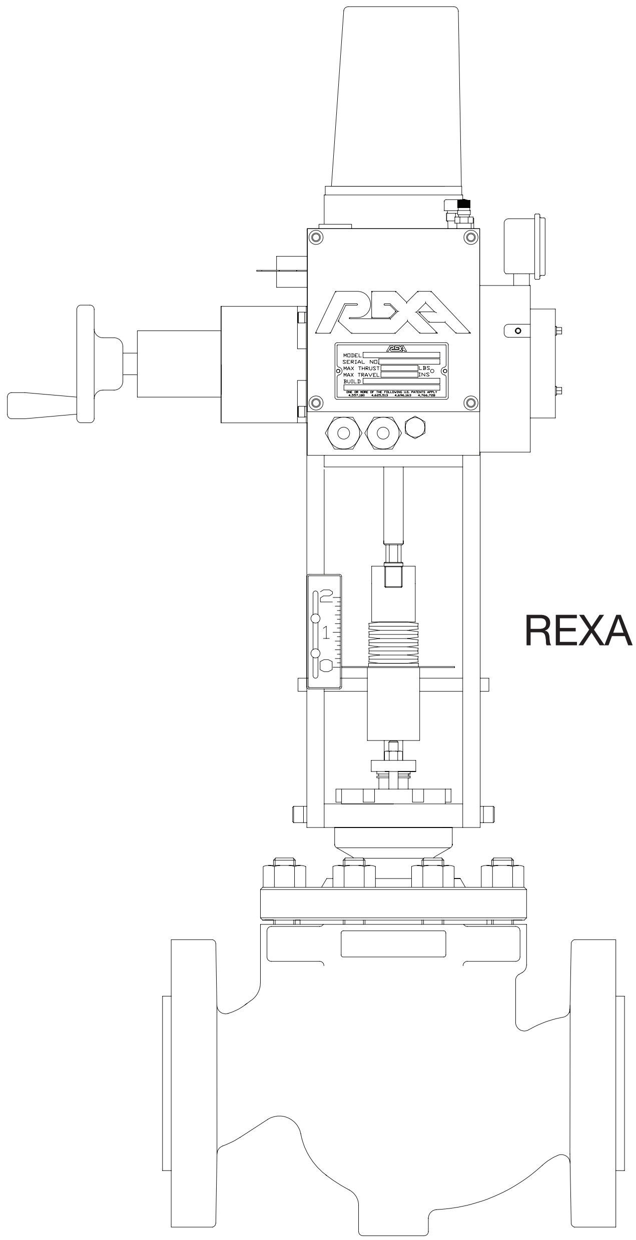
Troubleshooting and Repair Manual for the REXA Series 2 Xpac

TS&R 11/15



REXA Electraulic™ Actuation

Serial #____________________________

Model #____________________________

Application__________________________

Tag # ______________________________

REXA • 4 Manley Street • W. Bridgewater, MA 02379 • (P) 508.584.1199 • (F) 508.584.2525

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Fundamental Safety Information

REXA actuators all 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:

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

Always observe the safety information listed in this documentation.

- Airborne noise is less than 60 dB.
- All Guards MUST be in place before operation. Failure to do so may result in injury or damage to equipment.
- Use the Actuator for its intended purpose ONLY. Using the actuator for uses other than what it is intended may result in injury or death.
- Do not use the Actuator should it be damaged in shipping or installation. Contact REXA.

WARNING LABELS

Hazardous Voltage
Turn Off and Lock Out system power before servicing.

General Warning
Refer to Installation Manual before servicing.

Attention
Important information provided.

Crush or Pinch Point Hazard
Turn Off and Lock Out system power before servicing.
Warn of Actuator movement if Spring Fail Unit.

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® with Syntec 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: *Reservoir 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

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 shall 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:

1. Notify all affected areas and employees of the impending Lock-Out situation, the reason for it, and estimated start and duration times.
2. Equipment shutdown and isolation: Place all switches in the “off” or “safe” position. Disconnect sources of power, ensuring all sources of both primary and secondary power to the equipment are interrupted.
3. Dissipate residual energy. Shutting down equipment does not mean there is no energy left in it. Check for trapped pressure, compressed spring or residual electricity in the system.
4. Lock-Out or Tag-Out all in-line points of control. In most cases, there may be more than one place, or more than one lock, if several people are working on the equipment.
5. Lock-Out verification: Take nothing for granted. Verify that the locked-out switch or control cannot be overridden. Test the equipment to be certain that the locked-out switch is de-energized, and not simply malfunctioning. Test all control points and modes to be sure that the equipment does not start.
6. Perform the work scheduled. Try to foresee all possible hazards. Ensure the new/repair work does not bypass the Lock-Out and reactivate the system.
7. Lock and/or tag removal. All locks and tags are to be left in place until all work is 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.
8. Equipment start-up. Make a final safety check before restarting equipment, to be certain it is safe to operate. Make sure of the following:

a) All tools and other items have been removed.

b) All machine guards are returned to their proper position. All electric, hydraulic, pneumatic or other systems are properly reconnected.

c) All employees are clear of equipment.

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

EDUCATION AND DISCIPLINE

The key to worker safety is education. The purpose of this document is for everyone to understand the importance of Lock-Out/ Tag-Out and how to recognize when it is in use. By educating all employees to 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.

1. General Information

1.1 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	Phone: (508) 584-1199
4 Manley Street	Fax: (508) 584-2525
West Bridgewater, MA 02379	Web: www.rexa.com

Note: It is important to have the model number and build code 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 a more detailed explanation.

1.2 ACTUATOR IDENTIFICATION

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

ACTUATOR IDENTIFICATION

The model number will provide a general description of the actuator and electronics as a set. The model number also provides the information required to correctly define what sections of this manual applies to a particular actuator. The build code 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 number, both mechanical and electrical build codes, 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 1.2-1 and 1.2-2 shows typical ID tags.

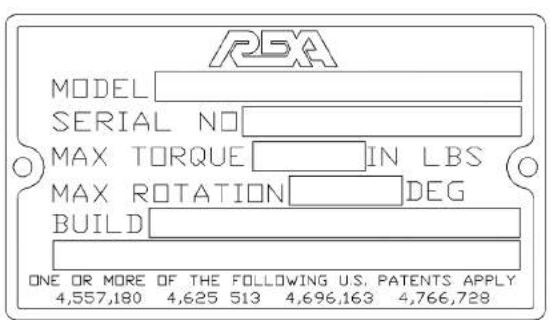


Figure 1.2-1 Mechanical ID Tag

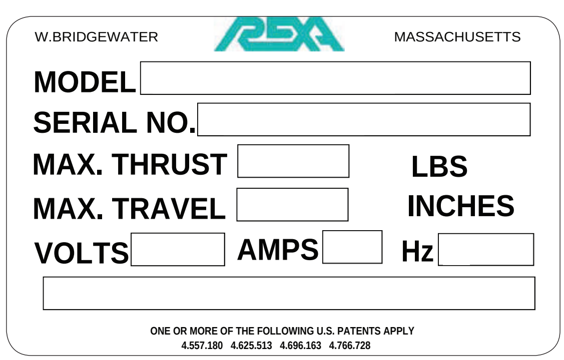
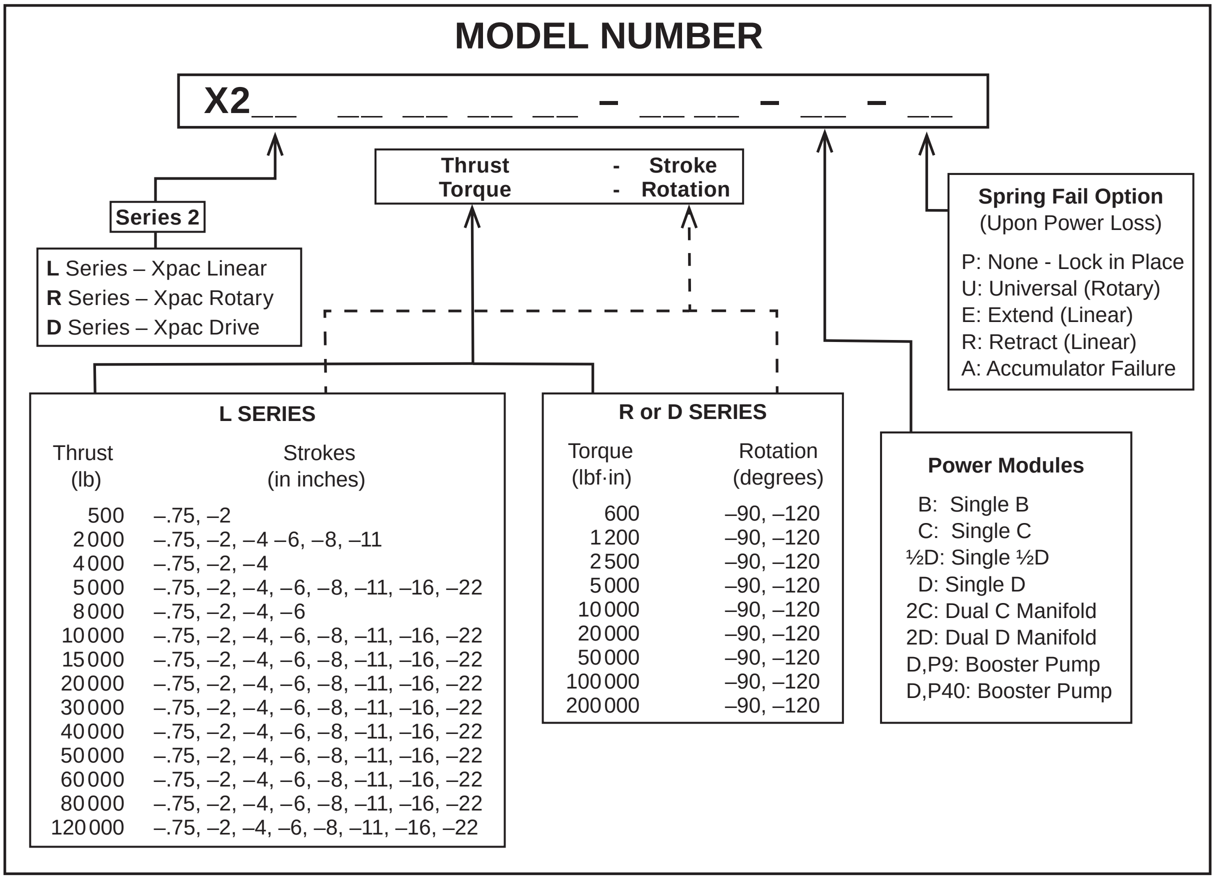


Figure 1.2-2 Electronics ID Tag

ACTUATOR IDENTIFICATION

1.2.1 Model Number

The basic model number is a generic description of the actuator. Figure 1.2.1 shows a break down of the model number tree and how it works.



Model Numbers — Examples:

X2L4000-4-C-P

Is a Linear **L** Series 2 **Xpac** with 4000 lb of thrust, stroke adjustable up to 4 inches, and C size power module. Lock in place upon loss of power.

X2R2500-90-B-U

A Rotary **R** Series 2 **Xpac** with 2500 lbf·in of torque, rotation adjustable to 90 degrees, and B size power module. Spring failure upon loss of power. .

Figure 1.2.1 Model Number

ACTUATOR IDENTIFICATION

1.2.2 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: **C0600000**. The C06 indicates the year of manufacture and the next five digits correspond to the unique order number.

1.2.3 Build Code

The build code 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 of the IOM.

1.3 GENERAL SPECIFICATIONS

1.3.1 Recommended Fluids and Lubricants

Intended Use	Specifications
Operating oil, standard	Castrol EDGE® with SYNTEC SAE 5W-50 Motor Oil
Operating oil, biodegradable	EnviroLogic® 3100 Series Hydraulic Fluid
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

1.3.2 Operating Temperatures

The following is a general guideline; refer to Technical Memo TM19-2 for further information.

Table 1.3.2-1 Linear Actuators *

	Actuator Construction	Standard			High Temp.
Temperature Range[1]	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		Separate Control Enclosure with CPU, motor driver, power supply, transient protection and termination.			
	Temp. Range	-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.

** All CSA electronics, mechanical stepper units and servo units are rated -40 °F to +104 °F (-40 °C to +40 °C).*

Table 1.3.2-2 Rotary Actuators & Drives *

	Actuator Construction	Standard			High Temp.
Temperature Range[1]	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		Separate Control Enclosure with CPU, motor driver, power supply, transient protection and termination.			
	Temp. Range	-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.

** All CSA electronics, stepper units and servo units are rated -40 °F to +104 °F (-40 °C to +40 °C).*

INSPECTION SCHEDULE

1.4 INSPECTION SCHEDULE

The REXA actuator requires minimal routine maintenance consisting primarily of visual inspections. However, as with any mechanical device, components will wear out. The frequency of use and the operating conditions are both factors that will dictate the maintenance schedule (see below). The following is a recommended list of visual inspections and their frequency.

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

Monthly

Check the oil indicator for proper oil level. Add oil if necessary following the instructions in the IOM, section 1.6.4. When oil is added, a visual inspection of the actuator is needed to determine where the loss of oil occurred and the necessary repair required.

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

Quarterly

Perform a visual inspection of the actuators for damage, oil leakage, 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:

- Mounting hardware and fasteners are tight
- Oil level is correct
- Tubing and fittings are tight
- Tubing is not touching or rubbing
- Power module fasteners are tight
- Actuator can hold position without re correcting
- Oil leaks
- Spring washer stack for damage (not all models)

- Check for moisture ingression or contaminants under the feed-back housing, wire cover and in the electronics enclosure
- Ground wire connectivity
- Ensure the feedback signal on the actuator is stable
- Inspect wiring for cuts, abrasions or tears

Maintenance Schedule

Items such as seals, O-rings, wear bands, bushings, seats and valves will from time to time need to be replaced. Since factors such as pressure, actuator travel, contaminants, temperature and output all play a role in determining how frequently preventive maintenance is required, this document should only be used as a guide. Actual maintenance history logs for the specific application should be generated for a better indicator of when preventive maintenance is required.

For example, a linear cylinder seal for a 2000 lb thrust actuator will wear out three times faster if the cycle stroke is six inches vs. two inches and, conversely, will last four times longer if the stroke is half inch vs. two inches. Seal life is also dictated by the pressure the seal is holding. As the pressure increases, so do the forces between the seals and the rods and bores they are sealing. As these forces increase so do the friction forces between these components causing a seal under pressure to exhibit more wear than one under less pressure. It is important to understand the application and its influence on the actuators' components when determining the frequency of preventive maintenance for each unit.

The soft goods—or seals—in each REXA actuator have been selected to provide a design life of at least ***1,000,000 cycles or 10,000,000 dither cycles.*** This equates to four years of service in a typical process control system. Seal design life estimates are based on the following assumptions:

> The actuator will only be loaded to its full output during 5% of its total travel—this is the case in 90% of control applications when the actuator is seating a valve.

INSPECTION SCHEDULE

If the full load of the actuator is required over a greater percentage of the stroke, then required maintenance will be increased.

Excessive loads—such as those exhibited when a cylinder "dead ends"—can cause excessive stress and premature wear.

2. Problem Identification

WHAT IS THE PROBLEM?

2.1 INTERFACE ISSUES

2.1.1 I forgot my Password; How do I get into Setup?

2.1.2 Warning relay open

2.1.3 Alarm relay open

2.1.4 Error code in display

2.1.5 Motor driver fault

2.1.6 No display, unusual display (ex., letters missing, sections burnt out, etc)

2.1.7 Actuator will not respond to HART command

2.1.8 Actuator will not respond to FF command

2.1.9 Actuator will not respond to Pulse command

2.1.10 Actuator will not respond to Analog command

2.1.11 Actuator will not respond to 1 Cont (On/Off) command

2.1.12 Actuator will not respond to 2 Cont (Manual Control) command

2.2 ACCESSORIES

2.2.1 External push buttons not functioning

2.2.2 Keypad buttons not functioning

PROBLEM IDENTIFICATION

2.4.5 Hydraulic surge not functioning

2.4.6 Unit moves to the wrong position for trip

2.4.7 No Accumulator Pressure reading on Display, but there is pressure on gauge

2.4.8 Solenoid is extremely hot to the touch

2.5 OIL LEAKS

2.5.1 External oil leaks

2.5.2 Reservoir relief dumps oil

2.5.3 The oil indicator is low, but no oil is visible / Repeated Reservoir filling, no visual oil leaks

2.6 MISCELLANEOUS

2.6.1 Water in unit. (Feedback, Module, Motor, electronics)

2.6.2 Cylinder binding

2.7 CALIBRATION

2.7.1 Setting PL or PH and unit reads “too high” or “too low”

2.7.2 Will not accept PL or PH value

2.7.3 Will not accept SL or SH value

INTERFACE ISSUES

2.1. INTERFACE ISSUES

RESOLUTIONS

2.1.1 I forgot my Password; how do I get into Setup?

Parameter *Password* has been added to the *Outputs* menu following parameter *Pos Xmitter.* If a value (other than the default value of 00000) is entered into *Password*, future entry into Setup mode will require the user to enter the *Password* value. Contact factory if you lost your password.

2.1.2 Warning relay open

WARNING: The output is in the “alarm” state whenever ALARM is in the "alarm" state or when the actuator detects a problem but can otherwise continue to operate.

Detectable problems include:

– Accumulator low or bad pressure detected during “normal operation” or following a failed recharge cycle. (See **TS&R section 3.1**, Accumulator low/bad pressure.)

– Drive fault active. Multiple drive units can usually continue to operate (with reduced performance) when one motor driver is bad, so a “warning” is issued. (See **TS&R section 3.2**, Drive Fault active.)

– Seat Load Cylinder reached its “Seated” position but the valve was not required to be seated (SLC stop). (See **TS&R section 3.3.1**, SLC reads Seated before actuator is on valve seat.)

2.1.3 Alarm relay open

The CPU board has two solid state relay “alarm” outputs; an ALARM and WARNING. The output is in the “alarm” state whenever the actuator is unable to follow the control signal/control scheme as defined in the Signals menu. An “alarm” occurs if the actuator is switched to Local Manual but not Remote Manual. An alarm relay change may be followed by an error code. (See Error code section.)

2.1.4 Error code in display

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 in a round-robin fashion at approximately 1 second intervals. All errors are cleared by power-on/reset or by entry into Setup mode in addition to the means identified below as "Cleared by". Any error identified as being detected in "All" modes will persist until corrected.

FB bad

Meaning: The actuator's main feedback is below 2 mA or either (**+**) or (**-**) **15 fail** is set or **A/D fail** is set.

Detected modes: All.

Actuator response in Auto mode: Freeze **-** no movement.

Cleared by: Self clearing when feedback greater than 2 mA or when **15 fail** or **A/D fail** clears.

Alarm/warning: **Alarm**
(See **TS&R section 3.4**, Feedback Bad.)

CS bad

Meaning: The analog control signal is below 2.5 mA or either the (**+**) or (**-**) 15 fail is set or A/D fail is set.

Detected modes: All.

Actuator response in Auto mode: Defined by Failsafe parameter (See **IOM section 6.1.6**, INPUTS Menu.)

Cleared by: Self clearing when control signal > 2.5 mA or when **15 fail** or **A/D fail** clears.

Alarm/warning: **Alarm**
(See **TS&R section 3.11**, Control Signal Bad.)

INTERFACE ISSUES

Mot stall

Meaning: Five attempts to move the actuator 1% of stroke in the time set in parameter Stall Time have failed (See **IOM section 6.1.7**, DRIVES Menu), or the “Seated” position was reached on the Seat Load Cylinder and the position of the main cylinder was greater than 1% above Position Lo.

Detected modes: Auto mode only.

Actuator response in Auto mode: Freeze in place – no movement in stall direction.

Cleared by: Any control signal change which requires actuator movement in the direction opposite to that in which the stall occurred. One retry is allowed for each signal reversal. One additional retry is allowed for each successful motor start/stop until five retries are “in the bank”.

Alarm/warning: Alarm
(See **TS&R section 3.5**, Mot stall.)

Dir error

Meaning: The actuator was detected moving in the wrong direction on two successive motor starts.

Detected modes: Auto mode only.

Actuator response in Auto mode: Freeze – no movement.

Cleared by: Only cleared by power-on/reset or entry into Setup.

Alarm/warning: **Alarm**
(See **TS&R section 3.6**, Direction Error.)

Drv fault

Meaning: One or more motor drives has detected a problem which could not be cleared with a drive reset. Will also appear when a fault/reset board does not have drive fault jumpers installed (in positions where a motor drive is not connected).

Detected modes: Auto mode only.

Actuator response in Auto mode: The actuator attempts to continue normal operation.

Cleared by: A drive reset is attempted when the fault is initially detected. If the fault does not clear on the first reset attempt, the **Drv fault** error is set. Additional drive resets (spaced at 10 second intervals) occur until the fault clears. See Alarms, above, for additional information.

Alarm/warning: **Warning**
(See **TS&R section 3.2**, Drive Fault.)

+15 fail or -15 fail

Meaning: The (+) or (-) 15 volt power supply is out of range by (+) or (-) 10% error band.

Detected modes: All.

Actuator response in Auto mode: Freeze – no movement. Also sets **Fb fail** and, if applicable, **Cs fail**.

Cleared by: Self clears if the supply returns to within a (+) or (-) 5% error band.

Alarm/warning: **Alarm**
(See **TS&R section 3.7**, +/-15VDC Fail.)

Pres bad

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

Detected modes: All.

INTERFACE ISSUES

Actuator response in Auto mode: The actuator continues with normal operation.

Cleared by: Transducer signal greater than 3 mA or less than 21 mA.

Alarm/warning: **Warning**
(See **TS&R section 3.1**, Accumulator low/bad pressure.)

Pres low

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

Detected modes: All.

Actuator response in Auto mode: The actuator continues with normal operation.

Cleared by: Successful recharge cycle.

Alarm/warning: **Warning**
(See **TS&R section 3.1**, Accumulator low/bad pressure.)

SlcFb bad

Meaning: The feedback signal from the seat load cylinder is less than 2 mA.

Detected modes: All.

Actuator response in Auto mode: Freeze – no movement.

Cleared by: Self clearing when feedback is greater than 2 mA.

Alarm/warning: **Alarm**
(See **TS&R section 3.3.2**, SLC Feedback bad.)

Slc stop

Meaning: The actuator has stopped at the “Seated” position of the seat load cylinder, but the control signal is greater than 0.2% (i.e., the seat load cylinder has reached the “Seated” position, but the control signal did not request it).

Detected modes: Auto mode only.

Actuator response in Auto mode: The actuator continues with normal operation.

Cleared by: Any control signal change which requires actuator movement in the direction opposite to that in which the stop occurred.

Alarm/warning: **Warning**
(See **TS&R section 3.3.3**, SLC stop.)

Key bad

Meaning: A bad reading of the key pad has occurred.

Detected modes: All.

Actuator response in Auto mode: The keypad reading is ignored and the actuator continues with normal operation.

Cleared by: Self clearing with a valid keypad reading.

Alarm/warning: **Warning**

Mem fail

Meaning: A memory location containing a Setup parameter value has failed to erase/write.

> ***NOTE:*** *The memory locations containing error counters are not checked.*

Detected modes: Setup mode only.

Actuator response in Auto mode: N/A

Cleared by: Only cleared by power-on/reset or by re-entry into Setup and reprogramming all parameters. Press Enter button to open parameter (“=” will flash); then press Enter again to write in new value.

INTERFACE ISSUES

Alarm/warning: **Alarm until cleared**

No inp bd

Meaning: One or more of the parameters in the Signals menu is selected and the required Contact Inputs Board is not installed (or failed to respond when read).

– Signal Type is set to 1 Cont, 2 Cont, or Pulse

– Trip is not set to Off

Detected modes: All.

Actuator response in Auto mode: Freeze in place and go to Setup mode. When Setup mode is entered the first incorrect parameter (as listed above) will be on display.

Cleared by: Changing the Signals menu parameter(s) to match the installed boards, or (with power off) installing the required board(s).

Alarm/warning: **Alarm**

A/D fail

Meaning: The A/D converter on the CPU Board has failed to respond.

Detected modes: All

Actuator response in Auto mode: Freeze - no movement. Also sets **Fb fail** and (if applicable) **Cs fail**.

Cleared by: Self clears if/when A/D responds.

Alarm/warning: **Alarm**

CPU fail

Meaning: The CPU has detected an unexpected interrupt.

Detected modes: All.

Actuator response in Auto mode: The actuator continues with normal operation.

Cleared by: Only cleared by power-on/reset or by entry into Setup mode.

Alarm/warning: **Alarm**

2.1.5 Motor driver fault

A motor driver has detected a problem and sent an error code to the CPU.

The drive fault is relayed to the CPU through the fault input terminal (TB3 for stepper, TB6 for servo). The fault input is 5 Vdc, and is only present when there is a problem. Actuators with more than one drive use an additional fault/reset board that is separate of the CPU. The purpose of this board is to use one fault signal for both drives, allowing the actuator to operate with 1 driver while the other is faulted.

REXA actuators use two styles of motor driver, Stepper and Servo.

To identify which driver you have, you must first locate the model number on the REXA identification tag located on the Electronics enclosure, or the actuator. (See photos below.)

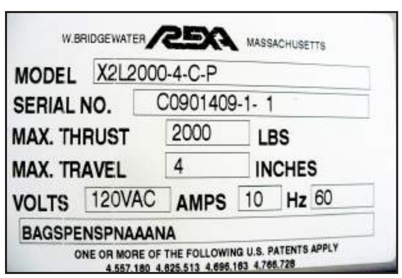


Photo 2.1.5-1 Electrical ID Tag

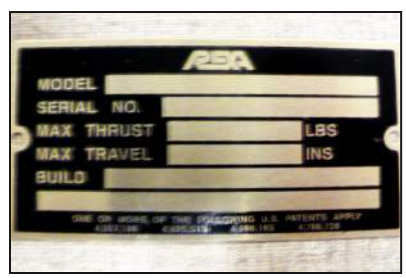


Photo 2.1.5-2 Mechanical ID Tag

Located in the Model number of the REXA is the module type. An example would be an X2L2000-4-**C**-P. The module type determines which style of driver you have. In this example, the driver type is **C**. (Refer to **TS&R section 1.2** for additional actuator identification information.)

INTERFACE ISSUES

Once the drive type is determined go to the corresponding section:

TS&R 3.2.1, B CSA drive fault IMS Driver
3.2.2, B CSA drive fault Potted Drive
3.2.3, C drive fault
3.2.4, Servo motor driver
3.2.5, Dual unit drive fault
3.2.6, Booster unit drive fault

2.1.6 No display, unusual display (ex., letters missing, sections burnt out, etc)

The REXA display is a vacuum fluorescent emissive display with keypad. The display could burn out if left on for long periods of time. To avoid this, the display is dimmed after one hour of no keypad use, but may be turned back on by pressing any key.

If the 14 position ribbon cable between the CPU and display comes loose or is plugged in backwards, the display will go out. The power indicator light may remain on, but the display will be blank.

If the 5 Vdc input from the Quad Power Supply is lost, the display will go blank.

(See **TS&R section 4.E.10** for repair/replacement of the display.)

2.1.7 Actuator will not respond to HART command

REXA actuators have an optional HART interface board that allows them to communicate through the HART 5.0 protocol. When this optional board is installed a two-wire 4 to 20 mA current loop runs between the control station and the REXA actuator. This analog line is attached to the HART BOARD and landed on connector TB1 to pins CS+ and CS-. If the actuator is not responding to this control signal, reference **TS&R section 3.11**, Control Signal Bad.

Through the universal HART command two dynamic variables (PV position of the actuator and SV differential pressure in the actuator) are transferred back to the control system. If these two variables are not being sent back, reference **TS&R section 2.7**, Calibration. If these variables are being sent back but the values are incorrect, reference the troubleshooting section on the transducers—**TS&R section 3.8,** HART Interface.

2.1.8 Actuator will not respond to FF command

REXA actuators have an optional FOUNDATION Fieldbus interface board. When this optional board is installed a two wire connection from the control station to the REXA actuator is used for communication. This connection is attached to the Foundation Fieldbus interface board.

If connection to the REXA actuator cannot be established, reference **TS&R section 3.9**, FOUNDATION Fieldbus.

If connection is established, reference other symptom section to complete troubleshooting.

2.1.9 Actuator will not respond to Pulse command

REXA actuators have an optional contact input board that allows the actuator to communicate through Pulse commands. The communication is established by either a 3 or 4 wire signal that carries AC or DC voltages that ranges from 24 V to 120 V. These voltage pulses are interpreted by the REXA controller in accordance with the setup parameters Pulse Duration and Pulse Increment.

If the actuator will not respond to the Pulse signals or the desired position is not being achieved, reference **TS&R section 3.10**, Pulse Control Signal.

2.1.10 Actuator will not respond to Analog command

REXA actuators have a standard analog control scheme built into the main CPU board that allows the actuator to position using a two-wire 4 to 20 mA current loop. If the actuator is not following a change in the analog control signal current or is reading a **CS bad** in the display, reference **TS&R section 3.11**, Control Signal Bad.

INTERFACE ISSUES

2.1.11 Actuator will not respond to 1 Cont (On/Off) command

REXA actuators have an optional contact input board that allows the actuator to be controlled through a single contact using the bias voltage from the Contact Input board, or a distinct voltage signal. The control is a 2 wire signal that carries AC or DC voltages that range from 24V to 120V. This voltage is interpreted by the REXA controller in accordance with the setup parameter Signal Type = 1 Cont.

If the actuator will not respond to the Contact signals, reference **TS&R section 3.12**, Contact Input Signal.

2.1.12 Actuator will not respond to 2 Cont (Manual Control) command

REXA actuators have an optional contact input board that allows the actuator to be controlled through 2 contacts using the bias voltage from the Contact Input board, or 2 distinct voltage signals. The control is a 3 or 4 wire signal that carries AC or DC voltages that ranges from 24 V to 120 V. This voltage is interpreted by the REXA controller in accordance with the setup parameter Signal Type = 2 Cont.

If the actuator will not respond to the Contact signals, reference **TS&R section 3.12**, Contact Input Signal.

2.2. ACCESSORIES

2.2.1 External push buttons don't work

The Electrical sub-assembly is equipped with an external door-mounted, 5 button membrane switch and display assembly.
The switches interface with the Actuator (whether it is setup in calibration, local control, or scroll through parameters) while in the Auto mode.

- If the actuator is powered up in Auto mode without pushing any buttons, the display will dim to half intensity. The first button push will "wake up" the display to full intensity. The button must be pushed a second time to activate its function.
- A menu or parameter may not be accessible in the current mode of operation. See **IOM section 6**, Modes of Operation and Control Parameters.
- To access modes of operation, 2 buttons must be pressed simultaneously. (See **IOM section 6**, Modes of Operation and Control Parameters.)
- The ribbon cable connecting the membrane switch assembly to the interface circuit board may be disconnected. See **TS&R section 3.13**, Display Problems.
- If you are trying to Calibrate Signal Lo and Signal Hi with the buttons, see **IOM section 6**, Modes of Operation and Control Parameters.
- +5 Vdc internal to the Control enclosure may be too low. (Contact the REXA factory.)

2.2.2 Internal Keypad buttons don't work

The Electrical sub-assembly is optionally equipped with an internal, CPU mounted, 5-button keypad switch and display assembly. The switches are used to interface with the Actuator (whether it be setup in calibration, local control, or scroll through parameters) while in the Auto mode.

ACCESSORIES

- If the actuator is powered up in Auto mode without pushing any buttons, the display will dim to half intensity. The first button push will “wake up” the display to full intensity. The button must be pushed a second time to activate its function.
- A menu or parameter may not be accessible in the current mode of operation. (See **IOM section 6**, Modes of Operation and Control Parameters.)
- To access modes of operation, 2 buttons must be pressed simultaneously.
- If you are trying to move the actuator in Local or Calibrate mode and the actuator will not move, see **TS&R section 3.15**, Control Issues.
- Are you trying to Calibrate Signal Lo and Signal Hi with the buttons? (See **IOM section 6**, Modes of Operation and Control Parameters.)
- +5 Vdc internal to the Control enclosure may be too low. (Contact the REXA factory.)

2.2.3 Drill Drive / Hand wheel doesn’t work

The handwheel is mounted to the actuator’s motor. To operate, you must engage the handwheel by pushing the handwheel toward the motor; the hand wheel / drill drive is disengaged via internal spring. One half-revolution may be required for proper engagement. The handwheel will declutch by moving outwards when the spring is released.

- The hand wheel can take several turns before you see movement from the actuator. (See **IOM Appendix M**, section M.1.2, Declutchable Handwheel.)
- Servo units do not allow for operation of the handwheel while the actuator is powered up. A holding current is present to prevent movement of the motor.
- Units with solenoids and accumulator systems must have the override handles locked to operate the handwheel. (See **IOM Appendix M**, section M.3.)

- If the Manual bypass valve is open, the hand wheel will not operate.

2.2.4 Manual Hand Pump doesn't work

The Manual hand pump is a piston style pressure device with directional knob located underneath the assembly. The hand pump assembly requires reservoir fluid to operate.

- Make sure the directional knob is in the up or down position.
- The hand pump can take several pumps before you see movement from the actuator (See **IOM Appendix M.2**, Manual Hydraulic Pump.)
- Units with solenoids and accumulator systems must have the override handles locked to operate the hand pump. (See **IOM Appendix M.2**, Manual Hydraulic Pump.)
- If the Manual bypass valve is open, the hand pump will not operate.

2.2.5 Gauges don't work

Most REXA units have several gauges installed. Module gauges show cylinder pressure, and some units are equipped with reservoir gauges (accumulator units). The power module gauges have shut off valves located beneath the gauge. If the gauge is not reading, ensure gauge isolation valves are open. If the gauge is still not reading, you may have a bad gauge, and it should be replaced.

2.2.6 Pressure Limiting Protection not working (unit building too much pressure)

The REXA pressure limiting valves are located on the power module underneath the motor junction cavity cover. The valves are factory set per specification. If the valves are tightened (CW rotation) then the internal pressure of the REXA unit will increase. The valves are adjustable and can be reset in the field.

CAUTION: If the actuator is connected to the driven device during adjustment, the equipment can become damaged.

ACCESSORIES

(See **TS&R section 3.14**, Pressure Limiting Valves.)

2.2.7 Torque or thrust data not accurate (from transducers)

Some REXA units are equipped with pressure transducers to relay internal pressure electronically.

Accumulator units use the pressure transducer to relay accumulator charge pressure, Hart or Fieldbus units use pressure transmitters to relay cylinder pressure as well.

The pressure transmitter is loop powered and sends a 4 to 20 mA signal. See **TS&R section 2.3.5**, How do I test my 4-20 mA Pressure Transmitter, for additional information.

2.2.8 Mechanical limit switches not functioning

REXA actuators have optional independent mechanical limit switches to provide redundant indication of the actuator's position. These limit switches are wired directly from the actuator cylinder to the DCS and are independent of the REXA electronics. Switch ratings and specifications can be found in Appendix A, Mechanical Limit Switches of the Installation and Operation Manual.

For repair/replace information on the switches for a rotary actuator, reference **IOM Appendix, section A.2**, Rotary.

For repair/replace information on the switches for a linear actuator reference **IOM Appendix, section A.**1, Linear.

2.3. CONTROL ISSUES

2.3.1 Actuator moves to wrong position

The REXA unit moving to the wrong position could be caused by:

- Control signal loss
  - The REXA unit may be programmed to move open, closed or in place on loss of control signal. (See **TS&R section 3.15.1**, Actuator Hunting–Electrical Noise.)
- Wiring errors
  - Incorrect wiring of the motor can cause incorrect or interrupted motor phase pulses causing the motor to travel briefly in the wrong direction. Check wiring per your REXA drawing.
  - Incorrect wiring of the feedback can cause the actuator to travel in the wrong direction. Check wiring per your REXA drawings.
- Manual bypass or Solenoid
  - If the bypass valve or solenoid is open, the REXA unit cannot build pressure. It is possible for the process or driven device to push the actuator in the wrong direction if these pressure relieving devices are open.

2.3.2 Actuator “hunting” (dithering during control)

The occurrence known as “hunting” can be caused by several different issues.

Electrical noise issues:

If the REXA feedback or control signal is constantly in flux the cabling may be installed incorrectly. (See **TS&R section 3.15.1**, Actuator Hunting–Electrical Noise.)

Gain/acceleration settings may be incorrect. Every REXA unit is tuned per power module and cylinder combination.

CONTROL ISSUES

Additional tuning may be required for faster pumps/motors and smaller cylinders.

2.3.3 Actuator “drifts” away from applied load

The REXA actuator is designed and specified to meet the required thrust or torque per a specific application. If the actuator is pushed by the process, then the following steps should be taken:

- Confirm your actuator has the required thrust or torque to overcome the process requirements. The actuator’s model number will determine the rated thrust or torque. (See **TS&R section 3.15.2**, Actuator Torque/Thrust requirements, for additional information.)
- Ensure bypass and solenoid valves are shut and tight.
- Ensure Pressure limiting valves are set correctly per the unit’s specification. (See **TS&R section 3.14**, Pressure Limiting Valves, for more information.)
- A damaged or failed piston seal can cause the REXA cylinder to lose internal pressure. (See **TS&R section 3.15.3**, Actuator drifting, for additional information.)

2.3.4 Position Feedback doesn’t match actual position

The REXA’s position transmitter output is digitally calibrated by the CPU during programming of the high and low positions. If your transmitter needs further calibration, see **TS&R section 3.15.6**, Position Transmitter calibration.

2.3.5 How do I test my 4-20 mA Pressure Transmitter?

See **TS&R section 3.1**, **Press bad**, step #4.

2.3.6 No position feedback signal

The REXA position transmitter is capable of transmitting a 4 to 20 mA output by using loop or internal power. Refer to your wiring diagram for proper termination information.

2.3.7 Electrical Limit Switches don't function

The REXA Control enclosure is equipped with two single-pole, single-throw, solid state relays that give limit indication. The position of that indication is set by parameters Relay #1 and Relay #2 in the Outputs menu, (IOM section 6.1.8). Refer to your wiring diagram for proper termination points. The relays are configured to be "open contact" when Main power is not applied. Also, the contact for Relay #1 will be open when actuator position is above the position given by parameter Relay #1, and will close when below the set point. The contact for Relay #2 will be open when actuator position is below the position given by parameter Relay #2 and will close when above the set point.

- If relays are not operating, be sure the actuator is above (Relay #2) or below (Relay #1) set points.
- Is the corresponding LED for each relay illuminating? If yes, check wiring terminations.
- Is the actuator position within the Relay set point, including deadband?
- The relays should have no more than 1.5 Ω resistance when the contact is closed. If it is greater (or the contact measures open when it should be closed), refer to **TS&R section 3.15.5**, Electrical Limit Switches.

2.3.8 Actuator will not seat, I can not get full travel.

The REXA actuator is designed and specified to meet the required travel for a specific application. If the actuator can not fully stroke the driven device, the following steps should be taken:

- Confirm your actuator has the required travel or rotation for the application. (See **TS&R section 3.15.2**, Actuator torque/thrust requirements, for additional information.)
- All REXA actuators have adjustable pressure limiting valves. Ensure that your actuator is generating enough pressure to overcome the process requirements. See **TS&R section 3.14**, Pressure Relief Valves, for adjustment procedures.

CONTROL ISSUES

- For TOO HIGH or TOO LOW indication on the display, see **TS&R section 3.15.6**, Too High/Too Low on display.
- Ensure no mechanical restriction or binding is causing the actuator to stop travel.

  Rotary units

  – Some rotary units have adjustable travel stops. Rotary SPRING FAIL stop may need to be set.

  Linear units

  – Engagement of valve stem into elastic coupling may be too deep. Check engagement and make changes if required. The engagement of the valve stem into the actuator should be 1.5 times the diameter of the stem. If the stem engagement can not be corrected, contact your local REXA representative.

  – Packing arrangement or anti-rotation may be interfering with actuator stroke.

2.3.9 Actuator does not meet stroke speed requirements

The REXA actuator is designed to meet a specific speed requirement. Refer to **TS&R 3.15.2**, Actuator torque/thrust requirements, for stroke times for your equipment. If your actuator is not meeting these requirements, you may need to adjust the HS setting in the parameter menu. (See **IOM section 6.1**, Setup Mode, for additional information.)

2.3.10 Booster Pump

Booster Pumps are an optional accessory installed on some actuators. They are used to increase the speed of the actuator. Booster pumps will turn on when the desired change in position is greater than the “Boost Pump” setting under the drives menu. To adjust this parameter, reference **section 6.1.7 in the IOM**.

2.3.11 Only one module on 2D or 2C units functions

REXA units with specific speed requirements sometimes use multiple modules to meet that specification. Dual module units require 2 sets of motors, drivers and cables. Refer to your specific wiring diagram to make sure you have the correct interconnect for your actuator. For redundant units, a separate electronics is required. If an error code is displayed on either driver, see **TS&R section 3.2**, Drive Fault.

2.3.12 Surrounding equipment disrupted by Actuator operation

Some REXA actuators use large motors that require high voltage and current. If the cables for the REXA actuator are run close to surrounding equipment or control cables, it is possible for noise to be induced onto the control lines of this equipment.

2.3.13 Servo Motor turning at low RPM when not commanded to move

When the actuator reaches its set point, the motor will come to a complete stop. The FMV holds the load in place which allows the power consumption of the unit to be very low. Since there are no moving components, it extends the life of the actuator. If the motor continues to rotate after the actuator has reached its new position, reference **TS&R section 3.15.1**, Actuator Hunting — Electrical Noise.

2.3.14 Actuator slows down and “resets” before getting to target position

Within the actuator CPU there is a timer that will shut down the motor and cause the system to reset if the actuator is not achieving a certain speed. There are numerous reasons why the actuator may be having a speed issue, and they range from tuning to having an actuator that is undersized for a given load.

- The "Gain" setting may be too low. This will cause the motor to slow down too much before it reaches the set point.
- If the actuator pressure is above 2400 psi when this is occurring, reference **TS&R 3.14**, Pressure Relief Valves.

CONTROL ISSUES

2.3.15 Actuator overshoots target position and returns

If the actuator does not slow down as it approaches the new target position, it will likely overshoot its new position. Within the sophisticated control scheme of the REXA electronics there are tuning parameters that will allow this overshoot to be tuned out.

- The "Gain" setting may be too high. Refer to the **IOM section 6,** Control Parameters, to ensure parameters are correct.

2.3.16 I have many errors logged in historical stats

The REXA electronics will keep a running count of error codes to log the problems the system encounters. This count is stored under the current stats and historical stats menus. The current stats can be reset in the setup menu, but the historical stats are a permanent running counter.

Reference the error codes section to determine possible root causes. Close monitoring of the unit should be performed to determine the root cause of these failures. Reference the specific error codes section for more information.

2.4. FAIL SAFE ISSUES

2.4.1 Accumulator will not recharge

The REXA accumulator system is self contained and does not require external equipment to recharge the system after a trip. If your accumulator is not recharging:

- Ensure that the parameter **ACCUM DIR** (accumulator fail direction) is set to the proper end. (See **IOM section C.2**, Accumulator Control Parameters for additional details.)
- The system requires additional oil to charge the accumulator; this oil is pulled from the reservoir system. There is a shut off valve located between the reservoir and the accumulator. This valve must remain OPEN.
- Some accumulator systems are designed to have more than one fail per recharge cycle. The accumulator system will only go through a recharge cycle if the pressure in the system requires.
- Some accumulator systems use an external trip signal to activate the fail condition. (See **IOM section C.1.1**, Trip Function, for additional information.)
- The accumulator system uses two external solenoids to operate the accumulator system. The REXA CPU controls power to the solenoids as defined during manufacturing of the system. For information on the solenoids see **TS&R section 4.M.11**.

2.4.2 Actuator does not recover after fail safe event

Some REXA actuators are equipped with a failsafe system when necessary. Several different failsafe systems are available:

Control signal fail

- Check your **FAILSAFE** parameter setting. (See **IOM section 6.1.6**, Inputs menu)
- Some control systems use a 0 to 20 mA input signal; in this situation, the FAILSAFE parameter needs to be

FAILSAFE ISSUES

set to OFF. Less than 2.5 mA is a valid signal for 0 to 20 mA systems.

Spring assist fail & Surge systems

- Spring fail units have an electrical solenoid in place of the manual bypass. This solenoid assembly may need to be adjusted to operate properly. (See **TS&R repair section 4.M.10-11** for information.)
- Surge systems have a trip input function that may need to be reset to continue normal operation. (See **IOM section 6.1.6**, Inputs menu, for additional information.)

Accumulator system fail

- Some accumulator systems have trip input function that may need to be reset to continue normal operation. (See **Appendix C in the IOM** for additional information.)

2.4.3 Unit will not move to fail position

Some actuators have spring fail or accumulator systems to move the driven device to a previously specified position upon loss of power or trip activation signal. The REXA standard system fails in place on loss of power and can be programmed to fail to a specified position on loss of control signal. For additional information on the loss of control signal function, see **IOM section 6**, Control Parameters.

If your equipment is spring fail or accumulator system design, it will be indicated on the model number of the actuator. (See **TS&R section 1.2**, Actuator ID, for information on REXA's model numbering system.)

If your actuator has an –E, –R or –U in the model number, you have a mechanical spring installed to fail the actuator upon activation of a failsafe event (loss of power or trip signal).

If your actuator has an –A in the model number, you have an accumulator system to fail the actuator upon activation of a failsafe event (loss of power or trip signal).

Before troubleshooting the failsafe system, make sure your solenoid manual overrides are in the correct position for failsafe event, and all shut off valves are in the open position.

Standard REXA internal solenoid identification, **section 4.M.11**.

High speed solenoid identification, **section 4.M.14**.

Also, ensure no mechanical restrictions are preventing the actuator from reaching fail position.

Trip input functions have additional parameters to determine the proper fail position and trip input functions. (See **IOM section 6.1.6**, Inputs Menu, for additional information.)

2.4.4 Actuator does not meet failsafe speed requirements

The REXA actuator is designed to meet the required fail speed for a specific application. If the actuator can not fully stroke the driven device in the time specified, the following steps should be taken:

Spring fail units:

- Standard solenoid (module mounted) units have no speed adjustment. To increase the fail speed of a standard internal REXA solenoid, please contact your REXA representative.
- High speed solenoid units have a needle valve installed in line with the solenoid. Turn the needle valve CCW to increase fail speed, CW to reduce fail speeds.

Accumulator systems:

- Some accumulator systems have a needle valve installed in line with the solenoid. Turn the needle valve CCW to increase fail speed, CW to reduce fail speeds.
- Some accumulator systems have a flow metering valve installed in line with the accumulator system. Adjust the metering valve to increase flow speed.

FAILSAFE ISSUES

– To further increase the speed of the accumulator system fail speed, please contact your REXA representative.

2.4.5 Hydraulic surge system not functioning

Hydraulic surge system uses a solenoid valve and spring to achieve fast motion in one direction. This surge operation only occurs with a change in the control signal input as defined by the Surge Breakpoint parameter in the setup menu. Reference **Appendix G in the IOM** for more information on setting the surge function correctly.

2.4.6 Unit moves to the wrong position for trip

REXA actuators can be configured to fail to either end position or stay in its last position. The fail-to-end position is achieved either by the use of a coil spring or a pressurized accumulator bottle and can be triggered by a loss of power, control signal or independent trip signal.

- If the actuator trips to the wrong end, reference **TS&R section 3.16.1**, Fail Direction.
- If the actuator does not trip on loss of power, reference **TS&R section 3.16.2**, No trip on loss of power.
- If the actuator doesn't trip on loss of control signal, see **TS&R section 3.16.3**, No trip on loss of control signal.
- If the actuator doesn't trip on loss of trip signal, reference **TS&R section 3.16.4**, No trip on loss of trip signal

2.4.7 No Accumulator Pressure reading on Display, but there is pressure on gauge

The REXA CPU constantly monitors the accumulator pressure. The data is used to send a warning alarm if the pressure drops to a level that a full fail safe trip can not be completed. This data is also used during an accumulator recharge to determine the maximum pressure the accumulator will be charged to. Reference **Appendix C in the IOM** for more details on setting up an accumulator system.

2.4.8 Solenoid is extremely hot to the touch

REXA uses high quality, aircraft-grade low leak solenoid valves to control our trip functions. These solenoids can be either energized all the time or only during a failsafe event. If the unit has solenoids that are energized continuously, these valves will be hot to the touch. Typically they will have a 60 °F (16 °C) temperature rise during normal operation. If the solenoid valves are measured to have a higher temperature rise, reference **TS&R 4.M.11**, Solenoids.

OIL LEAKS

2.5. OIL LEAKS

2.5.1 External oil leaks

Under normal operating conditions the REXA actuator will not use additional make-up oil. The REXA unit may show signs of oil weeping shortly after installation. When the actuator is exposed to an increase in temperature, the reservoir may weep slightly until equilibrium is met. If the reservoir continues to weep or leak oil, please contact your local REXA representative.

2.5.2 The oil indicator is low, but no oil is visible / Repeated Reservoir filling, no visual oil leaks

When the oil level indicator is below the scribe mark, refer to **IOM section 1.6**, Oil, for filling instructions. If the cycle of retracting and filling continues, the actuator could be leaking internally. The actuator will continue to function as long as the oil level is maintained, contact your local REXA representative.

2.5.3 Reservoir relief leaks oil

The actuators reservoir pressure relief valve is set between 40 and 120 psi depending on the design of the equipment. Upon installation it is normal for the equipment to weep some oil from the reservoir pressure relief valve during temperature changes. If the leak persists, please contact your local REXA representative.

2.6 MISCELLANEOUS

2.6.1 Water in Module

The REXA power module is rated to meet the requirements of NEMA 4X. It is important to see if the location of where the water is entering can be identified. Typically the largest root cause of water getting into the unit is from improper installation of the conduit and not using pipe thread sealant during installation.

- First check the conduit fitting to insure they are tight and pipe sealant has been used.
- For water in the module wire cavity or under the rotary housing, reference **TS&R 3.17.1**, Module/Motor.
- For water under a linear feedback housing, reference **TS&R section 3.17.2**, Electronics.

2.6.2 Cylinder binding

Most mechanical restrictions are an application or mounting-related problem. Binding will be indicated by erratic motion, noticeable bending of the actuator stem or driven device, slower speed or restricted travel. These issues should be corrected immediately as they have the potential to shorten the life of the actuator bushings or valve packing.

If you suspect you are having binding issues, please call the factory for assistance.

CALIBRATION

2.7 CALIBRATION

2.7.1 Setting PL or PH and the unit reads “too high” or “too low”

When calibrating a REXA actuator, the end points are recorded as Position Lo and Position High. If during the set up procedure PL or PH is being set to a point that is too close to the mechanical end stop, the display will read “too high” or “too low”. (Reference **TS&R 3.15.6**, Too High/Too Low on display.)

- If the actuator feedback changes when the unit runs, reference **TS&R 3.15.1**, Actuator Hunting—Electrical Noise.
- If the actuator feedback doesn’t change when stroking the actuator, reference **TS&R 3.6.2**, Feedback.
- If the feedback only changes during a portion of the actuators stroke, reference **TS&R 3.6.2**, Feedback.

2.7.2 Will not accept PL or PH value

When calibrating a REXA actuator the end points are recorded as PL and PH. If during the set up procedure PL or PH are set too close together (within 10% of each other) the values will not be accepted.

- If the actuator feedback changes when the units is being run reference **TS&R 3.15.1**, Actuator Hunting—Electrical Noise.
- If the actuator feedback doesn’t change when stroking the actuator reference **TS&R 3.6.2**, Feedback.
- If the feedback only changes during a portion of the actuators stroke reference **TS&R 3.6.2**, Feedback.

2.7.3 Will not accept SL or SH value

The REXA actuator will allow calibration of the incoming control signal for precision control. The actuator will record the two control signal inputs that correspond to the low travel end points. If during the set up procedure SL or SH are out of range, they will not be accepted. (Reference **TS&R 3.11**, Control signal calibration.)

3. Troubleshooting

3.1 ACCUMULATOR LOW/BAD PRESSURE

Press bad

This error appears when the CPU does not receive an analog signal from the pressure transmitter.

1. Ensure the wiring to the Transmitter is correct according to the drawing. It should be as follows.

CPU	Transmitter
+15V	RED
Acc+	BLACK

Shield should be landed at both the Electronic enclosure back panel and at the Transmitter terminal strip at the actuator.

2. Check the CPU by simulating a 4 to 20 mA signal; this can be done by removing the wires connected to the Transmitter and directly applying a 4 to 20 mA signal generator (see photos). Connect the positive end of your signal generator to Acc+ and the negative end to Acc-.

ACCUMULATOR LOW/BAD PRESSURE

3. Begin by scrolling to the "Accum Pres" parameter under the Drives menu. Apply the recommended signal and take note of the display reading.

Signal (mA)	Display (#)
4	0
8	750
12	1500
16	2250
20	3000

If these readings are correct, then the CPU is good.

If these readings do not match, replace the CPU. (See **TS&R 4.E.4**.)

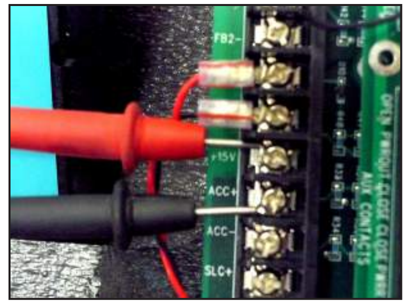


Photo 3.1-1
Acc+ and Acc-

4. If the CPU is working properly, the problem may be with the Pressure Transmitter.

To test the Pressure Transmitter:

a.) Disconnect Pressure Transmitter Cable at the actuator junction box.

b.) Connect current source as shown; red lead to red, black lead to black.

c.) Turn dial on current source to full output (clockwise)

d.) Display should read mA signal that corresponds to pressure

4 mA = 0 psi
16.8 mA = 2400 psi
20.0 mA = 3000 psi

Photo 3.1-2
Signal generator

e.) Pressure will not change as you move dial on current source as the current source is fixed (based on the pressure reading of the pressure transducer).

f.) The mA reading should correspond to pressure on the pressure gauge

0.00667 mA per 1 psi
2400 psi*0.00667 = 16 mA

If these readings don't match or no loop power can be sourced, then the Pressure Transmitter is bad. (See **TS&R 4.M.25**, Pressure Transducer Repair.)

Photo 3.1-3
Red and black leads

ACCUMULATOR LOW/BAD PRESSURE

Press Low

The "Press Low" error occurs when the accumulator pressure is below the warning pressure value (under the Drives menu).

1. Start by initializing a re-charge cycle. Once a re-charge cycle has begun and display reads "Auto-Rchg", scroll up using the up arrow 15 times till display reads "Accum Pres".
2. Hold down the Enter Key and observe the Accumulator Pressure rising. This pressure should begin around 1900 lb because that is the pre-charge pressure of the Nitrogen on the other side of the Piston Accumulator. The increase in Pressure should be a steady rise of pressure until the pressure has reached the recharge pressure value under the Drives menu. There should be a 200 psi differential between the "Rechrg Pres" and the "Warn Pres" values.
3. If the accumulator has started its recharge cycle and the "Accum Pres" is at 1900 lb (or very close to the initial pressure), allow the Actuator to perform its recharge cycle to determine if the problem has been solved.

   If you notice that the accumulator has started its recharge cycle much lower than the 1900 lb, stop the recharge cycle by holding down the AUTO & MANUAL buttons at the same time. This will take the Actuator out of its re-charge cycle and back into setup mode for further evaluation of the problem.
4. Look at the Accumulator Pressure gauge located at the Actuator. This pressure should match what you see under the Drives Menu "Accum Pres". If the gauge is reading higher than what the transmitter shows, (between 1900 and 2400), go back to the **Pressure Bad** section and perform the same checks to determine if the problem is in the CPU or Transmitter. Repair or return the defective component if a problem is found.
5. If the Accumulator gauge and pressure Transmitter are both reading the same value (1700 psi or below), then there was a loss of Nitrogen from the Accumulator bottle. (See **TS&R 4.M.26**, Replacing Accumulator Bottle.)

DRIVE FAULT

3.2 DRIVE FAULT.

Photo 3.2 B stepper driver external power supply

3.2.1 B CSA drive fault IMS Driver

B Stepper Driver IMS Style with separate Power Supply:

The REXA B motor driver with external power supply is the first version of CSA approved stepper driver. It was used from 2005 to 2009 and only on a few model REXA units. There is no fault relay for this version driver. A jumper wire is installed on the CPU board between FLT+/FLT- disabling this feature. The IMS style driver does not have the logic I/O to enable this feature.

Interconnecting Cabling:

To test the cabling, remove the cable from the actuator and electronics. Verify the integrity of the cable by checking each wire to ensure there are no line breaks or shorts. Use a DMM to test the cables. If a problem is found with the interconnecting cables, replace the cable and recheck the unit for problems.

Stepper Motor:

The REXA Stepper module uses a 4 pole, brushless DC electromagnetic stepper motor. A sequence of voltage inputs from the driver module creates movement. If the sequence is interrupted by a loss of current, a short to ground or to another phase, a driver fault can result. To check the integrity of the motor, use a DMM to read the resistance between each motor phase.

Phase A
Wire pair Green (phase A) and Green/Black (phase A-)

Phase B
Wire pair Red (phase B) and Red/Black (phase B-)

The motor resistance must be 0.3 ohms between each phase wire (A/A-, B/B-). A reading of 0.6 or higher, or 0.1 or lower means the motor is bad and must be replaced. See section **TS&R 4.M.5** to replace the B motor.

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Stepper Drive:

The version 1 CSA X2 REXA actuator uses an IMS Stepper module driver to create motor movement. Some versions of REXA use an AMCI potted drive explained in the following sections. See photos to verify the style driver installed.

Photo 3.2.1-1
Version 1 CSA Driver

Photo 3.2.1-2
Version 2 CSA Driver

For version 1 drive continue on; version 2 drivers please skip to **TS&R section 3.2.2**, B CSA drive fault Potted Drive

The version 1 CSA IMS driver sends a 60 Vdc square wave pulse signal to the motor to create movement. The frequency of these pulses is proportional to the High Speed setting in the Speed/ACC menu. The IMS style driver uses power from the separate motor power supply to drive the motor.

The motor power supply uses the incoming power supply to power the motor/driver combination. Verify the incoming power at the power supply board TB1 located underneath the CPU board.

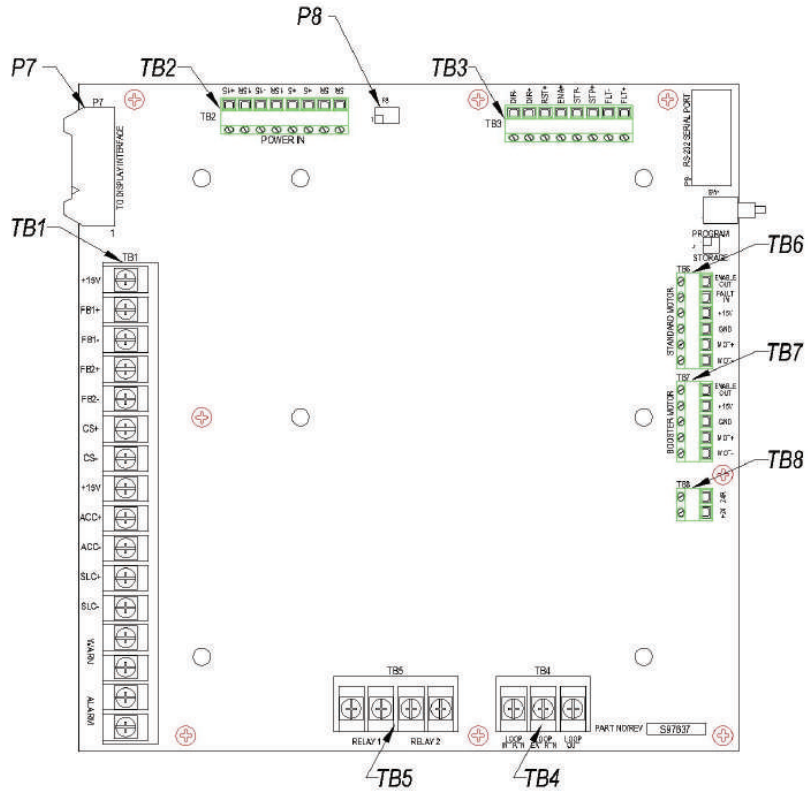

Figure 3.2.1 Power supply board

The driver must have a supply of 60 Vdc from this module. To verify the motor power supply voltage read the red/black output wires coming from the large blue capacitor. If the 60 Vdc is not present, change the power supply module. If the 60 Vdc is present, change the motor driver. (See **TS&R section 4.E.3** for instructions on the power supply module or **TS&R section 4.E.6−4.E.9** for driver replacement.) If the power supply and driver voltages are correct, continue on to the CPU.

CPU signals to the driver:

The stepper driver converts signals from the CPU to physical movement by the motor. The direction and speed of the motor is determined by input from the CPU.

DRIVE FAULT

Place the actuator in the Local mode to continue these checks. To read these signals, place a DMM on the terminals indicated. In the Local mode, attempt to move the motor.

1. *Direction*: The TB3 terminals, Dir- and Dir +. is the output to the driver that determines direction of motor movement. In LOCAL mode:
   - a.) Press the Down button, 0 Vdc should be present, motor direction should be counterclockwise.
   - b.) Press the UP button, 5 Vdc should be present, motor direction should be clockwise.

If the voltage is not consistent when pressing the up/down buttons on the display, change the CPU. (See **TS&R section 4.E.4**.)

2. *Enable:* The TB3 terminal ENA+ and ENA-, sends a 5 Vdc signal to the driver to enable the drive to send the pulses to the motor. If the 5 Vdc is not present during movement (present on both directions), change the CPU. (See **TS&R section 4.E.4**.)
3. *Step pulse:* TB3 terminals STP-, STP+. The pulse output to the drive is 10 microseconds wide. This is too fast to read via a DMM. An oscilloscope can measure the pulses.

   400 pulses = 1 revolution of motor movement.

If the pulses are not present, change the CPU. (See **TS&R section 4.E.4**.)

3.2.2 B CSA drive fault Potted Drive

A drive fault can be caused by damage to the motor, driver or its interconnecting cables. The first step to determine the problem is to identify what part of the assembly is at fault.

Photo 3.2.2 Potted drive

Interconnecting Cabling:

A drive fault can be caused by a short or wire break in the cable run. To test the cabling, remove the cable from the actuator and electronics. Verify the integrity of the cable by checking each wire to ensure there are no line breaks or shorts. Use a DMM or MEG device to test the cables. If a problem is found with the interconnecting cables, replace the cable and recheck the unit for problems.

Stepper Motor:

The REXA Stepper module uses a 4 pole, brushless DC electromagnetic stepper motor. A sequence of voltage inputs from the driver module creates movement. If the sequence is interrupted by a loss of current, a short to ground or to another phase, a driver fault can result. To check the integrity of the motor, use a DMM to read the resistance between each motor phase.

Phase A
Wire pair Green (phase A) and Green/Black (phase A-)

Phase B
Wire pair Red (phase B) and Red/Black (phase B-)

The motor resistance must be 0.3 ohms between each phase wire (A/A-, B/B-). A reading of 0.6 or higher, or 0.1 or lower means the motor is bad and must be replaced. See **TS&R section 4.M.5** to replace the B motor.

Stepper driver:

The version 2 CSA AMCI potted driver sends a 160 Vdc square wave pulse signal to the motor to create movement. The frequency of these pulses is proportional to the High Speed setting in the Speed/ACC menu. The potted AMCI drive receives a 5 Vdc signal from the CPU through a N/O switch internal to the drive. If there is a problem with the driver the switch changes state and the CPU initiates a driver fault. Any failure to the driver will change the state of this switch. A motor fault (as indicated above) or loss of input or

DRIVE FAULT

output power is recognized as a driver fault. Place the REXA unit in the Local mode to perform the following checks:

- Check incoming power to the drive. TB1 on the driver is the incoming power. Place a DMM on these terminals to verify the power input. If no voltage is present, there is a problem with the input power, or the motor thermostat has changed state.
- The motor thermostat is located on the actuator internal to the stepper motor. This switch is triggered at 350 °F (~180 °C). If the motor is allowed to cool (less than 300 °F [~150 °C]) the thermostat interlock will reset and power will be restored to the drive.
- If the 110 Vac power is present and the motor temperature is below 300 °F (~150 °C), check the output of the driver to the motor. As stated above, the driver sends a 160 Vdc square wave pulse to the motor.
- In Local mode, run the motor in either direction and check the output of the driver on TB2 terminals (A/A- and B/B-). If no output is present, the driver has failed and must be replaced. See **TS&R sections 4.E.6-4.E.9** for information on driver replacement.

CPU signals to the driver:

The stepper driver converts signals from the CPU to movement by the motor. The direction and speed of the pulses is sent to the driver in steps. The CPU first determines direction and then the drive is enabled. After that the pulse speed is sent to the driver. To determine if the driver is faulty, you must first check the CPU output.

1. *Direction:* TB3 terminals Dir- and Dir +. The direction is determined with high or no voltage on these terminals. In LOCAL mode:
   a.) Press the Down button, 0 Vdc should be present, motor direction should be counterclockwise.
   b.) Press the UP button, 5 Vdc should be present, motor direction should be clockwise.

If the voltage is not consistent when pressing the up/down buttons on the display, change the CPU. (See **TS&R section 4.E.4**.)

2. *Enable:* TB3 terminal ENA+. The CPU sends a 5 Vdc signal to enable the drive to send the pulses to the motor. If the 5 Vdc is not present during movement, change the CPU. (See **TS&R section 4.E.4**.)
3. *Step pulse:* TB3 terminals STP-, STP+. An oscilloscope can measure the pulses.

   400 pulses = 1 rpm of motor movement

If the pulses are not present, change the CPU. (See **TS&R section 4.E.4**.)

3.2.3 C drive fault

A drive fault can be caused by damage to the motor, driver or its interconnecting cables. The first step in determining the problem is to identify what part of the assembly is at fault.

Interconnecting Cabling:

A drive fault can be caused by a short or wire break in the cable run. To test the cabling, remove the cable from the actuator and electronics. Verify the integrity of the cable by checking each wire to ensure there are no line breaks or shorts. Use a DMM or MEG device to test the cables. If a problem is found with the interconnecting cables, replace the cable and recheck the unit for problems.

Stepper Motor:

The REXA Stepper module uses a 4 pole, brushless DC electromagnetic stepper motor. A sequence of voltage inputs from the driver module creates movement. If the sequence is interrupted by a loss of current, a short to ground or to another phase, a driver fault can result. To check the integrity of the motor, use a DMM to read the resistance between each motor phase.

DRIVE FAULT

Phase A
  Wire pair Green (phase A) and Green/Black (phase A-)

Phase B
  Wire pair Red (phase B) and Red/Black (phase B-)

The motor resistance must be 0.3 ohms between each phase wire (A/A-, B/B-). A reading of 0.6 or higher or 0.1 or lower, means the motor is bad and must be replaced. See **TS&R section 4.M.5** to replace the B motor.

Stepper driver:

The REXA C electronics use an AMCI drive to send a 160 Vdc square wave pulse signal to the motor to create movement. The frequency of these pulses is proportional to the High Speed setting in the Speed/ACC menu. The AMCI drive receives a 5 Vdc signal from the CPU through an N/O switch internal to the drive. If there is a problem with the driver the switch changes state and the CPU initiates a driver fault. Any failure to operate condition will change the state of this switch. A motor fault (as indicated above) or loss of input or output power is recognized as a driver fault. Place the REXA unit in Local mode to perform the following checks:

- Check incoming power to the drive. TB1 on the driver is the incoming power. Place a DMM on these terminals to verify the power input. If no voltage is present, there is a problem with the input power, or the motor thermostat has changed state.
- The motor thermostat is located on the actuator internal to the stepper motor. This switch is triggered at 350 °F (~180 °C). If the motor is allowed to cool (under 300 °F [~150 °C]), the thermostat interlock will reset and power will be restored to the drive.

- If the 110 Vac power is present and the motor temperature is below 300 °F (~150 °C), check the output of the driver to the motor. As stated above, the driver sends a 160 Vdc square wave pulse to the motor. In the Local mode, run the motor in either direction and check the output of the driver on TB2 terminals (A/A- and B/B-). If no output is present, the driver has failed and must be replaced. See **TS&R sections 4.E.6-4.E.9** for information on the driver replacement.

CPU signals to the driver:

The stepper driver converts signals from the CPU to movement by the motor. The direction and speed of the pulses is sent to the driver in steps. The CPU first determines direction and then the drive is enabled. After that the pulse speed is sent to the driver. To determine if the driver is faulty you must first check the CPU output.

1. *Direction:* TB3 terminals Dir- and Dir+. The direction is determined with high or no voltage on these terminals. In LOCAL mode:
   a.) Press the Down button; 0 Vdc should be present, motor direction should be counterclockwise.
   b.) Press the UP button; 5 Vdc should be present, motor direction should be clockwise.

If the voltage is not consistent when pressing the up/down buttons on the display, change the CPU. (See **TS&R section 4.E.4**.)

2. *Enable:* TB3 terminal ENA+. The CPU sends a 5 Vdc signal to enable the drive to send the pulses to the motor. If the 5 Vdc is not present during movement, change the CPU. (See **TS&R section 4.E.4**.)
3. *Step pulse:* TB3 terminals STP-, STP+. The pulse output to the drive is 10 microseconds wide. This is too fast to read via a normal meter. An oscilloscope can pick up the pulses.

   400 pulses = 1 revolution of motor movement.

If the pulses are not present change the CPU. (See **TS&R section 4.E.4**.)

DRIVE FAULT

3.2.4 Servo Motor Driver

REXA Omega Series Servo Motor Driver

This section covers the troubleshooting of the REXA Omega series servo driver. All Omega series drivers operate identically regardless of the motor and driver type. The part numbers and input/output voltages may differ, but the troubleshooting is the same. To troubleshoot the Omega series driver, it is recommended that the REXA CPU be placed in the Local mode.

REXA's Omega series Digital PWM Brushless Servo Amplifier offers the latest in high performance DSP control of brushless servo motors. The REXA unit operates in the VELOCITY Mode configuration. In this mode of operation, the servo driver module generates a tachometer signal which is used to close a velocity loop specific to the version of software loaded onto the driver and the corresponding motor type. The control of the velocity loop is via the REXA CPU. The signal from the CPU is an analog +/-3 Vdc signal. The slope and amplitude of this signal controls the acceleration, speed, and deceleration of the motor. See REXA Series 2 XPAC **IOM Section 6** CPU control parameters for tuning details.

Table 3.2.4 Servo motor driver

Features:	Characterization
Digital current loops	Current loop bandwidths up to 3 kHz.
Digitally tuned	All parameters set digitally. No potentiometers to adjust DSP control for the ultimate in high performance.
Silent operation	12.5KHz PWM standard.
Complete isolation	Complete optical isolation between signal and power stage.
Fault protection	Short from output to output, short from output to ground, amplifier RMS over current, amplifier under/over voltage, amplifier over temperature, motor over temperature.
RS-232	High speed (115.2 K baud) serial communication interface for set up and tuning.
Non-volatile memory	All parameters and positions are stored in non-volatile memory for reliability.
Status indicator	7-segment display indicates amplifier status and diagnostics.

The REXA Omega drive is pre-programmed at the factory for the specific motor on the actuator ordered.

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Troubleshooting the Omega driver begins with the outputs from CPU to the driver. To initiate motor movement, the CPU sends signals to the driver:

These signals are common for all models of Omega drive:

3.2.5–A Input/Output signals from CPU to Driver (TB6 STANDARD MOTOR)

ENABLE OUT: Blue wire—Signal to driver from CPU to engage movement; 0 Vdc during normal operation, 5 Vdc present during fault or reset condition.

FAULT IN: Red wire—Signal from driver to CPU to indicate problem with driver, motor or cabling; 0 Vdc during normal operation, 5 Vdc during fault condition.

+15V: No connection (15 Vdc available for logic power, not used on Omega Drive).

GND: Black wire—optically isolated ground for driver logic.

MOT-/+: Green wire with Black ground—Analog signal from CPU to driver to indicate operation speed, +3 Vdc /-3 Vdc (1 mV = 1 RPM of motor speed).

A MAX Hi Speed of 100% = 2.4 mV between these terminals, actual motor speed is 2400 RPM.

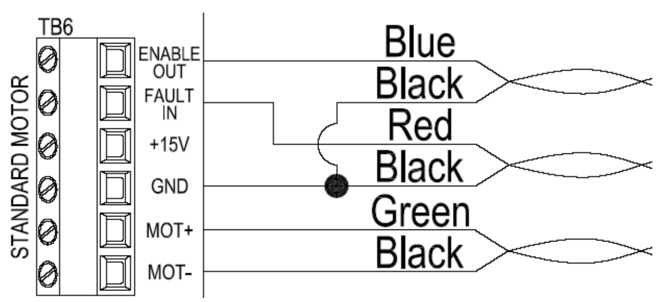

Figure 3.2.5–A Terminal block 6 Standard Motor

DRIVE FAULT

3.2.5–B Input/output signals from CPU to Dual D Drivers (TB6 STANDARD MOTOR)

Both drivers are terminated together as the above single driver at the TB6 terminal block, with the exception of the fault input. A separate board (fault/reset board) is used to have one incoming fault signal from both drivers.

FAULT IN: Signal from driver to CPU to indicate problem; 0 Vdc during operation, 5 Vdc during fault condition.

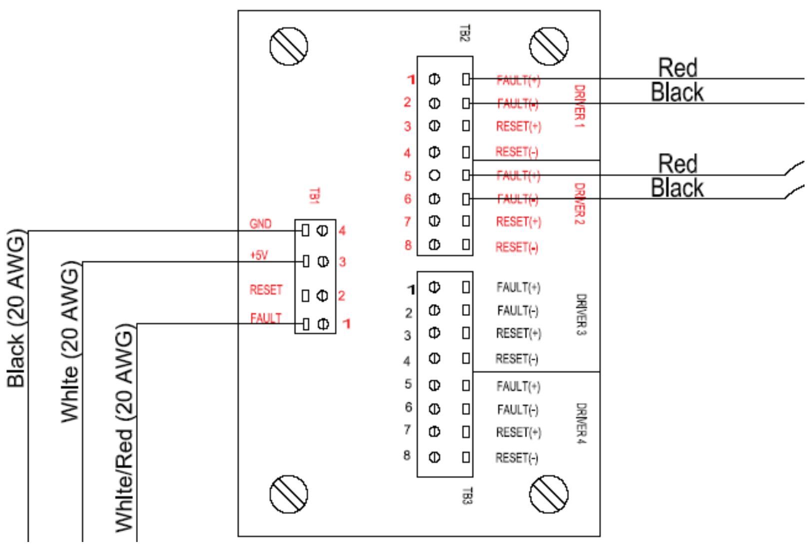

Figure 3.2.5–B Fault/reset board for Dual D and Booster Drivers

3.2.5–C Input/output signals from CPU to Servo Driver with Booster Driver (TB6 & TB7 Standard and Booster motor terminals)

For units with Booster pump option, the Servo driver is terminated as standard single input. The Booster driver is terminated to TB7. The input and output signals have the same value for booster and servo motors. The drivers share a fault/reset board for common fault input to the CPU (same as Figure 3.2.5–B, above).

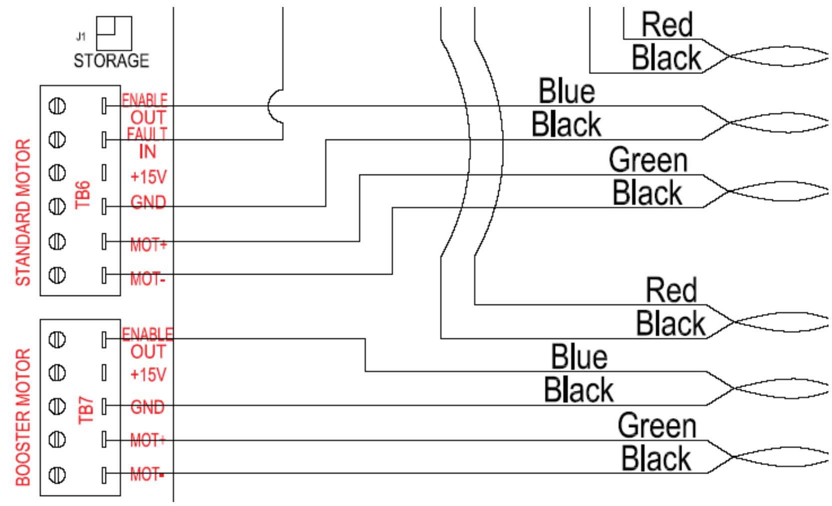

Figure 3.2.5–C Standard motor and booster motor termination

3.2.6 Driver Fault code identification

When a driver fault code is sent to the CPU (5 Vdc present on FAULT IN) from a driver, it will have a corresponding code on the driver display. While in AUTO mode, the CPU will send a “reset” signal to the driver in an attempt to clear the fault. The CPU will continue to send reset signals (approximately every 3 seconds) until the condition is corrected (until the fault is cleared). Removing the unit from AUTO mode will stop the reset signal and allow you to view the error code on the Omega display.

A diagnostic LED display is provided on each Omega driver, it is a 7-segment LED display. The drive generates Hall sensors and when the driver and motor are operating normally, one of the outer six segments is lit. Each of the six outer segments represents one of the six Hall states in a commutation cycle of a motor. During motor movement the display will show an O, all six segments lit (one at a time) in the direction the motor is turning.

DRIVE FAULT

REXA Omega Series Fault Codes (specific to the Omega drive LED display)

The fault codes below are shown on the drivers display when the CPU is not sending a reset signal to the driver. A description of the error code and possible causes are listed below:

Fault code = S. Immediate short code. (Electronic Circuit Breaker, high speed)

– Motor phase line to line short, or line to ground (direct short)

– Electronic “noise” on resolver cable (interference)

– Bad motor power cable

– Seized or shorted motor

Fault code = L. Secondary short code, (Low speed ECB tripped)

– Green and Blue Resolver wires reversed or loose

– Motor seized

– Incorrect motor connected to driver

– Any driver, Red and Black wires reversed or loose

For low and high speed short codes, be sure to inspect motor and cable integrity by use of a multi or MEG meter. Test for a short from phase to phase or from phase to ground. Also, inspect for wrong connection; i.e., blue and green wires swapped.

Fault code = E. Resolver error

– Resolver line break

– Resolver cable electrical noise (interference)

To correct the resolver error code, inspect cable connections and/ or damage or corrosion to the cables. Be sure to separate resolver (signal) cables from high power cables and other power sources (at least 3 meters [~10']).

Fault code = H. Driver Over-temperature (upper case H)

– Omega driver temperature is too high (185 °F [85 °C])

DRIVE FAULT

An **H** error code indicates the ambient temperature (at electronics enclosure) is too high for the driver to operate (ambient temperature range for Omega drivers -40 °F to +150 °F [-40 to +65 °C]).

This is a recoverable error. The ambient temperature for the electronics must be brought back below the 150 °F (65 °C) threshold in order to keep the 185 °F (85 °C) temperature switch on the driver heat sink from opening. Since high temperatures will shorten the life of electrical components; the electronics should be installed in a controlled environment.

Fault code = h. Motor over temperature (lower case h).

– Motor temperature is over thermostat set point (340 °F [170 °C])

The thermostat located in the motor has changed state. This is a normally closed switch. If the temperature of the motor is below 340 °F (170 °C), check thermostat cable connections (yellow/orange resolver wires).

Fault code = b. Over Voltage fault.

– Incoming power is over 252 Vac input power

Check incoming power supply. Refer to actuator specification sheet for power requirements.

Fault code = ≡ (three horizontal bars)**.** Power on commutation failed.

– Driver unable to ZERO motor position on start up

Wiring errors (resolver/motor) can cause commutation errors. Check all motor and resolver wiring at every termination; specifically, white/brown motor reference pair.

Fault code = = (two horizontal bars)**.** Invalid Hall state detected.

Invalid Hall state is internal to the Omega driver. The drive has failed and will need to be replaced.

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Fault code = 1. EEPROM checksum failed.

Checksum failure is internal to Omega driver; the write cycle has been interrupted or incorrect data has been written. Recycling power may recover the drive, if not, the drive must be replaced.

Fault code = C. Clamp condition active.

The REXA CPU has disabled the driver (fault relay) this will be followed by a reset signal from the CPU. There must be a corresponding condition for the CPU to clamp the driver. Check for drive faults, power problems (low or high incoming power) and resolver or control cable problems.

Fault code = F. Foldback condition active.

A foldback error is a warning that an unusual amount of current is needed to move the motor. During this condition in which unusually high current is detected, the power supply shuts down to protect the system. This can be caused by a shorted motor (see S error checks), or an open or incorrectly wired red/black resolver pair (cosine pair).

Fault code = O. This is a status indication of normal operation, the motor is moving.

Fault code = 8. Reset code

The CPU has sent a reset signal to the driver. (See **TS&R section 3.2.1**, CPU signals to the driver.)

Fault code = U. Driver power supply, bus Under Voltage

The incoming power supply is low; check incoming power.

3.2.7 Actuator “run away” when unit is powered up

Upon power up, some units can “run away” from the current position even if in the Local mode. When wired incorrectly, units with multiple drivers and motors can move without command. The cause of this can be due to wiring problems between driver/motor pair when either a motor or resolver cable is connected to the incorrect driver/motor pair.

DRIVE FAULT

Table 3.2.7 is for reference when dealing with a unit that moves without command.

Table 3.2.7 Motor Run Away.

THE FOLLOWING IS A LIST OF PROBABLE CAUSES FOR MOTOR TO RUN AWAY UPON POWER UP:										
	MOTOR			**RESOLVER FEEDBACK**						**MOTOR RUN AWAY**
AMPLIFIER'S PIN OUT	PHASE R	PHASE S	PHASE T	COSINE	COSINE RTN	SINE	SINE RTN	REFERENCE	REFERENCE RTN	—
MOTOR'S CABLE PIN OUT	PHASE S	PHASE T	PHASE R	COSINE	COSINE RTN	SINE	SINE RTN	REFERENCE	REFERENCE RTN	YES
	PHASE R	PHASE S	PHASE T	COSINE	COSINE RTN	SINE	SINE RTN	REFERENCE	OPEN	YES
	PHASE R	PHASE S	PHASE T	COSINE	COSINE RTN	SINE	SINE RTN	REFERENCE RTN	REFERENCE	YES
	PHASE R	PHASE S	PHASE T	COSINE RTN	COSINE	SINE RTN	SINE	REFERENCE	REFERENCE RTN	YES

1. If motor's power cables phase S, T and R are connected to amplifier's phase R, S and T, respectively, and motor's resolver feedback cable are properly connected, then the motor would run away upon power up.
2. If motor's power cables are properly connected to amplifier, and motor's resolver feedback cable REFERENCE RTN line is not connected to the amplifier, then the motor would run away upon power up.
3. If motor's power cables are properly connected to amplifier, and motor's resolver feedback cables REFERENCE RTN and REFERENCE are connected to amplifier's REFERENCE and REFERENCE RTN, respectively, then the motor would run away upon power up.
4. If motor's power cables are properly connected to amplifier, and motor's resolver feedback cables COSINE RTN and COSINE, SINE RTN AND SINE are connected to amplifier's COSINE, COSINE RTN, SINE and SINE RTN, respectively, then the motor would run away upon power up.
5. If all the motor's cables are properly connected to the amplifier, then there is one possibility that the motor would run away upon powerup. That is: in Motion Maestro and the amplifier are set to run in current mode. In the Control Panel window, if the sign of the current command and the sign of the Actual Velocity (RPM) do not match, and if the velocity loop is closed, then the motor would run away upon power up.

DRIVE FAULT

3.2.8 Servo Motor resistance readings

Check motor resistance.

Table 3.2.8 Servo motor resistance

	Resistance	Inductance	DC_Bus
Glentek_Full_D	1.4 Ohms	6.5 mH	280 V
Glentek_Half_D_120	.77 Ohms	3.25 mH	160 V
Glentek_Half_D_240	.77 Ohms	3.25 mH	280 V
Kollmorgen_Full_D	2.48 Ohms	38 mH	280 V
Kollmorgen_Half_D_120	2.34 Ohms	25 mH	160 V
Kollmorgen_Half_D_240	2.34 Ohms	25 mH	280 V

Replace motor if readings are not as noted above; replace driver if readings are correct.

3.2.9 DC Bus Voltage check

The DC Bus Voltage = 1.414 × AC line voltage. This voltage ***cannot*** be measured with a multimeter. An Oscilloscope is the best method to measure the Phase to Phase voltage at the motor. A REXA Omega Maestro program on a PC can also read this voltage (contact the REXA service department). The picture below is 100 V per division (5 v/d × a 20X probe), 295 V is the DC Bus voltage for 208 Vac/3-phase. For 240 Vac units, this voltage would be 340 V, and a 120 Vac unit would have 170 V DC Bus Voltage.

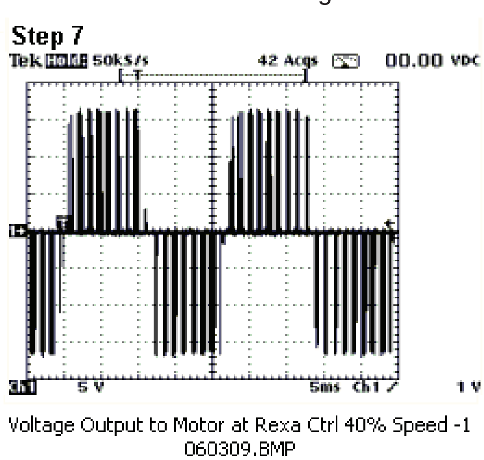


Figure 3.2.9 DC Bus voltage

3.2.10 REXA Omega Drive Motor Wiring

Most installation problems are with wiring. The following shows standard motor power module:

Table 3.2.10 Motor wire color and function chart.

COLOR	FUNCTION
RED	COSINE
BLACK	COSINE GROUND
BLUE	SINE
YELLOW	SINE GROUND
RED/WHITE	REFERENCE
YELLOW/WHITE	REFERENCE GROUND
GREEN	RESOLVER SHIELD
BLUE	PHASE R
GRAY	PHASE S
ORANGE	PHASE T
GREEN	MOTOR CASE GROUND
WHITE	TEMPERATURE SWITCH
WHITE	TEMPERATURE SWITCH

Standard Servo Motor Wiring at the Power Module

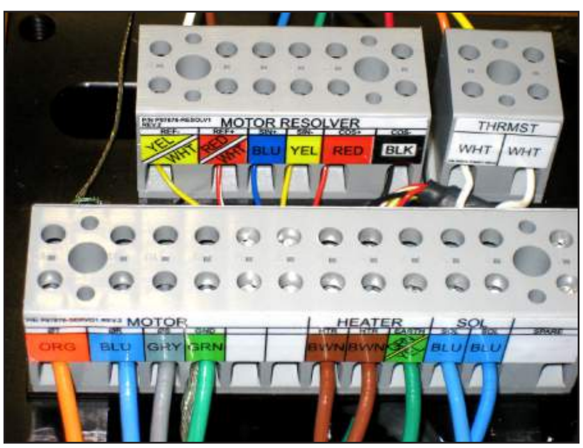


Photo 3.2.10-1 Motor Power (from enclosure side)

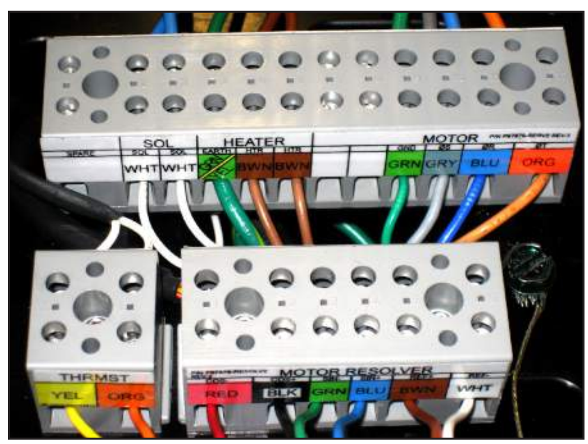


Photo 3.2.10-2 Motor Resolver (from enclosure side)

SEAT LOADING CYLINDER

3.3 SEAT LOADING CYLINDER PROBLEMS

The SLC acts as a mechanical elastic coupling. Instead of a mechanical coupling, the internal hydraulic pressure of the actuator (2000 psi) is used to show that the valve is in its seated position.

Refer to the **IOM Appendix B**, Figure B.3, for Loading Methods.

3.3.1 SLC reads Seated before actuator is on valve seat

Use the pressure gauges to verify that the pressure is above 2000 psi. This will happen when the actuator is driven into its mechanical stop (not the valve seat). The split clamp will need to be adjusted.

- Remove the split clamp and drive the valve to its seated position.
- Drive the actuator to its seated position. Move the actuator back open approximately ¼".
- Install the split clamp by lining up the valve shaft threads and the actuator shaft threads.
- Calibrate the actuator in Setup (PL & PH).

If the actuator is at 50% stroke and reading seated:

- Try to drive the actuator open then back closed in Local mode.
- If the unit still cannot go further than 50%, remove the split clamp and stroke the actuator completely closed and open, building pressure (2 000 to 2 300) on both gauges.
- If the proper pressure is obtained, the valve shaft is stuck or something is keeping it from going closed.

3.3.2 SLC Feedback bad

Verify the wires are all connected at the enclosure and actuator (Red +15, White SLC+ & Black SLC-).

Simulate a 4 to 20 mA signal at the enclosure on SLC+ and SLC-. If the error goes away, the problem is at the actuator or the actuator cable.

- Land the wires back and remove the FB cover on the SLC. Remove the white and black wire and simulate a 4 to 20 mA signal.
  - If the error goes away, the cables are good.

Two other components to check are the FB board and pot.

- Look to see if the red LED light is on the FB board; if not, check to see if the red and black wires can display 15 Vdc.
  - If the 15 Vdc is present and there is no LED light, change the feedback board (see **TS&R section 4.E.16**, Remote Mounted Feedback Board).
- Check the pot by using an Ohm meter. Using the orange and black wires to do so, you should read 0 to 5000 ohms.

3.3.3 SLC Stop

SLC stop is simply the valve seat. In order to correctly connect the valve shaft and actuator shaft follow these steps:

- Make sure both shafts line up perfectly.
- Drive the valve to its seated position.
- Drive the actuator to its seated position. Move the actuator back open approximately ¼". Install the split clamp by lining up the valve shaft threads and the actuator shaft threads.
- Calibration of the actuator can be done in Setup (PL & PH).

FEEDBACK BAD

3.4 FEEDBACK BAD

When dealing with feedback issues it is always necessary to ensure you have proper supply voltage to the electronics and that all the wiring is properly landed. The supply voltage is proportional to the CPU power supply. If the actuator's incoming power supply is low, high or unstable, the CPU power will also be affected.

The REXA feedback system begins with a potentiometer located on the mechanical assembly, cabling that carries the signal from the actuator to the electronics and the CPU which interprets and reports the position indication. The CPU operating voltage is provided by the Quad Power supply. The QPS is converting the incoming power to various dc voltages to operate CPU, display, the actuator internal feedback and the position transmission back to the operating control system.

Check all connections to ensure the landed wiring is not pinched down on the wire insulation, preventing a good connection.

If the actuator display reads FEEDBACK BAD, the following steps should be taken:

- Check wiring on a **non-contacting feedback.**
- Your wiring should be as follows: Red wire (supply voltage) is the +15 Vdc, White wire (4 to 20 mA signal) is the FB+, and the Black wire (reference) is FB-.
- The shield should be landed at the electronics and not at the actuator.
- These connections should be checked at every termination and junction box at every point between the CPU and the potentiometer.
- Refer to your wiring diagram for additional information.

To check the Quad power supply voltages see the diagram in Figure(s) 3.4–1, 2 or 3.

FEEDBACK BAD

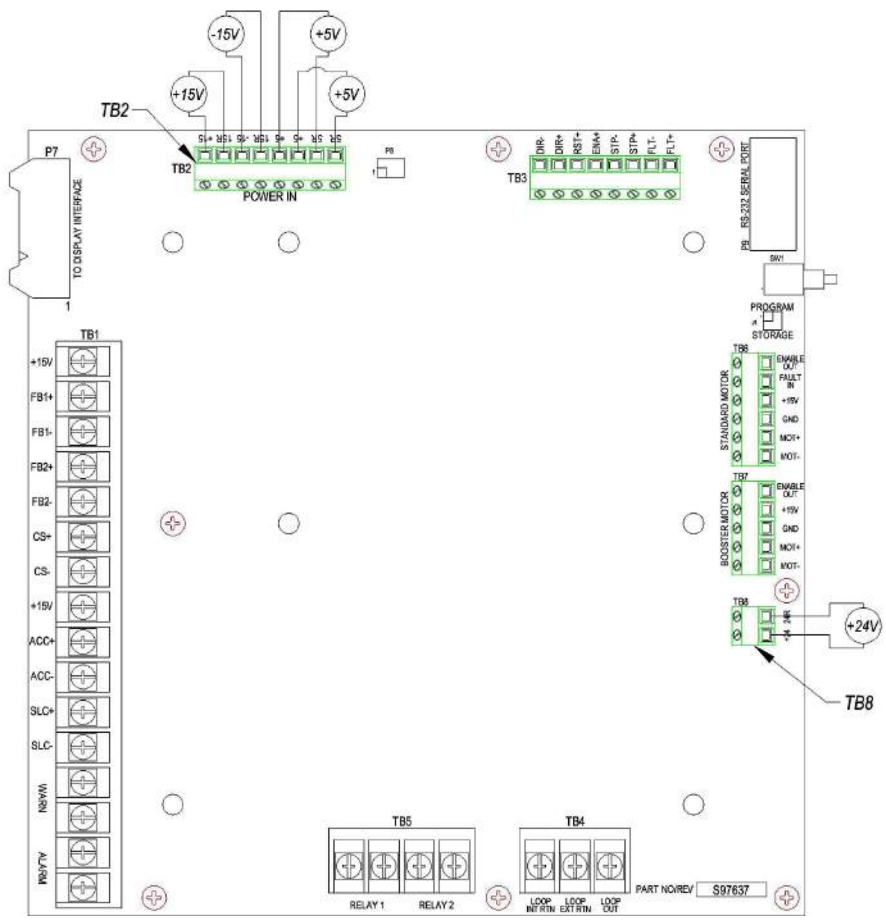


Figure 3.4-1 CPU voltage

Once all CPU voltages are confirmed and wiring has been inspected, the next step to resolve the FEEDBACK BAD error is to simulate a feedback signal directly to the CPU board. This will determine if the problem is with the CPU or with the potentiometer.

FEEDBACK BAD

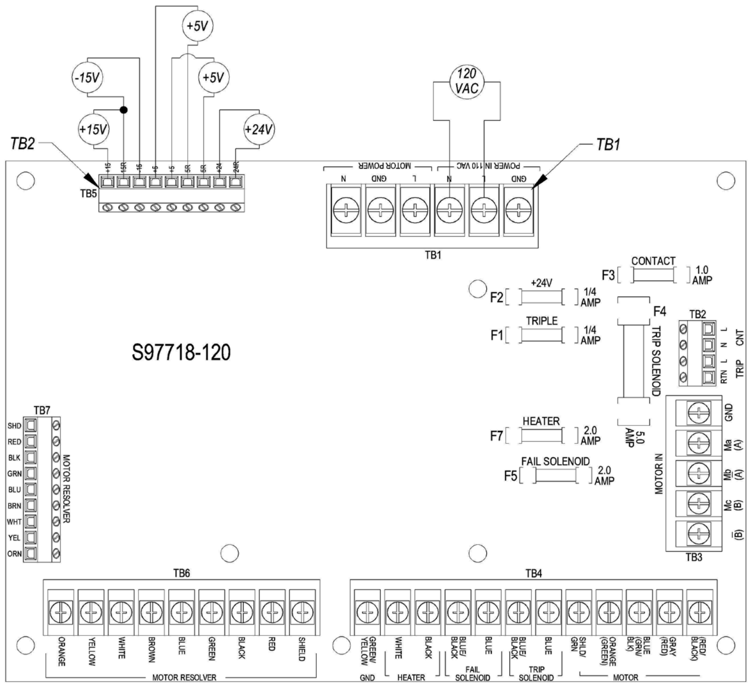


Figure 3.4-2 QPS 120 V

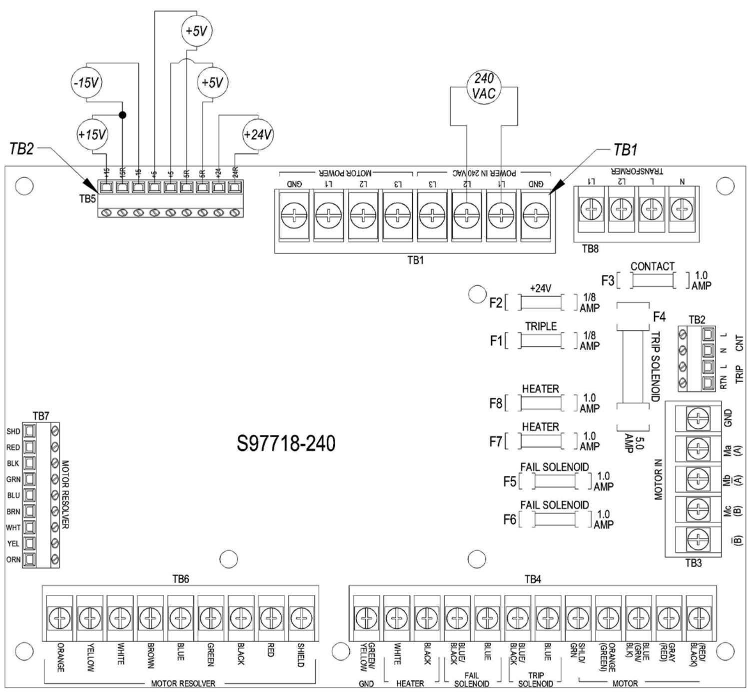


Figure 3.4-3 QPS 240 V

FEEDBACK BAD

- Place the actuator in Local mode, and remove the + and – FB wires. With a 4 to 20 mA source send a signal directly into the CPU at terminal 1 FB+/-.
- If the CPU can register and report a feedback signal, then the problem lies in the potentiometer assembly. Replace the potentiometer. (Refer to **TS&R section 4.M.20**.)
- If after simulating the feedback signal there is no change in feedback status, the problem lies with the CPU. (See **TS&R section 4.E.4**, CPU Assembly.)

Some actuators may come with a separate feedback circuit board. The feedback circuit board is not needed for most standard products (non-contacting potentiometer send a direct 4 to 20 mA signal to the CPU board). For units with a feedback board, additional terminations may result in a feedback bad error.

MOT STALL

3.5 MOT STALL

Problem:

Mot stall means that five attempts to move the actuator 1% of stroke in the time set in Stall Time (See **IOM section 6**, Modes of Operation and Control Parameters) have failed or, with a Seat Load Cylinder, the "Seated" position was reached on the Seat Load Cylinder and the position of the main cylinder was greater than 1% above Position Lo.

In both situations, the actuator cannot match actuator position to control signal input. A stall error can be caused by multiple systems; the first step in troubleshooting the stall error is to identify the cause. The actuator will need to be removed from service but may not need to be completely removed from the installation.

If possible, isolate the actuator from the process and place the unit in the Local mode for troubleshooting. Follow the steps below to identify if the stalling problem is mechanical or electronic:

1. Check oil level. See **IOM section 1.6.4** for oil filling instructions. If filling the system with oil solves the stalling problem, the unit can be put back into service. It should be closely monitored and serviced as soon as possible. See **TS&R section 2.5**, Oil Leaks, to locate a possible oil leak.
2. Check hydraulic system pressure. See **TS&R section 3.1** for system pressure troubleshooting.
3. Check output of driver.
4. Check motor resistance.

Solution:

3.5.1 Motor stall hydraulic

A stall error can be caused by high system pressure or low system pressure. The actuator will only generate enough pressure to overcome the process forces. It is not unusual for the actuator to operate well below the rated 2000 psi system pressure. With the unit in Local mode, stroke the actuator and observe the pressure gauges. If the actuator will not stroke via electronics, skip to section 3.5.2.

Use the handwheel/drill drive to confirm the mechanical system is operating.

For Servo units, the system power must be off to operate with handwheel.

For accumulator system handwheel operation see **IOM Appendix C, section C.4,** Manual Override.

For spring fail system, see **IOM section M.3**.

If the system builds pressure quickly and can not move, skip to **TS&R section 3.1**.

If the system builds no pressure, skip to TS&R section 3.1.

High pressure stall

A "high pressure" stall indicates the actuator either has to build too much pressure to operate the driven device, or the system is working too hard and can not follow the control signal. If one of the pressure gauges is over 2200 psi, the actuator is operating at its limit. Some possible causes of this may be binding in the linkage, hitting against a mechanical stop (cylinder limit, blockage in valve etc.).

To resolve a high pressure stall, remove the linkage and stroke the actuator to see if it will operate normally.

If the actuator can stroke with no problems while not connected to the driven device, then the problem lies in the linkage.

If the system still stalls while not connected to the driven device, check your calibrated low and high positions. See I**OM section 6**, Modes of Operation and Control Parameters for additional calibration information.

If the problem persists please contact your local REXA representative.

MOT STALL

Low/no pressure stall

A "low pressure" stall can be any situation where the actuator can not build enough pressure to move the driven device. A low pressure stall can be caused by an open solenoid (see **TS&R section 4.M.11**) or manual bypass (see **IOM Appendix C and M**), a failed suction check valve, improperly adjusted pressure relief valves or damaged cylinder piston seal.

- First verify the manual bypass and solenoid levers are in the correct position.
- Then verify the adjustable pressure relief valves have been set properly. See **TS&R section 4.M.7** for additional information on the adjustable pressure relief valves.
- If the unit will operate in one direction only, the suction check valves need to be replaced. See **TS&R section 4.M.9** for information regarding suction check valve replacement.
- If the unit can not build pressure in either direction, the piston may be worn and must be replaced. This will require the unit be taken out of service for repair.

3.5.2 Motor stall electronic

Electronic stall problems can be caused by the driver, cabling, speed/acceleration parameter settings or the motor itself. To confirm and replace the failed component, it is best to verify the operation of each component before replacing parts.

- Stall errors can be caused by a loose or corroded connection. Verify the system wiring for loose/corroded and correct connections at every termination from the motor, through all junction boxes, cabling and then to the driver.
- Gain and acceleration settings can cause motor stalls by operating too slow when nearing the actuators set point. Refer to **IOM section 6.1.5** for additional information on gain/acceleration settings.
- Refer to **TS&R section 3.2**, Drive Fault, for troubleshooting motor and driver components.

3.6 DIRECTION ERROR

Wiring is the most common cause for the motor not to move (or move in the wrong direction). For both stepper and servo units it is essential that the motor is ground at the power module and at the REXA electronics.

- For stepper units make sure the motor is wired correctly at the power module and the REXA stepper electronics. Refer to **TS&R Appendix C** for wiring schematic.
- For servo units, make sure that the motor wires and resolver wires are wired correctly at the power module and the REXA stepper electronics. Refer to **TS&R Appendix C** for wiring schematic.

REXA Electronics:

Ensure the position high and position low is correctly calibrated. Refer to **IOM section 6,** Modes of Operation and Control Parameters.

Make sure the deadband is calibrated according to the application. Refer to **IOM section 6**, Modes of Operation and Control Parameters.

Feedback:

- Make sure the feedback wires are wired correctly and properly shielded at the actuator as well as ground at the REXA electronics. Refer to **TS&R Appendix C** for feedback wiring schematic.

Mechanical

Bypass:

- Make sure that the bypass is closed by turning the bypass plug clockwise. If the bypass is opened while the actuator is in auto mode and/or in actuation, a direction error will be indicated on the display and the motor will stall as a result.

DIRECTION ERROR

Solenoid:

– Make sure the lever on the solenoid is in its correct position according to the application; this applies to the power module solenoid and/or high speed solenoids.

Hand Pump:

There are many ways the hand pump can cause a direction error:

– If the pump is being stroked while the actuator is running in the opposite direction of which the pump was stroked, then a direction error will be indicated.
– If the actuator is static in auto mode while the pump is stroked in any direction, a direction error will be indicated.
– If the direction knob on the pump is stuck in-between both pump directions, then the system will act as a bypass and cause a direction error to be indicated.

3.7 +/- 15 VDC FAIL

If you receive this error, please contact your local REXA representative.

HART INTERFACE

3.8 HART INTERFACE

__NOTE:__ Setup issues are not covered in this trouble shooting section and can be found in Appendix N of the IOM.

CS problem

If the actuator is receiving a CS bad error, remove both analog wires and hook them directly into the CS+ and CS- located on the CPU board.

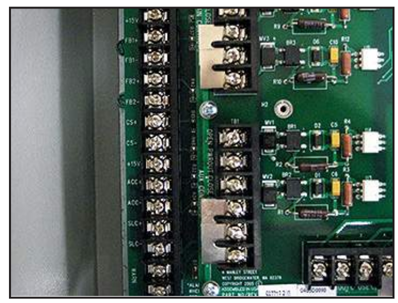


Photo 3.8-1
CPU CS+ and CS-

To identify the CPU board, reference **TS&R section 4.E.2**. The location of the CS+ and CS- on the CPU is shown in Photo 3.8-1. If the CS bad error continues, reference **TS&R section 3.11**, CS BAD.

If the problem goes away, replace the HART interface board. (See **TS&R 4.E.13**.)

No Digital communication is taking place

__NOTE:__ Be sure that block jumper J1 is in the STORAGE position. If the J1 block jumper is missing or not in the STORAGE position, move the jumper to the STORAGE position or secure a replacement block jumper before continuing.

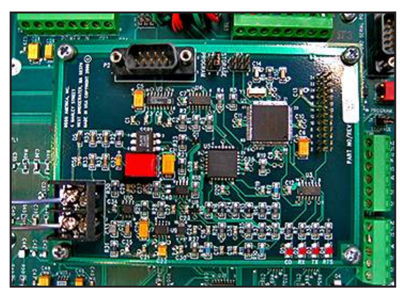


Photo 3.8-2
HART board

Under normal operation (when there is digital communication) the **CD**, **RX**, **TX**, **RTS** LEDs located on the HART board will flash in succession repeatedly. These LEDs are shown on the lower right side of the board Photo 3.8-2.

If all the lights are out this means there is no digital signal being sent to the REXA system. Troubleshoot the incoming control line with a HART compatible hand held device to determine if there is a digital signal to the REXA input lines. If this can be confirmed, replace the Hart board (see **TS&R 4.E.13**).

If only the **CD**, **RX** and **RTS** lights are flashing in succession and the TX light stays off, then check the software version installed in the

HART INTERFACE

CPU. This is identified as Version located under the outputs menu in set up mode. Below is a list of software that is compatible with HART (at the time this manual was written).

X01_9_AV
XB1_6_AX
XB0_7_AX
XS0_4_BB
X01_9_AV
XR5_3_AQ
XA0_4_AV
XT1_3_AY
XT2_3_BA
XC0_1_BE
XD0_0_BF
XM0_2_AZ

If the software installed is not listed above, record the actuator serial number and contact the REXA factory to determine the correct software version for the application.

FOUNDATION FIELDBUS

3.9 FOUNDATION FIELDBUS

NOTE: *Setup issues are not covered in this trouble shooting section and can be found in Appendix K of the IOM.*

No Digital communication is taking place

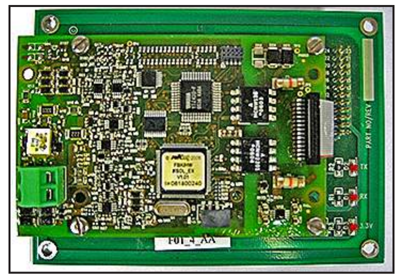


Photo 3.9
Foundation Fieldbus

Under normal operation (when there is digital communication) the 3.3 V, Rx and Tx LEDs located on the FOUNDATION Fieldbus adapter card will flash in succession repeatedly at a rate of 20 flashes / sec. These LEDs are shown on the lower right corner as seen in Photo 3.9.

– If the 3.3 V and the Tx LEDs are on and the Rx flashes very faintly, then check the software version installed in the CPU.

This is identified as Version located under the outputs menu in set up mode. Below is a list of software versions compatible with FOUNDATION Fieldbus (at the time this manual was written).

XR3_1_AJ
XR4_0_AG
X02_7_AW
XA1_5_AW
XM1_0_BG
XM2_0_BH

– If the software installed is not listed above, record the actuator serial number and contact the REXA factory to determine the correct software version for the application.

– If all three LEDs remain on, this indicates the wrong software has been installed in the CPU, and there is no digital signal being received from the DCS.

– If the Rx and 3.3 V remain on this indicates the digital signal from the DCS is not being received. Troubleshoot the incoming control line with a Foundation Fieldbus compatible hand held device to determine if there is a digital signal to the REXA input lines. If this can be confirmed replace the Foundation Fieldbus board. (Reference **TS&R section 4.E.14** for replacement procedures.)

PULSE BOARD

3.10 PULSE CONTROL SIGNAL

Some applications use a Pulse Control signal rather than a 4 to 20 mA modulating signal to position the actuator. The Pulse signal should have amplitude of 24–120 volts, with a minimum duration of 10 ms and maximum duration of 999 ms.

If Signal Type = Pulse cannot be accessed in the INPUTS menu:

- For the Signal Type parameter to display Pulse in the INPUTS menu, you must have the appropriate circuit board assembly installed. The circuit board is mounted atop the CPU as shown below.

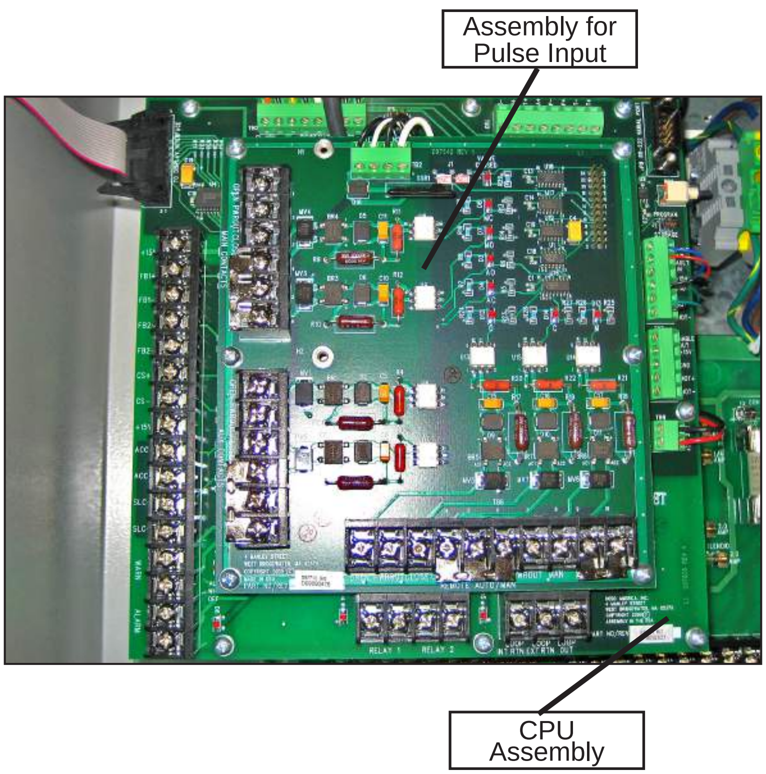


Photo 3.10 Pulse control circuit board

PULSE BOARD

If actuator will not move when pulses are applied or moves in wrong direction:

– Verify signals, open and close, are connected as shown in the following drawings.

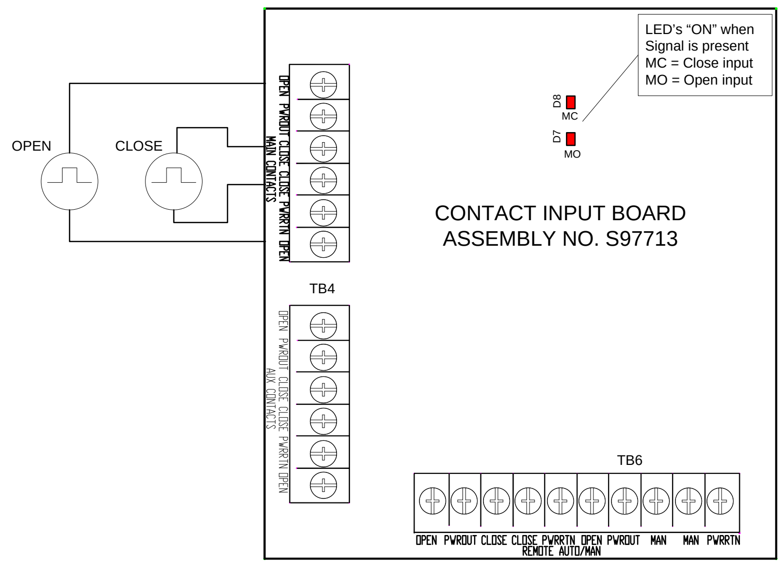


Figure 3.10-1 Pulse Signal Input – Using Active Voltage Signals

Or

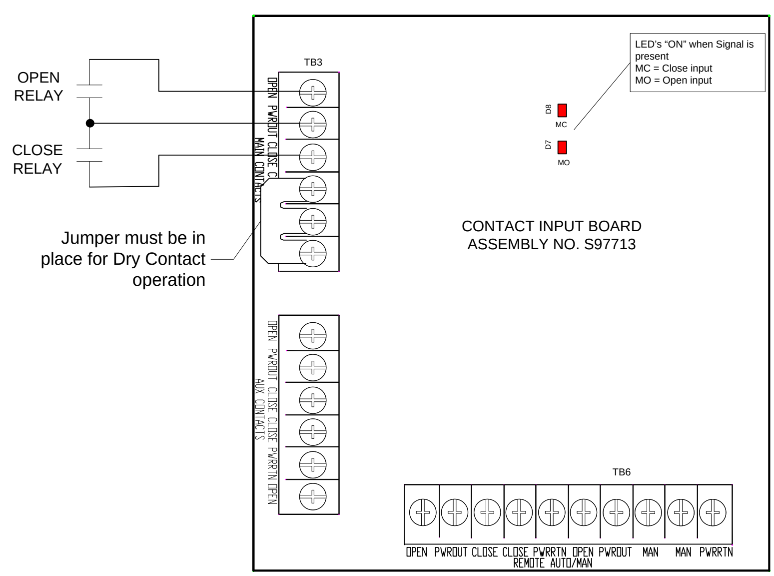


Figure 3.10-2 Pulse Signal Input – Using REXA Relays & Bias Voltage

PULSE BOARD

If Pulse input Signals are NOT polarity sensitive.

- Verify Signal Type = Pulse in the INPUTS menu
- Verify the signal amplitude is 24 V or greater, not to exceed 120 V.
- Verify Actuator is in “Auto” mode. Pulse control will not operate the actuator in Local or Setup modes.
- Verify that parameter Pulse Dur (Pulse duration) is equal to or just slightly less than the minimum pulse width being applied. For example, if a control pulse of 100 ms is being applied, Pulse Dur should be set to 95 ms to be sure the pulse is read by the input.
- Verify that the number of pulses being applied command the actuator to move beyond its deadband setting. For example, Pulse Dur = 100 ms and Pulse Inc (Pulse Increment) =0.1%. For every valid 100 ms pulse, the actuator will move 0.1% in the commanded direction. However, if the parameter Deadband = 0.5%, the actuator will not move until 5 successive pulses are given to command a move outside the 0.5% deadband.
- Verify the LED’s MC and MO illuminate when a pulse is applied.

Are both LEDs on when no pulses are applied? This indicates leakage current, typical of solid state devices, coming from the control system. The input board is interpreting both inputs as active (due to this leakage current) and the actuator will not move. 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 must be added across the input signal terminals and will bypass the current.

- Verify the circuit board is seated properly on the CPU mating 24-pin connector.

PULSE BOARD

- Verify the inputs with a known good source. Disconnect all wires from the DCS to the input board. If a jumper is present, remove it. Using a handheld current device, apply a 20 mA signal between the CLOSE–CLOSE inputs. The actuator should travel toward positioned defined by parameter Position Lo and the MC LED should illuminate. Now apply the signal between the OPEN–OPEN terminals. The actuator should travel toward the position defined by parameter Position Hi. If this operation is successful, re-check the incoming signals from the DCS.

CAUTION: 120 Vac is present on the PWR OUT and PWR RTN terminals.

If all the above do not solve the problem or the LEDs' MC and MO are not illuminating, the Contact In/Relay Out board must be replaced per **TS&R section 4.E.5**.

If actuator moves beyond target position when pulses are applied:

- Verify Signal Type = Pulse and not 1 Cont or 2 Cont.
- Verify pulse duration and pulse increment settings are set to values determined by your application.
- Verify the number of pulses being given. Multiple pulses may be read by the input. Pulse Dur may need to be adjusted to a higher value so that fraction of a pulse is not interpreted as a valid pulse.

One long pulse is interpreted as multiple Pulses. For example, with Pulse Dur = 100 ms and Pulse Inc = 0.1% and a pulse 500 ms in duration is applied, the actuator will move 0.5%, as the 500 ms pulse is interpreted as five, 100 ms pulses.

CONTROL SIGNAL BAD

3.11 CONTROL SIGNAL

The Control Signal is typically a 4 to 20 mA modulating signal which commands the actuator to travel to a set point.

3.11.1 If actuator Position does not match Control Signal Input (Control Signal Calibration)

Calibrate the DCS's 4 to 20 mA control signal to the actuator control enclosure. The default values for parameters Signal Lo and Signal HI are 4.0 mA and 20.0 mA, respectively. If the DCS control signal is slightly different than these values, actuator position will not match incoming control signal. Parameters Signal Lo and Signal Hi cannot be changed by pressing the arrows. An active 4 to 20 mA signal must be applied.

– Using the DCS control signal, access Signal Lo in the Calibrate menu and press the ENTER button for the "="to flash. Apply the signal that corresponds to command the actuator to travel to Position Lo, typically 4.0 mA. The actual current input will be displayed in mA and may vary slightly from the default value. Lock this value in by pressing the ENTER (↵) button, stopping the "=" from flashing.

– Apply the signal that corresponds to command the actuator to travel to Position Hi, typically 20.0 mA. The actual current input will be displayed in mA and may vary slightly from the default value. Lock this value in by pressing the ENTER (↵) button, stopping the "=" from flashing. The actuator position should now match the control signal input when in "AUTO" (⮌) mode.

Photo 3.11-1
Signal Lo

Photo 3.11-2
Signal Hi

NOTE: *Unknwn appears if control signal failure occurs while calibrating. Error appears, briefly, if an unacceptable value is entered. The unacceptable value is rejected and the previous value is retained.*

NOTE: *If Failsafe does not = Off, input signal value must be greater than 2.5 mA and the span must be greater than 3.8 mA. (Refer to IOM section 6.1.6, INPUTS Menu.)*

NOTE: *If Failsafe = Off, the span for Signal Hi must be greater than 3.8 mA or vice versa.*

3.11.2 CS Bad reading (Control signal is less than 2.5 mA)

- Verify Signal Type = Analog in the INPUTS menu
- Verify Control Signal is greater than 2.5 mA
- Verify the polarity of the applied Control Signal. The control signal input is polarity protected and current will not flow if the polarity is not correct.
- If the polarity is correct, be sure the 4 to 20 mA loop from the Control system is operating.

Using an ammeter, and again verifying polarity, vary the 4 to 20 mA current from the control system and confirm that it is correct. If it is not correct, the hand held current source can be used until the control system problem is resolved. If at any time the DCS control signal is suspect, use a handheld current source to verify operation of the actuator.

If the Control signal is correct from the control system, verify that the Control signal surge suppressor is not damaged. Do so by applying the control signal directly to the CPU board, bypassing the surge suppressor. Remove the wires on the CPU CS+ and CS- inputs that connect to the suppressor before applying the signal. Apply the known good control signal while in parameter Signal Lo and the "=" is flashing. Vary the signal. If the input matches the Control signal input, you have verified the Control Signal surge suppressor is defective and must be replaced. (Refer to **TS&R section 4.E.12** for Control Signal Surge Suppressor replacement.)

CONTROL SIGNAL BAD

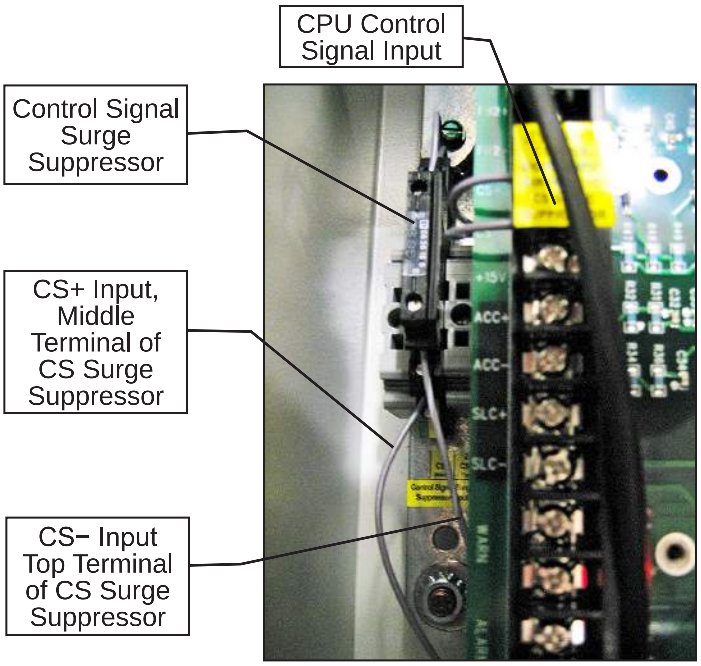


Photo 3.11-3
CPU connections

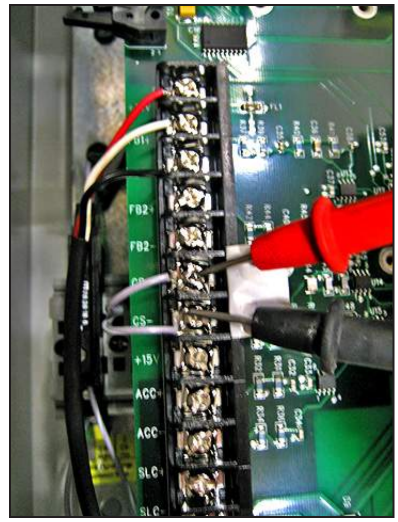


Photo 3.11-4
Digital voltmeter connections

If the CPU still does not read the Control Signal, reconnect the Control Signal surge suppressor wires to the CS+ and CS− inputs. Apply the control signal to the surge suppressor input. Using a Digital Voltmeter, measure the dc voltage across the CS+ and CS− inputs on the CPU board.

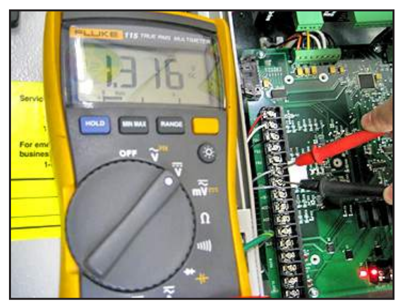


Photo 3.11-5
DC voltage for 4 mA

The dc voltage should vary between 1.3 Vdc (for 4 mA input) to 4.0 Vdc (for 20 mA) input. If the voltage varies with change in Control Signal but the display still reads CS Bad, the CPU must be replaced. Replace the CPU. (Reference **TS&R section 4.E.4**, CPU Assembly.)

3.11.3 Control Signal "dithering" or noisy

If the Control Signal from the DCS is varying at a high frequency on the REXA display, it may be contributed to a noisy signal or dithering built into the control system.

Photo 3.11-6
DC voltage for 20 mA

Verify that the control signal cable from the DCS is a shielded, signal type cable and the shield is landed to ground at the DCS only. In addition, be sure this signal cable is segregated from high voltage cables as they may induce voltage onto the signal causing it to vary.

Some control systems have a built in "dither signal" to operate with older actuators to always have them move. Be sure this function is disabled in your control system.

Should the above not remedy the problem, use a handheld current source to drive the control signal input.

- If the signal becomes quiet and the display is steady, you have verified the problem is with the incoming control signal and not the actuator input.
- If the display still varies with a steady input signal, the CPU must be replaced per **TS&R section 4.E.**4.

3.11.4 Actuator travels to Position Lo or Position Hi when CS Bad error occurs

Verify the Failsafe parameter is set to the appropriate setting.

Failsafe defines the position the actuator moves to via the motor if the Analog control signal falls below 2.5 mA.

Only in menu if Signal Type = Analog.

Select:

Inplac: Actuator remains in current position.

Close: Actuator goes to Position Lo.

Open: Actuator goes to Position Hi.

Off: Used for zero based control signal (i.e., 0 to 20 mA).

3.11.5 CS Bad error does not appear when Control Signal drops below 2.5 mA

- Verify Signal Type = Analog
- Verify Failsafe does not = Off

CONTACT INPUT BOARD

3.12 CONTACT INPUT SIGNAL

Some applications use a Contact Input signal rather than a 4 to 20 mA modulating signal to position the actuator. The Contact Input signal should have amplitude from 24 to 120 V. There are two types on Contact signal inputs.

The first is a single contact, or ON/OFF signal. This is strictly for two position control of the actuator. When the signal is present on the OPEN input, the actuator will travel toward position as defined by parameter Position Hi. When the signal is not present, the actuator will travel toward the position defined by parameter Position Lo.

The second is two contacts, or “Manual” control of the actuator. The actuator will travel toward Position Lo as long as the “Close” Input is active. The actuator will travel toward Position Hi as long as the “Open” input is active. If neither input is active, the actuator will remain at the current position. If both inputs are active, the actuator will remain at the current position.

If Signal Type = 1 Cont or 2 Cont, the CS Bad error code will not be displayed in Auto mode. CS Bad only applies to a 4 to 20 mA Control Signal

If Signal Type = 1 Cont or 2 Cont cannot be accessed in the INPUTS menu

For the Signal Type parameter to display 1 Cont or 2 Cont in the INPUTS menu, you must have the appropriate circuit board assembly installed. The circuit board P/N is S97713, and is mounted atop the CPU as shown in Photo 3.12-1.

CONTACT INPUT BOARD

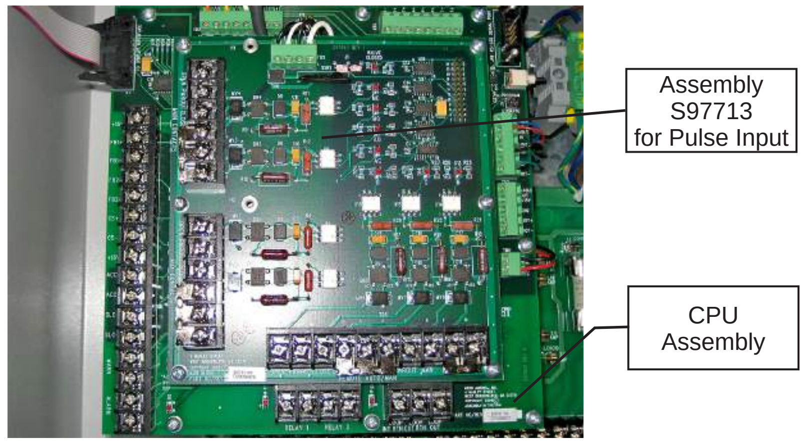


Photo 3.12-1 Contact input board

Using 1 Cont, actuator will not move.

– Verify the single contact is connected in one of the configurations shown below.

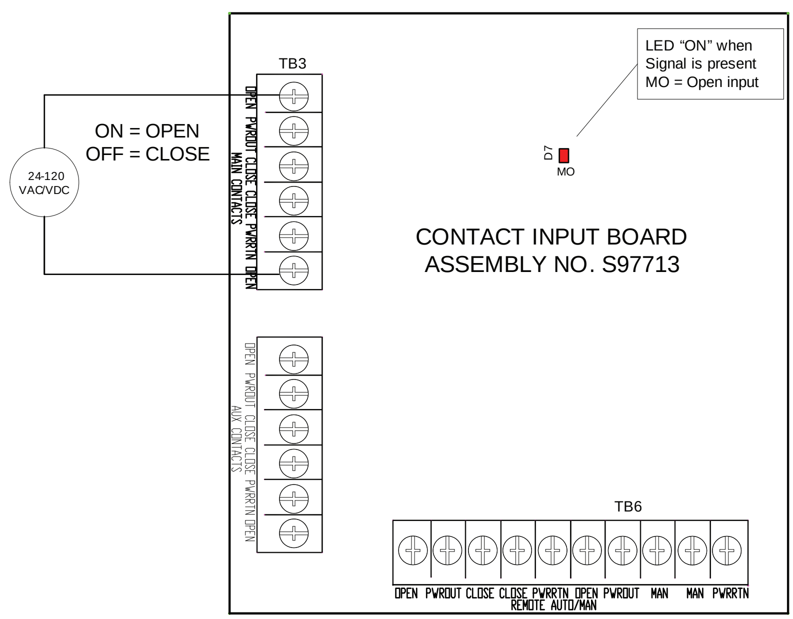


Figure 3.12-1 1 Contact Signal Input – Using an Active Voltage Signal

Or

CONTACT INPUT BOARD

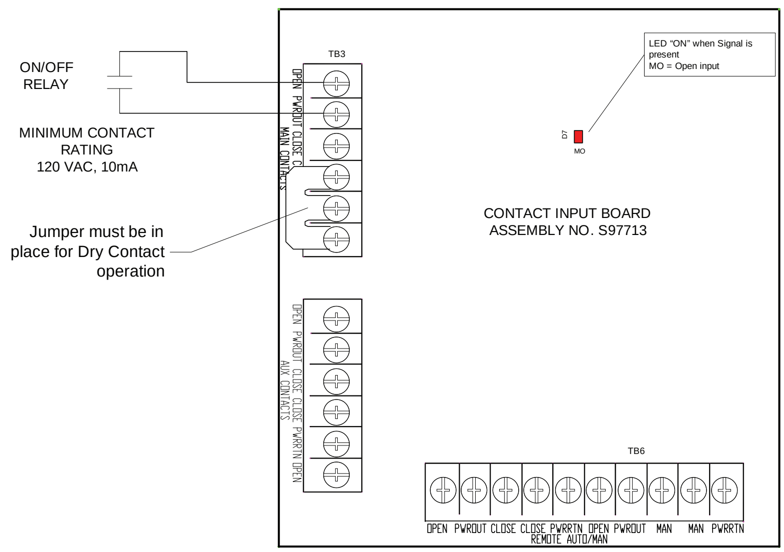


Figure 3.12-2 1 Contact Signal Input
– Using Relay and Bias Voltage from REXA

Contact Input signal is NOT polarity sensitive.

- Verify Signal Type = 1 Cont in the INPUTS menu
- Verify the signal amplitude is 24 V or greater, not to exceed 120 V.
- Verify Actuator is in "Auto" mode. 1 Cont control will not operate the actuator in Local or Setup modes.
- Verify circuit board is seated properly on the CPU mating 24-pin connector.
- Verify the inputs with a known good source. Disconnect all wires from the DCS to the input board. If a jumper is present, remove it. Using a handheld current device, apply a 20 mA signal between the OPEN–OPEN inputs. The actuator should travel toward the position defined by parameter Position Hi, and the MO LED should illuminate. Now remove the signal. The actuator should travel toward the position defined by parameter Position Lo. If this operation is successful, re-check the incoming signals from the DCS.

CAUTION: 120 Vac is present on the PWR OUT and PWR RTN terminals.

– If all the above do not solve the problem or the LED MO is not illuminating, the Contact In/Relay Out board must be replaced per **TS&R section 4.E.5**.

Using 1 Cont, actuator always runs toward Position Hi even when no signal is applied.

Are the LEDs on when no signal is applied? This indicates leakage current, typical of solid state devices, coming from the control system. The input board is interpreting the input as active due to this leakage current, and the actuator will not move. 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 must be added across the input signal terminals to bypass the current.

Using 2 Cont, actuator will not move.

– Verify the 2 signals are connected in one of the configurations shown below.

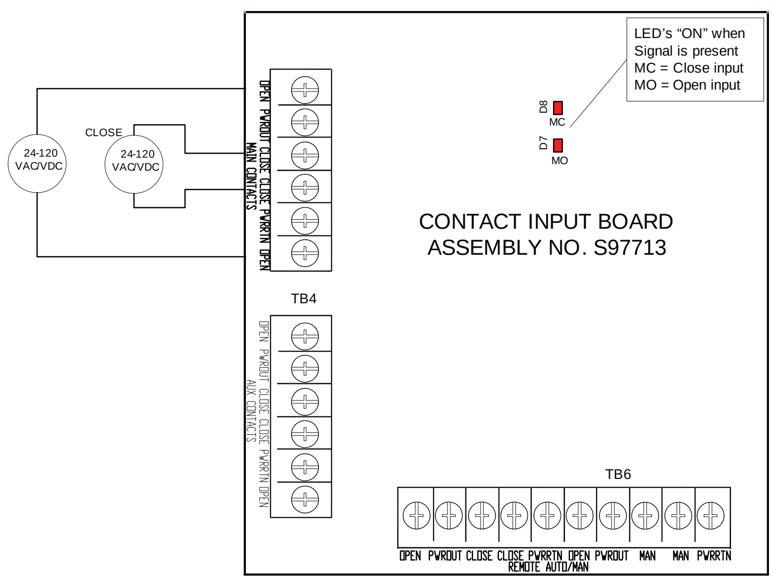


Figure 13.2-3 2 Contact Signal Input – Using an Active Voltage Signal

CONTACT INPUT BOARD

Or

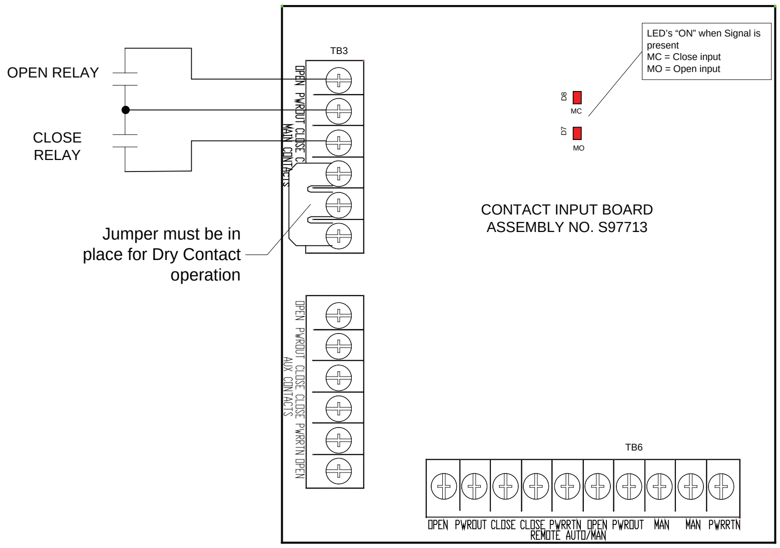


Figure 13.2-4 2 Contact Signal Input
– Using Relays & Bias Voltage from REXA

Contact Input signal is NOT polarity sensitive.

- Verify Signal Type = 2 Cont in the INPUTS menu
- Verify the signal amplitude is 24 V or greater, not to exceed 120 V.
- Verify Actuator is in “Auto” mode. 2 Cont control will not operate the actuator in Local or Setup modes.
- Verify the circuit board is seated properly on the CPU mating 24-pin connector.
- Verify the LED’s MC and MO illuminate when a signal is applied.

Are both LEDs on when no signal is applied? This indicates current leakage—typical of solid state devices—coming from the control system. The input board is interpreting both inputs as active due to this leakage current, and the actuator will not move. 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 must be added across the input signal terminals to bypass the current.

Verify the inputs with a known good source. Disconnect all wires from the DCS to the input board. If a jumper is present, remove it. Using a handheld current device, apply a 20 mA signal between the CLOSE–CLOSE inputs. The actuator should travel toward the position defined by parameter Position Lo, and the MC LED should illuminate. Apply the signal between the OPEN–OPEN terminals. The actuator should travel toward the position defined by parameter Position Hi. If this operation is successful, re-check the incoming signals from the DCS.

CAUTION: 120 Vac is present on the PWR OUT and PWR RTN terminals.

– If all the above do not solve the problem, or the LEDs MC and MO are not illuminating, the Contact In/Relay Out board must be replaced per **TS&R section 4.E.5**.

Using 2 Cont, actuator moves to Position Lo when OPEN signal is removed.

– Verify CLOSE signal is not active

– Verify Signal Type = 2 Cont and **NOT** 1 Cont.

DISPLAY PROBLEMS

3.13 DISPLAY PROBLEMS

3.13.1 Ribbon Connector

The ribbon cable connecting the membrane switch assembly to the interface circuit board may be disconnected.

Ribbon cable is disconnected

- When the ribbon cable is connected, the keypad display on the front of the enclosure will show the green power LED illuminated, and the display should read SETUP. If these two conditions are not present, the ribbon cable may be disconnected.
- Check that the ribbon cable is secured into CPU board connector P7 and the latches are closed so the cable can not pull out. The pink stripe on the ribbon cable should be facing Pin 1 of connector P7. The other end of the ribbon cable connecting to the display interface board should also be checked. The pink stripe on the ribbon cable should be facing Pin 1 on connector P1 of the display interface board with latches securely locking the ribbon cable in place.

Is power transmitting from CPU to the display?

- When there is no power, the VFD display will have no read-out, and the green LED on the keypad will not be illuminated.
- Before replacing CPU board, check +5 Vdc is present from Power Board. Measure dc voltage at terminal TB2 on CPU board. Measure the dc voltage with a DMM between Pin 6 (+5 Vdc) and Pin 7 (Ground). A +5 Vdc should be present; if not, Power Board needs to be replaced. (See **TS&R section 4.E.3** to replace Power board.)

- On CPU connector P7, disconnect the ribbon cable while powered. The exposed gold plated pins of the connectors can be measured to check if power is being output from CPU to the display. Measure the dc voltage with a DMM between Pin 2 (+5 Vdc) and Pin 14 (Ground). +5 Vdc should be present. If not, CPU board may need replacement. See **TS&R section 4.E.4** to replace CPU board.
- If +5 Vdc is present at TB2 on the CPU and at connector P7 and the display is still not functioning, then the ribbon cable should be replaced.

If +5 Vdc power is present from above, but still no display read-out:

External Display

- If the Green power LED is illuminated on the keypad display, but the VFD readout is not present, then the VFD display needs to be replaced. (See **TS&R section 4.E.10**).

Internal Display

- If the read-out is not present on the VFD display, but the push buttons work on the display interface board, then the VFD needs to be replaced. (See **TS&R section 4.E.11**.)

3.13.2 Control Issues

Trying to move the actuator in Local or Calibrate mode and the actuator will not move

- Ensure the keypad display green power LED is illuminated.
- Ensure that the Ribbon Cable (with blue connectors from the display interface to the keypad) has not come loose and is seated properly.
- Reset the Electronics by pushing SW1 on the CPU board.

PRESSSURE RELIEF VALVES

3.14 PRESSURE RELIEF VALVES

If the unit is creating more pressure than the application requires, the following steps should be taken to rectify this problem:

– Unscrew the adjustment cap on the pressure relief valve and check if the spring color is the correct color for the application (see **IOM Appendix O**). The wrong color spring can provide more or less pressure for the application.

If the spring in the pressure relief valve bonnet is correct, reapply the cap adjustment but do not tighten.

– Run the unit to see if the application is still building pressure on the pressure relief valve side that has been worked on.

If the actuator does not build pressure, the pressure relief valve is performing as designed. Pressure is not building because the valve stem is allowing fluid back into the system.

– Refer to **IOM Appendix O** to reset the pressure relief valve to its factory setting.

NOTE: *This process should be done to both pressure relief valves.*

If the actuator continues to build pressure, unbolt the pressure relief valve bonnet from the power module (Refer to **TS&R 4.M.7, Pressure Limiting Valve**).

If the valve stem is loose in the bonnet hole, check for contaminants in the pressure relief valve cavity.

– Place the pressure relief valve bonnet back into the pressure limiting cartridge cavity and refer to **IOM Appendix O** to reset the pressure relief valve.

– If the pressure relief valve continues to build too much pressure, refer to **TS&R 4.M.7**.

If the valve stem is tight/stuck in the bonnet hole, order a pressure relief valve replacement kit.

PRESSURE RELIEF VALVES

– Reinstall as referenced in TS&R 4.M.7, and refer to **Appendix O in the IOM** to reset the pressure relief valve.

CONTROL ISSUES

3.15 CONTROL ISSUES

3.15.1 Actuator Hunting – Electrical Noise

The actuator will not stop moving around its target position. This is referred to as “hunting” for position. There are many different factors that may cause the actuator to hunt for position; one is electrical noise.

Electrical Noise on the Control Signal

If the actuator is in “auto” mode and the display is fluctuating greater than the deadband setting AND the motor is turning, the cause may be electrical noise on the incoming control signal.

To determine if the control signal is unstable, you can observe the incoming control signal by using the Up or Down arrows to view parameter “Control Sig”. If the mA is fluctuating, the Control Signal is noisy.

- Ensure the Control Enclosure has a solid earth ground connection. (Refer to **TS&R section 4.E.1**.)
- Ensure the control signal cable from the DCS is a shielded cable.
- Ground the shield of the Control signal cable at the DCS end only.
- Ensure that the DCS does not have a built-in “dither” signal on the control signal output. This is found on some older control system/actuator combinations.
- Using a handheld current source, apply a 4 to 20 mA signal into the Control Signal input while observing the parameter Control Sig. If the display is steady, try operating the actuator with the hand-held device. If the actuator operates properly with the hand-held, the DCS signal is noisy and should be checked.

Electrical Noise on the Actuator Feedback Signal

If the actuator is in “auto” mode and the display is fluctuating greater than the deadband setting AND the motor is turning, the cause may be electrical noise on the feedback signal from the actuator.

The feedback signal from the actuator is a 4 to 20 mA loop which tells the CPU the actuator position. If this loop is noisy, the actuator may “hunt” to find the target position. To determine if the feedback signal is unstable, you can observe the actuator feedback signal in the “setup” mode.

- – Place the actuator into setup mode.
- – Access the “deadband” parameter in the Control menu.
- – Increase the deadband by 0.5%.
- – Place actuator into “Auto” mode

▶ Does the actuator stop hunting? If so, the problem is most likely noise. If not, noise may not be the issue.

- – In the “Calibrate” menu, scroll down to parameter Position Lo.
- – Record the value for Position Lo.
- – Press the “enter” button. The “=” will flash.
- – The value for Position Lo will indicate the current position of the actuator.

DO NOT PRESS ENTER.

▶ If the display is fluctuating, the feedback signal from the actuator is noisy.

- – Press the reset button on the upper right corner of the CPU. This will exit parameter Position Lo and default back to its previous value.
- – Ensure that the Control Enclosure has a solid earth ground connection. (Refer to **TS&R section 4.E.1**)
- – Ensure the feedback signal cable from the actuator is a shielded cable.

CONTROL ISSUES

- Ground the shield of the feedback signal cable at the control enclosure end only.
- Ensure the Feedback cable is in a signal level tray or conduit. Having the Feedback cable in a tray or conduit with high voltage cable can cause the signal to be noisy due to induced voltage on the feedback signal from neighboring cables.
- Ensure the Green/Yellow ground wire in the module cable is terminated at both actuator and control enclosure. This wire equalizes the ground potential at the control enclosure and actuator, thus eliminating possible current flow on the feedback cable shield.

▸ Faulty Feedback Device?

If the actuator is hunting or dithering for position, and feedback and control signal noise have been ruled out, it is possible that the actuator feedback device is faulty. The feedback device may have a random spot within its stroke in which the feedback signal is intermittent, giving the appearance of a noisy signal. The linear actuator uses a conductive plastic potentiometer with a 4 to 20 mA feedback board, and the rotary and drive actuators use a non-contacting device that transmits a 4 to 20 mA signal. Refer to **TS&R section 3.4** to troubleshoot feedback devices.

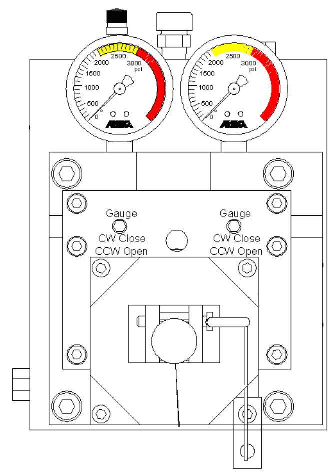
3.15.2 Actuator Torque / Thrust requirements

REXA Actuators and Drives are a self contained Electraulic™ device that utilizes a reversible hydraulic pump, driven by the motor, to pressurize either side of a double acting cylinder.

The output thrust/torque of each cylinder is based on an internal pressure of 2000 psi. That 2000 psi pressure multiplied by the effective area of the cylinder equates to the output thrust/torque.

Each X2 REXA standard power module is shipped from the factory with 2 pressure gauges; one to monitor each side of the cylinder.

The simplest way to ensure your actuator is producing the specified amount of torque/thrust is to observe the pressure gauges during operation. The gear pump will only produce as much pressure as needed to overcome the process forces. If the actuator is producing from 0 to 2200 psi without producing a stall error then it is operating within specifications. If the actuator stalls out or fails to produce over 2000 psi then consult **TS&R section 3.5.1**.



3.15.3 Actuator drifting

Actuator “drifts” away from applied load.

If your actuator is being “pushed” by the process, resolving this problem can be difficult and may require that the unit be removed from service.

The REXA actuator is designed to operate on 2000 psi internal oil pressure. At 2000 psi the cylinder is at its rated output. Each REXA unit has been designed to meet a specific application’s thrust or torque requirement. If your REXA unit is operating above the 2000 psi limit, you may have an undersized cylinder for your application.

Every REXA X2 power module has adjustable pressure relief valves to protect the actuator from over-pressurizing. If these relief valves are shut off or not operating properly, the unit may build too much pressure and damage itself or the surrounding equipment. To verify the cylinder output, see the serial tag located on the electrical

CONTROL ISSUES

or mechanical assembly. Refer to **TS&R section 1.2**, Actuator Identification, for additional information. Please contact your local REXA representative if you believe your cylinder is undersized.

If your actuator is correctly sized and still drifting away from the load, with the pressure gauges ON run the actuator in the direction of the load to see if internal pressure can be built.

- If no pressure builds but motor is turning, check the Manual bypass and / or override solenoids.
- If pressure builds but immediately drifts down, check the pressure relief valve setting. (See TS&R section 3.14.)
- If pressure builds but drifts down slowly, the unit may have a leaking piston seal or problem with the flow matching valve. Contact your REXA representative.

3.15.4 Position Transmitter Calibration

Xmitter Low {Transmitter Low} is the parameter to calibrate the Output zero of the 4 to 20 mA Position Transmitter.

Photo 3.15.4-1
Xmitter Low readout

To calibrate the 4 mA Zero, connect a DMM to the Position Transmitter Output on the CPU. Set the DMM to read milliamperes (mA). 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 will change the current output by one micro-amp (1 μA). The acceptable range for Xmitter Lo is 3.9 to 4.1 mA.

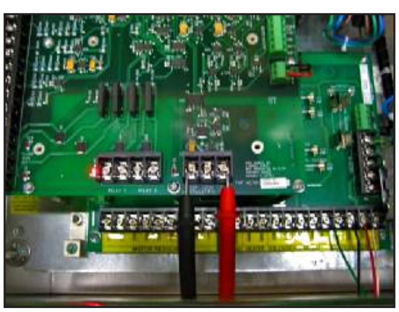


Photo 3.15.4-2
DMM connection

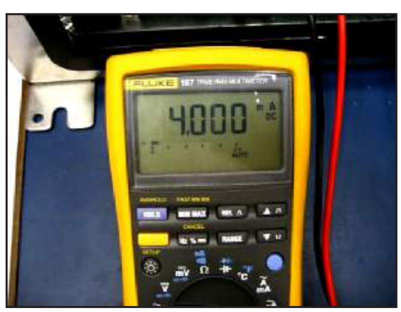


Photo 3.15.4-3
DMM display

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

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

To calibrate the 20 mA Span, connect a DMM to the Position Transmitter Output on the CPU. Set the DMM to read milliamperes (mA). 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 change the current output by one micro-amp (1 µA).

__NOTE:__ The Position Transmitter will output the mA signal that corresponds to the current position of the actuator 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.

Photo 3.15.4-4
Xmitter Hi readout

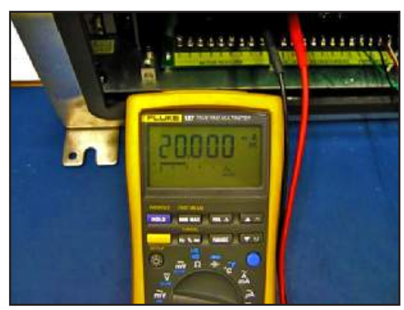


Photo 3.15.4-5
DMM display

__NOTE:__ Xmitter Hi and Xmitter Lo values are not transmitted over the bus in Foundation Fieldbus units.

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 to automatically re-calibrate its output.

CONTROL ISSUES

3.15.5 Electrical Limit Switches

The Electrical Sub-Assembly is equipped with two SPST 1 Form A PhotoMos relays that are configured as electronic limit switches. The termination points for these relays are located on the CPU board assembly at TB5, Relay 1 and Relay 2. The relays close based on the value of parameters RELAY #1 and RELAY #2 in the OUTPUTS menu. Refer to **IOM Section 6.1.8**.

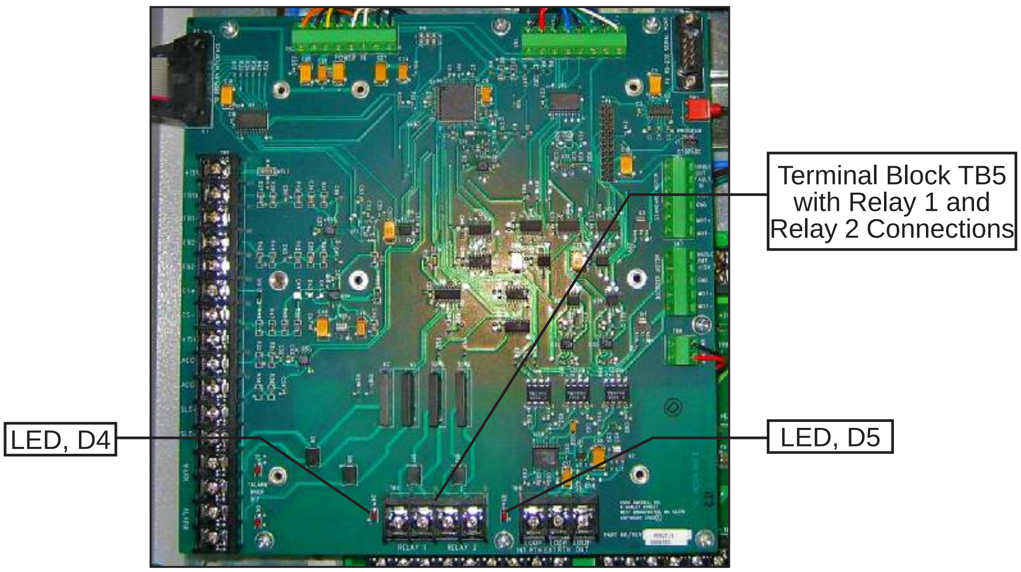


Photo 3.15.5-1 Terminal Blaock TB5

Electrical limit switch rating = 200 Vac/Vdc, 1 A

Can the electrical Limit Switches be configured Normally Open or Normally Closed?

– No. The relays are SPST, solid state devices with a Normally Open contact only. The relay contact is “open” when power is off or the relay is not within the “active” range determined by actuator stroke.

Do the solid state relays have leakage current when they are off?

- The leakage current in the "off" state should be no greater than 10 mA. If it is greater, the relay is defective and the CPU should be replaced per **TS&R section 4.E.4**.

If RELAY 1 does not give a closed contact indication:

- **Is the actuator stroke below the value set in parameter Relay#1?**
  - If no, bring the actuator to within the active range of Relay #1 or adjust parameter Relay #1.
- **Is the LED D4 lit?**
  - If No, replace the CPU Board according to section 4.E.4
  - LED D4 is lit, but I do not have a closed contact.

    Confirm the actuator is within the active range for Relay #1. Using an ohmmeter, measure the resistance across the terminals at TB5 for Relay 1. The "on" resistance of the relay should be approximately 0.7 Ω but no greater than 1.1 Ω.

    If the resistance is greater than 1.1 Ω or an open circuit, the relay is faulty and the CPU should be replaced per **TS&R section 4.E.4**.

RELAY 2 does not give a closed contact indication

- **Is the actuator stroke below the value set in parameter Relay #2?**
  - If not, bring the actuator to within the active range of Relay #2 or adjust parameter Relay #2.
- **Is the LED D5 lit?**
  - If No, replace the CPU Board according to **TS&R section 4.E.4**.
  - LED D5 is lit, but I do not have a closed contact.

CONTROL ISSUES

– Confirm the actuator is within the active range for Relay #2. Using an ohmmeter, measure the resistance across the terminals at TB5 for Relay 2. The “on” resistance of the relay should be approximately 0.7 Ω but no greater than 1.1 Ω.

– If the resistance is greater than 1.1 Ω or an open circuit, the relay is faulty and the CPU should be replaced per **TS&R section 4.E.4**.

3.15.6 Too High/Too Low on display

The display reads Too Low or Too Hi, and you cannot calibrate your high / low position.

The actual physical mechanical travel, of the REXA cylinder is recorded in the CPU. To prevent the unit from hitting the cylinder end during operation an electrical “cushion” is added.

– Back the actuator away from the cylinder end until the CPU allows the value to be set. If possible, disengage the driven device linkage slightly to allow the actuator more room to travel. If no changes can be made that will satisfy proper safe operation, contact your local REXA representative.

3.16 TRIP SIGNAL

REXA actuators can be configured to fail to either end position or stay in its last position. The fail to end position is achieved by either the use of a coil spring or a pressurized accumulator bottle. It can be triggered by a loss of power, control signal or independent trip signal.

3.16.1 Fail direction

The Fail direction is factory configured—based on information provided—to fail to either calibrated end, but not both, and is not field reversible.

Please contact your REXA representative.

3.16.2 No trip on loss of power

The actuator does not trip on loss of power reference.

- ▶ If equipped with a high-speed solenoid, ensure the solenoid override levers are both in Position A for normal actuator operation. Refer to **IOM Appendix C, section C.4,** Manual Override.
  - – Ensure the Accumulator bottles are charged and the Shutoff valves are in their proper position. Refer to **IOM Appendix C**, Accumulator Fail.
- ▶ If equipped with a REXA solenoid, a bypass control toggle lever will be present on the power module. Ensure that the lever is in its ‘normal position’. Refer to **IOM section C.4**, Manual Override.
  - – Check software settings for Trip option and / or Accumulator option under Inputs menu. Refer to **IOM section 6**, Modes of Operation and Control Parameters, for proper setting when using Trip function to fail on loss of power.
  - – Check fuses on triple power supply board with DMM. Fuses F5, F6 are for REXA spring fail solenoid. Fuse F4 is for High-Speed solenoids, and Fuse F3 is for

TRIP SIGNAL

Contact Input Board. Using a DMM, a good fuse will measure close to Zero Ohms or show continuity. A blown fuse is an open circuit or will read infinity on the meter. See **TS&R section 4.E.17** to replace blown fuses on Triple Power Supply.

3.16.3 No trip on loss of control signal

The actuator doesn't trip on loss of control signal.

If Analog control signal falls below 2.5 mA, the actuator should move to fail safe position via motor.

- Check that the Failsafe option is enabled. Refer to **IOM section M.3**, Failsafe Unit Operation.
- Ensure the Accumulator bottles are charged and the Shutoff valves are in their proper position. Refer to **IOM Appendix C**, Accumulator Fail.

NOTE: *Local and Remote Manual mode will override Failsafe position*

3.16.4 No trip on loss of trip signal

The actuator doesn't trip on loss of trip signal reference

- Check that the trip signal (24–120 Vac/Vdc) is wired to the correct terminals of the contact input board. Ensure that any required jumpers are in place. Check that the Trip option and/or Accumulator option is enabled. Refer to **IOM Appendix C**, Accumulator Fail.
- Check fuses on triple power supply board with DMM. Fuses F5, F6 are for REXA spring fail solenoid. Fuse F4 is for High-Speed solenoids, and Fuse F3 is for Contact Input Board. Using a DMM, a good fuse will measure close to Zero Ohms or show continuity. A blown fuse is an open circuit or will read infinity on the meter. See **TS&R section 4.E.17** to replace blown fuses on Triple Power Supply.

TRIP SIGNAL

- If equipped with high-speed solenoids, ensure the solenoid override levers are both in Position A for normal actuator operation. Refer to **IOM section C.4**, Manual Override.
  - Ensure the Accumulator bottles are charged and the Shutoff valves are in their proper position. Refer to **IOM Appendix C**, Accumulator Fail.
- If equipped with a REXA solenoid, a bypass control toggle lever will be present on the power module. Ensure that the lever is in its ‘normal position’. Refer to **IOM section C.4**, Manual Override.

WATER INGRESS

3.17 WATER INGRESS

3.17.1 Module / Motor

The Mechanical Sub Assembly (MSA) of the REXA Actuator is designed to thrive in the most hostile ambient environments. The MSA is rated NEMA 4X (protection against rain, snow, hose directed water and corrosion resistant). When properly installed your MSA should provide years of weather tight operation.

The MSA has multiple conduit entries. Each of the entries ship from the factory with a stainless steel plug installed with sealant around the threads to eliminate the possible ingress of water. If a plug is removed and replaced with a conduit fitting both local and National Electrical Codes (NEC) must be complied with to ensure proper installation and sealing.

The MSA also has a wire terminal cover that allows access to the module terminal strips. This cover incorporates an O-ring to form the seal against the environment. The ¼ inch bolts used to hold the cover on should be torqued to 120 lb·in to ensure the proper pressure on the O-ring.

Each motor should be equipped with either a hand wheel or a motor cover on the back end of the motor. These items are equipped with an O-ring to make sure the motor is sealed from any elements. If the back end of the motor is left unsealed, water or other elements may cause damage to the motor or wire terminals.

3.17.2 Electronics

The Electrical Sub Assembly (ESA) of the REXA actuator, although typically remote mounted from the MSA, is also rated for outdoor use. The standard steel enclosure is rated NEMA 4 (protection against rain, snow and hose directed water). When properly installed your ESA should give you years of weather tight operation.

The closing mechanism on the ESA is a single point quarter turn latch that requires the use of a tool for opening. When properly closed the cover is compressed against the gasket to form a seal against the environment.

All electrical connections to the ESA should be made at the gland plate found at the bottom of the enclosure. The gland plate can be removed, drilled for the different entry points, and then re-installed with the gasket in place. When installing conduit fittings both local and National Electrical Code (NEC) must be complied witih to ensure proper installation and sealing.

4.E. Electrical Repair

4.E.1 GROUND LOOPS

4.E.1.1 What is a Ground Loop?

A Ground Loop can be present in a system when points nominated as Grounds are at different potentials, and there is more than one electrical path connecting these Grounds, and signal lines are connected in such a way that circulating ground currents are able to flow through one or more signal conductors.

The resulting current that flows in the loop can be very large — in extreme cases hundreds of amps — but is more commonly less than 500 mA. The voltage drop along the wire that is part of the measurement circuit is impressed on the signal voltage thus causing the error. Because this current is variable, it cannot be "calibrated out."

4.E.1.2 Why Ground Anyway?

Three reasons for grounding measurement systems:

- The first is safety. Should a high voltage accidentally come into contact with the measurement system, the measurement system would become dangerous. A grounded

GROUND LOOPS

measurement system would cause a fuse to "open" thus rendering the system safe.

- The second reason for grounding is to ensure the measuring system is operating within its operating voltage range. If the system were not grounded, the system could be charged to high voltage levels by static electricity or insulation leakage. At some point, the system's insulation would break down, possibly causing measurement errors in the process.
- A third reason grounds may be introduced into a system is due to sensor needs. For example, to obtain the best possible thermal contact and response time, a thermocouple may be welded to the object of interest — hence grounding the thermocouple. Another example is the pH electrode — it is in electrical contact with the fluid being measured.

4.E.1.3 Solutions (or a Single Ground is a Good Ground)

1. **Eliminate the loop**
   The simplest and most effective method to avoid ground loop problems is to ensure the measurement system is connected to a single ground point. Eliminate the loop. However, this is not always possible as sensors must sometimes be grounded; communications links with computers introduce additional grounds, or electrical safety demands multiple grounds. But there are solutions:
2. **Use Differential Inputs**
   The use of differential inputs (as opposed to single ended inputs) is effective in overcoming ground loop errors as no current passes down the two measurement wires. However, differential inputs are only as good as their common mode rating. If the ground voltage difference exceeds the rating the errors will be introduced.
3. **Shield Grounds**
   If shielded wires are used, the shielding should be grounded at one end of the cable only, preferably the measurement system end. If grounded at both ends, ground current will flow through the shield and inductively induce noise into the signals wires (which should be twisted to minimize this

effect). Also, it is possible that injecting the loop current into the shield connection points may cause errors in the measuring device or the sensor.

4. **Isolation at the sensor**
   If possible, electrically isolate all the wiring associated with the sensor from the area in which the sensor is installed. This may need to include power supplies. The preferred grounding point is at the measuring device.

   Sometimes it is not possible to isolate the sensors or its wiring. In these cases it is necessary to isolate at the measuring device by providing a fully isolated input for that sensor. If there is only one such sensor in the system, it may be possible to use its ground as the system's ground.
5. **Isolation at the measuring device input**
   Providing isolation at each of the measuring device's inputs is the best but most expensive solution. Typically such isolation will double the equipment cost. Also, isolation has its limitations — speed and accuracy are often sacrificed to contain the costs.
6. **Isolation at the measuring device output**
   In small systems a cost effective solution is to provide isolation at the measuring devices output interface such as RS232, Ethernet, USB or modem.
7. **Isolation (floating) of the measuring device**
   An unconventional but occasionally practical method of isolation in a small setup is to isolate the entire measuring device by allowing it to operate off batteries. The method can provide almost any level of isolation required, but if used to isolate very high voltages, extreme care must be taken against forgetful contact.

The simple rule still applies — a single ground is a good ground. Sometimes you may have no choice where the ground may be placed (as with a grounded thermocouple grounded for good thermal contact and response time), but remove ALL other grounds.

GROUND LOOPS

4.E.1.4 Causes of Ground Potential Differences

Understanding the cause of ground potential differences can be of some help in minimizing their impact on the measuring system and also in negating effects such as corrosion.

- Electric trains and trams —
  Electric traction systems often use the tracks as a the return path for the current drawn from overhead power lines.
- Ground returns in electrical power systems
- Ground returns in marine power plants
- Lightning strike
- Galvanic corrosion prevention systems
- Inductively induced currents

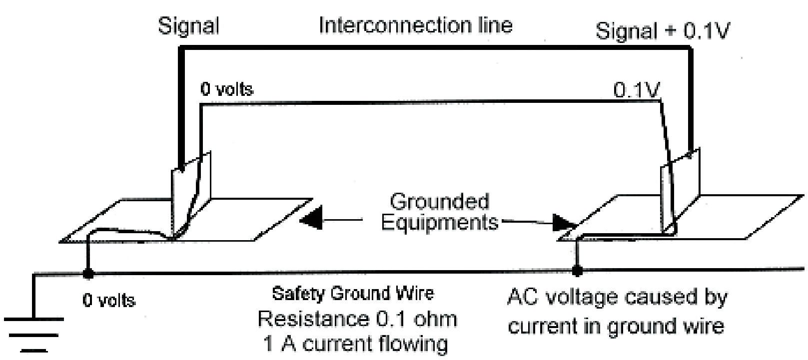


Figure 4.E.1.4 Ground Loop

4.E.1.5 Ground loops and REXA Equipment

- Related to signal wires (Feedback, pressure transmitter)
- Earth ground connection between actuator and electronics
- Signs of ground loop problems:
  - Noisy/unstable feedback, control or pressure transmitter signal
  - High voltage measurement between Earth Ground and Neutral conductors at the control enclosure power input.

4.E.1.6 What fixes a ground loop?

Typically, a ground loop is fixed by cleaning up the interconnecting wiring to have:

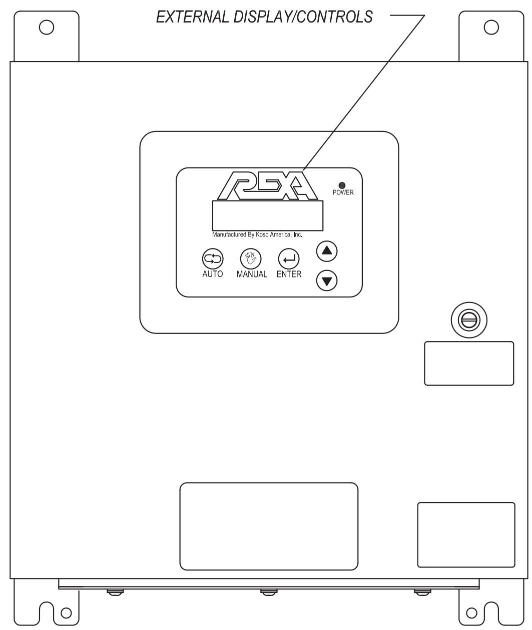
- Shields terminated at ONE end of the cable only
- Shields connected to the backplane of the electronics enclosure
- AC Ground from the AC source brought to the control enclosure and actuator rather than ground to building steel only
- Good earth ground connections
- Trial and error… ground loops can be difficult to solve and require patience and thorough site evaluation. Every installation is different; take it one step at a time

STANDARD AND CSA B/C-PUMP CONTROL ENCLOSURE

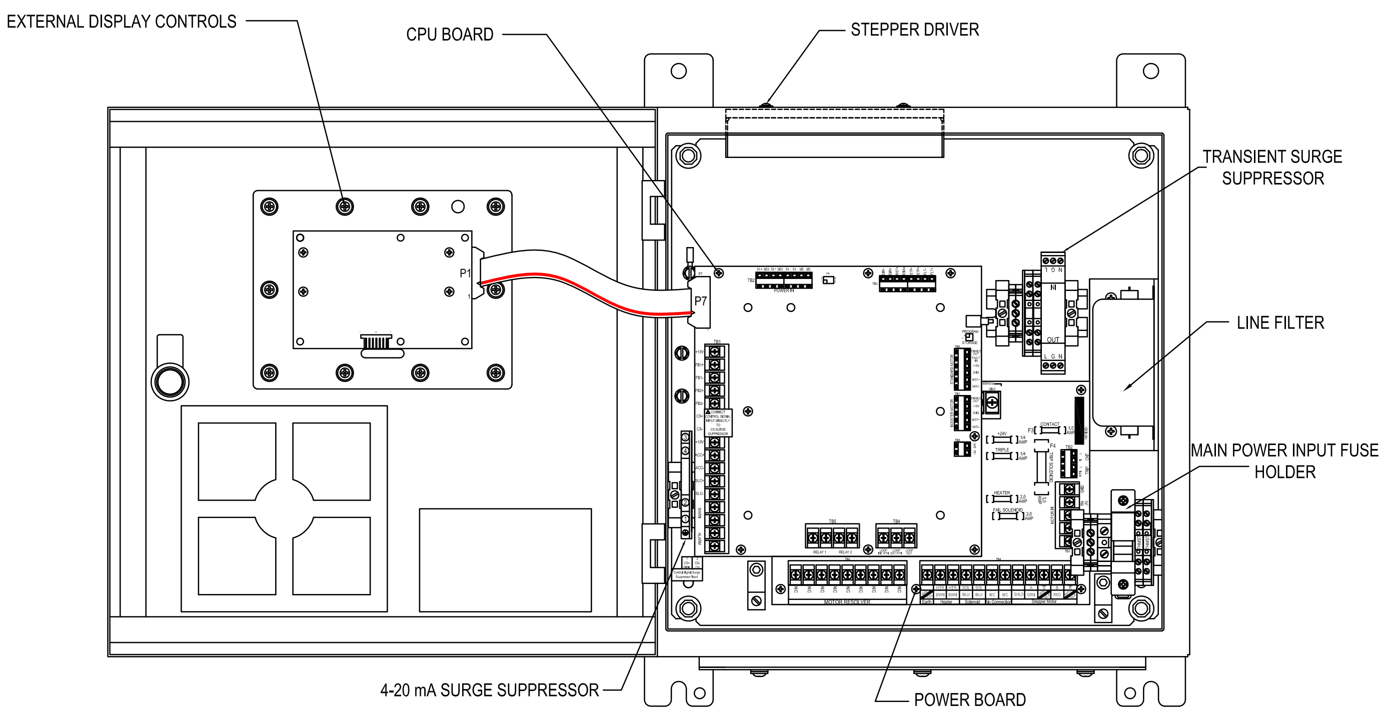
4.E.2 COMPONENT REPLACEMENT

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

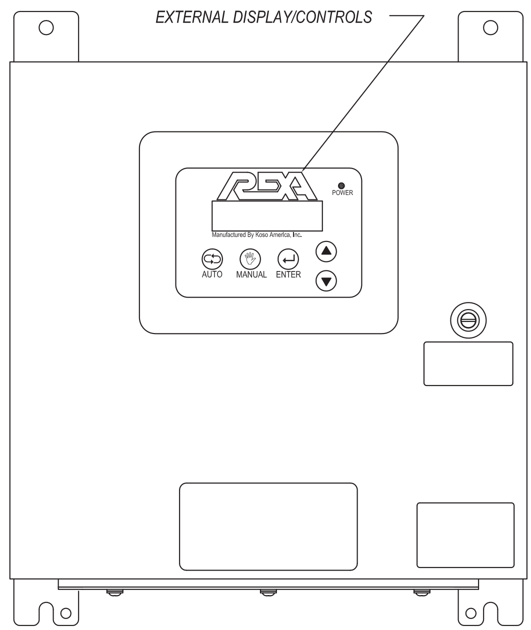
NOTE: *Assumed starting position is facing the upright electronic unit with the enclosure door open.*



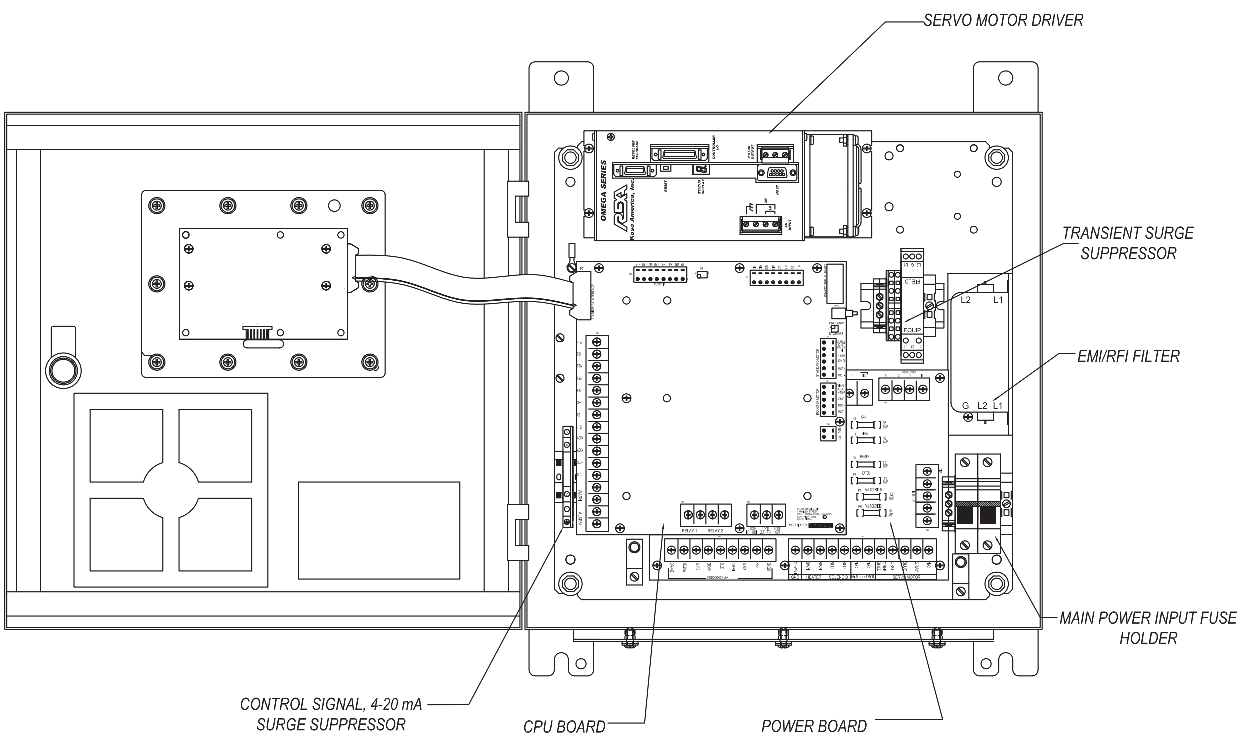
Figures 4.E.2-1&2 Standard and CSA B/C-Pump Control Enclosure



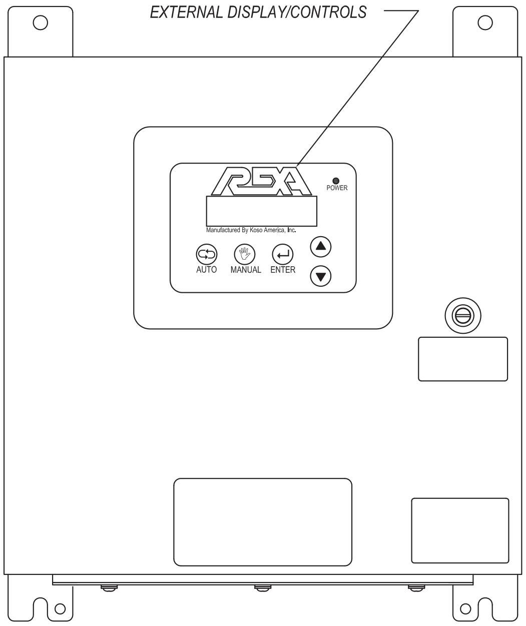
D-PUMP CONTROL ENCLOSURE



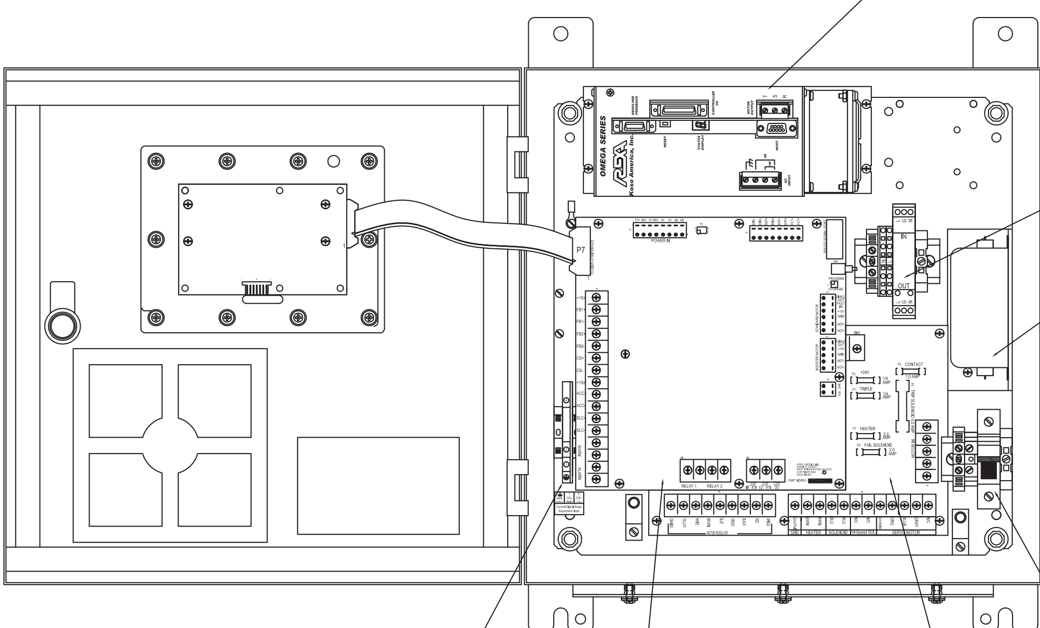
Figures 4.E.2-3&4 D-Pump Control Enclsure



1/2 D-PUMP CONTROL ENCLOSURE

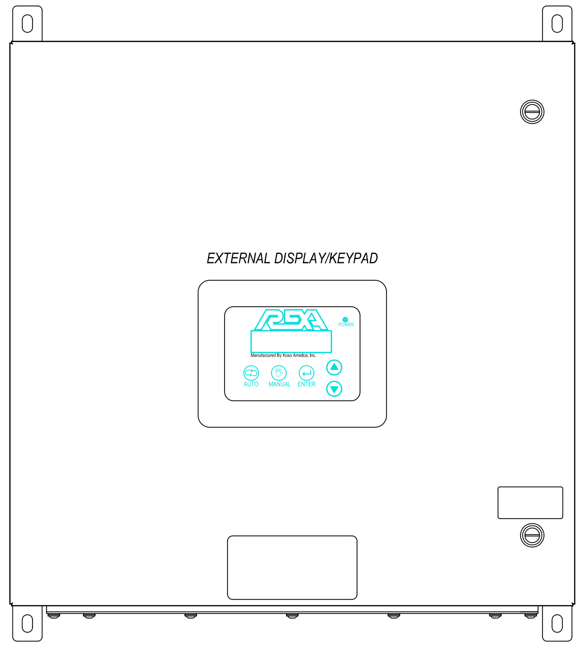


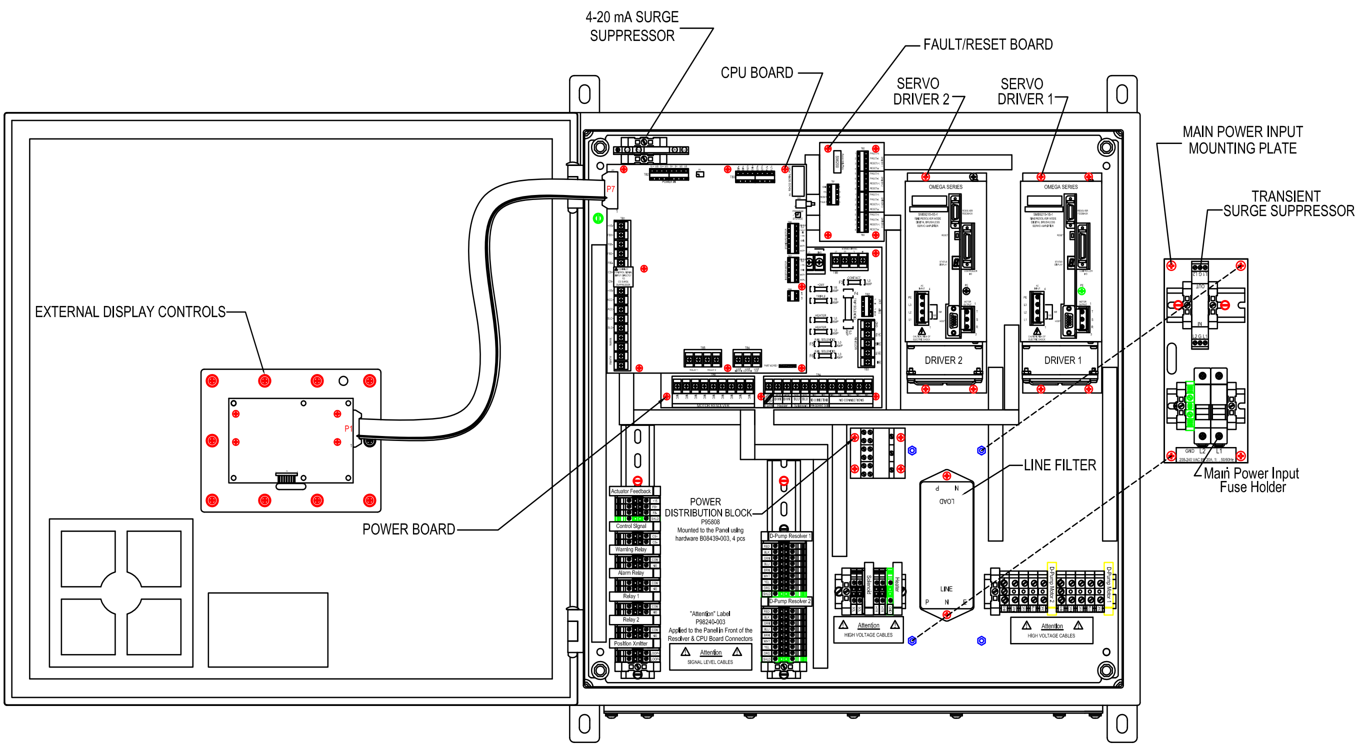
Figures 4.E.2-5&6 1/2D-Pump Control Enclsure



2D-PUMP CONTROL ENCLOSURE

Figures 4.E.2-7&8 2D-Pump Control Enclsure





POWER SUPPLY ASSEMBLY

4.E.3 POWER SUPPLY ASSEMBLY

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

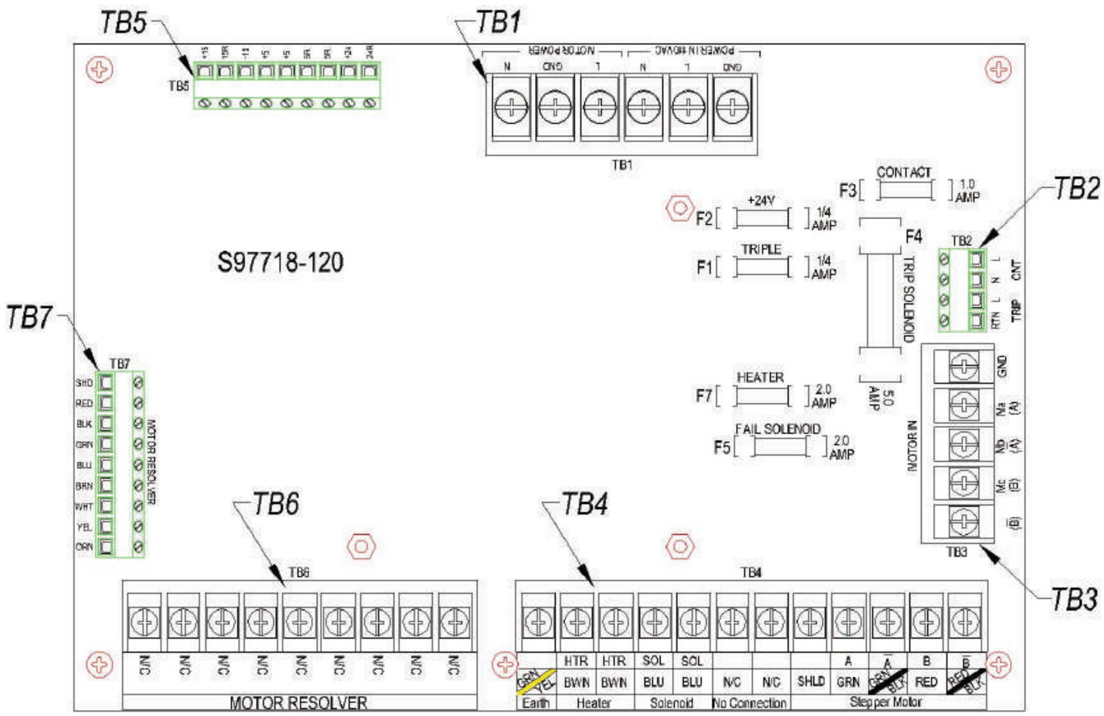


Figure 4.E.3-1 Stepper Power Supply Assembly

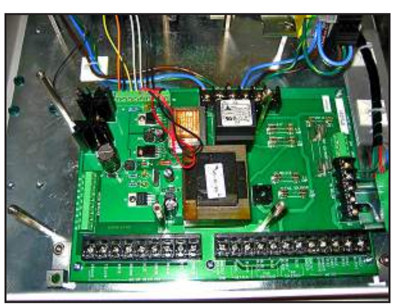


Photo 4.E.3-1
Power Supply Assembly
(Stepper)

POWER SUPPLY ASSEMBLY

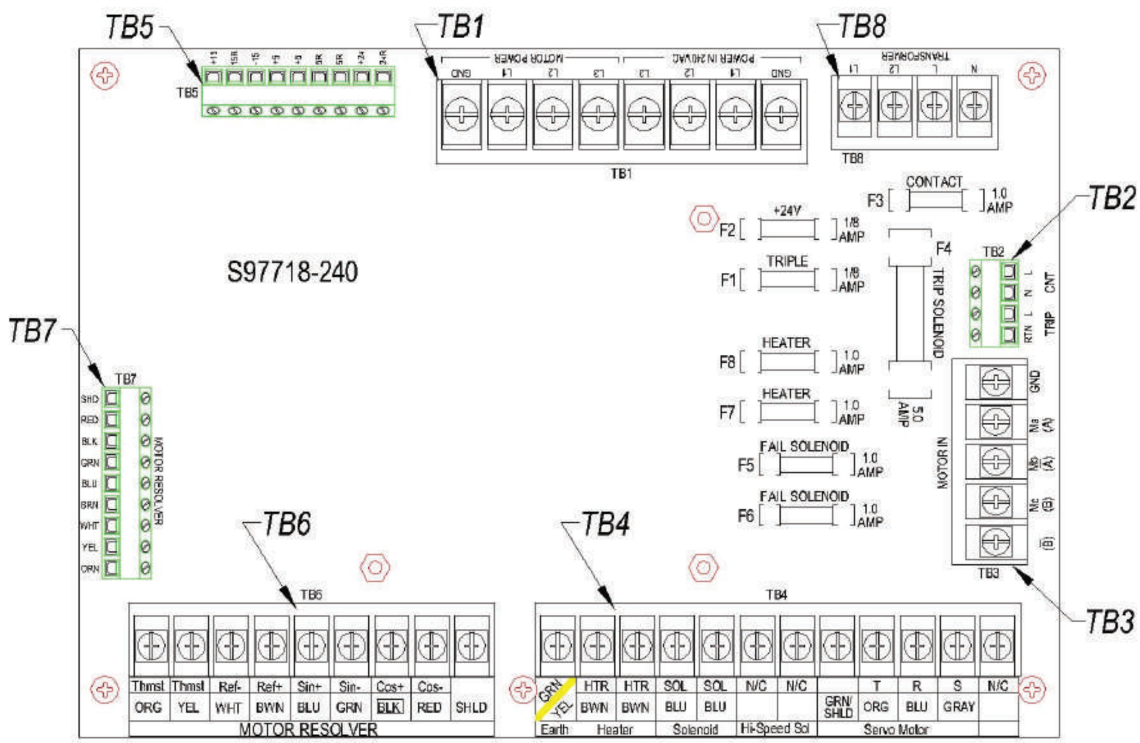


Figure 4.E.3-2 Servo Power Supply Assembly

4.E.3.1 REMOVAL

1. Remove the CPU board per **TS&R section 4.E.4.1**.
2. Remove the wires from the green connector at the top left of the Power Supply, TB5.

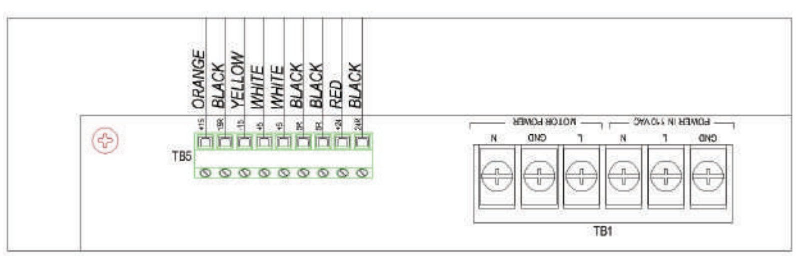


Figure 4.E.3.1-1 TB5 Power Supply

3. Remove the AC power wires from the "Power In/Motor Power" terminal, TB1.

POWER SUPPLY ASSEMBLY

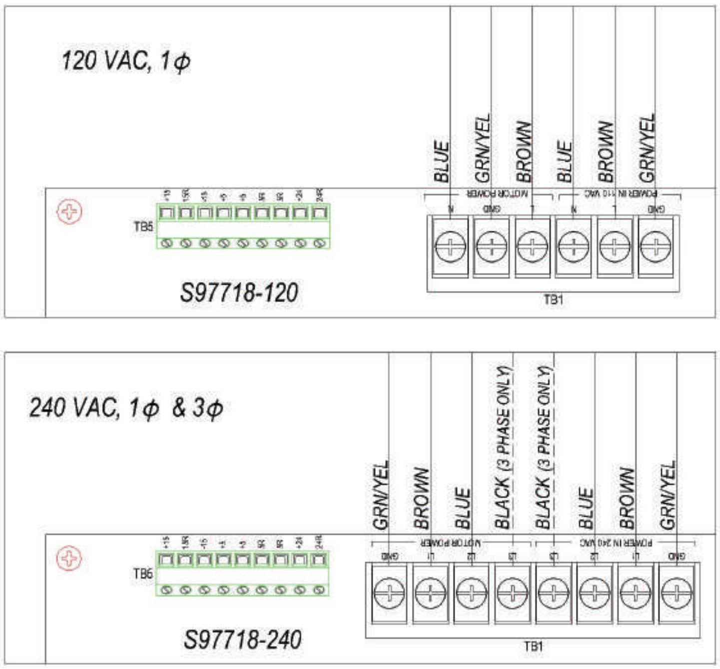
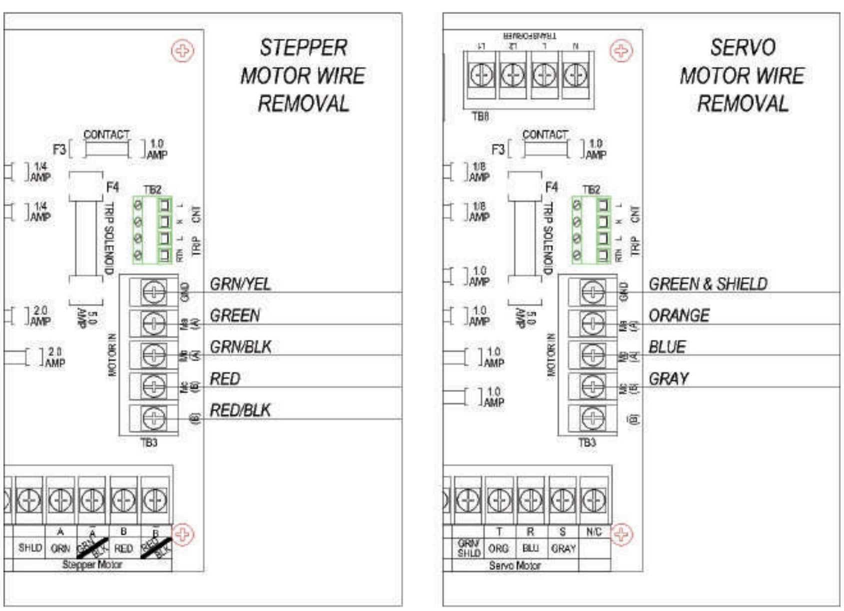


Figure 4.E.3.1-2 TB1 Power Supply

4. Remove any Motor wires that may be connected into the "Motor In" terminal, TB3.



Figures 4.E.3.1-3,4 TB3 "Motor In" Terminal

POWER SUPPLY ASSEMBLY

__NOTE__: All mounting hardware and wires that were removed will be required for the replacement of the power supply.

5. Remove any Resolver wires that may be connected to the "Motor Resolver" terminal, TB7.

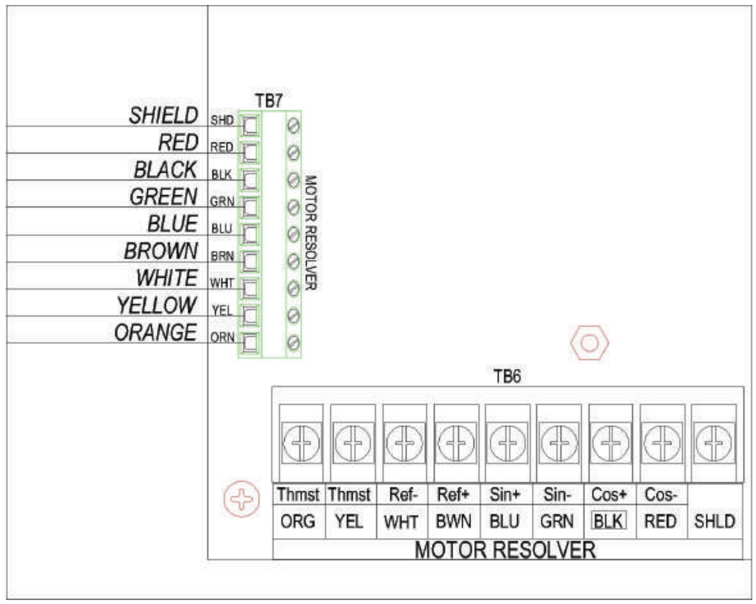


Figure 4.E.3.1-5 TB7 "Motor Resolver" terminal

6. Remove any wires that may be connected to TB2 and TB3.

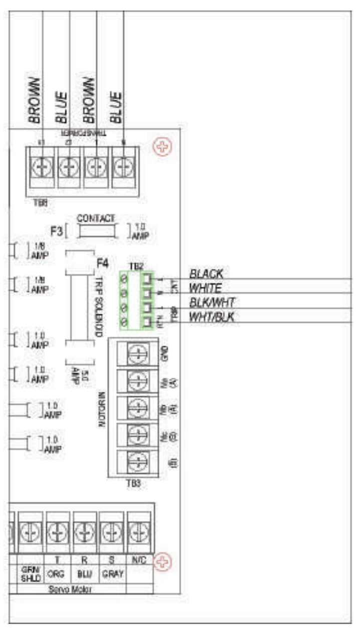


Figure 4.E.3.1-6 TB2 & 3

POWER SUPPLY ASSEMBLY

7. Remove the Screws (6-32 x 0.25") and Standoffs (6-32 x 1.75" with 6-32 x 0.625") used to secure the power supply, the standoffs will require a ¼ nut driver for removal. Make sure all wires have been removed from the power supply. Remove the power supply from the control enclosure.

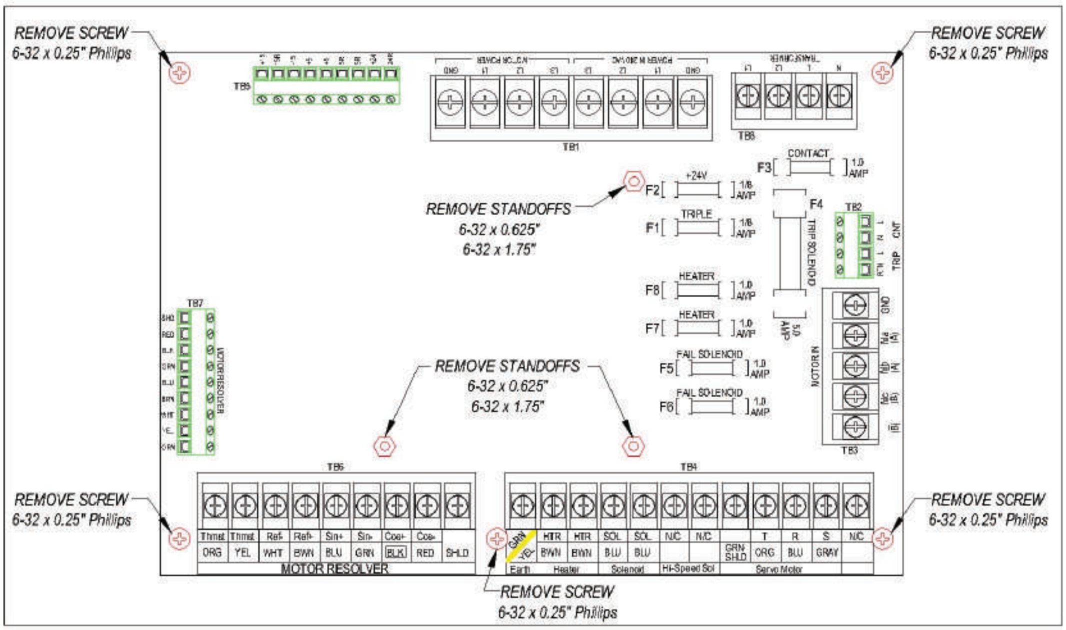


Figure 4.E.3.1-7 Power Supply and "Standoffs"

POWER SUPPLY ASSEMBLY

4.E.3.2 REPLACEMENT

1. Install the replacement power supply using the 6-32 x 0.5" standoffs mounted to the control enclosures panel. Use the Screws (6-32 x 0.25") and the Standoffs (6-32 x 1.75" with 6-32 x 0.625") that were removed from the old power supply.

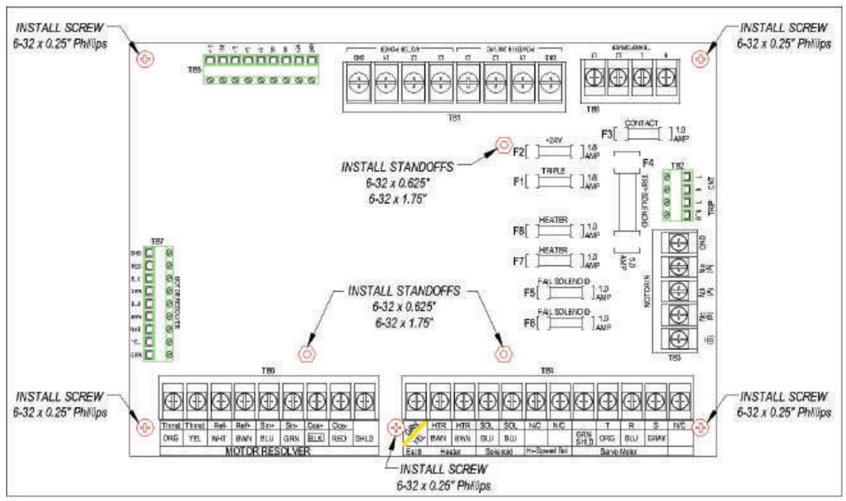


Figure 4.E.3.2-1 Power Supply placement

2. Reconnect the motor cable wires to the “Motor In” terminal on the power supply, TB3.

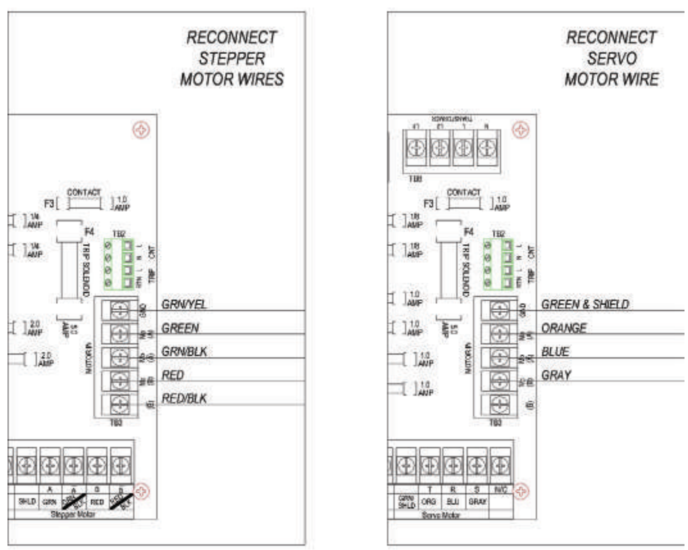


Figure 4.E.3.2-2,3 TB3 motor cable wire connections

POWER SUPPLY ASSEMBLY

3. Reconnect the AC power wires to the “Power In/Motor Power” terminals, TB1.
4. Reconnect the DC power wires to TB5.
5. Reconnect any Resolver wires to the “Motor Resolver” terminal TB7.
6. Reconnect any wire that may have been connected to terminal TB2 and TB8.
7. Replace the CPU board per **TS&R section 4.E.4.2**.

4.E.4 CPU ASSEMBLY

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

NOTE: *Assumed starting position is facing the upright electronic unit with the enclosure door open.*

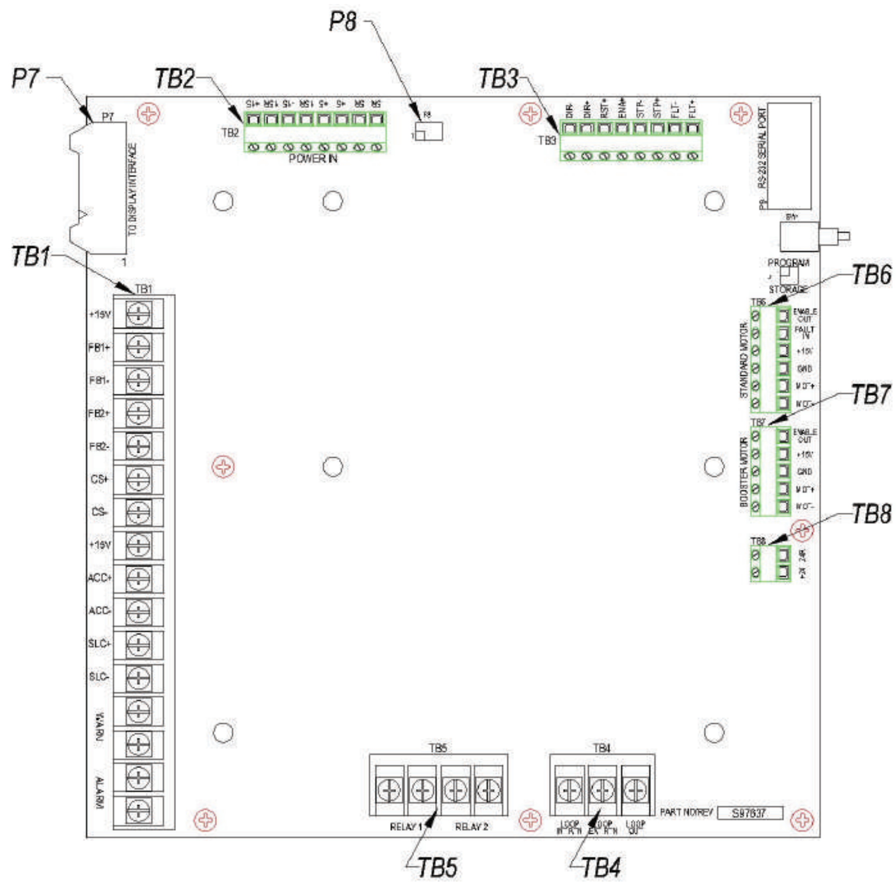


Figure 4.E.4 CPU Assembly drawing

CPU ASSEMBLY

4.E.4.1 Removal

1. Remove the Ribbon Cable connected to the “To Display Interface” connector, Location P7.

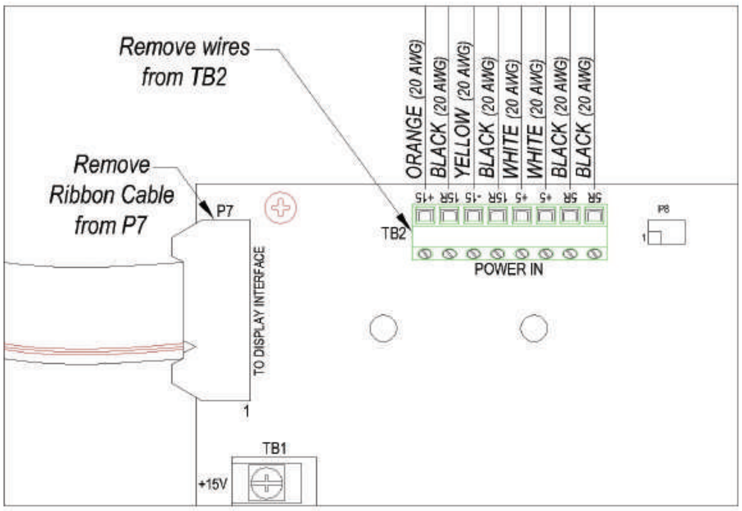


Figure 4.E.4.1-1 P7, TB2 Ribbon Cable & Wire Connections

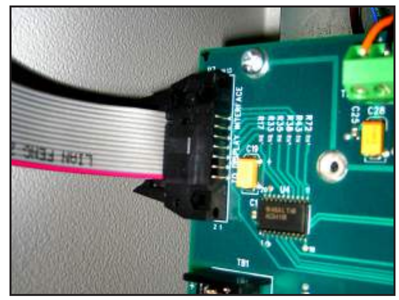


Photo 4.E.4.1-1
Ribbon connection

2. Remove the DC Power wires connected to the “Power In” connector, Location TB2.
3. Remove any Stepper Driver Logic wiring connected to Location TB3 (Stepper Units Only).

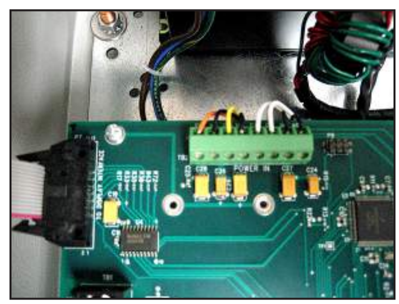


Photo 4.E.4.1-2
TB2 connections

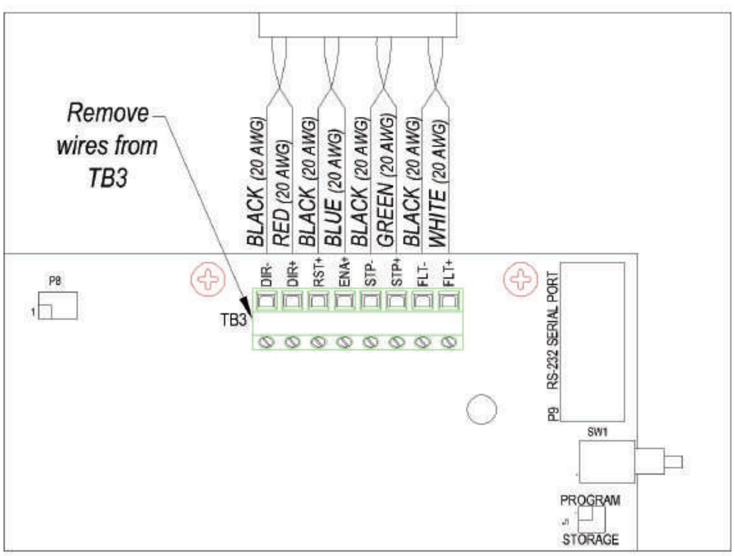


Figure 4.E.4.1-2 TB3, Stepper Driver Wiring

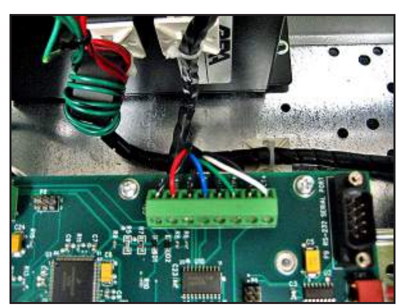


Photo 4.E.4.1-3
TB3 connections

CPU ASSEMBLY

4. Remove any Servo Driver Logic wiring connected to the "Standard Motor" connector, Location TB6 (Servo Units Only).
5. Remove any Booster Driver Logic wiring connected to the "Booster Motor" connector, Location TB7 (Booster Units Only).
6. Remove the DC Power wires connected to Location TB8.

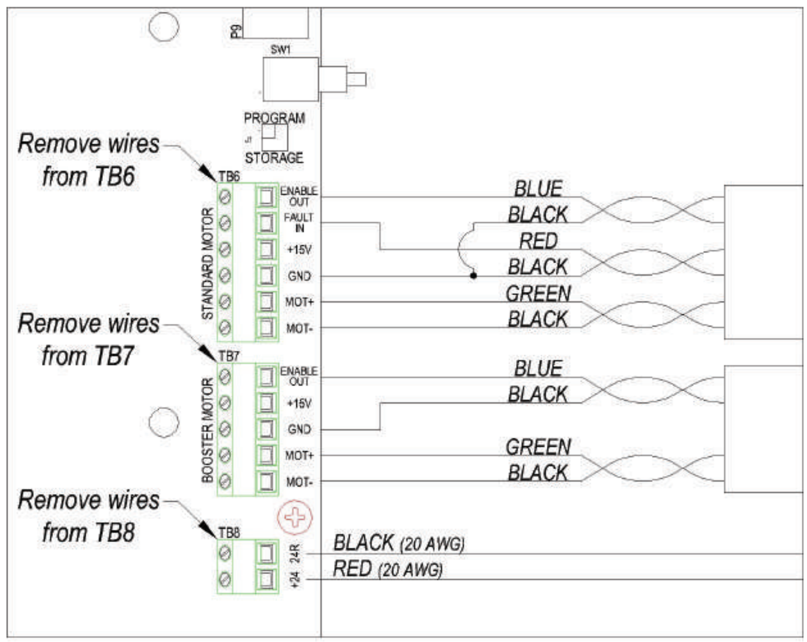


Figure 4.E.4.1-3 TB6, TB7 & TB8 Wire Connections

CPU ASSEMBLY

7. Make a note of all wires that are connected to Location TB1, write the location of each wire down if necessary. Remove all wires connected to TB1.

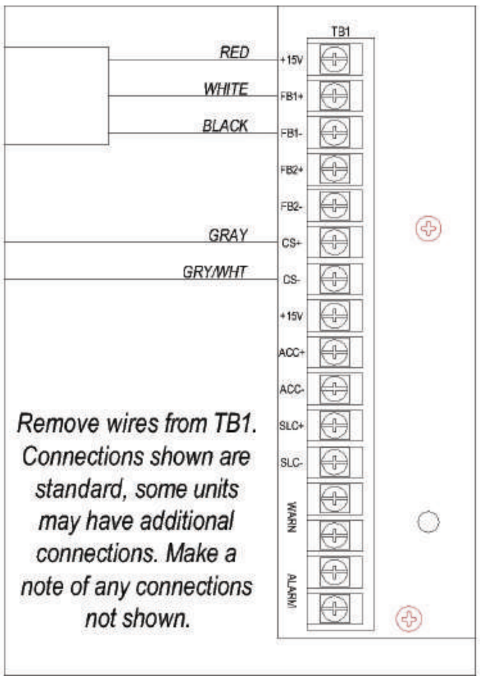


Figure 4.E.4.1-4 TB1 Wire Connections

Photo 4.E.4.1-4
TB1 Connections Terminal

CPU ASSEMBLY

8. Make a note any wires that may be connected to Locations TB4 & TB5, write the location of each wire down if necessary. Remove all wires connected to TB4 & TB5.
9. Remove the 6-32 x 0.25" Phillips head screws (8 pcs.) that mount the CPU. This hardware will be required for installing the new CPU Board.

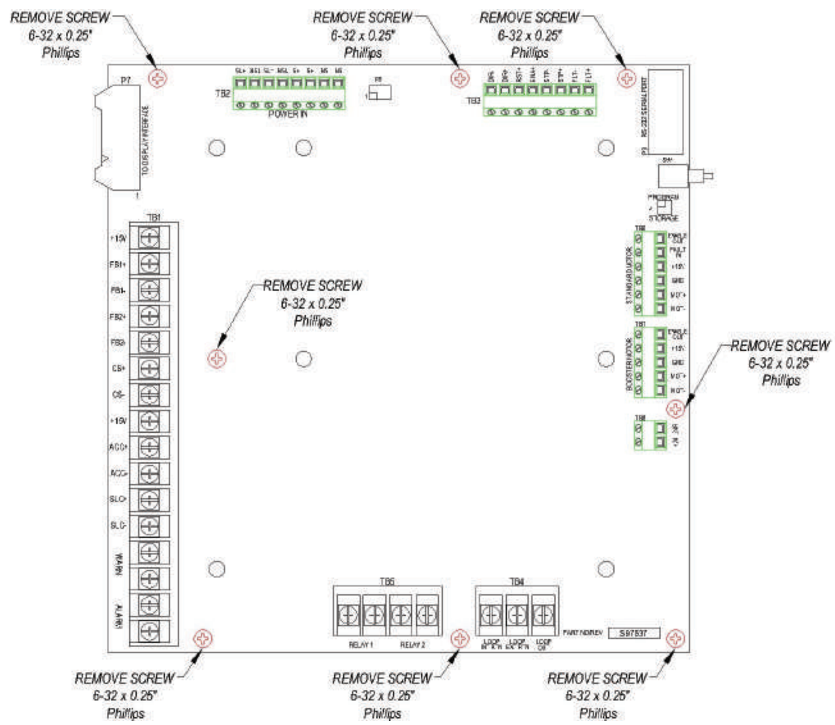


Figure 4.E.4.1-5 Screw Location, CPU Board

10. Remove the CPU.

CPU ASSEMBLY

4.E.4.2 Replacement

1. Install the replacement CPU Board to the Standoffs using the 6-32 x 0.25" hardware removed from the old CPU Board.

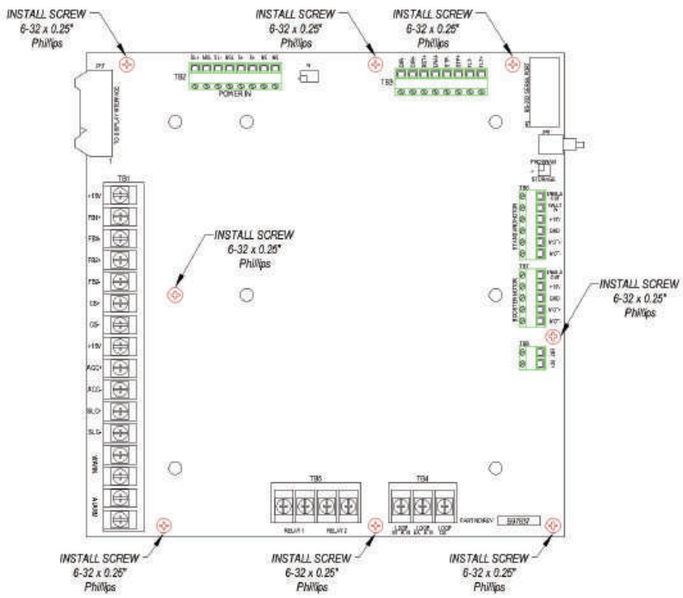


Figure 4.E.4.2-1 Screw Location, CPU Board

2. Reconnect the Ribbon Cable to the “To Display Interface” connector, Location P7. The Red Stripe on the Ribbon Cable should be oriented to Pin 1 at connector P7.

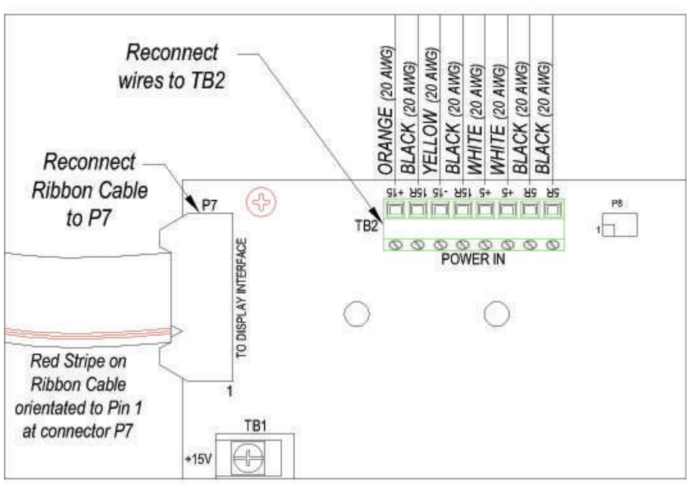


Figure 4.E.4.2-2 Cable to P7 and TB2 wire connections

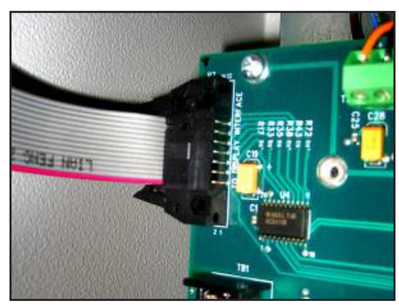


Photo 4.E.4.2-1
Ribbon Connector

CPU ASSEMBLY

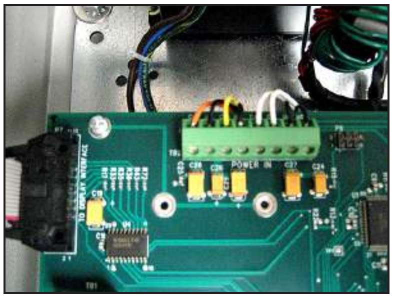


Photo 4.E.4.2-2
DC Power Connections

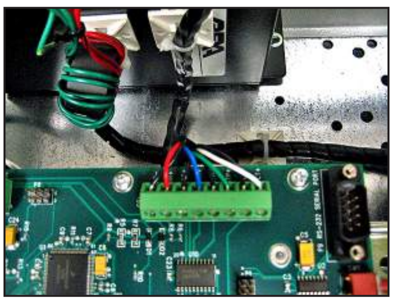


Photo 4.E.4.2-3
TB3 connections

3. Reconnect the DC Power wires to the “Power In” connector, Location TB2.
4. Reconnect any Stepper Driver Logic wiring that was connected to Location TB3 (Stepper Units Only).

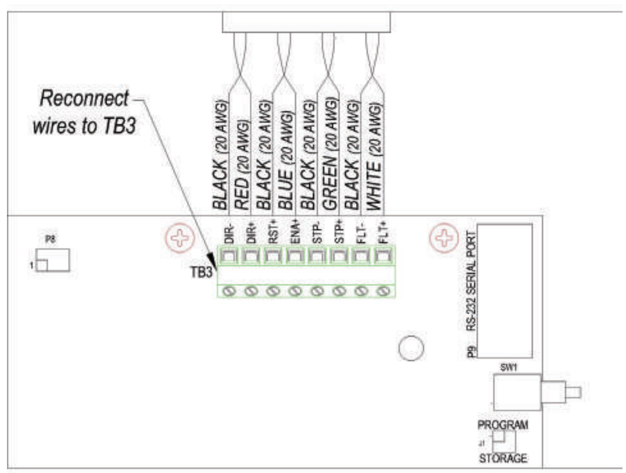


Figure 4.E.4.2-3 TB3 connections drawing

5. Reconnect any Servo Driver Logic wiring to the “Standard Motor” connector, Location TB6 (Servo Units Only).
6. Reconnect any Booster Driver Logic wiring to the “Booster Motor” connector, Location TB7 (Booster Units Only).
7. Reconnect the DC Power wires to Location TB8.

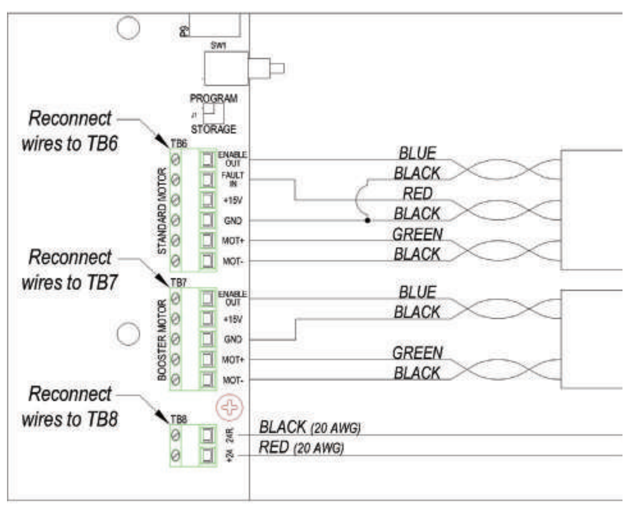


Figure 4.E.4.2-4 Connections to TB6, TB7 & TB8 drawing

CPU ASSEMBLY

8. Reconnect all wires that were removed from Location TB1.

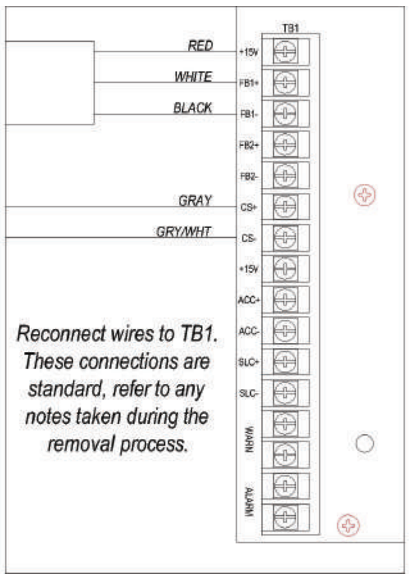


Figure 4.E.4.2-5 CPU connections at TB1

4.E.5 CONTACT IN / RELAY OUT ASSEMBLY

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

NOTE: *Assumed starting position is facing the upright electronic unit with the enclosure door open.*

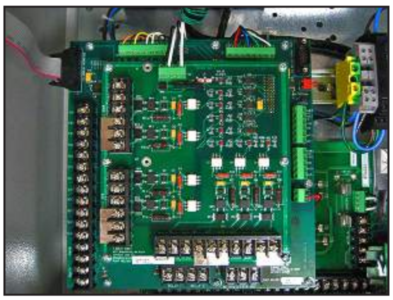


Photo 4.E.5
Contact Board

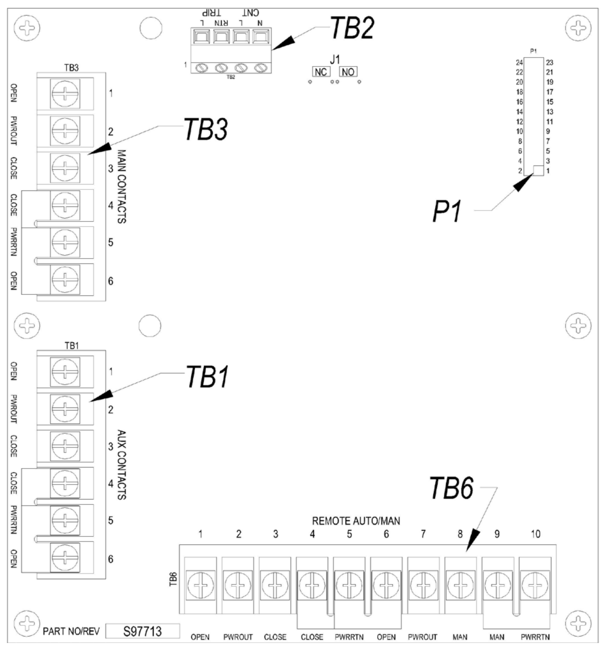


Figure 4.E.5 Contact In/Relay Out board drawing

4.E.5.1 Removal

1. Remove the wires connected to location TB2.

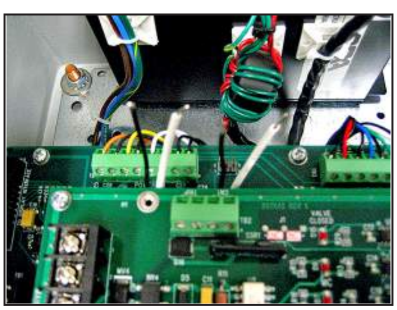


Photo 4.E.5.1-1
TB2 Contact Wires

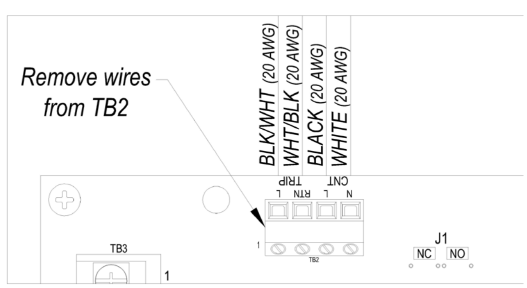
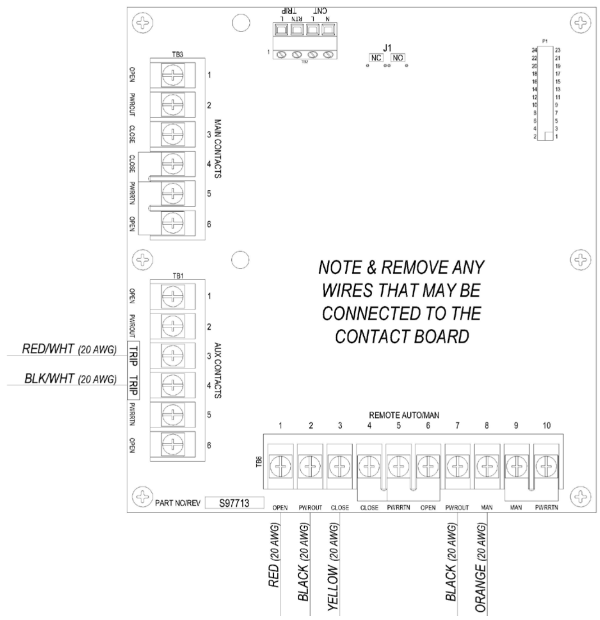


Figure 4.E.5 .1-1 TB2 wiring drawing drawing

CONTACT IN / RELAY OUT ASSEMBLY

2. Remove any other wires that may be screwed into the contact boards terminals, and note their location for later replacement.



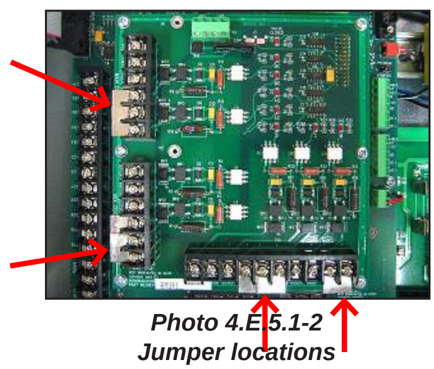


Photo 4.E.5.1-2
Jumper locations

Figure 4.E.5.1-2 TB3, TB1 & TB6 drawing

3. Remove any Jumpers installed at locations TB3, TB1 & TB6; make a note of their location as these jumpers will be required for the new board.

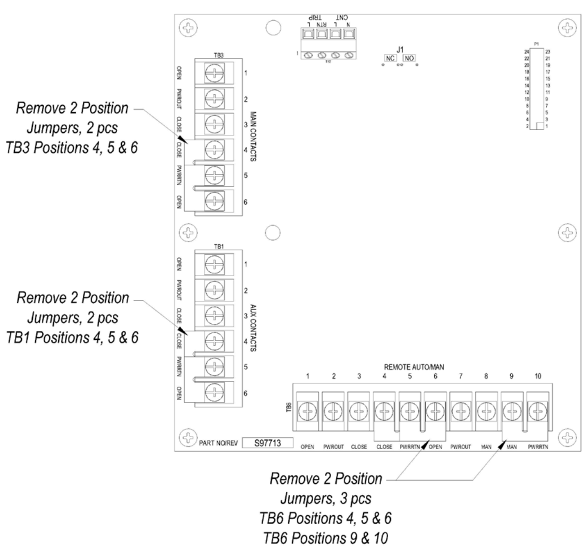


Figure 4.E.5.1-3 Jumper location drawing

CONTACT IN / RELAY OUT ASSEMBLY

4. Remove the 6-32 x 0.25" Phillips head screws (6 pcs.) that secure the Contact board. This hardware will be required for installing the replacement board.

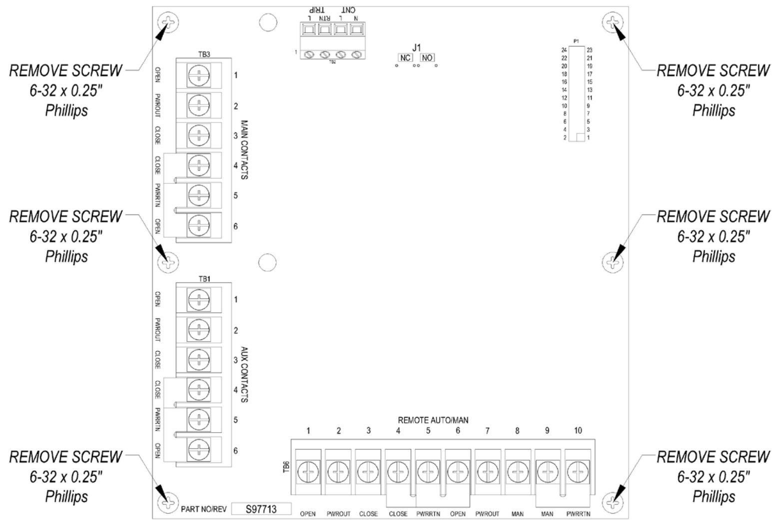


Figure 4.E.5.1-4 Screw location drawing

5. Unplug the 24-pin female connector on the contact board (location P1) from the 24-pin male connector on the CPU board (location P1). Tag the board as defective and completely remove from the control enclosure.

Photo 4.E.5.1-3
Board removal

CONTACT IN / RELAY OUT ASSEMBLY

4.E.5.2 Replacement

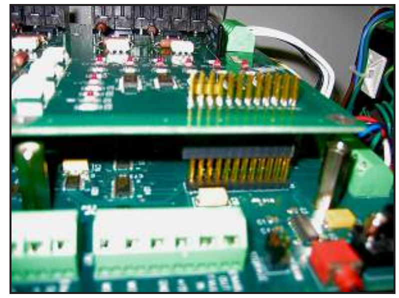


Photo 4.E.5.2-1
Contact board placement

1. Secure the replacement board to the mounting Standoffs using the 6-32 x 0.25" Phillips head screws (6 pcs.). Be sure to line up connector P1 on the Contact board with connector P1 on the CPU.

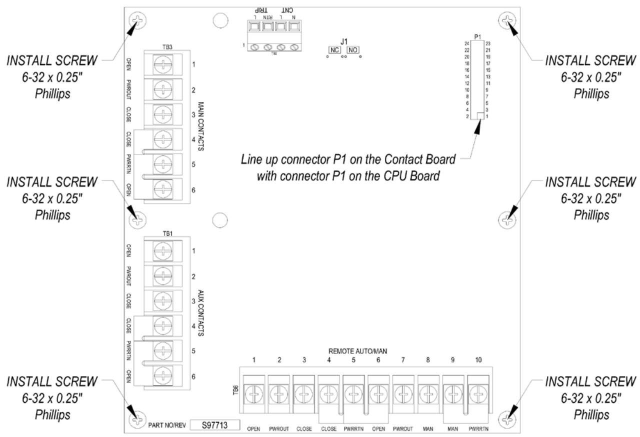


Figure 4.E.5.2-1 Screw placement drawing

2. Replace any 2 Position Jumpers removed from locations TB3, TB1 & TB6. Refer to any notes taken during the removal process.

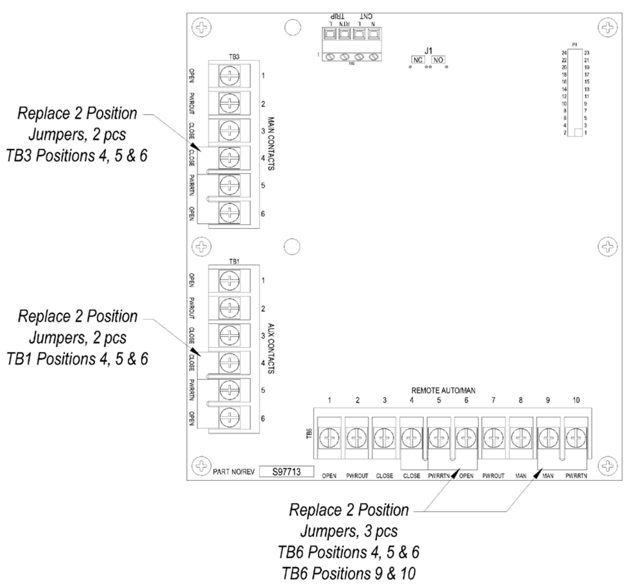


Figure 4.E.5.2-2 TB3, TB1 & TB6 locations

CONTACT IN / RELAY OUT ASSEMBLY

Photo 4.E.5.2-2
TB2 Wiring connections

3. Reconnect the wires that were installed at location TB2.

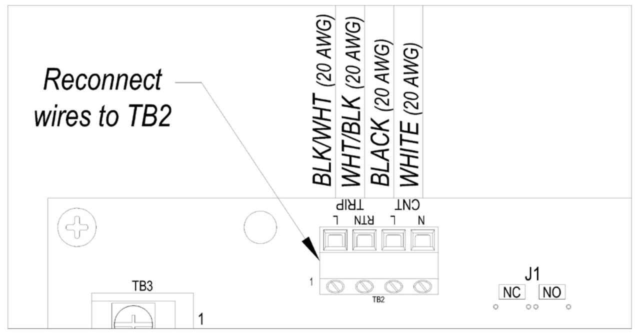


Figure 4.E.5.2-3 TB2 connection drawing

4. Refer to your notes and reconnect any additional wires that may have been installed to the Contact Board.

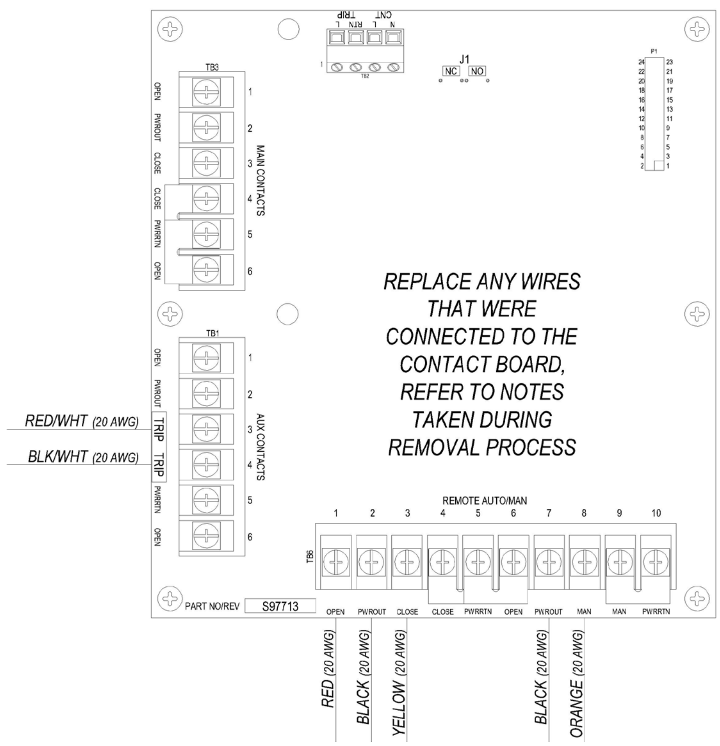


Figure 4.E.5.2-4 Contact In/Relay out drawing

STD. B/C STEPPER MOTOR DRIVER

4.E.6 STEPPER MOTOR DRIVE (STD. B&C)

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

NOTE: *Assumed starting position is facing the upright electronic unit with the enclosure door open.*

4.E.6.1 Removal (STD B&C)

1. Disconnect the AC Power connector (Left), the Motor Power connector (Middle) and the Driver Logic connector (Right).

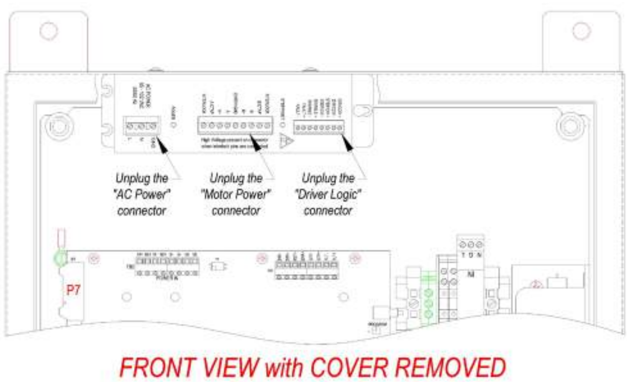


Figure 4.E.6.1-1 Standard B/C power connections drawing

2. Locate the four driver mounting screws and nylon washers on the top of the control enclosure. Remove this hardware using a 1/8" Allen wrench. This hardware will be required to install the replacement driver. Tag the driver as defective and completely remove from control enclosure.

Figure 4.E.6.1-2 Mounting screw location

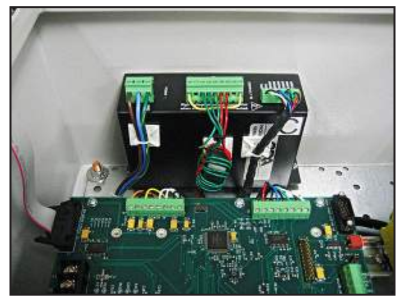


Photo 4.E.6.1-1
Stepper Motor Drive

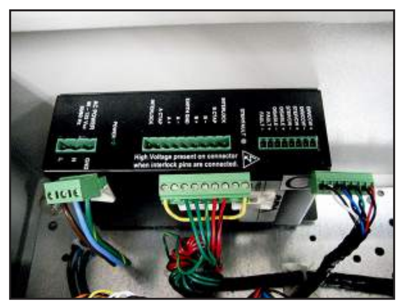


Photo 4.E.6.1-2
Motor Connectors

Photo 4.E.6.1-3
Enclosure mounting screws

Photo 4.E.6.2-1
Thermal Coat

4.E.6.2 Replacement (STD B&C)

1. Apply a thin layer of thermal coat to the back of the driver.
2. Mount the replacement driver to the top of the control enclosure using the four screws and nylon washers that were removed from the defective driver.

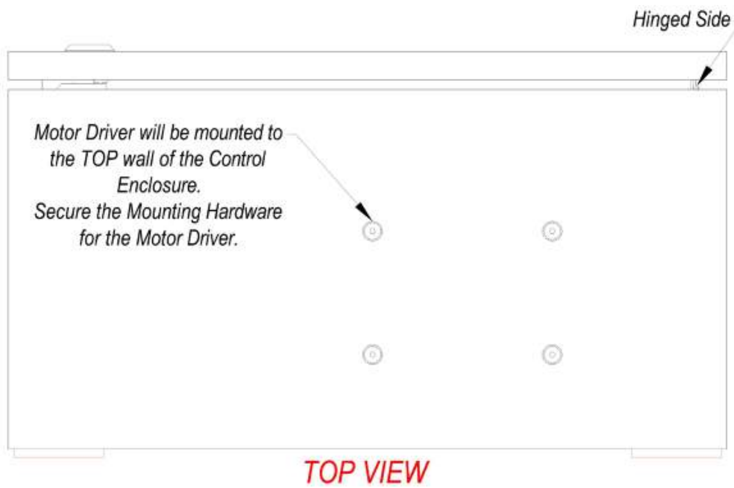


Figure 4.E.6.2-1 Mounting screw location

Photo 4.E.6.2-2
Mounted Driver

a.) Plug the AC Power (left), Motor Power (middle) and Driver Logic (right) connectors into the driver in their respective locations.

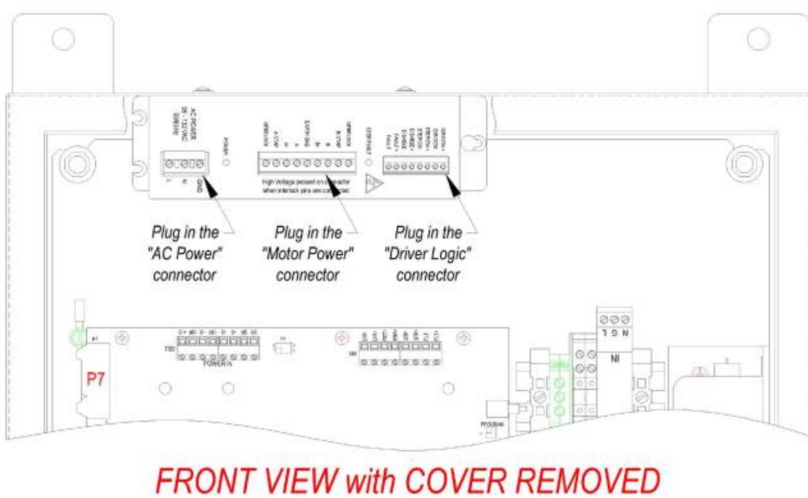


Figure 4.E.6.1-1 Standard B/C power connections drawing

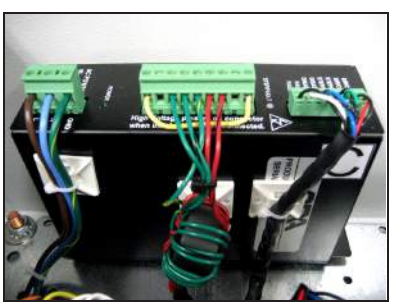


Photo 4.E.6.2-3
Stepper Motor Drive

CSA B STEPPER MOTOR DRIVE

4.E.7 CSA B STEPPER DRIVER

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

NOTE: *Assumed starting position is facing the upright electronic unit with the enclosure door open.*

Photo 4.E.10.
CSA B stepper motor in enclosure

4.E.7.1 Removal

1. Locate the B CSA Driver and disconnect the motor cable from location P1.

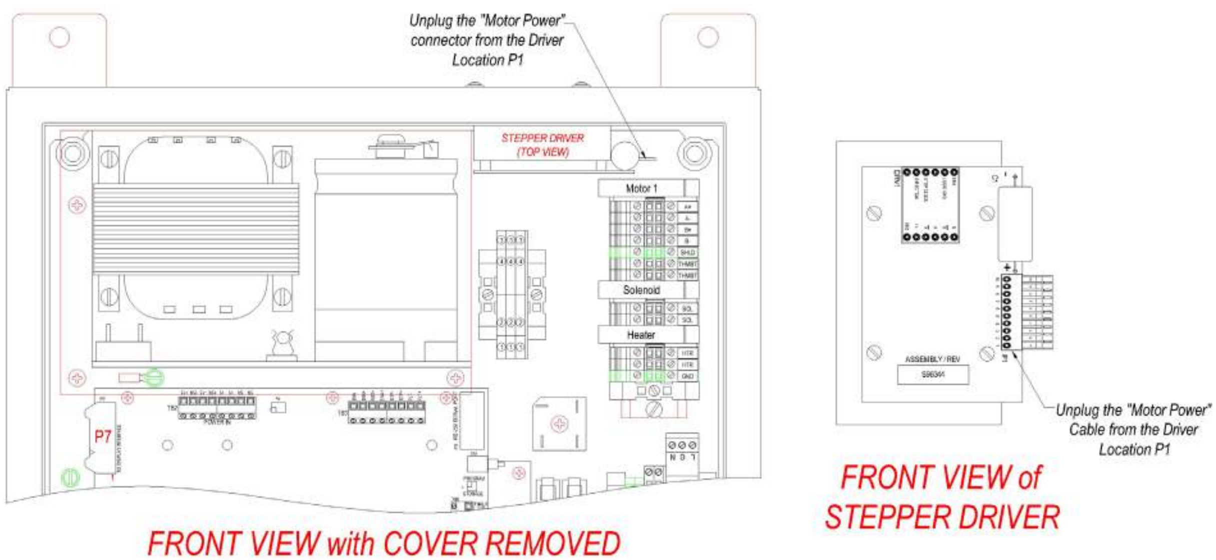


Figure 4.E.7.1-1 CSA B stepper driver drawing

2. Locate the four driver mounting screws and nylon washers on the top of the control enclosure. Remove this hardware using a 1/8" Allen wrench. This hardware will be required to install the replacement driver. Tag the driver as defective and completely remove from control enclosure.

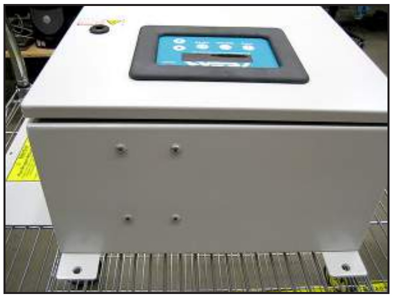


Photo 4.E.7.1-2
CSA B exterior mounting

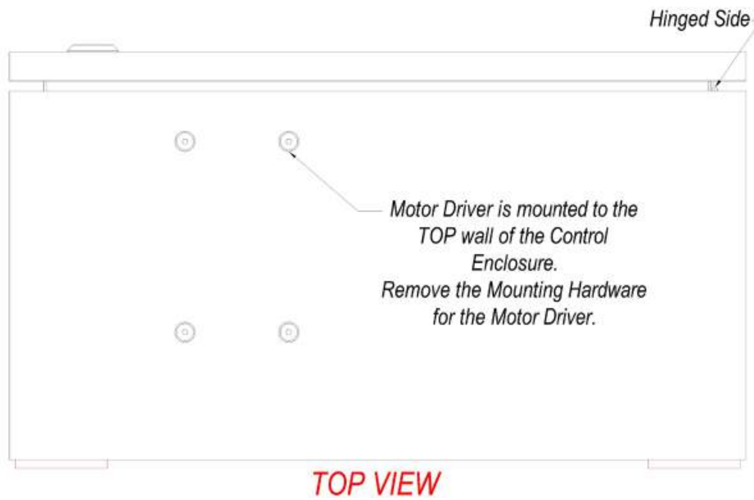


Figure 4.E.7.1-2 Mounting diagram

4.E.7.2 Replacement

1. Apply a thin layer of thermal coat to the driver mounting plate.
2. Mount the replacement driver to the top of the control enclosure using the four screws and nylon washers that were removed from the defective driver.

Figure 4.E.7.2-1 Mounting diagram

3. Reconnect the Motor cable to location P1 on the Driver.

CSA B STEPPER MOTOR DRIVE

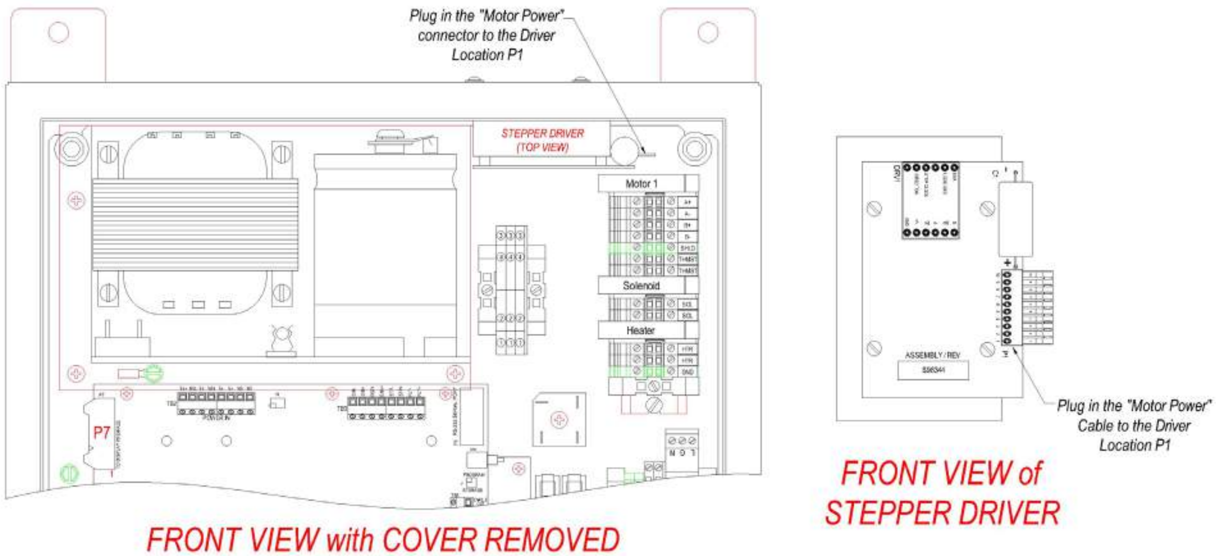


Figure 4.E.7.2-2 CSA B stepper driver drawing

4.E.8 CSA C STEPPER MOTOR DRIVE

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

4.E.8.1 Removal

Photo 4.E.8.1-1
Power connections

Photo 4.E.8.1-2
Cables disconnected

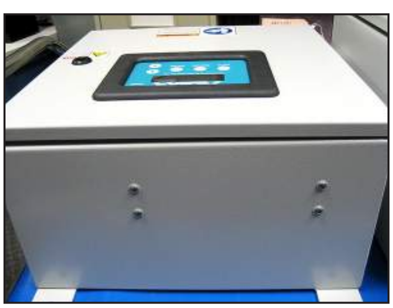


Photo 4.E.8.1-3
Mounting screws

1. Disconnect the power connector (Left), the motor connector (Middle) and the logic connector (Right).

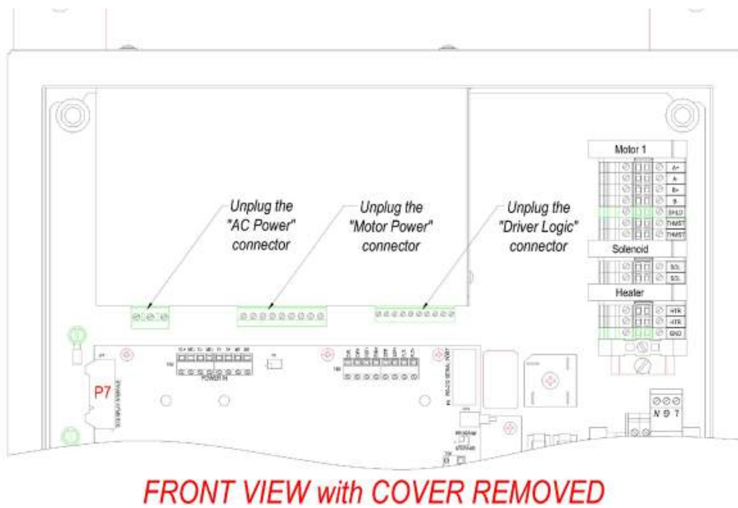


Figure 4.E.8.1-1 Power connections drawing

2. Locate the four driver mounting screws and nylon washers on the top of the control enclosure. Remove this hardware using a 1/8" Allen wrench. This hardware will be required to install the replacement driver. Tag the driver as defective and completely remove from control enclosure.

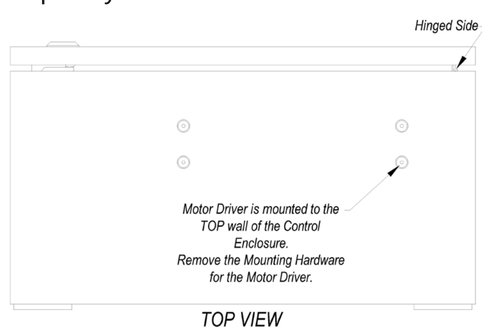


Figure 4.E.8.1-2 Enclosure mounting drawing

CSA C STEPPER MOTOR DRIVE

4.E.8.2 Replacement

1. Apply a thin layer of thermal coat to the bottom of the driver.
2. Mount the replacement driver to the top of the control enclosure using the four screws and nylon washers that were removed from the defective driver.

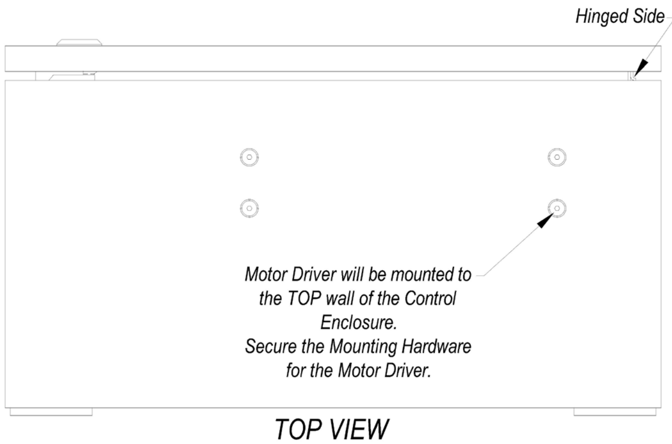


Figure 4.E.8.2-1 Enclosure mounting location

3. Plug the AC Power (left), Motor Power (middle) and Driver Logic (right) connectors into the Driver in their respective locations.

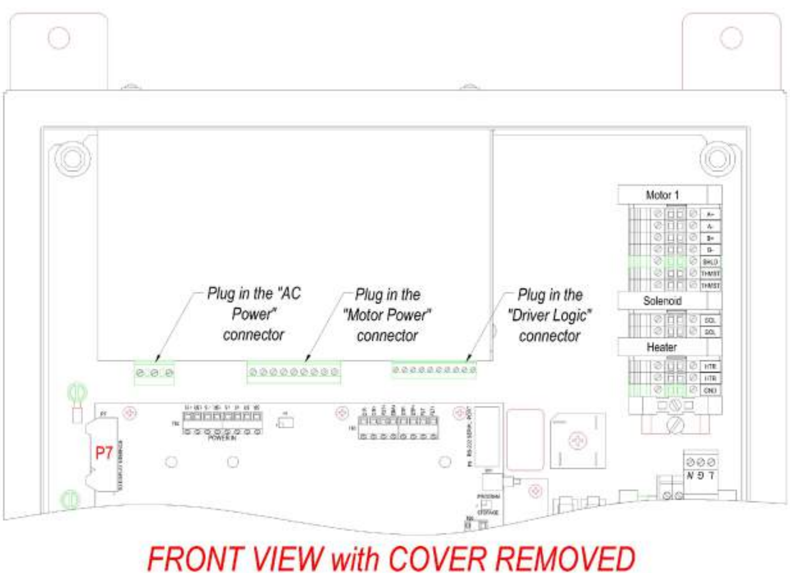


Figure 4.E.8.2-2 Cable connections

Photo 4.E.8.2-1
Therma coat

Photo 4.E.8.2-2
Stepper motor attached to enclosure

Photo 4.E.8.2-3
Cables connected

4.E.9 1/2D, D SERVO MOTOR DRIVE

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

NOTE: *Assumed starting position is facing the upright electronic unit with the enclosure door open.*

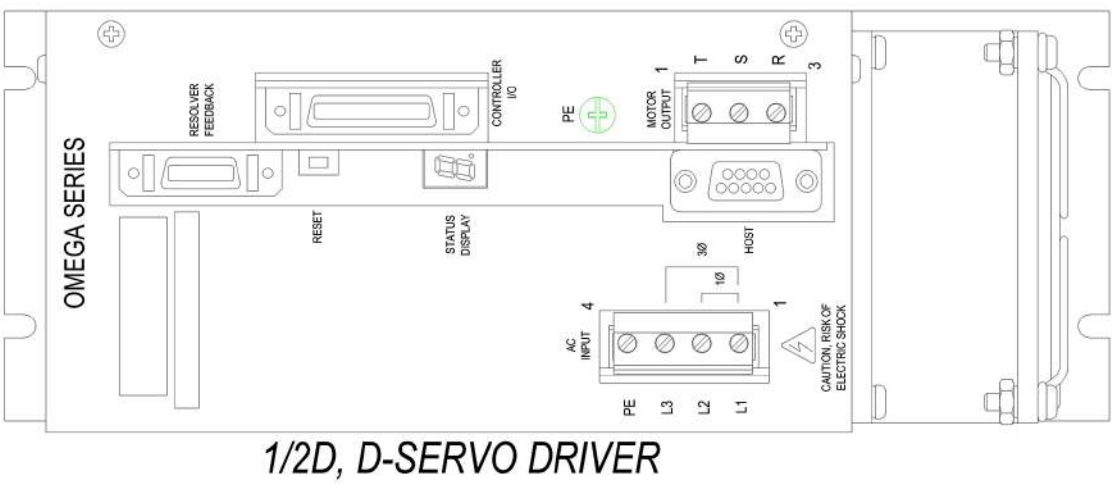


Figure 4.E.9-1 Servo Motor Driver

Photo 4.E.9-1 Servo Motor Driver

SERVO MOTOR DRIVE

4.E.9.1 Removal

1. Cut away any wire ties that may be securing any cables to the tie down bases applied to the Servo Driver.

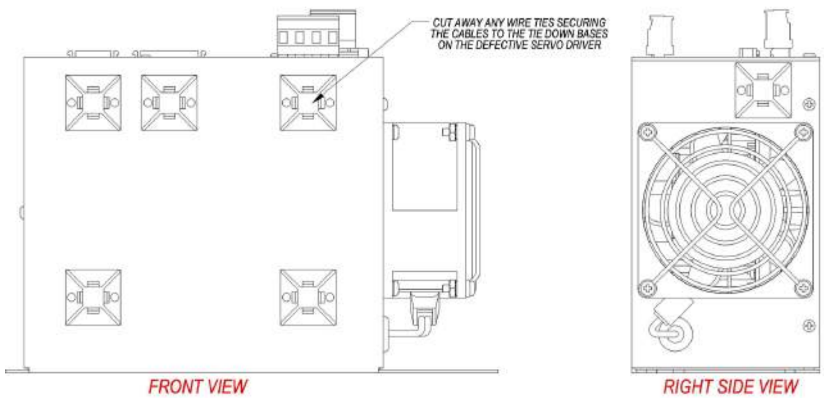


Figure 4.E.9.1-1 Tie down bases

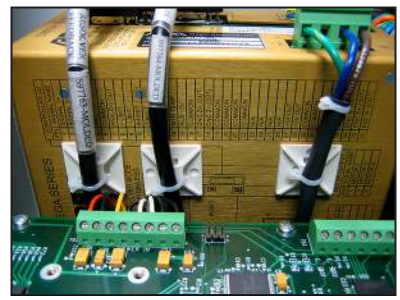


Photo 4.E.9.1-1
Cable tie downs

2. Disconnect the “Controller I/O” and “Resolver Feedback” cables by loosening the two thumb screws on each cable. Unplug the “Motor Output” connector and remove the Green/Shield wire from the ground Screw. Unplug the “AC Input” connector.

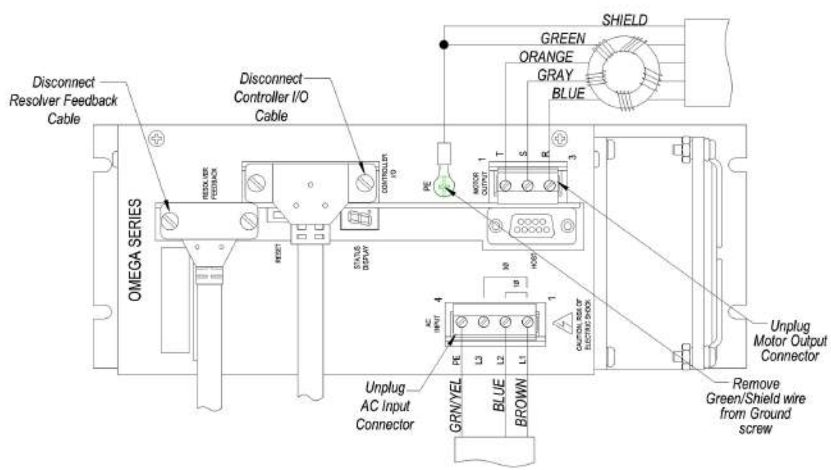


Figure 4.E.9.1-2 Servo drive cable connections

Photo 4.E.9.1-2
Servo drive cable connections

Photo 4.E.9.1-3
Mounting screws

3. Remove the four 8-32 x 0.50" Philips head screws securing the Driver to the panel. This hardware will be required to install the replacement drive. Tag the Driver as defective and completely remove from the control enclosure.

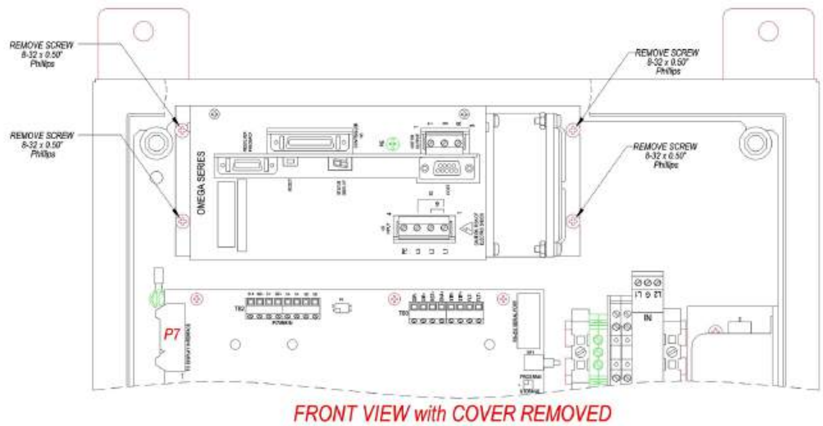


Figure 4.E.9.1-3 Servo driver & panel drawing

4.E.9.2 Replacement

1. Secure the replacement Driver to the panel using the 8-32 x 0.50" Phillips head screws removed from the defective driver.

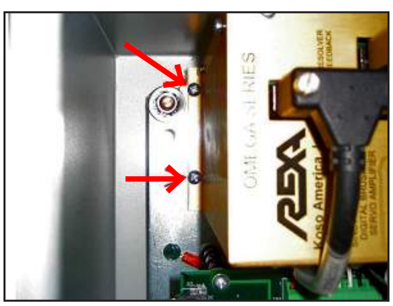


Photo 4.E.9.2-1
Screw placement

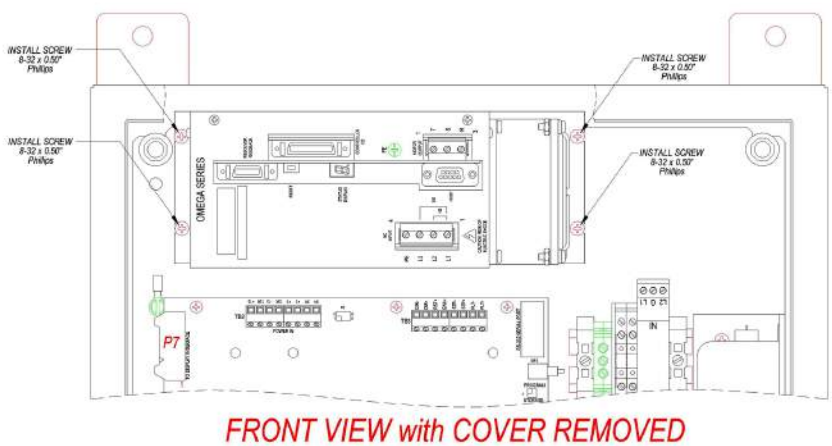


Figure 4.E.9.2-1 Servo driver & panel drawing

SERVO MOTOR DRIVE

2. Reconnect the “Resolver Feedback” and “Controller I/O” cables. Plug in the “Motor Output” connector and secure the Green/Shield wire to the ground screw. Plug in the “AC Input” connector.

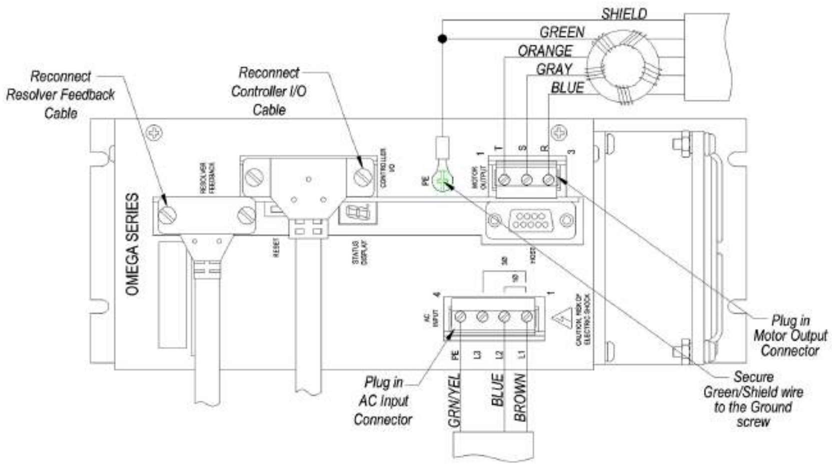


Figure 4.E.9.2-2 Servo Motor Drive Connections

Photo 4.E.9.2-2
Servo Motor Drive Connections

Photo 4.E.10
VFD Display

4.E.10 VFD DISPLAY ASSEMBLY (EXTERNAL)

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

NOTE: *Assumed starting position is facing the upright electronic unit with the enclosure door open.**

4.E.10.1 Removal of the External VFD Display:

The External Display Assembly is mounted to the cover of the control enclosure.

1. Disconnect the Ribbon Cable from the Display Interface connector P1.
2. Remove the 10 screws that secure the External Display to the enclosure's cover.
3. Tag the Display as defective and completely remove it from the cover of the control enclosure.

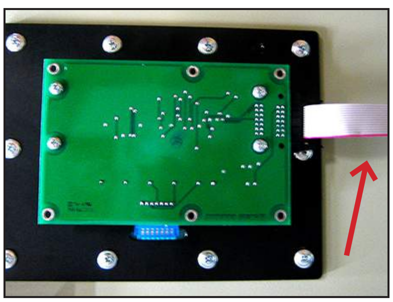


Photo 4.E.10.1-1
Ribbon Cable Position

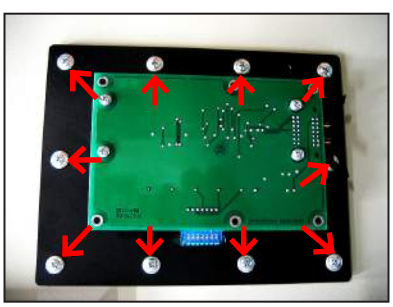


Photo 4.E.10.1-2
Screw Removal

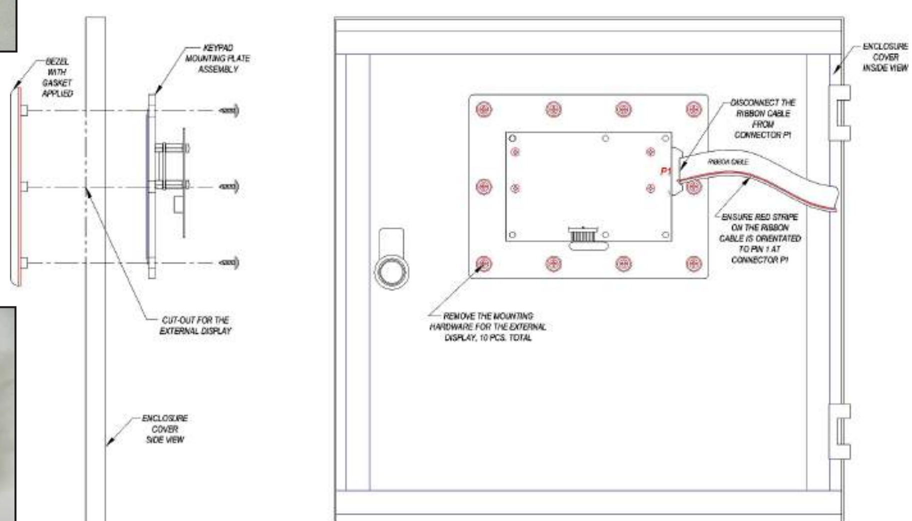


Figure 4.E.10.1-1 VFD Removal Drawing

EXTERNAL VFD DISPLAY

4.E.10.2 Replacement of the display assembly:

1. Apply the gasket to the bezel then place thru the cut-out on the outside of the enclosure cover. Secure the Keypad mounting plate assembly to the bezel using the hardware provided.
2. Connect the ribbon cable to the back of the display assembly location P1. The red stripe on the ribbon cable should be orientated to pin 1 on connector P1.

Photo 4.E.10.2-1
Bezel & display (front view)

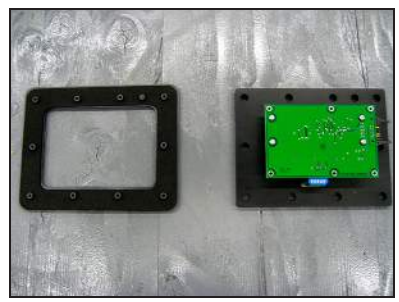


Photo 4.E.10.2-2
Bezel & display (back view)

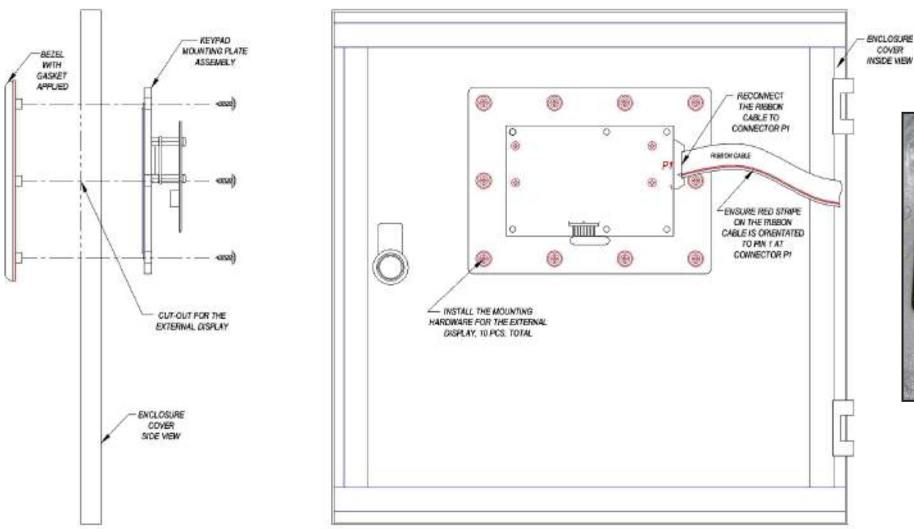


Figure 4.E.10.2-1 VFD Replacement Drawing

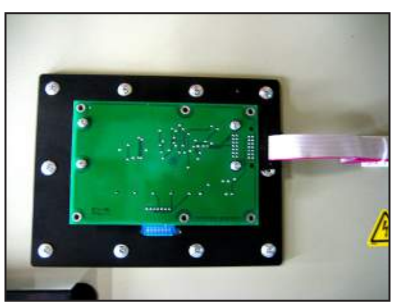


Photo 4.E.10.2-3
Connected VFD Display

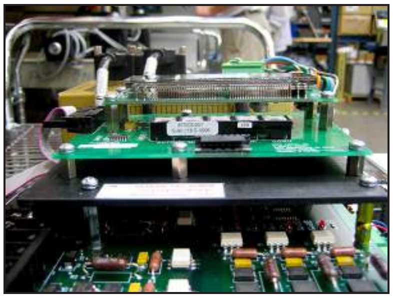


Photo 4.E.11-1
VFD Display Assembly

Photo 4.E.11-2
Internal Display Interface

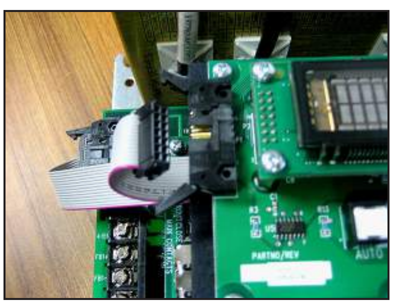


Photo 4.E.11.1-1
Ribbon Cable

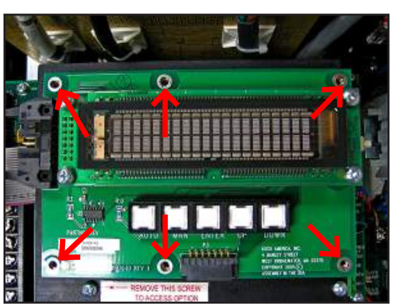


Photo 4.E.11.1-2
Mounting Screws

4.E.11 VFD DISPLAY ASSEMBLY (INTERNAL)

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

NOTE: *Assumed starting position is facing the upright electronic unit with the enclosure door open.**

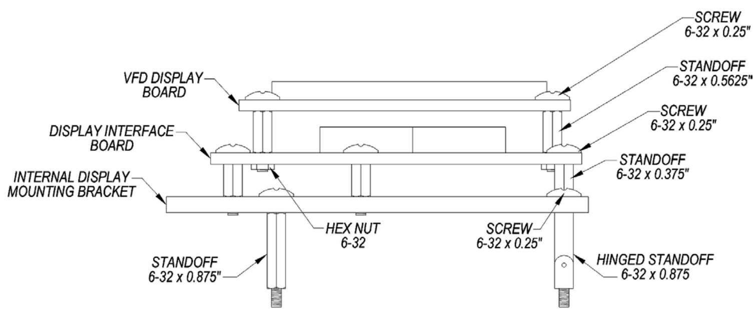


Figure 4.E.11-1 Internal VFD Display Assembly Drawing

4.E.11.1 Removal of the Internal Display Assembly

1. Disconnect the ribbon cable from connector P1 of the Display Interface Board.
2. Remove the six 6-32 x 0.25" screws used to secure the Display Interface Board.
3. Tag this Board assembly as defective and completely remove from control enclosure.

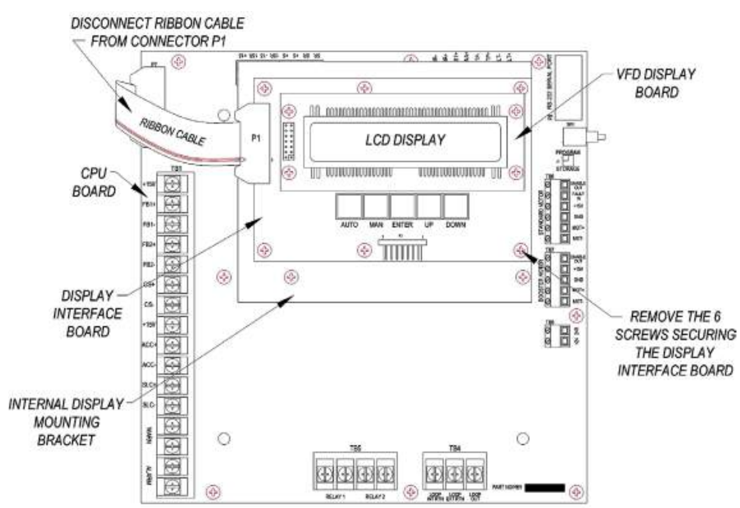


Figure 4.E.11.1-1 Internal VFD Removal Drawing

INTERNAL VFD DISPLAY

4. Remove the Internal Display Mounting Bracket from the CPU Board by removing the three 6-32 x 0.375" screws.

Photo 4.E.11.1-3 Mounting Bracket

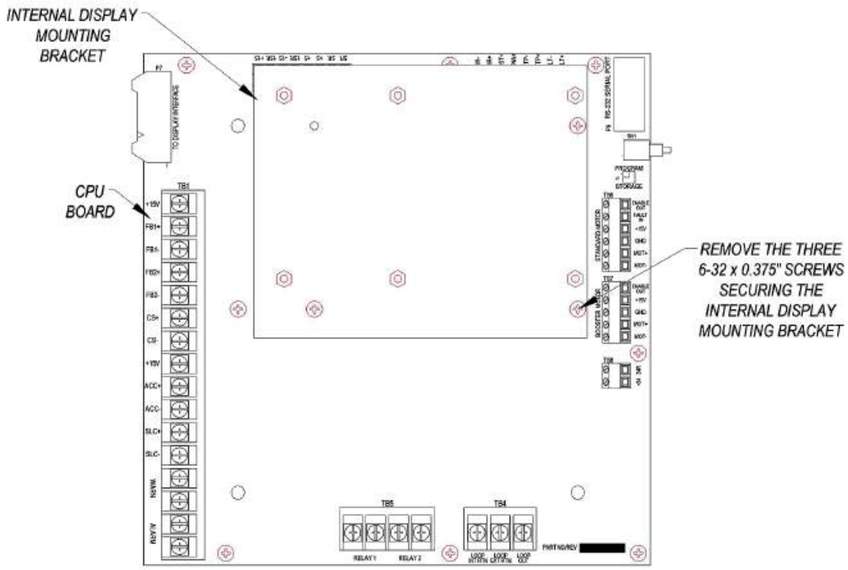


Figure 4.E.11.1-3 VFD Removal Drawing

4.E.11.2 Replacement of the Display Assembly:

1. Secure the Internal Display Mounting Bracket to the CPU Board. The Bracket will be secured to three of the four Standoffs using the 6-32 x 0.375" screws provided. Install the 6-32 x 0.375" standoffs to the Bracket in the 6 places shown below.

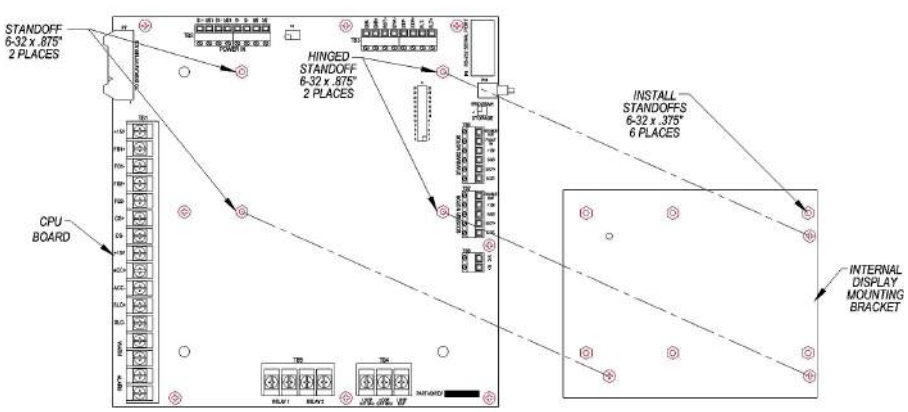


Figure 4.E.11.2-1 VFD Replacement Drawing

INTERNAL VFD DISPLAY

2. Install the 6-32 x .5625 standoffs into the front side of the Display Interface Board; secure the standoffs using 6-32 Hex Nuts in the 4 places shown below. Secure the Display Interface Board to the six standoffs installed on the Mounting Bracket using 6-32 x 0.25" screws provided.

Photo 4.E.11.2-1
Internal VFD Diplay Assembly

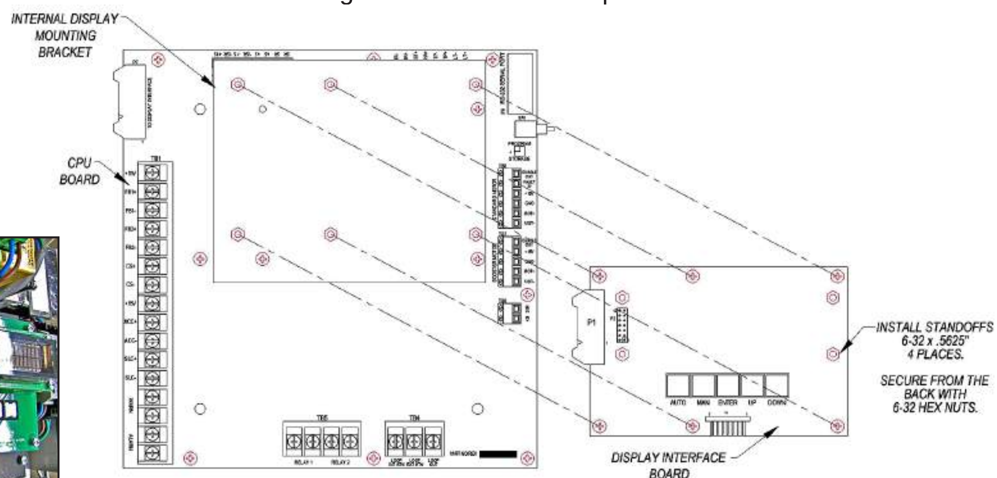


Figure 4.E.11.2-2 VFD Replacement Drawing

3. Reconnect the Ribbon Cable to connector P1 on the Display Interface Board. Ensure the red stripe on the ribbon cable is orientated to Pin 1. Secure the VFD Display Board to the four standoffs installed on the Display Interface Board using the 6-32 x .25" screws provided. Ensure that the 14 pin female connector on the VFD Display Board seats properly on the 14-pin male connector on the Display Interface Board.

Photo 4.E.12.2-2
Internal VFD Diplay Assembly

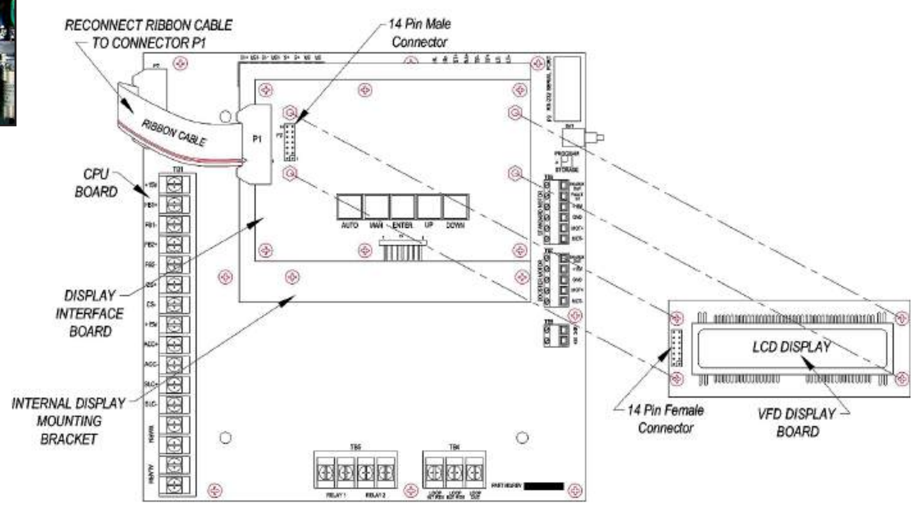


Figure 4.E.11.2-4 VFD Replacement Drawing

SURGE SUPPRESSOR

4.E.12 REPLACING SURGE SUPPRESSOR

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

NOTE: *Assumed starting position is facing the upright electronic unit with the enclosure door open.**

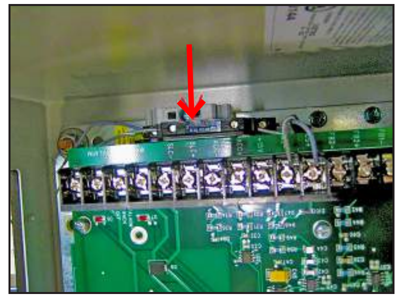


Photo 4.E.12.1-1
Signal Surge Suppressor

CONTROL SIGNAL SURGE SUPPRESSOR

4.E.12.1 Removal of Control Signal Surge Suppressor (Photo 4.E.12.1-1):

1. Disconnect output wires from the Suppressor. (Photo 4.E.12.1-2)
2. Using a long length flat screwdriver, reach down into the enclosure and place the flat head into the release latch on the Suppressor. (Photo 4.E.12.1-3)
3. Pull the screw driver downward to release the latch and the Suppressor should pop up off of the Din Rail. (Photo 4.E.12.1-4)
4. You can now remove the Suppressor. (Photo 4.E.12.1-5)

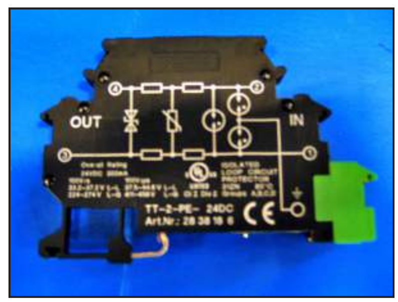


Photo 4.E.12.2-1
Replacement Suppressor

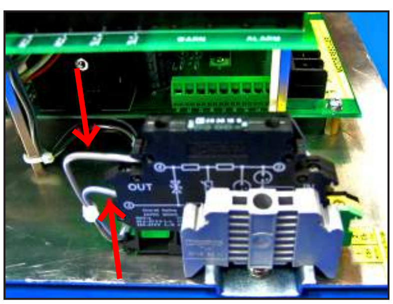


Photo 4.E.12.1-2
Output Wires

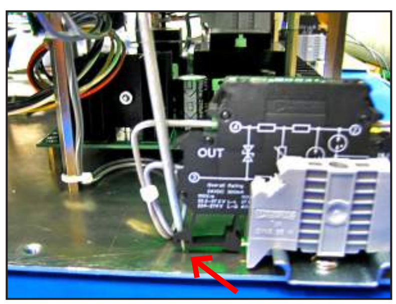


Photo 4.E.12.1-3
Release Latch

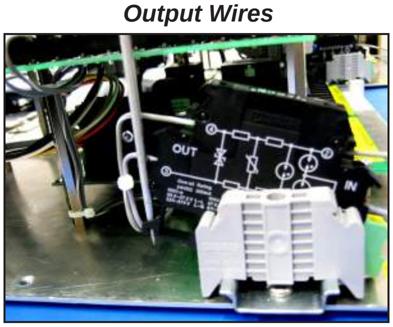


Photo 4.E.12.1-4
Suppressor Released

Photo 4.E.12.1-5
Suppressor Removed

SURGE SUPPRESSOR

4.E.12.2 Replacement of Control Signal Surge Suppressor:

1. Locate the replacement Suppressor. (Photo 4.E.12.2-1)
2. Place the Suppressor into position between the two end stops and snap it into place on the DIN Rail. (Photo 4.E.12.2-2)
3. Replace the wires into their respective locations and screw them in. (Photo 4.E.12.1-2)
4. The Control Signal Surge Suppressor is now replaced.

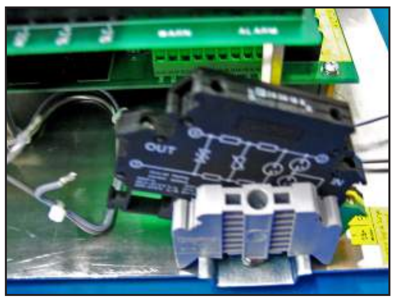


Photo 4.E.12.2-2
Position Suppressor

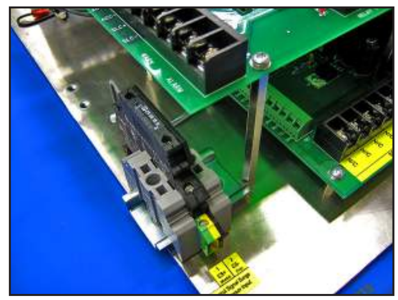


Photo 4.E.12.2-3
Suppressor Replaced

AC SURGE SUPPRESSOR
(STD. B, C, 1/2D, D, 2D, DP9, DP40)

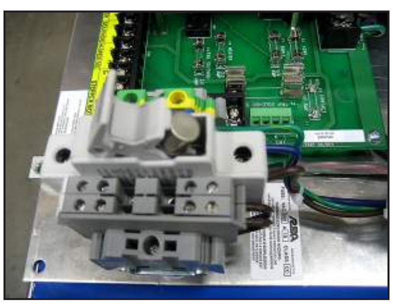


Photo 4.E.12.3-1
Fuse

4.E.12.3 Removal of the AC Surge Suppressor:

1. Make sure that the power to the unit is off. Open the fuse holder to ensure that no power comes on while you are working on the unit. (Photo 4.E.12.3-1)
2. Locate the AC Power Surge Suppressor. (Photo 4.E.12.3-2)
3. Unscrew the power input wires from the Surge Suppressor. (Photo 4.E.12.3-3)

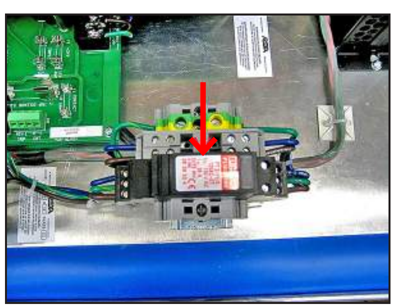


Photo 4.E.12.3-2
AC Power Surge Suppressor

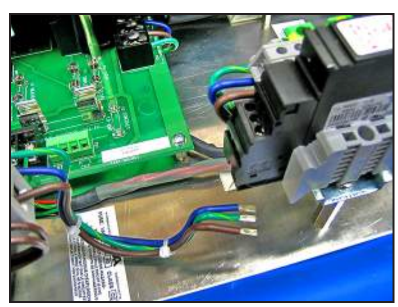


Photo 4.E.12.3-3
Input wires

HART® INTERFACE

4. Unscrew the power output wires from the Surge Suppressor. (Photo 4.E.12.3-4)
5. Now all power wires are removed from the Surge Suppressor. (Photo 4.E.12.3-5)
6. Place a long, narrow flat head screw driver in the release latch of the Surge Suppressor. (Photo 4.E.12.3-6)
7. Push down and towards the Suppressor to release it from the Din Rail.
8. Remove the Surge Suppressor.
9. The AC Power Surge Suppressor is now removed. (Photo 4.E.12.3-7)

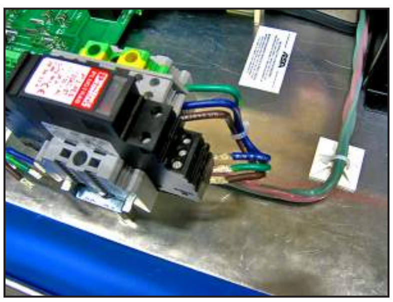


Photo 4.E.12.3-4
Output wires

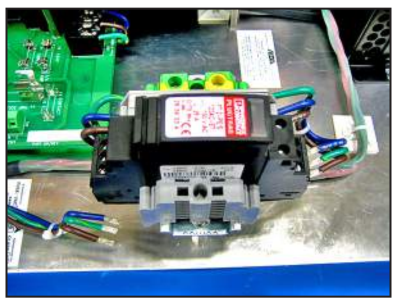


Photo 4.E.12.3-5
All power wires removed

Photo 4.E.12.3-6
Release latch

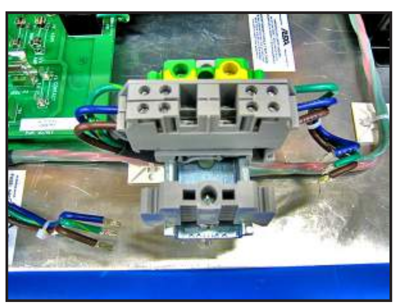


Photo 4.E.12.3-7
Unit with AC Surge Suppressor removed

4.E.12.4 Replacement of the AC Power Surge Suppressor:

1. Locate the replacement Surge Suppressor. (Photo 4.E.12.4-1)

2. Screw the 3 power input wires back into the Surge Suppressor. (From left to right: Blue, Green (GND), Brown) (Photo 4.E.12.4-2)
3. Screw the 3 power output wires into the Surge Suppressor. (From left to right: Blue, Green (GND), Brown) (Photo 4.E.12.4-2)
4. The power wires are now reconnected.
5. The Surge Suppressor is now replaced.
6. Close the fuse block (Photo 4.E.12.3-1) and return power to the unit. If the unit powers up normally, the Surge Protector was successfully replaced.

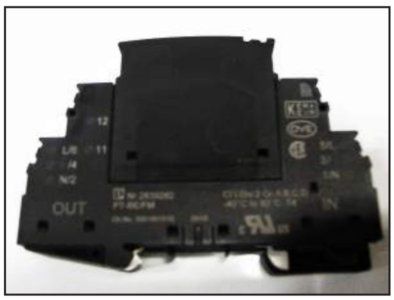


Photo 4.E.12.4-1
AC Surge Suppressor

Photo 4.E.12.4-2
Input and output wires

HART® INTERFACE

4.E.13 REPLACING HART® INTERFACE ASSEMBLY (S97695)

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

Photo 4.E.13.1-1
HART interface assembly

4.E.13.1 Removal of the Hart Interface Assembly (See Photo 4.E.13.1-1)

1. Remove the Control Signal wires from the board. (Photo 4.E.13.1-2) These wires are gray and gray/white and are screwed into the two terminals (CS- & CS+) on top of the board. (Photo 4.E.13.1-3)

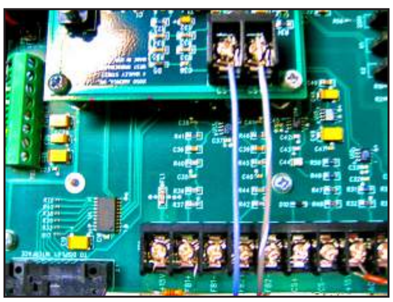


Photo 4.E.13.1-2
Control signal wires

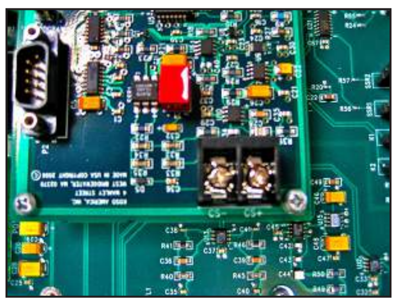


Photo 4.E.13.1-3
Terminals CS- and CS+

2. Unscrew these terminals and remove the wires.
3. Remove the Phillips head mounting screws from the four corners of the Hart board and set aside for mounting the replacement. (Photo 4.E.13.1-4)

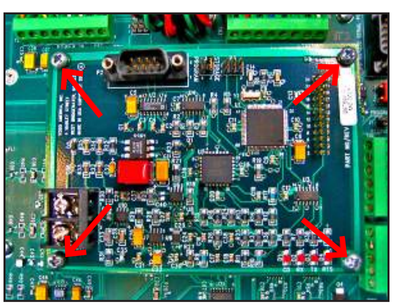


Photo 4.E.13.1-4
Mounting screws

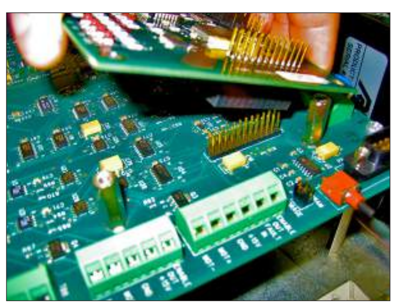


Photo 4.E.13.1-5
Removal from standoffs and CPU pins

4. Lift the Hart board up to remove it from the standoffs and to disconnect it from the CPU pins. (Photo 4.E.13.1-5) It may be necessary to wiggle the board forward and back slightly while lifting in order to make its removal easier.
5. The Hart Interface Assembly is now removed. (Photo 4.E.13.1-6)

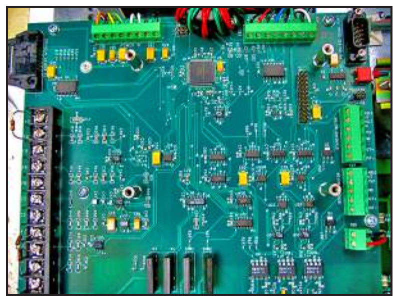


Photo 4.E.13.1-6
Hart interface board removed

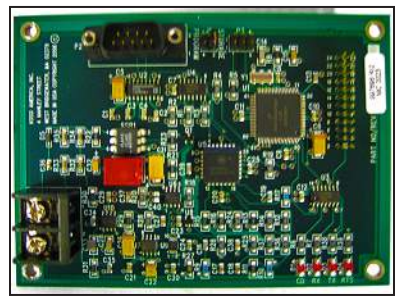


Photo 4.E.13.2-1
Hart interface board

4.E.13.2 Replacement of the Hart Interface Assembly:

1. Locate the replacement board. Make sure that your replacement board has been pre-programmed before you install it. (Photo 4.E.13.2-1)
2. Place the Hart board on top of the CPU board. The connector on the bottom of the board should match up perfectly with the pins on the CPU board. (Photo 4.E.13.1-5)
3. Firmly push the board down so that it rests on the 4 standoffs at the corners. (Photo 4.E.13.2-2)
4. Secure the Hart board to the standoffs with the 4 screws set aside during removal. (Photo 4.E.13.1-4)
5. Reconnect the control signal wires. Place the gray/white wire under the ‘CS+’ terminal and turn the screw to clamp the wire in. Place the gray wire under the ‘CS-’ terminal and turn the screw to clamp the wire in.
6. Return power to the unit and check for proper functionality.

Photo 4.E.13.2-2
Hart board on standoffs

FOUNDATION FIELDBUS

4.E.14 REPLACING FIELDBUS ASSEMBLY

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

4.E.14.1 Removal of the Foundation Fieldbus Assembly (Photo 4.E.14.1-1)

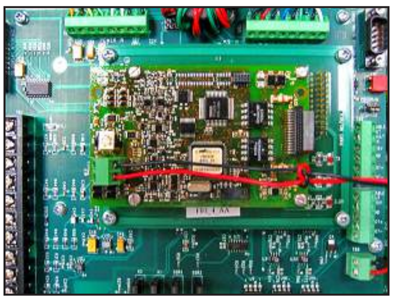


Photo 4.E.14.1-1
Foundation Fieldbus Assembly

1. Remove the signal wires coming from the Foundation Fieldbus that are screwed into the Signal Input terminal (unlabeled) (Photo 4.E.14.1-2).
2. Using a small flat-head screwdriver unscrew the wires from the terminal.
3. Unscrew the entire assembly from the CPU mounted standoffs setting aside the 4 Phillips-head screws to be used in the replacement. (Photo 4.E.14.1-3,4).
4. Slowly remove the assembly from the CPU by pulling upwards.
5. It may be necessary to wiggle the assembly up and down while pulling in order to ensure that the pins on the top of the CPU and the connector on the bottom of the assembly aren't bent or damaged. (Photo 4.E.14.1-5).

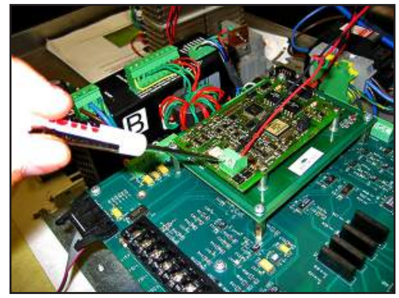


Photo 4.E.14.1-2
Signal Wires

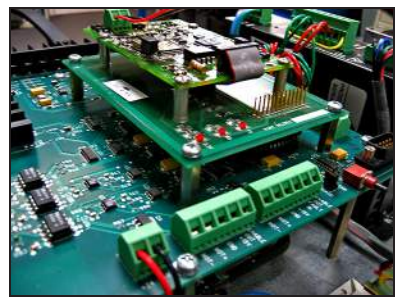


Photo 4.E.14.1-3
Mounted Standoffs

Photo 4.E.14.1-4
Mounting Screws

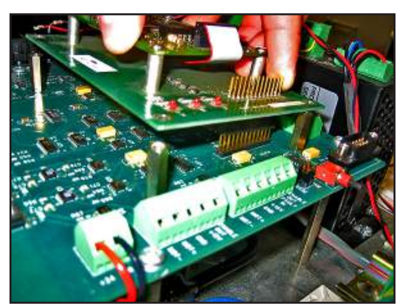


Photo 4.E.14.1-5
CPU pins

FOUNDATION FIELDBUS

4.E.14.2 Replacement of the Foundation Fieldbus Assembly (Photo 4.E.14.2-1)

Photo 4.E.14.2-1
Foundation Fieldbus

1. Ensure that the power is off to the unit and the Foundation Fieldbus.
2. Carefully place the replacement assembly on top of the CPU and standoffs, being sure to properly line up the pins on the CPU and the connector on the bottom of the Fieldbus Assembly. (Photo 4.E.14.2-2)
3. Firmly press the assembly down so that it is seated atop the standoffs and is snugly fitted with the pins.
4. Mount the assembly to the standoffs. Using the 4 Phillips-head screws that had been set aside, screw them into the four corners of the assembly and into the threaded standoff holes. (Photo 4.E.14.2-3)
5. Connect the two signal wires. These wires are non-polar, so it makes no difference which wires you screw into which terminal as long as one wire goes into each terminal. (Photo 4.E.14.1-2)
6. Return power to the electronics unit and to the Foundation Fieldbus.

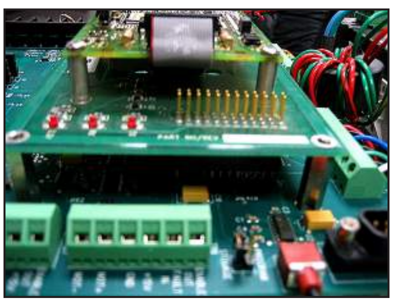


Photo 4.E.14.2-2
Pins

Photo 4.E.14.2-3
Threaded standoff holes

EMI / RFI FILTER

4.E.15 REPLACING EMI / RFI FILTER

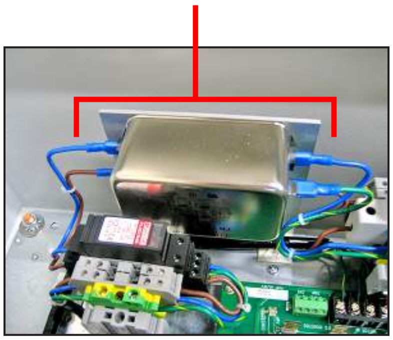


Photo 4.E.15
EMI/RFI Filter, bracket & wires

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

4.E.15.1 Removal of the Filter:

1. Pull the fuse holder open to make sure that no power goes to the unit while it is being serviced. (Photo 4.E.15.1-1)
2. Locate the Filter and remove the power input wires to the Filter. Needle nose pliers may be needed to remove the connectors, as the connections are very secure. (Photo 4.E.15.1-2)

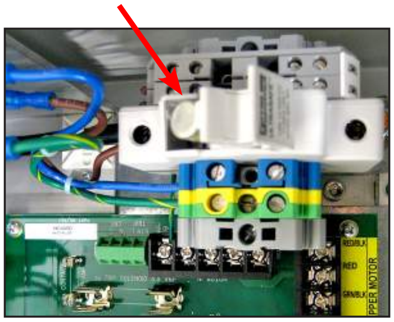


Photo 4.E.15.1-1
Open fuse holder

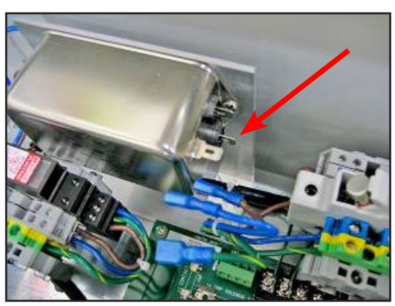


Photo 4.E.15.1-2
Detached input wires

3. Remove the power output wired to the Filter. Again, use needle nose pliers if necessary. (Photo 4.E.15.1-3)

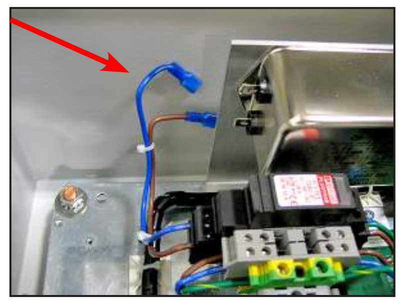


Photo 4.E.15.1-3
Detached output wires

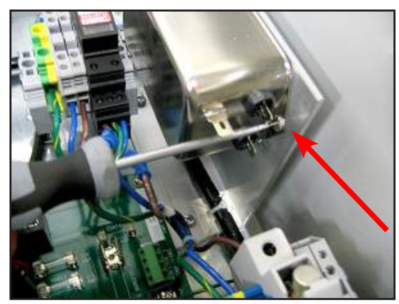


Photo 4.E.15.1-4
Bracket screw removal

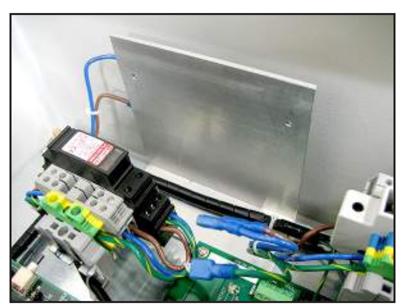


Photo 4.E.15.1-5
Bracket, filter removed

4. Use a flat head screwdriver to remove the two screws that mount the Filter to the bracket. Set the screws aside for the replacement process. (Photo 4.E.15.1-4)
5. Remove the Filter. (Photo 4.E.15.1-5)

4.E.15.2 Replacement of the Filter:

1. Use the mounting screws, mount the replacement Filter to the bracket. (Photo 4.E.15.1-4,5)
2. Reconnect the 3 power input wires to the right side of the filter. The Green/Yellow (GND) wire connects to the left pin, The Blue (Neutral) wire connects to the top right pin and the Brown (Line) wire connects to the bottom right pin. (Photo 4.E.15.2-1)
3. Give the wires a light tug to make sure the connections are secure.
4. Reconnect the 2 power output wires to the left side of the filter. The Blue (Neutral) wire connects to the top pin and the Brown (Line) wire connects to the bottom pin. (Photo 4.E.15.2-2)
5. The filter replacement is complete (Photo 4.E.15.2-3); close the fuse holder (Photo 4.E.15.1-1) and return power to the unit.
6. If the unit starts up and initializes properly the replacement is complete.

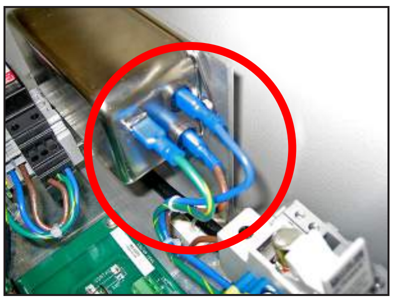


Photo 4.E.15.2-1
Three power input wires

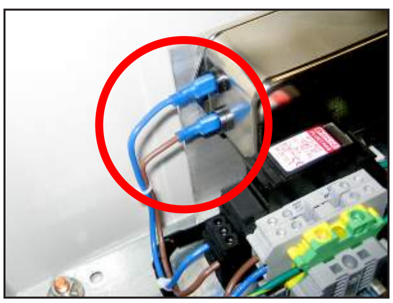


Photo 4.E.15.2-2
Two power output wires

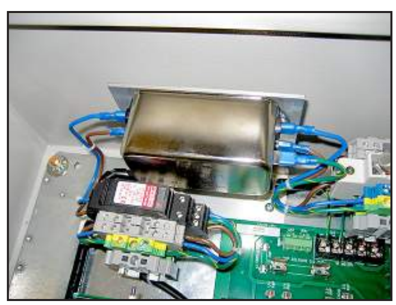


Photo 4.E.15.2-3
Complete Filter replacement

REMOTE MOUNTED FEEDBACK BOARD

4.E.16 REPLACING REMOTE MOUNTED FEEDBACK BOARD

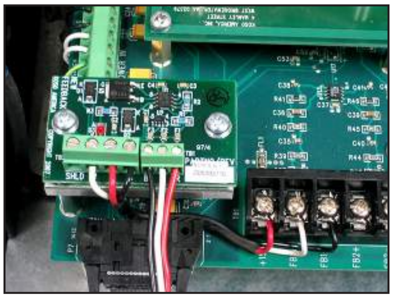


Photo 4.E.16
Feedback Board

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

4.E.16.1 Removal of Feedback Board

1. Using a small flat head screwdriver, remove the feedback wires (White, Red & Black) from the Feedback Board terminals TB1 & TB2. (Photo 4.E.16.1-1,2)

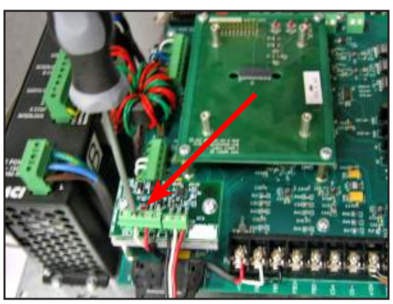


Photo 4.E.16.1-1
Feedback wires at TB1 & TB2

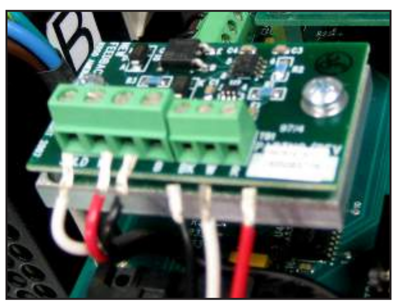


Photo 4.E.16.1-2
Feedback Board wires removed

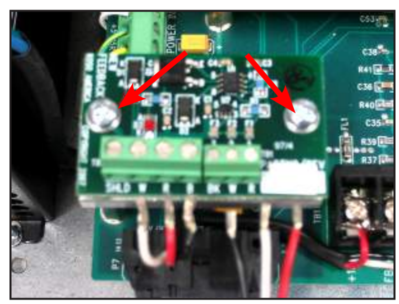


Photo 4.E.16.1-3
Feedback mounting screws

2. Locate and remove the 2 Phillips head screws used to mount the Feedback Board to the mounting plate. (Photo 4.E.16.1-3)
3. Set these screws aside, as they will be needed to mount the replacement Feedback Board.
4. Remove the Feedback Board from the mounting plate. (Photo 4.E.16.1-4)

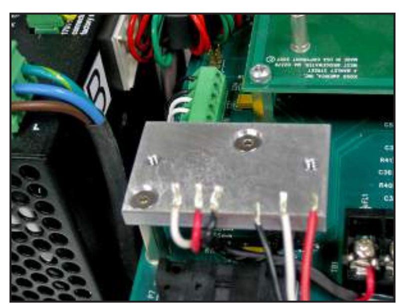


Photo 4.E.16.1-4
Feedback mounting plate

REMOTE MOUNTED FEEDBACK BOARD

4.E.16.2 Replacement of Feedback Board

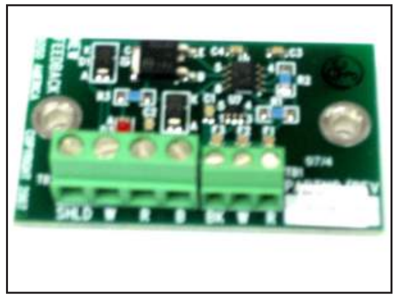


Photo 4.E.16.2-1
Feedback Board

1. Using the screws that were previously set aside, mount the new Feedback Board to the mounting plate. (Photo 4.E.16.1-4)
2. Using the small flat head screwdriver, screw the wires into their respective locations. The wires from the CPU screw into Feedback Board terminal TB2 and the wires from the actuator screw into terminal TB1.

NOTE: *The labels on the terminals dictate which wire goes to which terminal. (W-White, R-Red & B-Black) (Photo 4.E.16.2-2)*

3. Power up the unit and check the display to make sure it does not read a feedback error (Fb bad).
4. The Feedback Board is now successfully replaced.

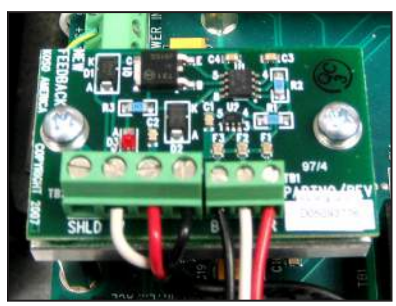


Photo 4.E.16-2
Feedback Board reconnected

FUSES

4.E.17 REPLACING FUSES (SINGLE POLE, DOUBLE POLE, 3 PHASE)

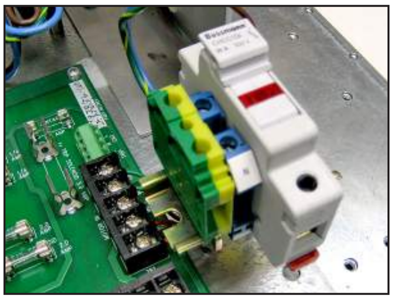


Photo 4.E.17-1
Single pole 120 Vac

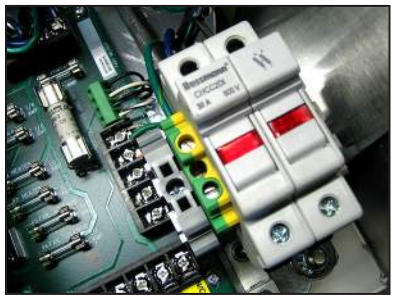


Photo 4.E.17-2
Double pole 240 Vac

Photo 4.E.17-3
3-phase 240+ Vac

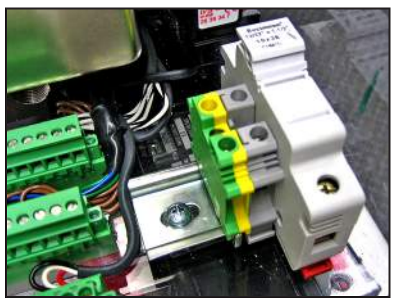


Photo 4.E.17-4
CE approved Single pole 120 Vac

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

4.E.17.1 Removal of a Fuse

1. Locate and pull open the fuse holder to reveal the fuse(s) inside and note its placement in the holder. (Photos 4.E.17.1-1, 2, 3, 4)

NOTE: *The placement of the fuse(s) differs. With a Bussman fuse holder the flat end of the fuse will go in first and the nipple end will be facing out. With a Ferraz Shawmut fuse holder the nipple end goes in first and the flat end is facing out. If the fuse in use is CE Approved, both ends will be flat and it may be inserted either way. (Photos 4.E.17.1-1,2,3,4)*

2. Remove the fuse(s) from the fuse holder. It may sometimes be necessary to use needle nose pliers or a similar tool to remove the fuse

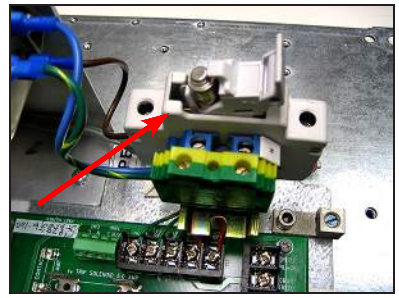


Photo 4.E.17.1-1
Open single pole

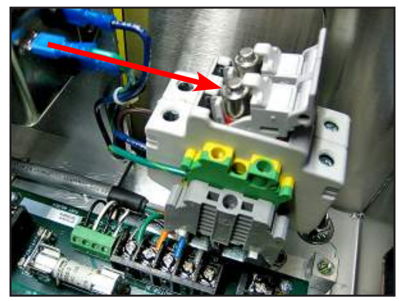


Photo 4.E.17.1-2
Open double pole

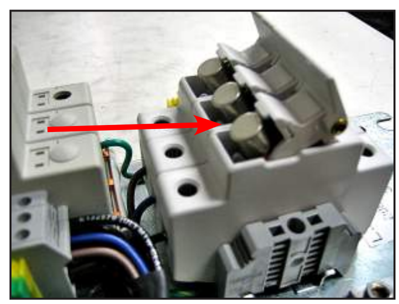


Photo 4.E.17.1-3
Open 3-phase

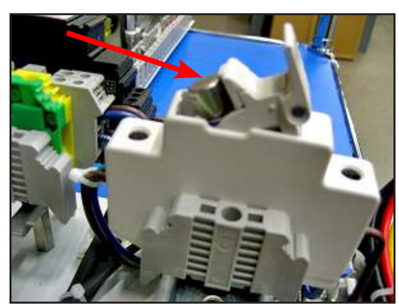


Photo 4.E.17.1-4
Open CE single pole

3. Note the amperage before discarding the spent fuse. Ensure that the replacement fuse(s) are of the same amperage and voltage rating. Do not confuse the spent fuse with the functioning replacement fuse.

4.E.17.2 Replacement of a Fuse

1. Locate and ensure that the amperage and voltage ratings are the same as the fuse that is being replaced.
2. Position the replacement fuse in the holder the same way that the previous fuse was installed. (See Photo 4.E.17.1-1, 2 & 3.)
3. Close the fuse holder. (See Photo 4.E.17.2-2, 3 & 4.)
4. Return power to the unit.
5. If the unit powers up properly then the fuse replacement was successful and is now complete.

Photo 4.E.17.2-1
Fuse

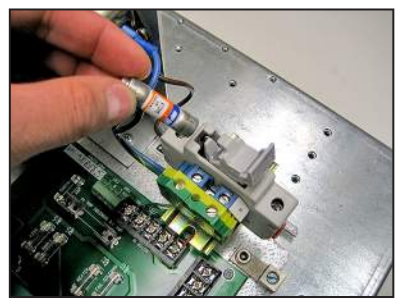


Photo 4.E.17.2-2
Fuse insertion

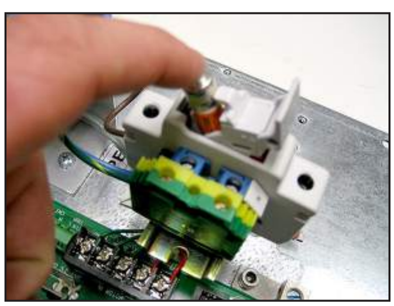


Photo 4.E.17.2-3
Fuse placement

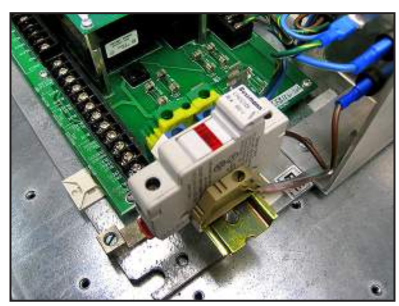


Photo 4.E.17.2-4
Completed fuse replacement

SWITCHES

4.E.18 REPLACING EXTERNAL SWITCH

Photo 4.E.18
External switches

CAUTION: MAKE SURE THE UNIT IS TURNED OFF AND POWER IS DISCONNECTED BEFORE REPLACING ANY COMPONENTS!

4.E.18.1 Removal of External Switch

1. Open the enclosure door to access the wiring to the switch you wish to replace. “OFF/OPEN/CLOSE” is now on the left and “MAN/AUTO” is now on the right. (Photo 4.E.18.1-1)
2. Locate the correct switch and unscrew the wires from the back. (Photo 4.E.18.1-2 or 3)
3. Close the enclosure door and loosen the large bolt— secures the switch to the control box—with an adjustable wrench. Finish unscrewing the bolt by hand. (Photo 4.E.18.1-4)
4. Remove the bolt and the aluminum switch label. (Photo 4.E.18.1-5)
5. Remove the Switch.

Photo 4.E.18.1-1
Interior switch wiring

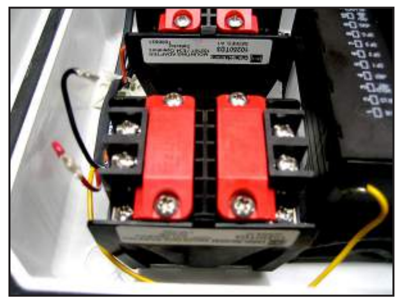


Photo 4.E.18.1-2
Open/Off/Closed wiring

Photo 4.E.18.1-3
Man/Auto wiring

Photo 4.E.18.1-4
Switch bolt

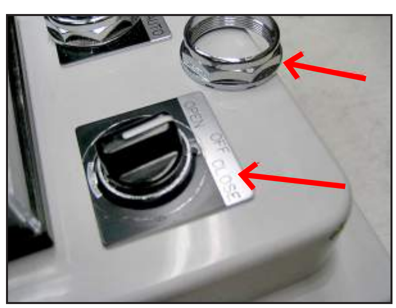


Photo 4.E.18.1-5
Switch label and bolt

Photo 4.E.18.2-1
Switch assemebly

4.E.18.2 Replacement of External Switch

1. Remove the bolt from the new switch assembly. (Photo 4.E.18.2-1)
2. Place the switch inside of the notched hole in the enclosure door. (Photo 4.E.18.2-2)
3. Place the switch position label over the switch handle. (Photo 4.E.18.1-5)
4. Place the bolt over the switch handle and hand tighten the bolt while lining up and straightening the switch and label.
5. Using an adjustable wrench, tighten the bolt just enough to lock the switch and label securely in place.
6. Open the enclosure door to access the switch wiring.
7. Wire the replacement switch as indicated in the Wiring Diagram, Figure 4.E.18.2-5 . (Also see “OFF/OPEN/ CLOSE” Switch, Photo 4.E.18.2-3 or “MAN/AUTO,” Photo 4.E.18.2-4.)
8. Power up the electronics and test each switch that was replaced to make sure that it is wired correctly and is operational.

Photo 4.E.18.2-2
Notched enclosure hole

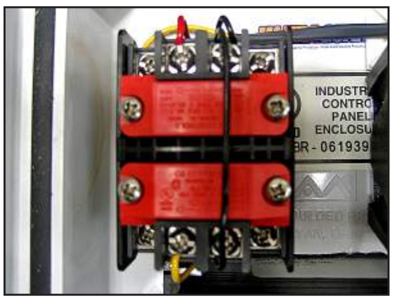


Photo 4.E.18.2-3
Open/Off/Closed wiring

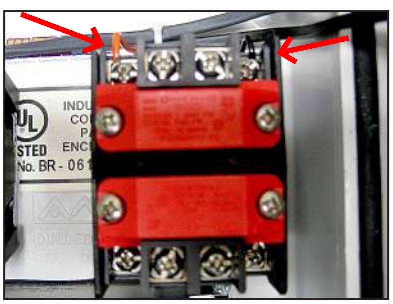


Photo 4.E.18.2-4
Manual/Auto wiring

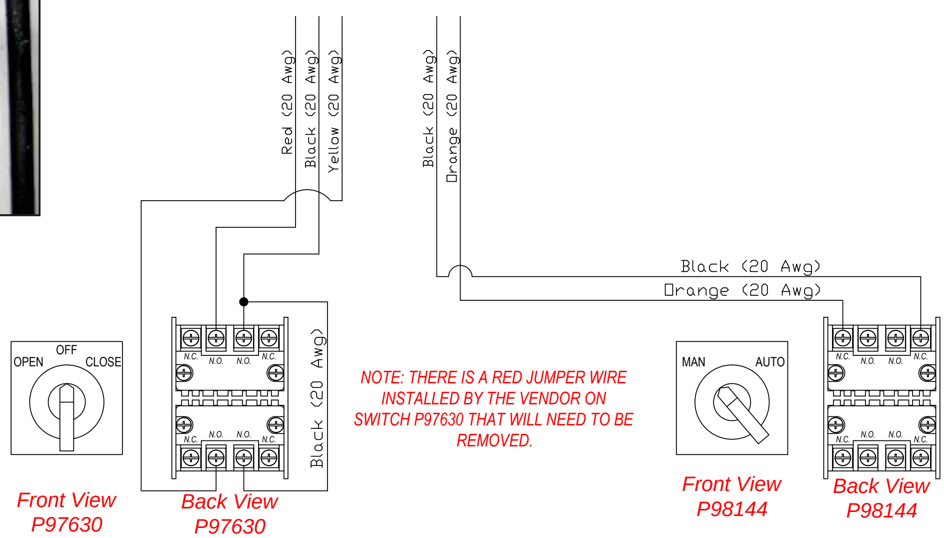


Figure 4.E.18.2-5 Switch wiring diagram

4.M. Mechanical Repair

4.M.1 COMPONENT IDENTIFICATION

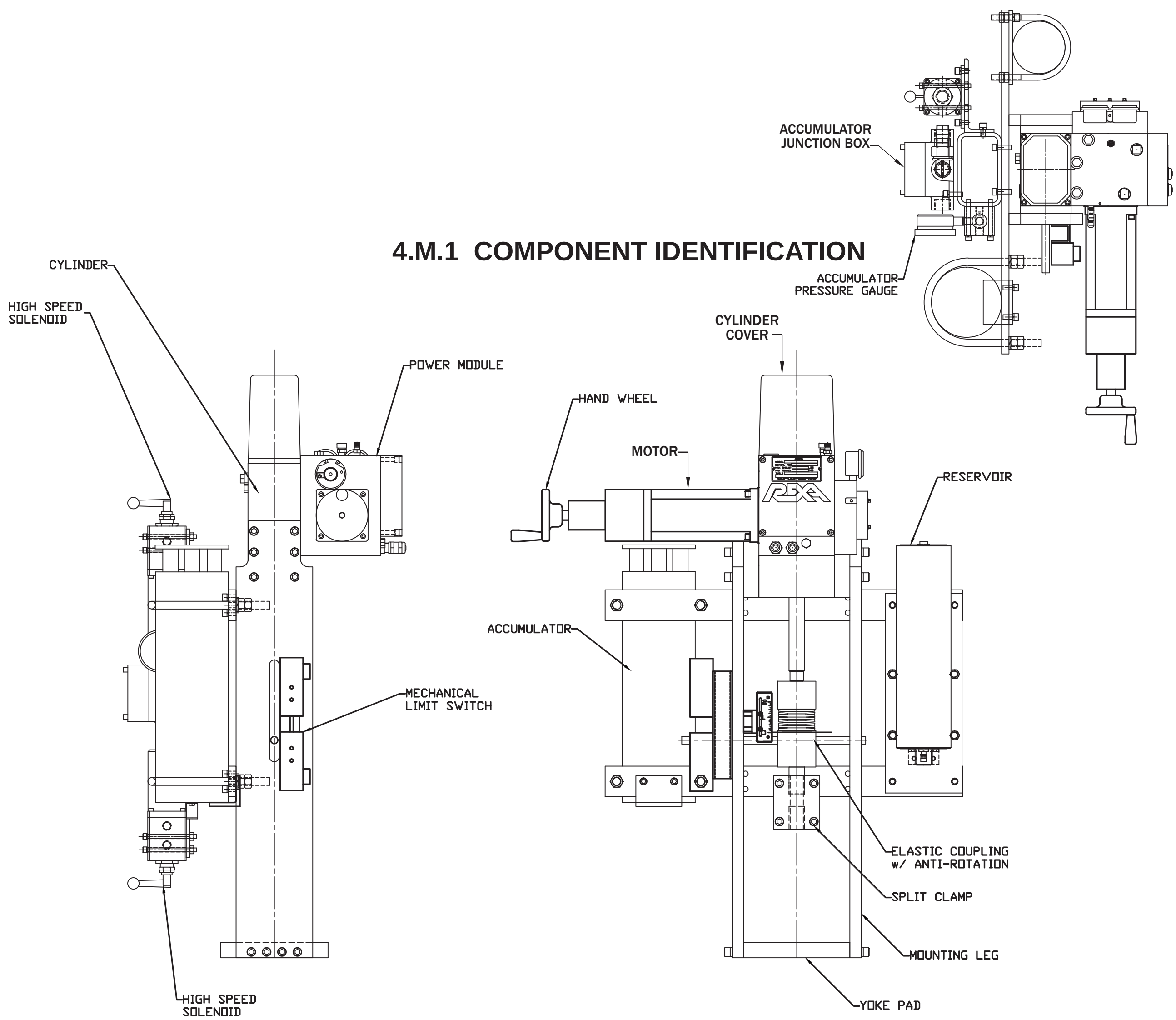


Figure 4.M.1-1 REXA Linear Cylinder Component Identification

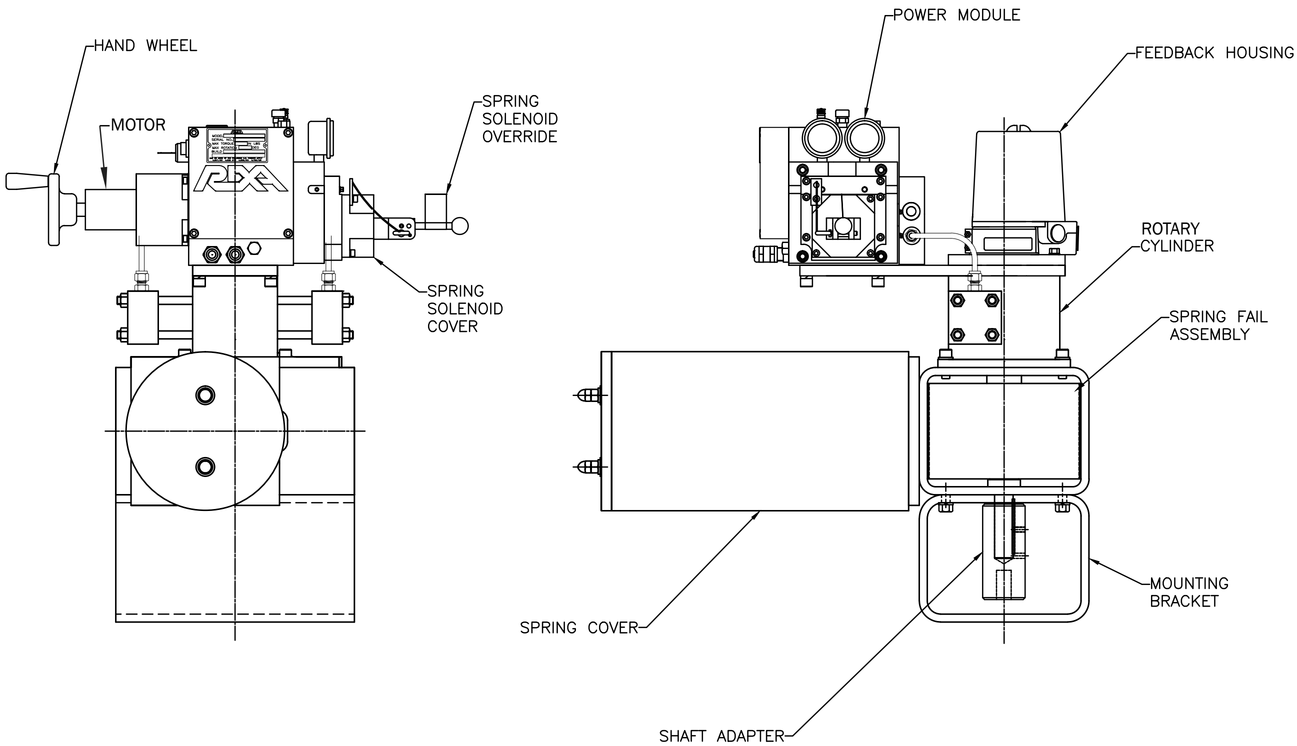


Figure 4.M.1-2 REXA Rotary Cylinder with Spring Fail

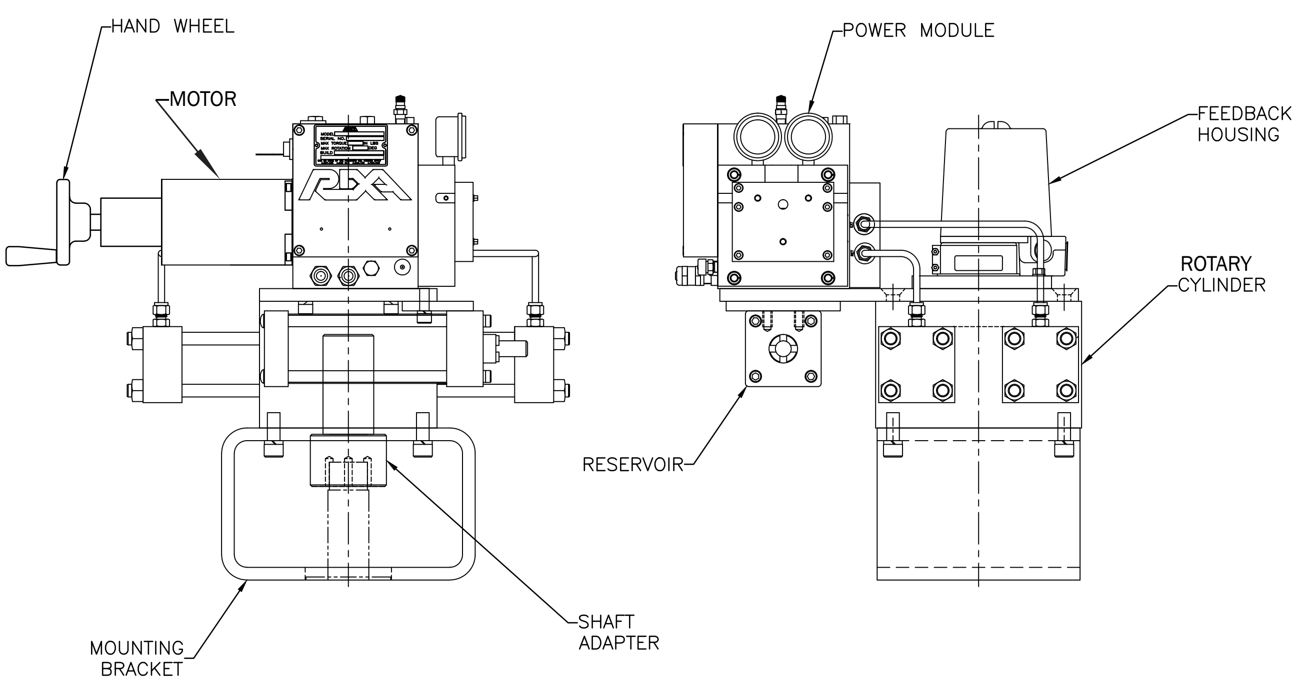


Figure 4.M.1-3 REXA Rotary Cylinder Fail in Place

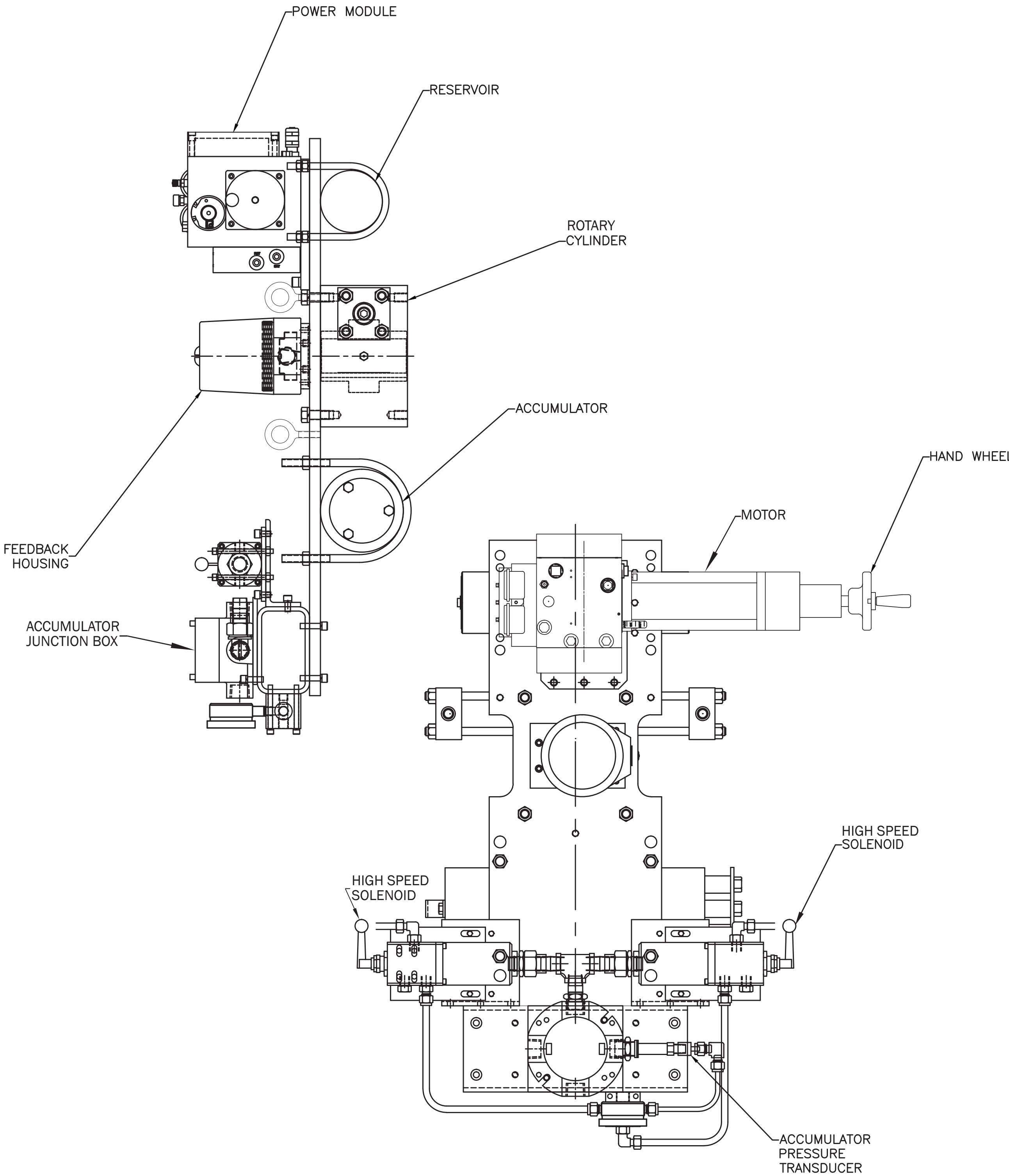


Figure 4.M.1-4 REXA Rotary Cylinder with Accumulator Package

POWER MODULE

4.M.2 OVERVIEW

All REXA Xpac actuators consist of a motor, a pumping system and a housing assembly referred to as the Power Module. There are many different configurations of REXA Xpac actuators. Two characterizing features are the size and number of Power Modules. All REXA Power Modules have many common parts and repair procedures.

The details for identifying all REXA models by our labeling system can be found in the Section 1.2.1 of this manual. Also, please note that each actuator will have at least one power module, but in some cases there are multiple power modules on one actuator assembly. To visually identify the size of the power module, see Figures 4.M.2-1, 2, 3 & 4. The key identifying features are the shape and length of the motor.

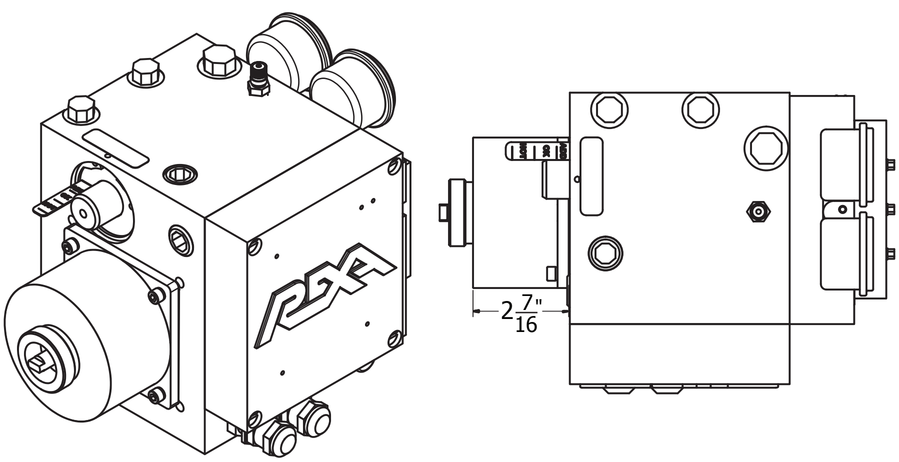


Figure 4.M.2-1: B Power Module

POWER MODULE

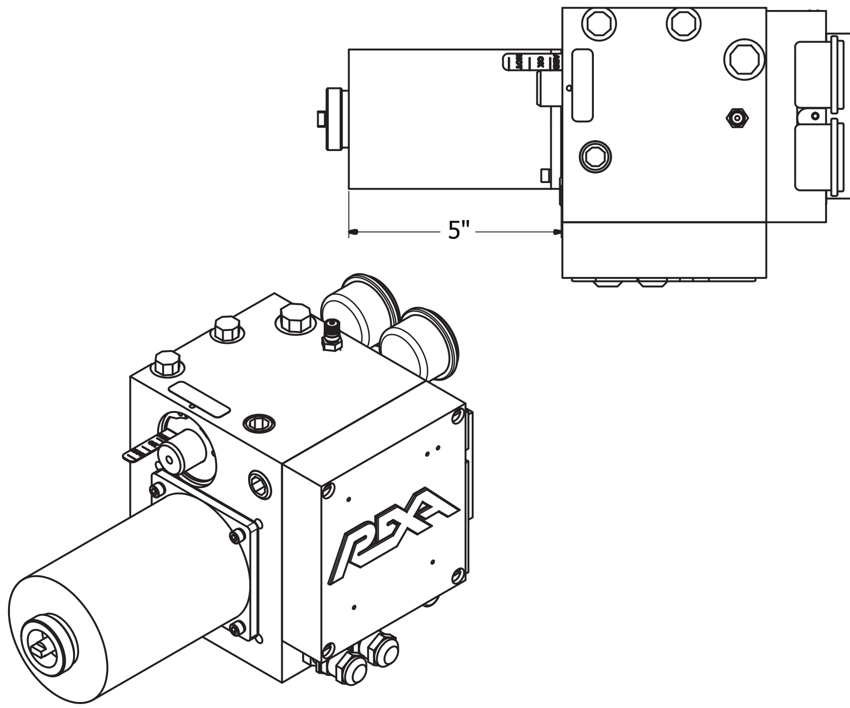


Figure 4.M.2-2: C Power Module

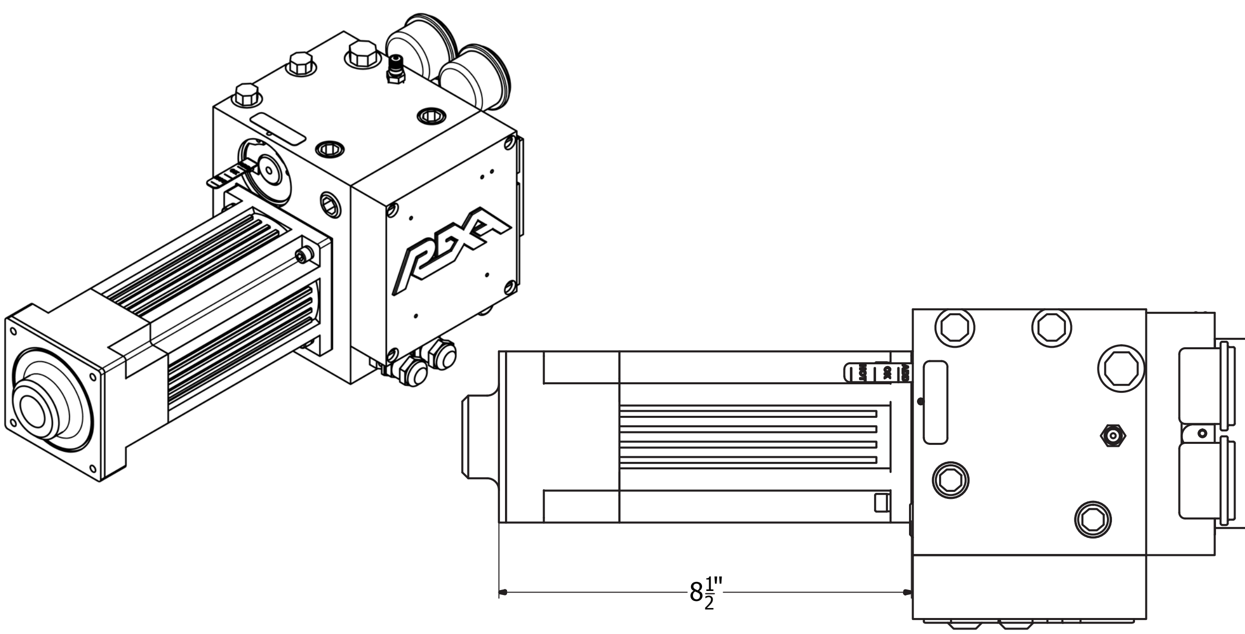


Figure 4.M.2-3: ½ D Power Module

POWER MODULE

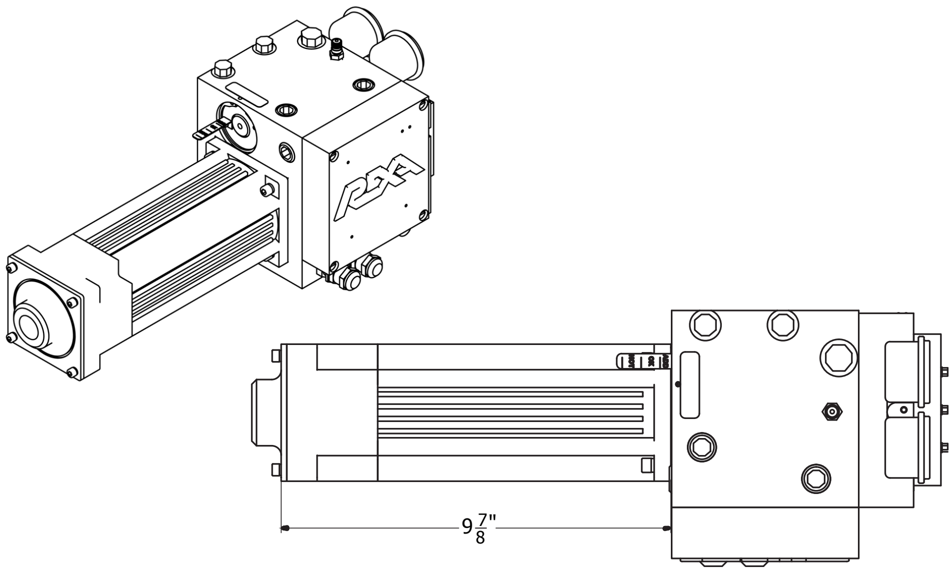


Figure 4.M.2-4: D Power Module

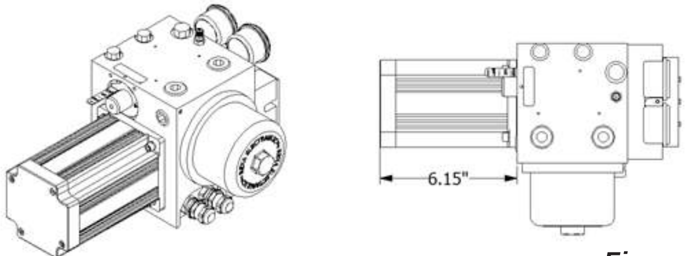


Figure 4.M.2-5 C Power Module Explosion Proof

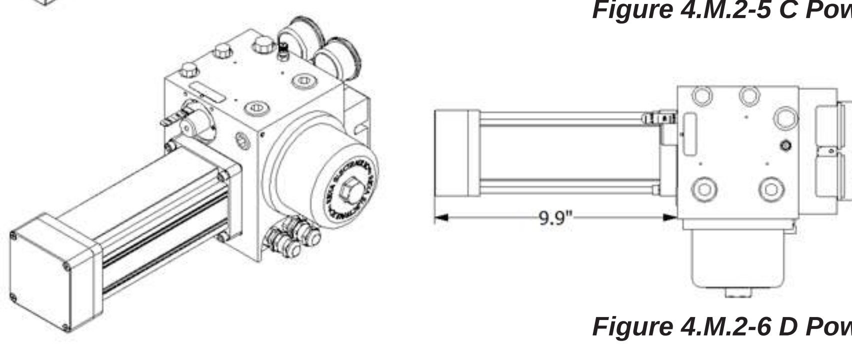


Figure 4.M.2-6 D Power Module Explosion Proof

NOTE: *With the exception of pump and motor sizing, all REXA Power Modules share many of the same components encountered during a rebuild. For this reason, we will refer to rebuilding only one module in this guide, and point out the differences between different-sized Power Modules as needed.*

4.M.3 POWER MODULE REMOVAL

CAUTION: **All external loads must be removed from the actuator before any service is performed.**

NOTE: *Tag and Lock-Out the unit for repair in accordance with local procedures. Repair of the power module will require removing the unit from service.*

It may be possible for certain repairs to be performed without removing the units from the installation site. Extra hazards may result from this type of repair and are not covered in the scope of this manual. Consult the factory for further information.

NOTE: *Due to the large number of custom applications of REXA actuators this manual doesn't show the exact steps to removing the power module but rather the general procedure that should be followed.*

4.M.3.1 Removal

1. Ensure that all pressure gauges read zero before disconnecting any pressure lines. One way to do this is by turning the bypass counterclockwise.

NOTE: *On some modules the dual gauges on the module may not read zero, but it is safe to proceed if they are both reading equal values.*

2. Ensure that power has been turned off to the unit.
3. An oil drain bin should be ready to catch any oil that may drain from disconnecting lines.
4. Disconnect the external conduit and wiring running to the power module.

NOTE: *Oil is under low pressure in the reservoir and will squirt out when reservoir plugs are removed.*

5. Disconnect either reservoir plug with the oil drain pan underneath. (Refer to Figure 4.M.3.1.) The reservoir should pull in forcing out oil from the removed port. If the reservoir does not pull in it may be necessary to push it in.

POWER MODULE

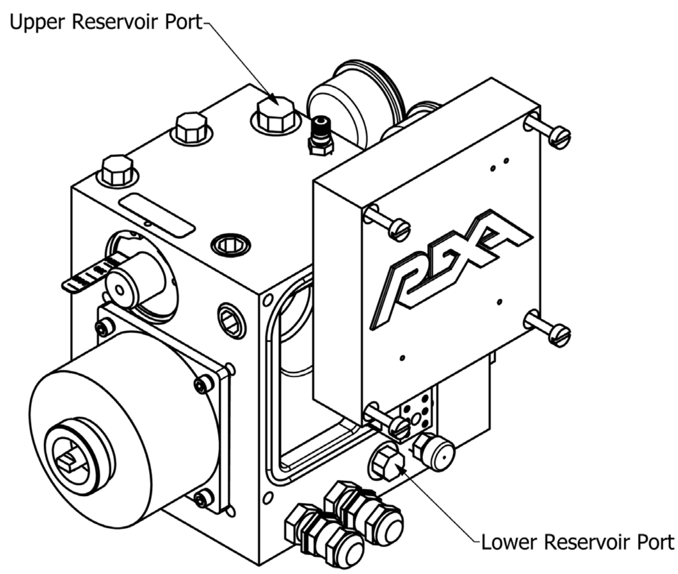


Figure 4.M.3.1 Power Module

6. Re-install the reservoir port plug.
7. Disconnect any external plumbing to the module, pressure and reservoir parts.
8. Remove the mounting screws from the module. This should allow you to completely remove the module for repair.
9. Place the module over the oil drain pan and remove the lower reservoir plug on the module.
10. Remove the upper reservoir plug on the module; this will allow the remaining oil to drain from the lower port.

4.M.4 RESERVOIR REBUILD (ALL SIZE MODULES)

Parts Required: Reservoir Seal Kit.
Kit to include: Cover Seal, Cover O-ring and Reservoir Piston O-ring.

CAUTION: Spring under compression, 20 lb pre-load.

NOTE: *All B, C, 1/2D and D size non-explosion proof modules share the same reservoir components and rebuild procedures. For the C and D explosion proof modules, the piston reservoir should seldom need replacement in the field. In the event that it will need replacement, the motor will need to be back out slightly to remove the reservoir cover. See section 4.M.6 removal of explosion proof motor.*

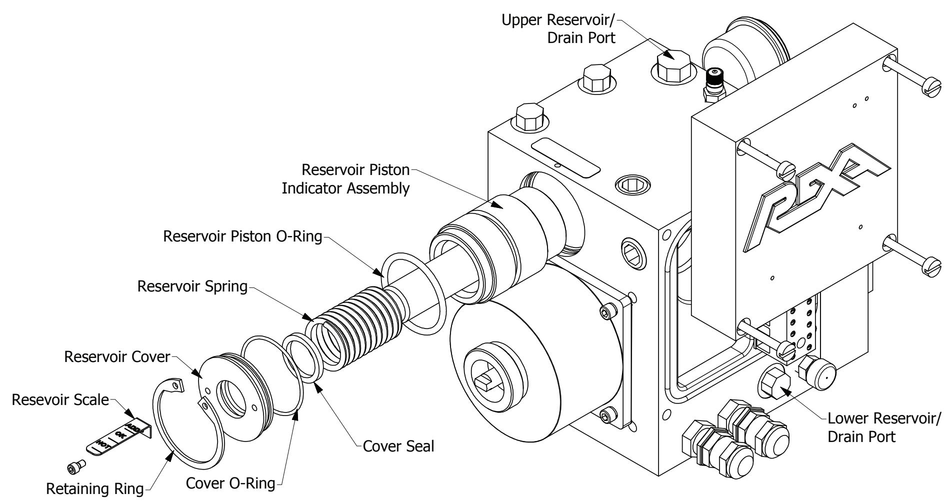


Figure 4.M.4 Reservoir Rebuild

4.M.4.1 Disassembly

CAUTION: Use care when removing the retaining ring as this releases pre-loaded spring and cover.

1. Make sure actuator has been drained of oil and both drain plugs have been removed.
2. Remove the reservoir scale.
3. Remove the retaining ring. It may be necessary to tap in on the reservoir cover to allow the retaining ring to release.

RESERVOIR

4. Use two 6-32 screws and thread them into the two tapped holes in the reservoir cover.
5. Pull the reservoir cover off using the two 6-32 screws. While doing so, be cautious; the reservoir has a spring load.
6. Remove the spring.
7. Remove the reservoir indicator piston assembly by pulling on the indicator.
8. Remove and discard the cover O-ring from the reservoir cover. Remove and discard the cover seal from the reservoir cover. Remove and discard the reservoir piston O-ring.

4.M.4.2 Cleaning and Inspection

1. Clean all components in a solvent/parts washer to remove all dirt and contaminants.
2. Clean out the reservoir cavity and be careful not to introduce any contaminants to the system.
3. Inspect reservoir bore for scratches. If they are deep enough to be felt, replace power module body.
4. If a full rebuild is being performed proceed to the removal sections for the relevant motor before re-assembly.

4.M.4.3 Re-Assembly

1. Lubricate the two new O-rings and the new cover seal.
2. Slide the new reservoir piston O-ring over reservoir piston indicator assembly.
3. Slide reservoir assembly back into the reservoir cavity.
4. Drop the reservoir spring over the indicator on the reservoir assembly.
5. Install the new cover O-ring in the O-ring groove on the outside of the cover.
6. Fit the new cover seal into the reservoir cover groove.

NOTE: *The O-ring side of the seal must face away from the module body.*

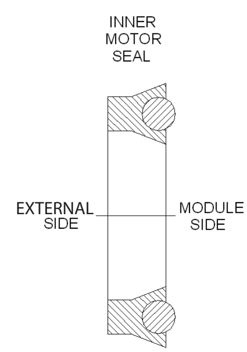


Figure 4.M.4.3: Inner motor seal

RESERVOIR

7. Re-install the reservoir cover and retaining ring. It is necessary to hold the reservoir spring compressed while installing the retaining ring.

MOTOR/SEAL REPLACEMENT

4.M.5 NON-EXPLOSION PROOF MODULE MOTOR REPLACEMENT OR SEAL REPLACEMENT

Parts Required: Appropriate Motor Seal Kit.
Kit to include 2 motors seals and the motor gasket.

NOTE: *All modules share similar motor mounting procedures and components. For simplicity the diagram below shows a B Module.*

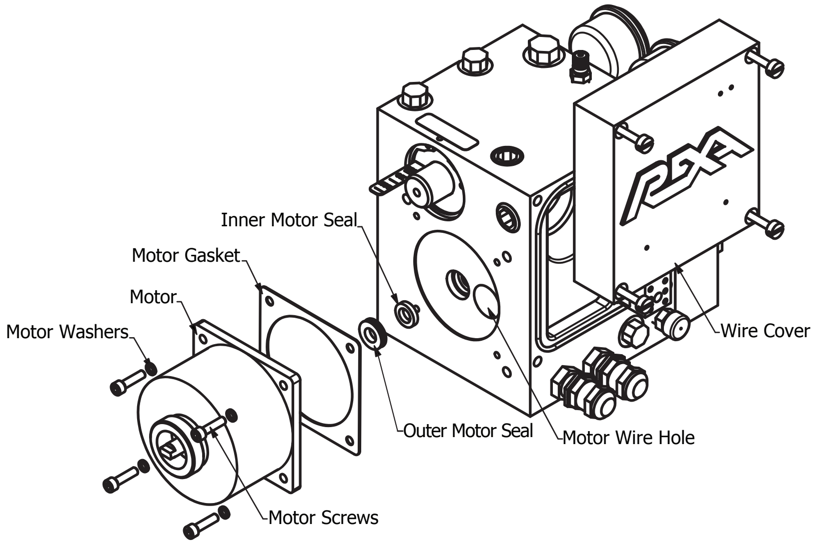


Figure 4.M.5 Motor Replacement

4.M.5.1 Disassembly

1. Ensure the actuator has been drained of oil and top drain plug has been removed.
2. Remove the four screws holding the wire cover on.
3. Locate and disconnect the motor wires from the terminal block under wire cover.
4. Remove the four motor screws and four lock washers.
5. Pull the motor straight out.

NOTE: *It may be necessary to lightly tap the sides of the motor with a rubber mallet to break the seal between the motor and module body.*

MOTOR/SEAL REPLACEMENT

6. Peel off the motor gasket and remove both motor seals. These three items can be thrown out after you have located the replacement parts in your rebuild kit.

4.M.5.2 Cleaning and Inspection

1. Clean off the motor face and casting face. Remove any remaining gasket material and sealant.
2. If a full rebuild is being performed proceed to the removal sections for the relevant power train before re-assembly.

4.M.5.3 Re-Assembly

1. Coat both new motor seals with petroleum jelly and insert as shown below into the module. Seal will not function properly if installed backwards.

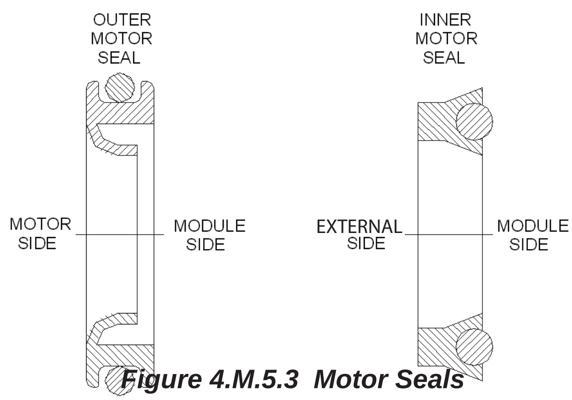


Figure 4.M.5.3 Motor Seals

2. Apply sealant on boss of the motor area of the module, and around the motor and mounting through-holes.
3. Place the gasket on the motor after installing sealant.
4. Orientate the motor shaft so that it engages with the pump coupling in the module.
5. Feed the wires into the motor wire hole on the module and slide the motor back into place. The motor should sit flush to the casting. Turn the motor shaft back and forth to ensure it is aligned with the pump coupling.

MOTOR/SEAL REPLACEMENT

CAUTION: Do not force the motor in place or tighten the mounting screws before turning the motor shaft, or damage will occur.

6. Apply blue Loctite® and install the four motor washers. Torque the screws in place to 50 lb·in.
7. Re-wire the motor to match the wire colors. For detailed wiring diagram, refer to Appendix P of the IOM.
8. Reinstall the wire cover and torque the screws in place to 50 lb·in.

4.M.5-2 EXPLOSION PROOF MODULE MOTOR REPLACEMENT OR SEAL REPLACEMENT

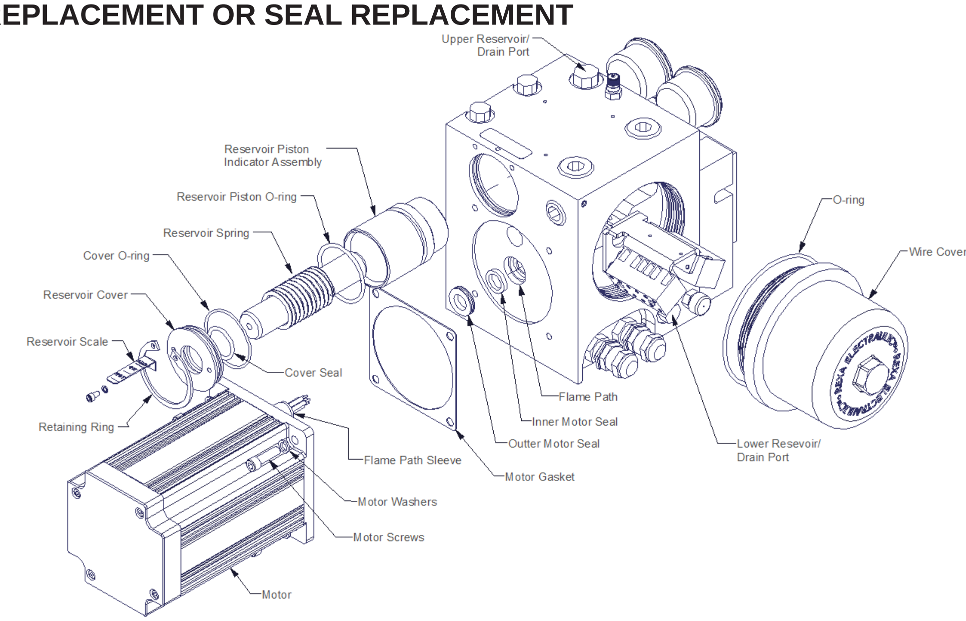


Figure 4.M.5-2 Explosion Proof Power Module Assembly

Note: *Motor & Module assembly is designed to be explosion proof per CSA and IEC requirements when Motor's Flame Path Sleeve is inserted into the Module's Flame Path. Prior to installation of the motors, inspect Motor's Flame Path Sleeve and Module's Flame Path to ensure no evidence of surface imperfections such as nicks and/or scratches deeper than 75 Uin by 0.04 inches in length. Do not using sharp tools to minimize possible damage to these critical areas during assembly of the motor onto the module.*

MOTOR/SEAL REPLACEMENT

4.M.5-2.1 Disassembly

1. Ensure the actuator has been drained of oil and top drain plug has been removed.
2. Remove the cover by unthreading it from the power module.
3. Locate and disconnect the motor wires from the terminal block under the wire cover.
4. Remove the four motor screws and four lock washers.
5. Pull the motor straight out.

NOTE: *It may be necessary to lightly tap the sides of the motor with a rubber mallet to break the seal between the motor and module body.*

4.M.5-2.2 Re-assembly

1. Coat both new motor seals with petroleum jelly and insert as shown below into the module. Seal will not function properly if installed backwards.
2. Apply sealant on boss of the motor area of the module, and around the motor and mounting through-holes.
3. Place the gasket on the motor after installing sealant.
4. Orientate the motor shaft so that it engages with the pump coupling in the module. ***(See Figure 4.M.5.3 Motor Seals)***
5. Feed the wires and flame path sleeve into the motor wire hole on the module and slide the motor back in place.

   CAUTION: Do not force the motor in place or tighten the mounting screws before turning the motor shaft, or damage will occur.

6. Apply blue Loctite® and install the four motor washers. Torque the screws in place to 50 lb•in.
7. Re-wire the motor to match the wire colors. For detailed wiring diagram, refer to Appendix P of the IOM.
8. Reinstall the wire cover and torque the cover to 30 ft-lb.

FILL AND OVERFILL VALVES

4.M.6 FILL AND OVERFILL VALVES

Note: All B, C, 1/2D and D size modules share the same external valves replacement procedures.

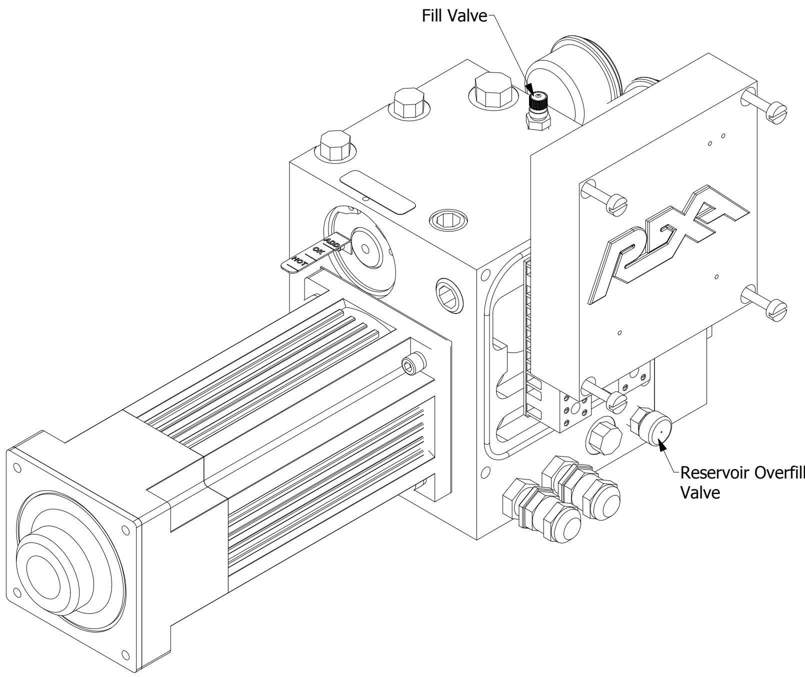


Figure 4.M.6 External Valves

4.M.6.1 Disassembly

1 Remove the reservoir overfill valve and the fill valve.

2 Clean out any sealant that may be left.

4.M.6.2 Re-Assembly

1 Coat the threads of the new overfill valve and the fill valve with thread sealant.

2 Screw both valves in place as shown above.

4.M.7 PRESSURE LIMITING VALVE

Table 4.M.7

Parts List					
Item	**Description**	**Qty**	**Item**	**Description**	**Qty**
1	Valve Bonnet	1	7	Quad Ring	1
2	Valve Stem	1	8	Star Washer	1
3	Spring Seat	1	9	Valve Seat Retainer	1
4	Spring	1	10	Cap Lock Nut	1
5	Spring Cap	1	11	O-ring - 106	1
6	O-ring - 015	1	12	Valve Seat	1

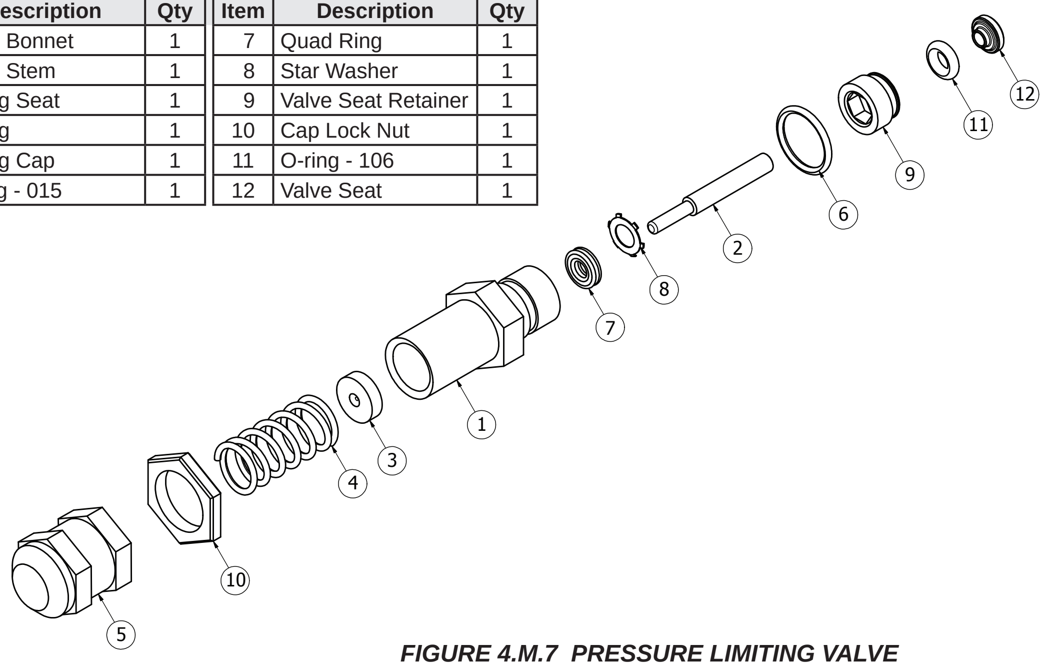


FIGURE 4.M.7 PRESSURE LIMITING VALVE

NOTE: *If the power module is still attached to the actuator system then make sure all pressure is relieved by turning the bypass counter clockwise. Refer to Figure 4.M.1-1: Linear Cylinder Component Identification. Not doing so may result in damage to unit and or injury to self.*

4.M.7.1 Disassembly

1. Loosen the spring cap (5) by turning the cap lock nut (10) clockwise and remove both items.
2. Remove the spring (4) and the spring seat (3).
3. Remove the valve bonnet (1) from the pressure relief cavity of the power module. On the power module side, remove the valve stem (2) and O-ring (6).
4. Using a pick, remove the star washer (8) and the quad ring (7) from the power module side of the pressure relief.

PRESSURE LIMITING VALVE

5. Using an allen wrench, remove the valve seat retainer (9).
6. Using a pick, remove the O-ring (11) inside the power module along with the valve seat (12).
7. The pressure relief O-rings (6 & 11) and quad ring (7) can be thrown out after you have located the replacement parts in your rebuild kit.

4.M.7.2 Cleaning and Inspection

1. Clean all components in a brake wash to remove dirt and contaminants.
2. Clean out pressure relief cavity and be careful not to introduce any contaminants into the system
3. Inspect for any metal files or gall marks in the pressure relief cavity

4.M.7.3 Re-assembly

1. Lubricate the new O-rings (6 & 11) and quad ring (7) before reinstalling.
2. Install the valve seat (12) and O-ring (11) into the power module cavity.

3 Using an allen wrench, place the valve seat retainer (9) into the cavity and torque to 25 lb•in.

4 Install the quad ring (7) and star washer (8) into the power module side of the valve bonnet (1).

5 Apply multi-purpose grease to the tip of the valve stem (2) and insert the valve stem (2) into the power module side of the valve bonnet (1).

6 Install the O-ring (6) onto valve bonnet (1) and insert the valve bonnet (1) into the power module. Torque the valve bonnet (1) to 25 lb•in.

7 Insert the spring seat (3) and spring (4) inside the valve bonnet (1). Install the cap lock nut (10) and spring cap (5) to the outside of the valve bonnet (1).

NOTE: *Refer to IOM Appendix O for adjustment range (psi) and spring color.*

4.M.8 DRIVE TRAIN REMOVAL

Parts Required: Module Rebuild Kit

NOTE: *All B, C, 1/2D and D size modules share the same rebuild procedures. Only the pump internals and coupling shafts are different.*

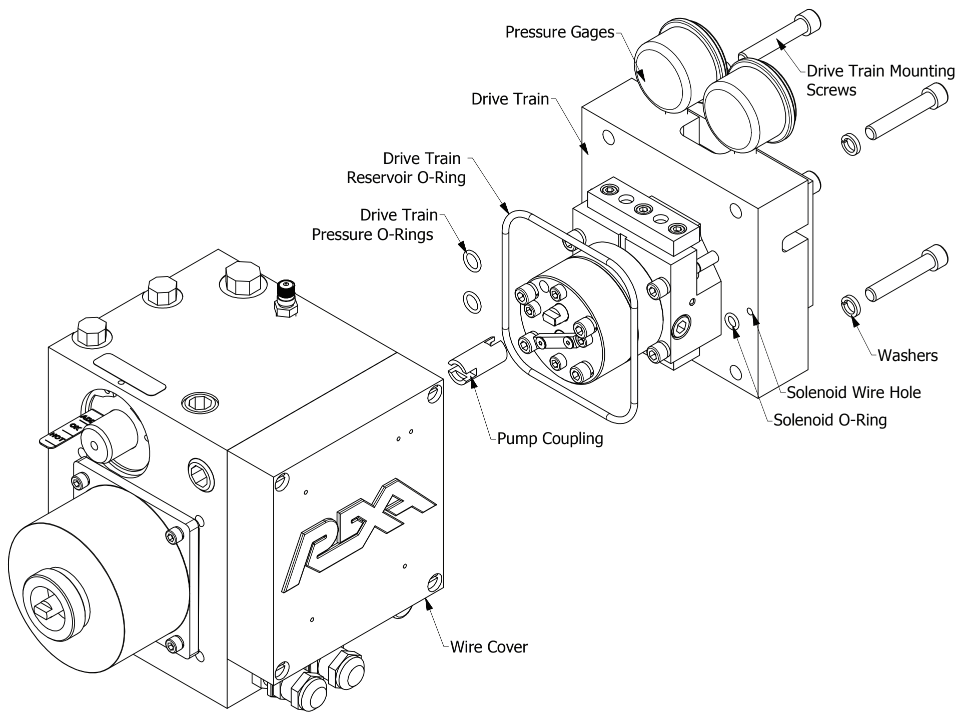


Figure 4.M.8 Drive Train

4.M.8.1 Disassembly

1. Ensure the oil has been drained from the module prior to disassembling the power train.
2. For spring fail units only:
   a.) Remove four screws holding wire cover on.
   b.) Disconnect two white solenoid wires.
2. Remove the four drive train mounting screws and lock washers.
3. Pull the power train assembly straight out.

DRIVE TRAIN

4. Remove the drive train pressure O-rings, wire cavity O-rings and drive train reservoir O-ring.
5. Remove the pump coupling.

4.M.8.2 Cleaning and Inspection

1. Clean out the inside of the module body. It is best if the reservoir and the motor are completely removed and the body can be completely sprayed out with contact cleaner.
2. Proceed with the drive train rebuild prior to assembly if performing a full rebuild.

4.M.8.3 Re-Assembly

1. Drop the pump coupling shaft into the shaft hole in the module. The B, C, and D shafts can be installed either side first because they are symmetrical. The ½D shaft will only go in one way. Check the fit of the shaft to the pump for correct orientation.
2. Place the new O-rings into the O-ring grooves of the module. Place a few dabs of petroleum jelly or grease over the O-ring to hold it in place.
3. Align the pump shaft orientation to the coupling so they mate up during installation. Slide the power train assembly back into the module. It is necessary to rotate the motor shaft to allow the pump coupling to align properly.

CAUTION: Do not force the drive train in place or tighten the mounting screws before turning the motor shaft, or damage will occur!

4. Apply blue Loctite® on the drive train screws and install the four lock washers. Torque screws in place to 190 lb·in.
5. For spring fail only:
   a.) Feed solenoid wires into the module.
   b.) Reconnect both wires to the terminal strip under the wire cover. There is no polarity, so either wire can go to either solenoid terminal.
   c.) Reinstall wire cover. Torque wire cover bolts to 50 lb·in.

4.M.8.4 Drive Train Rebuild

Parts Required: Module Rebuild Kit

NOTE: *All B, C, 1/2D and D size modules share the same rebuild procedures. Only the pump internals and coupling shafts are different.*

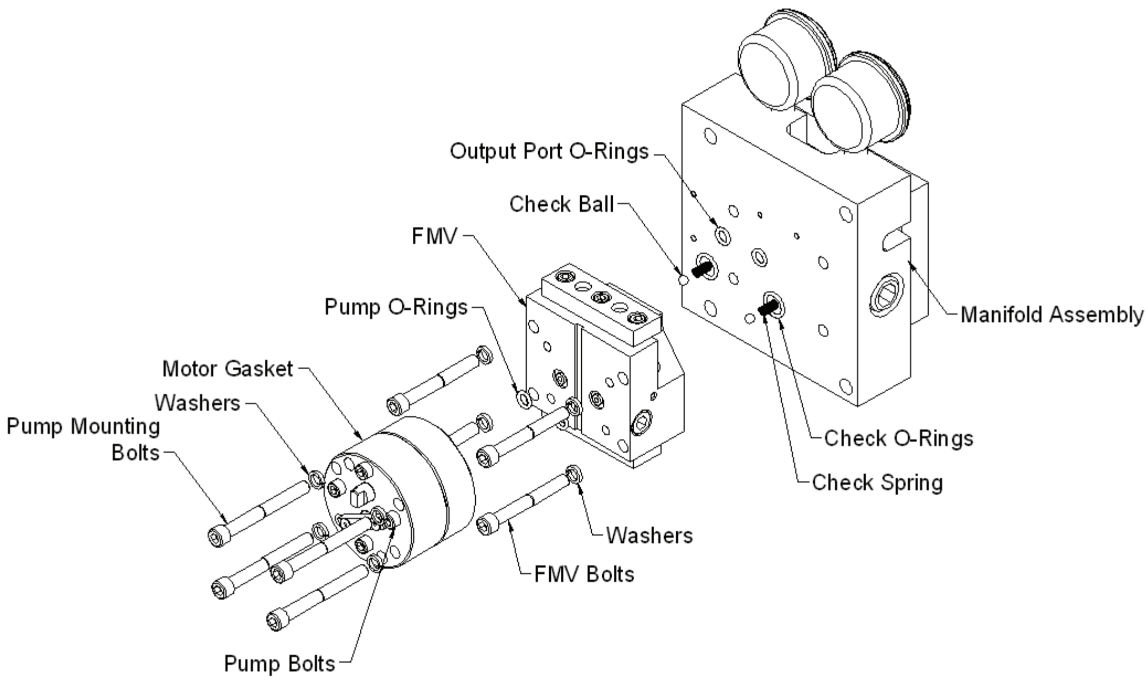


Figure 4.M.8.4 Drive Train Rebuild

4.M.8.5 Disassembly

1. Remove the four 1/4-20 pump mounting bolts and lock washers. ***Do not remove the #10-32 pump screws holding the pump together!***
2. Separate the pump from the rest of the assembly. Place it driven shaft up. Take extreme care to protect the drive shaft of the pump once it is unbolted. Laying it on its output shaft will cause damage and it will need to be replaced. **The pumps are not serviceable and should never be opened or cleaned**.

3. Remove both pump O-rings from the face of the flow match valve (FMV).
4. Remove the four 1/4-20 flow match valve screws and lock washers.

CAUTION: There are check balls and springs between the two faces. Be careful not to lose these components while separating the flow match valve from the manifold.

5. Remove the four O-rings from the flow match valve face.

4.M.8.6 Cleaning and Inspection

1. The outer surfaces of these components can be cleaned in solvent. Extreme care must be taken to ensure no contaminants enter the pump or flow match valve during cleaning.
2. Turn the pump shaft 360°. It should be free to turn with no binding felt. Replace pump if the shaft will not turn or binding is felt.
3. Continue to the suction check valve replacement and manifold rebuild before reassembly if a full rebuild is being preformed.

4.M.8.7 Re-Assembly

1. Place new O-rings into the O-ring groove of the flow match valve face. Place a few dabs of petroleum jelly over the O-ring to hold them in place.
2. Insert a check ball then a check spring into each hole on the flow match valve.
3. Align the flow match valve to the manifold as shown in Figure 4.M.8.4. The gauges are on the top side along with the corner cutouts of the flow match valve. Apply blue Loctite® on the flow match screws and install the 4 lock washers. Torque the 4 screws in place to 100 lb·in.

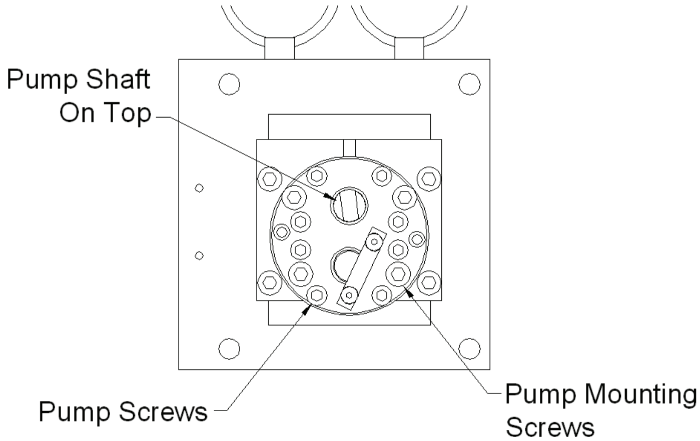


Figure 4.M.8.7 Flow Match Valve Face

4. Align the pump to the flow match valve as shown Figure 4.M.8.7. Note the location of the pump driven shaft. Apply blue Loctite® on the pump screws and install the four lock washers. Torque the screws in place to 100 lb·in.

4.M.9 SUCTION CHECK VALVE

Parts Required: Suction Check Rebuild Kit

NOTE: *All B, C, 1/2D and D size modules share the same rebuild procedures.*

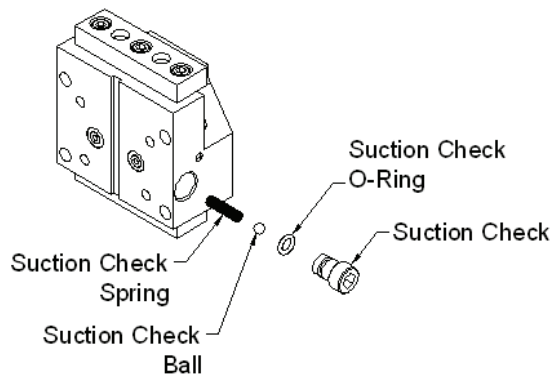


Figure 4.M.9 Suction Check Valve

4.M.9.1 Disassembly

1. Unthread the suction check valve.
2. Remove the suction check valve O-ring
3. Remove the suction check ball and the suction check spring from the flow match body.

4.M.9.2 Cleaning and Inspection

1. The suction check cavity can be cleaned with brake wash but care must be taken not to introduce any contaminants into the valve.

4.M.9.3 Re-Assembly

1. Slide the new suction check spring into the valve cavity of the flow match valve.
2. Set a new suction ball onto the spring.
3. Install a new suction check O-ring into the groove on the suction check. Thread in the suction check valve and torque to 250 lb·in.

MANIFOLD

4.M.10 STANDARD MANIFOLD REBUILD

Parts Required: Module Rebuild Kit

NOTE: *All B, C, 1/2D and D size modules share the same rebuild procedures; however, slow speed spring fail units are different. High temperature units also share the same procedure; however, high temperature kits are available with different materials.*

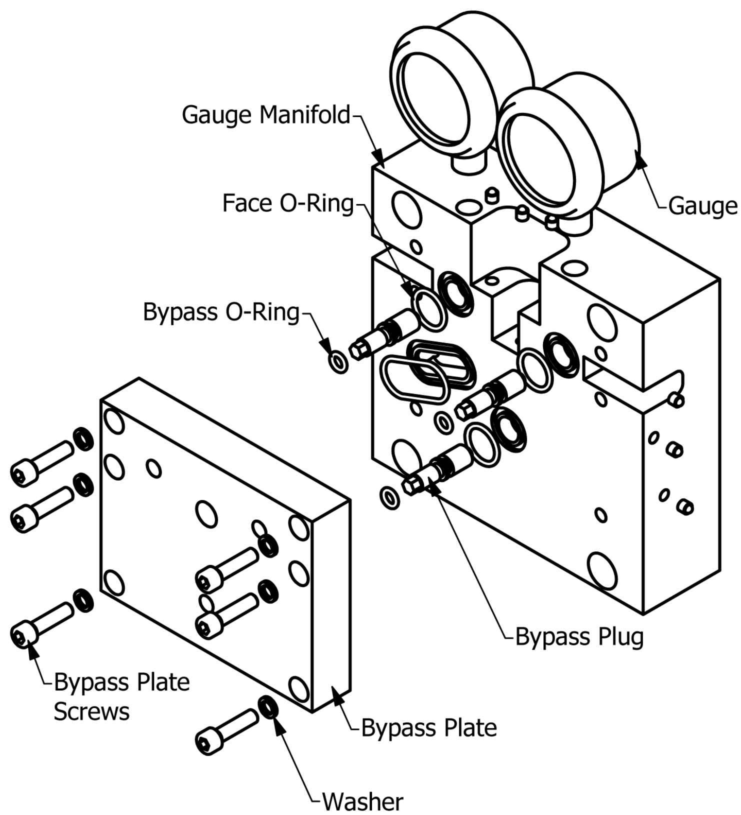


Figure 4.M.10 Manifold

4.M.10.1 Disassembly

1. Unthread the six bypass plate screws.
2. Remove the bypass plate.
3. Unthread all three bypass plugs from the bypass plate.
4. Remove the four face O-rings from the gauge manifold.

5. Remove the gauges—if they are being replaced—at this time. If the unit is a high temperature unit it will not have gauges installed…the ports will be plugged.

4.M.10.2 Cleaning and Inspection

Clean the bypass plate and the gauge manifold with brake wash. Ensure no contaminants are allowed to enter the ports of the gauge manifold.

4.M.10.3 Re-Assembly

1. Install new bypass plug O-rings into the O-ring groove of the bypass plug. Lubricate the O-rings with petroleum jelly. Repeat this for all three plugs. Be careful to avoid sliding the O-ring over the threads of the bypass plug, which can cause damage to the O-ring.

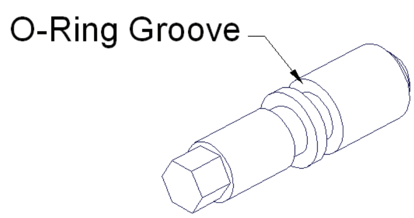


Figure 4.M.10.3 O-ring Grooves

2. Thread the three bypass plugs into the bypass plate. Once the hex protrudes through the plate enough, use a hex head screw driver and thread the plug until it bottoms into the plate.

NOTE: *If this is not done, the plugs will keep this plate from mounting properly in the following steps.*

3. Install the four face O-rings into the O-ring grooves of the gauge manifold. Use petroleum jelly or grease to hold the O-rings in place.
4. Align the bypass plate with the gauge manifold, apply blue Loctite® on the bypass plate screws and install the washers. Torque to 50 lb·in.

SOLENOID

4.M.11 SOLENOID

Parts Required: Solenoid Rebuild Kit

NOTE: *All B, C, 1/2D and D size modules share the same rebuild procedures. High temperature units also share the same procedure; however, high temperature kits are available with different materials.*

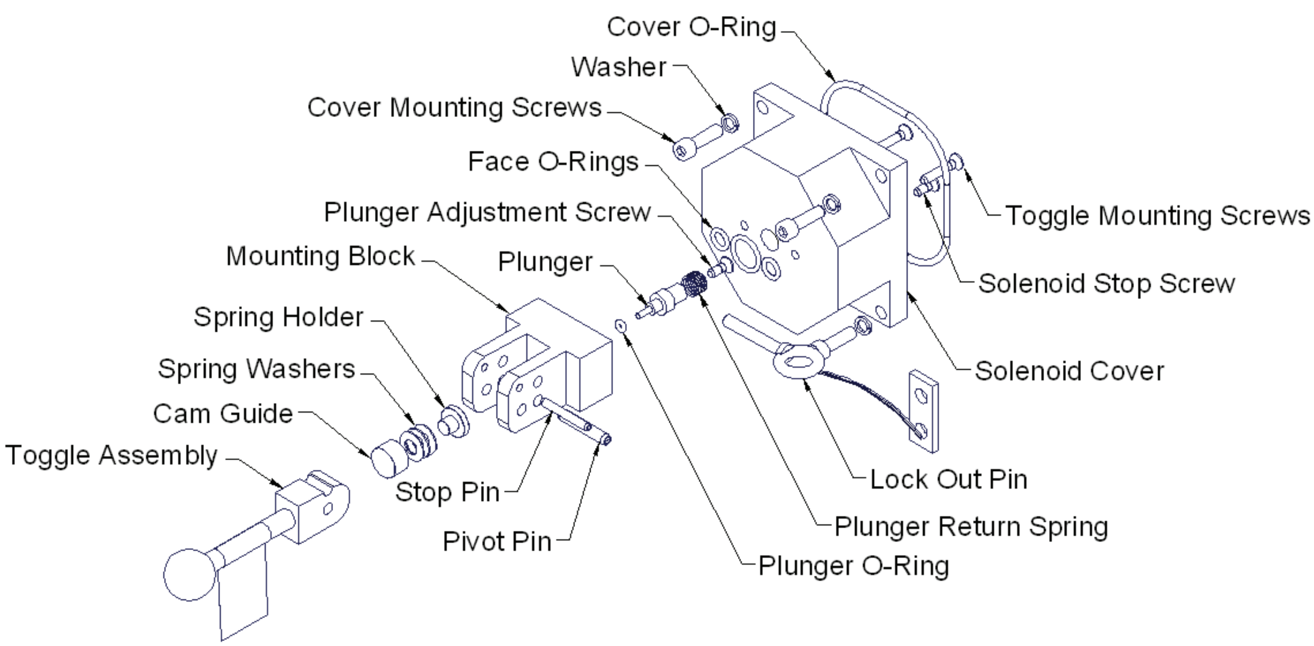


Figure 4.M.11 Solenoid Cover

4.M.11.1 Disassembly (Solenoid Cover)

1. Remove the cover mounting screws and washers.
2. Remove the solenoid cover and cover O-ring.
3. Remove the two toggle mounting screws and O-rings
4. Remove the three face O-rings.
5. Remove the plunger return spring, plunger and plunger O-ring.
6. Tap out the Pivot Pin in order to remove the toggle assembly, cam guide, spring washers and spring holder.

4.M.11.2 Cleaning and Inspection (Solenoid Cover)

Clean all components with brake wash.

4.M.11.3 Re-Assembly (Solenoid Cover)

1. Locate the three new spring washers from the rebuild kit. Install them onto the spring holder as shown below. Note the “bow” location of the spring washers in the diagram, installing the springs in the wrong orientation will cause the bypass not to function.

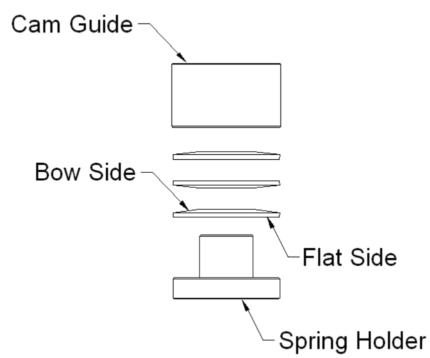


Figure 4.M.11.3-1 Spring Washers

2. Install the Cam guide over the springs and onto the spring holder as shown above.
3. Place the spring assembly into the mounting block, spring holder side first.

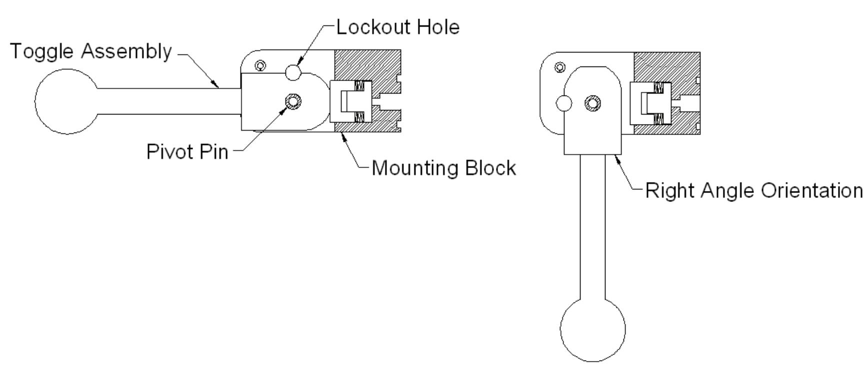


Figure 4.M.11.3-2 Toggle Assembly

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4. Align the toggle assembly as shown above into the mounting block; note the location of the Lock-Out hole. Press the new pivot pin in place.
5. Lubricate the new O-rings. Slide the plunger O-ring over the small diameter of the plunger, and down to the first shoulder as shown below.

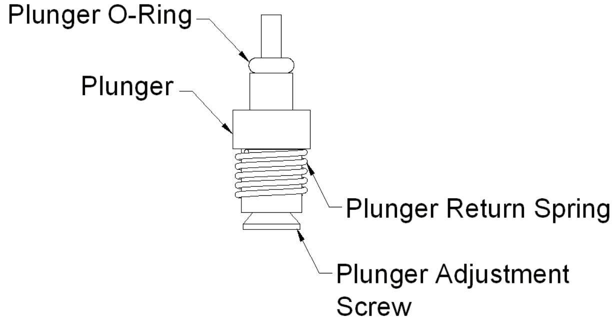

Figure 4.M.11.3-3 Plunger

6. Slide the plunger return spring over the plunger as shown above and install the plunger adjustment screw into the bottom of the plunger until tight.
7. Insert the plunger assembly into the mounting block as shown below.

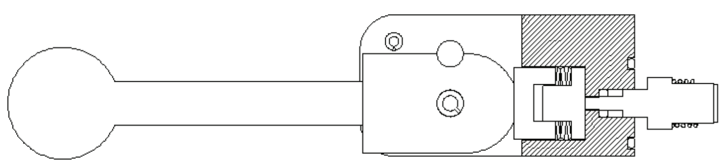

Figure 4.M.11.3-4 Mounting Block

8. Place the three face O-rings into the O-ring grooves of the mounting block. Coat the O-rings with petroleum jelly to hold them in place during assembly.
9. Continue onto the setup, **TS&R section 4.M.12**.

4.M.11.4 Disassembly (Solenoid Manifold)

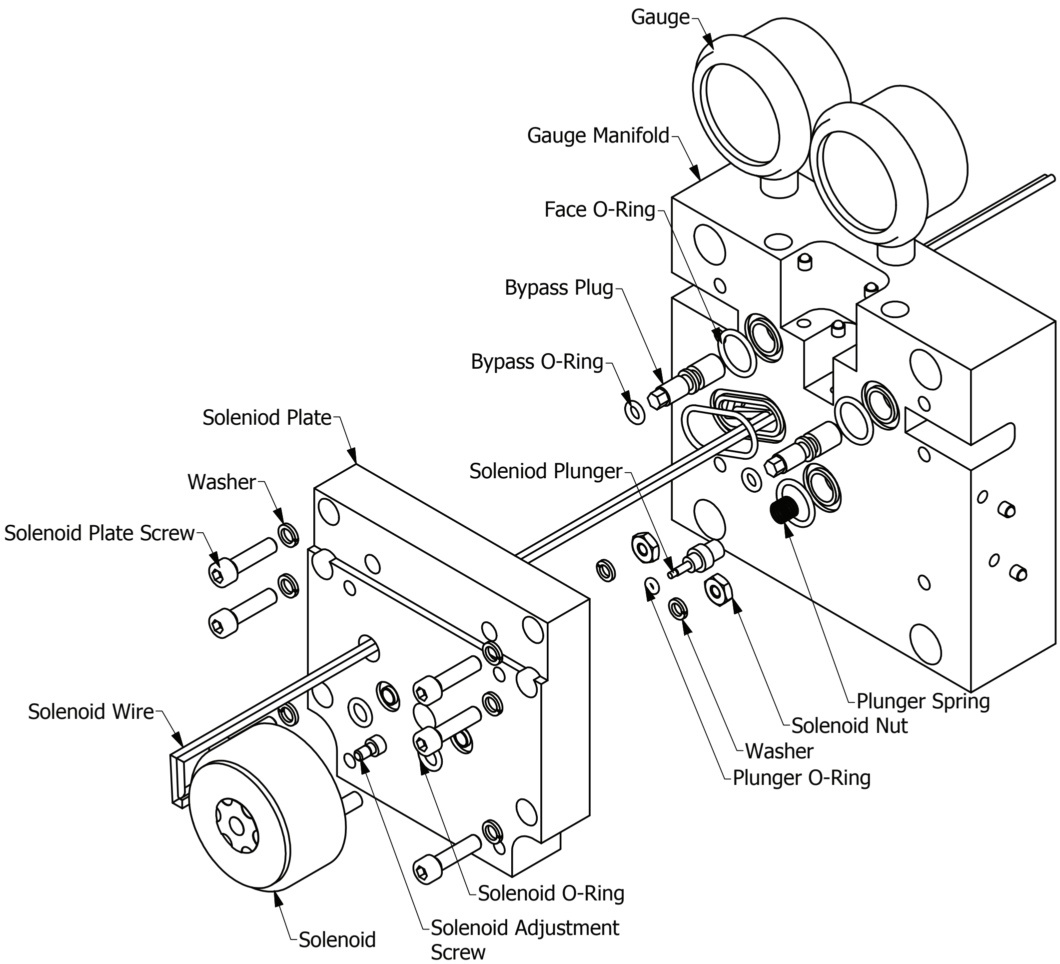

Figure 4.M.11.4 Solenoid Manifold

NOTE: *Mark position of solenoid wires on terminal strip. There is no polarity, so either wire can go to either solenoid terminal.*

1. Ensure power is off. Remove solenoid wire from terminal strip.
2. Remove the solenoid plate screws and the solenoid plate.
3. Locate and remove all four face O-rings and the plunger spring.
4. Remove the solenoid plunger and the plunger O-ring.

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5. Unthread both bypass plugs from the solenoid plate.
6. Remove both bypass O-rings from the bypass plugs.
7. Remove the solenoid nuts, solenoid O-rings and the solenoid.
8. If the solenoid is being replaced remove the solenoid adjustment screw.

4.M.11.5 Cleaning and Inspection (Solenoid Manifold)

Clean all components with brake wash.

4.M.11.6 Re-Assembly (Solenoid Manifold)

1. Install the solenoid adjustment screw into the solenoid if a new solenoid is being installed.
2. Place the solenoid O-rings into the grooves on the solenoid plate. Coat the O-rings with petroleum jelly or grease to hold them in place.
3. Install the solenoid so that the two mounting studs slide through the O-ring holes. Thread solenoid wires through solenoid manifold.
4. Install the washers and solenoid nuts to hold the solenoid in place.
5. Install new bypass plug O-rings into the O-ring groove of the bypass plug. Lubricate O-rings with petroleum jelly. Repeat this for both plugs. Be careful to avoid sliding the O-ring over the threads of the bypass plug which can cause damage to the O-ring.

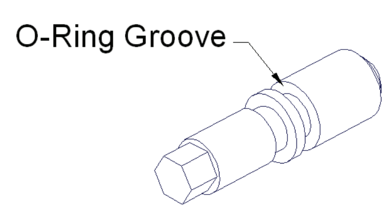

Figure 4.M.11.6-1 Bypass Plug

6. Thread both bypass plugs into the solenoid plate. Once the hex protrudes through the plate enough, use a hex head screw driver and thread the plug in until it bottoms into

the plate. If this is not done the plugs will keep this plate from mounting properly later in the following steps. Feed solenoid wires through solenoid plate and engage manifold according to Figure 4.M.11.4.

7. Install the four face O-rings into the O-ring grooves of the gauge manifold. Use petroleum jelly to hold the O-rings in place.
8. Coat the plunger O-ring with petroleum jelly for lubrication. Slide this O-ring over the solenoid plunger as shown below. Slide the plunger spring over the solenoid plunger as shown below.

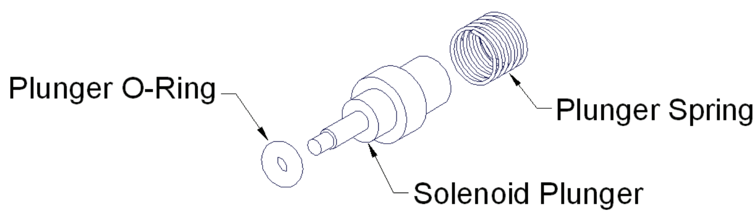

Figure 4.M.11.6-2 Solenoid Manifold Plunger

9. Insert the solenoid plunger assembly into the center hole of the solenoid plate. It will slide in O-ring side first. Feed solenoid wires through power module to heater cavity junction box. Terminate accordingly.
10. Making sure the plunger spring stays in place, align the solenoid plate to the gauge manifold, apply blue Loctite® on the solenoid plate screws and install the washers. Torque to 50 lb·in.

SOLENOID

4.M.12 SOLENOID SET UP

1. Press in on the solenoid plunger and measure the gap between the plunger and solenoid body using feeler gauges. The gap should measure 0.015 inches. If this measurement is out of specification it will be necessary to remove the plunger and readjust the solenoid adjustment screw.

Photo 4.M.12-1 Plunger Gap

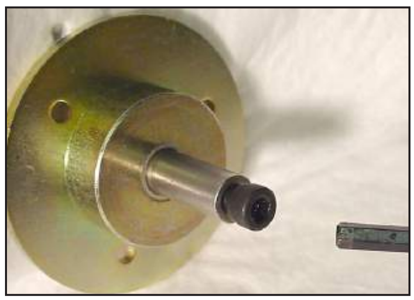

Photo 4.M.12-2 Plunger

2. Toggle the cover / latch assembly into the latched position shown below (the lever in the vertical position).

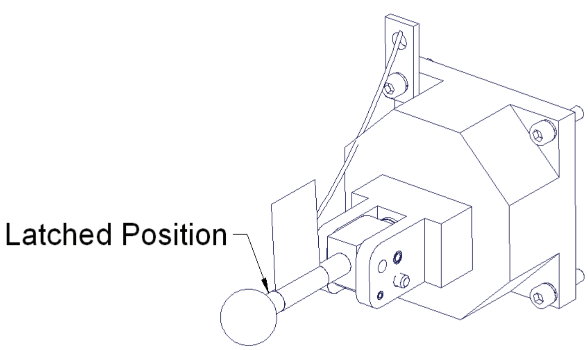

Figure 4.M.12-1 Cover/Latch Assembly

3. Remove plunger adjusting screw, apply blue Loctite®, and replace screw. Re-apply power to the actuator.
4. With the solenoid energized, place the cover/latch assembly over the solenoid, aligning the notch in the cover with the solenoid wires.
   a.) Measure the gap between the bottom of the cover and the solenoid mounting plate. The gap should measure .020 inches. The best way to measure the gap is to

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insert one .020 feeler gauge under one edge of the cover and press down on the cover directly over the gauge. Now insert the other .020 feeler gauge under the cover directly opposite the first gauge as shown below.

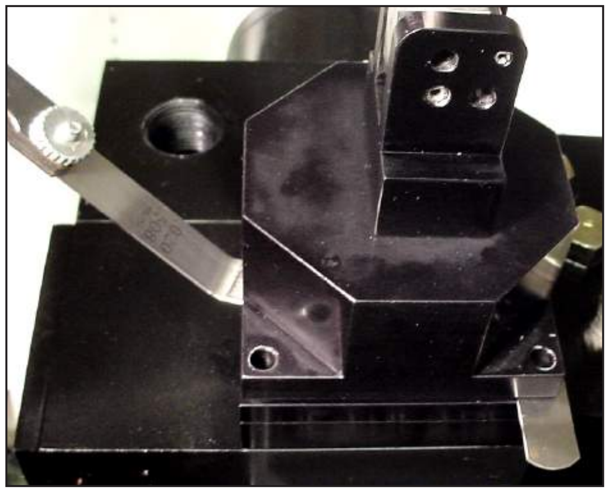

Photo 4.M.12-3 Cover/Mounting Plate

b.) Adjust the gap to .020 inches by removing the cover and turning the screw directly in the center of the cover cavity in or out until the desired gap is achieved. Re-adjust as required to achieve the proper gap.

c.) Place the lever in the unlatched position and attach the cover.

d.) Remove the cover and re-set the gap in step b.

e.) Reinstall the cover with the lever in the unlatched position.

NOTE: *A Padlock with 3/16" diameter shank may be used in place of the tethered pin to prevent unauthorized toggling of the lever.*

f.) Install the tethered pin to lock the handle in place.

SOLENOID

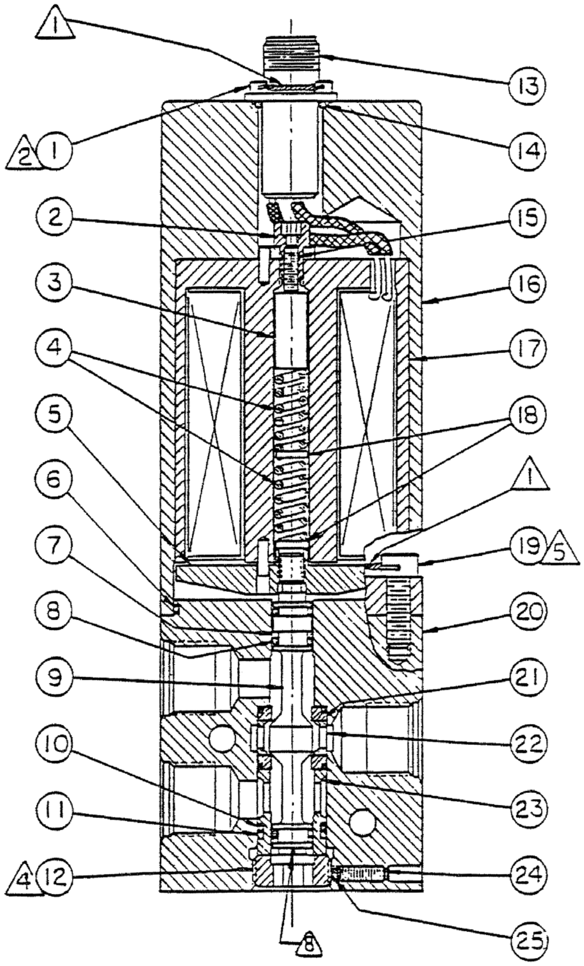

Figure 4.M.14-1 Solenoid Cut-away

Table 4.M.14 Solenoid Cutaway

ID No.	Description	ID No.	Description
1	Screws	13	Electrical connector
2	Set screw	14	O-ring
3	Spring pad	15	Set screw
4	Springs	16	Coil housing
5	Armature	17	Coil Assembly
6	O-ring	18	Spring pads
7	Backup rings	19	Socket head screws
8	O-rings	20	Valve body
9	Poppet	21	Seat assemblies
10	O-rings	22	Cage
11	Backup rings	23	Guide
12	Retainer	24	Set screw
		25	Locking pad

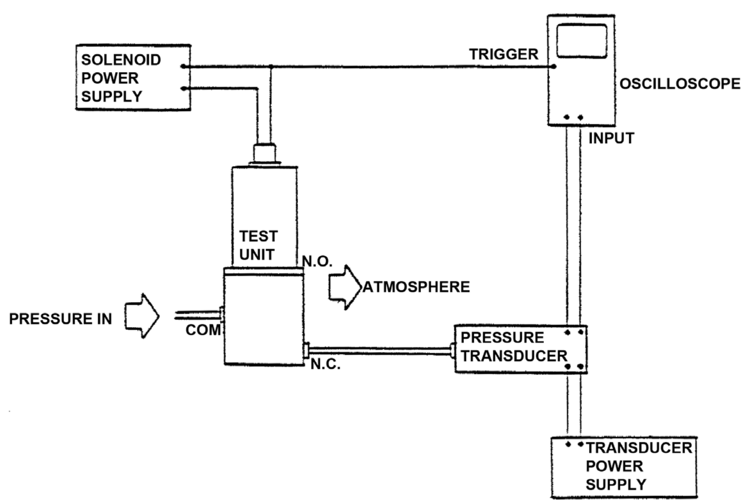

Figure 4.M.14-2 High SpeedSolenoid Layout

SOLENOID

4.M.13 SOLENOID TESTING

1. Stroke the unit against the spring until the end of stroke is reached. Remove power to trip the solenoid. The actuator should begin to move immediately, except in the case of a B module Class 1 Division 2 which can take up to 10 seconds to begin moving.
2. Reapply power to the actuator and immediately stroke the unit fully against the spring. Solenoid must re-engage immediately upon power up. If it does not, proceed to the next step for adjustment of the solenoid open travel stop.

SETUP OF THE OPEN STOP

a.) Remove the cover/latch assembly. Back out the adjustment screw in the cover cavity ¼ turn and retest. Continue to adjust at ¼ turn intervals and retest as required until the re-latching of the solenoid is immediate.

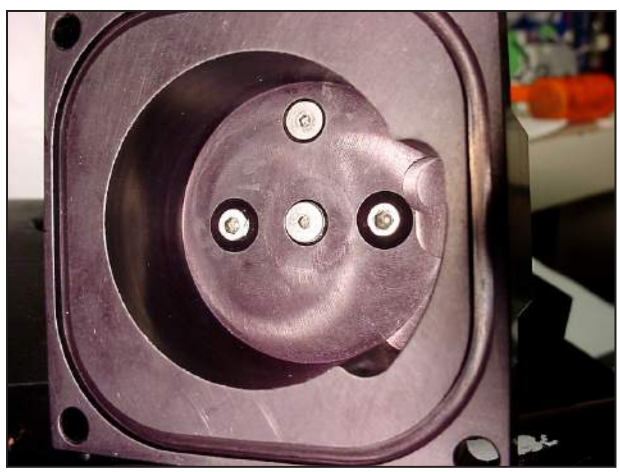

Figure 4.M.13 Latching Cover

VERIFICATION OF MANUAL LATCHING OPERATION

b.) In LOCAL mode stroke the actuator against the spring to the end of travel. Record current position. Manually latch the solenoid and turn power off.

c.) Observing the CPU display may test rotary units drift. No drift is to be allowed for 5 minutes.

HIGH SPEED SOLENOID

4.M.14 HIGH SPEED SOLENOIDS

This section describes installation of Repair Kit Parts and subsequent testing on this solenoid valve. The repair kit allows users of solenoid valve to update the subject valve to the latest configuration at their own discretion.

Installation of Repair Kit Parts into existing solenoid valves is available. However, for those valve users choosing to perform their own installation, the following information is provided.

4.M.14.1 Description of Valve

1. Solenoid valve is a 3 way, 2 position solenoid valve.
2 When the solenoid coil is de-energized the NO port is connected to the COM port, and the NC port is closed. Sealing force on the NC seat is provided by springs within the solenoid assembly. When the solenoid coil is energized the NC port is connected to the COM port, and the NO port is closed. Sealing force on the NO seat is provided by the energized solenoid coil.

4.M.14.2 Equipment Requirement

1. Regulated pressure source, 0 to 3000 psig clean air.
2. Electric power supply to match solenoid voltage, 2 amperes minimum.
3. Torque wrench, audible adjustable, 5 to 150 lb·in.
4. Torque wrench, dial style, memory pointer, 0 to 30 lb·in.
5. Pressure transducer, fast response, 0 to 3000 psig.

4.M 14.3 Disassembly

1. Remove four socket head screws (19) securing solenoid assembly to valve body (20). Orient whole unit with solenoid below valve body when pulling two sections apart as there are loose parts within solenoid.

2. After completing above procedure, note relative distance between armature (5) and valve body for later use. Remove armature from poppet. Hold armature while turning poppet counterclockwise utilizing slot in opposite end of poppet from armature.
3. Loosen set screw (24) 2 to 3 turns. Do not remove set screw or locking pad (25) unless replacement is necessary. Remove retainer (12).
4. To remove internal valve components, push against threaded end of poppet until components can be removed from valve body. Check inside valve body for possibility of an O-ring remaining, and remove.
5. Discard all items from valve for which replacement parts are included in the Repair Kit.

4.M 14.4 Cleaning and Examination of Parts

1. Clean metal valve components using commercial cleaning solvents or detergent solutions. DO NOT wash solenoid assembly.
2. Visually inspect all metal parts for nicks, scratches, or other damage that can affect valve performance. Examine the bores in valve body (20) and guide (23) for nicks and scratches that can affect a-ring sealing.

4.M 14.5 Initial Assembly

1. O-rings are lightly lubricated with Monsanto MCS 352 or BAC 5001 or DAC ACO-DPM 5073.
2. Assemble cage (22), seat assemblies (21), O-rings (8), backup rings (7), O-rings (10). Guide (23), and backup rings (11) onto poppet (9) with the exception of one O-ring (10) used on seat assembly nearest threaded end of poppet. Place this one O-ring into its final location within valve body (20).
3. Insert poppet and associated components into valve body. Using 3/8 hex wrench secure retainer (12). Torque retainer 8 to 10 lb·ft. Tighten set screw (24) to secure retainer.

HIGH SPEED SOLENOID

5. Apply small amount of anti-seize compound to threads on poppet (9). Thread armature assembly (5) onto poppet to approximate location of preceding section 4.M.14.3, step #2.
6. Remove four screws (1) securing electrical connector (13). Raise connector sufficiently to access space beneath. Using 5/64 hex wrench, turn set screw (15) 3 to 4 turns counterclockwise, from electrical connector end.
7. Assemble spring pad (3), springs (4), and spring pads (18) into coil assembly (17). While aligning pin extending from coil assembly with hole in armature assembly, place valve body assembly onto coil housing (16). Pin must align with hole to avoid damage. Secure coil housing (16) to valve body (20) (orientation optional) using four cap screws (19). Torque 55 to 57 lb·ft.

4.M 14.6 Adjustment and Final Assembly

1. Cap COM port. Connect air pressure source to NO port NC port open to atmosphere. Energize solenoid coil via electrical connector pins A and B, polarity optional, with approximately 24 Vdc. Turn poppet (9) counterclockwise until air just starts to flow from NC port. Then turn poppet clockwise until air flow just ceases. DE•ENERGIZE COIL. Turn poppet an additional 1/8 to 1/4 turn clockwise.
2. Using 5/64 hex wrench, turn set screw (15) clockwise until solenoid pull-in voltage is 70% of rated voltage.
3. NC port open to atmosphere with muffler. Increase air pressure at NO port to 3000 psig. Cycle valve fifteen times minimum using 70% of the valves rated voltage. Valve operation shall be sharp and without hesitation.

4.M 14.7 Final Tests

1. Cap COM port. Connect air pressure source to NO port. NC port open to atmosphere. Energize solenoid coil via electrical connector pins A and B. Turn poppet (9) counter-clockwise until air just starts to flow from NC port. Then turn

4.M.15 HAND WHEEL / DRILL DRIVE

Parts Required: Hand Wheel Kit

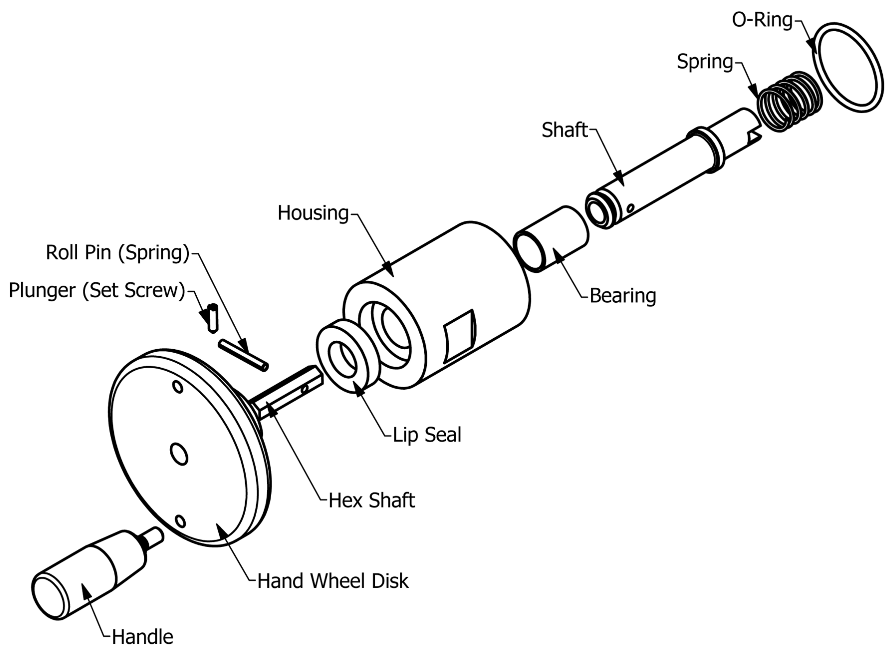

Figure 4.M.15 Handwheel/Drilldrive

4.M.15.1 Disassembly

1. Refer to Figure 4.M.15 and remove the hand wheel from the back end of the motor by unscrewing the housing.
2. Remove the spring.
3. Remove the O-ring.

4.M.15.2 Re-Assembly

1. Replace the spring.
2. Replace the O-ring.
3. Screw hand wheel back onto the end of the motor.

MANUAL HAND PUMP

4.M.16 HAND PUMP

The manual hydraulic pump 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.

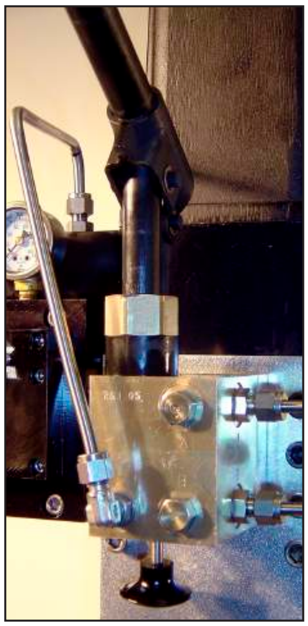

Photo 4.M.16 Manual Hand Pump

4.M.16.1 Removal

1. Turn off power to the unit. Open bypass and confirm that there is no internal pressure.
2. Clamp the oil reservoir. Refer to TS&R Appendix F for information on indicator clamping.
3. Place an oil drain pan under the hand pump.
4. Remove any tubing connected to the hand pump and mounting plates.
5. Unscrew the bolts that connect the hand pump to the mounting plate.
6. Remove the mounting plate from the hand pump.

MANUAL HAND PUMP

4.M.16.2 Replacement

1. Attach the mounting plate to the new hand pump.
2. Replace hand pump and mounting plate assembly to the original position.
3. Re-attach the tubing to the hand pump.
4. Unclamp oil reservoir and bleed the unit.
5. To operate the hand pump, insert lever into the piston assembly and pump the handle up and down.
6. To reverse the direction of the pump either push in or pull out on the black knob located on the bottom of the pump.

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

COMMERCIAL LINEAR CYLINDERS

4.M.17 COMMERCIAL LINEAR CYLINDERS

The cylinder consists of a double rod end through shaft cylinder. There are two bushings with seals, a wiper, shank, piston disk, piston seals and cylinder body. The sizes range from 2000 –10000 lb greater than 6˝ stroke and greater than 10000 lb with almost any stroke size required.

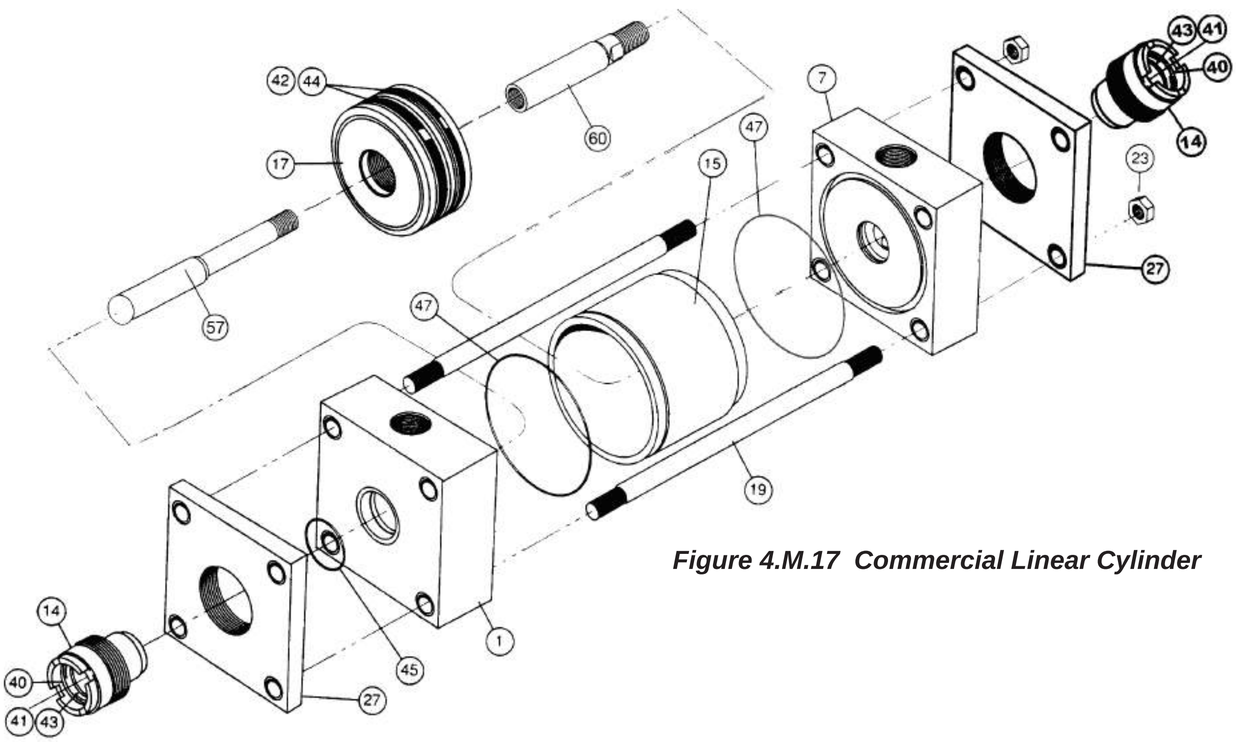

Figure 4.M.17 Commercial Linear Cylinder

Table 4.M.17 **Parts List**

Item No.	Description	Qty	Item No.	Description	Qty
1	*Head, Ported, Non-cushioned*	*1*	*41*	*Lipseal, Gland*	*2*
7	*Cap, Ported Non-cushioned*	*1*	*42*	*Lipseal, Piston*	*2*
14	*Gland*	*2*	*43*	*Backup Washer, Gland*	*2*
15	*Cylinder Body*	*1*	*44*	*Backup Washer, Piston*	*2*
17	*Piston Body, Lipseal Type*	*1*	*45*	*O-ring, Gland to Head Seal*	*2*
19	*Tie Rod*	*4*	*47*	*O-ring, Cylinder Body End Seal*	*2*
23	*Tie Rod Nut*	*4*	*57*	*Piston Rod*	*1*
27	*Retainer*	*2*	*60*	*Piston Rod Extension*	*1*
40	*Wiper Seal, Gland*	*2*			

COMMERCIAL LINEAR CYLINDERS

4.M.17.1 Disassembly

NOTE: *Tag-Out and Lock-Out the unit for repair in accordance with local procedures. Repair of the cylinder will require removing the unit from service.*

Seals Replacement

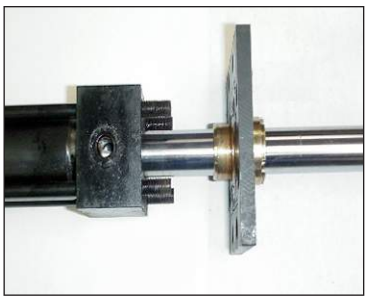

Photo 4.M.17.1-1: Retainer Plate

CAUTION: While assembling and disassembling the cylinder, be aware of oil discharging from unprotected ports.

1. Clamp the reservoir piston to prevent oil from discharging from power module when removing. Remove tubing feeding the cylinder.
2. Remove the fasteners holding the feedback arm to the cylinder shaft. Remove all plates, fasteners and legs as necessary to free the cylinder from the assembly. Remove the cylinder from the unit.
3. Loosen and remove the four tie rod nuts (23).
4. Remove the retainer plate (27).
5. Remove the bronze gland (14) on the retainer plate (27) by unscrewing counter clockwise.

Photo 4M.17.1-2: Tools for gland removal and installation

NOTE: *Residual oil will drain at this point.*

6. Remove the cap assembly (7).
7. Remove the piston and piston rod assembly (57, 17, 60).

Photo 4M.17.1-3: Parker tool for gland removal

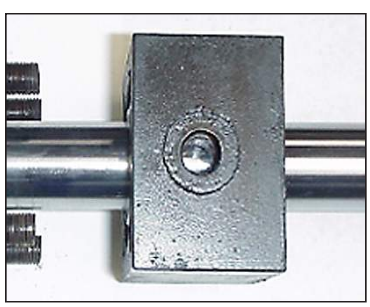

Photo 4M.17.1-4: Cap/Head Assembly

Photo 4M.17.1-5: Piston Rod Assembly

COMMERCIAL LINEAR CYLINDERS

8. Remove the cylinder body (15).
9. Remove the head assembly (1). Tie rods may be left installed in the retainer.
10. Remove the seals from the piston disk (17) and inspect the disk for wear and damage. Replace as necessary.
11. Inspect the cylinder body (15) for wear and damage. Replace as necessary.
12. Remove the seals (40, 41 & 43) from the glands (14) and inspect the gland for wear and damage. Replace as necessary.
13. Remove and discard the following O-rings: two glands to head seals (45) and two cylinder body end seals (47). Inspect the O-ring seating surface for damage. Replace as necessary.

NOTE: *Lubricate all surfaces, seals and O-rings prior to assembly.*

Photo 4M.17.1-6: Cylinder Body

Photo 4M.17.1-7: Piston Disk Assembly

4.M.17.2 Reassembly

1. Place one new set of piston lipseals (42) and back-up washer (44) on one side of the piston disk with the open end toward the shaft end.
2. Slide the piston disk assembly (57, 17, 60) into the cylinder body (14). Slide the piston disk assembly to the end of the body to expose the seal groove with no seals. Do not slide the piston disk assembly all the way out of the cylinder body.
3. Place the other new piston lipseal (42) and back-up washer (44) on the piston disk. Slide the piston disk assembly (57, 17, 60) back into the cylinder body (15).
4. With both glands, install new wiper seal (40), gland lipseal (41) and gland backup washer (43) into the gland.
5. Install new cylinder body end seal O-ring (47) into head (1) and cap (7). Also install new gland to head seal (45).
6. Install gland (14) to retainer (27). Ensure that the gland is installed only two turns. If required, install tie rods to retainer so that the tie rod ends are flush to the retainer.

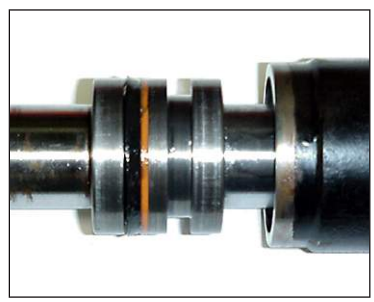

Photo 4M.17.1-8: Piston disk with one set of seals into cylinder

Photo 4.M.17.1-9: Piston disk ready for second set of seals

COMMERCIAL LINEAR CYLINDERS

Photo 4M.17.1-10: Gland and Seals

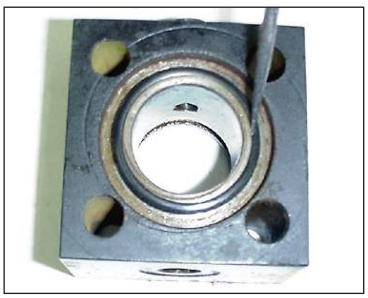

Photo 4M.17.1-11: Head/Cap Seals

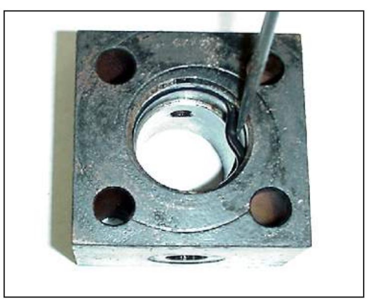

Photo 4M.17.1-12: Head/Cap Seals

7. Install head (1) to retainer (27). Slip the cylinder body (15) with piston disk assembly (57, 17, 60) over the tie rods (19) and onto the head.
8. Install cap (7) to cylinder body (15).
9. Install retainer plate (27) to cap (7).
10. Thread the tie rod nuts onto the tie rods. Torque the tie rod nuts (23) in accordance with Table 4.M.17.2.
11. Tighten gland (14) so that the top of the gland to the retainer is 0.25".
12. Install power module, tubing and feedback items. Install unit to valve.

Table 4.M.17.2 TORQUE (lb·ft)

Size	Cylinder Bore	Rod Size	Tie Rod (lb·ft)
L2 000	*1.5"*	*1"*	*18*
L5 000	*2.5"*	*1.75"*	*45*
L10 000	*3.25"*	*2"*	*120*
L15 000	*4"*	*2.5"*	*131*
L20 000	*4"*	*1.75"*	*131*
L40 000	*6"*	*3"*	*528*
L60 000	*7"*	*3"*	*800*
L80 000	*8"*	*3.5"*	*1 168*

REXA LINEAR CYLINDERS

4.M.18 REXA LINEAR CYLINDERS

The current linear block cylinder line consists of five models. These models can reach force outputs up to 10 000 lb. Each of these models comes in different stroke options typically 2″, 4″ and 6″. To identify the model/size of your cylinder reference the model number. The first digit will be an **L** signifying it is a linear stroke. The next three to five digits before the dash is the thrust output. For more details on Model numbering refer to TS&R section 1.2.1. You can also confirm the output by measuring the shank diameter and reference the table below.

Shank Diameter	*Cylinder Size*
9/16"	*L500*
9/16"	*L2 000*
1"	*L4 000*
1-5/16"	*L10 000*

4.M.18.1 Cylinder Removal Procedure for All REXA Block Cylinders

NOTE: *Tag-Out and Lock-Out the unit for repair in accordance with local procedures. Repair of the linear cylinder will require removing the unit from service.*

Due to the large number of custom applications of REXA actuators this manual doesn't show the exact steps to separate the power module but rather the general procedure that should be followed.

1. Remove any external loads or springs attached to the unit before attempting any service. In some cases the power will be needed to remove these loads.

CAUTION: Failure to properly remove loads on the actuator can result in injury or death.

2. Clamp the reservoir indicator to prevent oil from draining out of the power module when disconnecting tubing. Be careful not to damage indicator.

REXA LINEAR CYLINDERS

3. Clean the module thoroughly. It is important that no contaminants enter the internals of the actuator.
4. Remove the power module from the cylinder.
5. Remove the cylinder from its mounting.

L500 - L2 000 LINEAR CYLINDERS

4.M.18.2 L500 and L2 000 Cylinder Rebuild Procedure For ¾ Inch, 2 Inch, 4 Inch and 6 Inch Stroke Units

PARTS REQUIRED: **Cylinder Seal Kit**

A. Feedback Removal

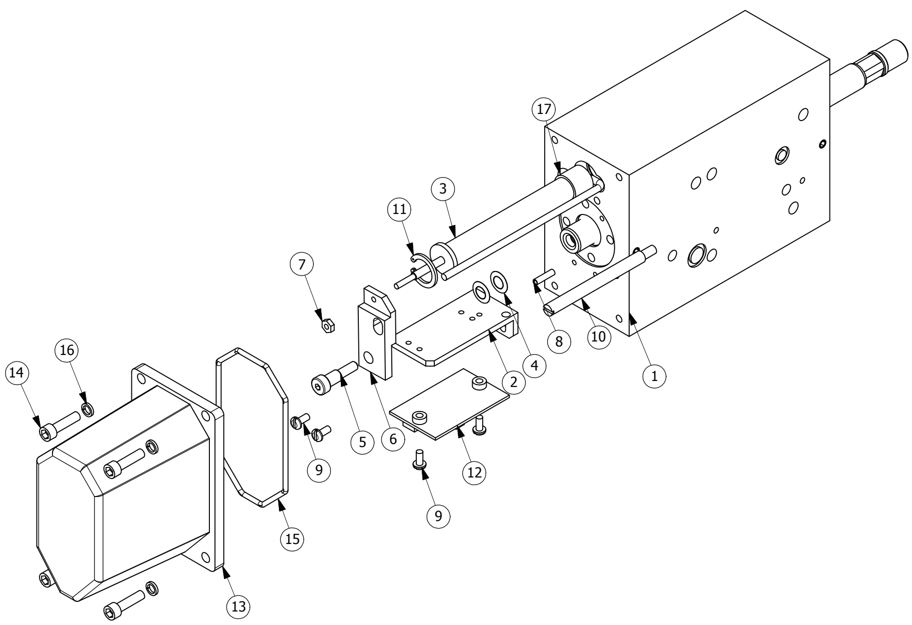

Figure 4.M.18.2-A L500 & 2 000 Feedback Removal

Table 4.M.18.2-A

Parts List					
Item	Description	Qty	Item	Description	Qty
1	Cylinder Body	1	10	Anti-Rotation Rod	1
2	Bracket, Circuit Board Mounting	1	11	Retaining Ring	1
3	Potentiometer	1	12	Circuit Board Assembly	1
4	Spring Washers	2	13	Cover. Cylinder	1
5	#10-32 Shldr Scr	1	14	SHCS #10-32 × .75	4
6	Feedback Arm	1	15	O-ring Viton - 150	1
7	Hex Nut Std #4-40 (SS)	1	16	#10 Lock Washer	4
8	Roll Pin (Spring	1	17	Anti-Vibration Tape Foam	1
9	SCR Pan HD SL #6-32NC	4			

4.M.18.2-A.1 Disassembly

1. Refer to Figure 4.M.18.2-A and remove the 4 SHCS (14) and lock washers (16).

2. Remove the feedback cover (13) and O-ring (15). The O-ring can be thrown out once the replacement is identified from the rebuild kit.
3. Record all termination points. Disconnect all wires connected to the circuit board (12)
4. Remove the 2 SCR pan head screws (9) to remove the circuit board (12).
5. Remove the 2 SCR pan head screws (9) to remove the circuit board bracket (2)
6. Remove the shoulder screw (5) and hex nut (7). Remove the 2 spring washers (4). While holding the potentiometer (3) rod, unscrew the feedback arm (6).
7. Remove the retaining ring (11), anti rotation rod (10), and the potentiometer (3).
8. Proceed to bushing rebuild Section B to continue disassembly.

4.M.18.2-A.2 Reassembly

1. Apply the bottom of the potentiometer with anti-vibration foam (17) then slide the potentiometer (3) into the potentiometer (3) hole in the cylinder (1). Ensure that the cable slides into its slot. Snap the retaining ring (11) into the ring groove above the pot.
2. Screw the feedback arm (6) onto the potentiometer (3). Thread the hex nut (7) on. Anytime the pot is removed you will need to adjust the pot height.
3. Align the 2 spring washers (4) to the end of the shank. Thread the potentiometer (3) into the feedback arm (6) over the spring washers (4). Install the shoulder screw (5).
4. Screw in the anti rotation rod (10).
5. Align the circuit board bracket (2) with its mounting hole on the cylinder and install the two SCR pan HD SL (9).
6. Rewire all wires back to the circuit board (12).
7. Install a new O-ring (15) into the cover (13). Petroleum jelly can be used to prevent the O-ring from falling out.

L500 - L2 000 LINEAR CYLINDERS

8. Place the cylinder cover (13) with the O-ring (15) back over the cylinder and install the 4 SHCS (14) with washers (16).

B. Bushing Rebuild

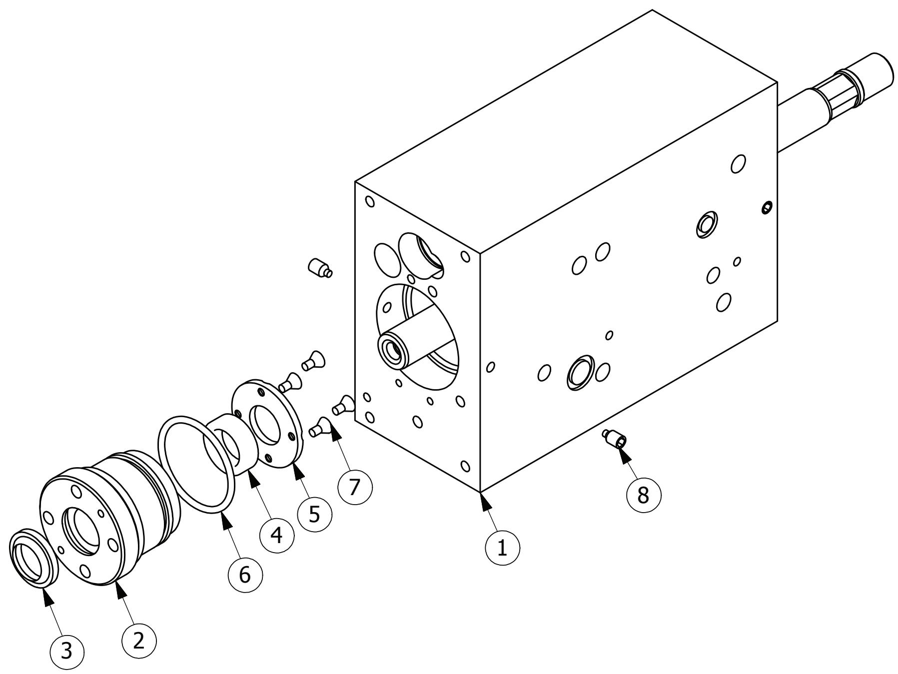

Figure 4.M.18.2-B L500 & 2 000 Bushing Rebuild

Table 4.M.18.2-B

Parts List		
Item	Description	Qty
1	Cylinder Body	1
2	Bushing	2
3	Rod Wiper	2
4	Rod Seal	2
5	Bushing End Cover	2
6	O-ring Viton - 026	2
7	SCR Flat HD Hex #4-40	8
8	Nylon Tipped Set Screw	4

CAUTION: While assembling and disassembling the cylinder, beware of oil discharging from unprotected ports.

L500-L2000 LINEAR CYLINDER

4.M.18.2-B.1 Disassembly

NOTE: *To prevent damage, use a dead blow hammer or soft face mallet.*

1. Refer to Figure 4.M.18.2-B and remove the two set screws (8).
2. Using a spanner wrench, remove the bushing. (2).
3. Lightly tap the opposite end of the shaft to force the bushing out.
4. Use a pick to remove the rod wiper (3) and O-ring (6). These items can be thrown out once the replacement parts are located from the rebuild kit.
5. Use an allen wrench to remove the 4 SCR flat HD HEX (7) from the bushing end cover (5) and remove the rod seal (4).
6. Repeat steps 1-5 on the opposite end.

NOTE: *If there is a spacer sleeve on the piston rod it needs to be reassembled on the same side or damage and improper operation may result.*

4.M.18.2-B.2 Cleaning and Inspection

1. Clean the bushings (2) in solvent and dry.
2. Inspect the bushing (2) bore for damage. If any visual marks can be felt in the bushing (2) bore then the bushing (2) will need to be replaced.
3. Continue to section C to complete disassembly.

4.M.18.2-B.3 Reassembly

1. Install the new rod wiper (3) with the pointed edge out. Install the new O-ring (6) into the O-ring groove on the outside of the bushing (2).
2. Install the new rod seals (4) into the seal groove. The open side must face the cylinder body. Installing these backwards will cause the seals to fail.
3. Lubricate the O-ring (6) and seals (3 & 4) prior to installation.

L500 - L2 000 LINEAR CYLINDER

4. Place the bushing end cover (5) back over the end of the bushing (2) and bolt the 4 hex head screws (7) back into the bushing (2).
5. Slide the bushing (2) into the cylinder body (1).
6. Tighten with spanner wrench.
7. Place Loctite® onto the two set screws (4) and install into the cylinder body. Turn the screws 1-¼ turns once you feel the screw contact the bushing (2).
8. Slide the piston assembly into the cylinder bore. Ensure the orientation of the output end. Lightly tap the assembly in if necessary.
9. Repeat steps 1- 7 for the opposite end of the cylinder.
10. Go back to the feedback reassembly in Section A to complete the rebuild.

C. Shank Rebuild.

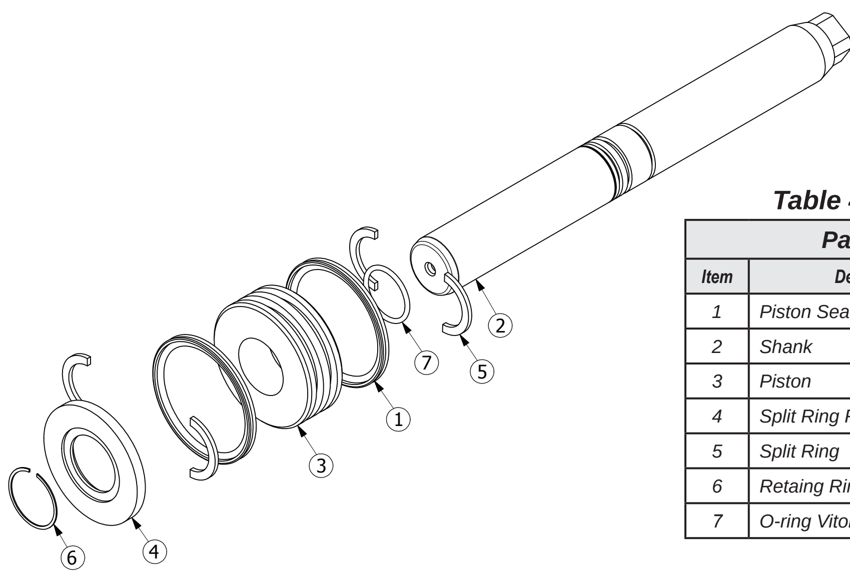

Table 4.M.18.2-C

Parts List		
Item	***Description***	***Qty***
1	*Piston Seal*	*2*
2	*Shank*	*1*
3	*Piston*	*1*
4	*Split Ring Retainer*	*1*
5	*Split Ring*	*4*
6	*Retaing Ring*	*1*
7	*O-ring Viton - 22*	*1*

Figure 4.M.18.2-C L500 & 2 000 Shank Rebuild

CAUTION: While assembling and disassembling the cylinder, beware of oil discharging from unprotected ports.

L500 - L2000 LINEAR CYLINDER

4.M.18.2-C.1 Disassembly

1. Refer to Figure 4.M.18.2-C and remove the retaining ring (6). Care must be taken not to scratch the shaft finish.
2. Slide the split ring retainer (4) off exposing the first set of split rings (5).
3. Separate the split rings (5) and slide the piston disk (3) off. The second set of split rings (5) should now fall off.
4. Remove the O-ring (7) from the piston shank (2) and both piston seals (1) from the piston disk (3). These three items can be thrown out once you have located the new replacements from your rebuild kit.

4.M.18.2-C.2 Cleaning and Inspection

1. Clean the piston shaft (2), piston (3), split ring retainer (4), split rings (5) and the retaining rings (6) in brake wash and dry. Ensure no residue or contaminants remain.
2. Inspect the piston shaft (2) for scratches. If you can detect scratches by running your finger nail around the shaft then the shaft will need to be replaced. Reference Table 4.M.18.2-C when ordering replacement parts.
3. Inspect the piston disk (3) for any burs around the outer surface that would scratch into the cylinder bore. If burs are found replace the piston disk.
4. Clean the cylinder bore in brake wash and dry. Be very cautious not to get contaminants into the ports. If any contaminates get into the system they could cause drifting problems.
5. Inspect the bore for wear or scratches. If the anodizing has worn through or any scuff marks can be felt replace the cylinder body. Ensure any new cylinders have ball plugs installed before reassembly.

L500 - L2 000 LINEAR CYLINDER

4.M.18.2-C.3 Reassembly

1. Lubricate the new O-ring. Slide the O-ring (7) into the O-ring groove of the shank (2). O-ring groove is located between the two identical split ring grooves.
2. Slide the new piston seals (1) into the piston disk (3).

NOTE: *The O-ring side of the seals must face away from each other. Improper orientation will cause the seals to leak.*

3. Install one set of split rings (5) into the lower split ring slot of the shank (2).
4. Slide the piston (3) on from the top insuring the counter bore fits over the split ring (5).
5. Install the second set of split rings (5) into the upper slot on the shank (2).
6. Slide the split ring retainer (4) over the second set of split rings (2).

NOTE: *The split ring retainer can only go on one way and should set flush to the piston disk (3).*

7. Install the retaining ring (6).
8. Lubricate the new piston seals (4). Go to the bushing rebuild reassembly Section B to continue the rebuild.

L4000 LINEAR CYLINDER

4.M.18.3 L4000 CYLINDER REBUILD PROCEDURE FOR ¾ INCH, 2 INCH AND 4 INCH STROKE UNITS

PARTS REQUIRED: **Cylinder Seal Kit**

A. Feedback Removal.

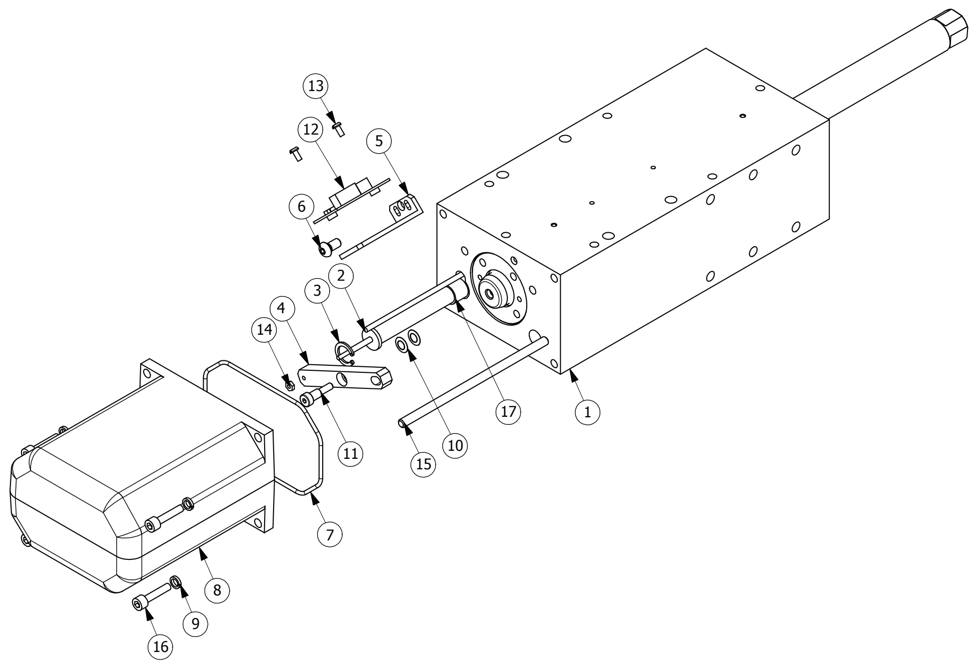

Figure 4.M.18.3-A L4000 Feedback Removal

Table 4.M.18.3-A

Parts List					
Item	*Description*	*Qty*	*Item*	*Description*	*Qty*
1	L4,000 Cylinder Body	1	10	Spring Washers	1
2	Potentiometer	1	11	#10-32 Shldr Scr	1
3	Retaining Ring	1	12	Circuit Board Assembly	1
4	Feedback Takeoff Arm	2	13	SCR Pan HD SL #6-32NC	1
5	Bracket, Circuit Board Mounting	1	14	Hex Nut Std #4-40 (SS)	4
6	SBCHS ¼-20	1	15	Anti-Rotation Rod	1
7	O-ring Viton - 156	1	16	SHCS .25-20	4
8	L4,000 Cylinder Cover	1	17	Anti-Vibration Tape Foam	1
9	Spring Lock Washer	4			

L4000 LINEAR CYLINDER

4.M.18.3-A.1 Disassembly

1. Refer to Figure 4.M.18.3-A and remove the 4 ¼-20 screws (16) and the 4 lock washers (9).
2. Remove the cylinder cover (8) and O-ring (7). The O-ring can be thrown out once the replacement is identified from the rebuild kit.
3. Disconnected all wires to the circuit board (12) and remove the 2 SCR pan head screws (13) to remove the circuit board (12)
4. Remove the SBHCS ¼-20 (6) to remove the circuit board bracket (5)
5. Remove the shoulder screw (11) and hex nut (14). Remove the 2 spring washers (10). While holding the potentiometer (2) rod, unscrew the feedback arm (4).
6. Remove the retaining ring (3), anti-rotation rod (15) and the potentiometer (2).
7. Jump to bushing rebuild Section B to continue disassembly.

4.M.18.3-A.2 Reassembly

1. Reapply anti-vibration tape foam (17) to the base of the potentiometer (2) and slide the potentiometer (2) into the potentiometer hole in the cylinder (1). Ensure the cable slides into its slot. Snap the retaining ring (3) into the ring groove above the potentiometer (2).
2. Screw the feedback arm (4) onto the potentiometer (2). Thread the hex nut (14) on.
3. Align the 2 spring washers (10) to the end of the shank. Spin the feedback arm (4) over the spring washers (10) and line up the holes. Install the SH shoulder screw (11).
4. Screw in the anti-rotation rod (15).
5. Align the circuit board bracket (5) at a 45° from the edge and install the SBHCS SS screw (6).

L4000 LINEAR CYLINDER

6 Align the circuit board (12) with its mounting hole on the circuit board bracket (5) and install the 2 SCR pan head screw (13).

7 Rewire all connecting wires to the circuit board (12).

8 Install a new O-ring (7) into the cover (8). Petroleum jelly can be used to hold the O-ring from falling out.

9 Install the 4 SHCS SS ¼-20 (16) and the 4 lock washers (9).

B. Bushing Rebuild

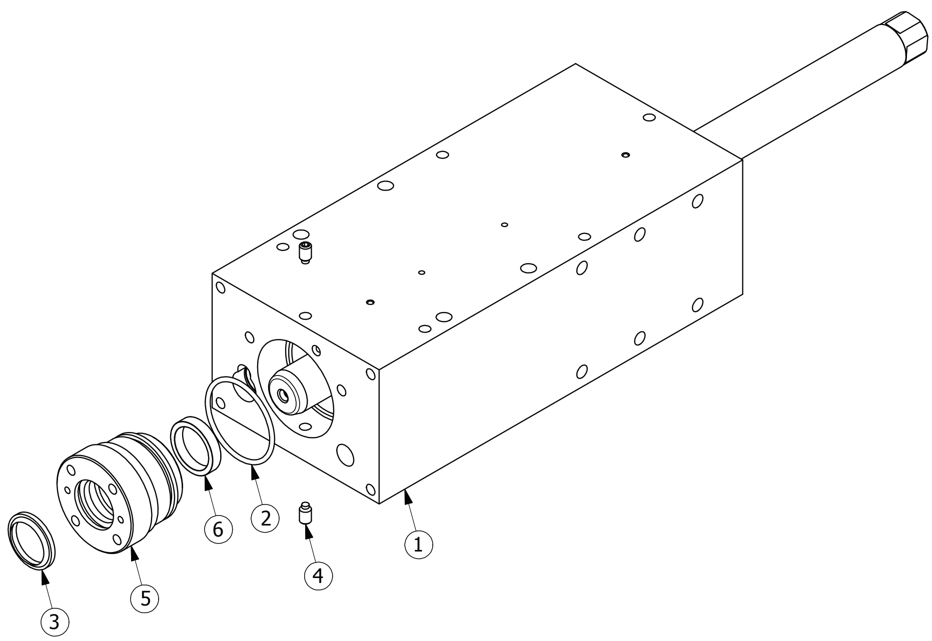

Figure 4.M.18.3-B L4,000 Bushing Rebuild

Table 4.M.18.3-B

Parts List		
Item	Description	Qty
1	L4000 Cylinder Body	1
2	O-ring Viton - 133	2
3	Rod Wiper	2
4	Nylon Tipped Set Screw ¼-20	4
5	L4000 Bushing	2
6	Rod Seal	2

L4000 LINEAR CYLINDER

CAUTION: While assembling and disassembling the cylinder, beware of oil discharging from unprotected ports.

4.M.18.3-B.1 Disassembly

NOTE: *To prevent damage, use a dead blow hammer or soft face mallet.*

1. Stroke the cylinder by striking it with a dead blow hammer from end to end with the open SAE ports over an oil drain bucket. Read caution above.
2. Refer to Figure 4.M.18.3-B and remove the two set screws (4).
3. Use a spanner wrench to remove the bushing (5).
4. Lightly tap the opposite end of the shaft to force the bushing (5) out.
5. Use a pick to remove the rod wiper (3), O-ring (2) and the rod seal (6). These items can be thrown out once the replacement parts are located from the rebuild kit
6. Repeat steps 2-5 on the opposite end.

NOTE: *If there is a spacer sleeve on the piston rod, it needs to be reassembled on the same side or damage and improper operation may result.*

4.M.18.3-B.2 Cleaning and Inspection

1. Clean the bushings (5) in brake wash and dry.
2. Inspect the bushing (5) bore for damage. If any visual marks can be felt by touch in the bushing (5) bore then the bushing (5) will need to be replaced.
3. Continue to Section C to complete disassembly.

4.M.18.3-B.3 Reassembly

1. Lubricate the O-ring (2) and seals (3 & 6) prior to installation.

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2. Install the new rod wiper (3) with the pointed edge out. Install the new O-ring (2) into the O-ring groove on the outside of the bushing (5).
3. Install the new rod seals (6) into the seal grooves. The O-ring side must face the cylinder body. Installing these backwards will cause the seals to fail.

4 Slide the bushing (5) into the cylinder body (1).

5 Screw in the bushing (5) into the cylinder body (1) and tighten with spanner wrench.

6 Use Loctite® on the 2 set screws (4) and install it into the cylinder body (1). Turn the screws 1 turn once you feel the nylon bottom contact the bushing retainer.

7 Slide the piston assembly into the cylinder bore (observe the orientation of the output end).

8 Repeat steps 1- 6 for the opposite end of the cylinder.

9 See the feedback reassembly Section A to complete the rebuild.

C. Shank Rebuild

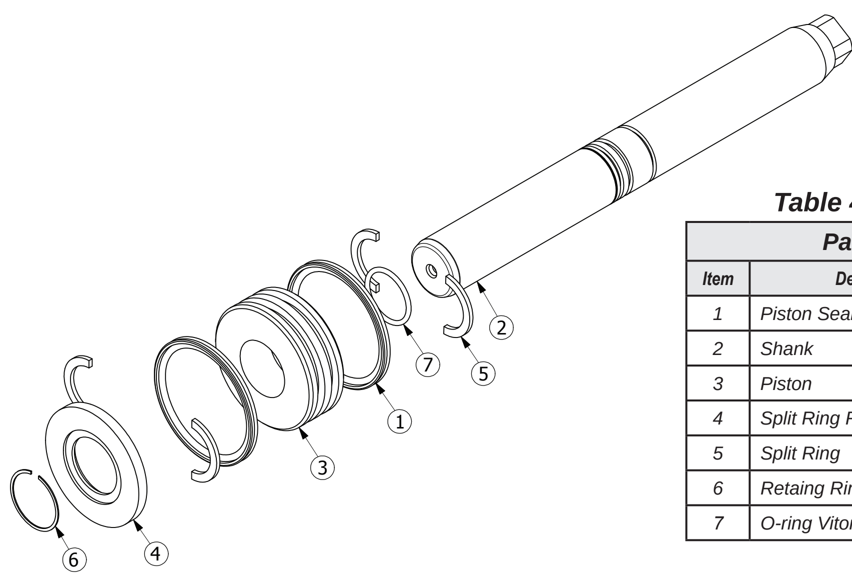

Table 4.M.18.3-C

Parts List		
Item	*Description*	*Qty*
1	Piston Seal	2
2	Shank	1
3	Piston	1
4	Split Ring Retainer	1
5	Split Ring	4
6	Retaing Ring	1
7	O-ring Viton - 22	1

Figure 4.M.18.3-C L4000 Shank Rebuild

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CAUTION: While assembling and disassembling the cylinder, be aware of oil discharging from unprotected ports.

4.M.18.3-C.1 Disassembly

1. Refer to Figure 4.M.18.3-C and remove the retaining ring (6). Care must be taken not to scratch the shaft finish.
2. Slide the split ring retainer (4) off exposing the first set of split rings (5).
3. Separate the split rings (5) and slide the piston disk (3) off. The second set of split rings (5) should now fall off.
4. Remove the O-ring (7) from the piston shank (2) and both piston seals (1) from the piston disk (3). These three items can be thrown out once you have located the new replacements from your rebuild kit.

4.M.18.3-C.2 Cleaning and Inspection

1. Clean the piston shaft (2), piston (3), split ring retainer (4), split rings (5) and the retaining rings (6) in solvent and dry. Ensure no residue or contaminants remain.
2. Inspect the piston shaft (2) for scratches. If you can detect scratches with your finger then the shaft (2) will need to be replaced. Reference Table 4.M.18.3-C when ordering replacement parts.
3. Inspect the piston disk (3) for any burs around the outer surface that would scratch into the cylinder bore. If burs are found replace the piston disk.
4. Clean the cylinder bore in brake wash and dry. Be very cautious not to get contaminants into the ports. If any contaminates get into the system they could cause drifting problems.
5. Inspect the bore for wear or scratches. If the anodizing has worn through or any scuff marks can be felt replace the cylinder body. Reference Figure 4.M.18.3-C. Ensure that any new cylinders have ball plugs installed before reassembly.

4.M.18.3-C.3 Reassembly

1. Lubricate all O-rings and seals prior to assembly. Slide the new O-ring (7) into the O-ring groove of the shank (2).
2. Slide the new piston seals (1) into the piston disk (3). Note the O-ring side of the seals must face away from each other. Improper orientation will cause the seals to leak.
3. Install one set of split rings (5) into the lower split ring slot of the shank (2).
4. Slide the piston (3) on from the top insuring the counter bore fits over the split ring (5).
5. Install the second set of split rings (5) into the upper slot on the shank (2).
6. Slide the split ring retainer (4) over the second set of split rings (5).

NOTE: *The split ring retainer can only go on one way and should be flush to the piston disk (3).*

7. Install the retaining ring (6).
8. Go to the bushing rebuild reassembly and feedback reassembly to complete the rebuild.

L10 000 LINEAR CYLINDER

4.M.18.4 L10 000 CYLINDER REBUILD PROCEDURE FOR 2 INCH AND 6 INCH STROKE UNITS

PARTS REQUIRED: **Cylinder Seal Kit**

A. Feedback Removal

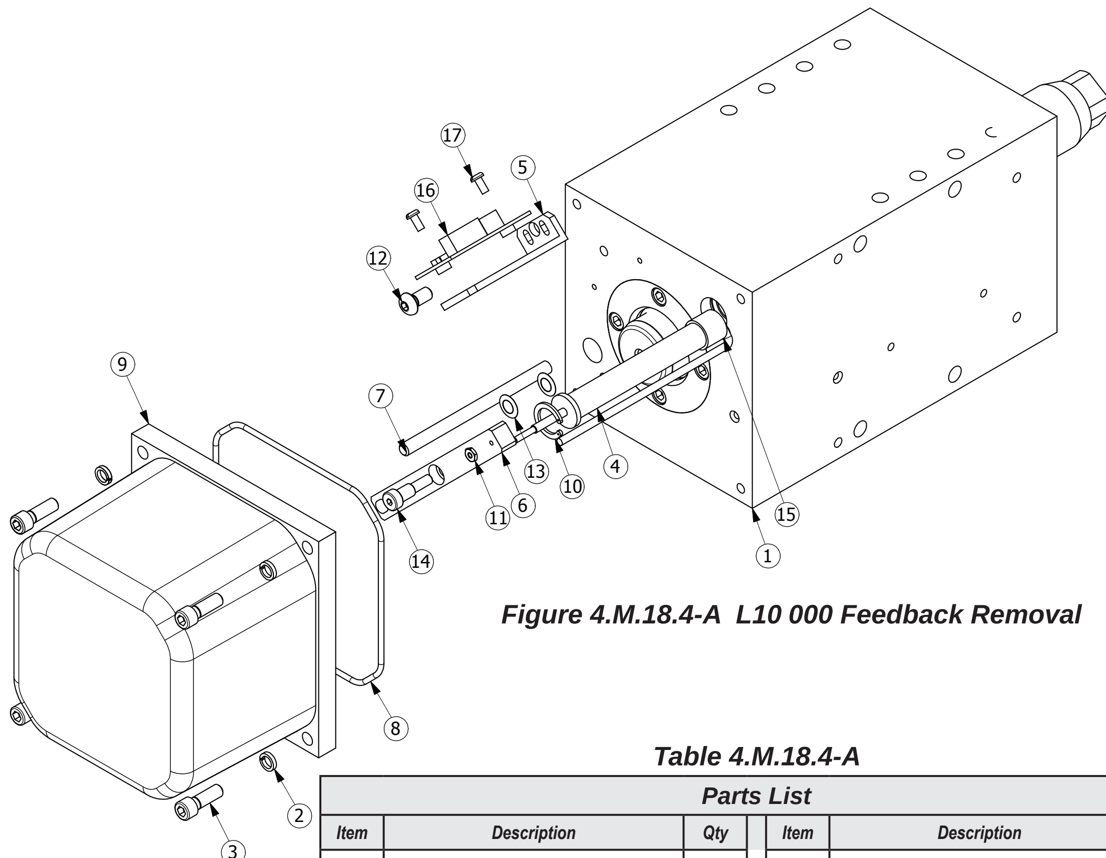

Figure 4.M.18.4-A L10 000 Feedback Removal

Table 4.M.18.4-A

Parts List

Item	Description	Qty	Item	Description	Qty
1	Cylinder Body	1	10	Retaining Ring	1
2	#10 Lock Washer	4	11	Hex Nut Std #4-40 (SS)	1
3	SHCS #10-32 × .75	4	12	BHCS SS 0.25 × 20	1
4	Potentiometer	1	13	Spring Washers	2
5	Bracket, Circuit Board Mounting	1	14	#10-32 Shldr Scr	1
6	Feedback Arm	1	15	Anti-Vibration Tape Foam	1
7	Anti-Rotation Rod	1	16	Circuit Board Assembly	1
8	O-ring Viton - 150	1	17	SCR Pan HD SL #6-32NC	2
9	Cover, Cylinderr	1			

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4.M.18.4-A.1 Disassembly

1. Refer to Figure 4.M.18.4-A and remove the 4 SHCS ¼-20 screws (3) and lock washers (2).
2. Remove the cover (9) and O-ring (8). The O-ring can be thrown out once the replacement is identified from the rebuild kit.
3. Mark termination points and disconnect all wires going to the circuit board (16). Remove the 2 pan head (17) to remove the circuit board (16).
4. Remove the BHCS SS ¼-20 (12) screw from the circuit board bracket (5).
5. Remove the shoulder screw (14) and hex nut (11). Remove the 2 spring washers (13). Hold the potentiometer (4) rod and unscrew the feedback arm (6).
6. Remove the retaining ring (10), anti-rotation rod (7) and the potentiometer (4).
7. Continue to bushing rebuild to continue disassembly.

4.M.18.4-A.2 Reassembly

1. Apply anti-vibration tape foam (15) to the base of the potentiometer (4) and slide the potentiometer (4) into the potentiometer hole in the cylinder (1). Ensure the cable slides into its slot. Snap the retaining ring (10) into the ring groove above the potentiometer (4).
2. Screw the feedback arm (6) onto the potentiometer (4). Thread the hex nut (11) on.
3. Align the 2 spring washers (13) to the end of the shank. Spin the feedback arm (6) over the spring washers (13) and line up the holes. Install the SH shoulder screw (14).
4. Screw in the anti-rotation rod (7).
5. Align the circuit board bracket (5) at a 45° from the edge and install the BHCS SS screw (12).

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6. Align the circuit board (16) with its mounting hole on the circuit board bracket (5) and install the 2 SCR pan head screw (17).
7. Rewire all connecting wires to the circuit board (16).
8. Install a new O-ring (8) into the cover (9). Petroleum jelly can be used to prevent the O-ring from falling out.
9. Install the 4 SHCS ¼-20 (3) and the 4 lock washers (2).

B. Top Bushing Rebuild

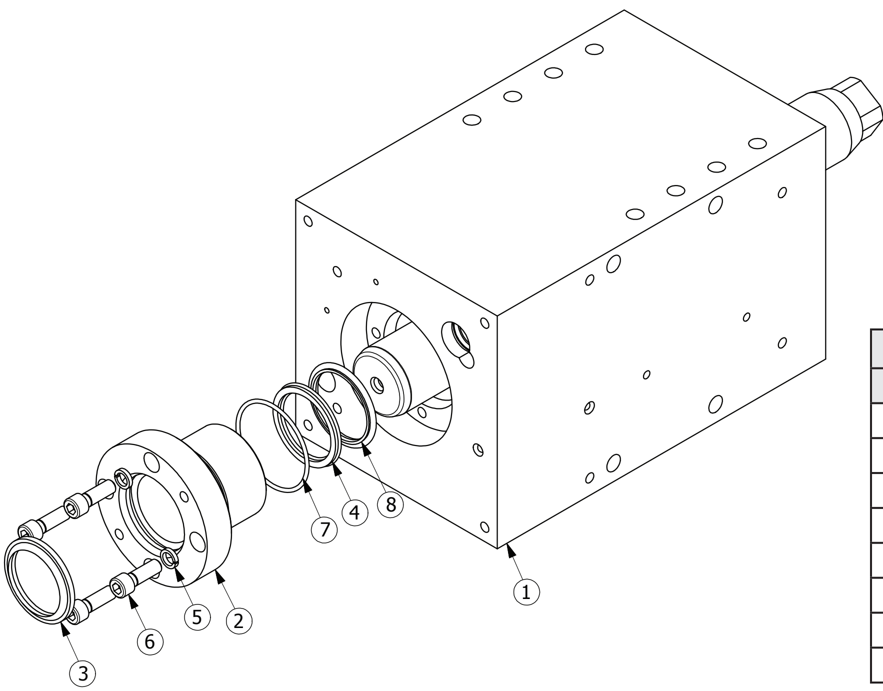

Figure 4.M.18.4-B L10 000 Top Bushing Rebuild

Table 4.M.18.4-B

Parts List		
Item	***Description***	***Qty***
1	*L10 000 Cylinder Body*	*1*
2	*L10 000 Cylinder Bushing*	*1*
3	*Rod Wiper*	*2*
4	*SQB Rod Seal*	*2*
5	*Lockwasher*	*8*
6	*SHCS SS ¼-20*	*8*
7	*O-ring Viton - 029*	*1*
8	*Rod Buffer*	*2*

CAUTION: While assembling and disassembling the cylinder, beware of oil discharging from unprotected ports.

4.M.18.4-B.1 Disassembly

NOTE: *To prevent damage, use a dead blow hammer or soft face mallet.*

1. Stroke the cylinder by striking it with a dead blow hammer from end to end with the open SAE ports over an oil drain bucket. Read caution above.
2. Refer to Figure 4.M.18.4-B and remove the four ¼-20 screws (6) and four lock washers (5).
3. Screw two of the ¼-20 screws (6) into the threaded holes of the bushing (2) to force it out.
4. Use a pick to remove the rod wiper (3), O-ring (7) the SQB rod seal (4), and the rod buffer seal (8). These items can be thrown out once the replacement parts are located from the rebuild kit.

4.M.18.4-B.2 Cleaning and Inspection

1. Clean the bushing (2) in brake wash and dry.
2. Inspect the bushing (2) bore for damage. If any visual marks can be felt by touch in the bushing (2) bore then the bushing (2) will need to be replaced.
3. Continue to Section C to complete disassembly.

4.M.18.4-B.3 Reassembly

1. Lubricate the O-ring and seals prior to installation.
2. Install the new rod wiper (3) with the pointed edge out. Install the new O-ring (7) into the O-ring groove on the outside of the bushing (2).
3. Install the new SQB rod seal (4) and rod buffer (8) into the seal grooves. The open side of the SQB rod seal (4) must face the cylinder body. Installing these backwards will cause the seals to fail.
4. After the end cap and shaft sections have been completed, slide the bushing (2) over the shank and into place. Ensure the screw holes line up. Install the four ¼-20 screws (6) and four lock washers (5). Use blue Loctite on the screws and torque to 100 lb•in.

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5. Slide the piston assembly into the cylinder bore. Lightly tap the assembly in if necessary. Note the orientation of the shank, output end goes in last.
6. Go back to the end cap rebuild reassembly in Section C to continue the rebuild.

C. End Cap Rebuild

Table 4.M.18.4-C

Parts List		
Item	***Description***	***Qty***
1	L10 000 Cylinder Body	1
2	L10 000 Cylinder Bottom Cylinder End Cap	1
3	Rod Wiper	2
4	SQB Rod Seal	2
5	Lockwasher	8
6	SHCS SS ½-13	8
7	O-ring Viton - 040	1
8	O-ring Viton - 047	1
9	Rod Buffer	2

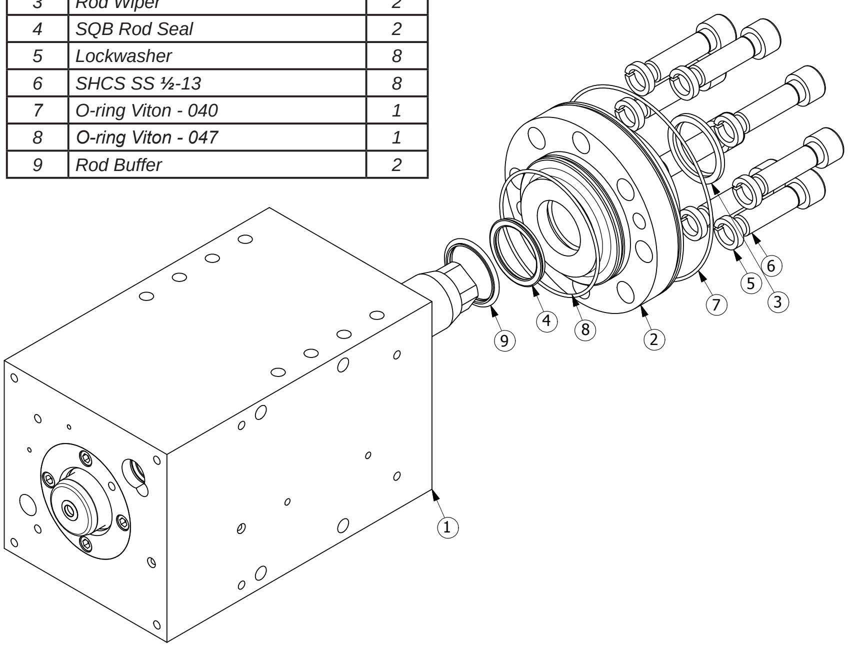

Figure 4.M.18.4-C End Cap Rebuild

CAUTION: While assembling and disassembling the cylinder, beware of oil discharging from unprotected ports.

4.M.18.4-C.1 Disassembly

1. Refer to Figure 4.M.18.4-C and remove the eight ½ - 13 screws (6) and eight lock washers (5).

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NOTE: *To prevent damage, use a dead blow hammer or soft face mallet.*

2. Lightly tap on the opposite end of the shaft to drive the end cap (2) out. The Shaft assembly should also come out; reference the Shaft Rebuild in Section D for rebuild.

NOTE: *If there is a spacer sleeve on the piston rod, it needs to be reassembled on the same side or damage and improper operation may result.*

3. Use a pick to remove the rod wiper (3), O-ring (7 & 8), and SQB rod (4) and rod buffer (9) seals. These items can be thrown out once the replacement parts are located from the rebuild kit.

4.M.18.4-C.2 Cleaning and Inspection

1. Clean the end cap in brake wash and dry.
2. Inspect the end cap (2) for damage. If any visual marks can be felt, then the end cap (2) will need to be replaced.
3. Continue to the Piston Shank Rebuild in Section D before reassembly.

4.M.18.4-C.3 Reassembly

1. Lubricate O-rings and seals prior to installation.
2. Install the new rod wiper (3) with the pointed edge out. Install the new O-rings (7 & 8) into the appropriate O-ring grooves.
3. Install the new SQB rod (4) and rod buffer (9) seals into the seal grooves. The open side of the SQB rod seal (4) must face the cylinder body. Installing these backwards will cause the seals to fail.
4. Slide the end cap (2) over the piston rod and back into the cylinder (1). Use 2 of the SHCS SS 1/2-20 screws (6) without washers to pull it back into place.
5. Install the eight ½ - 13 screws (6) and eight lock washers (5). Use Blue Loctite® on the screws and torque to 65 lb•ft.

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6. Go to the Feedback Rebuild Reassembly in Section A to finish the rebuild.

D. Shank Rebuild

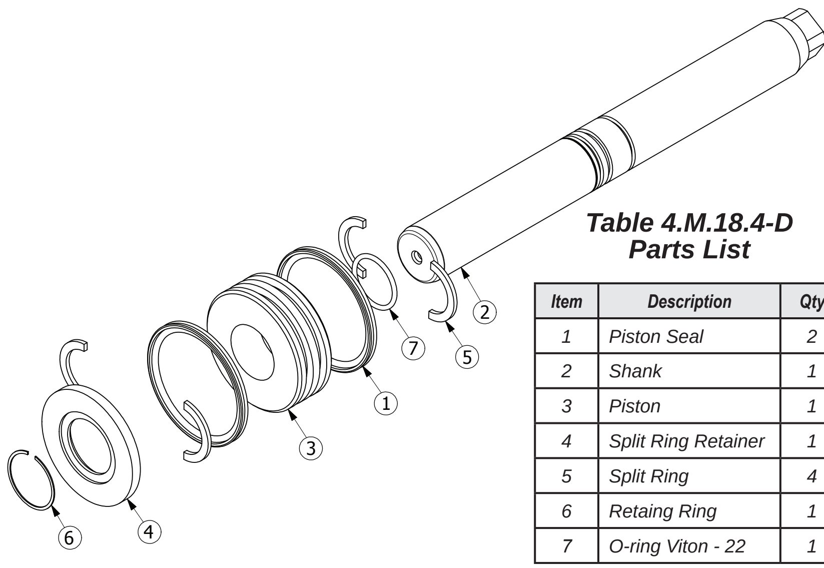

Table 4.M.18.4-D
Parts List

Item	Description	Qty
1	Piston Seal	2
2	Shank	1
3	Piston	1
4	Split Ring Retainer	1
5	Split Ring	4
6	Retaing Ring	1
7	O-ring Viton - 22	1

Figure 4.M.18.4-D L10 000 Shank Rebuild

CAUTION: While assembling and disassembling the cylinder, beware of oil discharging from unprotected ports.

4.M.19.4-D.1 Disassembly

1 Refer to Figure 4.M.18.4-D and remove the retaining ring (6). Care must be taken not to scratch the finish of the shank.

2 Slide the split ring retainer (4) off exposing the first set of split rings (5).

3 Separate the split rings (5) and slide the piston disk (3) off. The second set of split rings should now fall off.

4 Remove the O-ring (7) from the shank (2) and both piston seals (1) from the piston disk (3). These three items can be thrown out once you have located the new replacements from your rebuild kit.

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4.M.18.4-D.2 Cleaning and Inspection

1. Clean the piston shaft (2), piston (3), split ring retainer (4), split rings (5) and the retaining rings (6) in solvent and dry. Ensure no residue or contaminants remain.
2. Inspect the piston shaft (2) for scratches. If you can detect scratches by running your finger nail around the shaft (2) then the shaft (2) will need to be replaced.
3. Inspect the piston disk (3) for any burs around the outer surface that would scratch into the cylinder bore. If burs are found replace the piston disk (3).
4. Clean the cylinder bore in brake wash and dry. Be very cautious not to get contaminants into the ports. If any contaminates get into the system they could cause drifting problems.
5. Inspect the bore for wear or scratches. If the anodizing has worn through or any scuff marks can be felt, replace the cylinder body. Ensure the new cylinder has ball plugs installed before reassembly.

4.M.18.4-D.3 Reassembly

1. Lubricate the new O-ring.
2. Slide the new O-ring (7) into the O-ring groove of the shank (2). Slide the new piston seals (1) into the piston disk (3).

NOTE: *The O-ring side of the seals must face away from each other. Improper orientation will cause the seals to leak.*

3. Install one set of split rings (5) into the lower split ring slot of the shank (2).
4. Slide the piston (3) on from the top insuring the counter bore fits over the split ring (5).
5. Install the second set of split rings (5) into the upper slot on the shank (2).
6. Slide the split ring retainer over (4) the second set of split rings (5).

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NOTE: *The split ring retainer can only go on one way and should set flush to the piston disk (3).*

7. Install the retaining ring (6).
8. Lubricate the new piston seals (1).
9. Go to end cap rebuild reassembly, top bushing rebuild reassembly and feedback reassembly to complete.

ROTARY CYLINDER

4.M.19 ROTARY CYLINDER

The actuator consists of a pinion and one or two racks located within the housing. Pressurization of alternate cylinder port(s) result in shaft rotation. The gear chamber is filled with Moly grease containing a minimum Molybdenum Disulfide (MSO2) content of 3%. In the event that maintenance is required, the following steps should be used as a guide:

Table 4.M.19 Parts List

Item No.	Description	QTY	
		Single Rack	Double Rack
1*	O-ring Pinion	2	2
2	Housing	1	1
3	Rack Bearing	1	2
4*	Wear Ring	2	4
5*	Piston Seal	2	4
5a*	Back-up Ring	2	4
6	Nylon Slug	2	4
7	Rack Bolt	2	4
8*	O-ring Cylinder	2	4
9*	O-ring End Cap	2	4
10	Tie Rod Nut	8	16
11	End Cap	2	4
12	Cylinder Tube	2	4
13	Tie Rod	8	16
14*	O-ring, Rack Bolt	2	4
15*	Back-up Ring, Rack Bolt	2	4
16	Piston	2	4
17	Rack	1	2
18	Relief Valve	1	1
19	Locking Screw	1	1
20	Drive Screw	4	4
21	Name Plate	1	1
22	Bearing	2	2
23	Pinion	1	1
24*	O-ring, Bearing Retainer	1	1
25	Bearing Retainer	1	1

1. Item with an asterisk denote items supplied with seal kit

2. Item 5a applies to Viton O-rings only.

3. Item 1 quantity differs by 2 due to design change (previous design/ current design)

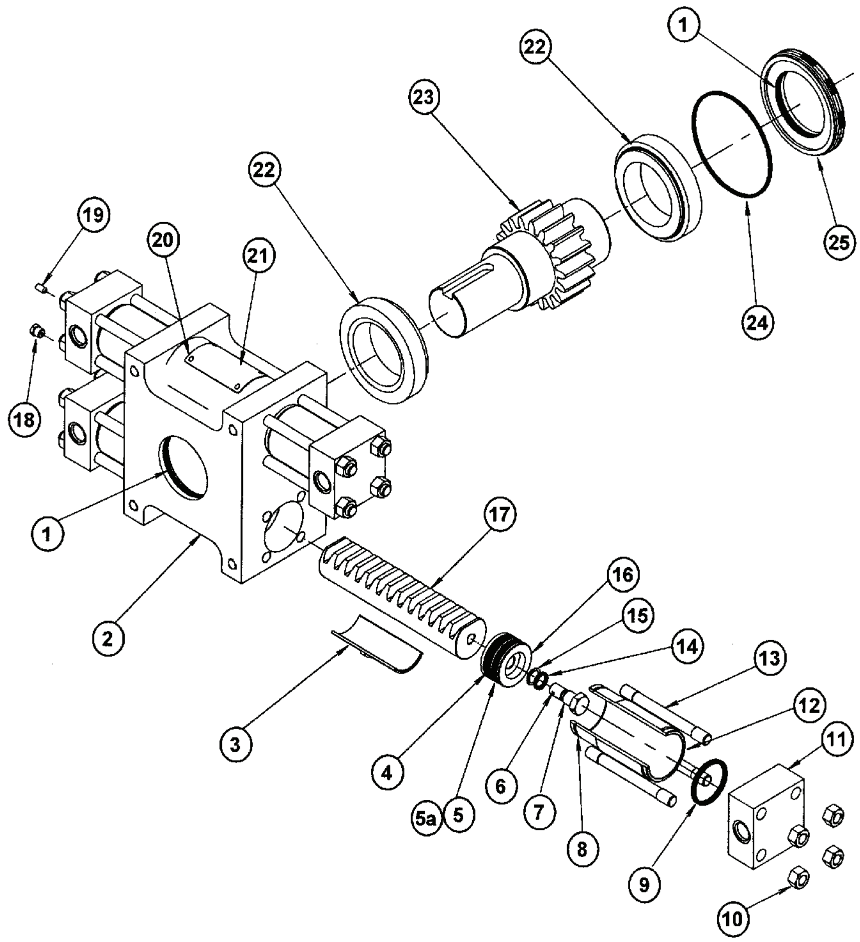


Figure 4.M.19 Rotary Cylinder

****X2 see note 3***

ROTARY CYLINDER

4.M.19.1 Assembly and Disassembly Procedures

***NOTE:** Tag-Out and Lock-Out the unit for repair in accordance with local procedures. Repair of the rotary actuator will require removing the unit from service.*

4.M.19.1-A Inspection & Replacement of End Cap Seals (9)

1. Open the manual bypass to relieve internal pressure, check gauges before proceeding.
2. Remove the actuator from the driven device.
3. Clamp the actuators reservoir piston (some units may have external reservoirs) and remove the hydraulic tubing feeding the cylinder.
4. Remove all fasteners, feedback, mounting, and motor/pump assemblies as necessary to free the cylinder from the assembly.
5. Remove the tie rod nuts/bolts (10) from the tie rods (13).
6. Pull end cap (11) free from the cylinder tube (12).
7. Inspect and/or replace end cap O-ring (9). Lubricate the seal and end cap with 5W-50 oil before re-installing.
8. Replace end cap(s) (11) on cylinder tube (12) and assemble tie rod nuts (10) to tie rods (13).
9. Torque the tie rod nuts/bolts per the Torque Table.

4.M.19.1-B. Inspection & Replacement of Wear Rings (4), Piston Seals (5) and Cylinder O-Ring (8).

1. Perform steps A1 and A2.
2. For 50 000 lb·in and greater models:
   a.) Remove Rack bolt (7).
   b.) Screw two threaded rods into the tapped holes in piston (16) and pull free from cylinder tube (12).
3. For models less than 50,000 lb·in:

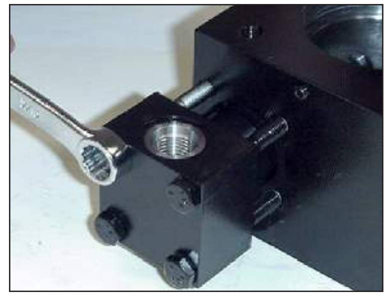


Photo 4.M.19.1-A-1
Tie rod nuts/bolts

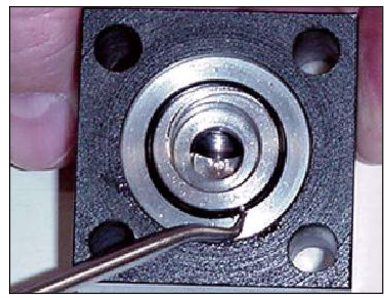


Photo 4.M.19.1-A-2
End cap O-ring

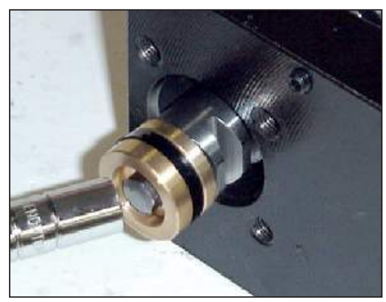


Photo 4.M.19.1-B-1
Rack bolt.

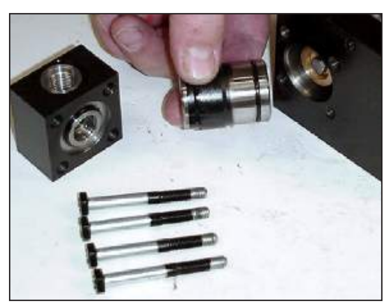


Photo 4.M.19.1-B-2
Cylinder tube

ROTARY CYLINDER

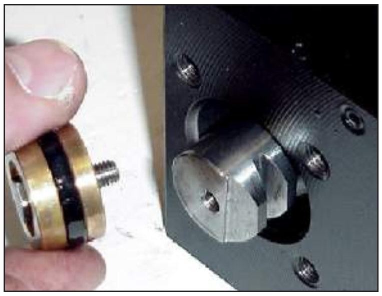


Photo 4.M.19.1-B-3
Piston


Photo 4.M.19.1-B-4
Cylinder O-ring

a.) Pull cylinder tube (12) free from housing (2).

b.) Remove Rack bolt (7).

4. Inspect piston (16) and replace piston seal (5).
5. Inspect and/or replace wear ring (4), (used on R2500 lb·in and above actuators only).
6. Inspect and/or replace cylinder O-ring (8).
7. Place cylinder tube (12) over rack and press in housing (2).
8. Slide piston (16) with piston seal and wear rings assembled onto it, into the cylinder tube (12), until it contacts the rack (17).

CAUTION: Nylon slug (6) is designed to prevent rack bolt from vibrating loose during operation. Ensure that it is on the rack bolt (7); replace if required.

9. Replace rack bolt (7) and torque per the torque table.
10. Replace end cap (11) and tie rod nuts (10), torque per *Table 4.M.19: Torque*.


Photo 4.M.19.1-C-1
Match Marking

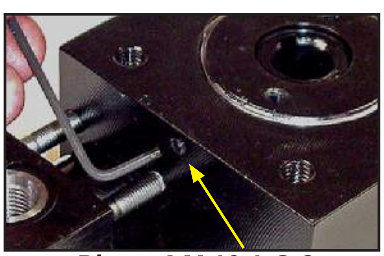


Photo 4.M.19.1-C-2
Lock Screw

4.M.19.1-C. Inspection and Replacement of Pinion and Bearing Retainer O-Rings

CAUTION: Berfore beginning, make match marks to enable re-establishment of correct timing. Failure to loosen the lock screw will damage threads on the bearing retainer.

1. Loosen lock screw (19).
2. Using a spanner wrench, remove the bearing retainer (25) by turning counter-clockwise. Remove the bearing retainer O-ring (24).
3. Remove upper bearing (22), pinion (23) and lower bearing (22).
4. Inspect and/or replace pinion O-ring (1) located at the “front” or blind-side of the housing (2).

ROTARY CYLINDER

5. Reinstall lower bearing (22), pinion (23) making sure match marks line up, and upper bearing.
6. Inspect and/or replace bearing retainer O-ring (24).
7. Apply Moly grease to bearing retainer threads (25) and reinstall into housing (2).
8. Torque bearing retainer (25) per the torque table.
9. Install and tighten locking screw per *Table 4.M.19: Torque*.

4.M.19.1- D. Complete Disassembly of Cylinder

1. Perform steps B1 through B3.
2. Perform steps C1 through C3.

CAUTION: Make match marks to re-establish correct timing.

3. Push the rack (17) from either end to remove from housing.

4.M.19.1- E. Reassembly of Cylinder

1. Perform C4 through C10. Refill gear chamber with Moly Grease.
2. Perform B4 through B10.

Table 4.M.19: Torque (lb·ft)

Size	Tie Rod Nut (10)	Rack Bolt (7)	Bearing Retainer (25)	Locking Screw (19)
R600/R1200	*6*	*3*	*15*	*2*
R2500/R5000	*15*	*15*	*30*	*4*
R10,000/R20,000	*30*	*40*	*100*	*4*
R50,000/R100,000	*130*	*130*	*250*	*15*
R200,000/R400,000	*525*	*360*	*500*	*15*

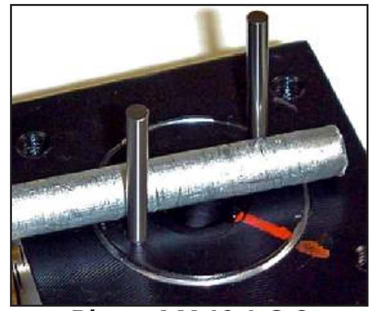


Photo 4.M.19.1-C-3
Bearing Retainer

Photo 4.M.19.1-C-4
Bearing Retainer O-ring

Photo 4.M.19.1-C-5
Upper Bearing

Photo 4.M.19.1-B-4
Cylinder O-ring

Photo 4.M.20-1
Feedback housing cover

Photo 4.M.20-2
Contacting Potentiometer

Photo 4.M.20-3
Non-contactingPotentiometer

4.M.20 ROTARY FEEDBACK

The rotary feedback assembly consists of a housing containing either a contacting or non-contacting potentiometer. The potentiometer is coupled to the rotary cylinder by means of a spring clip and transmits the actuator position to the CPU.

4.M.20.1 Identification

Contacting potentiometer

When removing the rotary feedback housing cover you will see the potentiometer mounted with three wires (orange, brown, and red) coming out of the potentiometer housing and going to a terminal block. (Photo 4.M.20-2)

Non-contacting potentiometer

When removing the rotary feedback housing cover you will see the potentiometer mounted with a black cable coming out of the potentiometer housing and four wires (white, brown, green, and a shield) going to a terminal block. (Photo 4.M.20-3)

4.M.20.2 Contacting Potentiometer

Any adjustments to the rotary potentiometer 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 failed position.

4.M.20.2- A Disassembly

1. Put the electronics into the “SETUP” mode and under calibration, scroll down to either “PL” or “PH”, depending on which end of the travel. If the actuator is somewhere in the middle, either position may be selected.

ROTARY FEEDBACK

2. Record the reading from the display before disconnecting power. If no reading is present, then move the actuator to either the full open or full closed position. A record of this number has been recorded on the data sheet inside the electronics enclosure.
3. Disconnect the incoming power.
4. Unscrew the cover of the feedback housing to expose the potentiometer. (Photo 4.M.20-1)
5. Disconnect the three wires coming from the potentiometer. (Photo 4.M.20.2-1)
6. Loosen the upper set screw on the potentiometer shaft coupling. (Photo 4.M.20.2-2)
7. Remove the two screws holding the potentiometer to the mounting plate and remove the old potentiometer. (Photo 4.M.20.2-3)

4.M.20.2-B Reassembly

1. Reinstall the new potentiometer into position on the mounting plate and bolt the two screws to the mounting plate.
2. Reattach the potentiometer shaft to the shaft coupling and tighten the upper set screw.
3. Rewire the three wires to the terminal strip as labeled.
4. Zip-tie the three wires to the post of the potentiometer mounting plate.
5. Screw the feedback housing cover back on and tighten securely.
6. Reconnect incoming power to the unit.
7. For calibration refer to **IOM section 6**, Modes of Operation and Control Parameters.

Photo 4.M.20.2-1
Contacting Potentiometer

Photo 4.M.20.2-2
Potentiometer shaft coupling

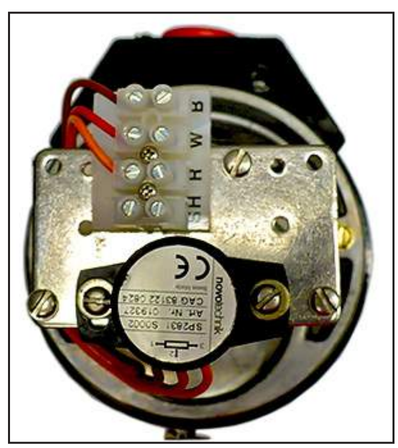


Photo 4.M.20.2-3
Mounting plate screws

Photo 4.M.20.3-1
Non-contactingPotentiometer

Photo 4.M.20.3-2
Upper set screw

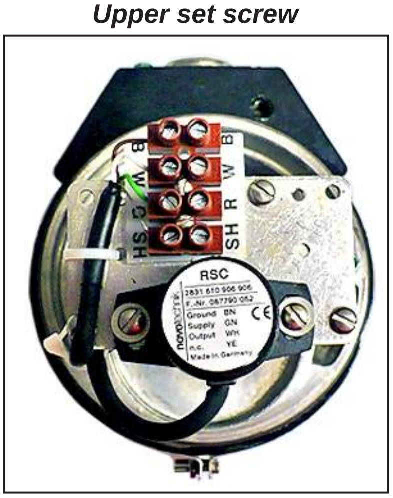


Photo 4.M.20.3-3
Mounting plate screws

4.M.20.3 Non-Contacting Potentiometer

General

Any adjustments to the rotary potentiometer 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 failed position.

4.M.20.3-A Disassembly

1. Put the electronics into the “SETUP” mode and under calibration, scroll down to either “PL” or “PH”, depending on which end of the travel. If the actuator is somewhere in the middle, either position may be selected.
2. Record the reading from the display before disconnecting power. If no reading is present, then move the actuator to either the full open or full closed position. A record of this number has been recorded on the data sheet inside the electronics enclosure.
3. Disconnect the incoming power.
4. Unscrew the cover of the feedback housing to expose the potentiometer. (Photo 4.M.20-1)
5. Disconnect the four wires coming from the potentiometer. (Photo 4.M.20.3-1)
6. Loosen the upper set screw on the potentiometer shaft coupling. (Photo 4.M.20.3-2)
7. Remove the two screws holding the potentiometer to the mounting plate and remove the old potentiometer. (Photo 4.M.20.3-3)

4.M.20.3-B Reassembly

1. Reinstall a new potentiometer on the mounting plate and bolt the two screws to the mounting plate.

ROTARY FEEDBACK

2. Reattach the potentiometer shaft to the shaft coupling and tighten the upper set screw.
3. Rewire the three wires to the terminal strip as labeled.
4. Zip-tie the three wires to the post of the potentiometer mounting plate.
5. Screw the feedback housing cover back on and tighten securely.
6. Reconnect incoming power to the unit.
7. For calibration refer to **IOM section 6**, Modes of Operation and Control Parameters.

4.M.20.4 Retrofitting with Contacting or Non-Contacting Potentiometer

General

Any adjustments to the rotary potentiometer 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 failed position.

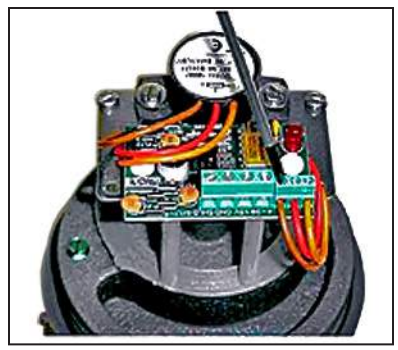


Photo 4.M.20.4-1
Feedback board wiring

4.M.20.4-A Disassembly

1. Put the electronics into the "SETUP" mode and under calibration, scroll down to either "PL" or "PH", depending on which end of the travel. If the actuator is somewhere in the middle, either position may be selected.
2. Record the reading from the display before disconnecting power. If no reading is present then move the actuator to either the full open or full closed position. A record of this number has been recorded on the data sheet inside the electronics enclosure.
3. Disconnect the incoming power.
4. Unscrew the cover of the feedback housing to expose the potentiometer. (Photo 4.M.20-1)

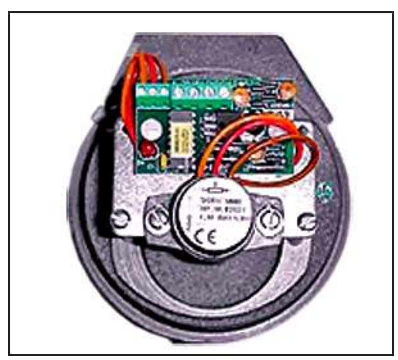


Photo 4.M.20.4-2
Pan head screws

ROTARY FEEDBACK

Photo 4.M.20.4-3
Upper set screw

5. Disconnect all wires going to the feedback board. (Photo 4.M.20.4-1)
6. Remove the feedback board by unscrewing the two nylon pan head screws. (Photo 4.M.20.4-2)
7. Loosen the upper set screw on the potentiometer shaft coupling. (Photo 4.M.20.4-3)
8. Remove the two screws holding the potentiometer to the mounting plate and remove the old potentiometer. (Photo 4.M.20.4-4)

4.M.20.4-B Reassembly

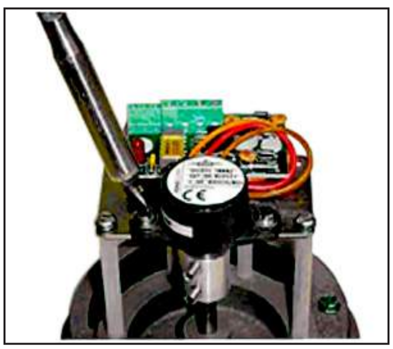


Photo 4.M.20.4-4
Mounting screws

4.M.20.4-B1 Contacting Potentiometer

Refer to contacting potentiometer reassembly.

NOTE: *During reassembly, replace feedback board with the terminal strip as pictured.*

4.M.20.4-B2 Non-Contacting Potentiometer

Refer to non - contacting potentiometer reassembly.

NOTE: *During reassembly, replace feedback board with the terminal strip as pictured.*

LINEAR FEEDBACK

4.M.21 - LINEAR FEEDBACK

General

Depending on the type of actuator application, there are three different types of linear potentiometers; each type is designated to a particular application. Note, in some cases the steps maybe the same if retrofitting a contacting potentiometer to a non-contacting potentiometer.

Identification

REXA Linear Cylinder Potentiometer

The REXA block cylinder is equipped with a contacting potentiometer located inside the cylinder block. For the disassembly and reassembly of the REXA block cylinder refer to **TS&R 4.M.18**.

Contacting Linear Potentiometer

Typically, contacting linear potentiometers are on applications that have a 23-inch stroke or less; but some applications use a non-contacting potentiometer. To determine whether the potentiometer is contacting or non-contacting, observe the color of the marker. The contacting potentiometer uses a black marker which slides on the sensor track.

Non-contacting Linear potentiometer

Non-contacting linear potentiometers are usually on applications that are over 23-inch stroke, but in some 23-inch stroke or less applications a non-contacting potentiometer is utilized. To determine whether the potentiometer is contacting or non-contacting, observe the color of the marker. The non-contacting potentiometer uses a yellow marker which slides on the sensor track.

LINEAR FEEDBACK

4.M.21.1 Contacting Linear Potentiometer

General

Any adjustments to the linear potentiometer 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 failed position.

4.M.21.1-A Disassembly

1. Put the electronics into "SETUP" mode and under calibration, scroll down to either "PL" or "PH", depending on which end of the travel. If the actuator is somewhere in the middle, either position may be selected.
2. Record the reading from the display before disconnecting power. If no reading is present, then move the actuator to either the full open or full closed position. A record of this number has been recorded on the data sheet inside the electronics enclosure.
3. Disconnect all the wires attached to the feedback board.
4. Unscrew the 2 SHCS and the set screw from the anti-vibration bracket and then remove the bracket.
5. Remove the anti-rotation rod.
6. Unscrew the shoulder screw from the cylinder shaft.
7. Detach the anti-rotation arm from the marker coupling.
8. Remove the sensor track by unscrewing the 4 SHCS from the 2 sensor brackets and removing the track from the potentiometer bracket.

4.M.21.1-B Reassembly

1. Attach the sensor track to the potentiometer bracket (wires should be on the top of the sensor) using the 2 sensor brackets and the 4 SHCS.
2. Attach the anti-rotation arm to the marker coupling.

LINEAR FEEDBACK

3. Reinsert the shoulder bolt and feedback spacer.
4. Screw the anti-rotation rod back into position through the designated hole in the anti-rotation arm.
5. Place the anti-vibration bracket back into position and screw in the 2 SHCS and set screw.
6. Rewire the sensor wires to the feedback board according to the wire schematic.
7. For calibration refer to **IOM section 6**, Modes of Operation and Control Parameters.

4.M.21.2 Non-Contacting Linear Potentiometer/Retrofit

General

Any adjustments to the linear potentiometer 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 failed position.

4.M.21.2-A Disassembly

1. Put the electronics into “SETUP” mode and under calibration, scroll down to either “PL” or “PH”, depending on which end of the travel. If the actuator is somewhere in the middle, either position may be selected.
2. Record the reading from the display before disconnecting power. If no reading is present, then move the actuator to either the full open or full closed position. A record of this number has been recorded on the data sheet inside the electronics enclosure.
3. Disengage all the wires connecting to the feedback board. Unscrew the 2 pan head screws and remove the feedback board.
4. Unscrew the 2 SHCS and the set screw from the anti-vibration bracket and then remove the bracket.

5. Remove the anti-rotation rod.
6. Unscrew the shoulder screw from the cylinder shaft.
7. Detach the anti-rotation arm from the marker coupling.
8. Remove the sensor track by unscrewing the 4 SHCS from the 2 sensor brackets and removing the track from the potentiometer bracket.

4.M.21.2-B Reassembly

1. Attach the sensor track to the potentiometer bracket (wires should be on the top of the sensor) using the 2 sensor brackets and the 4 SHCS.
2. Attach the anti-rotation arm to the marker coupling. Note the replacement retrofitting sensor; the marker will be yellow.
3. Reinsert the shoulder bolt and feedback spacer.
4. Screw the anti-rotation rod back into position through the designated hole in the anti-rotation arm.
5. Place the anti-vibration bracket back into position and screw in the 2 SHCS and set screw.
6. Mount the terminal strip in the location where the feedback board was mounted.
7. Rewire the sensor wires to terminal strip as labeled or view wiring schematic.
8. For calibration refer to **IOM section 6**, Modes of Operation and Control Parameters.

LINEAR FEEDBACK

4.M.21.3 Non -Contacting Linear Potentiometer

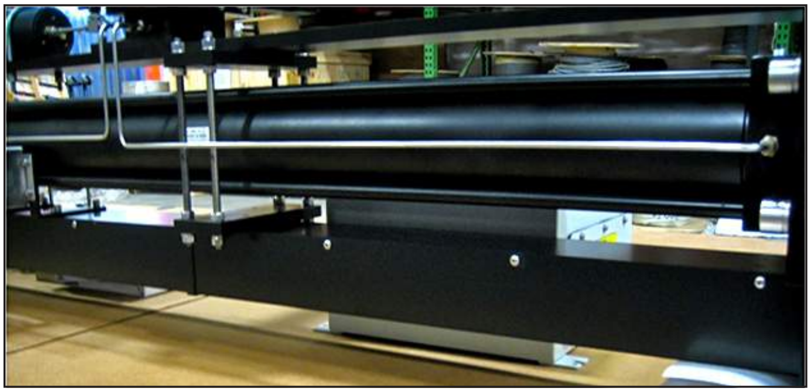


Photo 4.M.21.3-1 Non-contacting potentiometer cover

4.M.21.3-A Disassembly

1. Run the actuator so that the cylinder is at its end stop.
2. Turn off power to the unit.
3. Unscrew the fourteen pan head screws to remove the two piece non-contacting potentiometer cover (Photo 4.M.21.3-1).
4. Disconnect the non-contacting potentiometer wires from the terminal strip inside the junction box. Remove the cable from the junction box. (Photo 4.M.21.3-2)
5. Loosen the hex nut on the magnet sensor to disengage the coupling from the feedback tie rod (Photo 4.M.21.3-3).
6. Remove the magnet sensor from the sensor track. This can be done by sliding the magnet sensor down to the bottom of the sensor track.
7. At the top of the sensor track, remove the sensor tie rod guide by unscrewing the two 1/4-20 hex bolt and washers (Photo 4.M.21.3-4).
8. Unscrew the four 10-32 SHCS and lock washers and remove the sensor track mounts and track (Photo 4.M.21.3-5).

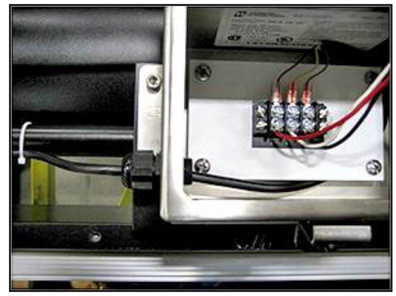


Photo 4.M.21.3-2
Terminal strip/wire connections

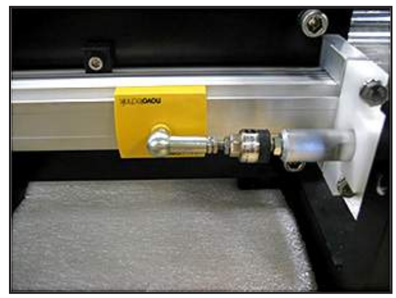


Photo 4.M.21.3-3
Magnet sensor

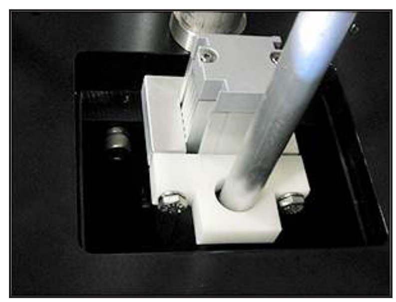


Photo 4.M.21.3-4
Sensor tie rod guide

Photo 4.M.21.3-5
Sensor track & mounts

LINEAR FEEDBACK

4.M.21.3-B Reassembly

1. Reinstall the four 10-32 SHCS and lock washer to the brackets for the sensor track.
2. Mounting the sensor track onto the brackets. Once aligned, tighten the 10-32 SHCS on the brackets.
3. Three inches from the top of the sensor track, reinstall the tie rod guide by installing the two hex head bolts and washers to clamp down the feedback tie rod guide to the sensor track.
4. Reinstall the sensor magnet by sliding the sensor magnet onto the sensor track with the coupling facing the feedback tie rod.
5. Reengage the magnet sensor coupling to the feedback tie rod and tighten the hex nut.
6. Rewire the non-contacting potentiometer cables to the junction box as shown Photo 4.M.21.3-2 or in wiring schematic.
7. Make sure there is a loop before any wire hole entries as shown in Photos 4.M.21.3-6 and 7. Use zip-ties to secure the cable.
8. Reinstall the two piece non-contacting sensor cover and reinstall the fourteen pan head screws as shown in Photo 4.M.21.3-1.

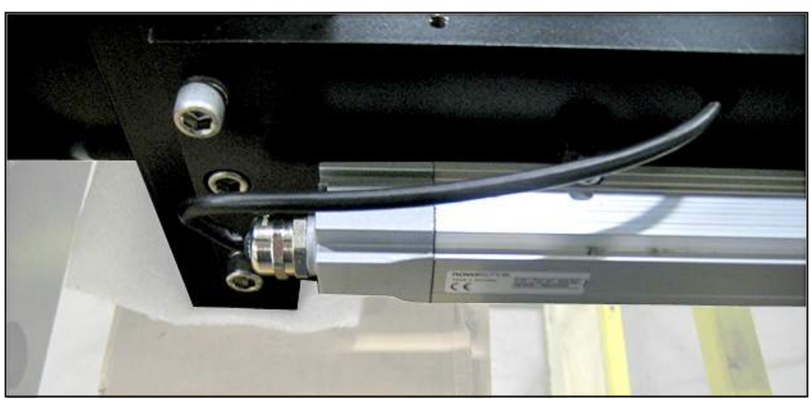


Photo 4.M.21.3-6

LINEAR FEEDBACK

Photo 4.M.21.3-7

ELASTIC COUPLING

4.M.22 ELASTIC COUPLING

General

The elastic coupling is used to apply a controlled load at the seated position with linear (L series) actuators. The elastic coupling is attached to the actuator between the stem and the driven device. Some valves are down seating and require a compression coupling. Valves that are up seating require a tension coupling.

NOTE: *An arbor or hydraulic press will be required to disassemble the elastic coupling. Ensure the press is in good working order and has sufficient force to handle the loads in the elastic couplings.*

Identification

REXA offers two types of elastic couplings. One has an open frame construction, which is the downseating coupling. See Photo 4.M.22-1. The second type has a closed frame construction, and is the upseating style. See Photo 4.M.22-2.

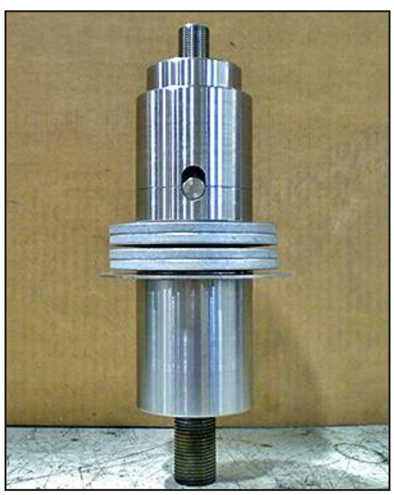


Photo 4.M.22-1
Downseating coupling

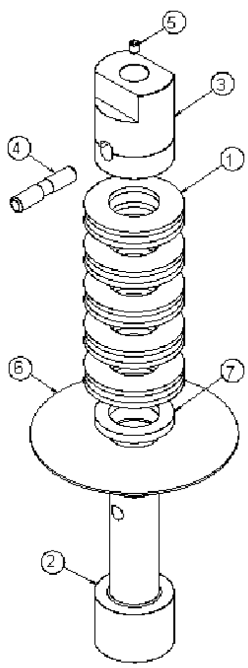
Photo 4.M.22-2
Upseating couplling

ELASTIC COUPLING

4.M.22.1 Open Spring Compression (Downseating) Load Type Elastic Coupling

Table 4.M.22.1 Parts List

Item	Qty	Description
1	10	Spring Washers
2	1	Spring Stop
3	1	Actuator Stem Adapter
4	1	Load Pin
5	1	#8-32 Set Screw
6	1	Stroke Indicator
7	1	Spacer



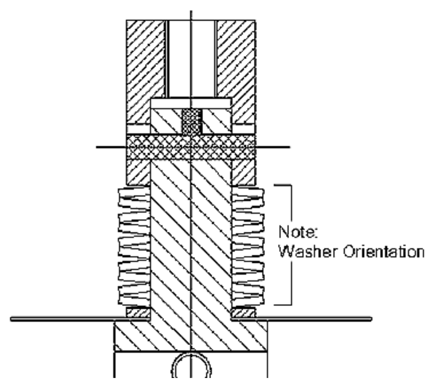


Figure 4.M.22.1

NOTE: *Repair of the elastic coupling will require removing the unit from service. Tag-Out and Lock-Out the unit for repair in accordance with local procedures.*

4.M.22.1-A Disassembly

1. Remove any external loads from the actuator. The pressure gauges both should read zero.
2. Remove the elastic coupling from the valve stem and actuator shaft by unthreading it from each end, or removing the split clamp from the valve end.
3. Remove the set screw (5) located in the thread hole of the actuator stem adapter (3).

ELASTIC COUPLING

4. Compress the elastic coupling until the load pin (4) moves to the center of the hole in the actuator stem adapter (3). This removes the internal spring load from the load pin (4).
5. Push the load pin (4) out of the assembly.
6. Slowly release the pressure on the coupling and note the arrangement of the spring washers (1).
7. Replace or modify components as necessary.

4.M.22.1-B Reassembly

1. Reassemble by placing the stroke indicator (6), spacer (7), spring washer (1) stack and actuator stem adapter (3) over the spring stop (2).
2. Line up the spring stop (2) hole with the actuator stem adapter (3) slot. Compress the spring washers (1) until the hole and slot line up.
3. Insert the load pin (4) into the hole. Make sure the flat on the pin is facing the set screw hole.
4. Slowly release the pressure on the spring washers (1).
5. Install the set screw using a thread lock.

ELASTIC COUPLING

4.M.22.2 Closed Spring Tension (Upseating) Load Type Elastic Coupling

Table 4.M.22.2 Parts List

Item	Qty	Description
1	1	Stem Adapter
2	1	Upper Cap
3	1	Stroke Indicator Disc
4	1	Lower Cap
5	8	Disc Spring
6	1	Spacer
7	8	Socket Hd Cap Screw
8	8	Lockwasher - Hi Collar
9	1	Travel Indicator
10	1	Spring

Photo 4.M.22.2-1
Indicator pin

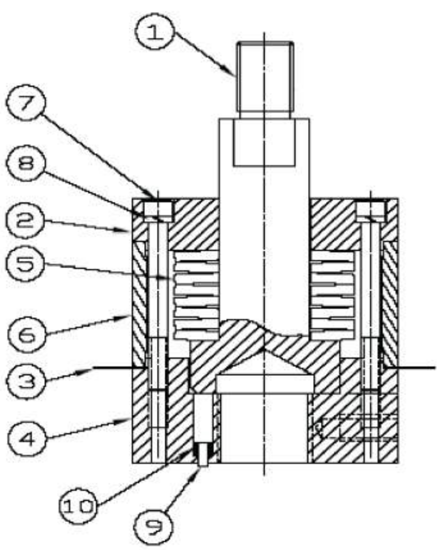


Figure 4.M.22.2

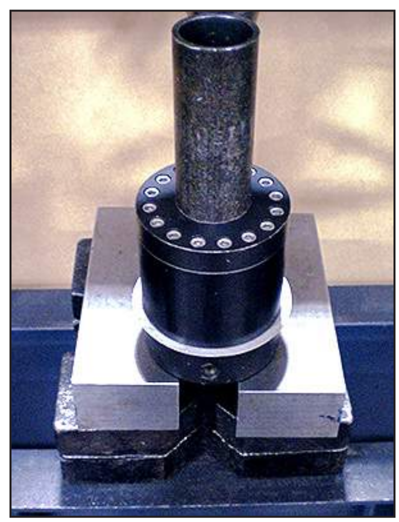


Photo 4.M.22.2-2
Top plate against load

NOTE: *Repair of the elastic coupling will require removing the unit from service. Tag-Out and Lock-Out the unit for repair in accordance with local procedures.*

ELASTIC COUPLING

4.M.22.2-A Disassembly

1. Remove any external loads from the actuator. The both pressure gauges should read zero.
2. Remove the elastic coupling from the valve stem and actuator shaft by unthreading it from each end, or removing the split clamp from the valve end.

NOTE: *Do not damage the indicator pin during this procedure. Use shims or provide the press base plate with proper clearance holes. See Photo 4.M.22.2-1 for reference.*

3. Place coupling in press, use tube stock to hold the top plate against the load. See Photo 2.M.22.2-2 for reference.
4. Remove bolts holding the coupling assembly together.
5. Slowly release the pressure on the coupling.
6. Remove the top plate, stem adaptor, cylindrical wall and note the arrangement of the spring washers. Also remove the seating indicator and spring which is under the stem adaptor.
7. Replace or modify components as necessary.

4.M.22.2-B Reassembly

1. Reassemble by placing the stroke indicator, indicator spring, spring washer stack, cylindrical wall and actuator stem adapter onto the valve step adapter.
2. Line up top plate with bolt holes in valve stem adaptor.
3. Compress the elastic coupling until all the parts fit together then tighten the loading bolts in a start pattern.
4. Install the set screw using a thread lock.

NOTE: *Coupling design may differ on some models. Please contact REXA for details if your coupling differs from the designs described above. Have serial and model number ready before contacting the factory.*

SEAT LOAD CYLINDER

4. M.23 SEAT LOAD CYLINDER


Photo 4.M.23
Seat Load Cylinder

The Seat Load Cylinder (SLC) is a hydraulic cushion that replaces the elastic coupling on larger REXA Actuators. This procedure will take you through the removal, disassembly and repair of the SLC.

CAUTION: Spring under tension; take care when removing hydraulic lines and mechanical spring.

4.M.23.1 Removal from Actuator

1. Place the REXA actuator in the Set Up or Local mode.
2. Power the REXA unit down and follow local Lock-out/Tag-out procedures.
3. Open manual bypass and pressure gauge isolation valves.
4. Verify system pressure is relieved; shut off isolation valves on both hydraulic lines connecting the SLC.

NOTE: *Record the termination of the feedback wiring.*

5. Remove SLC feedback cover, disconnect wires and conduit from the assembly.
6. Leaving the isolation valves connected to the actuator, remove hydraulic lines from the SLC.
7. While supporting the SLC assembly, remove the bolts holding the SLC to the mounting plate.

4.M.23.2 Disassembly

1. Remove shoulder bolts (19) from the spring button.
2. Remove screws (16) holding spring tube (1) to cylinder assembly.
3. Slide spring tube (1) off of the assembly.

NOTE: *Record the spring pre-compression length before proceeding.*

4. Holding the stem extension (5) still, remove jam nuts (8) relieving the spring pressure.

SEAT LOAD CYLINDER

5. Remove coil spring (3, 4) and spring buttons (7, 6). Some SLC assemblies have more than one spring.
6. The stem extension (5) has a tack weld holding the extension to the hydraulic cylinder. Cover all open hydraulic ports and carefully grind weld away to remove extension from hydraulic cylinder.
7. Remove mounting plates (9) and adaptor port (10) from cylinder assembly.

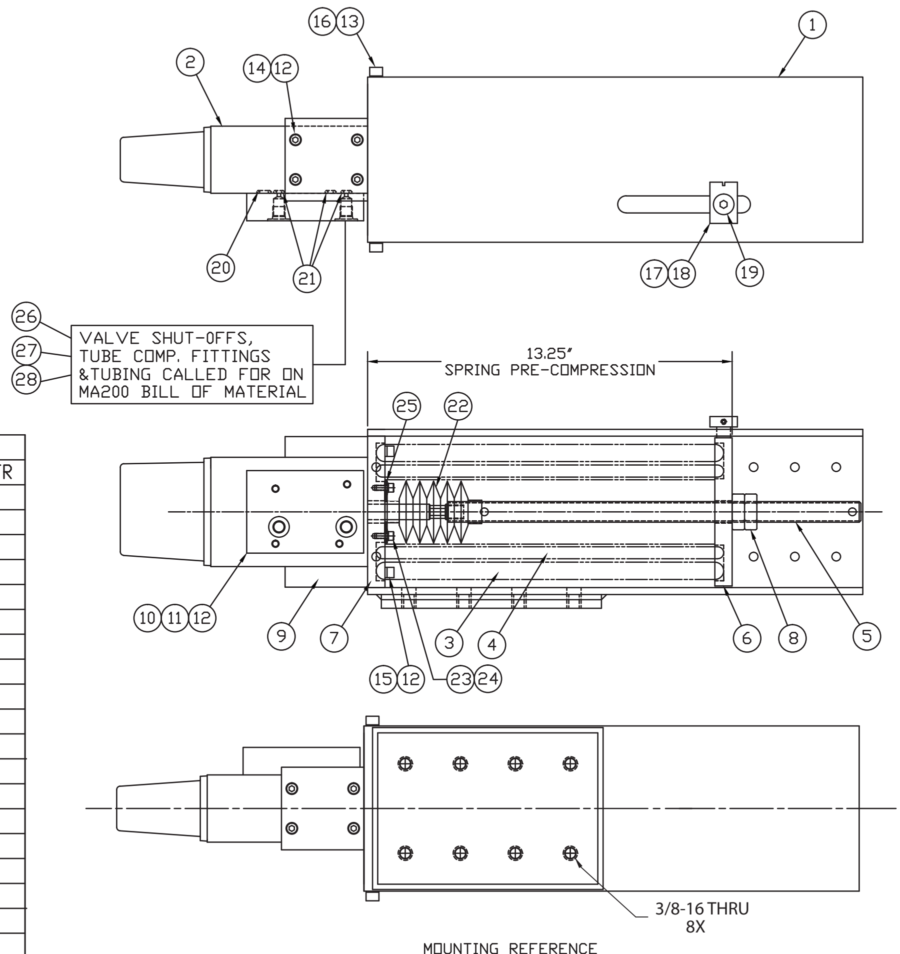


Figure 4.M.23.2 SLC

Table 4.M.23.2 Parts List

ITEM	QTY	DESRCIPTION
28	3	TUBE .250, .035 WALL
27	2	TUBE CONN STR -4 COMP-4STR
26	2	VALVE, SHUTOFF, SWAGELOK
25	1	FLANGE, DUST BOOT
24	3	LKWSHR HI #10 S.S. .047TK
23	3	SHCS #10-32 x .437 S.S.
22	1	DUST BOOT
21	3	O-RING, VITON -010
20	1	O-RING, VITON -012
19	1	SHOULDER SCREW, Ø.5 X.5 LNG
18	1	SET SCREW, #10-32 X .31
17	1	INDICATOR
16	4	CAP SCREW, 5/16-18 X 1.00
15	4	CAP SCREW, 1/4-20 X 1.25
14	8	CAP SCREW, 1/4-20 X 1.00
13	4	HI-LOCK WASHER, 5/16"
12	16	HI-LOCK WASHER, 1/4"
11	4	CAP SCREW, 1/4-20 X 2.50
△2 10	1	BLEED PORT ADAPTER
9	2	MOUNTING PAD
8	2	JAM NUT, 3/4-10
7	1	SPRING BUTTON, UPPER
6	1	SPRING BUTTON, LOWER
5	1	STEM EXTENSION, .75-10 UNC
4	1	COMPRESSION SPRING
3	1	COMPRESSION SPRING
△2 2	1	CYLINDER ASSY. L2K-2
1	1	SPRING TUBE, STD MTG

SEAT LOAD CYLINDER

4.M.23.3 Repair

REXA SLC assemblies come in L2000 and L4000 cylinder sizes. Refer to section 4.M.18 to repair the hydraulic cylinder assembly.

4.M.23.4 Reassembly

1. Replace mounting plates (9) and adaptor port (10) to cylinder assembly.
2. Thread stem extension (5) onto hydraulic cylinder stem. Use high grade thread locker to prevent the unthreading of shafts.
3. Install coil spring (3,4) and spring buttons (7,6).
4. Holding the cylinder stem (5) still, thread jam nuts (8) onto the stem extension (5). Use an anti-seize compound to prevent the assembly from galling.
5. Tighten jam nuts (8) until the spring is compressed to the proper length.
6. Install spring tube (1) and tube mounting bolts (16).
7. Install shoulder bolts (19) into the spring button.

4.M.23.5 Re-Installation

1. Re-install the SLC onto the mounting plate on the REXA unit.
2. Connect hydraulic lines.
3. Replace SLC feedback cover, connect conduit and feedback wiring.
4. Close manual bypass and purge system of air.
5. Verify operation of the SLC system. System pressure at the seated position should be 2000 psi. Adjust spring tension as needed.

4.M.24 BOOSTER PUMP

4.M.24.1 Motor

NOTE: *P9 and P40 size modules share similar motor mounting procedures and components*

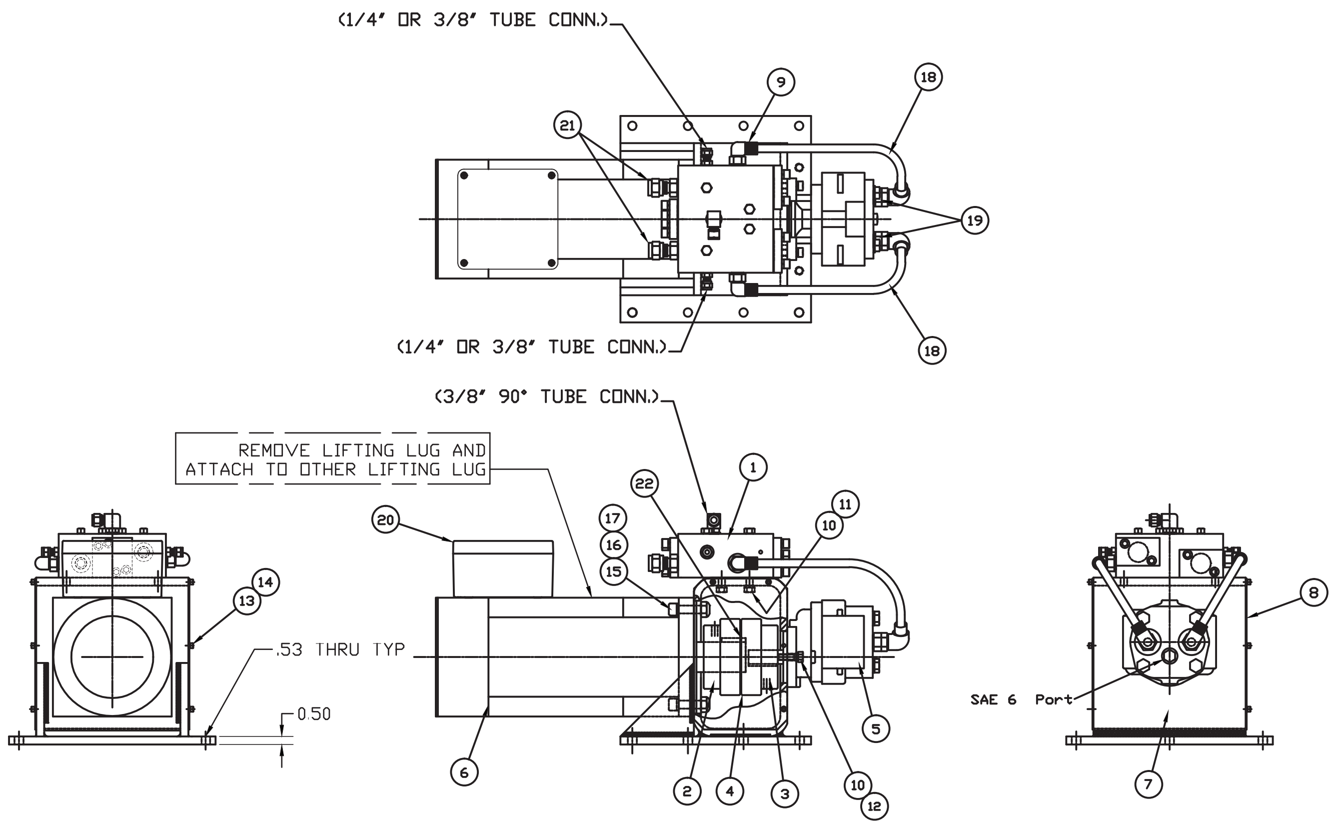


Figure 4.M.24.1 Booster Pump drawing (P40 shown)

BOOSTER PUMP

Table 4.M.24.1 Parts List

22	1	KEY 14mm x .358 x 1.5 LONG
21	2	FITTING, TUBE 1/2" TUBE TO SAE -8 PORT
20	1	JUNCTION BOX ASSEMBLY
19	2	ADAPTER, SAE 16 MALE TO SAE 8 FEM
18	6ft	TUBING, 1/2"O.D.x.065 WALL ANN S.S.
17	4	PLN WASHER 1/2 (SS)
16	4	LOCK NUT 1/2-13 (SS)
15	4	SHCS 1/2-13 X 2.0 LONG (AS)
14	12	SHCS #10-32NF x .44 LONG (SS)
13	12	#10 HI-COL LKWSHR (SS)
12	2	HX HD BLT 3/8-24NF x 1.25 LONG (AS)
11	4	HX HD BLT 3/8-16NC x 1.5 LONG (SS)
10	6	3/8 LKWSHR REG (SS)
9	4	ELBOW 90°, STR TH'D, SAE 8 TO 1/2" TUBE
8	2	COVER, FOR MOUNTING BRACKET
7	1	BRACKET, MOUNTING P40 BOOST PUMP
6	1	MOTOR, SERVO, P40 SIZE, GLENTEK
5	1	PUMP, HYDRAULIC GEAR, GEARTEK, SIZE C65
4	1	HYTREL INSERT, MAGNALOY MOD #500
3	1	COUPLING, MAGNALOY MOD #500 (ø.875 SHAFT)
2	1	COUPLING, MAGNALOY MOD #500 (ø48mm SHAFT)
1	1	MANIFOLD SUB-ASSEMBLY
ITEM	QTY	DESCRIPTION

4.M.24.1.A Disassembly

1. Ensure that the power has been turned off from the unit.
2. Disconnect as necessary any conduit and wires to the motor from the terminal block
3. Ensure the actuator has been drained of oil and top drain plug has been removed.
4. Remove set screw from coupling (2).
5. Remove the four motor bolts and four lock washers.
6. Pull motor straight out.

4.M.24.1.B Reassembly

1. Orientate the motor shaft so that it engages with the pump coupling.

CAUTION: DO NOT FORCE THE MOTOR IN PLACE OR TIGHTEN THE MOUNTING SCREWS BEFORE TURNING THE MOTOR SHAFT OR DAMAGE WILL OCCUR!

2. Apply blue Loctite on motor bolts and install the four motor washers.
3. Replace set screw in the coupling (2).
4. Reconnect wires. Refer to **IOM Appendix D** for more information.

4.M.24.2 Pump

4.M.24.2.A Disassembly

1. Confirm that all pressure gauges read zero before disconnecting any pressure lines.
2. Ensure the actuator has been drained of oil and top drain plug has been removed.

NOTE: *An oil drain bin should be ready to catch any oil that may drain from disconnecting lines.*

3. Disconnect tubing from the pump.
4. While supporting the pump, remove set screw from coupling (2).
5. Remove two bolts (12) and two lock washers.
6. Remove pump.

4.M.24.2.B Reassembly

1. Engage replacement pump with mounting bracket and coupling.
2. Apply blue Loctite on pump screws and install the motor washers.
3. Replace set screw in coupling.
4. Reconnect tubing, tighten adapters (19) and refill actuator with oil.
5. Before running motor, prime the pump by turning the coupling by hand approximately 5 rotations. This will move the oil throughout the pump and manifold.

BOOSTER PUMP

4.M.24.3 Manifold

4.M.24.3.A Disassembly

1. Confirm that all pressure gauges read zero before disconnecting any pressure lines
2. Ensure the actuator has been drained of oil and top drain plug has been removed.

NOTE: *An oil drain bin should be ready to catch any oil that may drain from disconnecting lines.*

3. Disconnect tubing from the manifold.
4. While supporting the manifold, remove four mounting bolts and take manifold off of mounting bracket.

4.M.24.3.B Reassembly

1. Secure the new manifold to the mounting bracket with the four mounting bolts.
2. Reconnect tubing, tighten adapters (19) and refill actuator with oil.
3. Before running motor, turn the coupling by hand approximately 5 rotations. This will move the oil throughout the pump and manifold.

4.M.25 TRANSDUCER

Identification

Below is a typical installation of a pressure transducer on a REXA actuator. The ¼" stainless steel tubing going to the transducer is the fluid side. The large, NPT wire end of the transducer threads into the transducer wiring box shown below.

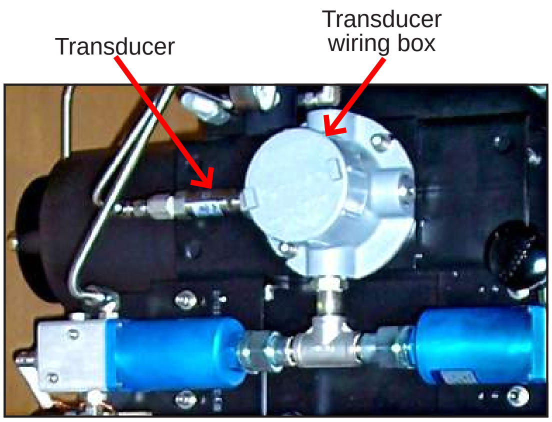


Figure 4.M.25 Transducer

CAUTION: The REXA pressure transducer may have up to 2 500 psi of fluid pressure connected to it. Care must be taken during this repair.

4.M.25.1 Disassembly

1. If the unit is an accumulator fail system, then the unit must be in its fail safe position and the accumulator in its trip state.
2. Open the manual bypass by turning the "Bypass" hex counterclockwise on the power module's front face. With the accumulator in the trip state this will drain the accumulator pressure to 0 psi.

NOTE: *Ensure that the high pressure accumulator gauge located on the gauge block reads 0 psi before proceeding.*

TRANSDUCER

3. Turn off electrical power to the unit.
4. Close the manual override levers on the accumulator solenoids for accumulator fail units only. Refer to IOM Appendix C, section C.4 for more details.
5. Remove the cover from the transducer wiring box and disconnect both leads going to the transducer.
6. Disconnect the ¼″ hydraulic fitting from the base of the transducer after placing an oil catch pan under the unit.
7. Unthread the transducer from the transducer wiring box.

4.M.25.2 Reassembly

1. Apply thread sealant to the threads on both ends of the transducer. Thread the transducer into the transducer wiring box.
2. Reconnect the ¼" hydraulic fitting to the base of the transducer.
3. Re-wire the transducer into the transducer wiring box. Refer to **Appendix P of the IOM** for interconnect wiring diagrams.
4. Re-install the transducer wiring box cover.
5. Turn on electrical power to the unit.

EXTERNAL RESERVOIR / ACCUMULATOR BOTTLE

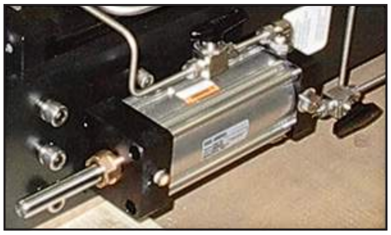


Photo 4.M.26-1
Piston cylinder

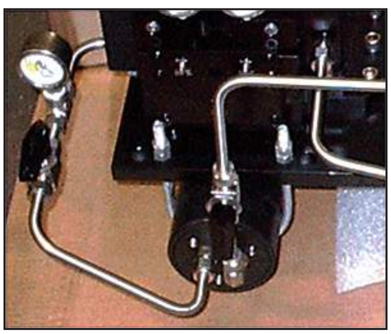


Photo 4.M.26-2
Accumulator bottle

Photo 4.M.26-3
Hydraulic port

4.M.26 EXTERNAL RESERVOIR AND ACCUMULATOR BOTTLE

Reservoir Identification

REXA uses two types of reservoir bottles depending on the oil volume required for the system. The first type is a spring loaded piston cylinder. It is identified by the gray body and stainless indicator rod protruding out one end. Depending on the system it may have one or two hydraulic lines coming off of the end cap.

CAUTION: The REXA reservoir is a pressure vessel that typically may have up to 60 psi of fluid pressure. Care must be taken during this repair.

The second type of reservoir is a low pressure accumulator bottle. These are typically painted black and there will be two hydraulic ports side by side on one end cap as shown in Photo 4.M.26-2. Any bottles having only one hydraulic port to the end cap is not a reservoir but is a high pressure fail safe accumulator. There are some units that will not have hydraulic lines to both of these ports but both ports will be present if it is a reservoir.

CAUTION: The REXA accumulator bottle is a pressure vessel that typically may have up to 2500 psi of fluid pressure. Care must be taken during this repair.

Accumulator Identification

REXA uses piston type accumulator bottles for all the accumulator fail units. An accumulator fail actuator will have both an accumulator and a reservoir bottle. The accumulator bottle can be identified by having only one hydraulic port located in the end cap as shown in Photo 4.M.26-3. Following the hydraulic line from the bottle will lead you to a pressure gauge indicating the pressure in the accumulator bottle.

EXTERNAL RESERVOIR / ACCUMULATOR BOTTLE

4.M.26.1 Disassembly:

1. If the unit is an accumulator fail system, then the unit must be in the fail safe position and the accumulator fail in the trip state.
2. Open the manual bypass by turning the "Bypass" hex counterclockwise on the power module's front face. With the accumulator in the trip state this will drain the accumulator pressure to 0 psi.

NOTE: *Ensure that the high pressure accumulator gauge located on the gauge block reads 0 psi before proceeding.*

3. Close the manual override levers on the accumulator solenoids for accumulator fail units only. Refer to **IOM Appendix C, section C.4** for more details.
4. For accumulator replacement – The bottle can now be safely removed, continue on for reservoir replacement.
5. On most reservoir bottles there will be a ¼-turn isolation valve. Close this isolation valve so that the handle is perpendicular to the valve body.
6. Clamp the reservoir power module indicator. See **TS&R Appendix F** for information on indicator clamping.
7. Attach the REXA bleed kit to one of the open purge ports on the power module body. Refer to **IOM section 1.6.7** for port identification.
8. Place an oil catch pan under the bleed kit port; open the reservoir ¼-turn valves, remove the REXA indicator clamp and open the ¼-turn valve on the purge kit. This will allow the system oil to drain.
9. Close off the ¼-turn valves going to the reservoir. The reservoir can now be safely removed.

EXTERNAL RESERVOIR / ACCUMULATOR BOTTLE

4.M.26.2 Reassembly:

1. Replace appropriate bottle.
2. Remove the bleed assembly.
3. Open up all isolating ball valves
4. Reference section 1.6 of the IOM for re-filling the actuator.

Appendix A

List of Recommended Tools

REXA offers three tool kits which provide the needed tools to rebuild power modules, control enclosures and most cylinders: the Standard Tool Kit (TK-2); the Tube Bending Kit (TK-3), and the Bleed Kit with Oil Gun (TK-4). Actuator Bleed Kit (K09275) and Oil Gun (S03082) are also available.

TK-2, the Standard Tool Kit

The standard tool kit is contained in a rugged, high-visibility tool case which features convenient removable pallets and a combinatyion lock for optimal security. The kit contains the following:

Description	Qty	Item #.
Hex Key Set, Ball End	13 pcs	TOOL-0001
Pick Set	4 pcs.	TOOL-0002
Side Cutter/Needle Nose Pliers	1 ea.	TOOL-0003
Stranded Wire Stripper/Cutter	1	TOOL-0004
Tongue and Groove 12" Channellock Pliers	1	TOOL-0005
Adjustable Wrench Set	3 pcs.	TOOL-0007
Retaining Ring Pliers	2 pcs.	TOOL-0008
Nut Driver Set	7 pcs.	TOOL-0009
Screw Driver Set	8 pcs.	TOOL-0010
Mini Screw Driver Set	2 pcs.	TOOL-0011
Combination Wrench Set	9 pcs.	TOOL-0012
Strap Wrench Set	2 pcs.	TOOL-0013
2 lb. Rubber Hammer	1	TOOL-0014
Mag Lite 2D Flashlight	1	TOOL-0015
Feeler Gauge	1	TOOL-0016
Hacksaw with Blade	1	TOOL-0017
Utility Knife	1	TOOL-0018
Tool Case	1	TOOL-0019

Photo A-1 Tool kit (TK-2)

TK-3, the Tube Bending Kit

The tubing kit contains the following:

Description	Qty	Item #
¼" Tube Bender	1	TOOL-0020
⅜" Tube Bender	1	TOOL-0021
Tube Cutter	1	TOOL-0022
Tube Deburring Tool	1	TOOL-0023

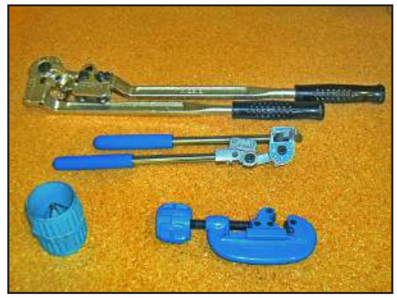


Photo A-2 Tube Bending Kit (TK-#)

TK-4, the Bleed Kit

The bleed kit contains the following:

Description	Qty	Item #.
Schrader Oil Gun Assembly	1	S03082
Bleed Kit	1	K09275

Photo A-3 Bleed Kit (TK-4)

Appendix B

Returning the Actuator for Repair

This section contains information on how to return a faulty actuator for repair or replacement.

B.1 Return Procedure

1. Call REXA at (508) 584-1199 during regular business hours to get a Returned Materials Authorization Number (RMA#).

NOTE: *Do not attempt to return materials or other equipment without a valid RMA number. Returns received without a valid RMA number are not accepted and are returned to sender.*

2. REXA is not responsible or liable for damage resulting from improper packaging or shipment.
3. Ship the actuator to:

   REXA
   4 Manley Street
   W. Bridgewater, MA 02379
   Attn: Repair Dept., RMA#____

4. REXA will determine the failure and cost to repair. No work will be performed without your authorization. A minimum charge for diagnostic evaluation will apply.

ELECTRAULIC™ ACTUATION

RETURN MATERIALS AUTHORIZATION

KOSO AMERICA, INC.
4 Manley Street
W. Bridgewater, MA 02379
Tel.: 508.584.1199
Fax: 508.584.2525

DATE:	SERIAL #	RETURN SHIPPING VIA:	CUSTOMER P.O.#	Commission/Installation Date (REXA use only)

SECTIONS ❶ THRU ❹ **MUST** BE COMPLETED BEFORE AN RMA WILL BE ISSUED.	Date Received	Date Evaluated	Date Scheduled

❶ BILLING ADDRESS

Company:______________________________
Address:______________________________
____
____
Contact:______________________________
Tel:______________ Fax:______________
e-mail:______________________________

❷ SHIPPING ADDRESS

Company:______________________________
Address:______________________________
____
____
Contact:______________________________
Tel:______________ Fax:______________
e-mail:______________________________

❸ ITEM(S) BEING RETURNED

☐ Actuator ☐ Electronics
☐ Other:________________

ENVIRONMENTAL CONDITION:
Ambient Temperature________
Location: ☐ INSIDE ☐ OUTSIDE

Include photo of problem & installation.

Electronics: SUPPLY VOLTAGE_________ CONTROL SIGNAL__________

Last error: _______ Number of: _______ starts × 1k _____ strokes × 1k _____

Fb bad ______ Dir error ______
Cs bad ______ Drv fault ______
Stall ______ *Drive display ______

*Drive display location

❹ PROBLEM / FAILURE DESCRIPTION *(Give **detailed** description(s) to the following questions on a separate sheet of paper and attach to this form to ensure conclusive findings)***:**

1. Date and time of failure?
2. When did the issue first begin? What were the characteristics of this event, and what actions were taken?
3. Describe the operational conditions at the time.
4. Describe what failed…and how.
5. How was the failure diagnosed?
6. Have there been any recent site shutdown or restarts on the installation or associated equipment?
7. Any normal or special maintenance procedures performed over the life of the unit? What was the reason and when (compared to failure date)?
8. What application/function does the actuator perform?

Action Requested: ☐ REPAIR ☐ TROUBLESHOOT / ADVISE ☐ REFURBISH **Requested Return Date:**____________

Prepared By:______________________________ **Representative:**______________________________

Notes:
1. Completing this form will ensure a faster and less costly turn around.
2. Before shipping the unit, make certain that the unit is properly cleaned to prevent injury to factory technicials while unpacking (due to hazardous substances on unit). If unit requires additional cleaning prior to receipt, turn arouond time and cost of order will increase.
3. Package the actuator properly and correctly to prevent damage during shipping. KOSO AMERICA is not responsible for damage during shipping.
4. A miinimum 2 hour diagnostic charge will apply to all non-warranty evaluations.
5. REXA RMA number **must** appear on all packages.

REP	
%	
BC	

REXA
Electraulic
Actuators & Drives

KOSO America
4 Manley Street
W. Bridgewater, MA 02379
Tel: 508•584•1199
Fax: 508•584•2525

RETURN MATERIALS AUTHORIZATION v03

DATE:	SERIAL #	RETURN SHIPPING VIA:	CUSTOMER P.O. #	WORK ORDER # (for REXA use only)

SECTIONS ❶ THRU ❹ *MUST* BE COMPLETED BEFORE AN RMA WILL BE ISSUED.	Date Received	Date Evaluated	Date Scheduled

❶ BILLING ADDRESS

Company: ______________________________

Address: ______________________________

____

____

Contact: ______________________________

Tel: _______________ Fax: _______________

e-mail: ______________________________

❷ SHIPPING ADDRESS

Company: ______________________________

Address: ______________________________

____

____

Contact: ______________________________

Tel: _______________ Fax: _______________

e-mail: ______________________________

❸ ITEM(S) BEING RETURNED

☐ ACTUATOR ☐ ELECTRONICS ☐ OTHER _______________

Model No.: ______________________________

Electronics: SUPPLY VOLTAGE __________ CONTROL SIGNAL __________

ENVIRONMENTAL CONDITION:

Ambient Temperature __________

Location: ☐ inside ☐ outside

❹ PROBLEM/FAILURE DESCRIPTION:

ACTION REQUESTED: ☐ REPAIR ☐ TROUBLESHOOT/ADVISE ☐ REFURBISH

REQUESTED RETURN DATE: _______________

PREPARED BY: ______________________ **REPRESENTATIVE:** ______________________

NOTES:

1. Completing this form will ensure a faster and less costly turn around on repair of the actuator.
2. Before shipping the actuator, make certain that the unit is properly cleaned to prevent injury to factory technicians while unpacking (due to hazardous substances on unit). If unit requires additional cleaning prior to repair, turn around time and cost of repair will increase.
3. Package the actuator properly and correctly to prevent damage during shipping. KOSO AMERICA is not responsible for damage during shipping.
4. A minimum 4 hour labor or 2 hour diagnostic charge will apply to all non-warranty repairs.
5. REXA RMA number **must** appear on all packages.

REP	
%	
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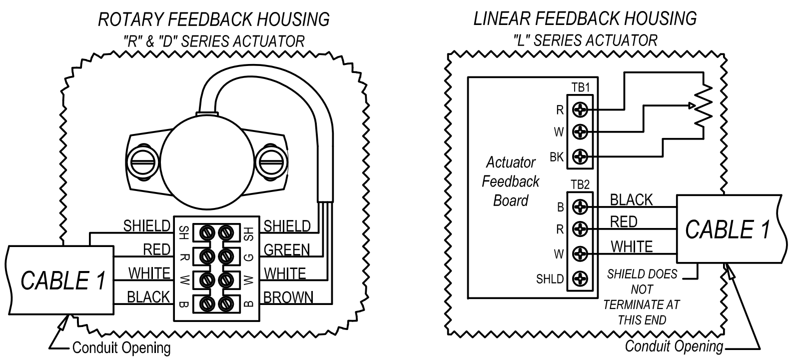
Appendix C

Circuit Schematics



(1) CABLE 1 - 3 CONDUCTOR *(SIGNAL LEVEL)*
18 AWG UP TO 300 FT.
OVERALL FOIL SHIELD
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX 0.25"
REXA PART # : P96192

(1) CABLE 2 - 11 CONDUCTOR *(HIGH VOLTAGE)*
4 TWISTED PAIR/1 TWISTED TRIAD
OVERALL FOIL SHIELD
16 AWG UP TO 300 FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.625"
REXA PART # : P96191-X2

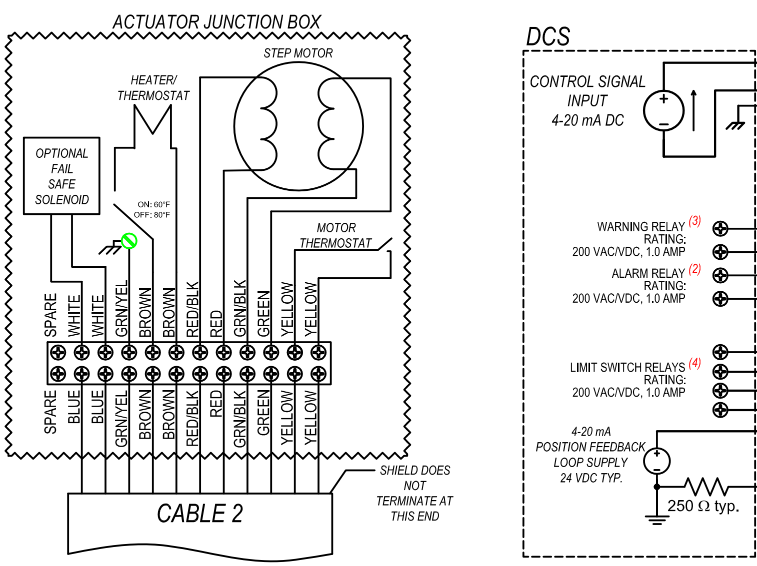
NOTES:

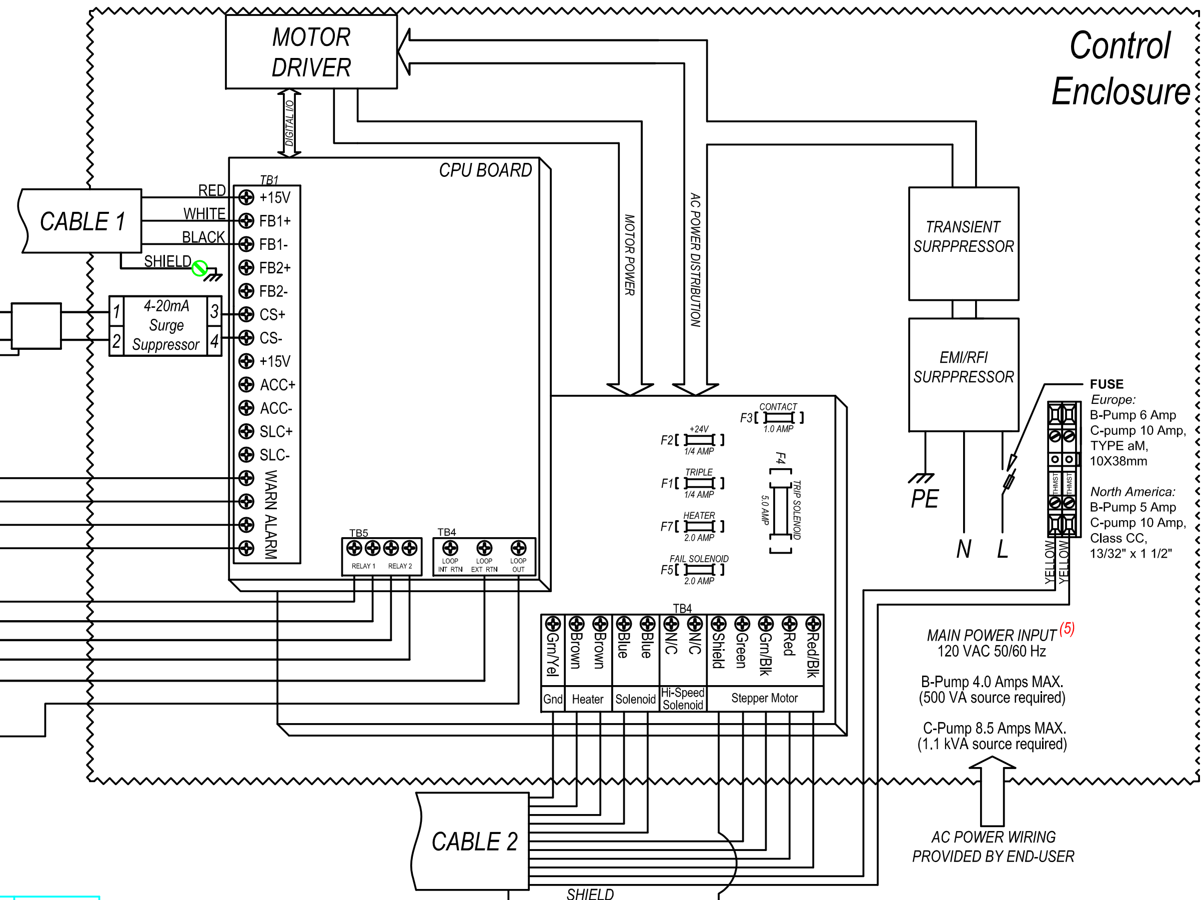
1. Cable lengths above 300 ft. must increase AWG Consult Factory
2. ALARM: The output is in the "alarm" state whenever the actuator is unable to follow the control signal/control scheme as defined in the Signals menu. An "alarm" occurs if the actuator is switched to local Manual.
3. WARNING: The output is in the "alarm" state whenever ALARM is in the "alarm" state or when the actuator detects a problem but can otherwise continue to operate.
4. LIMIT SWITCH INDICATION: Both relay 1 and relay 2 are solid state, normally open, switches. When a relay is active, its output is conductive.
5. To comply with IEC 61010, a Supply disconnect device with the proper rating should be used. The supply disconnecting device shall disconnect (isolate) the Control Enclosure/Actuator from the supply when required.

⚠ Attention ⚠

For Proper Actuator Operation

1.) Signal Level Cables must remain separate from High Voltage cables in a separate tray or conduit.
   a.) Keep cables separate by at least 1 meter.
2.) Maintain shield coverage of the Motor Power cable all the way to the terminal block.
3.) Maintain shield coverage of the Signal cables all the way to the terminal block
3.) REXA Motor and Power cables must be kept away from sensitive equipment and associated wiring by at least 1 meter.
4.) REXA Feedback cables must be at least 1 meter away from high voltage cables.





D97904 Rev. 4
STEPPER WIRING DIAGRAM

REV.	DESCRIPTION	DATE	APRVD
4	Added Control Signal Surge Suppressor.	1/6/10	KCL

D97904 — STEPPER WIRING DIAGRAM

D97904-.5D — ½D SERVO WIRING DIAGRAM

NOTES:
1. Cable lengths MAX. 700 ft.
2. ALARM: The output is in the "alarm" state whenever the actuator is unable to follow the control signal/control scheme as defined in the Signals menu. An "alarm" occurs if the actuator is switched to local Manual.
3. WARNING: The output is in the "alarm" state whenever ALARM is in the "alarm" state or when the actuator detects a problem but can otherwise continue to operate.
4. LIMIT SWITCH INDICATION: Both relay 1 and relay 2 are solid state, normally open, switches. When a relay is active, its output is conductive.
5. To comply with IEC 61010, a Supply disconnect device with the proper rating should be used. The supply disconnecting device shall disconnect (isolate) the Control Enclosure/Actuator from the supply when required.

(1) CABLE 1 - 3 CONDUCTOR *(SIGNAL LEVEL)*
18 AWG UP TO 700 FT.
OVERALL FOIL SHIELD
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX 0.25"
REXA PART NO.: P96192

(1) CABLE 2 - 4 INDIVIDUALLY SHIELDED PAIRS, *(SIGNAL LEVEL)*
OVERALL FOIL SHIELD
20 AWG UP TO 700FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.42"
REXA PART NO.: P98272

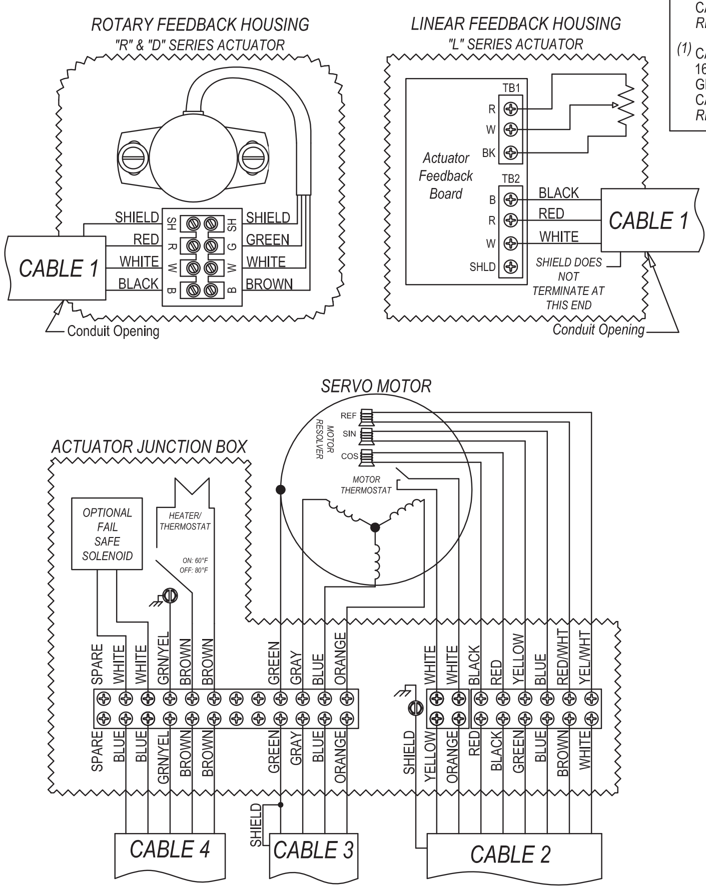
(1) CABLE 3 - 4 CONDUCTOR, *(HIGH VOLTAGE)*
OVERALL FOIL SHIELD
14 AWG UP TO 700FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.61"
REXA PART NO.: P96402-14

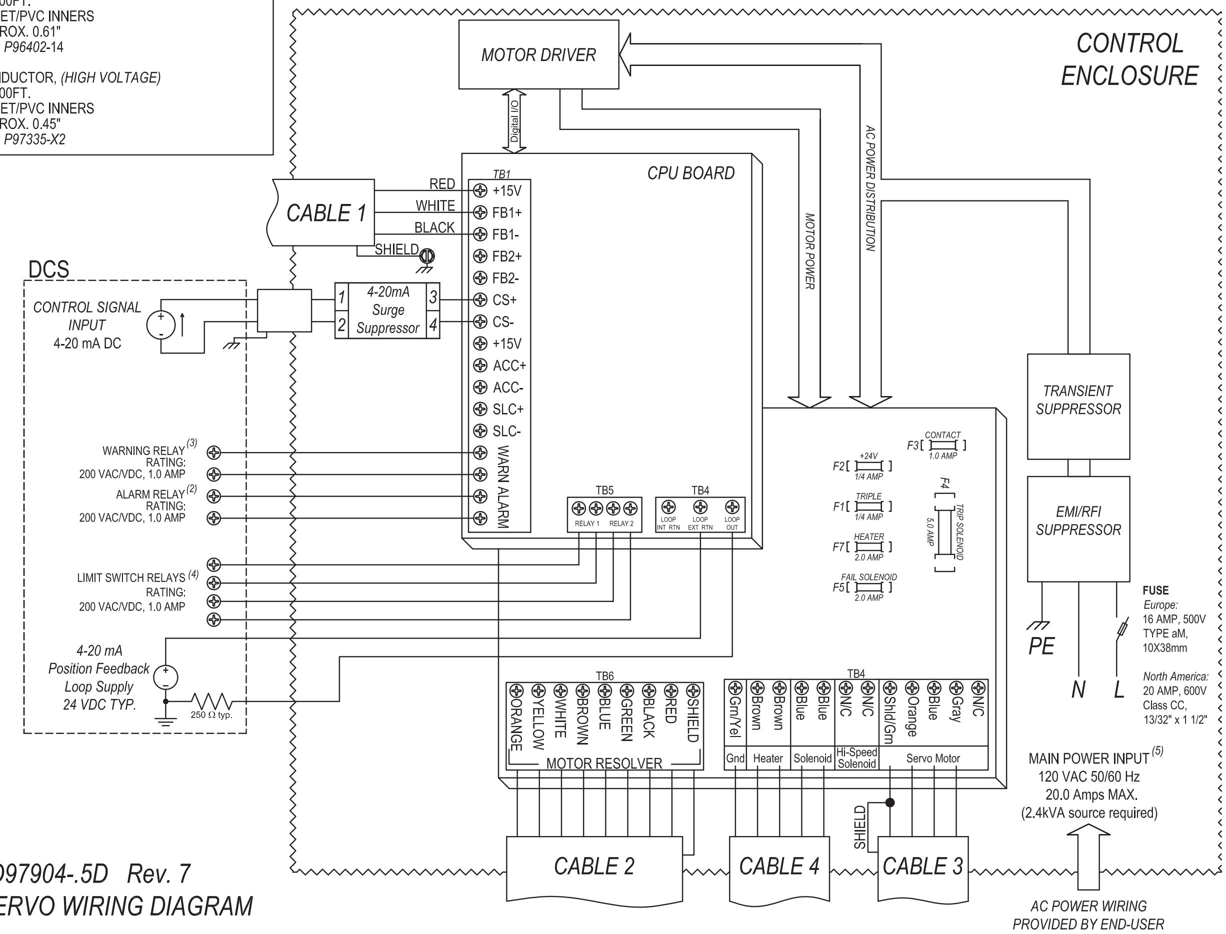
(1) CABLE 4 - 5 CONDUCTOR, *(HIGH VOLTAGE)*
16 AWG UP TO 700FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.45"
REXA PART NO.: P97335-X2

⚠ **Attention** ⚠

For Proper Actuator Operation:
1.) Signal Level Cables must remain separate from High Voltage cables in a separate tray or conduit.
a.) Keep cables separate by at least 1 meter.
2.) Maintain shield coverage of the Motor Power cable all the way to the terminal block.
3.) Maintain shield coverage of the Signal cables all the way to the terminal block
3.) REXA Motor and Power cables must be kept away from sensitive equipment and associated wiring by at least 1 meter.
4.) REXA Feedback cables must be at least 1 meter away from high voltage cables.

Servo Driver PHASE T is Motor ORANGE
Servo Driver PHASE R is Motor BLUE
Servo Driver PHASE S is Motor GRAY
MOTOR RETURN to Servo Driver is Motor Green





D97904-.5D Rev. 7
1/2D SERVO WIRING DIAGRAM

NOTES:

1. Cable lengths MAX. 700 ft.
2. ALARM: The output is in the "alarm" state whenever the actuator is unable to follow the control signal/control scheme as defined in the Signals menu. An "alarm" occurs if the actuator is switched to local Manual.
3. WARNING: The output is in the "alarm" state whenever ALARM is in the "alarm" state or when the actuator detects a problem but can otherwise continue to operate.
4. LIMIT SWITCH INDICATION: Both relay 1 and relay 2 are solid state, normally open, switches. When a relay is active, its output is conductive.
5. To comply with IEC 61010, a Supply disconnect device with the proper rating should be used. The supply disconnecting device shall disconnect (isolate) the Control Enclosure/Actuator from the supply when required.

⚠ **Attention** ⚠

For Proper Actuator Operation:

1.) Signal Level Cables must remain separate from High Voltage cables in a separate tray or conduit.
   a.) Keep cables separate by at least 1 meter.

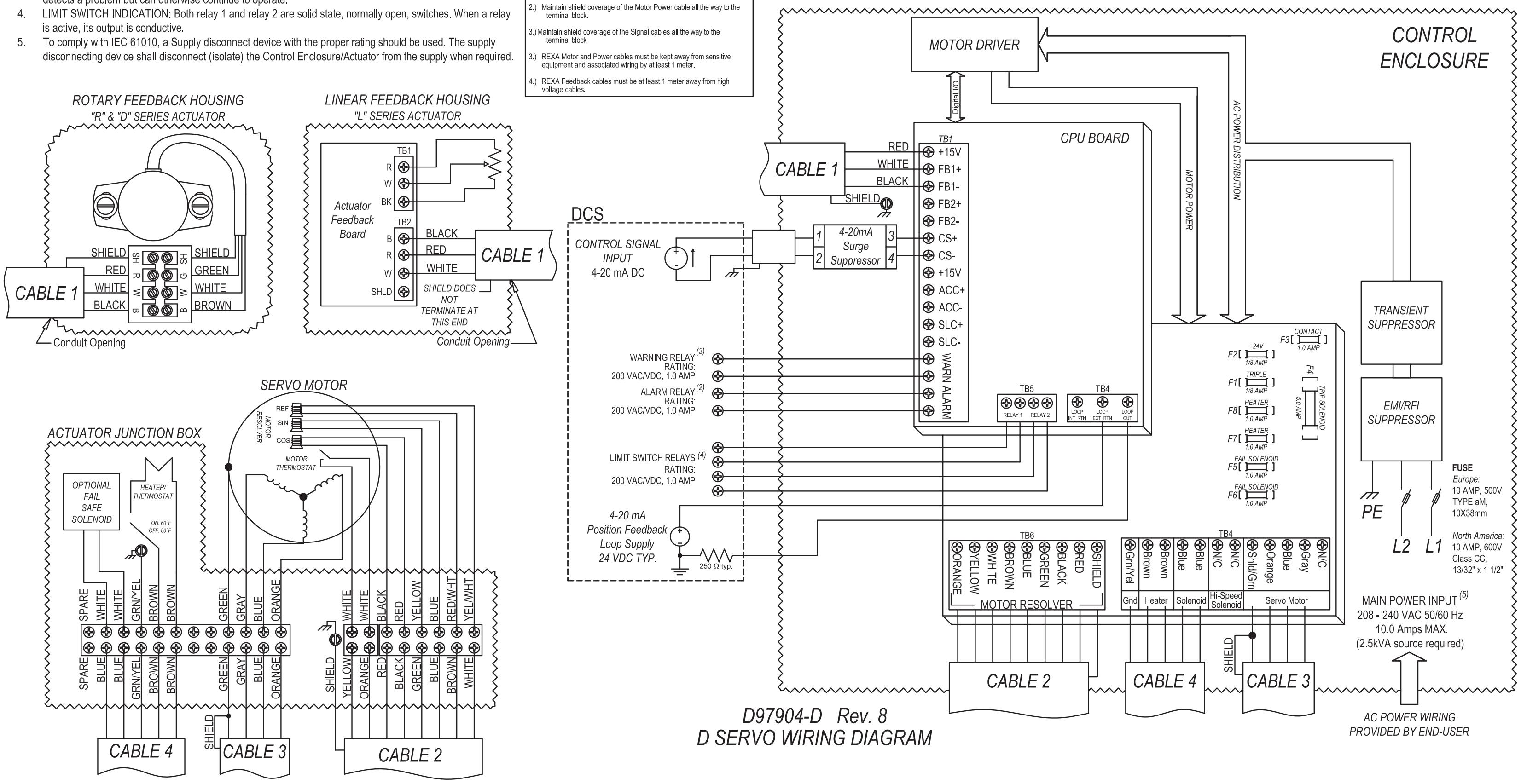
2.) Maintain shield coverage of the Motor Power cable all the way to the terminal block.

3.) Maintain shield coverage of the Signal cables all the way to the terminal block

3.) REXA Motor and Power cables must be kept away from sensitive equipment and associated wiring by at least 1 meter.

4.) REXA Feedback cables must be at least 1 meter away from high voltage cables.

Servo Driver PHASE T is Motor ORANGE
Servo Driver PHASE R is Motor BLUE
Servo Driver PHASE S is Motor GRAY
MOTOR RETURN to Servo Driver is Motor Green



D97904-D Rev. 8
D SERVO WIRING DIAGRAM

(1) CABLE 1 - 3 CONDUCTOR *(SIGNAL LEVEL)*
18 AWG UP TO 700 FT.
OVERALL FOIL SHIELD
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX 0.25"
REXA PART NO.: P96192

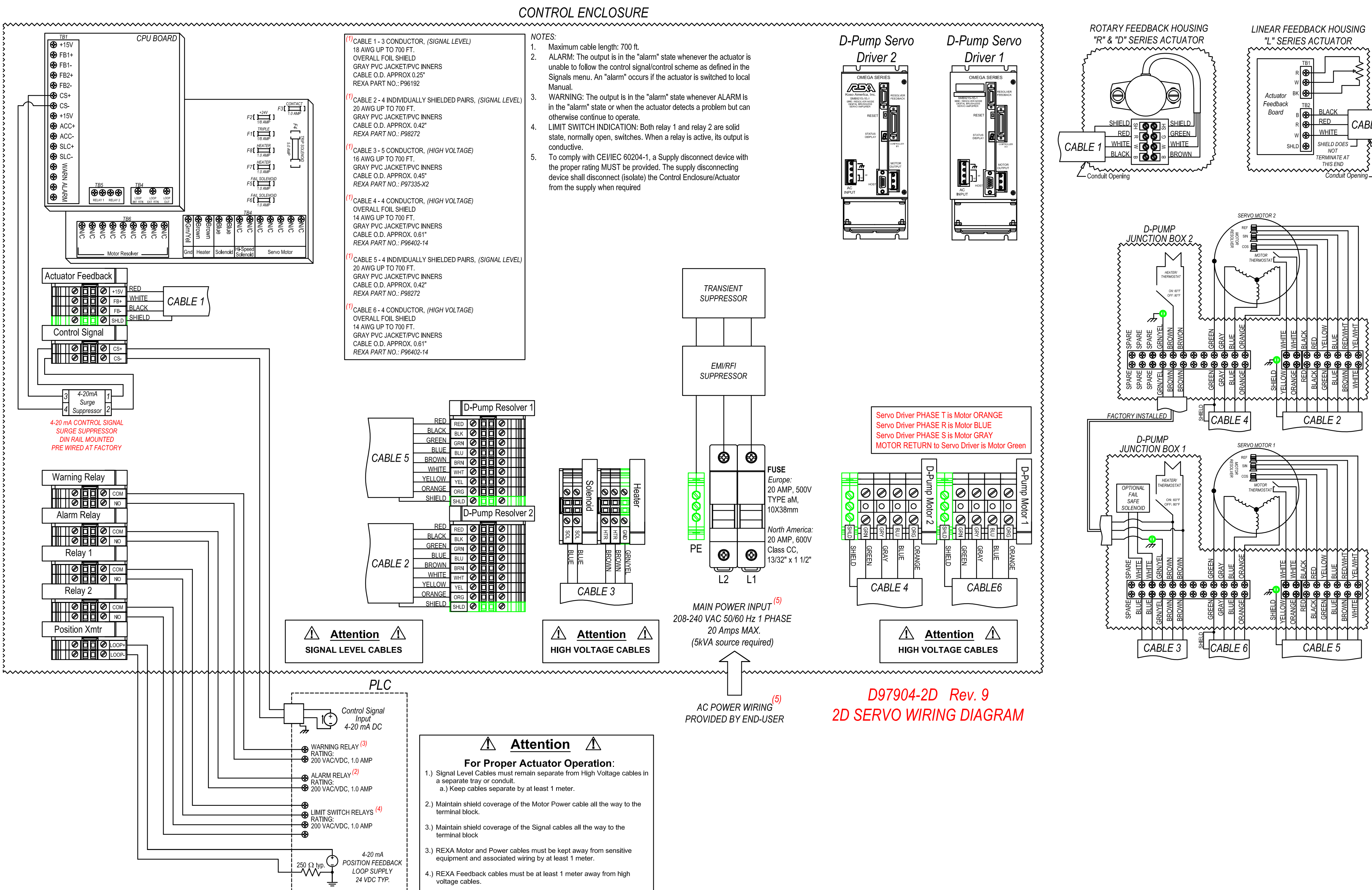
(1) CABLE 2 - 4 INDIVIDUALLY SHIELDED PAIRS, *(SIGNAL LEVEL)*
OVERALL FOIL SHIELD
20 AWG UP TO 700FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.42"
REXA PART NO.: P98272

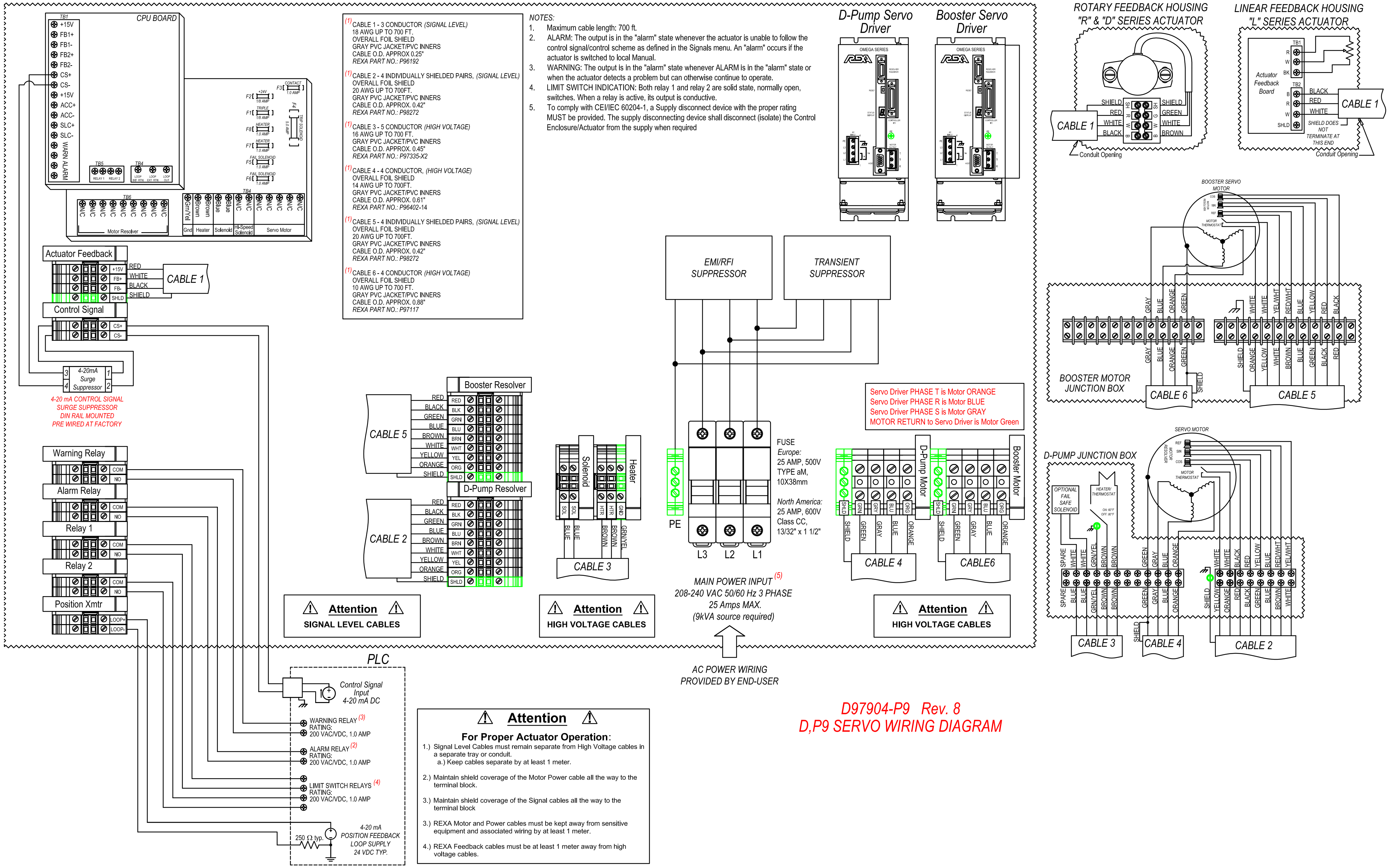
(1) CABLE 3 - 4 CONDUCTOR, *(HIGH VOLTAGE)*
OVERALL FOIL SHIELD
14 AWG UP TO 700FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.61"
REXA PART NO.: P96402-14

(1) CABLE 4 - 5 CONDUCTOR, *(HIGH VOLTAGE)*
16 AWG UP TO 700FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.45"
REXA PART NO.: P97335-X2

D97904-D — D SERVO WIRING DIAGRAM

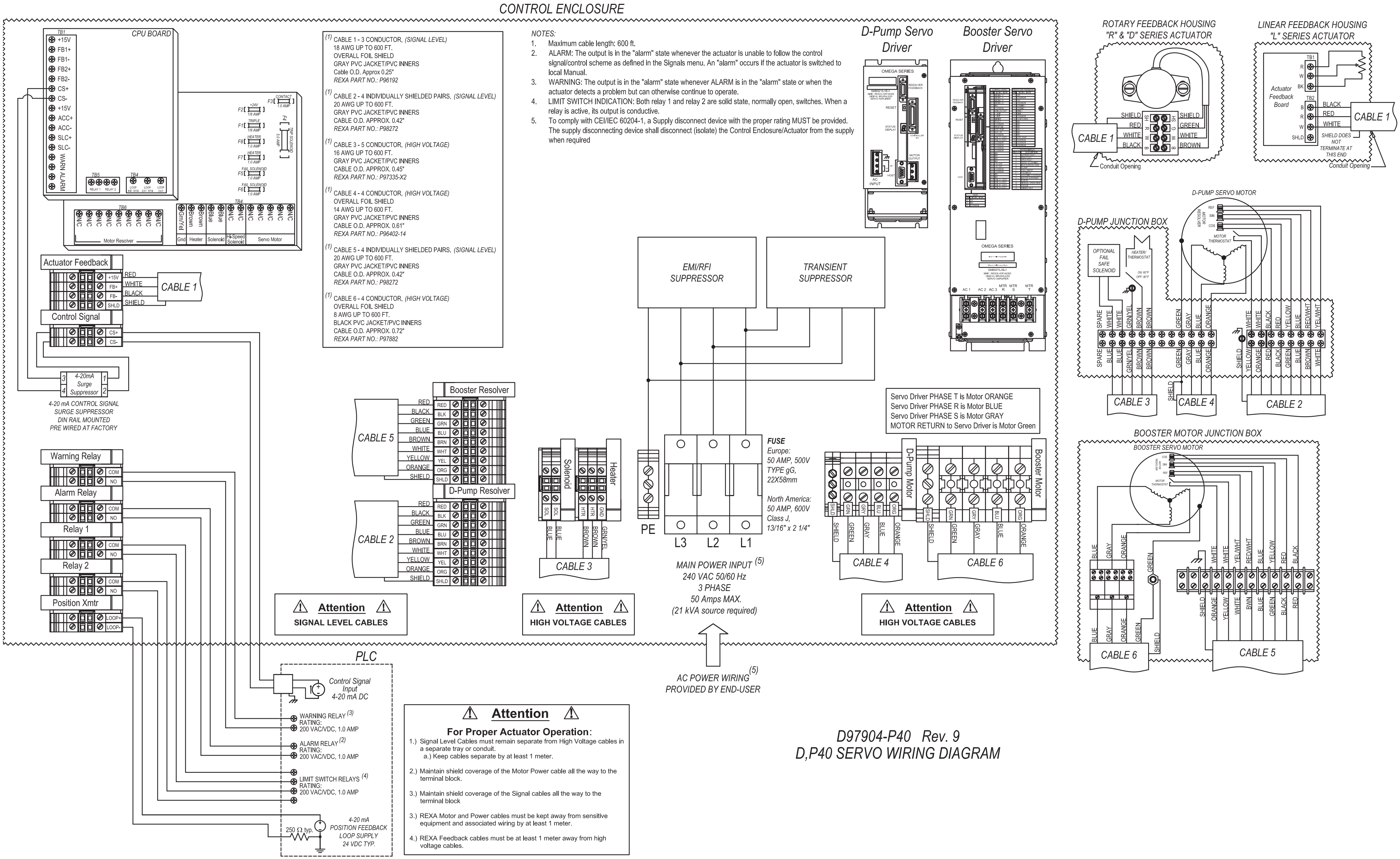
D97904-2D — 2D SERVO WIRING DIAGRAM





D97904-P9 — D,P9 SERVO WIRING DIAGRAM

D97904-P40 — D,P40 SERVO WIRING DIAGRAM



NOTES:
1. Cable lengths above 300 ft. must increase AWG Consult Factory
2. ALARM: The output is in the "alarm" state whenever the actuator is unable to follow the control signal/control scheme as defined in the Signals menu. An "alarm" occurs if the actuator is switched to local Manual.
3. WARNING: The output is in the "alarm" state whenever ALARM is in the "alarm" state or when the actuator detects a problem but can otherwise continue to operate.
4. LIMIT SWITCH INDICATION: Both relay 1 and relay 2 are solid state, normally open, switches. When a relay is active, its output is conductive.
5. To comply with IEC 61010, a Supply disconnect device with the proper rating should be used. The supply disconnecting device shall disconnect (isolate) the Control Enclosure/Actuator from the supply when required.

⚠ Attention ⚠

For Proper Actuator Operation

1.) Signal Level Cables must remain separate from High Voltage cables in a separate tray or conduit.
 a.) Keep cables separate by at least 1 meter.

2.) Maintain shield coverage of the Motor Power cable all the way to the terminal block.

3.) Maintain shield coverage of the Signal cables all the way to the terminal block

3.) REXA Motor and Power cables must be kept away from sensitive equipment and associated wiring by at least 1 meter.

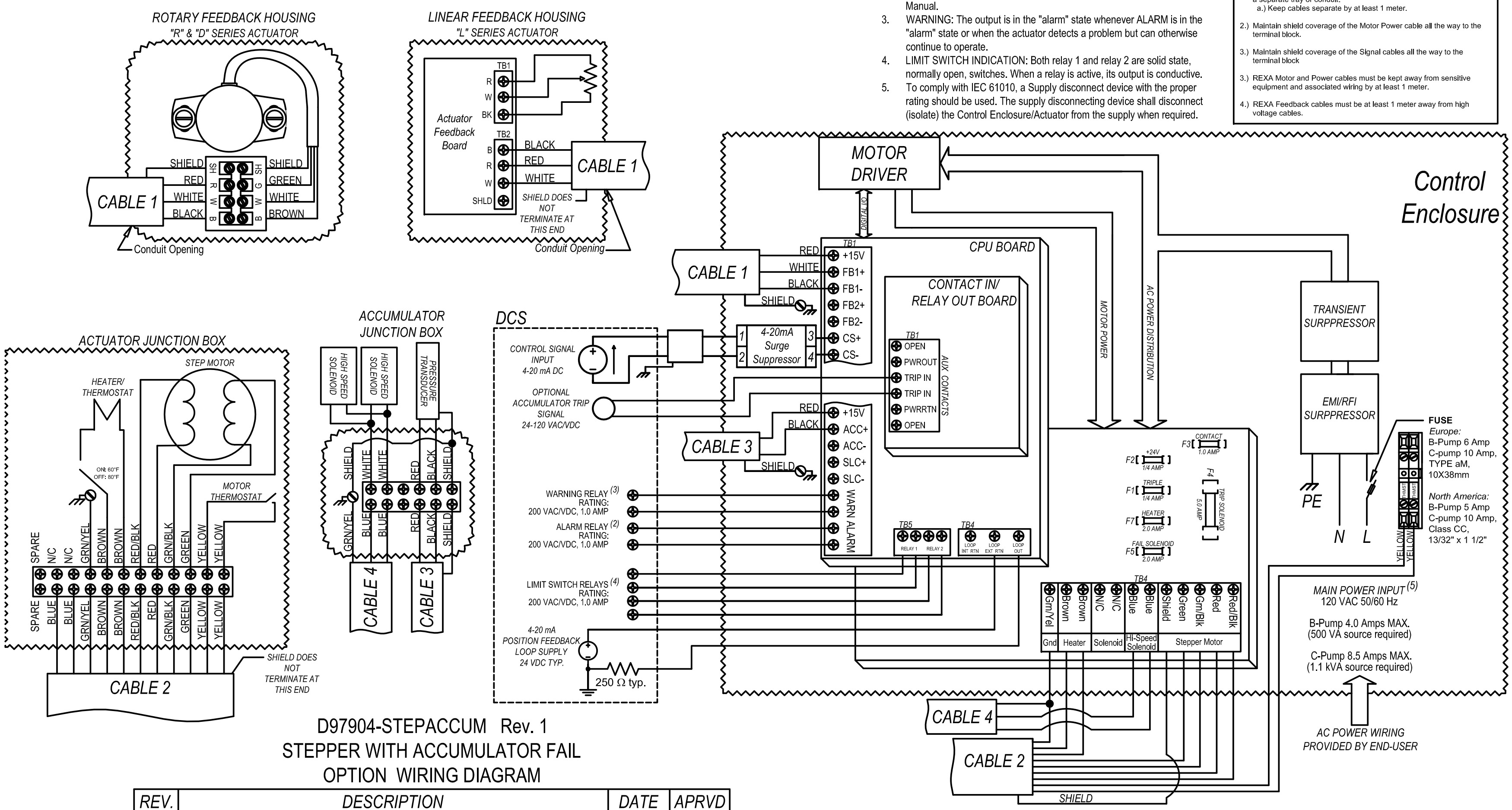
4.) REXA Feedback cables must be at least 1 meter away from high voltage cables.

(1) CABLE 1 - 3 CONDUCTOR *(SIGNAL LEVEL)*
18 AWG UP TO 300 FT.
OVERALL FOIL SHIELD
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX 0.25"
REXA PART # : P96192

(1) CABLE 2 - 11 CONDUCTOR *(HIGH VOLTAGE)*
4 TWISTED PAIR/1 TWISTED TRIAD
OVERALL FOIL SHIELD
16 AWG UP TO 300 FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.625"
REXA PART # : P96191-X2

(1) CABLE 3 - 3 CONDUCTOR *(SIGNAL LEVEL)*
18 AWG UP TO 300 FT.
OVERALL FOIL SHIELD
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX 0.25"
REXA PART # : P96192

(1) CABLE 4 - 3 CONDUCTOR *(HIGH VOLTAGE)*
16 AWG UP TO 300 FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.275"
REXA PART NO.: P97981



D97904-STEPACCUM Rev. 1
STEPPER WITH ACCUMULATOR FAIL
OPTION WIRING DIAGRAM

REV.	DESCRIPTION	DATE	APRVD
1	Added Control Signal Surge Suppressor. Added Jumper to Accumulator Junction Box. Added Rexa Part number & Signal level/High Voltage Designation	01/07/10	KCL

D97904-STEPACCUM — STEPPER WITH ACCUMULATOR FAIL OPTION

D97904-.5DACCUM — ½D SERVO WITH ACCUMULATOR FAIL OPTION

NOTES:

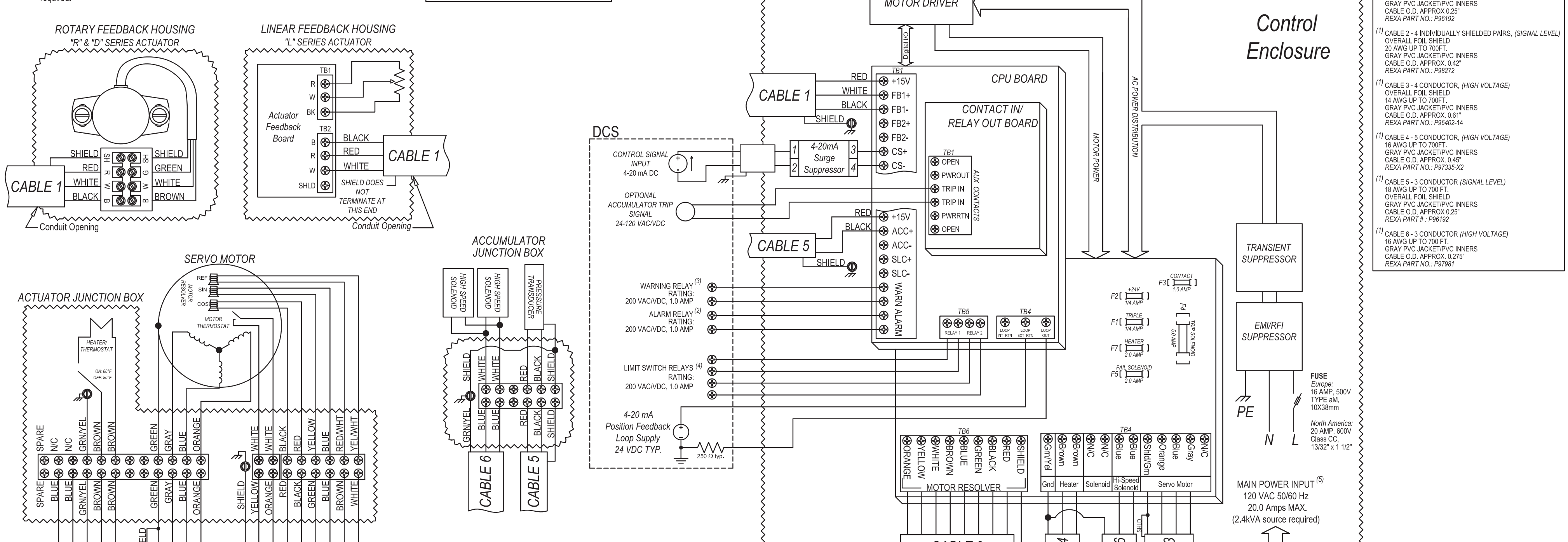
1. Cable lengths MAX. 700 ft.
2. ALARM: The output is in the "alarm" state whenever the actuator is unable to follow the control signal/control scheme as defined in the Signals menu. An "alarm" occurs if the actuator is switched to local Manual.
3. WARNING: The output is in the "alarm" state whenever ALARM is in the "alarm" state or when the actuator detects a problem but can otherwise continue to operate.
4. LIMIT SWITCH INDICATION: Both relay 1 and relay 2 are solid state, normally open, switches. When a relay is active, its output is conductive.
5. To comply with IEC 61010, a Supply disconnect device with the proper rating should be used. The supply disconnecting device shall disconnect (isolate) the Control Enclosure/Actuator from the supply when required.

⚠ **Attention** ⚠

For Proper Actuator Operation:

1.) Signal Level Cables must remain separate from High Voltage cables in a separate tray or conduit.
 a.) Keep cables separate by at least 1 meter.
2.) Maintain shield coverage of the Motor Power cable all the way to the terminal block.
3.) Maintain shield coverage of the Signal cables all the way to the terminal block
3.) REXA Motor and Power cables must be kept away from sensitive equipment and associated wiring by at least 1 meter.
4.) REXA Feedback cables must be at least 1 meter away from high voltage cables.

Servo Driver PHASE T is Motor ORANGE
Servo Driver PHASE R is Motor BLUE
Servo Driver PHASE S is Motor GRAY
MOTOR RETURN to Servo Driver is Motor Green



D97904-.5DACCUM Rev. 3
1/2D SERVO WITH ACCUMULATOR FAIL OPTION WIRING DIAGRAM

NOTES:
1. Cable lengths MAX. 700 ft.
2. ALARM: The output is in the "alarm" state whenever the actuator is unable to follow the control signal/control scheme as defined in the Signals menu. An "alarm" occurs if the actuator is switched to local Manual.
3. WARNING: The output is in the "alarm" state whenever ALARM is in the "alarm" state or when the actuator detects a problem but can otherwise continue to operate.
4. LIMIT SWITCH INDICATION: Both relay 1 and relay 2 are solid state, normally open, switches. When a relay is active, its output is conductive.
5. To comply with IEC 61010, a Supply disconnect device with the proper rating should be used. The supply disconnecting device shall disconnect (isolate) the Control Enclosure/Actuator from the supply when required.

⚠ Attention ⚠

For Proper Actuator Operation:

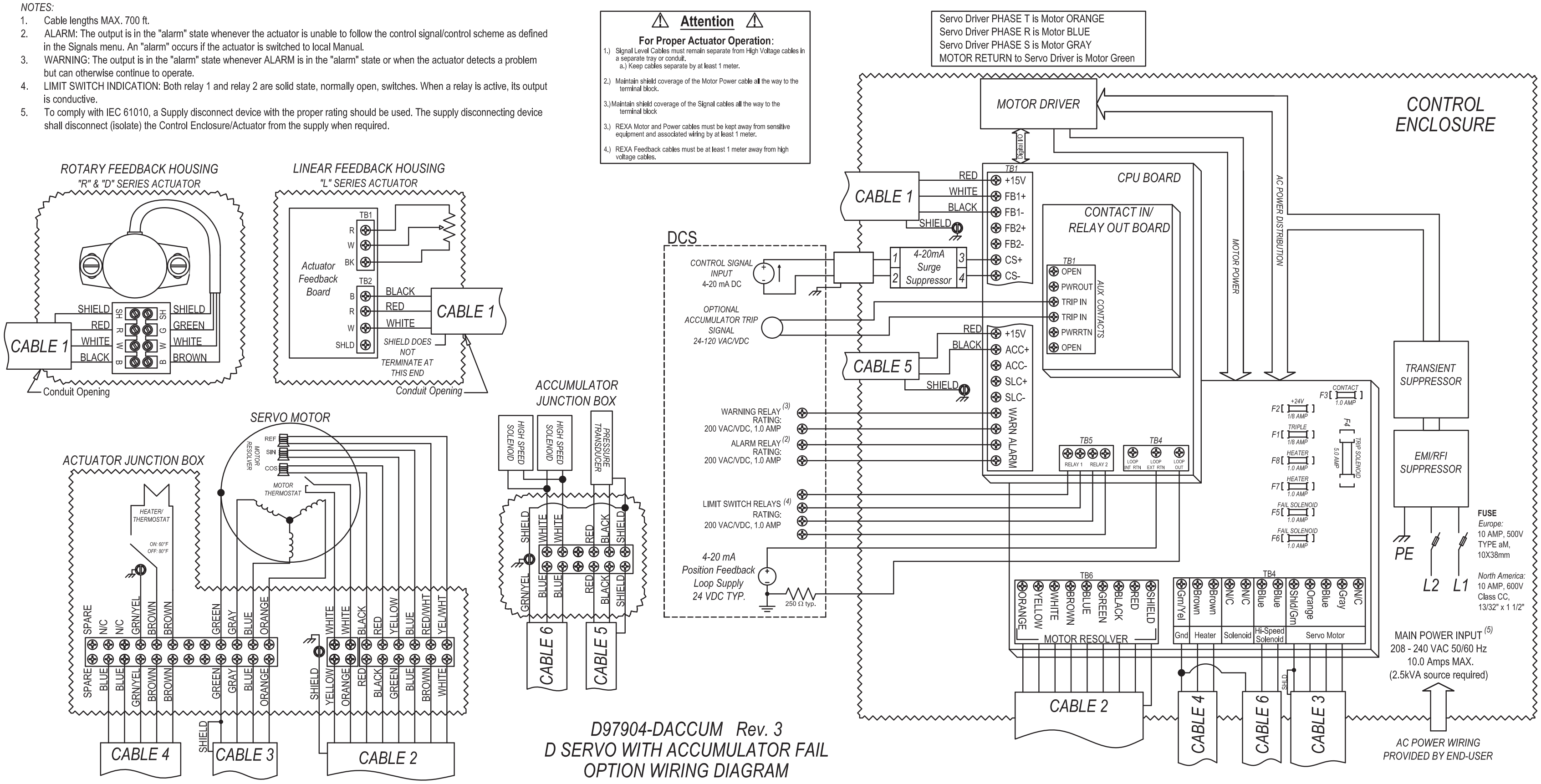
1.) Signal Level Cables must remain separate from High Voltage cables in a separate tray or conduit.
   a.) Keep cables separate by at least 1 meter.

2.) Maintain shield coverage of the Motor Power cable all the way to the terminal block.

3.) Maintain shield coverage of the Signal cables all the way to the terminal block

3.) REXA Motor and Power cables must be kept away from sensitive equipment and associated wiring by at least 1 meter.

4.) REXA Feedback cables must be at least 1 meter away from high voltage cables.



(1)CABLE 1 - 3 CONDUCTOR *(SIGNAL LEVEL)*
18 AWG UP TO 700 FT.
OVERALL FOIL SHIELD
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX 0.25"
REXA PART NO.: P96192

(1)CABLE 2 - 4 INDIVIDUALLY SHIELDED PAIRS, *(SIGNAL LEVEL)*
OVERALL FOIL SHIELD
20 AWG UP TO 700FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.42"
REXA PART NO.: P98272

(1)CABLE 3 - 4 CONDUCTOR, *(HIGH VOLTAGE)*
OVERALL FOIL SHIELD
14 AWG UP TO 700FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.61"
REXA PART NO.: P96402-14

(1)CABLE 4 - 5 CONDUCTOR, *(HIGH VOLTAGE)*
16 AWG UP TO 700FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.45"
REXA PART NO.: P97335-X2

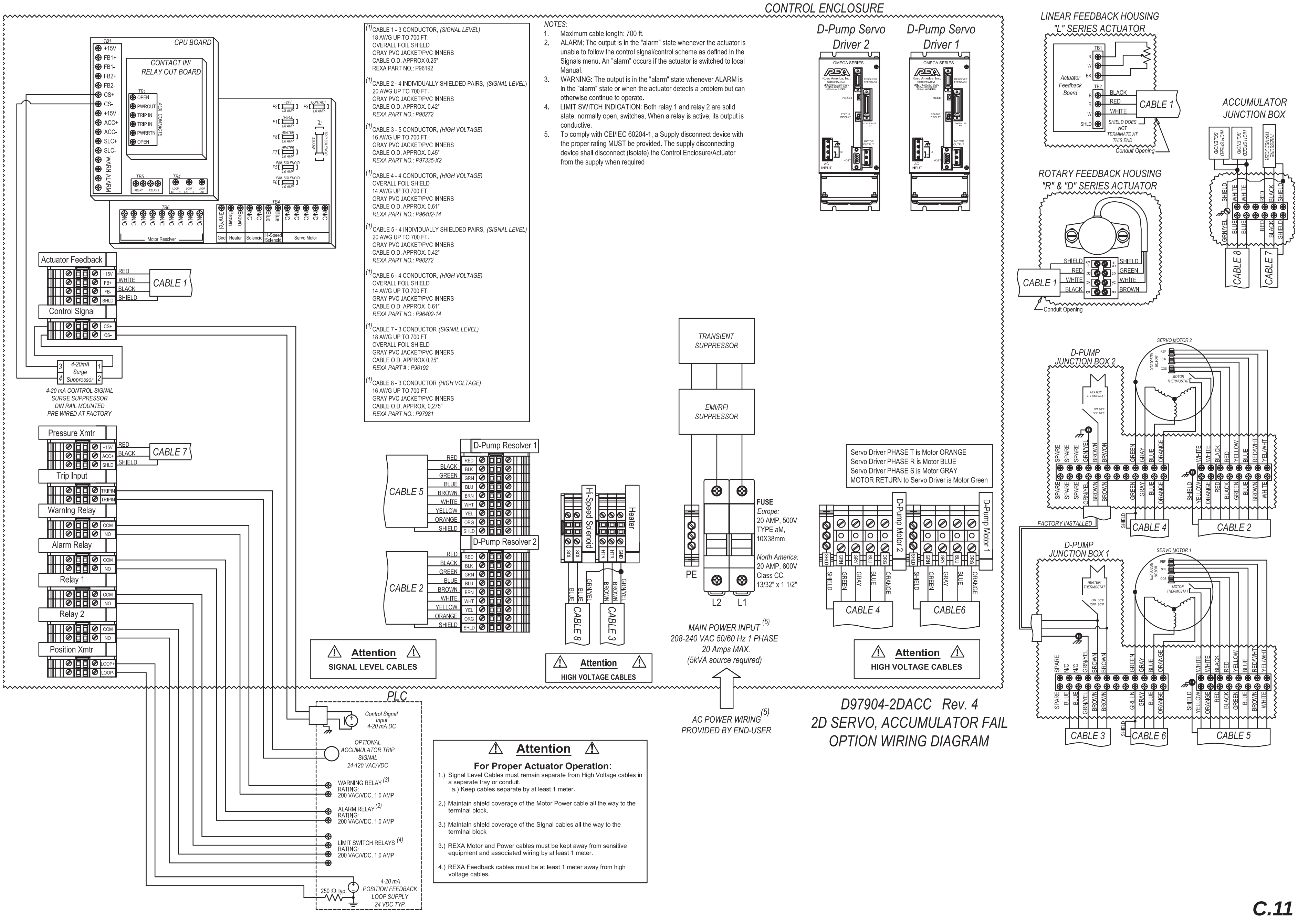
(1)CABLE 5 - 3 CONDUCTOR *(SIGNAL LEVEL)*
18 AWG UP TO 700 FT.
OVERALL FOIL SHIELD
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX 0.25"
REXA PART # : P96192

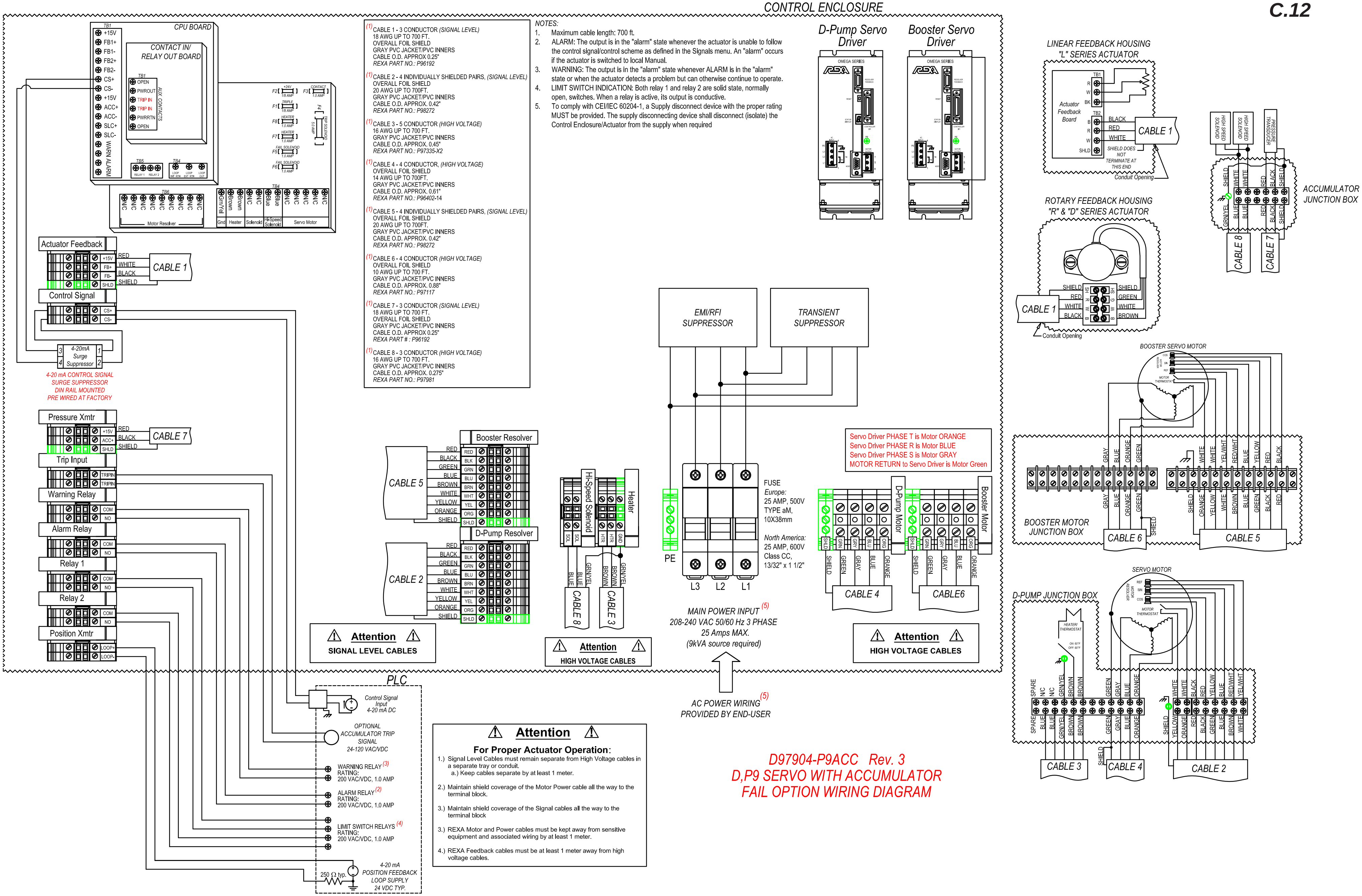
(1)CABLE 6 - 3 CONDUCTOR *(HIGH VOLTAGE)*
16 AWG UP TO 700 FT.
GRAY PVC JACKET/PVC INNERS
CABLE O.D. APPROX. 0.275"
REXA PART NO.: P97981

D97904-DACCUM Rev. 3
D SERVO WITH ACCUMULATOR FAIL OPTION WIRING DIAGRAM

D97904-DACCUM — D SERVO WITH ACCUMULATOR FAIL OPTION

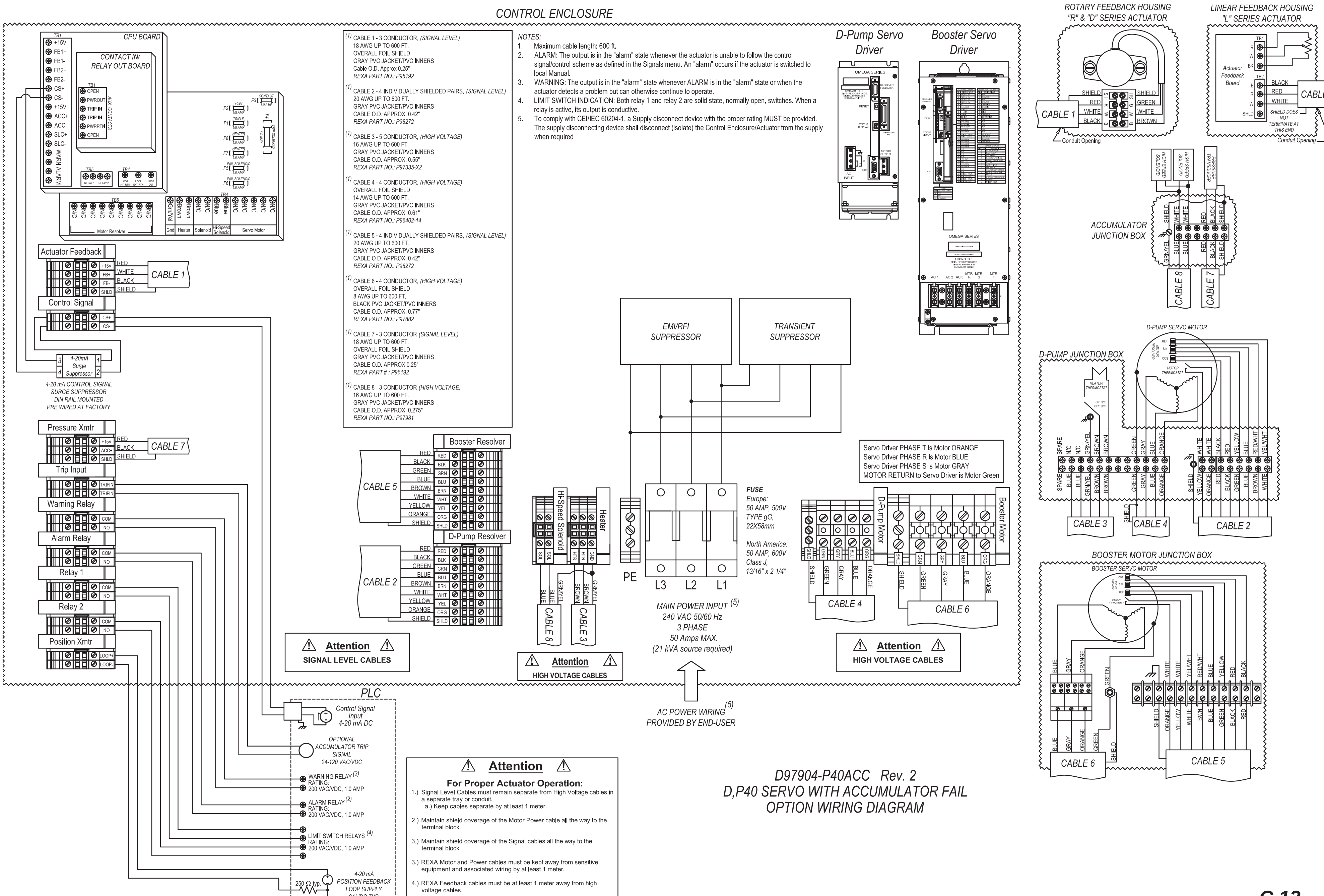
D97904-2DACC — 2D SERVO WITH ACCUMULATOR FAIL OPTION





D97904-P9ACC — D,P9 SERVO WITH ACCUMULATOR FAIL OPTION

D97904-P40ACC — D,P40 SERVO WITH ACCUMULATOR FAIL OPTION



D97904-P40ACC Rev. 2
D,P40 SERVO WITH ACCUMULATOR FAIL OPTION WIRING DIAGRAM

Appendix D

Cable Specifications

X2 MODULE CABLE SPECIFICATION

CABLE TYPE:	4 Twisted pair, 1 twisted triad
CONDUCTORS:	#16 AWG 19/29 Stranded Tinned Copper
CABLING:	4 Twisted pair, 1 twisted triad, wrap with an aluminum/mylar tape (foil side in). Pull in a #16 AWG tinned copper drain wire under this tape.
JACKET:	Gray PVC
FILLER:	As required
INSULATION:	Color Coded PVC Pair 1. Red with Red/Black Pair 2. Green with Green/Black Pair 3. Blue with Blue Pair 4. Yellow with Yellow Triad Brown and Brown and Green/Yellow
RATINGS:	Voltage rating; 600 volts Temp rating; -20 °C to +105 °C (-4 °F to +220 °F) Flammability; Passes UL VW-1 flame test
LABELING:	Label PVC jacket with company name and note (Repeat ever 1.0'); REXA P96191-X2 ***! ATTENTION ! – HIGH VOLTAGE CABLE – MUST BE SEPARATED FROM SIGNAL LEVEL CABLES AND SENSITIVE EQUIP-MENT BY AT LEAST 1 METER***
APPROX. O.D.	0.5 – .625"

FEEDBACK CABLE SPECIFICATIONS

CABLE TYPE:	3 Conductor
CONDUCTORS:	#18 AWG 16/30 Stranded Tinned Copper
CABLING:	3 Conductors together and wrap with an aluminum/mylar tape (foil side in). Pull in same AWG tinned copper drain wire over this tape.
JACKET:	Gray PVC
FILLER:	As required
INSULATION:	Color Coded PVC 1. Red 2. White 3. Black
CHARACTERISTICS:	Voltage rating; 600 volts Temp rating; -20 °C to +105 °C (-4 °F to +220 °F) Flammability; Passes UL VW-1 flame test
LABELING:	Label PVC jacket with company name and note (Repeat ever 1.0'); REXA P96192 ***! ATTENTION ! – LOW VOLTAGE CABLE – MUST BE SEPARATED FROM HIGH VOLTAGE CABLES AND HIGH VOLTAGE EQUIPMENT BY AT LEAST 1 METER***
APPROX. O.D.	0.230 – .250"

SOLENOID CABLE SPECIFICATIONS

CABLE TYPE:	3 Conductor
CONDUCTORS:	#16 AWG 19/29 Stranded Tinned Copper
CABLING:	3 Conductors pulled in a PVC jacket.
JACKET:	Gray PVC
FILLER:	As required
INSULATION:	Color Coded PVC Blue Blue Green/Yellow
CHARACTERISTICS:	Voltage rating; 600 volts Temp rating; -20 °C to +105 °C (-4 °F to +220 °F) Flammability; Passes UL VW-1 flame test
LABELING:	Label PVC jacket with company name and note (Repeat ever 1.0'); REXA P97981 ***! ATTENTION ! – HIGH VOLTAGE CABLE – MUST BE SEPARATED FROM HIGH SIGNAL LEVEL CABLES AND SENSITIVE EQUIPMENT BY AT LEAST 1 METER***
APPROX. O.D.	0.25 – .275"

HEATER/SOLENOID CABLE SPECIFICATIONS

CABLE TYPE:	1 Twisted pair, 1 twisted triad
CONDUCTORS:	#16 AWG 19/29 Stranded Tinned Copper
CABLING:	1 Twisted pair, 1 twisted triad
JACKET:	Gray PVC
FILLER:	As required
INSULATION:	Color Coded PVC Pair 1. Blue with Blue/Black Triad Black and White and Green/Yellow
CHARACTERISTICS:	Voltage rating; 600 volts Temp rating; -20 °C to +105 °C (-4 °F to +220 °F) Flammability; Passes UL VW-1 flame test
LABELING:	Label PVC jacket with company name and note (Repeat ever 1.0'); REXA P97335 ***! ATTENTION ! – HIGH VOLTAGE CABLE – MUST BE SEPARATED FROM SIGNAL LEVEL CABLES AND SENSITIVE EQUIPMENT BY AT LEAST 1 METER***
APPROX. O.D.	0.4 – 0.45"

D – PUMP MOTOR CABLE SPECIFICATIONS

CABLE TYPE:	UL type TC (tray cable), 4 conductor, overall foil shield
CONDUCTORS:	#14 AWG 41×30 Stranded Tinned Copper
CABLING:	4 Conductors together and wrap with an aluminum/polyester tape (foil side in), 100% coverage. Pull in a #14 (41/30) AWG tinned copper drain wire under this tape.
JACKET:	Gray PVC
FILLER:	As required
INSULATION:	Color Coded PVC / Nylon 1. Orange 2. Blue 3. Gray 4. Green
CHARACTERISTICS:	UL type TC Voltage rating; 600 volts Temp rating; -20 °C to +90 °C (-4 °F to +195 °F) Flammability; Passes UL VW-1 flame test Sunlight resistant Direct burial Indoor/outdor use
LABELING:	As required by UL for TC type cable Label PVC jacket with company name and note (Repeat ever 1.0'); REXA P96402-14 ***! ATTENTION ! – HIGH VOLTAGE CABLE – MUST BE SEPARATED FROM SIGNAL LEVEL CABLES AND SENSITIVE EQUIP-MENT BY AT LEAST 1 METER***
APPROX. O.D.	0.60 – 0.61"

RESOLVER CABLE SPECIFICATIONS

CABLE TYPE: Power Limited Tray Cable, 20 AWG pairs stranded (7/28) tinned copper conductors, twisted pairs, PVC Insulation, Indiviually shielded plus an overall foil shield (100% coverage), PVC Jacket

CONDUCTORS: #20 AWG 7/28 Stranded Tinned Copper Conductors, Colored PVC insulation, 300 volt, 105 °C (220 °F)

CABLING: 4 Twisted Pairs, Min 2 twist/inch:
Pair 1: Red paired with Black
Pair 2: Green paired with Blue
Pair 3: Brown paired with White
Pair 4: Orange paired with Yellow

Inner SHEILDING (per pair): ALULMINUM FOIL-Polyester TAPE, 100% coverage, Foil Facing IN with a 22 AWG (7/30) tinned copper DRAIN WIRE pulled over the tape

Outer SHEILDING: ALULMINUM FOIL-Polyester TAPE, 100% coverage, Foil Facing OUT with a 22 AWG (7/30) tinned copper DRAIN WIRE pulled over the tape

INSULATION: Color Coded PVC, 0.016" WALL NOM.

JACKET: Gray PVC, 0.053" WALL NOM.

FILLER: As required

CHARACTERISTICS: Voltage rating; 300 volts
Temp rating; -30 °C to +105 °C (-22 °F to +220 °F)
Flammability; Passes UL VW-1 flame test
UL type PLTC
Sunlight resistant
Direct burial
Indoor/outdor use

LABELING: UL File #…20 AWG TYPE PLTC 105 °C 300 V (UL)
Label PVC jacket with company name and note;
REXA P98272 ***! ATTENTION ! – LOW VOLTAGE CABLE – MUST BE SEPARATED FROM HIGH VOLTAGE CABLES AND EQUIPMENT BY AT LEAST 1 METER***

APPROX. O.D. 0.40 – 0.42"

P40 MOTOR CABLE SPECIFICATIONS

DESCRIPTION:	Cable, 4/C 8 AWG shielded
CONDUCTORS:	
Wire Size & Type:	8 AWG (7×24/30) tinned copper, 10-0100-253
Insulation Type:	PVC 105C, 60-0600-34
Nom. Ins. Thickness:	0.036
Conductor diameter:	0.237
Tolerance:	.008"
Colors:	Orange, Blue, Gray, Green
Covering	Each conductor covered with clear nylon
Insulation Type:	Clear Nylon, 60-0875-02
Nom. Ins. Thickness	0.007
Conductor diameter	0.250
Tolerance:	(+/-) .009"
ASSEMBLY:	
Core Cabling:	4/C Cable around filler
Filler:	Gray or White fibrillated polypropylene (center)
Lay direction:	Left
Binder:	Fleece tape (100% coverage, 35% min. overlap)
<u>Shield 1</u>	
Shield:	Aluminum/polyester (100% coverage, 35% min. overlap, foil facing outward)
Drain Wire:	10 AWG stranded tinned copper (in contact with foil and TC shield (0.120 O.D.) *NOTE: Drain wire may be parallel*
<u>Shield 2</u>	
Type:	Braid Ends; 8
Material:	Tinned copper carriers; 48
Required coverage:	90% minimum coverage Angle; 37.25
AWG:	#34, 10-0100-14 Pics/Inch; 4.60
JACKET:	Gray PVC
Material type:	Tube Black, PVC, Oil, water & sunlight resistant, 60-0600-34, Nom. jacket thickness–0.060

***NOTE**: outer jacket will show evidence of the underlying wire form. Apperance will worsen with addition of drain wire.*

(continued)

Cable diameter:	0.764
***NOTE**: O.D. will increase by 0.120" on major diameterl*	
Tolerance:	(+/-) .028"
Print:	Ink jet white
Legend:	REXA p/n P97882 ***!ATTENTION! – HIGH VOLTAGE CABLE – MUST BE SEPARATED FROM SIGNAL LEVEL CABLES AND SENSITIVE EQUIPMENT BY AT LEAST 1 METER***
Ratings:	105C; Voltage rating of conductors is equivalent to SAB 08610804 (UL)/c(UL) 600v; UL-AWM: 1000 V; cable not UL/CSA rated
Tests misc.:	
Test 1:	Continuity Put Ups; Bulk
Test 2:	Short Reels; Wood
Test 3:	Physical.dimensional weight; 478 lb/mft
Approvals:	UL/CSA; None

Appendix E

Parameter Sheet

REXA "X2" DATA SHEET

CALIBRATE	CONTROL	SPEED/ACCEL	INPUTS	DRIVES	OUTPUTS	CURRENT STATS	HISTORIC STATS
POSITION LOW	DEADBAND	MAX HI SPEED	SIGNAL TYPE	DRIVE TYPE	RELAY #1	MEM FAIL	MEM FAIL
POSITION HIGH	MIN MOD	GAIN	FAILSAFE	STALL TIME	RELAY #2	A/D FAIL	A/D FAIL
SIGNAL LOW	BUMPLESS	HI ACCEL	TRIP	BOOST PUMP	POS XMITTER	DRIVE FAULT	DRIVE FAULT
SIGNAL HIGH	SURGE BKPT	ACCEL BKPT		ACCUMULATOR	VERSION	PRES BD	PRES BD
PULSE DUR	SEAT LD CYL	LO ACCEL		RECHRG PRES		SLC FB BAD	SLC FB BAD
PULSE INC	FLOW CHAR	2 SPEED		WARN PRES		FB BAD	FB BAD
		MAX LO SPEED	MAX UP SPEED	RECHRG TIME		CS BAD	CS BAD
		SPEED BKPT	MAX DN SPEED	ACCUM DIR		DIRECTION	DIRECTION
		MAX MAN SPEED		ACCUM PRES		STALL	STALL
						SLC STOP	SLC STOP
						STARTS (X1K)	STARTS (X1K)
						STROKES (X1K)	STROKES (X1K)
						LAST ERROR	

CUSTOMER:

APPL:

REXA MDL# REXA SERIAL# DATE:

SITE CONTACT: PHONE: ( ) EMAIL:

COMMENTS:

Appendix F

Field Service Memo

KOSO AMERICA
4 Manley Street
W. Bridgewater, MA 02379
Tel: 508.584.1199
Fax: 508.584.2525

Indicator Clamping

In the past it has been said that for simple maintenance procedures clamping of the aluminum X1 reservoir indicator is recommended to avoid draining of the actuator's oil. This is an acceptable procedure for the X1 power module because the reservoir indicator is aluminum, which will not corrode and also does not pass through any seals.

An issue arises when this same procedure is performed on either an X2 power module or any REXA actuator (X1 or X2) with an external auxiliary reservoir. The X2 reservoir indicator should not be clamped as you can damage the stainless finish. The X2 reservoir indicator passes through a seal and damage to the indicators' finish will result in the seal tearing while the indicator passes in and out. A tear in the indicator seal will allow water and other elements to enter the power module's electrical connection area. A similar issue exists with both X1 and X2 units which utilize an external auxiliary reservoir. The oil level indicator on an external reservoir is chrome plated and equally susceptible to damage. Once the finish on the indicator has been compromised there is a potential for corrosion. To avoid this we continue to recommend that these oil indicators not be clamped and that the oil be drained to complete maintenance and repairs.

However, it is our understanding that certain simple procedures become far less time consuming if oil is not drained from the unit. For situations like this we recommend that all possible precautions be taken to ensure the integrity of the oil level indicators' finish. A simple step must be taken to protect the oil level indicator. For this we recommend use of a rubber hosing to shield the indicator from the teeth of the clamping device.

Please observe the photos below depicting this clamping procedure with a pair of vise grips. Following this procedure correctly will prevent the need to drain the oil during simple actuator maintenance or repair and will also adequately protect the finish of the indicator.