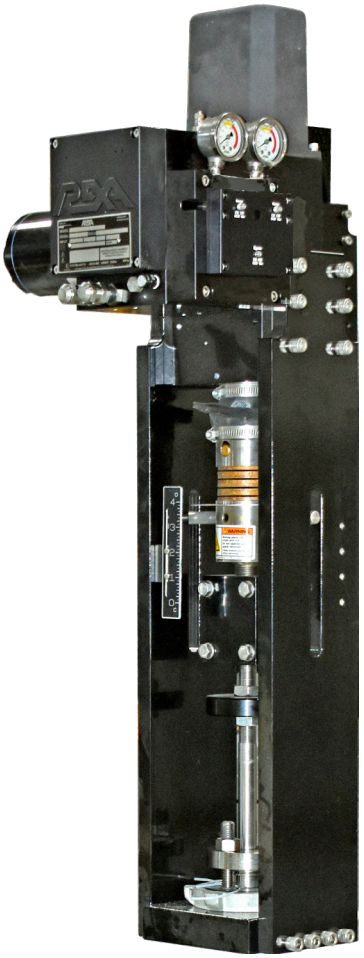
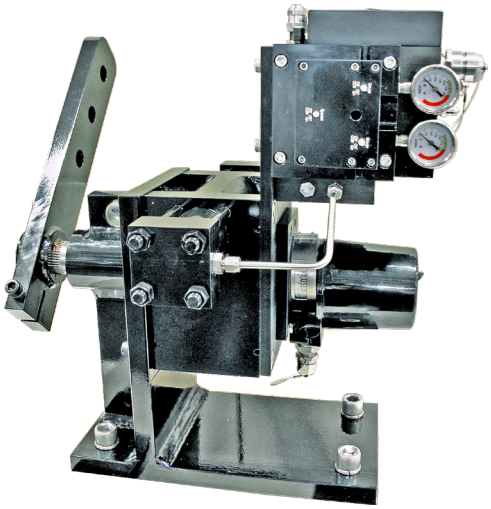
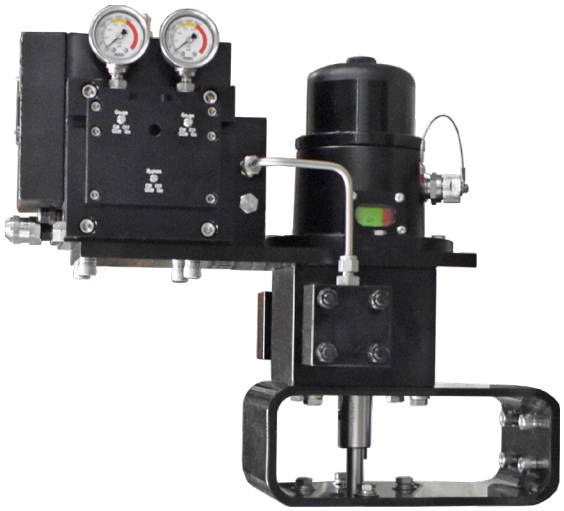
Installation and Operation Manual for the REXA Xpac Series 3

REXA Electraulic™ Actuators and Drives

Revision 8
9/2022 - Present
ISO 9001







Serial # .....
Model # .....
Application .....
Tag # .....

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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

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 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, insure 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 Castrol EDGE® SAE 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 cylinder (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® 767 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 repair, 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 employees 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:

Notify all affected areas and employees of the impending Lock-Out situation, the reason for it, and estimated start and duration times.

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.

6. Lock and/or tag removal. All locks and tags are to be left in place until all work is completely 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.

7. 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 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.

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.

CLASS I ZONE 1: Ex db [ia IIC] IIB T3

CLASS I ZONE 2: Ex nA [ia] IIC T3 Gc*
(coming soon)

**Note: For Zone 2, the [ia] portion is optional since the actuator portion of the assembly could be 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.

CLASS I ZONE 1: **II 2G Ex db [ia IIC] IIB T3**
(coming soon)

CLASS I ZONE 2: **II 3G Ex nA 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.

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.

SPECIFIC CONDITIONS OF USE (Zone 1) IECEx CSA 16.0041X

General

1. Ambient Temperatures below -10°C: use field wiring suitable for minimum ambient temperature
2. Cable entry devices and blanking elements shall be certified for protection type "d"; suitable for IP ratings and correctly installed
3. Unused apertures shall be closed with suitable blanking elements
4. End User shall ensure adequate earthing or equipotential bonding is suitable for the installation of the metallic conduit

X3 Electronic Assembly

5. **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.
6. **TRANSIENT SUPPRESSION DEVICE:** End user shall provide transient suppression of the supply terminals limiting to 140% of the rated supply
7. Electronic enclosure shall be positioned such that the risk of impact to the window is low
8. **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
9. **FASTENERS:** only M16X2.0X60MM Stainless Steel hex bolts are to be used
10. **LITHIUM CELL:** shall be replaced by certified REXA service personnel using only the following type of cell:
    a. Rayovac BR2335, Lithium Carbon-Monofluoride (BR) Coin Cell. Rated 300mAh @ 3.0V. Operating Ambient: -40°C to 85°C
11. **FUSE REPLACEMENT** table is as follows:

FUSE REPLACEMENT TABLE

System Description	Standard Fuse (A)	Alternate Configuration Fuse (A)	Fuse Type
D Module, 230 VAC	10	20	Type 'aM'; 500V, IR 120kA, 10mm x 38mm
B Module, 115 VAC	6	10	
C Module, 115 VAC	10	16	
2C Module, 115 VAC	16	NA	
1/2D Module, 230 VAC	10	20	
1/2D Module, 115 VAC	20	32	
B Module, 230 VAC	4	10	
C Module, 230 VAC	6	12	
2B Module, 230 VAC	10	NA	
2C Module, 230 VAC	12	NA	
2B Module, 115 VAC	10	NA	

X2 or X3 Actuator Assembly

12. **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

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

14. **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 18.8SS • 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 18.8SS • 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 18.8SS • Min Yield Strength =207 Mpa [30ksi], Min Tensile Strength=517MPa [75ksi]

15. **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

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. Rayovac BR2335, Lithium Carbon-Monofluoride (BR) Coin Cell. Rated 300mAh @ 3.0V. Operating Ambient: -40°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 18.8SS • 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 18.8SS • 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 18.8SS • 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

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. Cable entry devices and blanking elements shall be certified for protection type "d"; suitable for IP ratings and correctly installed
3. Unused apertures shall be closed with suitable blanking elements
4. End User shall ensure adequate earthing or equipotential bonding is suitable for the installation of the metallic conduit

X3 Electronic Assembly

5. 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.
6. TRANSIENT SUPPRESSION DEVICE: End user shall provide transient suppression of the supply terminals limiting to 140% of the rated supply
7. Electronic enclosure shall be positioned such that the risk of impact to the window is low
8. LITHIUM CELL: shall be replaced by certified REXA service personnel using only the following type of cell:
   a. Rayovac BR2335, Lithium Carbon-Monofluoride (BR) Coin Cell. Rated 300mAh @ 3.0V. Operating Ambient: -40°C to 85°C
9. FUSE REPLACEMENT table is as follows:

FUSE REPLACEMENT TABLE:

System Description	Standard Fuse (A)	Alternate Configuration Fuse (A)	Fuse Type
B Module, 115 VAC	6	10	Type 'aM'; 500V, IR 120kA, 10mm x 38mm
B Module, 230 VAC	4	10	
C Module, 115 VAC	10	16	
C Module, 230 VAC	6	12	
2B Module, 115 VAC	10	N/A	
2B Module, 230 VAC	10	N/A	
2C Module, 115 VAC	16	N/A	
2C Module, 230 VAC	12	N/A	
1/2D Module, 115 VAC	20	32	Standard: Type 'aM'; 500V, IR 120kA, 10mm x 38mm Alternate: Type 'aM'; 400V, IR 120kA, 10mm x 38mm
1/2D Module, 230 VAC	10	20	Type 'aM'; 500V, IR 120kA, 10mm x 38mm
D Module, 230 VAC	10	20	
Dual 1/2D Module, 115 VAC	32	N/A	Type 'aM'; 400V, IR 120kA, 10mm x 38mm
Dual 1/2D Module, 230 VAC	20	N/A	Type 'aM'; 500V, IR 120kA, 10mm x 38mm
Dual D Module, 230 VAC	20	N/A	
D, P9, 230 VAC	25	N/A	Type 'aM'; 400V, IR 120kA, 10mm x 38mm
D, P40, 230 VAC	50	N/A	Type 'aM'; 690V, IR 120kA, 22mm x 58mm

X2 or X3 Actuator Assembly

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

11. 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 18.8SS • 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 18.8SS • 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 18.8SS • Min Yield Strength =207 Mpa [30ksi], Min Tensile Strength=517MPa [75ksi]

SPECIFIC CONDITIONS OF USE (Zone 2) SIRA 17ATEX4360X

General

1. Unused apertures shall be closed with suitable blanking elements

X3 Electronic Assembly

2. **TRANSIENT SUPPRESSION DEVICE:** End user shall provide transient suppression of the supply terminals limiting to 140% of the rated supply
3. Electronic enclosure shall be positioned such that the risk of impact to the window is low
4. **LITHIUM CELL:** shall be replaced by certified REXA service personnel using only the following type of cell:
   a. Rayovac BR2335, Lithium Carbon-Monofluoride (BR) Coin Cell. Rated 300mAh @ 3.0V. Operating Ambient: -40°C to 85°C
5. **FUSE REPLACEMENT** table is the same table used in the section above per Zone 2 certificate IECEx CSA 17.0013X.
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 18.8SS • 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 18.8SS • Min Yield Strength =207 Mpa [30ksi], Min Tensile Strength=517MPa [75ksi]
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CE

EC Declaration Of Conformity
ACCORDING TO:
MACHINERY DIRECTIVE 2006/42/EC
EMC DIRECTIVE 2014/30/EC

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 Kent Introl Limited Armytage Road, Brighouse, West Yorkshire HD6 1QF

Contact: Brian Richmond (QHSE Director) or Peter Dix (Technical Director)

Telephone: +44(0)1484 710311 Fax: +44(0)1484 407407

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)

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

RoHS Directive 2011/65/EU

Applicable Harmonized Standards:

Health/Safety: Machinery Directive 2006/42/EC Annex I, EN60204-1:2006, EN ISO 12100:2010, EN61310-1:2008, EN61310-2:2008, EN ISO 13850:2015, IEC61010-1:2010

EMC: EN61326-1:2013, EN61000-6 Part -2:2005 and -4:2007; EN55011:2016: IEC61000-4-2:2008, IEC 61000-4-3:2010, IEC61000-4-4:2012, IEC61000-4-5:2014, IEC61000-4-6:2013, IEC61000-4-8:2009, IEC61000-4-11:2004

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

EU Declaration of Conformity

According to: Directive 2014/34/EU

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Contact: Brian Richmond (QHSE Director) or Peter Dix (Technical Director)

Telephone: +44(0)1484 710311 Fax: +44(0)1484 407407

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

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, EN60204-1:2006+A1:2009/AC 2010, EN ISO 12100:2010
EMC:	EN61326-1:2013, EN61000-6 Part -2:2005 and -4:2007+A1:2011; EN55011:2009+A1:2010
ATEX:	EN 60079-0:2012/A11:2013; 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

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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

Designation: II 3G Ex nA II T3 Gc -40C ≤ Ta ≤ 65C Cert: SIRA 17ATEX4360X

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, EN60204-1:2006+A1:2009/AC 2010, EN ISO 12100:2010
EMC:	EN61326-1:2013, EN61000-6 Part -2:2005 and -4:2007+A1:2011; EN55011:2009+A1:2010
ATEX:	EN 60079-0:2012/A11:2013, 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

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 Kent Introl Limited Armytage Road, Brighouse, West Yorkshire HD6 1QF

Contact: Brian Richmond (QHSE Director) or Peter Dix (Technical Director)

Telephone: +44(0)1484 710311 Fax: +44(0)1484 407407

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:

- Be suitable for the Voltage and Full Load Ampere Rating of all downstream equipment supplied by the Panel;
- The supply disconnecting device shall be one of the following types:
    - Switch-disconnector with fuses, in accordance with IEC 60947-3, utilization category AC-23B or DC-23B
    - 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.
    - A circuit breaker suitable as an isolation device per IEC 60947-2
    - 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 the system is installed.
- Be provided with a Lock Out Tag Out capability in the Off (Down) position.
- The Handle must be RED in color to indicate it is suitable as an E-Stop device.

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

1 General Information

1.1 About REXA

REXA is located in West Bridgewater, Massachusetts, USA. We manufacture, sell and service the highest quality actuators and drives. The driving force of these units is a self-contained electrically driven hydraulic pumping system, thus the term Electraulic™ is coined. This Installation and Operation Manual is part of REXA's continuing commitment to supply only the highest quality products and services to our customers. Customer support is our top priority at REXA.

Please contact the factory if this manual, or your Sales Representative, fails to provide required information.

1.2 Factory Support

REXA is a full service company. We have a fully staffed service department with factory trained and certified service personnel for both factory and on site repair. For repair, service, sales, warranty or parts order, you may contact the factory at the following REXA, Inc.

4 Manley Street
West Bridgewater, MA 02379

Phone: (508) 584-1199
Web: www.rexa.com

Note: It is important to have the model code and serial number for both the electronics and the actuator in addition to the serial number for 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 electronics. Reference the sections below on Actuator Identification for more detailed explanation.

1.3 Actuator Identification

The model number, mechanical build number, electronics build number and serial numbers are all used to identify an individual actuator and electronics.

The model number will provide a general description of the actuator and electronics 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 features your actuator may have that make it unique.

Since most applications are custom, this is the only identification that fully allows us to identify the unit. The factory requires these numbers whenever service or information is requested. Supplying the model, both mechanical and electrical build numbers, and the serial number will ensure the quickest and most accurate response to your request. These numbers can be found on the ID tags located on the actuator and on the serial tag on the electronics. Figure 1.3 shows a typical ID tag.

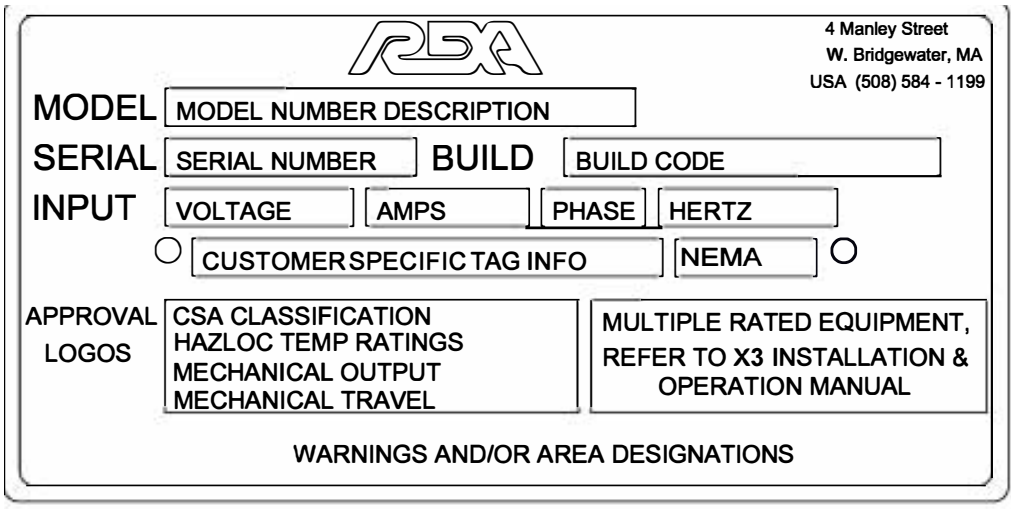

Figure 1.3 ID Tag

1.3.1 Model Number

The basic model number is a generic description of the actuator. Figure 1.3.1 shows a break down of the model number tree and how it works.

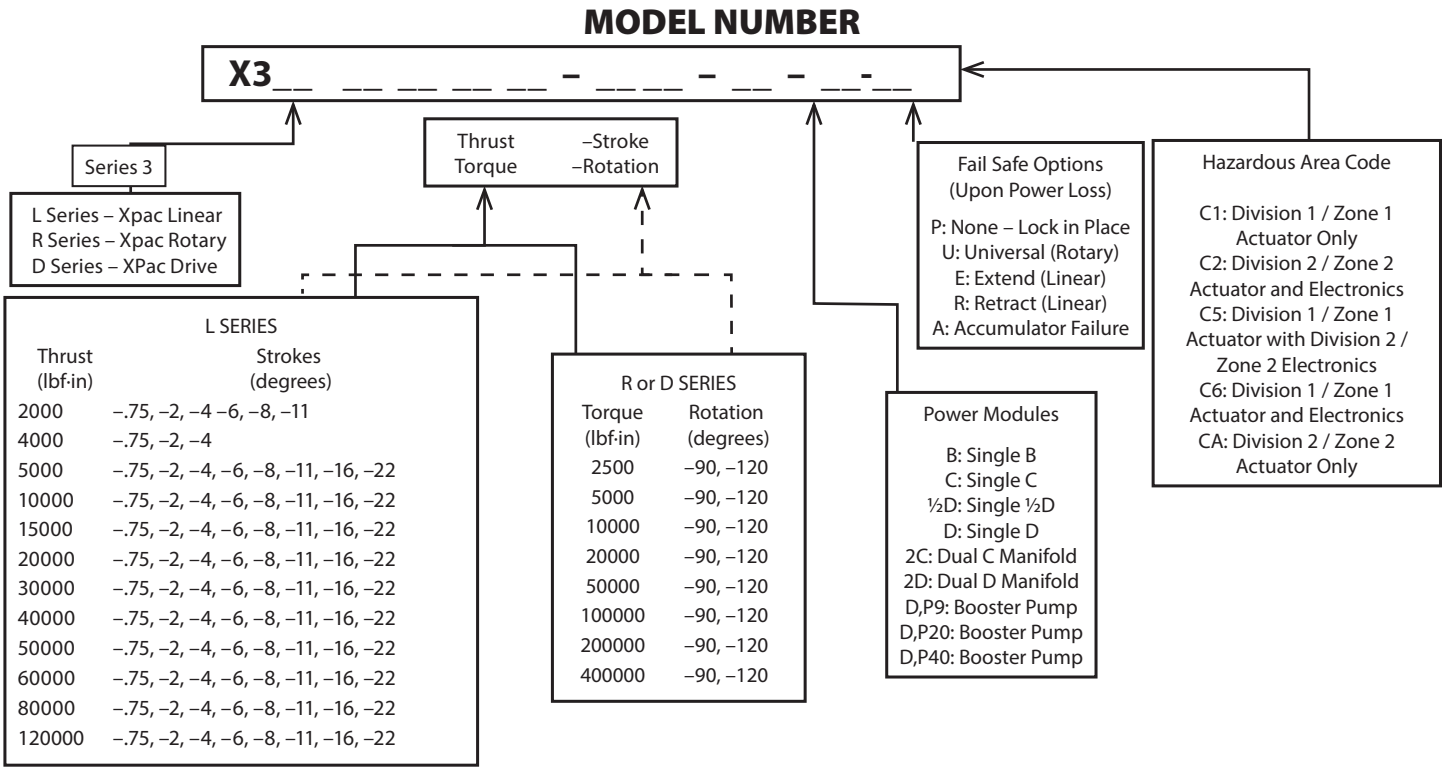

Figure 1.3.1 Model Number

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.

1.3.2 Serial Number

Serial numbers are assigned to every job at REXA. Job specific information as well as sales and engineering information are stored under a specific serial number. A typical serial number will look like: RC1800000. The RC1 indicates the year of manufacture and the next four digits correspond to the unique order number.

1.3.3 Build Number

The build number is a catalog number we use to designate in complete detail the construction of the actuator. From this number all configurations can be defined. There are two different categories of build numbers; one is for the mechanical sub-assembly, and the second is for it's corresponding electronics sub-assembly. Within the mechanical sub-assembly there is a build number for Rotary and Drive Actuators, and a separate build number for Linear Actuators. The build numbers are shown in Appendix H.

1.4 General Specifications

1.4.1 Recommended Fluids and Lubricants

Intended Use	Specifications
Operating fluid, all REXA Actuators	Castrol EDGE® SAE 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

1.4.2 Operating Temperatures

The following is a general guideline.

Table 1.4.2-1 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
Electronics Temp. Range		Separate Control Enclosure with CPU, motor driver, power supply, transient protection and termination.			
		-40 °F to +140 °F (-40 °C to +60 °C)		-40 °F to +120 °F (-40 °C to +50 °C)	
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.*

Table 1.4.2-2 Rotary Actuators & 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" of thermal insulation 2	Heat tracing & 1" therm 2	Optional High Temp. Construction
Electronics Temp. Range		Separate Control Enclosure with CPU, motor driver, power supply, transient protection and termination.			
		-40 °F to +140 °F (-40 °C to +60 °C)		-40 °F to +120 °F (-40 °C to +50 °C)	
Motor Type		Stepper		Servo	

Table 1.4.2-3 CSA Temperature Ratings

Power Module	Operating Temperatures				Duty* Cycle	Notes
	Actuator		Electronics			
B, 115Vac	-40 °F to +150 °F	(-40 °C to +65 °C)	-40 °F to +140 °F	(-40 °C to +60 °C)	S1	
B, 230Vac	-40 °F to +150 °F	(-40 °C to +65 °C)	-40 °F to +104 °F	(-40 °C to +40 °C)	S1	
C, 115Vac	-40 °F to +150 °F	(-40 °C to +65 °C)	-40 °F to +140 °F	(-40 °C to +60 °C)	S1	
C, 230Vac	-40 °F to +150 °F	(-40 °C to +65 °C)	-40 °F to +104 °F	(-40 °C to +40 °C)	S1	
2C, 115Vac	-40 °F to +150 °F	(-40 °C to +65 °C)	-40 °F to +140 °F	(-40 °C to +60 °C)	S1	
.5D, 115Vac	-40 °F to +150 °F	(-40 °C to +65 °C)	-40 °F to +150 °F	(-40 °C to +65 °C)	S1	
.5D, 230Vac	-40 °F to +150 °F	(-40 °C to +65 °C)	-40 °F to +150 °F	(-40 °C to +65 °C)	S1	
D, 230Vac	-40 °F to +150 °F	(-40 °C to +65 °C)	-40 °F to +131 °F	(-40 °C to +55 °C)	S1	
Dual .5D, 115Vac	-40 °F to +150 °F	(-40 °C to +65 °C)	-40 °F to +150 °F	(-40 °C to +65 °C)	S1	
Dual .5D, 230Vac	-40 °F to +150 °F	(-40 °C to +65 °C)	-40 °F to +150 °F	(-40 °C to +65 °C)	S1	
2D, 230Vac	-40 °F to +150 °F	(-40 °C to +65 °C)	-40 °F to +131 °F	(-40 °C to +55 °C)	S1	
D,P9, 230Vac	-40 °F to +140 °F	(-40 °C to +60 °C)	-40 °F to +122 °F	(-40 °C to +50 °C)	S8	1, 2
D,P20, 230Vac	-40 °F to +140°F	(-40 °C to +60 °C)	-40 °F to +122 °F	(-40 °C to +50 °C)	S8	1, 2
D,P40, 230Vac	-40 °F to +140°F	(-40 °C to +60 °C)	-40 °F to +122	(-40 °C to +50 °C)	S8	1, 2

Notes

1. Duty cycle for D,P9, D,P20, or D,P40 power module motor is S1, booster motor will remain S8.
2. Uses 48 Vdc to 72 Vdc converter.

S1 Duty cycle S1 is defined as continuous operation at load.

S8 Duty cycle S8 is defined as periodic duty with rest period between operation, variable load/speeds.

**Duty Cycle definitions taken from IEC 60034-1 applies to all rotating electrical machines.*

1.4.3 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.

1.4.4 Transportation and Storage

This equipment will withstand, or has been protected against, transportation and storage temperatures of –25 °C (–13 °F) to +55 °C (+131 °F) and for short periods up to +70 °C (+158 °F).

It has been packaged to prevent damage from the effects of normal humidity, vibration and shock.

1.5 Maintenance Schedule

The REXA actuator requires minimal routine maintenance consisting primarily of visual inspections. As with any mechanical device, components will wear over time. The frequency of use and the operating conditions are both factors that will dictate the maintenance schedule.

Note: With time and experience, a predictable schedule of maintenance and replacement of seals may be developed.

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, error codes and gauge pressures)

1.6 Oil

1.6.1 Oil Level Inspection

The REXA Xpac 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 make up oil for the flow matching valve and is an integral component within the module. As the size of the actuator cylinders increase 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 .

A closed-loop hydraulic system means that the oil in the actuator is isolated from the environment and immune to degradation with time as a result of exposure to moisture and other atmospheric elements. Since the hydraulic system is sealed and spring-loaded, it is also unaffected by the orientation in which the actuator is applied.

A periodic, visual inspection of the REXA Xpac Actuator is required in order 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.

Auxiliary Expansion Chamber Settings	Thermal Expansion Chamber Settings
With the accumulator fully discharged, the accumulator pressure gauge must read 0 PSI. Fill until indicator extension is XXX ±½" **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 indicator extension should be @ XXX ±½"	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

1.6.2 Standard Units

There is an oil level indicator on the actuator body located on the same face as the motor shown in Figures 1.6.2-1—1.6.2-3. 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. Reference Figures 1.6.2-1 through 1.6.2-3 showing the different indication levels.

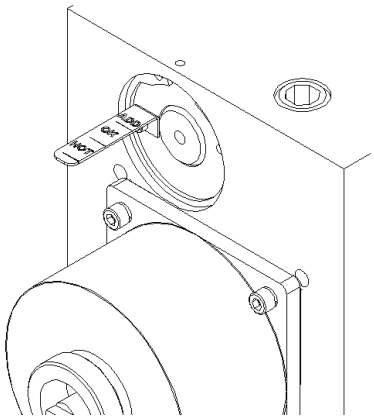

Figure 1.6.2-1 Add oil indication

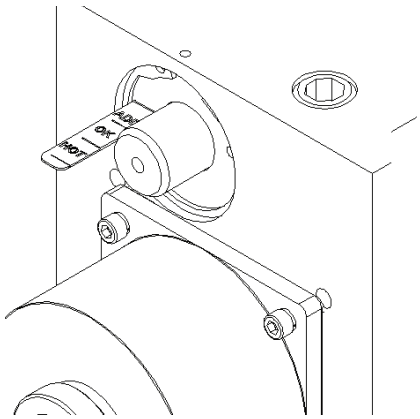

Figure 1.6.2-2 Full oil indication

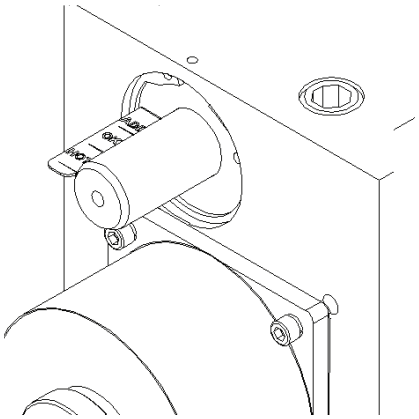

Figure 1.6.2-3 Oil Expansion

Larger units will require additional make up oil and an external auxiliary expansion chamber will be plumbed in series with the internal thermal expansion chamber. The internal thermal expansion chamber will still show the oil level however there is also an indicator rod in the external auxiliary expansion chamber. At an ambient condition of 70 °F it should be protruding out approximately 3-½ inches as measured from the base of the bushing shown in Figure 1.6.2-4.

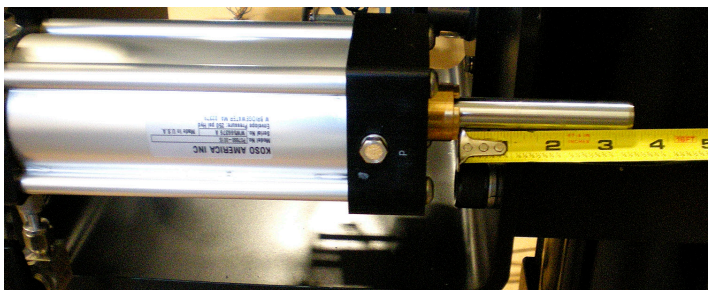

Figure 1.6.2-4 External Auxiliary Expansion Chamber

1.6.3 Accumulator Fail

In an accumulator fail unit the thermal expansion chamber provides oil for the flow matching valve and to charge the accumulator system. There are two different style accumulator bottles used depending on the size of the system. The first type uses a visual indicator rod as shown in Figure 1.6.2-4 and is typically used on smaller units. As the accumulator bottle volume needs increase, a gas pressurized bottle is used and a pressure gauge is provided (Figure 1.6.3) to show the oil level.

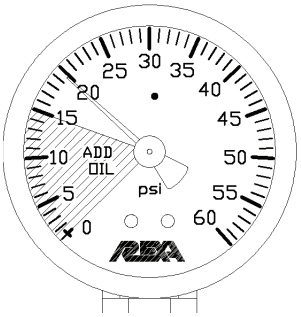

Figure 1.6.3 Accumulator Pressure Gauge

In order to check the level of the oil in an accumulator system you must locate the "Auxiliary Expansion Chamber Settings" label shown below. This can be found on the accumulator bottle.

The accumulator bottle can be checked when the accumulator is fully charged or fully discharged. Compare the actuator condition to the proper settings listed on the accumulator bottle labels. Reference section 1.6.4 and add oil if necessary.

1.6.4 Filling

If the addition of oil is required, it should be filled with Castrol EDGE® SAE 5W-50 motor oil (Figure 1.6.4-1). An unusual application may require different oil. (Refer to the actuator serial plate.) The actuator does not need to be taken out of service when adding oil.

Figure 1.6.4-1 Castrol EDGE

Note: Although Castrol Edge oil is recommended, oil of equal quality may be used.

REXA Xpac Actuators are filled through a standard Schrader-style Fill Valve located on the power module. Use any oil gun equipped with a Schrader-style fitting. The mating half of a Schrader-style fitting can be obtained at any auto parts store, purchased through a REXA Sales Rep, or purchased directly from REXA's Inside Sales Office. The following steps will guide a user to successfully fill a REXA Xpac Actuator with oil:

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. Overfilling will also promote oil weeping from the overfill protection due to thermal expansion. If an accumulator unit is overfilled, the reservoir can be over pressurized and catastrophic seal damage can occur.

PROCEDURE (9 steps):

1. Locate and Remove the fill valve cover (Figure 1.6.4-2).

Figure 1.6.4-2 Fill Valve with cover.

2. Fill the oil gun with oil (Figure 1.6.4-3).

Figure 1.6.4-3 Fill the oil gun.

3. To purge any air out of the oil gun, line and fitting; first, pump the handle a few times until the lever gets firm (Figure 1.6.4-4)

Figure 1.6.4-4 Purge the air.

4. Depress the small valve in the center of the female Schrader fitting (on the oil Pump) with a suitable device like a small screwdriver or punch until you get clean, air-free oil (Figure 1.6.4-5).

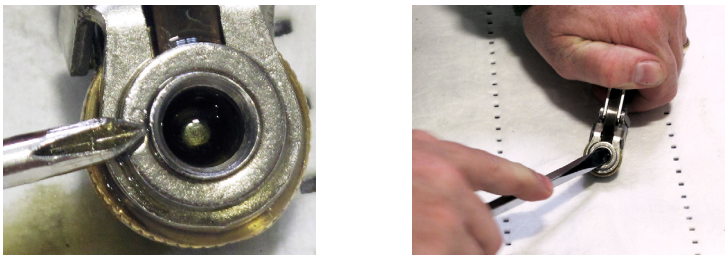

Figure 1.6.4-5 Oil Pump Valve.

5. Attach the oil fill gun to the actuator's Schrader fitting (Figure 1.6.4-6).

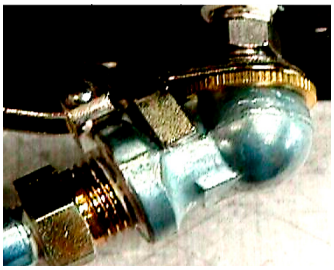

Figure 1.6.4-6 Fill Valve with Schrader fitting.

6. Add oil until the indicator is in the "OK" section of the scale (Figure 1.6.2-2). Reference the accumulator bottle labels for correct filling of Accumulator units.
7. Remove the oil gun from the Fill Valve.
8. Re-install the fill valve cover.
9. Drain and store the Fill Gun in a clean place for future use.

1.6.5 Overfilling, Oil Weeping, and Thermal Expansion

All REXA Xpac Actuators contain a Thermal Expansion Valve located next to the Schrader-style Fill Valve. If an actuator is overfilled with oil, it should be expected that oil will purge out of the Thermal Expansion Chamber. Simply wipe-off whatever oil may be purged.

The thermal expansion valve is built into every REXA Xpac Actuator in order to allow the actuator to relieve the chamber of excess oil pressure due to thermal expansion. 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 an 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 in order 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.

1.6.6 Air Purging

As previously noted, all REXA Xpac Actuators are characterized by a closed-loop, hydraulic system that is responsible for their distinguished reputation as being unmatched in rigidity, precision and control. This is, in part, due to the advantages of using hydraulics in place of pneumatic actuation. Air is a compressible medium that results in many inherent disadvantages, such as poor control and rigidity, when used in actuation.

In light of these facts, it is obvious that the presence of any air in the closed-loop hydraulic system of a REXA Xpac Actuator is extremely disadvantageous and detracts from performance of the actuator. Certain repair and replacement procedures will involve exposing the internal hydraulic system to the outside environment and may introduce unwanted air to the system. The presence of air in the hydraulic system is likely to cause problems such as unstable positioning. For this reason, whenever the closed-loop hydraulic system of a REXA Xpac Actuator is opened to the atmosphere, it is imperative that necessary steps are taken to remove any air from the system. When purging a REXA Xpac Actuator of air, there are two main areas of concern: the thermal expansion chamber and the hydraulic system.

1.6.7 Thermal Expansion Chamber Purging

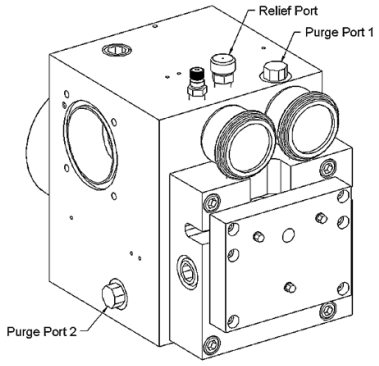

Figure 1.6.7-1 Purge Ports

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. If it does not feel "stiff," there is air in the chamber.

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

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 (Figure 1.6.7-1) are both at corners of the thermal expansion chamber volume and most likely will be the highest points.

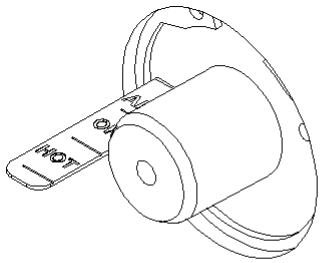

Figure 1.6.7-2 Full Indicator "OK" – flush with front face

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.

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

4. Retighten the plug before proceeding.

5. Refill to the correct oil level.

   Note: Some actuator orientation 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.

1.6.8 Hydraulic System Purging

To purge the actuator of air, it is recommended that you use the REXA bleed kit. See Figure 1.6.8-2 for details.

1. Change the Max Man Spd to 30% or less. (Refer to section 6.1.5.)

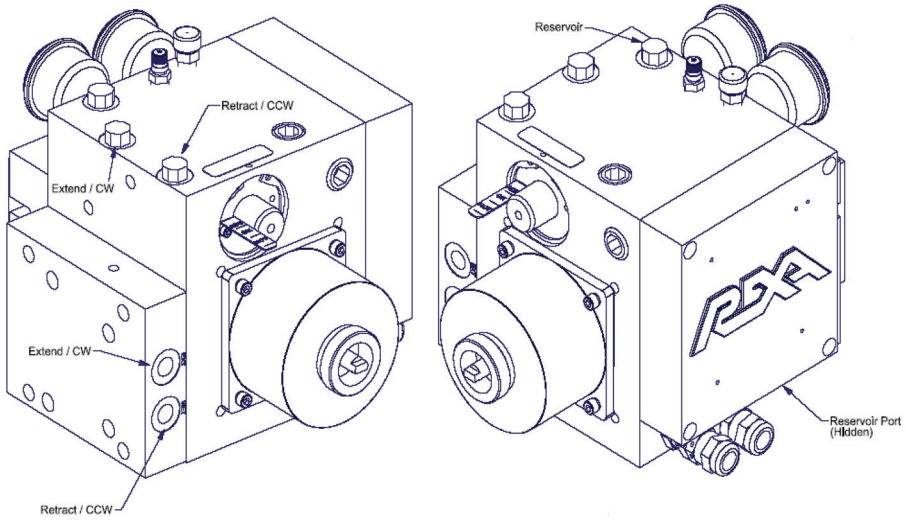

Figure 1.6.8-1 Extend/CW and Retract/CCW Ports

2. Open the manual bypass to relieve internal pressure. (Refer to C1.4.)

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

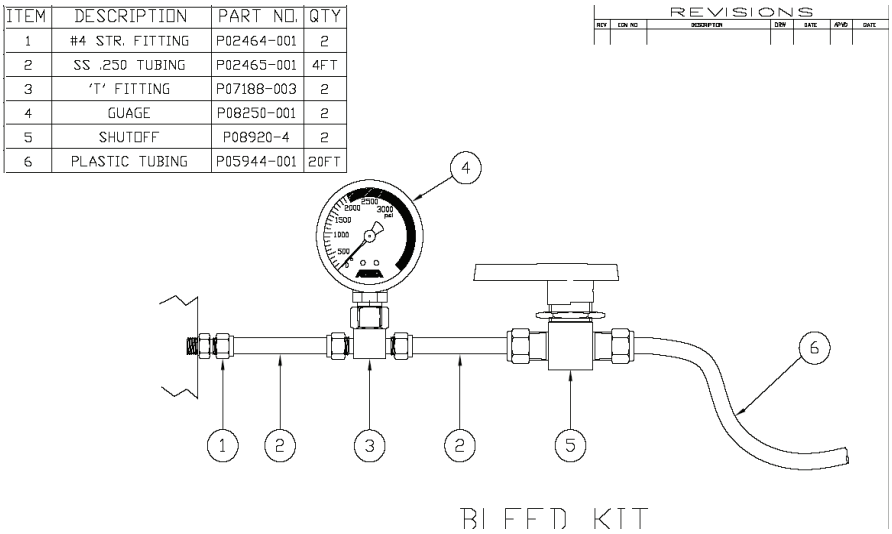

Figure 1.6.8-2 Bleed Kit (PN: K09275)

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 SCL, etc.

4. Attach the REXA bleed kit (Figure 1.6.8-2) to the open ports Extend/CW and Retract/CCW. Follow the hydraulic lines to differentiate between pressure direction (Figure 1.6.8-1).

5. Run the actuator through its full stroke constantly pumping oil into the thermal expansion chamber. **Do not let the chamber run dry, or you will need to purge the chamber and start over.**

1.7 Tool Requirements (Power Module Only)

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

- Flashlight
- Standard Set of Allen Wrenches
- Set of Picks
- 3/16″ Nut Driver
- Snap Ring Pliers
- Wire Strippers
- Crimper
- Oil Gun with Schrader Fill Assembly
- Soft Blow Hammer
- Set of Flat Tip Screwdriver
- Set of Combination Wrenches
- 12″ Channel Lock Pliers
- 3/8″ Nut Driver
- Needle Nose Pliers
- Wire Cutter
- Digital Volt Meter

1.8 Theory Of Operation

1.8.1 Overview

The REXA Xpac is a microprocessor controlled, self-contained, Electraulic™ (electro-hydraulic) actuator or drive 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 Castrol EDGE® SAE 5W-50) from one side of a double acting cylinder to the other. Once the correct position is reached, the motor shuts off. Power is not required to maintain actuator position. The hydraulics are controlled by a dedicated microprocessor contained within the control enclosure. Software designed for the Xpac allows the user to set actuator operation parameters.

Note: Although Castrol Edge oil is recommended, oil of equal quality may be used.

The Xpac consists of two major components, the 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. Connecting the actuator and enclosure are the module cable and the feedback cable.

1.8.2 Actuator

The heart of the actuator is the Electraulic Power Module. Consisting of a motor, gear pump, flow match valve (FMV), make-up oil thermal expansion chamber, heater, thermostat and bypass solenoid (spring fail units only), the Power Module delivers oil at a nominal 2000 psi to a hydraulic cylinder. Four different size modules, B, C, ½D and D, are available meeting hazardous area but non-explosion proof requirements. For applications requiring hazardous area and explosion proof approvals, two different power modules, C and D are available. The major functional difference between the sizes is pumping volume and thus, the maximum stroking speed of an actuator.

The B and C modules are driven with a stepper motor and therefore have a slower frequency response then the D series modules which are driven with servo motors. More detailed information on the frequency response and flow rates can be found in product/technical memos. The only visible difference among all 4 sizes of modules is the motor.

There are three types of hydraulic cylinders. On smaller size linear actuators (thrust of 10 000 lb or less and strokes of 6 inches or less), the L series cylinder is manufactured from a solid block of aluminum. Larger size C series cylinders are made of a fabricated tie-rod construction. The third type, used on rotary (series R) and drive (series D) units, is a rack and pinion rotary design.

A position sensor, provides feedback position to the control electronics. The feedback assembly is sealed in a NEMA 4X cover and mounted within or adjacent to the cylinders. The connection of the position sensor is by direct mechanical means.

The B and C modules shown in Figure 1.8.2-1&2 are the two sizes of stepping motor modules. They both have cylindrical motor cases. The motor case lengths are depicted in Figure 1.8.2-1&2 for module identification purposes. With the exception of pump and motor size, these two modules share many of the same components so both modules will be depicted on one rebuild diagram for each of the applicable service sections.

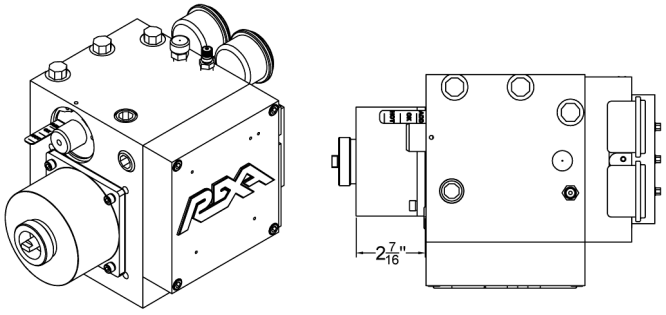

Figure 1.8.2-1 B Module

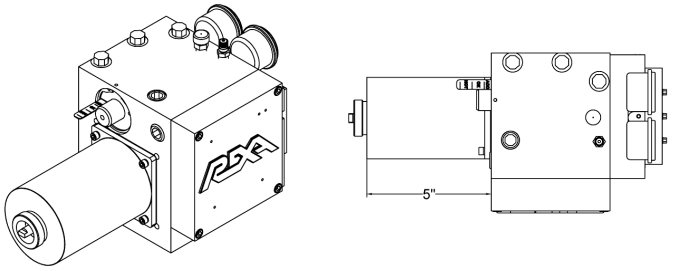

Figure 1.8.2-2 C Module

The 1/2D and D modules shown in Figure 1.8.2-3&4 are the two sizes of servo motor modules. They both have square case motors. The motor case lengths are depicted in Figure 1.8.2-3&4 for module identification purposes. Again, with the exception of pump and motor size, these two modules share many of the same components so both modules will be depicted on one rebuild diagram for each of the applicable service sections.

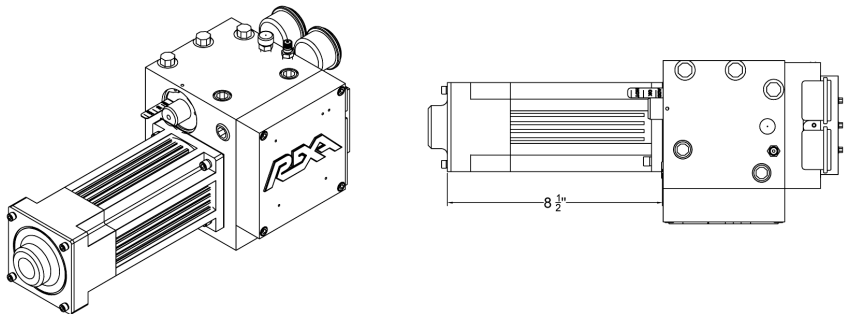

Figure 1.8.2-3 ½D Module

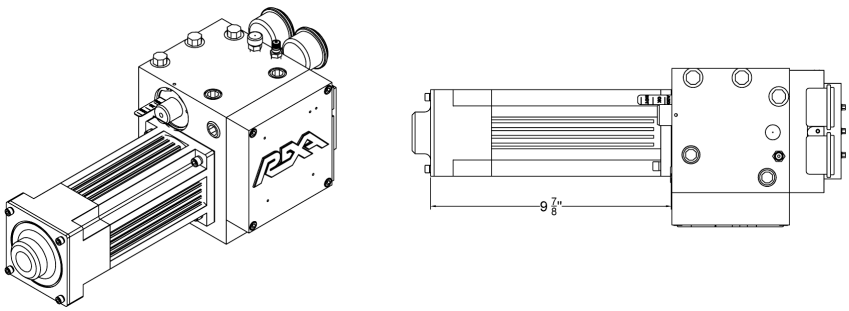

Figure 1.8.2-4 D Module

The C and D explosion proof modules shown in Figure 1.8.2-5&6 are two sizes of power modules offered for applications requiring hazardous area and explosion proof approvals. The motor case lengths are depicted in Figure 1.8.2-5&6 for module identification purposes. With the exception of pump, motor size, and cover, these modules share many of the same components as the non-explosion proof modules so both modules will be depicted on one rebuild diagram for each of the applicable service sections.

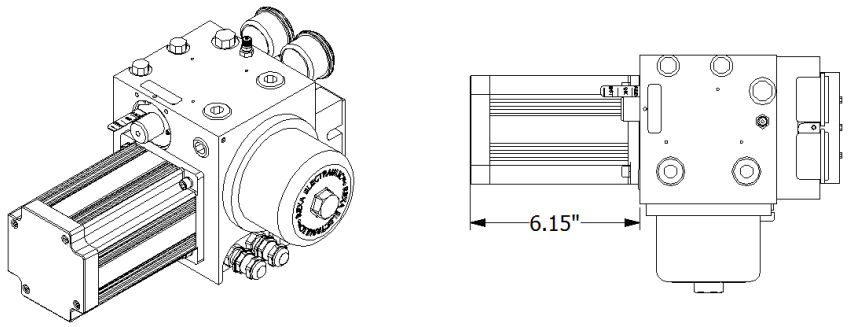

Figure 1.8.2-5 C Module

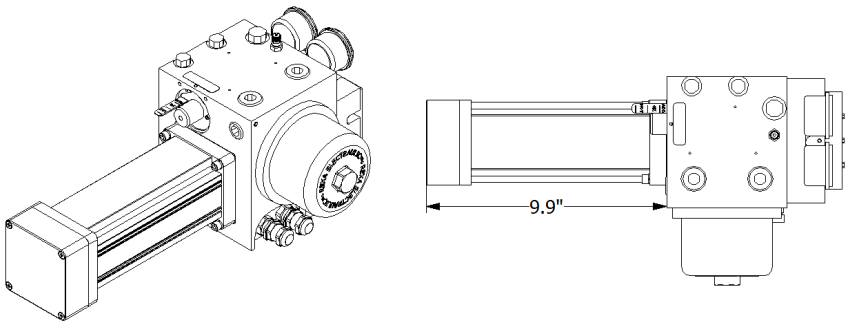

Figure 1.8.2-6 D Module

1.8.3 Control Sub-Assembly

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

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

The CPU consists of a microprocessor, an analog-to-digital (A/D) converter, an isolated 4-20 mA position transmitter, electronic limit switches, as well as warning and alarm relays. The CPU will also accept optional I/O interface boards.

The power supply develops DC voltages from the incoming AC power. The DC voltages, +5, +15 and +24 Vdc, provide power to the CPU, actuator feedback circuit, the optional interface boards as well as optional loop supply (+24 Vdc) for the Position Transmitter.

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 CPU 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.

Refer to Tables 1.8.3-1 and 1.8.3-2 for Terminal Block ratings.

Figure 1.8.3 Typical Control Enclosure

316 Stainless-Steel Enclosure Specifications For Single Module Actuators:

- UL 508 Types 12, 4
- CSA Type 12, 4
- Complies with NEMA Type 12 and 4X
- IEC 529, IP66 Construction

1.8.4 REXA Terminal Blocks

Low Power Terminal Block

Connection Description: CPU connections/ Resolver/ Solenoids/ Heater/ Stepper Motor Power

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

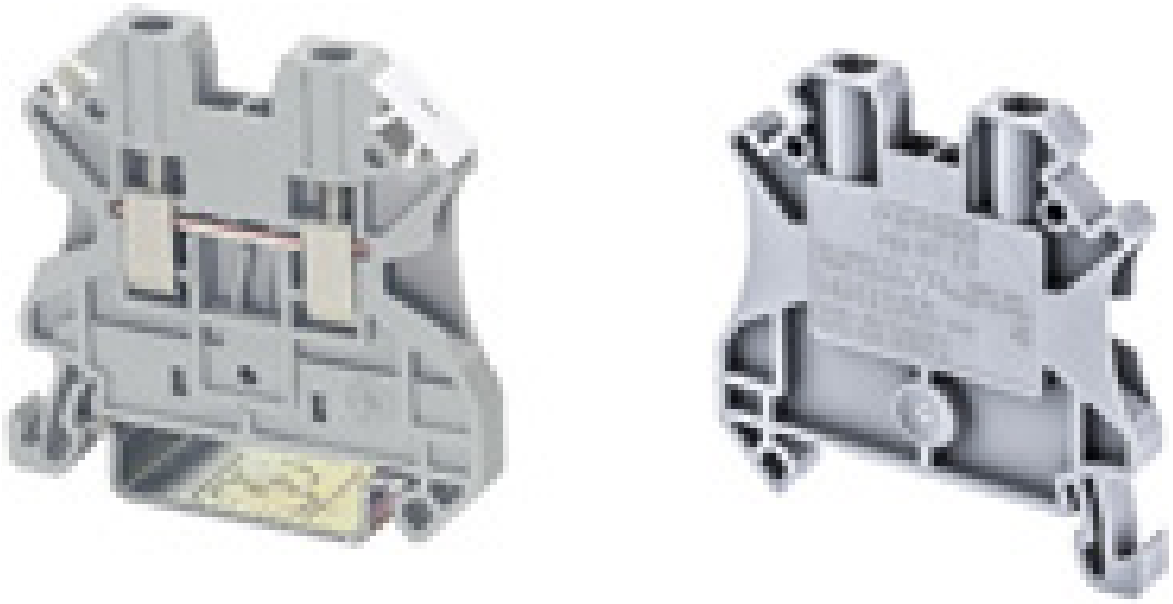

Figure 1.8.4-1 Low Power Terminal Block

Medium Power Terminal Block

Connection Description: Servo Motor and P9 Booster Motor Power

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)

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

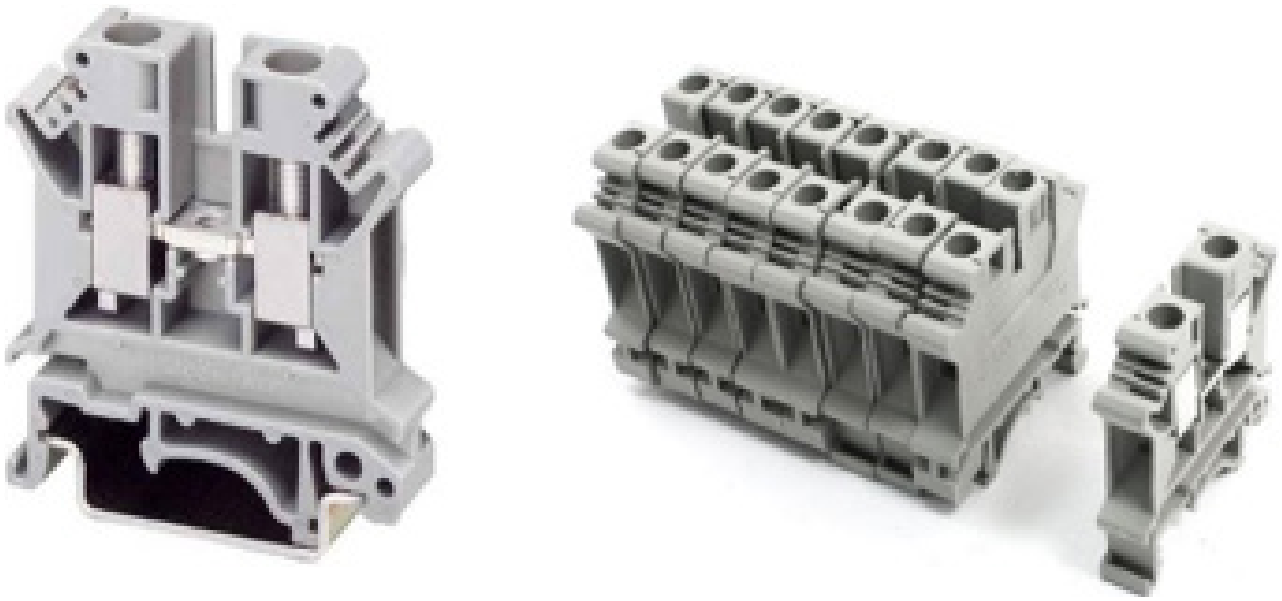

Figure 1.8.4-2 Medium Power Terminal Block

High Power Terminal Block

Connection Description: P40 Booster Motor Power

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: 50A

Figure 1.8.4-3 High Power Terminal Block

High Power Terminal Block

Physical (Plug):

- 24 position female plug with dual-entry port hub
- Operating Temperature: -40°F to 257°F (-40°C to 125°C)
- Insulating Material: PA (polyamide)
- Contacts: Silver plated copper alloy
- Inflammability Rating: UL94V0

Connections (Plug):

- Screw Thread: M6
- Wire Range: 20 to 14 AWG (0.5mm2 to 2.5mm2)
- Tightening Torque: 4.42 in-lbs. to 7.08 in-lbs. (0.5 Nm to 0.8 Nm)
- Stripping Length: 0.32" (8mm)

Physical (Hub):

- Housing Material: Aluminum, die-cast
- Operating Temperature: -40°F to 257°F (-40°C to 125°C)
- Surface Material: Powder coated, gray
- Locking Screw Material: Stainless steel
- Protection: IP66, NEMA 4X

Connections (Hub):

- Screw Thread: Phillips screw
- Tightening Torque: 26.55 in-lbs. (3.0 Nm)

Electrical:

- Voltage Rating: 600V
- Current Rating: 16A

Female Plug

(actual number of positions not shown)

Dual-entry Port Hub,

M32 (top) thread & M25 thread (side)

Figure 1.8.4-4 Female Plug Pinout Connection

Figure Recommended Installation Practices

1. Remove female plug from hub by loosening the four screws to gain access to wire termination screws.
2. Signal level connections will use the M25 entry port: these are identified in red highlight in the table above
3. Power level connections will use the M32 entry port
4. It is critical to use separate conduits for signal and power to eliminate noise interference
5. REXA offers M32 to 1" NPT adaptors and M25 to¾" NPT adaptors
6. Wire connections to female plug per pinout table above
7. Strip wires and torque connections per specifications
8. Re-attach female plug by tightening the four screws to hub
9. Tightly secure the entry port conduits and apply Loctite
10. Torque the top and bottom hub screws per specification to maintain IP rating of the hub

Note: images below show a female plug mounted within hub, the actual number of positions is not shown. The correct terminal hub installation requries separate conduits entries for power wiring and signal wiring

Figure 1.8.4-5 Wire Termination Hub

Table 1.8.4-1 Control Enclosure Terminal Blocks

Mechanical	
Termination Torque	10 lbf·in Max.
Operating Temperature	-40 °F to +221 °F (-40 °C to +105 °C)
Material	
Contact	Brass, Tin Plated
Screw	#6-32, Combo Head, with SEMS Washer
Insulator Body	Polycarbonate, UL 94V-0, Black
Electrical	
Voltage Rating	300 Vac
Current Rating	20 Amp
Wire Range	12-24 AWG

Table 1.8.4-2 Actuator Terminal Blocks

Mechanical	
Termination Torque	12 lbf·in Max.
Operating Temperature	-40 °F to +250 °F (-40 °C to +125 °C)
Material	
Contact	Copper Alloy
Screw	Screw M3, Slotted
Insulator Body	Polyamide PA, UL 94V-2, Gray
Electrical	
Voltage Rating	300 Vac
Current Rating	20 Amp
Wire Range	10-28 AWG

1.8.5 Operational Summary

The CPU converts an incoming control signal into a target position. The current position is determined through the feedback assembly mounted on the actuator. The difference between the target and current position is the error. If the error exceeds the user set deadband then the CPU will initiate corrective action by starting the motor.

A reversible hydraulic pump is driven by the motor. The pump can pressurize either side of a double acting cylinder through one of two sides of the Flow Matching Valves, FMV-1 and FMV-2. Each FMV side is comprised of a ported spool with an integral pilot operated check valve.

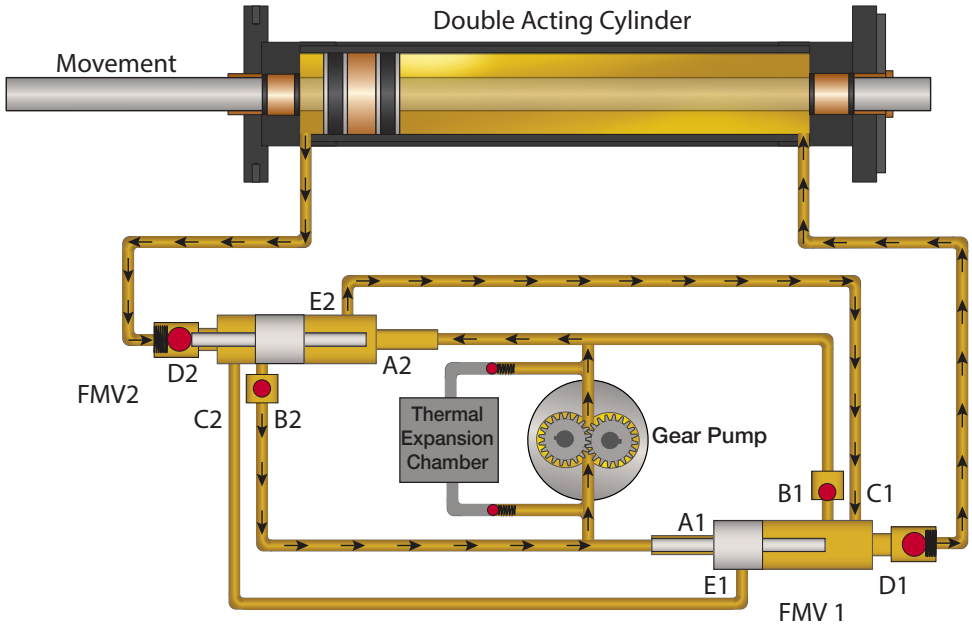

Figure 1.8.5-1 Hydraulic Schematic

In the example in Figure 1.8.5-1; to move the cylinder piston to the left, the pump turns in the direction to pressurize FMV-2 through port A2. The spool in FMV-2 becomes unbalanced by the pressure differential and moves to the left, lifting its check valve, opening port D2 to port B2 and port A2 to port E2.

High pressure fluid flows through Port E2 to the right side chamber of the cylinder. Since the hydraulic circuit is closed, the same amount of oil that flows into the right side of the piston must be extracted from the left side. This allows oil movement without an active reservoir. This oil flows through the open check valve of FMV-2 and into pump suction.

By rotating the pump in the opposite direction, the FMVs operate in reverse to move the cylinder piston to the right. When the pump stops, both check valves close, and the hydraulic oil is locked within the cylinder. Motor operation is not required to maintain position.

Each actuator has an internal hydraulic bypass circuit. This circuit creates a direct connection from one side of the hydraulic cylinder to the other. It is useful for relieving internal pressure in the actuator and allowing an external load to move the actuator. The nut labeled bypass on the actuator face as shown in Figure 1.8.5-2 controls this circuit. Turning this bypass in all the way puts the unit in its normal operation. Turning the bypass out 1 to 2 turns will open this bypass circuit.

Note: This bypass nut is only on units without internal solenoids.

Each pressure gauge on the actuator has its own on/off isolation valve (Figure 1.8.5-2). This valve should remain off unless pressure is being read from the gauge. This will protect the gauge from constant cycling, thus extending its life. When closing this valve you will create an internal pressure trap in the gauge; therefore, you should not expect to see 0 psi when off.

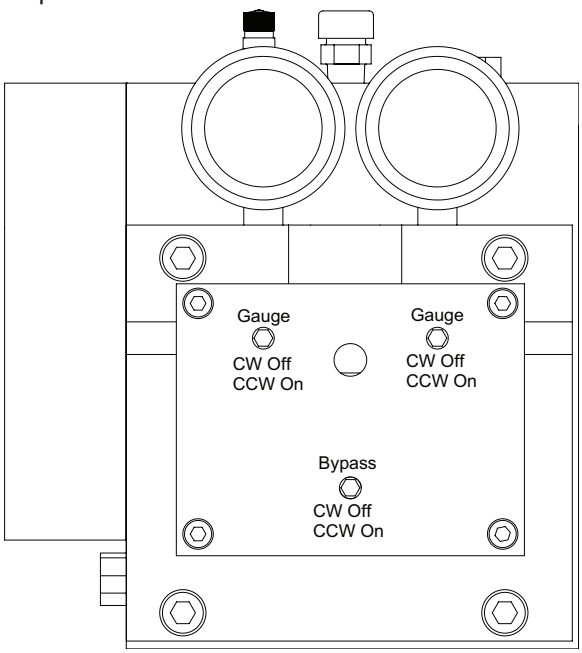

Figure 1.8.5-2 Bypass

2 Delivery

2.1 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.

2.2 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 ambient environment must be:

- 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 10 °F – 120 °F (–12 °C – 50 °C).

2.3 Unpacking

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.

2.3.1 Unpacking System, Lifting


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


If a piece of the system weighs between 80 lb and 129 lb (36 kg – 59 kg), a three-man lift must be used.


Above 129 lb (59 kg), a machine assist must be used (forklift or crane)

2.4 Installation Requirements

2.4.1 Operational and Maintenance Clearances

Volts to Ground	Condition 1
0–600	900 mm (3 ft)

Exposed live parts are on one side and no live or grounded parts are on the other side of the working space. Or, exposed live parts on both sides are effectively guarded by wood or other suitable insulating materials. Insulated wire or insulated busbars operating at not over 300 V to ground shall not be considered as live parts.

2.4.2 Hazards Due to Height


Use Safety Harness when working aloft above 1.8 m and consult Plant Safety Policy for safety consciousness and harness requirements.

3 Electrical Installation

Control Enclosure Overview

The electrical installtion block diagram (Figure 3) gives a general overview of the Control Enclosure and Actuator installation.

Note: Not all actuators will have all the options shown in Figure 3.

3.1 Control Enclosure Installation

The Control Enclosure must be mounted in a location conducive to its operation. Ideally, it should be mounted in a Control Room environment.

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

Note: Reaffirm with unit's tagging the Control Enclosure's intended location.

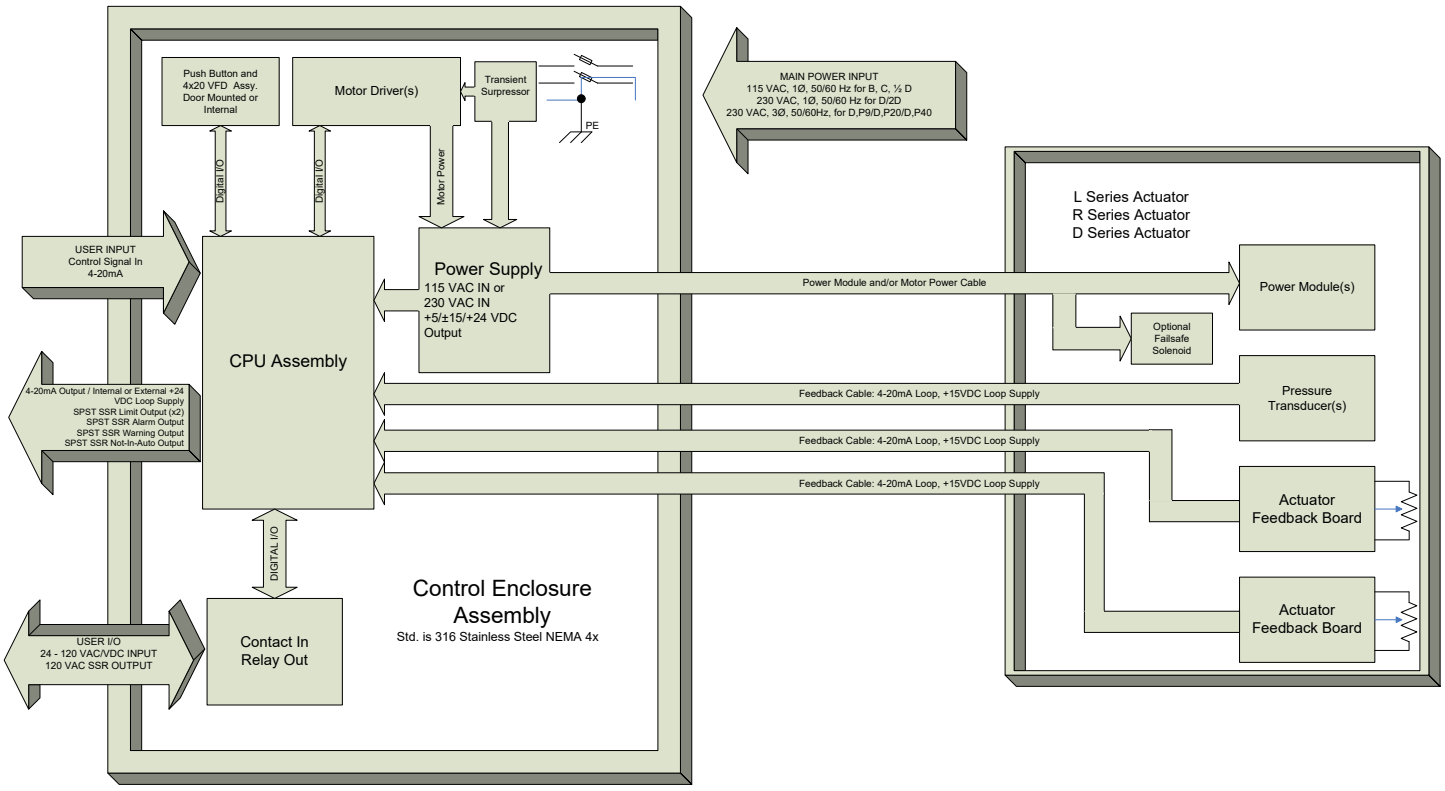

Figure 3.1 Electrical Installation Block Diagram

3.2 Main Power

The Main Power requirements for the Control Enclosure/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 control enclosure as shown in Figure 3.2. If no control enclosure is used, the nameplate will be attached to the backplane on which the Electronics is mounted.

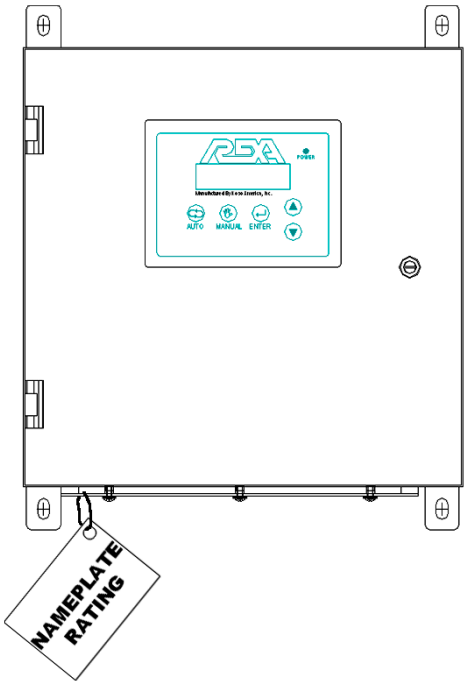

Figure 3.2 Control Enclosure

In general, the Main Power requirements are given in Table 3.2; however, the Nameplate rating takes precedence.

Table 3.2 Power Requirements

Power Module Size	Incoming Voltage	Maximum Current Required	Motor Power Requirement*
B	115 VAC ±10%, 50/60 Hz	4.0 amp	500 VA
C	115 VAC ±10%, 50/60 Hz	8.5 amp	1100 VA
½ D	115 VAC ±10%, 50/60 Hz	20.0 amp	2400 VA
B	230 VAC ±10%, 1Ø, 50/60 Hz	2.0 amp	500 VA
C	230 VAC ±10%, 1Ø, 50/60 Hz	3.0 amp	1100 VA
½ D	230 VAC ±10%, 1Ø, 50/60 Hz	10.0 amp	2400 VA
D	230 VAC ±10%, 1Ø, 50/60 Hz	10.0 amp	2400 VA
D,P9	230 VAC ±10%, 3Ø, 50/60 Hz	25.0 amp	9000 VA
D,P20	230 VAC ±10%, 3Ø, 50/60 Hz	30.0 amp	12000 VA
D,P40	230 VAC ±10%, 3Ø, 50/60 Hz	50.0 amp	21000 VA

** If another voltage is to be used, an External Step Up/Down Transformer of the proper size must be used.*

Note: Dual module configurations, i.e. 2C, 2 1/2D and 2D, power consumption requirements are twice their single module.

3.2.1 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 Control Enclosure/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 Control Enclosure.

d. Shall be marked as the disconnecting device for the equipment.

Refer to the Nameplate Rating of the Control Enclosure sub-assembly for proper sizing of the required disconnect device.

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 Lock Out Tag Out capability in the Off (Down) position.
- The Handle must be RED in color to indicate it is suitable as an E-Stop device.

3.2.2 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 should be provided at both Control and Actuator.

3.2.3 Grounding Symbols

PE Protective Earthing


Safety Earth Ground


Noise Free (EMI) Ground


Frame/Chassis Ground

3.2.4 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 Machine to determine Voltage and amperage requirements when determining the wiring size (mm2).

- The supply wiring must be approved for use in the country in which this equipment is installed or bear the <HAR> Mark.
- 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 wiring rules 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.

3.2.5 Cordage

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

- It must be approved for use in the country in which this equipment is installed or bear the <HAR> Mark.
- The maximum length of the cordage should not exceed the values established by the National Electric Code of the country in which it is installed.
- The outer jacketing of the cordage 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 Label, should be consulted when selecting the proper size (mm2) of the cordage.
- 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 cordage should be routed to the Control Cabinet 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 for details of interconnect cable requirements.

3.2.6 Fuse Identification / Replacement

Table 3.2.6-1 CSA/General Locations Fuse Replacement/Identification

System Description	Standard Fuse (A)	Alternate Configuration Fuse (A)	Fuse Type
B Module, 115 VAC	5	15	Type 'CC'; 600 VAC, IR 200kA, 10mm x 38mm
B Module, 230 VAC	5	15	
C Module, 115 VAC	10	20	
C Module, 230 VAC	10	20	
2B Module, 115 VAC	10	N/A	
2B Module, 230 VAC	10	N/A	
2C Module, 115 VAC	15	N/A	
2C Module, 230 VAC	15	N/A	
1/2D Module, 115 VAC	20	30	
1/2D Module, 230 VAC	10	20	
D Module, 230 VAC	10	20	
Dual 1/2D Module, 115 VAC	30	N/A	
Dual 1/2D Module, 230 VAC	20	N/A	
Dual D Module, 230 VAC	20	N/A	
D, P9, 230 VAC	25	N/A	
D, P20, 230 VAC	30	N/A	
D, P40, 230 VAC	50	N/A	Type 'J'; 600 VAC, IR 200kA, 27mm x 60mm

Table 3.2.6-2 ATEX/IEC Locations Fuse Replacement/Identification

System Description	Standard Fuse (A)	Alternate Configuration Fuse (A)	Fuse Type
B Module, 115 VAC	6	10	Type 'aM'; 500V, IR 120kA, 10mm x 38mm
B Module, 230 VAC	4	10	
C Module, 115 VAC	10	16	
C Module, 230 VAC	6	12	
2B Module, 115 VAC	10	N/A	
2B Module, 230 VAC	10	N/A	
2C Module, 115 VAC	16	N/A	
2C Module, 230 VAC	12	N/A	
1/2D Module, 115 VAC	20	32	Standard: Type 'aM'; 500V, IR 120kA, 10mm x 38mm Alternate: Type 'aM'; 400V, IR 120kA, 10mm x 38mm
1/2D Module, 230 VAC	10	20	Type 'aM'; 500V, IR 120kA, 10mm x 38mm
D Module, 230 VAC	10	20	
Dual 1/2D Module, 115 VAC	32	N/A	Type 'aM'; 400V, IR 120kA, 10mm x 38mm
Dual 1/2D Module, 230 VAC	20	N/A	Type 'aM'; 500 V, IR 120kA, 10mm x 38mm
Dual D Module, 230 VAC	20	N/A	
D, P9, 230 VAC	25	N/A	Type 'aM'; 400V, IR 120kA, 10mm x 38mm
D, P40, 230 VAC	50	N/A	Type 'aM'; 690V, IR 120kA, 22mm x 58mm

Table 3.2.6-3 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 × 20mm
	F2	Trip / Fail Solenoid	250	2.0	35	S500	5 × 20mm
	F3	Trip / Fail Solenoid	250	2.0	35	S500	5 × 20mm
	F4	Heater	250	2.0	35	S500	5 × 20mm
	F5	Position Transmitter	250	1/4	35	S506	5 × 20mm
	F8	Line	250	1/4	35	5ST	5 × 20mm
115 V Power Supply	F1	Trip / Fail Solenoid	250	2.0	35	S500	5 × 20mm
	F2	Heater	250	3.15	35	S500	5 × 20mm
	F3	Line	250	1/2	35	S506	5 × 20mm
	F4	Position Transmitter	250	1/2	35	S506	5 × 20mm

3.3 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 enclosure.
- A removable gland plate is provided on the bottom of the 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 Locktite 567™ or equivalent to prevent ingress of moisture.
- Be sure fittings are tightened securely.
- Must maintain IP66 for steel, IP67 for stainless and fiberglass electronics enclosures, as well as actuator assembly.
- For applications requiring hazardous and explosion proof systems, conduit and conduit fittings must be properly installed to NEC (National Electrical Code) wire 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 the National Electrical Code (NEC) and appropriate Local Codes for installation of Industrial equipment.

Refer to Appendix P for Interconnect Diagram.

Warning: The position transmitter used in the REXA CPU is extremely accurate and sensitive. Because of its high sensitivity, directly shorting this circuit with an ammeter can cause damage to the circuit. The load resistance of the DCS needs to be present to protect this circuit from a direct short. Without the load resistance (i.e., using an ammeter), premature failure of the Position Transmitter may occur. Refer to the Troubleshooting and Repair Manual for proper testing procedure.

4 Mechanical Installation

The Xpac can operate any device requiring force and stroke or torque and rotation. These include louvers, dampers, variable speed drives, and valves. These instructions apply to any device that may be controlled by the Xpac.

4.1 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 sub-assembly number and actuator serial number match.
- Verify that there is sufficient clearance for installation.
- Ensure that interconnect cables are present and are the proper length.
- Make certain that all the necessary equipment, tools and personnel are present for installation.
- Ensure all hydraulic tube fittings are tight.

4.2 R Series (Rotary)

Generally, R Series actuators are shipped with a four bolt mounting pattern and stem connection. REXA can also provide custom mounting components to adapt to the device being controlled. Contact your sales representative for more details.

4.2.1 Rotary Mounting (Fail in Place)

This operation requires the unit to be closed using the handwheel or manual hydraulic pump. Refer to Appendix M Manual Operators for handwheel or manual hydraulic pump information. If the unit is not supplied with either, it must connect to the electronics and manual operation used to drive it to the closed position. 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 position 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.

4.2.2 Rotary Mounting (Universal Spring Fail)

The universal rotary spring package is a bolt on addition to the REXA R Series Actuator. The unit may rotate in either a clockwise or counterclockwise direction upon power loss. To complete this feature, a normally open solenoid valve is installed in the power module and usually wired to the input power. Please refer to Product Memo 4, Spring Fail, for additional information.

If the unit has a REXA solenoid valve it will have the toggle lever shown below. Toggling this lever will override the function of the solenoid. If the unit has no power and you need to use the Handwheel, Drill Drive or Manual Hydraulic Pump the lever must be in the solenoid override position as shown in Figure 4.2.2.

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

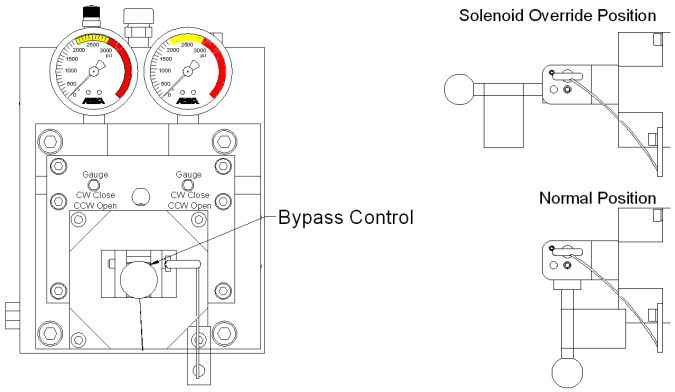

Figure 4.2.2 Solenoid Override Position

The spring package will be pre-loaded (compressed) to a specified torque as indicated on the order. The pre-loaded torque is set at an angle of 45° to the spring axis. Installation of the driven device within 5° of this position is acceptable.

Actuators are usually shipped in the fail position. Refer to Appendix M, Manual Operators, for information concerning the Handwheel or Manual Hydraulic Pump.

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 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 position 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.

4.2.3 Rotary Mounting Accumulator

Fail mode 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 mode.

The following operation requires the unit to be in the closed position; if it is not, use the handwheel or manual hydraulic pump. Refer to Appendix M, Manual Operators, for information concerning the Handwheel or Manual Hydraulic Pump. If the unit is not supplied with a handwheel or manual hydraulic pump, the unit must be connected to the electronics and manual operation used to drive it to the closed position. 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 position 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.

4.3 L Series (Linear)

REXA L Series Actuators utilize a sliding stem, piston-style cylinder. Mounting to the driven device is typically done with a bolted yoke assembly. Stem connections will vary by application. Refer to Appendix B for information on Stem Connection & Seat Loading Methods.

4.3.1 Linear Mounting (Fail in Place)

Actuators are usually shipped in the retracted position. Refer to Appendix M, Manual Operators, for information concerning the Handwheel or Manual Hydraulic Pump. Refer to Appendix B, Stem Connections 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, rotate the driven device to the retracted position.

b. Retract the actuator stem to a position that will allow mounting the actuator without contacting the valve stem. If the optional handwheel is not available, the unit must be connected to the electronics and manual operation used to drive it to the closed position. 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 stem until the coupling contacts the valve stem.

e. Thread the driven device stem into the coupling for a distance of at least one and one half times the stem diameter and use a lock nut against the coupling to prevent the stem from rotating out.

Note: There are wrench flats machined on the actuator stem for this purpose. No damage will occur if the actuator stem is rotated.

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.

Support the actuator in a manner that prevents stem bending. Securely tighten the mating connection. 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 shaft. If any movement of the actuator shaft can be seen during the process, loosen the mounting hardware, realign the actuator and repeat steps f, g and h.

4.3.2 Linear Mounting (Spring Fail)

The spring fail option for linear actuators consists of a spring mounted underneath the hydraulic cylinder and a normally open solenoid valve installed on top of the power module. The spring can be specified to extend or retract the stem upon power loss. It is not field reversible. The solenoid valve is usually wired to the input power.

If the unit has a REXA solenoid valve it will have the toggle lever shown in Figure 4.3.2. Toggling this lever will override the function of the solenoid. If the unit has no power and you need to use the hand wheel, drill drive or manual hydraulic pump the lever must be in the solenoid override position as shown in Figure 4.3.2. Note that the REXA solenoid valve option is only available for systems with B, C, 1/2D, and D power modules rated for hazardous but non-explosion proof environments.

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

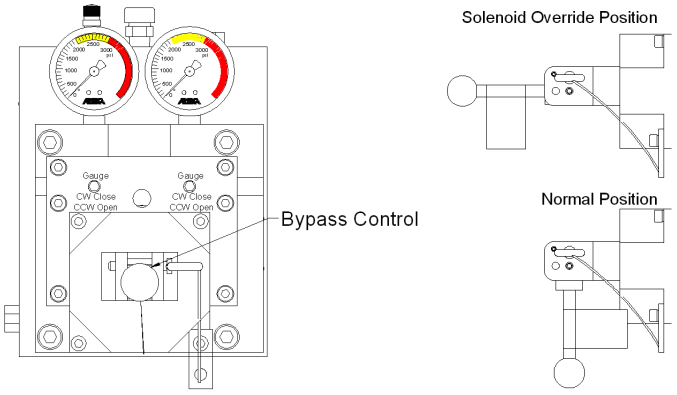

Figure 4.3.2 Solenoid Override Position

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

4.3.3 Linear Mounting Accumulator

Fail mode 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 mode.

Actuators are usually shipped in the retracted position. Refer to Appendix M, Manual Operators, for information concerning the Handwheel or Manual Hydraulic Pump. Refer to Appendix B, 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, rotate the driven device to the retracted position.

b. Retract the actuator stem to a position that will allow mounting the actuator without contacting the valve stem. If the optional handwheel is not available, the unit must be connected to the electronics and manual operation used to drive it to the closed position. 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 stem until the coupling contacts the valve stem.

e. Thread the driven device stem into the coupling for a distance of at least one and one half times the stem diameter and use a lock nut against the coupling to prevent the stem from rotating out.

Note: There are wrench flats machined on the actuator stem for this purpose. No damage will occur if the actuator stem is rotated.

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. Securely tighten the mating connection. 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, de couple the actuator shaft. If any movement of the actuator shaft can be seen during the process, loosen the mounting hardware, realign the actuator and repeat steps f, g and h.

4.4 D Series (Drive)

By the addition of a rugged L-shaped mounting base, a lateral load bushing and a lever arm, the R Series Actuator becomes an excellent drive. Applications requiring long strokes or non-axial loaded rotary motion are effectively solved by this unit. Traditionally, a drive-type actuator is used for "DAMPER" control.

4.4.1 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. Table 4.4.1 lists the base hole, minimum bolt diameter and recommended bolt torques. Standard bolting or threaded studs are acceptable, but material strength must be an SAE Grade 8. Hardened load washers and lock washers must be used. The Handwheel or Manual Hydraulic Pump is used to position the Drive Arm.

Table 4.4.1- Drive Base Bolting

Model	Hole Diameter	Min. Bolt Diameter	RECOMMENDED Bolt Torque	
			Minimum	Maximum
D2 500/5 000	.56"	½"	20 lb·ft	30 lb·ft
D10 000/20 000	.81"	¾"	200 lb·ft	250 lb·ft
D50 000/100 000	1.00"	1"	650 lb·ft	700 lb·ft

Note: Bolting to be SAE Grade 8.

4.4.2 Drive Arm

Connection to the driven device (linkage) is by means of the drive arm. Standard arms are based upon actuator size. Each arm includes multiple connection points. See Figure 4.4.2-1. Custom arms are available upon request.

The connecting link and other linkage should be selected to withstand the maximum load imposed by the drive. This will vary depending upon the effective length of the arm. The following equation should be used to determine the minimum safe working load of the connecting linkage:

For most installations, the optimum alignment of the drive arm and the driven (damper) arm is when they are parallel to each other and perpendicular to the connecting linkage at mid-rotation. Refer to Figure 4.4.2-2. This is accomplished by a combination of linkage length and drive arm adjustments. A slotted spline connection between the drive arm and shaft provides multiple mating angles (5°-10° intervals).

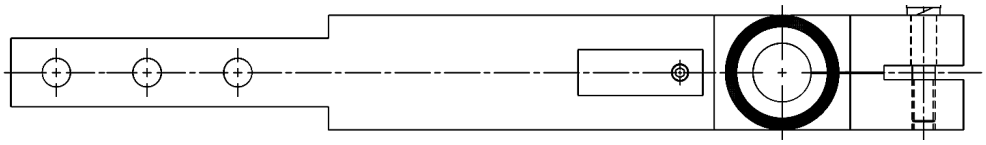

Figure 4.4.2-1 Drive Arm Assembly Reference Drawing

$$\text{Load} \frac{\text{Rated Drive Torque}}{\text{Effective Lever}} \text{ x 5}$$

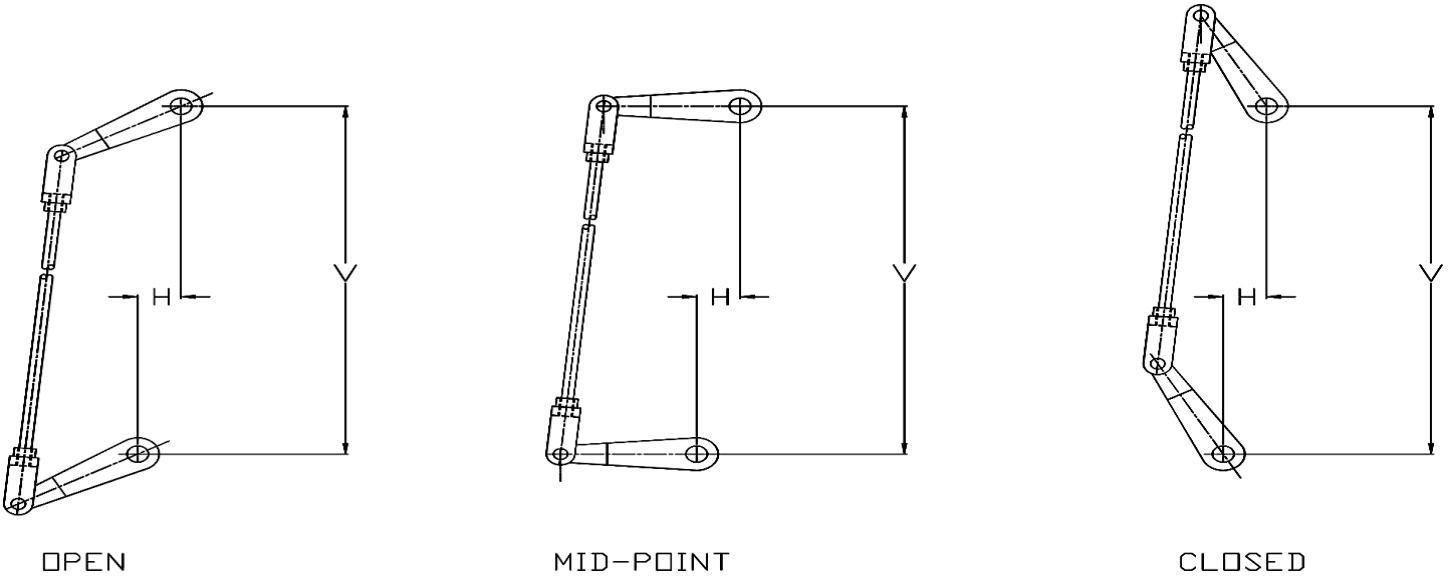

Figure 4.4.2-2 Drive Arm Alignment

5 Start-Up Considerations

5.1 Start-Up Checklist

At this time the actuator, electronics sub-assembly and driven device should be installed. Before applying power to the unit and calibrating the actuator the following items should be considered:

5.1.1 Inspection of Electronic Sub-Assembly Installation

Check the following:

- Inspect incoming voltage connection.
- Test for correct incoming voltage
- Control signal connections are secure.
- Outgoing signals are connected properly.
- Interconnection cable wiring is correct at electronic sub-assembly, actuator junction boxes and terminal blocks.
- Feedback cables are connected and shielded properly at actuator/electronics.
- All ground wires are secured.
- All electrical connections are tightened properly.
- Conduit connections are secure and watertight with thread sealant.
- Electronics are free of tools and debris.
- Proper personnel has been notified for lock out/ tag out procedures.

5.1.2 Inspection of Mechanical Actuator Installation

Check the following:

- Oil level is correct.
- Motor and feedback wires are connected properly and securely.
- Actuator mounting fasteners are tight.
- Coupling/split clamp installed properly.
- All conduit connections are secure and watertight with thread sealant.
- All tools and equipment are clear of operating area.
- Safety related covers and labels are installed and clearly marked.
- Proper personnel has been notified for lock-out/tag-out procedures.

5.2 Alignment

Any noticeable bending of the actuator stem or driven device should be immediately corrected. Not only will operation be impaired, but damage to the actuator seals and bushings or driven device may occur. When mounting the actuator to the driven device the actuator shafts and couplings must align properly.

5.2.1 Lateral Alignment

Any misalignment needs to be corrected or it will reduce the life of the actuator and cause damage to the driven device. In most cases, lateral alignment is corrected by stroking the actuator with the mounting or mating connection in a loosened condition. This will allow the connection to self-align. If there is insufficient clearance, then the appropriate bore diameters must be increased.

5.2.2 Longitudinal Alignment

LINEAR

Failure to reach full stroke is caused by a mechanical limitation within the actuator or driven device. Incorrect yoke leg lengths or thread engagement in the stem coupling may reduce the travel. In most cases, the required adjustment is small and can simply be made by changing the length of thread engagement of the stem coupling. Further adjustment can only be made by changing the length of the yoke legs.

If the actuator is installed in a vertical position, manually stroke it to allow the stem connection to self-align. 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 so that there is no noticeable indication of stem bending. Securely tighten the mating connection. Manually stroke the actuator and carefully observe the stem for any evidence of lateral (side to side) misalignment.

ROTARY (<90° Rotation)

Failure to reach the full 90° rotation is usually not binding, but rather an installation problem. With the actuator separated from the driven device, rotate the driven device to the closed position. Move the actuator in the same direction until the end of rotary piston travel is reached. The connections between the driven device and the actuator should be within 2-4 degrees. If a large discrepancy exists between the mating connections, the adapter may be incorrect.

DRIVE

Drive units can create an extraordinary amount of force. Any misalignment of the drive/driven arms, or incorrect linkage arrangements, can cause damage to the actuator or the driven device. All mechanical connections and stroke limits should be set carefully and inspected.

5.3 Initial Calibration

Refer to Section 5.4, Rotary and Drive Spring Stops, and Section 5.5, Cylinder End Stops, prior to calibrating rotary or drive units with spring or accumulator fail option.

- Apply AC Power.
  Line 2 will display the CALIBRATE menu header.
- If not already in CALIBRATE, simultaneously press **AUTO** and **MANUAL** for 5 seconds.
- Scroll down to Position Lo with the arrow.
- Press the **ENTER** (↵) key. = will begin to flash. Value will change to current actuator position.
- Move the actuator to the Position that corresponds to 4.0 mA.

  Refer to Appendix B, Stem Connection & Seat Loading Methods.
- Press the **ENTER** (↵) key to lock in that value.

⚠ **CAUTION: The end point should not be set against a mechanical stop without a spring 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 will need to be calibrated higher until this warning goes away.

- Scroll down to Position Hi with the arrow.
- Press the **ENTER** (↵) key to lock in that value.
- Press the **ENTER** (↵) key. = will begin to flash. Value will change to current actuator position.
- Move the actuator to the Position that corresponds to 20.0 mA.
- Press the **ENTER** (↵) key to lock in that value.

⚠ **CAUTION: The end point should not be set against a mechanical stop without a spring 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 will need to be calibrated lower until this warning goes away.

- Scroll down to Signal Lo with the ▼ arrow.
- Press the **ENTER** (↵) key. = will begin to flash.
- Apply the actual 4.0 mA Control Signal from the DCS. The value in the display will change; showing what is being read from the DCS.
- Press the **ENTER** (↵) key to lock in that value.
- Scroll down to Signal Hi with the arrow.
- Press the **ENTER** (↵) key. = will begin to flash.
- Apply the actual 20.0 mA Control Signal from the DCS. The value in the display will change; showing what is being read from the DCS.
- Press the **ENTER** (↵) key to lock in that value.
- Scroll down to TIME with the ▼ arrow.
- Press the **ENTER** (↵) key. = will begin to flash. Change current hours, minutes, and seconds using ▲ or ▼ arrow. Press the **ENTER** (↵) key to advance between hours, minutes, and seconds.
- Press the **ENTER** (↵) key to lock in each value.
- Scroll down to DATE Press the ▼ arrow.
- Press the **ENTER** (↵) key. = will begin to flash. Change current year, month, and day using ▲ or ▼ arrow. Press the **ENTER** (↵) key toadvance between year, month, and day.
- Press the **ENTER** (↵) key to lock in each value.

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

To enter the Auto mode:

- Simultaneously press Auto (↻↺) and **ENTER** (↵).
  Line 1 of the display will change to Auto followed by the Current Status.
  Line 2 will be blank.
- When the keys are released
  Line 2 will display the current Position.

5.4 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 for this purpose by turning the spring stop adjustment screw in or out to modify the actuator's final fail position.

To install a Spring Fail unit, position the spring lever to the 45° location by extending the spring stop as shown in Figure 5.4. Rotate the driven device to the required failure position. Adjust the spring stop to allow mating of the shafts and alignment of the mounting bolts.

Once mounted, the spring stops should be adjusted to a position that transfers torque onto the driven device at the fail position.

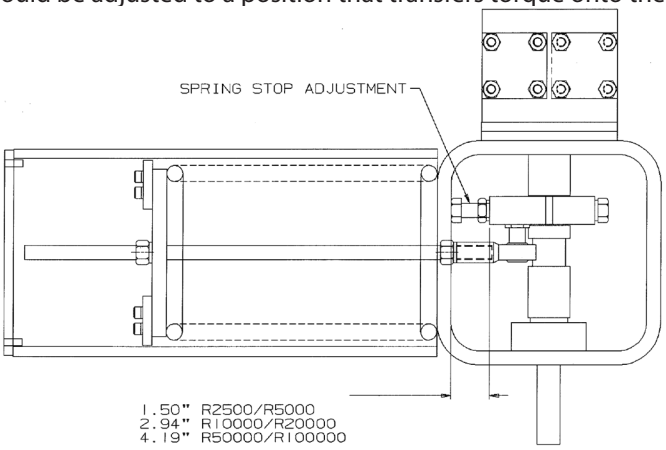

Figure 5.4 Universal Spring Alignment

5.5 Cylinder End Stops

Cylinder end 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, cylinder end stops can be utilized for this purpose. These stroke adjusters can reduce cylinder rotation 0–5 degrees.

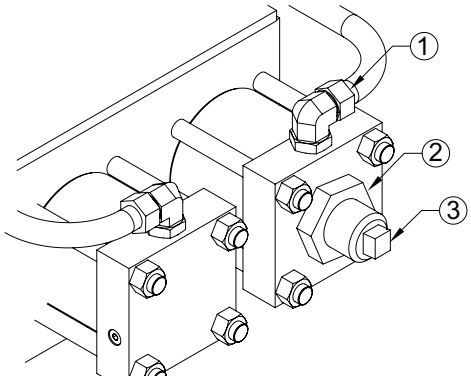

Figure 5.5 Stroke Adjustment

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

Note: Each actuator is tested and shipped from the factory with the thread seal and jam nut lightly torqued—enough to seal during factory acceptance testing. This procedure assures that the sealing rubber is undamaged and will properly seal once the stroke adjustor is fully adjusted in the field by the end user, and the threaded elements are firmly tightened to full torque.

5.5.1 End Stop Adjustment

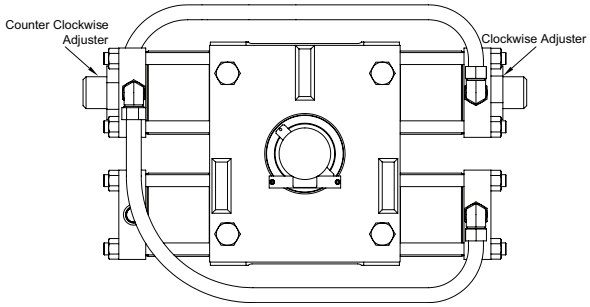

Figure 5.5.1-1 Cylinder End Stops

WARNING: The Calibrated end points PL and PH must not be set with the actuator against the cylinder end stop.

1. Position the actuator in the desired final fail position slightly beyond the calibrated end stop. This can be done when calibrating PL and PH.

   Note: Failure to follow this step will lead to a potential situation where the electronics may try to drive the actuator beyond its physical limit, and a stall condition will result.

2. Turn off the power breaker in the electronics.

3. Locate the correct stroke adjuster (refer to Figure 5.5.1-1).

4. Locate the hydraulic fitting (1) connected directly to the stroke adjuster cylinder cap as shown in Figure 5.5. Loosen this fitting to allow oil to escape during this adjustment process.

5. Loosen the jam nut (Figure 5.5.1-2) 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. This rod has a hollow hex in the end to allow easy adjustment.

WARNING: As the stroke adjusters are turned in, fluid will be displaced and need to leak out of the system. Failure to exhaust fluid will damage internal components of the actuator.

9. The actuator is shipped from the factory with this adjustment rod threaded fully out to the end of travel to give the full rotation of the actuator. The adjustment screw can only be rotated clockwise (inward) from this shipped position.

   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. Use an allen wrench drive inserted into the hollow hex adjustment screw end to adjust the stroke adjustor. Rotate clockwise to decrease the stroke of the actuator. Each stroke adjustor provides a minimum of 5 degrees of actuator rotation adjustment.

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 Table 5.5.1 shows this relationship.

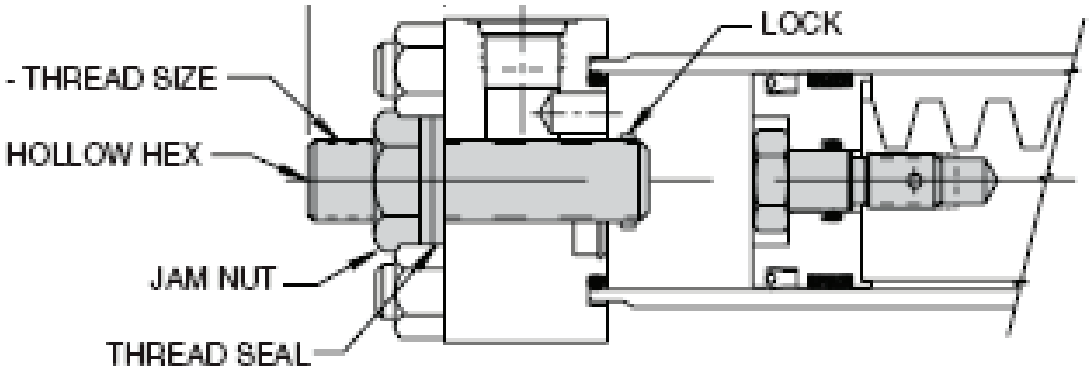

Figure 5.5.1-2 End Stop Detail

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 5.5.1.

14. Tighten the hydraulic fitting that was loosened in step 4.

Table 5.5.1 Stroke Adjustor

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 (lb·ft)	50	150	300	375

5.5.2 R200 000/R400 000 End 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 is located externally. Refer to Figure 5.5.2. 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 counter clockwise 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. Table 5.5.1 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.

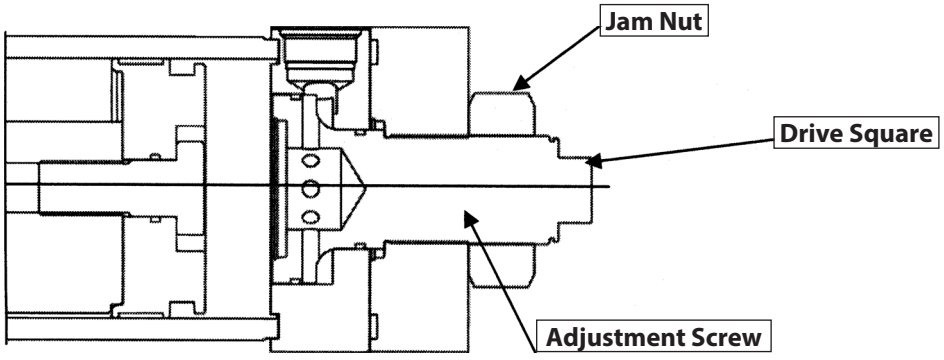

Figure 5.5.2 R200 000/R400 000 Stroke Adjuster

6 Modes of Operation & Control Parameters

The user interface is a four-line display with a five-button keypad. The display dims after five minutes without keypad usage. If an additional five minutes pass without keypad usage, the display turns off completely. Pressing any of the five keys will wake up the display.

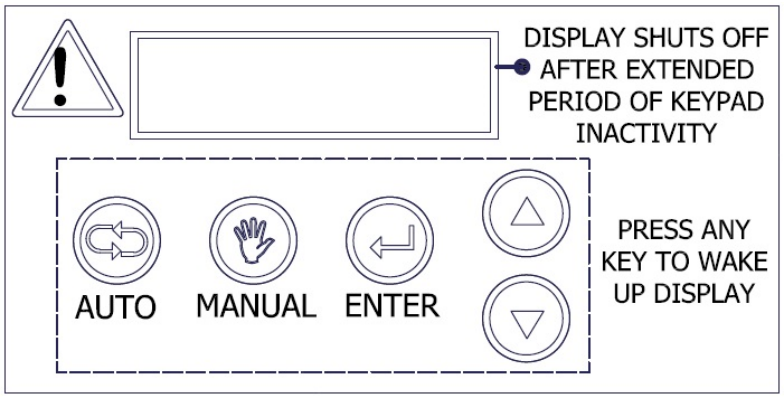

Figure 6.0.1 Display Label on Inside of Flip Cover

The REXA electronics has three different operating modes:

- SETUP – Calibration Mode
- AUTO – Remote Mode
- MANUAL – Local Mode

Enter each operating mode as shown below:

Figure 6.0.2 Modes of Operation

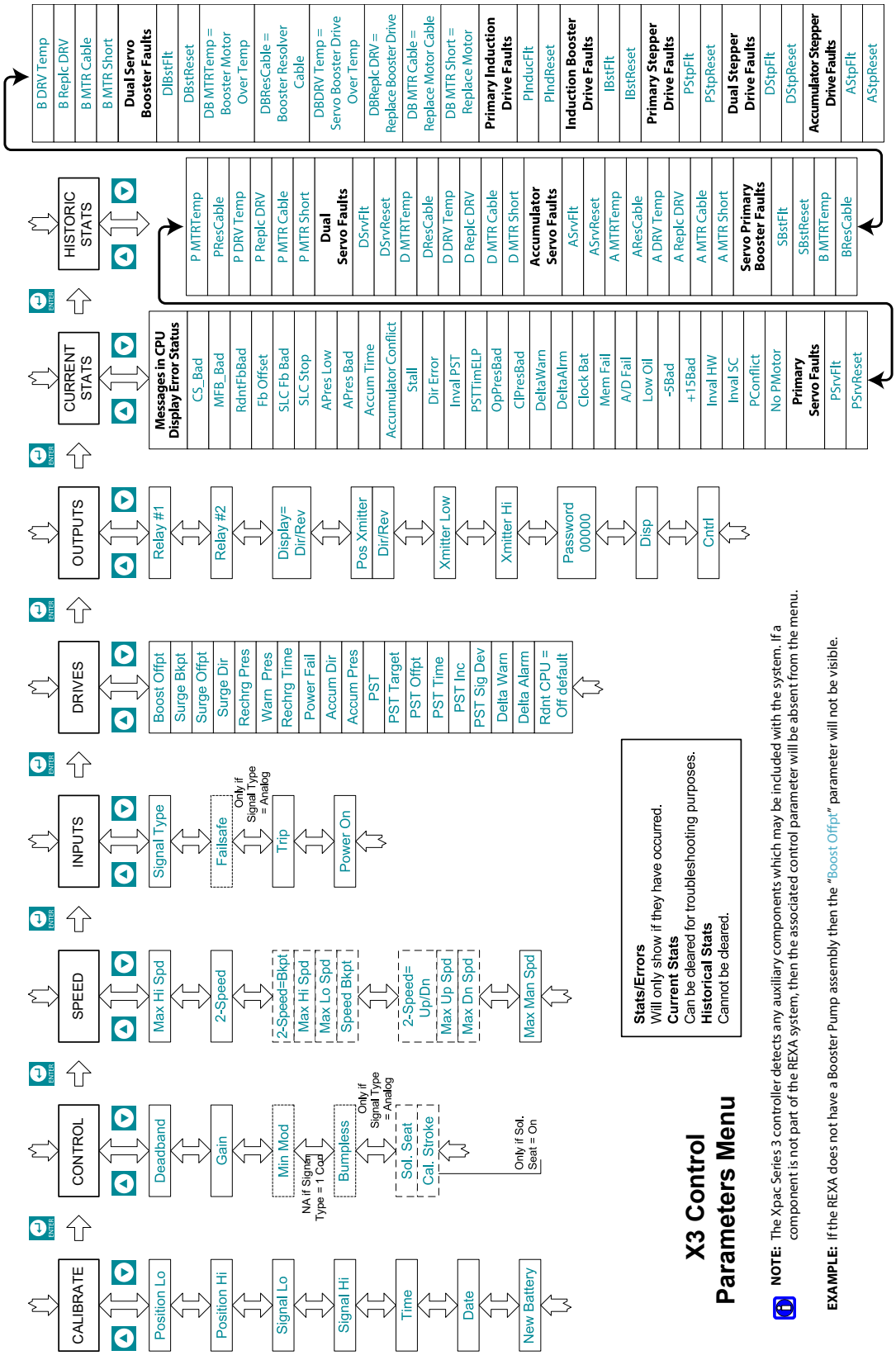

Figure 6.0.3 Control Parameters Menu

NOTE: The Xpac Series 3 controller detects any auxiliary components which may be included with the system. If a component is not part of the REXA system, then the associated control parameter will be absent from the menu.

EXAMPLE: If the REXA does not have a Booster Pump assembly then the "Boost Offpt" parameter will not be visible.

6.1 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 6.0.2 to access SETUP mode and change the parameters.

SETUP mode can be password protected. The default password value is 0000. 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.

6.1.1 Menu Navigation

To enter SETUP mode, simultaneously press and hold the AUTO and MANUAL keys for 5 seconds.

Note: While in SETUP mode the actuator will not follow a control signal.

The menu tree of the control parameters is shown in figure 6.1.1

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.

6.1.2 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.

6.1.3 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, the span from Signal Lo to Signal Hi must be greater than 3.8 mA. Refer to the Inputs menu for Failsafe information.

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.

6.1.4 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.

Range: 1 to 999

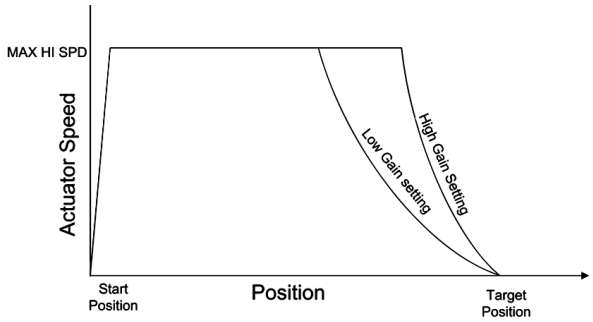

Figure 6.1.4 Gain

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.

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.

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

Bumpless (Bumpless Transfer) is a safeguard to prevent unwanted actuator movement when returning from MANUAL or SETUP mode into AUTO mode. 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 5% of the new control signal or change the control signal to be within 5% the new actuator position. The adjustment must be made within the set Deadband 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 or 1 Contact. 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 of accumulator to seat the valve.

Range: 0.3 in to 99.9 in

6.1.5 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.

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.

6.1.6 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 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.

Off: Used for zero based control signal, i.e, 0-20 mA

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

Note: Failsafe function only affects AUTO mode operation.

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 = Unpwrd, the trip input is to remove power

When Trip = Pwrd, the trip input is to present power

Power On parameter defines the mode the electronics will be in when 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.

6.1.7 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 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 trips this allows the REXA electronics 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 0.1% to 5%.

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 Warn Pres + 3000 psi.

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.

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.

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.

Accum Dir (Accumulator Direction) defines the direction the accumulator will move the actuator a power loss of trip event. This parameter is factory. Its only purpose is to inform the REXA electronics as to which direction to operate the motor during a recharge cycle after a trip. Accumulator fail-safe direction is not field reversible.

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 with an online-recharge accumulator or a spring fail-safe, the following parameters are in the menu:

PST defines an actuator use of partial stroke testing.

The parameter can be set to:

Off, CntPwr, CntUnp, Signal, Auto, ConPAu, CUnpAu

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 less "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 Max Target is added to the drive's menu if PST Inc is on. PST Max Target = 50.0 to 90.0% settable range, not greater than PST Target.

PST Signal Deviation is the 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 has to be turn 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 setting value. When it is active Warn Relay is active, the actuator will still modulate normally.

Units: # (psi)

Range: 500 to 2300 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 2400

Rdnt CPU defines if the REXA system is equipped with redundant CPU's. Redundant CPU configured, BACKUP CPU modulates with 5% DEADBAND, MAIN CPU controls all moves < 5% deviation. When Main CPU in Alarm, BACKUP CPU will take role of MAIN CPU and reduces Deadband to parameter setting in CONTROL Menu.

When redundant is selected in the menu a new parameter is available in the Calibration menu called "Linearize"

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

Calibration process:

1. Calibrate Position Low and Position High for both electronics
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 redundant electronics and enter the delta recorded into the linearize parameter.

The redundant 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.

6.1.8 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 direct acting with 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 the Red lead of the DMM to the LOOP OUT terminal. Connect the black lead of the DMM to LOOP INT RTN terminal. 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 actuators 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 the Red lead of the DMM to the LOOP OUT terminal. Connect the black lead of the DMM to LOOP INT RTN terminal. 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 actuators 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 in order 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_06.1.2018_AA

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

6.1.9 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 the following;

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

Press Enter – the equals sign begins blinking

Press Down – the value field resets to zero

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.

Note: See Appendix F. Errors and Error Displays for more information.

Messages in CPU Display Error Status:

CS bad:
MFB bad:
Rdnt_FB bad:
Fb Offset:
Slc Fb bad:
Slc stop:
APres_Low:
APres_Bad:
Accum_Time:
Accumulator Conflict: (A_Conflict)
Stall:
Dir error:
Inval PST:
PSTTimELP:
OpPresbad or ClPresbad:
Clock Bat:
Delta Alarm:
Delta Warn:

Power Supply Errors:

-5Bad:
AC High
AC Low
+15Bad:

System Configuration Errors:

No inp bd:
Inval HW:
Inval SC:
PConflict:
No PMotor:

Motor Errors:

PSrv_Flt:
PSrvReset:
P MTRTemp:
PResCable:
P DRV Temp:
P Replc DRV:
P MTR Cable:
P MTR Short:

Dual Servo Faults:

DSrvFlt:
DSrvReset:
D MTRTemp:
DResCable:
D DRV Temp:
D Replc DRV:
D MTR Cable:
D MTR Short:

Accumulator Servo Faults:

ASrv Fault:
ASrvReset:
AMTRTemp:
AResCable:
A DRV Temp:
A Replc DRV:
A MTR Cable:
A MTR Short:

Servo Primary Booster Faults:

SBstFlt:
SBstRest:
SBstMTRTemp:
SBstResCable:
SBstDRV Temp:
SBstReplc DRV:
SBstMTR Cable:
SBstMTR Short:

Dual Servo Booster Faults:

DSBstFlt:
DSBstReset:

Primary Induction Drive Faults:

PInducFlt:
PIndReset:

Induction Booster Drive Faults:

IBstFlt:
IBstReset:

Primary Stepper Drive Faults:

PStpFlt:
PStpReset:

Dual Stepper Drive Faults:

DStpFlt:
DStpReset:

Accumulator Stepper Drive Faults:

AStpFlt:
AStpReset:

6.2 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.

6.2.1 Display Fields in Auto Mode

Field 1 displays the Operating mode.

Field 2 displays the unit status.

Field 3 displays the parameter position or alternate.

Field 4 separates fields 3 and 5 with "space = space".

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.

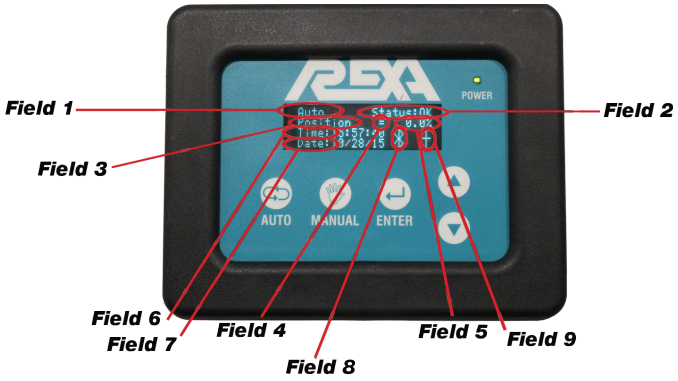

Figure 6.2.1

6.2.2 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.

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

6.2.3 Parameter Viewing

In Auto mode the Control Parameters may be viewed (but not altered) by using the Up or Dn keys. The Down key pressed displays "Live Control Signal".

The next 2 presses of the Down key displays 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 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 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 current signal is more than 0.5% above Signal Hi.

Unknwn when control signal is not applied.

A. Mechanical Limit Switches

The mechanical limit switches are independent devices installed on the yoke of the linear units and in the feedback housing area of rotary or drive units. Electrical connections are made directly to the switches independent of REXA electronics. Position will be indicated regardless of actuator power status.

A.1 Linear

A.1.1 General Specifications

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

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

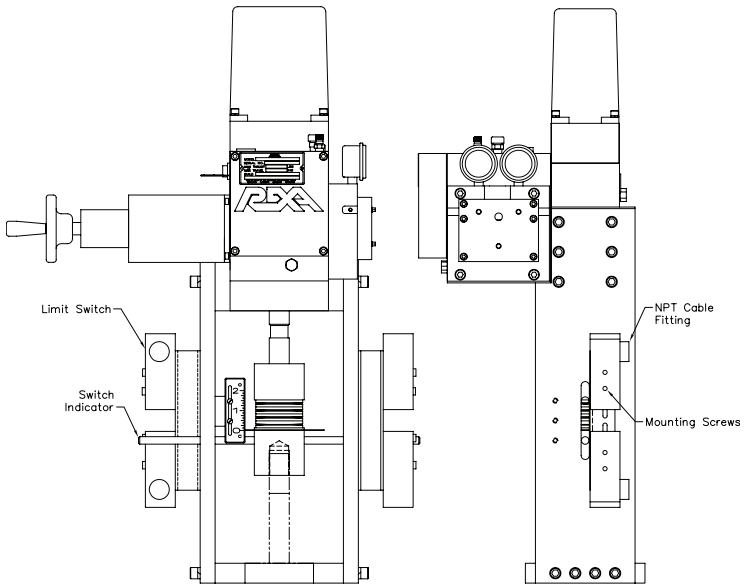

Figure A.1 Linear Limit Switches

A.1.2 Linear 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.

A.1.3 Linear Adjustment

Loosen the two mounting screws approximately 1½ to 2 turns and slide the entire switch to the required position. Securely retighten the screws.

A.2 Rotary

A.2.1 General Specifications

Quantity: 2 or 4

Type: Single Pole, Double Throw (SPDT)

Rating: 10 amp @ 24 Vdc, 0.5 amp @ 125 Vdc,

10 amp @ 110 Vac - resistive

Differential Travel (Hysteresis): 5½˝

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

GRP. A, B, C & D (optional).

Connection: Within the feedback housing (½˝ NPT) screw terminals

Optional DPDT Rotary Limit Switches

Quantity: 2

Type: Double Pole, Double Throw (DPDT), Positive Pressure

Rating: 0.3 amp @ 125 Vdc, 0.15 amp @ 250 Vdc,

10 amp @ 125 or 250 Vac

Differential Travel (Hysteresis): 5½˝

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

Connection: Directly to screw terminal on the switch.

Figure A.2 Rotary Limit Switch Schematic

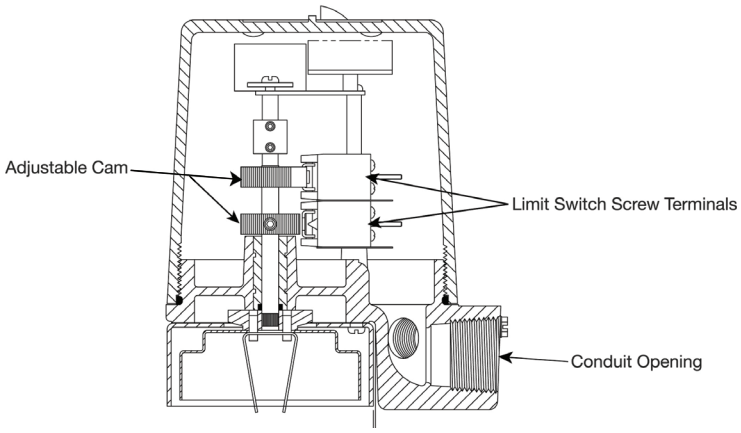

Figure A.2 Rotary Limit Switch Schematic

A.2.2 Rotary Wiring

Remove the cylinder feedback cover (over the cylinder pinion) by unscrewing. Refer to Figure A.2.3. Take care to keep threads clean and free from damage. Thread the cable through the ½˝ NPT fitting and make connections directly to the microswitches. Refer to Figure A.2. The cable should be grounded in accordance with Local and National Electrical Code.

A.2.3 Rotary Adjustment

For adjustment, the switch cam can be relocated by loosening the set screw and repositioning. Make sure that the O-ring gasket is in place and tightly seal the cavity. (See Figure A.2.3)

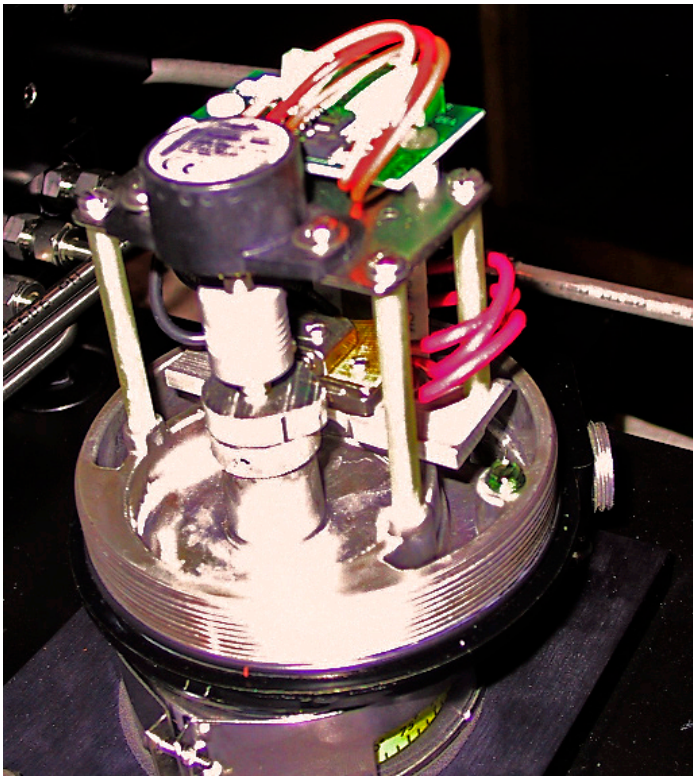

Figure A.2.3 Rotary Limit Switch

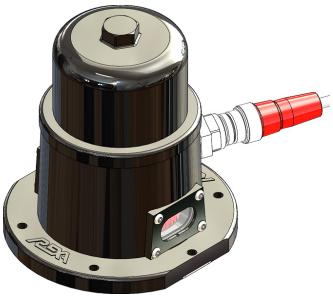

Figure A.3.1.1: REXA VPM

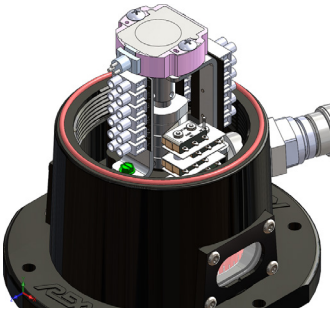

Figure A.3.1.2: Sensor, Terminal & Switches

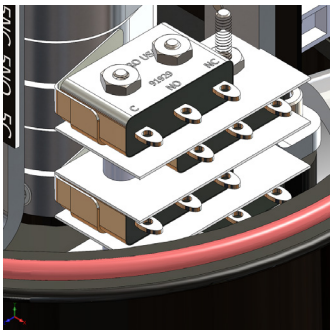

Figure A.3.1.3: Limit-Switches 11HM1

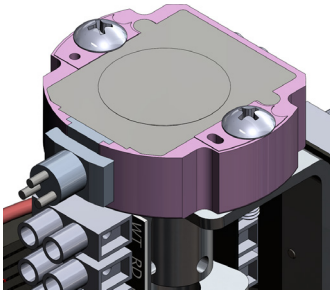

Figure A.3.2: Rotary Touchless sensor

A.3 Rotary Valve Position Monitor (VPM)

A.3.1 General Specifications

The Rotary Valve Position Monitor (VPM) or Feedback assembly consists of a 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 CPU.

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

Switches

Type: Hermetically Sealed, Single Pole, Double Throw (SPDT), Positive Pressure

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

A.3.2 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 option, take note of the CPU display when the actuator is in the fail position.

B. Stem Connection & Seat Loading Methods

B.1 Theory of Operation

Actuators which must come up against a hard stop require a spring loaded element between the actuator and driven device. This spring loaded element provides a controlled loading without over stressing mating parts. Its purpose is the same as torque limit switches found on gear motor actuators but without the inherent adjustment difficulties and potential for faulty calibration.

B.2 Elastic Coupling

For applications that extend or retract against a hard stop, linear Xpac 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 for fail-in-place units and 50% of the rated thrust for spring fail actuators.

The coupling provides a visual indication of compression (seat load) and should be compressed to its rated mark when the driven device is at the end of travel. At that point, the load on the driven device is approximately the net rated output of the actuator. Lower rated couplings are available for applications that require reduced seat load.

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.

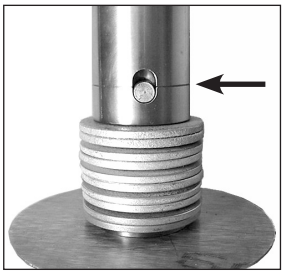

Figure B.2-1 Preloaded Coupling

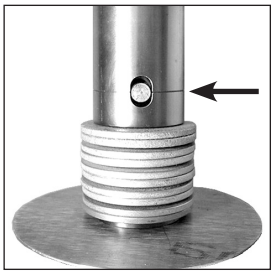

Figure B.2-2 Rated Load Coupling

Enclosed spring couplings (not shown) have a small telltale pin protruding from the top or bottom. As the coupling compresses, the pin is drawn into the coupling. When the pin is flush with the coupling, it is at its rated output.

Note: The output of each coupling may be verified through the pressure gauges.

Note: To translate pressure gauge readings into actuator output, use the following formula:

$$\left(\frac{\text{Pressure gauge reading}}{2\,000\ \text{psi}}\right) \times \text{actuator rated output} = \left[\text{actual output}\right]$$

For additional output calculation data, refer to Appendix O.

B.3 Seat Loading Cylinder

On larger size units 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 as shown Figure B.3.

The Seat Loading Cylinder utilizes a pre-compressed load equivalent to 80% (1 600 psi) of the nominal working pressure (2 000 psi). As the power modulepumps hydraulic fluid into the actuator cylinder, the output shaft will begin to extend. Once the force on the extension shaft reached the preset 80% of the actuator's rated output, the pressure in the top of the actuator cylinder will reach the limit that begins to compress the spring on the seat load cylinder. This will occur when the driven device reaches its end of stroke. 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 by the Flow Matching Valves.

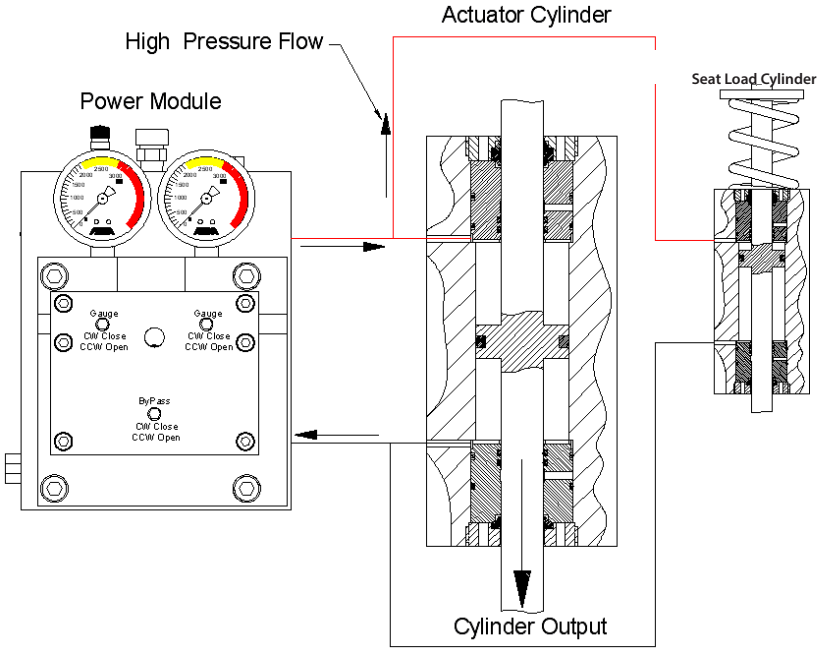

Figure B.3 Seat Loading Cylinder

B.3.1 Mechanical Installation

The Seat Loading Cylinder is mounted to the side of the main cylinder at the factory. All hydraulic piping and spring preload will be complete. Mechanical installation is not required.

B.3.2 Electrical Installation

Operation of the Seat Loading Cylinder requires the connection of a feedback cable between the SLC and the control enclosure. The standard cable consists of a red, white and black wire and a tinned copper ground wire. Each individual wire is 18 AWG. The feedback cable is not restricted by distance.

The feedback connection is made directly to the screw terminals on the feedback printed circuit board. Remove the four cap screws cover using care not to damage the internal components. Feed the cable through the ½ inch NPT opening. Wiring connection is made directly to the feedback printed circuit board per Figure B.3.2. Replace the cover on the cylinder and securely fasten. Refer to the Electrical Installation section.

Refer to certified electrical drawing for wiring details.

Table B.3.2 SLC Connections
SLC—½ inch NPT on cylinder (Screw Termination)

Signal Name	Wire Colors	Terminal
+15 Vdc	Red	15V
Feedback (+)	White	4-20
Feedback (-)	Black	GND

B.4 Solenoid Auto-Seating

For linear valve applications that require fail-safe in the same direction as the seated position, the elastic coupling and seat load cylinder are considered to be redundant and unnecessary. Using an elastic coupling on a spring fail or accumulator fail REXA is like using a spring in series with another spring. For these applications REXA handles the seat loading with software that automatically controls the solenoid operation as the actuator positions close to the seat. This control menu parameter is called Solenoid Seat (Sol. Seat). The software concept is similar in operation to the Min Mod functionality. Rather than use 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.

B.5 Calibration

Operation of the actuator is the same as a unit with an elastic coupling. The only difference is at the Seated Position. Instead of compressing a coupling, the spring on the SLC is compressed until the indicator on the SLC leg is at the seated point. See Figure B.5-1.

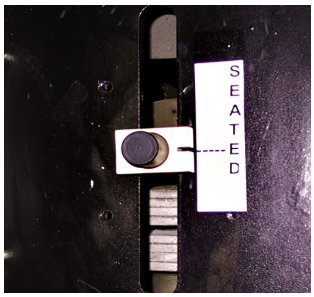

Figure B.5-1
SLC Indicator–Seated

Position Lo is set by moving the stem to the corresponding Signal Low Extend Position. Signal low position is the "SEAT" position. The seat load cylinder flag must line up with the "SEAT" indicator mark on the spring housing cover. The "SEAT" indicator mark is factory set for each application. The preset tension of the spring should not be changed without consulting the REXA factory.

With Position Lo on the display, press the (E)NTER key. = will begin to blink. Using the Scroll Up and Scroll Down keys, position the actuator to the desired point and press (E)NTER again. The displayed value will be recorded as the Position Low endpoint.

Position Hi is set by moving the stem to the corresponding Signal High, Retract Position.

B.5.1 Reverse Acting Calibration

Position Lo is set by moving the stem to the corresponding Signal Low Retract Position. Signal Low Position is the "SEAT" Position. The seat load cylinder flag must line up with the "SEAT" indicator mark on the spring housing cover. The "SEAT" indicator mark is factory set for each application. The preset tension of the spring should not be changed without consulting the REXA factory.

Position Hi is set by moving the stem to the corresponding Signal High Extend position.

With Position Hi on the display, press the (E)NTER key. = will begin to blink. Using the Scroll Up and Scroll Down keys, position the actuator to the desired Extend point and press (E)NTER again. The displayed value will be recorded as the Position Hi endpoint. When calibration is complete, and before returning to "AUTO" mode, depress the RESET button located on the top of the REXA CPU board. This will set the new seated value as the SLC target. See Figure B.5-2.

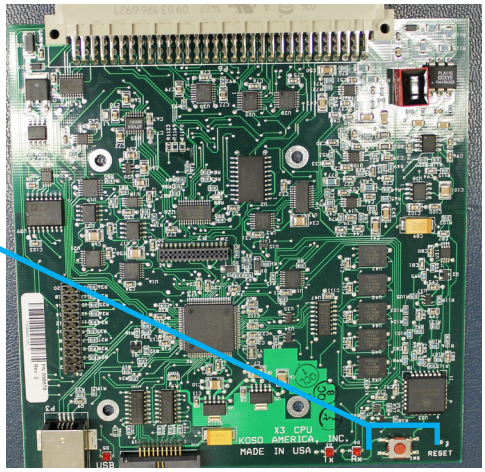

Figure B.5-2 Reset Switch

C1. Standard Accumulator Fail-Safe

C1.1 Theory of Operation

System operation is based on a piston type accumulator with nitrogen gas on one side of the piston and oil on the other.

The Standard Accumulator Fail-Safe is identified by a blue solenoid (see figure C1).

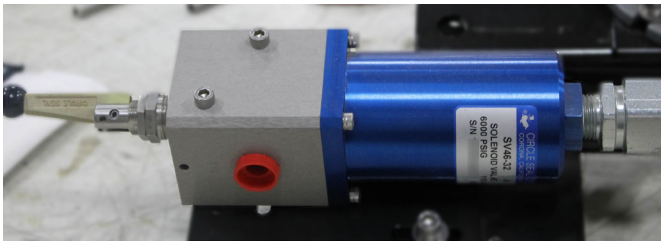

Figure C1.1 Standard Accumulator Fail-Safe

C1.1.1 Trip Function

Refer to Figure C.1.1-A (Standard Accumulator), Trip Condition, to follow the fluid flow path during a trip. The arrows indicate the flow direction. Under a trip condition or loss of electric power, two solenoid valves open simultaneously. One solenoid allows oil under pressure from the accumulator to be released and enter the failure side of the actuator driving it in the fail direction. The other solenoid allows the oil to be displaced from the opposite side of the cylinder into an collection bottle. To control the fail speed a needle valve is installed on the outlet of the second solenoid valve.

C1.1.2 Recharge Function

Reference Figure C.1.2-B to follow fluid path during recharge of Standard Accumulators. When the trip condition ends or power is restored, a pressure transducer signals that the CPU has low pressure in the accumulator. This signal tells the CPU to run the power module in the direction required to drive the actuator in the fail direction. Since the actuator cylinder is already at the end of its travel, the oil being pumped from the collection bottle by the power module will be allowed to flow into the accumulator. When the proper recharge pressure is reached, the CPU stops the power module and closes the solenoid valves. Normal operation is now resumed and the actuator will follow the control signal.

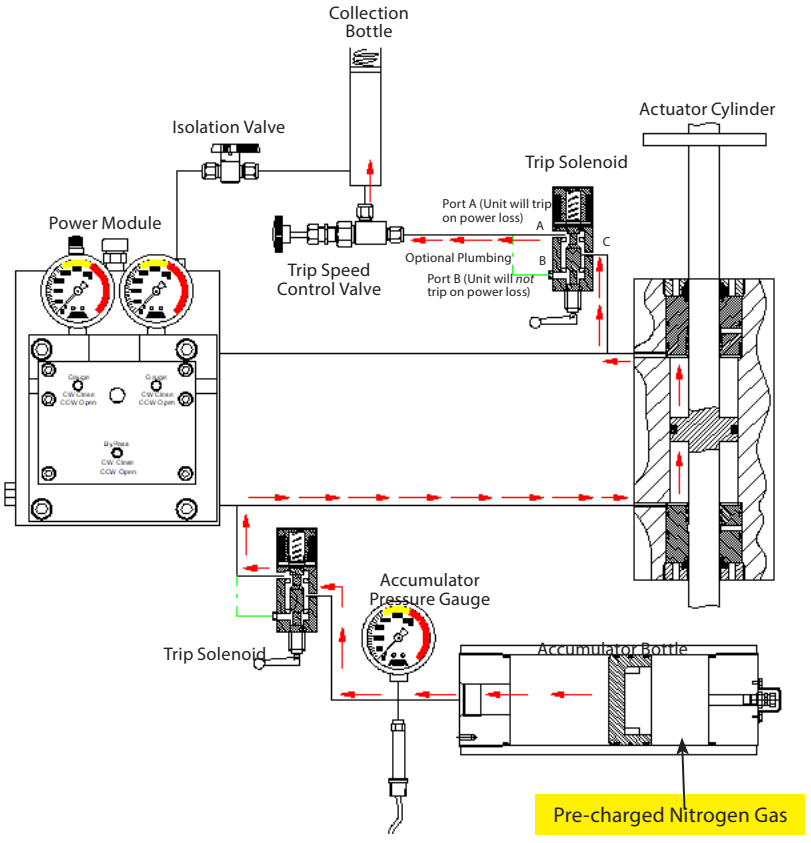

Figure C1.1.1 (Standard Accumulator) Trip Condition

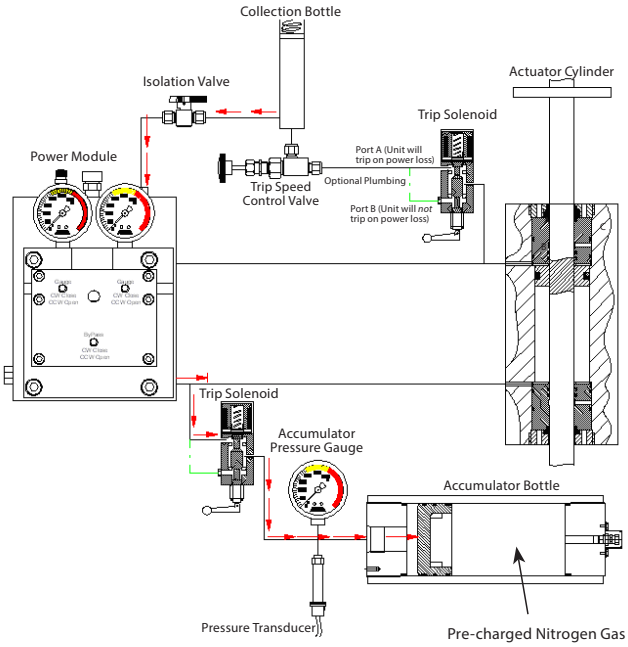

Figure C1.1.2 Recharge Condition

C1.2 Accumulator Control Parameters

Five parameters in the electronics are used to control accumulator functions. These may be found under the Drives menu and are: Rechrg Pres, Warn Pres, Rechrg Time, Accum Dr and Accum Pres.

Reference the DRIVES Menu in Modes of Operation & Control Parameters.

C1.3 Recharging

The recharge cycle will only occur if:

1. The CPU is in the Auto mode when power is restored after a loss of power or removal of trip signal,

   And

2. The pressure transducer output is less than Rechrg Pres

If the CPU is NOT in Auto mode when power is restored or trip signal is removed, the unit must be placed in Auto and the reset button MUST be pushed.

IMPORTANT: All actuators are shipped in the failed or tripped condition. The actuator may initially power up in Setup mode. With the trip signal inactive (or not connected), put the actuator in Auto then either press the reset button or cycle power off and back on. The actuator will go through a fail cycle, a re-charge cycle and then return to following the control signal. If this operation is not performed, the actuator will follow the control signal, but the accumulator will remain uncharged, rendering the actuator incapable of performing a trip or fail operation. However, a low pressure warning will indicate insufficient pressure to perform a fail operation.

C1.4 Manual Override

Accumulator actuators with solenoid valves are supplied with manual override levers. This feature enables a way to manually change states of the solenoid valves with electrical power off or in trip mode. Units are shipped from the factory with the solenoid override levers in position A (Figure C1.4-1).

They must be in this position for normal operation of the actuator. To use the handwheel during a power off or trip situation both solenoid override levers must be moved to position B.

Once both overrides are moved to position B, the handwheel may be operated in a normal manner (Refer to Appendix M, Manual Operators). After handwheel use, and prior to returning the actuator to normal service, (power restored or trip signal removed) both solenoid override levers must be returned to position A.

NOTE: When returning the levers to the normal open position the actuator will stroke in the trip direction.

It is recommended that both override levers be safety wired in position A when the handwheel is not in use.

For operation of Manual Override, refer to Appendix M, Manual Operators.

WARNING: After using the handwheel, the overrides must be returned to the A position or the unit will not operate correctly when power is restored or trip signal removed. If only one override is returned to the A position after a trip, damage to the power module may occur.

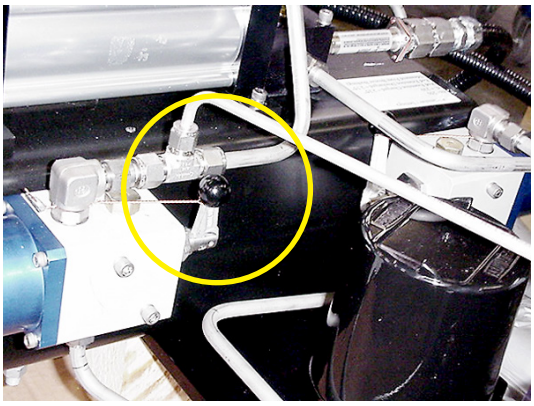

Figure C1.4-1 Solenoid Manual Override Levers (Position A)

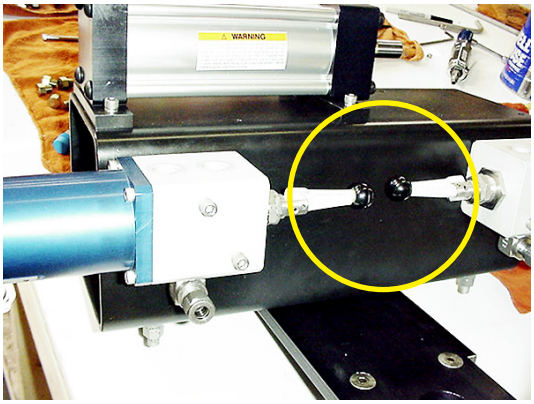

Figure C1.4-2 Solenoid Manual Override Levers (Position B)

C1.5 Discharging

There will be times that it is necessary to fully discharge the oil-side of the accumulator system; such as when maintenance is being performed. To perform this task, do the following:

1. Remove power to the actuator.
2. If the unit is fail-in-place during power loss, place both solenoid valves in position B as shown in Figure C1.4-2.
3. Open the manual bypass located on the front face of the module. Refer to Figure C1.5.
4. Check to ensure that all the pressure gauges read 0 psi.

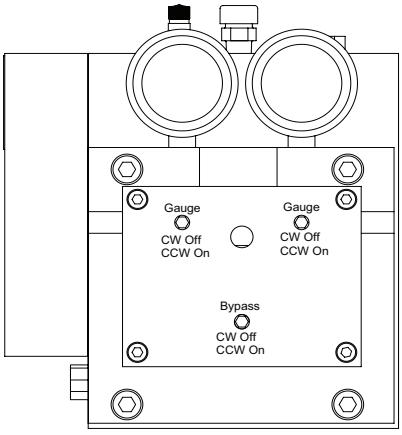

Figure C1.5-1 Bypass Drawing

C2. Online Recharge Accumulator Fail-Safe

C2.1 Theory of Operation

System operation is based on a piston type accumulator with nitrogen gas on one side of the piston and oil on the other. The Online Accumulator Fail-Safe is identified by a recharge module, that consists of either a stepper or servo motor, attached to a solenoid and manifold assembly (see figure C2).

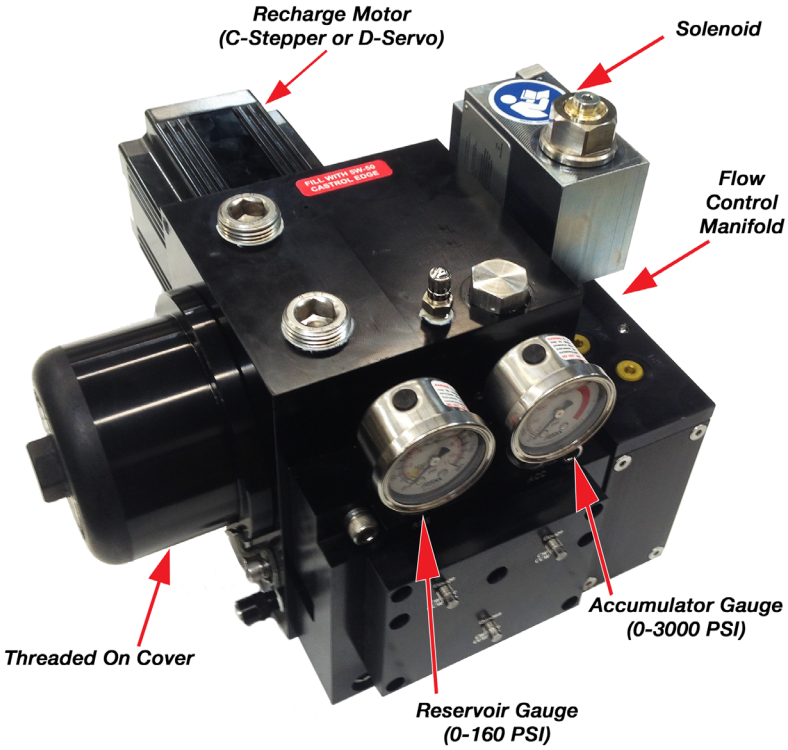

Figure C2.1 Online Accumulator Fail

C2.1.1 Trip Function

Refer to Figure C2.1.1-B (Online Recharge Accumulator), Trip Condition, to follow the fluid flow path during a trip. The arrows indicate the flow direction.Under a trip condition or loss of electric power, the solenoid valve opens (deenergizes), allowing the accumulator pressure to pilot open two PO check valves. Accumulator pressure then flows from the accumulator "ACC" to the high pressure port "HP" to move the actuator by displacing oil in the low pressure port "LP" through the Trip Speed Control Valve into an auxiliary expansion chamber. The Trip Speed Control Valve integral to the flow control manifold is used to control the fail speed.

If the system is tripped with a trip signal, the system will recharge the accumulator as soon as the actuator has reached its trip position; this allows the system to readily modulate after removal of the trip signal.

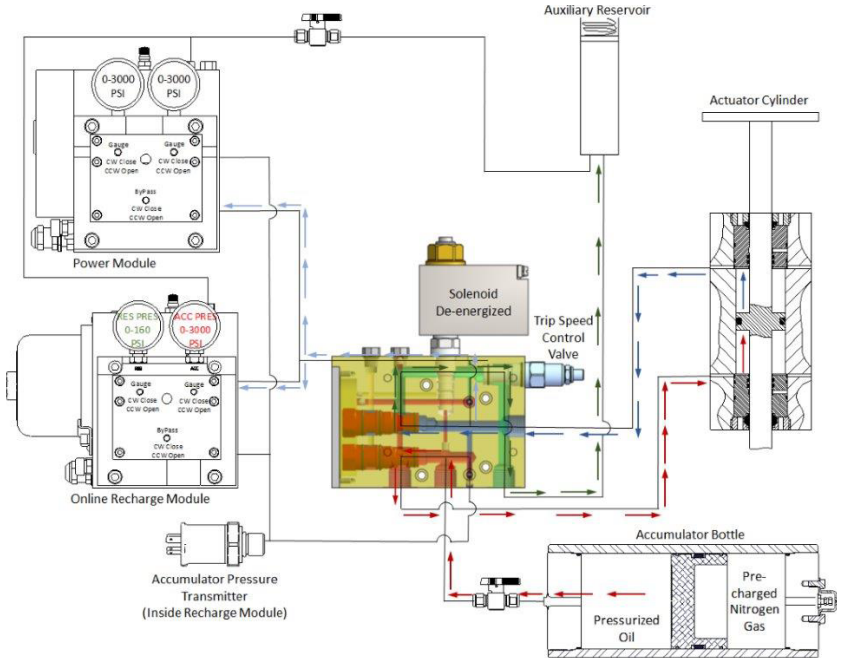

Figure C2.1.1 Trip Condition

C2.1.2 Recharge Function

Reference Figures C2.1.2-B, C2.1.2-C and C2.1.2-D for the Online Recharge Accumulators.

After a trip condition, the Online Recharge Accumulator drives the accumulator to the fail direction to charge the accumulator. The solenoid is always closed (energized) and both the power and the recharge modules participate in driving the motor towards the fail direction and in recharging the accumulator.

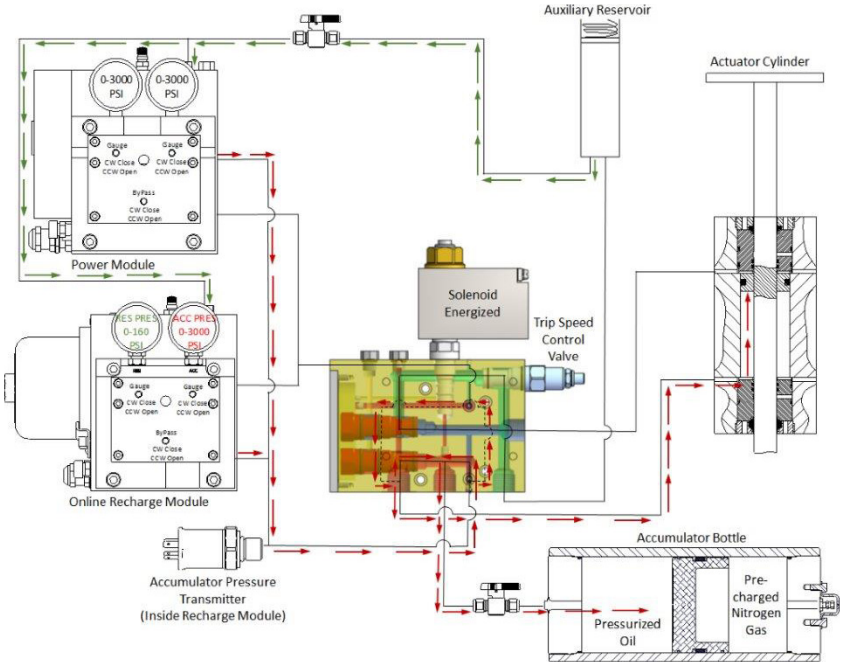

Figure C2.1.2-A Recharge After Trip Condition

During normal operation, if the accumulator pressure falls below Rechrg Pres -100 psi, the online recharge module pumps the oil from the reservoir to top off the accumulator pressure to the proper recharge pressure set by Rechrg Pres.

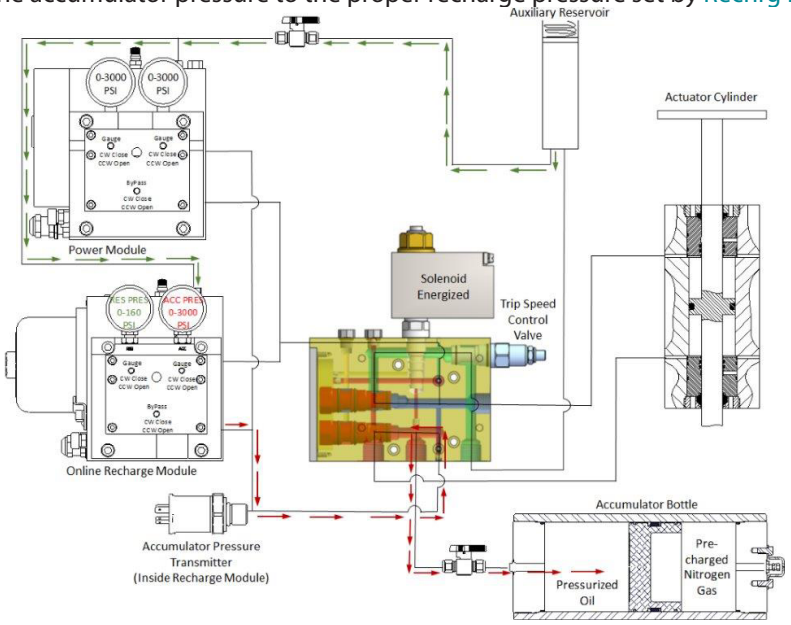

Figure C2.1.2-B Online Recharge to Top Off Accumulator Pressure

Recharging of the accumulator per Figure C2.1.2-C can occur simultaneously to modulating of the actuator per C2.1.2-D in either the PL or PH directions.

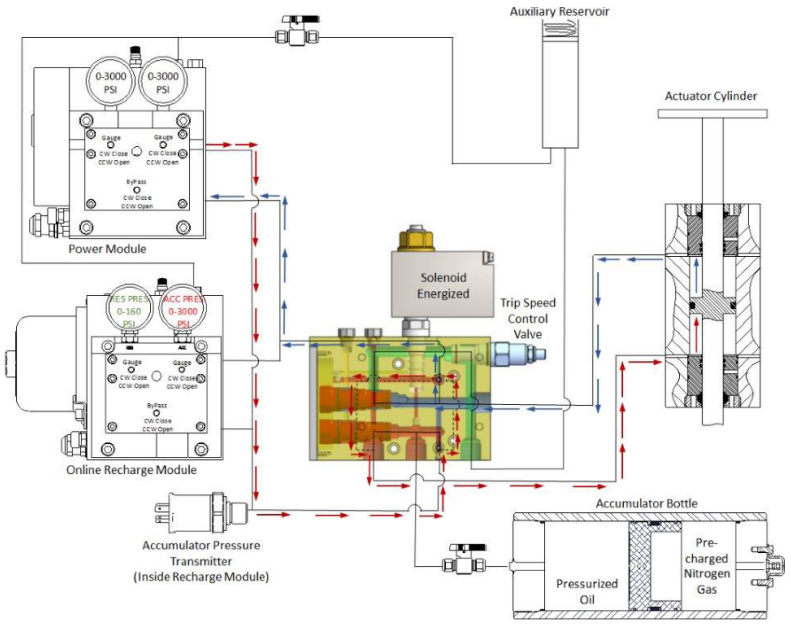

Figure C2.1.2-C Modulation to Follow the Control Signal

C2.2 Accumulator Control Parameters

Six parameters in the electronics are used to control accumulator functions. These may be found under the Drives Menu and are:

Rechrg Pres, Warn Pres, Rechrg Time, Power Fail, Accum Dr and Accum Pres.

C2.3 Recharging

There are two conditions where the recharge cycle will occur as follows:

Condition 1 - The CPU is in the Auto mode when power is restored after loss of power or removal of trip signal AND the pressure transducer output is less than the Rechrg Pres - 100 psi.

Note: Under this condition, both the Power and the Online Recharge Modules will participate in the recharge of the accumulator.

Condition 2 – When in Auto Mode and the accumulator pressure drops below Rechrg Pres - 100 psi, the Online Recharge Module will recharge the accumulator. Module will recharge the accumulator. In the Auto Mode, pressing the reset button will momentarily move the actuator to the Fail Direction and turn on both the Power and Recharge Modules to recharge the accumulator if the accumulator pressure is less than the Rechrg Pres - 100 psi.

C2.4 Manual Override

The online accumulator actuators can be manually operated (with a hand wheel or hand pump) by following the procedures below while referring to Figure C2.4-3 (Online Recharge Actuators):

1. Close shut-off valve (Item 1) to isolate the accumulator pressure.
2. Unlock the Trip Speed Control Valve (Item 2) by turning the 9/16 jam nut counter clockwise. With a 5/32 Allen wrench, turn the adjustment knob clockwise completely in to shut off the valve. Note the number of turns in.
3. Open the bypass on the Recharge Module (Item 3) for 10 seconds to equalize the pressures within the solenoid valve manifold. After 10 seconds, close the bypass.

The system is now ready for operation with either the hand wheel/drill drive or the manual pump (see figure...). After the manual override operations are complete, return the system to its normal operation by opening the shut-off valve (Item 1) and setting the Trip Speed Control Valve (Item 2) to its original open position.

WARNING! If there is NO power to the solenoid, opening the shut-off valve (Item 1) will connect the actuator to high pressure. Opening the Trip Speed Control Valve (Item 2) to its original position will move the actuator towards the Fail Direction. To ensure the system does not trip to the Fail Direction, ensure that there is power to the solenoid.

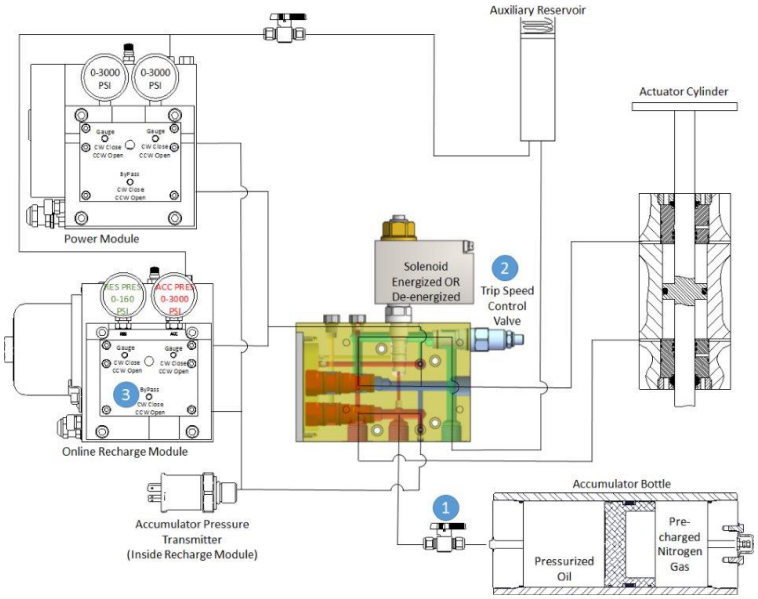

Figure C2.4 Manual Override Condition

C2.5 Discharging

There will be times when it is necessary to fully discharge the oil-side of the accumulator system; such as when performing maintenance. For the Online Recharge Accumulator, one of two steps can be done to discharge the accumulator pressure.

Note: Discharging using the manual bypass (item 3) on the online recharge module will not move the acuator.

1. Discharge when the Actuator Power is removed.

   a. Remove power to the actuator to fail the unit in the Trip Condition.

   b. Open the bypass (item 3) on the online recharge module. Refer to Figure C2.5-2. The accumulator pressure will discharge into the reservoir bottle. When the Accumulator gauge reads 0 psi, all accumulator pressure has been completely discharged.

2. Discharge when in the Calibration Mode.

   a. Ensure that the actuator is in the desired operating position.

   b. Place the CPU in Calibration Mode.

   c. Open the bypass (item 3) on the online recharge module. Refer to Figure C2.5-2. The accumulator pressure will discharge into the reservoir bottle. When the accumulator gauge reads 0 psi, all accumulator pressure has been completely discharged.

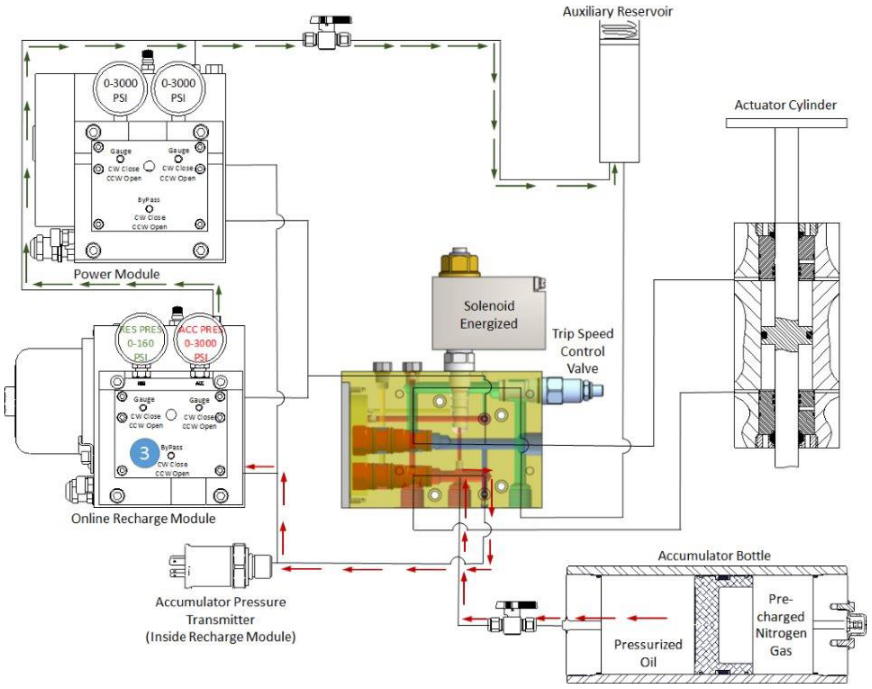

Figure C2.5 Manual Override Condition

D. Booster Pump Configuration

D.1 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 volume 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.

Two sizes of BOOSTER PUMPS are available: the P9 and the P40. The P9 is used in combination with the D size power module to provide 5 times the capacity of a D size power module or 2.5 GPM. A P40 with D size power module has the pumping capacity for 11 GPM.

D.2 Mechanical Installation

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

D.2.1 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.

[1]Ambient temperature only. Direct solar heat load must be avoided.

D.3 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 seal-tite 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.

Refer to Appendix P, Interconnect Diagrams.

Important!

- 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.
- 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. However, the resolver cables may be run with the feedback cable or other low power conductors.
- Failure to follow the above may inhibit the proper operation of the actuator.

D.4 Control Parameters

Refer to DRIVES menu, Modes of Operation & Control Parameters.

E.1 Bluetooth Graphical User Interface

E.1 Bluetooth Connection

Complete installation utilizing the installation wizard. Desktop Icon (Figure 1) will launch the GUI.

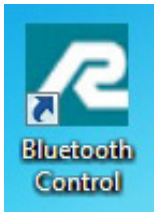

Figure 1.1 Desktop Icon

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.

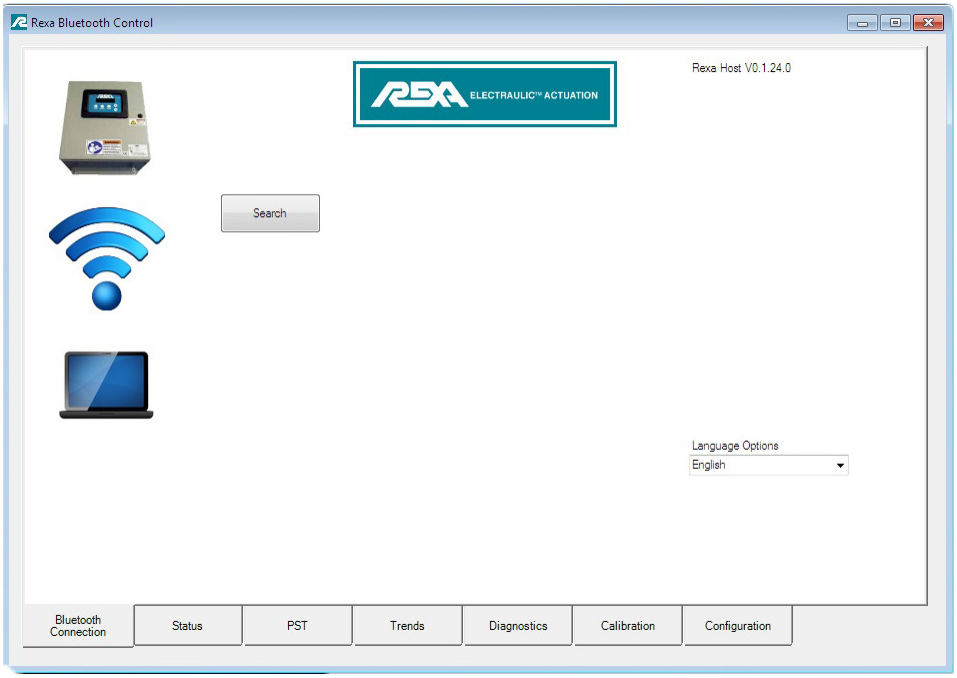

Figure 1.2 Initial Screen

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.

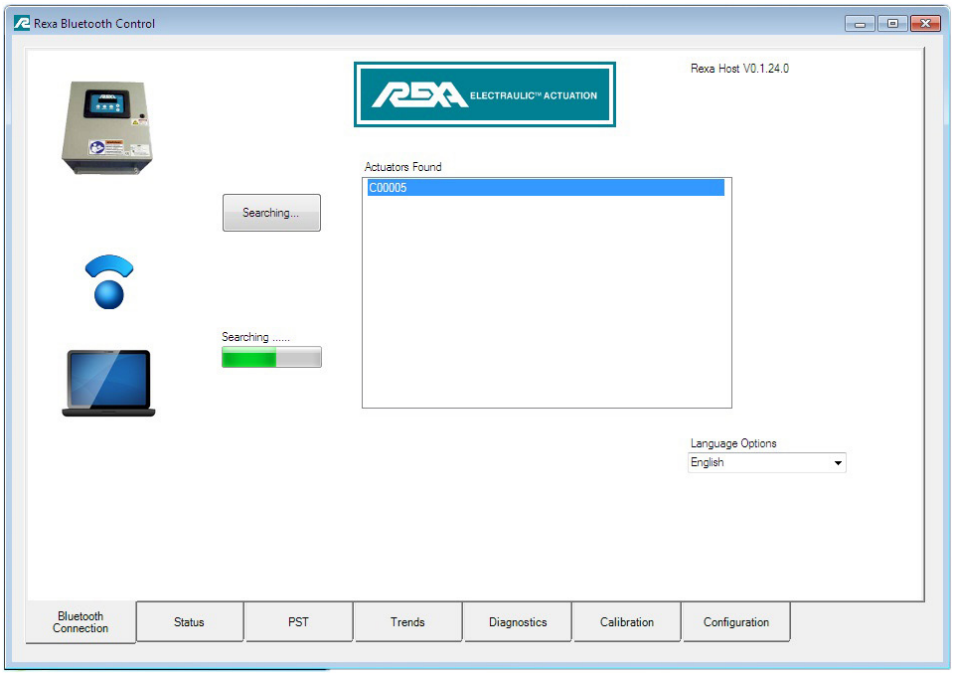

Figure 1.3 Bluetooth Connection

The connection process will begin and the program will prompt you to enter the password to connect. Enter password and click "Ok".

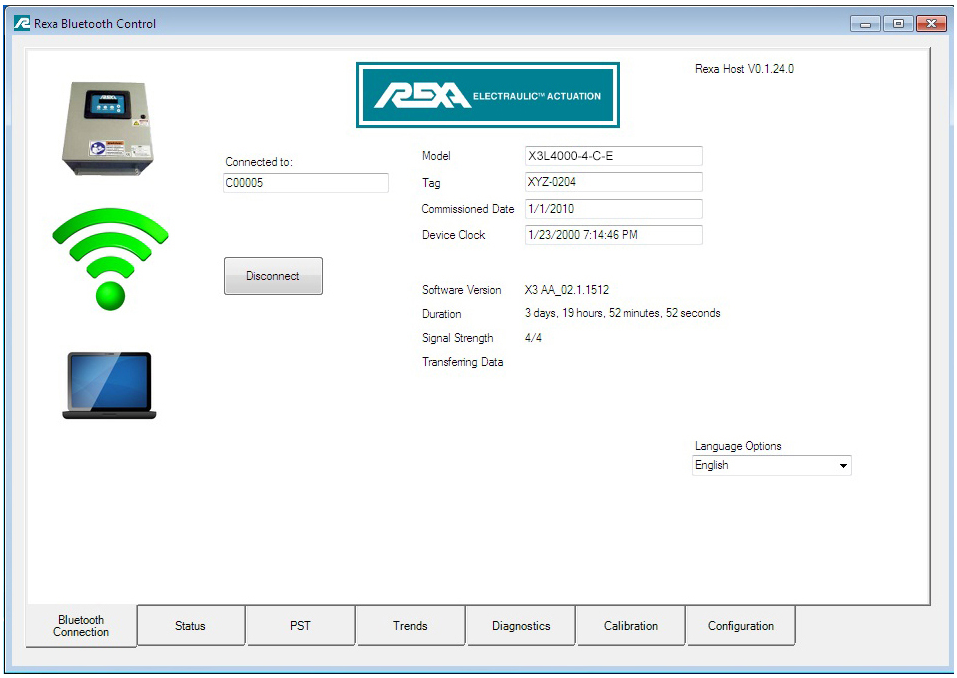

Figure 1.4 Search for Actuators

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.

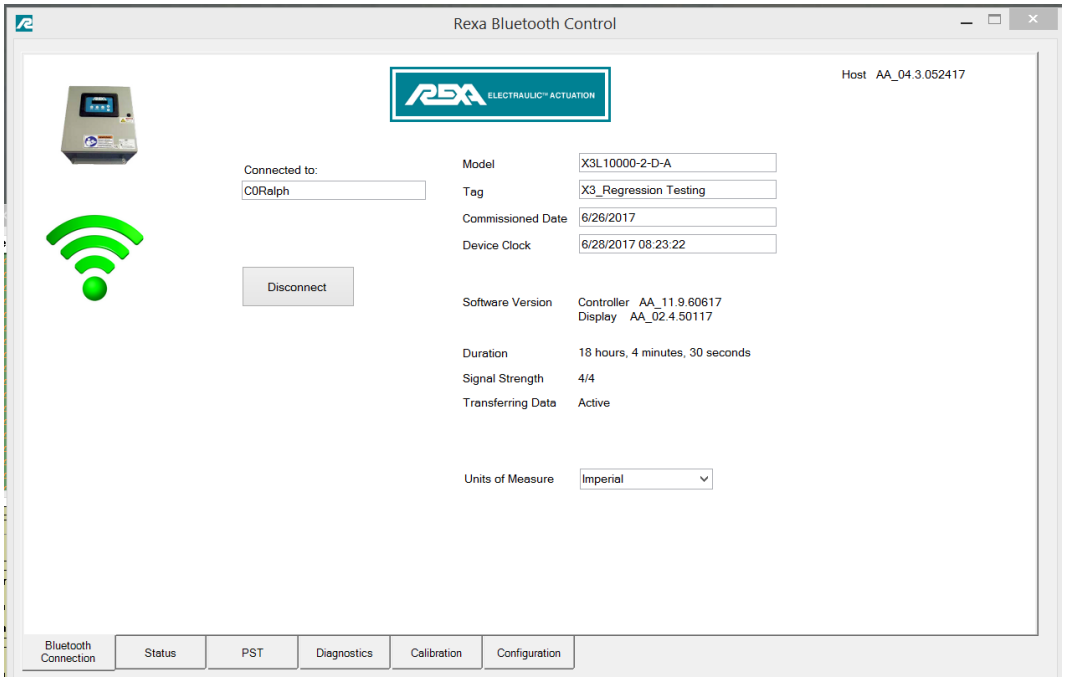

Figure 1.5 Enter Pairing Key

E.2 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.

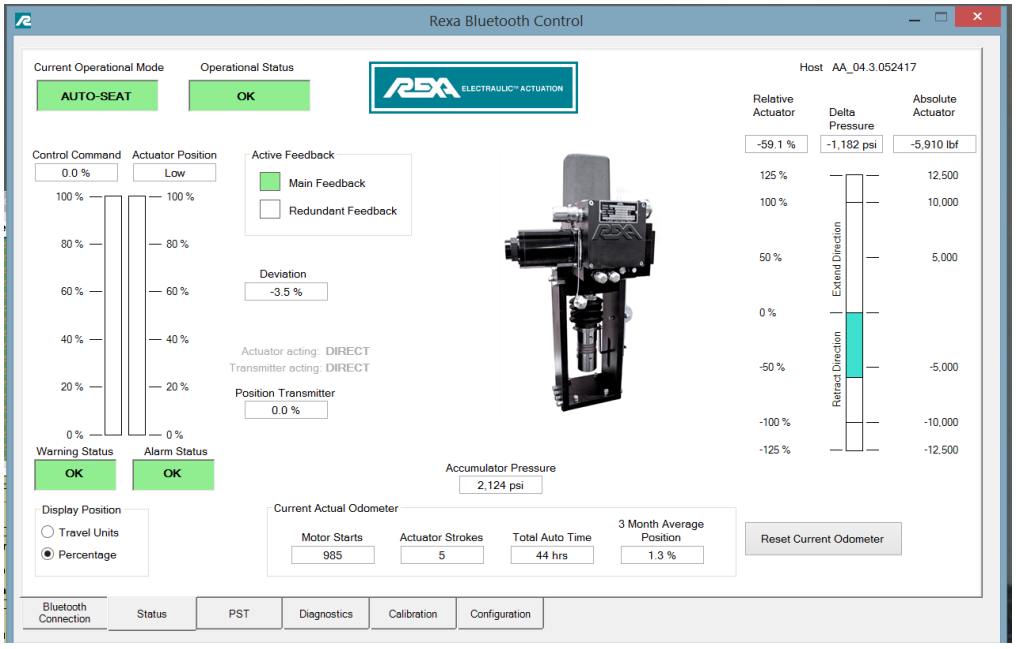

Figure 2 Status

E.3 PST

The "PST" screen indicates the status of the last PST event (pass/fail) and allows for the trigger of a manual PST event if desired. The PST function will only appear in the GUI if the actuator supplied is equipped with PST construction and programming.

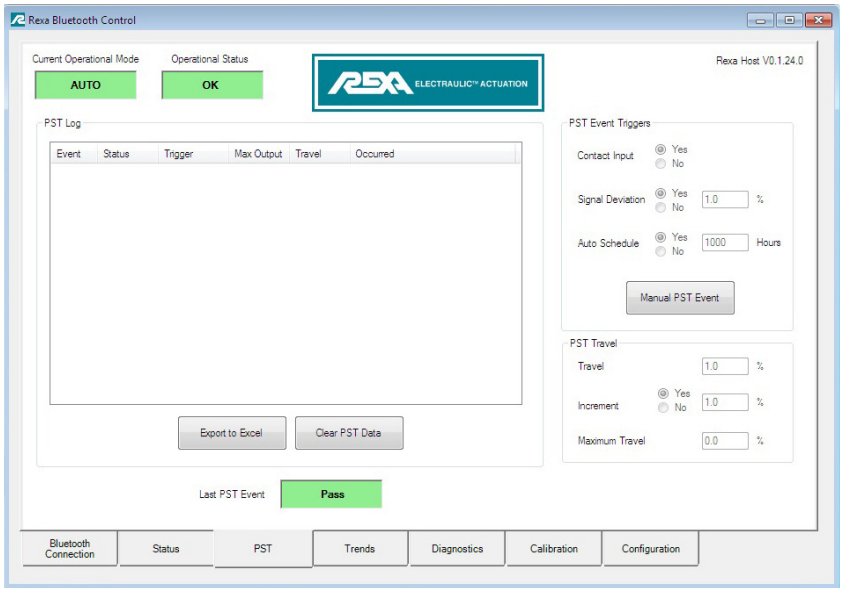

Figure 3 PST

E.4 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.

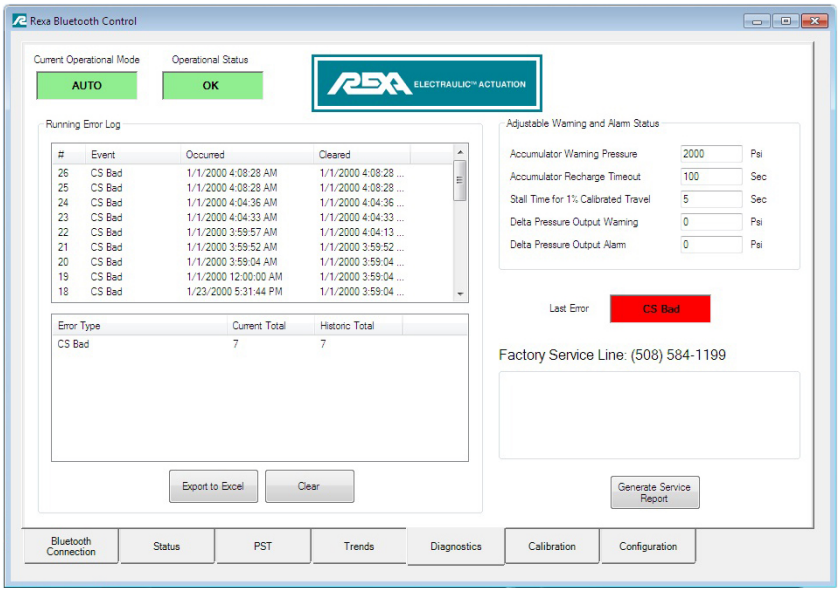

Figure 4 Diagnostics

E.5 Calibration

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

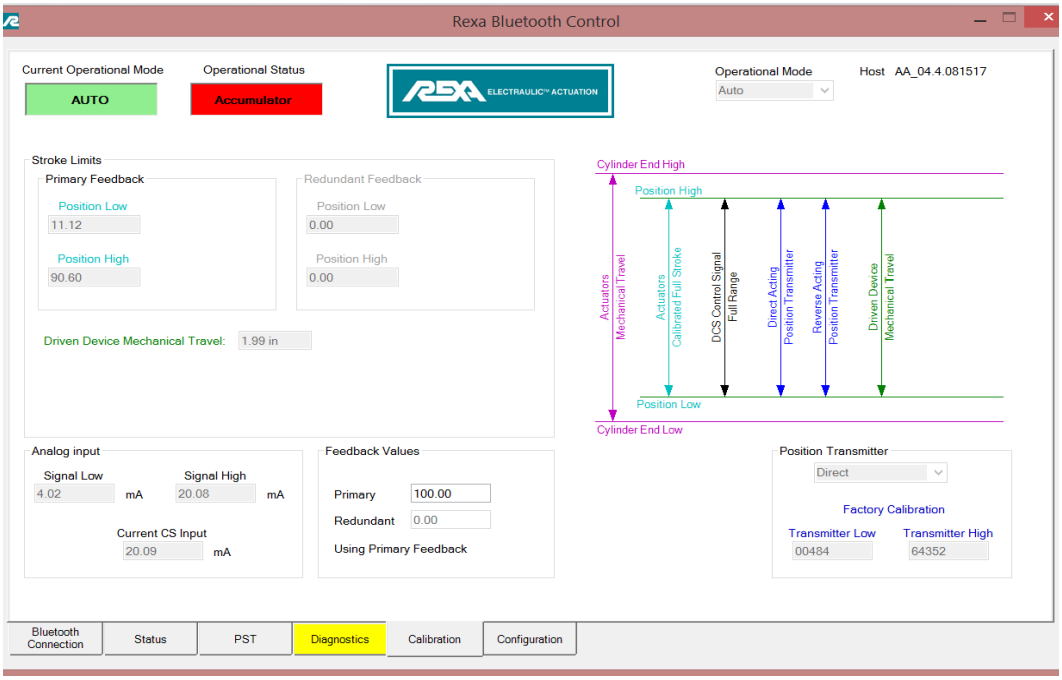

Figure 5 Calibration

E.6 Configuration

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

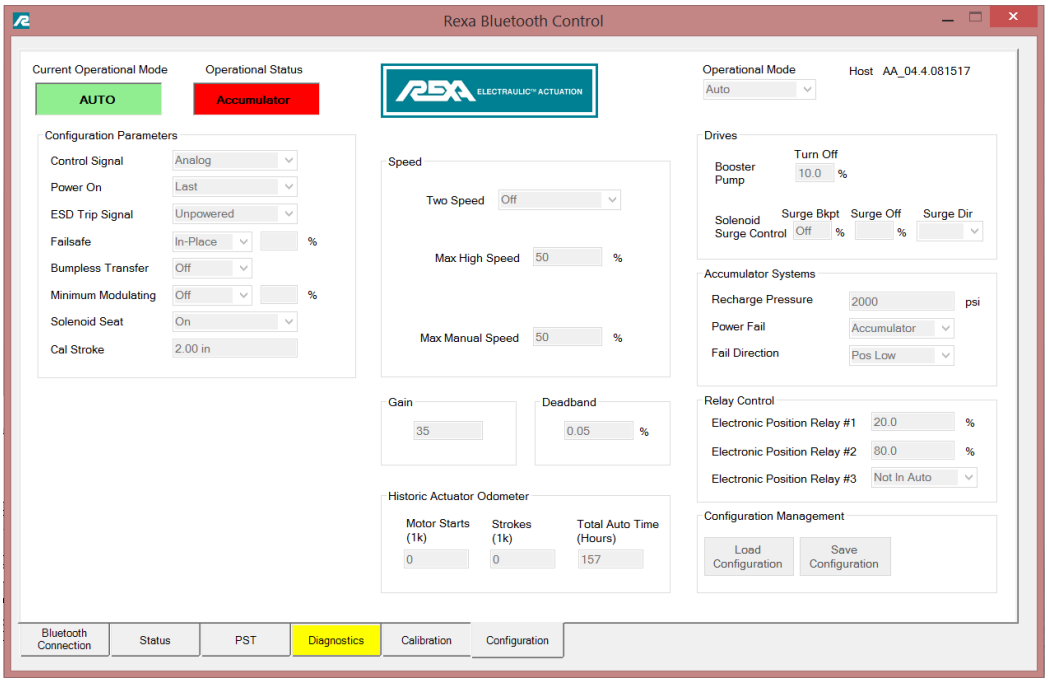

Figure 6 Configuration

F. Errors and Error Displays

The following are the error messages which appear on line 1 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 in a repeating fashion. By means identified in the "Cleared by" sections which follow. To fix some of these alarm code errors it may be necessary to refer to the Trouble Shooting and Repair manual.

Messages in CPU Display Error Status:

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.

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; (+) 15_fail is set, or A/D fail is set.

Indicators: Alarm and Warning opens. MFB_Bad is displayed. Actuator will not move.

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

Rdnt_FB bad:

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

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

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%.

Slc Fb bad:

Cause: The Feedback signal from the Seat Load Cylinder is less than 2 mA.

Indicators: Alarm and Warning relays open. Slc Fb bad is displayed. Actuator will not move.

Cleared by: Self clearing when Feedback > 2 mA.

Slc stop:

Cause: The actuator has detected a "Seated" position from the seat load cylinder feedback, but the main cylinder is ±1% from its "Seated" position.

Indicators: Warning relay opens. Slc stop is displayed.

The actuator continues with normal operation; however, the main cylinder may not seat properly.

Cleared by: Any control signal change which effects movement in the opposite direction in which the stop occurred will clear the error.

APres_Low:

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

Indicators: Warning relay opens. Pres low is displayed. Actuator continues to operate normally.

Cleared by: Successful Accumulator recharge cycle.

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. Actuator continues to operate normally.

Cleared by: Cleared successful Recharge cycle

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 install, and successful Sys_Config.

Stall:

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

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: Alarm and Warning relays open. Stall is displayed. Actuator will not move.

Cleared by: CPU Reset 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 CPU reset switch, or entering the Setup mode.

Inval PST:

Cause: A PST cycle was initiated when the Position was not at 100%.

Indicators: Inval_PST is displayed

Cleared by: Successful PST cycle

PSTTimELP:

Cause: A PST cycle was initiated but did not complete in time set in PST_Time.

Indicators: PSTTimeELP is displayed

Cleared by: Successful PST cycle

OpPresbad or ClPresbad:

Cause: The open or close pressure 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. Op or Cl Pres bad is displayed.

Actuator continues to operate normally in Auto mode.

Cleared by: Transducer signal being greater than 3 mA.

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

Clock Bat:

Cause: Battery voltage low, Indicates 10 year timer has expired

Indicators: Clock Bat displayed

Cleared by: Replace clock battery (located on power board) and reset battery timer in the calibrate menu.

Delta Alarm:

Cause: Indicates delta pressure exceeded alarm limit.

Indicators: Alarm and warning relays open. Pressure Output is displayed.

Cleared by: Actuator output returning to below alarm range.

Delta Warn:

Cause: Indicates delta pressure exceeded warning limit.

Indicators: Warning relay open. Pressure Output is displayed.

Cleared by: Actuator output returning to below warning range.

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

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 is displayed. Actuator will not move.

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

If condition not cleared, replace Power Board.

AC High

Cause: Main Power supply into the actuator rises above 131VAC on 115VAC rated unit or rises above 261VAC on 230VAC unit.

Indicator: Actuator will log events in the counters of the REXA GUI or over any digital protocol such as HART. Relay warning and alarm relay indicators will not indicate these events.

Cleared by: Once the AC power goes below 128VAC on 115VAC rated unit or goes below 256VAC on 230 VAC units.

AC Low

Cause: Main Power supply into the actuator drops below 101VAC on 115VAC rated unit or drops below 193VAC on 230VAC unit.

Indicator: Actuator will log events in the counters of the REXA GUI or over any digital protocol such as HART. Relay warning and alarm relay indicators will not indicate these events.

Cleared by: Once the AC power goes above 104VAC on 115VAC rated unit or goes above 197VAC on 230 VAC units.

+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 not cleared, replace Power Board.

System Configuration Errors:

No inp bd:

Cause: 1. Signal Type can not be set to 1 Cont, 2 Cont, a 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 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 (Invalid Hardware) is displayed

Cleared by: Correct hardware configuration install, 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 (Invalid Software Configuration) is displayed

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

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.

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.

Motor Errors:

PSrv_Flt:

Cause: Fault line from Primary Servo Motor indicating fault state Indicator:

Indicators: PServoFlt. 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 drive fault error until fault condition is corrected.

PSrvReset:

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

Indicators: PSrvReset is displayed. Warning relay opens.

Cleared by: End of Reset Signal generation by CPU

P MTRTemp:

Cause: The Primary Servo Motor is over temperature.

Indicators: PMTRTemp is displayed. Warning relay opens.

Cleared by: 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.

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 Driver has returned to normal temperature.

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

D MTRTemp:

Cause: The Dual Servo motor is over temperature.

Indicators: DMTRTemp is displayed. Warning relay opens.

Cleared by: 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.

D DRV Temp:

Cause: The Dual Servo Motor Driver is over temperature.

Indicators: D_DRV_Temp is displayed. Warning relay opens.

Cleared by: 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.

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:

ASrv Fault:

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

Indicator: Warning relay opens Display: AServoFlt.

Cleared by: CPU to issue driver reset immediately.

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: DMTRTemp 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 reduced stroke time.

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

SBstRest:

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

Indicators: SBsteset 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: 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.

SBstDRV Temp:

Cause: The Servo Booster Motor Driver is over temperature.

Indicators: SBstDRV_Temp is displayed. Warning relay opens.

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

SBstReplc DRV:

Cause: The Servo Booster Motor Driver has a shorted 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.

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.

DSBstReset:

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

Indicators: DBstReset 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 CPU

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: At least one motor drive has detected a problem.

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 PStpFlt error until fault condition is corrected.

PStpReset:

Cause: The primary stepper motor drive has detected a problem.

Indicators: PStpReset 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:

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. The actuator may or may not continue normal operation depending on actuator construction.

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

AStpReset:

End of Reset Signal generation by CPU

G. Surge Control Option

G.1 Theory of Operation

High speed operation in one direction during upset conditions can best be handled with REXA's Surge Control Option. This option gives the actuator the ability for fast operation in one direction. During normal movements actuator stroking speed is determined by Power Module speed capabilities. To obtain this second surge speed a coil spring drives the actuator when a solenoid valve opens. Four additional components are added to the standard actuator:

Mechanical Spring - provides the force to move the actuator in the surge direction.

Solenoid Bypass Valve - bypasses the actuator's normal hydraulic circuit.

Solid State Relay - interfaces the CPU with the solenoid.

Needle Valve - allows adjustment in Surge Control speed

The CPU will deenergize/energize the solenoid through the electronic relay to allow controlled high speed motion in the spring direction. Control of this feature is accomplished with the Surge Breakpoint (SG) parameter in the Setup menu.

If the change in control signal is less than the Surge Breakpoint, the actuator operates normally. If the change in control signal is greater than the Surge Breakpoint (and in the surge motion direction), then the solenoid opens and the actuator is driven by the spring to the new position.

If the actuator is overshooting during a surge event, the Surge Offpt parameter can be used to eliminate this overshoot. Reference the Drive Menu section in Modes of Operation & Control Parameters in the IOM for additional information regarding setting the Surge Offpt parameter. Increasing this Surge Offpt parameter will reduce the overshoot until the unit begins to slow down too much prior to hitting its target position. Figure G.1-1 illustrates the overshoot from a surge event. Increasing the Surge Offpt would be required to eliminate this issue. Figure G.1-2 shows the expected results when the Surge Offpt parameter is tuned properly. Figure G.1-3 shows an undershoot condition. Decreasing the Surge Offpt percentage will reduce the undershoot.

Various configurations of the spring package may have been provided. The spring may be installed to open or close the driven device. Fail-safe position can either be lock in place or in the surge direction.

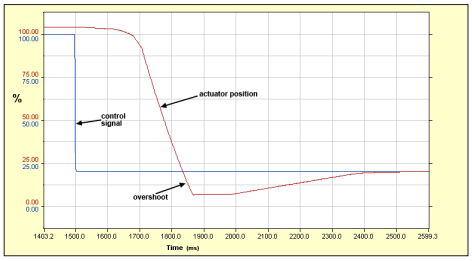

Figure G.1-1 Overshoot

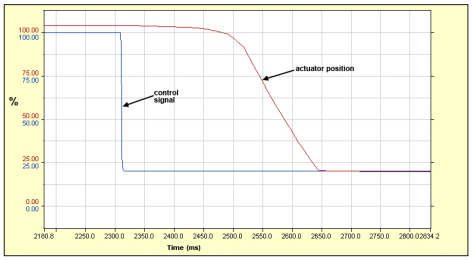

Figure G.1-2 Target position

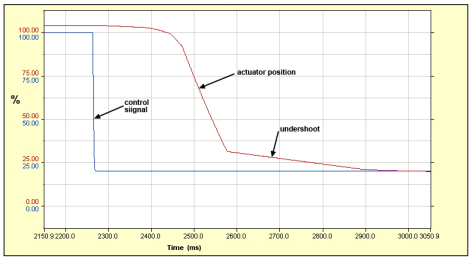

Figure G.1-3 Undershoot

G.2 Installation

The fast response solenoid is a 3-way configuration and piped external to the hydraulic cylinder. An adjustable needle valve is in line with the solenoid to allow custom adjustment of the surge speed to meet a particular installation. The wires used for the surge solenoid are a pair of blue wires in the module cable. Refer to certified electrical drawing for wiring details.

G.3 Calibration

Refer to the Control & DRIVES menu for additional information.

H. Build Numbers

The build number is a catalog number REXA uses to designate in complete detail the construction of the actuator. From this number all configurations can be defined. There are two different categories of build numbers; one is for the mechanical sub-assembly, and the second is for it's corresponding electronics sub-assembly. Within the mechanical sub-assembly there is a build number for Rotary and Drive Actuators, and a separate build number for Linear Actuators.

Linear Series Actuator

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

1 Actuator Type
C= Commercial Linear Cylinder
L= REXA Block Cylinder
P= Power Module Only

2 Output
C= 2,000 lbs
D= 4,000 lbs
E= 5,000 lbs
F= 10,000 lbs
G= 15,000 lbs
H= 20,000 lbs
I= 30,000 lbs
J= 40,000 lbs
K= 80,000 lbs
L= 120,000lbs
M= 60,000 lbs
X= N/A

3 Actuator Stroke/Rotation
A= 0.75″
B= 2″
C= 4″
D= 6″
E= 8″
F= 11″
M= 12″
G= 16″
H= 22″
I= 28″
J= 36″
K= 42″
L= 48″
N= 30″
O= 54″
V= 60″
P= 66″
W= 72″
Q= 84″
Y= 96″
U= 120″
Z= Special

4 Power Module Size
B= B Module
C= C Module
M= 2C Module
D= D Module
F= 1/2 D Module
O= Dual 1/2 D Module
G= 2D Module
H= D,P9 Module
U= D,P20 Module
I= D,P40 Module
Z= Special

5 Fail Safe Mode/Surge Method
P= Fail in Place (Std.)
E= Fail Extend Low Spring
R= Fail Retract Low Spring Load
H= Fail Extend High Spring Load
B= Fail Retract High Spring
A= Accumulator Extend
M= Accumulator Retract
D= Hydraulic Solenoid Bypass
X= N/A

6 Fail Mode Speed
H= High Speed Soleoid
N= N/A (Std.)
S= Standard Solenoid
T= WF1 High Speed Solenoid- NO
U= WF1 High Speed Solenoid- NC

7 Heater/Solenoid Voltage
A= 115 Volts AC
B= 230 Volts AC
H= 115 VAC/24 VDC
I= 230 VAC/24 VDC
J= No Heater/115 Volts AC
K= No Heater/230 Volts AC
N= No Heater

8 Temp. Rating and Stem Boot
B= Standard Temp With Stem Boot
H= High Temp Rating
L= Std. Temp Rem. Feedback w/ Stem Boot
N= NEPCI- No Gauges w/ Stem Boot
R= Standard Temp Remote Feedback
S= Standard Temp Rating (Std.)
T= High Temp w/ Linear Stem Boot

9 Manual Override
C= Manual Pump & Handwheel
H= Handwheel/Drill Drive
N= None (Std.)
P= Manual Hand Pump

10 Cable Connection
S= Terminal Strip (Std.)
T= Quick Release Connectors

11,12 Mechanical Switches
A= 2 Switches-SPDT 4X
C= 2 Switches-SPDT Class 1, Div 2
D= Oil Level Switch & 2SPDT Class 1, Div 2
E= 4 Switches SPDT Class 1, Div 2
F= Oil Level & 4SPDT Class 1, Div 2
G= 2 Switches DPDT Class 1, Div 2
H= Oil Level & 2DPDT Class 1, Div 2
J= 4 Switches DPDT Class 1, Div 2
K= Oil Level Switch & 4DPDT Class 1, Div 2
N= No Switches
O= Oil Level Switch

13 Area Approvals
A= ATEX Sone 1, CE
B= IECEx Zone 2
C= CSA Class 1, Div 1
D= NEMA 4X CSA Class 1, Div 1, Tnemec
E= CSA Class 1, Div 1
F= SIL General
G= NEMA 4X Class 1, Div 1, Tnemec
H= SIL, CSA Class 1, Div 1
I= SIL, CSA Class 1, Div 1
M= CE, General Locations
N= ATEX ZONE 2, CE
P= IECEx Zone 1
S= General Locations (Std.)
T= NEMA 4X, Tnemec

14 Output Limit/Protection
C= 37%-73% Total Output
D= 74%-99% Total Output
E= 100%-140% Total Output (Std.)
N= NONE

15 Design
X= X3

16 On/Off Module
N= None

17 Accumulator Recharge Motor
C= 0.3 C-Module
D= D Module
N= None

18 Oil
C= Cold Temp Oil
F= Biodegradable Oil
O= O2 Service (Krytox)
S= Castrol Edge 5W-50

19 Special Cylinder
F= Female Threads
G= Sngl Rod End/Nitron 50 Chrome Pit
R= 17-4 Plated Chrome Shaft
S= Standard Cylinder
T= 316 SS Plated Chrome Shaft
U= Complete 316SS Cylinder
V= Nitronics 50 Plated Chrome Shaft
W= 316SS Cyl w/ Nitronics 50 PC Shaft

20 PST Trigger
A= Accumulator Solenoid
E= External PST Solenoid
N= None
S= Internal PST Solenoid
U= Fail Safe Solenoid

21 Advanced Sensors
B= Redundant Feedback
C= Non-Contact & Diff Press
D= Contact Pot & Diff Press
E= Non-Contact Pot
R= Contact Potentiometer

22 Accumulator Rating
A= ASME Marked Accumulator
C= CE Marked Accumulator
N= None

23 Corrosion Protection
A= AC-15 Accum. Bottles
S= Standard

24 Open
N= None (Std.)

25, 26 Specials
A= Design 1
B= Design 2
Z= Special

27 Revision
A= Design 1
Z= Special

Rotary/Drive Series Actuator

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

1 Actuator Type
D= Drive Units
R= Rotary Cylinders

2 Output
C= 2,500 in*lbs
D= 5,000 in*lbs
E= 10,000 in*lbs
F= 20,000 in*lbs
G= 50,000 in*lbs
H= 100,00 in*lbs
I= 200,000 in*lbs
J= 400,000 in*lbs
K= 566,000 in*lbs
L= 300,000 in*lbs
M= 30,000 in*lbs
Z= Special

3 Actuator Stroke/Rotation
A= 90 Degrees (Std.)
B= 180 Degrees
C= 270 Degrees
D= 280 Degrees
E= 120 Degrees
I= 320 Degrees
J= 350 Degrees

4 Power Module Size
B= B Module
C= C Module
M= 2C Module
D= D Module
F= 1/2 D Module
O= Dual 1/2 D Module
G= 2D Module
H= D,P9 Module
U= D,P20 Module
I= D,P40 Module
Z= Special

5 Fail Safe Mode/Surge Method
P= Fail in Place (Std.)
E= Fail Extend Low Spring
R= Fail Retract Low Spring Load
H= Fail Extend High Spring Load
B= Fail Retract High Spring
A= Accumulator Extend
M= Accumulator Retract
D= Hydraulic Solenoid Bypass
X= N/A

6 Fail Mode Speed
H= High Speed Soleoid
N= N/A (Std.)
S= Standard Solenoid
T= WF1 High Speed Solenoid- NO
U= WF1 High Speed Solenoid- NC

7 Heater/Solenoid Voltage
A= 115 Volts AC
B= 230 Volts AC
H= 115 VAC/24 VDC
I= 230 VAC/24 VDC
J= No Heater/115 Volts AC
K= No Heater/230 Volts AC
N= No Heater

8 Temp. Rating and Stem Boot
B= Standard Temp With Stem Boot
H= High Temp Rating
L= Std.Temp Rem. Feedback w/ Stem Boot
N= NEPCI- No Gauges w/ Stem Boot
R= Standard Temp Remote Feedback
S= Standard Temp Rating (Std.)
T= High Temp w/ Linear Stem Boot

9 Manual Override
C= Manual Pump & Handwheel
H= Handwheel/Drill Drive
N= None (Std.)
P= Manual Hand Pump

10 Cable Connection
S= Terminal Strip (Std.)
T= Quick Release Connectors

11,12 Mechanical Switches
A= 2 Switches-SPDT 4X
C= 2 Switches-SPDT Class 1, Div 2
D= Oil Level Switch & 2SPDT Class 1, Div 2
E= 4 Switches SPDT Class 1, Div 2
F= Oil Level & 4SPDT Class 1, Div 2
G= 2 Switches DPDT Class 1, Div 2
H= Oil Level & 2DPDT Class 1, Div 2
J= 4 Switches DPDT Class 1, Div 2
K= Oil Level Switch & 4DPDT Class 1, Div 2
N= No Switches
O= Oil Level Switch

13 Area Approvals
A= ATEX Sone 1, CE
B= IECEx Zone 2
C= CSA Class 1, Div 1
D= NEMA 4X CSA Class 1, Div 1, Tnemec
E= CSA Class 1, Div 1
F= SIL General
G= NEMA 4X Class 1, Div 1, Tnemec
H= SIL, CSA Class 1, Div 1
I= SIL, CSA Class 1, Div 1
M= CE, General Locations
N= ATEX ZONE 2, CE
P= IECEx Zone 1
S= General Locations (Std.)
T= NEMA 4X, Tnemec

14 Output Limit/Protection
C= 37%-73% Total Output
D= 74%-99% Total Output
E= 100%-140% Total Output (Std.)
N= NONE

15 Design
X= X3

16 On/Off Module
N= None

17 Accumulator Recharge Motor
C= 0.3 C-Module
D= D Module
N= None

18 Oil
C= Cold Temp Oil
F= Biodegradable Oil
O= O2 Service (Krytox)
S= Castrol Edge 5W-50

19 Special Cylinder
F= Female Threads
G= Sngl Rod End/Nitron 50 Chrome Pit
R= 17-4 Plated Chrome Shaft
S= Standard Cylinder
T= 316 SS Plated Chrome Shaft
U= Complete 316SS Cylinder
V= Nitronics 50 Plated Chrome Shaft
W= 316SS Cyl w/ Nitronics 50 PC Shaft

20 PST Trigger
A= Accumulator Solenoid
E= External PST Solenoid
N= None
S= Internal PST Solenoid
U= Fail Safe Solenoid

21 Advanced Sensors
B= Redundant Feedback
C= Non-Contact & Diff Press
D= Contact Pot & Diff Press
E= Non-Contact Pot
R= Contact Potentiometer

22 Accumulator Rating
A= ASME Marked Accumulator
C= CE Marked Accumulator
N= None

23 Corrosion Protection
A= AC-15 Accum. Bottles
S= Standard

24 Open
N= None (Std.)

25, 26 Specials
A= Design 1
B= Design 2
Z= Special

27 Revision
A= Design 1
Z= Special

Electronic Control Enclosure

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

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1 Power Module Size

B= B Module

C= C Module

D= D Module

F= ½D Module

G= 2D Module

H= D-P9 Module

I= D-P40 Module

M= 2C Xpac Module

2 Power Supply

A= 120 VAC

B= 240/208 VAC

C= 480 VAC

H= 415 VAC 1–Phase

I= 240 VAC 3–Phase

J= 480 VAC 3–Phase

K= 380 VAC 3–Phase

L= 600 VAC 3–Phase

M= 240 Volts Module w/o transfer

N= 600 VAC 1-Phase

O= 380 VAC 1-Phase

T= 400 VAC 3-Phase

P= 575, 3-Phase

U= 208 Ctl. & Servo/480 Ind. Boost, 3 ph.

V= 240 VAC 1-Ph, Xfrmr 1/2D 120V

S= 200 VAC, 1-Phase

3 Control Signal

G= Analog 4-20 mA w/ Surge Sup. (Std.)

T= Two Position - 1 Signal

M= Manual - 2 Signal

J= Hart 4–20 mA w/ Surge Sup.

Z= Special

4 Area Approvals

S= General Locations (Std.)

C= CSA Class 1, Div 2 (B,C,D)

E= CSA Class 1, Div 1

N= Atex/CE Zone 2

5 Enclosure Material

T= 316 Stainless Steel, NEMA 4X (Std.)

P= Painted Steel, NEMA 4 (Std. X2)

6 Controls

E= External (Std.)

I= Internal

C= Int Controls w/ Ext Buttons/Window

Z= Special

7 Remote Manual Station

A= Basic Station

B= Basic Station with Display

C= Remote Station Compatibility

N= None (Std.)

8 Actuator Temperature Rating

S= Standard 200 °F (93 °C) Temp Rating

H= High 250 °F (121 °C) Temp Rating

R= Remote Feedback Std. 200 °F (93 °C)

M= High Temp Rating, Rotary or Drive

9 Position Transmitter

A= Active 4–20 mA

P= Passive 4–20 mA (Std.)

10 Solenoid Control

N= None (Std.)

A= Accumulator System

S= Spring Surge Option

11, 12 Software

A= Standard Software (Std.)

13 Electronics Supplied

Y= Yes

14 Cable Termination

T= Quick Connect Cables

F= Quick Release Actuator End Only

D= Din Rail

15 Design

X= X3

16 On/Off Module

N= None

17 Accumulator Recharge Motor

N= None

C= R1-C Module

18 Seating Control

N= None

S= Solenoid seat

L= Seat load cylinder

19 Wireless

N= No Wireless Transmitter

B= Bluetooth Diagnostics

20 PST-Trigger

N= No PST

C= No Contact Input

T= Contact Input

L= Local Button

T= Local and Contact

21 Advanced Sensors

N= None (Std.)

C= Output monitoring

D= Contact Pot & Analog Diff Pressure

E= Non-Contact

22 Switches

N= Linear Act. None

T= Linear Act. Two Switches

G= Linear Act. 2 DPDT

R= Rotary Act. None

P= Rotary Act. Two Switches

X= Rotary Act. Four Switches

A= Linear Act. None w/ Low Oil

B= Linear Act. Two w/ Low Oil

C= Linear Act. Four w/ Low Oil

D= Rotary Act. None w/ Low Oil

E= Rotary Act. Two w/ Low Oil

F= Rotary Act. Four w/ Low Oil

H= Linear Act. Four

23 Trip Signal

N= None

A= Loss of power only

B= 24-120 Trip signal only

C= 24 VDC- Customer Power Solenoids

D= 120 VDC- Customer Power Solenoids

E= Dry Contact

24 Environmental Protection

N= None (Std.)

C= Conformal Coating

25, 26 Specials

N= None

27 Revision

A= Design 1

Z= Special

Mounting Systems
Linear Series Mouning

1 2 3 4 5 6 7 8 9

☐☐☐☐☐☐☐☐☐

1 Actuator Type

N= No Mounting Hardware
L= REXA Block Cylinder
C= Commercial Linear Cylinder

2 Output

C= 2,000 lbf (8,896 N)
D= 4,000 lbf (17,793 N)
E= 5,000 lbf (22,241 N)
F= 10,000 lbf (44,482 N)
G= 15,000 lbf (66,723 N)
H= 20,000 lbf (88,964 N)
I= 30,000 lbf (133,447 N)
J= 40,000 lbf (177,929 N)
M= 60,000 lbf (266,893 N)
K= 80,000 lbf (355,858 N)
L= 120,000 lbf (533,787 N)
Z= Special

3 Actuator Stroke

A= .75" (.02 m)
B= 2" (.05 m)
C= 4" (.10 m)
D= 6" (.15 m)
E= 8" (.20 m)
F= 11" (.28 m)
G= 16" (.40 m)
H= 22" (.56 m)
I= 28" (.71 m)
J= 36" (.91 m)
K= 42" (1.07 m)
L= 48" (1.22 m)
Z= Special

4 Valve Attachment

S= Down Seat Split Clamp
B= Up Seat Split Clamp
N= No Clamp

5 Certified Drawings

A= Actuator Outline
C= Control Enclosure Outline
E= Electrical Interconnect Schematic
O= Actuator & Interconnect
D= Actuator & Enclosure & Interconnect
N= No Certified Drawings

6 Other Documentation

B= Bill of Materials
C= Certificate of Conformance
F= Final Inspection Report
A= All (BOM, COC & FIR)
N= No Other Documentation

7 Variations

N= No Factory Mount & Calibrate
A= L2 000 Mount & Calibrate
B= L4K-L10K Mount & Calibrate
C= L15K & Up, Mount & Calibrate

8 Inspection Level

S= Standard Inspection
A= Advanced Inspection (Level II)
P= Premium Inspection (Level I)

9 Packaging

D= Domestic (Std.)
E= Export

Rotary Series Mounting

1 2 3 4 5 6 7 8 9

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1 Actuator Type

N= No Mounting Hardware
R= Rotary Cylinder

2 Output

C= 2,500 lb·in (282 N·m)
D= 5,000 lb·in (565 N·m)
E= 10,000 lb·in (1,130 N·m)
F= 20,000 lb·in (2,260 N·m)
G= 50,000 lb·in (5,650 N·m)
H= 100,000 lb·in (11,300 N·m)
I= 200,000 lb·in (22,597 N·m)
J= 400,000 lb·in (45 194 N·m)
Z= Special

3 Actuator Rotation

A= 90 Degrees (Std.)
B= 180 Degrees
C= 270 Degrees
D= 280 Degrees
E= 120 Degrees
Z= Special

4 Valve Attachment

N= No Mounting Hardware
A= 4" or less
B= 6" to 10"
C= 12" to 14"
D= 16" to 20"
E= 20" and up

5 Certified Drawings

A= Actuator Outline
C= Control Enclosure Outline
E= Electrical Interconnect Schematic
O= Actuator & Interconnect
D= Actuator & Enclosure & Interconnect
N= No Certified Drawings

6 Other Documentation

B= Bill of Materials
C= Certificate of Conformance
F= Final Inspection Report
A= All (BOM, COC & FIR)
N= No Other Documentation

7 Variations

N= No Factory Mount & Calibrate
A= Factory Mount & Cal 4" or Less
B= Factory Mount & Cal 6" to 10"
C= Factory Mount & Cal 12" to 14"
D= Factory Mount & Cal Over 16"

8 Inspection Level

S= Standard Inspection
A= Advanced Inspection (Level II)
P= Premium Inspection (Level I)

9 Packaging

D= Domestic (Std.)
E= Export

The most common codes are shown above. However, the Xpac 3 is an engineered product and REXA practices a policy of continuous improvement. As such, additional codes may be available or may be added without notice. Please contact the factory for information on any code not shown above.

Drive Series Mounting

1 2 3 4 5 6 7 8 9

☐☐☐☐☐☐☐☐☐

1 Actuator Type

D= Drive Unit

2 Output

C= 2,500 lb·in (282 N·m)
D= 5,000 lb·in (565 N·m)
E= 10,000 lb·in (1,130 N·m)
F= 20,000 lb·in (2,260 N·m)
G= 50,000 lb·in (5,650 N·m)
H= 100,000 lb·in (11,300 N·m)
I= 200,000 lb·in (22,597 N·m)
J= 400,000 lb·in (45,194 N·m)
Z= Special

3 Actuator Rotation

A= 90 Degrees (Std.)
B= 180 Degrees
C= 270 Degrees
D= 280 Degrees
E= 120 Degrees
Z= Special

4 Valve Attachment

S= Standard Base & Arm
A= Standard Base & Custom Arm
B= Custom Base & Standard Arm
C= Custom Base & Custom Arm

5 Certified Drawings

A= Actuator Outline
C= Control Enclosure Outline
E= Electrical Interconnect Schematic
O= Actuator & Interconnect
D= Actuator & Enclosure & Interconnect
N= No Certified Drawings

6 Other Documentation

B= Bill of Materials
C= Certificate of Conformance
F= Final Inspection Report
A= All (BOM, COC & FIR)
N= No Other Documentation

7 Variations

N= No Linkage Kit
C= Custom Linkage Kit

8 Inspection Level

S= Standard Inspection
A= Advanced Inspection (Level II)
P= Premium Inspection (Level I)

9 Packaging

D= Domestic (Std.)
E= Export

Linear Fisher Mounting

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

1 Actuator Type

N= No Mounting Hardware
L= REXA Block Cylinder
C= Commercial Linear Cylinder

2 Output

C= 2,000 lbf (8,896 N)
D= 4,000 lbf (17,793 N)
E= 5,000 lbf (22,241 N)
F= 10,000 lbf (44,482 N)
G= 15,000 lbf (66,723 N)
H= 20,000 lbf (88,964 N)
Z= Special

3 Actuator Stroke

A= .75" (.02 m)
B= 2" (.05 m)
C= 4" (.10 m)
D= 6" (.15 m)
E= 8" (.20 m)
F= 11" (.28 m)
G= 16" (.40 m)
Z= Special

4 Valve Attachment

S= Down Seat Split Clamp
B= Up Seat Split Clamp
N= No Clamp

5 Certified Drawings

A= Actuator Outline
C= Control Enclosure Outline
E= Electrical Interconnect Schematic
O= Actuator & Interconnect
D= Actuator & Enclosure & Interconnect
N= No Certified Drawings

6 Other Documentation

B= Bill of Materials
C= Certificate of Conformance
F= Final Inspection Report
A= All (BOM, COC & FIR)
N= No Other Documentation

7 Fail Safe Mode

P= Fail In Place (Std.)
E= Fail Extend Low Spring Load
R= Fail Retract Low Spring Load
H= Fail Extend High Spring Load
B= Fail Retract High Spring Load
A= Accumulator Extend
M= Accumulator Retract
Z= Special

8 Seat Loading Method

N= None (Std.)
S= Seat Load Cylinder
C= Elastic Coupling Extend
U= Elastic Coupling Retract
Z= Special

9 Mount & Cal

N= No Factory Mount & Calibrate
A= L2 000 Mount & Calibrate
B= L4K-L10K Mount & Calibrate
C= L15K & Up, Mount & Calibrate

10 Inspection Level

S= Standard Inspection
A= Advanced Inspection (Level II)
P= Premium Inspection (Level I)

11 Packaging

D= Domestic (Std.)
E= Export

12 Yoke Boss

A= 2-1/8"
C= 2-3/16"
E= 3-9/16"
G= 5"

13 Stem Thread

B= 3/8"–24
D= ½"–20
F= ¾"–16
H= 1"–14
I= 1-¼"–12

14 Stem Height

A= 4-¾"
B= 6-3/16"
C= 6-5/8"
D= 8-7/8"
E= 9-5/8"

15 Valve Stroke

A= ¼" to 1"
B= 1-1/8" to 1-7/8"
H= 2" and up
Z= Special

16 Variations

N= None

17 Revision

A= Current Rev

M. Manual Operators

The Xpac has two types of manual operators available: Declutchable Handwheel / Drill Drive and Manual Hydraulic Pump. Since both options utilize our hydraulic circuit for override operation, they will only function if the system is in working order.

CAUTION: Before attempting to operate any manual override feature, make sure that the electric power is OFF.

M.1 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.

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

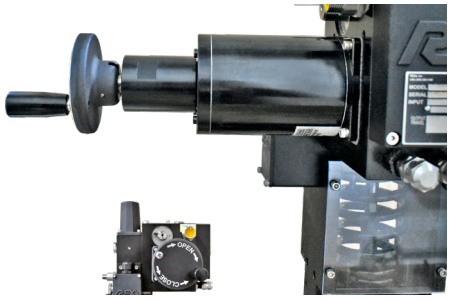


Figure M.1-1 Handwheel Assembly

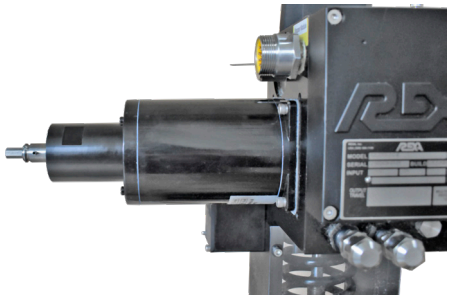


Figure M.1-2 Drill Drive

Figure M.1-3 Drill Drive with Drill

M.1.2 Declutchable Drill Drive

The drill drive is part of the handwheel assembly that can be used on standard B, C, 1/2D, and D power modules rated for hazardous but non-explosion proof environments to drive the unit. The handwheel can be removed by simply pulling on it to expose a 5/16" hex drive. To operate, 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 drive must contact a slot on the end of the motor shaft. Clockwise rotation of the manual operator 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.

Note: The actuator's drive train and cylinder must be in proper working order to operate handwheel/drill drive.

CAUTION: Care must be taken to ensure the drill gun is limited to 2 000 rpm. Running into a mechanical stop using a drill may damage the actuator and potentially the equipment it is attached to. As the actuator nears the end point, decrease drill speed so damage doesn't occur.

M.2 Manual Hydraulic Pump

The manual hydraulic pump can be installed on all units and needs only the cylinder side of the hydraulic circuit and the FMV check valves to be in working order. If the gear pump or suction check valves fail, the manual hydraulic pump will still provide a means for manual operation.

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.

Note: It is not advisable to leave the lever in the piston assembly when the hydraulic pump is not in use.

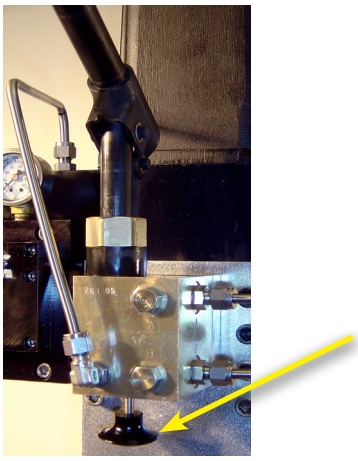


Figure M.2 Manual Hydraulic Pump

Manual Hydraulic Pump Speeds (# Of Pumps)

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

M.3 Fail-Safe Unit Operation

Fail-safe units, Spring Return and Accumulator, utilize solenoid valves in the fail-safe operation. Upon loss of power these solenoids will change state. Generation 1 High Speed Solenoid

In order for manual operation, solenoids must be in position B for normally open solenoids. Manually override them so they appear as shown in Figure M.3.

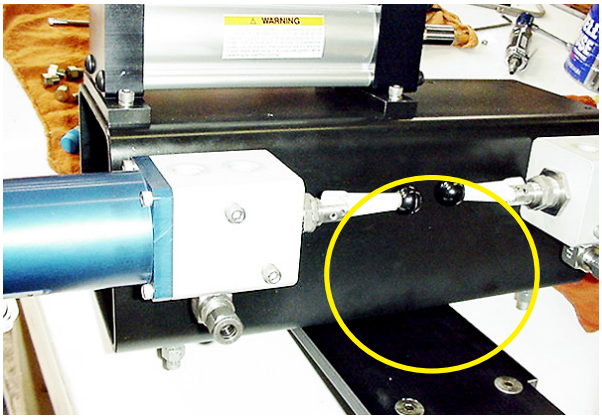


Figure M.3 Generation 1 Solenoid Manual Override Levers (Position B)

M.3.1 Generation 2 High Speed Solenoid

To manually override the second generation of high speed solenoids follow the below steps.

1. Remove the cover of the solenoid.

2. Turn the jam nut counter clockwise to loosen.

3. Turn the needle valve adjustment knob clockwise to close. This will keep the solenoid valve closed without power and will allow use of the manual hydraulic pump.

*Note: Count and record how many turns are needed to fully turn the needle valve adjustment knob clockwise to close. This quantity will be used to reset the needle valve adjustment knob to the same position, retaining its factory-set trip speed as specified by the customer.

WARNING: After using the handwheel, the overrides must be returned to their open position or the unit will not operate correctly when power is restored or trip signal removed. If only one override is returned to the open position after a trip, damage to the power module may occur. Changing the override(s) back may also cause the actuator to run to the fail-safe position.

Refer to Rotary Spring Fail and Linear Spring Fail sections under Mechanical Installation for additional information.

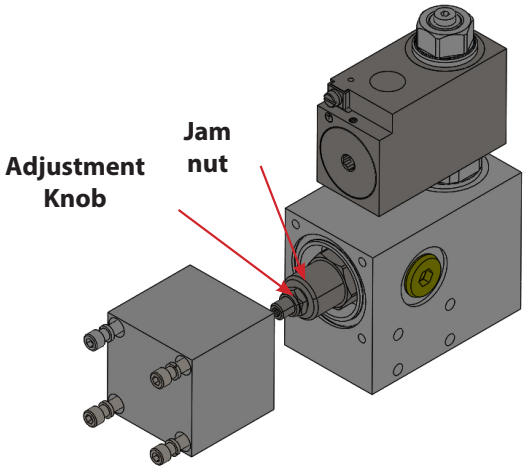


Figure M.3.1 Generation 2 Solenoid

HART® Field Device Setup and Specification

Table of Contents

1. 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		

1.1 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

2. TERMS & 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.

3. 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 analog control signal is the only way to remotely move/control 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 calibration mode.*

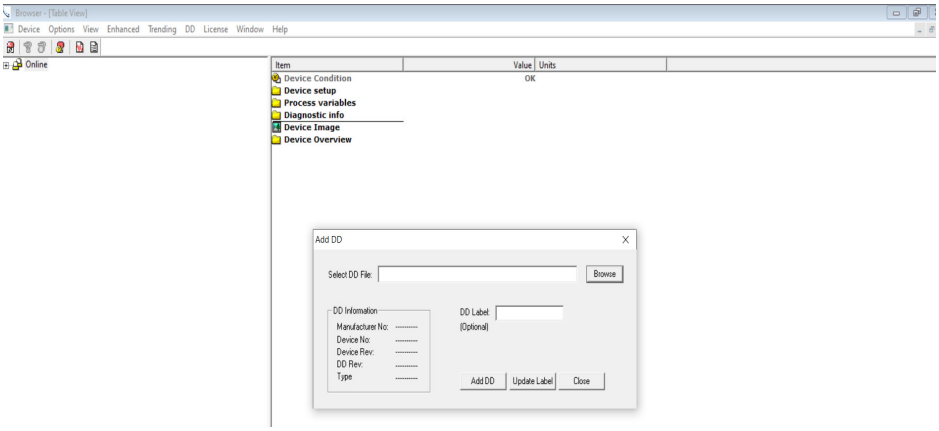
4. PRODUCT INTERFACES

4.1. 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 platform's 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.

4.2. Install/Update REXA DD

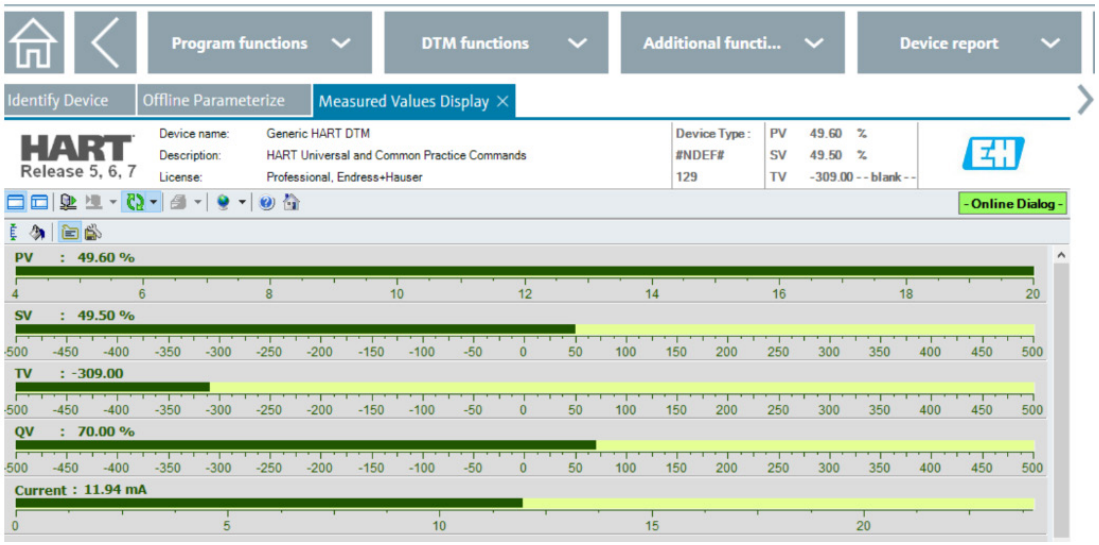
All host HART application have a way to set up a new device onto the network which allows users to install/update/upload device descriptor "DD" files. The "DD" files consist of two separate files, an "xxxx.fm8" and "xxxx.sym" file. Below is an example screen capture.



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

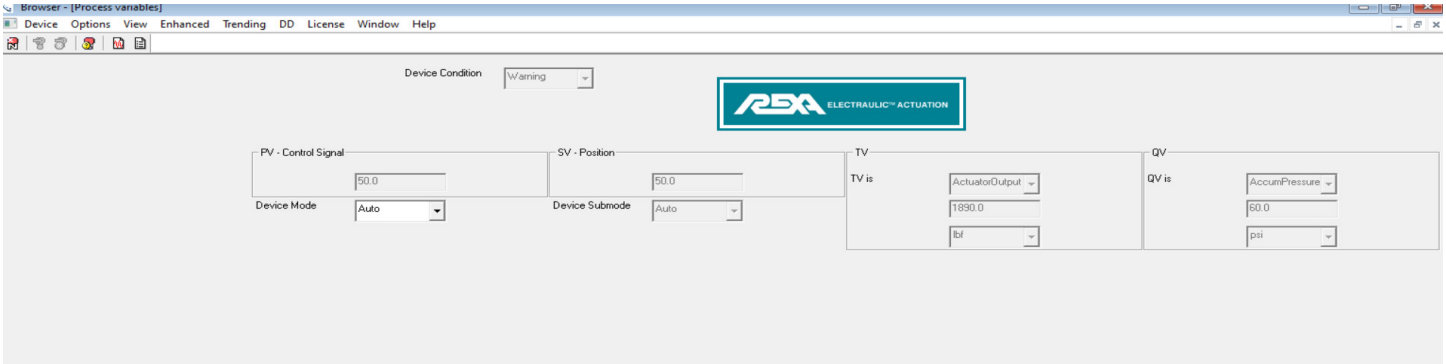
Basic HART Commands / Generic DTM Option

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 screen shot below provides an example. Variable are listed as "PV" – Primary variable, "SV" Secondary Variable, "TV" – Tertiary Variable, "QV" Quaternary Variable.

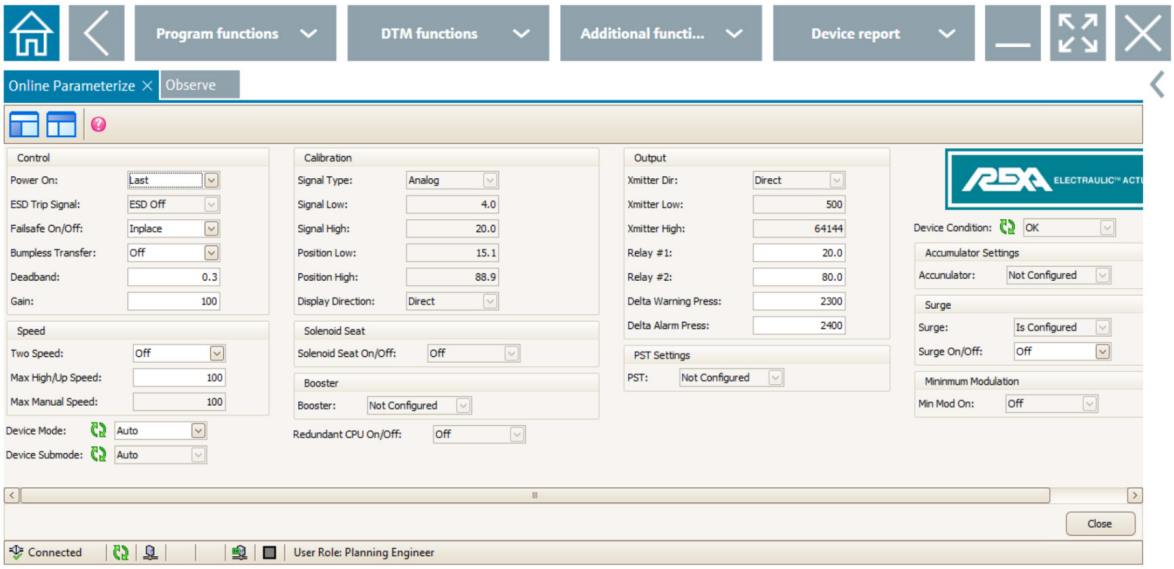


DD & Advanced iDTM Translators

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 provides an example of how the information will be presented in a GUI format with the correct variable labels and units.



Without the use of the DD and iDTM technology formed GUI screens as shown below would just be presented as a data file.



4.3. Setup Device Polling Address Search Range

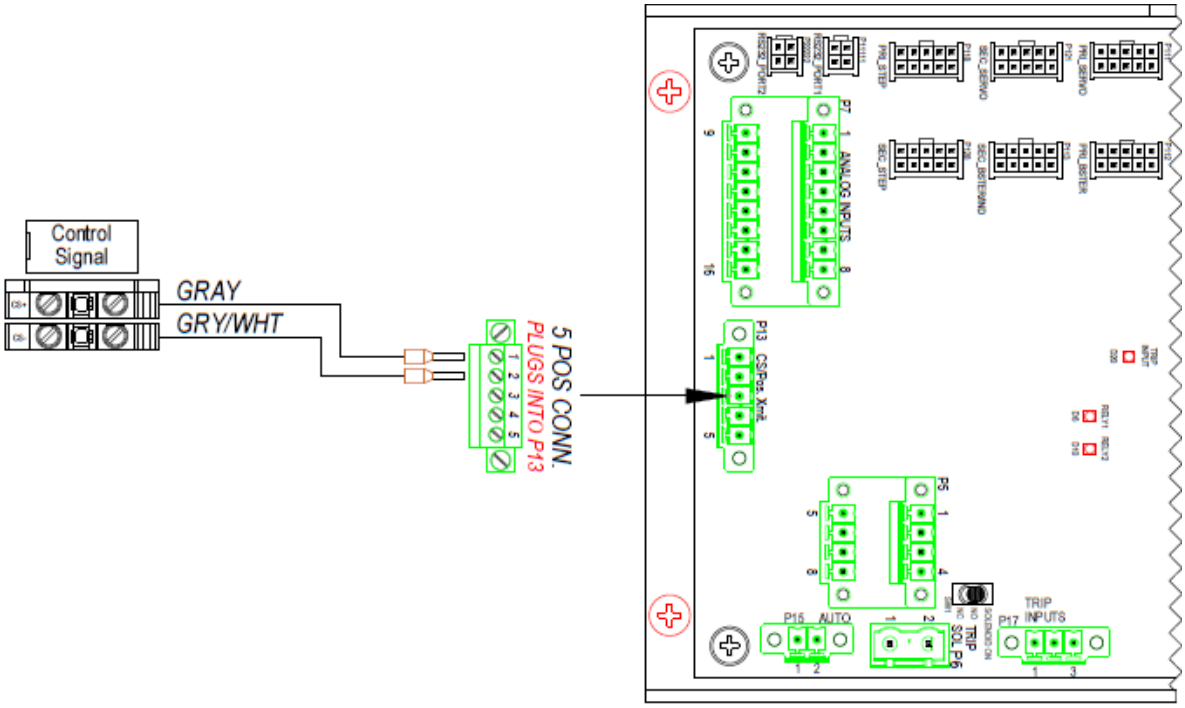
REXA is configured with the polling address 0 (can be updated as needed to 64).

4.4. Connect to the Actuator

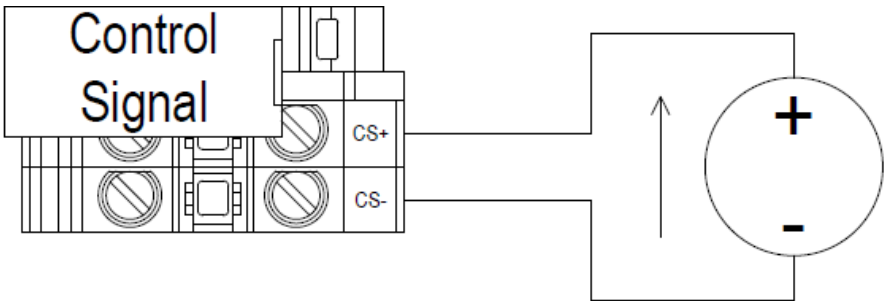
Connect two-wire 4-20mA loop to actuator from a HART compatible HOST card

Picture 1 and 2 illustrate the factory and customer control signal connections.

X3 Interconnect Board



Picture 1 Control Signal Factory Connections



Control Signal Input 4-20mA DC with HART Communication

Picture 2 Control Signal Customer Connections

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

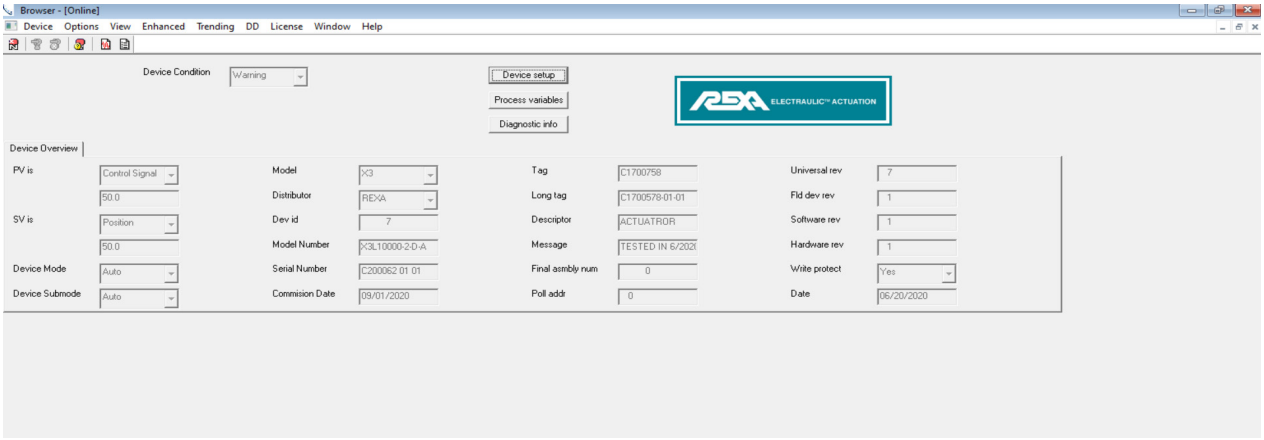
4.5. Device Online Menu

**Not available on all models.

Write Protection

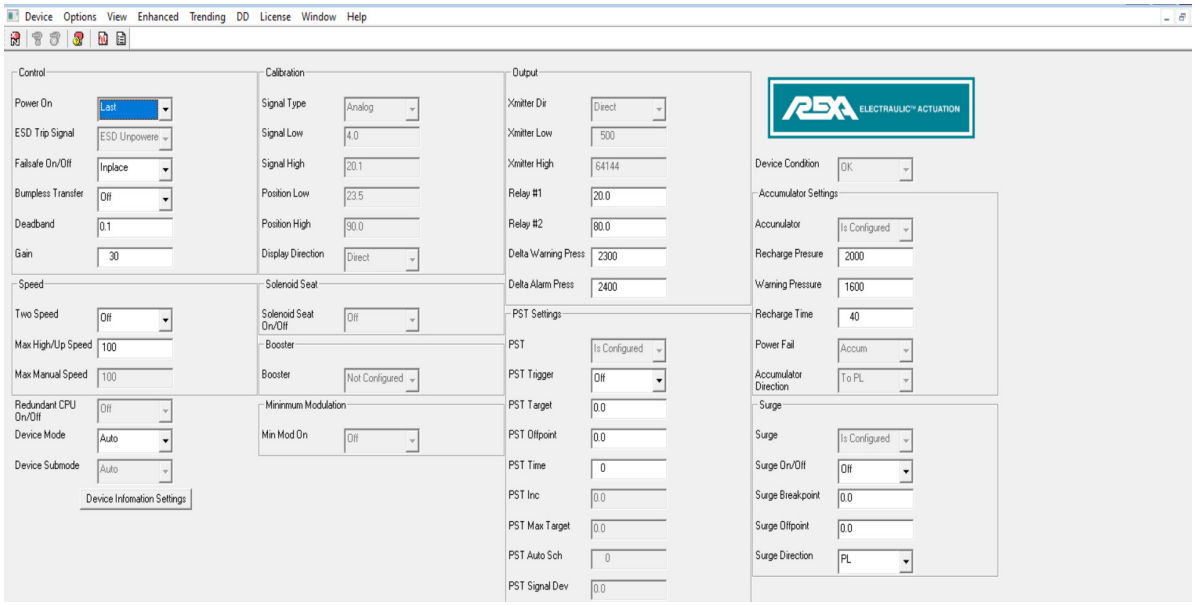
Write is only allowed in setup mode. To write a parameter, the value of the parameter needs to be modified and may also need to be highlighted, and a send or apply button has to be clicked to send its value to the device.

Host HART application allows user to get an overview of the device through online menus or navigation windows provide in the host application. While the device is Online the parameters are greyed out and can not be modified. In order to modify parameters, the device must be put into setup Mode.

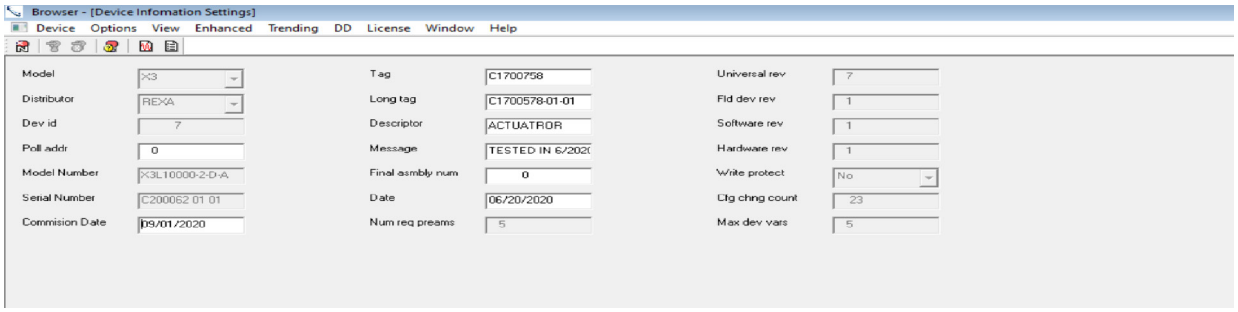


4.6. Device Settings

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



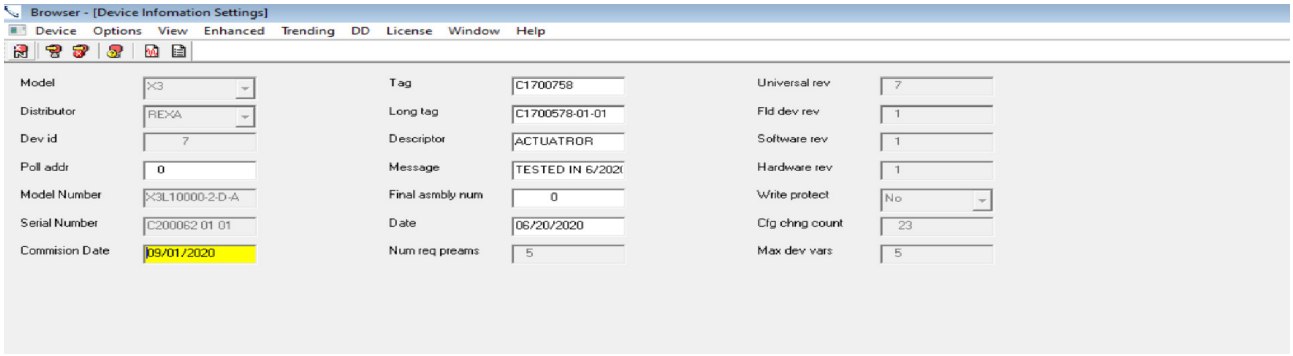
Device Identification Settings can be further opened as follows



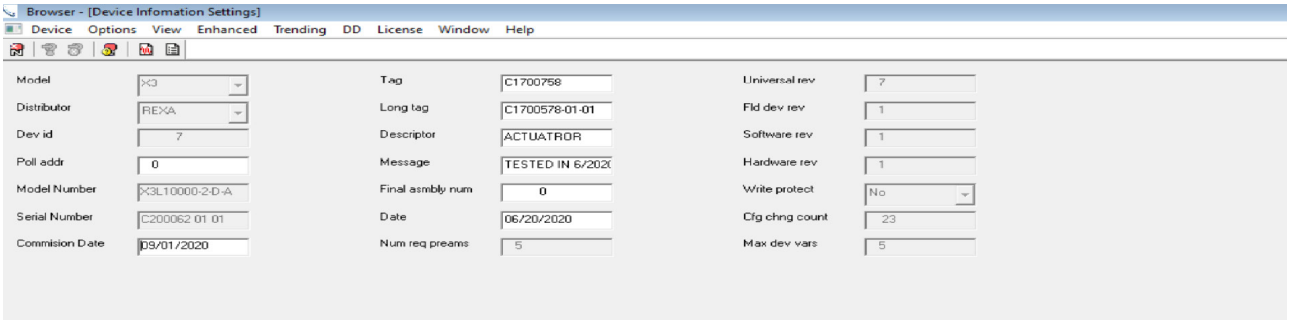
At the setup page, the parameters in white is writable while the ones in grey are read-only.

Below are the example of setting commission date:

Before the setting:



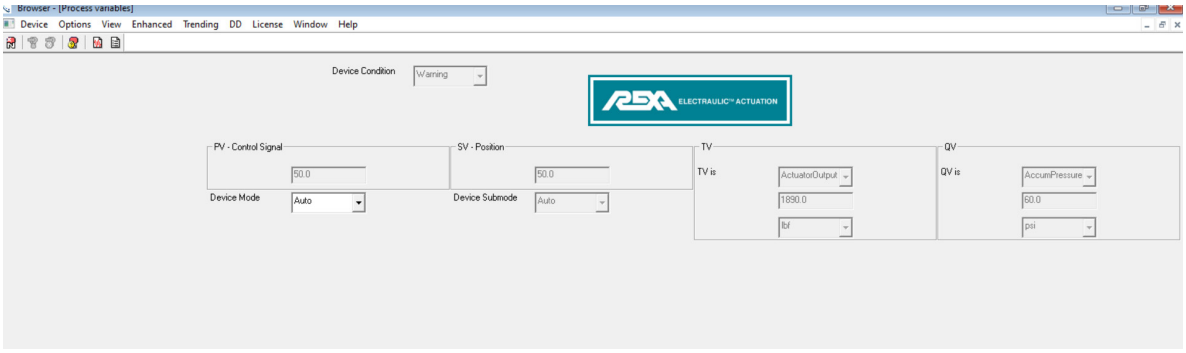
After the setting:



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

4.7. Monitor X3 Device's Operation Process

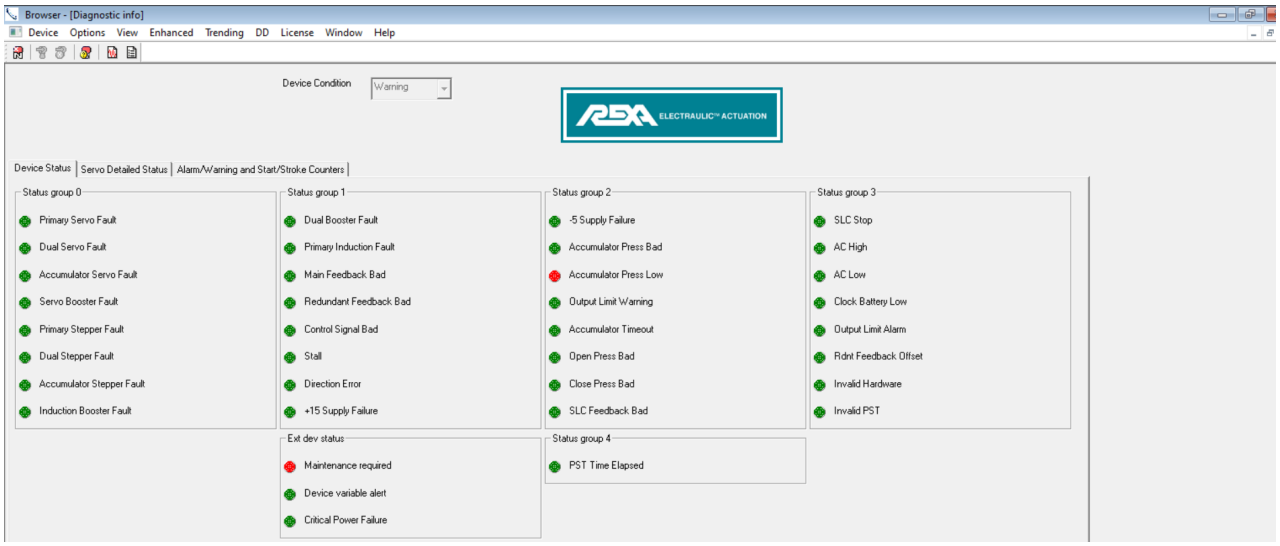
Host HART application can monitor X3 device through process variables.



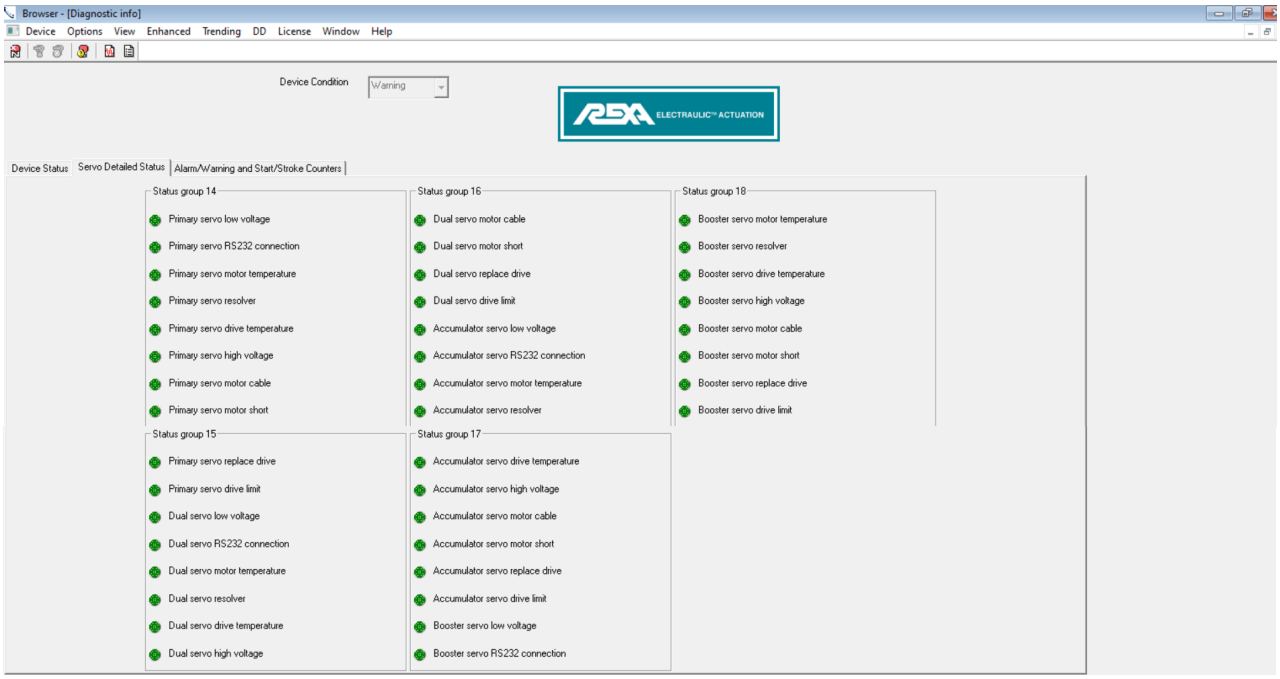
The actuator can be in auto, manual, or setup modes. It is settable through HART command and the front panel.

4.8. Get X3 Device Diagnostic Information

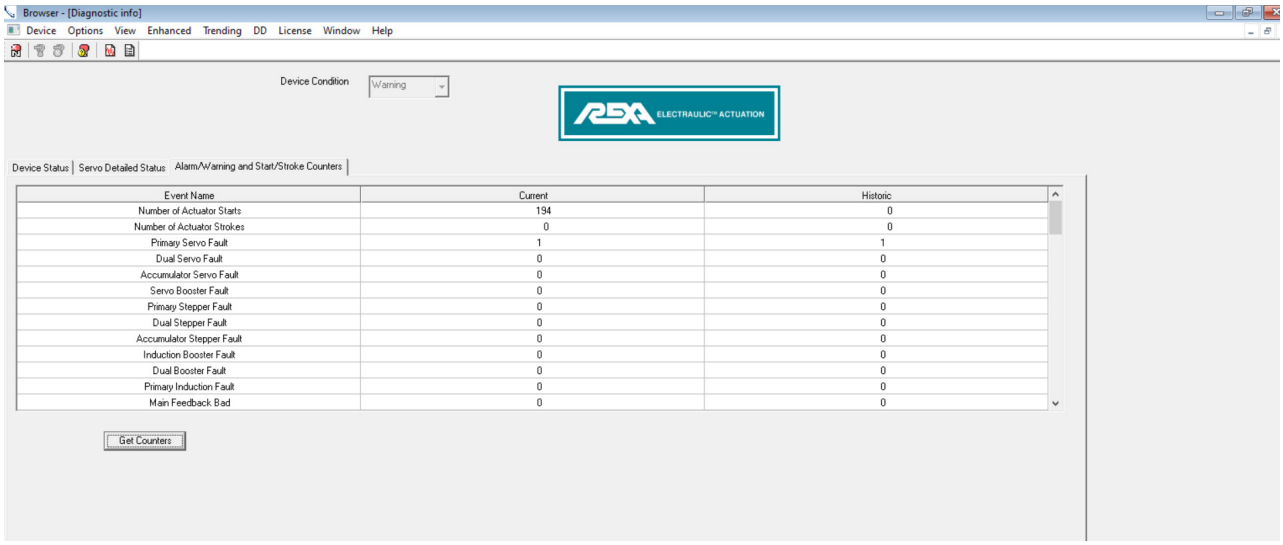
By going to menu diagnostic, user can obtain X3's diagnostic information.



Further clicking on "Servo Detailed Status" on diagnostics page, user can get Servo Motor Detailed Status information:



Also, by clicking on "Alarm/Warning and Start/Stroke Counters" on the diagnostic page, user can navigate to the counter page:



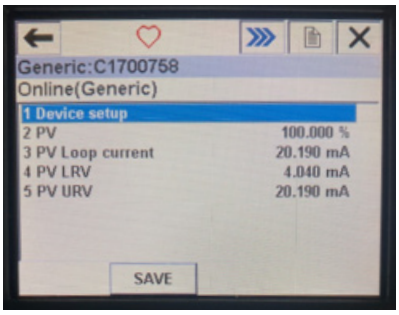
To get updated counters, user can click on the "Get Counters" button, and further click on "OK" on the question of "Read All The Counters Now?"

5. POSSIBLE TROUBLE SHOOTING METHODS

5.1. HART Secondary Master Device

Using HART secondary master device, either hand-held like Emerson 475 or Trex, or tablet or laptop with HART applications to check the HART wiring and communications.

For example, the HART probes of Emerson 475 can be connected to 4-20mA control signal two wires that are connected to X3 and read X3's control signal settings through generic DD as shown below:



6. 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. The position 2 and pressure 2 can be a fixed value used for testing purpose

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.

6.1. Control Signal

4~20mA input signal as the setpoint of the position control. This variable is displayed in percentage.

6.2. Position

This variable is the current position of the actuator and is displayed in percentage of the actuators calibrated span.

6.3. Torque/ Thrust

The actuator differential pressure (close pressure – open pressure) are used for calculating its torque or thrust based on the device's model number. A positive value indicated extending/CW and a negative valve indicates retracting/CCW.

6.4. Accumulator

4~20mA accumulator pressure signal represents the pressure from 0 to 3000psi.

7. STATUS INFORMATION

7.1. 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.

7.2. 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.

7.3. Additional Device Status (Command #48)

Command #48 returns 19 bytes of status data, with the following status information:

Table 1				
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
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 RS232 connection	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 motor cable	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 RS232 connection	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 motor cable	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 RS232 connection	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 motor cable	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 RS232 connection	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 motor cable	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

8. UNIVERSAL COMMANDS

Universal Commands	0, 1, 2, 3, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 38, 48

9. COMMON PRACTICE COMMANDS

Common Practice Commands	33, 50, 54

10. DEVICE-SPECIFIC COMMANDS

The following device-specific commands are implemented:

Command #131: Read Commission Date, Model Number and Serial Number
Command #132: Read Device Mode and Condition
Command #133: Read Configurations and Control Parameter Settings
Command #134: Read Accumulator Parameter Settings
Command #135: Read Output Parameter Settings
Command #136: Read PST Trigger
Command #137: Read PST Time
Command #138: Read PST Auto Schedule
Command #139: Read PST Targets
Command #140: Read PST Signal Control
Command #142: Read Failsafe
Command #143: Read Cal. Stroke
Command #144: Read Surge On
Command #145: Read Surge Settings
Command #146: Read Speed Breakpoint
Command #147: Read Low/Down Speed
Command #148: Read Speeds
Command #149: Read Min Mod
Command #150: Read Delta Pressure Settings
Command #151: Read Booster On
Command #152: Read Booster Offpoint
Command #153: Read Calibration Parameters
Command #154: Read Redundant Calibration Parameters
Command #170: Read Warning/Alarm Counters Part 1
Command #171: Read Warning/Alarm Counters Part 2
Command #172: Read Warning/Alarm Counters Part 3
Command #174: Read Warning/Alarm Counters Part 5
Command #175: Read Warning/Alarm Counters Part 6
Command #176: Read Actuator Start and Stroke Counters
Command #185: Write Gain
Command #186: Write Failsafe State
Command #187: Write Failsafe
Command #188: Write Power On
Command #189: Write Bumpless
Command #190: Write Deadband
Command #191: Write Surge On
Command #192: Write Surge
Command #193: Write PST Trigger
Command #194: Write PST Targets
Command #195: Write Delta Pressure Settings
Command #196: Write Relays
Command #197: Write Booster On
Command #198: Write Booster Offpoint
Command #199: Write Accumulator
Command #200: Write Two Speed
Command #201: Write Maximum High Speed
Command #202: Write Maximum Low Speed
Command #203: Write Speed Breakpoint
Command #204: Write Device Mode
Command #205: Write Commission Date

11. TABLES

11.1. Unit Codes

Name	Unit Code	Unit
Torque Unit	240	lbf.in
Thrust Unit	241	lbf

12. UNSUPPORTED MODES

12.1. Burst Mode

This Field Device does not support Burst Mode.

12.2. Catch Device Variable

This Field Device does not support Catch Device Variable.

O. Output Load Protection

O.1 Theory of 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 as shown in Figure O.2. The valve to the left controls the pressure in the extend or clockwise direction.

O.2 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 Table O.2

Table O.2 Adjustment Range	
Adjustment Range (psi)	2,250-3,000
Spring Color	Brown (Std)

Standard springs are 2,250 – 3,000 psi unless specified otherwise. The limiting cartridge is then factory set to 2,300 – 2,400 psi. 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 Figure O.2. This value should be the delta between the two gauges when calculating actual output.

O.3 Adjustment:

- Loosen the lock nut while holding the adjustment cap in place.
- While running the actuator in 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 lb·in (11 N·m) and test set pressure.

O.4 Spring Change:

- Loosen the lock nut.
- Unthread the adjustment cap.
- Replace the spring.
- Replace the adjustment cap.
- Follow the adjustment procedure (O.3), above.

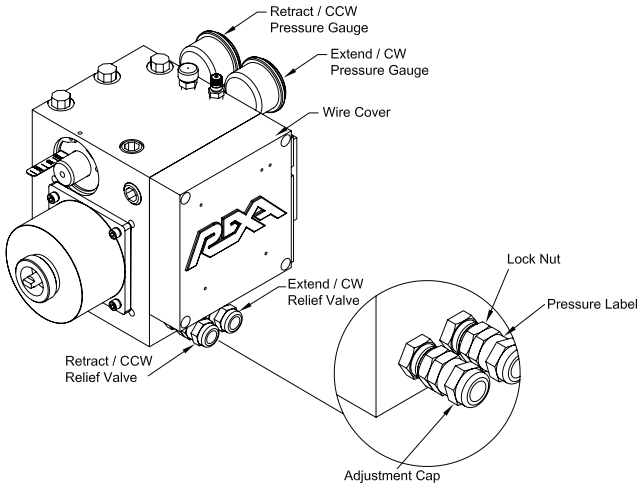


Figure O.2 Pressure Relief Valve

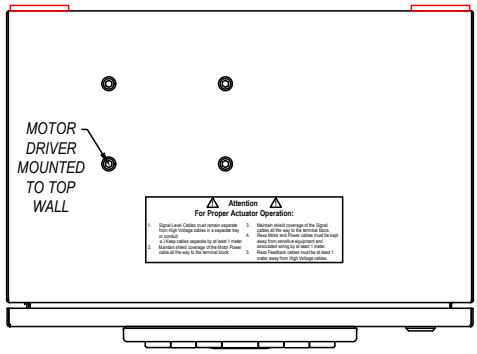
P. Control Enclosure Drawings & Interconnect Diagrams

B and C Stepper Enclosure Diagram

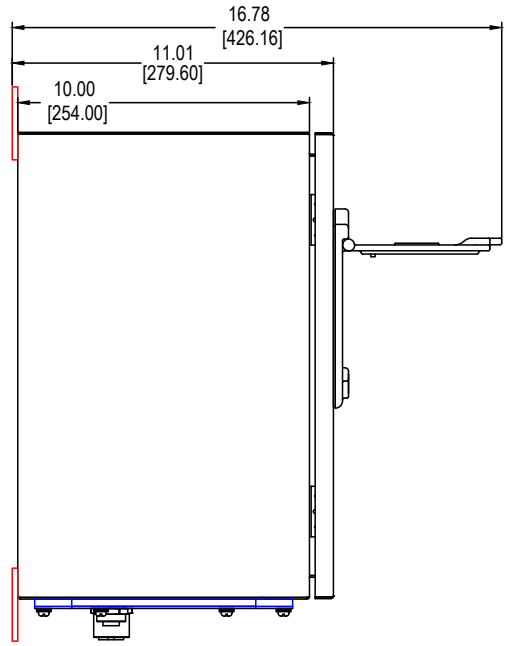
STANDARDS
- UL 508 Type 3R, 4, 4X and 12
- CSA Type 3R, 4, 4X and 12
- Complies with
  - NEMA 3R, 4, 4X, 12 and 13
  - IEC 60529, IP 66

CONSTRUCTION
- Formed 316 stainless steel, 16 Gauge.
- Smooth, continuously welded seams, ground smooth.
- Formed lip on enclosure to exclude flowing liquids and contaminants.
- Door latches feature the added safety of quarter turn slot requiring use of tool for opening.
- Seamless poured-in place gasket for door cover.
- Oil resistant gaskets are permanently secured at 4 gland plate cutouts.
- Collar studs provided for mounting inner panel.
- Bonding stud provided on door and grounding stud installed in enclosure.
- Stainless steel hinge pins and quarter turns.
- Approximate Weight with Contents Installed is 45 Pounds (20.4 Kilograms).

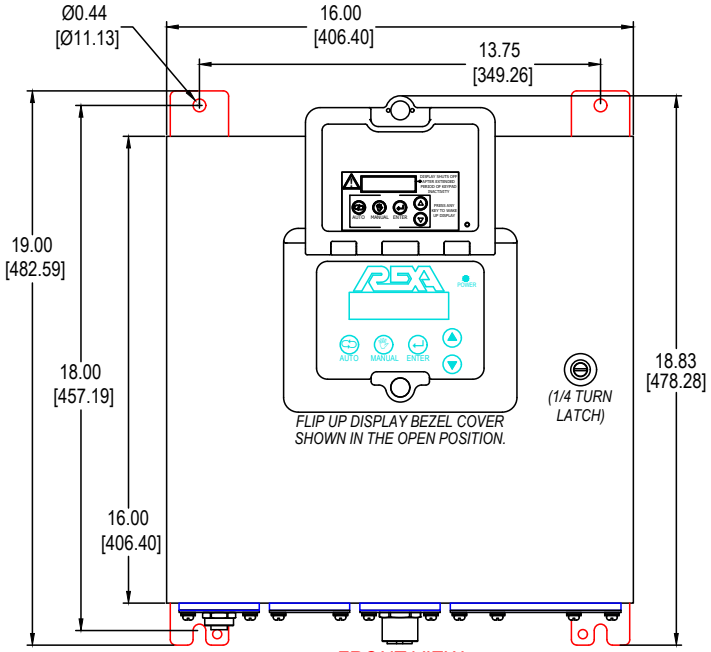
FINISH
- Cover/Enclosure & Gland Plates are natural stainless steel with a smooth brushed finish.



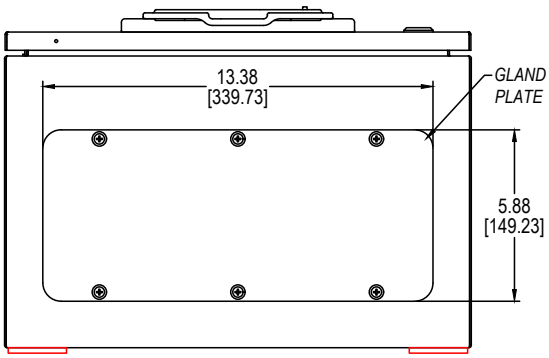
TOP VIEW



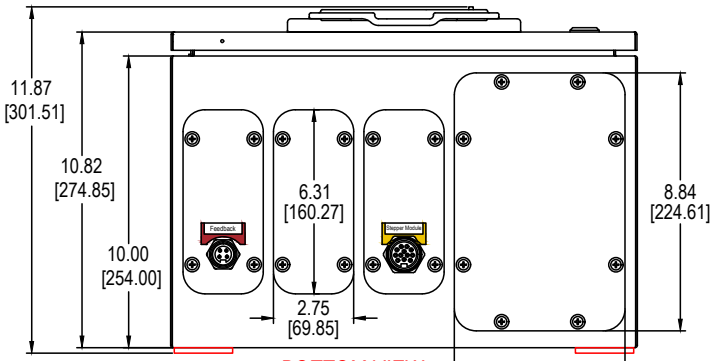
LEFT SIDE VIEW



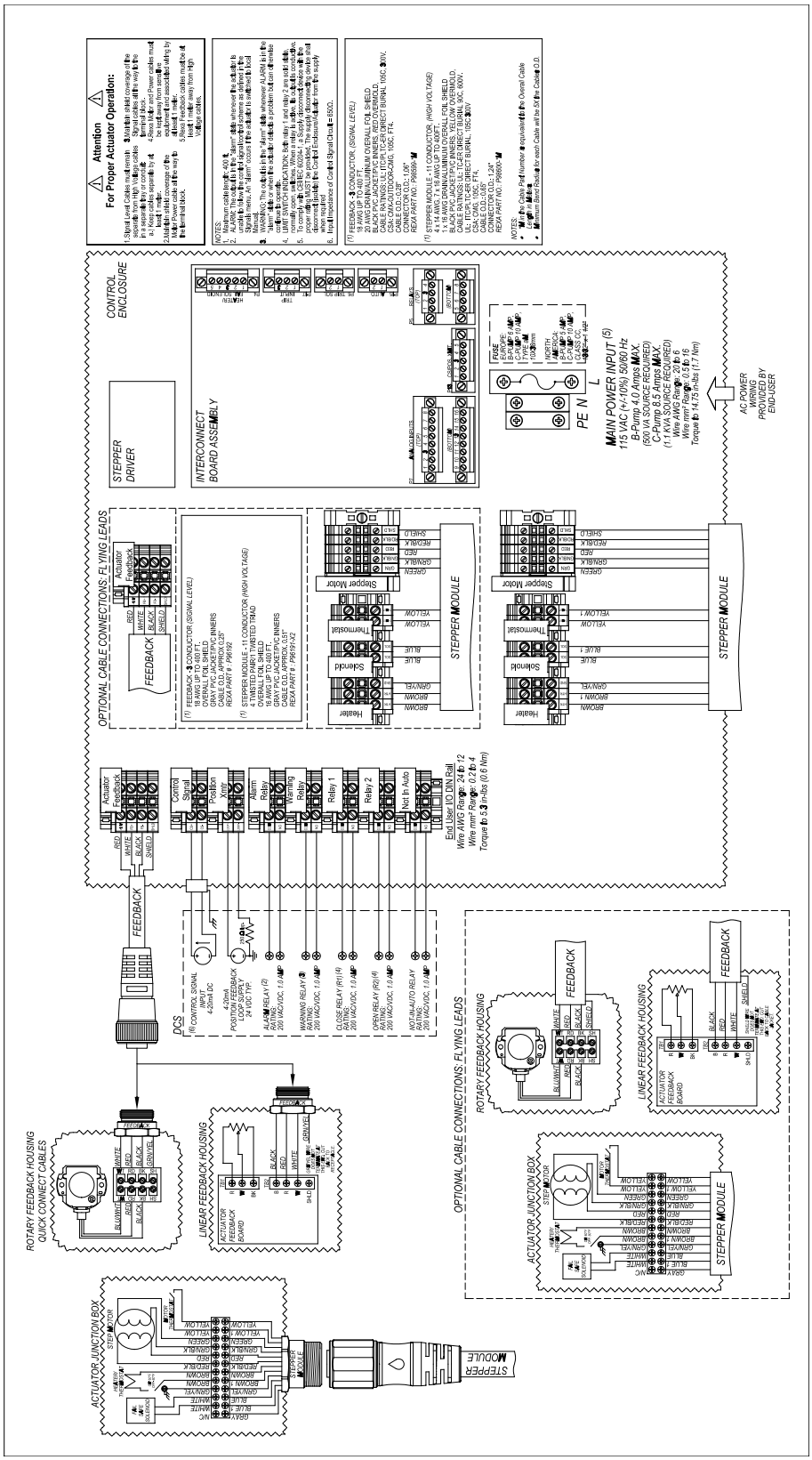
FRONT VIEW

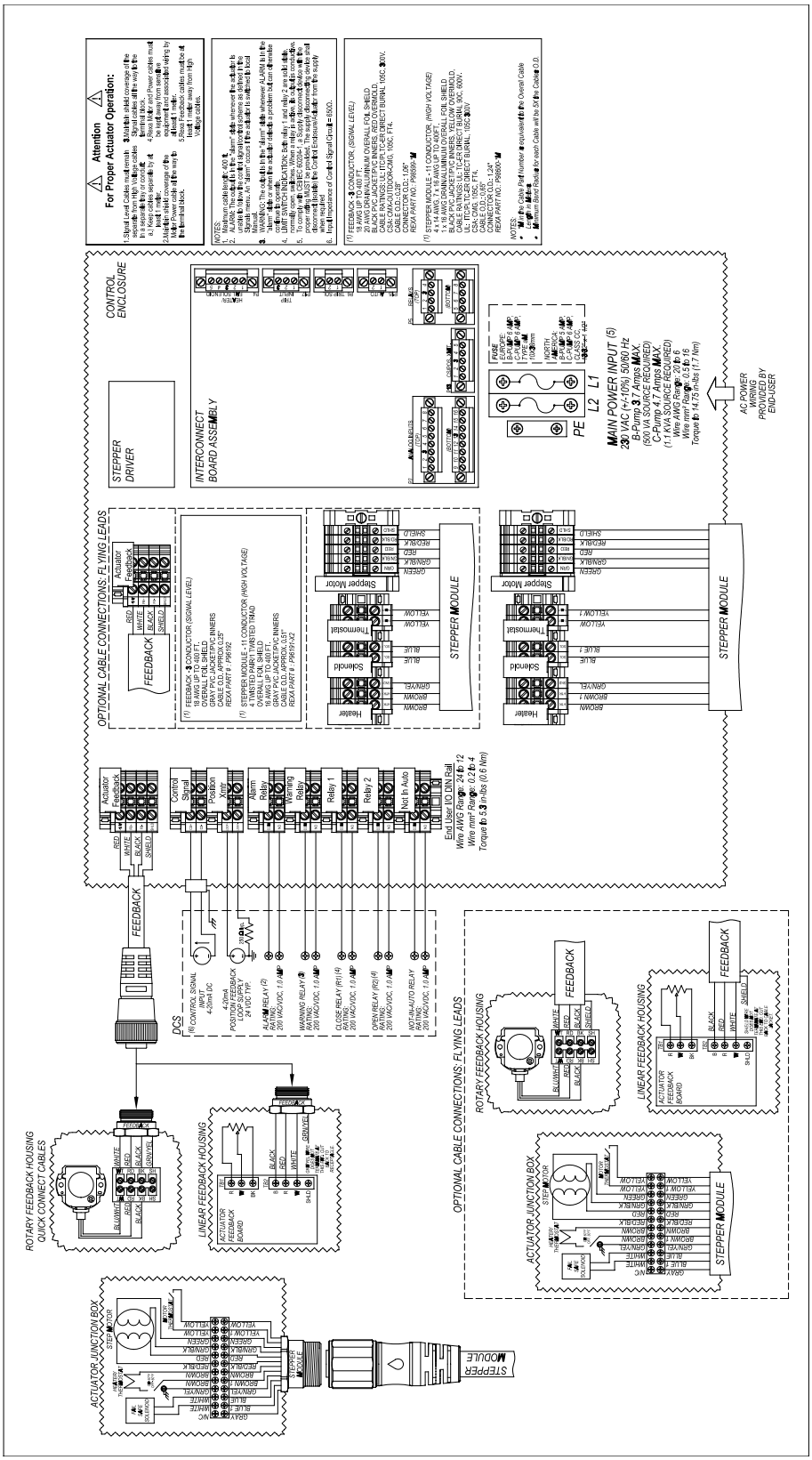


BOTTOM VIEW
No Quick Connects



BOTTOM VIEW
With Quick Connects


ACTUATOR END ONLY QUICK CONNECTS & FLYING LEADS
B and C Stepper 115 VAC Wiring Diagram
CONTROL ENCLOSURE
STEPPER DRIVER
INTERCONNECT BOARD ASSEMBLY
OPTIONAL CABLE CONNECTIONS: FLYING LEADS
MAIN POWER INPUT (5)
115 VAC (+/-10%) 50/60 Hz
AC POWER WIRING PROVIDED BY END-USER
STEPPER MODULE
Heater
Solenoid
Thermostat
Stepper Motor
FEEDBACK
ROTARY FEEDBACK HOUSING
QUICK CONNECT CABLES
LINEAR FEEDBACK HOUSING
ACTUATOR JUNCTION BOX
STEPPER MODULE
DCS
End User I/O DIN Rail
Actuator Feedback
Control Signal Position Amp
Alarm Relay
Warning Relay
Relay 1
Relay 2
Not In Auto

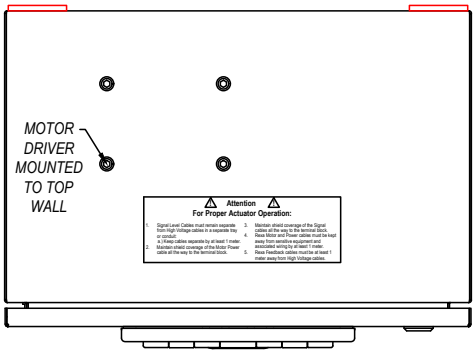

ACTUATOR END ONLY QUICK CONNECTS
& FLYING LEADS
B and C Stepper 230 VAC Wiring Diagram
CONTROL ENCLOSURE
STEPPER DRIVER
INTERCONNECT BOARD ASSEMBLY
MAIN POWER INPUT (5)
AC POWER WIRING PROVIDED BY END-USER
OPTIONAL CABLE CONNECTIONS: FLYING LEADS
STEPPER MODULE
FEEDBACK
ROTARY FEEDBACK HOUSING
LINEAR FEEDBACK HOUSING
ACTUATOR JUNCTION BOX
DCS
Heater
Solenoid
Thermostat
Stepper Motor
Actuator Feedback
Control Signal
Position Feedback
Alarm Relay
Warning Relay
Relay 1
Relay 2
Not In Auto

2C Stepper Enclosure Diagram

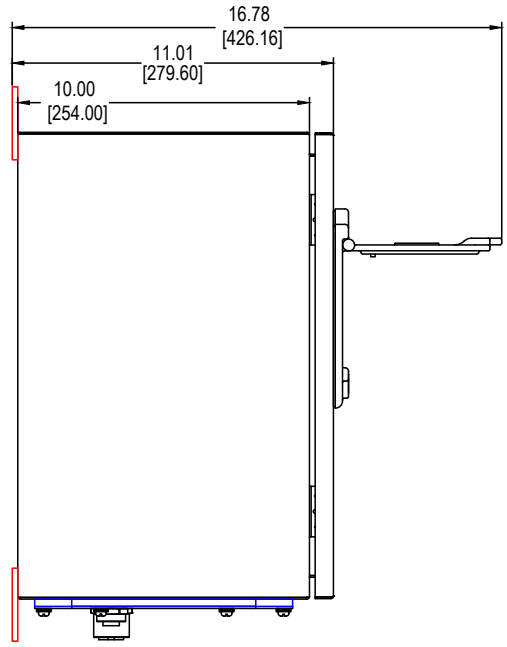
STANDARDS
- UL 508 Type 3R, 4, 4X and 12
- CSA Type 3R, 4, 4X and 12
- Complies with
  - NEMA 3R, 4, 4X, 12 and 13
  - IEC 60529, IP 66

CONSTRUCTION
- Formed 316 stainless steel, 16 Gauge.
- Smooth, continuously welded seams, ground smooth.
- Formed lip on enclosure to exclude flowing liquids and contaminants.
- Door latches feature the added safety of quarter turn slot requiring use of tool for opening.
- Seamless poured-in place gasket for door cover.
- Oil resistant gaskets are permanently secured at 4 gland plate cutouts.
- Collar studs provided for mounting inner panel.
- Bonding stud provided on door and grounding stud installed in enclosure.
- Stainless steel hinge pins and quarter turns.
- Approximate Weight with Contents Installed is 45 Pounds (20.4 Kilograms).

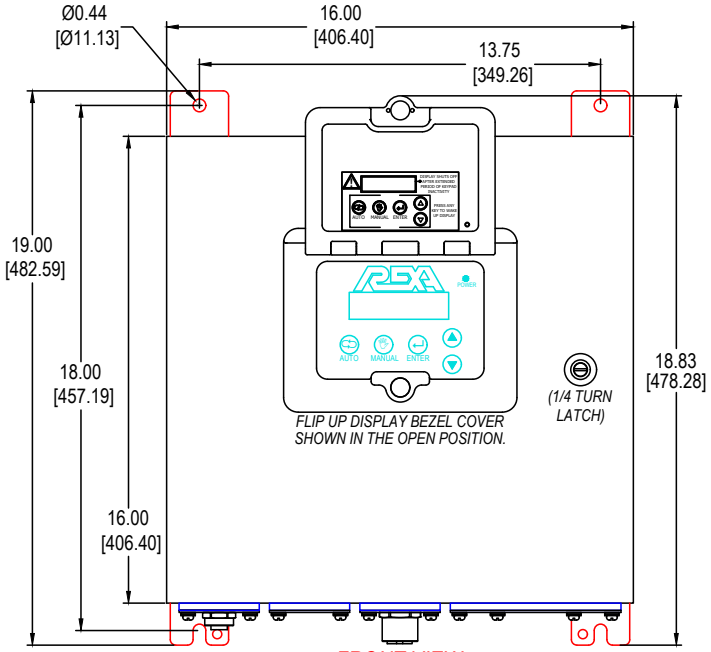
FINISH
- Cover/Enclosure & Gland Plates are natural stainless steel with a smooth brushed finish.



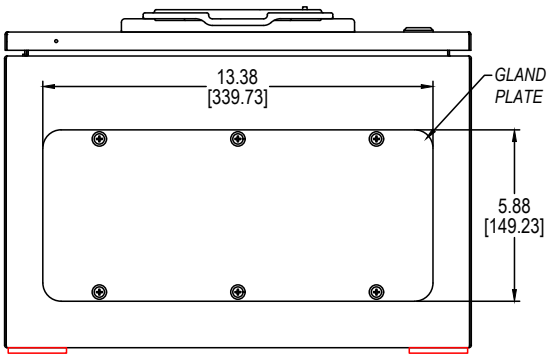
TOP VIEW



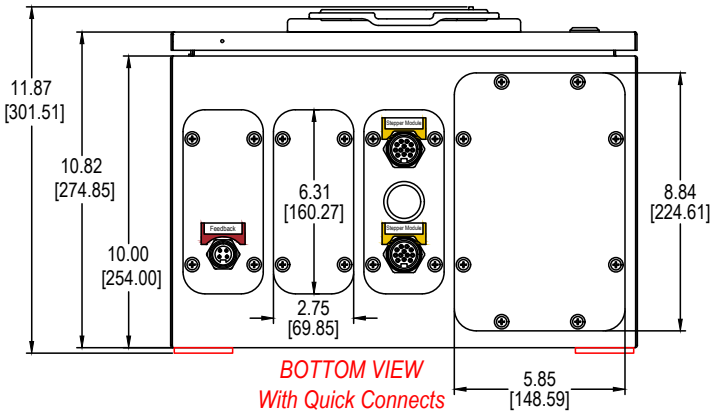
LEFT SIDE VIEW



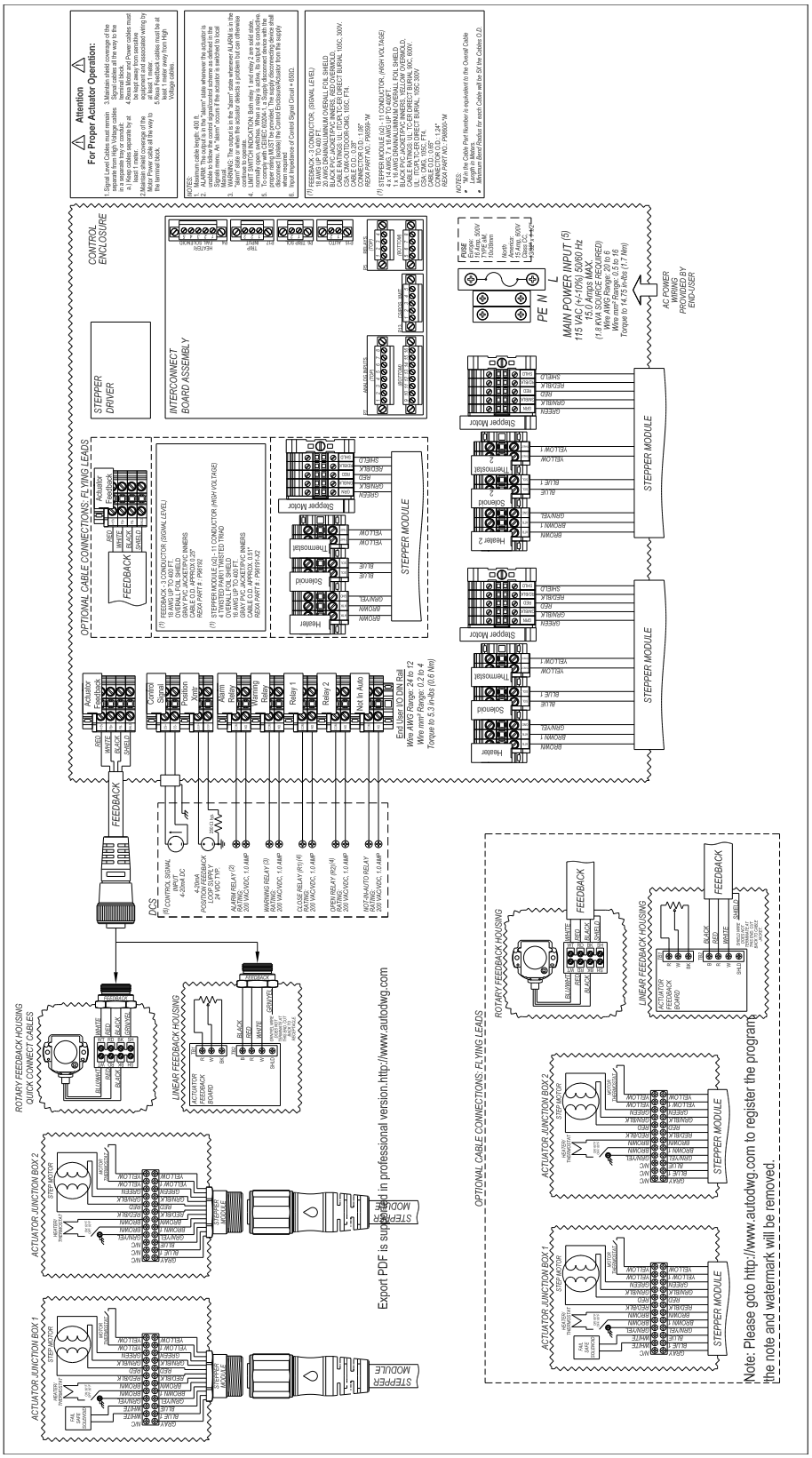
FRONT VIEW



BOTTOM VIEW
No Quick Connects



BOTTOM VIEW
With Quick Connects

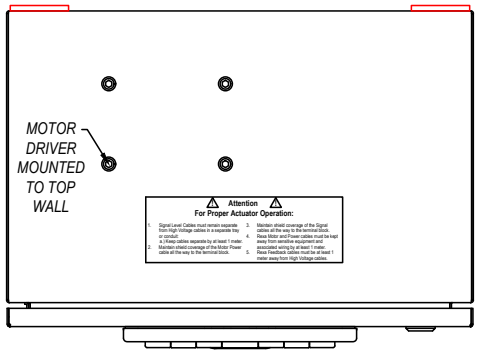

ACTUATOR END ONLY QUICK CONNECTS & FLYING LEADS
2C Stepper 115VAC Wiring Diagram
Export PDF is supported in professional version.http://www.autodwg.com
Note: Please goto http://www.autodwg.com to register the program
the note and watermark will be removed.

½D and D Servo Enclosure Diagram

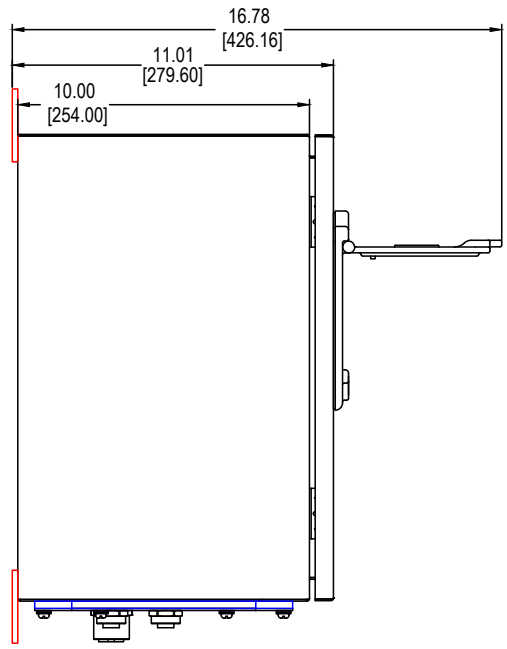
STANDARDS
- UL 508 Type 3R, 4, 4X and 12
- CSA Type 3R, 4, 4X and 12
- Complies with
  - NEMA 3R, 4, 4X, 12 and 13
  - IEC 60529, IP 66

CONSTRUCTION
- Formed 316 stainless steel, 16 Gauge.
- Smooth, continuously welded seams, ground smooth.
- Formed lip on enclosure to exclude flowing liquids and contaminants.
- Door latches feature the added safety of quarter turn slot requiring use of tool for opening.
- Seamless poured-in place gasket for door cover.
- Oil resistant gaskets are permanently secured at 4 gland plate cutouts.
- Collar studs provided for mounting inner panel.
- Bonding stud provided on door and grounding stud installed in enclosure.
- Stainless steel hinge pins and quarter turns.
- Approximate Weight with Contents Installed is 45 Pounds (20.4 Kilograms).

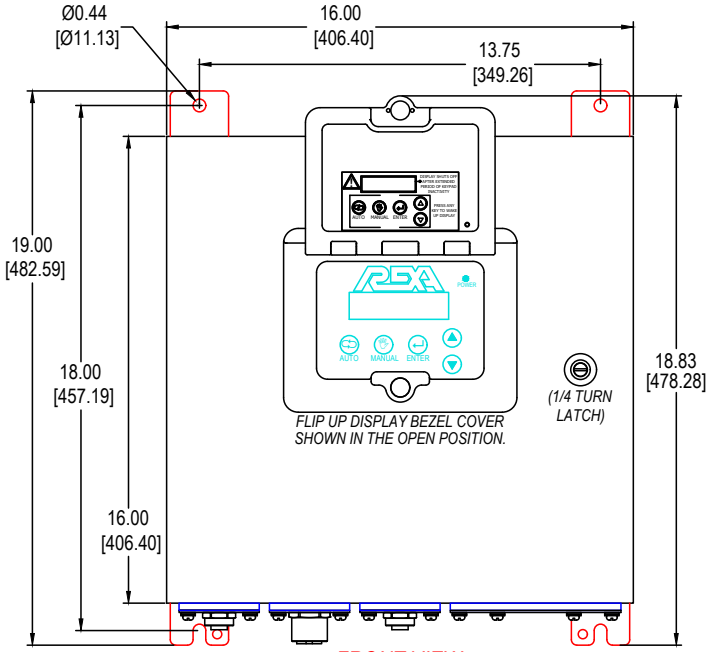
FINISH
- Cover/Enclosure & Gland Plates are natural stainless steel with a smooth brushed finish.



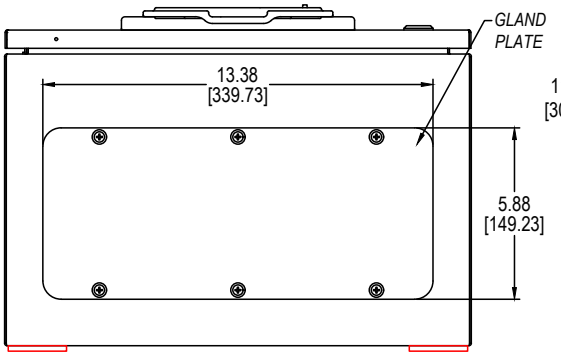
TOP VIEW



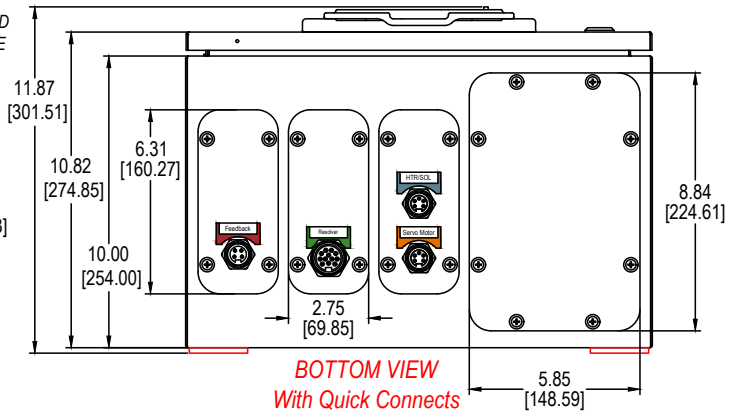
LEFT SIDE VIEW



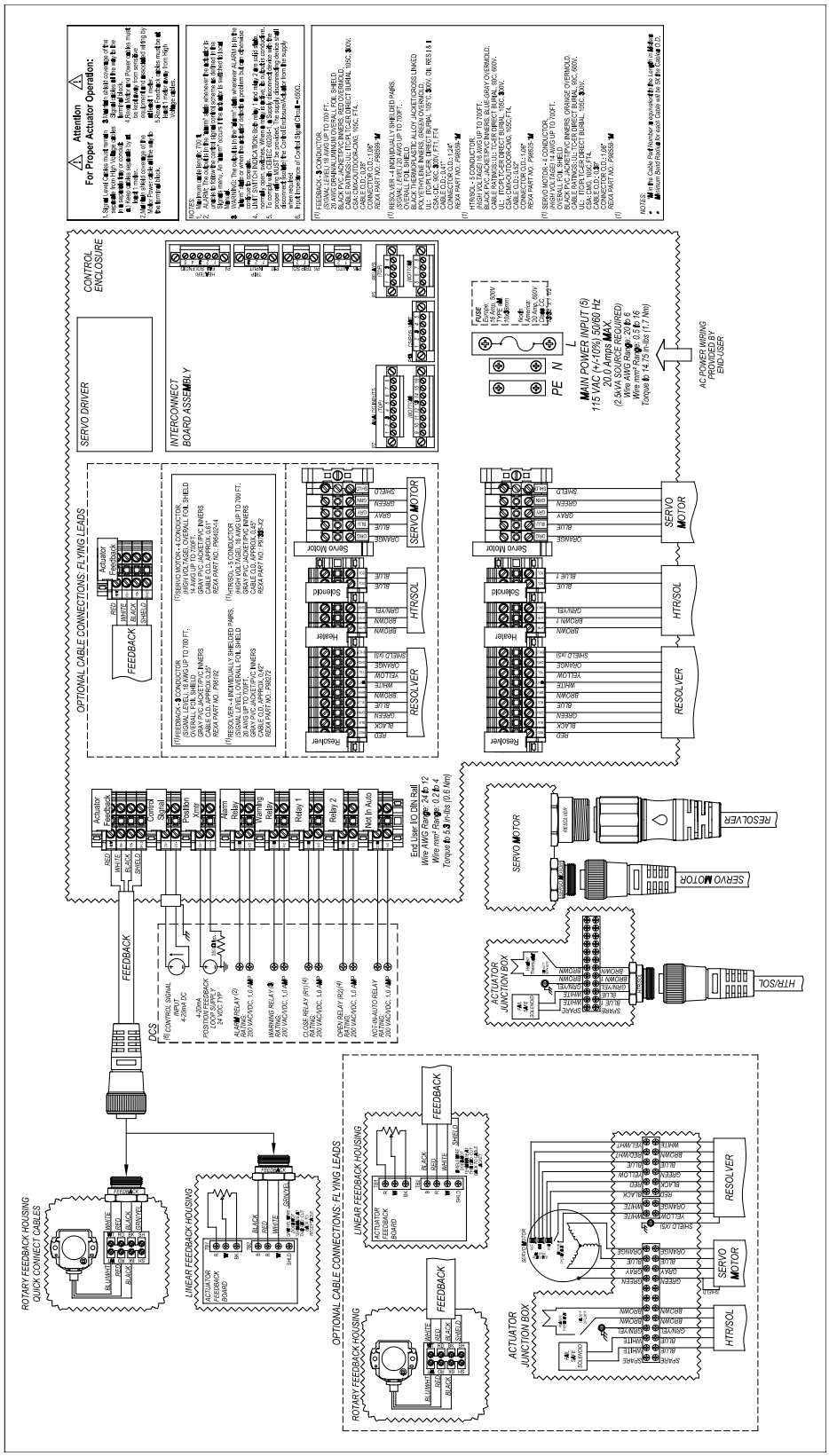
FRONT VIEW



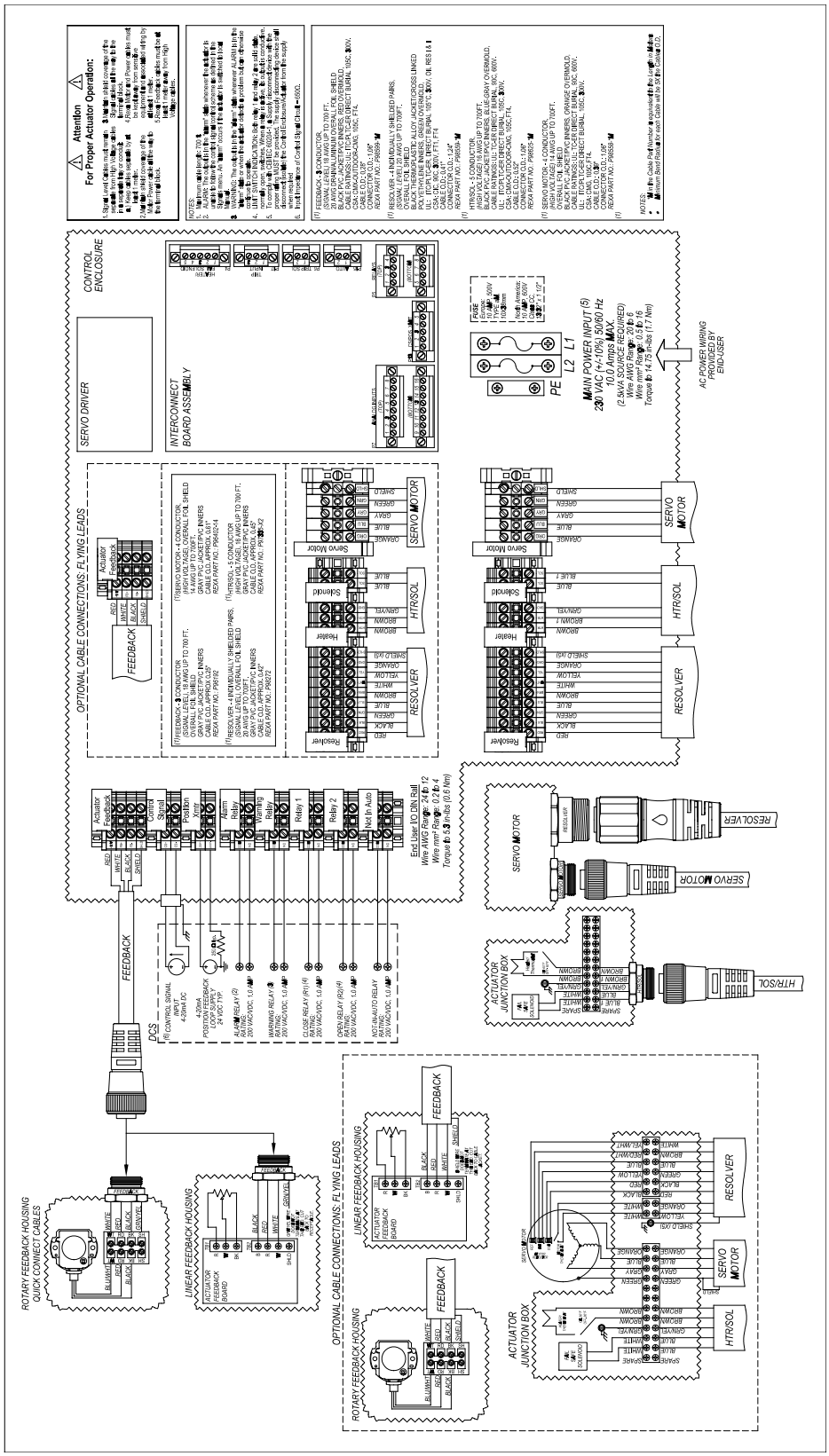
BOTTOM VIEW
No Quick Connects



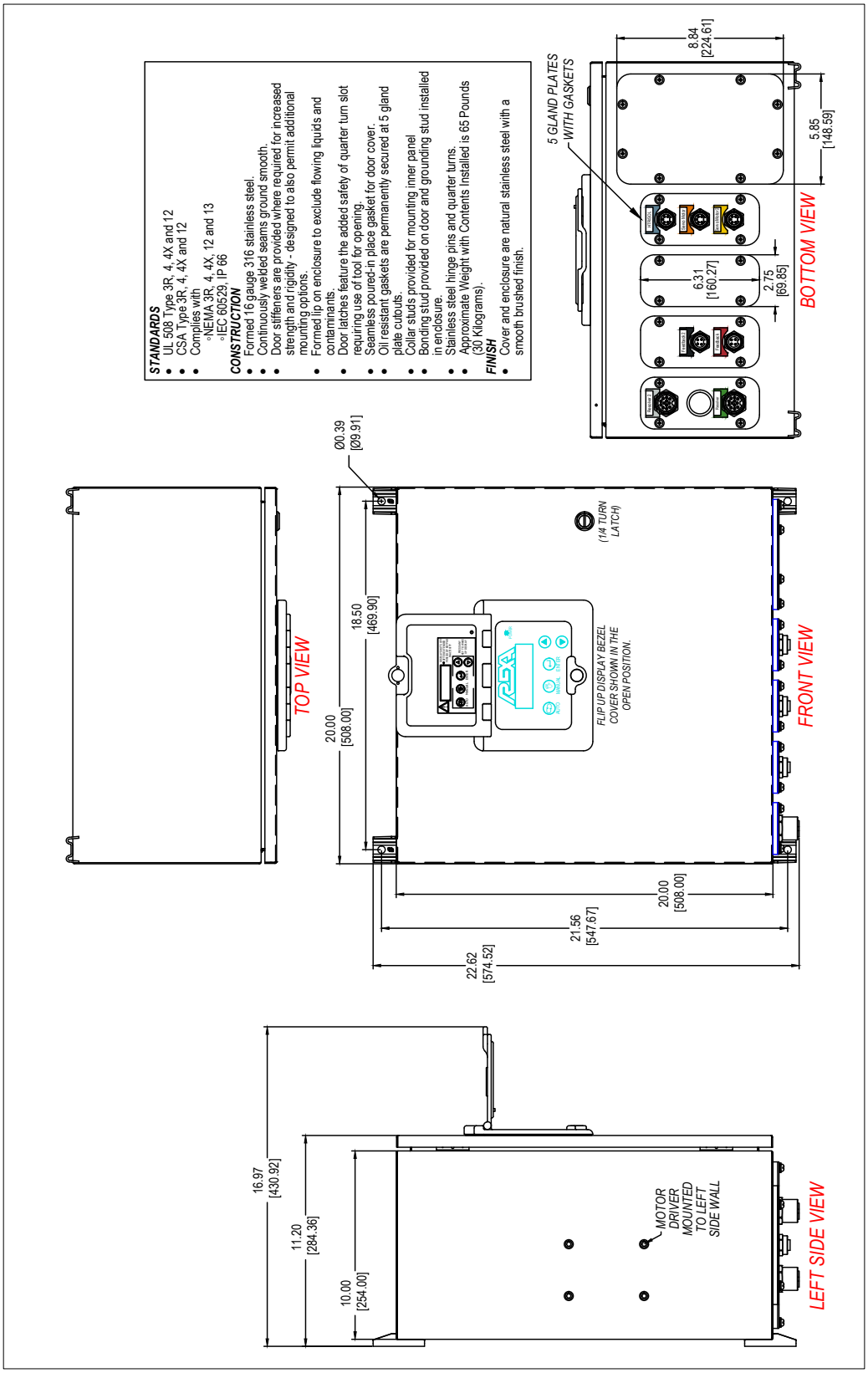
BOTTOM VIEW
With Quick Connects



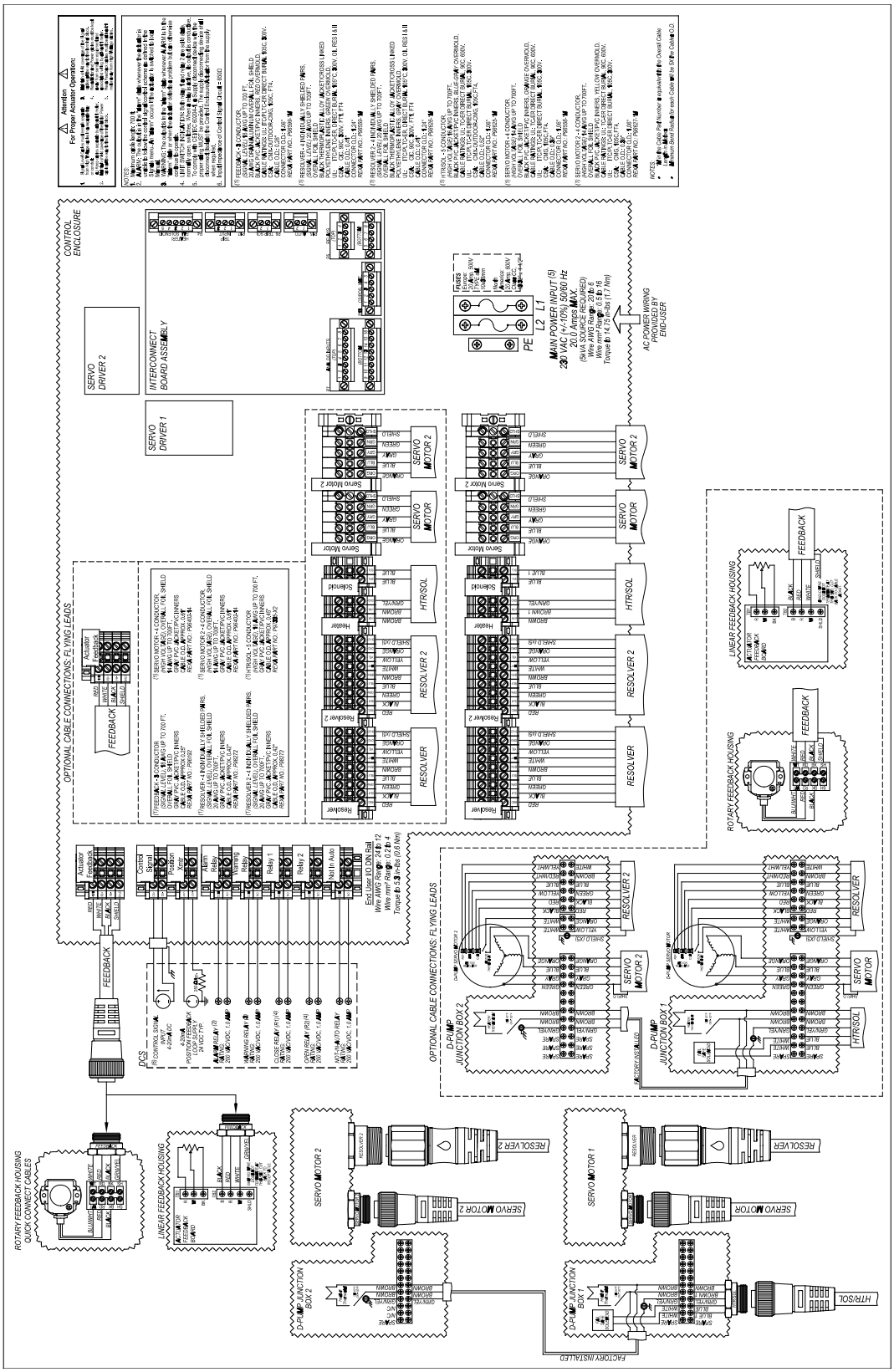
½ D Servo 115VAC Wiring Diagram

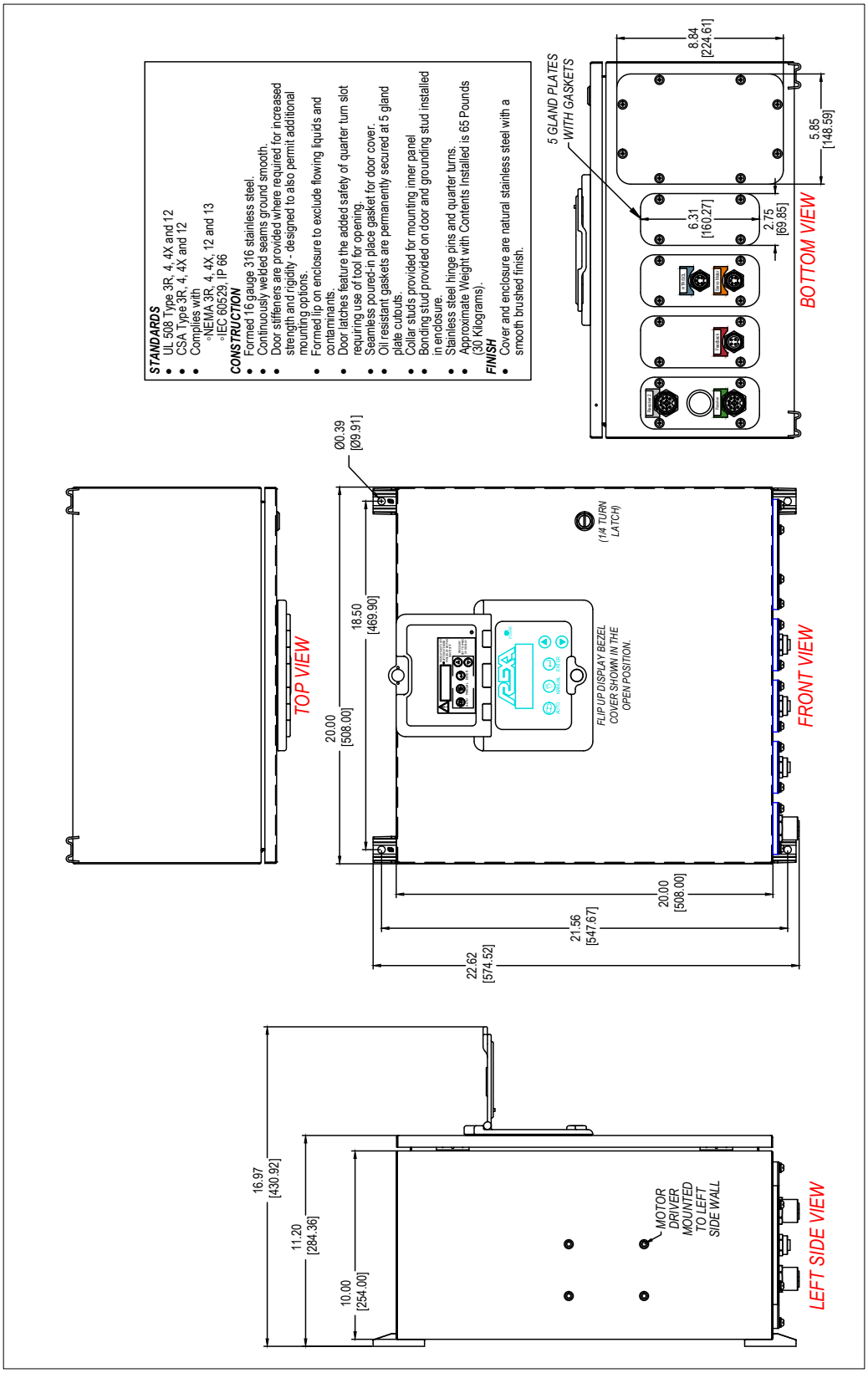


D Servo 230 VAC Wiring Diagram

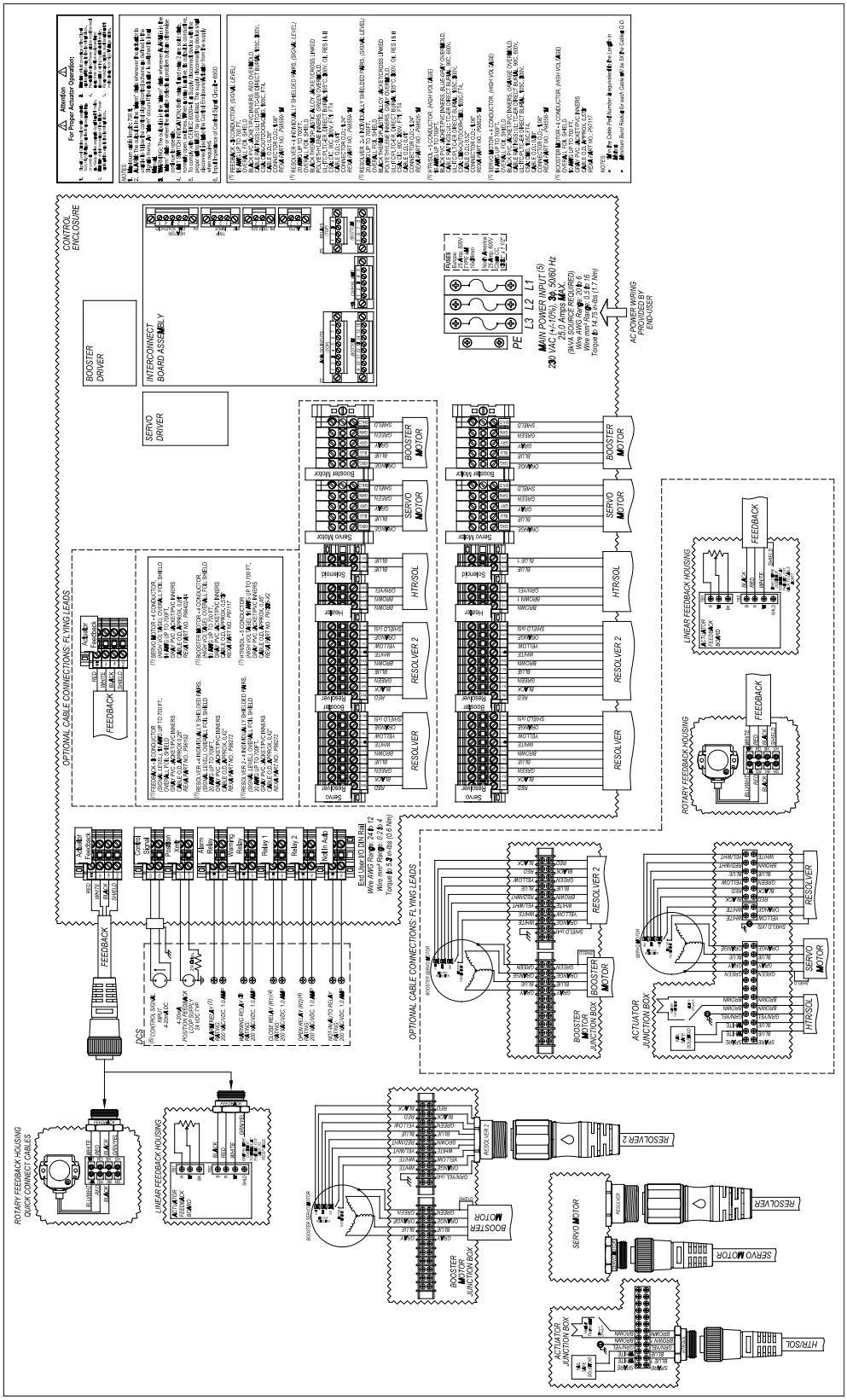


Dual ½D and D Servo Enclosure Diagram

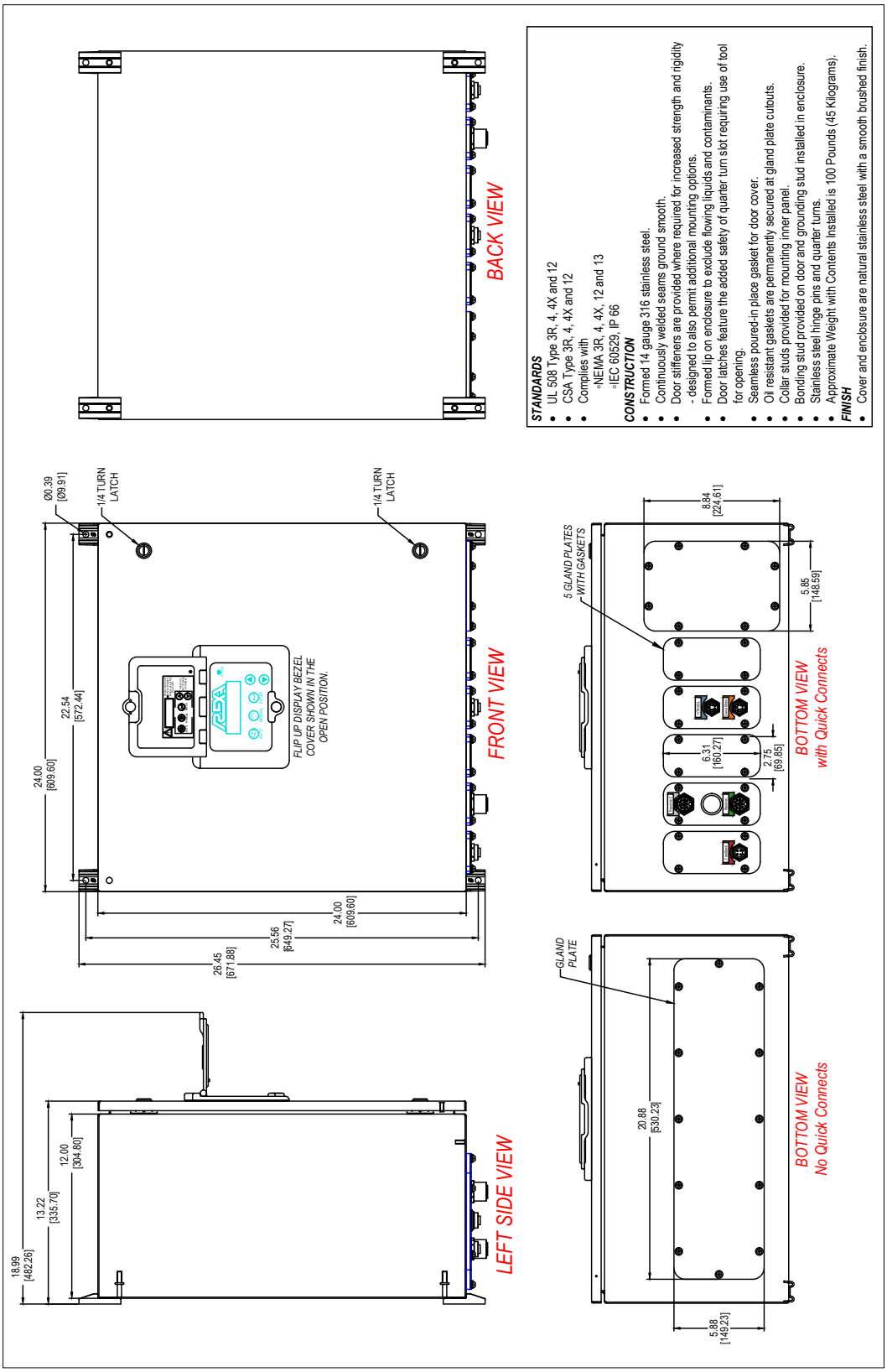

ACTUATOR END ONLY QUICK CONNECTS & FLYING LEADS
CONTROL ENCLOSURE
SERVO DRIVER 2
INTERCONNECT BOARD ASSEMBLY
SERVO DRIVER 1
OPTIONAL CABLE CONNECTIONS: FLYING LEADS
MAIN POWER INPUT (5)
230 VAC (+/-10%) 50/60 Hz
20.0 Amps MAX.
(5kVA SOURCE REQUIRED)
AC POWER WIRING PROVIDED BY END-USER
SERVO MOTOR 2
SERVO MOTOR
HTRSOL
RESOLVER 2
RESOLVER
FEEDBACK
LINEAR FEEDBACK HOUSING
ROTARY FEEDBACK HOUSING
D-PUMP JUNCTION BOX 2
D-PUMP JUNCTION BOX 1
FACTORY INSTALLED
DCS
2D Servo 230 VAC Wiring Diagram

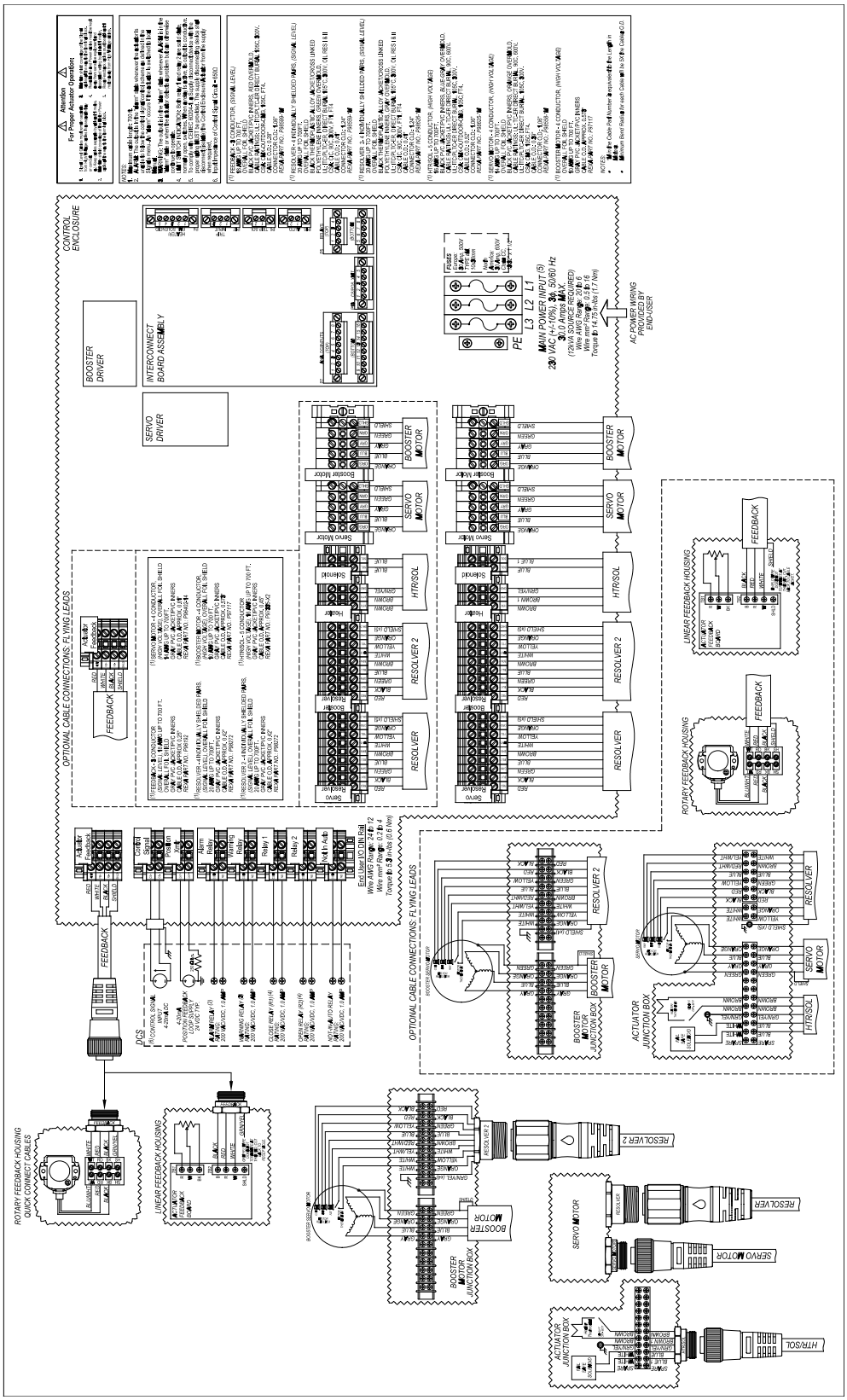


D,P9 Servo 230 VAC Enclosure Diagram


ACTUATOR END ONLY QUICK CONNECTS & FLYING LEADS
D,P9 Servo 230 VAC Wiring Diagram
CONTROL ENCLOSURE
OPTIONAL CABLE CONNECTIONS: FLYING LEADS
BOOSTER DRIVER
INTERCONNECT BOARD ASSEMBLY
SERVO DRIVER
AC POWER WIRING PROVIDED BY END-USER
FEEDBACK
RESOLVER
RESOLVER 2
HTR/SOL
BOOSTER MOTOR
SERVO MOTOR
LINEAR FEEDBACK HOUSING
ROTARY FEEDBACK HOUSING
ACTUATOR JUNCTION BOX
BOOSTER MOTOR JUNCTION BOX
QUICK CONNECT CABLES
DCS

D,P20 Servo 230 VAC Enclosure Diagram





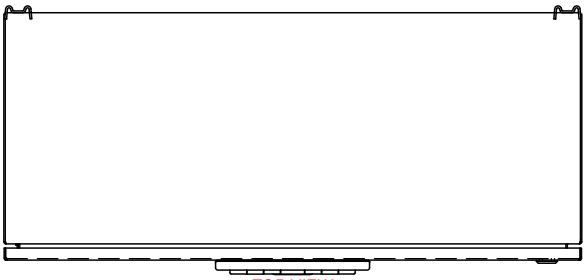
D,P20 Servo 230 VAC Wiring Diagram

D,P40 Servo 230 VAC Enclosure Diagram

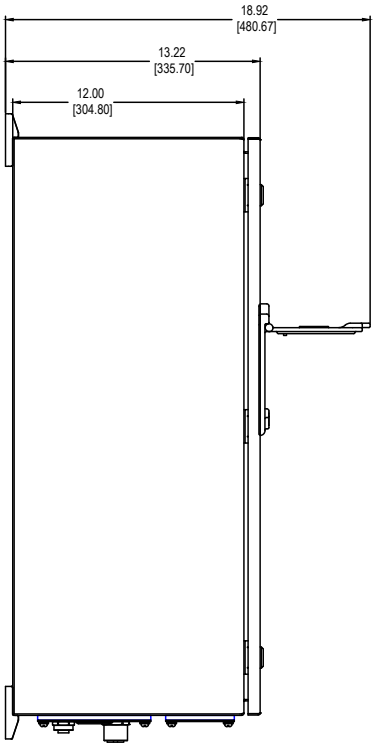
STANDARDS
- UL 508 Type 3R, 4, 4X and 12
- CSA Type 3R, 4, 4X and 12
- Complies with
  - NEMA 3R, 4, 4X, 12 and 13
  - IEC 60529, IP 66

CONSTRUCTION
- Formed 14 gauge 316 stainless steel.
- Continuously welded seams ground smooth.
- Door stiffeners are provided where required for increased strength and rigidity - designed to also permit additional mounting options.
- Formed lip on enclosure to exclude flowing liquids and contaminants.
- Door latches feature the added safety of quarter turn slot requiring use of tool for opening.
- Seamless poured-in place gasket for door cover.
- Oil resistant gaskets are permanently secured at 6 gland plate cutouts.
- Collar studs provided for mounting inner panel.
- Bonding stud provided on door and grounding stud installed in enclosure.
- Stainless steel hinge pins and quarter turns.
- Approximate Weight with Contents Installed is 191 Pounds (87 Kilograms).

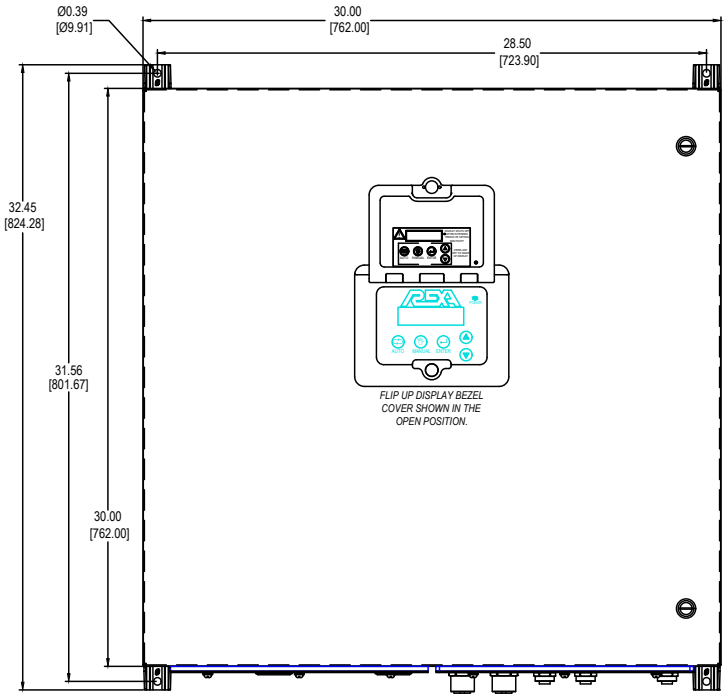
FINISH
- Cover and enclosure are natural stainless steel with a smooth brushed finish.



TOP VIEW

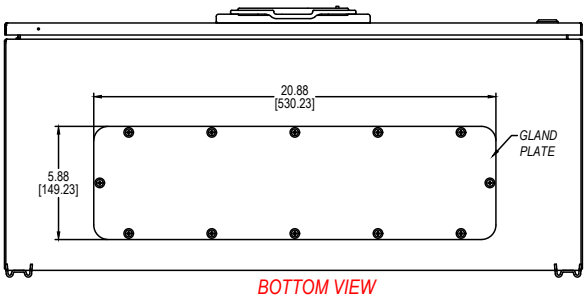


LEFT SIDE VIEW

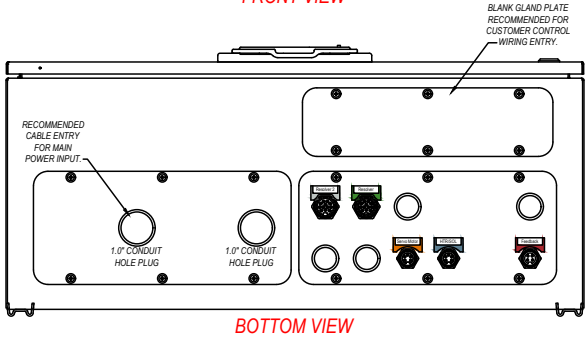


FLIP UP DISPLAY BEZEL COVER SHOWN IN THE OPEN POSITION.

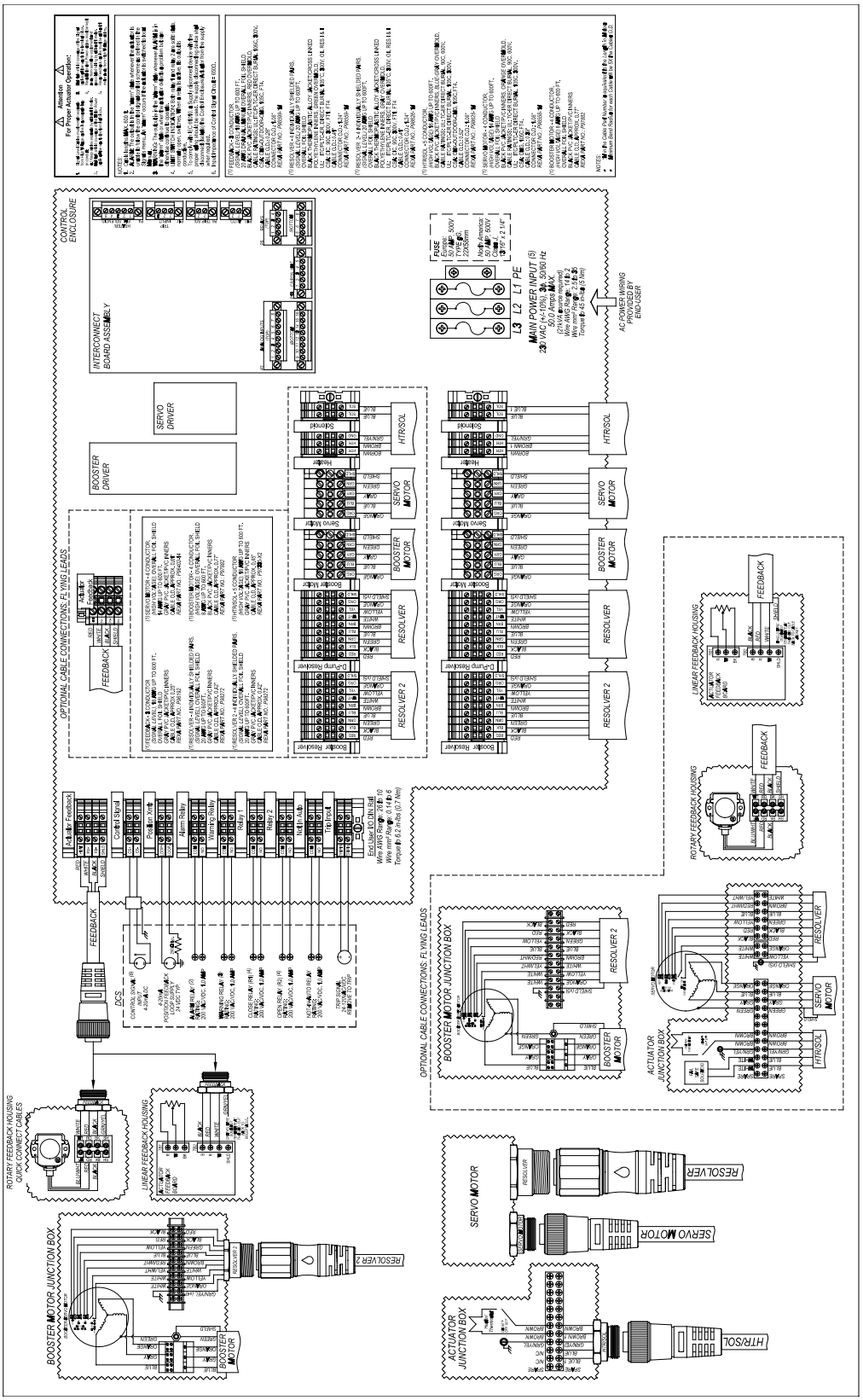
FRONT VIEW



BOTTOM VIEW
No Quick Connects



BOTTOM VIEW
with Quick Connects



D,P40 Servo 230 VAC Wiring Diagram

Q. Contact Input Options

Contact Inputs

Note: Refer to the Inputs menu, Signal Type parameter in the Modes of Operation & Control Parameters section.

Q.1 Signal Input Range

Voltage:	OFF: 0 to 8 volts, AC or DC
	ON: 22 to 120 volts, AC or DC
	Undefined: 8 to 22 volts, AC or DC
Current:	OFF: Less than 1 mA
	ON: 1.8 mA to 10 mA; proportional to voltage
Impedance:	12K ohms

Electromechanical or solid state switching devices may be used to activate the control signal. The following points should be observed:

ON state:

Most AC and many DC solid state switching devices require a minimum current flow in order 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 pulse auxiliary 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.

Q.2 1 Cont

The single contact (1 Cont) option of 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.

Note: Actuator will continue to move in desired direction as long as a signal is present or until target is reached.

Refer to certified drawing for wiring details.

Q.3 2 Cont

The dual contact (2 Cont) option of 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 input Close is active, the actuator travels towards Position Lo.

Note: Actuator will continue to move in desired direction as long as a signal is present or until target is reached.

Refer to certified drawing for wiring details.

R. Remote Manual Control

R.1 Remote Manual (RemoteMan)

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 the 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.

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

The RemoteMan mode is only accessible if the Contacts Input board is installed on top of the CPU. Refer to certified drawing for wiring details.

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.

S. Safety Manual for ESD SIL Compliance

S.1 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 insure 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 found in the REXA report KOS 13-10-03 R0001, titled FMEDA REXA, Xpac. An example of the system and application environment in which the product will be embedded once delivered is shown in the following drawing.

S.2 System Set Up

In order to properly set up the ESD control system the following measures must be taken:

1. The actuator must to 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.

S.3 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.

3.1. The safety solenoids defined on the hydraulic schematic must be wired directly into the main safety system. It is possible for the REXA controller to control these solenoids but in order to minimize the number of components in the safety loop they must be wired directly into the safety system for SIL applications.

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

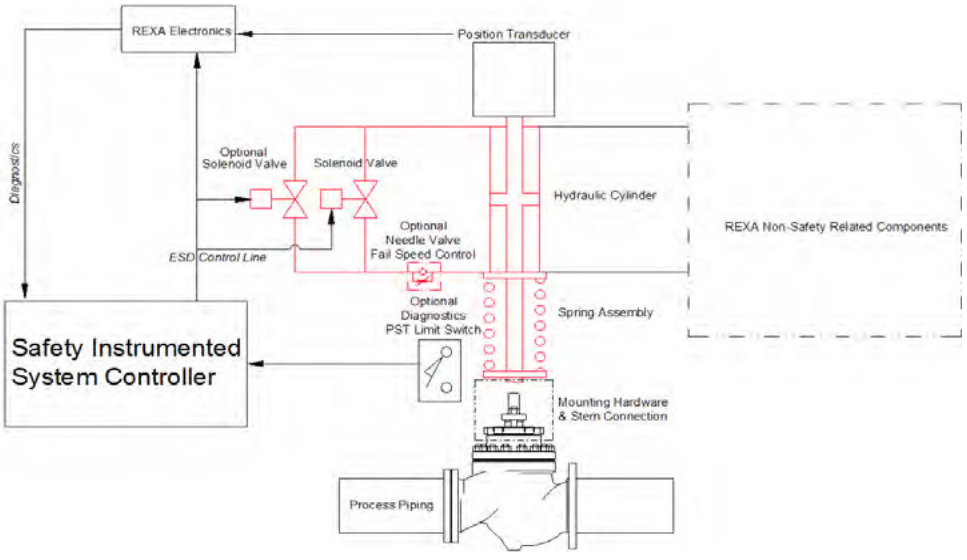


Figure S-1: Example Safety Instrumented Function

3.3. This system is designed to full stroke at the rate shown on the provided actuator data sheet provided for this specific order.

3.4. 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.

3.5. The REXA Actuator is available in normally open or normally closed ESD configurations.

3.6. A 24 hour mean time to repair should be assumed for safety availability calculations.

S.4 Safety Critical Components

4.1. Definition - Some of the components on this actuator are identified as safety critical. If the failure of any component would inhibit the safety function of this REXA Actuator it is deemed a Safety critical component.

4.2. Only OEM supplied replacement parts can be used as suitable replacement parts for any component identified as Safety critical.

4.3. This actuator was supplied to meet a strict number of specifications and may not be modified in the field.

S.5 System Diagnostics

5.1. Built into the REXA CPU 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 alarmed feature that would indicate the system may not perform its intended trip function is the stall alarm.

5.1.1. Stall Alarm – If the actuator fails to move 1%, within the adjustable stall time setting, while positioning thealarm relay will open indicating an alarm event.

5.1.2. Partial stroke testing is performed to verify the actuator is capable of performing it's 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 insure the actuator actually 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:

5.1.3. Verification from the REXA position transmitter that the actuator followed the change in the control position and performed its PST function.

5.1.4. Redundant verification from an optional PST limit switch can be provided, this limit switch needs to be wired directly into the SIS system.

5.2. The test results are to be recorded and stored for the life of the product.

5.3. Strict adherence to this manual will ensure this system will function as designed.

S.6 Site Acceptance Test Procedures

A cognizant engineering 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.

6.1. Run the actuator open and verify stroking times meet the specification sheet.

6.2. Run the actuator close and verify stroking time meet the specification sheet.

6.3. Perform an ESD trip and verify stroking time meet the specification sheet.

6.4. Run the actuator to it's PST position to verify position feedback and the optional PST limit switch is functioning properly.

S.7 Environmental Requirements

7.1. The actuator has been designed and verified to withstand the worse case environmental conditions as listed in this IOM.

T. Position Transmitter

T.1 Position Transmitter

The position transmitter provides a two-wire 4-20 mA signal that is proportional to actuator position. The transmitter's output is optically isolated from the electronics. Both an active and passive transmitter are available. A passive position transmitter is similar to other two-wire transmitters in that an external dc power source is required. An active two-wire transmitter with its own 24 Vdc power supply is available.

Note: Position feedback can be changed in the field from active to passive or passive to active by rewiring the feedback. Refer to certified drawing for wiring details.

Refer to OUTPUTS Menu (6.1.8) in Modes of Operation & Control Parameters for calibration procedures.

	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	

Whenever the actuator is unable to follow the applied control signal, the Alarm Relay will change state (de-energize).

Alarm Relay:

Response: ½ second of any "fail to operate condition"

Alarm Contacts: SPST

Rating: 1 amp @ 30 Vdc, 0.3 amp @ 120 Vac - resistive

Connection: Terminal strip on the auxiliary board

U. Electronic Relays
Limit Switch, Alarm, and Warning

Electronic Relays

The electronic limit, not in auto, alarm and warning relays are located on the interconnect board. An indicator LED shows the status (energized-ON) of each relay.

Two of the relays are configured in the Setup Mode to activate upon user defined stroke limits. The third relay is an alarm indicator and the fourth is a warning indicator. The fifth indicates the system is not in auto mode.

U.1 Limit Switch Relays

LED D6 will illuminate when the Relay 1 is active; indicating the actuator position is at, or below, the value set in parameter Relay 1.

LED D10 will illuminate when the Relay 2 is active; indicating the actuator position is at, or above, the value set in parameter Relay 2.

U.2 Alarm and Warning Relay

LED's D12 and D16 on the interconnect board are always active and lit when the actuator operates normally without any error and is following the control signal. Once the actuator detects an error, the Alarm and Warning Relays open and LEDs D12 and D16 will turn off.

When the CPU detects an error, which opens the Warning Relay only, LED D16 will turn off. The Warning relay is a signal from the control enclosure that means the REXA CPU detects a problem but can still operate and follow the Control Signal.

The Alarm relay is a signal from the control enclosure that means the REXA CPU detects a problem, and cannot follow the Control Signal.

When the system is put into Local or Setup modes, LED D8 will turn off.

If PST is configured to PST confirm (from GUI only), the LED D8 is ON until PST cycle is active. When PST cycle reaches the PST target the LED turns off, then illuminates when the actuator has motored back to 100% position.

Refer to certified drawing for warning alarm and relay wiring details.

General Specifications	
Quantity:	4 (2 Limit, 1 Warning, 1 Alarm)
Type	High Capacity PhotoMOS Relay
Rating	1 amp @ 200 VAC/VDC
Turn On Time:	<3 mS
Differential Travel (Hysteresis):	0.1%
Connection:	Terminal strip on the CPU board

X. Cable Installation Guide for Power and Control Cables

Note: Information within this document is based on best practices. For complete installation guidelines, standards, and restrictions please consult applicable electrical code for the region of installation.

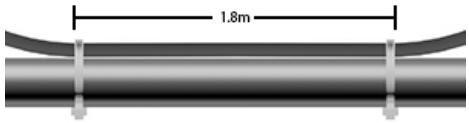
X.1 Connector Installation

Our connectors are designed to be able to be connected by hand and meet the rated ingress protection for the product. We do not recommend the use of a wrench with our products for tightening unless it is a torque wrench with the proper torque setting.

Recommended torque for tightening Mini 7/8" + 1" connectors: 2 Nm

X.2 Cable Support

Cables should be supported to prevent movement on 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.



X.3 Proper Bend Radius

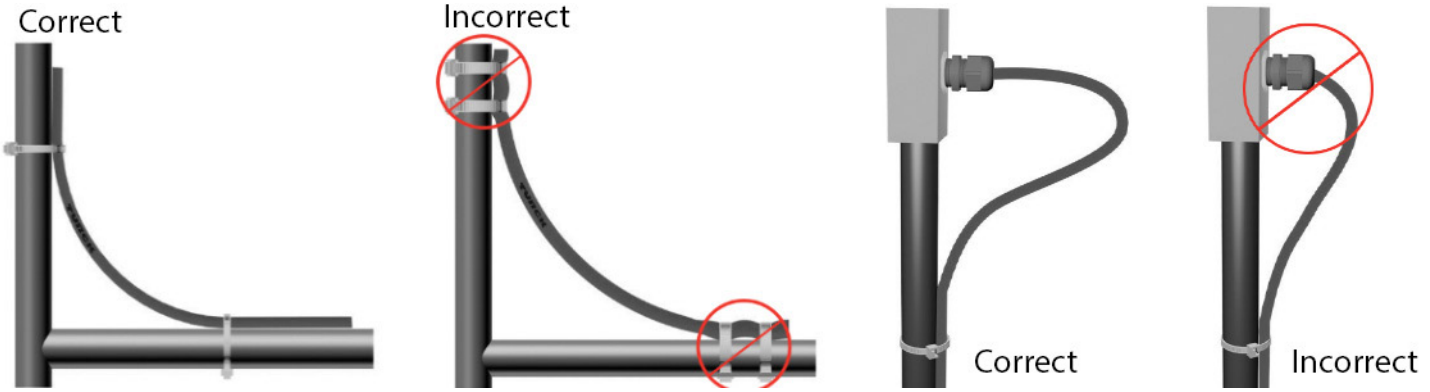
Minimum bend radius for Fixed Applications: Standard cable - 10x cable diameter

X.4 Tying Cables with Cable Ties

When tying 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.

X.5 Eliminating Stress Points in Cable Dress

Installing cables to allow for adequate stress loops and freedom of motion increase the life of the cables.



Y. Basis Weight Control

Y.1. Control Overview

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

24VDC decrease 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.

Y.2. 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.

Y.3. 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 moves 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%

Z. Air Ship Fill Procedures

Z.1. Accumulator Systems

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

This actuator was prepared for air transportation and required to comply with IATA's hazardous goods regulations. 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. The instructions below outline how to use compressed nitrogen to properly restore the accumulator nitrogen pressure.

Procedure:

1. Determine accumulator bottle oil capacity by tag. See Figure 1 below. Use Table 1 below to determine nitrogen volume value.

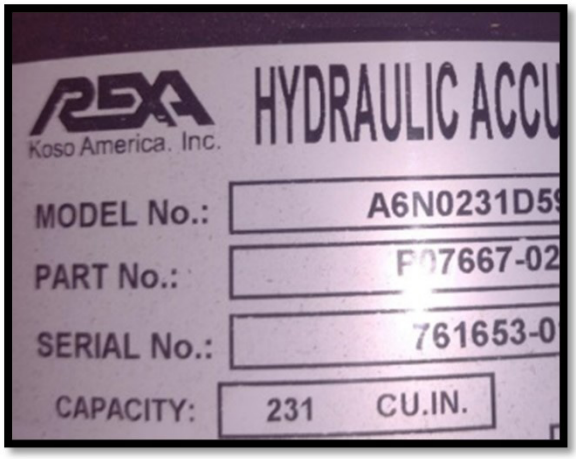


Figure 1

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)

Table 1

2. Locate and remove the gas valve guard and gas valve cap. See Figure 2 below.

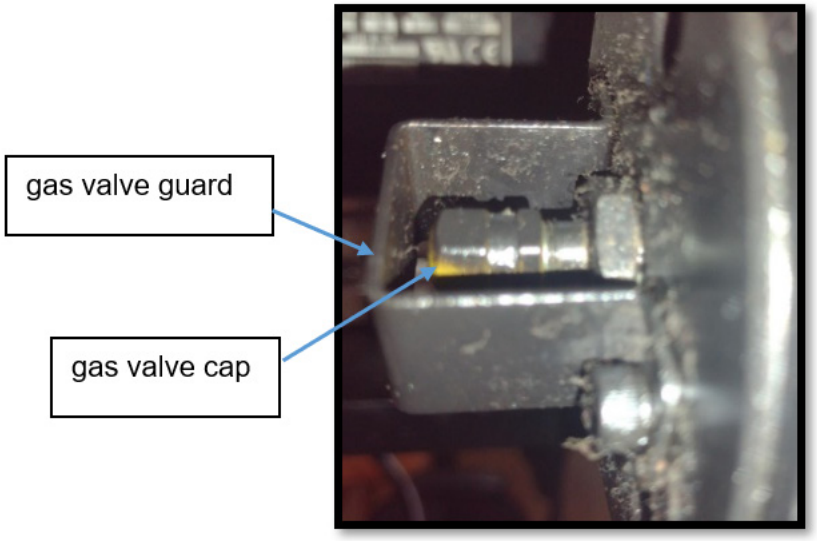


Figure 2

3. Add nitrogen using appropriate charge kit (REXA part number K09851-3000). See Figure 3 below. Using the Pre-Charging Procedure on the next page, add nitrogen until the pressure reaches what is shown on the bottle tag. See Figure 4.

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 pressure.*

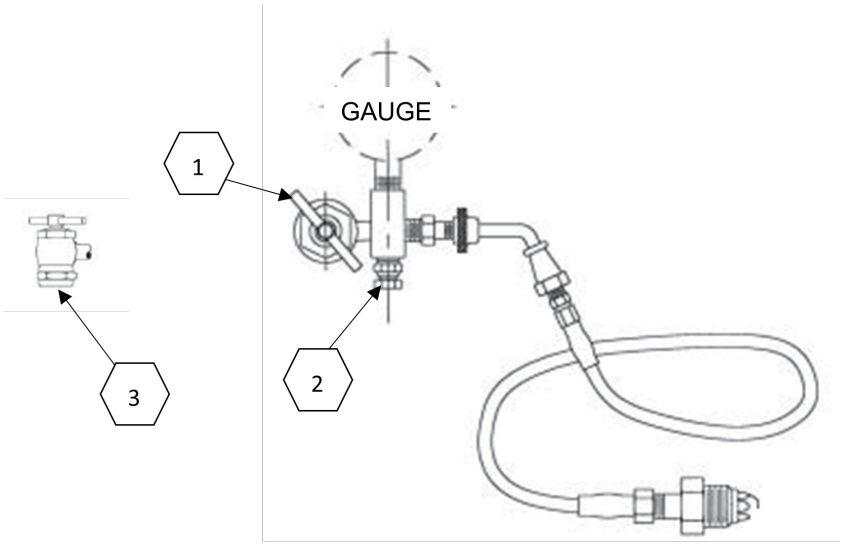


Figure 3

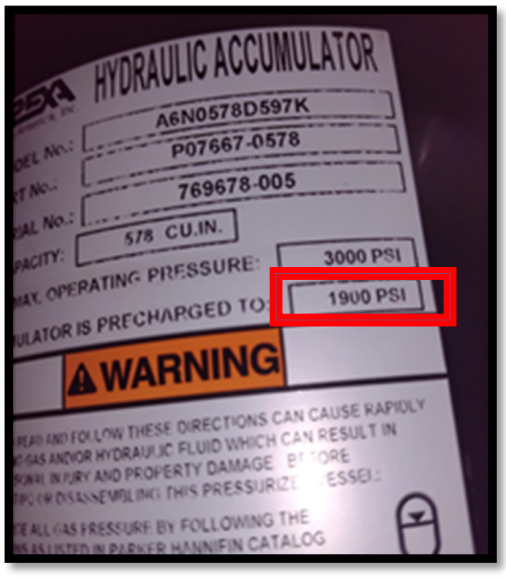


Figure 4

Pre-charging Procedure:

- Back out the gas chuck "T" handle (Figure 3: Item 1) all the way (counter-clockwise) before attaching charging assembly to accumulator gas valve.
- Close the bleed valve (Figure 3: Item 2)
- Attach swivel nut (Figure 3: Item 3) to gas valve and tighten (10-15 in. lb. [11.5-17 cm kg]). 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.
- For the gas valve shown in Figure 6, 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.*
- Open the nitrogen bottle valve and slowly fill accumulator. Shut off when gauge indicates desired pre-charge.
- Let the pre-charge set for 10 to 15 minutes. 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 rubber valve seat.
- When finished pre-charging the accumulator, turn "T" handle all the way out on the gas chuck (Figure 3: Item 1), then open the bleed valve (Figure 3: Item 2).

For the gas valve as shown in Figure 6, with a wrench, tighten hex nut at point "D" to close internal poppet (5-8 ft. lbs. [5.7-9.2 cm kg]).

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

Replace the gas valve cap (10-15 in. lbs. [11.5-17 cm kg]) and valve guard. (The gas valve cap serves as a secondary seal.)

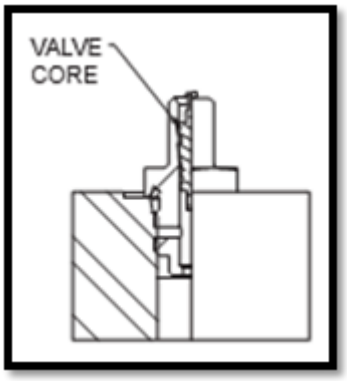


Figure 5

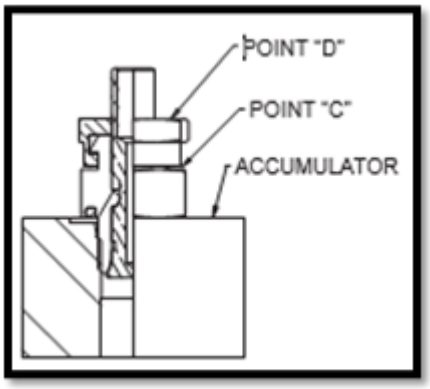


Figure 6

Z.2. Oil Fill Procedure

This actuator was prepared for air transportation and was required to comply with ITAR's hazardous goods regulations. The internal thermal expansion tank pressure was dropped to 20 PSI. This needs to be filled back up to 75 PSI using REXA's standard oil, Castrol SAE 5W-50 motor oil. If 5W-50 is not available, other oils may be substituted*. However, using other oils may result in a derating of the actuator low and/or high temp rating. Refer to table 1 below

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 Castrol 5W-50 no substitutes are allowed.

Procedure:

1. Locate and remove the oil fil valve cover.

Figure 1

2. Fill the oil gun.

Figure 2

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

Figure 3

4. Depress the small valve in the center of the female Schrader fitting (on the oil pump) with a suitable tool such as a small screwdriver or punch. Continue until oil flows freely without any signs of air bubbles.

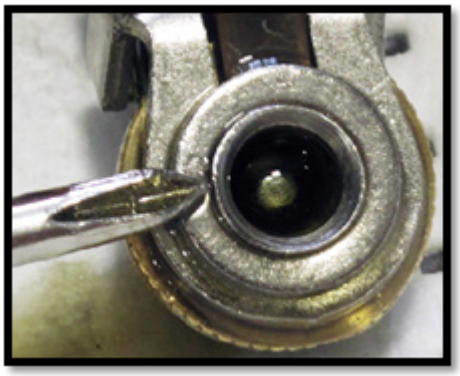


Figure 5A

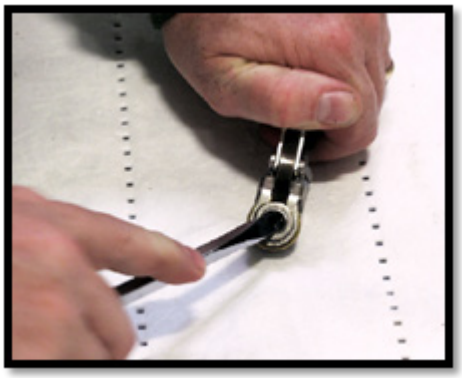


Figure 4B

5. Attach the oil gun fitting to the actuator oil fill valve

Figure 5

6. Add oil until the thermal expansion chamber gauge reads within 70-80PSI.

Figure 6

7. Remove the oil gun fitting from the actuator fill valve.

8. Reinstall the fill valve cover on the actuator.

9. Drain and store the oil gun in a clean location.

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.