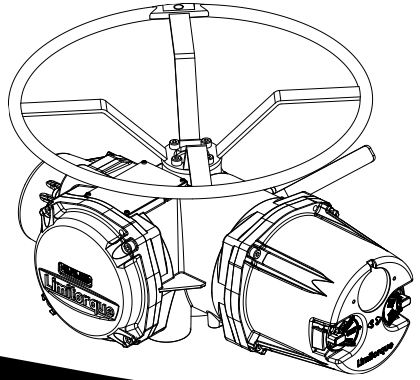
FLOWSERVE

MX Electronic Actuator

FCD LMENIM2306-01 – 8/07

USER INSTRUCTIONS

Installation
Operation
Maintenance



Experience In Motion

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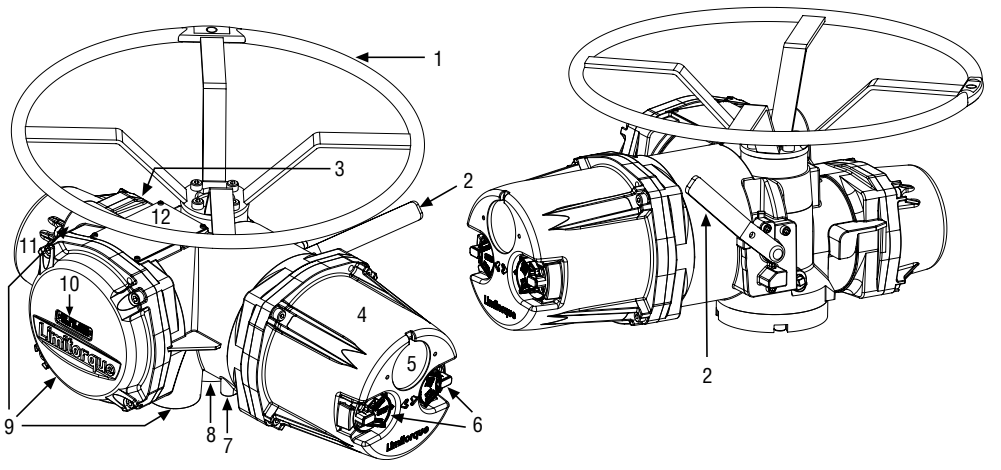
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Figure 1.1 – MX-05 Actuator



Piece	Description
1	Handwheel
2	Declutch Lever (MX-05)
3	Oil Fill
4	Controls Cover
5	LCD
6	Control Knob
7	Ground Lug
8	Thrust/Torque Base
9	Conduit Entry
10	Terminal Compartment
11	Motor
12	Nameplate

1 Important Notes

- Please read this manual in its entirety before attempting to install or operate your MX 2006 actuator. A full understanding of the installation and operation options will assist you in installing the actuator in the most effective manner. Limitorque has designed the MX actuator for long life even in the harshest environments. Flexible control and protection options are provided to ensure the actuator meets your requirements.
- All actuator enclosures are sealed by O-rings, and cable entries are supplied with threaded plugs to protect the terminal compartment until the unit is wired. If the actuator cannot be installed immediately, it is recommended that it be stored in a clean, dry place, preferably in an area that is not subject to large fluctuations in temperature.
- Disconnect all incoming power before opening any cover on the actuator. The user/operator must ensure that safe working practices are employed at all times and are in accordance with local or national standards that are enforced at the particular site.
- To install and commission the actuator, only the terminal compartment cover needs to be removed. See Figure 1.1, Item 10. Settings for commissioning the actuator are done externally; therefore, no other covers need to be removed. The actuator was assembled in ideal dry conditions and the total sealing of the enclosure protects all electrical components against deterioration.

NOTE: Removal of any cover, other than the terminal compartment cover, will invalidate the unit warranty. Exposure of actuator components to an environment that results in deterioration of internal components will also invalidate the unit's warranty.

- During final field installation, ensure that all cable entries are correctly sealed in accordance with National Standards or Regulatory Authorities. All temporary transit plugs must be removed and any unused cable entries closed in an approved manner. See Section 3.3.3, Sealing Cable/Conduit Entries.

2 Quick Start

Quick Start provides step-by-step instructions for commissioning each MX actuator. This information is also available in Bulletin LMAIM2310, Quick Start-Up Instructions. These instructions are for the following:

- Position limits calibration – can be performed one of two ways:
- Electrical operation: See Section 2.1.2, Electrical Operation Feature.
- Handwheel operation: See Section 2.1.3, Handwheel Operation Feature.
- DDC operation: See Section 2.2, DDC Option.
- FF operation: See Section 4.9, FF Option.
- PB operation: See Section 4.10, PB Option.
- DeviceNet operation: See Section 4.11. DN Option.

When these Quick Start instructions are complete, the position limits will be set and the actuator will be ready for normal operation.

NOTE: The actuator has been configured with all customer-specified parameters and no further calibration should be necessary. If full valve data was not provided when ordering, or if changes are needed for parameters, see Sections 3.4 and 4, Commissioning the Actuator and Customizing the Actuator.

2.1 Calibrate – Position Limits

1. Install the MX actuator on the valve.
2. Refer to the nameplate for the correct main power supply voltage. Switch on the main power to the unit.
3. Turn the red knob to the STOP position. The “SET CLOSE POSITION LIMIT” message will be displayed. When the red knob is in “LOCAL” or “REMOTE,” the liquid crystal display (LCD) screen will read “SET POSITION LIMITS.”

4. Calibrate end position limits one of two ways:
   - Electrically, using the control panel. See Section 2.1.2, Electrical Operation Feature.
   - Manually, using the handwheel. See Section 2.1.3, Handwheel Operation Feature.

Once the position limits have been set, the screen message will indicate the valve position as a percentage of the valve opening.

While setting limit switches, place the red selector knob in the "LOCAL" position to permit the actuator to run open or closed in push-to-run mode (inching) only.

⚠ **CAUTION:** Extreme care must be taken as the valve approaches its end position.

The unit will not function with the red selector knob in the "REMOTE" position until both limit switches are set.

The existing configuration of the actuator/valve parameters may be viewed by entering the "SETUP" mode.

2.1.1 Entering the Setup Mode

1. Place the red selector knob in the "STOP" position.
2. Within 10 seconds, place the black control knob in the "YES" position, then the "NO" position, then again in the "YES" position (in quick succession—approximately one-two seconds).
3. The message "SETUP?" will appear in the LCD display for 10 seconds. If no setup action is taken within 10 seconds, the unit will reset.

   Use the black control knob to answer "YES" or "NO" to the questions appearing in the display.

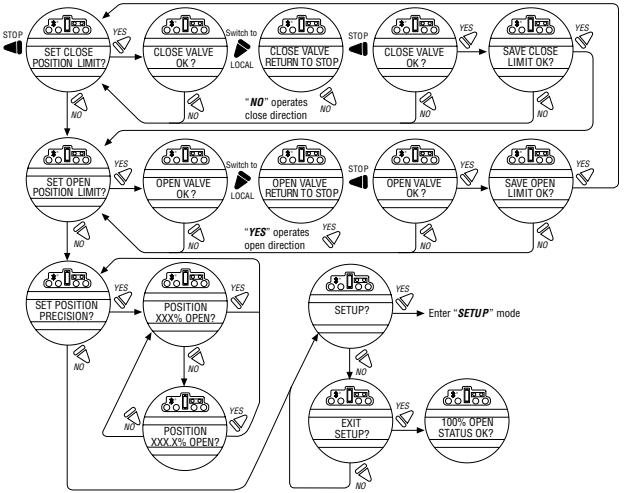
2.1.2 Electrical Operation Feature

This feature allows for quick and simple calibration. To set the position limits electrically, enter the "CHANGE SETTINGS" mode via the "SETUP" mode.

1. Enter the “SETUP” mode as detailed in Section 2.1.1, Entering the Setup Mode.
2. When screen prompt reads “CHANGE SETTINGS,” select “YES.”
3. The screen will display the “CHANGE SETTINGS” mode menu items. Select “NO” until screen displays “CHANGE POSITION SETUP.” User may select to set close limit first or open limit first.
4. Select “YES.” “CLOSE” or “OPEN VALVE - OK?” is displayed.
5. Place the red selector knob in the “LOCAL” position. Move the black knob in the intended direction. The LCD screens are shown in Figure 2.1.
6. When valve has reached desired position, return the red selector switch to “STOP” and complete calibration.

The position settings are now complete. The actuator will now function as ordered, and may be run electrically to inspect for correct operation.

Figure 2.1 – Electrical operation



2.1.3 Handwheel Operation Feature

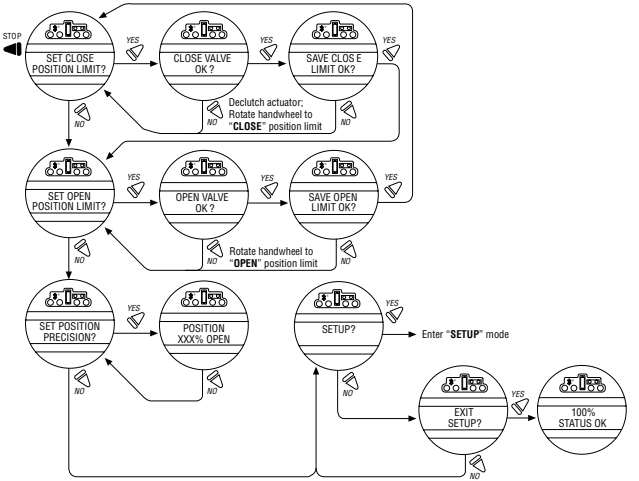
To set the position limits manually, enter the “CHANGE SETTINGS” mode via the “SETUP” mode.

1. Enter the “SETUP” mode as detailed in Section 2.1.1, Entering the Setup Mode.
2. When LCD reads “CHANGE SETTINGS?”, select “YES.”
3. The LCD will display the “CHANGE SETTINGS” mode menu items. Select “NO” until screen displays “CHANGE POSITION SETUP?”
4. Select “YES.” See Figure 2.2. Manually set position limits:
   a. Close position limit
      1. “SET CLOSE POSITION LIMIT?” is displayed.
      2. Select “YES.” “CLOSE VALVE - OK?” is displayed.
      3. Depress the declutch lever, and at the same time slowly rotate the handwheel until the clutch is fully engaged. Release the lever; the clutch will be retained in the handwheel mode by spring-loaded latches.
      4. Ensure the valve is fully closed, then move the valve in the open direction for one handwheel turn to allow for coasting of the motor.
      5. When the valve is in the desired position, select “YES” again. The LCD will read “SAVE CLOSE LIMIT OK?”
      6. Select “YES” if the valve’s close limit position is correct. The close position limit is set.
   b. Open position limit
      1. “SET OPEN POSITION LIMIT?” is displayed.
      2. Select “YES.” “OPEN VALVE - OK?” is displayed.
      3. Depress the declutch lever, and at the same time slowly rotate the handwheel until the clutch is fully engaged. Release the

lever; the clutch will be retained in the handwheel mode by spring-loaded latches.

4. Ensure the valve is fully open, then move the valve in the close direction for one handwheel turn to allow for coasting of the motor.
5. When the valve is in the desired position, select "YES" again. The LCD will read "SAVE OPEN LIMIT OK?"
6. Select "YES" if the valve's open position limit is correct. The open position limit is set.
7. Move the valve in the close direction. The open lamp should extinguish within one turn of the handwheel.
8. Move the valve back in the open direction and check that the open lamp illuminates just before the full open position is reached (approximately ½ to 1 turn).
9. If the calibration requires adjustment, select "NO" at the "SET CLOSE POSITION LIMIT?" prompt and repeat the "SET OPEN POSITION LIMIT?" routine.
10. Select "NO" to exit "POSITION SETUP?" or "YES" to return to "SET CLOSE POSITION LIMIT?"

Figure 2.2 – Handwheel operation



2.2 DDC Option

The following instructions assume that all DDC option parameters are set with the exception of the address.

1. After setting position limits, remain in the “SETUP” mode. If not in the “SETUP” mode, enter the “SETUP” mode as detailed in Section 2.1.1, Entering the Setup Mode.
2. When LCD reads “CHANGE SETTINGS?”, select “YES.”
3. The LCD will display the “CHANGE SETTINGS” mode menu items. Select “NO” until screen displays “CHANGE DDC?” Select “YES.” LCD will display DDC menu items.
4. Select “YES” for each menu item until “DDC ADDRESS OK?” appears. Select “NO.”
5. Enter an address from one to 250 by toggling “NO” until the correct address is displayed. User may select to hold the knob in the “NO”

direction and the number will automatically increment by one until the preferred address is reached.

⚠ **CAUTION:** The network address must be entered in accordance with the user address assignment sheet. This assignment sheet should correspond to the contract specifications. The same address must not be used anywhere else in the same network.

The DDC address does not have to be set to exit the setup.

2.3 Check the Settings

1. Operate the valve to the fully "CLOSE" position. Verify that the "CLOSE" (default GREEN) LED illuminates just as the travel limit is reached, and the valve position is displayed as "0% OPEN."
2. Operate the valve to the fully "OPEN" position. Verify that the "OPEN" (default RED) LED illuminates just as the travel limit is reached, and the valve position is displayed as "100% OPEN."

3 Installation and Operation

3.1 Preparing the Stem Nut

The MX has two (2) basic base designs:

- Torque-only base, designated by a “B” prefix
- Thrust-only base, designated by an “A” prefix

3.1.1 Type “B” Bases: Torque-only Applications

Standard B4/B4E Base

The standard MX actuator base is the B4 torque-only. It includes a mounting plate and steel torque nut, which may be machined to fit a valve or gearbox. A B4E torque nut can be provided and may be installed to allow for extended stem acceptance.

NOTE: Some MX actuators are supplied with single piece drive sleeves that have been bored and keyed. These are typically mounted directly to gearboxes.

Figure 3.1 – B4 base

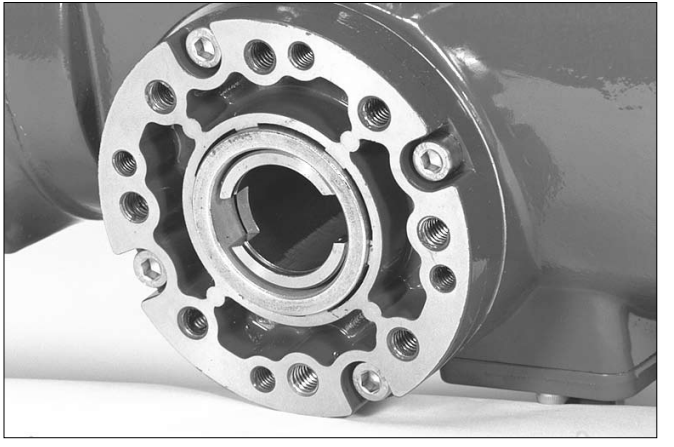
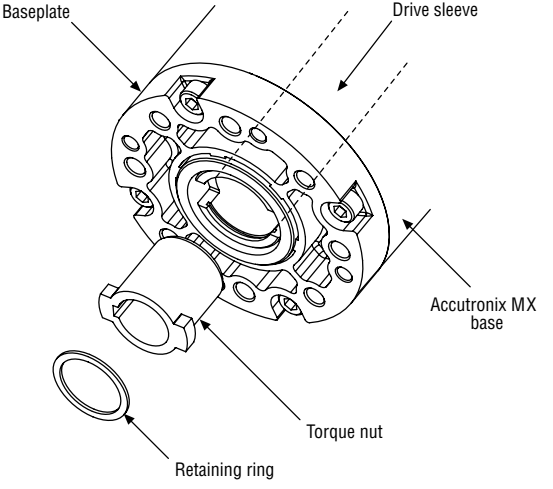


Figure 3.2 – B4E base



Figure 3.3 – Exploded view of B4/B4E base (MX-05 shown)



Disassembly

1. Remove the retaining ring (B4 base) or spiral-wound ring (B4E base) that retains the torque nut in the drive sleeve.
2. Remove the torque nut. If the torque nut is difficult to remove, insert a suitable device into the drive sleeve through bore and gently tap it loose from the handwheel end.
3. Machine the torque nut to suit the valve stem or gearbox input shaft (see LMASS1326/LMASS2326, MX Performance and Dimensions for maximum stem capacity). Ensure sufficient clearance for a smooth, sliding fit.

Reassembly

1. Clean the torque nut thoroughly and lightly grease.
2. Replace the torque nut in the drive sleeve. Ensure the torque nut meshes with the drive lugs.
3. Refit the retaining ring (B4 base) or spiral-wound ring (B4E base).

Optional B1 Base (not available for MX-85, MX-140 and MX-145)

An optional torque base assembly may be added to allow for a greater stem acceptance. This base is supplied with a fixed bore and key as defined by ISO 5210.

Disassembly

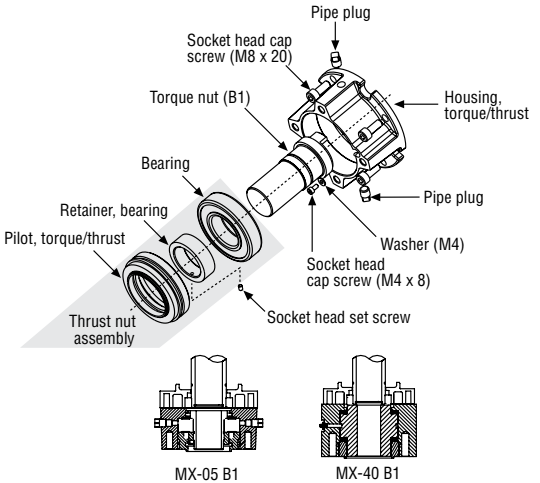
No disassembly is required since the torque nut has been machined to an international standard. Clean the bore and lightly grease.

Figure 3.4 – B1 base



NOTE: Fill base with a Lithium based EP0 grease.

Figure 3.5 – Exploded view of B1 base



3.1.2 Type "A" Bases: Thrust-only Applications

Standard A1/A1E Base

The standard MX actuator thrust base is the A1, and may be bolted directly to the actuator. The thrust base contains a bronze alloy thrust nut that may be machined to suit the valve stem.

An A1E (extended) thrust nut can be provided and may be installed to reach shorter stems.

Figure 3.6 – A1 base



Disassembly – Units MX-05/10/20/40
Refer to Figure 3.7.

Disassembly of the main housing from the base may be recommended to allow the base to remain on the valve if the actuator must be removed for service.

Pilot removal
MX-10/20: Remove the screw and washer holding the valve pilot to the thrust base and remove pilot.

MX-40: Turn counterclockwise (CCW) and remove.

Thrust bearing and nut removal
1. Remove the first set of thrust washers and bearing.
2. Remove stem nut.

   NOTE: The thrust washers, bearing, and thrust nut may be removed at the same time. The second set of thrust washers and bearing does not have to be removed.
3. Machine the thrust nut to suit the valve stem. Ensure sufficient clearance to avoid unnecessary wear and heating during operation.

Reassembly – Units MX-05/10/20/40
Refer to Figure 3.7.

1. Clean the thrust nut, washers, and bearing(s) thoroughly.
2. Slide second set of thrust washers and bearing in place if removed.

NOTE: Order of assembling thrust washers and bearing must be as follows: washer, thrust bearing, washer.

Pilot installation
MX-05/10/20: Slide pilot into thrust base assembly and secure with washer and screw. Tighten fully.

MX-40: Place pilot into thrust base and turn clockwise (CW) until pilot is tight.

NOTE: Fill base with Nebula EP 0, Conoco Conolith EP 00, Mobil SHC 632, Dynalife-L-EP0, Triton ELL, or Lithium based EP0 grease.

Disassembly – Units MX-85

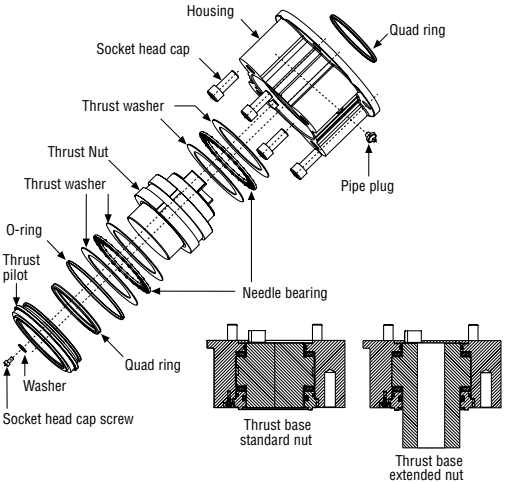
Refer to Figure 3.8.

Disassembly of the main housing from the base may be recommended to allow the base to remain on the valve if the actuator must be removed for service.

Thrust base mounting plate removal

Remove the six socket head cap screws holding the valve mounting plate to the thrust base housing and remove mounting plate.

Figure 3.7 – Exploded view of A1/A1E base (MX-05/10/20/40 only)



Thrust bearing and nut removal

1. Remove the first set of thrust washers and bearing.
2. Remove stem nut.

NOTE: The thrust washers, bearing, and stem nut may be removed at the same time. The second set of thrust washers and bearing does not have to be removed.

3. Machine the stem nut to suit the valve stem. Ensure sufficient clearance to avoid unnecessary wear and heating during operation.

Reassembly – Units MX-85

Refer to Figure 3.8.

1. Clean the stem nut, washers, and bearing(s) thoroughly.
2. Slide second set of thrust washers and bearing in place if removed.
3. Install stem nut. Lubricate thoroughly.
4. Install first set of thrust washers and bearing.

NOTE: Order of assembling thrust washers and bearing must be as follows: washer, thrust bearing, washer.

NOTE: Fill base with Nebula EP 0, Conoco Conolith EP 00, Dynalife-L-EP0, Mobil SHC 632, Triton ELL, or Lithium based EP0 grease.

Thrust baseplate installation

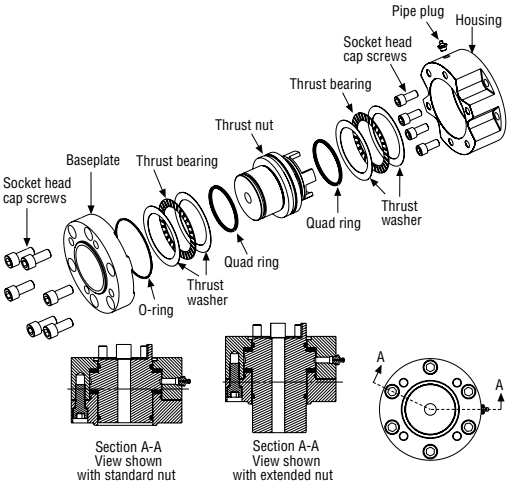
Mount baseplate to thrust base housing and install the six socket head cap screws to the proper torque per Table 3.1.

Table 3.1 - Hardware and torque for thrust base mounting

Screw Size	Torque	
	ft-lb	N m
M8 or 5⁄16 in. (8 mm)	12-14	16-19
M10 or 3⁄8 in. (9 mm)	25-30	33-40
M12 or 1⁄2 in. (13 mm)	40-50	53-67
M16 or 5⁄8 in. (16 mm)	90-100	122-135
M20 or 3⁄4 in. (19 mm)	180-200	244-271

NOTE: Screw mounting torque for mounting thrust base to main housing or thrust baseplate to thrust base housing.

Figure 3.8 – Exploded view of thrust base (MX-85 only)



Disassembly – Units MX-140/MX-145
Refer to Figure 3.9.

Disassembly of the main housing from the base may be recommended to allow the base to remain on the valve if the actuator must be removed for service.

Pilot removal
Remove the two screws and washers holding the valve pilot to the thrust base and remove pilot.

Thrust bearing and nut removal
1. Remove the first set of thrust washers and bearing.
2. Remove stem nut.

   NOTE: The thrust washers, bearing, and stem nut may be removed at the same time. The second set of thrust washers and bearing does not have to be removed.
3. Machine the stem nut to suit the valve stem. Ensure sufficient clearance to avoid unnecessary wear and heating during operation.

Reassembly – Units MX-140
Refer to Figure 3.9.

1. Clean the stem nut, washers, and bearing(s) thoroughly.
2. Remove pipe plug.
3. Slide second set of thrust washers and bearing in place if removed.
4. Install stem nut. Lubricate thoroughly.
5. Install first set of thrust washers and bearing.
6. Install pipe plug.

NOTE: Order of assembling thrust washers and bearing must be as follows: washer, thrust bearing, washer.

NOTE: Fill base with Nebula EP 0, Conoco Conolith EP 00, Dynalife-L-EP0, Mobil SHC 632, Triton ELL, or Lithium based EP0 grease..

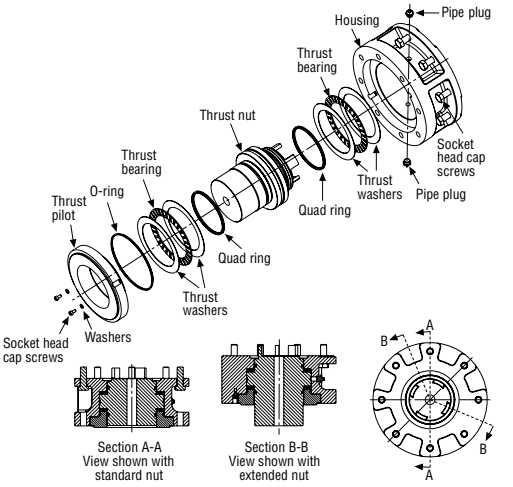
Pilot installation

Slide pilot into thrust base assembly and secure with the two washers and screws. Tighten fully.

3.1.3 Type “BL” Drive: Splined Drive Application

Steel alloy splined nuts are provided to a standard involute spline category for rising and rotating stem valves per customer requirements. Disassembly and reassembly is the same as the B4 base and the torque nut. See Section 3.1.1, Type “B” Bases: Torque-only Applications.

Figure 3.9 - Exploded view of thrust base (MX-140/MX-150 only)



3.2 Mechanical Installation onto Valve or Gearbox

NOTE: Refer to MX Maintenance and Spare Parts bulletin (LMAIM1314/ LMAIM2314) for more detailed instructions.

Before installing the actuator onto a valve or gearbox, check the following to ease installation:

- Verify that mounting flange is suited dimensionally to mate with the actuator base. Ensure that it is perpendicular to the valve stem or gearbox input shaft.
- Ensure the stem nut mates with the valve stem or input shaft. For screwed nuts, it is advisable to run the stem nut down the entire length of the stem to check for tightness. Keyed or splined shafts should exhibit a smooth, sliding fit with the key installed.
- Ensure there is adequate engagement of the stem nut with the valve stem or input shaft when mounted. Generally, the minimum length of engagement is 1.5 times the diameter of the stem.
- Verify that mounting studs or bolts are the correct length to suit the thickness of the mounting plate.
- Verify hardware specifications for English style:
- Socket head cap screw per ASTM A 574 and ANSI 18.3.
- Hex head cap screw per SAE J429 Grade 5.
- Verify hardware specifications for metric style: hex and socket head cap screws per Property Class 12.9.
- Clean and lubricate the valve stem or input shaft.
- Ensure adequate lifting facilities and slings are available at the installation site.

NOTE: Do not use the handwheel to lift the actuator.

3.2.1 Mounting (Type “B” Bases): Torque-only

Refer to Figures 3.1 - 3.5.

1. Ensure torque nut is secured inside actuator drive sleeve with retaining ring.
2. Lower actuator onto the valve or gearbox stem. Align the stem nut key and keyway with valve or gearbox stem key seat.
3. Verify that the actuator and valve mounting adapter flanges mate correctly.
4. Secure the actuator to the valve mounting adapter with mounting bolts.

3.2.2 Removal (Type “B” Bases): Torque-only

Refer to Figures 3.1 – 3.5.

1. Remove the bolts that secure the actuator to the valve mounting adapter. If type B1 base is used in addition to the standard type B4 baseplate, you may leave the B1 base attached to the actuator and remove as a unit.
2. Lift the actuator from the actuator mounting adapter.

3.2.3 Mounting (Type “A” Bases): Thrust-only

Refer to Figures 3.6 – 3.9.

1. The following are two options for mounting the type A base actuator:
   a. If the type A thrust base was removed from the valve mounting adapter, replace the thrust base onto the valve mounting adapter. Ensure the thrust base stem nut has the lugs positioned upward to engage with the drive sleeve slots when the actuator is reinstalled. Rotate the bronze nut while holding the base steady.

   or

   b. If the thrust base is installed on the valve mounting adapter, proceed to step two.

2. Lower the actuator along the threaded valve stem and onto the valve mounting plate. Ensure the thrust base stem nut lugs properly engage and align with the drive sleeve slots.
3. Install the bolts to secure the actuator to the thrust base assembly.

3.2.4 Removal (Type "A" Bases): Thrust-only

1. Remove the bolts that secure the actuator to the thrust base assembly.
2. Remove the type A thrust base by removing the bolts that secure the actuator to the valve mounting adapter.

   or

   Leave the type A thrust base mounted to the valve mounting adapter until ready to remount the actuator. The thrust base will maintain valve position provided that the valve stem threads are locking.
3. Lift the complete actuator from the thrust base.

3.3 Electrical Connections

Verify that the supply voltage details on the nameplate are correct for this installation. Setup is non-intrusive; therefore, remove only the terminal cover to make electrical connections and to commission the actuator.

WARNING: The removal of any other covers without Limitorque's approval will void the warranty. Limitorque will not accept responsibility for any damage or deterioration that may occur as a result of cover removal.

3.3.1 Removing Terminal Cover

Remove the terminal cover as follows:

1. Remove the four cover screws using a 6 mm hexagonal wrench.
2. Remove the cover. XP units have long-spigoted covers and two tapped holes 180° apart. If the XP cover is difficult to remove, fit two of the

cover screws into the tapped holes in the cover flange and jack out the cover. Take care to turn the screws by equal increments. Do not lever the cover off with a screwdriver, or similar object, since this may damage the flamepath on an explosionproof unit or the O-ring seal and seating face.

3.3.2 Terminal Compartment Documents

The OEM and user installation kits, wiring diagram, and test report are contained in the terminal compartment or with the actuator. Do not place them in the terminal compartment when the electrical connections have been completed.

NOTE: This instruction does not apply to valve manufacturers or similar installers of the actuator onto a valve prior to shipping to site. It is important that these items are available at the final destination site.

3.3.3 Sealing Cable/Conduit Entries

The sealing of cables and conduit entries should be done in accordance with National Standards or the Regulatory Authorities that have certified the actuators. This is particularly true for units that are certified for use in hazardous areas where the method of sealing must be to an approved standard and cable glands, reducers, plugs, and adapters must be approved and separately certified. All conduit entries should be sealed against the climatic conditions prevailing on-site, especially if temporary submersion is possible. All unused conduit entries should be sealed with threaded metal plugs. Plastic plugs are installed by Limitorque for shipping only and must not be used as permanent seals.

3.3.4 Recommended Terminal Connections

Power Terminals

Ring tongue connectors used on the power terminals should comply with the dimensions shown in Figure 3.10. For Additional information, consult terminal manufacturer.

Figure 3.11 details the allowable voltage and current parameters for the terminal block power terminals. Preload the M5 screws to 1.6-3.2 N m (1.2-2.33 ft-lb).

Control Terminals

Ring tongue connectors used on the control terminals should comply with the dimensions shown in Figure 3.12. For additional information, consult terminal manufacturer. Preload the M3 screws to 0.33-0.66 N m (0.25-0.50 ft-lb).

NOTE: Alternative manufacturers may be substituted only if dimensions are in accordance with Figure 3.12.

NOTE: The use of spade terminals is not recommended for secure electrical connections.

Figure 3.10 – Power terminal connector size limitations

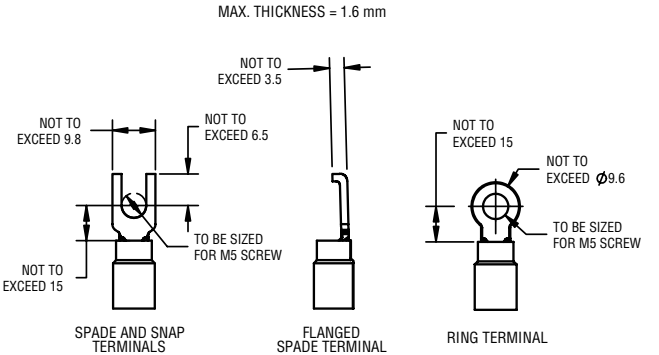


Figure 3.11 – Terminal block rating; power terminals

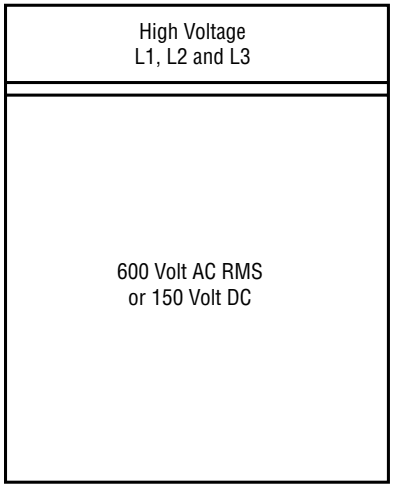
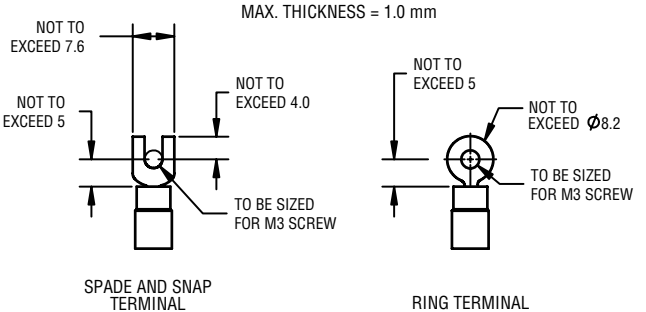


Figure 3.12 – Control terminal connector size limitations



NOTE: Limitorque recommends the use of the following connector for optimum results: Thomas and Betts #RZ22-6.

NOTE: Alternative manufacturers may be substituted only if the dimensions are in accordance with Figure 3.12.

Table 3.2 lists the maximum allowable voltage and current parameters for the terminal block control terminals.

Table 3.2 – Terminal block rating; control terminals

Low Voltage Row	Rating
1	50 Volt, 0.5 amp AC RMS for Points 1 through 16
2	125 Volt, 0.5 amp AC RMS for Points 17 through 35
3 and 4	250 Volt, 5 amp AC RMS for Points 36 through 54

3.3.5 Termination of Cables

All terminations should be made with insulated ring terminals using the appropriate crimping tool. See Figures 3.10 and 3.11 for power terminal connection recommendations. See Figure 3.12 and Table 3.2 and 3.3 for control terminal connection recommendations.

3.3.6 Cable Connections

See Figure 3.14 for connection information.

1. Connect the main power supply cables, including the earth/ground wire using the M5 screws provided.
2. Attach the earth/ground wire to the separate screw on the inside of the terminal compartment.
3. Attach the protective cover included in the OEM bag with the 2.5 mm screws.

4. Use the M3 screws installed in the terminal block to connect the control cables in accordance with the wiring diagram and the project specification.
5. Ensure that all connections are tight, including any spare termination screws that have not been used.

NOTE: A "Customer Connection(s) Diagram" sticker is attached to the interior of the terminal compartment cover. This may be removed and user termination numbers inscribed adjacent to Limitorque's terminal block numbers for field connection reference. The diagram may also be used to assist in locating the terminal block positions. Service and factory contacts are contained on the sticker.

Certification is based on the use of appropriately rated wire for the application. Installation shall be in accordance with the current issue of the applicable national and or local electric code or regulations.

Table 3.3 – Required ratings for external wires

Up to	Use wire rated at least
40°C Ambient	75°C
55°C Ambient	90°C
60°C and 65°C Ambient[1]	105°C

Note 1: Refer to unit nameplate.

3.3.7 Network Installations

The Limitorque MX offers a number of network options: DDC-Modbus, Foundation Fieldbus H1, Profibus DP_V1, Profibus PA, and DeviceNet.

Ensure that the network cable type is Belden 3074F, Belden 3105, Belden 9841 or another cable that is within 5% of the following specifications.

- Nominal impedance: 120 ohms @ 1 MHz
- Line to shield capacitance: 23.0 pF/ft (75.5 pF/m)
- Line to line capacitance: 12.8 pF/ft (42.0 pF/m)

Using other cables may result in decrease of internodal distance and/or an increase in communication error.

Particular care should be taken when terminating twisted-pair shielded cables in a control network. Avoid nicks, cuts, or abrasions in the insulation of data communication cables, since this may result in inadvertent ground connection. Also, excess cable should be cut, not coiled or looped, to prevent noise induction into the network.

Figure 3.13 – View of terminal block

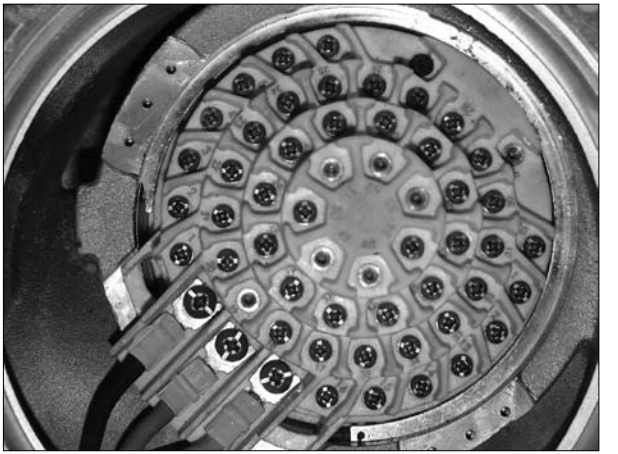
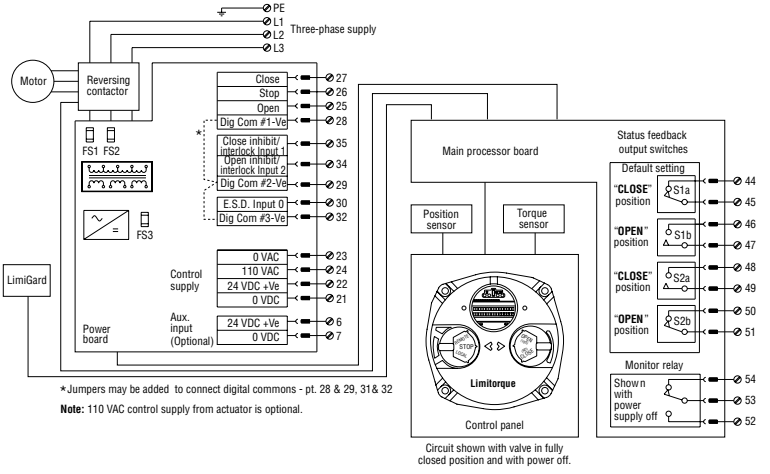
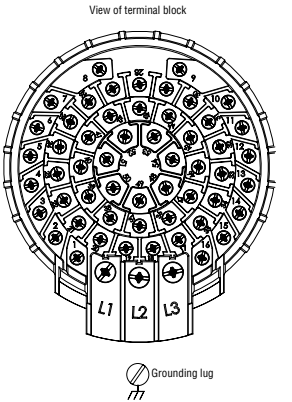


Figure 3.14 – Standard wiring diagram





Cable Preparation

Prepare the network cable for connection to the MX actuator terminal block as illustrated in Figures 3.15 through 3.18.

⚠ **CAUTION:** Strip stranded conductors carefully; do not damage the strands. This will weaken the conductor. Do not nick conductors when stripping away the insulation. Nicking stresses the conductor and can cause the conductor to break. This type of damage may not be apparent and failure can occur later without warning.

1. Remove 2 to 3 in. (5 to 8 cm) of the outer plastic jacket as shown in Figure 3.15. Do not cut or nick the drain wire or the insulated conductors.

Figure 3.15 – Removing outer plastic jacket



2. Separate the cable parts. Unbraid the braided shield and peel back the foil shield to the same point where the outer jacket was removed as shown in Figure 3.16.
3. Cut away the braided shield and the foil shield. Strip the insulation from the conductors approximately ½ inch (1 cm) as shown in Figure 3.17.
4. Apply heat shrink tubing to insulate the drain wire and to provide stress relief to the cable.
5. Install ring tongue connectors as shown in Figure 3.18.

⚠ **CAUTION:** Do not melt the insulation.

6. Connect the network cables to the MX actuator terminal block per Table 3.4 and appropriate wiring diagram. Table 3.4 details a connection for the loop topology.

Figure 3.16 – Separating cable parts

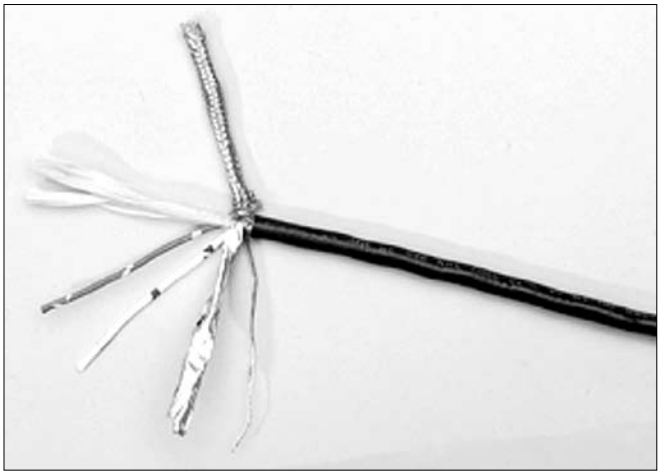


Figure 3.17 – Stripping conductors and applying heat shrink tubing

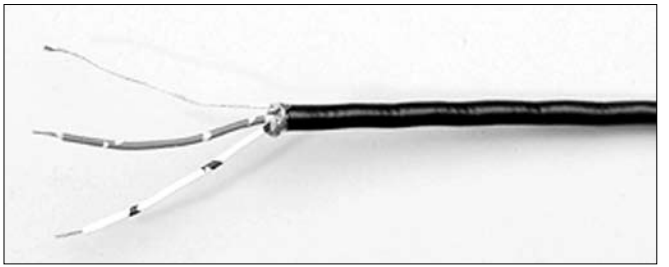


Figure 3.18 – Ring tongue connectors



Table 3.4 – Loop topology connections

Terminal Block Number	DDC
4	DATA-A1* (-)
5	DATA-A1 (+)
14	DATA-A2* (-)
13	DATA-A2 (+)
3	Surge Protection

In terms of voltage, DATA is negative with respect to DATA*.

NOTE: Surge protection must be grounded to be effective.

NOTE: Ground each segment of the cabling at only one point to prevent ground loops, which can affect system performance. Verify the actuator is properly grounded.

Limitorque defines an effective local earth ground as the M3 taps on the housing next to the terminal block.

NOTE: Safety ground may not be disturbed.

NOTE: Shielding is not sufficient to prevent induction of stray voltages onto signal leads from the power lines.

A network wiring diagram for a single loop is shown in Figure 3.19.

After installation is complete and prior to operation, inspect the network cable and its connection to each field unit for the following:

There should not be:

- Nicks in the insulation—this can cause a short to the grounded shield.
- Cut strands in a stranded conductor—this can cause a poor connection and eventually an open circuit.

- Cable armor shorted to the cable shield/drain wire—this may not be at ground potential and could be subject to lightning surges.
- Shield/drain wire grounded at more than one end of each cable segment (the section between each adjacent actuator on the loop). This will avoid ground loop problems.
- Ground/earth connection except at true ground potential and effective at all times.

3.3.8 Foundation Fieldbus Installation

Ensure that the Foundation Fieldbus cable type is Belden 3076F, or another cable that is within 5% of the following specifications.

- Characteristic impedance: 100 ohms @ 31.25 kHz
- Resistance, each wire: 7.32 ohms/1000 ft
- Attenuation: 0.914 dB/1000 ft @ 39 kHz
- Capacitative Unbalance: 3.6 pF/ft

Using other cables may result in decrease of internodal distance and/or an increase in communication error.

Particular care should be taken when terminating twisted-pair shielded cables in a FF control network. Avoid nicks, cuts, or abrasions in the insulation of data communication cables, since this may result in inadvertent ground connection. Also, excess cable should be cut, not coiled or looped, to prevent noise induction into the network.

Cable Preparation

Prepare the network cable for connection to the MX actuator terminal block as follows in Figure 3.15 through 3.18. Table 3.5 details connections for Foundation Fieldbus.

Table 3.5 – Foundation Fieldbus connections

Terminal Block Number	FF Function
4	DATA (-)
5	DATA (+)

The shield must be connected to ground or earth at only one place. The cable shield is generally grounded at the power conditioner.

Reference the Fieldbus Foundation Application Guide 31.25 kbit/s Wiring and Installation guide for more information on network wiring.

⚠ **CAUTION:** Strip stranded conductors carefully; do not damage the strands. This will weaken the conductor. Do not nick conductors when stripping away the insulation. Nicking stresses the conductor and can cause the conductor to break. This type of damage may not be apparent and failure can occur later without warning.

3.3.9 Network Wiring – Profibus DP/PA Installation

Profibus is based on RS 485 communication. The standard EN 50170 specifies the cable for use with Profibus DP.

The following specifications need to be fulfilled by the Profibus cable:

Table 3.6 – Profibus cable specifications

Parameter	Type – Profibus DP
Impedance	135 to 165 ohm/3 to 20 MHz
Capacity	< 30 pF/m
Resistance	< 110 ohm/km
Wire gauge	> 0.64 mm
Conductor area	> 0.34 mm^2

The Profibus DP cable is a shielded twisted pair cable.

In general, there are two different types of cables available. The most commonly used cable has solid wire for the Profibus line. When there is a need for more flexiblity (bending) and higher environmental resistance, a cable with stranded wire for the Profibus line and special jackets shall be used. Limitorque recommends the use of:

• Belden 3079A Specifications, 22 AWG, shielded, solid two conductor

Key Specifications

- Capacitance/ft = 8.5 pF
- Nominal Impedance (ohms) – 150.0

Network Wiring - Profibus PA

Please refer to IEC 61158 & ANSI/ISA S.50.02 Part 2-1992 for network wiring guidelines. Refer to Table 3.5 for connections.

3.3.10 Network Wiring – DeviceNet

DeviceNet is a CAN-based protocol that uses five wires including a shield. Two of the conductors are used for 24 VDC power and up to 8 amps (4 amps for NEC Class 2) may be passed along the hi-way from a suitable power source. Two conductors are used for the CAN bus signals, CAN_H and CAN_L, which are usually smaller in diameter. Flowserve recommends Belden 3082A cable for connecting to a DeviceNet network. The specifications for this cable are preferred.

Table 3.7 – DeviceNet cable specifications

Parameter	Type – Profibus DP
Impedance	135 to 165 ohm/3 to 20 MHz
Capacity	< 30 pF/m
Resistance	< 110 ohm/km
Wire gauge	> 0.64 mm
Conductor area	> 0.34 mm^2

Please refer to Table 3.4 for connections.

3.3.11 Replacing Terminal Cover

Verify that the O-ring seal and spigot joint are clean and in good condition. Lightly coat these items with mineral-based lubricant before replacing the terminal cover and four retaining screws.

3.3.12 External Earth/Ground Connections

In order to help meet the local electric codes of the installation, one external connection point is provided on the main gear housing for the attachment of earth/ground cables. See Figure 3.20 and 3.22. This is in addition to the ground connection inside the terminal compartment.

3.4 Commissioning the Actuator

Before attempting to commission the actuator, verify that the actuator is installed correctly on the valve and main power is “ON.”

After making the initial electrical connections detailed in Section 3.3, Electrical Connections, the MX actuator may be commissioned without removing any covers. No special tools are required. Configuration is accomplished through the use of the LCD and the control knobs mounted on the control panel.

For positioning the actuator:

1. Place the red knob in the “LOCAL” position.
2. Move the black knob to the “OPEN” or “CLOSE” position.

For configuring the actuator:

1. Place the red knob in the “STOP” position.
2. Move the black knob to the “YES” or “NO” position and release to answer questions appearing on the LCD display.

The OPEN and CLOSE position limits must be set after the actuator has been mounted on the valve. See Section 3.4.4, Setting Position Limits. All other actuator parameters are factory-set either in accordance with a Limitorque standard set of default values (see Section 3.4.1, Default Configuration Set) or the requirements specified with the purchase order. Reconfirm these preconfigured settings prior to placing the actuator into service since the requirements of the application may have changed after the manufacture of the actuator. See Section 3.4.2, View the Existing Settings.

3.4.1 Default Configuration Set

Unless otherwise specified, actuators are shipped with the following configuration:

- When Open stopped by position limit; Open seating (position)
- When Close stopped by position limit; Close seating (position)
- Maintained local control; Mode (maintained)
- Clockwise to close; Close direction (CW)
- ESD – User configurable inputs; default is “OFF”
- Inhibits on; Inhibit status (Default = OFF)
- Remote control – three-wire maintained
- Password – 100

Figure 3.19 – User network connection for loop topology/ Typical for all two-wire network protocols

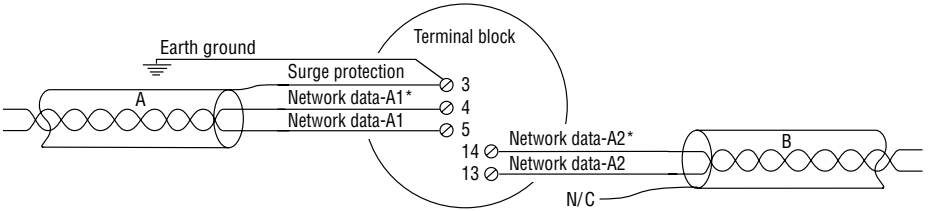
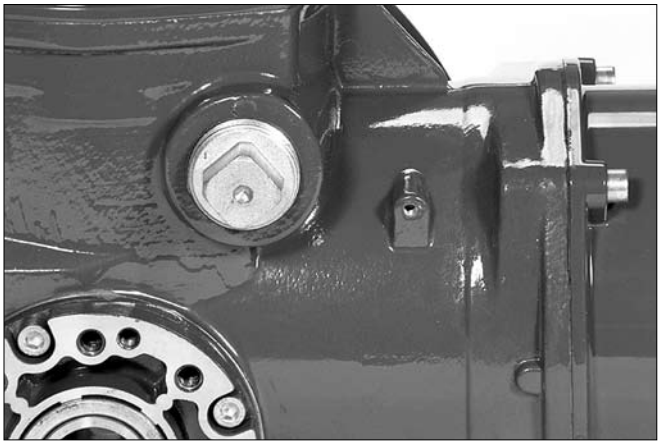


Figure 3.20 – External earth/ground connection – housing



Modutronic Option Proportional band – 15% Deadband – 2% Polarity – 20 mA = Open Action on loss of signal = Close	**Modbus RTU protocol** 9600 baud Analog scale = 0-100 Proportional band – 15% Deadband – 2% Offset – 0 mA
FF Option and PB Option Analog scale = 0-100 Proportional band – 15% Deadband – 2%	

If the default configuration is acceptable, no further configuring is necessary. If any default setting needs to be changed, see Section 4, Customizing the Actuator.

3.4.2 View the Existing Settings

All the existing setup data may be viewed on the LCD display by following a simple step-by-step dialog that may be selected in the following languages:

English (default), Spanish, French, German, Italian, Portuguese, Russian, Malay and Mandarin.

1. Enter the "SETUP" mode as detailed in Section 2.1.1, Entering the Setup Mode.
2. Select the dialog language. Toggle "NO" to scan the language options. Select "YES" when the desired language appears on the LCD.
3. Scan menu selections on LCD and select "YES" when "VIEW SETTINGS" appears.
4. Scan through the series of displays and answer "YES" or "NO" at the appropriate prompts. Each display shows the state or value of the existing settings. See Figure 3.21.

NOTE: The "VIEW SETTINGS?" mode can be accessed without entering a password, but no changes to the settings can be made in this mode.

3.4.3 Entering the Setup Mode

To customize the actuator, view settings, or view diagnostics, the user must enter the "SETUP" mode. A three-digit password is required to customize the actuator. All actuators are supplied with the same default password (100). See Sections 4.2 and 4.3, Password Entry and New Password for entering and changing password. Main power must be applied to execute the setup procedure. As an alternative, 24 VDC may be connected to terminals 37 and 38 for setup, although actuators must be manually positioned. It is recommended that the actuator be mounted to the valve before commissioning the actuator.

Enter the "SETUP" mode as follows:

1. Place the red knob in the "STOP" position.
2. Within 10 seconds, place the black control knob in the "YES" position, then the "NO" position, then again in the "YES" position (in quick succession—approximately one-two seconds).

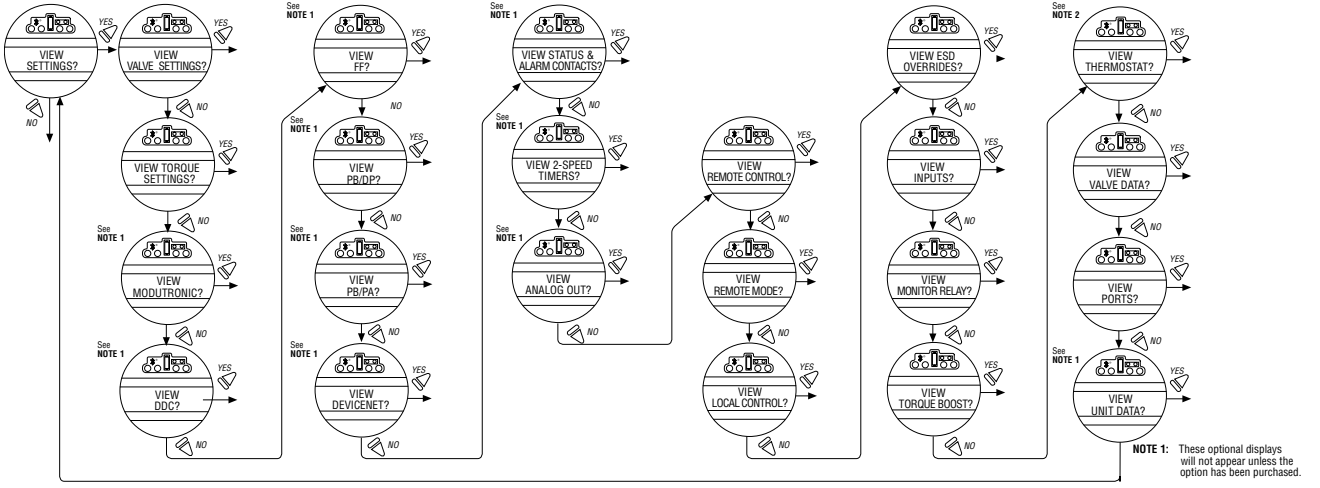
3. The LCD will display “SETUP?” for 10 seconds. If no action is taken within the 10 seconds, the unit will return to “STATUS OK.”
4. Using the black knob, answer “YES” or “NO” to the questions appearing on the LCD display.

NOTE: While in the “SETUP” mode, if there is a lapse of 15 minutes from last action, the unit will return to the “SETUP?” display. Any changes that have been made will be stored.

5. When configuration is complete, answer “YES” to “EXIT SETUP?” or move the red knob from “STOP” to “LOCAL” or “REMOTE.”

After exiting the “SETUP” mode, all settings will automatically be saved to a non-volatile memory and retained, even when power is removed from the actuator. However, if power is removed from the unit while the unit is in “SETUP” mode, customization changes will be lost.

Figure 3.21 – View settings



NOTE 1: These optional displays will not appear unless the option has been purchased.

3.4.4 Setting Position Limits

This section will advise how to configure end-of-travel limits.

The actuator's position limits may be set by manual operation or electrical operation.

☠ **WARNING:** If the actuator will not move after setting the limits, the limits have been set incorrectly.

Set Close Position Limit (Handwheel Operation)

1. Enter the "SETUP" mode as detailed in Section 2.1.1, Entering the Setup Mode.
2. Enter "POSITION SETUP?" routine.
3. From the "SET CLOSE POSITION LIMIT?" display, select "YES." "CLOSE VALVE OK?" will be displayed on the LCD.
4. Engage manual override as detailed in Section 3.5.1, Manual Operation.
5. Ensure that the valve is fully closed.
6. Move the valve in the open direction for one handwheel turn to allow for coasting of the motor.
7. When the valve is positioned correctly, select "YES" again. The LCD will display "SAVE CLOSE LIMIT OK?"
8. Select "YES."

The close position limit is now calibrated. Check the position limit setting as follows:

1. Move the valve in the open direction. The close lamp should extinguish with approximately one turn of the handwheel.
2. Move the valve back in the close direction and check that the close lamp illuminates just before the full close position is reached (approximately ½ to 1 turn).
3. Select "YES" at the "SET OPEN POSITION LIMIT?" prompt.

4. Set Position Precision? The MX permits position to be reported to the User in either default mode of XXX% OPEN, or single precision mode of XXX.X% OPEN. This may be preferred in Modulating or other positioning applications such as network move-to, analog fail move-to, communication loss move-to, or ESD move-to.

If the calibration requires adjustment:

1. Select "NO" at the "SET OPEN POSITION LIMIT?" prompt.
2. Repeat the "SET CLOSE POSITION LIMIT?" routine.

NOTE: The green LED is the default setting for indicating the (CLOSE) position.

Set Open Position Limit (Handwheel Operation)

1. From the "SET OPEN POSITION LIMIT?" display, select "YES." "OPEN VALVE OK?" will be displayed on the LCD.
2. Engage manual override as detailed in Section 3.5.1, Manual Operation.
3. Ensure that the valve is fully open.
4. Move the valve in the close direction for one handwheel turn to allow for coasting of the motor.
5. When the valve is positioned correctly, select "YES" again. The LCD will display "SAVE OPEN LIMIT OK?"
6. Select "YES."

The open position limit is now calibrated. Check the open position limit setting as follows:

1. Move the valve in the close direction. The open lamp should extinguish with approximately one turn of the handwheel.
2. Move the valve back in the open direction and check that the open lamp illuminates just before the full close position is reached (approximately ½ to 1 turn).
3. Select "YES" at the "SET OPEN POSITION LIMIT?" prompt or "NO" to exit "POSITION SETUP?" dialog.

If the calibration requires adjustment:

1. Select “NO” at the “SELECT CLOSE POSITION LIMIT?” prompt.
2. Repeat the “SELECT OPEN POSITION LIMIT?” routine.

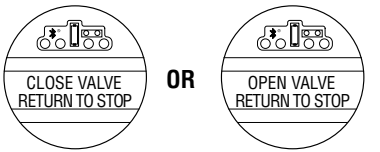
NOTE: The red LED is the default setting for indicating the (CLOSE) position.

Set Close or Open Position Limit (Electrical Operation)

1. Enter the “SETUP” mode detailed in Section 2.1.1, Entering the Setup Mode.
2. Enter “POSITION SETUP?” routine.
3. During “CLOSE VALVE - OK?” or “OPEN VALVE - OK?,” move the red knob to “LOCAL” and use the “OPEN” and “CLOSE” switch.

Unit will only operate locally and only in the push-to-run configuration (Inching mode). This does not exit the startup routine—moving red selector knob back to “STOP” returns the user to the same message. This permits the valve to be placed at its travel limits and avoids the necessity to use the handwheel. The unit will run while the black knob is engaged with no stop limit when in this mode. Any previously set travel limits will be ignored.

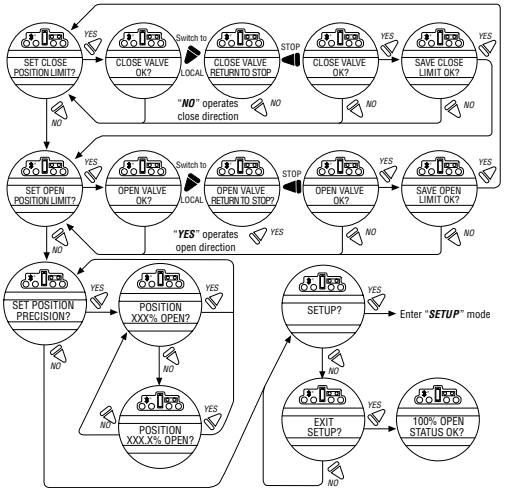
1. Move the red knob to “LOCAL” and move the black knob in the intended direction. LCD display will read:



2. Once the “CLOSE” or “OPEN” valve position limit has been reached, return the red knob to “STOP” and complete setting the “CLOSE” or “OPEN” position limit. See Figure 3.22.

NOTE: Once the travel limits have been set, the actuator may be operated electrically from the remote inputs. Local maintained operation is also permitted. Check the operation of the actuator to ensure that the torque and limit settings are satisfactory. Place the selector switch in "LOCAL" and rotate the "OPEN/CLOSE" switch to operate the actuator in the "MOTOR" mode.

Figure 3.22 – Position setup – electrical operation



Moving the red knob from “STOP” to “LOCAL” or “REMOTE” automatically saves to non-volatile memory all the changes that have been made.

3.5 Operating the MX Actuator

3.5.1 Manual Operation

Operate the actuator with the handwheel as follows:

1. Depress the declutch lever and, at the same time, slowly rotate the handwheel until the clutch is fully engaged.

2. Release the lever and it will return to its original position. The clutch will be retained in the handwheel mode by spring-loaded latches.

Manual operation is now possible and the actuator can only be returned to motor operation by energizing the motor. Energizing the motor will trip the spring-loaded latch and allow the clutch to disengage from the handwheel and re-engage with the gear drive. To prevent unauthorized manual operation of the actuator, the declutch lever may be padlocked in “MOTOR” mode. A ½ inch size padlock is recommended.

3.5.2 Electrical Operation

Before applying power to the actuator, check that the supply voltage details on the nameplate are correct for this installation. An incorrect supply connected to the actuator terminals could cause fuses to blow or cause permanent damage to the electrical components in the unit. Phase rotation need not be checked since all units are supplied with an Autophase Correction feature. Apply power to the actuator but do not operate the actuator without first checking that it has been set up and configured correctly for its intended application.

Figure 3.23 – Declutch lever shows direction of engagement (MX-05 shown)



3.5.3 Local Control

Once the position limits have been set (see Section 3.4.4, Setting Position Limits) and the default mode is the maintained mode, the actuator can be controlled locally from the control panel.

1. Place the red selector knob in the “LOCAL” position.
2. Select “OPEN” or “CLOSE” via the black control knob.

If maintained control has been selected, the actuator will continue to run when this control knob is released. The actuator may be stopped at any time by placing the red selector knob in the “STOP” position, or the direction may be reversed or stopped using the black control knob.

If non-maintained control mode (inching) has been selected, the actuator can be inched to any intermediate position by holding the black control knob in the desired position, “OPEN” or “CLOSE,” for as long as necessary. The actuator will stop when the knob is released.

3.5.4 Remote Control

Once the position limits have been set, and "REMOTE" mode is enabled:

1. Place the red selector knob in "REMOTE" to permit command control by a remote device. Local "OPEN/CLOSE" mode will be prevented.
2. Rotating the red selector knob to the "STOP" position will automatically stop the actuator regardless of the remote control signal unless ESD override has been selected. See Section 4.17, ESD (Emergency Shutdown) Overrides.

The red selector knob may be locked in or out of any of its three positions, "LOCAL/STOP/REMOTE," using a padlock. A ¼ inch padlock is recommended.

The LCD displays status and valve position. In normal operation mode, the top line displays "XX % OPEN," while the bottom line displays "STATUS OK." Refer to Section 4.12, Status and Alarm Contacts for a list of "ALARM" or "STATUS MESSAGES." Table 3.8 details the LED indicators' default settings.

3.5.5 Local Indication

Figure 3.24 – Control panel

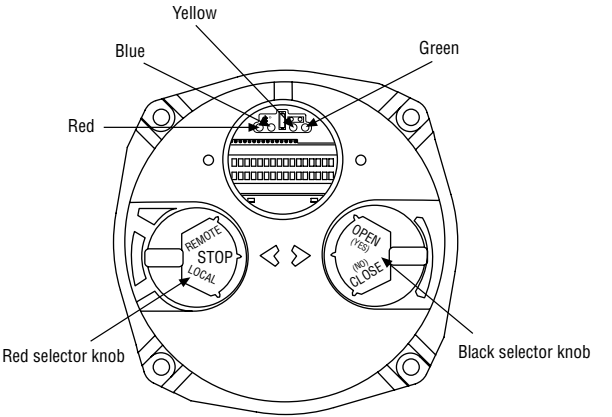


Table 3.8 – LED Indicators – default settings

LED Indicator			Operation Description
Yellow	Red	Green	
OFF	ON	OFF	Valve is fully open (Red knob in “REMOTE”)
OFF	OFF	ON	Valve is fully close (Red knob in “REMOTE”)
OFF	OFF	Blinking	Valve is closing (Red knob in “REMOTE”)
OFF	Blinking	OFF	Valve is opening (Red knob in “REMOTE”)
ON	OFF	OFF	Actuator in“REMOTE” and stopped in mid-travel
Blinking	OFF	OFF	Monitor relay alarm or actuator (red knob) in “LOCAL” or “STOP”

Red and green LED indicators can be reversed. See Section 4.16, Local Control.

NOTE: The blue LED indicator is supplied to indicate Bluetooth availability in the MX. This LED will light when the Bluetooth feature is recognized by an external Bluetooth enabled device.

4 Customizing the Actuator

The actuator settings can be customized; i.e., the default settings can be changed and the purchased options can be configured.

Language selection can also be customized. At the “SETUP IN ENGLISH?” prompt, select “NO” to move between the following languages: English, Spanish, German, French, Italian, Portuguese, Russian, Malay and Mandarin.

4.1 Changing the Existing Settings

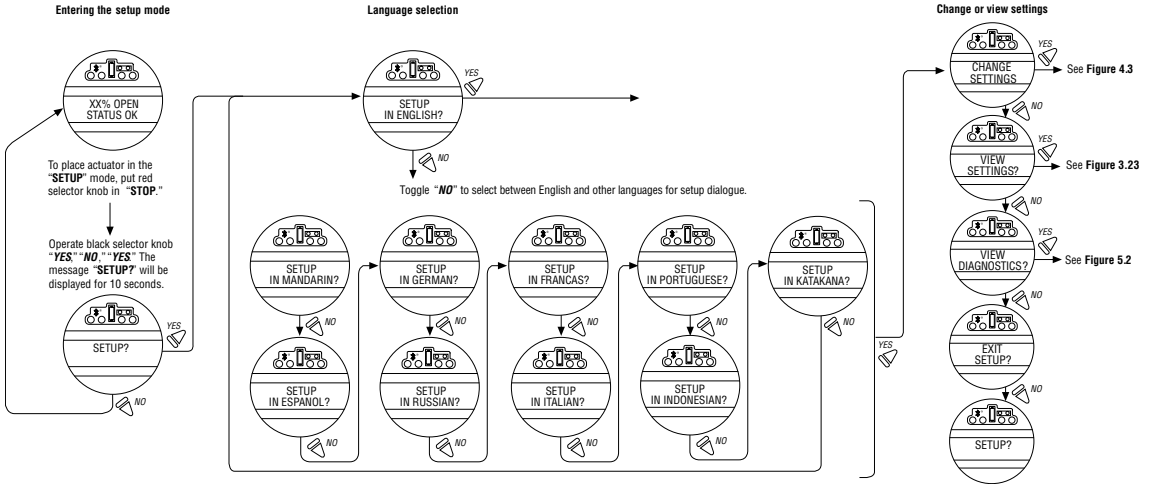
1. Verify main power is ON.
2. Enter the “SETUP” mode as detailed in Section 2.1.1, Entering the Setup Mode.
3. Answer “YES” to “Change Settings.”
4. Enter password if required. See Section 4.2, Password Entry. To change any of the existing settings or to set the end-of-travel limits for the Open and Close positions of the valve, it may be necessary to enter a password.
5. Answer “YES” or “NO” to each of the following groups of setup data. A “YES” allows the selected setup data group menu to be displayed. A “NO” moves the user to the next setup data group. For details of each data group, see Sections 4.2 – 4.17.8, Password Entry through Motor Thermostat.
   - Valve setup
   - Torque setup
   - Position setup
   - Modutronic
   - DDC (distributed digital control)
   - FF (Foundation Fieldbus control)
   - PB (Profibus Control)
   - DN (DeviceNet Control)
   - Status and alarm contacts
   - Two-speed timer

- View Analog Out
- Remote control
- View Remote mode
- Local control
- ESD Overrides (emergency shutdown)
- Inputs
- Monitor Relay
- Diagnostic reset
- TAG
- LCD contrast
- Password
- Torque boost
- Thermostat
- Valve Data
- Ports
- Restricted (consult factory)

6. Make changes in each setup group as desired. Each display shows the state or value of the existing settings. See Figure 4.3.
7. When configuration is complete, answer “YES” to “EXIT SETUP?” Alternatively, the “SETUP” mode may be terminated at any time by moving the red selector knob from “STOP” to “LOCAL” or “REMOTE.” All the changes made so far will automatically be saved.

NOTE: Once you exit this mode and enter either the “VIEW SETTINGS?” mode or “VIEW DIAGNOSTICS?” mode, the password will need to be entered again to gain access to the “CHANGE SETTINGS?” mode in order to make further changes.

Figure 4.1 – Entering the setup mode



4.2 Password Entry

Default = 100

Unauthorized entry to the “CHANGE SETTINGS?” mode is prevented by a password protection feature. If password protection is not required, the password may be set to “000.” The user will not be prompted to enter a password when the password is set to “000.”

1. Enter the password digit by digit. The password is a three-digit number, ranging from 000-999. The factory default is 100.
2. If the wrong password is entered, re-enter the correct one. After three attempts to enter the correct password, a recovery screen will appear. The screen will display a serial number that can be used for password recovery. A password recovery service is available. Contact Limitorque service coordinator at (434) 528-4400.

4.3 New Password

The password may be changed from the default of 100 to a customer-selected value as indicated in Figure 4.5.

The new password becomes effective as soon as the operator answers “YES” to the “RECORD PASSWORD?” display.

NOTE: Take care to record the new password in a secure location to ensure its retrieval in the future, yet prevent unauthorized access to the actuator “SETUP” routine.

If password protection is not required, the password may be set to “000.” The user will not be prompted to enter a password when the password is set to “000.”

4.4 Valve Setup

Valve setup enables the actuator to be changed to suit the type of valve that it is mounted on.

Figure 4.2 – Main menu selections

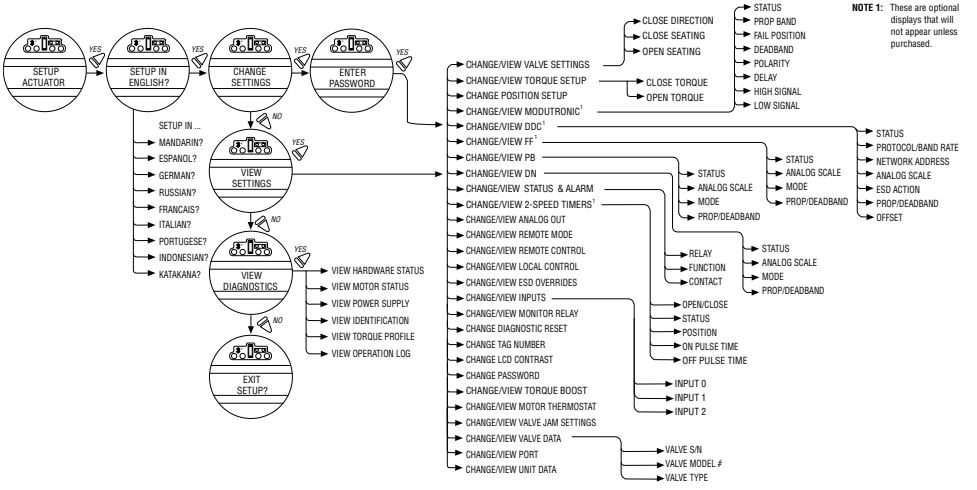
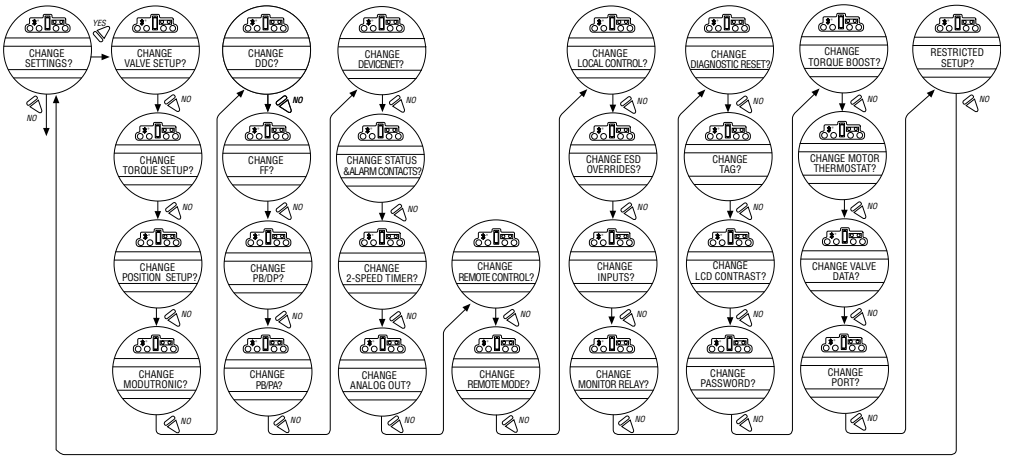


Figure 4.3 – Changing settings

Section	Pg.
4.1 Changing the Existing Settings	55
4.2 Password Entry	55
4.3 New Password	55
4.4 Valve Setup	55
4.5 Torque Setup	61
4.6 Position Setup	62
4.7 Modutronic Option	65
4.8 DDC Option	70
4.9 FF Option	75
4.10 PB Option	77
4.11 DN Option	84
4.12 Status and Alarm Contacts	86
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4.14 Analog Output	92
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4.20 Diagnostic Reset	108
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4.23 Torque Boost	112
4.24 Motor Thermostat	113
4.25 Change Valve Data	113
4.26 Change Port	116



NOTE: See topic list for appropriate page for each setting.

Figure 4.4 – Password entry

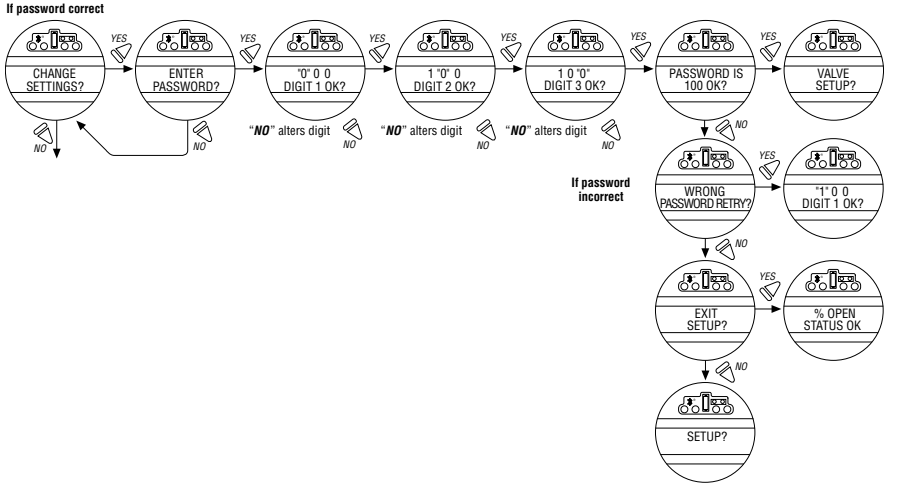


Figure 4.5 – New password

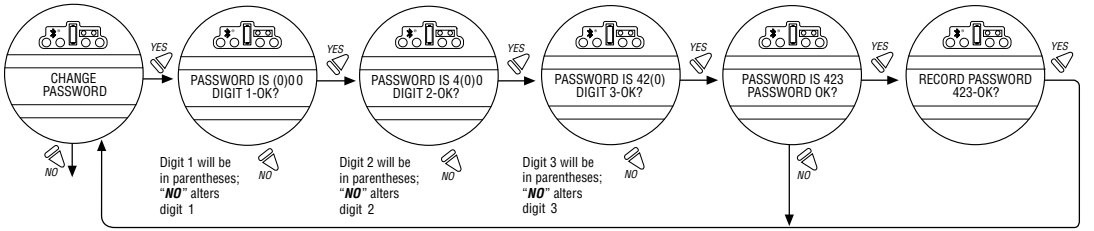
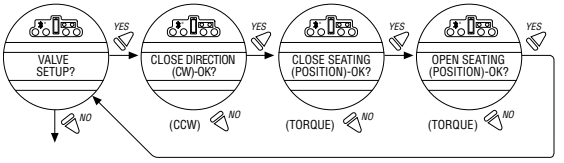


Figure 4.6 – Valve setup



4.4.1 Close Direction

Default = CW to Close

The majority of valves require clockwise (CW) rotation of the actuator drive sleeve when viewed from the handwheel.

1. Engage manual override and check whether the valve closes with CW or CCW rotation of the handwheel.
2. Select “NO” until the required direction is displayed, then “YES.”

NOTE: If in doubt as to valve seating, consult the valve manufacturer.

NOTE: For torque seated valves, ensure that the “POSITION” limit is not set at “TORQUE” seat. It is recommended that the “POSITION” limit be set approximately one handwheel turn (360˚) in the opposite direction from the “TORQUE” seat.

4.4.2 Close Seating

Default = Position Seating

1. Configure the actuator to close on “TORQUE” limit for seating valve types such as wedge gate and globe.
2. Select “POSITION” limit for valve types such as ball, butterfly, plug, sluice gate, parallel slide, knife gate, and through conduit.
3. Select “NO” until the required seating is displayed.
4. Select “YES.”

4.4.3 Open Seating

Default = Position Seating

The majority of valves, regardless of their construction, seat on position limit in the open direction. Some valves are “back-seating” and require torque limit in the open direction.

1. Select “NO” until the required seating is displayed.
2. Select “YES” to return to the “VALVE SETUP?” display.

4.5 Torque Setup

The output torque can be changed between 40% and 100% of the rated torque as follows:

1. From “VALVE SETUP?”, select “YES” to enter the “TORQUE SETUP?” routine.
2. Select “YES” to change the settings.

If “NO” is selected, the “POSITION SETUP?” routine will be entered.

Figure 4.7 – Typical XP nameplate

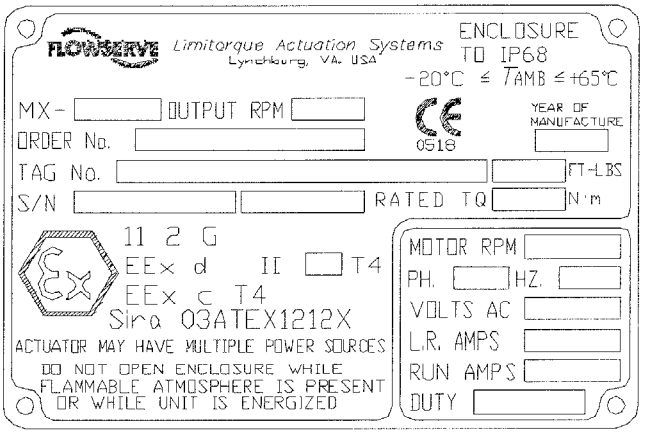
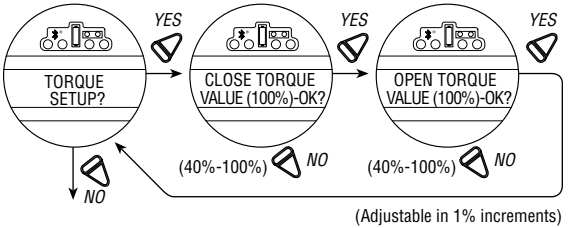


Figure 4.8 – Torque setup



4.5.1 Close Torque Valve or Open Torque Valve

The output torque from the actuator to close or open the valve may be configured between 40% and 100% of the rated torque (as stated on the actuator nameplate), in 1% increments (unless limited by the factory).

To Increase the % of Torque Required:

1. Select “NO” until the desired % is indicated.
2. Select “YES” to save the required torque.

Should the user select a maximum torque setting less than 100% due to valve or gearbox limitations, this selection can be password protected.

4.6 Position Setup

Change Settings Menu. After successfully entering the password, answer “NO” to the Change Settings menu prompts until you reach the prompt “CHANGE POSITION SETUP?” Answer “YES.”

4.6.1 Set Position Limits for Electrical Operation

1. Set closed valve position. At the “CLOSE VALVE–OK?” prompt, move the red control knob to “LOCAL.” Hold the black control knob in the “CLOSE” position until the valve has reached the desired position. Move the red control knob to “STOP.”
2. Set the open valve position. At the “OPEN VALVE–OK?” prompt, move the red control knob to “LOCAL.” Hold the black control knob in the “OPEN” position until the valve has reached the desired position. Move the red control knob to “STOP.”

3. Inspect for correct operation. The position calibration is now complete. The actuator will function as ordered. Inspect for correct operation by running actuator electrically.

NOTE: For torque seated valves, ensure that the Position limit is not set at torque seat. It is recommended that the Position limit be set approximately one handwheel turn (360˚) in the opposite direction from the torque seat.

4.6.2 Set Position Limits for Manual Operation

1. Set close position. At “SET CLOSE POSITION LIMIT?” answer “YES.” At “CLOSE VALVE-OK?” depress declutch lever and slowly rotate handwheel until clutch is fully engaged. Release declutch lever; the clutch will stay in handwheel mode. If the valve is fully closed, move the handwheel one turn in the open direction to allow for coasting of the motor. When valve is in the desired location, select “YES.” At “SAVE CLOSE LIMIT-OK?” select “YES” to set the close position or “NO” to adjust the setting.
2. Set open position. At “SET OPEN POSITION LIMIT?” select “YES” to get “OPEN VALVE-OK?.” Engage the clutch (see step 1). Valve should be fully opened. Move the handwheel one turn toward the closed position to allow for coasting of the motor. When valve is in the desired location, select “YES” again to set the open position or “NO” to adjust the setting.
3. Checking the settings. Turn the handwheel and verify that the open and close LED’s function correctly (see Checking the Settings). If adjustments are necessary, select “NO” to return to “CHANGE POSITION SETUP?” and repeat from step 1.

Figure 4.9 – Electrical operation

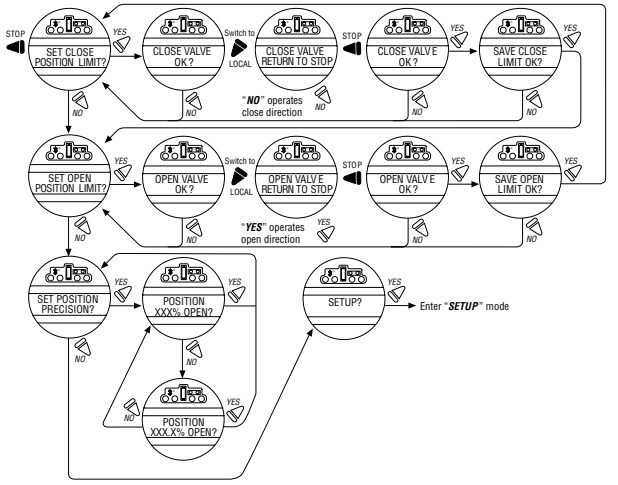
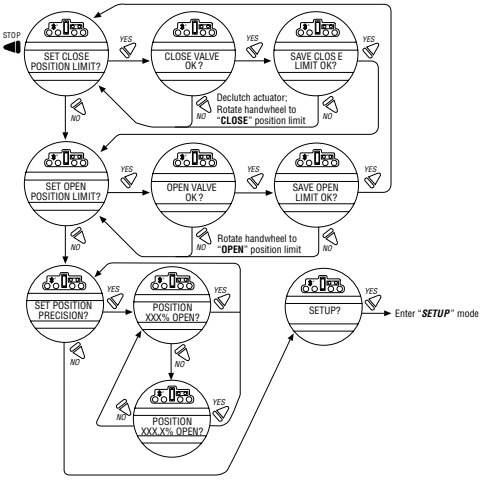


Figure 4.10 – Handwheel operation



4.7 Modutronic Option

The Modutronic option enables the actuator to be controlled via a milliamp input signal.

- If the Modutronic option has been purchased, it is automatically calibrated when position limits are set. No further adjustments are required, unless the defaults do not suit the application.

• If the Modutronic option has not been purchased, the screens for changing Modutronic will not be available. To add the Modutronic option, please consult Limitorque service at (434) 528-4400.

4.7.1 Status

Default = OFF

1. Select “NO” to change Modutronic status to “ON.” If “OFF” is selected, no further menus will be displayed.

4.7.2 Proportional Band

Proportional band is the range of errors between position and demand signal that will produce reduced speed (pulsing).

Default = 15%

To change from the default, select “NO” until the required value is displayed. The value is adjustable between 1% and 100%, in 1% increments.

4.7.3 Fail Position

Fail position enables the customer to change the response of the actuator on loss of the milliamp signal.

Default = “CLOSE” Position

Fail position takes effect when the signal level falls below 2 mA or above 20.5 mA.

To Change the Default Position:
Select "NO" to choose whether the valve moves to "CLOSE" or

"OPEN" position, or "STOP" (stops) in its present position at the time of signal failure.

4.7.4 Deadband

Default = 2%

The deadband should be wide enough to prevent "hunting" of the actuator but as low as possible to give adequate response to changes in the error signal.

To Change from the Default:
Select "NO" to adjust the value between 1% and 50%, in 1% increments to suit the application.

4.7.5 Polarity (20 mA)

Polarity allows the user to change the valve position corresponding to the maximum milliamp value.

Default Setting is: 20 mA = Full Open

Select "NO" to select the required position of the valve that is to correspond to the maximum signal level of 20 mA.

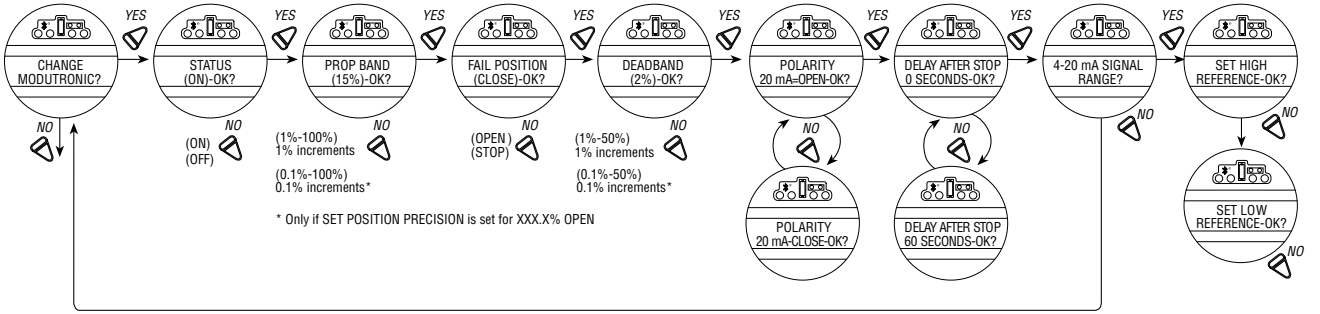
Choose between: 20 mA = Full Close or Full Open.

4.7.6 Delay After Stop

Default setting = 0 seconds

To change from the default setting, select "NO" to adjust the length of delay time after the actuator stops modulating. The delay after stop is adjustable from 0-60 seconds.

Figure 4.11 – Modutronic option



4.7.7 4-20 mA Signal Range

Signal range allows the user to change the signal range from the default range.

Default Setting is for High Reference = 20 mA (High Reference can also be scaled to some older 10-50mA instrumentation systems. A 166.66 Ohm resistor should be placed across the milliamp inputs when scaled from 10-50 mA.)

Default Setting for Low Reference = 4 mA

To change signal range (i.e. 4 mA-12 mA or 12 mA-20 mA or others) answer “YES.” Proceed from “SET HIGH REFERENCE” to “SET HIGH REFERENCE - OK?” A “YES” answer will require the use of a calibrator. If no, change to the signal range is required, answer “NO” and return to “CHANGE MODUTRONIC?” dialog.

4.7.8 Set High Reference

Default = 20 mA

1. Select “NO” to accept pre-existing setting (no change).
2. Select “YES” to enter the display “APPLY HIGH LEVEL CONTROL SIGNAL.”
3. Apply this signal to terminal 28 and 39 indicated on the wiring diagram.
4. Select “YES” again to record this signal as the high reference. See Figure 4.10.

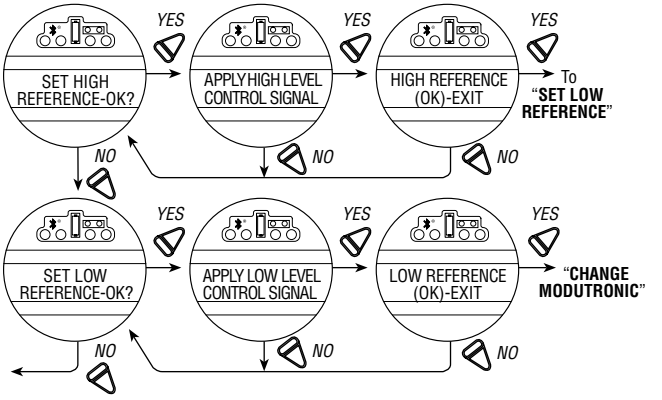
4.7.9 Set Low Reference

Default = 4 mA

1. Select “NO” to move from “SET HIGH REFERENCE” to “SET LOW REFERENCE.”

2. Select “YES” to enter the display “APPLY LOW LEVEL CONTROL SIGNAL.”
3. Using a calibrator, apply the low signal, and select “YES” to record this signal as the low reference.

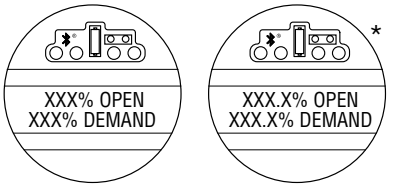
Figure 4.12 – Modutronic signals



Flow to “**CHANGE MODUTRONIC**”

4.7.10 Modutronic LCD Display

When the Modutronic option has been purchased, is set to "ON," and the red selector switch is in "REMOTE," the normal LCD display will read:



* If SET POSITION PRECISION is set to XXX.X% OPEN

XXX% Demand is the percentage value of the milliamp input signal.

4.8 DDC Option

DDC option enables the actuator to be controlled by an RS-485 serial communication signal. If the DDC option has been purchased, it is automatically enabled. The customer must set the DDC address.

The MX comes equipped with Modbus-Lite, a multi-drop version of DDC as standard. This is limited to a multi-drop network of 32 units only. For other applications a full suite of DDC-Modbus options is available. The DDC setup routine applies to both Mobus-Lite & full suite DDC-Modbus.

NOTE: If the DDC option has not been purchased, the screens for changing DDC will not be available. To add the DDC option, please consult Limitorque service at (434) 528-4400.

The Modutronic option is not available with the DDC option. DDC is available with "Move-To" feature. Consult factory for either option.

4.8.1 Status

Default = ON

DDC Status enables user to change from the default condition to turn on and off the digital control capability of the actuator.

To Change from the Default Setting:
Select "NO" to switch DDC to "OFF." If "OFF" is selected, no further menus will be displayed.

4.8.2 Network Address

Default = 1

Network address allows user to assign a unique network address to an actuator.

1. The network address must be entered in accordance with the Instrument Data Sheet, and care must be taken to ensure that the same address is not used anywhere else in the same network.
2. Select "NO" for small incremental changes or hold it continuously in that position for larger changes until the required value is displayed. The address may be set at any value between 001 and 250.

4.8.3 Protocol

Default = Modbus RTU 9600 Baud

Protocol changes the communication language/speed from the default to match the application.

To Change from the Default Language:
Select "NO" to choose between MODBUS, ASCII, or RTU, and the baud rate depending on the design of the DDC system. Refer to the contract documentation.

4.8.4 Analog Scale

Default = 0-100

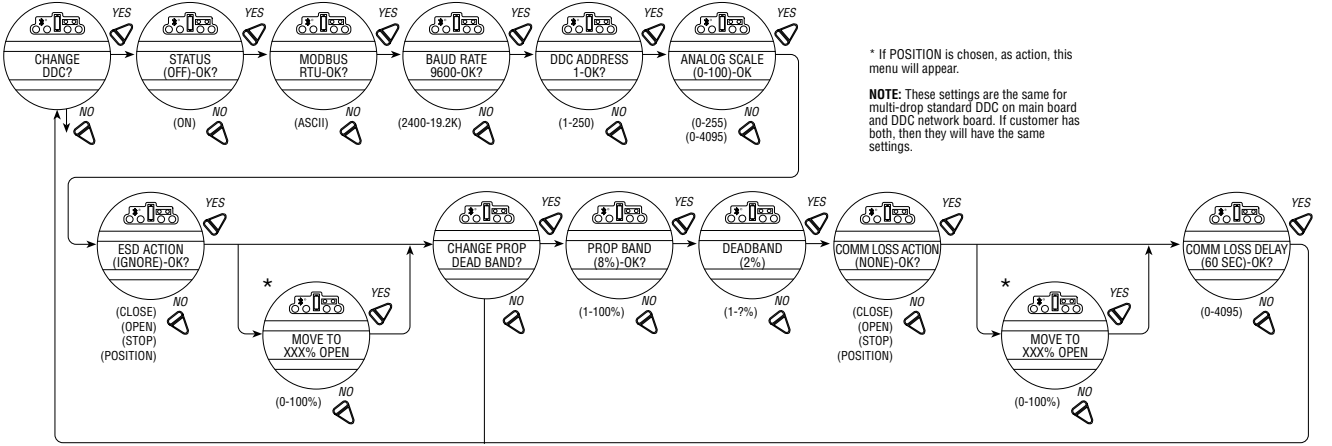
Analog scale allows the user to change the scaling of the analog input from the default.

To Change from the Default Range:
Select “NO” until the required scale is displayed. 0-255 and 0-4095 counts are available.

4.8.5 ESD Action

A network ESD function can be enabled after the ESD configuration has been established for the unit. This network ESD can be selected to either ignore the command; Close, Open, Stop, or Position the actuator.

Figure 4.13 – DDC



4.8.6 Proportional Band

Proportional band is the range of errors between position and demand signal that will produce reduced speed (pulsing).

Default = 15%

To change from the default, select “NO” until the required value is displayed. The value is adjustable between 1% and 100%, in 1% increments.

4.8.7 Deadband

Default = 2%

The deadband should be wide enough to prevent “hunting” of the actuator but as low as possible to give adequate response to changes in the error signal.

To Change from the Default Range:
Select “NO” to adjust the value between 1% and 50%, in 1% increments to suit the application.

4.8.8 Move To

If positioning is selected as an action, then the Move To dialog will appear. Position is configurable from 0-100%.

4.8.9 Comm Loss Delay

Default = 60 sec.

The User may select the amount of time delay before communication loss is flagged to the network. This selection is configurable from 0-60 seconds.

4.8.10 Comm Loss Action

Default = None

The User may select what action the actuator should take when network communication is interrupted. This action is configurable as Close, Open, Stop, Position.

4.9 FF Option

FF option enables the actuator to be controlled by a Foundation Fieldbus communications signal. If the option has been purchased, it is automatically enabled. A Fieldbus System configuration tool must be used by the customer to set the FF address.

NOTE: If the FF option has not been purchased, the screens for changing FF will not be available. To add the FF option, please consult Limitorque service at (434) 528-4400.

The Modutronic option is not available with the FF option. FF is provided with “Move-To” feature. Consult factory for either option.

4.9.1 Status

Default = ON

FF Status enables user to change from the default condition to turn on and off the digital control capability of the actuator.

4.9.2 Analog Scale

Default = 0-100

Analog scale allows the user to change the scaling of the analog input from the default.

To Change from the Default Range:
Select “NO” until the required scale is displayed. 0-255 and 0-4095 counts are available.

4.9.3 ESD Action

A network ESD function can be enabled after the ESD configuration has been established for the unit. This network ESD can be selected to either ignore the command; Close, Open, Stop, or Position the actuator.

4.9.4 OPEN/CLOSE Mode

Default = YES

To select operation as typically ”OPEN” or “CLOSE,” select “YES.” To select operation as position mode, select “NO.”

4.9.5 Proportional Band

Proportional band is the range of errors between position and demand signal that will product reduced speed (pulsing).

Default = 15%

To change from default, select “NO” until the required value is displayed. The value is adjustable between 1% and 100%, in 1% increments.

4.9.6 Deadband

Default = 2%

The deadband should be wide enough to prevent “hunting” of the actuator but as low as possible to give adequate response to changes in the error signal.

To change from default, select “NO” to adjust the value between 1% and 50%, in 1% increments to suit the application.

4.10 PB Option

PB option enables the actuator to be controlled by a Profibus communications signal. If the option has been purchased, it is automatically enabled.

A Fieldbus System configuration tool must be used by the customer to set the PB address.

NOTE: If the PB option has not been purchased, the screens for changing PB will not be available. To add the PB option, please consult Limitorque service at (434) 528-4400.

The Modutronic option is not available with the PB option. PB is provided with “Move-To” position feature. Consult factory for either option.

Figure 4.14 – FF

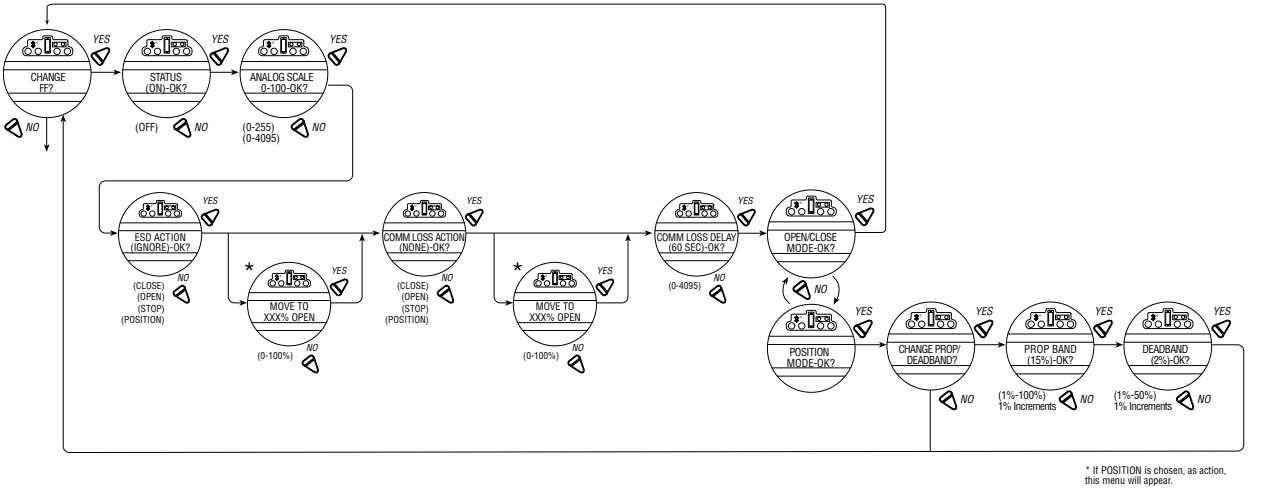
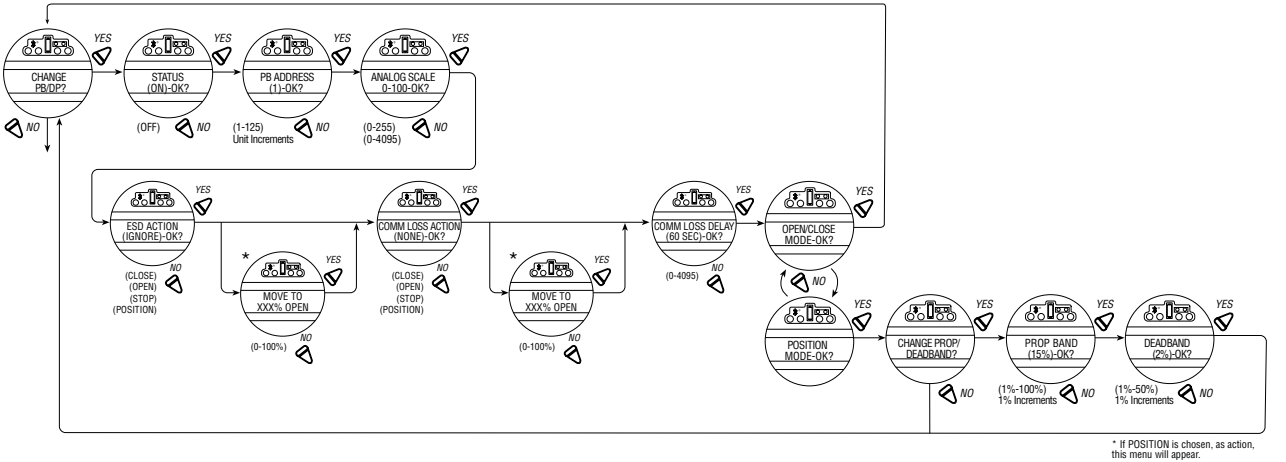


Figure 4.15 – Profibus DP



4.10.1 Status

Default = ON

PB Status enables user to change from the default condition to turn on and off the digital control capability of the actuator.

4.10.2 PB Address

Default = 1

Network address allows user to assign a unique network address to an actuator.

1. The network address must be entered in accordance with the Instrument Data Sheet, and care must be taken to ensure that the same address is not used anywhere else in the same network.
2. Select “NO” for small incremental changes or hold it continuously in that position for larger changes until the required value is displayed.

   The address may be set at any value between 001 and 125 (DP), or 01 and 32 (PA).

4.10.3 Analog Scale

Default = 0-100

Analog scale allows the user to change the scaling of the analog input from the default.

To Change from the Default Range:
Select “NO” until the required scale is displayed. 0-255 and 0-4095 counts are available.

4.10.4 ESD Action

A network ESD function can be enabled after the ESD configuration has been established for the unit. This network ESD can be selected to either ignore the command; Close, Open, Stop, or Position the actuator.

4.10.5 OPEN/CLOSE Mode

Default = YES

To select operation as typically “OPEN” or “CLOSE,” select “YES.” To select operation as position mode, select “NO.”

4.10.6 Proportional Band

Proportional band is the range of errors between position and demand signal that will product reduced speed (pulsing).

Default = 15%

To change from default, select “NO” until the required value is displayed. The value is adjustable between 1% and 100%, in 1% increments.

4.10.7 Deadband

Default = 2%

The deadband should be wide enough to prevent “hunting” of the actuator but as low as possible to give adequate response to changes in the error signal.

To change from default, select “NO” to adjust the value between 1% and 50%, in 1% increments to suit the application.

Figure 4.16 – Profibus PA

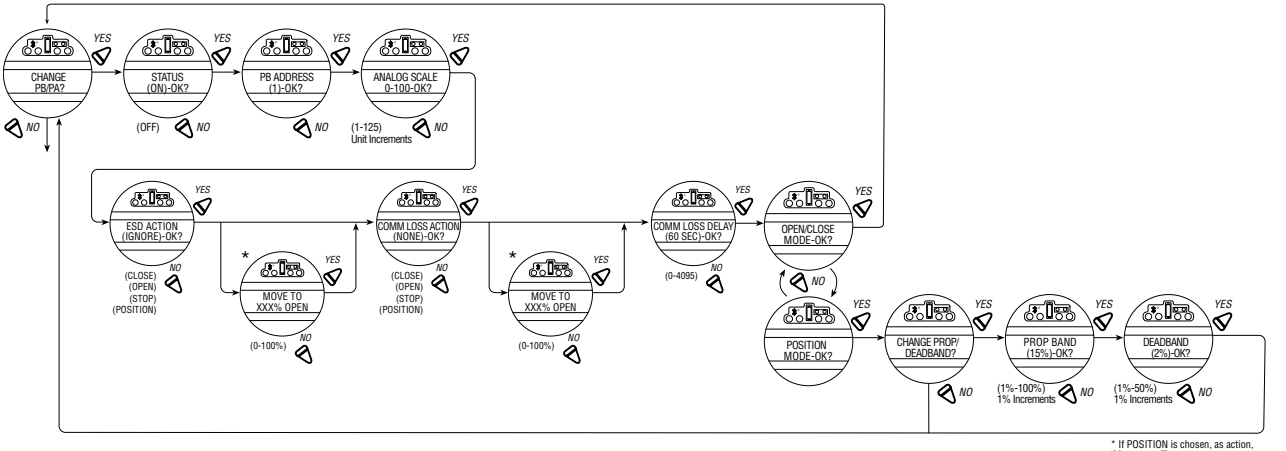
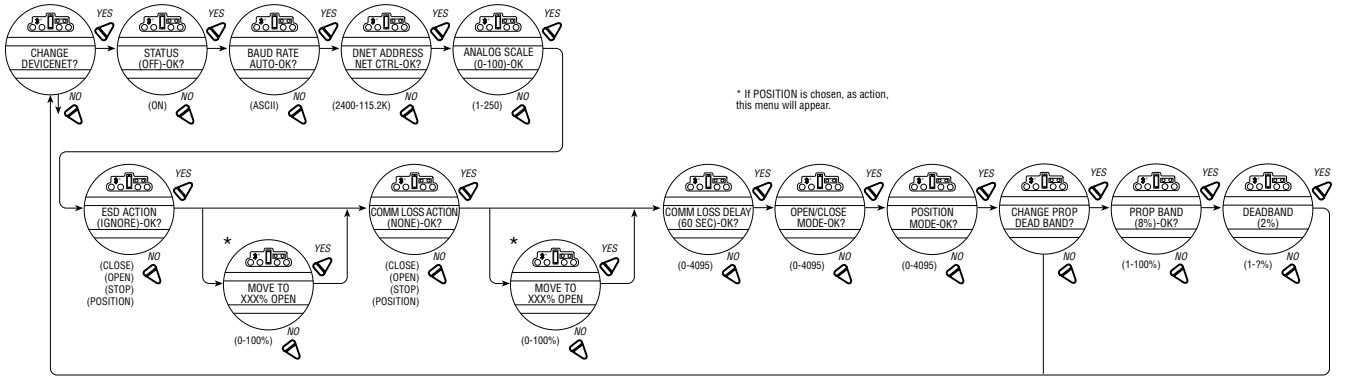


Figure 4.17 – DN Option



4.11 DN Option

DN option enables the actuator to be controlled by a DeviceNet communications signal. If the option has been purchased, it is automatically enabled. A DeviceNet System configuration tool must be used by the customer to set the DN address.

NOTE: If the DN option has not been purchased, the screens for changing DN will not be available. To add the DN option, please consult Limitorque service at (434) 528-4400.

The Modutronic option is not available with the DN option. DN is provided with “Move-To” feature. Consult factory for either option.

4.11.1 Status

Default = ON

DN Status enables user to change from the default condition to turn on and off the digital control capability of the actuator.

4.11.2 Baud Rate

Default = 125K Baud

Baud rate changes the communication speed from the default to match the application.

To Change from the Default Speed:
Select “NO” to choose between 125k, 250k, 500k baud rate depending on the design of the DN system. Refer to the contract documentation.

4.11.3 Network Address

Default = 1

Network address allows user to assign a unique network address to an actuator.

1. The network address must be entered in accordance with the Instrument Data Sheet, and care must be taken to ensure that the same address is not used anywhere else in the same network.

2. Select “NO” for small incremental changes or hold it continuously in that position for larger changes until the required value is displayed. The address may be set at any value between 001 and 63.

4.11.4 Analog Scale

Default = 0-100

Analog scale allows the user to change the scaling of the analog input from the default.

To Change from the Default Range:
Select “NO” until the required scale is displayed. 0-255 and 0-4095 counts are available.

4.11.5 ESD Action

A network ESD function can be enabled after the ESD configuration has been established for the unit. This network ESD can be selected to either “IGNORE” the network command; or Close, Open, Stop, Position the actuator.

4.11.6 Proportional Band

Proportional band is the range of errors between position and demand signal that will produce reduced speed (pulsing).

Default = 15%

To change from the default, select “NO” until the required value is displayed. The value is adjustable between 1% and 100%, in 1% increments.

4.11.7 Deadband

Default = 2%

The deadband should be wide enough to prevent “hunting” of the actuator but as low as possible to give adequate response to changes in the error signal.

To Change from the Default Range:
Select "NO" to adjust the value between 1% and 50%, in 1% increments to suit the application.

4.12 Status and Alarm Contacts

The status and alarm contacts permit wiring to existing contacts for visibility of operation or fault conditions. (See wiring diagram for contact ratings.)

The status contacts (S) and optional alarm contacts (R) may be configured to have any one of the following functions:

- "CLOSING" – valve closing
- "OPENING" – valve opening
- "STOPPED" – valve stopped in mid-travel
- "VALVE MOVING" – either direction
- "LOCAL SELECTED" – red selector knob in "LOCAL"
- "MOTOR OVERTEMP" – thermistor range exceeded
- "OVERTORQUE" – torque exceeded in mid-travel
- "MANUAL OVERRIDE" – actuator moved by handwheel
- "VALVE JAMMED" – valve can't move
- "CLOSE TORQUE SW" – torque switch trip at "CLOSED"
- "OPEN TORQUE SW" – torque switch trip at "OPEN"
- "LOCAL STOP/OFF" – red selector knob at "STOP"
- "LOST PHASE" – one or more of three phases lost
- "ESD SIGNAL" – signal active
- "CLOSE INHIBIT" – close inhibit signal active
- "OPEN INHIBIT" – open inhibit signal active
- "ANALOG IP LOST" – 4-20 mA not present
- "REMOTE SELECTED" – red selector in "REMOTE"
- "LIMIGARD ACTIVE" – (future—LimiGard™ functionality is not affected)
- "HARDWARE FAILURE" – indication
- "NETWORK CONTROLLED" – permits relay control via DDC, FF, or other network driver

- "CLOSE" – valve closed "(0% OPEN)"
- "OPEN" – valve open "(100% OPEN)"
- "MID-TRAVEL" – valve position, 1-99% open
- "CSE CONTROL" – CSE station in LOCAL or STOP and controls actuator

4.12.1 Status and Alarm Contact Default Settings

All actuators are supplied with the following status or alarm (optional) contact default factory settings:

Status Contacts

S1a – Normally closed contact at valve fully Close

S1b – Normally closed contact at valve fully Open

S2a – Normally open contact at valve fully Close

S2b – Normally open contact at valve fully Open

Alarm Contacts (Optional/requires I/O board)

R1 – Normally closed contact when Motor Overtemp

R2 – Normally closed contact when Remote Selected

R3 – Normally open contact when Torque Overload

R4 – Normally open contact when Analog I/P lost

To change any of the default settings:

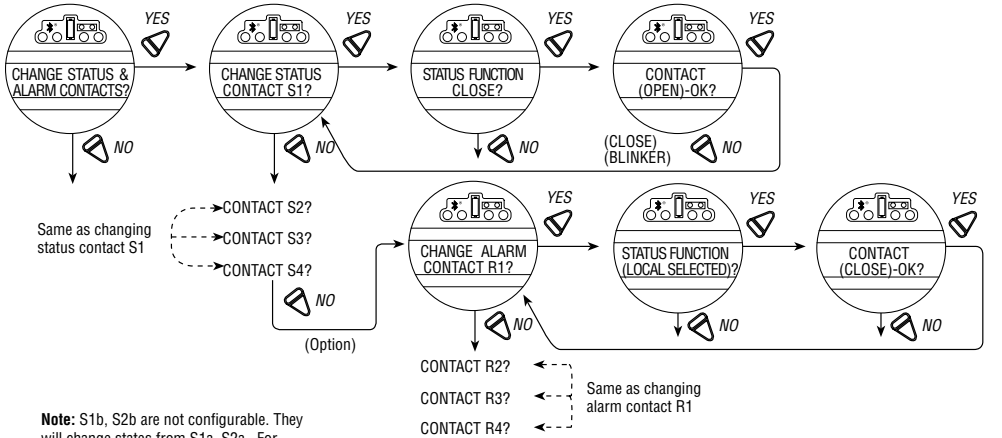
Select "CHANGE STATUS & ALARM CONTACTS?" from the "SETUP" routine.

Select "YES" to enter the "SETUP" routine for each individual contact. Select "NO" until the particular contact is referenced in the display, then "YES" to make the changes.

4.12.2 Status Function

Toggle "NO" through the range of functions, as listed, until the desired feature is displayed.

Figure 4.18 – Status and alarm contacts (Shown with optional boards added)



Note: S1b, S2b are not configurable. They will change states from S1a, S2a. For example, if S1a is configured for normally closed, then S1b will be normally open.

Status functions:
1. CLOSING
2. OPENING
3. STOPPED
4. VALVE MOVING
5. LOCAL SELECTED
6. MOTOR OVERTEMP
7. OVERTORQUE
8. MANUAL OVERRIDE
9. VALVE JAMMED
10. CLOSE TSW
11. OPEN TSW
12. LOCAL STOP/OFF
13. LOST PHASE
14. ESD SIGNAL
15. CLOSE INHIBIT
16. OPEN INHIBIT
17. ANALOG I/P LOST
18. REMOTE SELECTED
19. LIMIGARD ACTIVE
20. HARDWARE FAILURE
21. NETWORK CONTROLLED
22. CLOSE
23. OPEN
24. MID-TRAVEL
25. CSE CONTROL

4.12.3 Contact

This mode allows the user to select the state of the contact when the function is active. Select "NO" to choose whether the contact is required to be normally closed, normally open, or blinker when the function is active. When "Blinker" has been selected, the contact will switch automatically between open and close (1 second open/1 second close).

4.12.4 Valve Position

This display will appear only if the function "MID-TRAVEL POSITION" has been selected. Toggle "NO" until the display indicates the required value of percentage "OPEN" at which the contact should trip. If the contact has been selected as normally closed, then it will close when the trip point has been reached, with the actuator moving in the open direction.

NOTE: Status contacts (AS) and optional AR contacts are latching type and will remain in their last set position in the event of a main power supply failure.

4.13 Two-speed Timer (Optional)

The optional two-speed timer extends the operating time of the actuator, in the closing and/or the opening direction, by pulsing the motor ON and OFF. Pulsing may be applied to full valve travel or only a part of it. The ON and OFF pulse times are adjustable.

1. Select "CHANGE 2-SPEED TIMERS?"
2. Select "YES" to enter the "CHANGE OPEN TIMER?" routine.
3. If slow opening is required, select "YES;" otherwise select "NO" to move into the "CHANGE CLOSE TIMER?" routine.

4.13.1 Status

Select "NO" to switch the timer ON or OFF. If OFF, no further menus will be displayed.

4.13.2 Start Position

If the Close or Open timer has been switched ON, pulsing will start when the set point is reached in the selected direction and the actuator will continue pulsing until the valve reaches the desired “STOP” position.

Select “NO” until the display indicates the required value of percentage OPEN at which the pulsing should start. Adjustable in 1% increments as listed:

Closing = 0% to 99%. Opening = 1% to 100%.

4.13.3 Stop Position

If the Close or Open timer has been switched ON, pulsing will commence as the valve moves out of its close position and the actuator will continue pulsing until stopped at the set point.

Select “NO” until the display indicates the required value of percentage open at which the pulsing should stop. Adjustable in 1% increments as listed:

Closing = 0% to 99%. Opening = 1% to 100%.

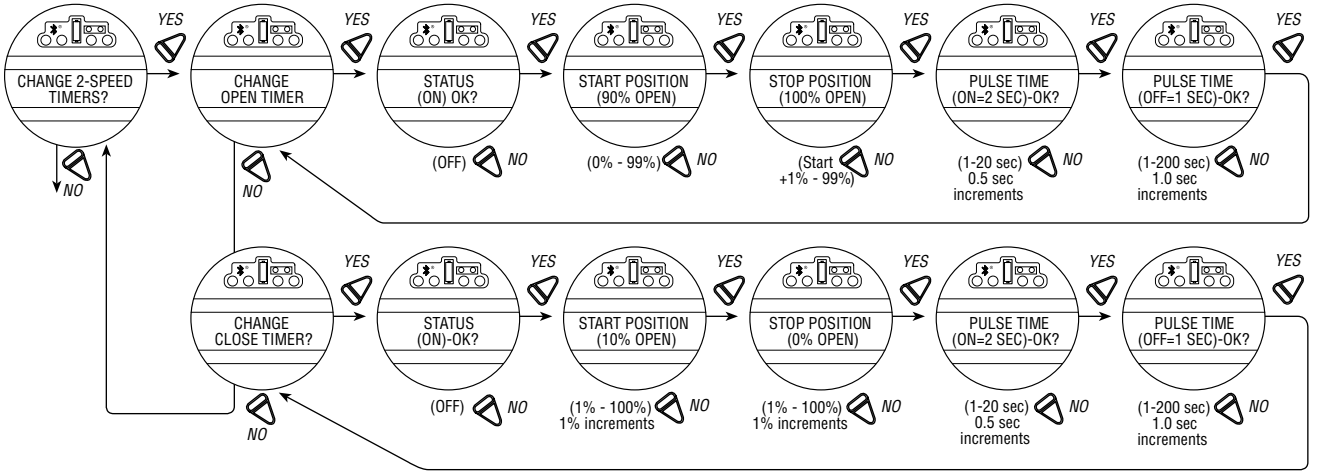
4.13.4 Pulse Time – ON

This mode allows user to change the ON pulse time from the default setting.

Default Setting = 2.0 Second

Select “NO” until the required length of ON pulse is displayed. Adjustable between 1 and 20 seconds, in 0.5 second increments.

Figure 4.19 – Two-speed timers



4.13.5 Pulse Time – OFF

This mode allows user to change the OFF pulse time from the default setting.

Default Setting = 1 Second

Select “NO” until the required length of OFF pulse is displayed. Adjustable between 1 and 200 seconds, in 1.0 second increments.

4.14 Change Analog Out

The MX comes equipped with optional configurable analog output feedback signal. The User may select between APT (Analog Position Transmitter) or ATT (Analog Torque Transmillter) functionality.

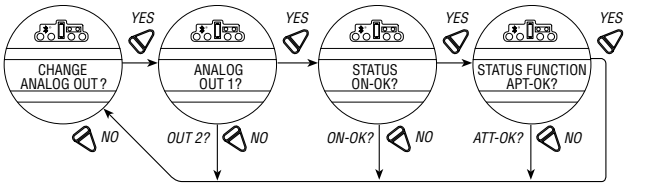


Figure 4.20 – APT polarity

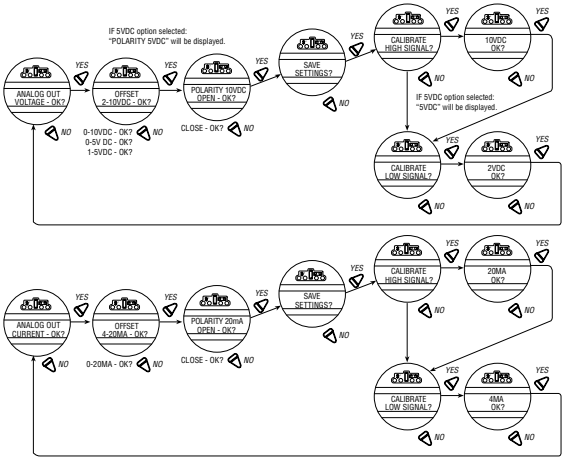
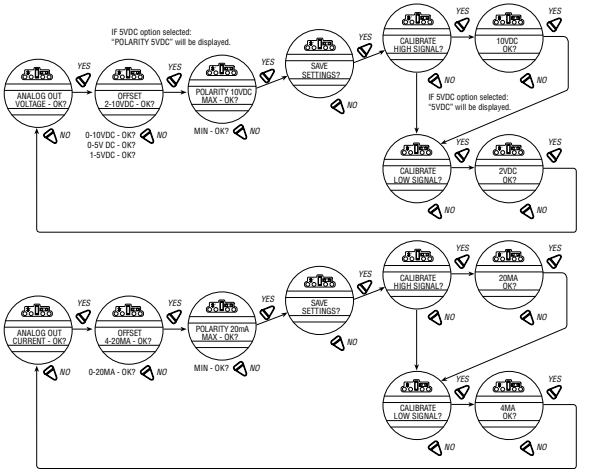


Figure 4.21 – ATT polarity



4.15 Remote Control

The actuator may be controlled remotely by two, three, or four wires, depending on the connections made in the terminal compartment of the actuator. Configuration is required during actuator setup.

This setting allows the user to change the mode of remote control from the default setting:

Default = Three-wire Maintain Control

1. Select “CHANGE REMOTE CONTROL?” from the “SETUP” routine.
2. Select “YES” to enter the display that indicates the type of remote control selected.
3. Select “NO” until the required control is displayed. The selections available are:
   - Three-wire Maintain Control (default except Modutronic)

     Requires two momentary contacts for self-maintained control in OPEN or CLOSE direction. (Momentary reverse signal of <1 second duration using the black knob may be used to STOP valve. A duration of >1 second using the black knob will reverse direction.)
   - Three-wire Inching Control

     Requires two “push-to-run” contacts to OPEN or CLOSE the valve, or STOP it in mid-travel.
   - Two-wire Control

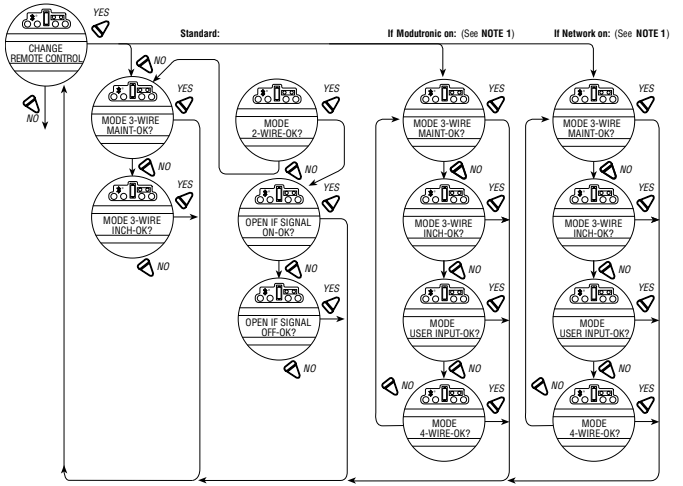
     Requires one NO or NC contact. Select “YES” for either.

     Valve OPENS if signal “ON.”

     or

     Valve OPENS if signal “OFF.”
   - Four-wire Control

Figure 4.22 – Remote control



NOTE 1: Two-wire discrete control not permitted.

Requires three momentary contacts for self-maintained control in OPEN or CLOSE direction, and mid-travel STOP.

- User Inputs (default Modutronic)

  Available in “DDC” mode only to provide network status of external volt-free contacts.

4. Select “YES” to exit.

NOTE 1: Not available when Modutronic, DDC control or FF control has been software enabled.

4.16 Remote Mode

Remote mode permits a User to select from multiple remote control permissions, or isolate remote control to a single control selection:

Multi Control mode (default) permits up to three discrete remote inputs - digital inputs, network inputs, or analog inputs. The MX will operate based upon the last type of command received.

Digital Control Only - MX will operate only upon the last digital input command received.

Network Control Only; MX will operate only upon the last network command received.

Analog Control only; MX will operate only upon the last analog input command received.”

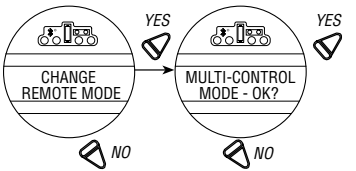
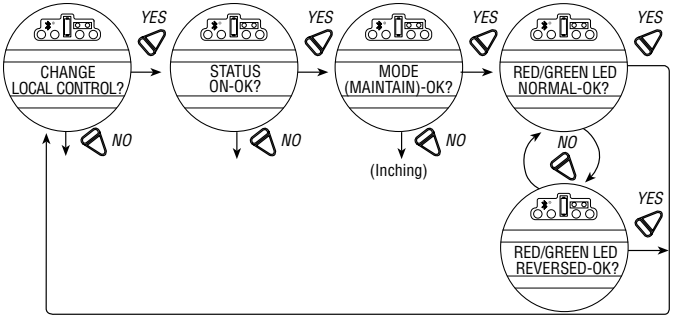


Figure 4.23 – Local control



- Maintain mode: the unit will operate continually in either direction when the black knob is actuated and released, until the position of the black knob is changed or the red knob is changed from “LOCAL” to either “STOP” or “REMOTE.”
- Inching mode: the unit will operate only when the black knob is held in the open or close position. If the black knob is released, the unit will stop.

To Customize the Settings:

1. Select “CHANGE LOCAL CONTROL?” from the “SETUP” routine.
2. Select “YES” to enter the mode display.
3. Select “NO” to change from Maintain to Inching control.

4.16.1 LED Customization

This selection allows the customer to reverse the colors of the LED in open and close mode from the default setting.

Default = Red-Open/Green-Close

1. After mode selection, select “YES” to change the colors of the LEDs.
2. Select “NO” to change from the default to Red-Close/Green-Open.

4.17 ESD (Emergency Shutdown) Overrides

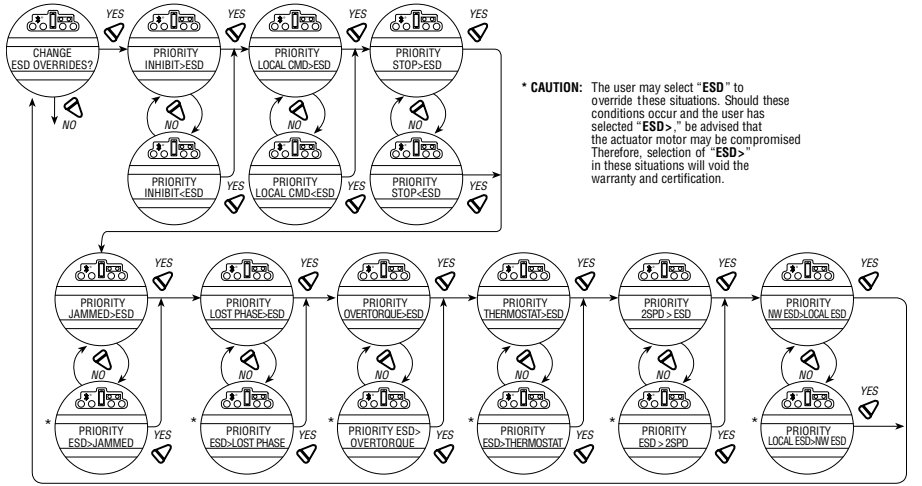
An external contact may be used to place the actuator in emergency shutdown mode. An ESD contact may be connected to the actuator to override existing command signals and send the valve to a predetermined position.

The ESD Action and Signal presence is selected in Section 4.18, Inputs. The default ESD input = Input 0., pt. 30 on wiring diagram.

4.17.1 ESD Override

It may be desirable that ESD override other events. These events are selectable. The “>” symbol after ESD indicates that ESD will override that particular event. Sections 4.18 - 4.24, Inputs through Motor Thermostat list the choices.

Figure 4.24 – ESD Overrides



*** CAUTION:** The user may select "**ESD**" to override these situations. Should these conditions occur and the user has selected "**ESD>**," be advised that the actuator motor may be compromised Therefore, selection of "**ESD>**" in these situations will void the warranty and certification.

4.17.2 Inhibit

Default = INHIBIT>ESD

To Customize the Settings:
Select "NO" to choose:

- "ESD>INHIBIT" – ESD overrides active inhibit signal
- "INHIBIT>ESD" – Active inhibit signal will override ESD

NOTE: Removing the wires to these terminals can disable active inhibits.

4.17.3 Local Command

Default = LOCAL>ESD

To Customize the Settings:
Select "NO" to choose:

- "ESD>LOCAL" – ESD overrides local command to operate actuator
- "LOCAL>ESD" – Local command to operate actuator overrides ESD

4.17.4 Stop

Default = STOP>ESD

To Customize the Settings:
Select "NO" to choose:

- "ESD>STOP" – ESD overrides stop command
- "STOP>ESD" – Stop command overrides ESD

4.17.5 Jammed Valve*

Default = JAMMED VALVE>ESD

To Customize the Settings:
Select "NO" to choose:

- "ESD>JAMMED VALVE" – ESD overrides jammed valve indication
- "JAMMED VALVE>ESD" – Jammed valve indication overrides ESD (default)

** See CAUTION on Figure 4.24.*

4.17.6 Lost Phase*

Default = LOST PHASE>ESD

To Customize the Settings:
Select "NO" to choose:

- "ESD>LOST PHASE" – ESD overrides lost phase indication
- "LOST PHASE>ESD" – Lost phase indication overrides ESD

** See CAUTION on Figure 4.24.*

4.17.7 Overtorque*

Default = OVERTORQUE>ESD

To Customize the Settings:
Select "NO" to choose:

- "ESD>OVERTORQUE" – ESD overrides overtorque situation
- "OVERTORQUE>ESD" – Overtorque situation overrides ESD

** See CAUTION on Figure 4.24.*

4.17.8 Motor Thermostat

Default = ENABLED

To Customize the Settings:
Select "NO" to choose:

- "ENABLED"
- "DISABLED"

NOTE: Disabling the motor thermostat voids all third party certifications including Factory Mutual, CSA, ANeZ, and ATEX. Disabling the motor thermostat removes protection from overheating the motor and may cause unsafe conditions.

4.17.9 Two-Speed Timer

Default = 2 speed timer > ESD

To customize the settings select "NO" to choose:

ESD > 2spd? – ESD overrides 2 speed timer

See caution in Figure 4.24

4.17.10 Network ESD

Default = Local ESD > NW ESD

To customize this setting, select "NO" to choose NW ESD > Local ESD.

4.18 Inputs

The User can select up to 3 Inputs (0, 1, 2) and configure them to perform these functions:

- ESD
- Inhibits
- User defined
- CSE

NOTE: Input 0 Default: The default for input 0 will be ESD, signal present, disabled, and ignore.

Input 1 Default: The default for input 1 will be open inhibit, signal present, and disabled.

Input 2: The default for input 2 will be close inhibit, signal present, and disabled.

The inputs will be the same as in previous versions of software. If a firmware upgrade is done from a previous version that did not have configurable inputs, to the later version that does, then the users settings will remain the same.

4.18.1 Status

Default Setting is: OFF

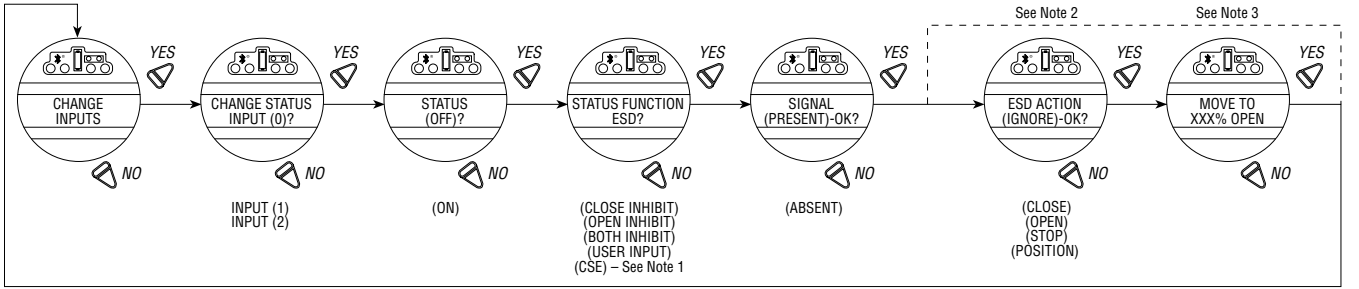
Select “NO” to choose whether the inhibit is “ON” or “OFF.”

4.18.2 Signal

Default Setting is: PRESENT

Select “NO” to choose whether the inhibit should be active when the signal is “PRESENT” or “ABSENT” from the terminals. Consult wiring diagram for connection details.

Figure 4.25 – Inhibits



NOTE 1: Only input 2 will display "CSE" as an option. The user must run the "remote" indication signal of the CSE to input 2, and define input 2, status function as CSE for it to work with Fieldbus/Profibus. If CSE option is chosen for input 2, they will only be able to select "SIGNAL PRESENT."

NOTE 2: The "ESD ACTION" menu will only appear if the user selects the "ESD" status function for the input. Otherwise the "SIGNAL PRESENT" menu will return to the "CHANGE INPUTS" menu.

NOTE 3: "MOVE TO" menu only appears if Position is chosen as action.

4.19 Monitor Relay

The monitor relay indicates the actuator is available for remote operation. The monitor relay will de-energize on loss of power or if any of the following functions become active:

Normal operation

Each selection is User configurable. Select "Enabled" to turn the feature on, and "Disabled" to turn the feature off.

- "LOCAL STOP/OFF" – Red selector knob in "STOP/OFF"
- "LOCAL SELECTED" – Red selector knob in "LOCAL"

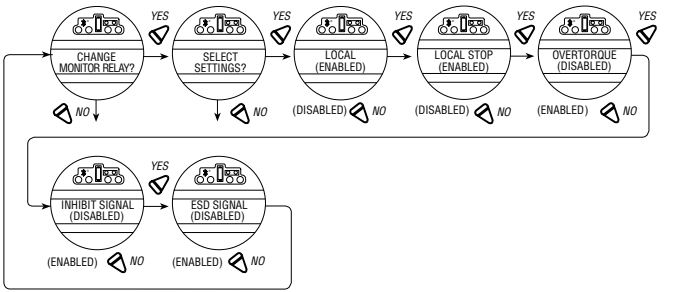
Fault indication

Each selection is User configurable. Select "Enabled" to turn the feature on, and "Disabled" to turn the feature off.

- "LOST PHASE" – Single phasing
- "VALVE JAMMED" – Valve cannot move when energized to pull out of valve seat.
- "MOTOR OVERTEMP" – Thermistor range exceeded

The yellow LED will blink when monitor relay is de-energized.

Figure 4.26 – Monitor relay



These functions are monitored continuously and may not be changed, but an additional three functions may be configured individually during setup.

1. Select "CHANGE MONITOR RELAY?" from the "SETUP" routine.

2. Select “YES” to enter the “SELECT SETTINGS?” display. Select “YES” to access each of the following three functions:
   - “OVERTORQUE” – Torque range exceeded in mid-travel, thermistor temperature exceeded, or malfunction in thermistor
   - “INHIBIT SIGNAL” – Inhibit “ON” and active
   - “ESD SIGNAL” – ESD “ON” and active
3. Select “NO” to:
   - “ENABLE” – will trip monitor relay or
   - “DISABLE” – will not trip monitor relay.

4.20 Diagnostic Reset

For diagnostic purposes the following parameters are recorded at certain points in the valve travel on every opening and closing stroke:

- Proportional measurements of torque
- Drive sleeve turns
- Contactor operations
- Maximum and minimum voltage
- Motor run time
- Stroke time

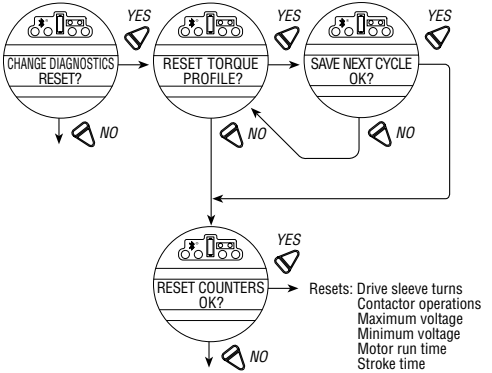
To enable the new values to be compared with previous measurements, it is essential to record reference values. Limitorque recommends this be done after the valve has been installed, commissioned, and is operating under normal process conditions, and after a plant shutdown or actuator/valve overhaul. The user may select to reset the torque profile at any time.

1. Select “RESET TORQUE PROFILE?” from the “RESET DIAGNOSTICS” routine.
2. Select “YES” to enter the “SAVE NEXT CYCLE?” display.
3. Select “NO” to switch the reset ON or OFF.

After the next complete cycling of the valve, in both the open and close directions, this reset will automatically be switched OFF.

4. Select “RESET COUNTERS” to reset all the listed parameters to “0.”

Figure 4.27 – Diagnostic reset



4.21 TAG Number

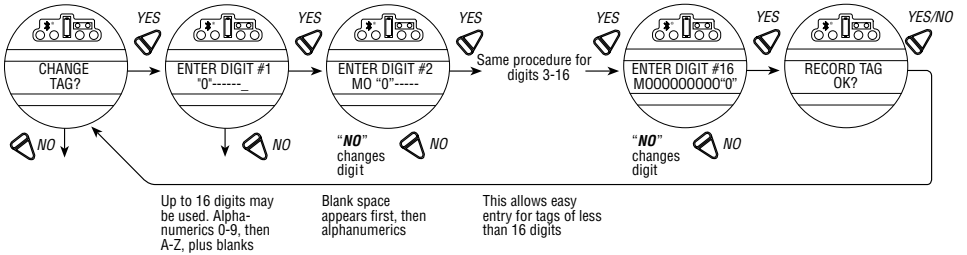
Defaults to blanks.

To Customize the Setting:

1. Select “CHANGE TAG?” from the “SETUP” routine.
2. Select “YES” to enter the “ENTER DIGIT” displays.
3. Select “NO” to choose the required number or letter for each digit of the valve tag number, up to a maximum number of 16 digits.

   The alphanumeric display scrolls from a symbol set, numerals and then A-Z in the following order: ! “ # $ % @ ‘ ( ) * + , - . / 0-9 : ; < = > ? A-Z. There is one blank at each end to enable a tag number with less than 16 digits to be entered clearly. To highlight the digit being entered, a dot appears over the space and the letter above the space disappears.

Figure 4.28 – TAG number

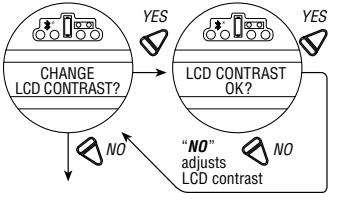


4.22 LCD Contrast

Permits adjustment of the viewing contrast of the LCD.

1. Select “YES” to enter the “LCD CONTRAST” display.
2. Select “NO” to adjust contrast to desired level.

Figure 4.29 – LCD contrast

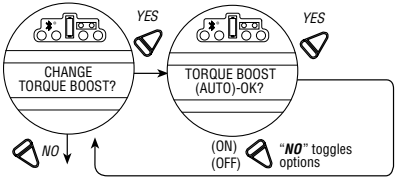


4.23 Torque Boost

Default = “AUTO”

Torque boost increases the capacity to move valves under conditions of low temperature or extreme valve stiffness. In the default setting, the MX will permit more output torque up to the unit’s maximum torque rating when the temperature falls below 32°F (0°C). When configured as ON, torque boost will be present under all conditions regardless of temperature, and when OFF, torque boost will not be present.

Figure 4.30 – Torque boost



4.24 Motor Thermostat

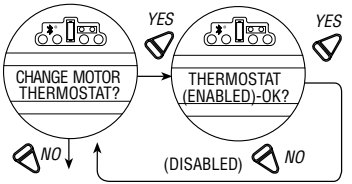
The thermostat setting may be customized:

1. Select “CHANGE MOTOR THERMOSTAT?” from the “SETUP” routine.
2. Select “YES” to enter the “MOTOR THERMOSTAT” display.
3. Select “NO” to choose between “ENABLED” and “DISABLED.”

In the “DISABLED” mode, the motor thermostat is bypassed and detection of an overheated motor does not prevent operation of the actuator. This feature is user-selected when required by the application and may be desirable during critical service.

NOTE: If the motor thermostat is disabled, third party certification including Factory Mutual, CSA, ANeZ, ATEX, and warranty, will be voided.

Figure 4.31 – Motor thermostat



4.25 Change Valve Data

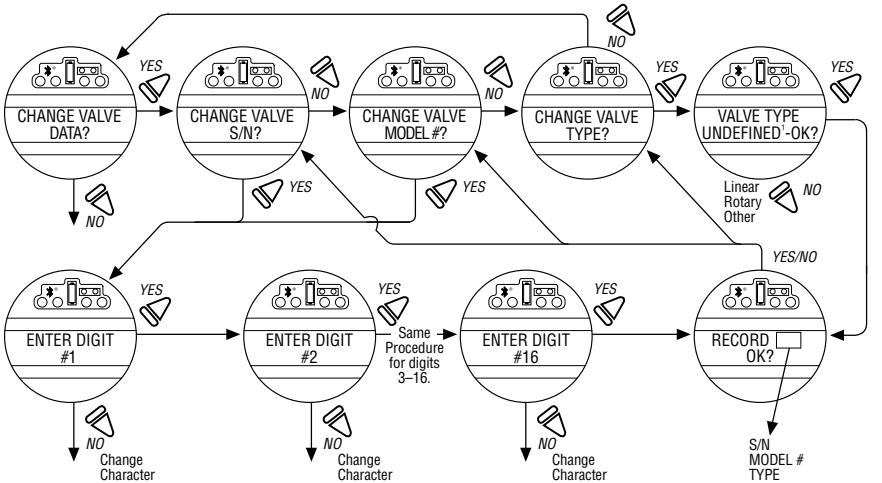
“Change Valve Data” allows the user to identify the type of valve the MX actuator is mounted to.

- If “YES” then “Change Valve S/N?” Select “YES” to “ENTER DIGIT” displays.
- Select “NO” to choose the required number or letter for each digit of the valve S/N, up to a maximum of 16 digits.

- Select “YES” when the desired number or letter is displayed.
- Follow same sequence for “CHANGE VALVE MODEL #?”, “CHANGE VALVE TYPE?”
- If “YES” to “CHANGE VALVE TYPE?” then “VALVE TYPE UNDEFINED-OK?” is displayed. “VALVE TYPE UNDEFINED-OK?” is only shown until the valve type is chosen. In the rare event that the user would need to “REINITIALIZE” the MX actuator, the screen will reappear. See Figure 5.1.

  The alphanumeric display scrolls from a symbol set, numerals and then A-Z in the following order: ! “ # $ % & ‘ ( ) * + , - . / 0-9 : ; < = > @ A-Z. There is one blank at each end to enable a tag number with less than 16 digits to be entered clearly. To highlight the digit being entered, a dot appears over the space and the letter above the space disappears.

Figure 4.32 – Change valve data



NOTE 1: Valve type "**UNDEFINED**" is only shown until the valve type is chosen. After that, it will not be displayed again unless Reinitialized.

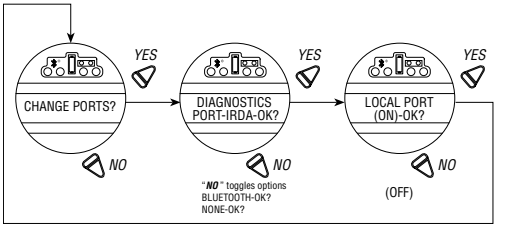
4.26 Change Port

The MX, using the dashboard software, communicate via the local port connections (refer to wiring diagram), via optional Bluetooth port, or via the IRdA port, located on the LCD board and accessible via the sight glass.

Both ports cannot be enabled simultaneously as they both share the same serial port on the main board.

Default = Local Port

Figure 4.33 – Change port



5 Troubleshooting

WARNING: This actuator is non-intrusive. Do not open the control compartment on the actuator unless absolutely necessary. It was sealed in dry, clean conditions in the factory and entry to this compartment should not be necessary. Unauthorized entry could void the warranty.

If the actuator will not operate, before attempting to troubleshoot, verify the following:

- LCD display reads “XX% OPEN,” “STATUS OK.”
- Red selector switch is not in the STOP position.
- All three phases of the main power supply are present at the actuator terminals.
- The supply voltage is the same as that stated on the actuator nameplate.
- Optional 110 VAC is measured at terminals 23 and 24.
- 24 VDC is measured at terminals 22 (+Ve) and 21.
- If 24 VDC power supply is ON, check that the loading does not exceed 5 W across terminals 21 and 22 (remove wires from 21, 22, 23, and 24).
- LCD and LED display on the control panel are illuminated.

If these checks are satisfactory, then attempt to locate the fault using the “VIEW DIAGNOSTICS” routine. It is also recommended that the actuator settings be verified using “VIEW SETTINGS.”

5.1 View Diagnostics Routine

1. Enter “VIEW DIAGNOSTICS” as detailed in Section 5.3, View Diagnostics.
2. Review the various displays to try to find the reason the actuator will not operate. The displays that may help to isolate the fault are as follows:
   - View Hardware Status
   - View Motor Status
   - View Power Supply

5.2 Troubleshooting Problems/ Corrective Action

(Refer to LMENIM2314, MX Maintenance and Spare Parts and the standard wiring diagram in the Section 3.3, Electrical Connections). We recommend that only Limitorque service personnel perform this operation.

1. Switch off the main power supply and 24 VDC supply at terminals 6 and 7 (if used).
2. Remove control compartment cover (ACP) and protect against the ingress of moisture or dust.
3. Remove any wiring that has been connected to terminals 21, 22, 23 and 24.
4. Switch on main power supply.
5. Measure VAC at 23, 24 – should be 110 VAC if actuator is supplied with optional 110 VAC circuit. If no power, check fuses FS1, FS2 (600

VAC, 1 A, fast acting, 10.3 x 38.1 mm tube) and FS3 (250 VAC, 0.1A, time delay, 5 x 20 mm glass tube) and replace if necessary. If replacing fuses does not fix the problem, replace damaged board. Contact Limitorque Service at (434) 528-4400.

6. Measure VDC at 21, 22 – should be 5 W at 24 VDC. If not, replace damaged board.
7. Replace the control compartment cover (ACP).

5.2.1 Actuator Fails to Operate

Actuator Fails to Operate from LOCAL Controls

1. Place the red selector knob in "LOCAL."
2. If motor runs but actuator output does not turn, check that declutch lever has returned to motor operation position. See Section 2.1.2, Electrical Operation Feature.
3. Check LCD display for following alarms:
   - If motor runs but no actuator movement is detected, check if the display says "JAMMED VALVE" and free if necessary.
   - Inhibit signal may be present or absent at the terminals. Check for signal and adjust as necessary. "INHIBIT ACTIVE" appears on display.
   - Thermal overload of the motor may have been detected. Check motor for high temperature. Thermal overload is self-resetting when motor cools. "MOTOR OVERTEMP" appears on the display.
4. Check to see if the position limits are set incorrectly on top of one another. See Section 3.4.4, Setting Position Limits.
5. Check to see if the reversing contact is plugged in correctly.

Actuator Fails to Operate from REMOTE Controls

1. Check that the actuator will operate from "LOCAL." If not, then carry out the checks described below.
2. Check that the red knob is in "REMOTE."

3. ESD signal may be present or absent at the terminals. Check for signal and adjust as necessary. (“ESD ACTIVE” at display.) If actuator previously operated in “LOCAL,” then the fault is probably in the remote control circuit. Check the integrity of the cabling and that the connections to the terminals are in accordance with the wiring diagram. If motor runs in “LOCAL,” but not “REMOTE,” adjust ESD to be greater than local.
4. Confirm correct monitor relay operation. See Table 3.5.

5.2.2 Jammed Valve Detected

1. Check that position limits have been set correctly. If valve is position-seated, the limits should stop the motor just before the end-of-travel. Recalibrate the position limits if necessary. See Section 3.4.4, Setting Position Limits.
2. Check that torque settings are correct for the valve. Recalibrate if necessary. See Section 4.5, Torque Setup.
3. Check the condition of the valve and lubrication of the valve stem and thrust bearings. The valve may have remained in the same position for a long time and become corroded internally or externally. Engage manual override and employ the handwheel drive to unseat the valve.
4. Verify that the actuator will now operate the valve. Open and close the valve a few times to check for correct operation throughout the travel.

NOTE: To free a jammed valve from the “CLOSE” or “OPEN” position, engage manual override and attempt to unseat it using the handwheel drive. If a rising stem valve is jammed in the close position, loosen the fixing bolts that attach the thrust base to the valve. This will release the compression in the drive components and reduce the effort to unjam the valve. Partly open the valve, then retighten the bolts.

5.2.3 Actuator Operates but Does Not Drive Valve

1. Verify that the declutch lever has returned to motor-operated position.
2. Verify that the stem nut is fitted correctly in the actuator base.
3. Verify that the stem nut has sufficient engagement with the valve stem.
4. Verify that the key is fitted in bore/keyway applications.

5.2.4 Valve Does Not Seat Correctly

1. Verify that any mechanical stops on quarter-turn gearboxes are correctly set.
2. Verify that position limits are calibrated correctly for the valve travel.
3. Verify that the torque-seating valves have been configured to close on torque, not position.
4. Verify that closing torque value has been set high enough to suit the process conditions.
5. Verify that the valve is not obstructed.

5.2.5 Status Messages

Normal display status is listed in Section 3.5.5, Local Indication. Status or alarm messages are listed below. Once a status or alarm condition occurs, the message will be displayed on the bottom line of the LCS screen until the condition is addressed and cleared. If multiple status or alarm conditions are active, the bottom display will cycle through each screen until the condition is addressed and cleared (one message per four seconds).

Status or Alarm Messages (XX = Input # (0, 1, 2))

"---% OPEN, STATUS OK" – Normal display

"---% OPEN, VALVE JAMMED" – Valve cannot start moving

"---% OPEN, LOST PHASE" – One of three phases lost

"---% OPEN, MOTOR OVERTEMP" – Thermistor range exceeded

"---% OPEN, OVERTORQUE" – Torque exceeded in mid-travel

"---% OPEN, HARDWARE FAILURE" – Indication

"---% OPEN, DDC OFF" – DDC enabled, but "OFF"

"---% OPEN, ESD ACTIVE" – ESD signal present

"---% OPEN, INHIBIT ACTIVE" – Inhibit signal present

"---% OPEN, FF OFF" – FF enabled but "OFF"

"---% OPEN, PB OFF" – PB enabled but "OFF"

"---% OPEN, DN OFF" – DN enabled but "OFF"

"---% OPEN, WARMING UP" – Warm up delay active (cold temperature option)

"---% OPEN, NO ANALOG SIGNAL" – 4-20 mA signal absent (Mod enabled, red selector switch in "REMOTE")

"---% OPEN, DDC COM LOST" – DDC enabled, signal absent

"---% OPEN, FF COM Lost" – FF enabled, signal absent

"---% OPEN, PB COM Lost" – PB enabled, signal absent

"---% OPEN, DN COM Lost" – DN enabled, signal absent

---%OPEN, ESD XX ACTIVE – Input # set for ESD, is asserted, and has highest priority

---%OPEN, ESD = XXX.X % = ESD ACTIVE and its action is "move to" ---.-% position

---%OPEN, ESD XX INHIBITED – Active ESD XX has been inhibited by an ESD override.

---%OPEN, ESD XX CONFLICT – ESD XX is set for ESD, asserted, and is in conflict with the active ESD.

---%OPEN, ESD OPEN – active ESD action is OPEN

---%OPEN, ESD CLOSED – active ESD action is CLOSED

---%OPEN, ESD STOP – active ESD action is STOP

---%OPEN, ESD IGNORE – active ESD action is IGNORE

---%OPEN, INHIBIT ACTIVE – INHIBIT signal is asserted

---%OPEN, INHIBIT CONFLICT – Conflict with multiple INHIBITs

"SET LIMITS" – Normal display if red selector knob is in "LOCAL" or "REMOTE" and position limits have not been set

"INITIALIZE" – "INITIALIZE" will be displayed if module has no actuator configuration. No operation will be permitted until initialization has been completed. Refer to "ROM ERROR" for routine on next page. See Figure 5.1.

RAM Error

The MX processor continually checks RAM for memory corruption errors. If corruption is detected, the processor will force a reset to clear RAM. The LCD will temporarily display the following prior to this reset:

"XX% OPEN"

"RAM ERROR"

After the reset, the display will read normally. Any momentary commands (DDC command, momentary pushbutton, etc.) that were not completely executed must be reissued.

ROM Error

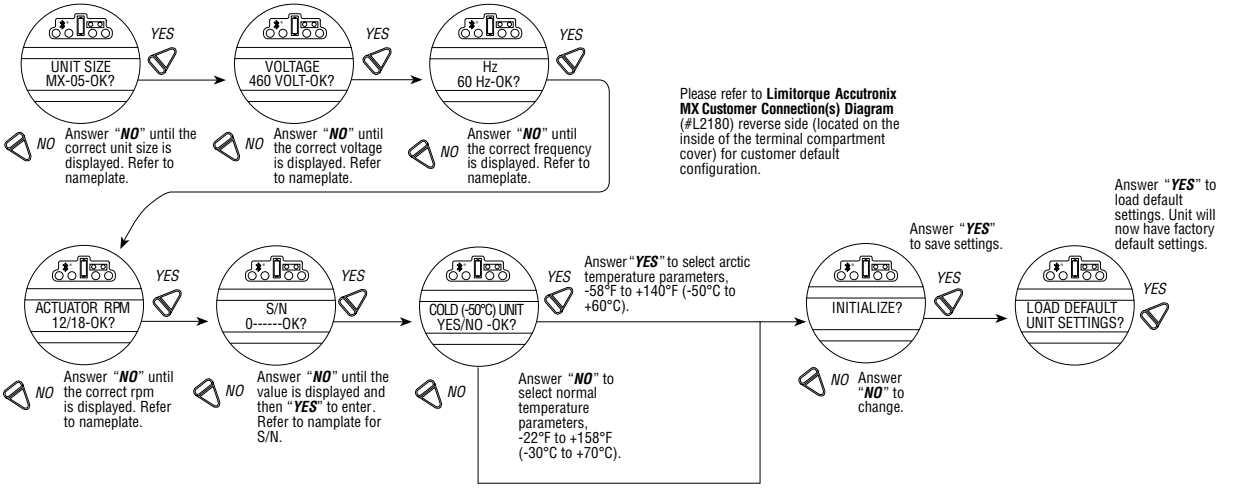
The MX processor continually checks EPROM for memory corruption errors. If corruption is detected, operation is disabled. If the selector switch is in "LOCAL" or "REMOTE," the LCD will display the following:

"XX% OPEN"

"ROM ERROR"

When the selector is placed in "STOP," the unit will require reinitialization and the LCD will display the following dialog:

Figure 5.1 – Initialize routine



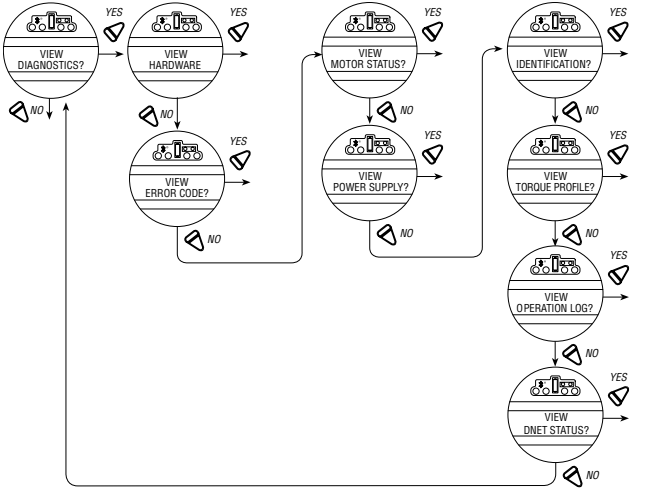
5.3 View Diagnostics

A large amount of historical data is stored in the actuator memory and can be retrieved very easily, without the need for password entry. The data is displayed in dialog format.

1. Enter the "SETUP" mode routine detailed in Section 2.1.1, Entering the Setup Mode.
2. Select "VIEW DIAGNOSTICS?"
3. Select "YES" to access the first display "VIEW HARDWARE?"

NOTE: It is recommended that ALL diagnostics information be recorded prior to contacting an authorized Limitorque service coordinator at (434) 528-4400. This information aids in diagnosing any problem the actuator may experience.

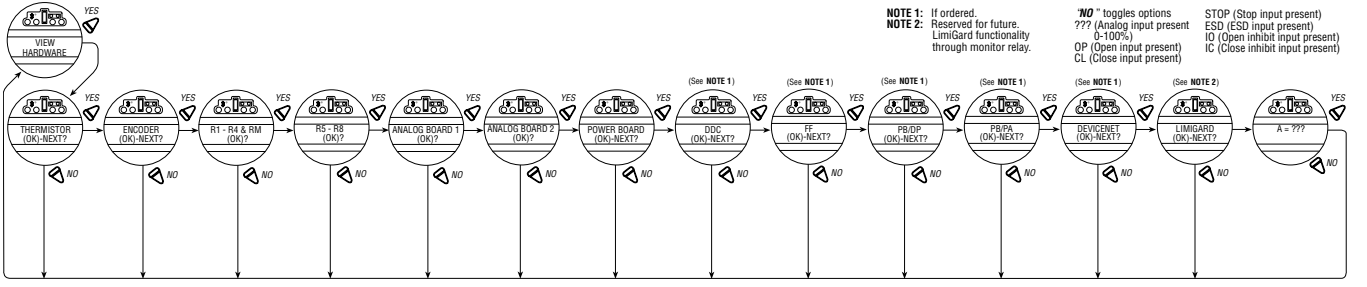
Figure 5.2 – Diagnostic overview



5.4 View Hardware Status

Accessing the "VIEW HARDWARE" routine will enable some of the actuator components to be reviewed for their integrity, as indicated below. These components are continuously being monitored.

Figure 5.3 – View hardware status

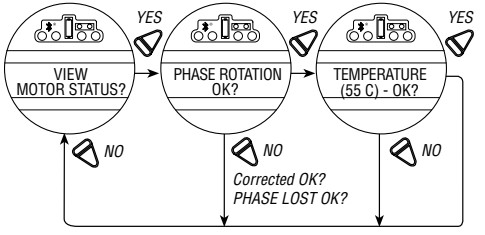


5.5 View Motor Status

Viewing “MOTOR STATUS” will provide information on the following:

- If the three-phase power supply is connected correctly.
- If autophase correction is in operation.
- If there is a fault or loss of a phase.
- Temperature of the windings in the motor.

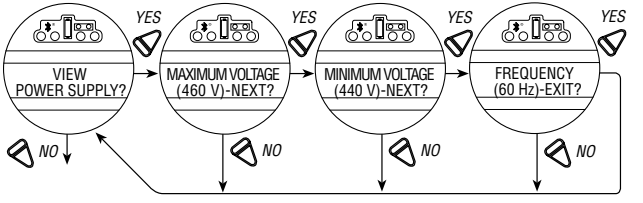
Figure 5.4 – View motor status



5.6 View Power Supply

Viewing “POWER SUPPLY” will provide historical data on the maximum and minimum voltages that have been applied to the actuator, as well as the frequency of the AC supply. These can be reset. See Section 4.20, Diagnostic Reset.

Figure 5.5 – View power supply

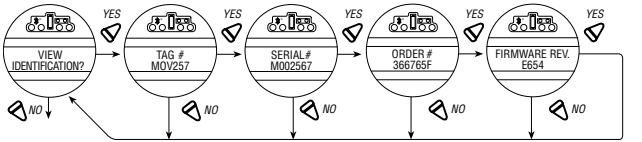


5.7 View Identification

In this dialog, the identity of the actuator may be reviewed. This dialog provides valuable information for the ordering of spare parts or checking the specification of the actuator.

NOTE: The serial number, order number, and software revision number were entered at the time of manufacture and cannot be changed on screen. The software revision number is necessary when option boards are ordered.

Figure 5.6 – View identification



*Network revisions will only be displayed if the optional network board is installed within the MX.

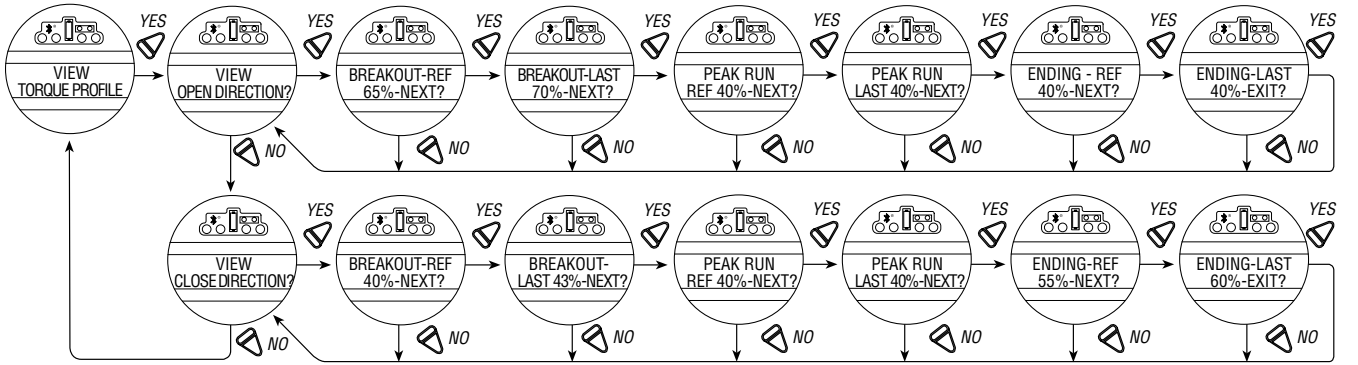
5.8 View Torque Profile

The information contained in the "TORQUE PROFILE" dialog provides indication of the condition of the valve relative to the last time that the "DIAGNOSTIC RESET" reference values were reset. See Section 4.21, TAG Number. It can give an indication of a change in the process conditions, such as an increase in pressure.

Details are given for the REFERENCE and the LAST torque, expressed as a percentage of the rated torque (stated on the nameplate, Figure 4.7) that occurred at BREAKOUT, ENDING, and PEAK RUNNING for both the opening and closing directions. Torque will be expressed proportionally as a reference only from 40% to 100% inclusive. Initial indication may read 0% until torque exceeds 40% minimum.

- "BREAKOUT" – Amount of torque required to unseat the valve.
- "ENDING" – Amount of torque required to seat the valve.
- "PEAK RUNNING" – Maximum torque detected while cycling from BREAKOUT to ENDING. (Maximum mid-travel torque.)

Figure 5.7 – View torque profile



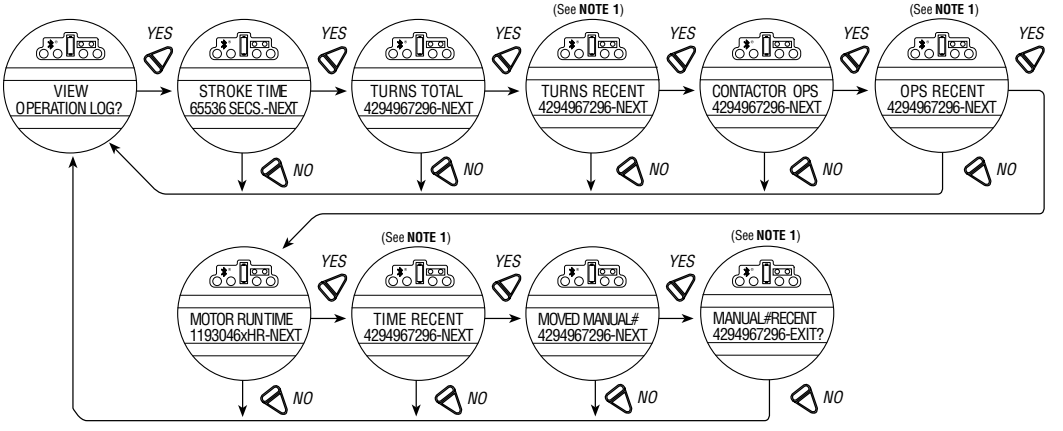
5.9 View Operation Log

The "OPERATION LOG" provides information to assist in the maintenance program for the actuator because it indicates the total number of actuator turns, contactor operations, motor run time, and declutching operations since the actuator was manufactured. These figures may not be reset except in "RESTRICTED SETUP." Contact factory.

The LCD screen definitions are as follows:

- "STROKE TIME" – Length of time of last actuator operation
- "TURNS TOTAL" – Total number of drive sleeve revolutions
- "TURNS RECENT" – Number of drive sleeve revolutions since last diagnostic reset. See Section 4.20, Diagnostic Reset, for reset diagnostics instructions.
- "CONTACTOR OPS" – Total number of contactor operations
- "OPS RECENT" – Number of contactor operations since last diagnostic reset. See Section 4.20, Diagnostic Reset, for reset diagnostics instructions.
- "MOTOR RUN TIME" – Total motor operational time
- "TIME RECENT" – Motor operational time since last diagnostic reset. See Section 4.20, Diagnostic Reset, for reset diagnostics instructions.
- "MOVED MANUAL #" – Total number of times unit has been operated manually
- "MANUAL # RECENT" – Number of times unit has been operated manually since last diagnostic reset. See Section 4.20, Diagnostic Reset, for reset diagnostics instructions.

Figure 5.8 – View operation log

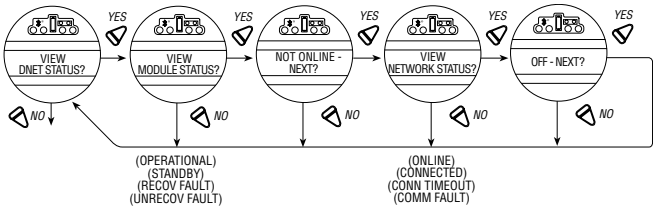


NOTE 1: Resetable – See **Section 4.20, Diagnostic Reset**.

5.10 View DNET Status?

This selection permits the User to view pertinent information that summarizes the status of the DeviceNet option board.

Figure 5.9 – View DNET status



VIEW MODULE STATUS?

Answer "YES" to determine status of individual DN board within the actuator.

Configuration choices are:

"OFF" = board installed but turned off

"STANDBY" = The device needs commissioning due to configuration missing, incomplete or incorrect.

"RECOVERABLE FAULT" = Conditions that can cause this event are e.g. communication fault, power fault or Limiguard fault of the SMT Main Board. Device may need resetting.

"UNRECOVERABLE FAULT" = Internal Diagnostic Fault detected e.g.

- Receive Queue Overrun
- Transmit Queue Overrun
- CAN Controller Overrun

Device may need replacing.

"SELF TESTING" = The device is in self-test mode.

VIEW NETWORK STATUS?

Answer "YES" to determine status of DN network.

"NOT ON LINE" = Device is not on-line.

- The device has not completed the self-test yet.
- The device may not be powered, look at Module Status Display.

"ONLINE" = Device is on-line but has no connections in the established state.

- The device has passed the SELF test, is on-line, bus has no established connections to other nodes.
- For a Group 2 Only device it means that this device is not allocated to a master.
- For a UCMM capable device it means that the device has no established connections.

"CONNECTED" = The device is on-line and has connections in the established state.

- For a Group 2 Only device it means that the device is allocated o a Master.
- For a UCMM capable device it means that the device has one or more established connections.

"CONN TIMEOUT" = One or more I/O Connections are in the Timed-Out state.

"COMM FAULT" = Failed communication device. The device has detected an error that has rendered it incapable of communicating on the network (Duplicate MAC ID, or Bus-off).

"ID COM FLT REQ" = A specific Communication Faulted device. The device has detected a Network Access error and is in the Communication Faulted state. The device has subsequently received and accepted an Identify Communication Faulted Request. Long Protocol message.

6 Maintenance

Under normal operating conditions, the MX is a maintenance-free actuator. For ordinary applications, the actuator will require no formal maintenance program. However, if the actuator is used under severe service conditions or operated in a Hazardous Location, the following maintenance procedures are required:

1. Check the oil level every 50 hours of operation at a minimum. Where conditions are severe due to frequent operation or high ambient temperatures, a more regular inspection interval should be maintained.
2. Change the gear oil every 100 hours of operation. See Section 6.1: Lubrication.
3. All ball bearings, oil seals, O-rings and quad-rings are to be replaced after 450 hours of operation. See Bulletin LMENIM2314, MX Maintenance and Spare Parts for disassembly procedures.

Clean and lubricate the valve stem regularly to avoid torque build-up and wear due to silting and corrosion. Infrequent operation can lead to corrosion and contamination of the valve stem thread lubricant. Check any thrust bearings that are fitted to the actuator for proper lubrication at regular intervals. For additional details refer to Bulletin LMENIM2314, MX Maintenance and Spare Parts.

6.1 Lubrication

MX actuators are oil-filled, as standard, using Mobil SHC 632. Exxon Teresstic SHP 320 may be used as a direct substitute. These products are synthetic machine oils suitable for ambient temperatures of -20°F to 250°F (-30°C to 120°C). For extreme low temperature conditions (< -30°C to -55°C), an alternative lubricant is available—Petro Canada TRAXON Synthetic 75W-90 with TOS. Consult factory for arctic temperature applications.

6.1.1 Oil Capacities

To avoid pressurization of the gearcase, the following recommended oil capacities should not be exceeded:

- MX-05 – 10 oz. (256 ml)
- MX-10 – 21 oz. (.6 liters)
- MX-20 – 48 oz. (1.4 liters)
- MX-40 – 65 oz. (1.9 liters)
- MX-85 – 192 oz. (5.7 liters)
- MX-140 – 192 oz. (5.7 liters)
- MX-150 – 192 oz. (5.7 liters)

6.1.2 Checking Oil Level

To check the level:

1. Remove the uppermost filler plug on the gearcase.
2. Check that the level of oil is within 1 inch (25 mm) of the hole (when actuator is mounted with base horizontal).

7 Regulatory Information

Application of Council Directive(s)

89/336/EC & 2004/108/EC; EMC Directive

89/392/EC; Machinery Directive

2003/10/EC; Airborne Noise Directive

94/9/EC; ATEX Directive

Standard(s) to which Conformity is Declared

Machinery; EN 60204-1

EMC - Emissions; EN 50081-1&2, EN 55011, CFR 47

Immunity; EN 50082-1&2, IEC 801-3 & IEC 801-6
ESD; IEC 801-2
EFT/Bursts; IEC 801-4
Surge Immunity; IEC 801-5, ANSI/IEEE C62.41
Mains (power) Harmonics; MIL-STD-462, Method CSO1 & CSO2

Airborne Noise; MIL-STD-740-1, Table 1, and EN 60204

ATEX

Electrical Apparatus for Potentially Explosive Atmospheres;
General Requirements EN 50014:1997(A1 and A2)
Flameproof “d” EN 50018:2000(A1)
Increased Safety “e” EN 50019: 2000
Essential Health and Safety Requirements PrEN 13463-5:2003
Non-Electrical Equipment for Potentially Explosive Atmospheres
EN 13463-1:2001

Manufacturer’s Name

Limitorque, a division of Flowserve Corporation

Manufacturer’s Address

5114 Woodall Road
Lynchburg, VA 24502

Importer's Name

Limitorque International

Importer's Address

Trinity House

Kennet Side

Newbury

Berkshire, RG15 5EH

England

Type & Description of Equipment

Valve Actuators

Model Number

MX SeriesNote: Tested with Limitorque products only and with standards applicable at time of tests.

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s). List as follows:



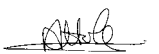
(Signature)

Earnest Carey
(Full Name)

Manager, Product Management
(Title)

Flowserve Limitorque
5114 Woodall Rd., Lynchburg VA 24502
(Place)

August 9, 2007
(Date)



Andy Hole

(Authorized EU Representative)

7.1 Conditions for Safe Use — Atex/Cenelec Applications

Atex/Cenelec certification of the MX product line is described in Certificate of Conformity SIRA No. 03ATEX1212X. This certificate details specific construction requirements that must be met in order to maintain the XP integrity of the actuator. The socket-head cap screws used with the MX electric valve actuators shall conform to the following requirements:

1. Socket-head cap screws to ISO Class 12.9 shall be used with all Group IIC devices.
2. K-500 Monel socket-head cap screws shall be permitted as an alternative to ISO Class 12.9 socket-head cap screws on all group IIB actuators.
3. A2 or A4 ISO Class 70 Stainless Steel socket-head cap screws shall be permitted as an alternative to ISO Class 12.9 socket-head cap screws or K-500 Monel socket-head cap screws for the motor cover of the Group IIB MX-85 actuators.

Notes:

Notes:

FLOWSERVE

FCD LMENIM2306-01 Printed in USA.

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United States
Flowserve Corporation
Flow Control
Limitorque Actuation Systems
5114 Woodall Road
P.O. Box 11318
Lynchburg, VA 24506-1318
Telephone: 1 434 528 4400
Telefax: 1 434 845 9736

ISO 9001 Reg. obtained

ANAB

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