MGD•100

Gas Detector and Controllers

Installation and Operation Manual
Instruction 6109-9000
Revision 1 – February 2013

Product Leadership • Training • Service • Reliability

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Section 1. Overview

1.1. General Information

The MGD-100 is the ideal gas detection solution for installations requiring a quality and affordable stand-alone gas detector. It consists of 1 to 6 remote gas sensors connected to and powered by a controller. The controller provides visual, audible, and relay alarms on the detection of gases. The system is available with one or two levels of alarm.

The MGD-100 can be used for:

- detecting refrigerant gases (including NH_3 and CO_2)
- speedy detection of combustible gases
- detection of toxic and VOC gases.

A range of gas detector and sensor enclosures are available for special applications.

The MGD Controller is required. With the MGD-100, it creates a stand-alone gas detection system and is used to remotely monitor up to six MGD-100 devices. Models are available with 1, 2, 4, and 6 channels. Wiring diagrams are provided later in this manual.

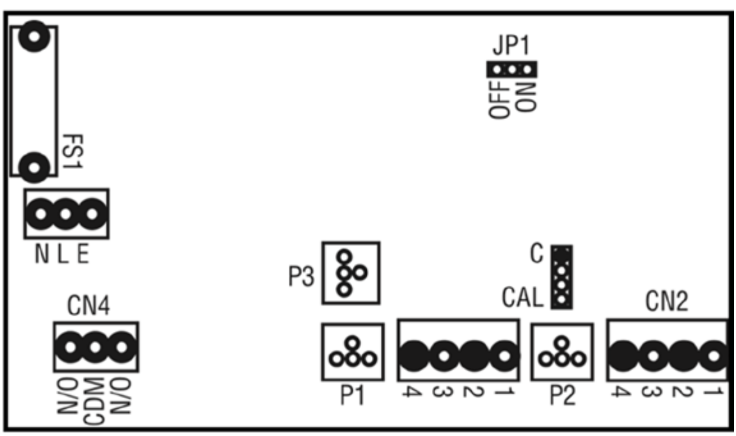

Figure 1. MGD 1- or 2-Channel Controller PCB

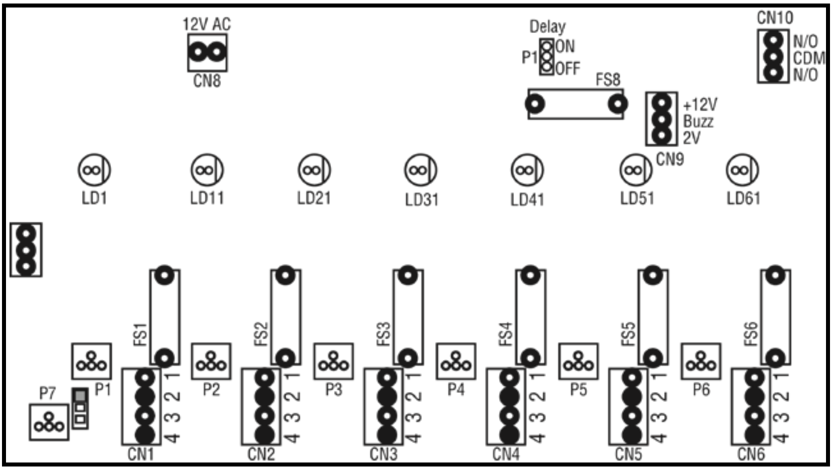

Figure 2. MGD 4- or 6-Channel Controller PCB

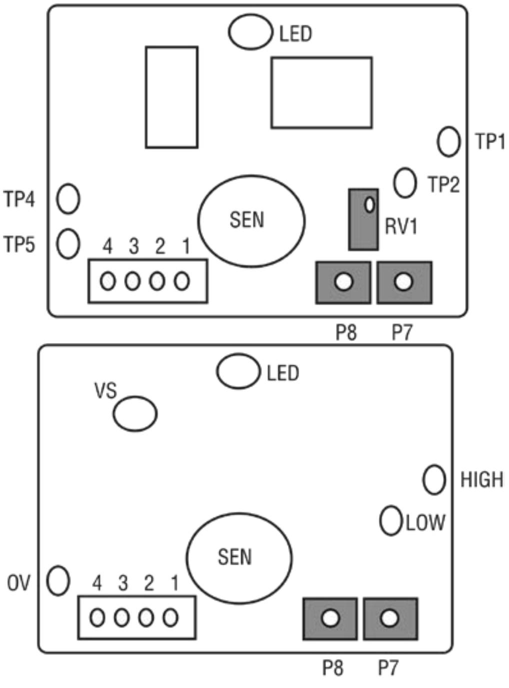

Figure 3. Example MGD-100 PCBs

1.2. Technical Specifications

Specification	Description			
Power Supply	110 VAC 60 Hz, 220 VAC 50 Hz, or 12 VDC (specified at time of order); Max power 20W			
	1- and 2-channel systems		**4- and 6-channel systems**	
Audible Alarm (Buzzer)	Internal, continuous	Internal, intermittent (low), continuous (high)	External, continuous	External, continuous
Alarm Silence	Jumper	Key Switch	Jumper	Key Switch
Alarm Levels	1 Level	2 Levels	1 Level	2 Levels
Alarm Reset	Automatic	Automatic (low alarm), manual (high alarm)	Automatic	Automatic (low alarm), manual (high alarm)
Alarm Delay	Selectable	Preset 25 sec (low) 30 sec (high)	Selectable	Preset 25 sec (low) 30 sec (high)
Visual Alarm LED(s)	Red	Yellow, Red	Red	Yellow, Red
Fault Indications	Red LED, relay		Red LED, relay	
Power Monitoring LED	Green		Green	
Alarm Relay(s)	10 A, 120V/230V		10 A, 120V/230V	
Communications Wiring	4-conductor cable, 200 ft (61 m) max w/ 22 AWG		4-conductor cable, 500 ft (152 m) max, 22 AWG	
Warm-up Delay	Minimum of 3 minutes			

<table>
<tr><th>Specification</th><th colspan="3">Description</th></tr>
<tr><td></td><td>1- and 2-channel systems</td><td colspan="2">4- and 6-channel systems</td></tr>
<tr><td>Standard Enclosure Ratings</td><td>MGD-100: IP41
Controller: IP51</td><td colspan="2">MGD-100: IP41
Controller: IP51</td></tr>
<tr><td>Dimensions and Weight: Controller</td><td>8.4” x 4.1” x 3.15”
214 x 105 x 80 mm
2.9 lbs / 1.3 kg</td><td colspan="2">10.3” x 10.4” x 303”
262 x 265 x 84 mm
5.7 lbs / 2.6 kg</td></tr>
<tr><td rowspan="8">Dimensions and Weights</td><td>IP41</td><td>3.35” x 5.59” x 2.09”
86 x 142 x 53 mm</td><td>6.3 oz
180 g</td></tr>
<tr><td>IP66</td><td>6.89” x 6.5” x 3.29”
175 x 165 x 82 mm</td><td>1 lb 6 oz
629 g</td></tr>
<tr><td>IP66 w/ Splash Guard</td><td>6.89” x 8.9” x 3.29”
175 x 225 x 82 mm</td><td>1 lb 9 oz
700 g</td></tr>
<tr><td>IP66 w/ Remote Sensor</td><td>6.89” x 6.1” x 3.29”
175 x 155 x 82 mm</td><td>1 lb 11 oz
790 g</td></tr>
<tr><td>IP66 w/ EXd Sensor Head</td><td>6.89” x 6.1” x 3.29”
175 x 155 x 82 mm</td><td>2 lb 10 oz
1185 g</td></tr>
<tr><td>IP66 w/ PRV Sensor Head</td><td>6.89” x 6.1” x 3.29”
175 x 155 x 82 mm</td><td>2 lb 0.3 oz
916 g</td></tr>
<tr><td>IP66 Airflow/ Duct (See Table)</td><td>6.89” x 4.9” x 3.29”
175 x 125 x 82 mm</td><td>1 lb 4 oz
578 g</td></tr>
<tr><td>EXd (ATEX only)</td><td>5.12” x 6.3” x 3.54”
130 x 160 x 90 mm</td><td>9 lb 4 oz
4200 g</td></tr>
</table>

NOTE: The hazardous area ***EXd Gas Monitor*** products are designed with individually certified EXd main housing enclosures and certified EXD remote or attached sensor enclosures. The main housing enclosure and its PCB assembly are also EXd certified, but the final **EXd Gas Monitor** assemblies (main enclosure and/or sensor assembly) are not currently EXD certified, but are pending additional testing.

Supported CFM/Duct Sizes for the Duct Mount Housing

Units	Duct Size				
Inches	12 x 12	12 x 24	18 x 18	24 x 24	24 round
Feet	1 x 1	1 x 2	1.5 x 1.5	2 x 2	Pi x 1 x 1
Area (ft^2)	1	2	2.25	4	3.14
CFM	**Ft/min (Based on CFM and Duct Size)**				
2800	2800	n/a	n/a	n/a	n/a
3000	3000	n/a	n/a	n/a	n/a
3400	3400	n/a	n/a	n/a	n/a
3800	3800	n/a	n/a	n/a	n/a
4000	4000	n/a	n/a	n/a	n/a
4400	4400	n/a	n/a	n/a	n/a
4800	4800	n/a	n/a	n/a	n/a
5000	5000	2500	n/a	n/a	n/a
5400	5400	2700	n/a	n/a	n/a
5800	5800	2900	2578	n/a	n/a
6000	6000	3000	2667	n/a	n/a
6400	6400	3200	2844	n/a	n/a
6800	6800	3400	3022	n/a	n/a
7000	7000	3500	3111	n/a	n/a
7400	7400	3700	3289	n/a	n/a
7800	7800	3900	3467	n/a	n/a
8000	8000	4000	3556	n/a	2548
8400	8400	4200	3733	n/a	2675
8800	8800	4400	3911	n/a	2803
9000	9000	4500	4000	n/a	2866
9400	9400	4700	4178	n/a	2994
9800	9800	4900	4356	n/a	3121
10000	10000	5000	4444	2500	3185

Section 2. Placing Sensors

2.1. Installation Warnings

NOTE: This instrument can be equipped with a semiconductor sensor for the detection of refrigerant, combustible and VOC gases. Semiconductor sensors are not gas specific and respond to a variety of other gases including propane exhaust, cleaners, and solvents. Changes in temperature and humidity may also affect the sensor's performance.

WARNING: Explosion hazard! Do not mount the MGD-100 in an area that may contain flammable liquids, vapors, or aerosols. Operation of any electrical equipment in such an environment constitutes a safety hazard.

CAUTION: The MGD-100 contains sensitive electronic components that can be easily damaged. Do not touch nor disturb any of these components.

NOTE: The mounting location of the monitor should allow it to be easily accessible for visual monitoring and servicing.

NOTE: The monitor must be connected by a marked, suitably located and easily reached switch or circuit-breaker as means of disconnection.

NOTE: Connect monitor power and signaling terminals using wiring that complies with local electrical codes or regulations for the intended application.

2.2. General Guidelines

NOTE: The MGD-100 should be installed plumb and level and securely fastened to a rigid mounting surface.

The MGD controller and its sensor(s) should be positioned carefully to avoid mechanical damage (from moving machinery, doors, etc.) and thermal extremes (close to heaters). Units should not be placed unprotected in direct strong drafts/airflows and areas where water or moisture is present unless an appropriate enclosure is used.

Avoid routing sensor cabling outside of premises, or between buildings via overhead cables. Also, sensor wiring should be kept a minimum of 20 in (500mm) from the main power supply and telephone cables.

When connecting the main power supply and/or sensor cables ensure a second mechanical fixing is used. Use a cable tie inside the enclosure within 1 in (25mm) of the cable termination.

When power to the unit is switched on, there is a 3-minute delay before the system activates. This allows the sensors to warm up to the correct temperature for gas detection. On a two-alarm unit, the green light on the alarm panel comes on after the delay, indicating that the system is ready. On a one-alarm system the green light comes on immediately. When a unit has been off or stored for a long time the stabilizing period may be longer than 3 minutes. After the 3 minutes has expired, alarms may activate. You may deactivate the siren until stabilization is complete. (Use the key switch on two-alarm units. Remove jumper JP1 in the case of a one-alarm unit).

Mount the controller using the mounting holes in the base such that the sensor cable terminal blocks are at the bottom of the unit in a convenient position.

Sensors must be located within the appropriate wire lengths from the controller.

In all cases the sensor supplied is designed for maximum sensitivity to a particular gas. However, in certain circumstances false alarms may be caused by the occasional presence of sufficiently high concentrations of other gaseous impurities. Examples of situations where such abnormalities may arise include the following:

- Plant room maintenance activity involving solvent or paint fumes or refrigerant leaks.
- Accidental gas migration in fruit ripening/storage facilities (bananas - ethylene, apples - carbon dioxide).
- Heavy localized exhaust fumes (carbon monoxide, dioxide, propane) from engine-driven forklifts in confined spaces or close to sensors.

A response delay is built in to the system to minimize the possibilities of false alarms (for two-alarm units only) or it may be selected for one-alarm units.

2.3. Machinery Rooms

There is no absolute rule in determining the number of sensors and their locations. However, a number of simple guidelines will help to make a decision. Sensors monitor a point as opposed to an area. If the gas leak does not reach the sensor then no alarm will be triggered. Therefore, it is extremely important to carefully select the sensor location. Also consider ease of access for maintenance.

The size and nature of the site will help to decide which method is the most appropriate to use. Locations requiring the most protection in a machinery or plant room would be around compressors, pressurized storage vessels, refrigerant cylinders or storage rooms or pipelines. The most common leak sources are valves, gauges, flanges, joints (brazed or mechanical), filling or draining connections, etc.

- When **mechanical or natural ventilation** is present, mount a sensor in the airflow.
- In machinery rooms where there is **no discernible or strong airflow** then options are:

  Point Detection, where sensors are located as near as possible to the most likely sources of leakage, such as the compressor, expansion valves, mechanical joints or cable duct trenches.

  Perimeter Detection, where sensors completely surround the area or equipment.
- For **heavier-than-air gases** such as halocarbon and hydrocarbon refrigerants such as R404A, propane, and butane sensors should be located near ground level.
- For **lighter-than-air gas** (e.g., ammonia), the sensor needs to be located above the equipment to be monitored on a bracket or high on a wall within 12 in (300 mm) of (or on) the ceiling – provided there is no possibility of a thermal layer trapped under the ceiling preventing gas from reaching the sensor.

NOTE: At very low temperatures (e.g., refrigerated cold store), ammonia gas becomes heavier than air.

- With similar density or miscible gases, such as CO or CO_2, sensors should be mounted about head high (about 5 feet [1.5 m]).
- Sensors should be positioned just far enough back from any high-pressure parts to allow gas clouds to form and be detected. Otherwise, a gas leak might pass by in a high-speed jet and not be detected by the sensor.
- Make sure that pits, stairwells and trenches are monitored since

they may fill with stagnant pockets of gas.

- If a pressure relief vent (PRV) pipe is fitted to the system, it may be a requirement to mount a sensor to monitor this vent pipe. It could be positioned about 6.5 ft (2 m) above the PRV to allow gas clouds to form.

- For racks or chillers pre-fitted with refrigerant sensors, these should be mounted so as to monitor the compressors. If extract ducts are fitted the airflow in the duct may be monitored.

2.4. Refrigerated Spaces

In refrigerated spaces, sensors should be located in the return airflow to the evaporators on a sidewall (below head-high is preferred), or on the ceiling, not directly in front of an evaporator. In large rooms with multiple evaporators, sensors should be mounted on the central line between 2 adjacent evaporators, as turbulence will result in airflows mixing.

2.5. Chillers

In the case of small water- or air-cooled enclosed chiller units mount the sensor so as to monitor airflow to the extract fans. With larger models also place a sensor inside the enclosure under or adjacent to the compressors.

In the case of outdoor units:

- For enclosed air-cooled chillers or the outdoor unit for variable refrigerant volume and variable refrigerant flow (VRV/VRF) systems, mount the sensor so as to monitor airflow to the extract fan. With large units also place a sensor inside the enclosure under or adjacent to the compressors.

In the case of non-enclosed outdoor units:

- If there is an enclosed machinery section, locate a sensor there.
- In the case of units with enclosed compressors, mount sensors in the enclosures.
- Where you have protective or acoustic panels mount the sensor low and under the compressors where it is protected by the panels.
- With air-cooled chillers or air-cooled condensers with non-enclosed condenser sections it is difficult to effectively monitor leaks in the coil sections. With some designs it will be possible

using an airflow sensor to monitor airflow to the start–up fans in the front or rear sections.

- If there is a possibility of refrigerant leaks into a duct or air-handling unit install a sensor to monitor the airflow.

Weatherproof sensors should be used for unprotected outdoor applications.

2.6. Air Conditioning (Direct Systems VRF/VRV)

For compliance with EN378, at least one detector shall be installed in each occupied space being considered and the location of detectors shall be chosen in relation to the refrigerant and they shall be located where the refrigerant from the leak will collect. In this case refrigerants are heavier than air and detectors should have their sensors mounted low, e.g., at less than bed height in the case of an hotel or other similar Category Class A spaces. Ceilings or other voids if not sealed are part of the occupied space.

CAUTION: Monitoring ceiling voids in a hotel room would not strictly comply with EN378.

Do Mount In-Room Sensors…	Don't Mount Sensors…
…at less than the normal heights of the occupants. E.g., in a hotel room this is less than bed height (between 8 and 20 in [200 and 500 mm] off the floor).	…under mirrors.
…away from drafts and heat sources like radiators, etc.	…at vanity units.
… to avoid sources of steam.	…in or near bathrooms.

IMPORTANT: Carefully consider ramifications of using too few sensors. A few extra sensors could make a significant difference if a gas leak occurs.

Section 3. Housing Dimensions

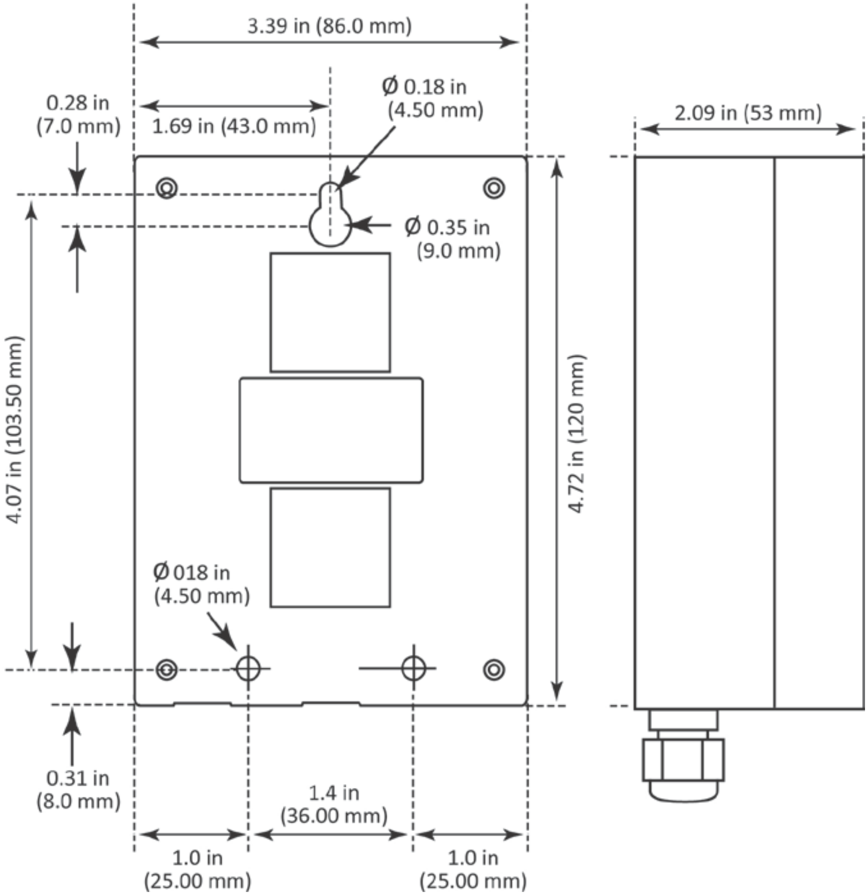

Figure 4. MGD-100 Standard Housing

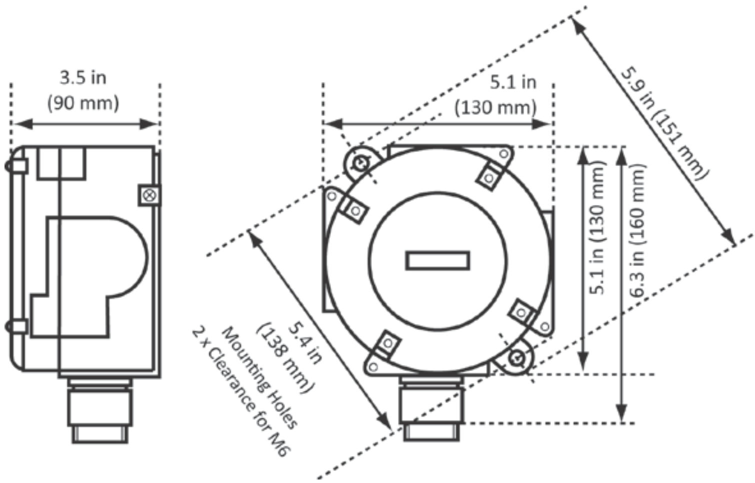

Figure 5. MGD-100 Exd Housing

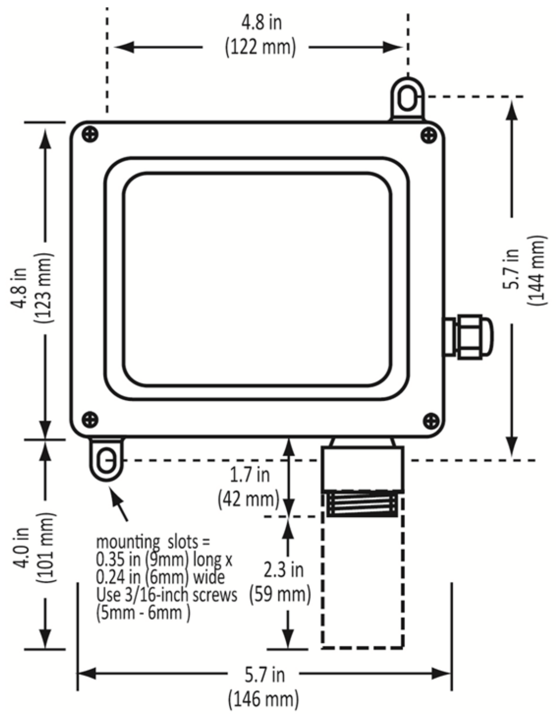

Figure 6. MGD-100 IP66 Housing (with Splash Guard)

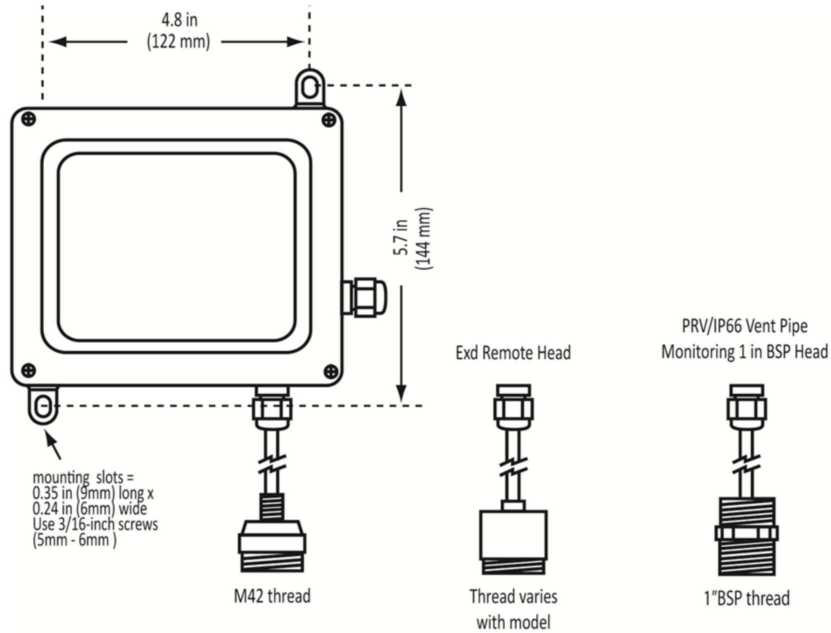

Figure 7. MGD-100 IP66 Housing with Remote Sensor

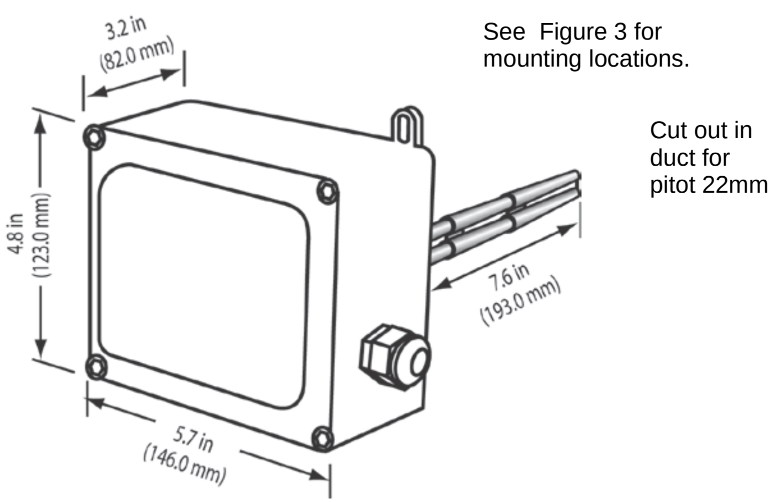

Figure 8. MGS-100 IP66 Housing with Airflow Duct Mount

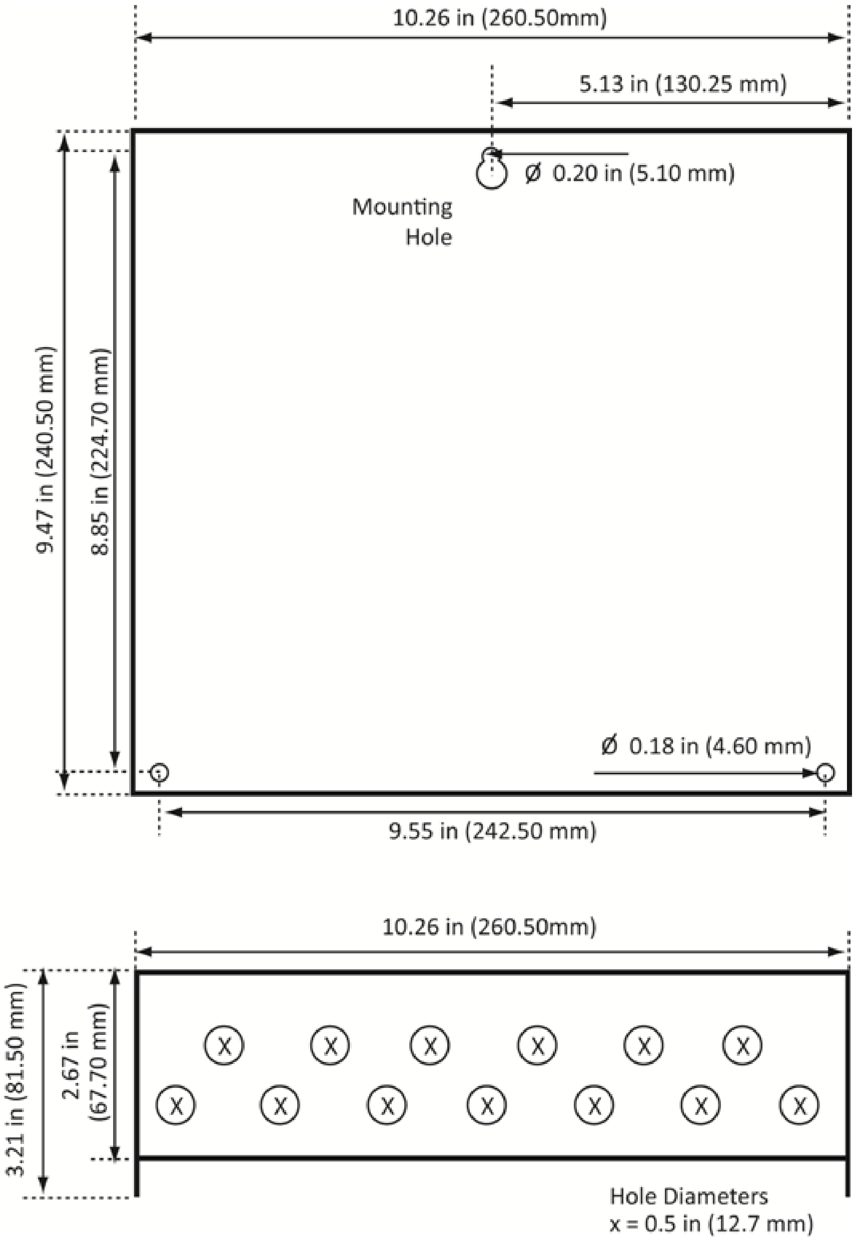

Figure 9. 4- & 6-Sensor Controller Housing

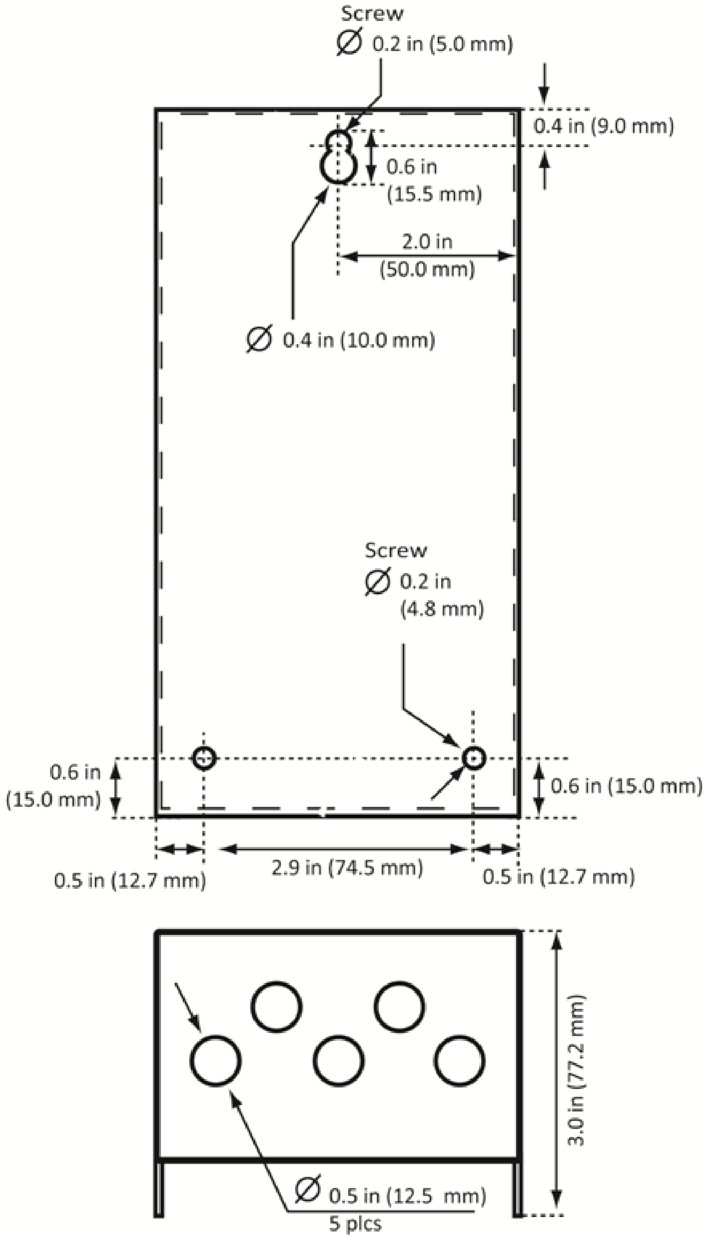

Figure 10. 1- to 2-Sensor Controller Housing

Section 4. Wiring Instructions

4.1. Wiring to MGD-100s

Step	Wiring to MGD-100s
1	Connect a 4-conductor cable (18 AWG recommended) to a terminal block on the MGD controller (CN1, CN2, etc).
2	Route the cable to an MGD-100.
3	For standard (IP41) MGD-100 housings, remove the lid by: • turning the cable clamp ½ turn counter clockwise to loosen the internal nut • depressing the clip on top of the enclosure to open.
4	Mount the MGD-100. See Section 3 for dimensions.
5	Connect the other end of the cable to the MGD-100 using terminal block CN1 positions 1,2,3 & 4. (installation should be such that pin 1 of the MGD controller is connected to pin 1 of the MGD-100).
6	Close the housing.
7	Repeat above sequence for any/all remaining MGD-100s.

NOTE: Install a 2200 Ohm resistor between input pins 2 and 3 on any unused channels. If unused channels do NOT have a resistor installed a fault will occur.

Maximum Wiring Lengths between MGD-100 and Controller

System	1-2 Channel Units	4-6 Channel Units
120 Volt	**Length:** 200 feet max **AWG:** 22 gauge **Type:** Stranded 4-wire cable **Ohms:** Max 3.52Ω/wire	**Length:** 500 feet max **AWG:** 22 gauge **Type:** Stranded 4-wire cable **Ohms:** Max 8.8Ω/wire
230 Volt	**Length:** 125 feet max **AWG:** 22 gauge **Type:** Stranded 4-wire cable **Ohms:** Max 3.52Ω/wire	**Length:** 325 feet max **AWG:** 22 gauge **Type:** Stranded 4-wire cable **Ohms:** Max 8.8Ω/wire

IMPORTANT: Ensure that connections 1 to 4 on the sensor connect to their corresponding numbers on the terminal block in the main control unit, otherwise the system will not function correctly.

NOTE: You may use different cables and longer distances provided the corresponding resistance shown above is not exceeded.

4.2. External Audible Alarm and DC Output

NOTE: This section applies to the external audible alarm and the 12 VDC output (4-6 channel systems only).

Step	Wiring the External Audible Alarm and DC Output
1	To install the audible alarm, connect positive lead to CN9 terminal (for one-alarm models) or CN11 terminal (for two-alarm models) marked +12V.
2	Connect the negative to the center terminal marked ‘BUZZ’.
3	The 12 VDC/100 mA output is obtained via CN9/CN11 terminals ‘+12V’ and ‘0V’. This output may be wired via the relays to obtain a switching 12 VDC output to drive an external relay or solenoid. **NOTE:** If both the buzzer and 12V DC output are connected correctly, they should not exceed 250 mA in total.
4	Connect terminal ‘+12V’ on CN9/CN11 to the ‘COM’ terminal of the relay and the device to be switched to either the N/O or N/C terminal (depending on whether a 12V output is required during an alarm condition or while the system is on standby).
5	The return from the device is connected to Zero on CN9/CN11.

4.3. Relays

Connect leads to terminal block for Common (COM) and N/O and/or N/C connections as required. Note that relays are rated as 10A @ 120/230 VAC.

Relay Wiring

Type	Two-Alarm Units	One-Alarm Units
1-2 Channel Units	CN5: Low-Level Alarm CN4: High-Level Alarm	CN4
4-6 Channel Units	CN10: Low-Level Alarm CN9: High-Level Alarm CN12: Fault Relays	CN10

NOTE: N/O (normally open) and N/C (normally closed) refer to contact status in standby mode. On a two-alarm system, a high-level alarm condition on any sensor will override a low-level alarm condition on another sensor.

NOTE: On 4- to 6-channel, two-alarm units, the high-level relay may be set for normal or Fail-Safe operation by setting jumper JP1 on the control unit's printed circuit board.

4.4. Power Connection

Use 3-wire, 20 AWG wire for 230V systems or 3-wire, 18 AWG wire for 120V systems. Connect the main power supply to terminal block CN3 (on 1 & 2 channel systems), or fused terminal block mounted on base of control unit (4 - 6 channel systems). Ensure that ground connections to the lid and base of the enclosure are maintained.

NOTE: Connection to the main power supply must be made via an approved, readily-accessible, switched and fused plug and socket (or as per local wiring regulations) which should be within 10 feet (3 meters) of the control unit.

NOTE: The main power supply cable should be of an approved type based on local regulations.

NOTE: The blanking plugs for cable entries should only be removed if being replaced by conduit fittings.

NOTE: If replacement of the main power fuse is required, use only the appropriate type from the table below.

Replacement Fuses (0.79 in [20mm])

Control Unit		Main Supply Fuse	Sensor Connection Fuse	Audible Alarm/Aux Fuse
230-Volt Systems	**1-2 Chan Units**	T50mA 230V Fuse	N/A	N/A
	4-6 Chan Units	T160mA 230V Fuse	T250mA 230V Fuse	T315mA 230V Fuse
120-Volt Systems	**1-2 Chan Units**	T100mA 120V Fuse	N/A	N/A
	4-6 Chan Units	T315mA 230V Fuse	T250mA 120V Fuse	T315mA 230V Fuse

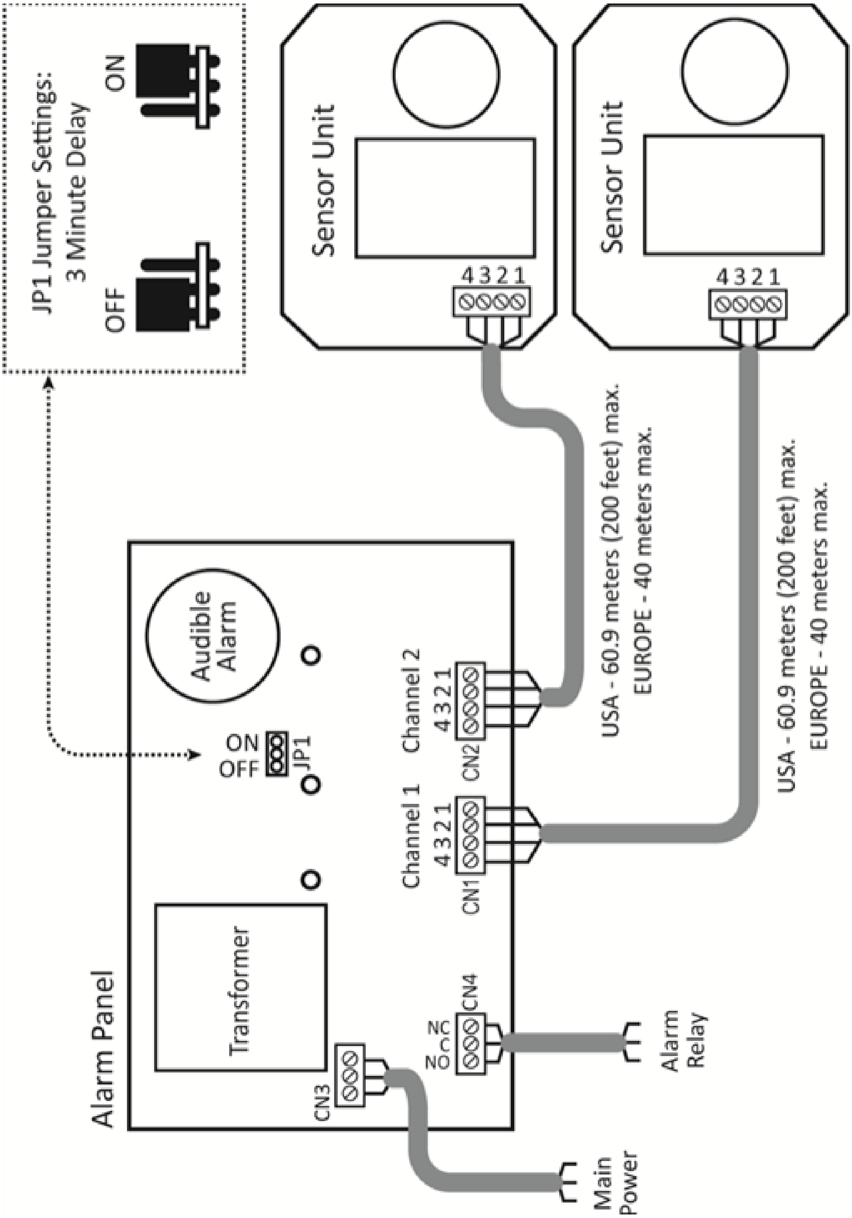

Figure 11. 1- & 2-Sensor, One-Alarm Installation Diagram

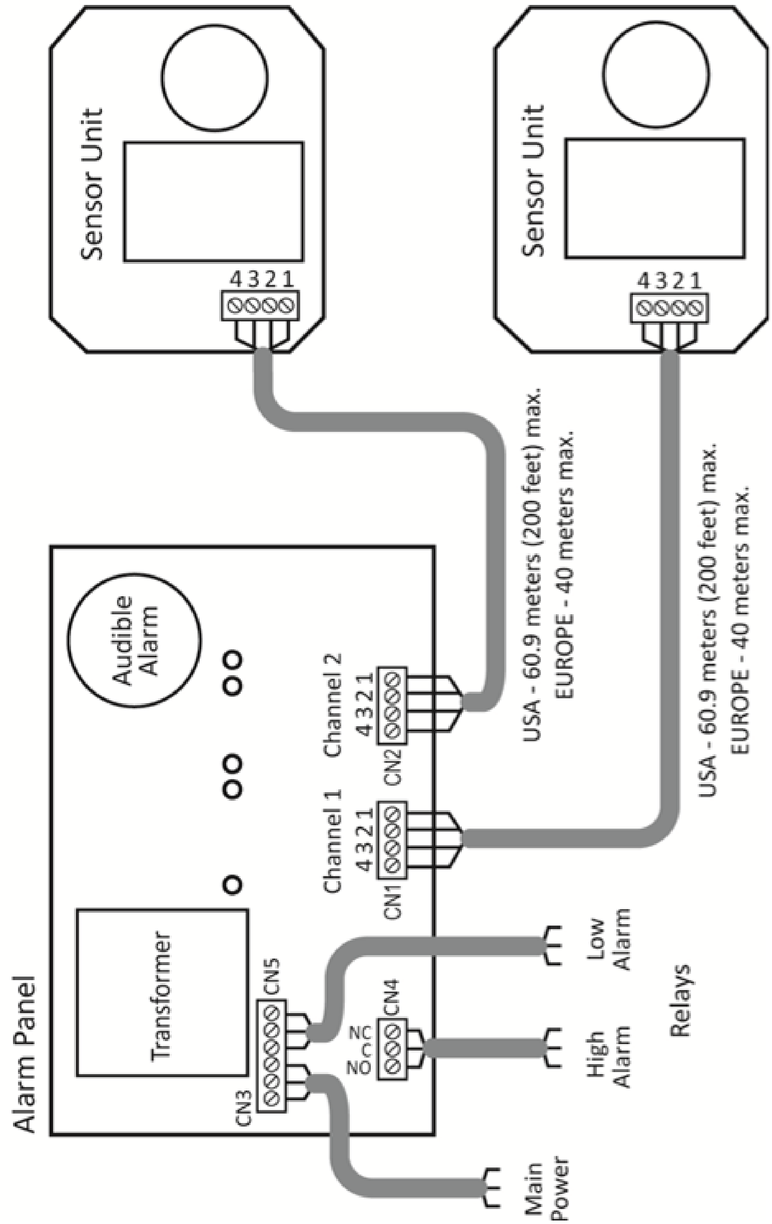

Figure 12. 1- & 2-Sensor, Two-Alarm Installation Diagram

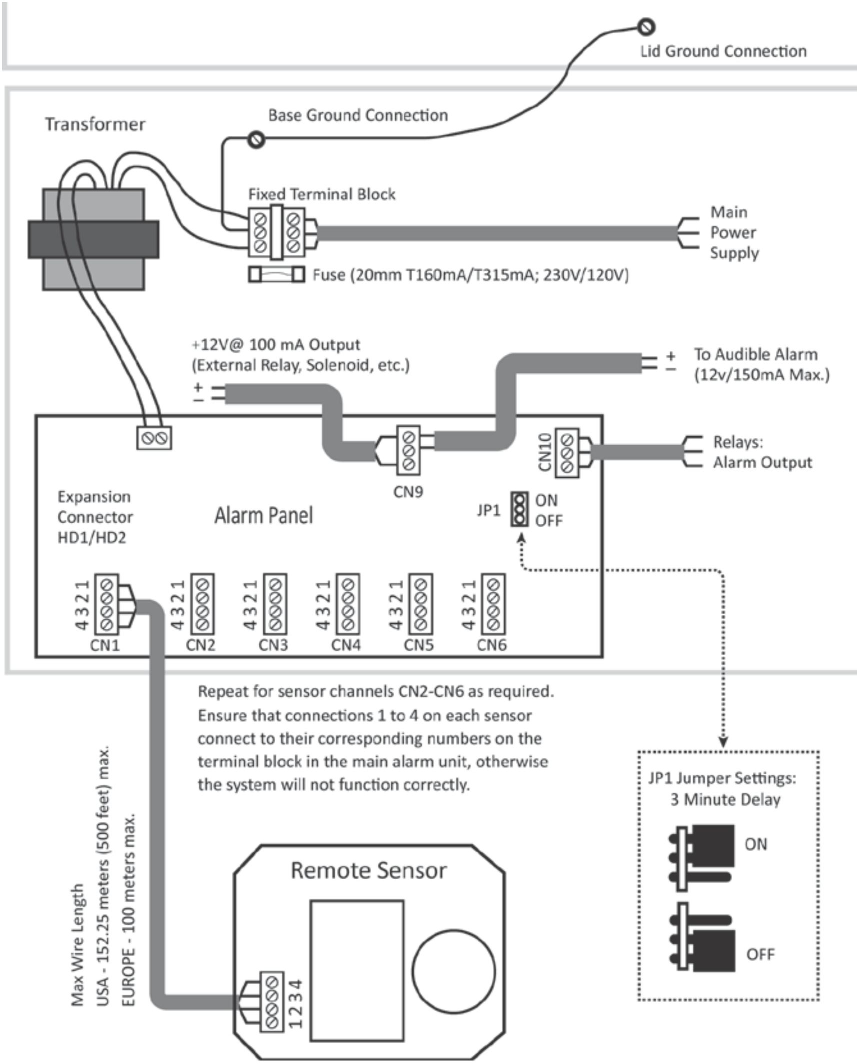

Figure 13. 4- & 6-Sensor, One-Alarm Installation

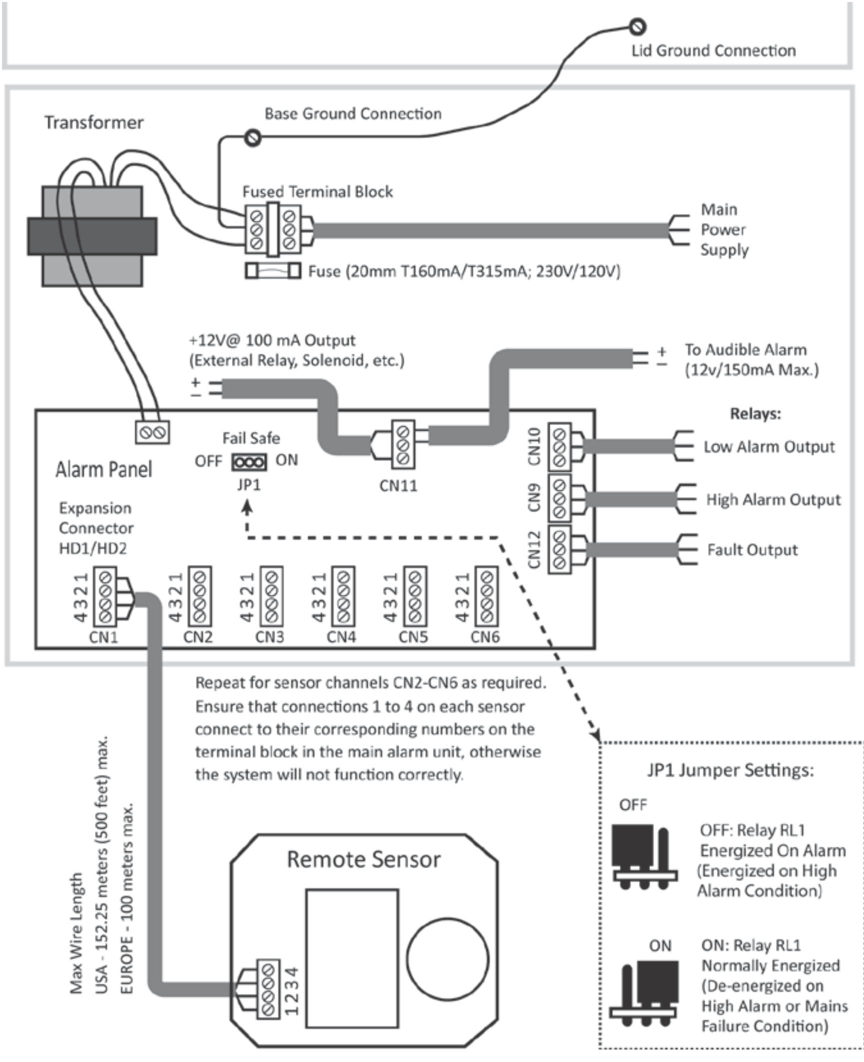

Figure 14. 4- & 6-Sensor, Two-Alarm Installation

Section 5. Operation and Stabilization

When power to the unit is switched on, there is a 3-minute delay before the system activates. This allows the sensors to warm up to the correct temperature for gas detection.

- On a two-alarm unit the green light on the alarm panel comes on after the delay, indicating that the system is ready.
- On a one-alarm unit the green light comes on immediately.

When a unit has been off or stored for a long time the stabilizing period may be longer than 3 minutes. After the 3 minutes has expired, alarms may activate. You may deactivate the siren until stabilization is complete. (Use the key switch on two-alarm units. Remove link on jumper JP1 in the case of a one-alarm units).

After the MGD-100 has been installed in accordance with the installation instructions, it is ready to monitor the chosen air space and detect gas leaks.

Each of the sensors has a green light to indicate that power is present.

To minimize false alarms, the system has a built in delay enforced between the arrival time of gas at the sensor unit, and the time when the alarm occurs. For one-alarm units, this delay is approximately 3 minutes. For two-alarm units, this delay is 20-25 seconds before a low-level alarm, and 25-30 seconds before a high-level alarm. This delay can be deactivated in a one-alarm unit by moving the link at position JP1 to the off position.

Operation State	Description
Idle	Only the green light on the panel is on. No gas is present.
Power Interrupted	If the green light is off, power to the unit has been interrupted. Refer to Section 7.
Alarm Conditions	One-alarm Units: One or more red lights on the panel turn on. The siren and the relays operate. This indicates that gas at one or more sensors is at a level higher than the alarm point.
	Two-alarm Units: Low Alarm: One of more yellow lights on the panel turn on. The audible alarm operates intermittently, and the low alarm relay operates: this indicates presence of a low level of gas on one or more sensors. High Alarm: One or more red lights on the panel turn on. The audible alarm operates continuously, and the high alarm relay operates: this indicates presence of a high level of gas on one or more of the sensors.
Resetting Alarms	On one-alarm units all of which have automatic reset no user intervention is required. The unit will reset shortly after the gas dissipates (all one-alarm systems reset automatically). On two-alarm units, low-level alarm conditions will reset automatically when the gas dissipates. High-level alarm conditions require a manual reset (by pressing the reset button). Please note that a high alarm condition can only be reset 30-60 seconds after the gas clears from around the sensors.
Audible Alarm	For the purpose of system maintenance, the audible alarm may be disabled temporarily on two-alarm units by using the key-switch. On one-alarm units this is achieved by setting a jumper on the control unit printed circuit board. The location of this is position JP1. Remove the link to disable the alarm.

Section 6. Functional Tests and Calibration

6.1. Introduction

To comply with the requirements of EN378 and the European F-GAS regulation, sensors must be tested annually. However, local regulations may specify the nature and frequency of this test.

CAUTION: Check local regulations on calibration or testing requirements.

CAUTION: The MGD-100 contains sensitive electronic components that can be easily damaged. Do not touch nor disturb any of these components.

NOTE: The MGD-100 is calibrated at the factory. After installation, a zero adjustment maybe required due to differences in environmental conditions.

IMPORTANT: If the MGD is exposed to a large leak it should be tested to ensure correct functionality by electrically resetting the zero setting and carrying out a bump test. See procedures below.

IMPORTANT: The testing and/or calibration of the unit must be carried out by a suitably qualified technician, and must be done:

- in accordance with this manual
- in compliance with locally applicable guidelines and regulations.

Suitably qualified operators of the unit should be aware of the regulations and standards set down by the industry/country for the testing or calibration of this unit. This manual is only intended as a guide and, insofar as permitted by law, the manufacturer accepts no responsibility for the calibration, testing, or operation of this unit.

The frequency and nature of testing or calibration may be determined by local regulation or standards.

EN378 and the F-GAS Regulation require an annual check in accordance with the manufacturer's recommendation.

IMPORTANT: Before testing the sensors on-site, the MGD must have been powered up and allowed to stabilize. See Section 5.

IMPORTANT: Failure to test or calibrate the unit in accordance with applicable instructions and with industry guidelines may result in serious injury or death. The manufacturer is not liable for any loss, injury, or damage arising from improper testing, incorrect calibration, or inappropriate use of the unit.

IMPORTANT: Bacharach recommends annual checks and gas calibration. Bacharach also recommends sensor replacement every 3 years or as required. Calibration frequency may be extended based on application, but should never exceed 2 years.

IMPORTANT: In applications where life safety is critical, calibration should be done quarterly (every 3 months) or on a more frequent basis. Bacharach is not responsible for setting safety practices and policies. Safe work procedures including calibration policies are best determined by company policy, industry standards, and local codes.

NOTE: For improved accuracy and response, the instrument should be zeroed and calibrated in the environment in which it is being installed.

There are two concepts that need to be differentiated:

Bump Test Exposing the sensor to a gas and observing its response to the gas. The objective is to establish if the sensor is reacting to the gas and all the sensor outputs are working correctly. There are two types of bump test.

- **Quantified:** A known concentration of gas is used.

- **Non-Quantified:** A gas of unknown concentration is used.

Calibration Exposing the sensor to a calibration gas, setting the "zero" or "Standby voltage", the span/range, and checking/ adjusting all the outputs, to ensure that they are activated at the specified gas concentration.

CAUTION: Before you carry out the bump test or calibration:

- Advise occupants, plant operators, and supervisors.
- Check if the MGD is connected to external systems such as sprinkler systems, plant shut down, external sirens and beacons, ventilation, etc. and disconnect as instructed by the customer.
- For one-alarm systems you should deactivate the 3-min alarm delay (if selected) by moving jumper JP1 to the "off" position.
- Ideally, for bump test or calibration the MGD should be powered up overnight. See Section 5 for more information.

6.2. Electrical Reset of One-Alarm Systems

Reset, if necessary, the Standby and Alarm Threshold Voltage to the factory settings as shown on the calibration label. Two adjustments are required and they are performed on the controller unit.

Electrical reset information is listed on the label on the side of the enclosure and is unique to that sensor.

Tools required:

- A voltmeter (crocodile clips recommended)
- Factory set point electric values (as shown on the rating label)
- Screwdriver (depending on enclosure).

Step	Electrical Reset of One-Alarm Systems
1	First disable the 3-minute alarm delay by moving the jumper link at JP1 to the "OFF" position. See Figure 11.

Step	Electrical Reset of One-Alarm Systems
2	For the sensor standby voltage, connect a voltmeter between 0V and +V on CN1, CN2, etc. See Figure 11. Adjust pot P1 for channel 1, P2 for channel 2, etc. (Set this to 2.0 V for IR units.)
3	For the alarm threshold voltage, connect a voltmeter between 0V and +V on cal header. See Figure 11. Adjust pot P3 (for 1/2 channel units) or P7 (for 4/6 channel units). (Set this to 3.5 V for IR units.)
6	For the alarm set point, connect the DC voltmeter between 0V and High (see Figure 3 on page 6). Adjust P7 to the alarm set point as per the rating label (normally 1.2V).
7	Carry out a bump test to ensure the sensor is functioning correctly. If the sensor does not go into alarm carry out a gas calibration.
8	Finally return the jumper JP1 to the original position.

6.3. Electrical Reset of Two-Alarm Systems

Reset, if necessary, the Standby and low /high Alarm Threshold Voltages to the factory settings as shown on the calibration label. This is performed on the sensor PCB.

Electrical reset information is listed on the label on the side of the enclosure and is unique to that sensor.

Tools required:

- A voltmeter (crocodile clips recommended)
- Factory set point electric values (as shown on the rating label)
- Screwdriver (depending on enclosure).

Step	Electrical Reset of Two-Alarm Systems
1	For the sensor standby voltage, connect a DC voltmeter between TP5 (0V) and TP4 (+V) as shown in Figure 12. Adjust pot RV1.
2	For low-level alarm voltage, connect your DC voltmeter between TP5 (0V) and TP2 (+V) as shown in Figure 12. Adjust pot P8.

Step	Electrical Reset of Two-Alarm Systems
3	For high-level alarm voltage, connect your DC voltmeter between TP5 (0V) and TP1 (+V) as shown in Figure 12. Adjust pot P7.

6.4. Bump Testing

After installation the units should be bump tested. Expose the sensors to test gas ampoules (NH_3, CO_2, etc.) or test cylinder (appropriate to the installation). The gas is heavier than air and should fall into the sensor, putting the system into alarm and lighting the red LED. The delay will prevent the audible alarm from sounding or the relay from switching (if a delay is set).

With a bump test you can see the functions of the sensor - the yellow/red LED will light, and the relay and audible alarm will function.

Ideally bump tests are conducted on site in a clean air atmosphere.

NOTE: Prior to carrying out a bump test, check and adjust the zero setting as described in the Calibration section.

NOTE: Procedures for bump test and calibration vary depending on the sensor technology used and the gas in question. The MGD-100 is available in two sensor versions: Semiconductor (SC) and Infrared (IR).

NOTE: Do not pressurize the sensor.

NOTE: For semiconductor sensors, you MUST use calibration gas in a balance of air (*not* N_2).

Step	Bump Testing Using Calibration Gas Cylinders
1	Remove the enclosure lid of the gas sensor and controller (non applicable to Exd Remote sensor and vent pipe model as monitoring of voltage can be done on controller).

2	Connect the voltmeter to the channel under test between Pin 4 and Pin 2, TP5 and TP4, or 0V and VS to monitor sensor response.
3	Expose the sensor to gas from the cylinder by using a plastic hose/hood to direct gas to the sensor head.

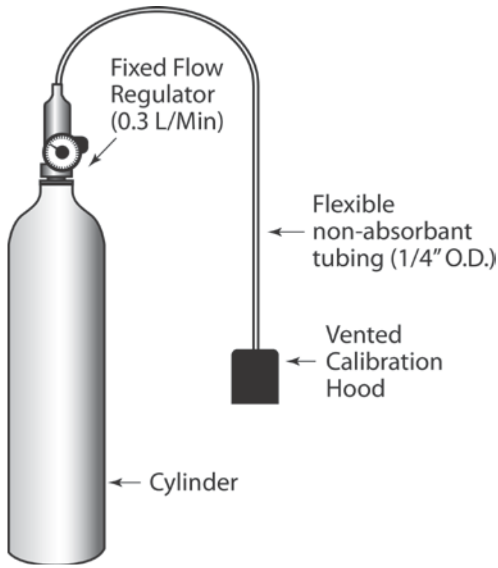

Figure 15. Gas Cylinder and Test Hardware

NOTE: If the bump test is unsuccessful, perform a calibration as described later in this manual.

IMPORTANT: After a semiconductor or electrochemical sensor is exposed to a substantial gas leak, the sensor should be checked and replaced if necessary.

Gas ampoules are convenient and inexpensive alternatives to using gas cylinders for bump testing.

Figure 16. Gas Ampoules for Bump Testing

Step	Bump Testing Using Gas Ampoules
1	Make sure that both the ampoules and the calibration beaker are clean and dry.
2	Unscrew the beaker wing nut and place the ampoule so that it sits in the base of the beaker (see Figure 16).
3	Tighten the wing-nut screw onto the ampoule without breaking it.
4	Remove the enclosure lid of the gas detector.
5	Connect a voltmeter to monitor sensor response. Measure between Pin 4 and Pin 2, TP5 and TP4, or 0V and VS.
6	Place the beaker over the sensor head using the multi sensor adaptor to fit the sensor, or, if an Exd, IP66 or remote sensor head version, screw the beaker on the remote sensor head M42 thread or M35 thread adaptor. It should be as tight fitting as possible to allow maximum gas exposure.
7	Tighten the wing-nut screw onto the ampoule until it shatters allowing the gas to diffuse in the beaker. It should be left in place for approximately 5 min.
8	The voltage output will increase. This confirms that the sensor is responding. A response equivalent to at least 50% (typically) of the test gas will confirm that the system is in order.

Step	Bump Testing Using Gas Ampoules
9	Remove the beaker from the sensor. Carefully remove any ampoule remains from the gas detector and beaker.

6.5. Calibration Overview

To comply with the requirements of EN378 and the European F-GAS regulation, sensors must be tested annually. However, local regulations may specify the nature and frequency of this test.

CAUTION: Check local regulations on calibration or testing requirements.

6.6. Calibration Options

There are two available calibration options:

- Exchanging the sensor board (available for two-alarm units and 1- and two-alarm IR units)
- Gas calibration.

These are explained in the next two sections.

6.7. Sensor Board Exchange

There are a number of advantages to sensor board exchange. It is simpler and quicker than gas calibration.

NOTE: Sensor board exchange is available for two-alarm semiconductor (SC) units and one- and two-alarm infrared (IR) units.

NOTE: Bacharach recommends exchanging your sensor PCB for a new pre-calibrated one every 3 years.

Tools required:

- A pre-calibrated sensor board
- A voltmeter (crocodile clips recommended)

Step	Sensor Board Exchange
1	Power off the unit and remove lid of sensor enclosure.
2	Note the color code of the cable in positions 1,2,3 and 4 of the connector block.
3	Undo the cable and 2 screws securing the sensor board and remove the board.
4	Fit the new pre-calibrated sensor and reconnect the cable in the correct color sequence at positions 1,2,3 and 4.
5	Power on the unit and allow to stabilize for 15 minutes (minimum).
6	Check voltage readings on positions 1,2,3 and 4 (see Table 1 on page 42) to ensure that wiring is correct. Note also in the table how to monitor the sensor as it stabilizes.
7	Carry out a bump test to confirm the sensor is responding.
8	Keep records of the test date, sensor serial number, and any observations.

6.8. Gas Calibration (One-Alarm Unit)

This section and the next cover calibration using calibration gas cylinders. Bacharach offers a calibration kit that consists of a calibration gas cylinder and a flow regulation valve with flexible non-absorbent tubing and vented calibration hood.

In some cases this option may be expensive relative to sensor exchange because of the cost of visiting a site, calibration gas, etc.

The procedure involves electrical set-up followed by adjustment using calibration gases. Equipment required is as follows:

- Gas cylinder with the appropriate target gas and concentration
- Gas cylinder with zero air
- Fixed flow regulator – rate 0.3L/min
- A voltmeter.

NOTE: This calibration procedure is for a one-alarm unit. For two-alarm units, refer to the calibration procedure in the next section.

First disable the 3-minute alarm delay on a one-alarm system by moving the jumper link at JP1 to the off position. Two adjustments are required and they are both performed on the controller unit.

If the sensor standby voltage (SSV) is greater than the alarm threshold voltage, as in when a gas leak occurs, then an alarm condition occurs (red LED, siren, relay operates).

If the SSV falls below 0.18 V, a fault condition will be shown on the controller (red LED, no siren, relay does not operate).

Step	Adjusting the Sensor Standby Voltage (SSV)
1	Connect a voltmeter between Pins 4 (-Ve) & 2 (+Ve) of the sensor terminal connector block for each channel in turn (CN1, CN2, etc.) and adjust calibration pot (P1, P2, etc.) to the SSV value as per calibration label on side of enclosure (for IR set SSV to 2V).

The alarm threshold voltage (ATV) is the voltage at which the alarm and relay activate at a given gas concentration. This voltage is normally set 3.5V.

Step	Adjusting the Alarm Threshold Voltage (ATV)
1	This voltage (3.5V normal factory setting) is set using: • 1 or 2 channel system controllers - the threshold pot “P3” • 4 or 6 channel system controllers - the threshold pot “P7”
2	Connect a voltmeter between Pins 4 (-Ve) & 2 (+Ve) of the sensor terminal connector block for each channel in turn (CN1, CN2, etc.). Apply calibration gas of the desired concentration to the sensor and wait until the sensor output signal stabilizes, then adjust the pot that corresponds to the channel being calibrated. This should be adjusted until the sensor goes into alarm and the red LED turns on (a voltage of approximately 3.55V). Remove the calibration gas and allow the sensor to return to its standby voltage. Record this voltage reading and keep on record for subsequent electrical set-ups. This is now calibrated for the gas concentration used. Repeat for any subsequent channels. Finally return jumper JP1 to its pre-calibrated position.

6.9. Gas Calibration (Two-Alarm Units)

NOTE: This calibration procedure is for a two-alarm unit. For one-alarm units, refer to the calibration procedure in the previous section.

NOTE: The delay on a two-alarm system is approximately 25 seconds and cannot be deactivated.

All adjustments are performed on the MGD-100 PCB. The Sensor Standby Voltage and two Alarm Threshold Voltages must be adjusted.

Step	Adjusting the Sensor Standby Voltage (SSV)
1	Connect the voltmeter between TP5 (0V) & TP4 (+Ve) and adjust pot RV1 for 0.3V (on IR units SSV is fixed).

Step	Adjusting the Low Alarm Threshold Voltage (ATV)
1	Monitor the voltage between TP5 (0V) & TP4 (+Ve)/0V and VS on IR units.
2	Apply the low concentration calibration gas to the sensor and wait until the sensor output signal stabilizes. Record this voltage.
3	Adjust P8 to the new value. Record and use the new value for subsequent electrical set-ups.

Step	Adjusting the High Alarm Threshold Voltage (ATV)
1	Monitor voltage between TP5 (0V) & TP4 (+Ve)/0V and VS on IR units.
2	Apply the high concentration calibration gas to the sensor and wait until the sensor output signal stabilizes. Record this voltage.
3	Adjust P7 to the new value. Record and use the new value for subsequent electrical set-ups.

CAUTION: The high alarm threshold voltage must be set higher than the low alarm threshold or the unit will not function correctly.

Section 7. Troubleshooting

Symptom	Possible Cause(s)
No lights displayed on panel	• Power failure (check supply) • Tripped circuit breaker or blown fuse on electrical supply • Blown fuse at the electrical supply on the controller PCB board
Red light is on, but no alarm condition is active (i.e., no siren and no relay operation after 3 minutes)	• Make sure the siren has not been deactivated (key switch on two-alarm, controllers, link on jumper JP1 on one-alarm controllers removed). • This indicates a wiring or sensor fault (call service provider). If these are in order the calibration pot may have been adjusted and may need to be reset. Check with us for instructions.
Controller is on, but the MGD 100(s) is not	• This may indicate a wiring fault between the controller and sensor or a sensor fault. Check power supply to the controller. Check connections between the controller and the sensor to ensure that the wires from positions 1 to 4 on the sensor are connected to the corresponding 1-4 on the controller. • On a 4 to 6 channel unit check that the sensor fuse on the particular sensor connection position in the controller is not blown.

NOTE: If false alarms are being triggered by background gases, paint fumes, etc., or extreme humidity or temperature conditions, you may adjust the settings to compensate.

One-Alarm Systems: You should reduce the SSV level in 0.5V increments until the condition clears.

Two-Alarm Systems: You should adjust the relevant alarm threshold voltage upwards in 0.2 V increments until the condition clears.

To make sure the gas detectors are wired up correctly you can check the voltages at the sensor cable terminal blocks on the controller PCB or sensor PCB using a voltmeter as outlined below in Table 1.

Place the negative probe on terminal position 4 and with the positive on 1, 3, 2, check the values. The readings are lower at the sensor due to power drop in the line.

The terminals should have the values shown in the table below.

You can monitor this as follows:

- **One-Alarm Systems:** Connect a voltmeter and monitor voltage between Pins 4 (-Ve) & 2 (+Ve) of the sensor terminal connector block for each channel in turn (CN1, CN2 Etc.) For IR monitor between 0V and VS.
- **Two-Alarm Systems:** Connect voltmeter and monitor voltage between TP5 (0V) & TP4 (+Ve). For IR monitor between 0V and VS.

Table 1. Connections Correct Values

Position Number	At the Sensor	Controller	Without Sensor Fitted
4	Is the negative side of the power supply	Negative	Negative
1	Power supply 7.2V minimum reading, unless you have power drop reduction.	+10V	+12-15V
3	Approximately 4-5V	+4.8-5V	+5V
2	one-alarm system - Sensor standby voltage* as shown on the calibration label on the side of the enclosure. two-alarm system - Typical internal reference values, approximately	(0=Fault)	0
		+0.4V	Sensor in standby
		+1.6V	Low Alarm Condition
		+2.8V	High Alarm Condition

* *The voltage signal from the sensor will start high and gradually fall (in clean air) to the SSV value shown on the calibration label. IR unit will display 0Volts until the 2 minute warm-up has finished.*

DECLARATION OF CONFORMITY

The manufacturer of the products covered by this declaration:	Bacharach, Inc. 621 Hunt Valley Circle New Kensington, PA 15068
Year(s) conformity is declared:	2012 (IEC/EN61010), 2011 (EN61326/EN55011)
Product(s):	MGD
Model(s):	MGD-100

The undersigned hereby declares that the above referenced products are in conformity with the provisions of the following standard(s) and is in accordance with the following directive(s).

Directive(s):

2004/108/EC	EU EMC Directive
2006/95/EC	Low Voltage Directive (LVD)

Standard(s):

IEC 61010-1: 2010 EN 61010-1: 2010	Safety Standards	Electrical Equipment for Measurement, Control, and Laboratory Use; Part 1: General Requirements
EN 61326-1: 2006	Electromagnetic Compatibility (EMC) Standards	Electrical Apparatus for the Detection and Measurement of Combustible Gases, Toxic Gases, or Oxygen

Signature: ______________________

Name: Doug Keeports
Title: VP of Product Development
Date: 5 October 2012

The technical documentation file required by this directive is maintained at the corporate headquarters of Bacharach, Inc.

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