AT-G-SENSE
**Gas Sensing System**

**INSTALLATION & OPERATING MANUAL**

aquilar - leak detection solutions

### *INTRODUCTION*

The AT-G-SENSE 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 AT-G-SENSE can be expanded into large gas detection systems using the optional AT-GSC-16 controller. Up to 16 AT-G-SENSEs can connect to an AT-GSC-16. 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.

### *APPLICATIONS*

The AT-G-SENSE 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 | Acetone, Benzene, Carbon Tetrachloride, Chloroform, Ethanol, Toluene, Trichloroethylene |

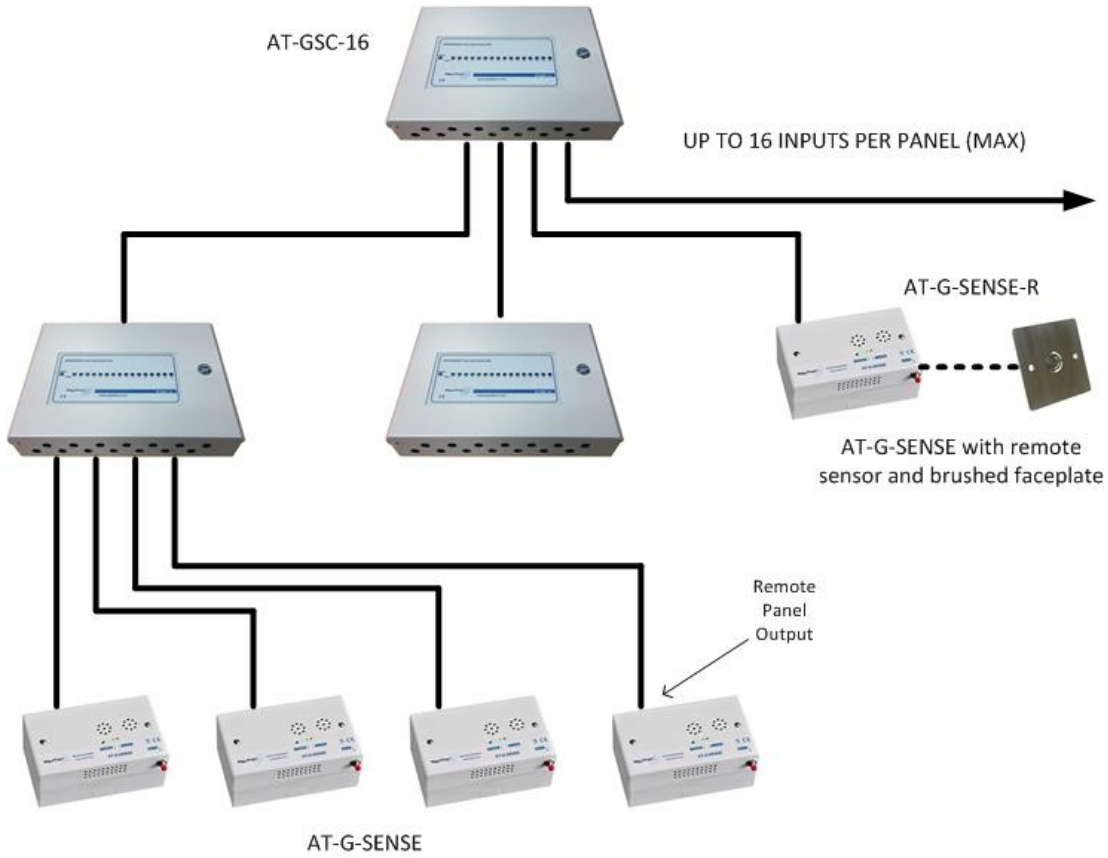
### *SPECIFICATIONS*

| Specification | AT-G-SENSE | AT-GSC-16 |
|---|---|---|
| Operating Power Supply | 11W Max 230VAC 50Hz | 11W Max 230VAC 50Hz |
| 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 (Volt Free) | 2 Relays: 1A @ 24VDC | 2 Relays: 10A @ 230/120VAC |
| Alarm Reset | Selectable manual or automatic | Remote reset, downstream resets any AT-G-SENSE or AT-SC-16 connected to a channel, after gas clears |
| Selectable Alarm Delay | 0, 5, 10 or 15 minutes | N/A |
| Warm-up Delay | 5 minutes | N/A |
| Enclosure Rating | Standard: IP30 | IP51 |
| Dimensions | See housings table | |
| Cable Recommendations | 7/0.2mm, 2 conductor (16-24 AWG, 2 conductor) 300m max | 7/0.2mm, 2 conductor (16-24 AWG, 2 conductor) 300m max |
| Approvals | CE, UL/CSA 61010-1, WEEE RoHS EuP | CE, UL/CSA 61010-1, FCC Part 15, Subpart B, WEEE RoHS EuP |

| AT-G-SENSE Housings | Specifications |
|---|---|
| Standard | Size: 147x82x62mm<br>Weight: 633g |
| Faceplate (Brushed Steel) | Size: 86x86mm<br>Weight: 86g |

| Category | | Sensor Characteristics | |
|---|---|---|---|
| PPM Range | | 10 to 10000ppm (typical) | |
| Temp Range | | -20°C to +50°C | |
| Humidity Range | | 0 to 95% Non-condensing | |
| Sensor Life Time | | 5 to 8 years (typical) for semiconductor sensors | |
| Typical Time to Alarm | | 24 seconds (response times may vary based on temperature of operation, enclosure and environmental conditions) | |
| Calibration Frequency | | See local regulations (annual test or calibrations typical). Semiconductor sensors are non-selective, but calibrated to a specific gas | |
| **Gas Type** | **Formula** | **Typical Range** | **Standard Alarm Setpoints** |
| HFCs | R134a, R404A. R407, R410A, R507 | 10-10000ppm | Refrigeration: 1000ppm<br>Air Conditioning: 10000ppm |
| HCFCs | R22 | 10-10000ppm | Refrigeration: 1000ppm<br>Air Conditioning: 10000ppm |
| CFCs | R11, R12 | 10-10000ppm | Refrigeration: 1000ppm<br>Air Conditioning: 10000ppm |
| Hydrocarbons | Methane (Natural Gas), Propane, Butane, LPG, Isobutane, H2 | 0-10000ppm | 5000ppm |
| Ammonia | NH3 | 0-10000ppm | Up to 10000ppm |
| VOCs | Acetone, Chloroform, Ethanol, Methanol, Methyl, Methylene Chloride, Ethyl, Ethylene Chloride | 0-10000ppm | 1000ppm |

***SAMPLE ARCHITECTURE DIAGRAM***



## *PLACING SENSORS*

General Guidelines

**NOTE:** This instrument can be equipped with a semiconductor sensor for the detection of refrigerant, combustible gases 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 performance.

The AT-G-SENSE and optional AT-GSC-16 (if applicable) should be positioned carefully to avoid mechanical damage (from moving machinery, doors etc) ad thermal extremes (close to heaters). Unprotected units should not be placed directly in areas with strong drafts, airflows and/or areas where water or moisture is present unless an appropriate enclosure is used.

Avoid routing cabling outside of premises or between buildings via overhead cables. Also, sensor wiring should be kept to 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 strain relief is used. Use a cable tie inside the enclosure within 25mm of the cable termination.

**NOTE**: The AT-G-SENSE and optional controllers must be located within the appropriate wire lengths from the AT-GSC-16 (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.

## *MACHINERY ROOMS*

There is NO ABSOLUTE RULE in determining the number of sensors and their location. 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 raised. 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. Most vulnerable 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 discernable 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.
- With heavier than air gases such as halocarbon and hydrocarbon refrigerants such as R404A, propane and butane, sensors should be located near ground level.
- With lighter than air e.g. ammonia, the sensor needs to be located above the equipment to be monitored e.g. on a bracket or high on a wall within 300mm of, or on the ceiling provided there is no possibility of a thermal layer trapped under the ceiling preventing gas reaching the sensor. (NB. At very low temperatures, such as in a refrigerated cold store, ammonia gas becomes heavier than air).
- With similar density or miscible gases, such as CO or CO2, sensors should be mounted about head height – 1.5m.
- Sensors should be positioned a little way back from any high-pressure parts to allow gas clouds to form. Otherwise any leakage of gas is likely to 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 pipe is fitted to the system, it may be a requirement to mount a sensor to monitor this vent pipe. It should be positioned about 2m above the PRV to allow gas clouds to form.

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

## *REFRIGERATED SPACES*

In refrigerated spaces sensors should be located in the return airflow to the evaporators on a sidewall, below head height 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.

### *CHILLERS*

In the case of small water or air-cooled enclosed chiller units, mount the sensor so as to monitor the 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 as to monitor airflow to the extract fan.
- With large units also place a sensor inside the enclosure 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 sensors 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.

### *AIR CONDITIONING (Direct Systems VRF/VRV)*

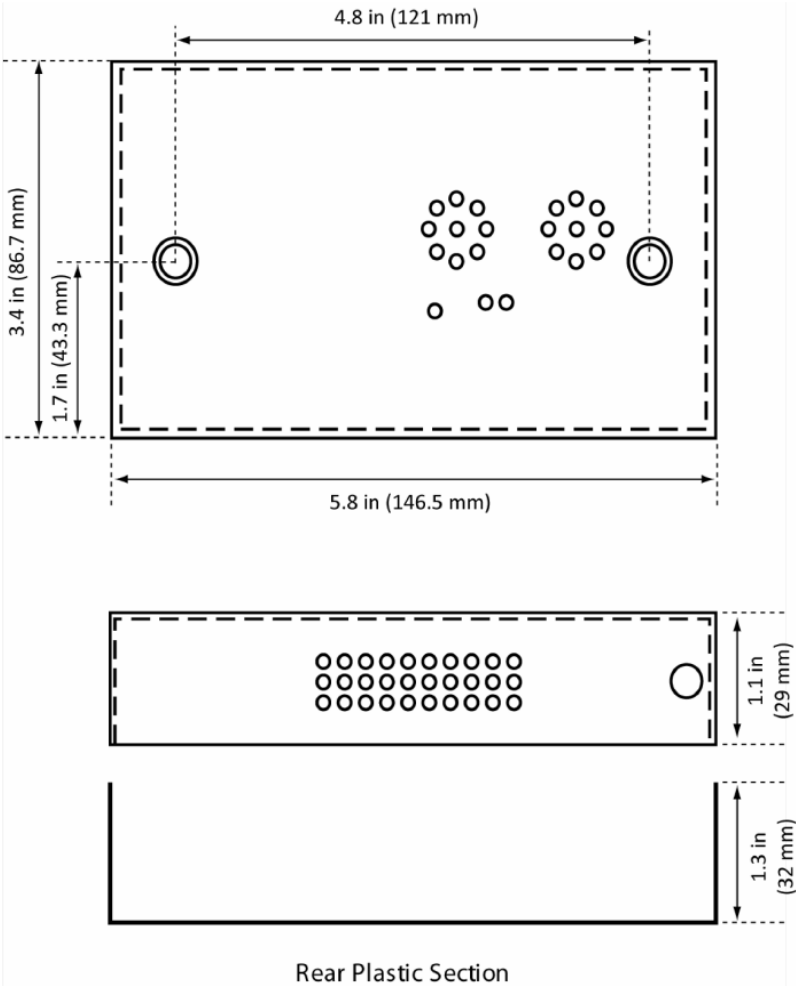
For compliance with EN378, at least one sensor shall be installed in each occupied space being considered and the location of detectors shall be chosen in relation to the refrigerant and they shall be located where the refrigerant from the leak will collect. In this case, refrigerants are heavier than air and detectors should have their sensors mounted low, e.g. at less than bed height in the case of a 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.

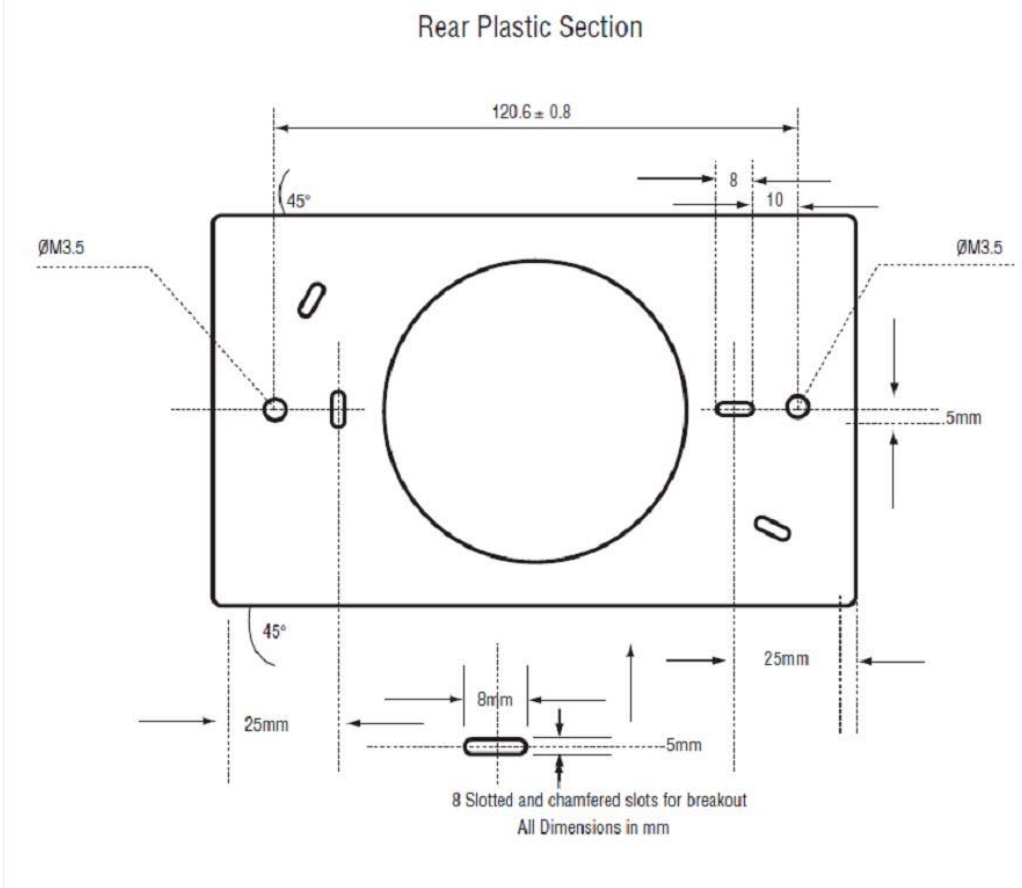
| Do Mount In-Room Sensors… | Don't Mount Sensors… |
|---|---|
| …at less than the normal heights of the occupants. E.g. in a hotel room this is less than bed height (between 200mm and 500mm) off the floor. | …under mirrors. |
| …away from drafts and heat sources like radiators, etc. | …at vanity units.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

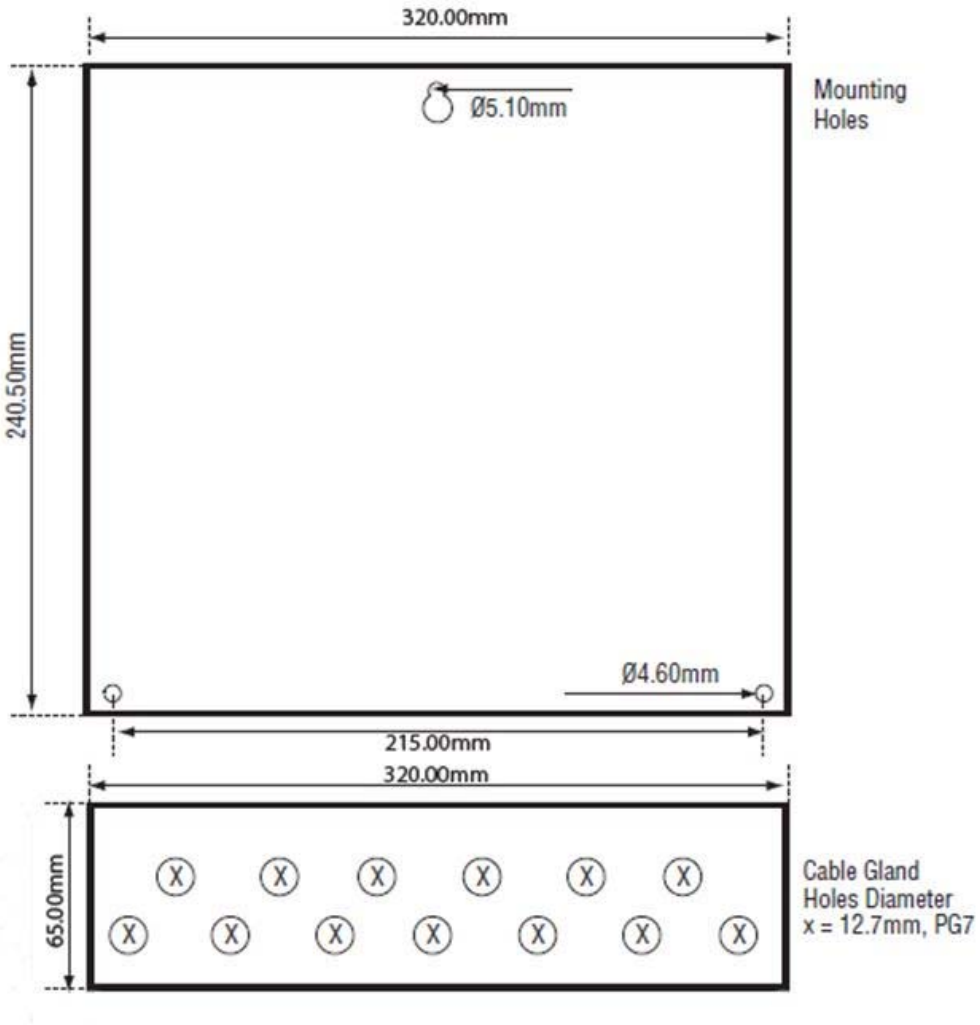
**IMPORTANT:** Carefully consider ramifications of using too few sensors. A few extra sensors could make a significant difference if a gas leak occurs.

***HOUSING DIMENSIONS***



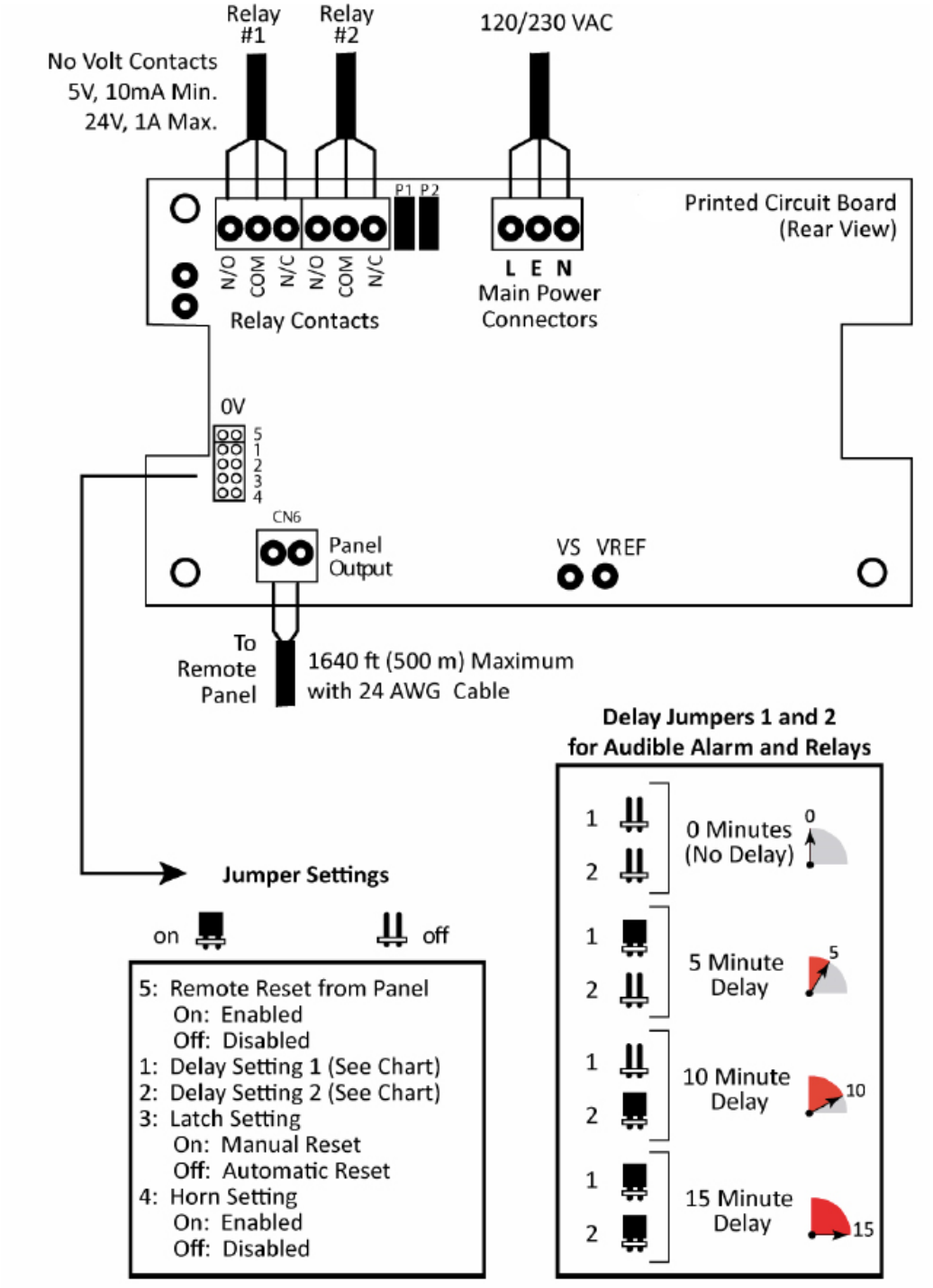

Rear Plastic Section





***WIRING THE AT-G-SENSE***

Open the AT-G-SENSE by removing the two front cover screws. Remove the metal faceplate and locate the connection terminals.




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

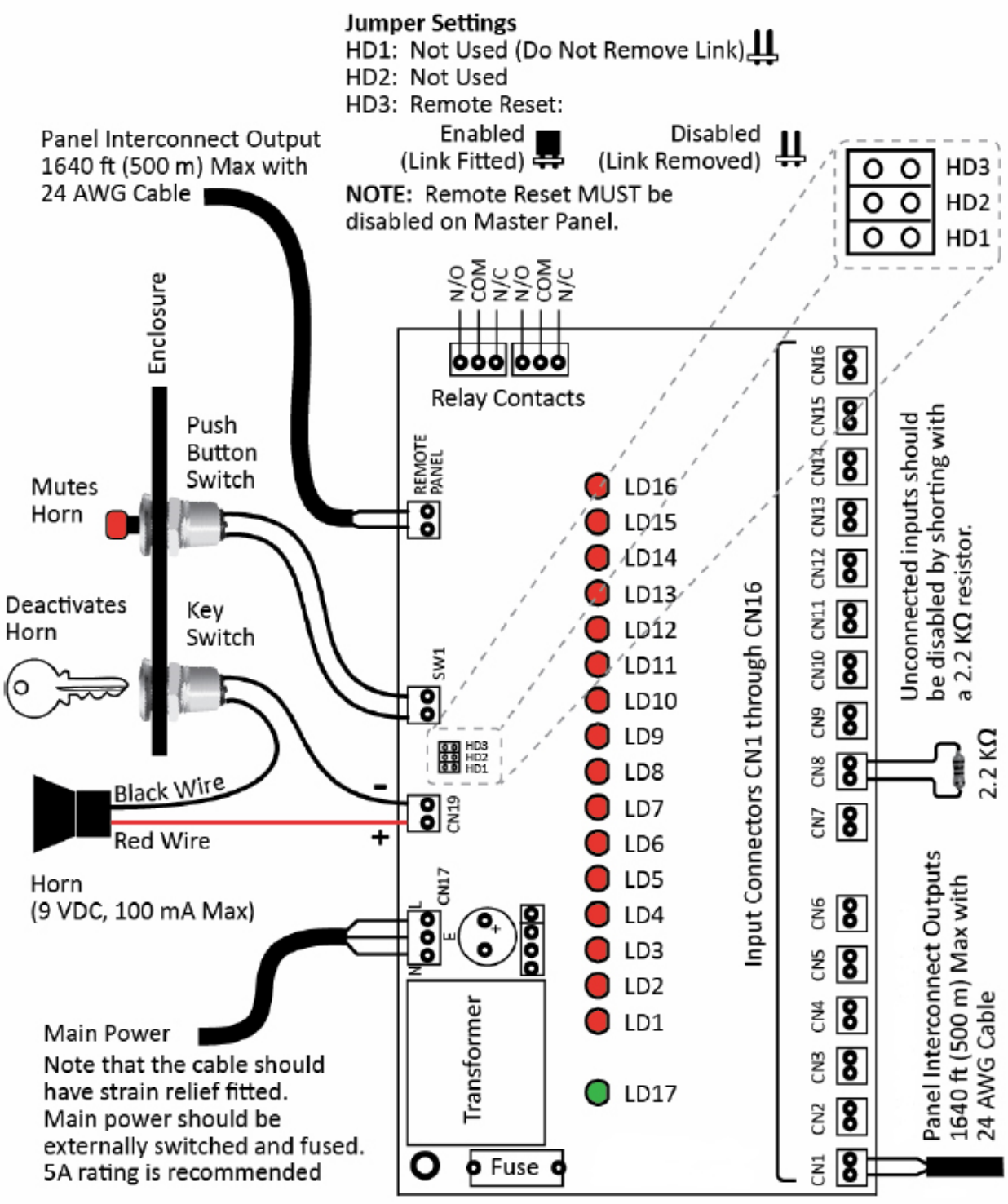
| Step | Wiring Instructions for the AT-G-SENSE |
|---|---|
| 1 | Connect the output to the remote AT-GSC-16 controller at CN6 using two-wire cable. It does not matter which wire goes into which terminal. If installing a standalone AT-G-SESNE, ignore this step. |
| 2 | Relay outputs – connect to NO or NC as required for one or both relays at positions CN4 and CN5. |
| 3 | Set relay and sounder delay using jumpers on header HD1 at positions 1 and 2. Factory default is no delay (both jumpers off). |
| 4 | Set the latching setting using jumper on header HD1 at position 3. Factory default is manual reset. |
| 5 | Set sounder enable/disable using jumper on header HD1 at position 4. Factory default is enabled. |
| 6 | Set remote reset setting using jumper HD1 at position 5. Factory default is enabled. |
| 7 | Connect mains power to terminal CN3. |

**NOTE**: Review and agree upon end-user requirements before setting sounder enable/disable, the relay/sounder delay and manual/automatic reset (latching).

**NOTE:** Connection to mains power supply must be via an approved readily accessible, switched fused (3A fuse) or as per local wiring regulations which should be within 3 meters of the controller. It should be part of the building installation and be marked as the disconnect for the device. The mains 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 a suitable replacement.

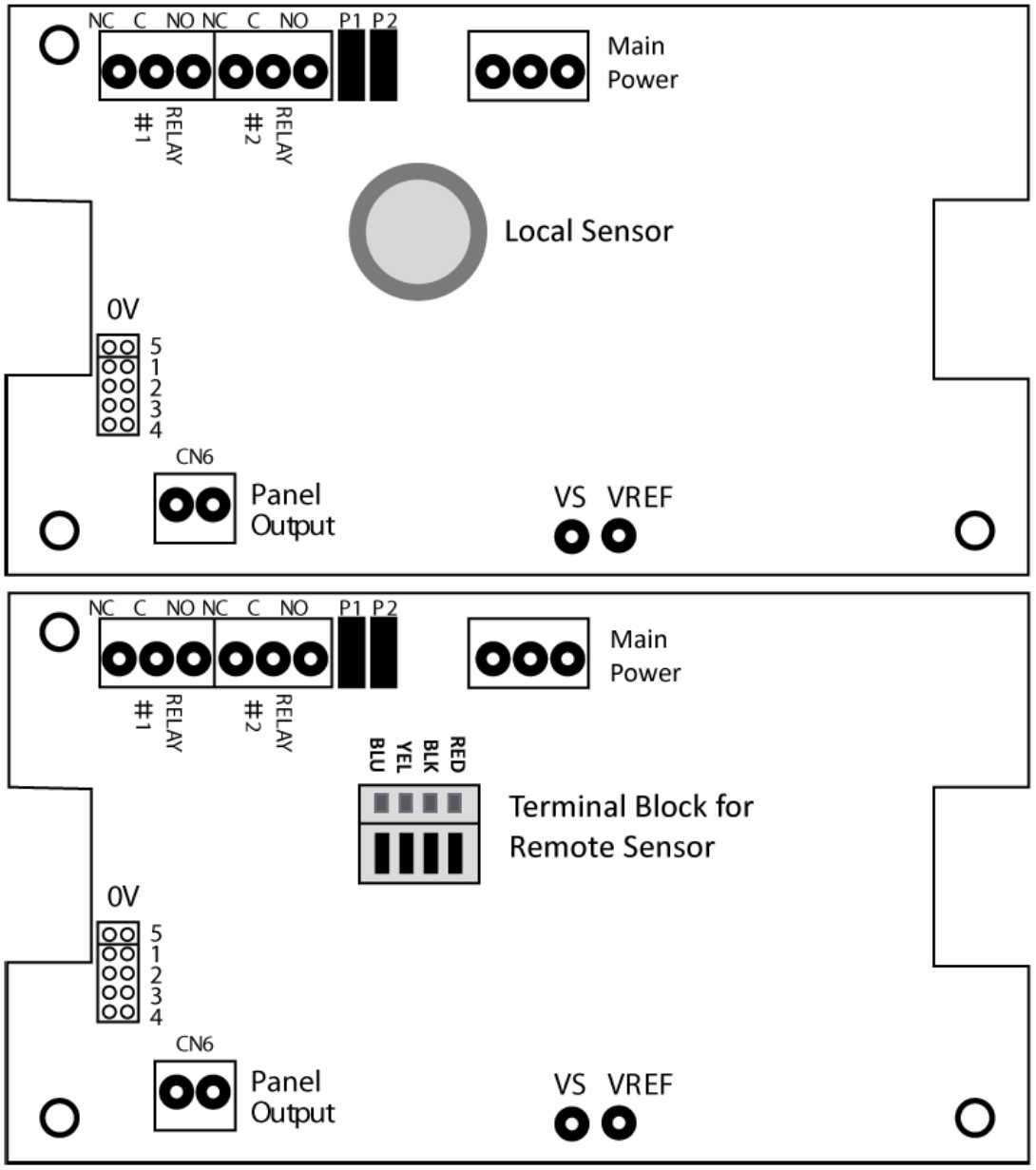
### *WIRING THE AT-GSC-16 CONTROLLER*

| Step | Wiring Instructions for the AT-GSC-16 |
|---|---|
| 1 | Connect the Remote Panel output to an input of the upstream AT-GSC-16 using two-wire cable. It does not matter which wire goes into which terminal. If an upstream AT-GSC-16 is not used, ignore this step. |
| 2 | Verify proper setting of the remote reset jumper (HD3) on each networked AT-GSC-16. Factory default is enabled. Note that the remote reset jumper MUST be disabled on the master panel. |
| 3 | Connect relay contacts to COM and either NO or NC as required for one or both relays. |
| 4 | If used in your application, wire the optional siren to connector CN19 using the + and - |
| 5 | Connect up to 16 AT-G-SENSE (panel output CN6) to input connectors CN1 through CN16 on the AT-GCS-16 using two-wire cable. It does not matter which wire goes into which terminal. Observe proper wire type and length limits. |
| 6 | Disable individual channels by installing a 2.2 KΩ resistor across each unused terminal block. |
| 7 | Observing proper polarity, connect mains power to terminal CN17. The power cable should have strain relief fitted. Note that mains power should be externally switched and fused. A 5A rating is recommended. |



***REMOTE SENSOR HEAD INSTALLATION***

If you do not wish to surface mount the AT-G-SENSE or need to match room décor, a remote sensor with a decorative faceplate can be supplied. The remote sensor is mounted in an electrical back box 44mm deep to which the faceplate is fitted.



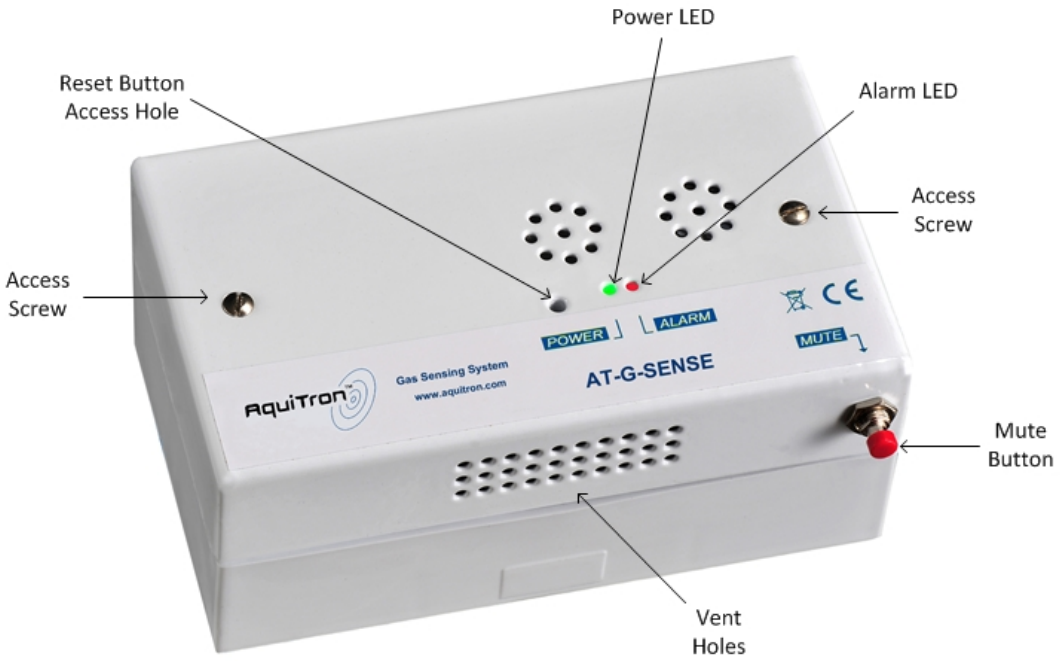

**NOTE:** For remote sensor configurations, the sensor is mounted on a small remote sensor board that connects to the AT-G-SENSE's main PCB via a 4-wire connecting cable.

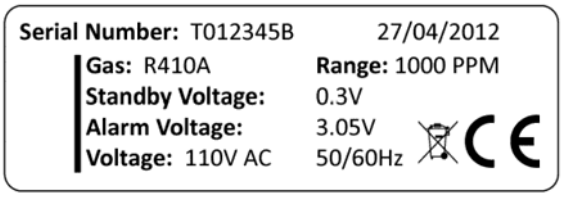
| Step | Instructions for Remote Sensor Head Installation |
|---|---|
| 1 | Remove the connector from the sensor PCB to feed the cable through conduit, the knockouts and the remote sensor board back box as needed. |
| 2 | Immediately refit the connector to the sensor board in the back box. The AT-G-SENSE and it's 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:<br>• Label the individual pairs, or<br>• 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 progress, 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 faceplate when construction is completed. |

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

***OPERATING INSTRUCTIONS***

| Operation State | Operating Instructions |
|---|---|
| Power Up | On power up there is an initial warm-up delay of 5 minutes, during which the green power LED will flash at 1 second intervals. After warm-up, the green LED will stay on. |
| Fault Condition | • The green power LED will be off<br>• The red alarm LED will be on<br>• External interface to the optional AT-GSC-16 controller will activate and show the fault condition on that panel. |
| Alarm Condition | In alarm condition:<br>• The green LED stays on<br>• The red LED will be on<br>• The siren operates (if it has not been disabled and after a delay if this option has been selected)<br>• The relay output activates (after a delay if this option has been selected)<br>• External interface on the optional AT-GSC-16 controller will be turned on<br>• The mute button on the exterior of the case may be pressed. (This will switch off the sounder if the sounder disable option is not selected)<br>• 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 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.<br>• If automatic reset is enabled, the alarm will reset by itself with no user intervention |



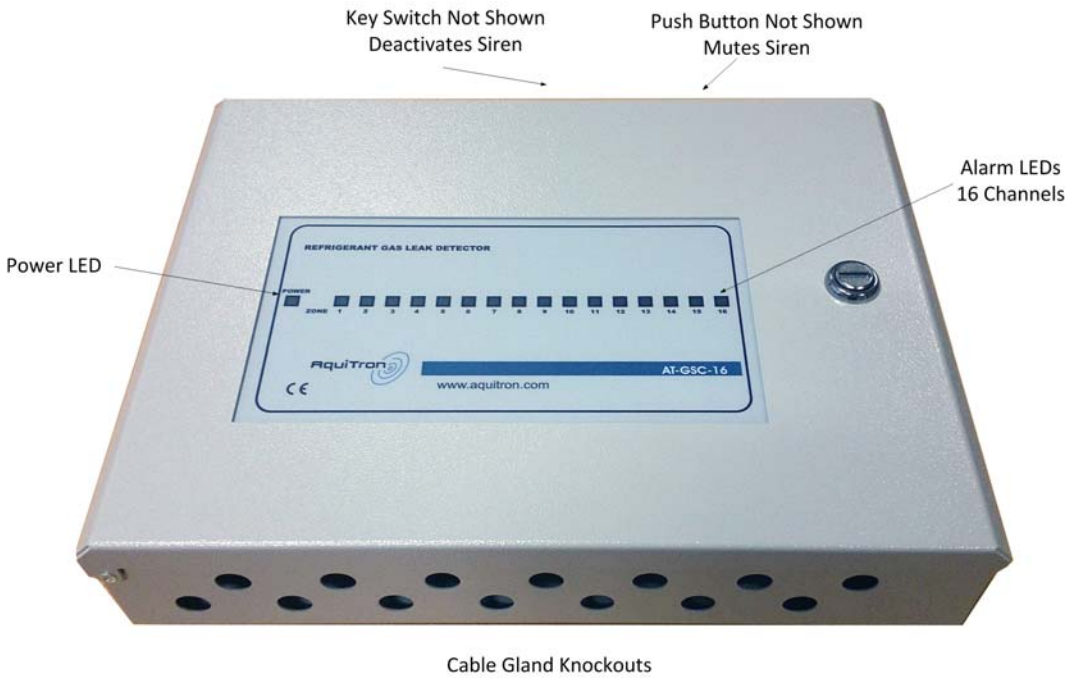




**SAMPLE LABEL**

***AT-GSC-16 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 of the sensors 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:<br>• The green LED stays on<br>• The red LED on the relevant channel comes on<br>• The relays operate<br>• The siren operates (can be muted by key switch)<br>• The output to a master or upstream operates to indicate there is a fault downstream. |

**NOTE:** If all the LEDs are blinking approximately every 5 seconds on a master panel, then remove the link on jumper position HD3 as this should be in the disabled position on a master panel (factory default is disabled).




***FUNCTIONAL TESTS AND CALIBRATION***
***OVERVIEW***

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

**IMPORTANT:** If the AT-G-SENSE 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 and in compliance with locally applicable guidelines and regulations.
Suitably qualified operators 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 manufacture 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 regulations 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:** Aquilar recommends annual checks and gas calibration. Calibration frequency may be extended based on application, but should never be exceed two years.

**IMPORTANT:** In applications where safety is critical, calibration should be done quarterly (every three months) or on a more frequent basis. Aquilar 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
- **Non-Quantified**: A gas of unknown concentration is used.

**CALIBRATION –** Exposing the sensor to a calibration gas, wetting 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.

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

**CAUTION:** Before you perform the bump test:

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

***BUMP TESTING***

After installation, the units should be bump tested. Expose the sensors to test gas.

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 from sounding and the relay from 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 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 AT-G-SENSE must have been powered up and allowed to stabilise for several hours, preferably overnight.

When testing the sensors, also ensure that the AT-GSC-16 controller functions correctly (if installed).

**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.

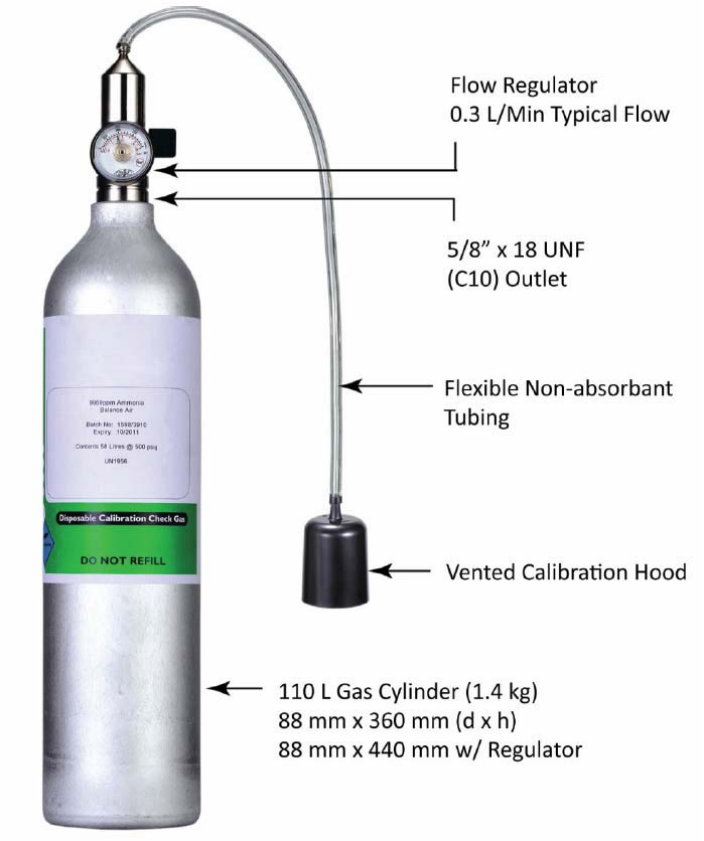
**NOTE:** Do not pressurise the sensor.

**NOTE:** You MUST use calibration gas in a balance of air (not N2).

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

| Step | Bump Testing Using Calibration Gas Cylinders |
|---|---|
| 1 | Remove the enclosure lid of the gas detector (not in the 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 AT-G-SENSE into a plastic bag or use a plastic hose/hood to direct gas to the sensor. A response of above 80% is acceptable. |

### *GAS CYLINDER AND TEST HARDWARE*



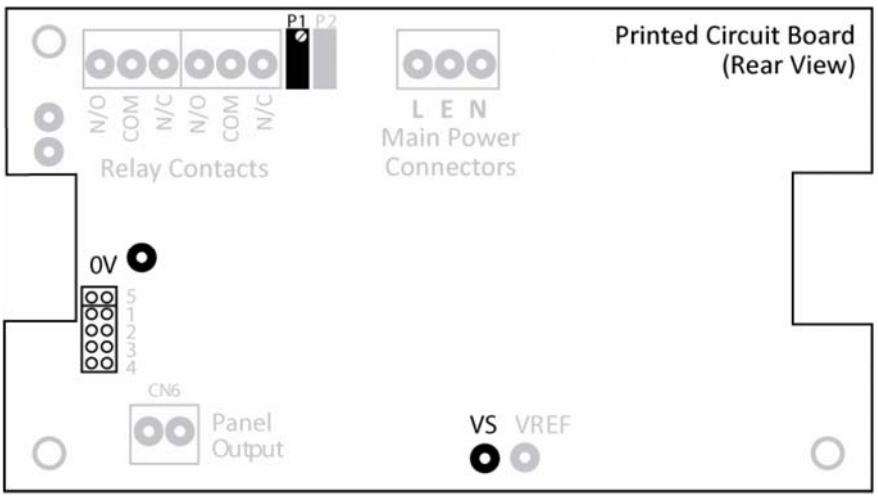

### *CHECKING AND SETTING THE ZERO SETTING*

Checking and setting the zero setting may be required upon initial installation.

Tools required:

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

| Step | Checking and Setting the Zero Setting |
|---|---|
| 1 | Ensure that the AT-G-SENSE is stabilised (on for more than 24 hours). |
| 2 | Ensure that adjustments are conducted on site in a clean air atmosphere. |
| 3 | Connect the voltmeter between 0V an VS |
| 4 | Compare the reading of the voltmeter to the factory standby voltage. Adjust P1 as necessary until the voltmeter reading matches the factory standby voltage within any tolerance specified on the rating label. |



### *AT-GSC-16 CONTROLLER*

If your installation has an AT-GSC-16 controller, ensure that the controller's functions are activating accordingly when testing the sensors.

| Step | Checking the AT-GSC-16 Controller |
|---|---|
| 1 | Red LED should illuminate for sensors that are in alarm. |
| 2 | Siren should sound if connected and if one or more alarms are present. |
| 3 | Relays should function properly if enabled and one or more alarms are present. |
| 4 | If enabled, remote reset will reset any downstream AT-G-SENSE or AT-GSC-16 connected to a channel, once gas has cleared. |

### *TROUBLESHOOTING*

| AT-G-SENSE Symptom | Possible Cause(s) |
|---|---|
| Green and Red LEDs off | • Check power supply. Check wiring.<br>• AT-G-SENSE was possibly damaged in transit. Check by installing another AT-G-SENSE to confirm the fault. |
| Red LED on, green LED off (indicates a fault) | • Sensor may be disconnected from printed circuit board. Check to see sensor is properly inserted into board.<br>• The sensor has been damaged or has reached the end of life and needs to be exchanged. Contact Aquilar for instructions and support. |
| Alarms in the absence of a leak | • Try setting an alarm delay.<br>• Perform a bump test to ensure proper operation.<br>• During operation record any alarms. Establish the cause or likely cause if no obvious leak has occurred. |
| **AT-GSC-16 Symptom** | **Possible Cause(s)** |
| Green LED off | • Check power supply. Check wiring.<br>• AT-GSC-16 was possibly damaged in transit. Check by installing another AT-GSC-16 to confirm. |
| All 16 red LEDs on a master panel are flashing every 5 seconds | • Remove the link on jumper position HD3 as this should be in the disabled position on a master panel. (factory default setting is disabled). |



**Aquilar Limited**
Weights and Measures House,
20 Barttelot Road, Horsham, West Sussex
RH12 1DQ. UK
Tel: + 44 (0) 1403 216100
Fax: +44 (0) 8707 940 320

E-mail: info@aquilar.co.uk
www.aquilar.co.uk