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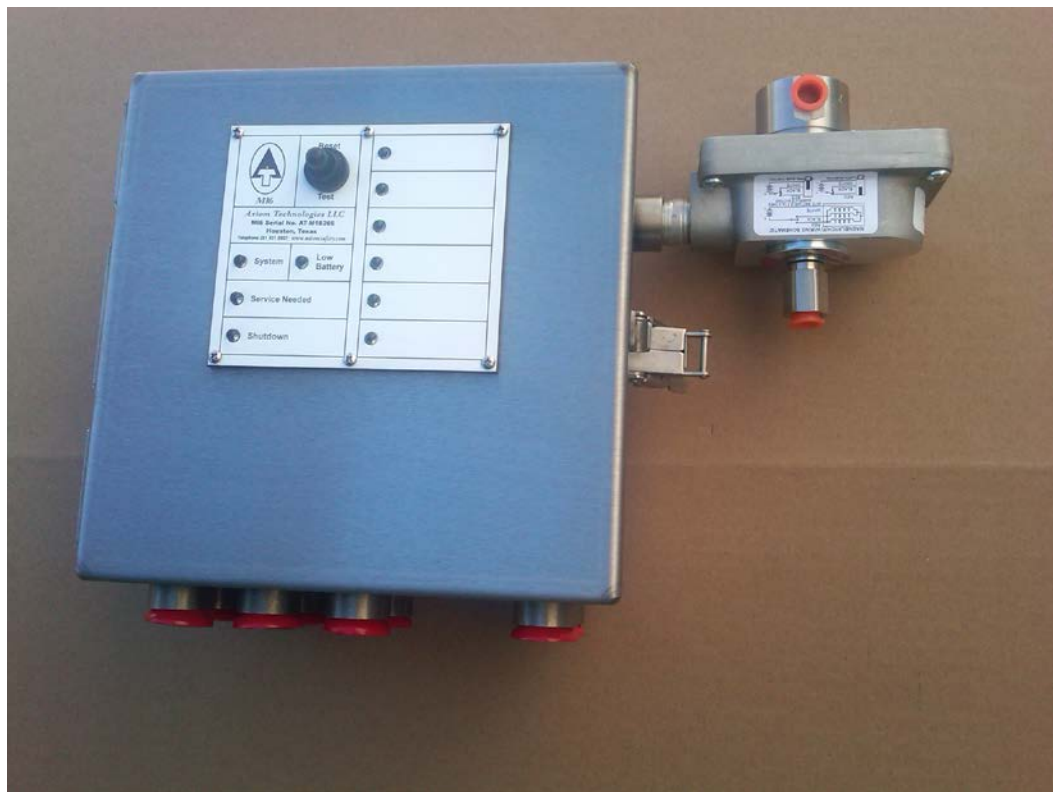
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MI6

USER'S MANUAL



SIX CHANNEL ALARM AND SHUTDOWN SYSTEM

GENERAL

The MI6 Six Channel Alarm and Shutdown System is a self supported, compact shutdown unit, providing six individual sensor inputs and two (2) solid state outputs. The MI6 has been designed to provide a safe and reliable mean to detect abnormal conditions on a production process and initiate a shutdown if any of the sensors show the operation is no longer within the 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 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 required except recommended periodic functionality test.

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

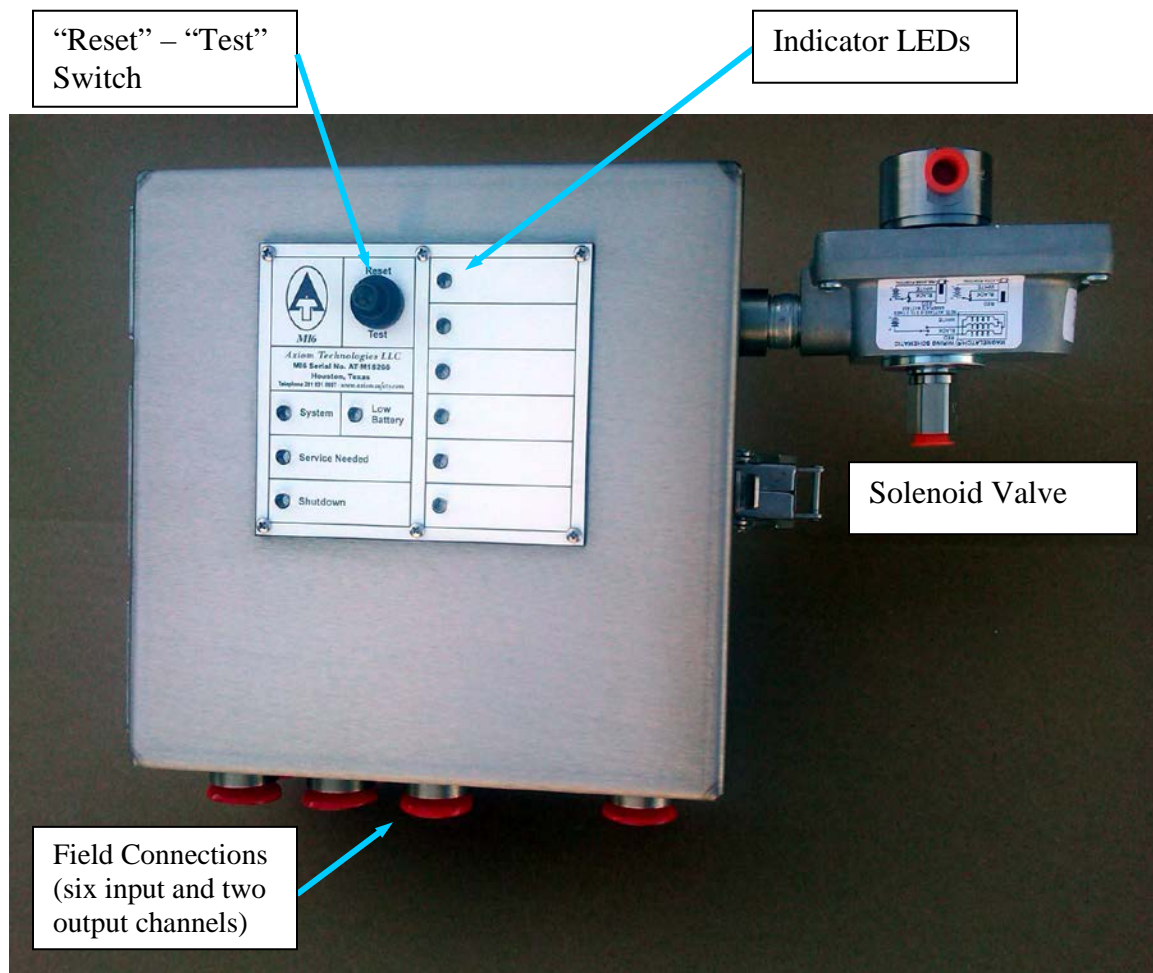


Fig. 1 MI6 General Layout

INSTALLATION

Typically, the MI6 is shipped with the battery module installed in the “storage position” for shipment. Remove the four studs holding the battery module, rotate it 180° and carefully re-install as shown on page 8 of this manual. The MI6 is now energized and the green LED blinking every second.

The MI6 can be wall mounted or mounted directly on the process line. The box is provided with a drain at the bottom to remove water condensation.

NOTE
DO NOT MOUNT THE MI6 SIDWAYS OR UPSIDE DOWN, AS THIS MAY ALLOW RAINWATER TO INGRESS AND ACCUMULATE IN THE ENCLOSURE

The typical connections for the solenoid valve are as follows:

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

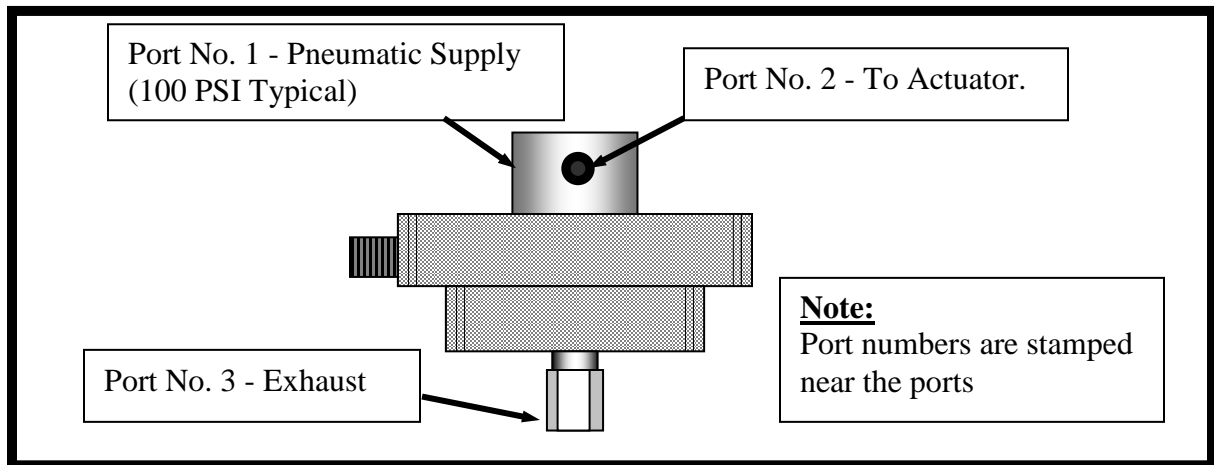



Fig. 2 Solenoid pneumatic/hydraulic typical connection


WARNING
THE MI6 OPERATES WITH NORMALLY-OPEN CONTACTS, WHERE A CONTACT CLOSURE INDICATES AN ALARM CONITION

Connecting Remote Sensors

As indicated before, the MI6 can connect up to six (6) external alarm sensors with each external sensor loop independently monitored for an alarm condition. In addition, the unit monitors the wiring integrity for interruption and insulation degradation. Each alarm loop is designed to be non-incendive, so the sensors (level or pressure switches), can be safely installed in hazardous areas without the need of explosion proof devices or special wiring methods. The two (2) solid state outputs must be powered from an external source (12 VDC or 24 VDC), See Appendix "A" for field wiring requirements.

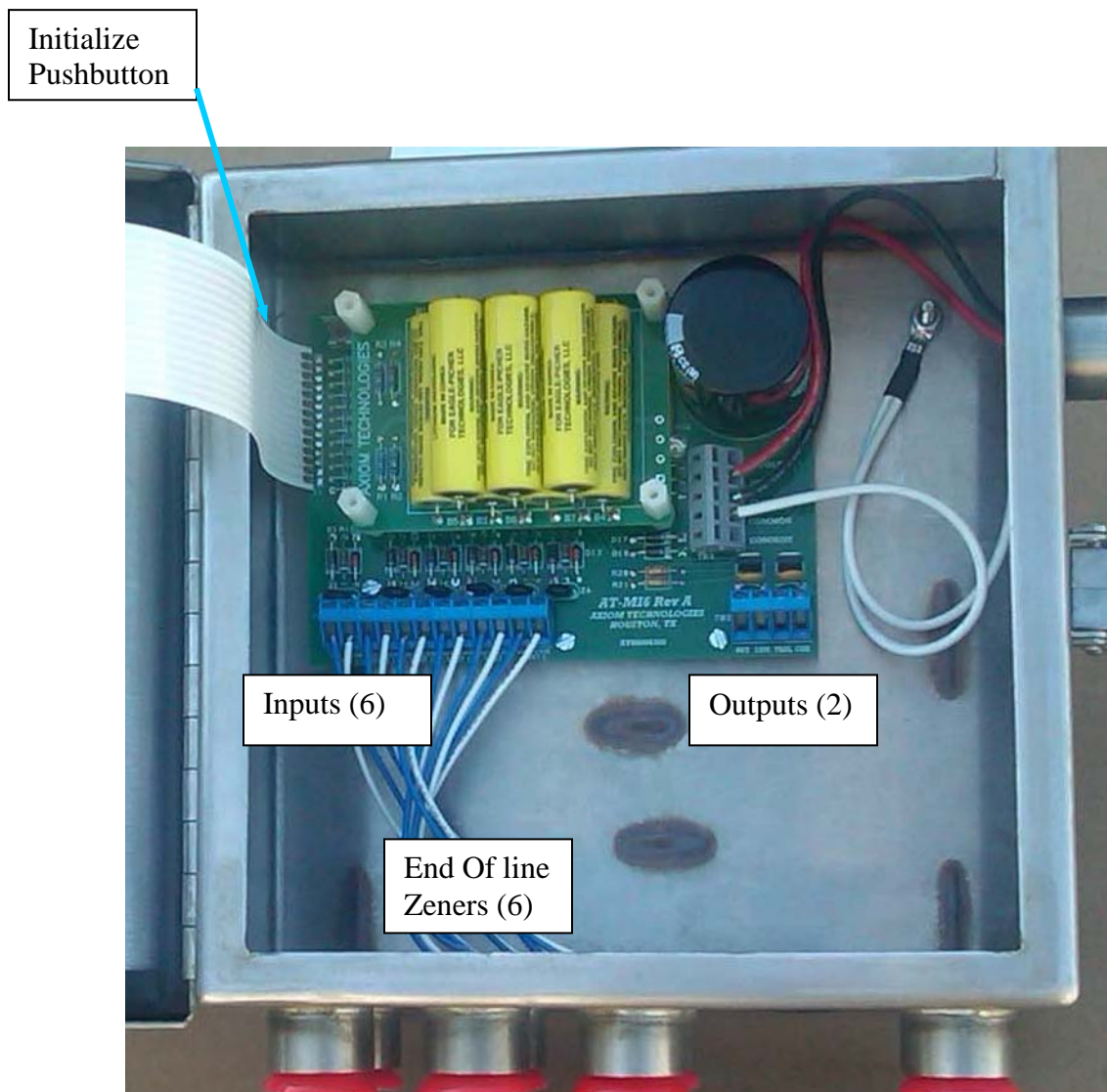


Fig. 3 MI6 Interior View with Initialize Pushbutton

Each input channel has an "End Of line Zener" (EOZ) that is to be connected in parallel with the sensing element. For example, if channel 3 of the field alarms is to be connected to a level switch installed on a water tank, then the EOZ is to be removed from the MI6 enclosure and connected in parallel with the level switch as shown on Appendix A

When in normal operation, the MI6 sends a short pulse of current to each remote sensor, verifying wiring conditions and the existence of an alarm.

With the EOZ (end of line Zener), the input should have a voltage between 7 and 8VDC, however, given the shortness of the pulse, this voltage can not be verified with a regular voltmeter.

For overcoming the above difficulty, the MI6 offers a mode where the inputs are energized for a few seconds at the time by following the procedure below:

- Open the MI6 enclosure and have voltmeter ready for reading voltage
- Press and hold the "Test – Reset" switch down to "Test" for about three seconds and then release.
- The first remote alarm blinks the corresponding LED for five seconds while the input is sending a current to the field connection.
- Read the voltage on first remote channel and confirm it is between seven (7) and eight (8) volts (around 7.3V being typical). A voltage below three (3) Volts is considered as "alarm".
 - Voltages above 8 VDC indicate the remote sensor is not connected
 - A reading of about 0 VDC may indicate the corresponding sensor is "close", or there is a short circuit in the loop, or the MI6 timed out the test on that channel.
 - A low voltage of about 0.5VDC may indicate the EOZ (End Of line Zener) has been connected backwards.
 - Other low voltages (between 3 and 6 VDC) may indicate insulation's deterioration in the field wiring.
- Once the MI6 stops the blinking the first channel, it will move automatically to channel 2; repeat voltage reading for channel 2, etc..

OPERATION

The system can be commanded to "Reset" or "Test" by pressing the toggle switch up or down respectively. By pushing to "Reset" the operator commands the unit to return to the flowing condition while the "Test" function allows the operator to see the last recorded cause of shutdown (corresponding LED blinks fast) and then the system proceeds to slow blink each red LED to confirm all indicator circuits are operating normally.

The system is shipped in the "RESET" condition. Detection of a closed contact will cause the MI6 to switch the solenoid valve into "shutdown", blinking the "Shutdown" LED. The corresponding alarm LED will blink once a second to indicate the actual cause of the shutdown even if the alarm goes away or another alarm is later detected.

EXAMPLE: If an MI6 senses an alarm condition in the production process, it will cause a shutdown and the associated LED will blink. After some time period, because of the shutdown, the sensed process condition causing the alarm may fall to the point where the alarm clears. In this case the MI6 continues flashing the alarm LED until the operator presses "Reset". If the operator wants to confirm the cause of alarm after the system is back to normal, he just need to press "Test" and the MI6 will blink the LED to show the last recorded cause of shutdown.

If the alarm condition is still present, the operator can press "Reset" and the existing alarm will be ignored for 30 minutes to allow the process to return to normal; there is no need to physically disturb the sensor before restoring the process. It is recommended not to physically bypass the alarm condition as this involves the risk of the operator forgetting to return the alarms to the proper setting once the process returns to normal. If more than 30 minutes is needed then it is suggested that the operator presses "Reset" again before the time expires for re-starting the 30 minutes counting.

If the process condition returns to normal before 30 the minutes expires, the MI6 will re-arm itself and will initiate shutdown again if an alarm is sensed.

The MI6 provides input and output interface points for a Remote Terminal Unit to either receive a remote "Stop" command or annunciate remotely, if a shutdown or malfunction occur.

Time Delay on Alarm Inputs

In some cases, it may be desirable to have a slower response to a given alarm channel, i.e. a tank level sensor may respond to waves or fluid motion in a tank. The MI6 offers the capability of introducing an eight (8) seconds delay on any of the six remote alarm channels.

For setting a time delay in any of the six field inputs, proceed as follows:

- 1- Open the MI6 enclosure
- 2- While holding the "Test – Reset" switch down, momentarily depress the "Initialize" pushbutton on the controller board (upper left corner as shown on Fig 3, Page 4) and then let go the "Test – Reset" switch. The green LED responds by flashing rapidly for a few seconds.
- 3- Next, the MI6 flashes the first field alarm LED, rapidly to show that there is no time delay set, slowly if a time delay exists.
- 4- If the flashing indicates the desired setting, then take no action and the MI6 will move to the next channel.
- 5- If a time delay is desired and the LED is flashing rapidly, press the "Test – Reset" down to set a time delay.
- 6- If a time delay is not wanted and the LED is flashing slowly, press the "Test – Reset" up to remove the time delay.
- 7- As the MI6 moves on to the next channel, repeat step 4 through 6 for setting the desired operation mode.
- 8- Once all channels have been set, the operator may repeat step 2 and confirm each channel has been set correctly.
- 9- Close enclosure and confirm the actual delay by tripping the alarm channels and observing the response on the MI6.

MAINTENANCE

The MI6 requires little maintenance but a minimum of a monthly visual examination and testing is recommended to insure that the unit as well as the systems and devices associated with the safety shutdown are operating properly.

It is recommended that once a year the sensor contacts (if not hermetically sealed) be cleaned with a soft piece of cloth and a non residue contact cleaner to insure optimum performance.

Note

When cleaning contacts do not use abrasives materials or fluids, as they will cause damage and severely reduce system's reliability.

Note

Avoid opening the enclosure in a rainy or dusty environment.

The batteries are expected to have a life of about 3 years before replacement is required. The MI6 routinely reads battery voltages and provides warning if the batteries need replacement. When the batteries are beginning to go low the MI6 will alternatively blink the green and "Lo Batt" LEDs to indicate that battery replacement is needed. If the batteries are not replaced within a few days, the MI6 will blink only the "Lo Batt." LED and initiate shutdown as further reduction in voltage may prevent the system from protecting the process.

WARNING - EXPLOSION HAZARD

BATTERIES MUST ONLY BE CHANGED IN AN AREA KNOWN TO BE NON-HAZARDOUS. REPLACE BATTERY MODULE WITH AXIOM TECHNOLOGIES PART NUMBER AT-LBP-36144.

WARNING

DO NOT ATTEMPT TO RECHARGE BATTERY MODULE AS THIS MAY TRIGGER AN UNSTABLE CONDITION WITHIN THE LITHIUM CELLS AND CAUSE AN EXPLOSION

Return used battery modules to Axiom Technologies for safe disposal.

REPLACING THE BATTERY MODULE

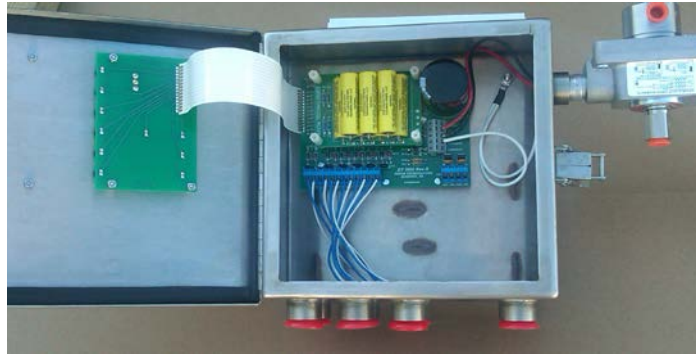


Fig. 4 Open enclosure; the battery module is shipped inside.



Fig. 5 Unscrew the four (4) nylon spacers.



Fig. 6 Align the battery module with threaded studs and push it in place gently. The “Axiom Technologies” printing on the module is to be on the left.

Note: Secure the battery module by reinstalling nylon spacers. Verify the green LED blinks about once per second to confirm successful battery module installation.



**THIS APPARATUS IS SUITABLE FOR USE IN A CLASS 1,
DIVISION 2, GROUP C, D OR UNCLASSIFIED LOCATIONS**

MI6 - ENVIRONMENTAL SPECIFICATIONS

Temperature range : -40 to +85°C

Humidity range : 0 To 95% max., non condensing

Altitude : 2,000 m. max.

Hazardous Area Classification : Suitable for Class I, Division 2, Groups C & D, Hazardous Locations. Temp. Code T3C

MI6 - SENSOR RATINGS

Sensors Trip Setting : To be determined by customer during installation

Solenoid Valve Pressure : 100 psi max. (standard), up to 150 psi available

MI6 - ELECTRICAL RATINGS

Electrical Source : Dual voltage lithium battery module 3.6 & 14.4 VDC

Current consumption : 285 mA max. on 3.6VDC Circuits

435 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.***



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**