IAM•100

Integrated Area Monitor and Optional 16-Channel Controller

Installation and Operation Manual
Instruction 6209-9000
Rev 0 – December 2012

Product Leadership • Training • Service • Reliability

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Section 1. Overview

1.1. Introduction

The IAM-100 is a system that combines sensor and monitoring features in an integrated unit. It is a stand-alone system used to detect gases in an area, room, zone, airspace or airflow.

The IAM-100 can be expanded into large gas detection systems using the optional IAM controller.

Up to 16 IAM-100s can connect to an IAM controller. The controller shows any sensor in alarm and has relays for control purposes. These controllers can be connected to each other enabling the construction of large gas detector systems.

1.2. Applications

The IAM-100 is an ideal solution for gas detection in the following occupied spaces:

- hotel rooms
- conference rooms
- apartment blocks
- office buildings
- air conditioned spaces
- storage facilities.
- theaters
- airports
- light industrial spaces
- large systems requiring many sensors.

Typical applications include the following.

Application Category	Examples
Refrigerant gases	Ammonia, Hydrocarbons, and Halocarbons (HFCs, HCFCs, CFCs)
Combustible gases	Methane, LPG, Propane, Butane, and Hydrogen
Volatile Organic Compounds (VOCs)	Acetone, Benzene, Carbon Tetrachloride, Chloroform, Ethanol, Toluene, Trichloroethylene

Figure 1. IAM-100

Figure 2. Optional IAM-100 Controller

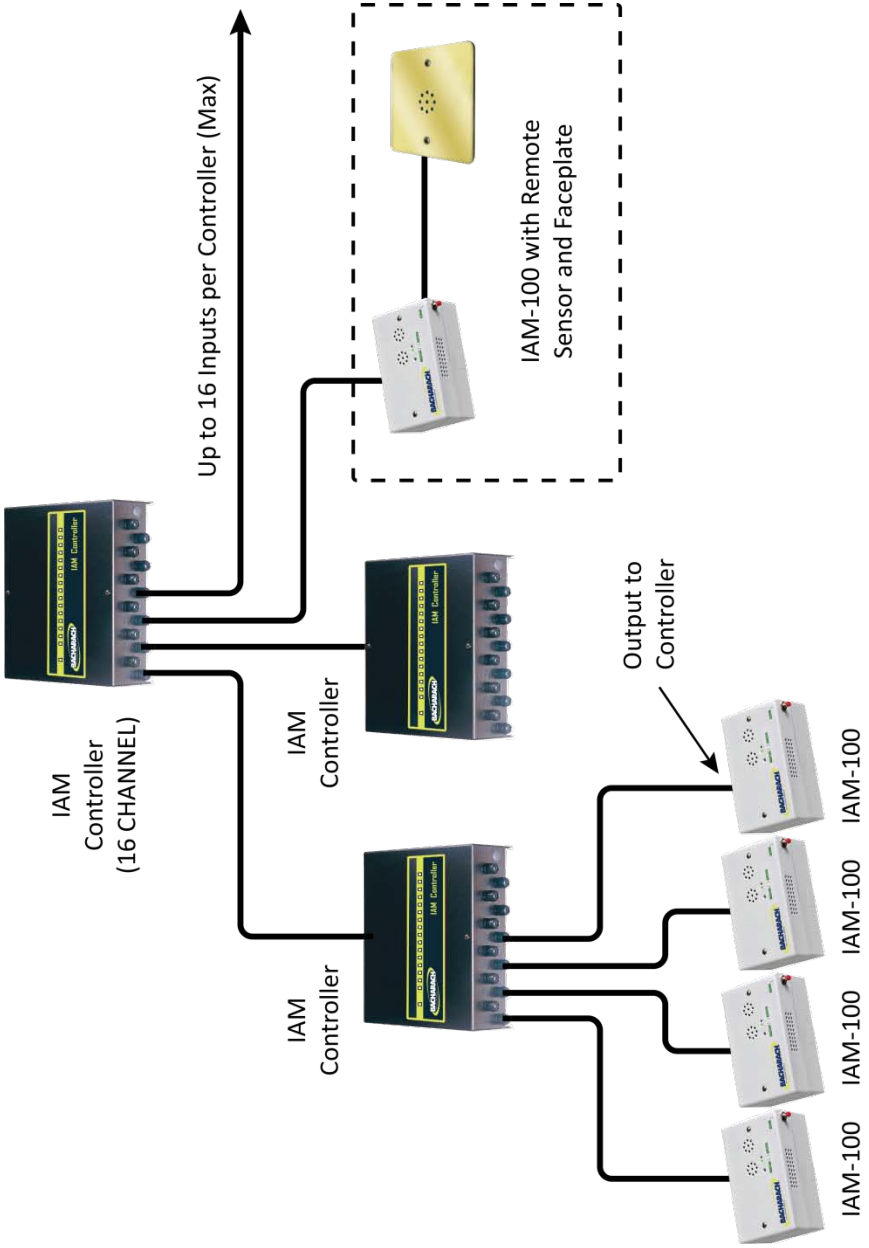


Figure 3. Sample Architecture Diagram

1.3. Specifications

Specification	IAM-100	IAM Controller
Operating Power Supply	230 VAC, 50 Hz; 11 W Max 120 VAC, 60 Hz; 11 W Max	230 VAC, 50 Hz; 11 W Max 120 VAC, 60 Hz; 11 W Max
Power Status	Green LED	Green LED
Alarm Status	Red LED	Red LED
Fault Status	Siren inactive, Green LED off, and Red LED on	Siren inactive, Green LED off, and Red LED on
Audible Alarms	Internal siren with mute button	External siren with mute button
Siren Deactivate	By onboard jumper	By key switch
Alarm Relays	2 Relays: 1 A @ 24 VDC	2 Relays: 10 A @ 230/120 VAC
Alarm Reset	Selectable manual or automatic	Remote reset, down stream which will reset any IAM-100 monitor or controller connected to a channel, once gas has cleared
Selectable Alarm Delay	0, 5, 10 or 15 minutes	N/A
Warm-up Delay	5 minutes	N/A
Enclosure Rating	Standard: IP41	IP51
Dimensions & Weight	See housings table on page 9	262 x 265 x 84 mm; 2.6 kg 10.3 x 10.4 x 3.3 in; 5.7 lb
Cable Recommendations	16-24 AWG, 2-conductor	16-24 AWG, 2-conductor
Approvals	CE UL/CSA/IEC/EN 61010-1 (Pending)	UL/CSA/IEC/EN 61010-1 (Pending)

IAM-100 Housings	Specifications			
Standard	Size: Weight:	147x88x62 mm 633 g	(5.8x3.5x2.4 in) (1.4 lbs)	
IP66	Size: Weight:	175x165x82 mm 800 g	(6.9x6.5x3.2 in) (1.8 lbs)	
IP66 with Splash Guard	Size: Weight:	175x225x82 mm 872 g	(6.9x8.9x3.2 in) (1.9 lbs)	
Splash Guard	Size: Weight:	75x50 mm 72 g	(3.0x2.0 in) (0.2 lbs)	
IP66 with Remote Head	Size: Weight:	175x155x82 mm 960 g	(6.9x6.1x3.2 in) (2.1 lbs)	
Remote Face Plate	Size: Weight:	86x86 mm 86 g	(3.4x3.4 in) (0.2 lbs)	

Category	Sensor Characteristics
Measurement Range	10 to 10,000 ppm (typical)
Temperature Range	-20ºC to +50ºC (IP66: -40 to +50C)
Humidity Range	0 to 95% Non condensing
Sensor Life Time	5 to 8 years (typical) for semiconductor sensors
Calibration Frequency	See local regulations (annual test or calibration typical). Semiconductor sensors are non-selective, but calibrated to a specific gas.

Examples	Gas/Formula	Typical Range
Refrigerants	HFCs (R134a, R404A, R407, R410A, R507), HCFCs (R22), and CFCs (R11, R12)	10-10,000 ppm
	Ammonia (NH_3)	0-10,000 ppm
Hydrocarbons	Methane (Natural gas), Propane, Butane, LPG, Isobutane, H_2	0-10,000 ppm
VOCs	Acetone, Chloroform, Ethanol, Methanol, Methyl and Methylene Chloride, Ethyl and Ethylene Chloride	0-10,000 ppm

Section 2. Placing Sensors

2.1. General Guidelines

The IAM-100 and optional controller (if applicable) 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 (500 mm) from the main power supply and telephone cables.

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

NOTE: IAM-100 and optional controllers must be located within the appropriate wire lengths from the central control unit (if used).

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.

An optional response delay may be activated to minimize the possibilities of false alarms.

2.2. 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.

2.3. 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.

2.4. 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 then 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 down 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.

2.5. 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

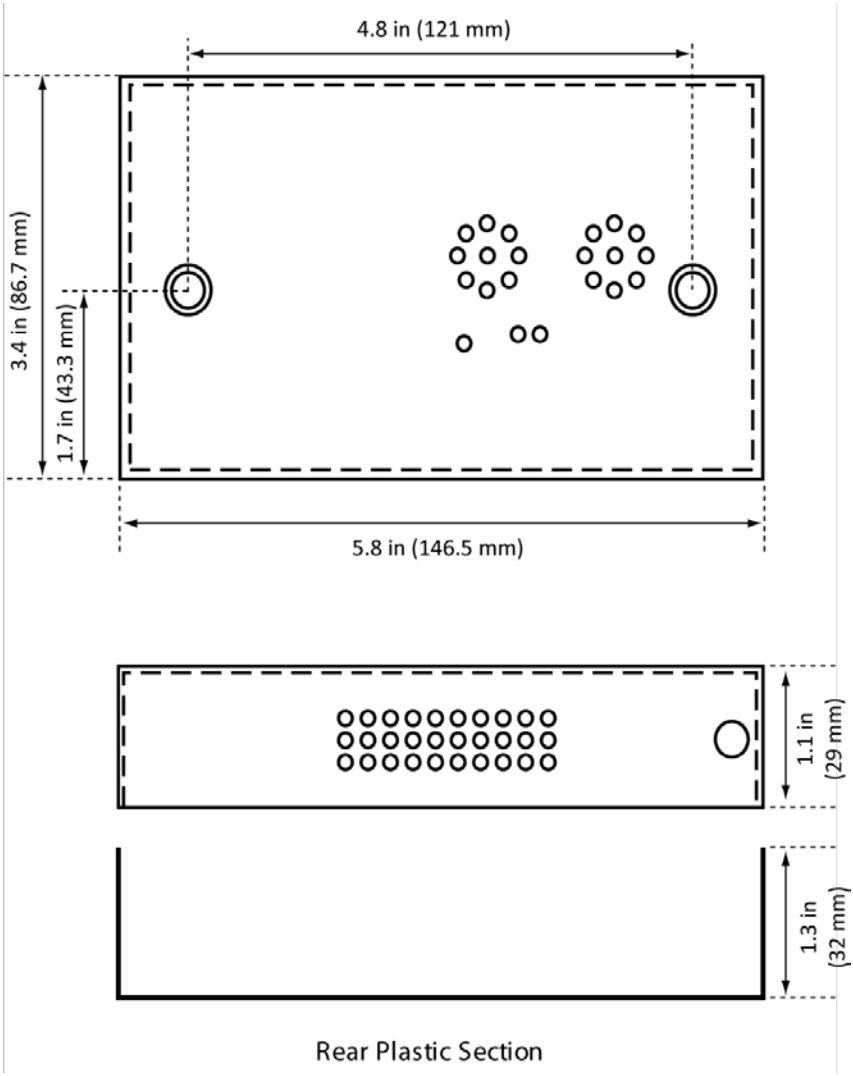


Figure 4. Dimensions of the IAM-100 Standard Housing

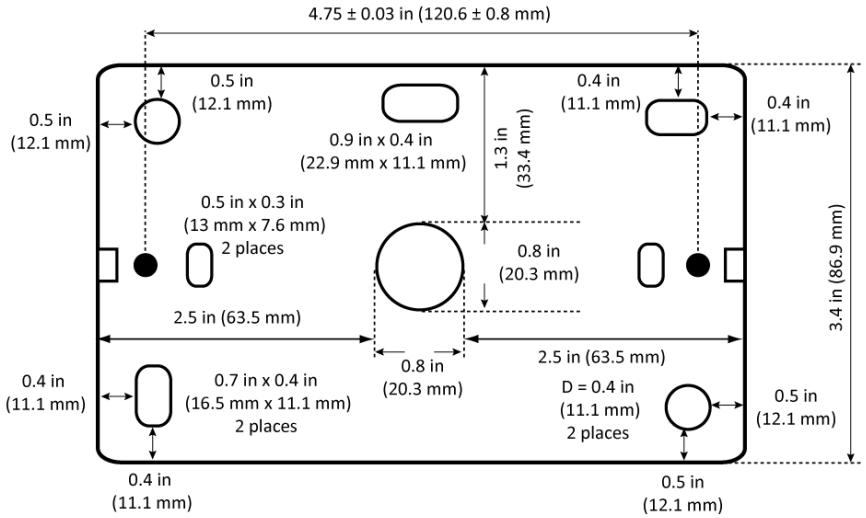


Figure 5. Typical Dimensions of the IAM-100 (Back)

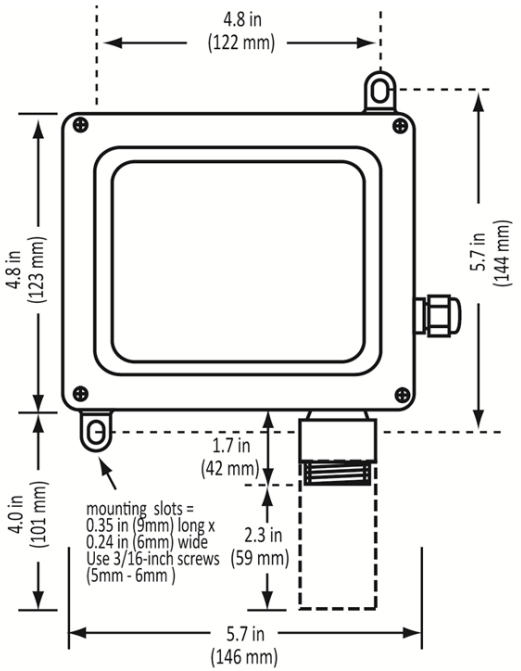


Figure 6. IP66 Housing (with Optional Splash Guard)

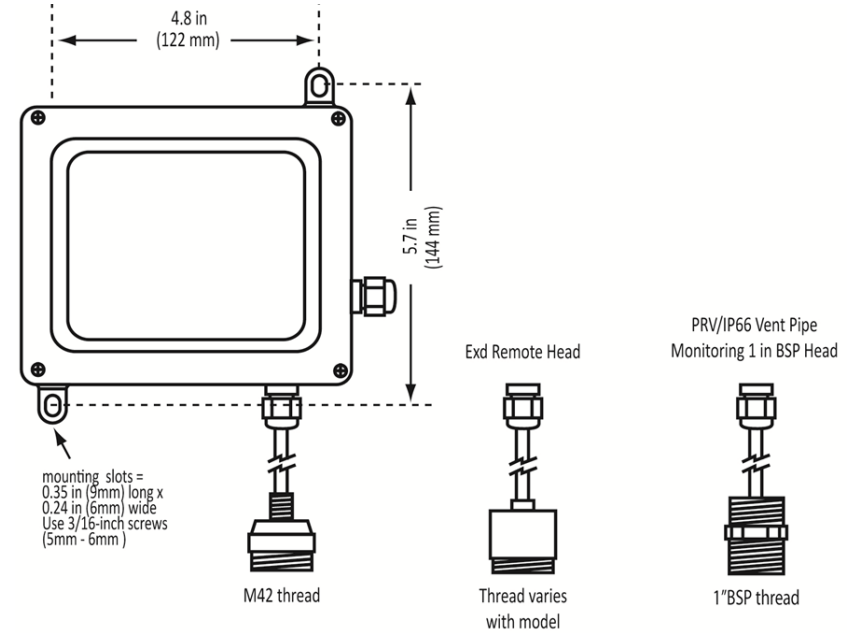


Figure 7. IP66 Housing with Remote Sensor Head

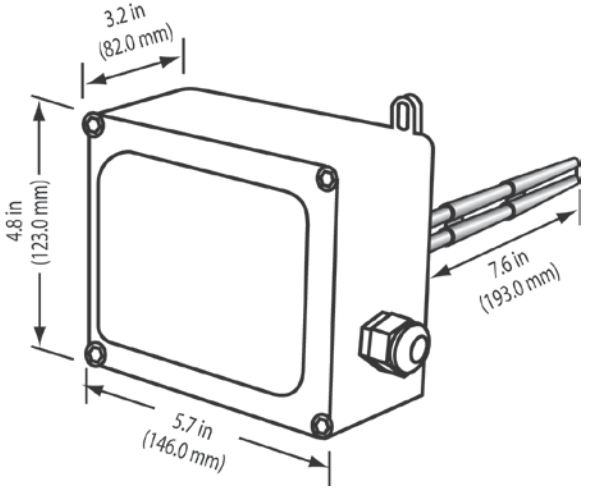


Figure 8. IP66 Housing with Airflow Duct Mount

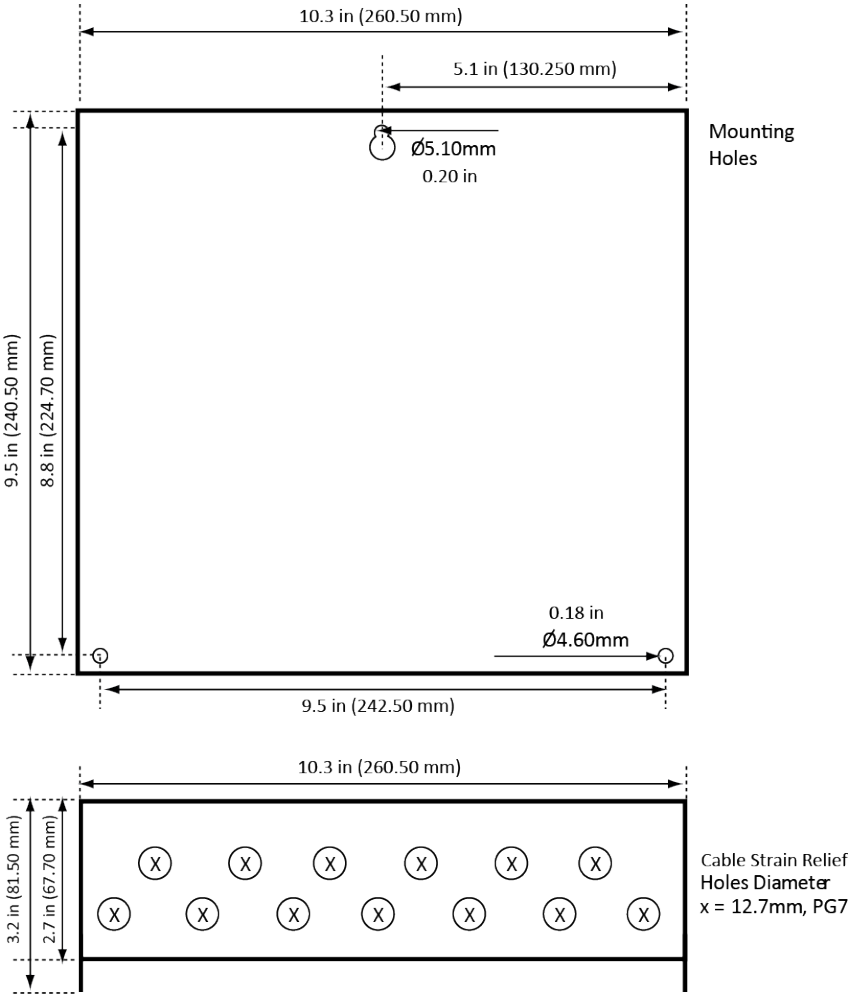


Figure 9. Controller Housing

Section 4. Wiring Instructions

4.1. Overview

Open the IAM-100 by removing the two front cover screws. Remove the metal faceplate and locate the connection terminals.

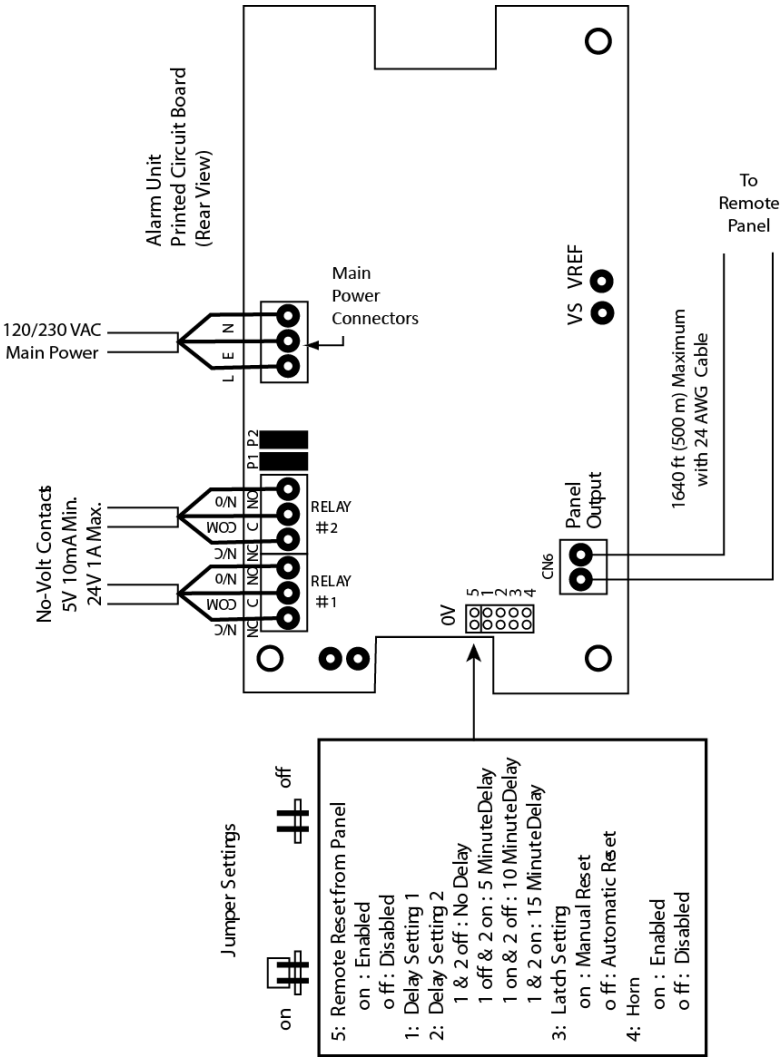


Figure 10. IAM-100 Internal Components

NOTE: The maximum wire size into terminal blocks is 16 AWG.

Step	Wiring Instructions
1	Connect the output to the remote IAM-100 Controller at CN6 (see Figure 10) using two-wire cable. It does not matter which wire goes into which terminal. If installing a stand alone IAM please ignore.
2	Relay Outputs - connect to NO or NC as required for one or both relays at positions CN4 and CN5. Relays are rated at 24 VDC/120 VAC 1A Max.
3	Set relay and sounder response delay using jumpers on header HD1 at position 1 and 2. Factory default setting is 0 minutes.
4	Set Latch using jumper on header HD1 at position 3. Factory default is Manual Reset.
5	Set Sounder condition using jumpers on header HD1 at position 4. Factory default is Enabled.
6	Set remote reset facility using jumper on HD1 at position 5. Factory default is Enabled.
7	Connect main power 120/230V LNE to terminal CN3 labeled LEN (connector block max wire size is 2.5 mm).

NOTE: Connection to main power supply must be via an approved readily accessible, switched spur and fused (3 Amp fuse) or as per local wiring regulations which should be within 3 meters (10 feet) of the controller. It should be part of the building installation and be marked as the disconnect for the device.

- The main power cable used should be of an approved type HAR, Cenelec approved, or locally approved equivalent.
- If replacement of the main fuse is required, use like for like.

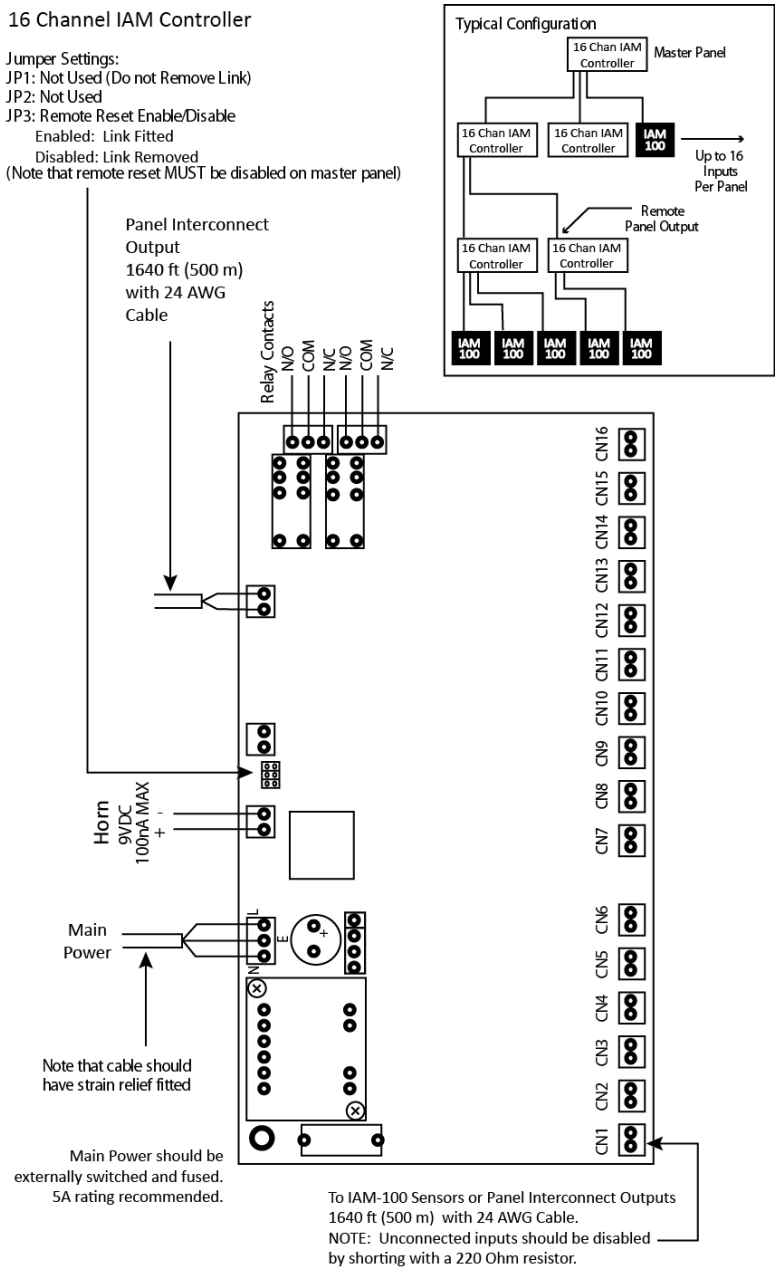


Figure 11. Controller Internal Components

4.2. Remote Sensor Head Installation

If you do not wish to surface mount the IAM or need to match room decor, we can supply a remote sensor with a decorative faceplate (standard: brushed stainless steel). The remote sensor is mounted in an electrical back box 44mm deep to which the vented face plate is fitted.

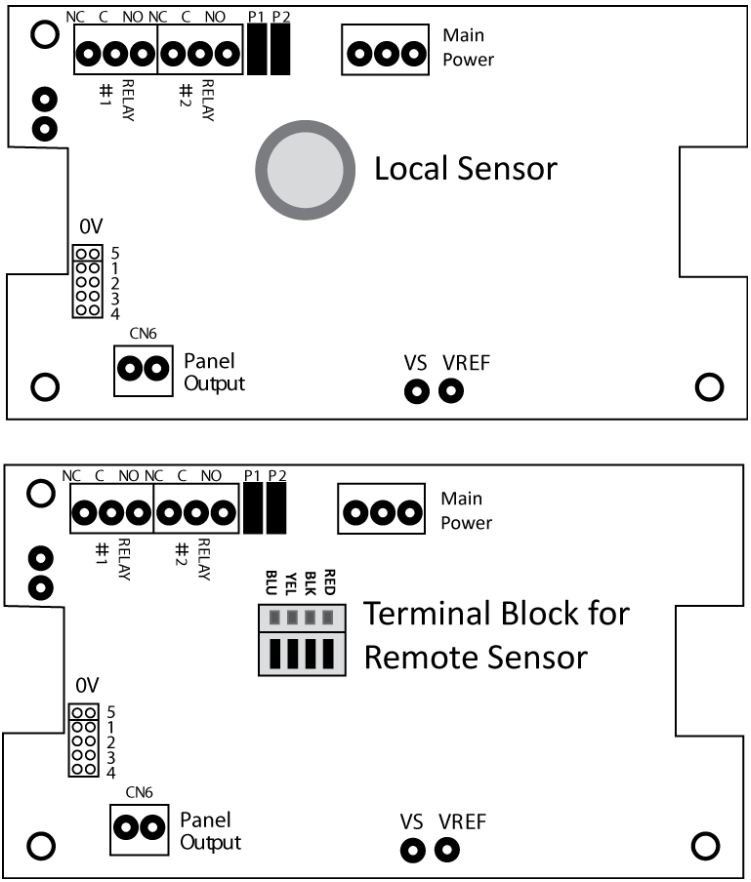


Figure 12. Local vs. Remote Sensor

NOTE: For remote sensor configurations, the sensor is mounted on a small remote sensor board that connects to the IAM-100's main PCB via a 4-wire connecting cable.

Step	Instructions
1	Remove the connector from the sensor PCB to feed the cable through conduit, the IAM-100 enclosure knockouts, and the remote sensor board backbox as needed.
2	Immediately refit the connector to the sensor board in the backbox. The IAM-100 and its corresponding remote sensor must be kept together as they are calibrated together and are a matched pair. To prevent mix-up, do not remove the sensor boards from a number of units at the same time unless you: • label the individual "pairs", or • ensure you verify that the serial number on the main PCB ***and*** the remote sensor PCB are the same when re-installing.
3	If construction is in process, fit a standard plastic blanking plate immediately after you install the sensor in the back box to avoid dust or damage to the sensor. You can fit the stainless steel vented plate when construction is completed.

IMPORTANT: Cleaning the decorative face plate should be limited to light dusting. It should not be sprayed with cleaning/ polishing aerosols.

Section 5. Operating Instructions

5.1. IAM-100

Operation State	Operating Instructions
Power Up	On power up there is an initial warm-up delay of 5 minutes, during which the green LED will flash at 1 second intervals. After warm-up, the green LED remains on (constant).
Fault Condition	Fault condition: • the green LED will be off • the red LED will be on • external interface to the optional IAM Controller panel will activate and show the fault condition on that panel
Alarm Condition	In alarm condition: • the green LED stays on. • the red LED will be on. • the siren operates (if it has not been disabled and after a delay if this option has been selected). • the relay output activates (after a delay if this option has been selected). • external interface to the optional IAM Controller will be turned on. • The mute button on the exterior of the case may be pressed. (This will switch the sounder off if the sounder disable option is not selected). • The reset button is accessible via a hole in the front panel, to the left of the green LED. This may be pressed to reset the alarm if the manual reset option is enabled (reset is only effective when the gas has cleared from around the alarm unit, indicated by the red LED turning off). A non-metallic object (e.g., match or toothpick) should be used to operate the reset button. • If automatic reset is enabled, the alarm will reset by itself without user intervention.

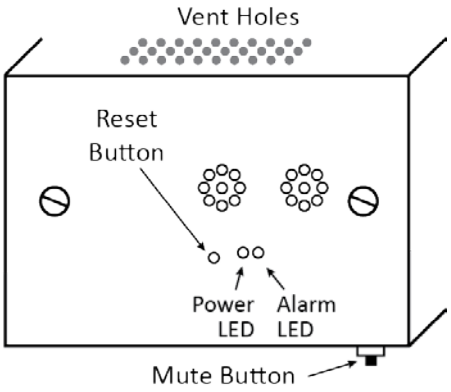


Figure 13. Reset Button, Mute Button, and Vent Holes

5.2. IAM Controller

State	Operating Instructions
Power Up	On power up the green LED will flash and will stay on if there are no faults.
Faults	If there are faults in any sensor on the system the green LED will go off and the red led will light indicating the sensor in fault. The output to a master or upstream panel will activate and show the fault condition also on that panel.
Errors	Should an alarm occur: • the green LED stays on • the red LED on the relevant channel comes on • the relays operate • the siren operates (can be muted by key switch) • the output to a master or upstream operates to indicate there is a fault downstream.

NOTE: If all the red LEDs are blinking approximately every 5 seconds on a master panel then remove the link on Jumper position JP3 as this should be in the disabled position on a master panel. (Factory default setting is disabled).

5.3. End-User Requirements

You should agree these important functions with the customer so that the system will operate as required.

Requirement	Description
Time Delay Response	Available on the audible alarm and relays to avoid false alarms, which is set with jumpers. The default delay is 0 minutes. You may wish to set to 15 minutes during start up and construction as you may have VOC (volatile organic compounds) fumes, paint etc in the rooms. They should be reset as required.
Siren	The units have an internal siren. You can disable this by jumper but the default setting is "enabled" in compliance with EN378. The customer may not want local alarms especially if you are connecting to a remote monitoring system. Check the customer's preference.
Reset	In the event of an alarm, you can have the units automatically reset or latch and require manual resetting. The default is latch/manual reset. If you are connected to a remote monitoring system you may prefer auto reset as being more convenient. However, if you prefer manual reset you will need to reset it after an alarm. If the unit is connected to an IAM Controller, you can also remotely reset the IAM alarm if enabled on the IAM-100 *and* if jumper JP3 is enabled on the IAM Controller.

Section 6. Functional Tests and Calibration

6.1. Overview

NOTE: The IAM-100 is calibrated at the factory and is not required to be calibrated at the time of installation.

IMPORTANT: If the IAM-100 is exposed to a large leak it should be tested to ensure correct functionality, and the sensor replaced if necessary.

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.

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: 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. 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.

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 perform the bump test:

- Advise occupants, plant operators, and supervisors.
- Check if the IAM-100 is connected to external systems and disconnect as instructed by the customer.
- Deactivate the alarm delay (if active) by removing the alarm delay jumpers per Figure 11.
- For bump test or calibration the IAM-100 should be powered up overnight.

6.2. Bump Testing

After installation, the units should be bump tested. Expose the sensors to test gas (NH_3, CO_2, etc.).

The bump test should put the system into alarm. The red LED will light showing the system is in alarm. The delay will prevent the siren sounding and relay switching (if delay is set).

To test the siren and or relay function, check the delay is set at zero using the header positions 1 and 2 (as shown in Figure 10) and expose to gas as above. You can mute the siren using the mute button.

After the gas has cleared and the red LED has switched off you can reset the alarm relay and siren by using the reset button (if manual reset has been selected).

Before testing the sensors on site the IAM-100 must have been powered up and allowed to stabilize for several hours, preferably overnight.

When testing the sensors, also ensure that the IAM Controller functions correctly (if installed) per section 6.4.

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

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

NOTE: Do not pressurize the sensor.

NOTE: You MUST use calibration gas in a balance of air (*not* N_2).

NOTE: Prior to carrying out a bump test, check and adjust the zero setting. Refer to Section 6.3.

Step	Bump Testing Using Calibration Gas Cylinders
1	Remove the enclosure lid of the gas detector (not in an exhaust area).
2	Connect a voltmeter to 0V and VS to monitor sensor response.
3	Expose the sensor to gas from the cylinder. You can place the entire IAM-100 into a plastic bag or use a plastic hose/hood to direct gas to the sensor. A response of above 80% is acceptable.

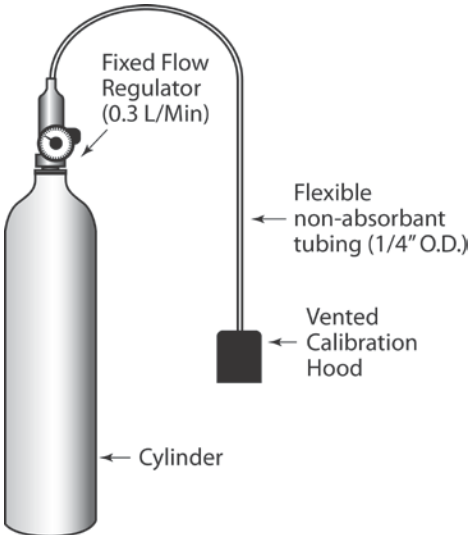


Figure 14. Gas Cylinder and Test Hardware

6.3. Checking and Setting the Zero Setting

Tools Required:

- A voltmeter (crocodile clips are recommended)
- Factory standby (zero) voltage from side label
- Screwdriver

Step	Checking and Setting the Zero Setting
1	Ensure that the IAM-100 is stabilized (on for more than 24 hours)
2	Connect the voltmeter between 0V and VS.
3	Compare the reading of the voltmeter to the factory standby voltage. Then adjust P1 as necessary until the voltmeter reading matches the factory standby voltage.

6.4. IAM Controller

If the installation has an IAM Controller, when testing the sensors also ensure that the controller's functions are activating accordingly.

Red LED	indicating which sensor is in alarm
Siren	if connected
Relays	if enabled
Reset Function	if enabled

Section 7. Troubleshooting

All IAM-100 units are checked and calibrated before shipping.

Symptom	Possible Cause(s)
Green and Red light off	• Check power supply. Check wiring. • IAM-100 was possibly damaged in transit. Check by installing another IAM-100 to confirm the fault.
Red light on, green led off (indicates a fault)	• Sensor may be disconnected from printed circuit board. Check to see sensor is properly inserted into board. • The sensor element has been damaged or has reached the end of life and needs to be exchanged. Contact Bacharach for instructions and support.
Alarms in the absence of a leak	• If you experience alarms in the absence of a leak, try setting an alarm delay. • Perform a bump test to ensure proper operation. • During operation record any alarms. Establish the cause or likely cause if no obvious leak has occurred.

CE DECLARATION OF CONFORMITY

The manufacturer of the products covered by this declaration:	Bacharach, Inc. 621 Hunt Valley Circle New Kensington, PA 15068
Year conformity is declared:	2010 (EMC: IAM-100 only), 2012 (Safety)
Product(s):	IAM
Model(s):	IAM-100 and Controller

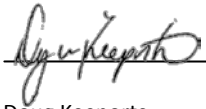
The undersigned hereby declares that the above referenced products are in conformity with the provisions of the following standard(s) and is in accordance with the following directive(s).

Directive(s):

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

Standard(s):

Safety Standards (Pending)	IEC 61010-1: 2010 EN 61010-1: 2010
Electromagnetic Compatibility (EMC) Standard	EN 61326-1: 2006

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.

World Headquarters
621 Hunt Valley Circle, New Kensington, Pennsylvania 15068
Phone: 724-334-5000 • Toll Free: 1-800-736-4666 • Fax: 724-334-5001
Website: www.MyBacharach.com • E-mail: help@MyBacharach.com