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MX16

USER'S MANUAL



COMPACT MULTI-CHANNEL SHUTDOWN SYSTEM

GENERAL

The MX16 alarm and shutdown system is a self supported, compact shutdown device that has been designed to provide a safe and reliable means to detect abnormal conditions on a production process and initiate a shutdown if any of the reading show the operation is no longer within the pre-set safety margins.

The system has been built to withstand the adverse conditions of the oil-field environment and provides a straightforward interface with the operator. Abnormal conditions are indicated by indicator lamps (LEDs), each associated with a front panel label indicating the condition detected.

Powered by lithium batteries, the system is expected to operate for about three years without replacing batteries, and there is little or no maintenance needed besides recommended periodical functionality testing.

The MX16 can connect up to sixteen (16) loop monitored external alarm inputs and six (6) solid state outputs for indicating shutdown and service alerts respectively.

The alarms channels can be connected to any “dry contact” (or “open collector”) type of sensor such as pressure or level switches, manual ESD stations, and telemetry shutdown commands, etc. Each remote loop is monitored for wire integrity for insuring that wiring faults are also detected.

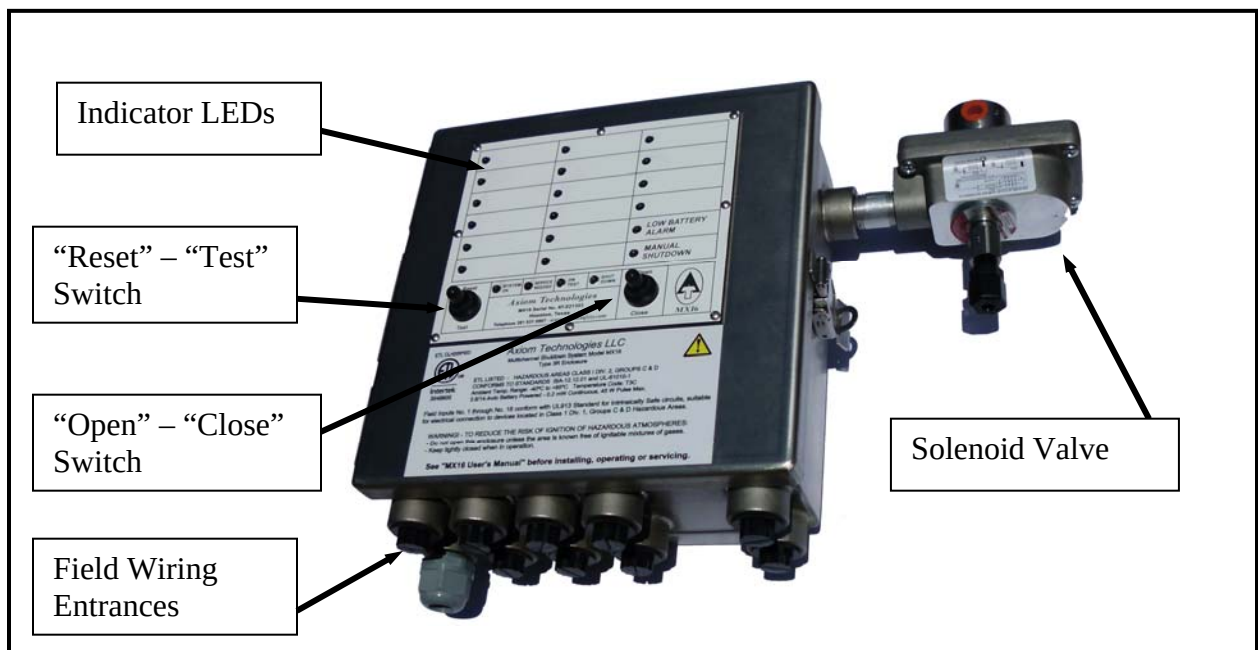


Fig. 1 MX16 General Layout

INSTALLATION

The enclosure of the MX16 is made of stainless steel and is provided with a pair of Strut Channels located on the back of the unit; it can be mounted on any vertical pole or pipe of up to 6" Outside Diameter.

**THE MX16 ENCLOSURE IS TO BE MOUNTED
UPRIGHT IN THE VERTICAL POSITION ONLY.**

BATTERY PACK INSTALLATION AND ACTIVATION

Typically, the MX16 is shipped with the battery module installed in the “storage position” for shipment. To insure correct operation of the MX16 proceed as follows:

1. Remove the four nylon nuts holding the battery module, rotate it 180° and carefully re-install as shown below (see Fig. 2).
2. Press and release the “Initialize” switch located in the upper left corner of the main board. The MX16 responds by testing all the LEDs and then blinks the System OK green LED every six seconds. **The MX16 is not yet ready to operate, and it will not respond if an alarm would be detected.**

Confirm that the well is either locked open or manually closed to prevent unintended operation before proceeding with the next steps.

3. Press “Open” on the “Open – Close” toggle switch located on the front. The MX16 responds with a fast flashing of the “System OK” green LED followed by the normal flashing of once per second. **Now the MX16 is ready to assume safety monitoring operation.**

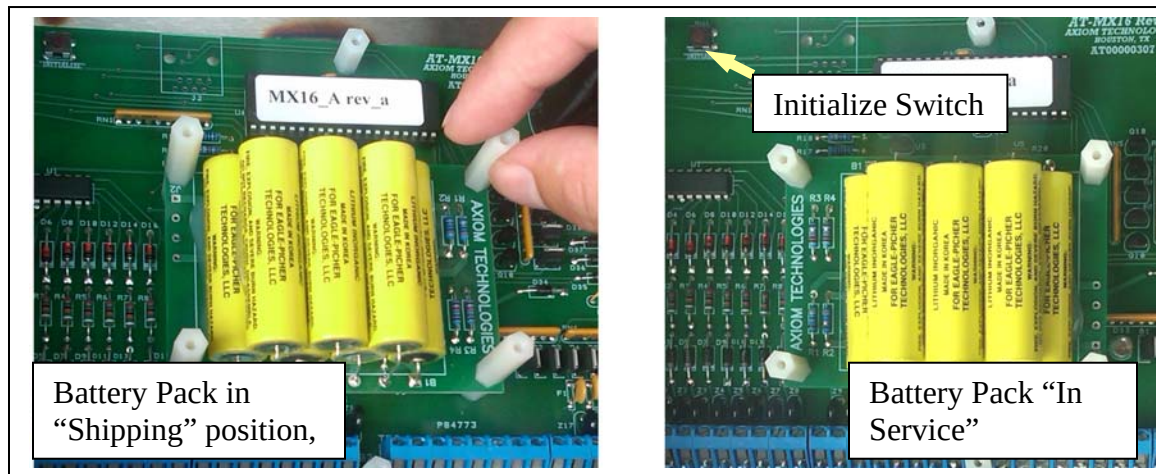


Fig. 2 Battery Pack installation

**THE BATTERY PACK IS TO BE REPLACED ONLY WITH BATTERY
MODULE AXIOM PART NO. AT-LBP-36144**



ELECTRONIC SYSTEM

The electronic circuits, sixteen (16) alarm inputs and six (6) outputs, are shown in Appendix "A" – MX16 Installation Notes, Drawing No. AT-MX16-I.



WARNING – EXPLOSION HAZARD

- **SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2**
- **DO NOT DISCONNECT EQUIPMENT OR REPLACE COMPONENTS UNLESS THE AREA IS KNOWN TO BE NON-HAZARDOUS**
- **PROTECTION MAY BE IMPAIRED IF THIS DEVICE IS USED IN AN APPLICATION OR MANNER NOT SPECIFIED IN THIS MANUAL**

The bottom of the enclosure has a total of ten (10) ½" NPT female fittings, where compatible cable glands or conduits may be connected for field wiring.

FIELD WIRING

For reliable operation, the wire used for connecting to the alarm switches, must retain reasonably good insulation resistance values. Severe wiring decay can be avoided by selecting the proper type of cable. If the cable is to be buried, then selecting a cable that will maintain a reasonable level of insulation resistance is critical.

Given the low currents involved with the alarm signals, the wiring selected can be as thin as #30 AWG and still operate satisfactorily at distances of over 3,000 FT. One of the best means for wiring the field sensors is to use direct burial telephone cable.

If the wire is to be run in conduits, then it must be verified that the wire insulation will not decay when wet, as water tends to accumulate in conduits, especially if run underground. If the insulation resistance would severely decay and fall below 100 KOhm, then the system may be unable to recognize conditions of open circuits (wiring failure) in the loop.

If the wiring is to be spliced, then the splicing is to be made in a junction box above ground or the proper repair kit is to be used for insuring the insulation's integrity.

The MX16 operates with “Normally Open” circuits as normal condition. For monitoring wiring integrity, an “End Of line Zener” is connected in parallel with the corresponding alarm switch. It is to be noted that the current for the inputs is well below incandescence levels and the highest current any given input could put out is 20 mA at a theoretical 16.8vdc.

The EOZs are shipped connected within the enclosure. When connecting an alarm to the MX16, the EOZ is to be moved from the box and connected in parallel with the alarm switch.

For example, if a “Water Tank High Level” alarm is to be connected to channel No. 1, then the end of line Zener at terminal TB1, position 1 (Labeled as IN1) is to be connected to the pair of wires (“Signal” and “Common”) running up to the tank. Then the EOZ is to be connected in parallel with the level switch at the water tank.

Assuming that a direct burial telephone cable is being used, it has a white wire as one conductor in each pair. It is common practice to parallel all white conductors in such a way that any white wire would provide the needed “common” point to the sensor being connected. At the MX16 enclosure, multiple white wires can be crimped together in a single ring lug and then the ring lug mounted on the “Common” stud.

If junction boxes are used, the same practice of connecting all white wires together offers a great simplification, as it eliminates the need to carefully select the correct white wire for any given alarm switch.

By observing the alarm LEDs on the front panel of the MX16, the installer can determine if a given alarm sensor has been correctly connected. For example, if the wiring to the alarm switch connected to channel No. 3 has not been properly connected, then the LED associated with channel No. 3 will remain double-blinking and the MX16 would not respond to the command for opening the SSV.

On the other hand, if there is a short circuit on the loop to channel No. 3 or the EOZ has been connected backwards, then Channel No. 3 will remain in alarm (single blinking). The opening of the SSV would be allowed but for only a limited amount of time, as the MX16 will shutdown if the existing alarm does not clear within thirty minutes.

The system monitoring of the alarm wiring operates by reading the voltage on each of the alarm channels and responding as follows:

0.0 through 3.0 VDC	Alarm
3.1 through 6.0 VDC	Wiring warning. The MX16 blinks the “Service Needed” LED but does not initiate shutdown. This condition may indicate a serious decay on the wiring’s insulation.
6.1 through 8.0 VDC	Normal, no alarm
8.1 VDC and above	Wiring Failure (Open circuit)

The scanning of all channels is done by sending very short pulses to each alarm sensor; the microprocessor monitors and compares the voltage value with the voltage ranges shown above to determine the condition of each given alarm channel. Given the above, pulses are too fast for a regular voltmeter to read; a test mode is available where each channel is scanned with a 5 seconds pulse so the technician would have the means to read these voltages with a regular voltmeter.

If the voltage of each channel is to be metered for troubleshooting purposes, then proceed as follows:

- Have a voltmeter ready in the range of 12 VDC. To facilitate reading, connect the common to any convenient place on the enclosure.
- Have the MX16 box un-latched.
- Press "Test" for about three seconds.
- The field loop voltage will be present for about five (5) seconds on channel No.1.
- After the five (5) seconds on channel one has expired, the voltage field loop voltage moves to channel No. 2 and the technician has again, five seconds to read the voltage.
- Every five seconds, the voltage reading moves to the next channel.
- A normal reading (no alarm) will be between 7.0 and 7.6 VDC.
- An alarm condition will read very close to 0.0 VDC.
- If one of the channels has the EOZ (End Of line Zener) connected backwards, then the reading would be about 0.5 VDC and the alarm would never clear until the EOZ is connected correctly.

Alarm Sensor Test Mode.

- Once the above routines are finished the MX16 goes into an "Alarm Switch Test Mode" where only the "On Test" blue LED blinks. When in this mode, the operator can cause the closure of the contacts on any alarm switch and the MX16 responds by flashing the corresponding alarm LED.
- The Alarm Switch Mode stays active for fifteen (15) minutes before returning to the normal alarm and shutdown mode.
- For interrupting the "Test" routine the operator may just press "Reset" and for confirming the MX16 is now on the Alarm and Shutdown mode, observe the "System OK" green LED which should be blinking once a second.

Time Delays

Channels 13-16 have a ten (10) second delay before an alarm is recognized and reported. They are intended for connection to alarms such as level indications on tanks or separators where sloshing of fluids may cause false alarms.

PNEUMATICS

Control of the pneumatic actuator is done by the solenoid valve, mounted on the right side of the box.

The solenoid valve is a three way magnetically latched device that is pulsed to open and pulsed to close the path of pneumatic pressure to the actuator. It is a time tested device that has shown unsurpassed reliability, however, the reliability of this device depends on a clean pneumatic supply.

It is recommended that a filter is installed upstream the solenoid valve to stop particulate matter from entering the valve which can cause leakage and/or failure to latch, when commanded to reassume production.

The typical connection is as follows:

Port 1 (normally closed)	Supply Pneumatic Pressure (100 PSI Typ.)
Port 2 (common)	Actuator
Port 3 (normally open)	Exhaust

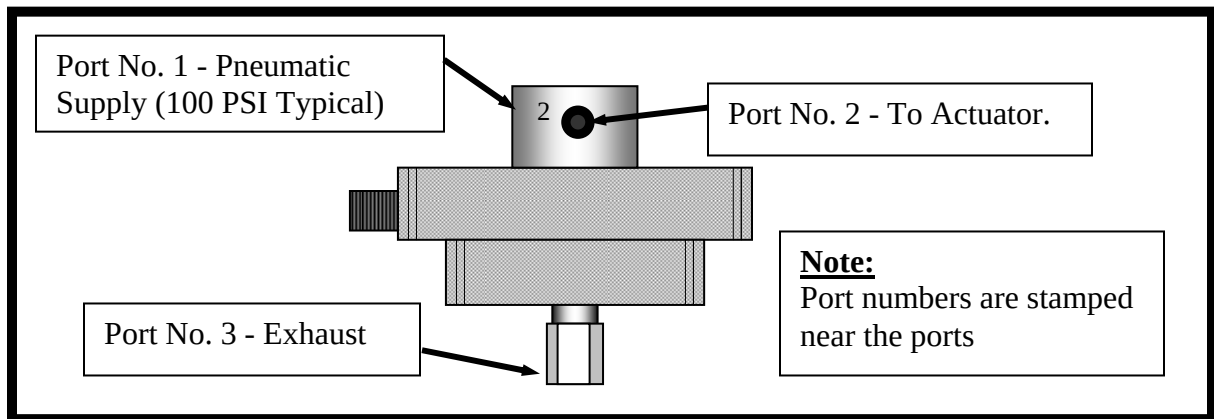


Fig. 4 Solenoid pneumatic typical connection

MX16 - ENVIRONMENTAL SPECIFICATIONS

Temperature range : -40 to +85C
Humidity range : 0 To 95% max., non-condensing
Altitude : 4,000 m. max.
Hazardous Area Classification : Certified for Class I, Division 2, Groups C & D,
Hazardous Locations. Temp. Code T3C
Alarm Circuits : Certified intrinsically safe

MX16 - PRESSURE RATINGS

Solenoid Valve Pressure : 100 psi max. (standard),

MX16 - ELECTRICAL RATINGS

Electrical Source : Dual voltage lithium battery module 3.6 & 14.4 VDC
Current consumption : 20 mA max. on 3.6VDC Circuits
0.5 mA (3 A max. pulse) on 14.4VDC Circuits



WARNING!

TO REDUCE THE RISK OF IGNITION OF HAZARDOUS ATMOSPHERES:
Do not open this enclosure unless the area is known free of ignitable
mixture of gases. Keep tightly closed when in operation.