read	Real	Float MS2B	Actuator Settings
40127	126				Float LS2B	Actuator Settings
40128	127	Signal Hi	Read	Real	Float MS2B	Actuator Settings
40129	128				Float LS2B	Actuator Settings
40130	129	Failsafe Position	Read	Real	Float MS2B	Actuator Settings
40131	130				Float LS2B	Actuator Settings
40132	131	Min. Mod. Position	Read	Real	Float MS2B	Actuator Settings
40133	132				Float LS2B	Actuator Settings
40134	133	Calibrated Stroke	Read	Real	Float MS2B	Actuator Settings
40135	134				Float LS2B	Actuator Settings
40136	135	Booster Offpt	Read	Real	Float MS2B	Actuator Settings
40137	136				Float LS2B	Actuator Settings
40138	137	Deadband	Read	Real	Float MS2B	Actuator Settings
40139	138				Float LS2B	Actuator Settings
40140	139	Speed Breakpoint	Read	Real	Float MS2B	Actuator Settings
40141	140				Float LS2B	Actuator Settings



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40142	141	Surge Breakpoint	Read	Real	Float MS2B	Actuator Settings
40143	142				Float LS2B	Actuator Settings
40144	143	Surge Offpoint	Read	Real	Float MS2B	Actuator Settings
40145	144				Float LS2B	Actuator Settings
40146	145	Relay #1	Read	Real	Float MS2B	Actuator Settings
40147	146				Float LS2B	Actuator Settings
40148	147	Relay #2	Read	Real	Float MS2B	Actuator Settings
40149	148				Float LS2B	Actuator Settings
40150	149	PST Increment	Read	Real	Float MS2B	Actuator Settings
40151	150				Float LS2B	Actuator Settings
40152	151	PST Large Increment	Read	Real	Float MS2B	Actuator Settings
40153	152				Float LS2B	Actuator Settings
40154	153	PST Signal Deviation	Read	Real	Float MS2B	Actuator Settings
40155	154				Float LS2B	Actuator Settings
40156	155	PST Offpoint	Read	Real	Float MS2B	Actuator Settings
40157	156				Float LS2B	Actuator Settings
40158	157	PST Target	Read	Real	Float MS2B	Actuator Settings
40159	158				Float LS2B	Actuator Settings
40160	159	PST Max Target	Read	Real	Float MS2B	Actuator Settings
40161	160				Float LS2B	Actuator Settings
40162	161	Transmitter Low	Read	Word	Unsigned 16 bit	Actuator Settings
40163	162	Transmitter High	Read	Word	Unsigned 16 bit	Actuator Settings



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40164	163	Recharge Time	Read	Word	Unsigned 16 bit	Actuator Settings
40165	164	Warning Pressure	Read	Word	Unsigned 16 bit	Actuator Settings
40166	165	Recharge Pressure	Read	Word	Unsigned 16 bit	Actuator Settings
40167	166	Gain	Read	Word	Unsigned 16 bit	Actuator Settings
40168	167	Max Down Speed	Read	Word	Unsigned 16 bit	Actuator Settings
40169	168	Max Up Speed	Read	Word	Unsigned 16 bit	Actuator Settings
40170	169	Max Manual Speed	Read	Word	Unsigned 16 bit	Actuator Settings
40171	170	Delta Alarm	Read	Word	Unsigned 16 bit	Actuator Settings
40172	171	Delta Warn	Read	Word	Unsigned 16 bit	Actuator Settings
40173	172	PST Schedule Time	Read	Word	Unsigned 16 bit	Actuator Settings
40174	173	PST Max Runtime	Read	Word	Unsigned 16 bit	Actuator Settings
40175	174	Trip Mode	Read	Word	Enumeration Refer to Appendix F8	Actuator Settings
40176	175	Analog CS Enabled	Read	Boolean	Boolean	Actuator Settings
40177	176	One-Contact Enabled	Read	Boolean	Boolean	Actuator Settings
40178	177	Two-Contact Enabled	Read	Boolean	Boolean	Actuator Settings
40179	178	Power-up Last Enabled	Read	Boolean	Boolean	Actuator Settings
40180	179	Power-up Local Enabled	Read	Boolean	Boolean	Actuator Settings
40181	180	Failsafe Position Enabled	Read	Boolean	Boolean	Actuator Settings
40182	181	Failsafe In-Place Enabled	Read	Boolean	Boolean	Actuator Settings
40183	182	Bumpless Transfer Enabled	Read	Boolean	Boolean	Actuator Settings
40184	183	Min. Mod. Enabled	Read	Boolean	Boolean	Actuator Settings
40185	184	Solenoid Seating Enabled	Read	Boolean	Boolean	Actuator Settings



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40186	185	Contact Board Present	Read	Boolean	Boolean	Actuator Settings
40187	186	Booster Motor Enabled	Read	Boolean	Boolean	Actuator Settings
40188	187	Power Fail Accumulator Mode	Read	Boolean	Boolean	Actuator Settings
40189	188	Power Fail In-Place Mode	Read	Boolean	Boolean	Actuator Settings
40190	189	Recharge Direction PL	Read	Boolean	Boolean	Actuator Settings
40191	190	Recharge Direction PH	Read	Boolean	Boolean	Actuator Settings
40192	191	Two Speed Up/Down Mode	Read	Boolean	Boolean	Actuator Settings
40193	192	Two Speed Breakpoint Mode	Read	Boolean	Boolean	Actuator Settings
40194	193	Surge Enabled	Read	Boolean	Boolean	Actuator Settings
40195	194	Surge Direction PL	Read	Boolean	Boolean	Actuator Settings
40196	195	Surge Direction PH	Read	Boolean	Boolean	Actuator Settings
40197	196	Surge Direction PL/PH	Read	Boolean	Boolean	Actuator Settings
40198	197	Mid-Point Relay Enabled	Read	Boolean	Boolean	Actuator Settings
40199	198	Redundant CPU Mode	Read	Word	Enumeration Refer to Appendix F9	Actuator Settings
40200	199	Reverse Acting Display	Read	Boolean	Boolean	Actuator Settings
40201	200	Reverse Acting Transmitter	Read	Boolean	Boolean	Actuator Settings
40202	201	PST Mode Contact Power	Read	Boolean	Boolean	Actuator Settings
40203	202	PST Mode Signal Deviation	Read	Boolean	Boolean	Actuator Settings
40204	203	PST Mode Scheduled/Auto	Read	Boolean	Boolean	Actuator Settings
40205	204	PST Mode Contact Unpowered	Read	Boolean	Boolean	Actuator Settings
40206	205	Model Character 1	Read	ASCII	ASCII	Actuator Identification
40207	206	Model Character 2	Read	ASCII	ASCII	Actuator Identification



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40208	207	Model Character 3	Read	ASCII	ASCII	Actuator Identification
40209	208	Model Character 4	Read	ASCII	ASCII	Actuator Identification
40210	209	Model Character 5	Read	ASCII	ASCII	Actuator Identification
40211	210	Model Character 6	Read	ASCII	ASCII	Actuator Identification
40212	211	Model Character 7	Read	ASCII	ASCII	Actuator Identification
40213	212	Model Character 8	Read	ASCII	ASCII	Actuator Identification
40214	213	Model Character 9	Read	ASCII	ASCII	Actuator Identification
40215	214	Model Character 10	Read	ASCII	ASCII	Actuator Identification
40216	215	Model Character 11	Read	ASCII	ASCII	Actuator Identification
40217	216	Model Character 12	Read	ASCII	ASCII	Actuator Identification
40218	217	Model Character 13	Read	ASCII	ASCII	Actuator Identification
40219	218	Model Character 14	Read	ASCII	ASCII	Actuator Identification
40220	219	Model Character 15	Read	ASCII	ASCII	Actuator Identification
40221	220	Model Character 16	Read	ASCII	ASCII	Actuator Identification
40222	221	Model Character 17	Read	ASCII	ASCII	Actuator Identification
40223	222	Model Character 18	Read	ASCII	ASCII	Actuator Identification
40224	223	Model Character 19	Read	ASCII	ASCII	Actuator Identification
40225	224	Model Character 20	Read	ASCII	ASCII	Actuator Identification
40226	225	Model Character 21	Read	ASCII	ASCII	Actuator Identification
40227	226	Model Character 22	Read	ASCII	ASCII	Actuator Identification
40228	227	Model Character 23	Read	ASCII	ASCII	Actuator Identification
40229	228	Model Character 24	Read	ASCII	ASCII	Actuator Identification



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40230	229	Model Character 25	Read	ASCII	ASCII	Actuator Identification
40231	230	Tag Character 1	Read	ASCII	ASCII	Actuator Identification
40232	231	Tag Character 2	Read	ASCII	ASCII	Actuator Identification
40233	232	Tag Character 3	Read	ASCII	ASCII	Actuator Identification
40234	233	Tag Character 4	Read	ASCII	ASCII	Actuator Identification
40235	234	Tag Character 5	Read	ASCII	ASCII	Actuator Identification
40236	235	Tag Character 6	Read	ASCII	ASCII	Actuator Identification
40237	236	Tag Character 7	Read	ASCII	ASCII	Actuator Identification
40238	237	Tag Character 8	Read	ASCII	ASCII	Actuator Identification
40239	238	Tag Character 9	Read	ASCII	ASCII	Actuator Identification
40240	239	Tag Character 10	Read	ASCII	ASCII	Actuator Identification
40241	240	Tag Character 11	Read	ASCII	ASCII	Actuator Identification
40242	241	Tag Character 12	Read	ASCII	ASCII	Actuator Identification
40243	242	Tag Character 13	Read	ASCII	ASCII	Actuator Identification
40244	243	Tag Character 14	Read	ASCII	ASCII	Actuator Identification
40245	244	Tag Character 15	Read	ASCII	ASCII	Actuator Identification
40246	245	Tag Character 16	Read	ASCII	ASCII	Actuator Identification
40247	246	Tag Character 17	Read	ASCII	ASCII	Actuator Identification
40248	247	Tag Character 18	Read	ASCII	ASCII	Actuator Identification
40249	248	Tag Character 19	Read	ASCII	ASCII	Actuator Identification
40250	249	Tag Character 20	Read	ASCII	ASCII	Actuator Identification
40251	250	Tag Character 21	Read	ASCII	ASCII	Actuator Identification



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40252	251	Tag Character 22	Read	ASCII	ASCII	Actuator Identification
40253	252	Tag Character 23	Read	ASCII	ASCII	Actuator Identification
40254	253	Tag Character 24	Read	ASCII	ASCII	Actuator Identification
40255	254	Tag Character 25	Read	ASCII	ASCII	Actuator Identification
40256	255	Tag Character 26	Read	ASCII	ASCII	Actuator Identification
40257	256	Tag Character 27	Read	ASCII	ASCII	Actuator Identification
40258	257	Tag Character 28	Read	ASCII	ASCII	Actuator Identification
40259	258	Tag Character 29	Read	ASCII	ASCII	Actuator Identification
40260	259	Tag Character 30	Read	ASCII	ASCII	Actuator Identification
40261	260	Tag Character 31	Read	ASCII	ASCII	Actuator Identification
40262	261	Tag Character 32	Read	ASCII	ASCII	Actuator Identification
40263	262	Serial Number Character 1	Read	ASCII	ASCII	Actuator Identification
40264	263	Serial Number Character 2	Read	ASCII	ASCII	Actuator Identification
40265	264	Serial Number Character 3	Read	ASCII	ASCII	Actuator Identification
40266	265	Serial Number Character 4	Read	ASCII	ASCII	Actuator Identification
40267	266	Serial Number Character 5	Read	ASCII	ASCII	Actuator Identification
40268	267	Serial Number Character 6	Read	ASCII	ASCII	Actuator Identification
40269	268	Serial Number Character 7	Read	ASCII	ASCII	Actuator Identification
40270	269	Serial Number Character 8	Read	ASCII	ASCII	Actuator Identification
40271	270	Serial Number Character 9	Read	ASCII	ASCII	Actuator Identification
40272	271	Serial Number Character 10	Read	ASCII	ASCII	Actuator Identification
40273	272	Serial Number Character 11	Read	ASCII	ASCII	Actuator Identification



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40274	273	Serial Number Character 12	Read	ASCII	ASCII	Actuator Identification
40275	274	Serial Number Character 13	Read	ASCII	ASCII	Actuator Identification
40276	275	Serial Number Character 14	Read	ASCII	ASCII	Actuator Identification
40277	276	CPU Software Version Character 1	Read	ASCII	ASCII	Actuator Identification
40278	277	CPU Software Version Character 2	Read	ASCII	ASCII	Actuator Identification
40279	278	CPU Software Version Character 3	Read	ASCII	ASCII	Actuator Identification
40280	279	CPU Software Version Character 4	Read	ASCII	ASCII	Actuator Identification
40281	280	CPU Software Version Character 5	Read	ASCII	ASCII	Actuator Identification
40282	281	CPU Software Version Character 6	Read	ASCII	ASCII	Actuator Identification
40283	282	CPU Software Version Character 7	Read	ASCII	ASCII	Actuator Identification
40284	283	CPU Software Version Character 8	Read	ASCII	ASCII	Actuator Identification
40285	284	CPU Software Version Character 9	Read	ASCII	ASCII	Actuator Identification
40286	285	CPU Software Version Character 10	Read	ASCII	ASCII	Actuator Identification
40287	286	CPU Software Version Character 11	Read	ASCII	ASCII	Actuator Identification
40288	287	CPU Software Version Character 12	Read	ASCII	ASCII	Actuator Identification
40289	288	CPU Software Version Character 13	Read	ASCII	ASCII	Actuator Identification
40290	289	CPU Software Version Character 14	Read	ASCII	ASCII	Actuator Identification
40291	290	Display Software Version Character 1	Read	ASCII	ASCII	Actuator Identification
40292	291	Display Software Version Character 2	Read	ASCII	ASCII	Actuator Identification
40293	292	Display Software Version Character 3	Read	ASCII	ASCII	Actuator Identification
40294	293	Display Software Version Character 4	Read	ASCII	ASCII	Actuator Identification
40295	294	Display Software Version Character 5	Read	ASCII	ASCII	Actuator Identification



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40296	295	Display Software Version Character 6	Read	ASCII	ASCII	Actuator Identification
40297	296	Display Software Version Character 7	Read	ASCII	ASCII	Actuator Identification
40298	297	Display Software Version Character 8	Read	ASCII	ASCII	Actuator Identification
40299	298	Display Software Version Character 9	Read	ASCII	ASCII	Actuator Identification
40300	299	Display Software Version Character 10	Read	ASCII	ASCII	Actuator Identification
40301	300	Display Software Version Character 11	Read	ASCII	ASCII	Actuator Identification
40302	301	Display Software Version Character 12	Read	ASCII	ASCII	Actuator Identification
40303	302	Display Software Version Character 13	Read	ASCII	ASCII	Actuator Identification
40304	303	Display Software Version Character 14	Read	ASCII	ASCII	Actuator Identification
40305	304	Current Day	Read	Word	Byte	Actuator Settings
40306	305	Current Month	Read	Word	Byte	Actuator Settings
40307	306	Current Year	Read	Word	Unsigned 16 bit	Actuator Settings
40308	307	Current Hour	Read	Word	Byte	Actuator Settings
40309	308	Current Minute	Read	Word	Byte	Actuator Settings
40310	309	Current Second	Read	Word	Byte	Actuator Settings
40311	310	Commission Day	Read	Word	Byte	Actuator Settings
40312	311	Commission Month	Read	Word	Byte	Actuator Settings
40313	312	Commission Year	Read	Word	Unsigned 16 bit	Actuator Settings
40314	313	Rated Rotation or Length	Read	Real	Float MS2B	Actuator Identification
40315	314				Float LS2B	Actuator Identification
40316	315	Rated Output	Read	DWord	Unsigned 32 bit MS2B	Actuator Identification
40317	316				Unsigned 32 bit LS2B	Actuator Identification



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40318	317	Torque or Thrust	Read	Word	Enumeration Refer to Appendix F10	Actuator Identification
40319	318	Fault Event #1	Read	Word	Enumeration Refer to Appendix F3	Last 10 Faults
40320	319	Fault Event #2	Read	Word		
40321	320	Fault Event #3	Read	Word		
40322	321	Fault Event #4	Read	Word		
40323	322	Fault Event #5	Read	Word		
40324	323	Fault Event #6	Read	Word		
40325	324	Fault Event #7	Read	Word		
40326	325	Fault Event #8	Read	Word		
40327	326	Fault Event #9	Read	Word		
40328	327	Fault Event #10	Read	Word		
40329	328	Fault Event Time Stamp #1	Read	QWord	Epoch MS2B	Last 10 Faults
40330	329				Epoch Next 2 Bytes	Last 10 Faults
40331	330				Epoch Next 2 Bytes	Last 10 Faults
40332	331				Epoch LS2B	Last 10 Faults
40333	332	Fault Event Time Stamp #2	Read	QWord	Epoch MS2B	Last 10 Faults
40334	333				Epoch Next 2 Bytes	Last 10 Faults
40335	334				Epoch Next 2 Bytes	Last 10 Faults
40336	335				Epoch LS2B	Last 10 Faults
40337	336	Fault Event Time Stamp #3	Read	QWord	Epoch MS2B	Last 10 Faults
40338	337				Epoch Next 2 Bytes	Last 10 Faults
40339	338				Epoch Next 2 Bytes	Last 10 Faults
40340	339				Epoch LS2B	Last 10 Faults
40341	340	Fault Event Time Stamp #4	Read	QWord	Epoch MS2B	Last 10 Faults
40342	341				Epoch Next 2 Bytes	Last 10 Faults
40343	342				Epoch Next 2 Bytes	Last 10 Faults
40344	343				Epoch LS2B	Last 10 Faults
40345	344	Fault Event Time Stamp #5	Read	QWord	Epoch MS2B	Last 10 Faults
40346	345				Epoch Next 2 Bytes	Last 10 Faults
40347	346				Epoch Next 2 Bytes	Last 10 Faults
40348	347				Epoch LS2B	Last 10 Faults
40349	348	Fault Event Time Stamp #6	Read	QWord	Epoch MS2B	Last 10 Faults
40350	349				Epoch Next 2 Bytes	Last 10 Faults
40351	350				Epoch Next 2 Bytes	Last 10 Faults
40352	351				Epoch LS2B	Last 10 Faults



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40353	352	Fault Event Time Stamp #7	Read	QWord	Epoch MS2B	Last 10 Faults
40354	353				Epoch Next 2 Bytes	Last 10 Faults
40355	354				Epoch Next 2 Bytes	Last 10 Faults
40356	355				Epoch LS2B	Last 10 Faults
40357	356	Fault Event Time Stamp #8	Read	QWord	Epoch MS2B	Last 10 Faults
40358	357				Epoch Next 2 Bytes	Last 10 Faults
40359	358				Epoch Next 2 Bytes	Last 10 Faults
40360	359				Epoch LS2B	Last 10 Faults
40361	360	Fault Event Time Stamp #9	Read	QWord	Epoch MS2B	Last 10 Faults
40362	361				Epoch Next 2 Bytes	Last 10 Faults
40363	362				Epoch Next 2 Bytes	Last 10 Faults
40364	363				Epoch LS2B	Last 10 Faults
40365	364	Fault Event Time Stamp #10	Read	QWord	Epoch MS2B	Last 10 Faults
40366	365				Epoch Next 2 Bytes	Last 10 Faults
40367	366				Epoch Next 2 Bytes	Last 10 Faults
40368	367				Epoch LS2B	Last 10 Faults
40419	418	Primary Servo Faults	Read	Word	Unsigned 16 bit	Fault Counters
40420	419	Dual Servo Faults	Read	Word	Unsigned 16 bit	Fault Counters
40421	420	Accumulator Servo Faults	Read	Word	Unsigned 16 bit	Fault Counters
40422	421	Boost Servo Faults	Read	Word	Unsigned 16 bit	Fault Counters
40423	422	Primary Stepper Faults	Read	Word	Unsigned 16 bit	Fault Counters
40424	423	Dual Stepper Faults	Read	Word	Unsigned 16 bit	Fault Counters
40425	424	Accumulator Stepper Faults	Read	Word	Unsigned 16 bit	Fault Counters
40426	425	Boost Induction Faults	Read	Word	Unsigned 16 bit	Fault Counters
40427	426	Dual Boost Induction Faults	Read	Word	Unsigned 16 bit	Fault Counters
40428	427	Primary Induction Faults	Read	Word	Unsigned 16 bit	Fault Counters
40429	428	Main Feedback Bad	Read	Word	Unsigned 16 bit	Fault Counters
40430	429	Redundant Feedback Bad	Read	Word	Unsigned 16 bit	Fault Counters
40431	430	Control Signal Bad	Read	Word	Unsigned 16 bit	Fault Counters
40432	431	Stalls	Read	Word	Unsigned 16 bit	Fault Counters
40433	432	Direction Error	Read	Word	Unsigned 16 bit	Fault Counters
40434	433	+15V Failure	Read	Word	Unsigned 16 bit	Fault Counters
40435	434	-5V Failure	Read	Word	Unsigned 16 bit	Fault Counters
40436	435	Accumulator Pressure Bad	Read	Word	Unsigned 16 bit	Fault Counters
40437	436	Accumulator Pressure Low	Read	Word	Unsigned 16 bit	Fault Counters
40438	437	Output (Delta) Limit Warning	Read	Word	Unsigned 16 bit	Fault Counters



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40439	438	Accumulator Timeout	Read	Word	Unsigned 16 bit	Fault Counters
40440	439	Open Pressure Bad	Read	Word	Unsigned 16 bit	Fault Counters
40441	440	Closed Pressure Bad	Read	Word	Unsigned 16 bit	Fault Counters
40442	441	Seat Load Cylinder Feedback Bad	Read	Word	Unsigned 16 bit	Fault Counters
40443	442	Seat Load Cylinder Stop	Read	Word	Unsigned 16 bit	Fault Counters
40444	443	AC Voltage High	Read	Word	Unsigned 16 bit	Fault Counters
40445	444	AC Voltage Low	Read	Word	Unsigned 16 bit	Fault Counters
40446	445	Clock Battery Low	Read	Word	Unsigned 16 bit	Fault Counters
40447	446	Output (Delta) Limit Alarm	Read	Word	Unsigned 16 bit	Fault Counters
40448	447	Redundant Feedback Offset	Read	Word	Unsigned 16 bit	Fault Counters
40449	448	Invalid Hardware	Read	Word	Unsigned 16 bit	Fault Counters
40450	449	Invalid PST	Read	Word	Unsigned 16 bit	Fault Counters
40451	450	PST Time Elapsed	Read	Word	Unsigned 16 bit	Fault Counters
40452	451	Primary Servo Low Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40453	452	Primary Servo Replace Motor Faults	Read	Word	Unsigned 16 bit	Fault Counters
40454	453	Primary Servo Motor Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40455	454	Primary Servo Resolver Faults	Read	Word	Unsigned 16 bit	Fault Counters
40456	455	Primary Servo Drive Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40457	456	Primary Servo High Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40458	457	Primary Servo Overspeed Faults	Read	Word	Unsigned 16 bit	Fault Counters
40459	458	Primary Servo Motor Short Faults	Read	Word	Unsigned 16 bit	Fault Counters
40460	459	Primary Servo Replace Drive Faults	Read	Word	Unsigned 16 bit	Fault Counters
40461	460	Dual Servo Low Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40462	461	Dual Servo Replace Motor Faults	Read	Word	Unsigned 16 bit	Fault Counters
40463	462	Dual Servo Motor Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40464	463	Dual Servo Resolver Faults	Read	Word	Unsigned 16 bit	Fault Counters
40465	464	Dual Servo Drive Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40466	465	Dual Servo High Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40467	466	Dual Servo Overspeed Faults	Read	Word	Unsigned 16 bit	Fault Counters
40468	467	Dual Servo Motor Short Faults	Read	Word	Unsigned 16 bit	Fault Counters



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40469	468	Dual Servo Replace Drive Faults	Read	Word	Unsigned 16 bit	Fault Counters
40470	469	Accumulator Servo Low Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40471	470	Accumulator Servo Replace Motor Faults	Read	Word	Unsigned 16 bit	Fault Counters
40472	471	Accumulator Servo Motor Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40473	472	Accumulator Servo Resolver Faults	Read	Word	Unsigned 16 bit	Fault Counters
40474	473	Accumulator Servo Drive Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40475	474	Accumulator Servo High Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40476	475	Accumulator Servo Overspeed Faults	Read	Word	Unsigned 16 bit	Fault Counters
40477	476	Accumulator Servo Motor Short Faults	Read	Word	Unsigned 16 bit	Fault Counters
40478	477	Accumulator Servo Replace Drive Faults	Read	Word	Unsigned 16 bit	Fault Counters
40479	478	Boost Servo Low Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40480	479	Boost Servo Replace Motor Faults	Read	Word	Unsigned 16 bit	Fault Counters
40481	480	Boost Servo Motor Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40482	481	Boost Servo Resolver Faults	Read	Word	Unsigned 16 bit	Fault Counters
40483	482	Boost Servo Drive Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40484	483	Boost Servo High Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40485	484	Boost Servo Overspeed Faults	Read	Word	Unsigned 16 bit	Fault Counters
40486	485	Boost Servo Motor Short Faults	Read	Word	Unsigned 16 bit	Fault Counters
40487	486	Boost Servo Replace Drive Faults	Read	Word	Unsigned 16 bit	Fault Counters
40488	487	Comm Loss Faults	Read	Word	Unsigned 16 bit	Fault Counters
40489	488	Lifetime Primary Servo Faults	Read	Word	Unsigned 16 bit	Fault Counters
40490	489	Lifetime Dual Servo Faults	Read	Word	Unsigned 16 bit	Fault Counters
40491	490	Lifetime Accumulator Servo Faults	Read	Word	Unsigned 16 bit	Fault Counters
40492	491	Lifetime Boost Servo Faults	Read	Word	Unsigned 16 bit	Fault Counters
40493	492	Lifetime Primary Stepper	Read	Word	Unsigned 16 bit	Fault Counters



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
		Faults				
40494	493	Lifetime Dual Stepper Faults	Read	Word	Unsigned 16 bit	Fault Counters
40495	494	Lifetime Accumulator Stepper Faults	Read	Word	Unsigned 16 bit	Fault Counters
40496	495	Lifetime Boost Induction Faults	Read	Word	Unsigned 16 bit	Fault Counters
40497	496	Lifetime Dual Boost Induction Faults	Read	Word	Unsigned 16 bit	Fault Counters
40498	497	Lifetime Primary Induction Faults	Read	Word	Unsigned 16 bit	Fault Counters
40499	498	Lifetime Main Feedback Bad	Read	Word	Unsigned 16 bit	Fault Counters
40500	499	Lifetime Redundant Feedback Bad	Read	Word	Unsigned 16 bit	Fault Counters
40501	500	Lifetime Control Signal Bad	Read	Word	Unsigned 16 bit	Fault Counters
40502	501	Lifetime Stalls	Read	Word	Unsigned 16 bit	Fault Counters
40503	502	Lifetime Direction Error	Read	Word	Unsigned 16 bit	Fault Counters
40504	503	Lifetime +15V Failure	Read	Word	Unsigned 16 bit	Fault Counters
40505	504	Lifetime -5V Failure	Read	Word	Unsigned 16 bit	Fault Counters
40506	505	Lifetime Accumulator Pressure Bad	Read	Word	Unsigned 16 bit	Fault Counters
40507	506	Lifetime Accumulator Pressure Low	Read	Word	Unsigned 16 bit	Fault Counters
40508	507	Lifetime Output Limit Warning	Read	Word	Unsigned 16 bit	Fault Counters
40509	508	Lifetime Accumulator Timeout	Read	Word	Unsigned 16 bit	Fault Counters
40510	509	Lifetime Open Pressure Bad	Read	Word	Unsigned 16 bit	Fault Counters
40511	510	Lifetime Closed Pressure Bad	Read	Word	Unsigned 16 bit	Fault Counters
40512	511	Lifetime Seat Load Cylinder Feedback Bad	Read	Word	Unsigned 16 bit	Fault Counters
40513	512	Lifetime Seat Load Cylinder Stop	Read	Word	Unsigned 16 bit	Fault Counters
40514	513	Lifetime AC Voltage High	Read	Word	Unsigned 16 bit	Fault Counters
40515	514	Lifetime AC Voltage Low	Read	Word	Unsigned 16 bit	Fault Counters
40516	515	Lifetime Clock Battery Low	Read	Word	Unsigned 16 bit	Fault Counters
40517	516	Lifetime Output Limit Alarm	Read	Word	Unsigned 16 bit	Fault Counters
40518	517	Lifetime Redundant Feedback Offset	Read	Word	Unsigned 16 bit	Fault Counters
40519	518	Lifetime Invalid Hardware	Read	Word	Unsigned 16 bit	Fault Counters
40520	519	Lifetime Invalid PST	Read	Word	Unsigned 16 bit	Fault Counters
40521	520	Lifetime PST Time Elapsed	Read	Word	Unsigned 16 bit	Fault Counters
40522	521	Lifetime Primary Servo Low	Read	Word	Unsigned 16 bit	Fault Counters



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
		Voltage Faults				
40523	522	Lifetime Primary Servo Replace Motor Faults	Read	Word	Unsigned 16 bit	Fault Counters
40524	523	Lifetime Primary Servo Motor Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40525	524	Lifetime Primary Servo Resolver Faults	Read	Word	Unsigned 16 bit	Fault Counters
40526	525	Lifetime Primary Servo Drive Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40527	526	Lifetime Primary Servo High Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40528	527	Lifetime Primary Servo Overspeed Faults	Read	Word	Unsigned 16 bit	Fault Counters
40529	528	Lifetime Primary Servo Motor Short Faults	Read	Word	Unsigned 16 bit	Fault Counters
40530	529	Lifetime Primary Servo Replace Drive Faults	Read	Word	Unsigned 16 bit	Fault Counters
40531	530	Lifetime Dual Servo Low Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40532	531	Lifetime Dual Servo Replace Motor Faults	Read	Word	Unsigned 16 bit	Fault Counters
40533	532	Lifetime Dual Servo Motor Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40534	533	Lifetime Dual Servo Resolver Faults	Read	Word	Unsigned 16 bit	Fault Counters
40535	534	Lifetime Dual Servo Drive Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40536	535	Lifetime Dual Servo High Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40537	536	Lifetime Dual Servo Overspeed Faults	Read	Word	Unsigned 16 bit	Fault Counters
40538	537	Lifetime Dual Servo Motor Short Faults	Read	Word	Unsigned 16 bit	Fault Counters
40539	538	Lifetime Dual Servo Replace Drive Faults	Read	Word	Unsigned 16 bit	Fault Counters
40540	539	Lifetime Accumulator Servo Low Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40541	540	Lifetime Accumulator Servo Replace Motor Faults	Read	Word	Unsigned 16 bit	Fault Counters
40542	541	Lifetime Accumulator Servo Motor Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40543	542	Lifetime Accumulator Servo Resolver Faults	Read	Word	Unsigned 16 bit	Fault Counters



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40544	543	Lifetime Accumulator Servo Drive Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40545	544	Lifetime Accumulator Servo High Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40546	545	Lifetime Accumulator Servo Overspeed Faults	Read	Word	Unsigned 16 bit	Fault Counters
40547	546	Lifetime Accumulator Servo Motor Short Faults	Read	Word	Unsigned 16 bit	Fault Counters
40548	547	Lifetime Accumulator Servo Replace Drive Faults	Read	Word	Unsigned 16 bit	Fault Counters
40549	548	Lifetime Boost Servo Low Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40550	549	Lifetime Boost Servo Replace Motor Faults	Read	Word	Unsigned 16 bit	Fault Counters
40551	550	Lifetime Boost Servo Motor Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40552	551	Lifetime Boost Servo Resolver Faults	Read	Word	Unsigned 16 bit	Fault Counters
40553	552	Lifetime Boost Servo Drive Temp Faults	Read	Word	Unsigned 16 bit	Fault Counters
40554	553	Lifetime Boost Servo High Voltage Faults	Read	Word	Unsigned 16 bit	Fault Counters
40555	554	Lifetime Boost Servo Overspeed Faults	Read	Word	Unsigned 16 bit	Fault Counters
40556	555	Lifetime Boost Servo Motor Short Faults	Read	Word	Unsigned 16 bit	Fault Counters
40557	556	Lifetime Boost Servo Replace Drive Faults	Read	Word	Unsigned 16 bit	Fault Counters
40558	557	Lifetime Comm Loss Faults	Read	Word	Unsigned 16 bit	Fault Counters
40559	558	Current Strokes 1K	Read	DWord	Unsigned 32 bit MS2B	Predictive Diagnostics
40560	559				Unsigned 32 bit LS2B	Predictive Diagnostics
40563	562	Current Starts 1K	Read	DWord	Unsigned 32 bit MS2B	Predictive Diagnostics
40564	563				Unsigned 32 bit LS2B	Predictive Diagnostics
40567	566	Up Counter	Read	Word	Unsigned 16 bit	Predictive Diagnostics
40569	568	Host Write Enable	Write/Read	Boolean	Boolean	Control
40570	569	Host Write Target	Write/Read	Real	Float MS2B	Control
40571	570				Float LS2B	Control
40572	571	Host Write Time	Write/Read	QWord	Epoch MS2B	Actuator Time



Register Address	Register Number	Description	Type	Data Type	Definition (Big Endian)	Group
40573	572				Epoch Next 2 Bytes	Actuator Time
40574	573				Epoch Next 2 Bytes	Actuator Time
40575	574				Epoch LS2B	Actuator Time
40577	576	Position Relay Status	Read	Word	Enumeration Refer to Appendix F11	Actuator Status
40578	577	Current Booster Starts 1K	Read	DWord	Unsigned 32 bit MS2B	Predictive Diagnostics
40579	578				Unsigned 32 bit LS2B	Predictive Diagnostics
40580	579	Current Online Recharge Starts 1K	Read	DWord	Unsigned 32 bit MS2B	Predictive Diagnostics
40581	580				Unsigned 32 bit LS2B	Predictive Diagnostics

Appendix F1 – PST Status Enumeration table

PST Status	Value
PST_HAS_NOT_RUN	0x00
PST_RUNNING	0x01
PST_RAN_AND_FAILED	0x02
PST_RAN_AND_PASSED	0x03
PST_NOT_APPLICABLE	0x04

Appendix F2 – Operational Mode Enumeration table

Operational Mode	Value
<i>Invalid Value</i>	0
Auto Mode	1
Setup Mode	2
<i>Invalid Value</i>	3
<i>Invalid Value</i>	4
Manual Mode	5
<i>Invalid Value</i>	6
<i>Invalid Value</i>	7
<i>Invalid Value</i>	8
<i>Invalid Value</i>	9
<i>Invalid Value</i>	10

Operational Mode	Value
Auto Test Mode	11
Auto Remote Mode	12
Auto Recharge Mode	13
Auto Trip Mode	14
Auto Seat Mode	15
Auto MM Mode	16
Auto BT Mode	17
Auto PST Mode	18
Manual PST Mode	19
Auto Backup Mode	20
Remote Test Mode	21
Remote Recharge Mode	22
Remote Trip Mode	23
Remote Seat Mode	24
Remote MM Mode	25
Remote BT Mode	26
Remote PST Mode	27
Remote Backup Mode	28
Manual Trip Mode	29
Manual Backup Mode	30
Auto API Mode	31
Manual API Mode	32

Appendix F3 – Last Event Enumeration table

Last Event/Fault	Value
NO_EVENT	0x00
Primary Servo Fault Event	0x01
Dual Servo Fault Event	0x02
Accum Servo Fault Event	0x03
Booster Servo Fault Event	0x04
Primary Stepper Fault Event	0x05
Dual Stepper Fault Event	0x06
Accum Stepper Fault Event	0x07
Booster Ind. Fault Event	0x08
Dual Ind. Fault Event	0x09
Primary Ind. Fault Event	0x0A
Main Feedback Bad Event	0x0B
Redundant Feedback Bad Event	0x0C



Last Event/Fault	Value
Control Signal Bad Event	0x0D
Stall Event	0x0E
Direction Error Event	0x0F
Plus 15V Bad Event	0x10
Neg. 5V Bad Event	0x11
Accum Press Bad Event	0x12
Accum Press Low Event	0x13
Output (Delta) Warning Event	0x14
Accum Timeout Event	0x15
Open Pressure Bad Event	0x16
Close Pressure Bad Event	0x17
Seat Load Cyl. Feedback Bad Event	0x18
Seat Load Cyl. Stop Event	0x19
AC High Event	0x1A
AC Low Event	0x1B
Clock Battery Low Event	0x1C
Output (Delta) Alarm Event	0x1D
Feedback Offset Event	0x1E
Invalid Hardware Event	0x1F
Invalid PST Event	0x20
PST Time Elapsed Event	0x21
Primary Servo Low Volt Event	0x22
Primary Servo Mtr Replace Event	0x23
Primary Servo Mtr Temp. Event	0x24
Primary Servo Resolver Fault Event	0x25
Primary Servo Driver Temp. Event	0x26
Primary Servo Hi Volt Event	0x27
Primary Servo Overspeed Event	0x28
Primary Servo Mtr Short Event	0x29
Primary Servo Driver Replace Event	0x2A
Primary Servo Unused Event	0x2B
Dual Servo Low Volt Event	0x2C
Dual Servo Mtr Replace Event	0x2D
Dual Servo Mtr Temp. Event	0x2E
Dual Servo Resolver Fault Event	0x2F
Dual Servo Driver Temp. Event	0x30
Dual Servo Hi Volt Event	0x31



Last Event/Fault	Value
Dual Servo Overspeed Event	0x32
Dual Servo Mtr Short Event	0x33
Dual Servo Driver Replace Event	0x34
Dual Servo Unused Event	0x35
Accum Servo Low Volt Event	0x36
Accum Servo Mtr Replace Event	0x37
Accum Servo Mtr Temp. Event	0x38
Accum Servo Resolver Fault Event	0x39
Accum Servo Driver Temp. Event	0x3A
Accum Servo Hi Volt Event	0x3B
Accum Servo Overspeed Event	0x3C
Accum Servo Mtr Short Event	0x3D
Accum Servo Driver Replace Event	0x3E
Accum Servo Unused Event	0x3F
Booster Servo Low Volt Event	0x40
Booster Servo Mtr Replace Event	0x41
Booster Servo Mtr Temp. Event	0x42
Booster Servo Resolver Fault Event	0x43
Booster Servo Driver Temp. Event	0x44
Booster Servo Hi Volt Event	0x45
Booster Servo Overspeed Event	0x46
Booster Servo Mtr Short Event	0x47
Booster Servo Driver Replace Event	0x48
Booster Servo Unused Event	0x49
Comm Loss Event	0x4A

Appendix F4 – Actuator Status Bit Mask

Actuator Status	Bit Mask
ACTUATOR_OK	0x00



ACTUATOR_WARNING	0x01
ACTUATOR_ALARM	0x02
ACTUATOR_NOT_IN_AUTO	0x04
ACTUATOR_TRIPPED	0x08

Appendix F5 – Active Feedback Enumeration

Active Feedback	Value
MAIN_FB_ACTIVE	0x00
REDUN_FB_ACTIVE	0x01

Appendix F6 – Active Warnings Bit Mask

Warning Faults	Bit Mask (64-bit)
NO_WARNING	0x0000000000000000
Primary Servo Fault Warning	0x0000000000000001
Dual Servo Fault Warning	0x0000000000000002
Accum Servo Fault Warning	0x0000000000000004
Booster Servo Fault Warning	0x0000000000000008
Primary Stepper Fault Warning	0x0000000000000010
Dual Stepper Fault Warning	0x0000000000000020
Accum Stepper Fault Warning	0x0000000000000040
Booster Ind. Fault Warning	0x0000000000000080
Dual Ind. Fault Warning	0x0000000000000100
Primary Ind. Fault Warning	0x0000000000000200
Main Feedback Bad Warning	0x0000000000000400
Redundant Feedback Bad Warning	0x0000000000000800
Accum Press Bad Warning	0x0000000000001000
Accum Press Low Warning	0x0000000000002000
Open Pressure Bad Warning	0x0000000000004000
Close Pressure Bad Warning	0x0000000000008000
Seat Load Cyl. Stop Warning	0x0000000000010000
AC High Warning	0x0000000000020000
AC Low Warning	0x0000000000040000
Output (Delta) Warning	0x0000000000080000
Clock Battery Low Warning	0x0000000000100000
Invalid Hardware Warning	0x0000000000200000
Primary Servo Low Volt Warning	0x0000000000400000
Primary Servo Mtr Replace Warning	0x0000000000800000



Warning Faults	Bit Mask (64-bit)
Primary Servo Mtr Temp. Warning	0x0000000001000000
Primary Servo Resolver Fault Warning	0x0000000002000000
Primary Servo Driver Temp. Warning	0x0000000004000000
Primary Servo Hi Volt Warning	0x0000000008000000
Primary Servo Overspeed Warning	0x0000000010000000
Primary Servo Mtr Short Warning	0x0000000020000000
Primary Servo Driver Replace Warning	0x0000000040000000
Dual Servo Low Volt Warning	0x0000000080000000
Dual Servo Mtr Replace Warning	0x0000000100000000
Dual Servo Mtr Temp. Warning	0x0000000200000000
Dual Servo Resolver Fault Warning	0x0000000400000000
Dual Servo Driver Temp. Warning	0x0000000800000000
Dual Servo Hi Volt Warning	0x0000001000000000
Dual Servo Overspeed Warning	0x0000002000000000
Dual Servo Mtr Short Warning	0x0000004000000000
Dual Servo Driver Replace Warning	0x0000008000000000
Accum Servo Low Volt Warning	0x0000010000000000
Accum Servo Mtr Replace Warning	0x0000020000000000
Accum Servo Mtr Temp. Warning	0x0000040000000000
Accum Servo Resolver Fault Warning	0x0000080000000000
Accum Servo Driver Temp. Warning	0x0000100000000000
Accum Servo Hi Volt Warning	0x0000200000000000
Accum Servo Overspeed Warning	0x0000400000000000
Accum Servo Mtr Short Warning	0x0000800000000000
Accum Servo Driver Replace Warning	0x0001000000000000
Booster Servo Low Volt Warning	0x0002000000000000
Booster Servo Mtr Replace Warning	0x0004000000000000
Booster Servo Mtr Temp. Warning	0x0008000000000000
Booster Servo Resolver Fault Warning	0x0010000000000000
Booster Servo Driver Temp. Warning	0x0020000000000000
Booster Servo Hi Volt Warning	0x0040000000000000
Booster Servo Overspeed Warning	0x0080000000000000

Warning Faults	Bit Mask (64-bit)
Booster Servo Mtr Short Warning	0x0100000000000000
Booster Servo Driver Replace Warning	0x0200000000000000
Comm Loss Warning	0x0400000000000000
PST Time Elapsed Warning	0x0800000000000000
Invalid PST Warning	0x1000000000000000
Feedback Offset Warning	0x2000000000000000
Accum Timeout Warning	0x4000000000000000

Notes: *Green is conditional (configuration dependent)

Appendix F7 – Active Alarms Bit Mask

Alarm Faults	Bit Mask (64-bit)
NO_ALARM	0x0000000000000000
Primary Servo Fault Alarm	0x0000000000000001
Dual Servo Fault Alarm	0x0000000000000002
Primary Stepper Fault Alarm	0x0000000000000004
Dual Stepper Fault Alarm	0x0000000000000008
Dual Ind. Fault Alarm	0x0000000000000010
Primary Ind. Fault Alarm	0x0000000000000020
Main Feedback Bad Alarm	0x0000000000000040
Redundant Feedback Bad Alarm	0x0000000000000080
Control Signal Bad Alarm	0x0000000000000100
Stall Alarm	0x0000000000000200
Direction Error Alarm	0x0000000000000400
RESERVED	
Seat Load Cyl. Feedback Bad Alarm	0x0000000000001000
Output (Delta) Alarm	0x0000000000002000
RESERVED	
Primary Servo Mtr Replace Alarm	0x0000000000008000
RESERVED	
Primary Servo Resolver Fault Alarm	0x0000000000020000
RESERVED	
Primary Servo Hi Volt Alarm	0x0000000000080000
Primary Servo Overspeed Alarm	0x0000000000100000
Primary Servo Mtr Short Alarm	0x0000000000200000

Alarm Faults	Bit Mask (64-bit)
Primary Servo Driver Replace Alarm	0x0000000000400000
RESERVED	
Dual Servo Mtr Replace Alarm	0x0000000001000000
RESERVED	
Dual Servo Mtr Replace Alarm	0x0000000004000000
RESERVED	
Dual Servo Hi Volt Alarm	0x0000000010000000
Dual Servo Overspeed Alarm	0x0000000020000000
Dual Servo Mtr Short Alarm	0x0000000040000000
Dual Servo Driver Replace Alarm	0x0000000080000000
Plus 15V Bad Alarm	0x0000000100000000
Neg. 5V Bad Alarm	0x0000000200000000

Notes: *Green is conditional (configuration dependent)

Appendix F8 – Trip Mode Enumeration

Trip Type	Value
TRIP_OFF	0x00
TRIP_UNPOWERED_SOL	0x01
TRIP_POWERED_SOL	0x02
TRIP_UNPOWERED_MOTOR_PL	0x03
TRIP_POWERED_MOTOR_PL	0x04
TRIP_UNPOWERED_MOTOR_PH	0x05
TRIP_POWERED_MOTOR_PH	0x06

Appendix F9 – Redundant CPU Mode Enumeration

CPU Redundancy Mode	Value
CPU_REDUNDANCY_OFF	0x00
CPU_REDUNDANCY_RESERVED_VALUE	0x01
CPU_REDUNDANCY_BACKUP_ROLE	0x02
CPU_REDUNDANCY_MAIN_ROLE	0x03

Appendix F10 – Torque or Thrust Enumeration

Torque or Thrust	Value
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TORQUE_UNITS (lb/in)	0x00
THRUST_UNITS (lb force)	0x01

Appendix F11 – Position Relay Status Enumeration

Position Relay Status	Value
RELAYS OPEN	0x00
RELAY 1 CLOSED	0x01
RELAY 2 CLOSED	0x02