FLOWSERVE

USER INSTRUCTIONS

Limitorque MX Electronic Actuator

MX Through Hole and SMT to MXa
Controls Conversion

FCD LMENIM2320-00 – 07/12

Installation
Operation
Maintenance



Experience In Motion

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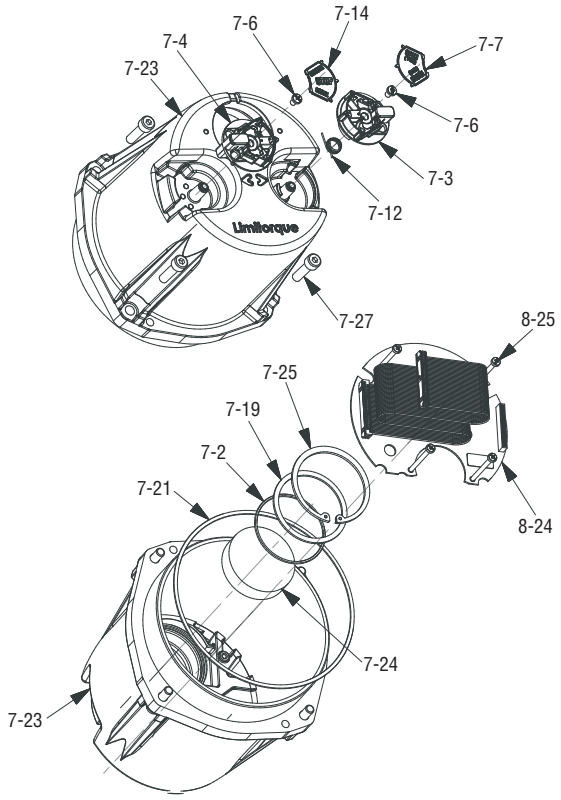
1 Electronic Assemblies

1.1 Control Panel (CP)

Table 1.1 – Control Panel Parts List

Part Number	Description	Qty.
7-2	O-ring	1
7-3	Black knob	1
7-4	Red knob	1
7-5	Brass pin (not shown)	2
7-6	Self-tapping screw	2
7-7	Black knob cap	1
7-9	Extension spring	1
7-10	Ball (not shown)	1
7-12	Torsion spring	1
7-14	Red knob cap	1
7-19	O-ring retainer	1
7-21	O-ring	1
7-23	Controls cover	1
7-24	Window	1
7-25	Snap ring	1
7-27	Socket head cap screw	4
8-24	PC board	1
8-25	Pan head machine screw (M4x6)	4

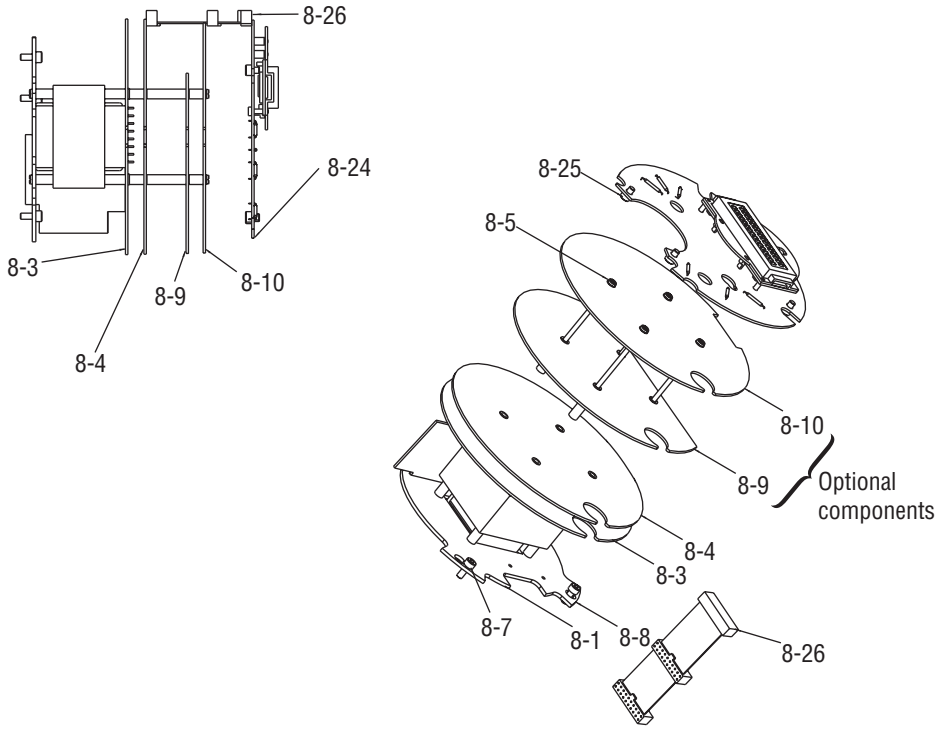
Figure 1.1 – Control Panel



NOTE: See Appendix A for bill of material (BOM) structure.

1.2 Removal of Through Hole Control Module (units supplied before September 2003)

Figure 1.2 – Control Module



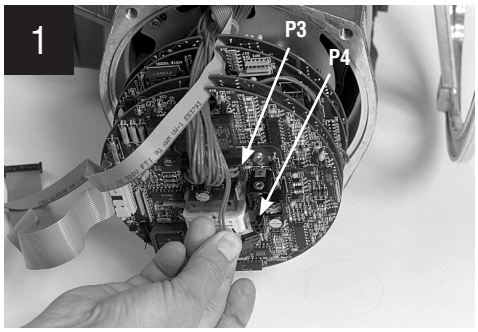
1.2.1 Removal

STEP 1

WARNING: Hazardous Voltage! Turn off all power sources to actuator before removing control module assembly. Power sources may include main power or control power.

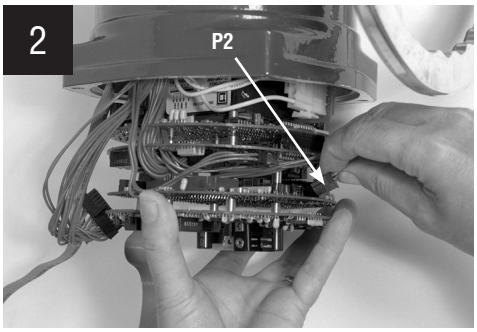
CAUTION: Potential to cause electrostatic damage to electronic components. Before handling electronic components, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

If the I/O option board is installed, disconnect wire harness plug P3 and P4.



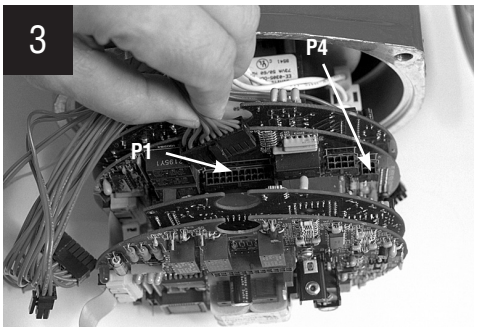
STEP 2

If DDC board is installed, disconnect wire harness plug P2.



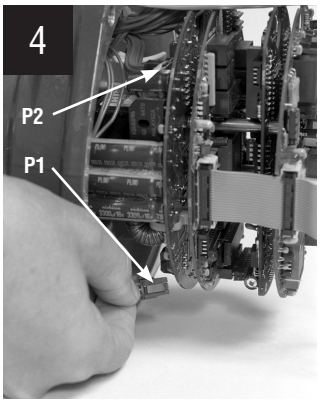
STEP 3

Disconnect wire harness plug P1 and P4 from the main processor board.



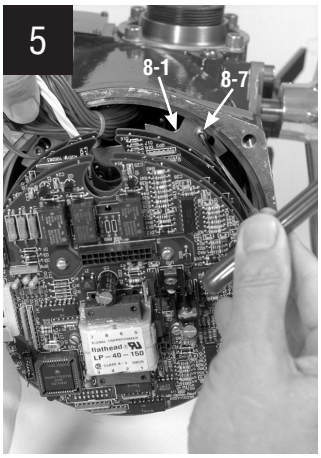
STEP 4

Disconnect wire harness plugs P1 and P2 from the main power board.



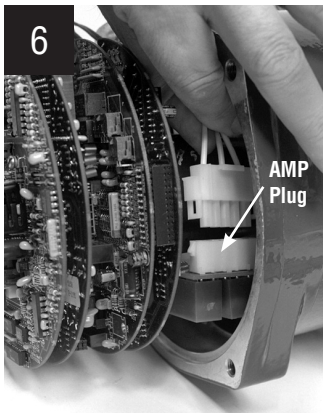
STEP 5

Using a 3 mm hex key, loosen the three M4 mounting plate screws (#8-7) located at the back of the controls compartment. Slightly rotate the complete control module assembly in a counterclockwise (CCW) direction, until the keyhole slots in the baseplate (#8-1) allow the heads of the screws to pass through.



STEP 6

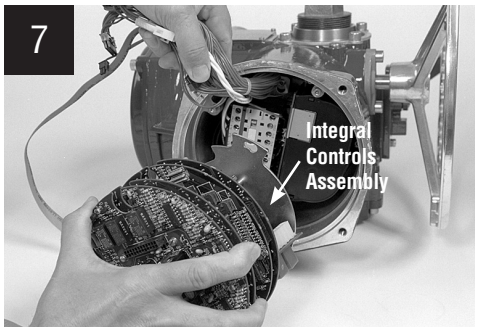
Disconnect the AMP® power connector from the fuse section of the main power board.



STEP 7

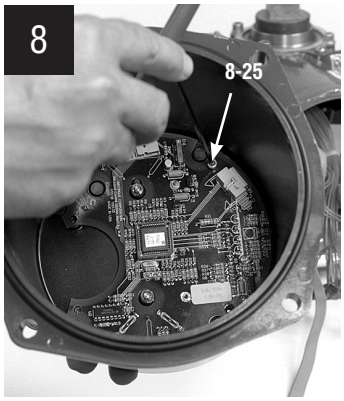
Remove the control module assembly from actuator housing (leave 20-pin ribbon cable connected to control module boards). Take control module assembly to work area to perform maintenance as required.

If control module assembly return is required for repair/replacement, remove the CP board from inside the CP cover as follows:



STEP 8

Using a 3 mm hex key, remove the four M4 screws (#8-25) that retain the CP board inside the CP cover.



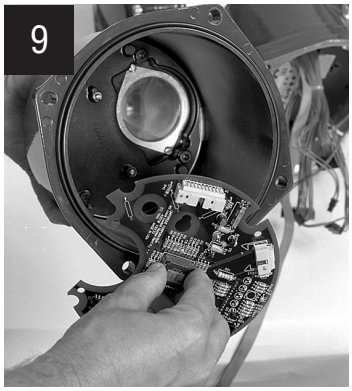
STEP 9

Lift the CP board out of the CP cover.

(See Section 1.2.3 for fuse replacement.)

(See Section 1.2.4 for control module return options.)

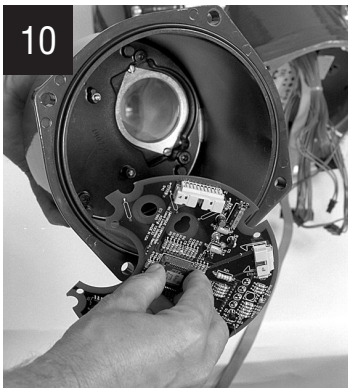
(See Section 1.2.5 for EPROM care and replacement.)



STEP 10

Discard the older version of the Control cover (extended knobs).

NOTE: PC boards should be discarded properly. Please take care to ensure they are discarded in accordance with environmental laws in the specific country where the actuators are installed.



1.3 Removal of SMT (Surface Mount Technology) Controls (most units supplied after September 2003 and before September 2007)

1.3.1 Removal Procedure

STEP 1

NOTE: The face of the CP may be installed in any one of four 90° incremental positions. When changing CP position, avoid over-twisting the ribbon cable.

Rotate the CP until the display orientation of the front face is correct for normal viewing, and then slide the CP assembly into the actuator housing.

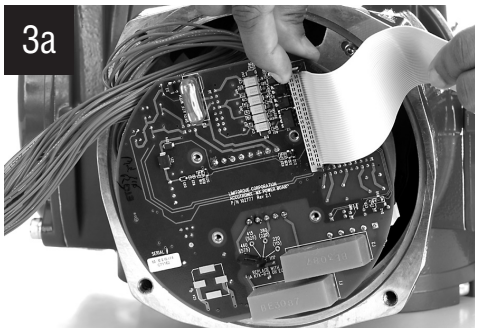


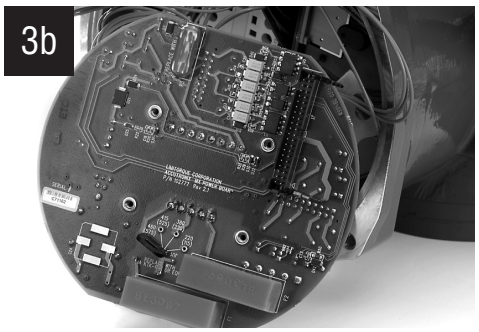
STEP 2

⚠ **CAUTION:** Potential to pinch cables. When remounting CP cover, take special care not to pinch the ribbon cables.

STEP 3

Using a screwdriver, remove the four M4 screws (#7-44) retaining the LCS/Main board inside the CP cover. Remove and discard the old style protruding knob control cover.





STEP 4

Disconnect all ribbon cables and interconnects as necessary from PCBs. Loosen the three (3) power assembly screws and rotate the controls assembly counter-clockwise (CCW) to remove.

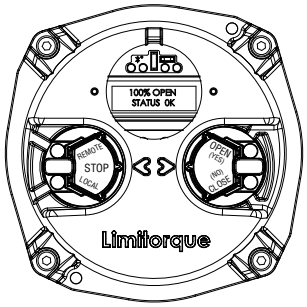
1.3.2 Control Module Return Options

Contact Flowserve Limitorque factory in Lynchburg, VA at 434-528-4400.

NOTE: PC boards should be discarded properly. Please take care to ensure they are discarded in accordance with environmental laws in the specific country where the actuators are installed.

1.4 Mounting of MXa Controls with 54-Point Terminal Block and Four LED Configuration

Figure 1.3 – SMT Controls with Four LEDs



1.4.1 Installation

STEP 1

⚠ **CAUTION:** Ensure the voltage jumper on power board (see Figure 1.3) is located in the proper slot for the nameplate and motor voltage! Follow the template provided on the Mylar protection barrier for proper voltage jumper location.

Table 1.2 - Voltage Jumper Positions

Supply Power	Jumper Position		
	(106V/115V/200V/212V) Transformer	|226V/366V/392V/450V| Transformer	[212V/505V/530V/572V] Transformer
110 VAC 50/60 Hz	(106)	n/a	n/a
115 VAC 60 Hz	(115)	n/a	n/a
120 VAC 60 Hz	(115)	n/a	n/a
208 VAC 60 Hz	(200)	n/a*	n/a
220 VAC 60 Hz	n/a	(226)	n/a
230 VAC 50/60 Hz	n/a	|226|	n/a
240 VAC 60 Hz	n/a	|226|	n/a
380 VAC 50/60 Hz	n/a	|366|	n/a
400 VAC 50 Hz	n/a	|392|	n/a
415 VAC 50 Hz	n/a	|392|	n/a
440 VAC 50/60 Hz	n/a	|450|	n/a
460 VAC 60 Hz	n/a	|450|	n/a
480 VAC 60 Hz	n/a	|450|	n/a
525 VAC 50/60 Hz	n/a	n/a	[505]
550 VAC 60 Hz	n/a	n/a	[530]
575 VAC 60 Hz	n/a	n/a	[572]
600 VAC 60 Hz	n/a	n/a	[572]

*This jumper selection should be used for the 208 VAC and 19 A contactor for MX-20/40.

NOTE: Brackets indicate setting for transformer in use. See marking on Power Assembly's shield to determine the installed transformer and use the primary taps voltage in the corresponding brackets to determine jumper position. "( )" indicates primary voltages for the (106V/115V/200V/212V) transformer, "| |" for the |226V/366V/392V/450V| transformer, and "[ ]" for the [212V/505V/530V572V].

NOTE: The power board must be installed prior to the 54 terminal block to permit motor connections to be made. Once complete, the terminal block can be installed.

All mounting hardware has been included in a blister pack within this kit. Please refer to kit number 26100-280.

⚠ **CAUTION:** Potential to cause electrostatic damage to electronic components. Before handling electronic components, ensure that you are discharged of static electricity by briefly touching a grounded metal object. Flowserve recommends the use of a wrist strap grounded to an appropriate ground.

STEP 2 – LCS/MAIN BOARD

Assemble the LCS/Main board into the actuator control cover using four (4) M4x8 screws.

STEP 3

Connect the yellow 12-pin wire cable harness from the 54-point terminal block to the J5 header.

STEP 4

Connect the two-wire blue cable harness from the 54-point terminal block to header J3.

STEP 5

Connect the grey keyed ribbon cable harness from the 54-point terminal block to header J4.

STEP 6

Connect the blue keyed 18-pin/wire cable harness from the 54-point terminal block to header J8.

STEP 7 – POWER BOARD

Install the three (3) standoffs (#1-55) into the housing mounting.

STEP 8

Install the power board complete with the electromechanical starter using the M4 power board mounting screws. Position power assembly over the three mounting screw heads (#1-45). Rotate the subassembly in clockwise (CW) direction until all three screws are seated in the key slots.

NOTE: The keyhole slots in the mounting plate (#8-1) are spaced in such a way that the control module assembly will mount in only one position.

Tighten the three screws (#1-45) with a 3 mm hex key.

STEP 9

Plug the 3-pin Molex harness (L1-L3) to plug into motor reverser. Plug the two (2) two-wire and thermistor cable (T1-3) to the motor leads.

1.4.2 Removal

For removal, follow installation instructions in reverse.

NOTE: See Appendix A for bill of material (BOM) structure.

1.5 Mounting of Standard and Optional Controls with 54-Point Terminal Block and Four LED Configuration

1.5.1 Installation

NOTES: RESTRICTIONS ON OPTION BOARD COMBINATIONS: Only one of the following can be on any unit: Modbus - DDC, Profibus PA, Profibus DP, FOUNDATION Fieldbus, DeviceNet.

A shield must be installed on the last board fitting between the last option board and the power board. See Figure 1.10 for illustration.

A maximum of four option boards can be used per unit, barring other restrictions. A four option board stack requires four (4) M4x70 pan head screws.

A maximum of three option boards can be used with SSMR due to size constraints. A three option board stack requires (4) M4x55 pan head screws.

A maximum of two option boards can be used with the 19 amp contactor, due to size constraints. A two option board stack requires (4) M4x40 pan head screws.

A single option board stack requires four (4) M4x25 pan head screws.

STEP 1 – STANDARD 2A, (4) "OS" CONTACTS (LCS/MAIN BOARD)

Connect to the control cover using (4) M4x8 pan head screws.

From the terminal block, connect 12-pin plug (Cable J1) to socket J5 on the main board.

STEP 2 – OPTION "OA", 4-5A "R" CONTACTS AND (1) 5A MR (MONITOR RELAY); DIGITAL OUTPUT BOARD CONNECTION

Connect to the control cover using four (4) M4x25 pan head screws.

Ensure that jumper on the DO board is located in the 1-2 position. Connect 12-to-22 pin adapter to Cable J1 (12-pin plug). Connect to the 22-pin socket J3 on DigOut board

NOTES: This will disable the digital relays on the main board. A keycode must be entered to restore them. Please contact factory at 434-528-4400 for the keycode.

A shield is required to be installed between the digital output board and any adjacent boards.

STEP 3 – OPTION "OC", 8-5A "R" CONTACTS AND (1) 5A MR (MONITOR RELAY); 2 DIGITAL OUTPUT BOARDS CONNECTION

Connect to the control cover using four (4) M4x40 pan head screws.

Ensure that the jumper on DigOut board 1 is in the 1-2 position and the jumper on DigOut board 2 is in the 3-4 position. Connect the 12-22 pin adapter to Cable J1 (12-pin), then connect it to socket J3 (22-pin) of board 1. Connect cable J5 to socket J3 of board 2.

STEP 4 – ANALOG OPTION BOARD CONNECTION

Connect to the control cover using four (4) M4x25 pan head screws if one analog board is installed. Connect to the control cover using four (4) M4x40 pan head screws if two analog boards are installed.

Ensure that jumpers 1 and 2 are in the same position. If there is only one board, both should be in the 1-2 position (Board 1). If there are two boards, the second board should have the jumpers in 2-3 position. Connect J8 (3-pin) cable to J3 of board 1. Connect J3 (4-pin) cable to J1 of board 2.

STEP 5 – MODBUS – DDC NETWORK BOARD CONNECTION

Connect to the control cover using four (4) M4x25 pan head screws if one DDC board is installed. Ensure that Jumpers 1 and 2 are both in the "A" position. Connect the J7 6-pin cable from the terminal block to socket J2.

STEP 6 – PROFIBUS-DP NETWORK BOARD CONNECTION

Connect to the control cover using four (4) M4x25 pan head screws if one Profibus-DP board is installed. Ensure that both jumpers are in the "A" position. Connect the J7 6-pin cable from the terminal block to socket J8.

STEP 7 – PROFIBUS-PA NETWORK BOARD CONNECTION

Connect to the control cover using four (4) M4x25 pan head screws if one Profibus-PA board is installed. Ensure that both jumpers are in the "A" position. Connect the J7 6-pin cable from the terminal block to socket J8.

STEP 8 – FOUNDATION FIELDBUS NETWORK BOARD CONNECTION

Connect to the control cover using four (4) M4x25 pan head screws if one FOUNDATION Fieldbus board is installed. Ensure that both jumpers are in the "A" position. Connect the J7 6-pin cable from the terminal block to socket J8.

STEP 9 – DEVICENET NETWORK BOARD CONNECTION

Connect to the control cover using four (4) M4x25 pan head screws if one DeviceNet board is installed. Ensure that both jumpers are in the "A" position. Connect the 6-pin cable from the terminal block to socket J8. Set aside yellow ground wire to be fastened to top of option board stack per Figure 1.10. Above the shield, the wire must make contact with the screw.

STEP 10 – ALIGNMENT OF OPTION BOARDS INTO LCS/MAIN BOARD

Line up screw sockets and stack the boards so that J7 (option board pins and sockets) fits in with the main board or any boards that are installed previously. Place shield so sockets match up with cuts in shield. If DeviceNet board (61-825-0058-4) is used, position grounding wire on top of shield before fastening screws. Fasten four screws, then align in cover and install to main housing. Please refer to Table 1.3 for the connector numbers.

Table 1.3 - Control Board Connectors

Control Board	Connector Number
DeviceNet	X1
Foundation Fieldbus	X1
Profibus PA	X1
PBDP	X1
Digital Out	J2
Modbus/DDC	X1
Analog	J2

Figure 1.4– Option Board Assembly

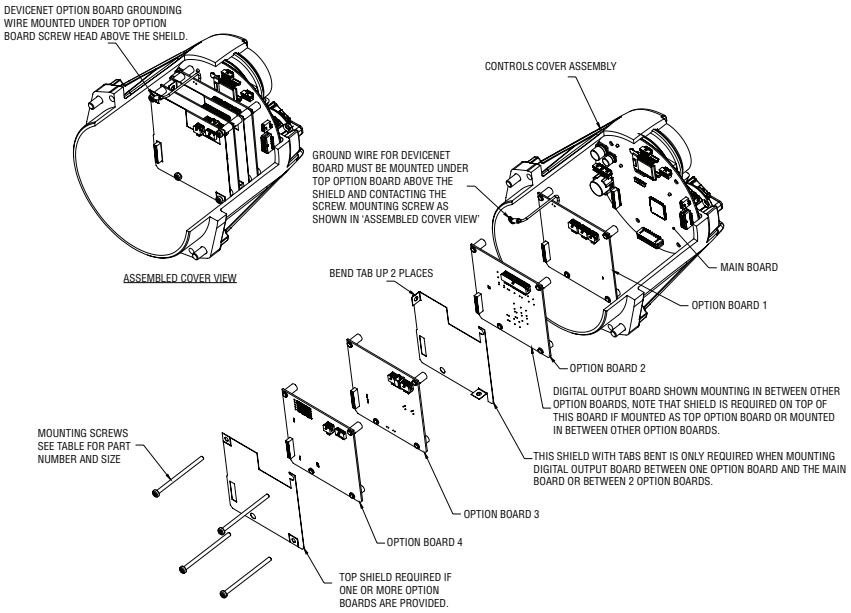


Table 1.4 - Screw Part Numbers

BOARD DESCRIPTION	SCREW PART NUMBER	DESCRIPTION	QTY.
MAIN WITH NO OPTION BOARDS	64-818-0001-35	M4X8	4
MAIN WITH 1 OPTION BOARD	64-818-0001-32	M4X25	4
MAIN WITH 2 OPTION BOARDS	64-818-0001-36	M4X40	4
MAIN WITH 3 OPTION BOARDS	64-818-0004-3	M4X55	4
MAIN WITH 4 OPTION BOARDS	64-818-0005-3	M4X70	4

⚠ **CAUTION:** Potential to pinch cables. When remounting ACP cover, take special care not to pinch ribbon cables.

Dress the cables being careful to position wires so that they pass perpendicularly over the housing flange.

NOTE: The face of the ACP may be installed in any one of four 90° incremental positions. When changing ACP position, avoid over-twisting the ribbon cable(s).

Rotate the ACP until the display orientation of the front face is correct for normal viewing, and then slide the ACP assembly into the actuator housing.

1.5.2 Removal

For removal, follow installation instructions in reverse.

1.6 Adding Electronic Options to Your MX Actuator

Listed below are the options available for the MX.

1. Modutronic option; does not require any hardware; however, a “keycode” from the factory is required.
2. Two-speed timer; does not require any hardware, however a “keycode” from the factory is required.
3. APT option; Analog Position Transmitter, non-contacting 4-20 mA position transmitter requiring the addition of an analog I/O (input/output) option board.
4. ATT option; Analog Torque Transmitter, non-contacting 4-20 mA torque transmitter requiring the addition of an analog I/O (input/output) option board.
5. R option; Alarm Relays, four latching relays requiring the addition of a digital output board. Latching relays do not change state when power is removed from the actuator, e.g. if the relay is CLOSED and power is removed, the relay will remain CLOSED.
6. DDC option; network communication field board that is required for two-wire twisted pair, MODBUS communication.
7. FF option; network communications board required for Foundation Fieldbus communication.
8. PB options network communications board required for either Profibus DP or PA communication.
9. DeviceNet; network communication board required for DeviceNet communication.

The procedure for adding electronic options to your MX actuator is as follows:

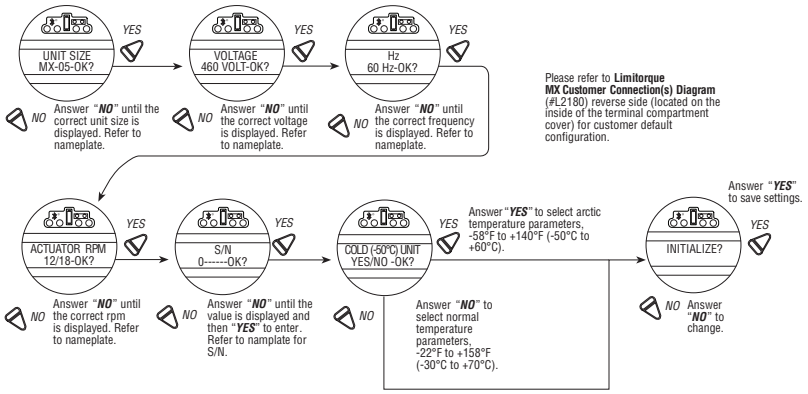
- For adding the Modutronic and two-speed timer options, the actuator QA Stamp ID must be supplied in order to acquire the necessary keycode.
- Each MX actuator is supplied a unique “QA Stamp ID”. This number is assigned during the end-of-line test sequence for each unit.
- This serial number is located on the second screen after the “Restricted Settings” screen. It is an eight-digit number after the letters “S/N”. Please refer to the IOM manual, LMENIM2306, supplied with your actuator for the Menu sequence. User must supply this number. Example: 12345678
- Also record the Order Number and Serial Number of the actuator. These numbers can be found on the unit nameplate.
- Once you have acquired the QA Stamp, O/N and S/N, please contact your assigned Service Coordinators for the keycodes required to turn on the desired options at (434) 528-4400.
- The “keycode” is then entered into the desired option menu found in “Restricted Settings” using the black knob on the ACP. A “NO” answer will change the value form 0-9 and A-E. A “YES” answer will truncate to the next space.
- After enabling the Modutronic option, if digital inputs are used for control, remote control may be set to user inputs.
- For adding the APT, ATT, and R options, the analog output board(s) and/or the digital output board(s) will be required. When these board(s) are installed into the actuator, it will already have the option(s) enabled. The unit will recognize the board and turn on the required software menu feature. Please refer to the IOM manual, LMENIM2306, supplied with your actuator for the Menu sequence. The user

will need to enable the menu options. Please contact your assigned Service Coordinators for purchase of these desired options at (434) 528-4400.

- For adding the DDC, FF, DN or PROFIBUS option, the DDC, FF, DeviceNet or PB option board is required. When these boards are received and installed into the actuator, it will recognize the board and turn on the required software menu feature. Please refer to the IOM manual, LMENIM2306, supplied with your actuator for the Menu sequence. The user will need to enable the menu options. Please contact your assigned Service Coordinators for purchase of the network options at (434) 528-4400.

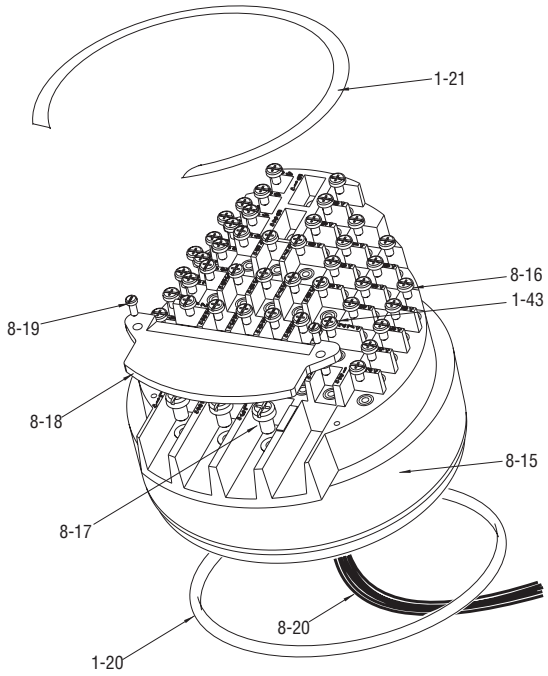
1.7 Restoring Power to Actuator with New Control Module

Figure 1.5 – Restoring Power to Actuator with New Control Module



1.8 51-Point Terminal Block (prior to March 2007)

Figure 1.6 – Terminal Block



1.8.1 Removal

⚠ **CAUTION:** Potential to cause electrostatic damage to electronic components. Before handling electronic components, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

First Remove

1. Control panel (subassembly #7). (See Section 1.1.)
2. Control module (subassembly #8). (See Section 1.2.1.)

STEP 1

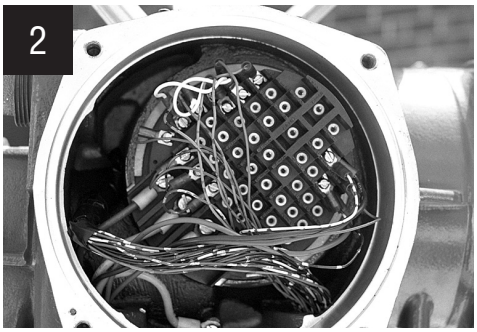
☠ **WARNING: Hazardous Voltage! Turn off all power sources to actuator before removing terminal block assembly. Power sources may include main power or control power.**

Using an M6 hex key, remove the four M8 screws (#8-14) that mount the terminal compartment cover to the actuator.



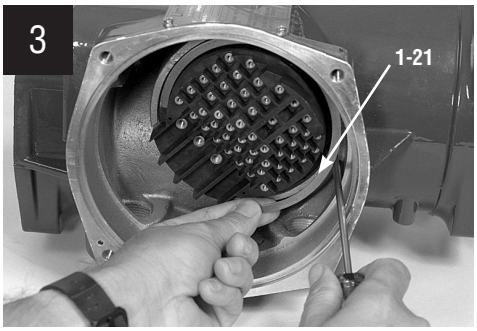
STEP 2

If actuator is already in service, disconnect incoming power leads L1, L2, and L3 (and control wiring from the terminal block if terminal block replacement is required).



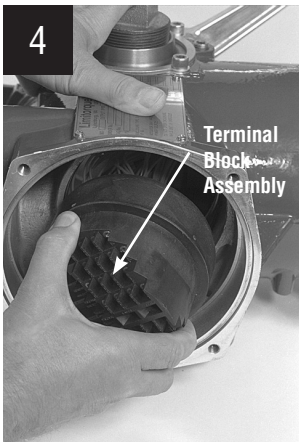
STEP 3

Using a flat head screwdriver, insert the screwdriver blade underneath the edge of the snap ring (#1-21) and work the blade around the back of the snap ring to remove it from the groove, thus allowing terminal block removal.



STEP 4

Remove terminal block assembly.



STEP 5

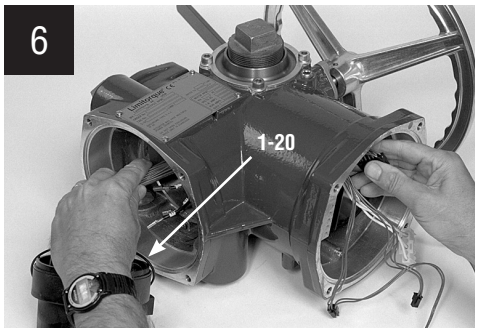
Disconnect leads L1, L2, and L3 from back of terminal block.



STEP 6

Feed the terminal block harness plugs over the contactor assembly (in the control module compartment) while removing the terminal block from the terminal block compartment.

NOTE: An O-ring (#1-20) is included with the terminal block assembly. Ensure you retain or replace the O-ring at remounting.



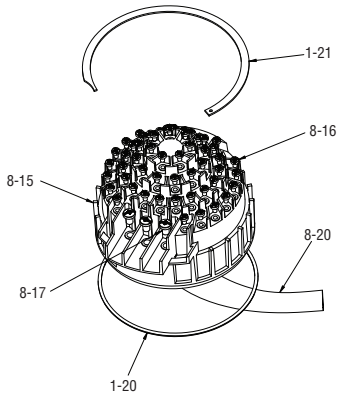
1.9 54-Point MXa Terminal Block

Table 1.5 – Terminal Block Parts List

Part Number	Description	Qty.
1-20	O-ring	1
1-21	Retaining ring	1
8-15	Terminal block	1
8-16	Self-lock combo head screw (M3x5)	52
8-17	Self-lock combo head screw (M5x8)	3
8-20	Control wiring harness	1

NOTE: The power board must be installed prior to the 54 terminal block to permit motor connections to be made. Once complete, the terminal block can be installed.

Figure 1.7 – Terminal Block



NOTE: Perform steps 6 through 1 (in that order) of Section 1.8 for installation of 54 point terminal block.

1.9.1 Terminal Block Shield Installation

STEP 1

Remove terminal block cover.

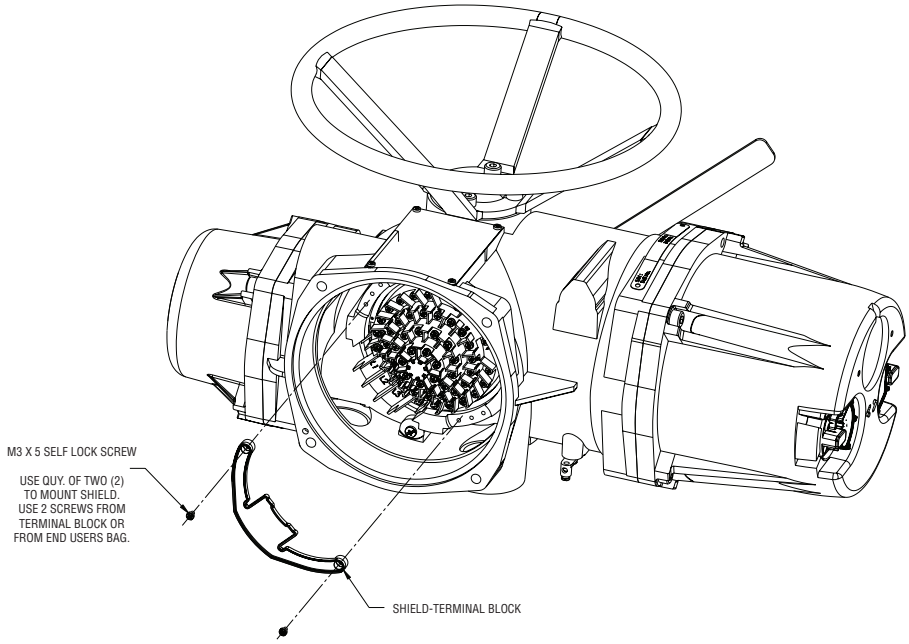
STEP 2

Use quantity of two screws from terminal block or from end user's bag to attach shield.

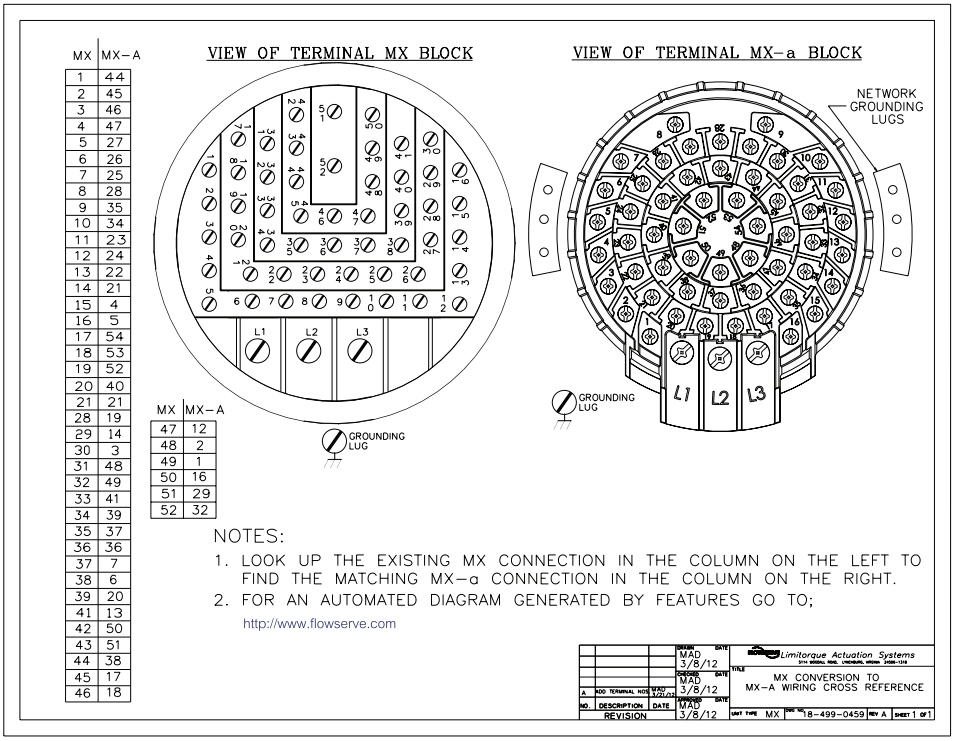
STEP 3

Remount terminal block cover.

Figure 1.8 – Terminal Block Shield



THIS DRAWING IS FOR REFERENCE ONLY. PLEASE FOLLOW THE MXA WIRING DIAGRAM SUPPLIED WITH THE CONVERSION KIT.



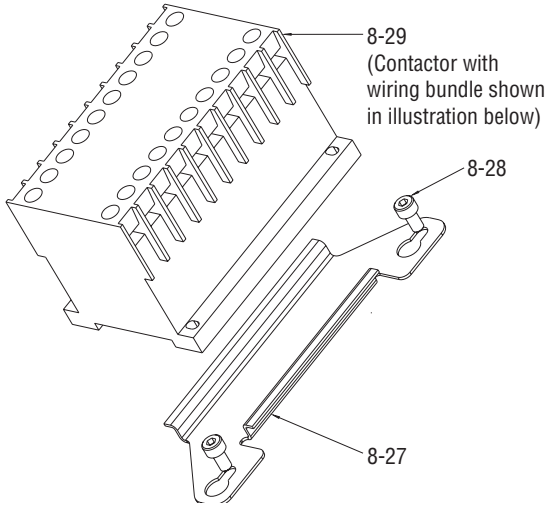
MX	MX-A
1	44
2	45
3	46
4	47
5	27
6	26
7	25
8	28
9	35
10	34
11	23
12	24
13	22
14	21
15	4
16	5
17	54
18	53
19	52
20	40
21	21
28	19
29	14
30	3
31	48
32	49
33	41
34	39
35	37
36	36
37	7
38	6
39	20
41	13
42	50
43	51
44	38
45	17
46	18

MX	MX-A
47	12
48	2
49	1
50	16
51	29
52	32

NOTE: See Appendix A for bill of material (BOM) structure.

1.10 Removal of Control Module-Contactor Assembly (Please see Section 1.4 for power board installation with contactor.)

Figure 1.9 – Control Module - Contactor Assembly and Wiring Diagrams



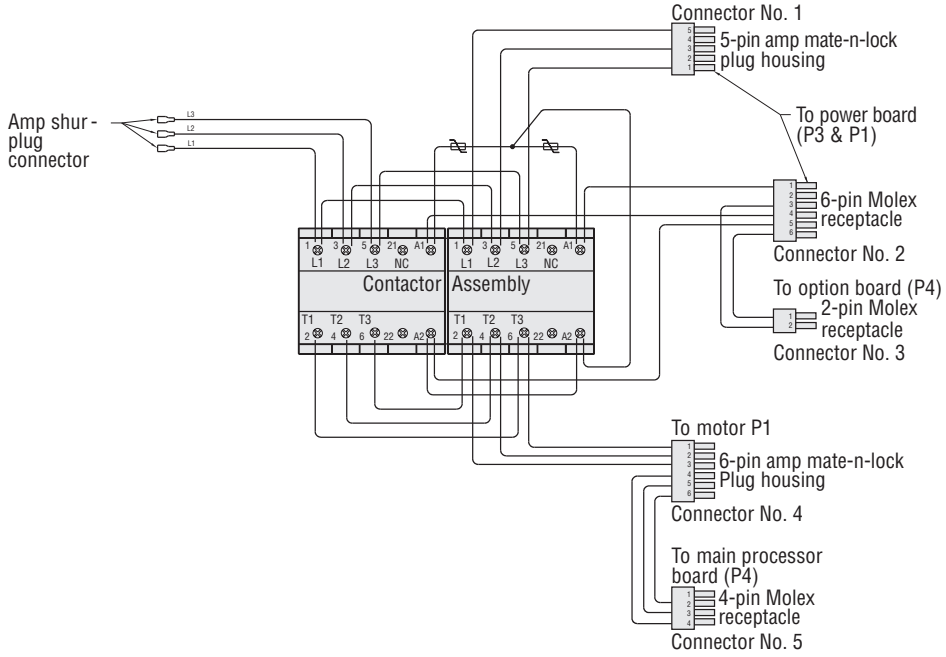
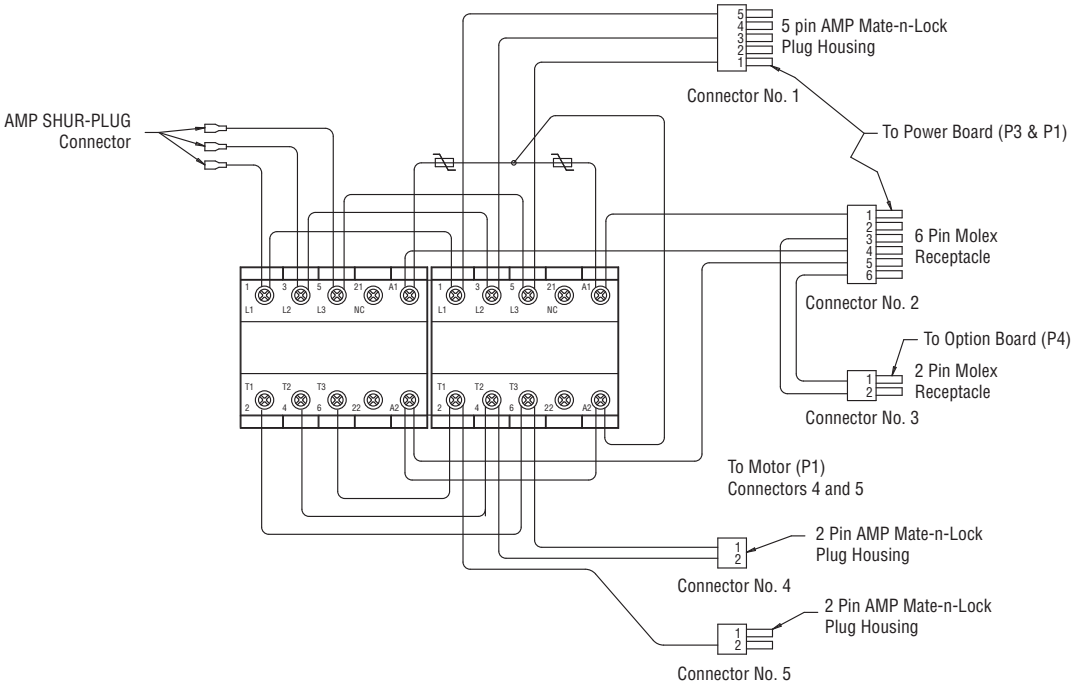


Figure 1.9 – (continued)



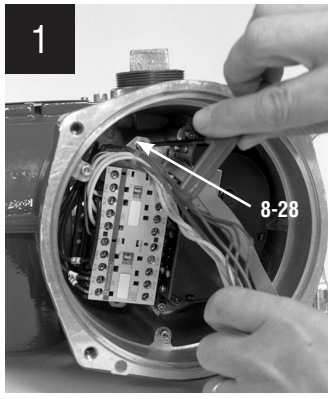
1.10.1 Removal

First Remove

1. Remove motor (subassembly #4).
2. Remove control panel (subassembly #7). (See Section 1.1.)
3. Remove control module (subassembly #8). (See Section 1.2.1.)
4. Remove terminal block (subassembly #15). (See Section 1.8.1.)

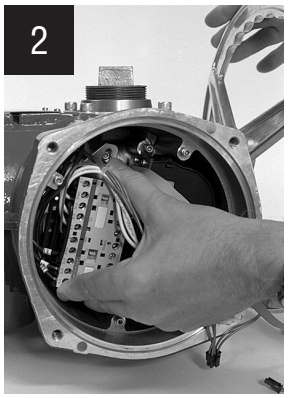
STEP 1

Using an M3 hex key, loosen the two 4 mm screws (#8-28) that mount the contactor assembly to the actuator.



STEP 2

Lift contactor assembly until the keyhole slots in the contactor mounting plate allow the heads of the M4 screws to pass through.



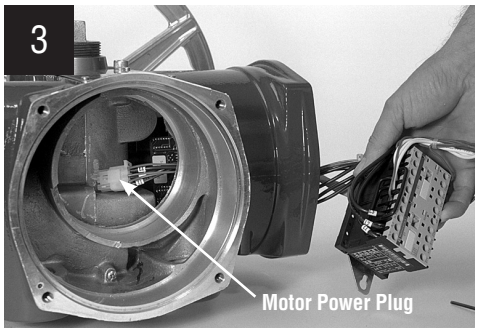
STEP 3

Remove the contactor assembly while threading the motor power socket out of the motor compartment.

NOTE: Only the MX-05, -10, -20 and -40 have the long motor power socket lead.

MX-85, -140, AND -150

Disconnect connectors 4 and 5 to motor lead harness.



1.11 Removal of 19 Amp Reverser on the MX-140 and -150 (not for most actuators shipped after September 2007)

STEP 1

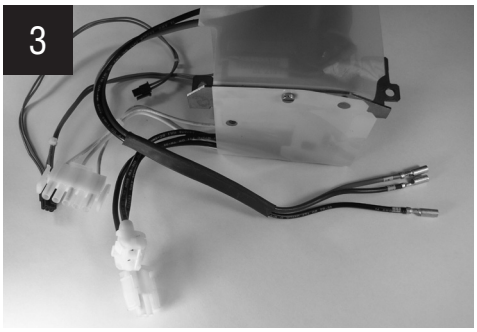
Follow the steps in 1.10.1. Remove control cover and disconnect the encoder and controls package. Remove controls package from MX housing.

STEP 2

Remove terminal cover, retaining ring, terminal block and O-ring to access the back of the terminal block.

STEP 3

Disconnect black, blue and brown wires (L1, L2 and L3) from back of terminal block.



STEP 4

Disconnect the lead seal from the reverser by unplugging the 2-pin and single-pin white connectors.

STEP 5

Disconnect and remove the encoder mounting screws and the encoder.

STEP 6

Remove the mounting screws for the reverser package and remove the reverser by moving the reverser towards the space previously occupied by the encoder. Discard the used reverser package.

1.12 19 Amp Power Assembly for MXa Units

Table 1.6 – 19 Amp Power Assembly

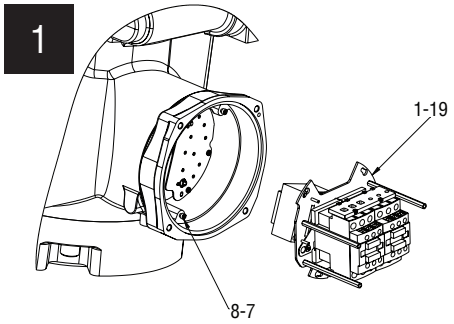
Part Number	Description	Qty.
1-19	Controls Assembly	1
8-3	Power Board	1
8-7	Mounting Plate Screws	3
8-10	Screws	3
8-12	Shield	1

1.12.1 Installation

STEP 1

Connect the two 2-pin white connectors to the lead seal.

Install the 19 amp controls assembly (1-19) by slightly rotating the controls assembly in the clockwise (CW) direction, then tighten the three M4 mounting plate screws (8-7).



STEP 2

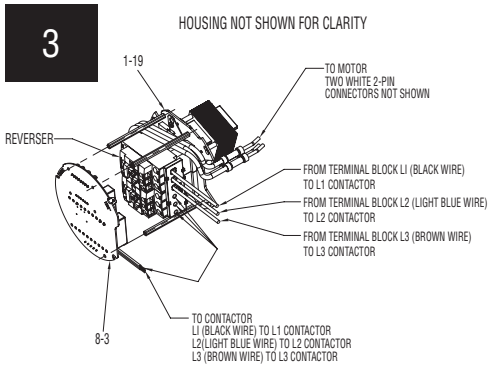
Connect the two 2-pin white connectors from the lead seal.

Install the 19 amp controls assembly (1-19) by aligning the keyhole slots in the baseplate to allow the heads of the screws to pass through the baseplate and slightly rotating the controls assembly clockwise (CW) direction. Tighten the three M4 mounting plate screws (8-7).

Connect the three terminal block wires from L1, L2 and L3 on reverser as shown by tightening the reverser screws.

STEP 3

Install the power board by installing the reverser screws and connecting the three power board wires to L1, L2 and L3 on reverser as shown.

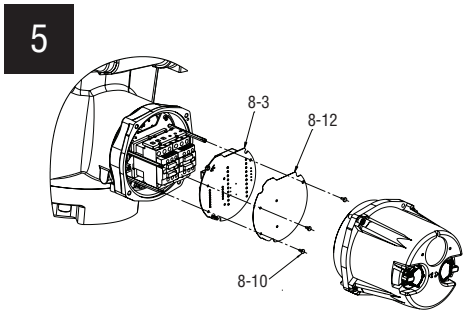


STEP 4

Install the three screws (8-10) and shield (8-12). Connect all connectors to power board (8-3)

STEP 5

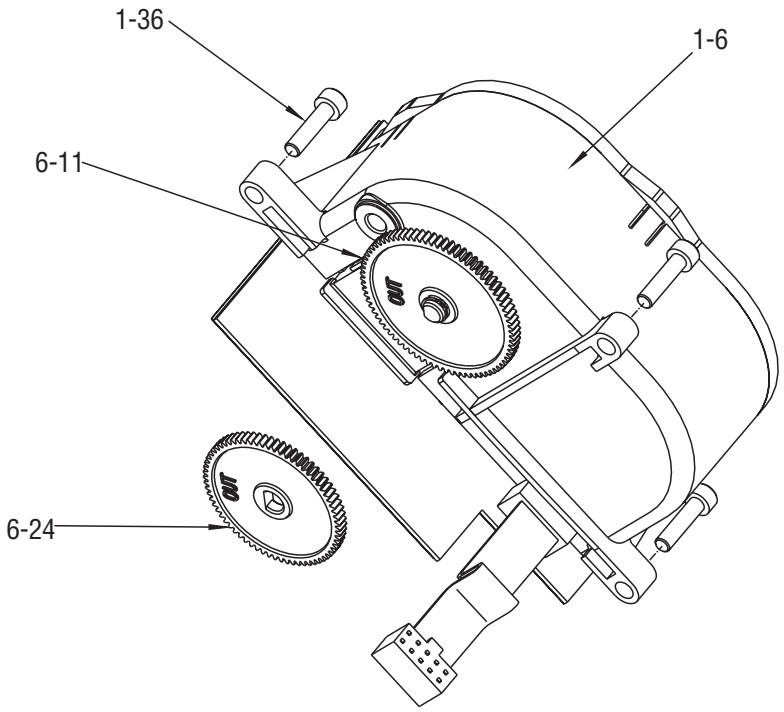
Install the ACP controls cover assembly



NOTE: See Appendix A for bill of material (BOM) structure.

1.13 Removal of Encoder (through hole and surface mount technology, most units prior to September 2007)

Figure 1.11– MX Through Hole and SMT Encoder



NOTE: See Appendix A for bill of material (BOM) structure.

1.13.1 Removal

NOTE: Before removal, you must:

⚠ **CAUTION:** Potential to cause electrostatic damage to electronic components. Before handling electronic components, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

1. Remove the control panel (subassembly #7). (See Section 1.1.)
2. Remove the control module (subassembly #8). (See Section 1.2.1.)

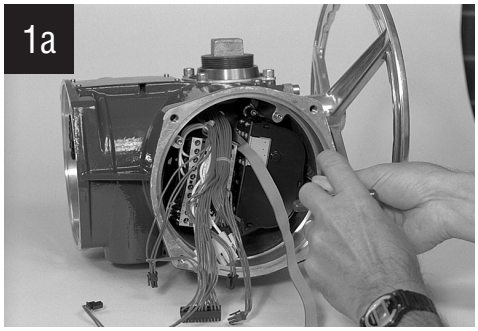
NOTE: The encoder is a sealed assembly of high-precision components and not suitable for repair. Should the encoder fail, it will be necessary to install a factory replacement.

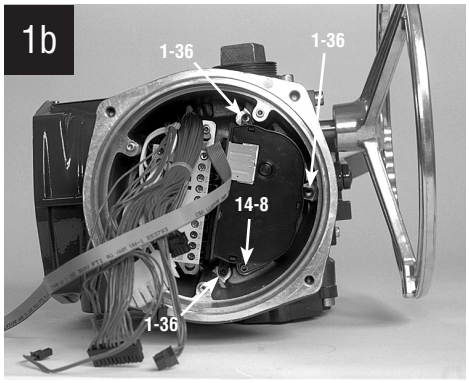
STEP 1

☠ **WARNING: Hazardous Voltage! Turn off all power sources to actuator before removing encoder assembly. Power sources may include main power or control power.**

⚠ **CAUTION:** To avoid accidental oil leakage when removing encoder screws (#1-36), be careful not to remove the encoder cartridge mounting screw (#14-8). The encoder cartridge screw is located near one of the encoder mounting screws. Accidentally removing the encoder cartridge mounting screw could cause oil leakage into the control compartment. (See Picture 1a.)

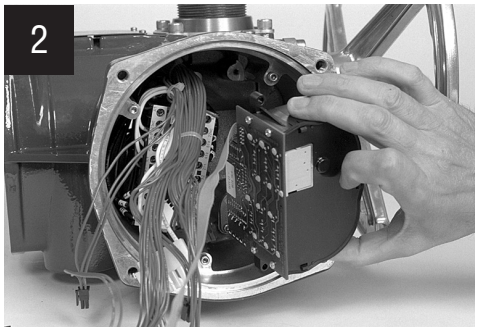
Remove the encoder by locating and removing the three M4 screws (#1-36) that mount the encoder to the actuator housing. Use a 3 mm hex key to remove the screws. Reference Picture 1b to locate screws (#1-36); note important cautionary statement discussed with Step 1 and 1a).





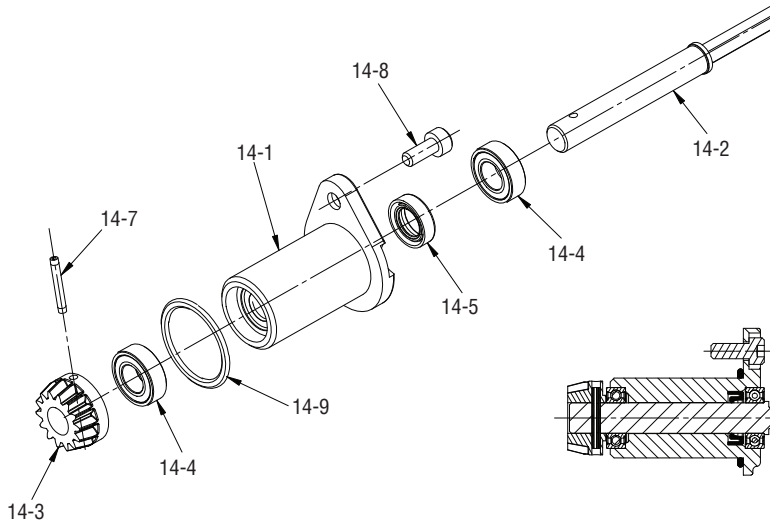
STEP 2

Pull the complete encoder straight out of the mounting holes to disengage the gear drive from the encoder drive cartridge pinion.



1.14 Removal of Encoder Drive Cartridge (most units prior to September 2007)

Figure 1.12 – Encoder Drive Cartridge (See Table 1.7 for part numbers)



1.14.1 Removal

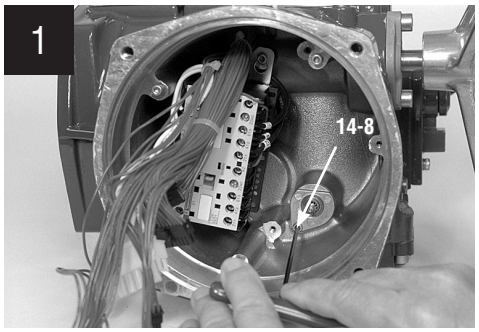
NOTE: Before removal, you must:

1. Drain oil.
2. Remove the CP cover (subassembly #7). (See Section 1.1.)
3. Remove the control module (subassembly #8). (See Section 1.2.1.)
4. Remove the encoder (subassembly #6). (See Section 1.13.1.)

STEP 1

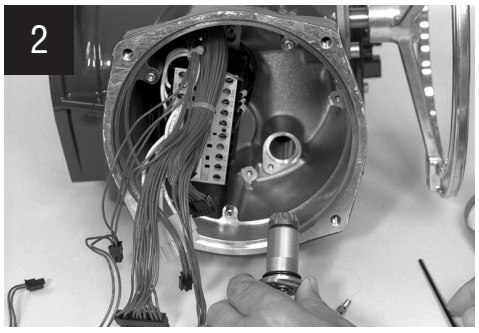
☠ **WARNING: Hazardous Voltage! Turn off all power sources to actuator before removing encoder drive cartridge. Power sources may include main power or control power.**

Remove the M4 screw (#14-8) using a 3 mm hex key.



STEP 2

Withdraw the complete encoder drive cartridge from the actuator housing.

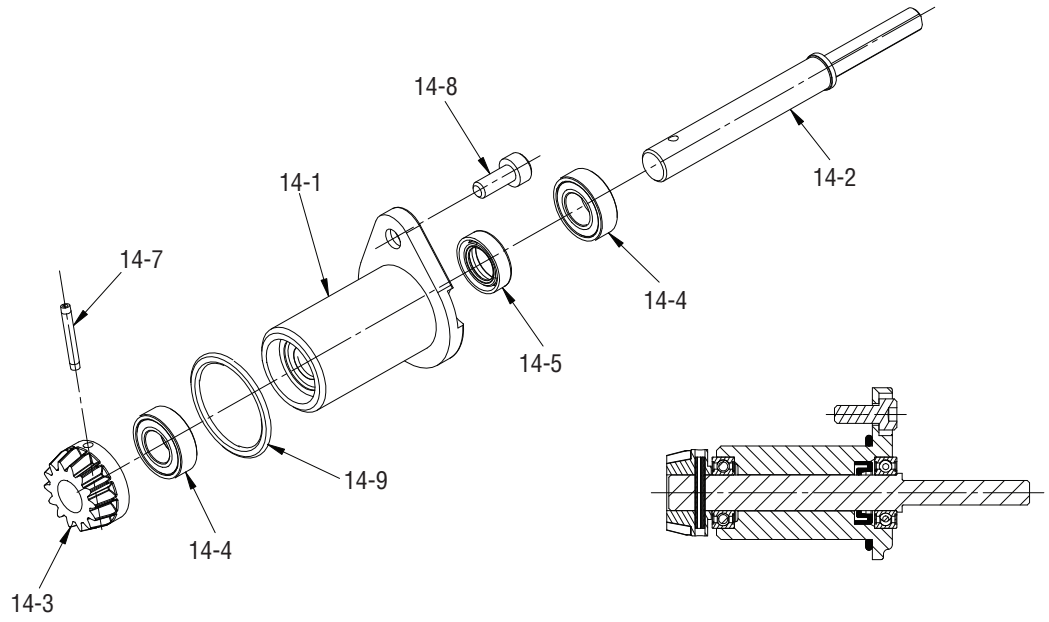


1.15 MXa Encoder Drive Cartridge Installation

Table 1.7– Encoder Drive Cartridge Parts List

Part Number	Description	Qty.
14-1	Encoder drive cartridge	1
14-2	Encoder drive shaft	1
14-3	Encoder pinion	1
14-4	Ball bearing	2
14-5	Oil seal	1
14-7	Roll pin	1
14-8	Socket head cap screw	1
14-9	O-ring	1

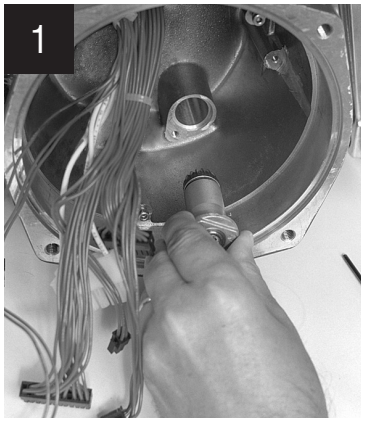
Figure 1.13 – Encoder Drive Cartridge



1.15.1 Installation

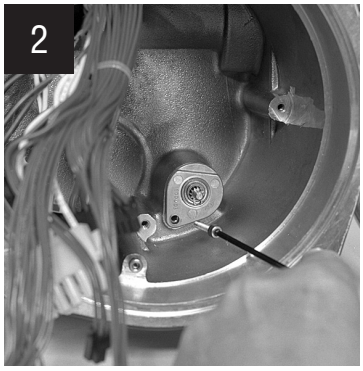
STEP 1

Fit the encoder drive cartridge into the actuator housing.



STEP 2

Using a 3 mm hex key, fit the M4 screw (#14-8) into the actuator housing to secure the encoder cartridge.



NOTE: See Appendix A for bill of material (BOM) structure.

1.16 Installation of MXa Encoder

Table 1.8 – Encoder Parts List

Part Number	Description	Qty.
1-6	Encoder assembly	1
1-36	Socket head cap screw (M4x10)	3

Figure 1.14 – Encoder

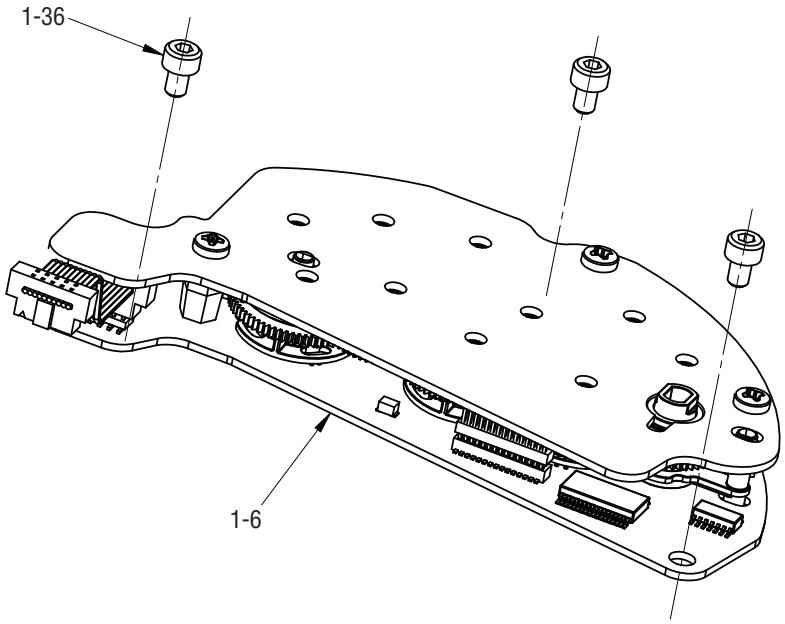


Table 1.9– Encoder Drive Sleeve Speed (RPM)

Drive Sleeve Speed ID	1	2	3	4	5	6	7	8
50 Hz	15[2]	22	33	43	65	84/110[1]	127/143[1]	165[2]
60 Hz	18[2]	26	40	52	77	100/131[1]	155/170[1]	200[2]

NOTE 1: MX-85, -140, and the only available speeds for the MX-150.

NOTE 2: N/A MX-85, -140, and -150.

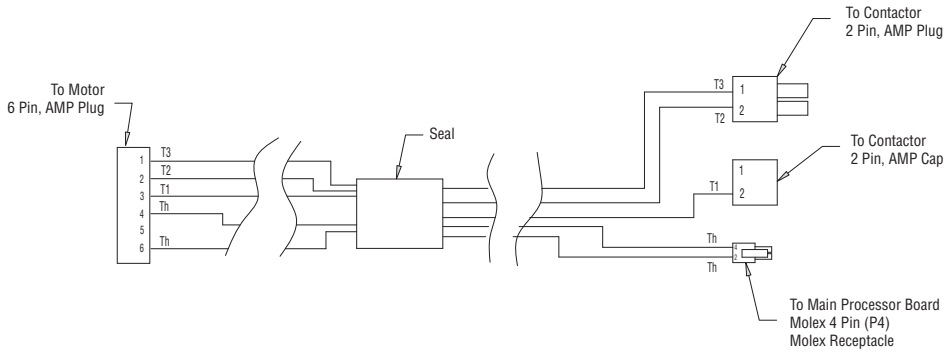
1.16.1 Installation

WARNING: Hazardous Voltage! Turn off all power sources to actuator before remounting encoder assembly. Power sources may include main power.

Align the three encoder mounting holes with the matching holes in the actuator housing and push the encoder straight on to the mounting boss, carefully positioning the encoder to ensure correct meshing with the encoder drive cartridge pinion. If needed to align gearing, declutch the actuator and turn handwheel until the encoder gear engages with the drive cartridge pinion). Fit the three M4 screws (#1-36) and tighten using a 3 mm hex key. Do not overtighten.

1.17 Motor Lead Harness (MX-85, -140, and -150)

Figure 1.15 – Motor Lead Assembly



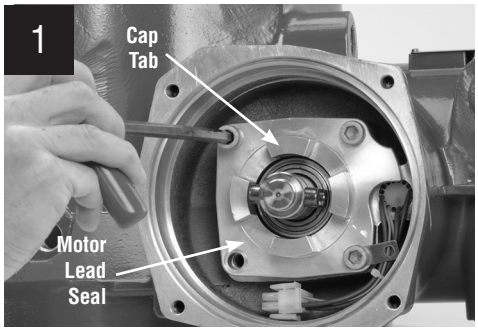
1.17.1 Removal

NOTE: Before removal, you must:

1. Remove the motor (subassembly #4).
2. Remove the CP (subassembly #7). (See Section 1.1.)
3. Remove the control module (subassembly #15). (See Section 1.6.1.)
4. Remove the contractor assembly (subassembly #8). (See Section 1.10.1.)

STEP 1

If the worm shaft assembly (subassembly #3) is still mounted in the unit, remove the four screws (#3-9) and rotate the cap (CCW) to rotate the cap tab away from the motor lead seal.



STEP 2

Remove the motor lead harness by threading the harness back through the housing and out the motor end. Work the three connectors out through the hole/slot in the housing one at a time.

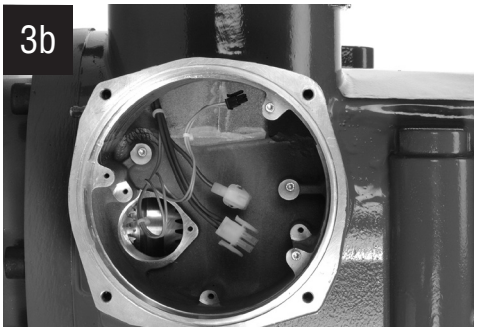


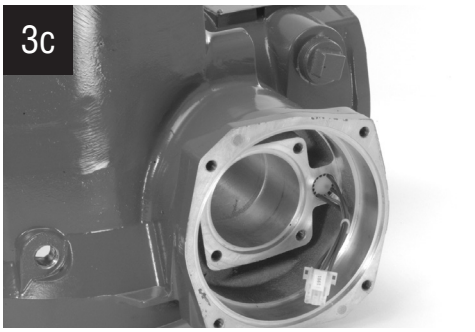
1.17.2 Remounting

STEP 3

Work the three connectors through the hole/slot in the housing. (Hole/slot is located in the motor cavity next to the worm shaft bore.) Thread the three connectors through the housing into the controls compartment cavity until the lead seal fits completely into the hole/slot in the housing.







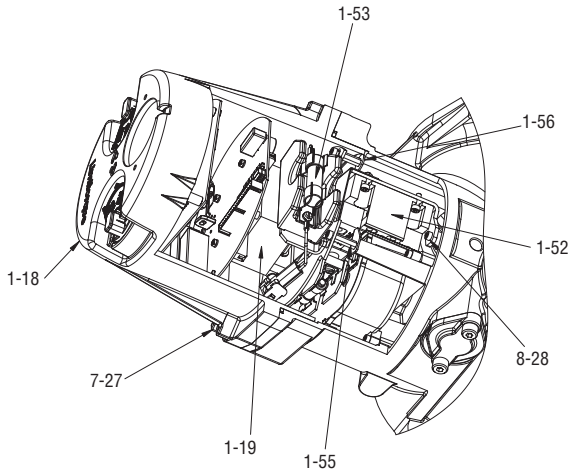
STEP 4

Remount all removed subassemblies according to the remounting instructions in the following order.

1. Contactor assembly (subassembly #8). (See Section 1.10.1.)
2. Control module (subassembly #15). (See Section 1.6.1.)
3. Control panel (subassembly #7). (See Section 1.1.)
4. Motor (subassembly #4).

1.18 Removal of Solid State Motor Reverser Upgrade Instructions (most units prior to September 2007)

Figure 1.16 – Cutaway View of MX SSMR Controls Area

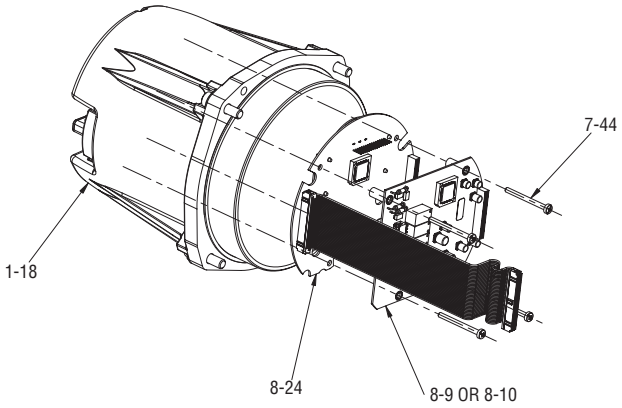


Tools required:

- M3 hex key
- M6 hex key
- Phillips head screwdriver
- Flat head screwdriver

1.18.1 Disassembly Procedure

Figure 1.17 – Disassembly Procedure



STEP 1

Remove contactor. See Section 1.10.1 for removal procedure.

NOTE: Removal of the contactor requires removal of the motor, CP cover, controls, and terminal block. Sections for these procedures are listed under the contactor removal. See Sections 1.1, 1.4 and 1.5.

STEP 2

Retain the Main/LCS board, power assembly, mounting screws, and any optional boards removed from the CP cover.

STEP 3

Discard the CP cover assembly and the four M8 mounting screws. A new CP with integral insulator and mounting screws is included in the upgrade kit.

STEP 4

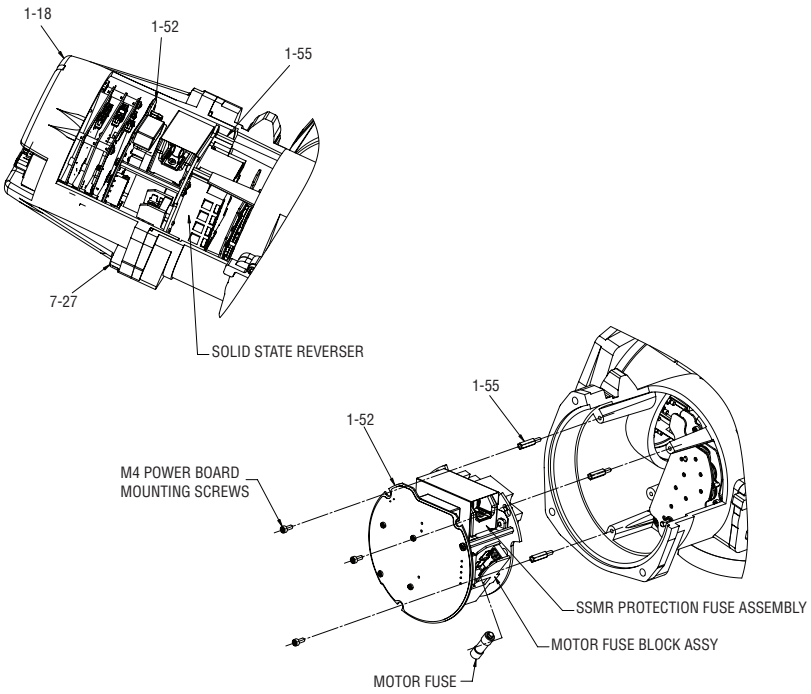
Discard the mechanical contactor assembly, keeping the two M4 mounting screws (8-28) per Figure 1.9.

1.19 Mounting of MXa SSMR (Solid State Motor Reverser)

Table 1.10 - SSMR Parts List

Part Number	Description	Qty.
1-18	Controls cover assembly	1
7-27	Socket head cap screws	4
1-52	Solid state reverser power assembly	1
1-55	Standoff	3

Figure 1.18 – SSMR (Solid State Motor Reverser)



⚠ **CAUTION:** Potential to cause electrostatic damage to electronic components. Before handling electronic components, ensure that you are discharged of static electricity by briefly touching a grounded metal object. Flowserve recommends the use of a wrist strap grounded to an appropriate ground.

STEP 1

Install the three (3) standoffs (#1-55) into the control board housing mounting holes.

STEP 2

Install the power board complete with the SSMR using the M4 power board mounting screws.

STEP 3

Ensure the SSMR fuses are correct per Table 1.11. Part numbers for the SSMR are the same as the note under Table 1.11. Confirm the motor FLA current from the MX nameplate.

STEP 4

Plug the 3-pin Molex harness (I1-L3) to plug into motor reverser. Plug the three-wire and thermistor cable (T1-T3) to the motor leads.

NOTE: See Appendix A for bill of material (BOM) structure.

Table 1.11 – SSMR Motor Fuse Table

Nameplate	Limitorque P/N	Ferraz-Shawut
.6 to .89	102478	ATDR 1-6/10
.9 to 1.34	102480	ATDR 2-½
1.35 to 2.25	102482	ATDR 4
2.26 to 3.2	102484	ATDR 6
3.21 to 4	102487	ATDR 9
4.1 to 6	102488	ATDR 12

Appendix A – Bill of Materials (BOM) Structure

Section 1.1 – Control Panel (CP)

A. 26100-097A : WP & SUBM - ALL

B. 26100-098A : XP-FM&CSA-C&D, ALL AGENCIES IIB

C. 26100-099A : XP-FM&CSA-B, ALL AGENCIES IIC

Section 1.4 – 12 Amp Power Assemblies for MXa Units

A. MX-05/10/20/40

1. 26100-219; Control- 110-208 VAC
2. 26100-216; Control – 220-480 VAC
3. 26100-222; Control – 575 VAC

B. MX-85/140

1. 26100-217 : CONTROL - 220-480 VAC

C. 64-516-0003-4 - LEAD SEAL ASSEMBLY

1. 26100-221 : CONTROL - 575 VAC

D. 64-516-0003-4 - LEAD SEAL ASSEMBLY

Section 1.9 – 54-Point MXa Terminal Block

A. 64-825-0120-51 : 14 AWG, W/FLA <= 12

B. 64-825-0120-52 : 8 AWG, W/FLA > 12

C. 64-829-0006-2 : INCREASED SAFTEY(ATEX & IECEx) RETAINING RING

D. 26100-241 : 14 AWG, W/FLA <= 12

E. 26100-242 : 8 AWG, W/FLA > 12

F. 100709 : RETAINING RING

G. CM1-M110X3.5-B46A : O-RING

Section 1.12 – 19 Amp Power Assemblies for MXa Units

A. MX-20/40

1. 26100-254 : CONTROL- 110-208 VAC & 220-480 VAC

B. MX-85/140/150

1. 26100-231 : CONTROL - 220-480 VAC

C. 64-516-0003-4 - LEAD SEAL ASSEMBLY

1. 26100-233 : CONTROL - 575 VAC

D. 64-516-0003-4 - LEAD SEAL ASSEMBLY

Section 1.15 – Removal and Replacement of MXa Encoder

A. 26100-095A

Section 1.16 – Mxa Encoder Drives

A. MX-05
   1. 25600-063 : ENCODER DRIVE ASSEMBLY
      i. 64-525-0005-3 : ENCODER DRIVE CARTRIDGE

B. MX-10
   1. 25700-031 : ENCODER DRIVE ASSEMBLY
      i. 64-525-0020-3 : ENCODER DRIVE CARTRIDGE

C. MX-20
   1. 25800-027 : ENCODER DRIVE ASSEMBLY
      i. 64-525-0021-3 : ENCODER DRIVE CARTRIDGE

D. MX-40
   1. 25900-033 : ENCODER DRIVE ASSEMBLY
      i. 64-525-0021-3 : ENCODER DRIVE CARTRIDGE

E. MX-85/140/150
   1. 26000-032: ENCODER DRIVE ASSEMBLY
      i. 64-525-0022-4 : ENCODER DRIVE CARTRIDGE

Section 1.19 – Mounting of MXa SSMR (Solid State Motor Reverser)

A. MX-05/10
   1. 26100-223 : 110-208 VAC, 4.8 AMP, W/FLA <= 4.8
   2. 26100-225 : 220-480 VAC, 4.8 AMP, W/FLA <= 4.8

B. MX-20/40
   1. 26100-223 : 110-208 VAC, 4.8 AMP, W/FLA <= 4.8
   2. 26100-224 : 110-208 VAC, 11 AMP, W/FLA < 4.8<= 11
   3. 26100-225 : 220-480 VAC, 4.8 AMP, W/FLA <= 4.8
   4. 26100-226 : 220-480 VAC, 4.8 AMP, W/FLA < 4.8<=11

C. MX-85
   1. 26100-236 : 220-480 VAC, 4.8 AMP, W/FLA < 4.8<=11

D. 64-516-0003-4

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FCD LMENIM2320-00 07/12 Printed in USA.

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Flowserve Corporation
Flow Control

United States
Flowserve Limitorque
5114 Woodall Road
P.O. Box 11318
Lynchburg, VA 24506-1318
Phone: 434-528-4400
Facsimile: 434-845-9736

England
Flowserve Limitorque
Euro House
Abex Road
Newbury
Berkshire, RG14 5EY
United Kingdom
Phone: 44-1-635-46999
Facsimile: 44-1-635-36034

Japan
Limitorque – Nippon Gear Co., Ltd.
NOF Bldg. 9th Floor
1-11-11, Kita-Saiwai, Nishi-Ku
Yokohama (220-0004)
Japan
Phone: 81-45-326-2065
Facsimile: 81-45-320-5962

Singapore
Flowserve Limitorque
12, Tuas Avenue 20
Singapore 638824
Phone: 65-6868-4628
Facsimile: 65-6862-4940

China
Limitorque Beijing, Pte., Ltd.
RM A1/A2
22/F, East Area, Hanwei Plaza
No. 7 Guanghua Road, Chaoyang District
Beijing 100004, Peoples Republic of China
Phone: 86-10-5921-0606
Facsimile: 86-10-6561-2702

India
Flowserve Limitorque, Ltd.
Plot No 4
Export Promotional Industrial Park
Whitefield, Bangalore 560066
India
Phone: 91-80-40146200
Facsimile: 91-80-28410286