GASMARK M1

GAS DETECTOR

Installation and Operation Manual

www.ctigas.com | 866-394-5861

CTi GAS DETECTION SPECIALISTS

Warning

Use this product only in the manner described in this manual.
If the equipment is used in a manner not specified by CTI, the protection provided by the equipment may be impaired.

This equipment should be installed by qualified personnel.

For technical support, contact:

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Table of Contents

1. GENERAL DESCRIPTION

The GASMARK™ M1 Gas Detector comprises a 24Vdc gas detection transmitter capable of accommodating a variety of GASMARK™ MSC/M Smart Sensor Modules.

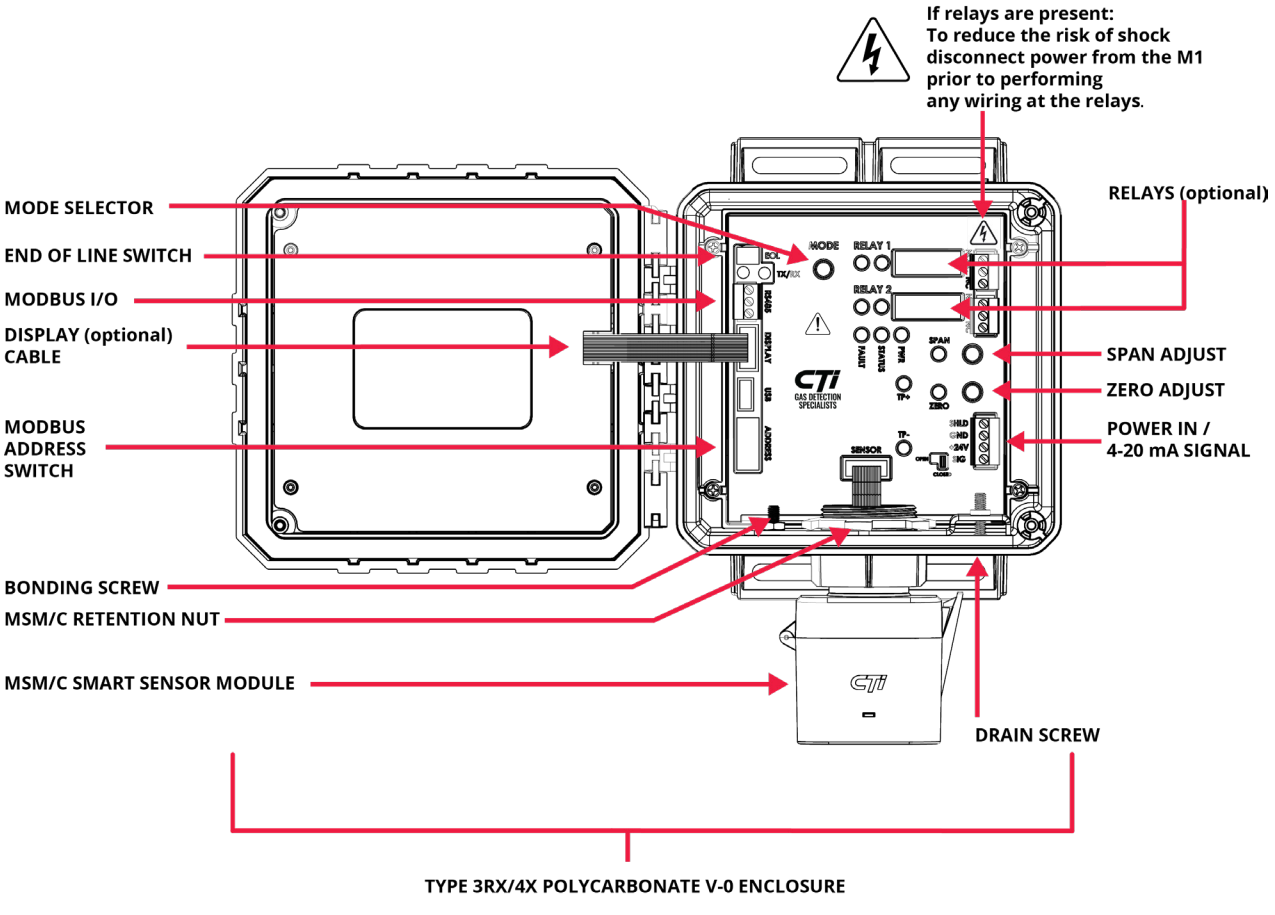
The M1 provides continuous real-time monitoring of gas concentrations without false alarms.

The GASMARK™ M1 can used in combination with a GASMARK™ M255 Gas Detection Control Panel, or another Modbus or 4-20mA monitoring device (PLCs or Entry Monitors.)

The GASMARK™ M1 is housed within a rugged polycarbonate enclosure suitable for all locations including freezer, washdown, and outdoors. The enclosure has been designed to accommodate new and retrofit installations with large slotted mounting feet allowing use of existing mounting hardware for locations where older CTI gas detectors were located.

1.0.1 Communication:
Communication protocols for the M1 are RS-485 Modbus RTU and 4-20 mA signal output. See Register Sets. Modbus data is formatted 8 -E-1 at 9600 baud

Figure 2. M1 Layout



1.1 INSTALLATION

When installing the GASMARK™ M1 gas detector, consideration must be taken to ensure the detector is easily accessible for calibration and maintenance. An inaccessible detector is likely to be neglected and may not perform properly.

Placement of the sensor should be near, ideally within 30 ft, of potential sources of a leak; and within the breathing zone of personnel for it's location.

1.1.1 Installation Guidelines:

- Always mount vertically with the MSC at the bottom.
- Keep detector and wire runs away from mercury vapor lights, variable speed drives, and radio repeaters to prevent electrical interference.
- Do not pull detector wiring with AC power cables. This can cause electrical interference.
- Avoid mounting on a vibrating surface.
- Protect detector from sources of physical damage (forklifts, etc.).
- Mount detector enclosure through the four mounting slots as shown in Figure 3.
- Mounting screws should be screwed into studs when mounting on a wall with studs.
- If studs are not available when mounting into drywall, use anchors rated for 10lbs (4.5kg).
- Contact CTI for sensor element selection involving CA (controlled atmosphere) rooms.
- More than one detector should be installed in each room for highly critical locations.
- When connecting to metallic conduit, attach appropriately sized conduit hub to conduit prior to connection with enclosure is made with fittings appropriate for location of detector.
- If multiple conduits are connected together, use the stud and nut, bottom wall of enclosure, to ensure the conduits are bonded together.
- After transmitter is installed and ready for power-up, install Smart Sensor into bottom of Gas Detector enclosure.

1.1.2 Mounting considerations:

- Most probable location(s) of a leak.
- Properties of the target gas.
- Air movement in the area due to ventilation or ambient conditions.
- Environment (temperature, humidity, wind, etc.).
- Presence of interference gases.
- See Sensor Element Specifications for target gas and range specific mounting instructions.

1.1.3 Location:

The enclosure of the GASMARK™ M1 has been designed to be installed in non-classified locations; the enclosure is environmentally sealed to allow the detector to be placed where it is needed. It can be installed in indoor, outdoor, freezer, or washdown areas.

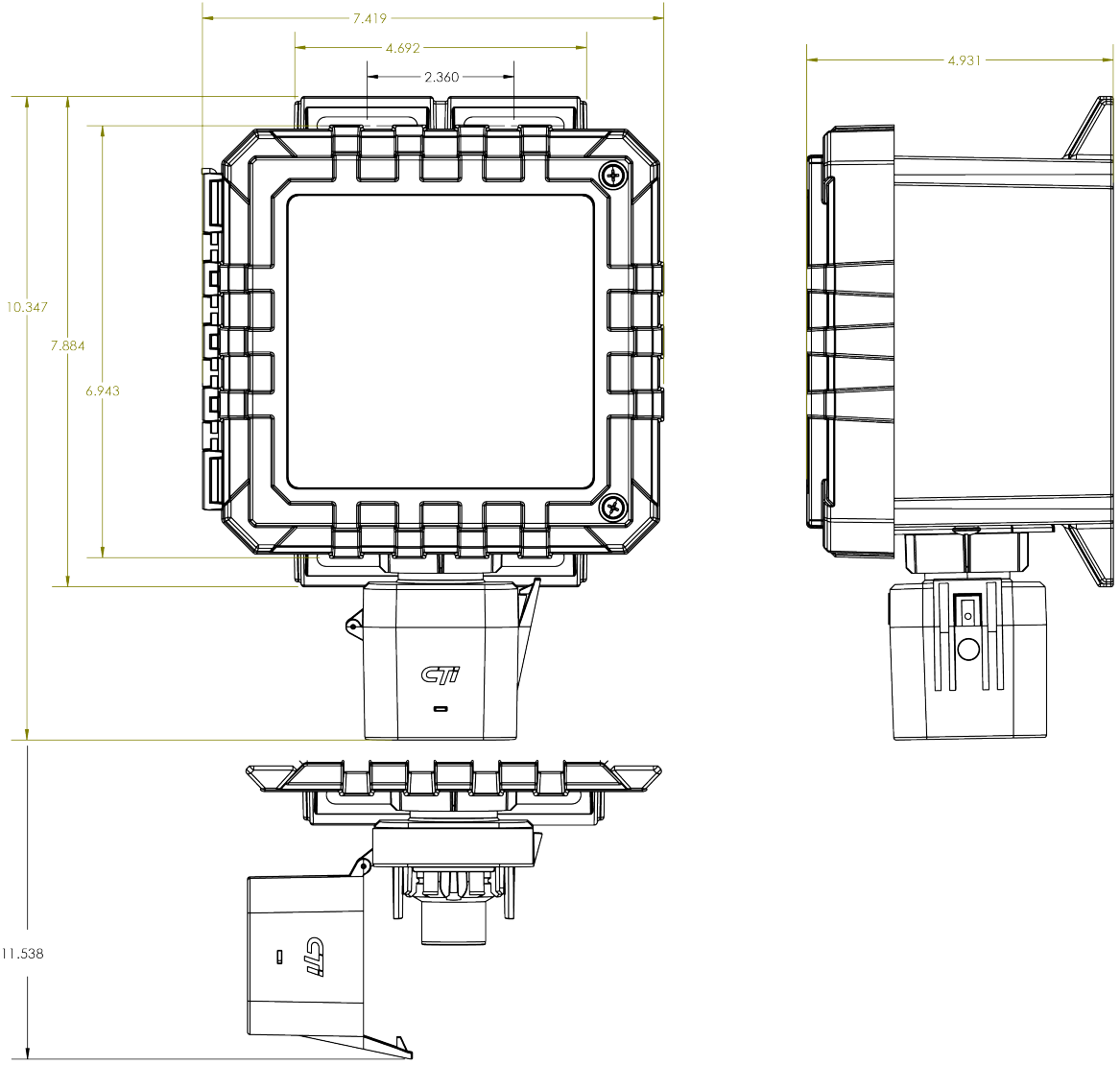
All external connections should use fittings rated for the environment in which the M1 Gas Detector is being installed.

As the MSC Smart Sensor is vital for the proper operation of the M1, the MSC must be properly installed into the bottom of the M1 enclosure to ensure full environmental protection.

1.1.4 Drainage:

If being mounted in a location where condensation through electrical conduit is known to occur, the drain hole located on the bottom surface of the M1 enclosure should remain open to allow water to drain. If locating where hose directed water will occur the captive screw and gasket of the drain should be closed any time wash down is happening.

Figure 3-5. Dimensions w/mounting centers



1.2 WIRING

1.2.1 Overview

The M1 comes equipped with both RS-485 Modbus and 4-20 mA output communication, and (2) two relay outputs (optional).

Electrical Power: 24 Vdc power supply with isolation or class II power supply, 500mA maximum current draw.
See transmitter and sensor element specifications for max current draw.

Always disconnect power at the controller and/or power supply before performing any wiring at the detector.

- Electrical wiring must comply with all applicable codes.
- To maintain environmental rating of the enclosure, conduit fittings of the same rating or better must be used.
- Terminal blocks are plug-socket type.

1.2.2 Power Wiring

- Recommend 14 AWG stranded copper with drain wire.
- If for Modbus Network use 2-conductor.
- If for 4-20 mA operation use 3-conductor wire.
- For longer runs or more devices, use 12 AWG stranded copper cable with drain wire.

Contact CTI for wiring questions.

Terminal Block Plug (Power):

SHLD: (if used) To case (earth) ground of monitoring equipment.

GND: To ground (0 Vdc) terminal of power supply.

24V: To 24 Vdc terminal of power supply.

SIG: (if used) To analog signal terminal out to control equipment. (See 4-20 mA Analog)

To prevent excessive voltage drops and/or power supply overloads, consider all 24 Vdc devices on each power supply. This includes gas detectors, horn-strobes, stack-lights, etc. Total current draw for all devices should not exceed the power supply rating.

Note: If the supply voltage drops below a device's minimum supply voltage at any device on the network, an additional power supply should be added. When utilizing the 24 Vdc supply for external devices (horn-strobes, etc.) through the on-board sensor relays, make sure the sensor's minimum supply voltage is maintained under full load (all devices active).

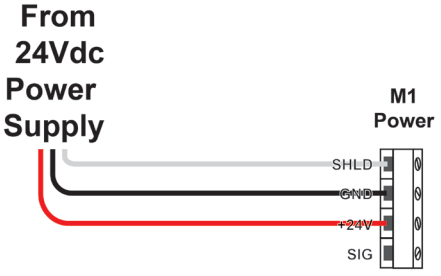


Figure 6. 24Vdc Power Terminal

1.2.3 Output Wiring

1.2.3.1 4-20 mA Analog

Output: Linear 4-20 mA output. Monitoring equipment may have a maximum input impedance of 400 ohms.

Cable Recommendation: 18/3 shielded cable (Belden 8770 or equivalent). Length of cable to detector should be no greater than 1,500 feet.

Monitoring: Equipment must be configured to indicate a fault if the signal is below 1 mA. All signals over 20 mA must be considered high gas concentrations.

- Always use 3-conductor, insulated, stranded, shielded copper cable with drain wire.
- If cable runs cannot be made without a splice; all splice connections should be soldered.
- Ground the shield at the main control panel. Connect the shield wire in the detector Terminal block labelled SHLD.

Terminal Block Plug (4-20 mA):

SHLD: To case (earth) ground of monitoring equipment.

GND: To ground terminal of power supply.

24V: 24 Vdc: To 24V terminal of power supply.

SIG: To analog 4-20 mA signal input of monitoring equipment.

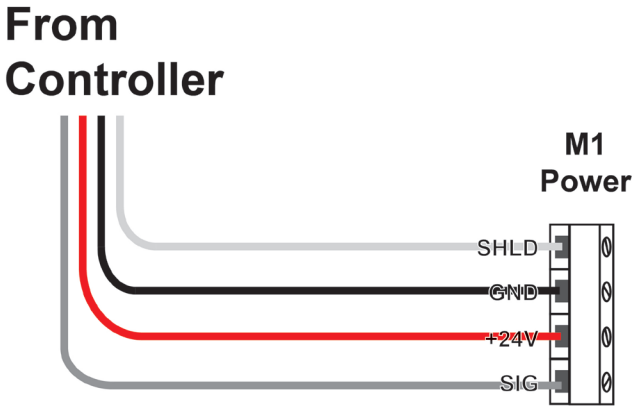


Figure 7. 24Vdc Power Terminal w/4-20 mA Signal

1.2.3.2 Relay Output Wiring

The M1 Gas Detector may be equipped with (2) two programmable, Form C, SPDT relays. These relays are rated at 5A @ 24 Vdc or 8A @ 120-240 Vac.

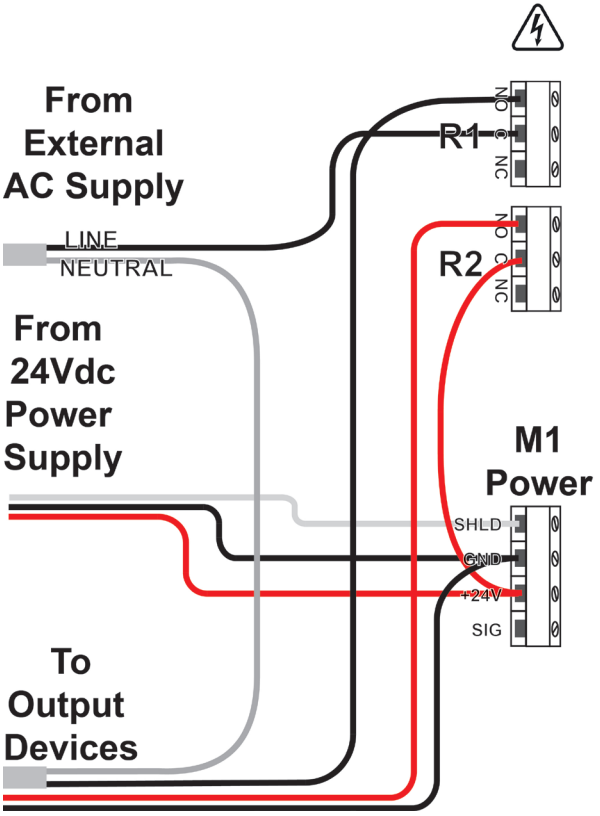
Each relay has a status LED. If LED is lit, the relay coil is energized.

The Form C relays are dry contacts and have no voltage on them. 24 Vdc can be provided by the 24V terminal and jumped to the common relay terminals. Keep in mind device current draw and minimum voltage requirements.

To reduce the risk of shock disconnect power from the M1 prior to performing any wiring at the relays.

If the relays are switching 120/240 Vac power signals, power must be pulled from external supply, do not pull detector wiring with 120 Vac wiring. This can cause electrical interference. Do not use the M1 enclosure as a junction box for 120 Vac power.

Figure 8. Relay Output



1.2.3.3 RS-485 Modbus

If wiring for RS-485 Modbus communication, a communication wire and a power wire will both be necessary.

RS-485 Communication Wiring

It is recommended to pull 24 Vdc power cable with the communication cables. These cables can share the same conduit.

Use RS-485 communication cable, 22 AWG, 2 conductor, twisted pair, stranded, with drain wire (Alpha 6460, or equivalent).

4,000 ft max per Modbus channel.

On RS-485 wiring avoid splices and T-taps. All terminations should be made at network device wire terminals.

Wire shields must be connected at all shield terminals, creating a continuous shield run from the controller to the device at the end of the line.

Each M1 detector has a communication port with four terminals, Shield, Ground, A, and B. The communication cable is connected so all devices are connected in parallel. All the 'A' terminals must be connected, and all the 'B' terminals must be connected, respectively.

Note: For all "end of line" devices, be sure to set the EOL switch position to "ON".

Terminal Block Plug (RS-485 Comm):

SHLD: To case (earth) ground of monitoring equipment.

A: To RS-485-A terminals of next and previous devices in line.

B: To RS-485-B terminals of next and previous devices in line.

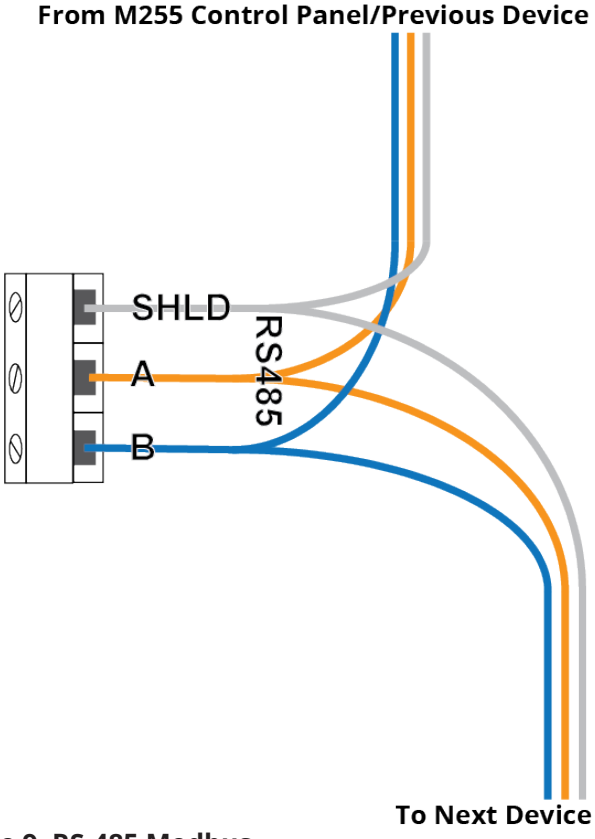


Figure 9. RS-485 Modbus

1.3 DISPLAY

The (optional) M1 Display provides an at-a-glance indication of the current state of the detector.

While in normal operation a user may adjust the display contrast by turning the Mode control, see control layout; control does not need to be pressed for activation.

The display will feature the following:

Concentration

The current concentration of the gas being measured as a value in specified units.

The displayed value utilizes a deadband (zero-blanking value) to prevent display of concentrations below minimum value for the sensor (see sensor specs).

Detector Name

If the M1 address is set to 0, “Stand Alone” will appear at the top of the display.

If M1 is attached Modbus network users may specify a name for the detector via the controller. It is recommended to use location-based naming. Character limit for this field is 20 characters.

Gas Detected

The Target Gas is determined by the sensor element and cannot be changed.

Units Measured

The Unit of measurement is determined by the sensor element and can not be changed.

Setpoints

Detectors in Stand Alone will display Alarm/Relay setpoints in the same units as Concentration.

Detectors attached to a M255 network will not display setpoints; setpoints are programmed at the M255.

Fault

If the detector is in a fault state “FLT” will appear in the lower right corner.

In Alarm

If the gas concentration meets or exceeds an Alarm/Relay setpoint an alarm indication will activate; a highlighted "ALARM" will appear under the concentration value and detectors in Stand Alone will highlight which setpoint has been exceeded.

Display Maintenance

The (optional) display on the M1 is able to be added/replaced in the field.

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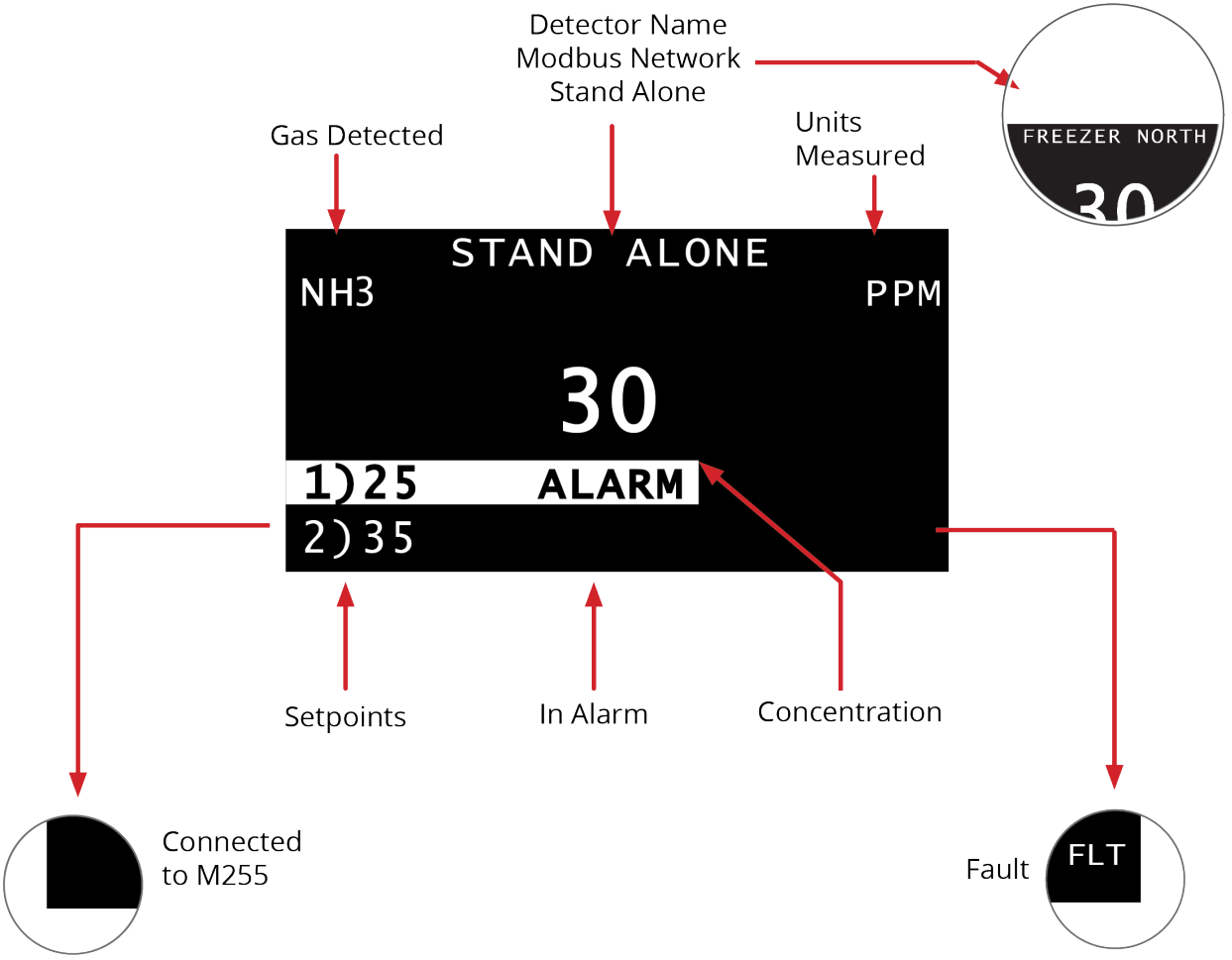
Power must be removed from the M1 before inserting/removing the display cable from the main M1 board.

Figure 10. Display Layout



1.4 INDICATIONS

Communication Fault:

4-20mA output drops to 0.5mA
Fault LED -
(If optional display is present, “FLT” will appear in lower right corner.)

Power Fault:

- Fault will occur when voltage drops below 11 Vdc
- 4-20 mA output drops to 0mA
- Fault LED –
- Power LED –  /second

Sensor Fault:

- 4-20mA output drops to 0.5mA
- Fault LED -  /second

Relay Active:

- Activation will delay for 2 seconds when signal exceeds set point
- Corresponding LED – 
- Relay will remain active for 10 seconds after clearing of alarm.

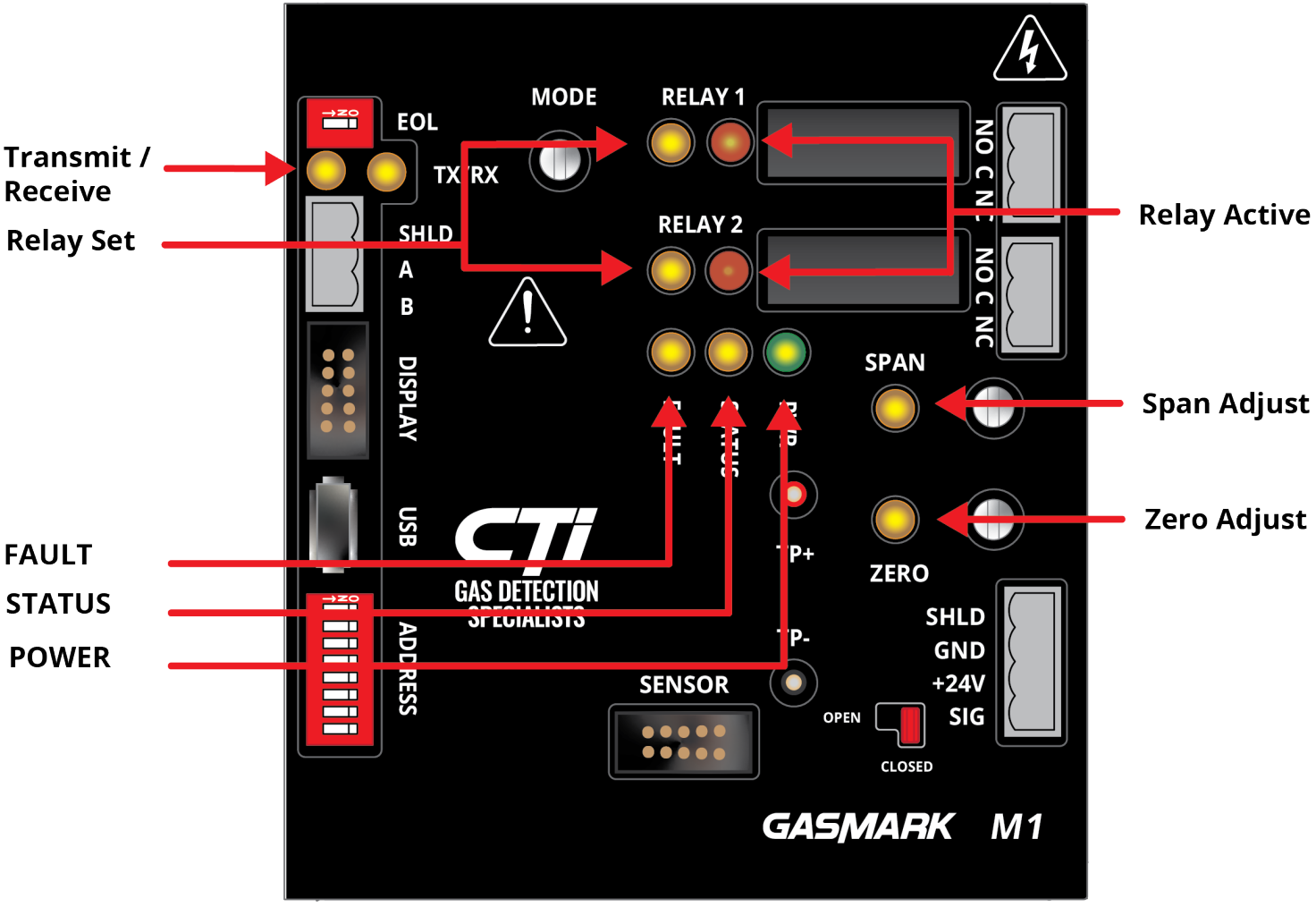
Alarm State (Modbus):

- Will activate when setpoint is exceeded.
- Alarm state will be displayed on controller only. M1 will not provide additional indication of Alarm.

Alarm State (Stand Alone):

- Will activate when setpoint is exceeded.
- Relay will energize the coil activating the corresponding
  Relay LED - 
- If optional Display is present "ALARM" will be displayed under the concentration value.

Figure 11. LED Indicators



2. Modbus Set-Up Modbus Communication with 4-20mA Output and Remote Control of Relays

Use this section of the manual for programming when Modbus communication is used by the M1 transmitter.

2.1 OPERATION

All monitoring functions will be performed at the GASMARK M255 or Modbus capable control panel. Calibration of sensor must be conducted at the detector using the internal rotary controls and a hand-held multimeter, capable of reading mVdc.

2.1.1 Modbus Address:

The M1 must be uniquely addressed to communicate on your Modbus network. This is accomplished via the 8-position DIP switch located on the left side of the control area. It may be addressed 1-255 depending on the sequence of the switch positions.

To ensure you are setting the switch to the correct address please use the Modbus DIP Switch Tool at ctigas.com.

Note: When assigning Modbus ID's; use sequential numbering starting at detector closest to the controller to avoid confusion.

2.1.2 Start-up:

Before applying power, make a final check of all wiring for continuity, shorts, grounds, etc. It is usually best to bypass or disconnect external alarms and other equipment from the M1 gas detector until the initial start-up procedures are completed. If not already done, plug sensor element into transmitter.

Indication while in Start-up
Power LED: /2 seconds
Status LED: /2 seconds

Note: Start-up will vary depending on the attached sensor.

Ready for normal operation

Power LED:

2.1.2.1 Start-up Test:

The M1 Gas Detector and MSC/M Sensor Element can be response tested and/or span calibrated after power up time delay.

- User exposes sensor to calibration gas.
- With a hand-held multimeter attached to test points, monitor signal. When exposed to gas detector should respond with mV corresponding to concentration. Alarm indicators should activate.
- If attached to Modbus network a second user should stay at the control panel to determine that each sensor, when exposed to the gas, is connected and responds, causing appropriate alarm functions.

2.1.2.1.1 Signal Levels

The M1 is designed to over-range approximately 8% up to 21.3 mA. Monitoring equipment must be configured to indicate a fault if the analog input signal is below 1 mA. All analog input signals over 20 mA must be considered high gas concentrations.

2.2 CONFIGURATION

2.2.1 Mode Selector:

Configurable features of the GASMARK™ M1 requires a user to enter into Operator Mode. To enter; press and hold the MODE rotary control for 3 seconds.

Modbus networked detectors go directly into Calibration Mode. All other configurable features are performed at the Modbus controller.

After completing calibration, the user will press the Mode control to exit Operator Mode and return to normal operation.

When in Calibration Mode the detector will automatically return to normal operation after 10 minutes of inactivity.

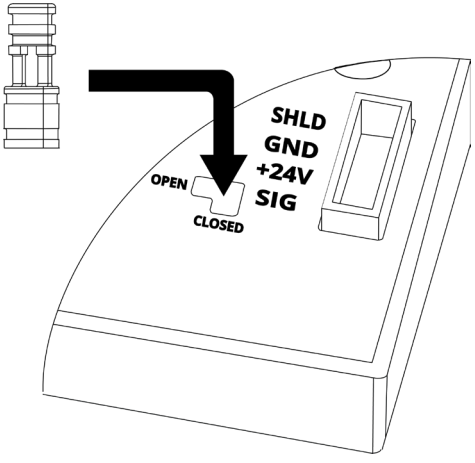


Figure 12.

2.3 MANUAL CALIBRATION

The M1 Manual Calibration does not require equipment to be in Calibration Mode to adjust the Zero and Span; it is recommended.

Connect hand-held multimeter to test points before performing any adjustments.

Use shorting plug set to "CLOSED" in order to see voltage displayed. See figure 12.

ZERO:

- Apply zero gas – (not required) if ambient environment is known to be clear of gas to which MSC is sensitive.
- Turn the Zero control until multimeter reads 40mV.

SPAN:

- Apply Span Gas. Use only certified Span Gas @ 0.8L/min flow.
- When output on multimeter has stabilized, or 2 minutes max.
- Turn the Span control until multimeter reads 200mV.

2.4 AUTO CALIBRATION

Connect hand-held multimeter to test points on M1 interface to monitor outputs.

Use shorting plug set to "CLOSED" in order to see voltage displayed. See figure 12.

Enter Operator Mode using the Mode rotary control (see Configuration). Once in Operator Mode press the mode control until the yellow LEDs located near the Span and Zero controls illuminate.

M1 will return to Normal Operation after 10 min of inactivity.

ZERO:

Step 1: Press the Zero control for 3 seconds to arm the Auto-Zero feature.

ZERO LED: /sec

Step 2: Apply Zero gas – (not required) if ambient environment is known to be clear of gas to which MSC is sensitive.

Step 3: Press the Zero control to begin Auto-Zero.

ZERO LED: /2 secs

If the Auto-Zero passes the detector will return to the Calibration Mode to begin SPAN.

ZERO LED:

If the Auto-Zero fails, the detector will enter an Auto Cal Fail state.

ZERO LED: /sec

STATUS LED: /sec

To clear the Cal Fail state a manual Zero can be performed using the Zero control and hand-held multimeter.

Expected Zero value for multimeter output: 40mV

SPAN:

Step 1: Press the Span control for 3 seconds to arm the Auto-Span feature.

SPAN LED: /sec

Step 2: Apply Full Scale Span gas. Use only Certified Span Gas @ 0.8L/min flow.

Step 3: Press the Span control to begin Auto-Span.

SPAN LED: /2 secs

If the Auto-Span passes the detector will return to the Calibration Mode.

SPAN LED:

Press the Mode control to return to Normal Operation.

If the Auto-Span fails the detector will enter into an Auto Cal Fail state.

SPAN LED: /sec

STATUS LED: /sec

To clear the Cal Fail state a manual Span can be performed using the Span control and hand-held multimeter.

Expected Span value for multimeter output: 200mV

If manual adjustments cannot be completed successfully an issue with the MSC may be present.

2.5 ALARM/RELAY OUTPUT

When connected to the GASMARK™ M255 via a Modbus network, the M1 Gas Detector may have multiple alarm setpoints.

The M255 also provides remote control of the two (optional) on-board relays.

Setpoints for Alarm and Relays are controlled independently via the GASMARK™ M255. See M255 Manual for information.

3. Stand-Alone or 4-20 mA Output Set-up with Local Control of Relays

Use this section of the manual for programming when the device is operating stand alone or 4-20 mA output is the only communication being used.

3.1 OPERATION

All operator functions will be performed using the internal rotary controls and a hand-held multimeter, capable of reading mVdc.

3.1.1 Modbus Address:

When in Stand Alone the M1 must have its address set to 0; position all switches on 8-position Dip Switch to the Off (left-hand) position.

3.1.2 Start-up:

Before applying power, make a final check of all wiring for continuity, shorts, grounds, etc. It is usually best to bypass or disconnect external alarms and other equipment from the M1 gas detector until the initial start-up procedures are completed. If not already done, plug sensor element into transmitter.

Indication while in Start-up

Power LED: /2 secs

Status LED: /2 secs

Note: Start-up will vary depending on the attached sensor.

Ready for normal operation

Power LED:

3.1.2.1 Start-up Test:

The M1 Gas Detector and MSC/M Sensor Element can be response tested and/or span calibrated after power up time delay.

- User exposes sensor to calibration gas.
- With a hand-held multimeter attached to test points, monitor signal. When exposed to gas detector should respond with mV corresponding to concentration. Alarm indicators should activate.

3.1.2.1.1 Signal Levels

The M1 is designed to over-range approximately 8% up to 21.3 mA. Monitoring equipment must be configured to indicate a fault if the analog input signal is below 1 mA. All analog input signals over 20 mA must be considered high gas concentrations.

3.2 CONFIGURATION

3.2.1 Mode Selector:

To enter Operator mode, the user should press and hold the MODE rotary control for 3 seconds.

This will illuminate the yellow LED for Relay 1.

Once in Operator mode the user can cycle between the following modes sequentially with an additional press of the MODE control.

As each mode is entered a corresponding LED will illuminate.

Relay 1: ●

Relay 2: ●

Calibration Mode – SPAN ● and Zero ●

Return to Normal Operation – No mode LEDs illuminated

3.3 MANUAL CALIBRATION

The M1 Manual Calibration does not require equipment to be in Calibration Mode to adjust the Zero and Span; it is recommended.

Connect hand-held multimeter to test points before performing any adjustments.

Use shorting plug set to "CLOSED" in order to see voltage displayed.
See figure 12.

ZERO:

- Apply zero gas – (not required) if ambient environment is known to be clear of gas to which MSC is sensitive.
- Turn the Zero control until multimeter reads 40mV.

SPAN:

- Apply Span Gas. Use only certified Span Gas @ 0.8L/min flow.
- When output on multimeter has stabilized, or 2 minutes.
- Turn the Span control until multimeter reads 200mV.

3.4 AUTO CALIBRATION

Connect hand-held multimeter to monitor outputs.

Use shorting plug set to "CLOSED" in order to see voltage displayed. See figure 12.

Enter Operator Mode using the Mode rotary control (see Configuration). Once in Operator Mode press the mode control until the yellow LEDs located near the Span and Zero controls illuminate.

M1 will return to Normal Operation after 10 min of inactivity.

ZERO:

Step 1: Press the Zero control for 3 seconds to arm the Auto-Zero feature.

ZERO LED: /sec

Step 2: Apply Zero gas – (not required) if ambient environment is known to be clear of gas to which MSC is sensitive.

Step 3: Press the Zero control to begin Auto-Zero.

ZERO LED: /2 secs

If the Auto-Zero passes the detector will return to the Calibration Mode to begin SPAN.

ZERO LED:

If the Auto-Zero fails, the detector will enter an Auto Cal Fail state.

ZERO LED: /sec

STATUS LED: /sec

To clear the Cal Fail state a manual Zero can be performed using the Zero control and hand-held multimeter.

Expected Zero value for multimeter output: 40mV

If manual adjustments cannot be completed successfully an issue with the MSC may be present.

SPAN:

Step 1: Press the Span control for 3 seconds to arm the Auto-Span feature.

SPAN LED: /sec

Step 2: Apply Full Scale Span gas. Use only Certified Span Gas @ 0.8L/min flow.

Step 3: Press the Span control to begin Auto-Span.

SPAN LED: /2 secs

If the Auto-Span passes the detector will return to the Calibration Mode.

SPAN LED:

Press the Mode control to return to Normal Operation.

If the Auto-Span fails the detector will enter into an Auto Cal Fail state.

SPAN LED: /sec

STATUS LED: /sec

To clear the Cal Fail state a manual Span can be performed using the Span control and hand-held multimeter.

Expected Span value for multimeter output: 200mV

If manual adjustments cannot be completed successfully an issue with the MSC may be present.

3.5 ALARM/RELAY OUTPUT

Detectors intended for Stand Alone must have must have relays for purposes of signalling an alarm.

3.5.1 Alarm/Relay Set:

Before starting, attach a hand-held multi-meter. User will enter Operator Mode, using the hand-held multimeter. When the yellow LED for the desired relay is illuminated turn the Mode control to adjust the setpoint, clockwise-increase/ counter-decrease. Monitor multimeter for display purposes.

Please see setpoint calculator for appropriate values. Value will automatically save.

If detector has more than 1 relay press the mode control to advance to Relay 2, repeat process.

4. MAINTENANCE

The M1 gas detector is designed for long life and minimal maintenance.

All gas detection systems should be monitored for service life this should include inspection of equipment and regular calibration cycles, to include testing of alarm and output functions. (See Sensor Replacement and Guidelines.) For proper operation, it is essential that the calibration schedule be adhered to.

Equipment should be used and serviced only by persons authorized by the customer, who have read and understand information in this manual, and only as described.

4.1 ENCLOSURE-EXTERNAL

Cleaning:

Cleaning of the M1 and MSC should only be done with a damp soft cloth, do not use solvents or chemicals which could interfere with the sensing capability.

Ice:

For Cold Weather-Outdoor and Freezer Operation occasional inspection of the MSC for icing should be performed to ensure atmosphere is able to reach the internal sensing element.

4.2 ENCLOSURE-INTERNAL

The M1 does not contain any internal user replaceable components other terminal connectors.

Always disconnect power at the controller and/or power supply before performing any wiring at the transmitter.

Inspection of the internal controls for the M1 and/or MSC enclosure should be performed during regular calibration activities or troubleshooting.

4.3 TROUBLESHOOTING

If the M1 Gas Detector experiences any irregularities in operation the detector will generate a fault signal.

The signal will be indicated both on the internal LEDs and any attached controller.

Note: If optional display is present, "FLT" will appear in lower right corner.

Power Fault

The M1 Gas Detector will indicate a power fault when the available supply voltage drops to less than 11Vdc.

Power LED:  /sec

If Modbus, controller will receive fault signal.

Inspect connections both at M1 24V connection and applicable power supply for corrosion or breaks. Replace wiring if necessary.

If wiring is correct, test available voltage from the supply, before and after the M1. Reduce the number of devices using the same supply output if necessary.

Communication Fault

A Communication fault can occur if the M1 loses communication with the GASMARK™ M255 controller or PLC.

- 4-20mA output drops to 0.5mA

Fault LED:

This is usually a wiring problem or addressing. On Modbus network this fault can occur if another device on the network shares the same Modbus ID. Otherwise it could be a hardware failure of the detector.

Check the RS-485 Modbus communication wiring. In most cases, if there is a break in communication wiring, all detectors after the break will be inoperative and should be obvious when viewed at the controller.

If the COMM FAULT is isolated to only one detector, check all wiring, screw terminals, and address at the detector.

Contact CTI if the problem persists.

Sensor Element Faults

See GASMARK™ MSC Smart Sensor.

4.4 SOFTWARE UPDATES

The M1 has an on board USB port for updating software. The software can be emailed to the user and loaded onto a USB flash drive. Follow these instructions to update the software:

1. Load the software onto a blank, FAT32 formatted USB flash drive (4GB max) in the root directory.
2. Insert the USB flash drive into the USB port.
3. Unplug the power connector to remove power from the M1.
4. Apply power to the M1.
5. While software update in progress the TX LED will remain solid and the RX LED will blink.

5. MSC/M GENERAL

The GASMARK™ MSC/M Smart Sensor is designed used with the GASMARK™ M1 Gas Detector.

Configuration: The MSC/M is available as the smart module online (MSM) or with a sensing element pre-installed MSC).

The MSM (smart module only) will have factory presets zero and span values but will require a full calibration upon install. See 5.4 for regarding installation of sensing element.

The MSC (smart module with sensor elements) arrives factory calibrated and provides plug-n-play functionality by storing calibration and all pertinent sensor data on the MSC itself, which in turn gets uploaded to the M1 transmitter once installed. The MSC can be calibrated off-site, independent of the transmitter, and can be installed without having to reconfigure the transmitter.

SAFECELL®

MSC/M Smart Sensors are equipped with SAFECELL® technology which regularly checks the electrical viability of the sensor element. Typically, the MSC/M will need to be replaced once the SAFECELL® fault has occurred.

Sensor Module Power

Power must be removed from the M1 before inserting/removing the sensor cable from the main M1 board.

5.1 INSTALLATION

The GASMARK™ MSC/M is intended to be installed into the bottom of the M1 Gas Detector via a robust quarter turn fitting.

See figure 13.

- Thread the ribbon cable through the opening on the bottom of the M1.
- Align the channel on the neck of the MSC/M with the lug on inner surface of the M1 twist lock fitting.
- Press upward and turn the right.
- Once installed the user should connect the ribbon cable to the Sensor Input header.

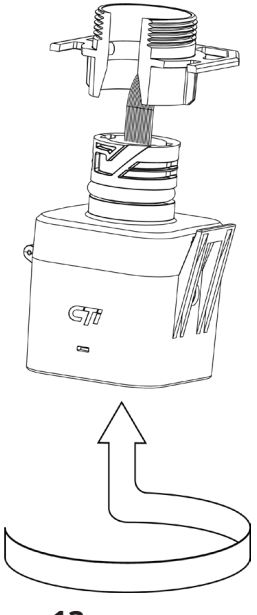


Figure 13.

5.2 TROUBLESHOOTING

5.2.1 Sensor Element Faults

5.2.1.1 SAFECELL® failure:

After six hours of continuous and consecutive SAFECELL® test fails,the MSC/M will generate a FAULT signal to the M1 transmitter:

- The 4-20 mA signal output will drop to 0.5 mA.

The M1 Gas Detector will indicate a Sensor Fault:

FAULT LED: /sec

Note: For Modbus communications, the detector will send the fault condition to the M255.

A SAFECELL® test failure is indicative of the sensor element being at or near the end of it's useful life.

The sensor element should be replaced at this time. Once the sensor element has been replaced or found to be viable, the fault condition will clear within 10 seconds.

If the problem persists it could be a failure of the MSC/M circuitry. Contact CTI.

5.2.1.2 Sensor not detected:

Sensor element is not installed or is not communicating properly. If installed, try disconnecting and reconnecting the sensor cable. Contact CTI if the problem persists.

5.3 CALIBRATION

The GASMARK™ MSC smart sensors are shipped with a factory calibration valid for 6 months. The MSM requires calibration when installed.

Reference M1 calibration instructions for procedure.

The MSC/M should be recalibrated within 6 months of its last calibration.

Calibration should be performed with certified calibration gas.

Calibration kits and calibration gas are available from CTI.

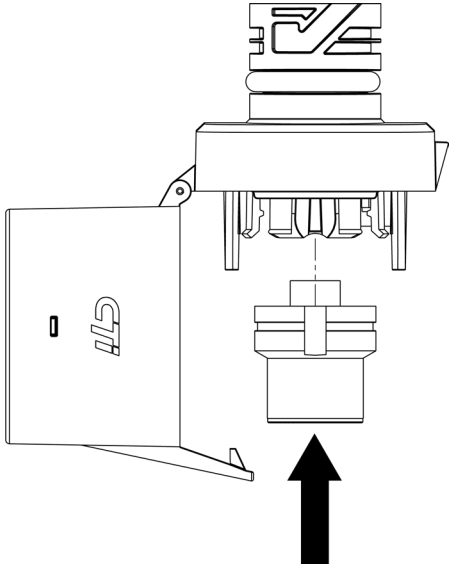


Figure 14.

5.4 SENSOR REPLACEMENT

The sensing elements in the smart sensor module are extremely reliable and designed for extended life. Several factors can contribute to shorter life span, including:

- Age (degradation over time).
- Constant exposure to high temperatures.
- Continuous, long term exposure to gases for which the sensor is sensitive.
- SAFECELL® Failure.

See Sensor Element Specifications.

If the MSC/M experiences a SAFECELL® failure which cannot be resolved replacement of the sensing element is recommended.

Replacement of the sensing element should be done after all troubleshooting efforts have been made; and should only be completed by qualified personnel.

Note: The new MSC/M should be recognized by the M1 transmitter within seconds.

5.4.1 Replacement Procedure:

(See figure 14)

- With a thumb/finger pull the tab on the side of the lower housing of the MSC/M this will allow the housing to hinge to the side.
- Inspect for any debris, corrosion, or material build-up which might have interfered with gas flow or caused a failure of electrical connectivity.
- Disconnect the sensing element by firmly pulling downward.
- Remove the shorting pin between the connector pins on the bottom of the new sensing element.
- Align the locating tab on the new sensing element with the groove on the MSC/M.
- Firmly press the sensing element up.
- Wait at least 10 seconds for the MSC/M and to be recognized by the M1 Gas Detector.
- Remove tabbed label on the new sensing element.
- Close the lower housing of the MSC/M.
- Perform an auto calibration.

6. REGISTER SET

The GASMARK™ M1 Gas Detector is designed to seamlessly integrate with the M255 Gas Detection Control Panel however, it may be connected with other detection controllers, or facility PLCs.

Users may utilize the following register sets to configure existing equipment for use with the GASMARK™ M1.

Input Register Map

Register Number	Register	NR	Min	Max	Notes
0	Type	1	5	5	Indicates what this device is. Value will be 5 for M1
1	Number of Relays	1	0	2	Indicates how many relays are supported on this M1
2	Zero	2	-1,000,000.00	1,000,000.00	Concentration of gas that represents 4 mA
4	Span	2	-1,000,000.00	1,000,000.00	Concentration of gas that represents 20 mA
6	Unit of Measure	3	ASCII	ASCII	The unit of measure for current gas concentration
9	Gas Name	5	ASCII	ASCII	The current gas being measured
14	Calibration Interval	1	0	24	Number of Months between calibrations
15	FG SN	2	0	999999999	Finished Good Serial Number for the M1
17	Transmitter SW Rev	5	ASCII	ASCII	Current software revision of the M1
22	PCA Rev	1	0	65535	Rev of the PCB assembly
23	PCA SN	2	0	999999999	PCB assembly Serial Number for the M1
25	Sensor SN	2	0	999999999	Finished Good Serial Number for the connected sensor
27	Sensor HW Rev	1	0	65535	Hardware revision for the connected sensor
28	Sensor SW Rev	1	0	65535	Current software revision of the connected sensor
29	Signal	1	0	65535	Current gas concentration
30	Status	1	0	65535	Bit-packed status of the M1. 0 - config changed, 1 - low power, 2 - power supply fault, 3 - low voltage fault, 4 - sensor start up, 5 - sensor over range, 6 - sensor fault, 7 - output sync
31	Supply Voltage	2	-3.4E+38	3.4E+38	Current supply voltage reading of the M1
33	Bootloader Version	1	0	65535	Bootloader version on the M1

Coil Register Map

Register Number	Register	Notes
0	Relay 1	Energized state of Relay 1
1	Relay 2	Energized state of Relay 2
2	Low Power	Low power state of the M1
3	Config Change	Indicates if the config has changed
4	Output Sync	Prompts the controller to update the outputs

Holding Register Map

Hold Reg	Register	NR	Min	Max	Notes
0	Name	11	ASCII	ASCII	Name given to the M1

7. SPECIFICATIONS

GASMARK™ M1 (POLYCARBONATE)	
Enclosure	Injection-molded, UL 3RX/4X polycarbonate enclosure with hinged lid. For non-classified areas.
Weight	4 lbs
Dimensions	10.35” high x 7.42” wide x 4.93” deep (263mm x 188mm x 125mm)
Power Supply	+24 VDC, (12-30 Vdc), power supply with isolation or class II power supply
Max Current Draw	350mA
Max Current Draw (w/Optional Display)	500mA
Output Signal	Linear 4-20 mA (max input impedance: 400 Ohms)
(Optional) Display	OLED, monochromatic, 2.7"x1.5"
Communication	RS-485, Modbus RTU
Data Format	8-E-1 @ 9600 baud
Alarms	User Configurable
Sensor Element Technologies	SAFECELL® Electrochemical
(Optional) Relay Outputs	(2) Programmable SPDT, Form C dry contacts. 5A @ 24Vdc or 8A 120-240Vac
Terminal Block Plugs (Field Wiring)	26-12 AWG, torque 4.5 lbs-in
4-20 mA Power/Output Wiring	3-conductor, shielded, stranded with drain wire, ≥ 18 AWG cable (Belden 8770 or equivalent) up to 1500 ft
RS-485 Communication Wiring	RS-485 communication cable, 22-24 AWG, 2 conductor, twisted pair, stranded, with drain wire (Alpha 6460, or equivalent).
RS-485 Power Wiring	Use 2-conductor 14 AWG stranded copper cable with drain wire (Belden 5100UE or equivalent).
Location	Indoor/Outdoor/Washdown
Pollution Degree	2
Storage Temperature	-40°F to 185°F (-40°C to 85°C)
Operating Temperature	-49°F to 122°F (-45°C to 50°C)
Operating Humidity (RH)	5-100% condensing
Altitude	Up to 4000m (13123 ft)
Certifications:	TBD

Sensor Module	MSC-NH3-EC (Low Range)
Target Gas	Ammonia (NH3)
Sensor Technology	SAFECELL® Electrochemical
Detection Method	Diffusion
Start-up Time	60 Seconds
Sensor Range	0-300 ppm
Field Selectable Zero	0 ppm
Default Span Values (ranges available)	0/100, 0/250
Default Alarm 1 Value	25 ppm
Calibration Interval	6 months
Calibration Gas Zero	20.9% O_2 or Clean Air
Calibration Gas Span	300 ppm NH3
Regulator Gas Flow	0.8 Lpm
Max Current Draw	510 mA
Resolution	1 ppm
Response Time (T50)	<30 seconds
Response Time (T90)	<60 seconds
Recovery Time (T10)	<60 seconds
Zero Drift	< 0.1% of full-scale per year
Span Drift (in clean air)	< 2% per month
Linearity	+/- 5% of full-scale
Repeatability	+/- 5% of full-scale
Storage Temperature	-40° to 185°F (-40°C to +85°C)
Operating Temperature	-50° to 122°F (-46°C to +50°C)
Operating Humidity (RH)	5-100% condensing
Recommended Mounting Height	~5ft above floor
Warranty	2 years
Life Expectancy	3-5 years

8. WARRANTY

Limited Warranty and Limitation of Liability

Calibration Technologies, LLC (CTI) warrants this product to be free from defects in material and workmanship under normal use and service for a period of two years (including the sensor element), beginning on the date of shipment to the buyer. This warranty extends only to the sale of new and unused products to the original buyer. CTI's warranty obligation is limited, at CTI's option, to refund of the purchase price, repair, or replacement of a defective product that is returned to a CTI authorized service center within the warranty period. In no event shall CTI's liability hereunder exceed the purchase price actually paid by the buyer for the product.

This warranty does not include:

a) routine replacement of parts due to the normal wear and tear of the product arising from use;

b) any product which in CTI's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation, handling or use;

c) any damage or defects attributable to repair of the product by any person other than an authorized dealer or contractor, or the installation of unapproved parts on the product.

The obligations set forth in this warranty are conditional on:

a) proper storage, operation, calibration, use, maintenance and compliance with the product manual instructions and any other applicable recommendations of CTI;

b) the buyer promptly notifying CTI of any defect and, if required, promptly making the product available for correction. No goods shall be returned to CTI until receipt by the buyer of shipping instructions from CTI; and

c) the right of CTI to require that the buyer provide proof of purchase such as the original invoice, bill of sale or packing slip to establish that the product is within the warranty period.

THE BUYER AGREES THAT THIS WARRANTY IS THE BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CTI SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, WHETHER ARISING FROM BREACH OF WARRANTY OR BASED ON CONTRACT, TORT OR RELIANCE OR ANY OTHER THEORY.

Need help?

We answer the phone and monitor email!
Monday-Friday
8:30a - 4:30p (Central Time)

sales@ctigas.com | 866-394-5861

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