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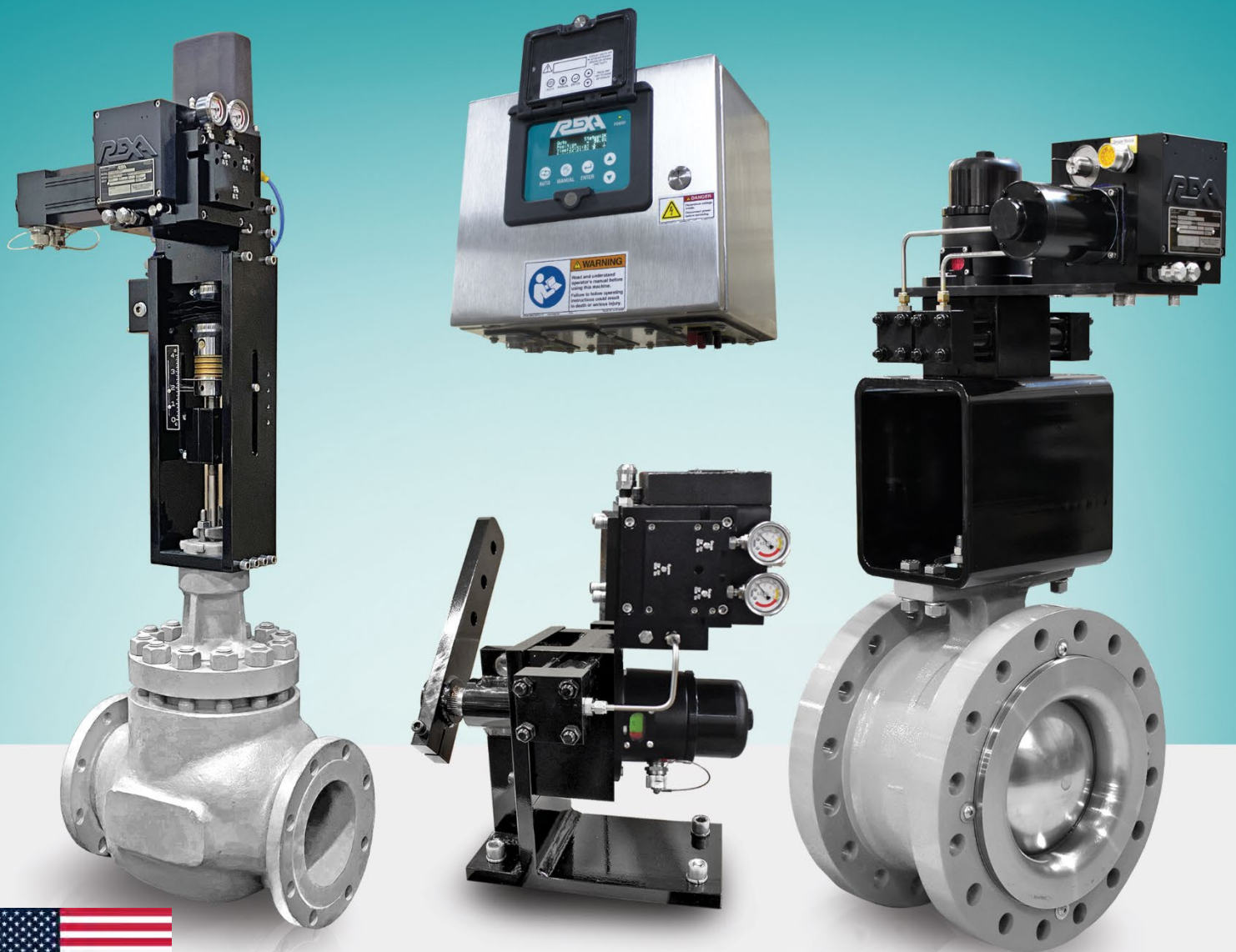
ISO 9001

Installation & Operation Manual
REXA MEGApac Series 3

REXA Electraulic™ Actuators and Drives



Made in the USA

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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 2 000 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 West Bridgewater, 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: 4 Manley Street
West Bridgewater, MA 02379

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.

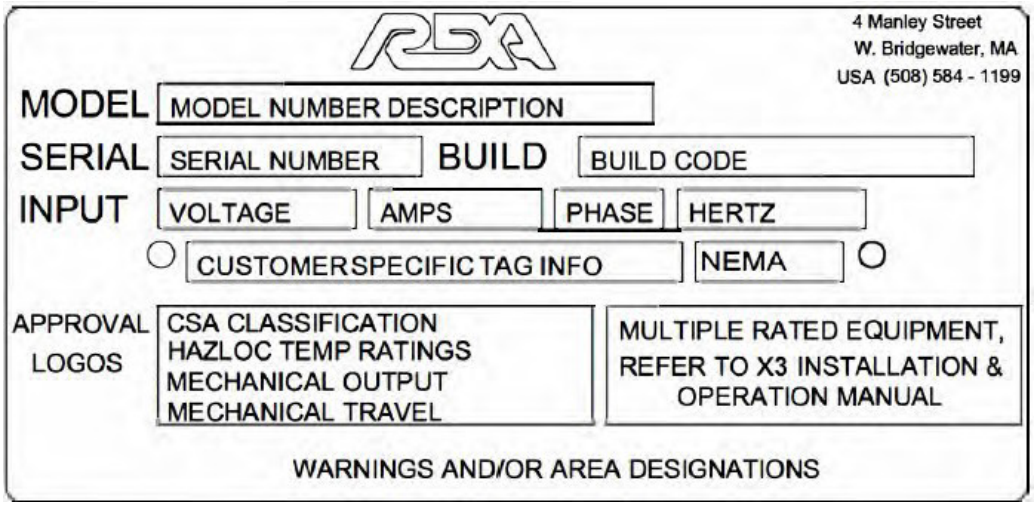


Figure 1: ID Tag

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 NUMBER

X3__ __ __ __ __ __ – __ __ – __ – __-__

Series 3

L Series – Xpac Linear
R Series – Xpac Rotary
D Series – XPac Drive

Thrust Torque –Stroke –Rotation

Fail Safe Options (Upon Power Loss)
P: None – Lock in Place
U: Universal (Rotary)
E: Extend (Linear)
R: Retract (Linear)
A: Accumulator Failure

Hazardous Area Code
C1: Division 1 / Zone 1 Actuator Only
C2: Division 2 / Zone 2 Actuator and Electronics
C5: Division 1 / Zone 1 Actuator with Division 2 / Zone 2 Electronics
C6: Division 1 / Zone 1 Actuator and Electronics
CA: Division 2 / Zone 2 Actuator Only

L SERIES

Thrust (lbf-in)	Strokes (degrees)
2000	–.75, –2, –4 –6, –8, –11
4000	–.75, –2, –4
5000	–.75, –2, –4, –6, –8, –11, –16, –22
10000	–.75, –2, –4, –6, –8, –11, –16, –22
15000	–.75, –2, –4, –6, –8, –11, –16, –22
20000	–.75, –2, –4, –6, –8, –11, –16, –22
30000	–.75, –2, –4, –6, –8, –11, –16, –22
40000	–.75, –2, –4, –6, –8, –11, –16, –22
50000	–.75, –2, –4, –6, –8, –11, –16, –22
60000	–.75, –2, –4, –6, –8, –11, –16, –22
80000	–.75, –2, –4, –6, –8, –11, –16, –22
120000	–.75, –2, –4, –6, –8, –11, –16, –22

R or D SERIES

Torque (lbf-in)	Rotation (degrees)
2500	–90, –120
5000	–90, –120
10000	–90, –120
20000	–90, –120
50000	–90, –120
100000	–90, –120
200000	–90, –120
400000	–90, –120

Power Modules
B: Single B
C: Single C
½D: Single ½D
D: Single D
2C: Dual C Manifold
2D: Dual D Manifold
D,P9: Booster Pump
D,P20: Booster Pump
D,P40: Booster Pump

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.

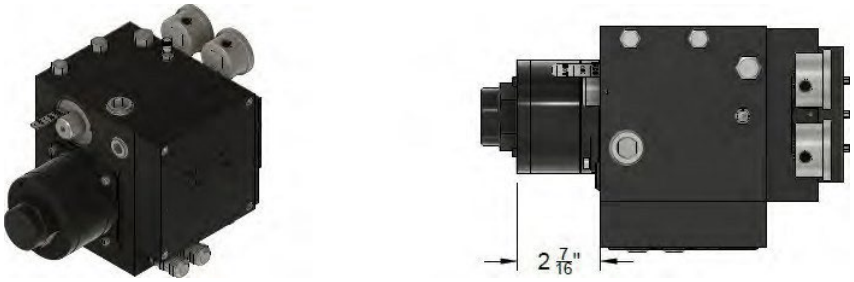
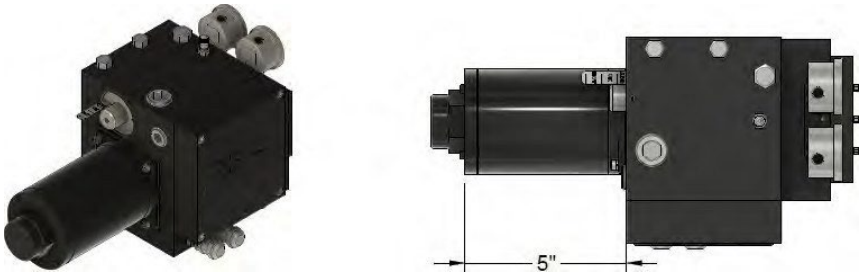


Figure 2: B Module (Above) vs C Module (Below)



The ½ D and D modules shown in Figure 3 are the two sizes of servo motor modules. They both have square case motors.

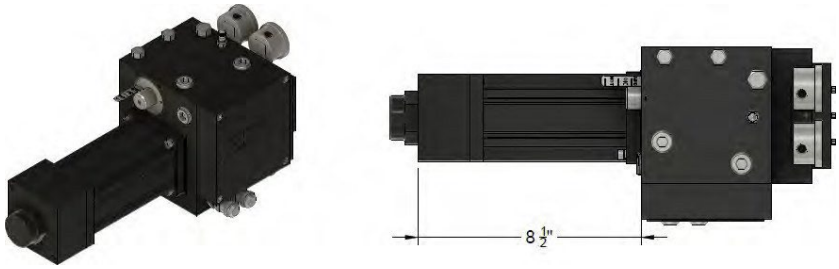
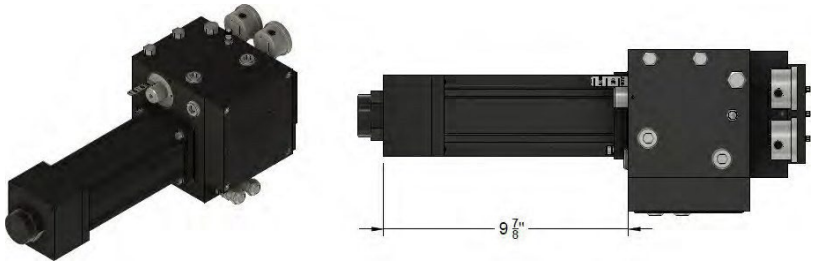


Figure 3: ½ D Module (Above) vs D Module (Below)



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.

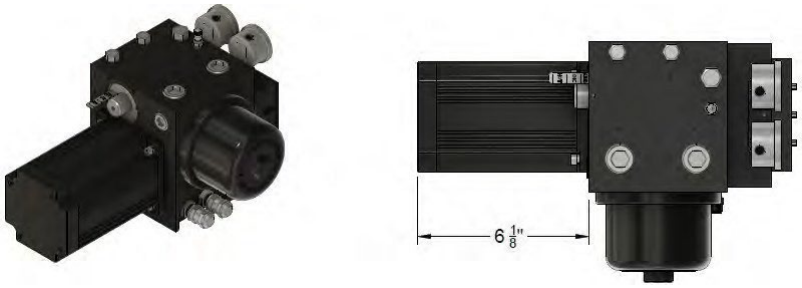
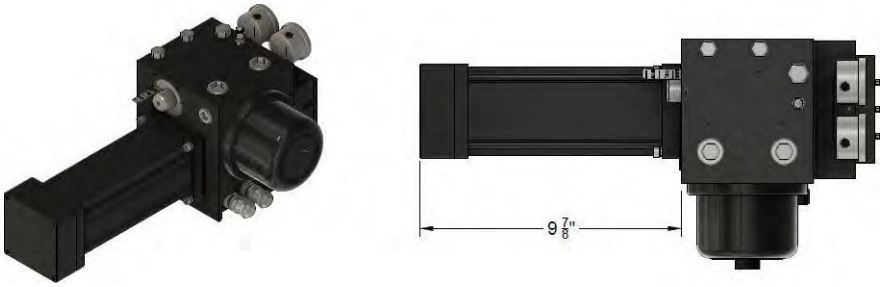


Figure 4: C Module (Above) vs D Module (Below)



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.

Figure 5: Electronic Control Enclosure

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

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

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.

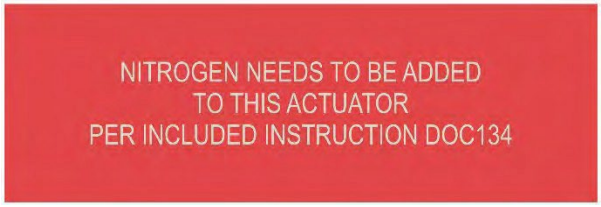


Figure 6: Shipment Label

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.

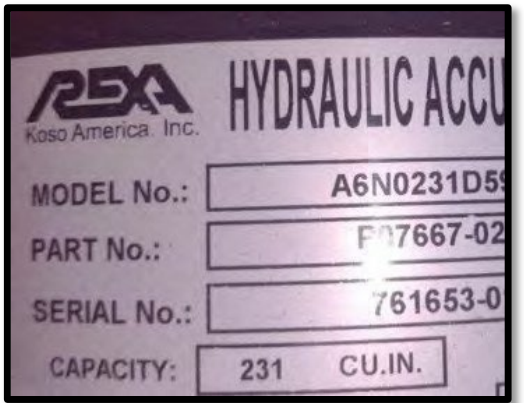


Figure 7: Accumulator Bottle Oil Capacity Tag

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.*

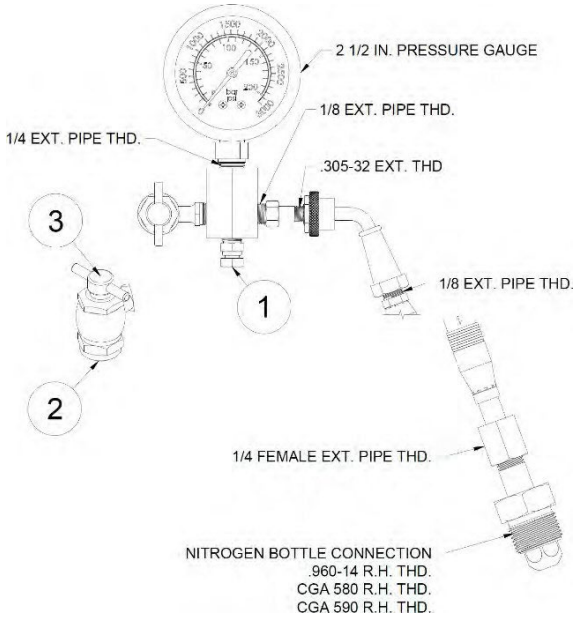


Figure 9: Charging Kit

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

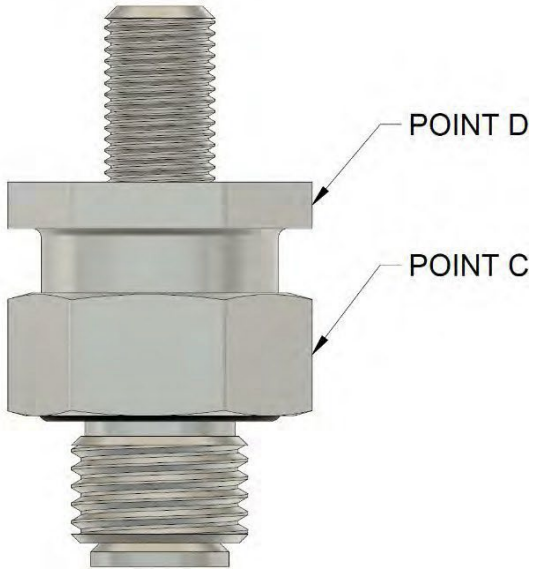


Figure 11B: Gas Valve Core

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 ¾” 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.*

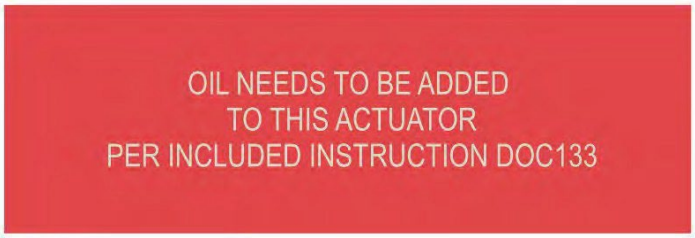


Figure 12

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 70-80 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

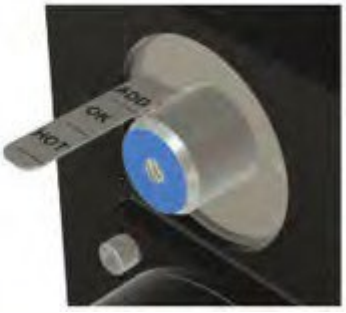


Figure 20: Oil Level Indicator “OK”

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.

ITEM	DESCRIPTION	PART NO.	QTY
1	#4 STR Fitting	P02461-001S	2
2	SS 0.250 Tube	P02465-001	4 FT
3	Tee Fitting	P03453-001S	2
4	Gauge Adapter	P05943-005S	2
5	Plastic Tubing	P05944-001	20 FT
6	Tubing Insert	P05945-170	2
7	Pressure Gauge	P08250-SAE4-001	2
8	Isolation Valve	P08920-4	2

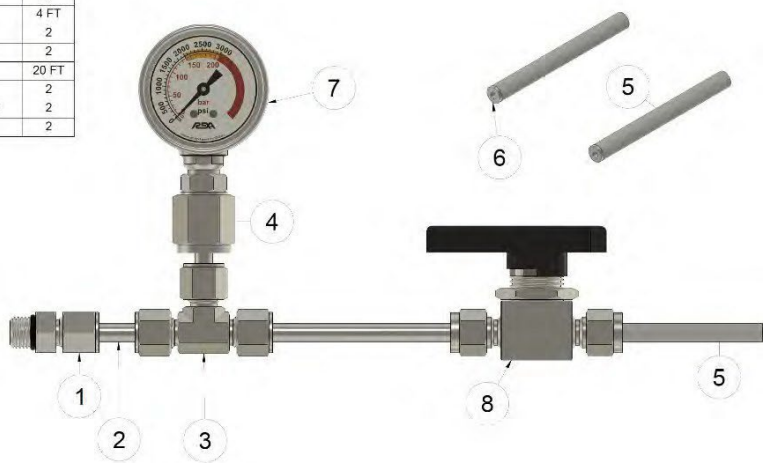


Figure 21: Bleed Kit (PN: K09275)

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.

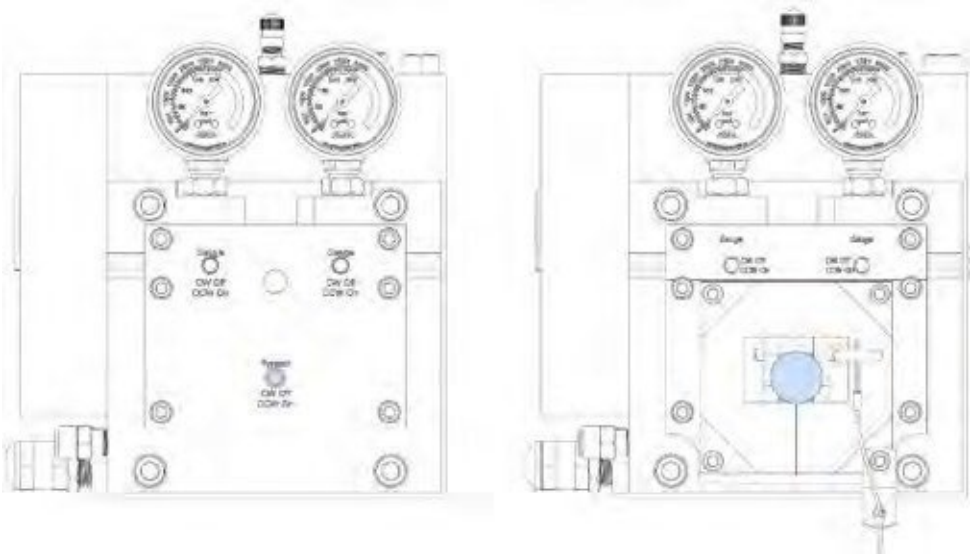


Figure 22: Bypass Valve Locator

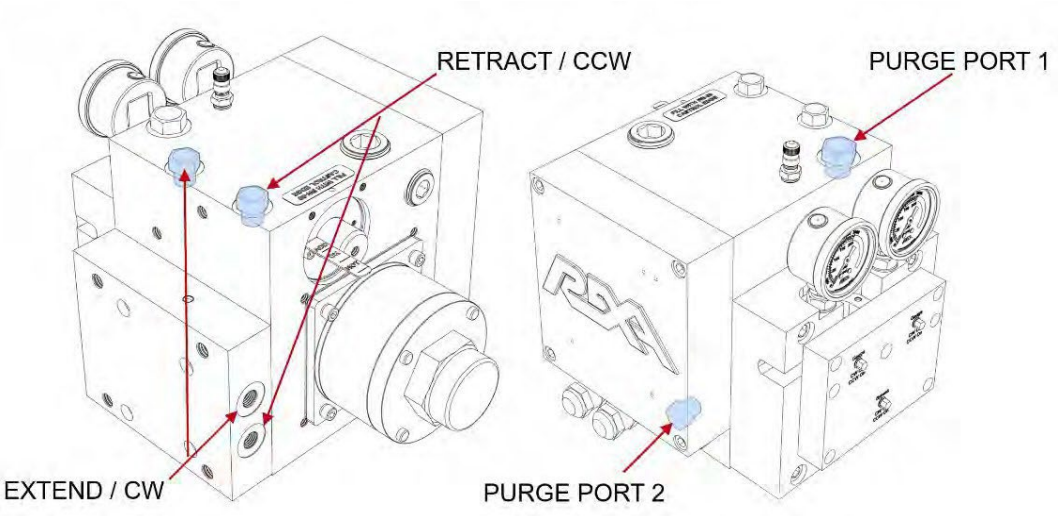


Figure 23: Extend/CW and Retract/CCW Ports

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 and Retract/CCW 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.

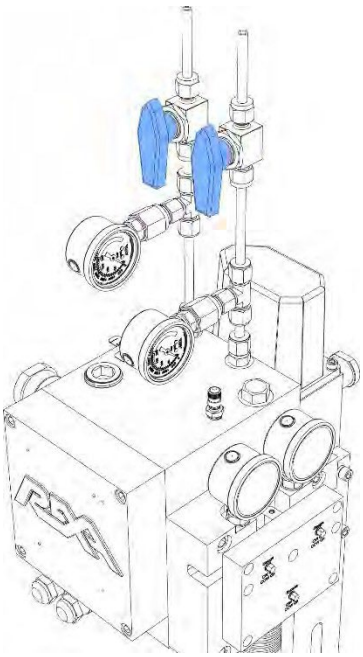


Figure 24: Isolation Valves

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 re-circulates 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.

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.

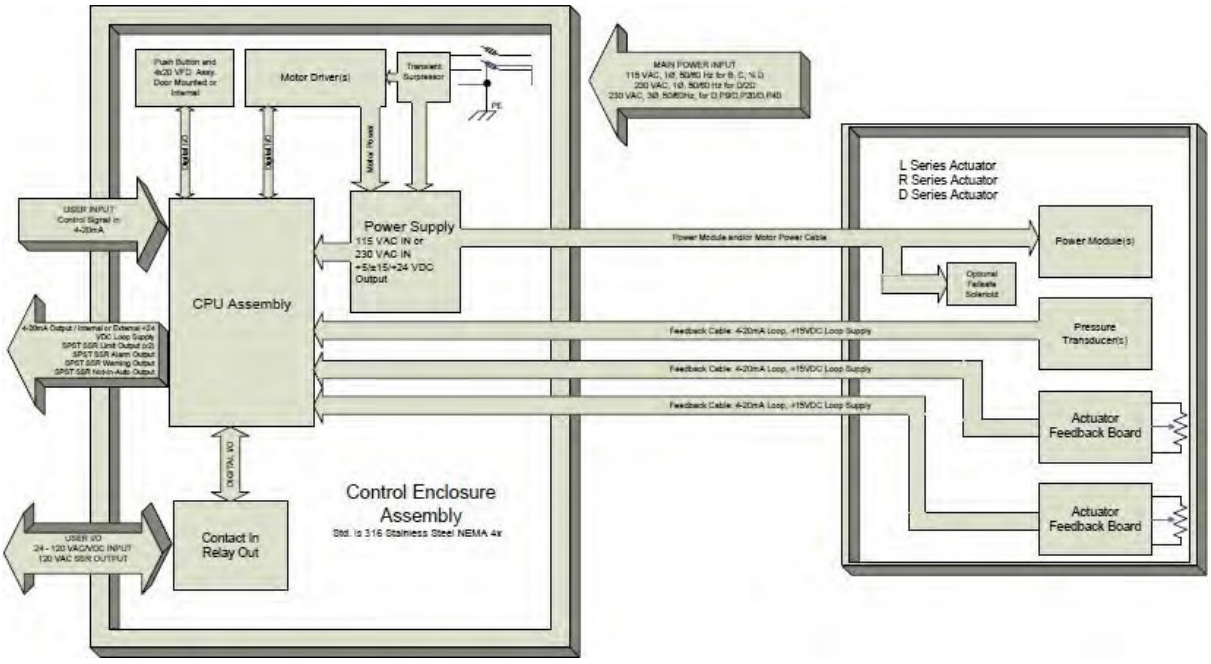


Figure 25: Electrical Installation Block Diagram

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.

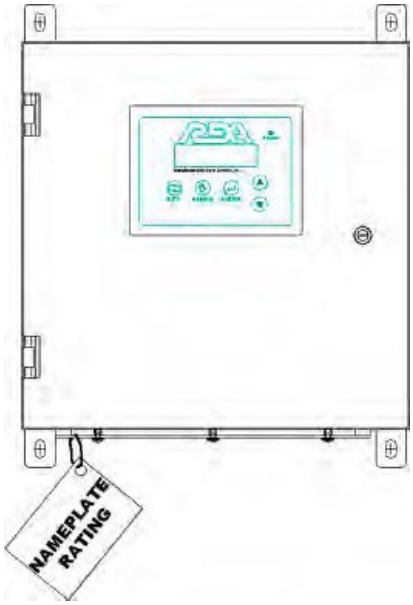


Figure 26: Electronic Control Enclosure

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:

a. Shall disconnect (isolate) the electronic control enclosure and actuator from the supply when required.

b. Shall be included in the building installation.

c. Shall be in close proximity and within easy reach of the electronic control enclosure.

d. 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:

  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.

- Be approved for use as a disconnect for the country in which this equipment is installed.
- Be provided with a lockout tagout 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

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.

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 600VAC 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 600VAC IR 200kA 27mm x 60mm
		D,2P40	100	N/A	N/A	Type CC
24VDC	N/A	1/3C	20	40	N/A	
		Dual 1/3C	40	N/A	N/A	Type J
		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	
		D,P40	50	N/A	N/A	Type aM 690V IR 80kA 22mm x 58mm

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

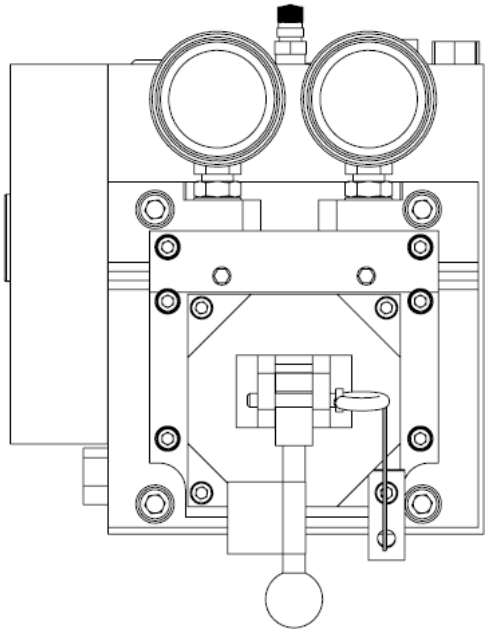


Figure 27A: Internal Solenoid

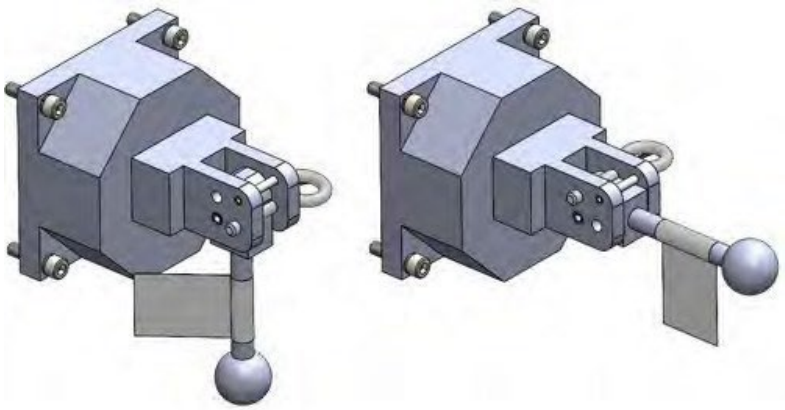


Figure 27B: Internal Solenoid Normal Operation (Left) vs Override Position (Right)

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. Thread the driven device stem into the coupling for a distance of at least one and a half times the stem diameter.

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.

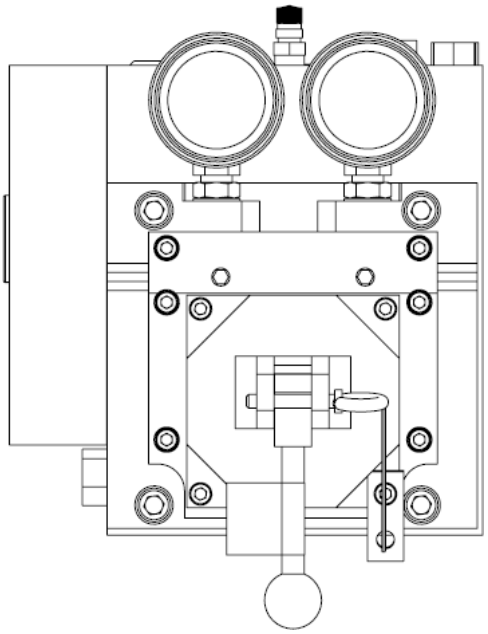


Figure 28A: Internal Solenoid

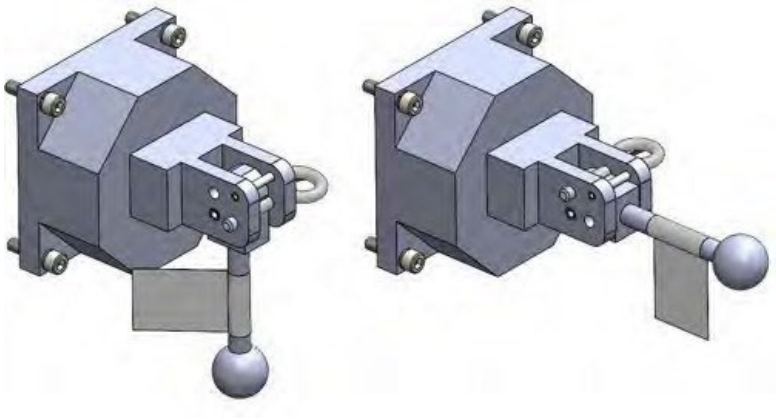


Figure 28B: Internal Solenoid Normal Operation (Left) vs Override Position (Right)

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”	½”	20 ft-lbs.	30 ft-lbs.
D10 000/ 20 000	.81”	¾”	200 ft-lbs.	250 ft-lbs.
D50 000/ 100 000	1.00”	1”	650 ft-lbs.	700 ft-lbs.
D200 000	1.3”	1 ¼”	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.

Figure 29A: Mini Low Power Terminal Block

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: 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.

Figure 29B: Standard Low Power Terminal Block

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: 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** for 5 seconds.
3. Scroll down to Position Lo with the down arrow.
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.

Figure 32: Initial Calibration

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.
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.
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.
16. Press the **ENTER** key. = will begin to flash.

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.
20. Press the **ENTER** key. = will begin to flash. Change current hours, minutes, and seconds using the up or down arrow. 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.
23. Press the **ENTER** key. = will begin to flash. Change current year, month, and day using the up or down arrow. 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**. 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.

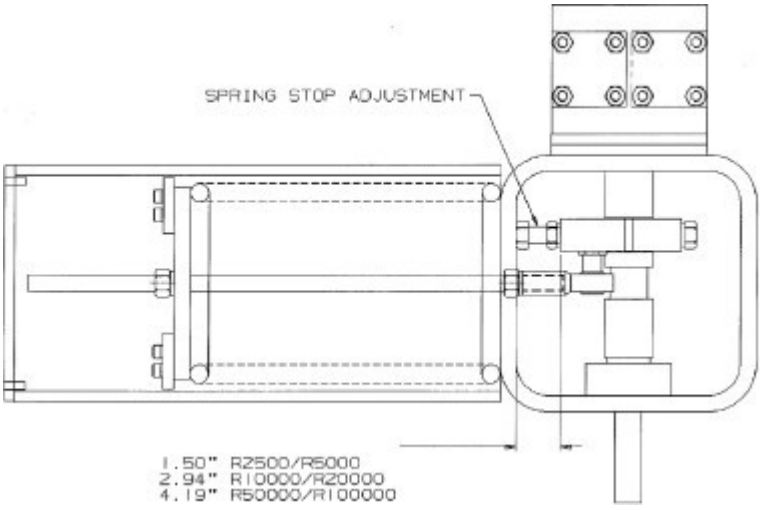


Figure 34: Spring Stop

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 0–5 degrees. See Figure 35 for details.

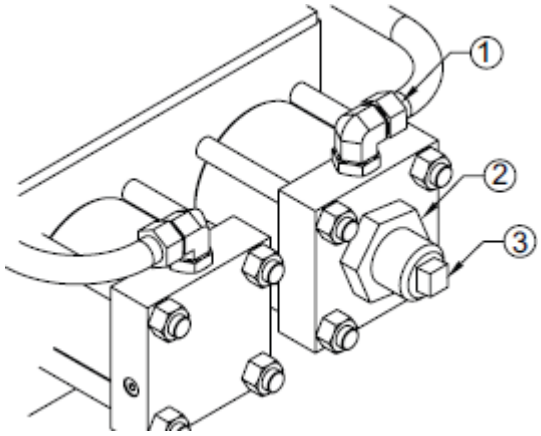


Figure 35: Stroke Adjustment

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

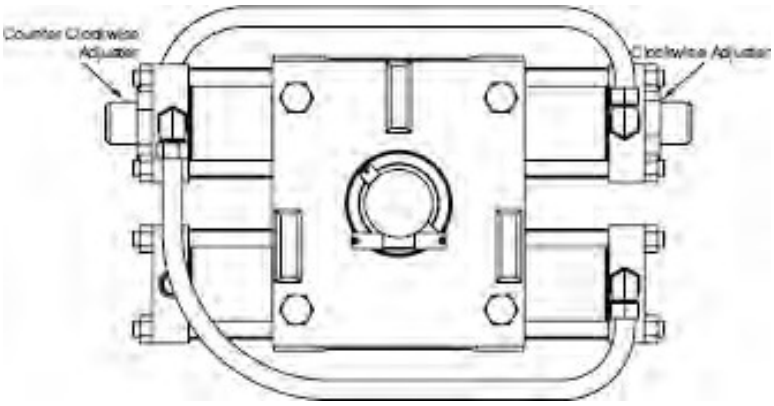


Figure 36A: Stroke Adjusters

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 adjustor provides a minimum of 5 degrees of actuator rotation adjustment.

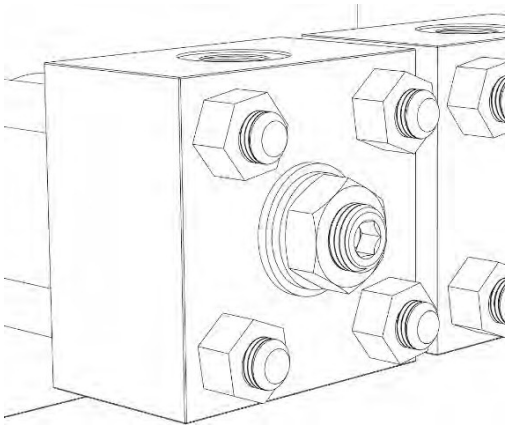


Figure 36B: 20,000 in-lbs. and Lower Stroke Adjuster

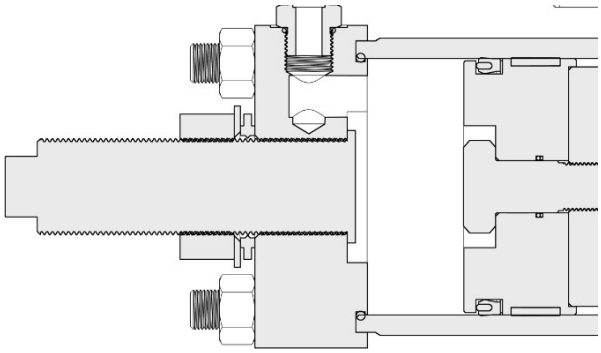


Figure 36C: 50,000 in-lbs. and Up Stroke Adjuster

11. The number of adjustment screw rotations needed to achieve the 5-degree 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 degrees 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.

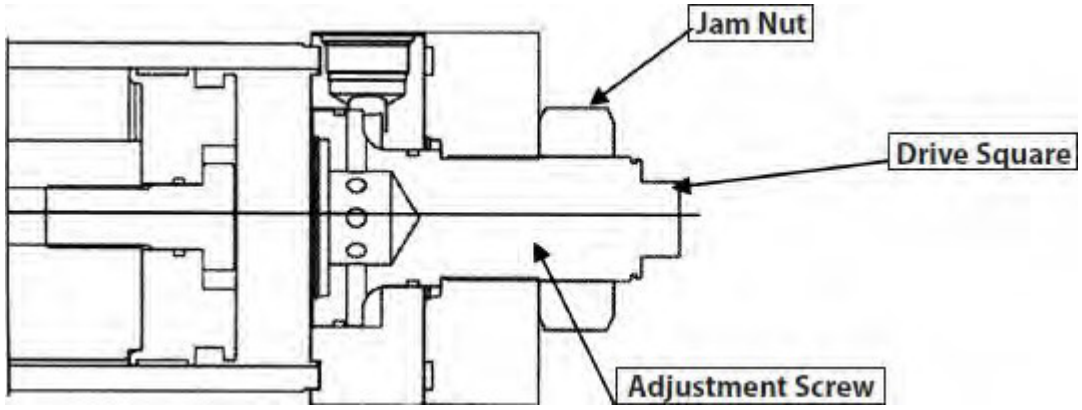


Figure 37: R200 000/R400 000 Stroke Adjuster

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.

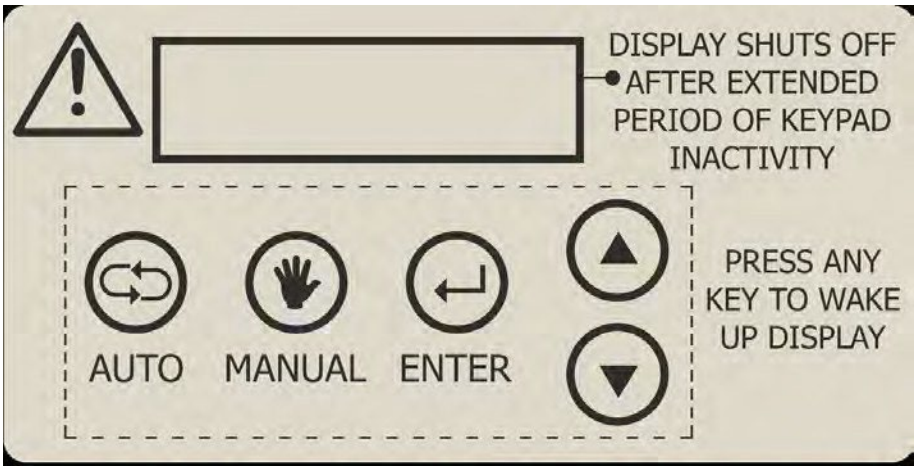


Figure 38: Display Label Inside Flip Cover

The REXA electronic control enclosure has three different operating modes:

- SETUP – Calibration Mode
- AUTO – Remote Mode
- MANUAL – 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 will scroll up and down each menu column.

6.1.3 Changing a Parameter

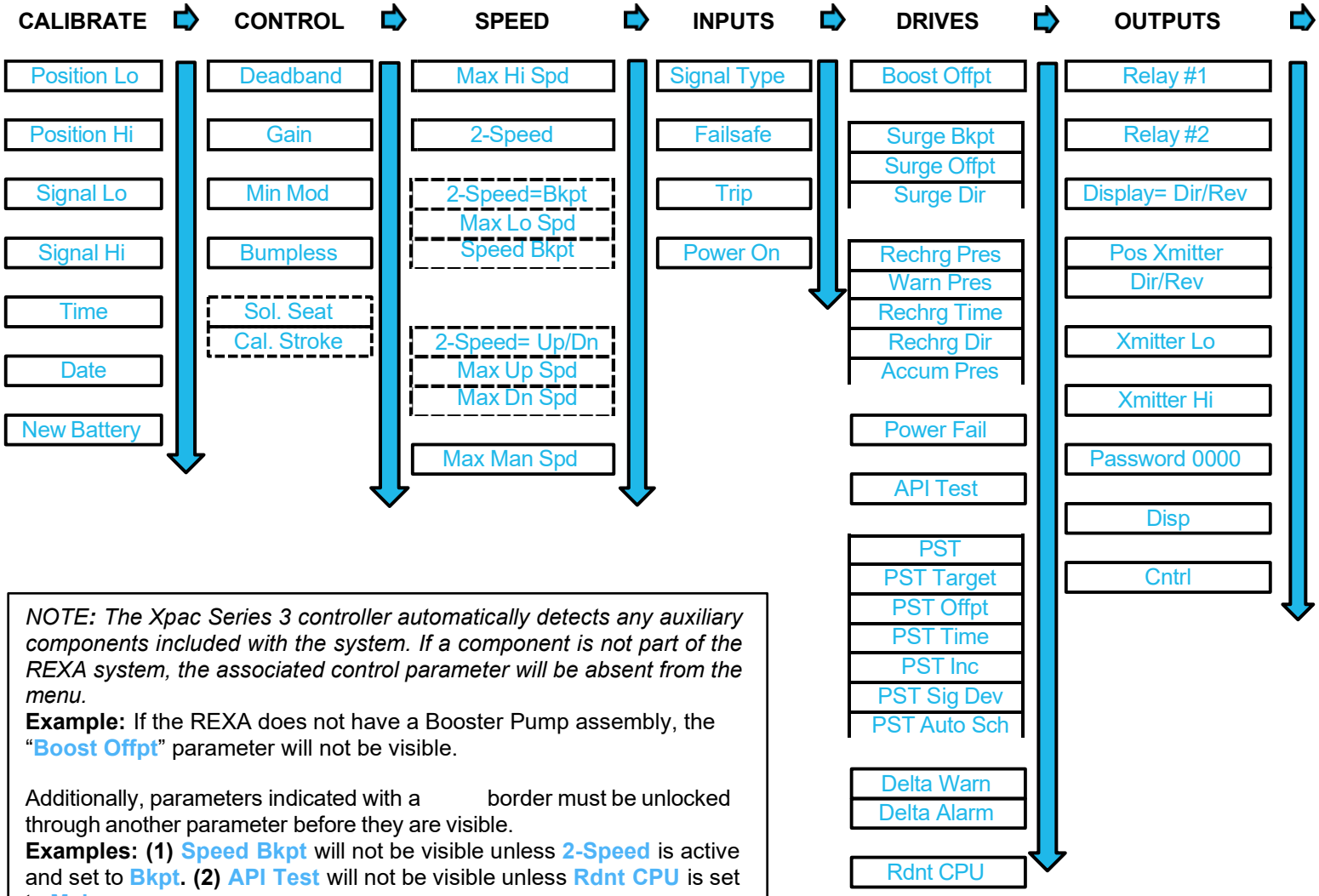
To access and change a parameter value, the parameter must be visible on the display (i.e. **Position Lo**).

Pressing the ENTER button 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 arrows will change the parameter value.

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

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 system. If a component is not part of the REXA system, 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.

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 Failsafe does not equal Off. If Failsafe 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 Failsafe 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%** percent 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**

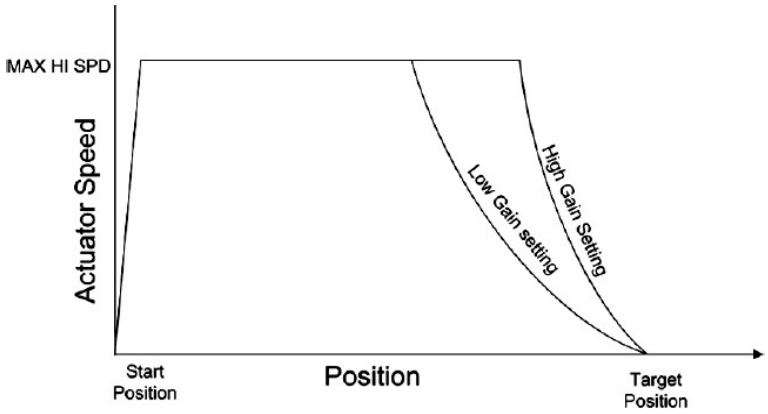


Figure 41: Gain

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%** percent of calibrated stroke/rotation

*NOTE: If set, this parameter will function in AUTO and MANUAL 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 **MANUAL** 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 percent from the calibrated end point. The following formula may be used to translate linear stroke to Rotary Percentage.

Rotary seat % = (4.5 / “Cal. Stroke” x .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** percent 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** percent 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%** percent 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%** percent 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%** percent 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: Failsafe 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 = UnpwrdPL**, the trip direction is to Position Lo and is active when no power is present on the input signal.

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

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

When **Trip = PwrdPH**, 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, MANUAL or SETUP**).

When **Power On = Local**, on power up or reset, if the previous mode was **AUTO**, the actuator will enter **MANUAL** (Local) 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 percent 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-recharge accumulator 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 Low), or **PH** (Position High) 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** 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** 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 Low and Position High 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 – the equals sign begins blinking.
2. Press Down – the value field resets to zero.
3. Press Enter – the new count is now zero.

NOTE: If the Up 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 ClPresbad:	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 Mode

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.

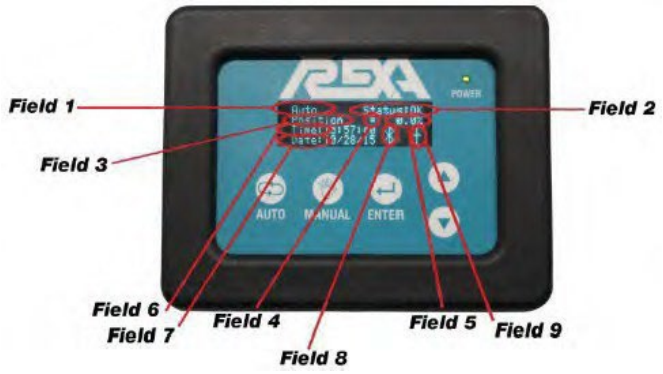


Figure 42: Current Stats and Historic Stats Menu

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.*

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:

Unknwn (Field 5) if the feedback signal from the actuator to the 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 Dn keys. Pressing the Dn 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)

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

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
Motor Type		Stepper		Servo	

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	-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	Standard oil & cartridge heater	1-inch thermal insulation[2]	Heat tracing & 1-inch thermal insulation[2]	Optional High Temp. Construction
Motor Type		Stepper		Servo	

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

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 43A, Figure 43B, and Figure 43C. 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 43A: Add Oil

Figure 43B: OK

Figure 43C: 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 44, is used in large actuator units and on accumulator fail-safe unit.

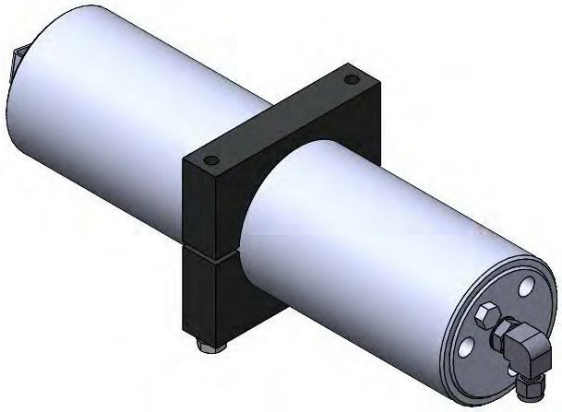


Figure 44: External Thermal Expansion Chamber

Figure 45A: 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 34A, Figure 43B, and Figure 43C. Typically, the PM oil level indicator is fully extended as in Figure 43C 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 to 80 psi. See Figure 45A for details. On typical accumulator fail-safe systems with the nitrogen charged external expansion chamber, the pressure gauge should read between 20 to 40 psi. See Figure 45B for details.

Figure 45B: Pressure Gauge

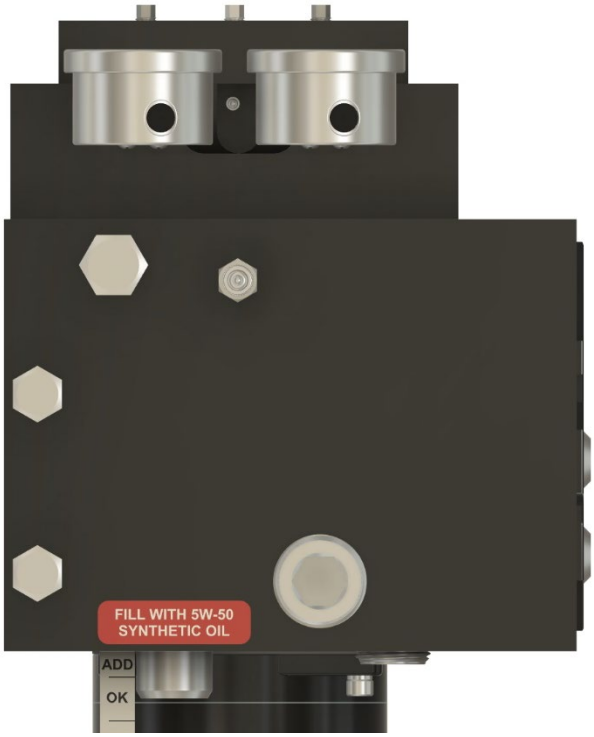


Figure 46: Oil Fill Sticker Locator

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 46 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 ±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 ±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 47: Thermal Expansion Relief Valve

The thermal expansion relief valve, shown in Figure 47, 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] IIB T3

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 2G Ex db [ia IIC] IIB T3**

ZONE 2: **II 3G Ex ec IIC T3 Gc and II 3(2)G Ex ec [ia Gb] 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.

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-0162X
KTL 21-KA4BO-0163X 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

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 on the E2X alternate pressure transmitter

X3 Electronic Assembly

7. 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.
8. TRANSIENT SUPPRESSION DEVICE: End user shall provide transient suppression of the supply terminals limiting to 140% of the rated supply.
9. Electronic enclosures shall be positioned such that the risk of impact to the window is low.
10. CONDUIT ENTRY SEALS: 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.
11. FASTENERS: only M16X2.0X60MM Stainless Steel hex bolts are to be used
12. 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.

13. FUSE REPLACEMENT table is as follows:

FUSE REPLACEMENT TABLE

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

X2 or X3 Actuator Assembly

14. CONDUIT ENTRY SEALS: 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.

15. SURFACE CLEANING: Actuator Assembly includes a non-metallic outer protective coating which may be cleaned with a damp cloth.

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

ACTUATOR FASTENERS REPLACEMENT TABLE:

Stepper Motor Mounting Screws (secures motor topower 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]

17. THREADED FLAMEPATHS: CUSTOMER TO ENSURE FINAL INSTALLATION COMPLIES WITH THE FOLLOWING TABLE:

FP #	Flamepath Description	Design Thread	Thread Pitch	Required Threads Engaged	Design Thread Length	Design Threads Engaged	Security Method
1,4	Threaded Cover	3.75-10UNS-2A	1/10UNC	≥ 5	Min: 14.78 Max: 15.24	Min: 5 Max: 6	¼-20UNC-2A Socket Hex bolt with mechanical latch provided on the power module
3,6	¾" and ½" NPT Actuator Power Module Entries	3/4"-14 NPT 1/2"-14 NPT	1/14	≥ 5	Min: 12.24 Max: N/A	Min: 11.76 Max: N/A	At least 5 threads to be fully engaged to internal NPT threads on power module. Internal threads gauge flush to 2 turns large with an L1 gauge

SPECIFIC CONDITIONS OF USE (Zone 1) SIRA 17ATEX1231X

II 2 G Ex db [ia IIC] IIB T3

X3 Electronic Assembly

1. CONDUIT ENTRY SEALS: 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.
2. FASTENERS: only M16X2.0X60MM Stainless Steel hex bolts are to be used
3. 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.

X2 or X3 Actuator Assembly

4. CONDUIT ENTRY SEALS: 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.
5. SURFACE CLEANING: Actuator Assembly includes a non-metallic outer protective coating which may be cleaned with a damp cloth.
6. 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]

7. THREADED FLAMEPATHS: CUSTOMER TO ENSURE FINAL INSTALLATION COMPLIES WITH THE FOLLOWING TABLE:

FP #	Flamepath Description	Design Thread	Thread Pitch	Required Threads Engaged	Design Thread Length	Design Threads Engaged	Security Method
1,4	Threaded Cover	3.75-10UNS-2A	1/10UNC	≥ 5	Min: 14.78 Max: 15.24	Min: 5 Max: 6	¼-20UNC-2A Socket Hex bolt with mechanical latch provided on the power module
3,6	¾" and ½" NPT Actuator Power Module Entries	3/4"-14 NPT 1/2"-14 NPT	1/14	≥ 5	Min: 12.24 Max: N/A	Min: 11.76 Max: N/A	At least 5 threads to be fully engaged to internal NPT threads on power module. Internal threads gauge flush to 2 turns large with an L1 gauge

8. Flamepath joints are not for repair on the E2X alternate pressure transmitter.

SPECIFIC CONDITIONS OF USE (Zone 2) IECEx CSA 17.0013X

General

1. Ambient Temperatures below -10°C: use field wiring suitable for minimum ambient temperature.
2. Unused apertures shall be closed with suitable blanking elements.
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. 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**	
		D,P40	**50**	**N/A**	**N/A**	**Type aM 690V IR 80kA 22mm x 58mm**

X2 or X3 Actuator Assembly

9. SURFACE CLEANING: Actuator Assembly includes a non-metallic outer protective coating which may be cleaned with a damp cloth.

10. 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

11. 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]

SPECIFIC CONDITIONS OF USE (Zone 2)

SIRA 17ATEX4360X

II 3 G Ex ec IIC T3 Gc

CSANe 23ATEX1094X

II 3(2)G Ex ec [ia Gb] IIC T3 Gc

General

1. Ambient temperatures below -10°C: use field wiring suitable for minimum ambient temperature
2. Unused apertures shall be closed with suitable blanking elements
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. FUSE REPLACEMENT table is the same table used in the section above per Zone 2 certificate IECEx CSA 17.0013X.

X2 or X3 Actuator Assembly

9. SURFACE CLEANING: Actuator Assembly includes a non-metallic outer protective coating which may be cleaned with a damp cloth.
10. 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
11. 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]

CE

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: 4 Manley Street
West Bridgewater, MA 02379 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: 4 Manley Street
West Bridgewater, MA 02379 USA

Brand Name:

Product Description: Electraulic (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: Ex db [ia IIC] IIB T3 -40C ≤ Ta ≤ 65C
Certificate: Sira17ATEX1231X

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: 4 Manley Street
West Bridgewater, MA 02379 USA

Brand Name:

Product Description: X2 and X3 Series Electraulic (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
Cert: SIRA 17ATEX4360X

II 3(2)G Ex ec [ia Gb] IIC T3 Gc -40C ≤ Ta ≤ 65C
Cert: CSANe 23ATEX1094X

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

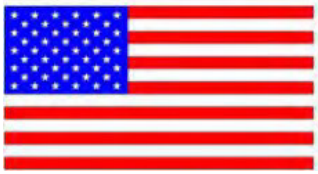
Applicable Harmonized Standards:

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., Incorporated 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 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.
4 Manley Street
West Bridgewater, MA USA

CE

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

<table>
<tr><th>REXA Power Module</th><th>Electronic Control Enclosure Temperature[1]</th><th>Actuator Assembly Temperature</th><th>Duty Cycle</th><th>T-Code Actuator</th></tr>
<tr><td>B Stepper – 115VAC</td><td rowspan="18">-40F to 131F
(-40C to 55C)</td><td rowspan="11">-40F to 150F
(-40C to 65C)</td><td rowspan="18">100%</td><td rowspan="4">T4</td></tr>
<tr><td>B Stepper – 230VAC</td></tr>
<tr><td>Dual B Stepper – 115VAC</td></tr>
<tr><td>Dual B Stepper – 230VAC</td></tr>
<tr><td>C Stepper – 115VAC</td><td rowspan="5">T3[2]</td></tr>
<tr><td>C Stepper – 230VAC</td></tr>
<tr><td>Dual C Stepper – 115VAC</td></tr>
<tr><td>Dual C Stepper – 230VAC</td></tr>
<tr><td>1/3C Stepper – 24VDC</td></tr>
<tr><td>Dual 1/3C Stepper – 24VDC</td></tr>
<tr><td>1/2D Servo – 115VAC</td><td rowspan="7">-40F to 176F
(-40C to 80C)</td><td rowspan="7">T4</td></tr>
<tr><td>1/2D Servo – 230VAC</td></tr>
<tr><td>Dual 1/2D Servo – 115VAC</td></tr>
<tr><td>Dual 1/2D Servo – 230VAC</td></tr>
<tr><td>D Servo – 115VAC</td></tr>
<tr><td>D Servo – 230VAC</td></tr>
<tr><td>Dual D Servo – 230VAC</td></tr>
<tr><td>D,P9 Servo – 230VAC</td><td rowspan="3">-40F to 121F
(-40C to 50C)</td><td rowspan="3">-40F to 140F
(-40C to 60C)</td><td rowspan="3">D = 100%
P9 & P40 Booster = 31.8%</td><td rowspan="3">T3C</td></tr>
<tr><td>D,P40 Servo – 230VAC</td></tr>
<tr><td>D,2P40 – 230VAC</td></tr>
</table>

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 2G Ex db [ia IIC] IIB T3

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 – 115VAC	-40C to 55C	-40C to 65C	100%	T3
B Stepper – 230VAC				
Dual B Stepper – 115VAC				
Dual B Stepper – 230VAC				
C Stepper – 115VAC				
C Stepper – 230VAC				
Dual C Stepper – 115VAC				
Dual C Stepper – 230VAC				
1/3C Stepper – 24VDC				
Dual 1/3C Stepper – 24VDC				
1/2D Servo – 115VAC				
1/2D Servo – 230VAC				
Dual 1/2D Servo – 115VAC				
Dual 1/2D Servo – 230VAC				
D Servo – 115VAC				
D Servo – 230VAC				
Dual D Servo – 230VAC				
D,P9 Servo – 230VAC	-40C to 50C	-40C to 60C	D = 100% P9 & P40 Booster = 31.8%	
D, P40 Servo – 230VAC				

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.

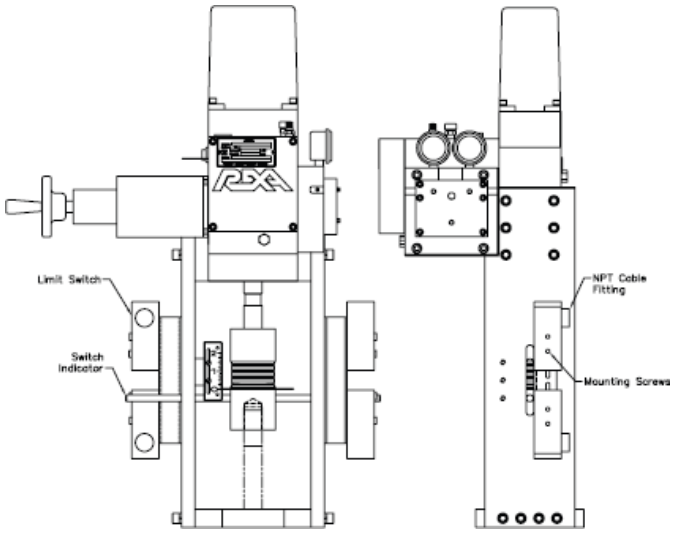
Rating: 5 amp @ 24 Vdc, 0.5 amp @ 125 Vdc,

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: ½”-14 NPT, screw terminals



Linear Limit Switches

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): ¼″

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

GRP. A, B, C & D.

Connection: ½″-14 NPT, screw terminals

Limit Switch Wiring

Remove the access plate by unscrewing the four slotted screws on the bottom of the unit. Thread the cable through the ½″ 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 1½ to 2 turns and slide the entire switch to the required position. Securely retighten the screws.

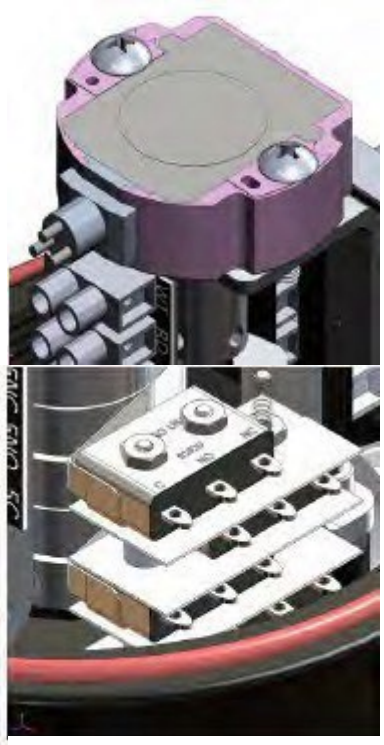
Rotary Mechanical Limit Switches

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

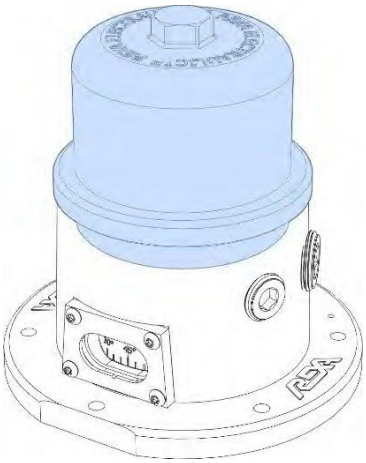
Rotary Valve Position Monitor Adjustment

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) ½″ NPT and one (1) ¾″ 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 ¾" 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.

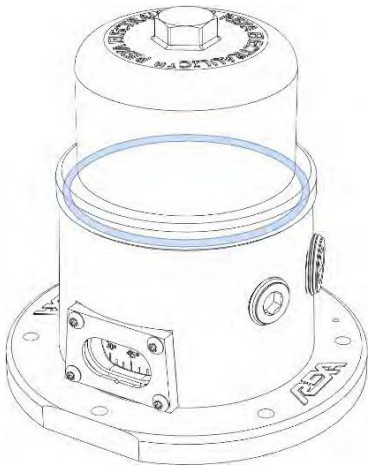
Rotary Wiring



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 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 ≤ Relay 1 Param
2	Relay 2	High Limit	Closed	Position ≥ 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. In this mode when the system is put into Local 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 @ 200VAC/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 Failsafe 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.

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.

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. **Inval 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 On-Line 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. The actuator may or may not continue normal operation depending on actuator construction.

Set up Mode: Actuator will move only if additional motors are available.

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

Auto Mode: Actuator will move only if additional 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.

Cleared by: The Primary 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.

P_DRV_Temp:

Cause: The Primary Servo Motor Driver is over temperature.

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

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_Replc_DRV:
Cause: The Primary Servo Motor Driver has a shorted output.

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

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.

Cleared by: The Primary Servo Motor Power cable short or open corrected.

P_MTR-Short:
Cause: The Primary Servo Motor has a short.

Indicators: **P_MTR-Short** is displayed. Warning relay opens.

Cleared by: The Primary Servo Motor has been replaced.

Dual Servo Faults:

DSrvFlt:
Cause: Fault line from Dual Servo Motor indicating fault state Indicator:

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

Set up Mode: Actuator will move only if additional motors are available.

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

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

Cleared by: CPU will attempt to reset Drv fault error until fault condition is corrected.

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.

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.

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.

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.

Cleared by: The Dual Servo Motor has been replaced.

Accumulator Servo Faults:

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

Indicator: Warning relay opens Display: **AServoFlt**.

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

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.

Cleared by: The Accumulator Servo Motor Resolver cable short or open corrected.

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.

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.

Cleared by: The Accumulator Servo Motor Power cable short or open corrected.

A_MTR-Short:
Cause: The Accumulator Servo Motor has a short.

Indicators: **A_MTR-Short** is displayed. Warning relay opens.

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.

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 output.

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

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.

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.

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 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. **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 & 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 Appendix V 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 Appendix V 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 Appendix V 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 Appendix V 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 Appendix V 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 Appendix V 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 no 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:	REXA	**Model Name(s):**	X3
Manufacture ID Code:	222 (DE Hex)	**Device Type Code:**	56961(DE81 Hex)
HART Protocol Revision:	7.6	**Device Revision:**	1
Number of Device Variables:	6		
Physical Layers Supported:	FSK		
Physical Device Category:	Actuator		

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, manual and auto modes.

NOTE: No parameters can be written into the actuator unless that actuator is in Setup Mode.

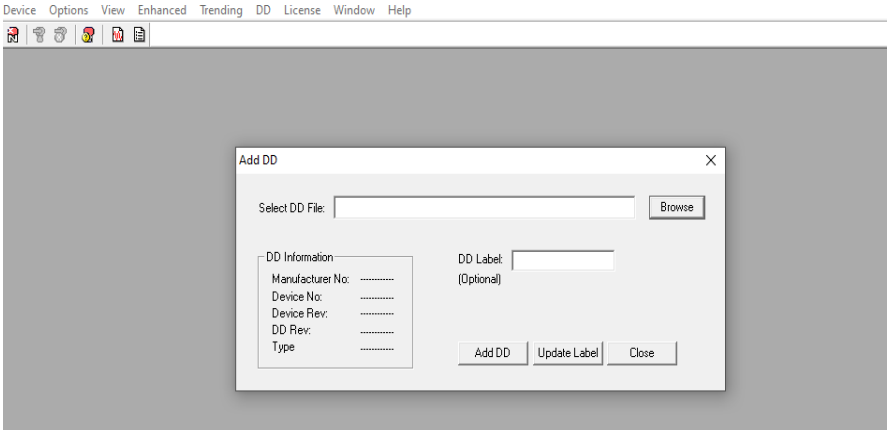
Product Interfaces

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.

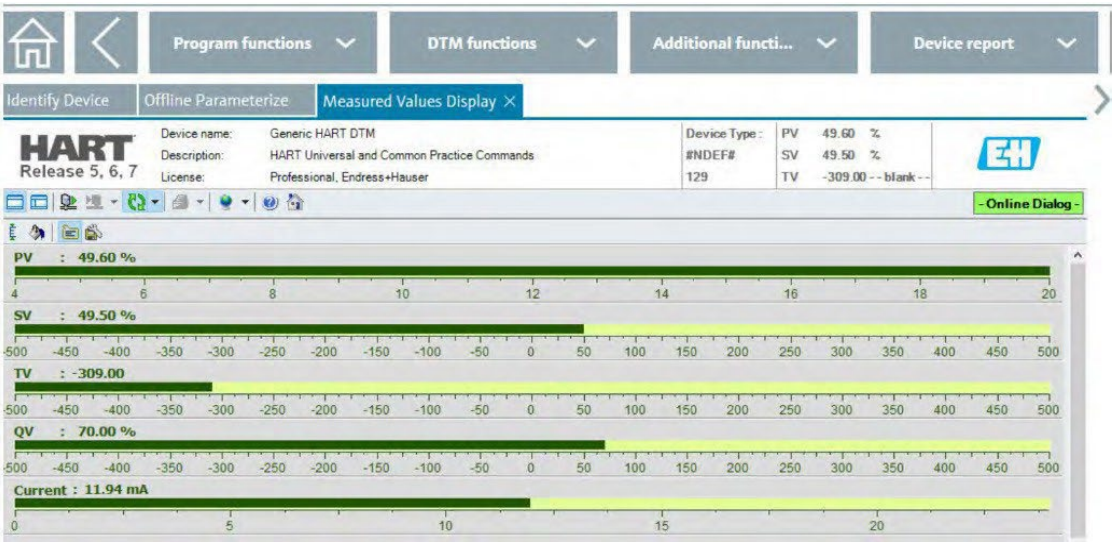


Install/Update REXA DD

There are multiple ways Host programs can handle the integration of a field device (Rexa Actuator).

Basic HART Commands / Generic DTM Option

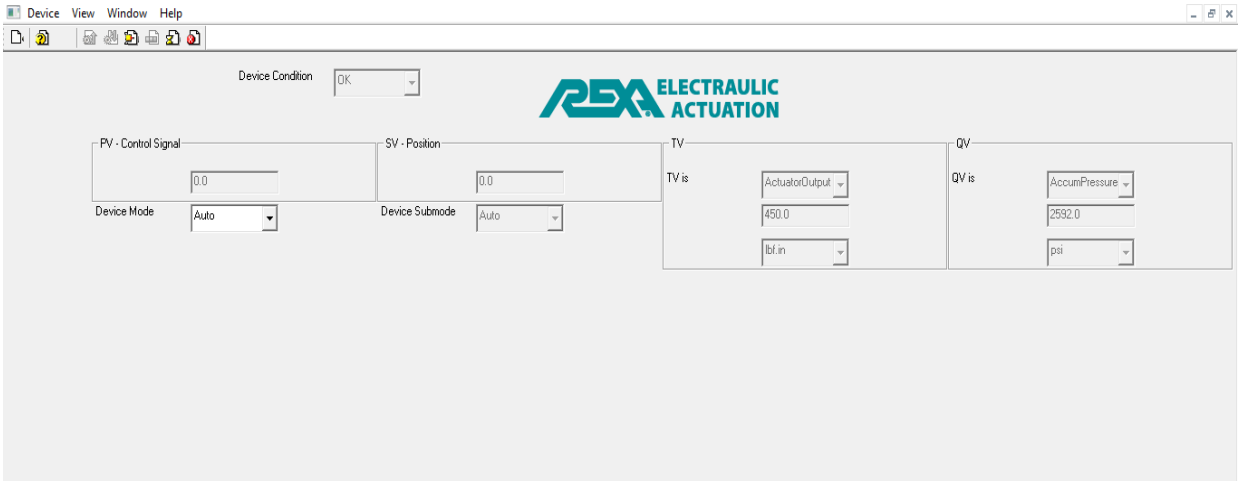
When a field device is connected to a HART Host and there are no device driver files installed the Host system will communicate using HART “Universal” and “Common Practice Commands”. The screenshot below provides an example. Variables are listed as “PV” – Primary variable, “SV” Secondary Variable, “TV” – Tertiary Variable, “QV” Quaternary Variable.



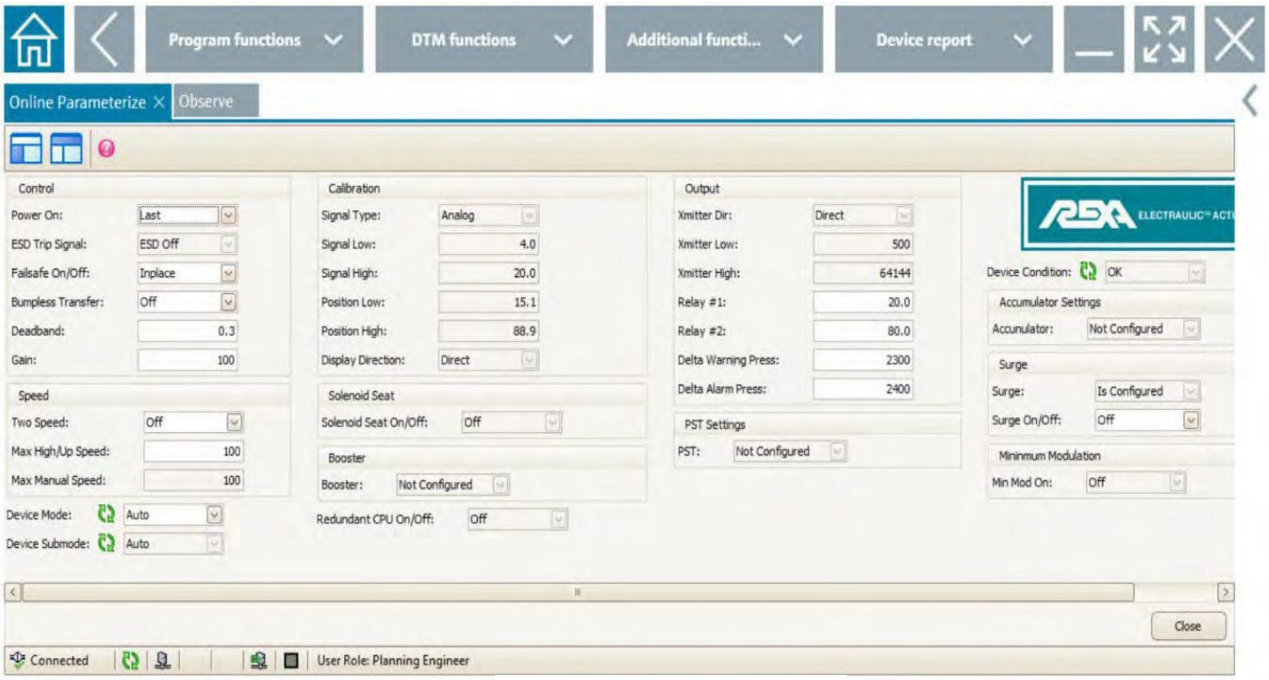
Basic HART Commands / Generic DTM Option

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.



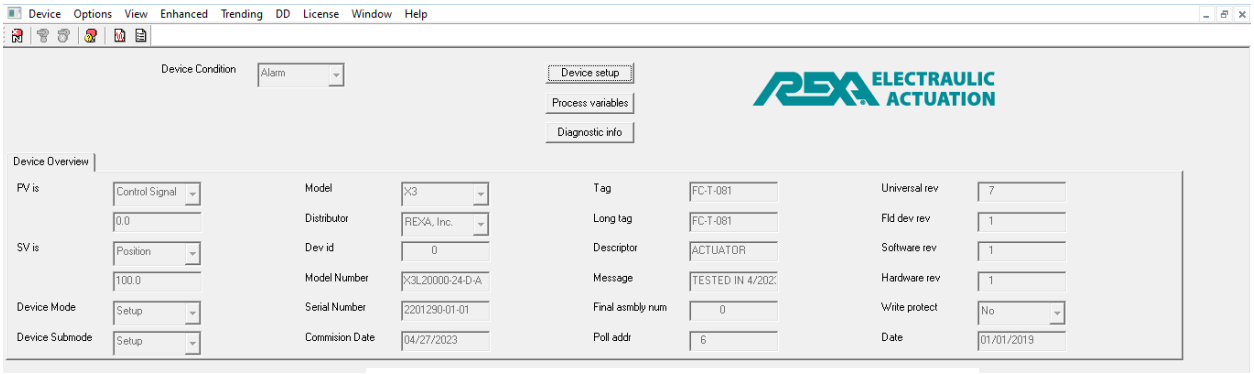
DD & Advanced iDTM Translators



GUI Screens

Setup Device Polling Address Search Range

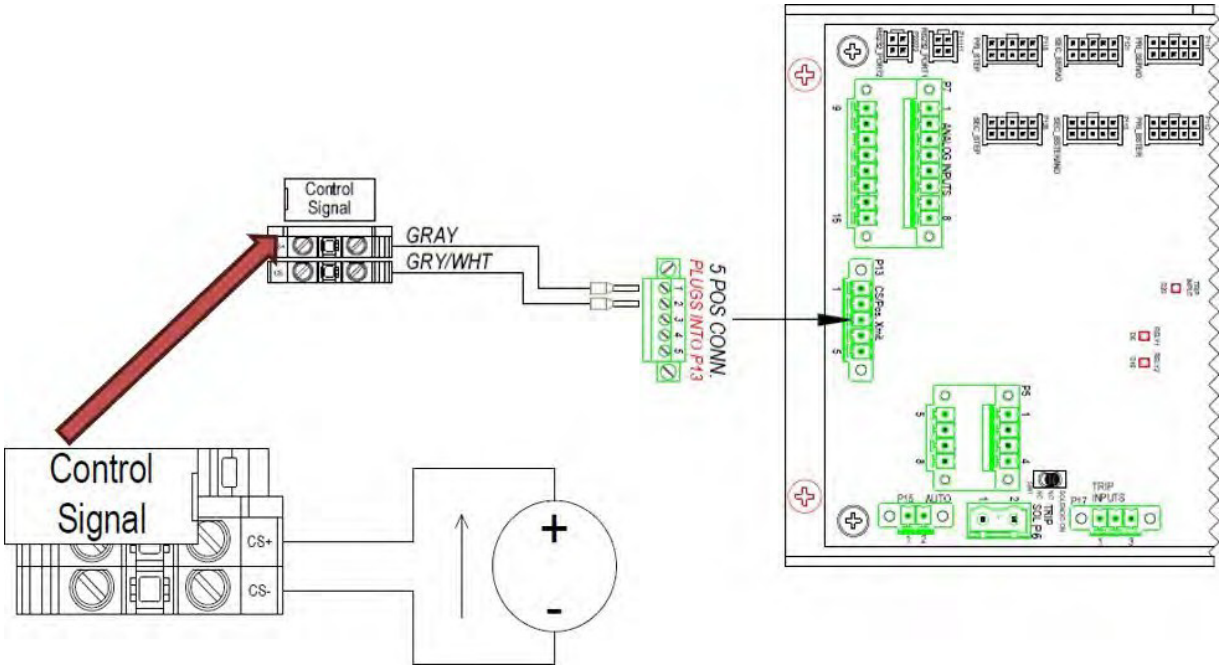
REXA is configured with the polling address 0 (can be updated as needed to 64).



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

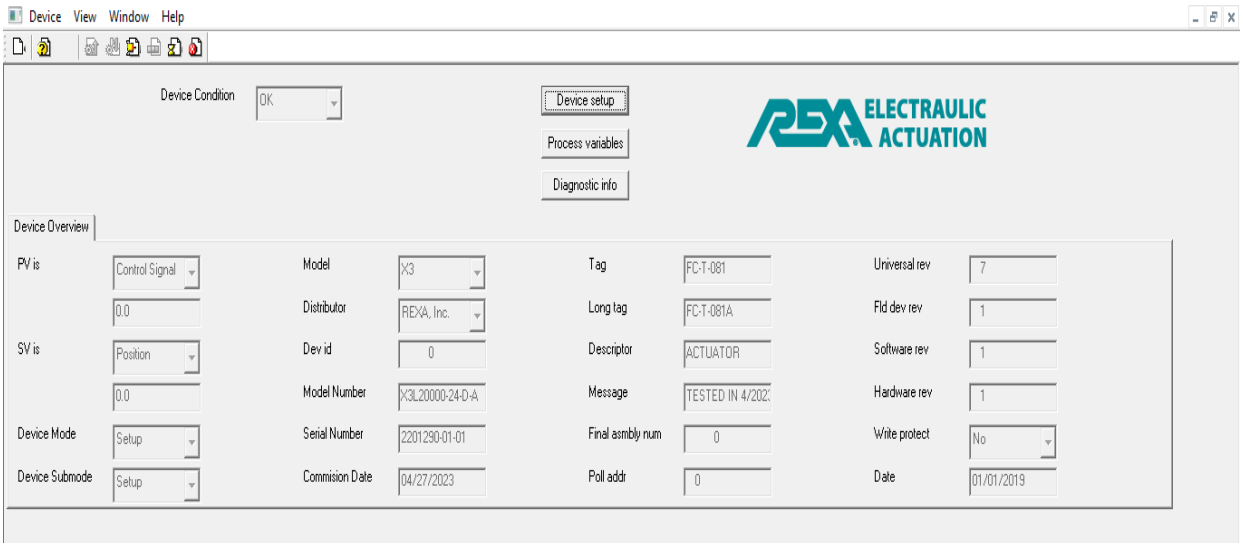
Not available on all models.

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.

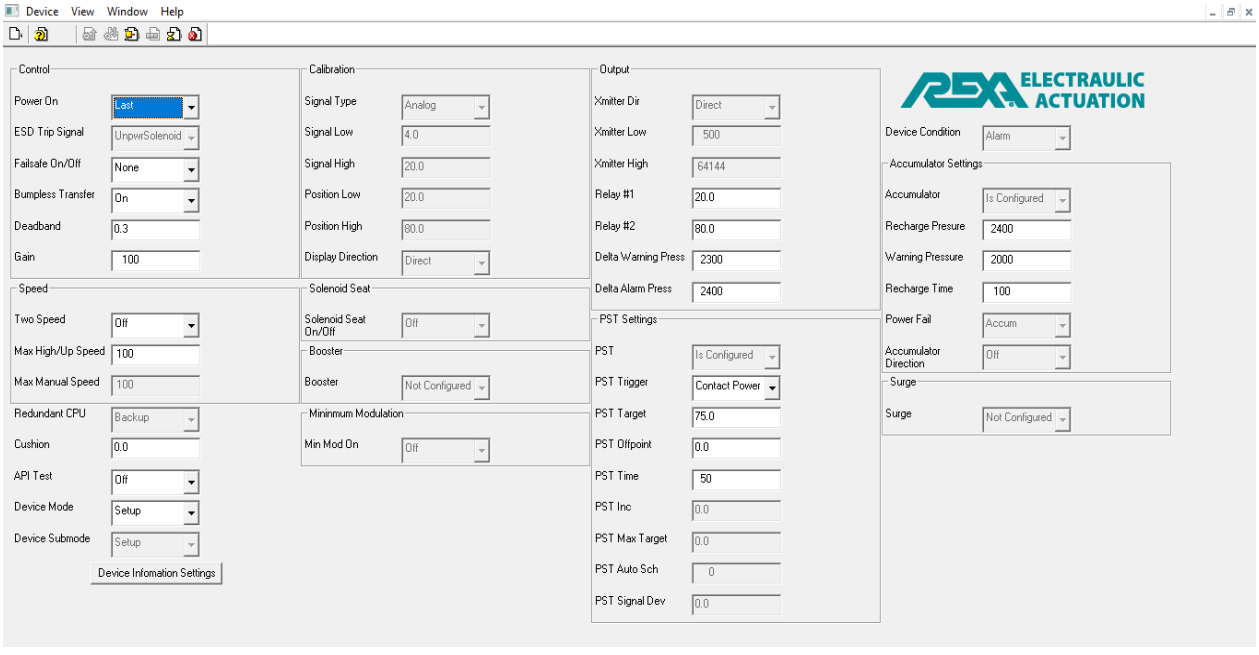
Host HART application allows user to get an overview of the device through online menus or navigation windows provided in the host application. While the device is Online the parameters are greyed out and cannot be modified. To modify parameters, the device must be put into setup mode.



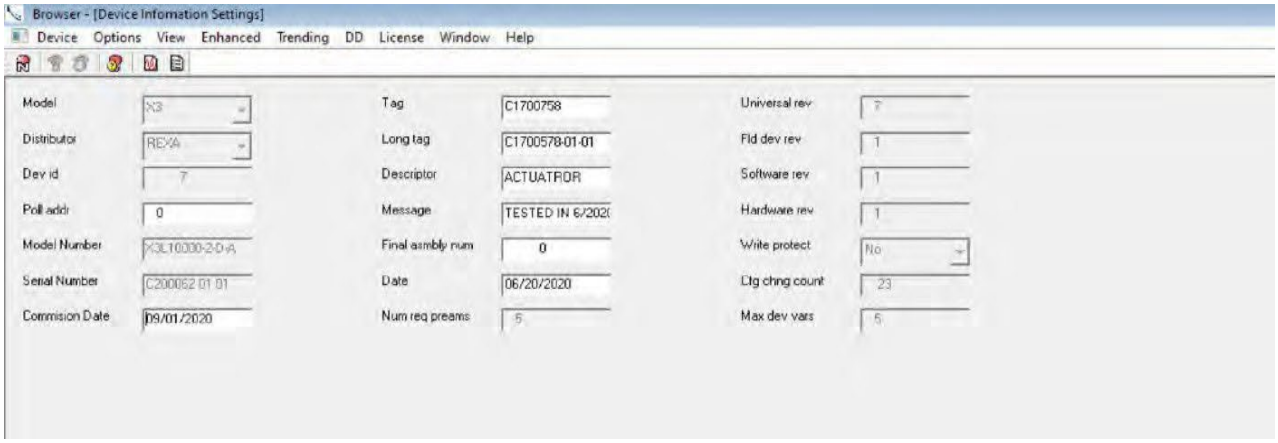
Write Protection

Device Settings

Navigate the online menu through host HART application, user can find the device setup menu.



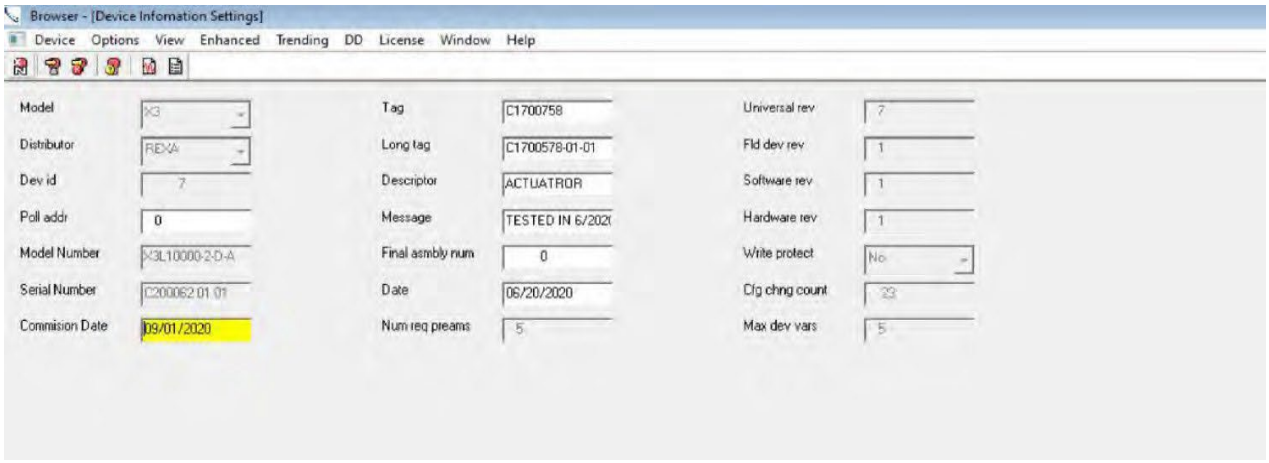
Online Menu Navigation



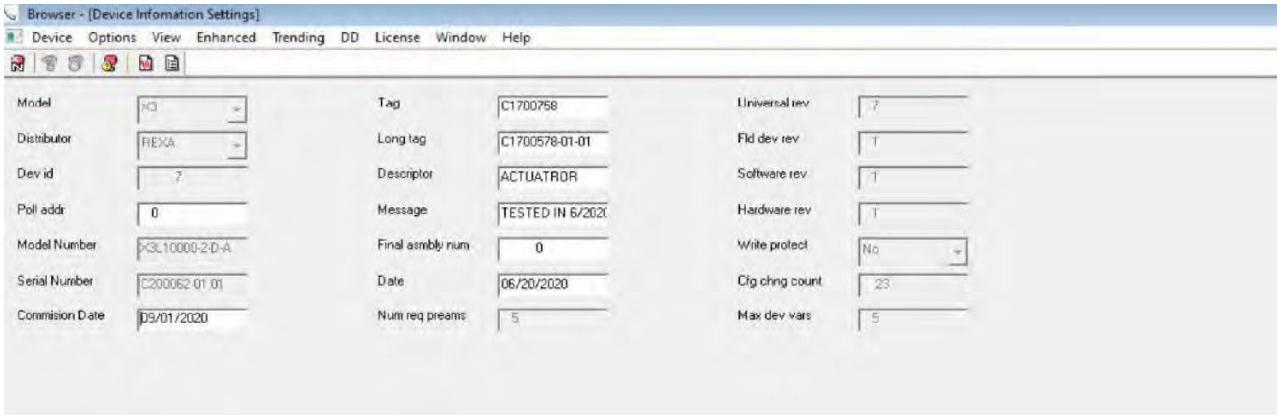
Device Identification Settings

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:



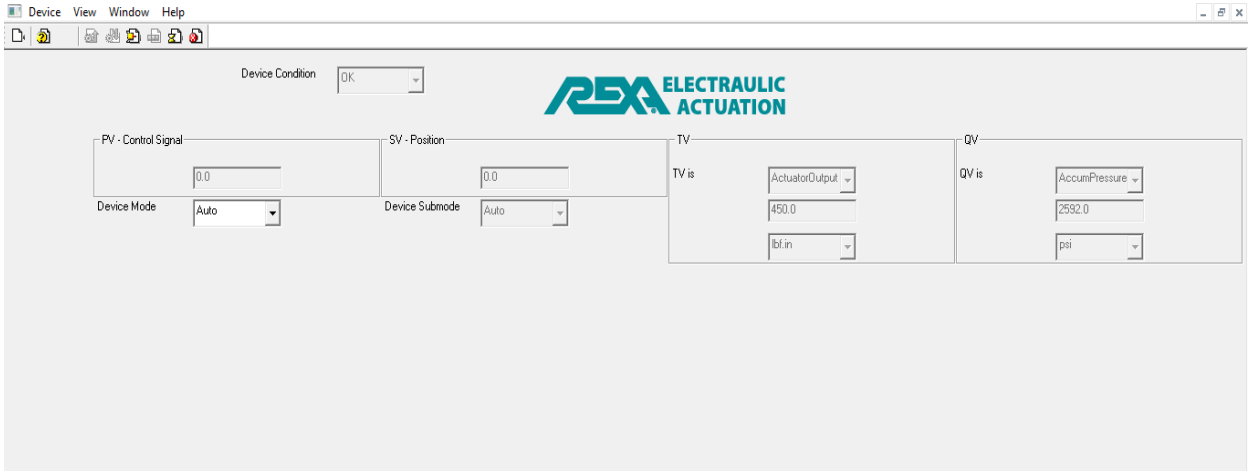
After setting commission date:



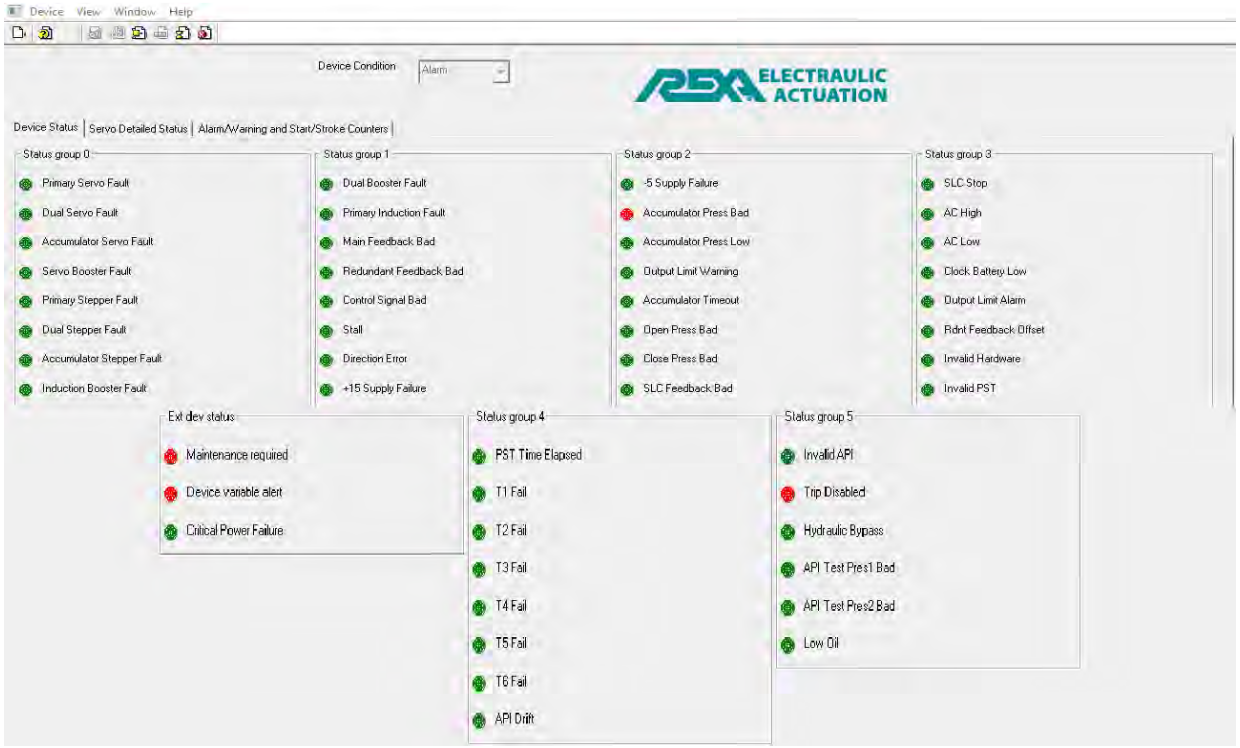
To satisfy the user's convenience, REXA treats short tag as a part of the long tag.

Monitor X3 Device's Operation Process

Host HART application can monitor X3 device in real time through process variables.

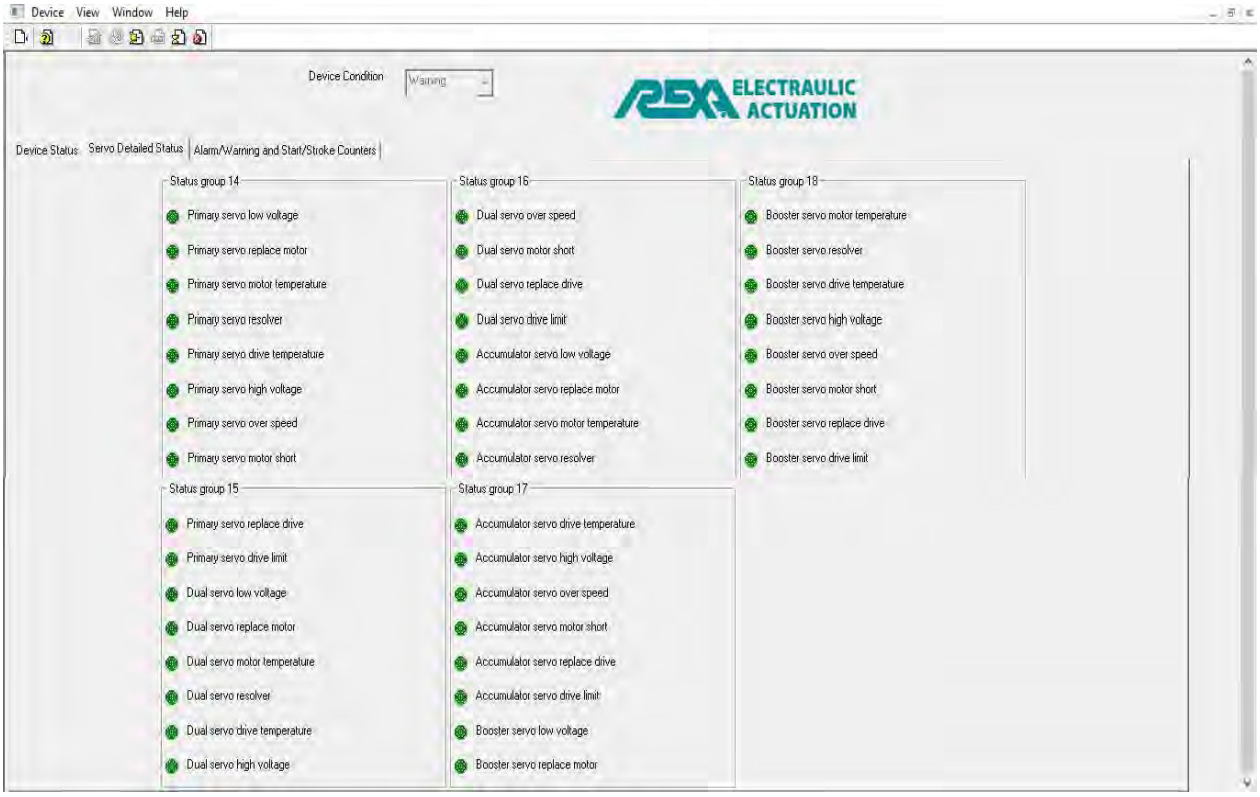


Monitor X3 Device's Operation Process



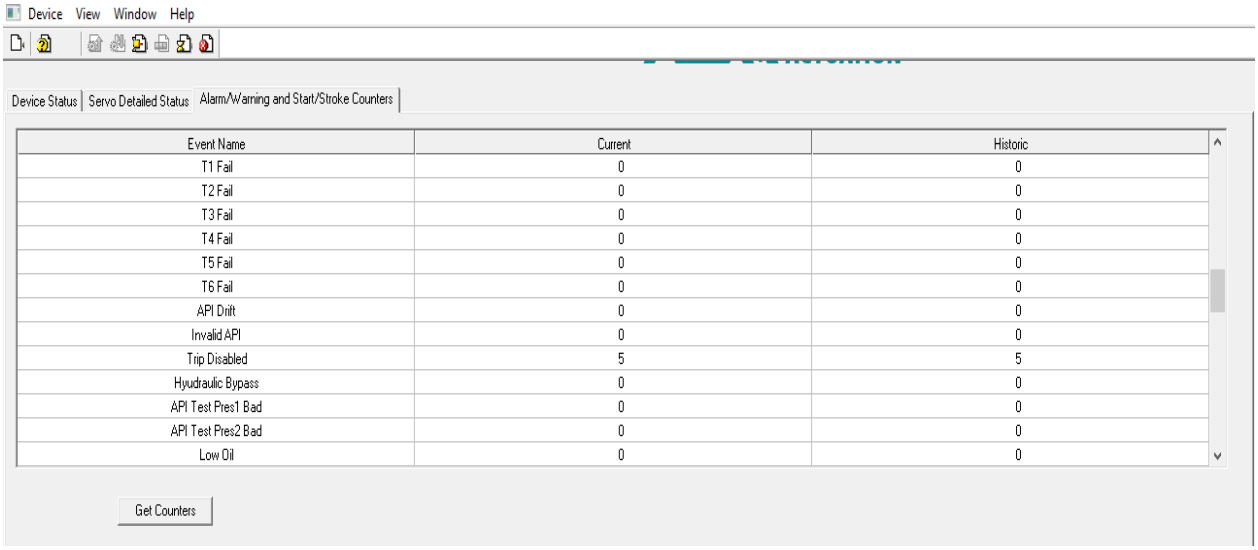
X3 Device Fault Information

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:



Event Name	Current	Historic
T1 Fail	0	0
T2 Fail	0	0
T3 Fail	0	0
T4 Fail	0	0
T5 Fail	0	0
T6 Fail	0	0
API Drift	0	0
Invalid API	0	0
Trip Disabled	5	5
Hyudraulic Bypass	0	0
API Test Pres1 Bad	0	0
API Test Pres2 Bad	0	0
Low Oil	0	0

Counter Page

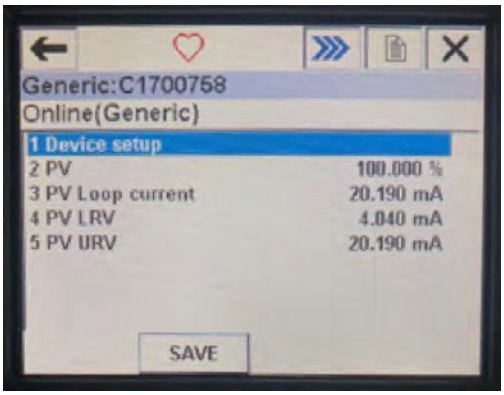
To get updated counters, user can click on the “Get Counters” button, and further click on “OK” on the question of “Read All The Counters Now?”

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 4 real time variables will show up and they will continuously update further confirming the Rexa is configured properly. as shown in the figure below.



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 the 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, and a negative valve indicates retracting/CCW.

Accumulator

4~20mA accumulator pressure signal represents the pressure from 0 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

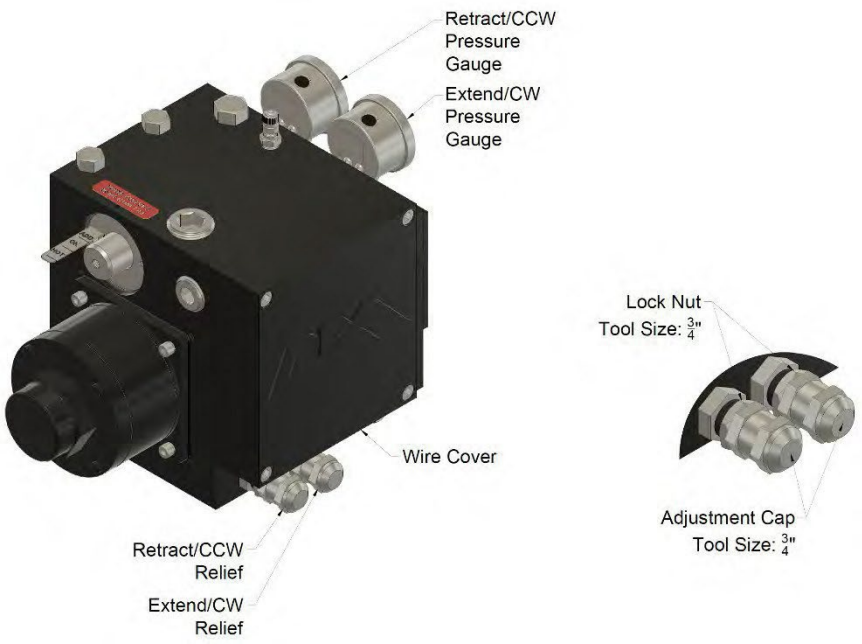
Burst Mode
This Field Device does not support Burst Mode.

Catch Device Variable
This Field Device does not support Catch Device Variable.

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	
Adjustment Range (psi)	**2,250-3,000**
Spring Color	**Brown (Std)**

NOTE: When using standard relief springs, each ¼ turn is approximately a 300 psi change.

Standard springs are 2,250 – 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 to increase the relief pressure and CCW 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:

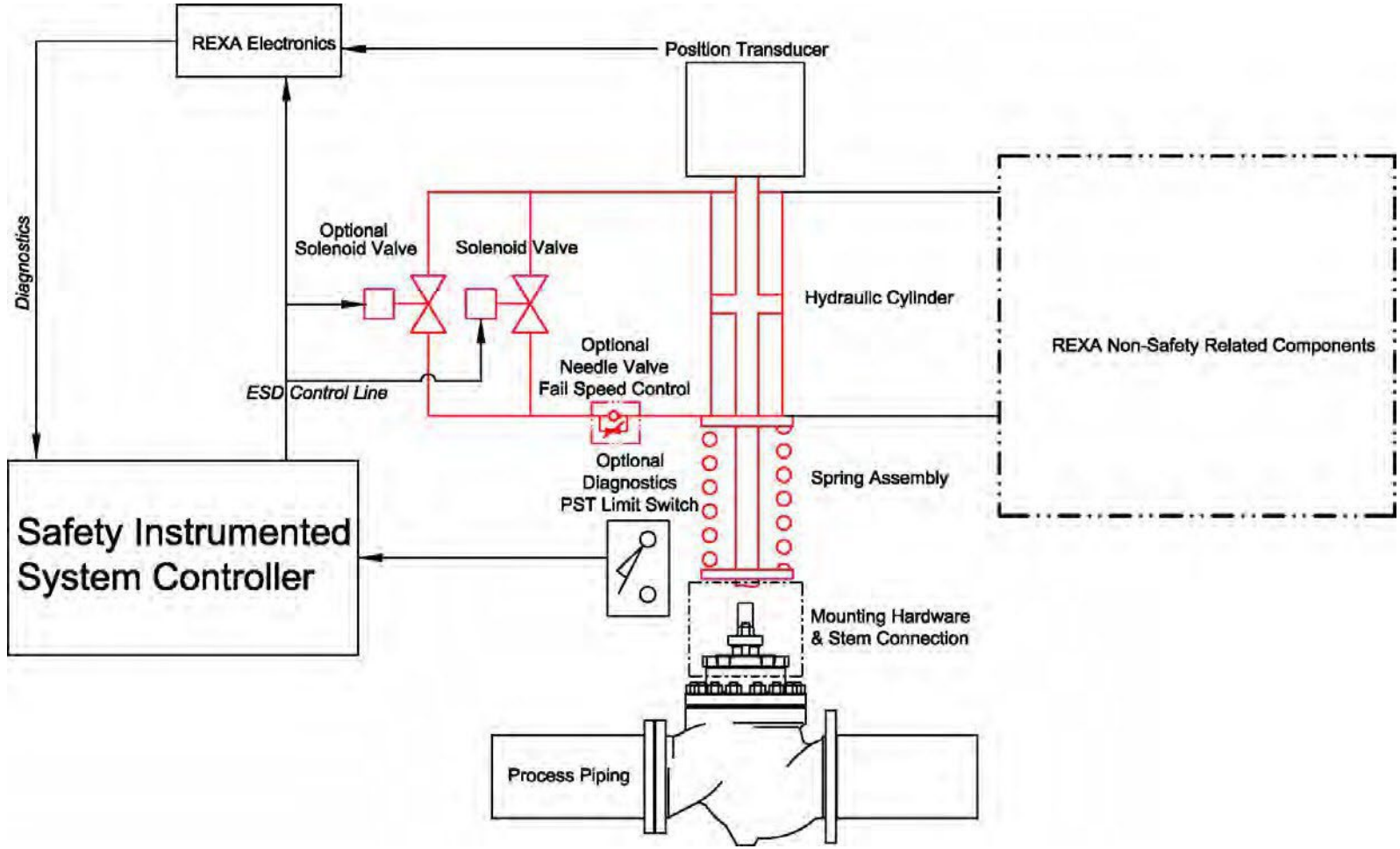
1. The actuator must be calibrated to the driven device; refer to the Mechanical and Electrical installation section of this manual.
2. The actuator end points need to be set. Reference the section of this IOM on setting mechanical end stops.

System Operation

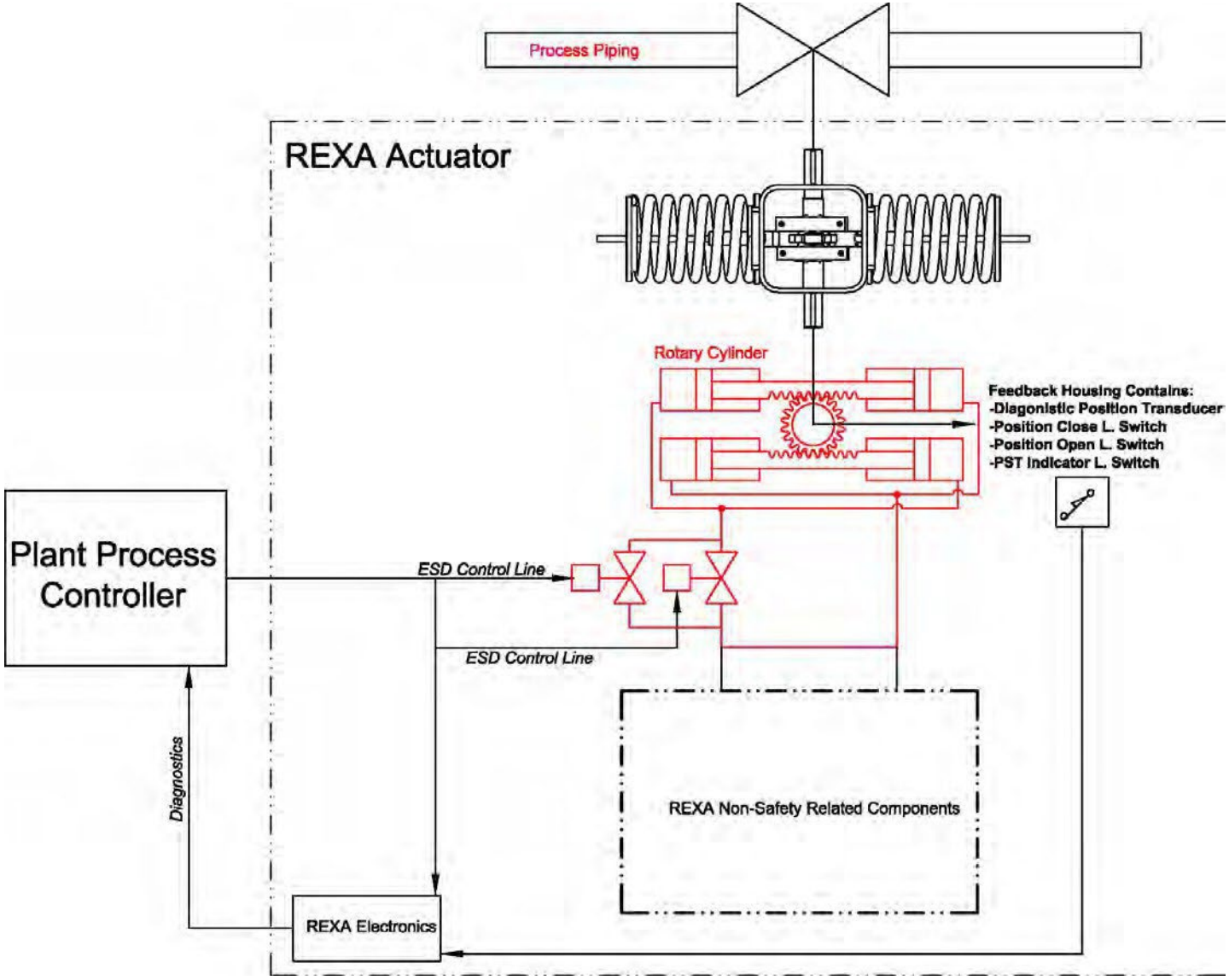
The primary safety function of the actuator is to place the driven device in the process safe position when input to the actuator's solenoid valves is de-energized. The safety function that carries the SIL certification is an ESD trip function. This trip function is designed to ensure the actuator can 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.

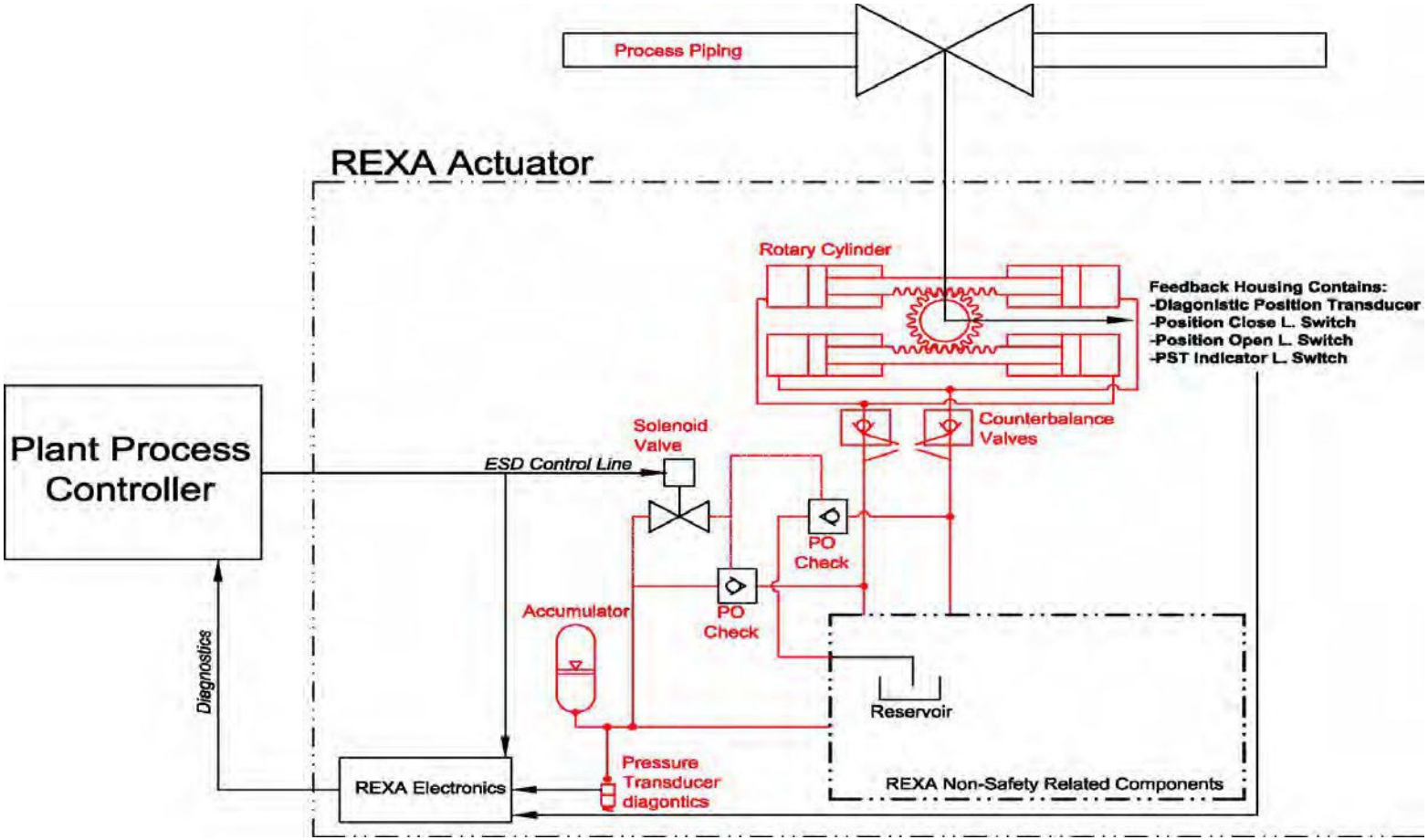
2. Since the safety solenoids are controlled directly by the safety system a trip relay must be installed to disable the REXA electronic control enclosure during a safety event. This relay will ensure the REXA electronic control enclosure cannot react to the safety system taking control of the actuator.



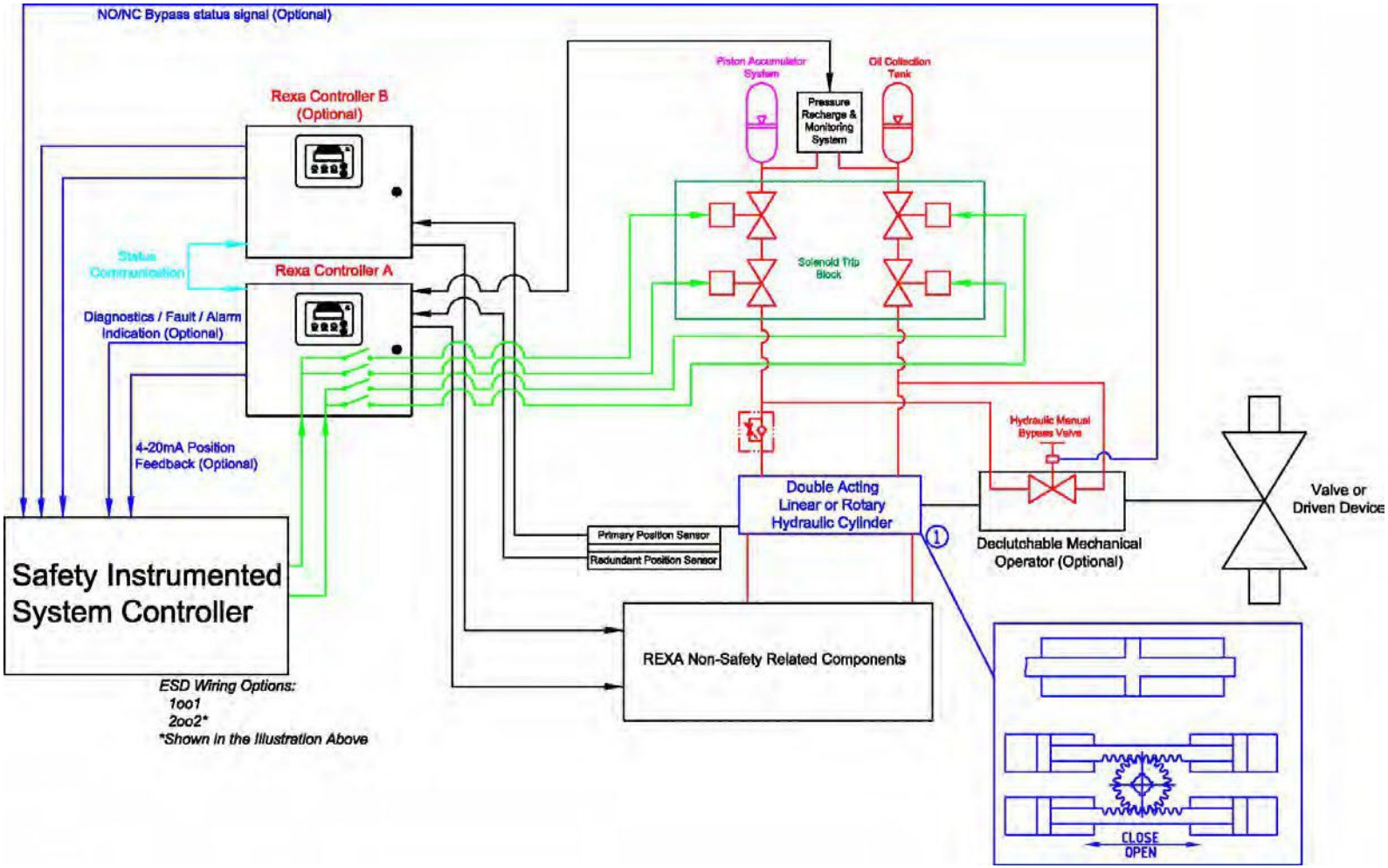
Example Safety Instrumented Function (Linear Spring Fail-Safe)



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 ESA 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 open and verify stroking times meet the specification sheet.
2. Run the actuator 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 x RLOAD) Vdc	24 Vdc (internal supply)
Maximum Supply Voltage	36 + (0.004 x RLOAD) 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.
24VDC / 115VAC / 230VAC	39.3” (1.0M)	15.0” (0.38M)	8.0” (0.2M)	8.0” (0.2M)

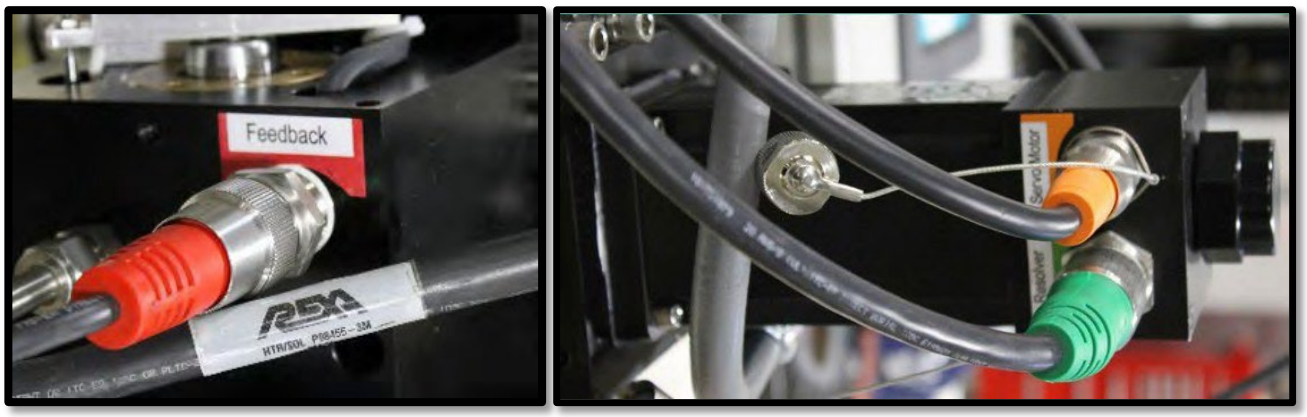
Table 2 – REXA Equipment and wiring in proximity to magnetic fields

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*lbf (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

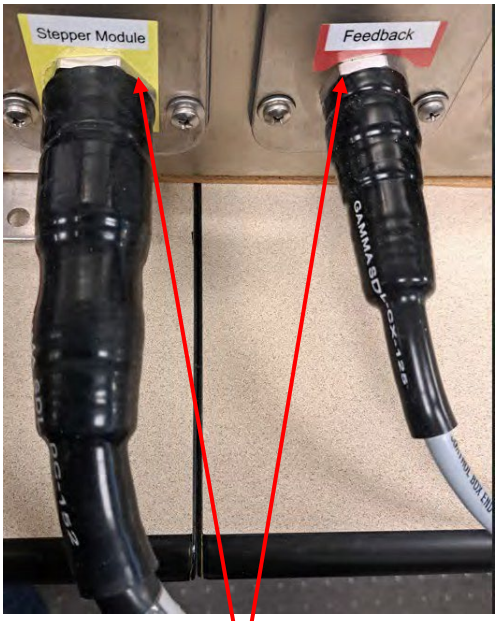
Figure 4A – Orientation of Tubing

The loose end of the plastic spiral must face toward the bottom (cable) end

Figure 4B – Tubing Position as shrinking begins

Tubing starting position must be tightly up against the large hex nut feature of the receptacle.

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)

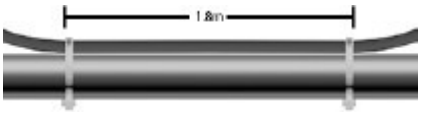
Installation Cable Length Limits

Actuator Product	Voltage	Quick Disconnect & High Temperature Cable Installation Length Limits	Standard Temperature Non-Quick Disconnect Length Limits
B or 1/3C Stepper Actuators	24VDC	400' (122M)	500' (152M)
	115VAC	500' (152M)	700' (213M)
	230VAC	300' (92M)	400' (122M)
C Stepper Actuators	24VDC	200' (61M)	300' (92M)
	115VAC	500' (152M)	700' (213M)
	230VAC	300' (92M)	400' (122M)
1/2D Servo Actuators	115VAC	700' (213M)	700' (213M)
	230VAC		
D Servo Actuators	230VAC	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

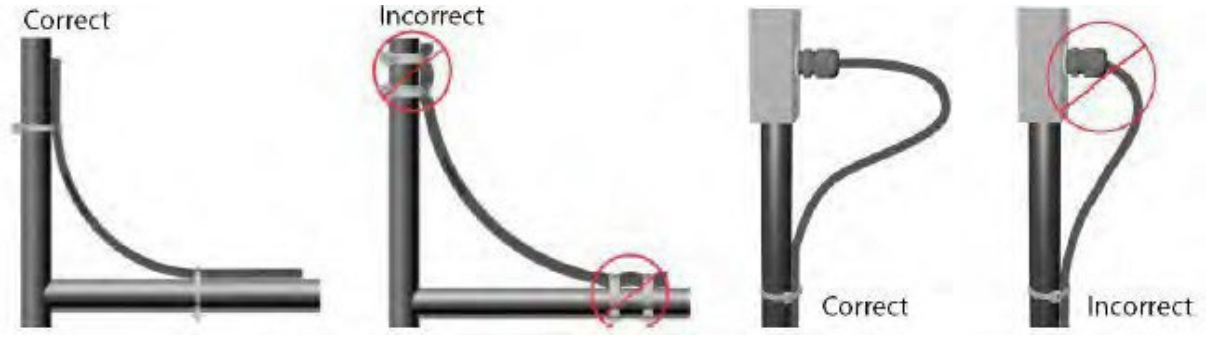
Minimum bend radius for Fixed Applications: Standard cable - 10x cable diameter

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

24VDC increases input, when active the actuator moves in one direction.

24VDC decreases input, when active the actuator moves in the other direction.

These 24VDC 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 24VDC 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.
      (Actual pulse time / Pulse Width) x 1% = 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.

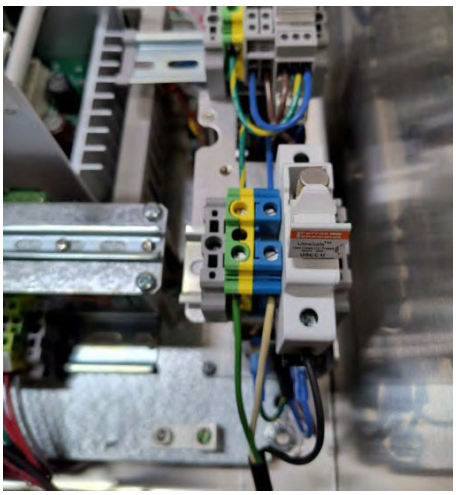
Bluetooth Connection Active

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.

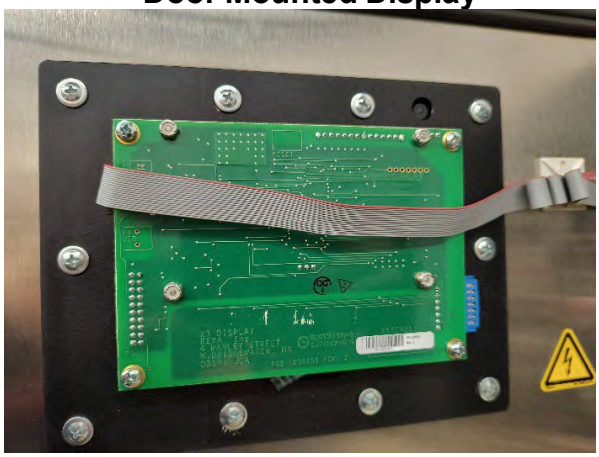
If Bluetooth functionality is not desired this feature can be easily disabled following the steps below:

1. Open the electronic control enclosure and disable the main power fuse holder.

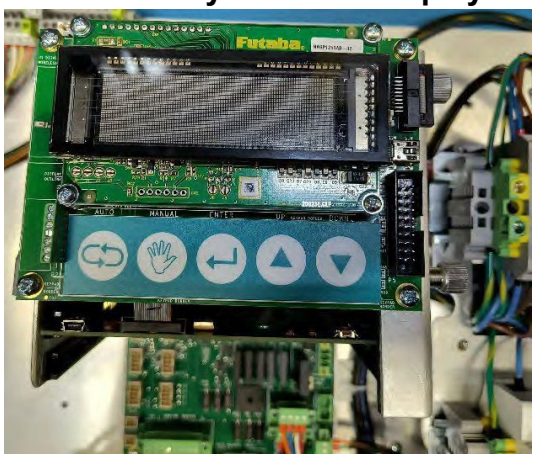


2. Locate the display board on the inside of the enclosure door or attached to the Interconnect board assembly.

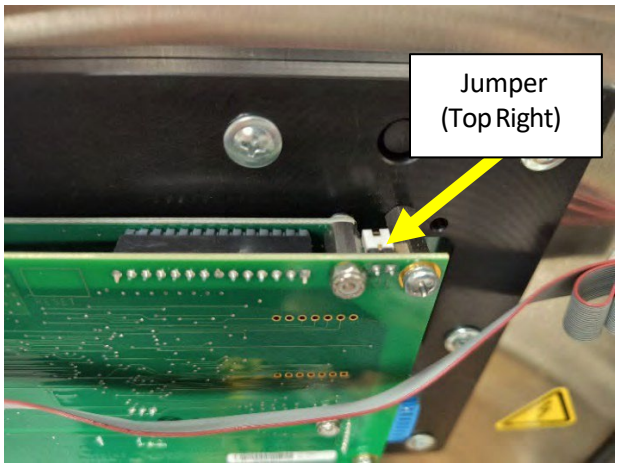
Door Mounted Display

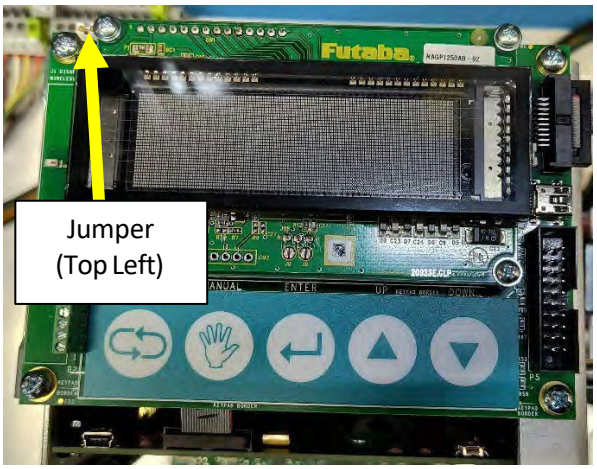


Internally Mounted Display

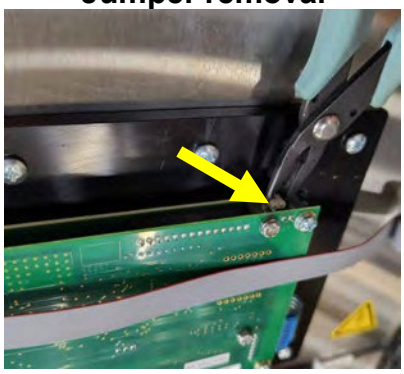


3. Use a small pair of pliers to remove the suitcase jumper located at the top corner of the board.

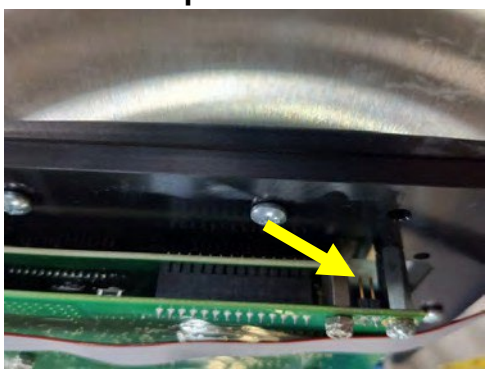




Jumper removal

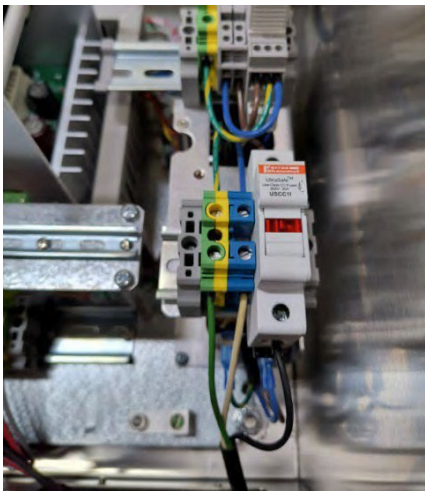


Jumper removed



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.

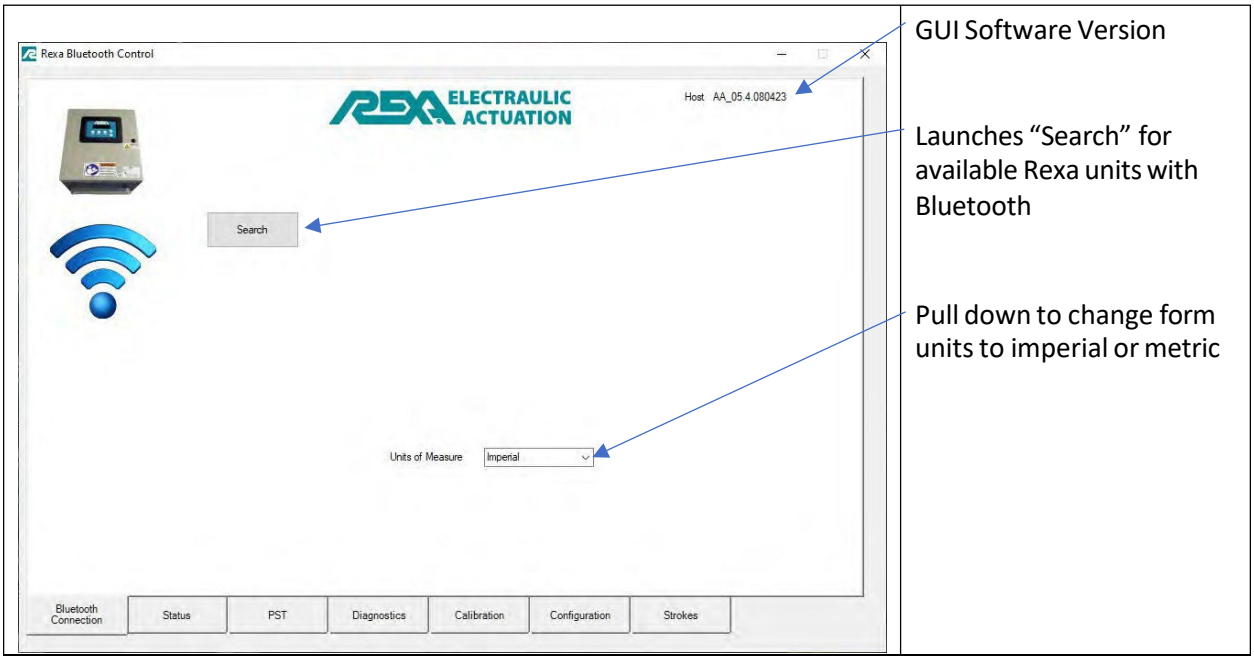
NOTE: Bluetooth can be re-enabled by just re-installing the suitcase jumper in the location outlined in the steps above.

Bluetooth Connection

Complete installation utilizing the installation wizard. The Desktop Icon will launch GUI.

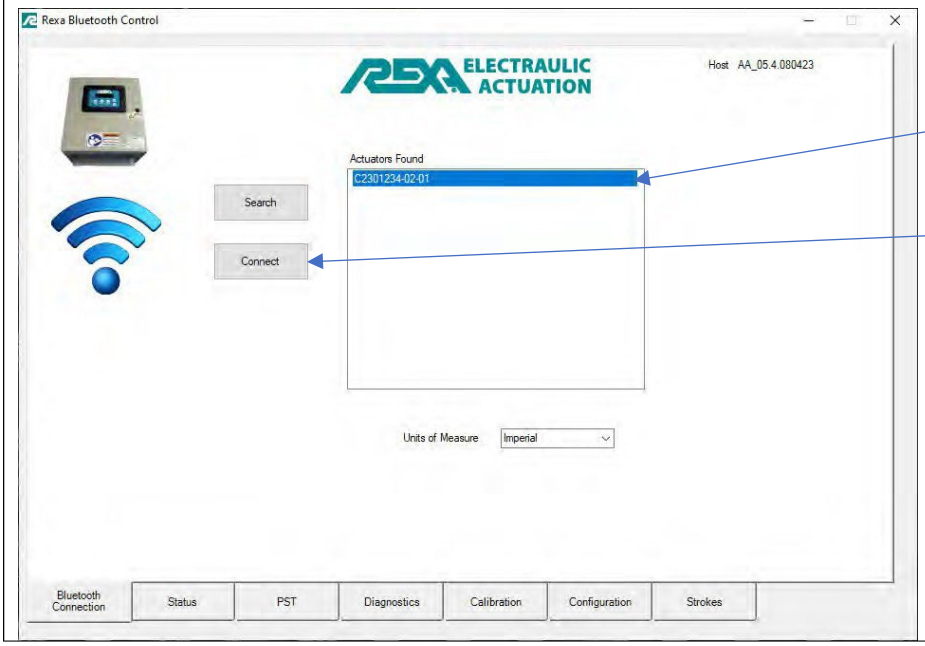
Desktop Icon

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.



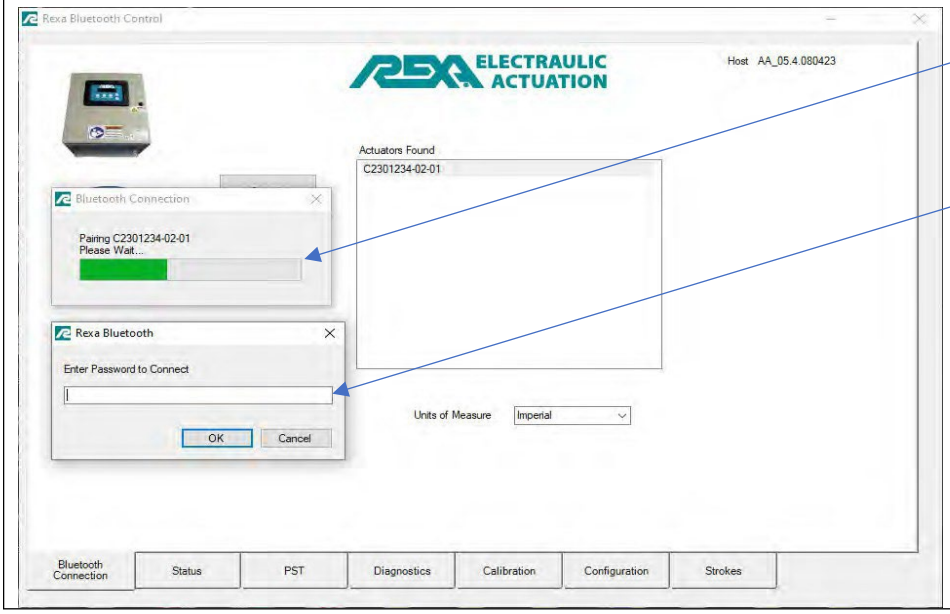
Initial Screen

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.



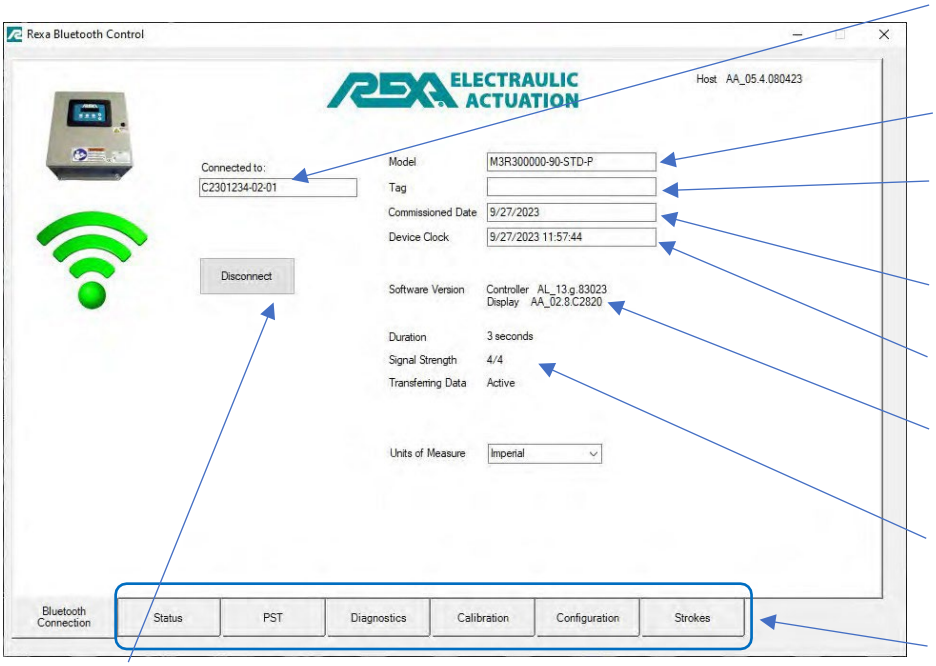
Search for Actuators

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.



Will disconnect from current actuator

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

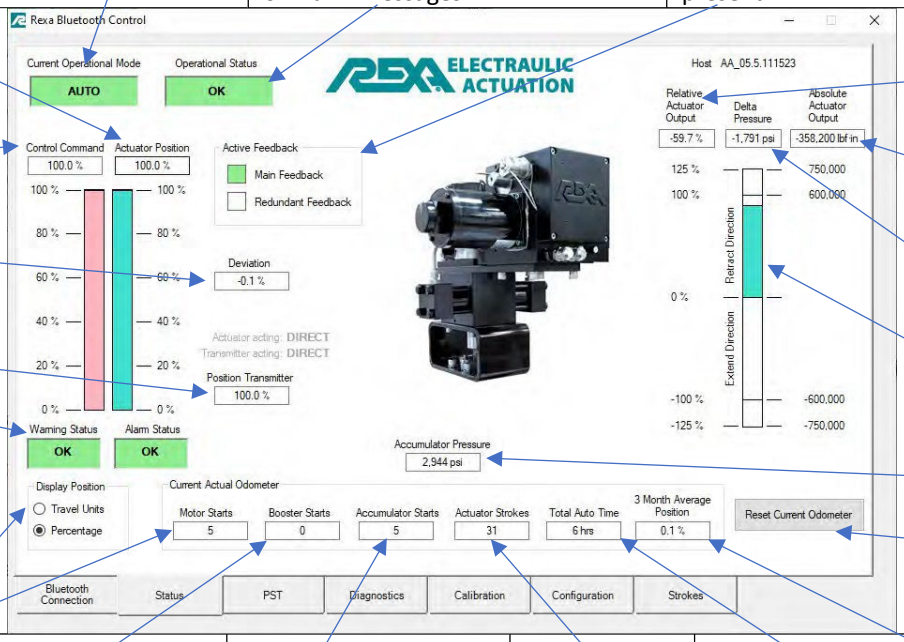
BT signal strength info and stats

Form tab options to change displayed content (Detailed in subsequent sections)

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.

	Mode of operation	Current status and active Warnings or Alarm messages		Feedback in use if (2) present	*NOTE: Only applicable with differential pressure active.*
Actuator feedback position (teal bar) Control Signal input (CS) (pink bar) Difference from CS to Position Position Trasmitter output Active Warning or Alarms (Yellow or Red when active) Change display units from % to inches or degrees				% of actuator capable output being used Current torque or thrust output Difference in Open and Close pressure Graphical representation of fields above Accumulator pressure Reset odometer readings to 0
# Positioning motor has turned on	# Booster motor has turned on (if applicable)	# Accum recharge motor has turned on (if applicable)	# of complete strokes	Total hours in Auto mode	Average actuator position over 3 months

Status

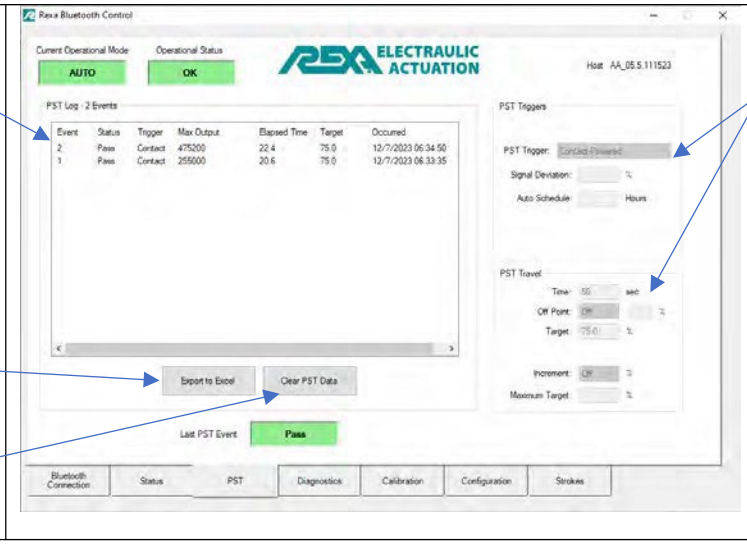
PST

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



PST control parameters.

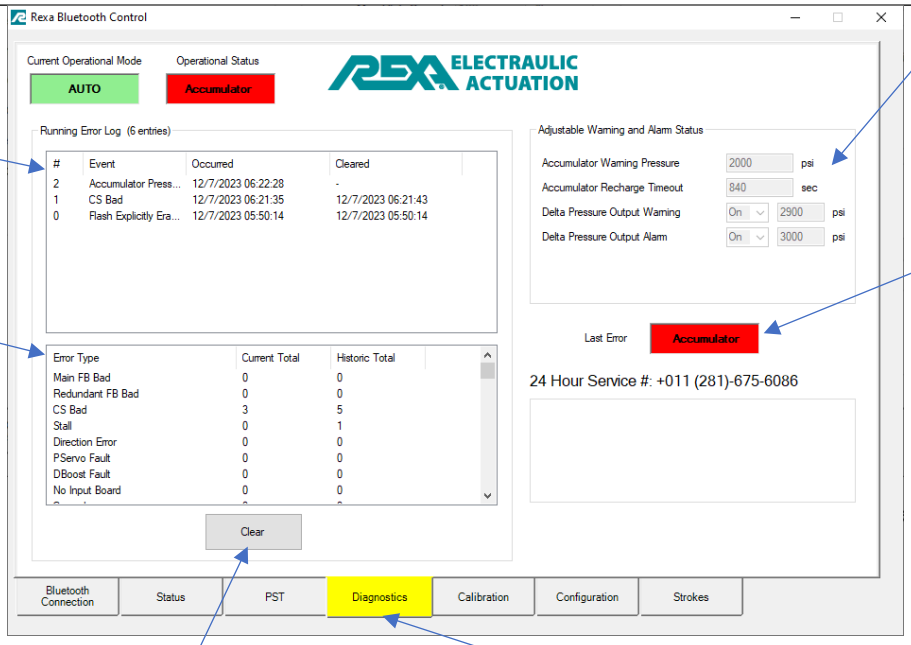
NOTE: Settings can be changed Locally via the electronic control enclosure display.

Pass / Fail status of the last PST event

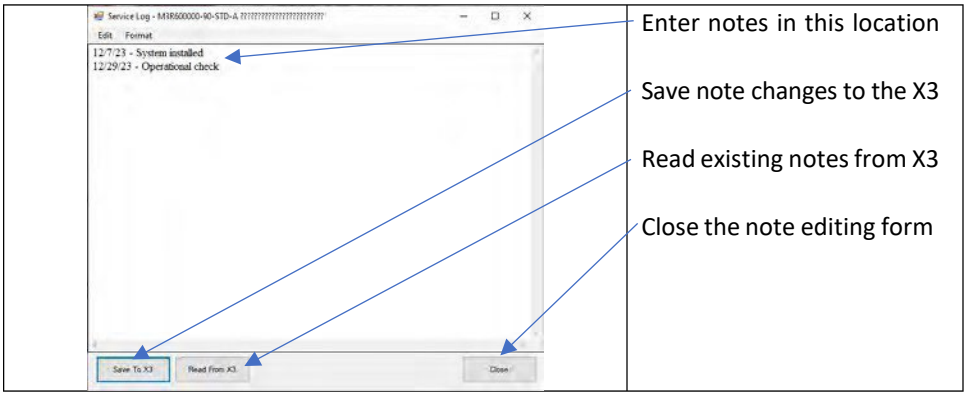
Patrial Stroke Test Screen

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.



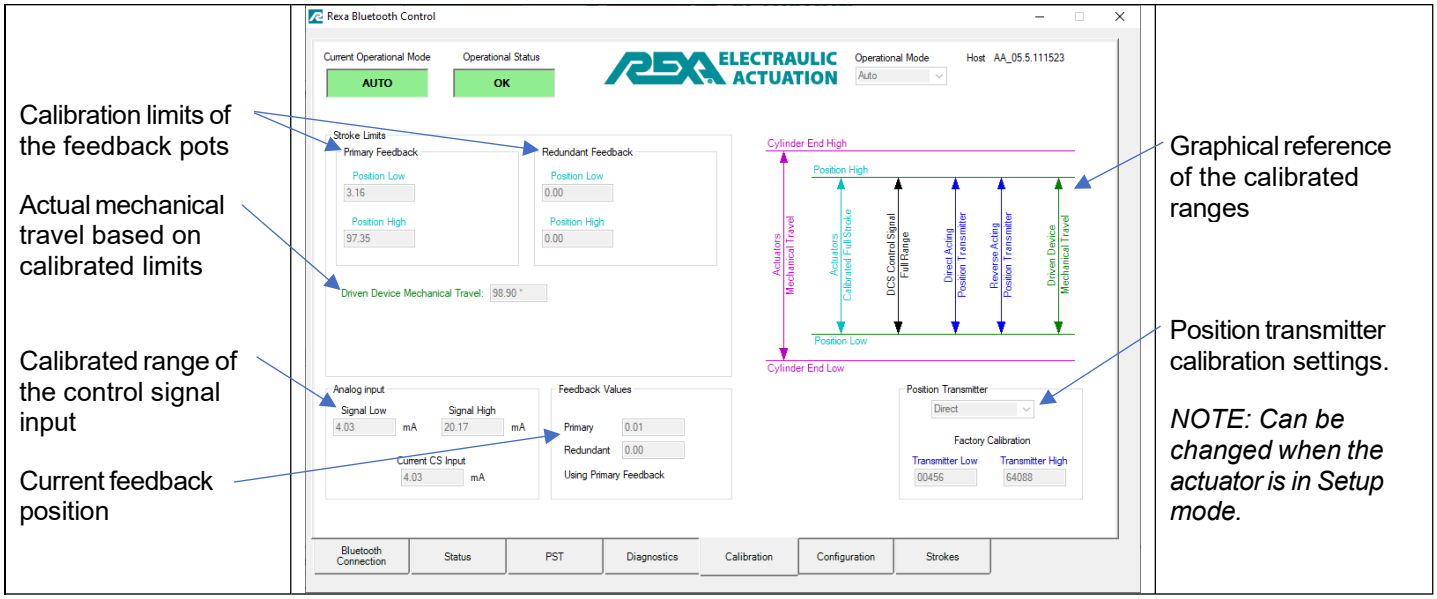
Diagnostics



Calibration

The “Calibration” screen allows the user to view calibrated parameters of the REXA actuator via Bluetooth control.

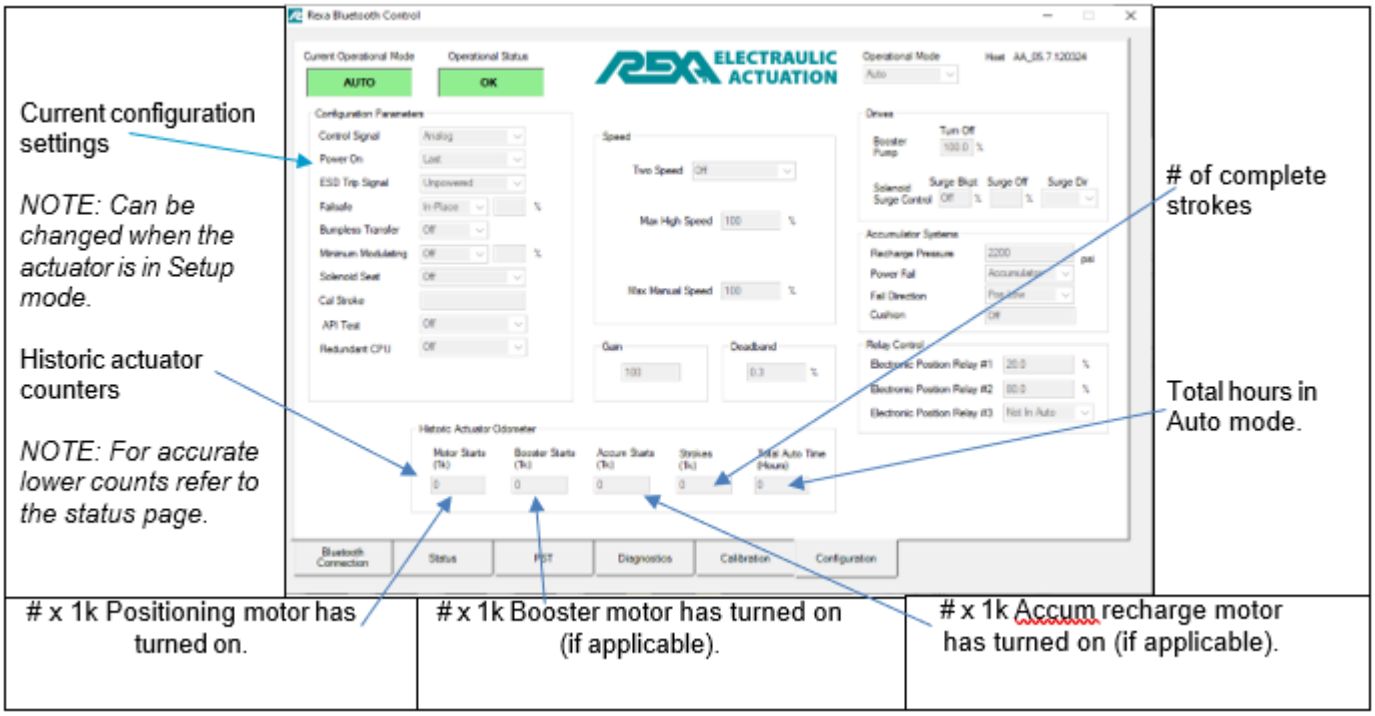
NOTE: All other calibration values can only be changed Locally via the electronic control enclosure display.



Calibration

Configuration

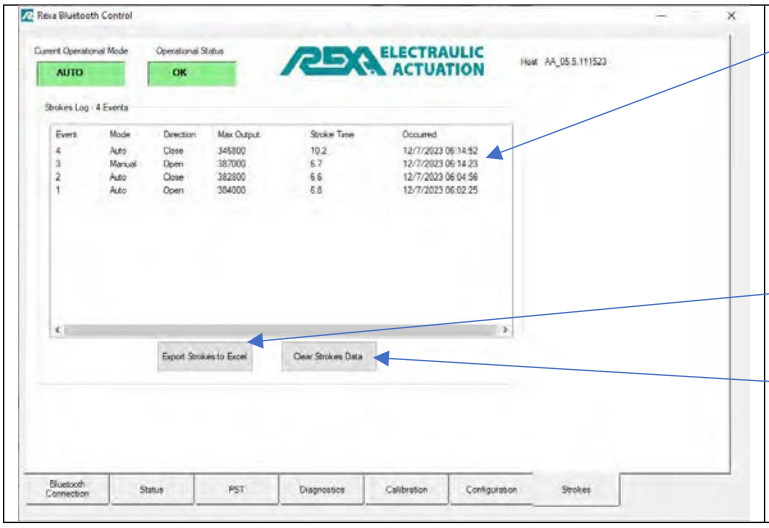
The “Configuration” screen allows the user to view all pertinent values that the actuator is currently programmed to.



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

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 Control Enclosure is provided by either the external or remote option.

RemoteMan allows the actuator to operate manually from a remote location or the external local controls. Once the Remote Manual mode is entered, the current status will be displayed along with Position.

The RemoteMan mode will be entered when the MAN Input of the Remote Auto/MAN Inputs is activated. The actuator is then controlled by activating the Open or Close Inputs of the Remote Auto/MAN Input.

External Control Option

Installed in the cover of the 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 RemoteMan (remote manual) modes. In RemoteMan 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 RemoteMan, 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 RemoteMan (remote manual) modes. In RemoteMan 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 RemoteMan, 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.

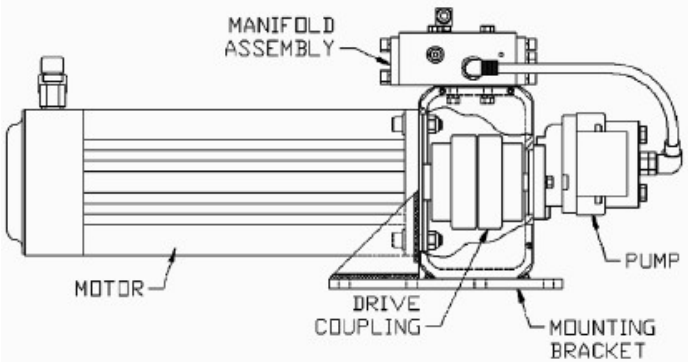
Three sizes of BOOSTER PUMPS are available: the D,P9, Dp20, and the D,P40.

- 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.

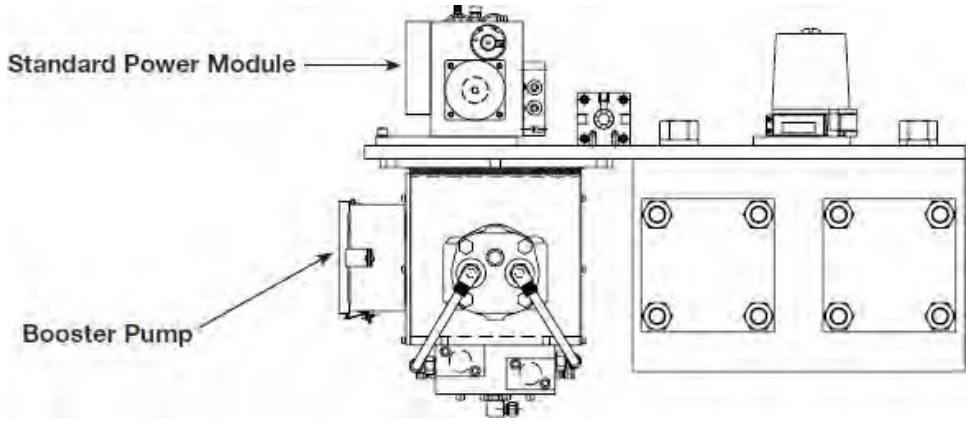
CAUTION: Motor power and motor resolver cables for the power module and booster pump motors must be shielded! The shield of each is connected to the green ground screw on the back panel of the control enclosure only. Failure to follow may inhibit the proper operation of the actuator.

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

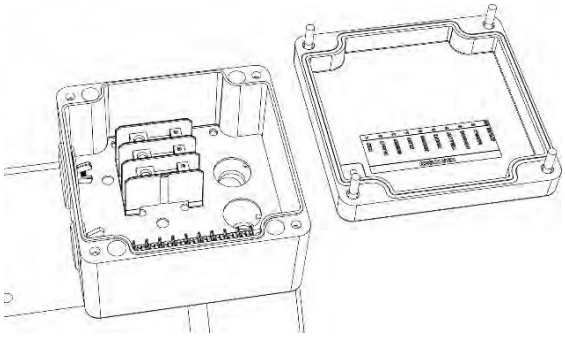
An Xpac Series 3 with the Booster Pump Configuration has no special installation procedure. Therefore, the standard installation should be followed.

Control Enclosure

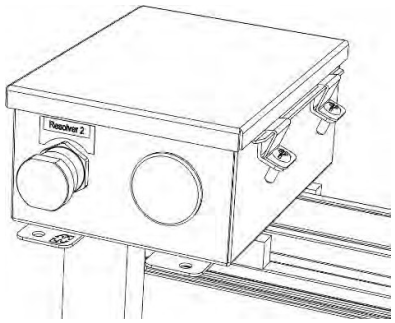
The major electrical components are located in a NEMA 4X enclosure. They have a wide temperature range[1] (-40 °F to 120 °F1 [-40 °C to +49 °C]) and can be field installed at a convenient location. Avoid areas subject to excessive vibration or heat. To reduce the possibility of water incursion, we recommend 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 Electraulic 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 Closed 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:	**24VDC 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

The REXA Electro-Hydraulic Actuator has four types of manual operators available: De-clutchable Handwheel / Drill Drive, Manual Hydraulic Pump, Gear Operated Mechanical Override-Linear, and Gear Operated Mechanical Override- Rotary.

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 Declutchable 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 rotation of the manual operator will retract the stem on a linear unit and clockwise rotate the shaft (looking at the feedback housing) on a rotary unit.

Linear Handwheel

Handwheel Revolutions			
Power Module	B	C, ½D	D
Linear (To move one inch per 1 000 lb of rated thrust)	~75	~25	~13
Rotary (90° of rotation/1 000 lb·in of rated torque)	~200	~65	~33

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.

Declutchable Drill Drive

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.

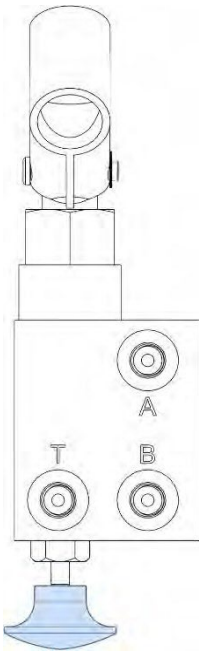
Drill Drive

Manual Operators: Hydraulic Pump

CAUTION: After use of manual hydraulic pump, the directional control knob must be cycled to ensure proper operation of the actuator.

CAUTION: Before attempting to operate ANY manual override feature, make sure that electrical power is turned OFF.

NOTE: Any isolations should remain closed until use of pump is necessary and closed when pump is no longer needed. Open any isolations plumbed to the hand-pump prior to use, typically there are three.



Directional Control Knob

The manual hydraulic pump can be installed on all units and needs only the cylinder side of the hydraulic circuit and the Flow Match Valve (FMV) check valves to be in working order.

To operate the manual hydraulic pump, insert lever into the piston assembly and pump the handle up and down. To reverse the actuator direction, either push in or pull out the black, direction control knob located on the bottom of the assembly.

Manual Hydraulic Pump Speeds (# Of Pumps)

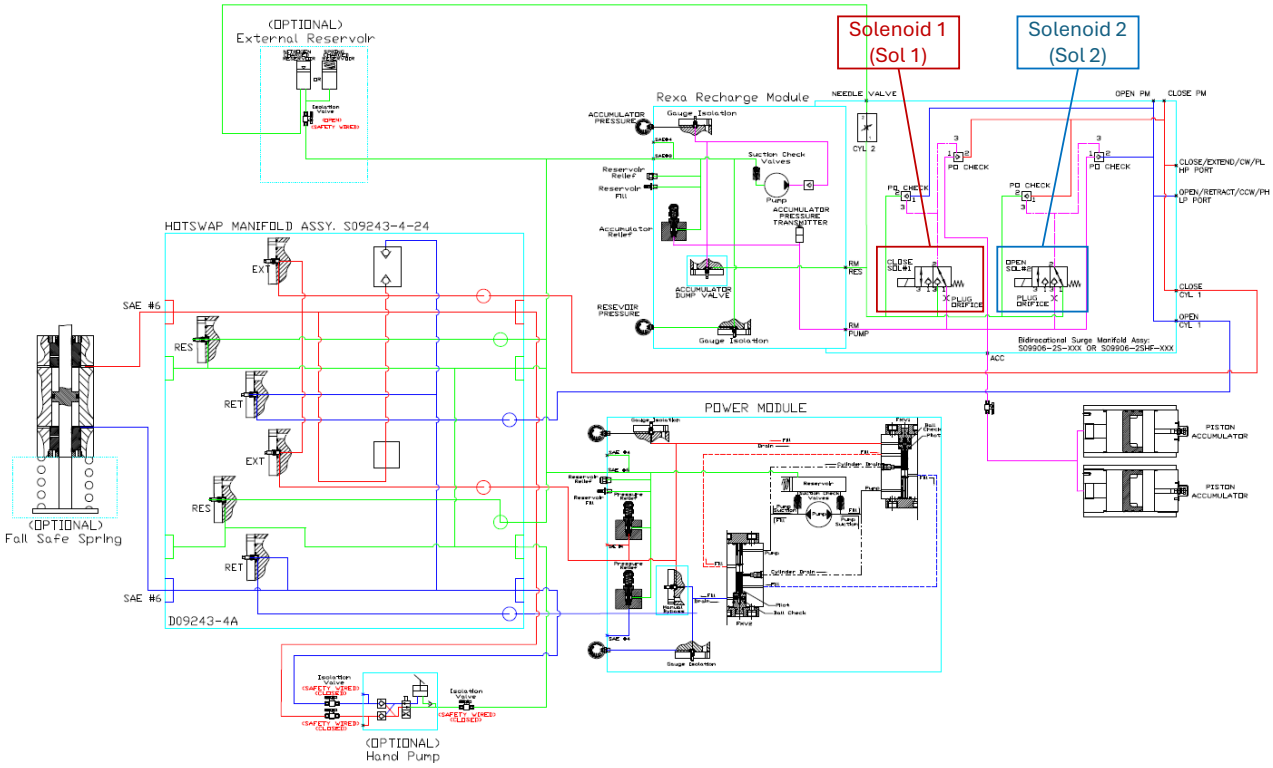
Linear	(To move one inch/1 000 lb of rated thrust)	~1
Rotary	(90° of rotation/1000 lb-in of rated torque)	~2.5

Manual Operator: Drill Drive or Hand Pump with Accumulator Fail-Safe Option

CAUTION: OAR systems contain high pressure; inappropriate identification and service of the system may result in system malfunction, inadvertent system trips or severe personal injury.

All X3 Accumulator Fail/Surge actuator systems have an OAR (On-line Recharge) module assembly that is hydraulically connected to the rest of the system to allow fail-safe of the actuator upon application of a trip signal or loss of power. In the event of power loss or system malfunction, actuator systems with a manual override option can be engaged to manually move the actuator to the required position.

The OAR system utilizes a 3-position 2-way solenoid poppet valve that is actuated by a solenoid coil to either pilot open or close the PO check valves connecting the high-pressure line in the accumulator bottle to the appropriate hydraulic lines to do work. The simplest and most common OAR unit is one with a solenoid that is energized during normal operation and de-energized to trip the actuator to the failsafe position upon loss of power or via a trip signal. A less common OAR configuration is one with a solenoid that is de-energized during normal operation and trips to the failsafe position when the solenoid is energized or with the application of a trip signal. Upon loss of power (with no trip signal), this OAR unit will fail in place. More complicated systems with Bidirectional Surge functionality are built off this operational theory using multiple solenoid and PO check valve configurations as illustrated below.

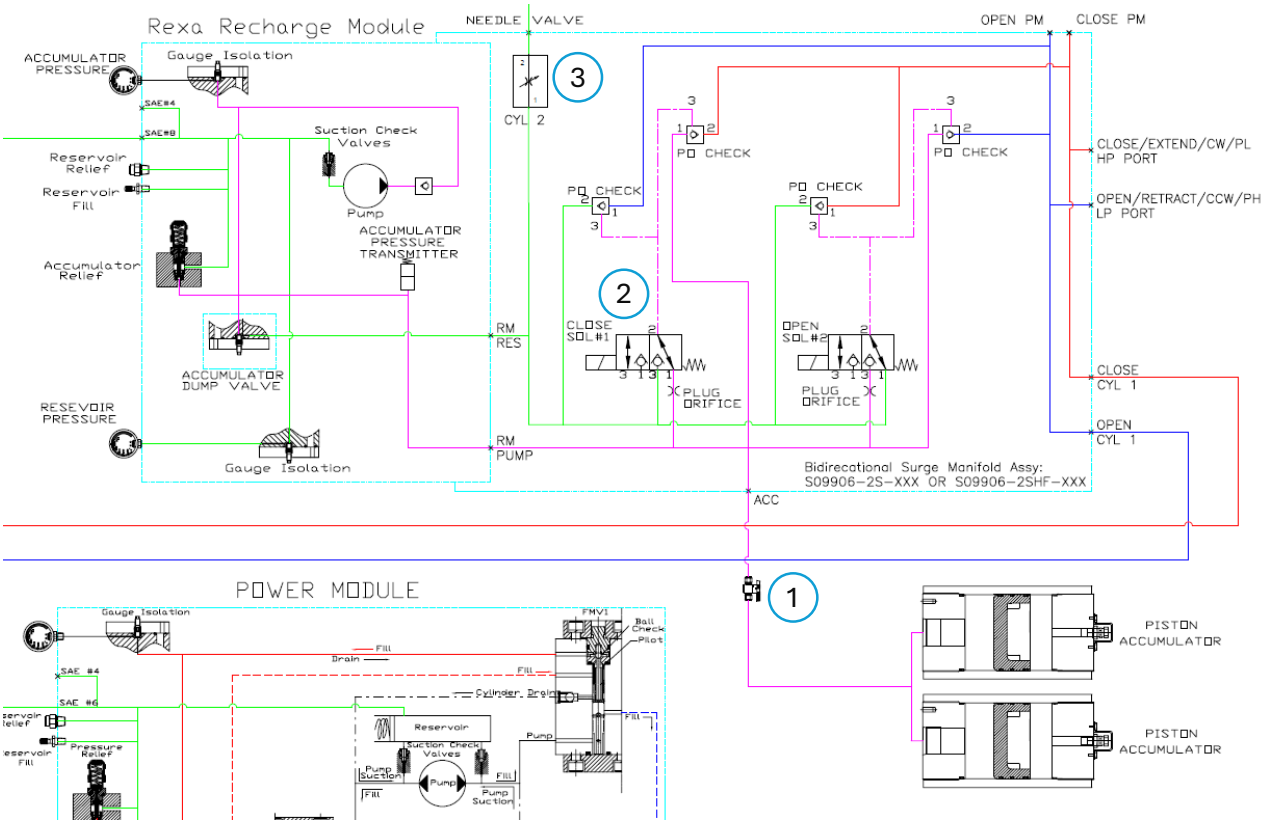


Sol 1 is energized, and **Sol 2** is de-energized during normal operation. Upon loss of power, **Sol 1** de-energizes to fail-safe the system to the Extend/PL/CW direction. **Sol 2** is de-energized during normal operation and on loss of power; therefore, the PO checks remain closed, allowing no flow to move the actuator to the Retract/PH/CCW direction.

Procedure

This procedure details the steps for manually operating REXA actuators with the Online Accumulator Failsafe and/or Surge option. On loss of power, OAR recharge module malfunction, or Accumulator bottle N2 pre-charge leaks, the following procedures must be followed to manually operate actuator systems with an online recharge accumulator system. A detailed view of the Bidirectional Surge manifold assembly is illustrated below with the relevant components ballooned for reference; however, the procedure can be applied to any OAR system with a dedicated recharge module.

NOTE: OAR 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.



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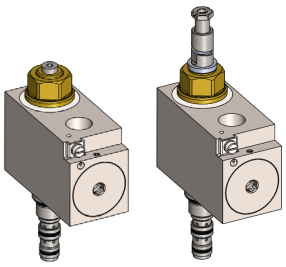
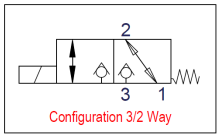


1. If manual operation of the system is required, close off Ball Valve (Item 1). This is to prevent oil backflow into the Accumulator Bottle when operating the manual override.

2. **Sol 1** (Item 2) needs to be either energized 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 below figure shows the solenoid with and without the override.

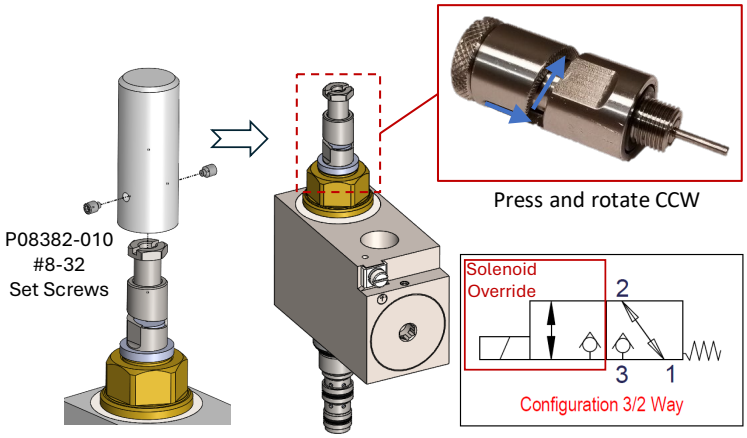


3-Way 2-Position Solenoid

If power is available to **Sol 1**, skip this section. If not, proceed to the below section:

a. Remove the manual override cover by (1) backing out the two #8-32 set screws with a 5/64 allen wrench and (2) lifting up the cover to expose the manual override. The manual override design is a spring reset with a detent locking feature.

b. The solenoid override can be engaged as illustrated in **Figure 4** to bottom out the plunger against the solenoid poppet. By doing so, ports 1 and 2 of the solenoid are isolated.

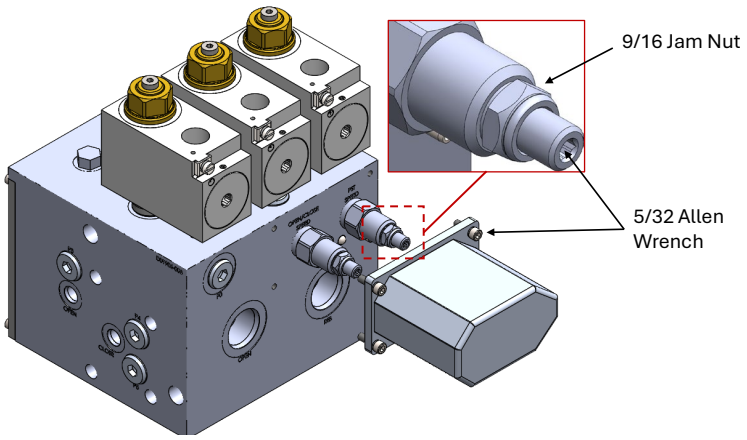


3-Way 2-Position Solenoid Valve Override

3. If necessary, remove the Needle Valve cover using a 5/32 Allen wrench. With a 9/16 wrench, loosen the jam nut on the Speed Control Needle Valve by turning the wrench counterclockwise. Using a 5/32 Allen wrench, Close off the Speed Control Needle Valve (Item 3) by turning it clockwise to ensure that no oil circulates through the manifold and backflows to the reservoir bottle when manually operating the override.

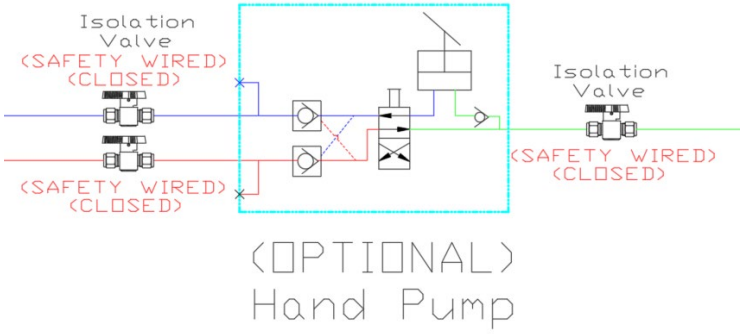
NOTE: Some OAR systems may be equipped with 2 needle valves. One needle valve is for PST control while the other is for Fail Safe/Surge Control. Both needle valves need to be closed.

NOTE: Record the number of turns to close the needle valve (s). The needle valve(s) need to be set back to that number of turns to not affect trip speed requirements when the OAR system is operational.



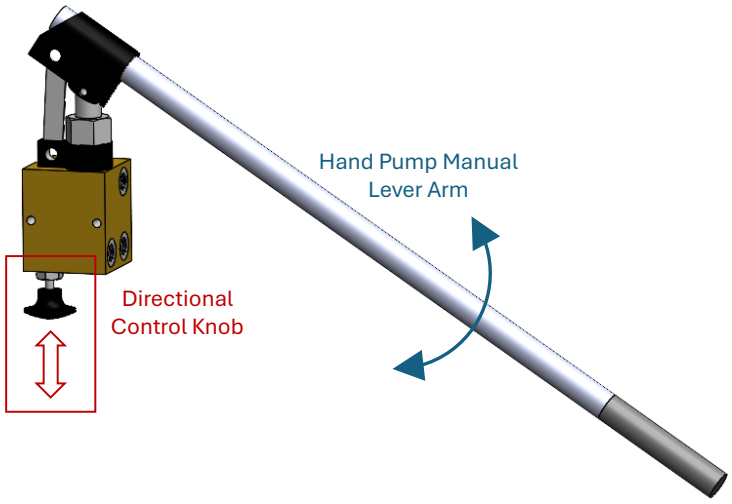
OAR System with Bidirectional Surge & PST Control

4. If the system is not configured with a manual hand pump, remove the Motor Cap and attach a Declutchable Drill Drive to the primary motor to move the actuator to the desired position.
   If the system is configured with a hand pump, open all the isolation ball valves on the hand pump to allow manual operation of the hand pump. All three isolation valves below need to be opened.



Hand Pump Isolation Ball Valves

To operate the manual hydraulic pump, insert the lever into the piston assembly and pump the handle up and down. To reverse the actuator direction, either push in or pull out the black, direction control knob located on the bottom of the assembly.



Hand Pump Assembly with Lever Arm & Directional Control Knob

5. To reconfigure the system back in the pre-manual override condition, reverse **Steps 1-4**, starting with **Step 4** → **Step 1** to open up all valves.

Manual Operators: Linear Mechanical Gear Drive

CAUTION: Before attempting to operate ANY manual override feature, make sure that electrical power is turned OFF.

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:

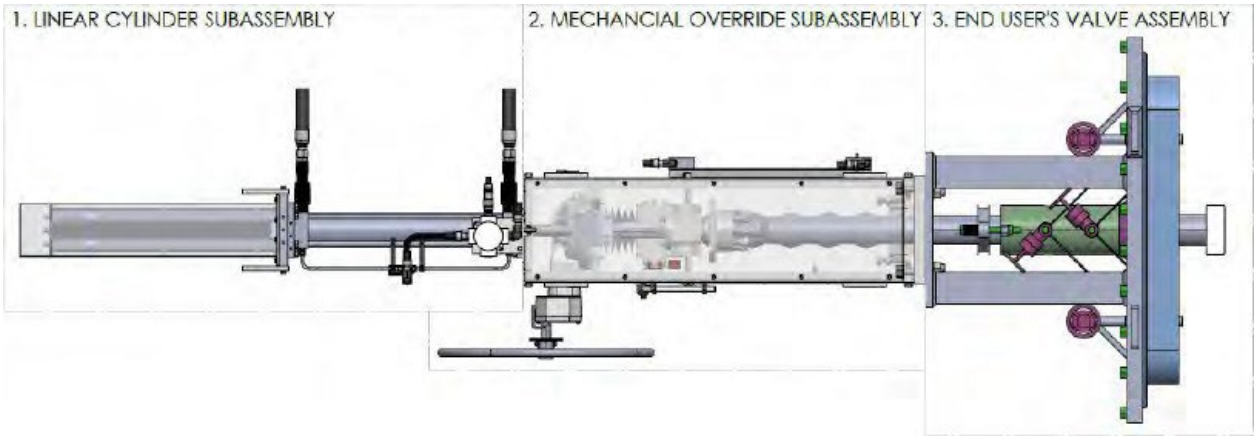


Figure 1: Linear Mechanical Gear Drive

Optional accessories such as LOTO (lock out tag out) 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 & 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.

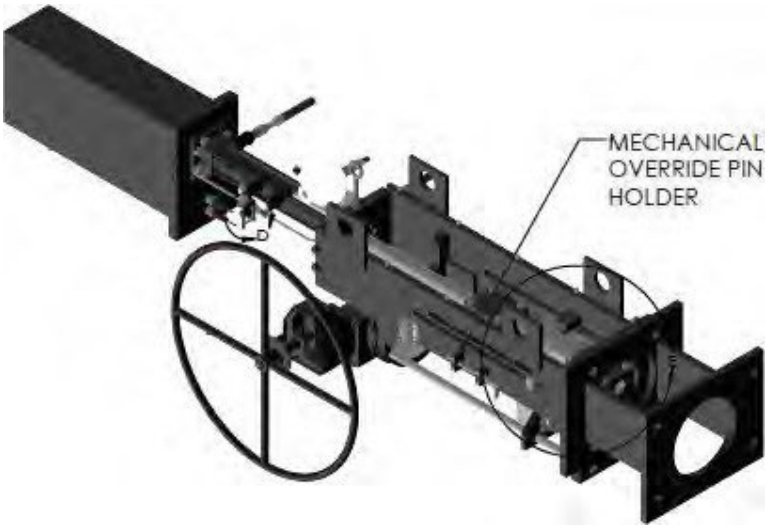


Figure 2

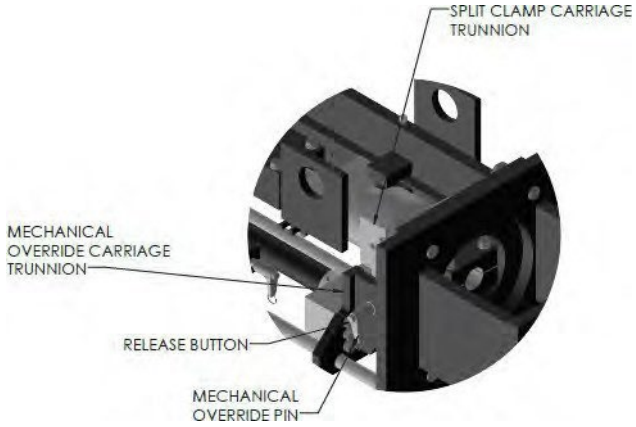


Figure 3

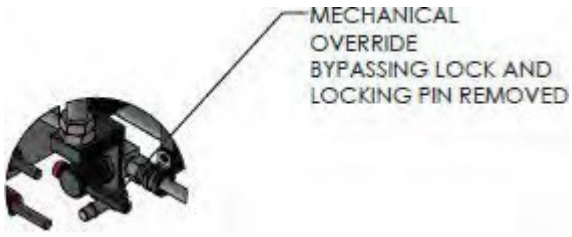


Figure 4

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.

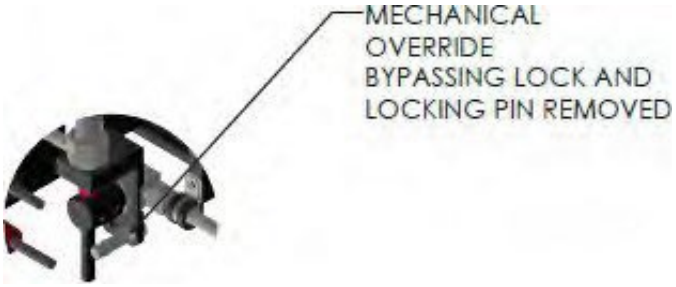
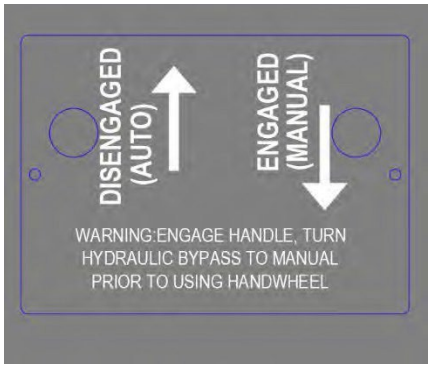


Figure 5

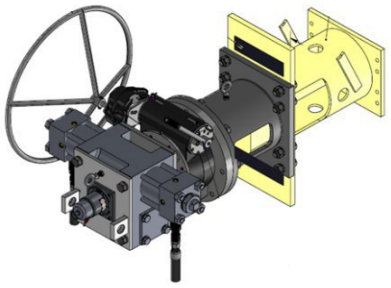
Manual Operators: Rotary Mechanical Gear Drive



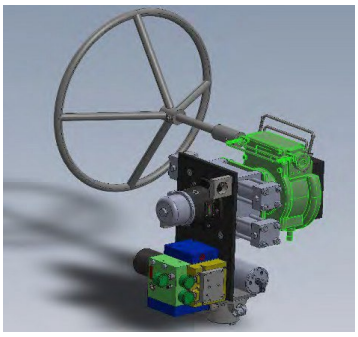
Hydraulic Bypass Warning

NOTE: Hydraulic Bypass valve MUST be opened, and the control electronics 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.

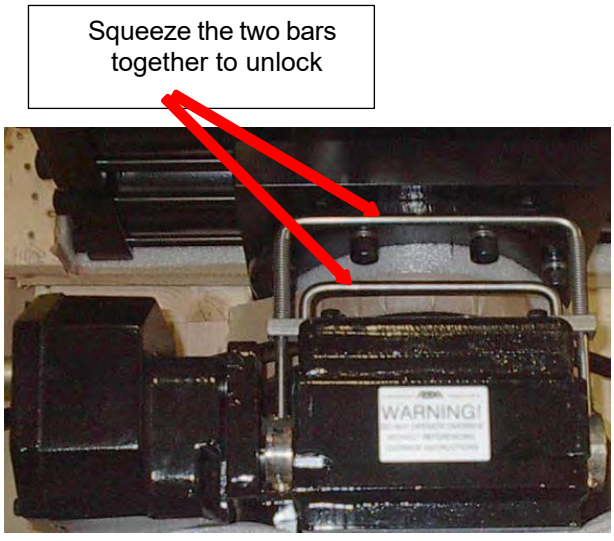


Rotary Mechanical Override



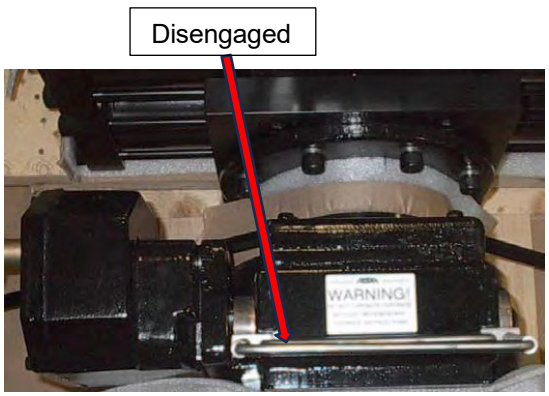
Manual Operation:

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.

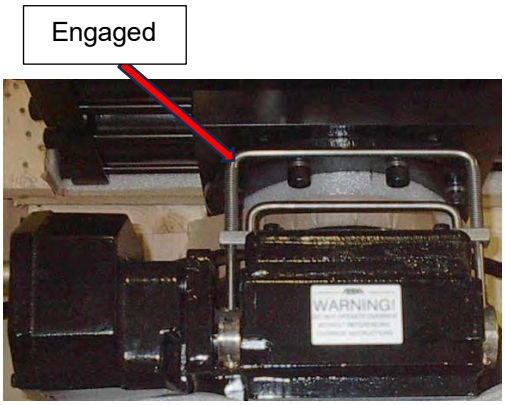


Override Handle Locator

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

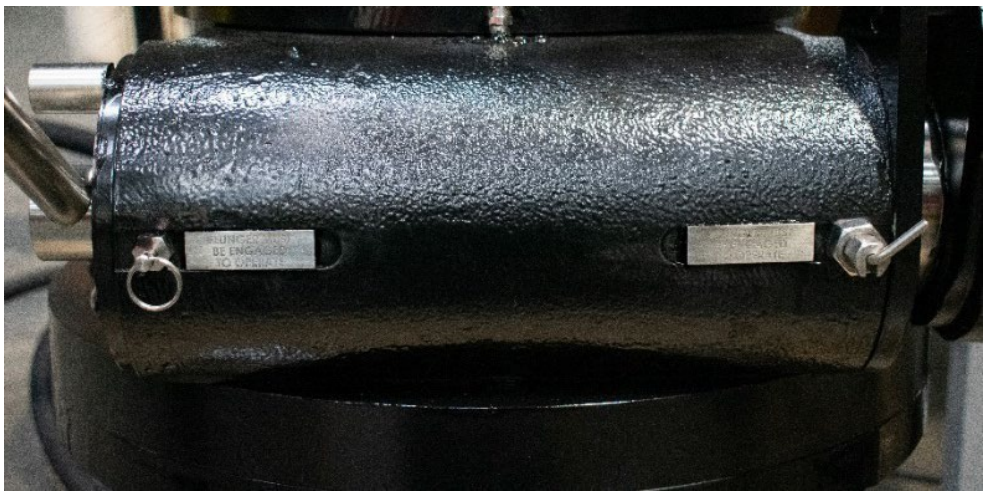


Override Handle - Engaged

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.

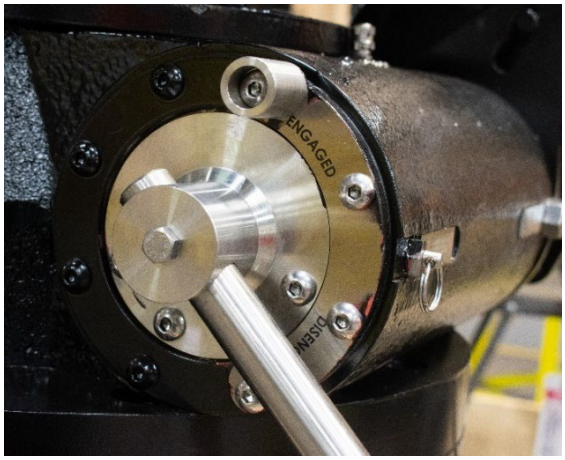
c. Release the handle and allow the override engagement handle to lock in the override position.

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.

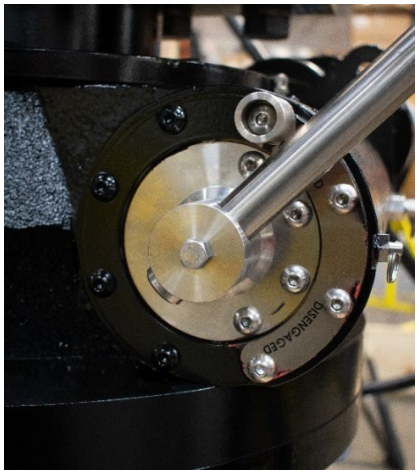


String Pins Locator

b. Rotate the declutching lever shown below to the ENGAGED position.



Override Handle - Disengaged



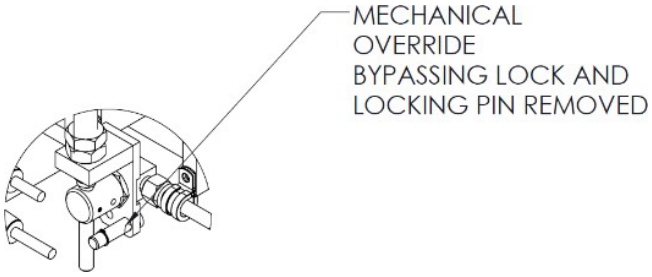
Override Handle - Engaged

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.

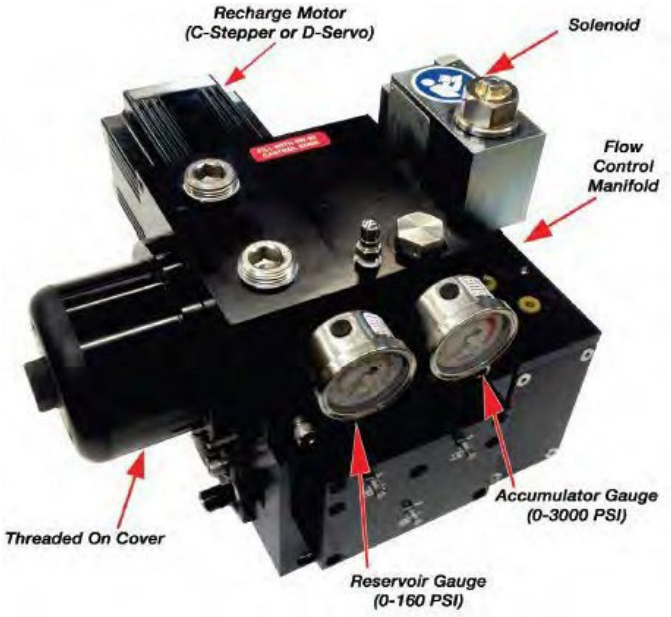
Accumulator Fail-Safe Option

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.



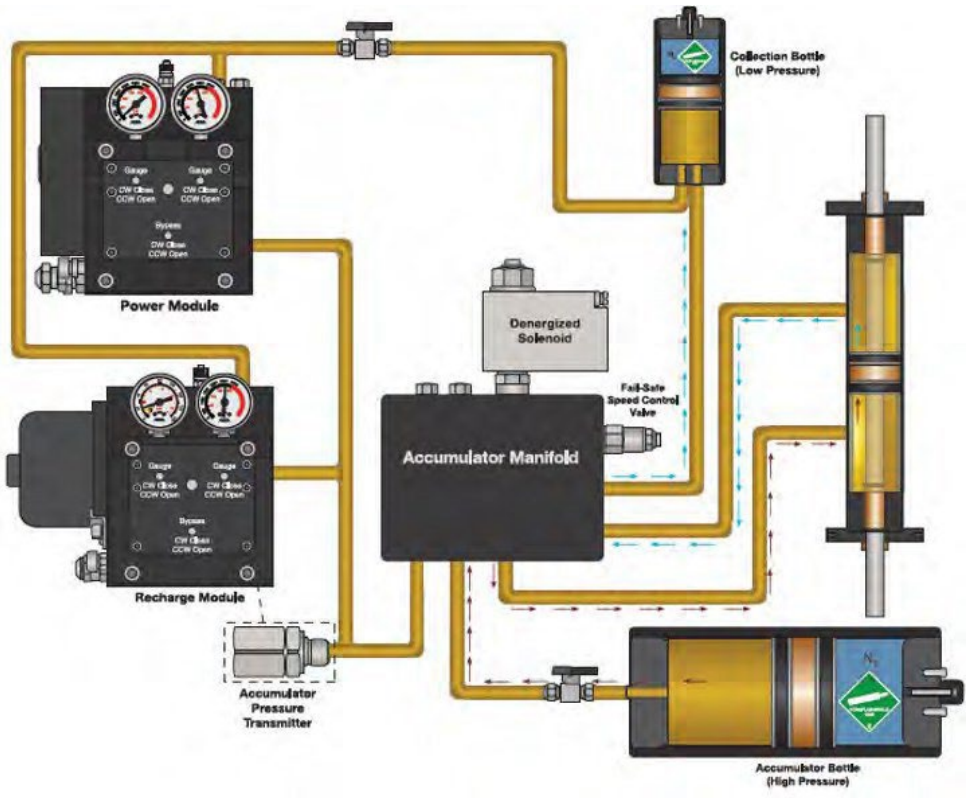
Online Accumulator Fail-Safe

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

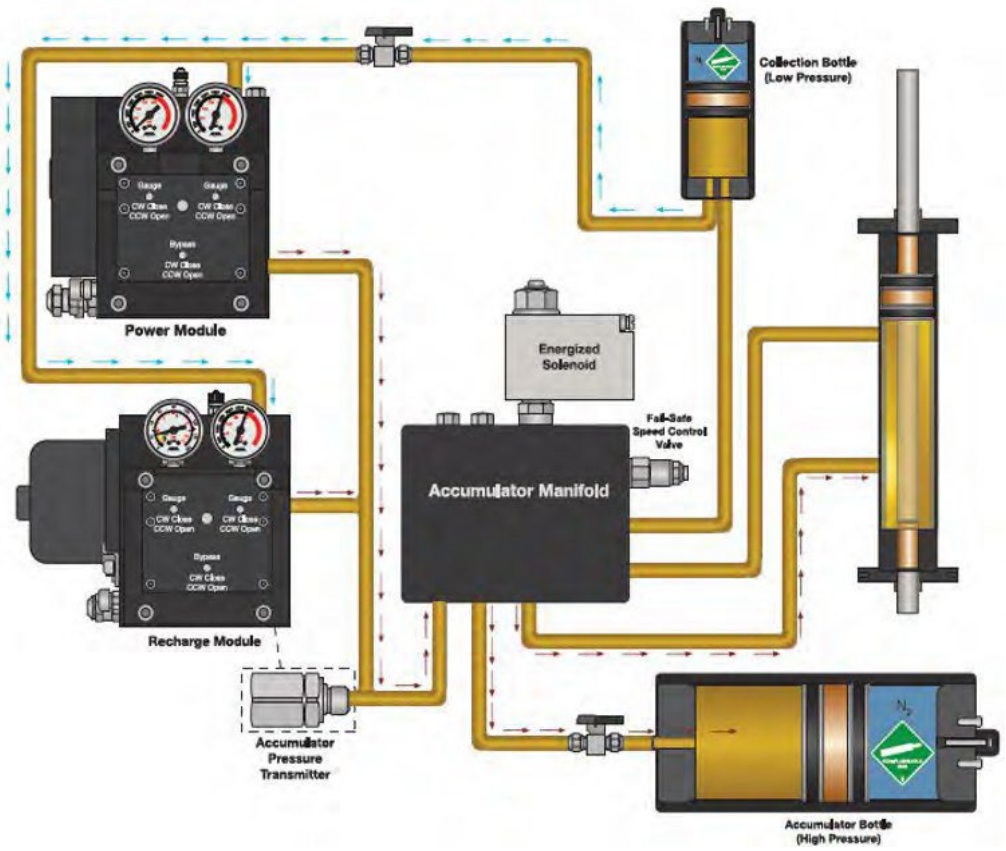


Fail-Safe Trip

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.

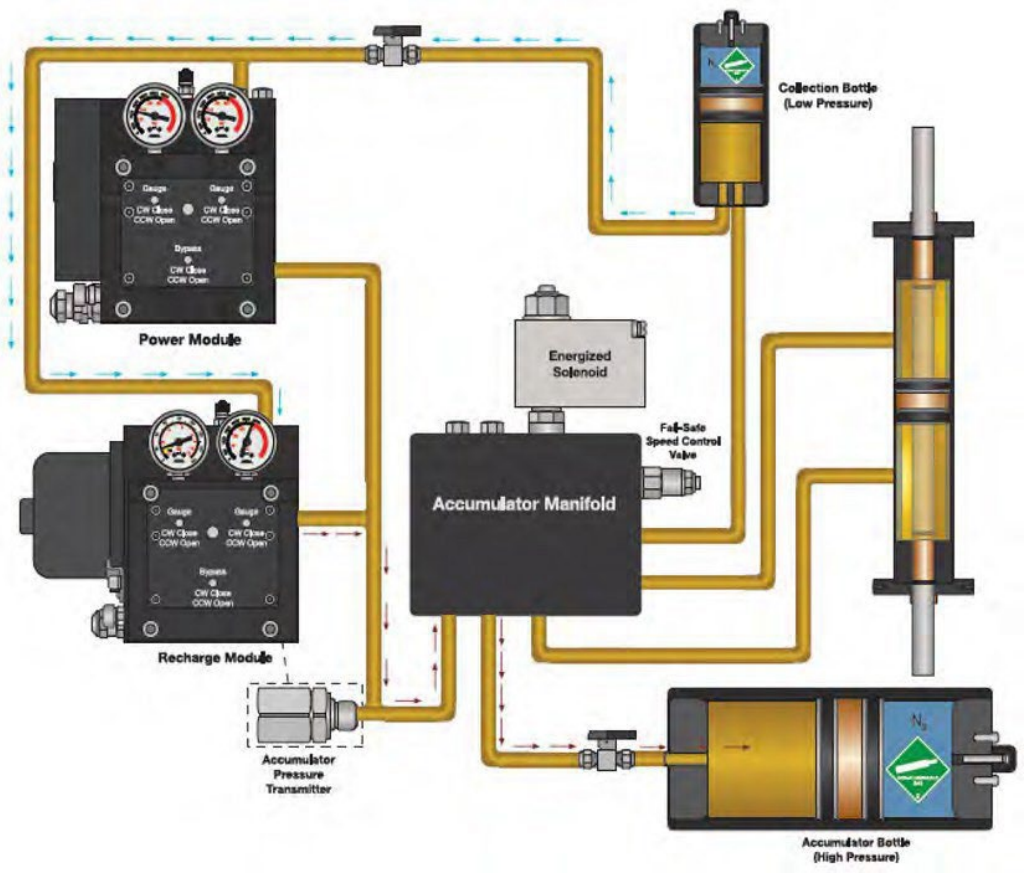
If the fail-safe condition is initiated with a trip signal and power is still available, the dedicated recharge module will begin charging the accumulator system as soon as the actuator has reached its trip position. This allows the system to readily modulate after removal of the trip signal. The figure 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.

Spring Force = (Spring Rate x Cylinder Travel) + 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.

Actuator Net Output Force = Cylinder Force - Spring Force

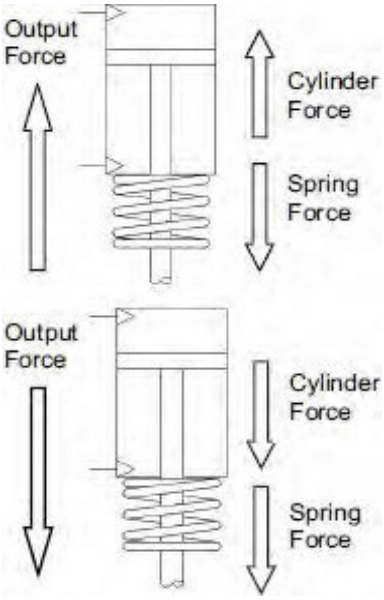


Figure 1: Spring Function

When calculating the force in the direction that extends the spring, we can add the spring force to the cylinder force.

Actuator Net Output Force = Cylinder Force + Spring Force

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.

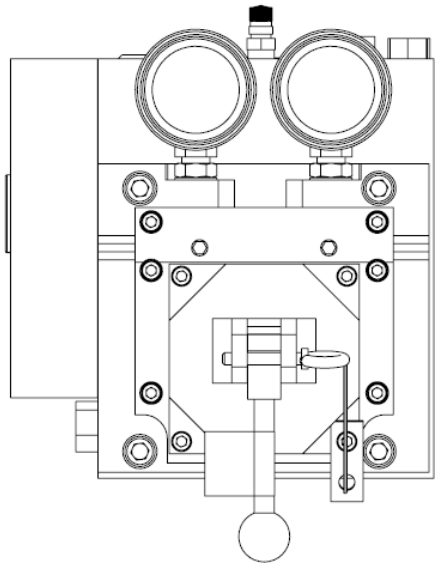


Figure 2: Internal Solenoid

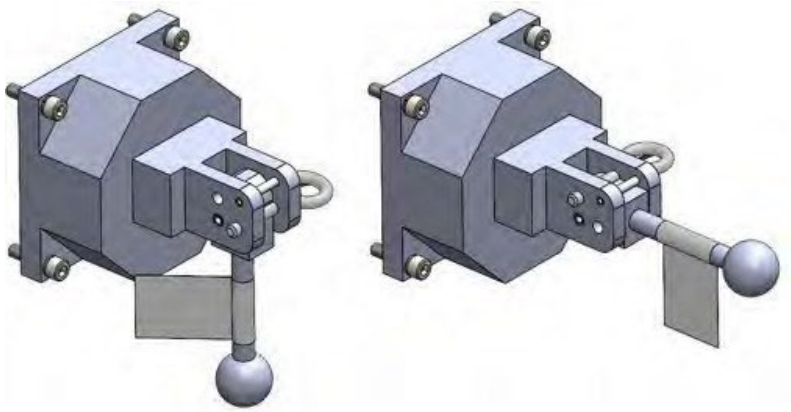


Figure 3: Internal Solenoid Normal Operation (Left) vs Override Position (Right)

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.

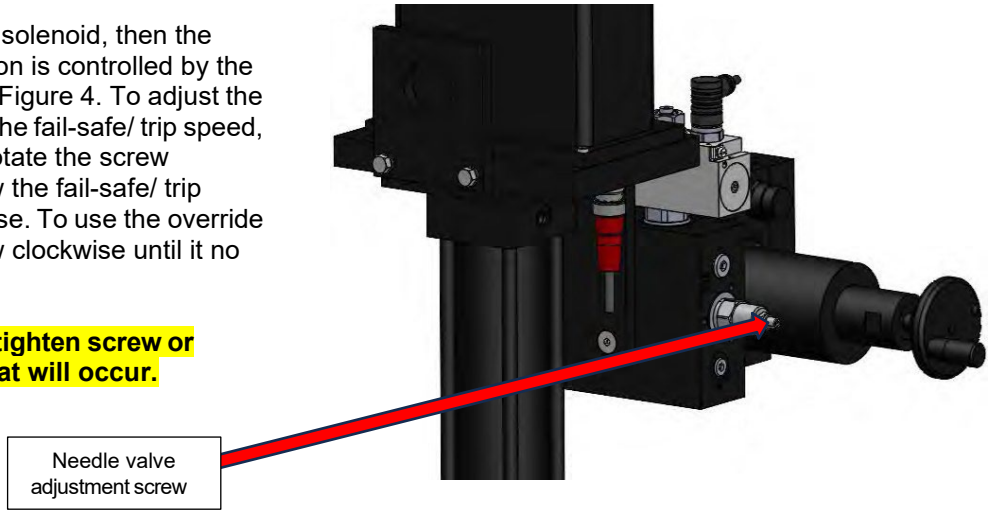


Figure 4: Needle Valve Adjustment Screw Locator

Linear Short-Stroking

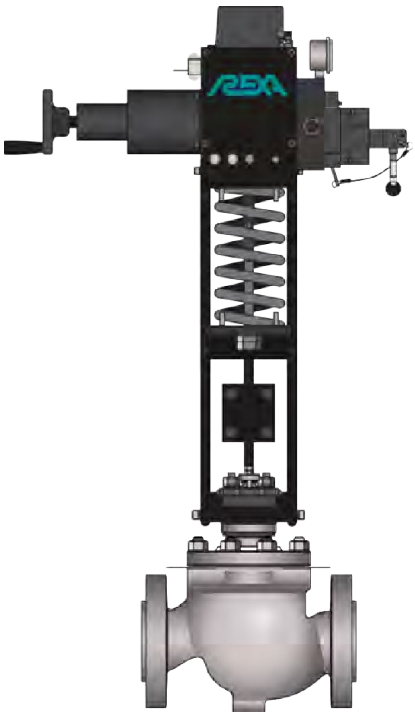
On linear actuators, the full rated stroke of the cylinder and spring may not be required in the application. This allows us to adjust the “spring end” by further pre-loading or additionally pre-compressing the spring and in turn derive more force out of the spring than the standard chart suggests. This 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*

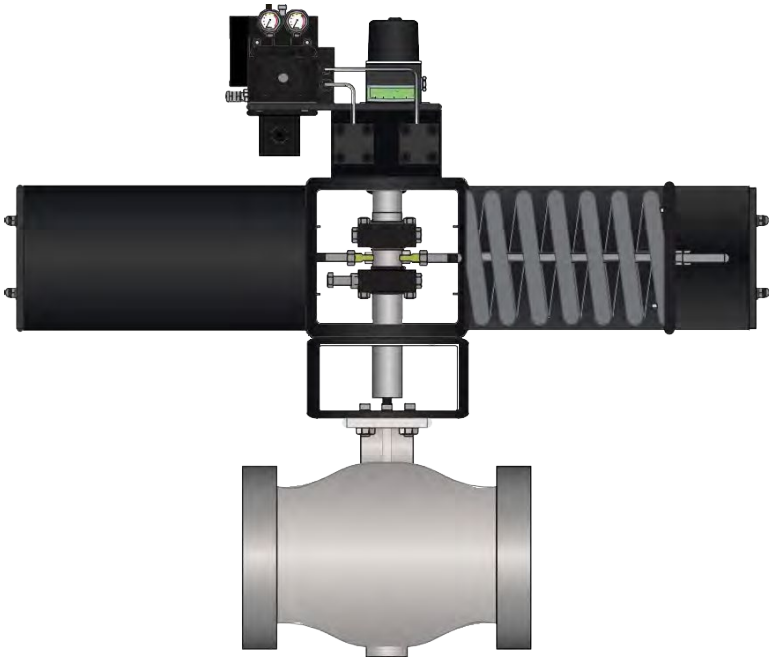
Rotary Spring Selection

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:

(Pressure Gauge reading ÷ 2,000 psi)* xxxxxxxx *actuator rated output = [actual output]

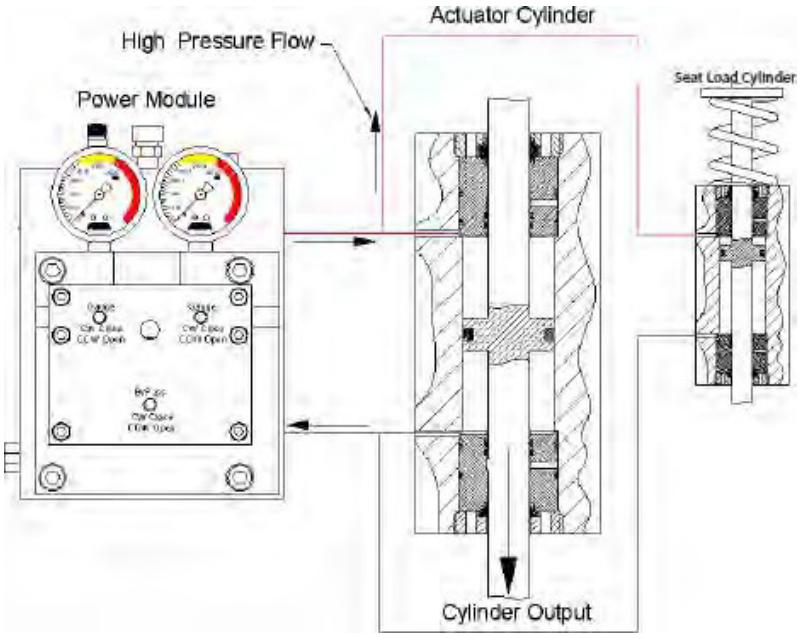
Seat Loading Cylinder

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.

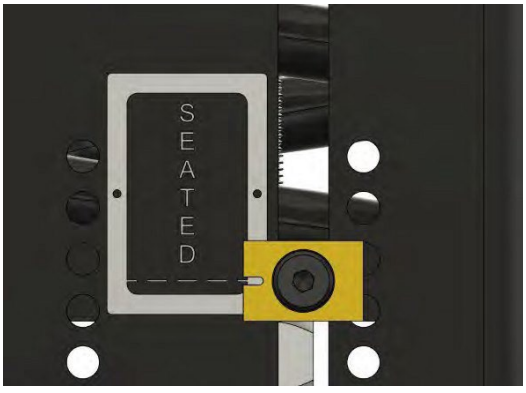
The Seat Loading Cylinder utilizes a pre-compressed load equivalent to 80% (1600 psi) of the nominal working pressure (2 000 psi). As the power module pumps hydraulic fluid into the actuator cylinder, the actuator will drive into the seat and the internal pressure will increase. Once the force on the 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 2,000 psi indicating full actuator output when setting the seated position.



Seat Loading Cylinder



SLC Indicator–Seated

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**
24VDC	**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.

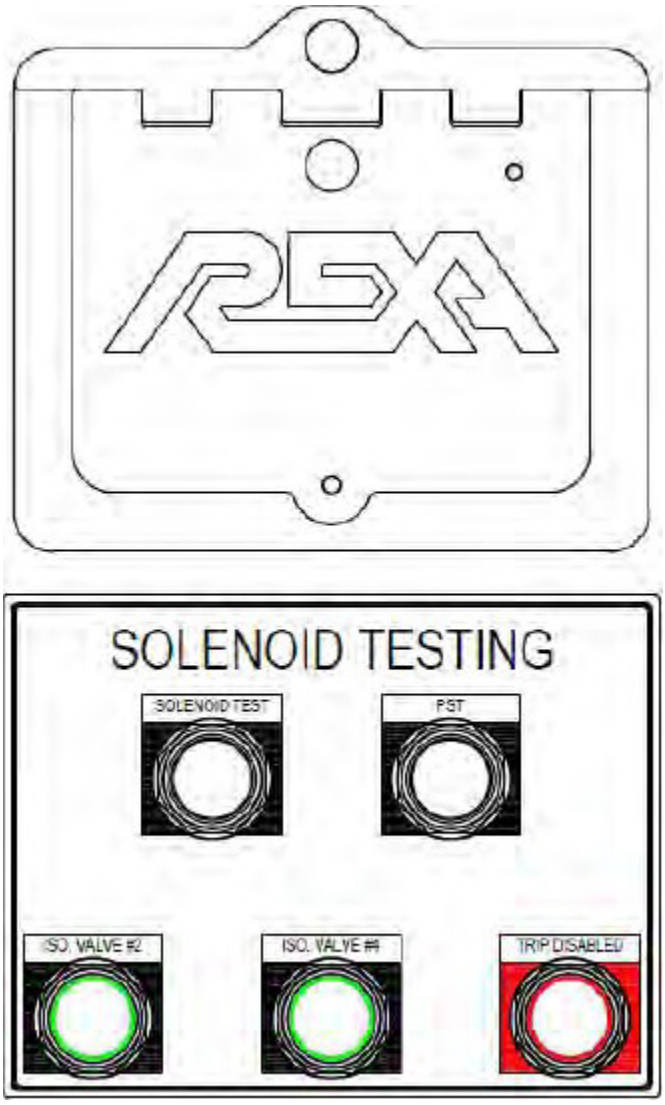


Figure 1: User Interface

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]

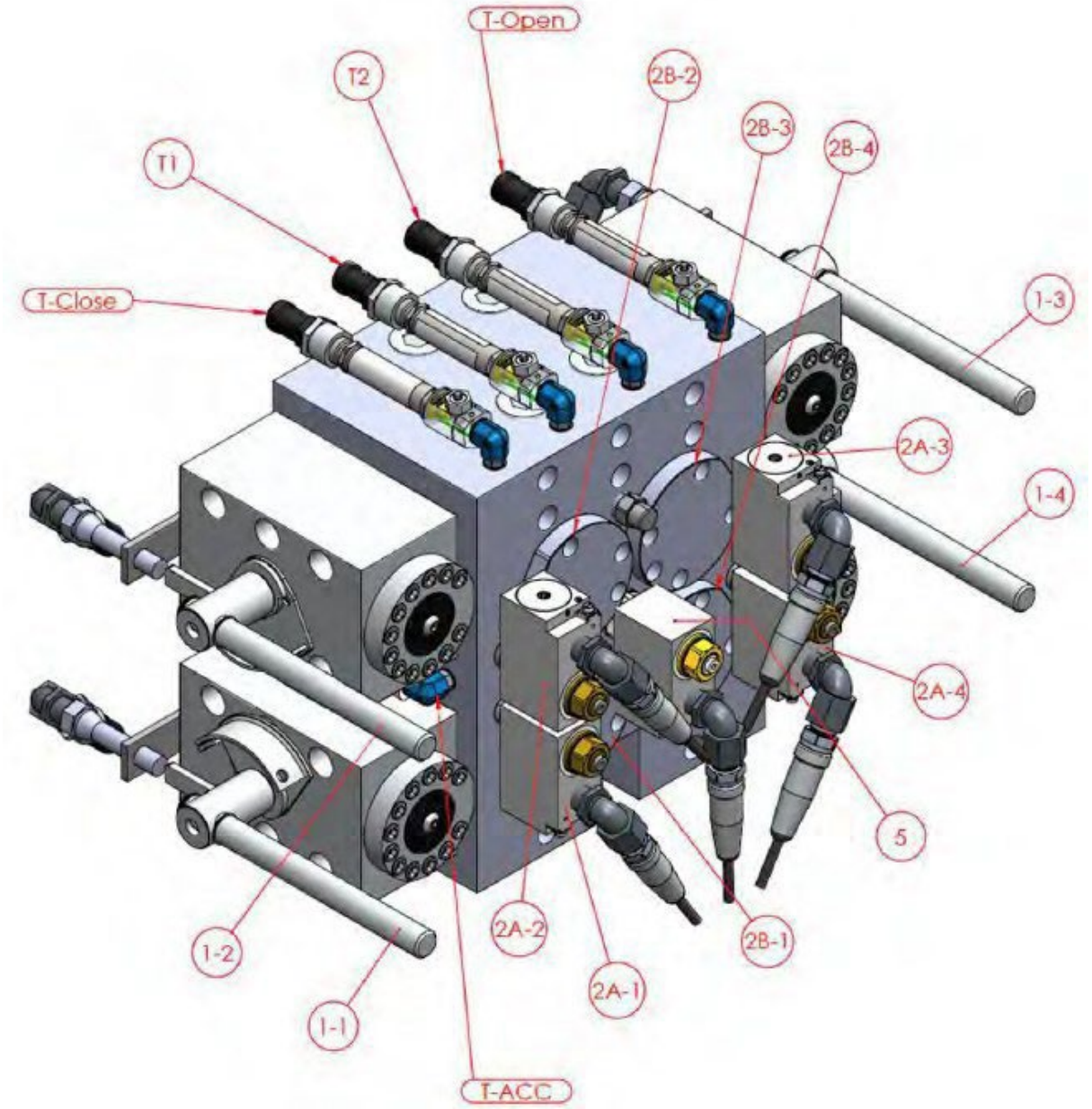


Figure 2: Trip Block Assembly

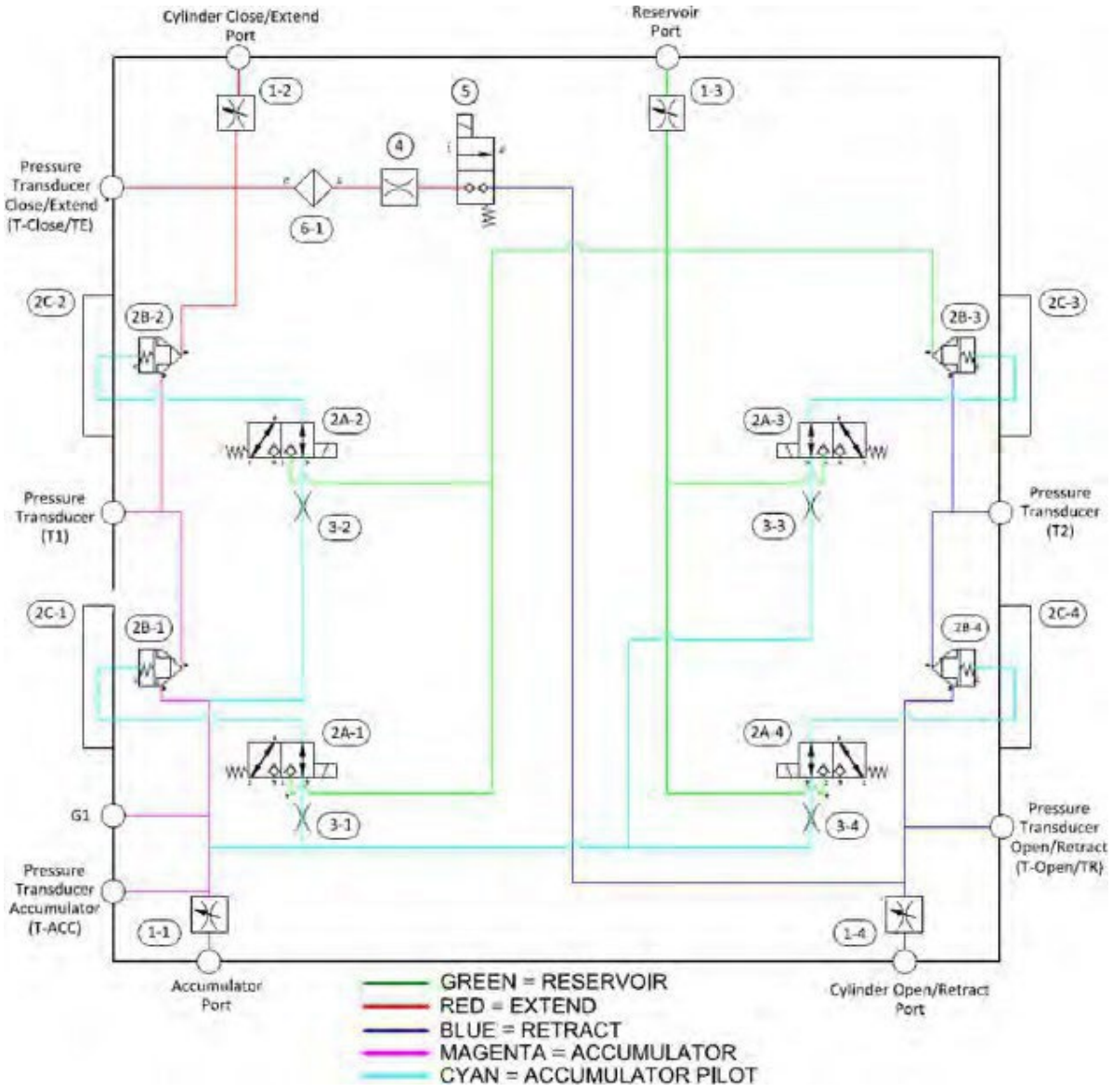


Figure 3: Trip Block Hydraulic Schematic

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 24VDC power.
- **PST**
  - The actuator will motor drive 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 – 500PSI & API Pres 2 = 150PSI. 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) 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.

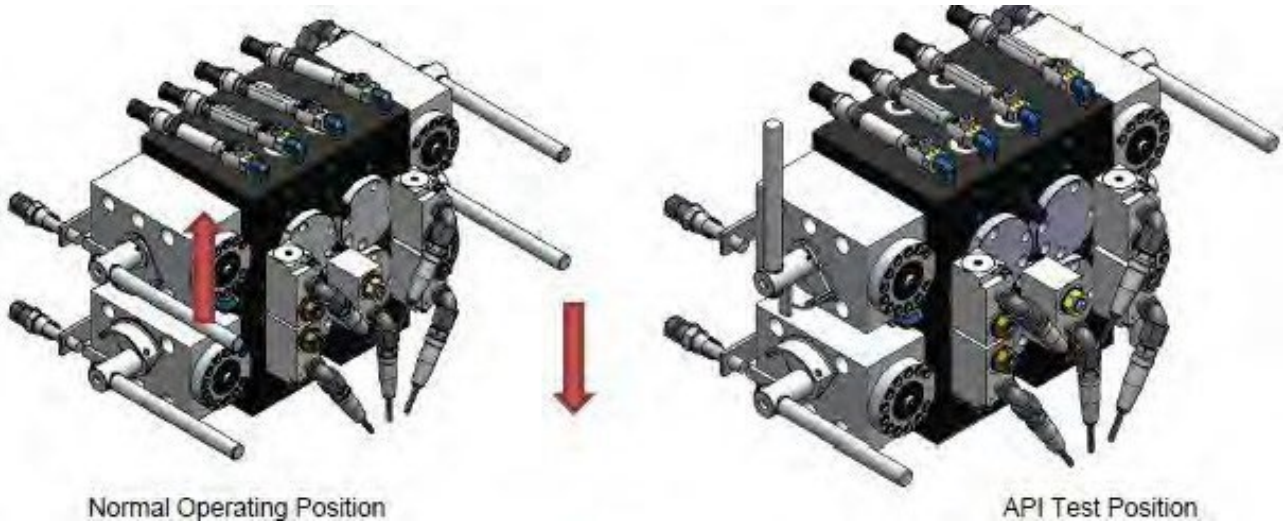


Figure 4: Isolation Valve Positions

3. Press the push button labeled ‘‘Solenoid TEST’’, the operation mode will change from AUTO to AUTO-API or if in LOCAL 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.

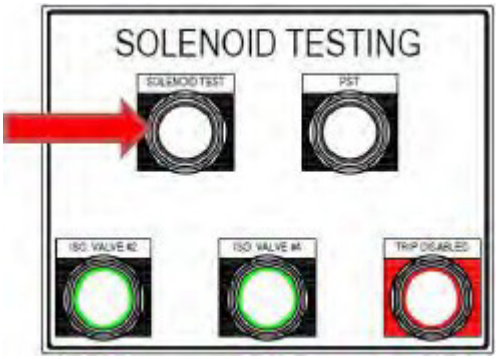


Figure 5: Solenoid Test Button Locator

4. Upon successful completion of the API Test sequence the mode will change back to AUTO or LOCAL 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 > 150PSI (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, and2A-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 "Manual".

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.

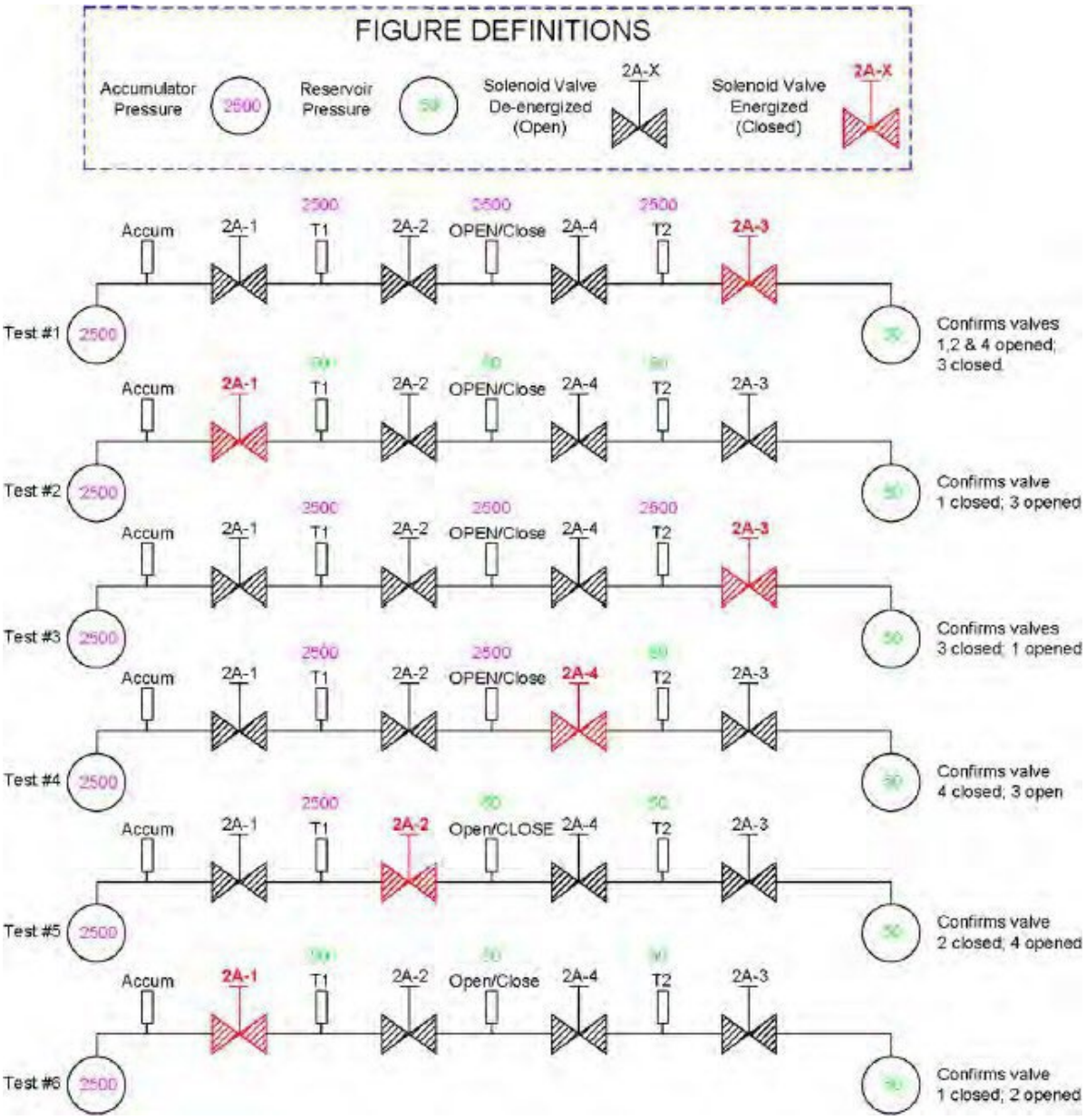


Figure 6: Simplified Solenoids Testing Sequence