INSTALLATION AND OPERATION MANUAL
ENVIRONMENTAL SYSTEM IR-SNIF
SINGLE ZONE MONITOR
MODEL IR-SNIF-1,2,3

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APPLICABILITY

Information presented in this manual can be generally applied to all IR-SNIF-1,2,3 refrigerant monitors. Specific details of programming and operator interface apply to software version ***4093 and later*** versions. To determine the version of an IR-SNIF-1,2,3, press the "*" key. This will display momentary screens that provide contact information for SenTech Corporation, the software version and any options enabled in the monitor. If your monitor has a version that is older than 4093 (smaller version number ***such as 3017***), a version specific appendix A, Programming and Operator Interface, is available. It can be downloaded from the SenTech Corporation website, www.sentechcorp.com, or directly from SenTech Corporation at 888-248-1988.

Contents

SAFETY PRECAUTIONS and WARNINGS

The following general safety precautions and warnings must be observed during all phases of installation, operation, service and repair of equipment. Failure to comply with these precautions, given here and elsewhere in the manual violates safety standards of design, manufacture, and intended use. SenTech Corporation assumes no liability for the customer's failure to comply with these requirements.

Definitions of safety symbols used on equipment and in manuals.

AC Voltage Terminal: Indicates areas of equipment where AC line voltages are used and present a potential risk of electrocution. Areas using line voltages should not be accessed during operation.

AC-to-DC Power Supply: Indicates AC line voltages are used and present on portions of the power supply, including the heat sinks. A potential risk of electrocution exists. Areas using line voltages should not be accessed during operation.

Protective Grounding Terminal: The protective ground is to prevent electric shock in case of an electrical fault. This symbol indicates that the terminal must be connected to earth ground before operation of the equipment.

Caution: This sign calls attention to a procedure or practice which if not adhered to could result in damage or destruction to a part of the product.

Other information and precautions:

Input Power: Power should be supplied through a two-pole circuit breaker located in a reasonable proximity to the equipment. Ensure that the voltages are correct and an appropriate ground connection is provided.
Do Not Open the Monitor with Power Applied: Line voltages exist on the terminal board inside the monitor and on the power supply inside (including the heat sinks). The door to the monitor and the power supply itself are marked with AC Voltage shock hazard warning labels. Remove power prior to opening the door.
Installation, Maintenance and Repair: These functions should only be done by qualified personnel following the instructions outlines in this manual. This is Installation Category III equipment.
Pollution Degree: This equipment is designed for a Pollution Degree of 1.
Cleaning: This equipment should be cleaned by wiping with a soft clean cloth.
Intended Purpose: This equipment is designed to be used as a continuous refrigerant monitor. It should not be used for any other purpose.

Model IR-SNIF-1,2,3 Specifications

Size:	10” x 12.5” x 4.75” (25.4cm x 31.2cm x 12cm)
Weight:	16 lbs. (7.2 kg)
Power:	120 or 240 Volt 50/60hz (41 Watts) (voltage must be specified at time of order)
Temperature:	32 deg F – 125 deg F (0 deg C – 50 deg C)
Humidity:	0 – 95 % non-condensing
Atmospheric Pressure:	75-106 Kpa Equipment rated for indoor use only
Range:	10 – 1000 ppm Standard
Tube Length:	0 – 250 ft (0 – 76 m)
Trip Point:	Low Alarm 0 – 1000 ppm Main Alarm 0 – 1000 ppm High Alarm 0 – 1000 ppm
Leak Wait:	Varies from seven (7) seconds to three (3) minutes depending on refrigerant concentration
Alarm Output:	Low, Main and High alarm relays, each with four (4) form C contacts rated 5 amps maximum
Analog Output:	0 – 10 volt proportional to 0 – 1000 ppm 4-20 mA proportional to 0-1000 ppm (optional)
Computer Interface:	RS-485 (optional)

INTRODUCTION and OVERVIEW

The SenTech Environmental System IR-SNIF-1,2,3 single zone monitor provides an early warning of developing refrigerant leaks. The unit samples ambient air and measures the amount of halogen based refrigerant gas in the air sample. When the proportion of refrigerant present exceeds a trip point, the system goes into alarm mode. Should the system assess the presence of refrigerant as a leak, using SenTech's "LEAK WAIT" algorithm, the user is notified. By discovering a leak shortly after it starts, the potential loss can be reduced to ounces of refrigerant, saving money and helping protect the environment.

Functional Description

The refrigerant monitor is composed of four major functional blocks: Pneumatics, Infrared Bench, Control Electronics and Power Supply. Refer to figure 1 for an overall block diagram.

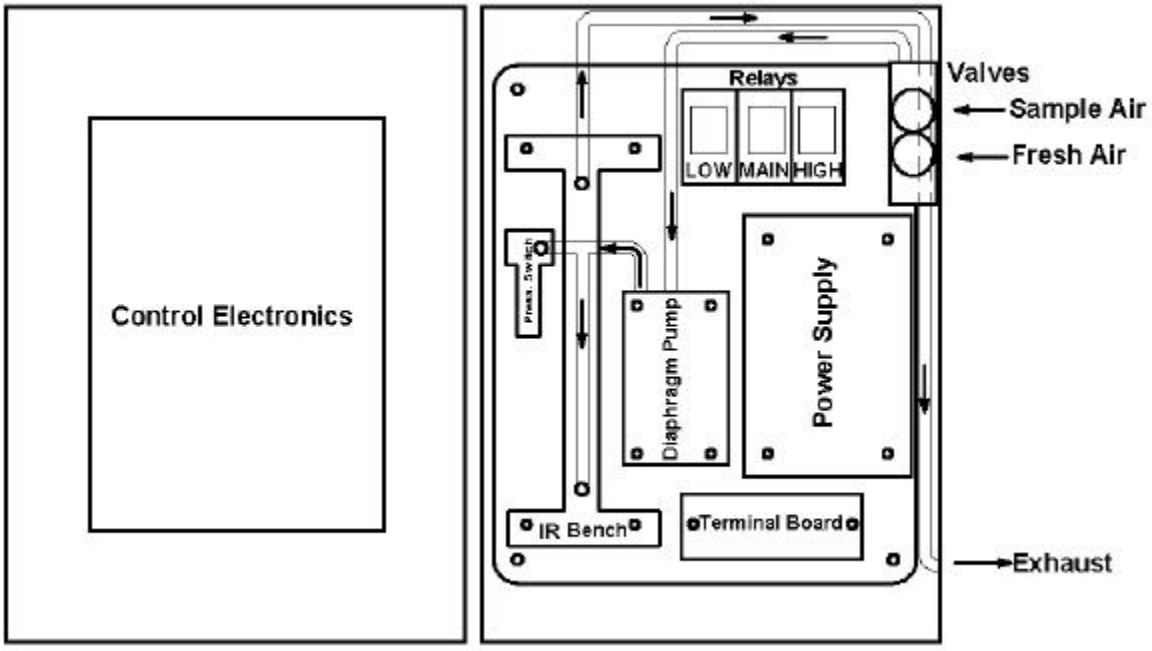

Figure 1 Overall Block Diagram

Pneumatics: Refer to the figure 2 for pneumatics block diagram. Tubing from the area to be monitored and from a reference air source (either fresh, outside air, or interior conditioned air that is free of refrigerants) is connected to the valve manifold. The electronics alternates between energizing the Sample air and the Auto zero air solenoids. The diaphragm pump draws air from the selected inlet and feeds the air through an orifice restrictor, through the infrared bench and to the exhaust port located on the lower right side of the unit. The pressure switch

monitors the pressure created by the flow from the pump and the restriction created by the orifice. Should pressure fall, a flow failure is detected, and signal is sent to the electronics.

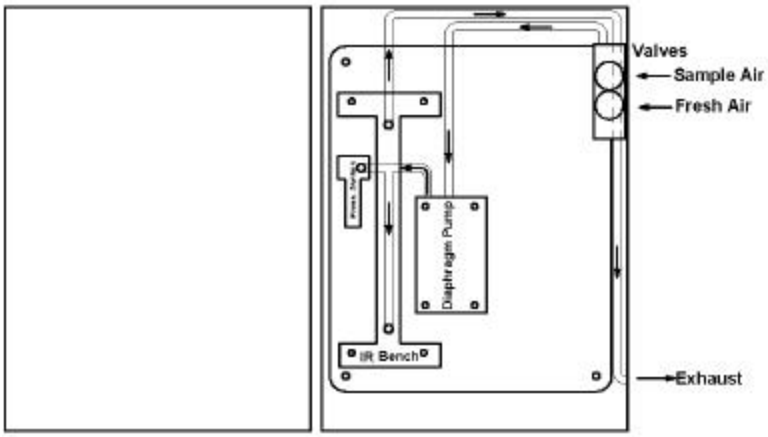

Figure 2 Pneumatics Diagram

Infrared Bench: Refer to the figure 3 for Infrared Bench diagram. The infrared bench has an integrated source circuit with infrared source at one end and an integrated detector circuit with filter and detector at the other. Presence of refrigerant in the sample air will cause a change in the output of the detector.

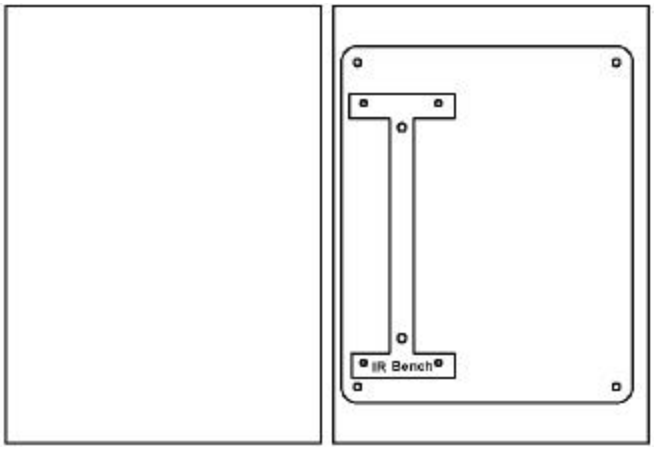

Figure 3 Infrared Bench

Control Electronics: Refer to the figure 4 for control electronics block diagram. The signal from the infrared bench is analyzed by the control circuit and converted into a digital measurement in ppm (parts per million). The ppm level is compared to trip points set for Low, Main and High alarm levels. If the ppm level exceeds the Low alarm threshold, the “Leak Wait” algorithm is used to determine

whether the monitor has experienced a transient exposure, or a leak truly exists. If the ppm level remains above the Low alarm threshold on completion of leak wait, the Low alarm relay is energized. If the signal continues to increase, the main alarm relay will be energized and ultimately the high alarm relay. Once the system enters Low, Main or High alarm, it will remain in that mode until the problem is cleared and the system is reset.

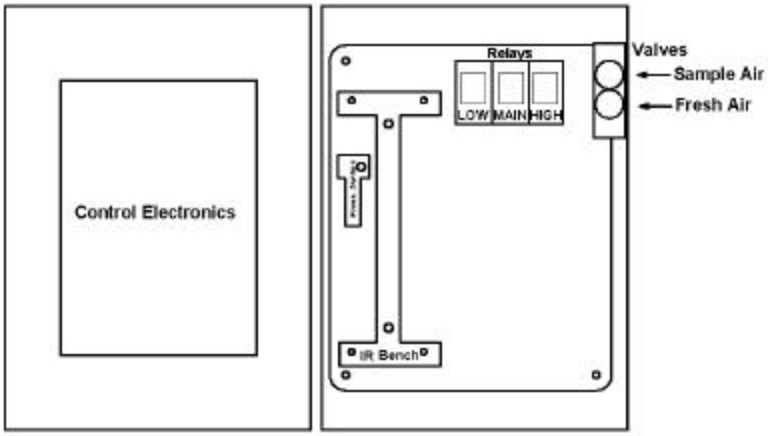

Figure 4 Control Electronics Diagram

Power Supply: Refer to the figure 5 for Power Supply diagram. Power is supplied to the monitor through terminals 1, 2 and 3 of the terminal board. Line voltage is fed through the fuse on the left side of the monitor (not shown), and to the diaphragm pump and power supply. The power supply converts AC line voltage to dc voltage. DC Voltage is fed through the terminal board to all of the electrical components of the monitor.

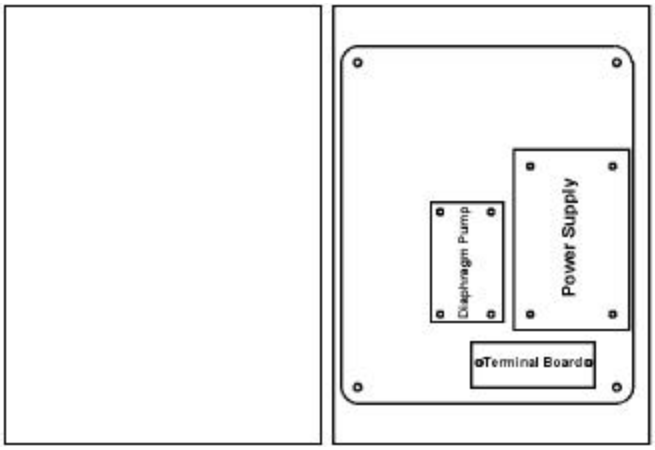

Figure 5 Power Supply Diagram

Sensitivity to Refrigerants

The system is sensitive in varying amounts to all of the halogen-based refrigerants, those containing molecules of fluorine, chlorine or both. As part of the initial setup, the specific refrigerant to be monitored is entered into the system. The control electronics compensates for the differing sensitivities, resulting in a true ppm reading for the refrigerant specified.

Factory Calibration

The IR-SNIF-1,2,3 is calibrated at the factory prior to shipment. The system maintains accuracy through automatic rezeroing. Periodically, the system switches to the fresh air inlet, and reestablishes a reference signal to which it compares sample air. This process eliminates the potential variations caused by changes that develop in electronics as components age. If a change in infrared energy or detection of the infrared energy develops, that change will be first measured in the reference signal, then also in the sample. The ppm level is based on the ratio of the sample to the reference. This ratio eliminates the effect of any variations, and eliminates the need to periodically calibrate a monitor in the field.

PPM vs. Leak Rate

The relationship between the actual amount of product lost and the resulting ppm level refrigerant in the air is complex. There is no direct relationship between the amount of refrigerant leaking and the concentration being measured. The size of the room, the location of the pick up point, the location of the leak and airflow in the room will all affect the actual concentration at the inlet. However, by judicious location of the inlets (see installation section) and maintaining the alarm set points at a level not too far above ambient, leaks should be detected substantially before they otherwise would be noticed. See Appendix B for a detailed discussion of room volume considerations. This appendix will help to provide a correlation between pounds of refrigerant lost over a given period to the ppm level measured. This correlation can be developed for a specific application.

INSTALLATION

Unpack and Inspect Material

IR-SNIF-1,2,3 Package: The IR-SNIF-1,2,3 package contains the following material:

1. IR-SNIF-1,2,3 Single Zone Monitor
2. Installation and Operation Manual
3. Hose barb fittings and 10 micron tube end filters (one hose barb and filter for each inlet – two of each are provided)
4. CTS/Warranty form to be completed and returned to Sentech

Optional Purchases: The IR-SNIF-1,2,3 package may also contain the following material:

1. Plastic FRPE tubing, ¼ inch OD for sample tube
2. Combination Horn/Strobe alarm
3. Horn alarm
4. Strobe alarm

Other Required Material: The following material is required but not provided by SenTech:

1. Primary power wiring
2. Wiring for connection to alarm devices or other building systems
3. Relay contactors for building system loads greater than 5 amps
4. ¼ inch tubing (if not purchased from SenTech, or if copper tube is required by local code

If any material is missing, or appears to be damaged, contact Sentech Corporation for assistance.

Identify Location for Monitor, Sample Points and Alarms

Monitor Location: ASHRAE-15 specifies that the refrigerant monitor is to be located in the mechanical room. There are two interpretations of this: the unit itself is to be installed in the mechanical room; or the sample point is to be located in the mechanical room. Because the IR-SNIF-1,2,3 is an active air draw monitor, it can be installed nearly anywhere in the vicinity of the area to be monitored.

If local codes allow, the monitor can be installed at the entrance to the mechanical room, with the sample tube routed into the mechanical room and the fresh air reference routed to an appropriate location. If the monitor is located outside the mechanical room, a fitting should be installed and an exhaust tube routed either into mechanical room, or outdoors. If it is routed outdoors, it must not be located near the fresh air reference.

If local codes require the monitor to be physically installed in the mechanical room, it should be installed in the best location for ease of use and routing of sample and fresh air tubing. If the monitor is installed in the same room as the

sample pick-up-point, no exhaust tube is required.

Caution: Liquid can affect the performance of the monitor. Pick-up-points must be protected from exposure to water and other liquids.

Sample Location: Since the monitor measures the concentration of refrigerant in the air, the pick up point should be mounted where it is most likely to sense leaking refrigerant. The criteria to consider in selecting the sample pick up point location include:

1. As close to the area of potential leaks as possible. On the 'downstream' side of the air flow pattern in the room.
2. Since refrigerants are typically heavier than air, the pick up tube should be terminated approximately 18 inches above the floor.
3. The sample tube should be located such that it will require no more than 250 feet (75 m) of tubing.

Reference Location: Since the monitor compares a fresh air reference to the sample, care must be taken in choosing a location. The fresh air reference tube should be routed to a location that will be free of refrigerant. This can be, but does not necessarily have to be, located outdoors. If the fresh air reference is routed outdoors, the following criteria should be used:

1. The tube end filter must be protected from the elements. Water, ice or insects can partially obstruct the tube end filter and change the reference signal.
2. The tube end filter must be located such that it can be inspected as part of the recommended quarterly preventive maintenance.
3. The tube end filters must not be located near exterior HVAC equipment, or any potential source of refrigerant.

Exhaust Location: The exhaust tube is required only if the monitor is not located in the same room as the sample pick-up-point. If an exhaust tube is installed, it should be run to the room being monitored, or to an exterior location. An exhaust tube must not be terminated near the fresh air reference.

Alarm Location(s): A combination horn/strobe alarm is recommended for a mechanical room. The alarm should be located inside the room such that it can be seen and heard from any area of the room. Additionally, a strobe alarm can be installed at each entrance to the room to alert the user of an alarm prior to entry to the room itself. Note that the IR-SNIF-1,2,3 has visual indicators of its alarm status. If the monitor is installed at the entrance to the room, a strobe should not also be required.

Electrical Power Connection

Caution: All installation wiring, service and maintenance should be performed by a qualified electrician in accordance with national and local codes.

TB-1 Power Wiring: The IR-SNIF-1,2,3 monitor is designed to operate on only 110 or 240 vac, but not both. It will operate on either 50 or 60 hz. The power supply in the monitor automatically detects the supply voltage. The diaphragm pump is designed to operate only on 110-120 vac or on 220-240 vac. Refer to figure 6 for a diagram of the terminal board.

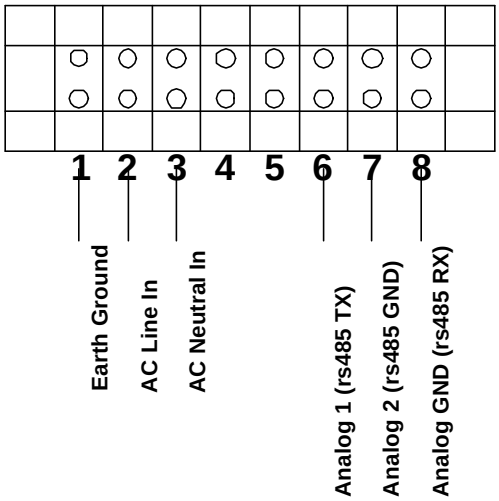

Figure 6.

Connect primary power to TB1 as follows:

1. Connect Earth Ground to TB1-1
2. Connect AC Line to TB1-2
3. Connect AC Neutral or Common to TB1-3

Caution: Verify that the monitor is designed for the appropriate line voltage. Connection of the incorrect voltage will damage the unit.

It is strongly recommended that power be supplied from a two-pole circuit breaker, located in reasonable proximity to the system. Power MUST NOT be supplied by plugging into a wall socket. The unit is a continuous monitor, and as a continuous monitor should be provided dedicated, permanent power. If a wall socket is used, there is a risk that the unit will inadvertently be unplugged, putting it off-line.

Electrical Alarm Connections

Alarm-to-Relay Connection: The IR-SNIF-1,2,3 monitor alarm relay sockets have two sets of NO/NC dry contacts. Refer to figure 7 for a diagram of the relay socket.

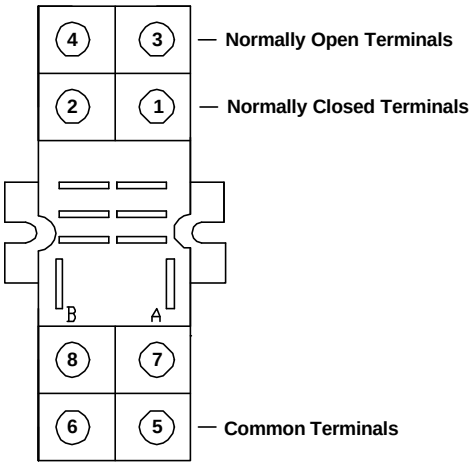

Figure 7.

The terminals are grouped as follows:

Terminal 5 = Common
Terminal 1 = NC
Terminal 3 = NO

Terminal 6 = Common
Terminal 2 = NC
Terminal 4 = NO

Caution: Ensure that external relay connections do not touch relay control terminals 7 and 8. A short circuit from the alarm wiring to the relay control wiring could damage the monitor, the alarms or both.

Alarm-to-Relay Connection: The typical Alarm connection uses the common terminal and normally open (NO) terminal to switch AC line voltage to the strobe alarm, horn alarm or combination horn strobe. Unless specified otherwise, SenTech Corporation recommends the following connections for alarms:

1. Strobe Alarm, or Strobe portion of Combination Horn/Strobe connected through LOW RELAY, terminals 6 and 4.
2. Horn Alarm, or Horn portion of Combination Horn/Strobe connected through MAIN RELAY, terminals 6 and 4.

Caution: Ensure that external relay connections do not touch relay control terminals 7 and 8. A short circuit from the exhaust fan wiring to the relay control wiring could damage the monitor, the alarms or both.

Fan-to-Relay Connection: The IR-SNIF-1,2,3 monitor alarm relay can support a load of up to 5 amps at line voltage. The typical high-speed exhaust fan will have a startup current in excess of the relay rated amp capacity. A pilot relay or contactor will normally be required to energize an exhaust fan. Unless specified otherwise, SenTech Corporation recommends the following connections for exhaust fans:

1. Fan, pilot relay or contactor connected through HIGH RELAY, terminals 6 and 4.

BMS-to-Relay Connection: The IR-SNIF-1,2,3 monitor alarm relay can provide alarm indications to the typical building management system (BMS) for Low, Main and High alarm levels. This connection is normally accomplished by switching a control voltage through the normally open

(NO) contacts of the respective relay. Unless specified otherwise, SenTech Corporation recommends the following relay connections for building management systems:

1. BMS discrete input connected through LOW, MAIN and/or HIGH RELAYS, terminals 5 and 3.

Other External Connections

TB1 Outputs: The IR-SNIF-1,2,3 is designed to provide two standard 0-10 volt analog outputs ***or*** two optional 4-20 mA analog outputs ***or*** optional rs-485 interface for use with ACC 070 SenTech COMM LINK PC to Refrigerant Monitor Interface, or ACC 065 SenTech Remote Control Panel Interface. Refer to Figure 8 for a diagram of the terminal board.

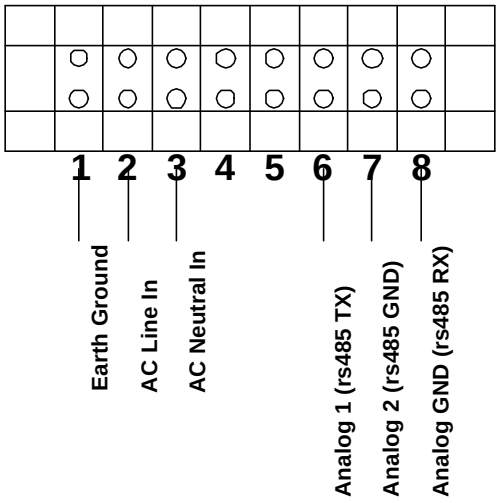

Figure 8.

0–10 Volt Analog Outputs: The IR-SNIF-1,2,3 monitor provides two 0–10 volt analog output proportional to 0–1000 ppm. Analog 1 provides a signal proportional to the current ppm level. Analog 2 provides a signal proportional to the peak ppm level measured. For applications where the IR-SNIF-1,2,3 is installed inside a mechanical room, the analog 1 signal can be used to drive an optional remote analog display at the entrance to the room. This signal could be used to provide an analog input to building management systems for remote monitoring of the ppm level and for trending of levels. This signal should NOT be used as a replacement for discrete alarm relay connections to a BMS. Analog output connections are as follows:

1. Use twisted pair wire for analog 1 connection, or four conductor twisted wire for both analog 1 and analog 2. Typical low voltage solid conductor wire is suitable for this signal. Shielded cable is preferred, but not always required.
2. Route twisted pair wire into the monitor and along the wire harness from the back-plate to the TB1 on the back-plate. Secure the twisted pair periodically to the wire harness using tie wraps.
3. Connect the appropriate wires to TB1-6, analog 1 plus, TB1-7, analog 2 plus, and TB1-8, reference ground.

4–20 mA Optional Analog Outputs: The IR-SNIF-1,2,3 monitor provides optional 4–20 mA analog outputs in place of the standard 0-10 volt analog outputs. To identify whether a monitor has 4-20 mA analog output installed,

examine the control board installed on the door of the monitor. Locate the chip sockets labeled U13 and U12. U13 and U12 are located in the center of the board, approximately 3.5 inches and 2 inches from the bottom of the board. If the monitor is configured for the standard 0-10 volt analog outputs, the sockets will be empty. If configured for 4-20 mA outputs, the sockets will have 4-20 mA drive chips installed. Connection to the 4-20 mA outputs is the same as for 0-10 volt outputs.

RS-485 Optional Serial Output: The IR-SNIF-1,2,3 monitor provides an optional RS-485 interface in place of the analog outputs. This interface is for use with ACC 070 SenTech COMM LINK PC to Refrigerant Monitor Interface, or ACC 065 SenTech Remote Control Panel Interface.

This interface provides the ability to display the refrigerant levels in each area and modify setpoints via a pc based interface. Used in conjunction with the ACC 070 COMM LINK, the interface allows for complete remote monitoring of multiple refrigerant monitors in the same facility.

This interface also provides the ability to display the refrigerant levels in each area and modify setpoints via a digital remote control interface. Used in conjunction with the ACC 065 Remote Control Panel Interface, the RS-485 interface allows for complete remote control and monitoring of multiple refrigerant monitors in the same facility.

To identify whether a monitor has rs-485 interface installed, examine the control board installed on the door of the monitor. Locate the connectors labeled P6 and P8. Connector P6 is located on the upper left corner of the board (as you look at the board from inside the door). Connector P8 is located on the center of the right side of the board. If the rs-485 interface is installed, the cable normally connected to the P8 (right side) will be absent, and a cable will be connected to P6 (upper left corner). If your monitor is configured for analog output, and rs-485 is required instead, contact SenTech Corporation technical support for assistance.

RS-485 digital connections are as follows:

1. Use twisted wire for RS-485 connection, either twisted triple wire, or four conductor twisted wire. Shielded cable is preferred, but not always required.
2. Route twisted pair wire into the monitor and along the wire harness from the back-plate to the TB1 on the back-plate. Secure the twisted wire periodically to the wire harness using tie wraps.
3. Connect the transmit conductor to TB1-6.
4. Connect the receive conductor to TB1-8.
5. If twisted triple wire is used, connect the remaining wire to TB1-7, reference or shield ground.
6. If two twisted pairs are used, connect one conductor from

each pair to TB1-7, reference ground or shield.

Custom Control Inputs/Outputs: The IR-SNIF-1,2,3 monitor has the capability to be programmed for additional optional inputs or outputs. The control circuit in the monitor is versatile and can accommodate additional analog or discrete measurement and control signals. This circuit also has the capability to provide additional discrete control signals. Please contact SenTech Corporation technical support to determine whether specific requirements can be provided.

STARTUP and PROGRAMMING

Apply Power

Caution: Before applying power, double-check all wiring.

Once the installation has been completed, and wiring has been checked, close the door to the monitor and apply power. The unit will go through its normal startup checks and warm-up procedure. It is important that the door remain closed to ensure a proper operation.

Initial Screens

If the IR-SNIF-1,2,3 has never been programmed, it will access default memory settings and display the following screen:

RESETTING DEFAULTS

Once the defaults have been stored, or if the monitor has been previously programmed, the following screen will be displayed. Since the monitor is factory calibrated, and factory programmed during quality control, it should display this screen on initial application of power.

restore from memory

Following memory initialization, the monitor will display the copyright screen.

SenTech Corporation IR-SNIF-1,2,3 Gas Monitor Copyright (c) 2003

The monitor will next display two Contact and Model Information screens. (Note: these screens can be accessed anytime during normal operation by pressing the "*" key.)

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Model IR-SNIF-1,2,3 Version 3017 Option Code 0 www.sentechcorp.com

Following display of the contact and model information screens, the IR-SNIF-1,2,3 will restore any alarms that have been saved into memory. The corresponding lights and relays will be energized. Any external alarms, exhaust fans or building management system connections will be activated. The monitor will then display the following optics warm-up screen.

Optics Warm up Timer 540 12:00 Press ENT for Menu

On completion of the warm-up, the monitor will enter Auto zero mode and begin normal operation.

If during the startup, a fault condition is detected, follow the instructions on the screen, and refer to the trouble-shooting section of this manual.

Normal Operation

During normal operation, the monitor will display one of two basic screens. First, it will measure the fresh air reference and display the Auto Zero screen. Then it will measure the sample air and display the Auto Sample screen.

The Auto Zero measurement will take approximately 25 seconds, and will be performed approximately every 3 minutes. If the monitor senses refrigerant in the sample air, it will lengthen the Auto Zero time to approximately 45 seconds.

```
** Auto  Zero**
Timer 24    12:00

Press ENT for Menu
```

The Auto Sample measurement will be taken for between 1 minute and 3 minutes, depending on the tube length programmed into the monitor. This screen will display the ppm reading, the time of day and the refrigerant programmed for the sample area.

```
Auto Sample AREA 1
PPM    0    12:00
R-134A
Press ENT for Menu
```

Initial Programming

Once the IR-SNIF-1,2,3 has completed warm-up, and entered Auto Zero, it can be programmed. While in Auto Zero or Auto Sample modes, press the “ENT” key to access the main menu.

```
1)…Alarms
2)…Rezero
3)…Manual
4)…Setup        ABORT
```

Key selections 1, 2 and 3 are used to display current alarms, manually initiate Auto Zero and enter the Manual Override mode. These functions are discussed in Appendix A of manual.

To program the monitor, press the “4” key to enter Setup. The monitor will require a password to access the setup screens. There are five setup passwords: 111, 222, 333, 444, 999. The first four passwords can be changed to user-defined codes. 999 cannot be changed.

```
* SenTech Monitor *
ENTER PASSWORD
Followed By ENT
Code :   0
```

If an incorrect password is entered, the fourth line of the screen will change to “Access Denied” and the monitor will return to normal operation.

```
* SenTech Monitor *
ENTER PASSWORD
Followed By ENT
  ACCESS DENIED
```

When the correct password has been entered the monitor will display the setup screen.

```
1)…IR Setup
2)…N/A
3)…System Setup
4)…Contact        ABORT
```

Press the “3” key to enter System Setup. System setup consists of two screens that allow the user to change passwords, change system flags, test the alarm circuits and set the time and date. The user can toggle from one screen to the other by using the left and right arrow keys.

```
1)…Change Code
2)…System Flags
3)…Alarm Test
          ABORT        ->
```

```
4)…Date/Time


<-          ABORT
```

Key selections 1 and 3 are used to change passwords required to enter setup and to test the alarm relay integration with building wiring. Refer to Appendix A of manual for instructions to change passwords. The alarm test function is described in the Final Test section of this manual.

Press the “2” to enter the System Flags screen. The system flag screen will display information for two settings, and a cursor to the right of the password flag.

The password flag can be set to either 0 or 1. If a 1 is entered, the monitor will require the user to enter a password to perform any functions of the monitor. This feature is useful if the monitor is installed in a public area, and controlled access to the monitor is needed. This flag is set to 0 by default.

Press the “ENT” to move the cursor to the horn relay flag. The horn relay flag can be set to 0, 1, 2 or 3. This flag changes the function of one relay to control an audible alarm. With the flag set to the 0, the alarm relays will be energized so long as the monitor is in an alarm state. If the user **dedicates** one alarm level to energize an audible alarm, the monitor can be programmed to allow one relay to be de-energized while the monitor is still in alarm. This feature is useful when the user is troubleshooting an alarm, and wants to work in silence. Set the horn relay flag to 1 to use the LOW relay as a dedicated horn relay. Set the horn relay flag to 2 to use the MAIN relay as a dedicated horn relay. Set the horn relay flag to 3 to use the HIGH relay as a dedicated horn relay. This flag is set to 0 by default.

The unit number flag is used to identify the monitor on a RS-485 network, if that option has been purchased. This flag is set to 1 by default.

```
PASSWORD FLAG 0    -
HORN RELAY FLAG 0
UNIT NUMBER FLAG 1
```

Press the “ENT” key to move the cursor to the next entry. When all entries have been viewed, press the “ENT” key again to return to the previous menu. The monitor should again display the system setup menu.

```
1)…Change Code
2)…System Flags
3)…Alarm Test
          ABORT      ->
```

Press the right arrow ”->” key to access the second system setup screen. Press the “4” key to set the date and time. The screen allows the user to set the month, day, hour and minute for the real time clock (RTC) in the controller. Entering information, or pressing the “ENT” key will move the cursor down to the next entry. Note that the RTC operates on a 24-hour clock. For example to enter 2 PM, enter the hour as 14, rather than 2.

```
RTC Month      3   -
RTC Day       10
RTC Hour      12
RTC Min       31
```

When the date and time have been entered, press the “ENT” key to return to the system setup screen.

When the date, time and system flags have been set correctly, press the “ABORT” key to return to the Setup menu.

```
1)…IR Setup
2)…N/A
3)…System Setup
4)…Contact      ABORT
```

As of January 1, 2003 the standard IR-SNIF monitor is capable of detecting and responding to the following list of refrigerants.

R-11, R-12, R-13, R-22, R-113, R-114, R-123, R-134A, R-401A, R-401B, R-402B-HP81, R-404A-HP-62, R-407A-AC9000, R-408A, R-409A, R-410A-AZ20, R-500, R-502, R-503, R-507-AZ50

This list changes over time, so it is recommended that the operator review the Gas Code screens for a complete list of gasses a given monitor is capable of monitoring.

Press the “1” key to enter Sample Setup. The sample setup screens allow the user to set the gas code for the refrigerant to be monitored, the distance of the tube used for the sample, and the Low, Main and high alarm thresholds. The first sample setup screen will display the gas code and the distance.

```
AREA       1
R-134A     8       <- ->
Distance  250
     ENT  or  ABORT
```

Press the left or right arrow keys to change from one gas type to another. The gasses are organized in numerical order, with refrigerants first, and fire suppression agents or blowing agents following refrigerants. Once the appropriate gas is displayed, press the “ENT” key to move the cursor from line two to line three.

Enter the tube length, in feet, if the tube length is greater than 100 feet. If the tube is shorter than 100 feet, leave the setting at the factory default of 100. When the distance has been entered, press the “ENT” key to display the second sample setup screen.

Alarm Low	25 -
Alarm Main	50
Alarm High	500
ENT or ABORT	

Unless specified otherwise, SenTech Corporation recommends the following alarm settings for all refrigerants *except R-123*:

Low = 25 ppm
Main = 50 ppm
High = 500 ppm

Unless specified otherwise, SenTech Corporation recommends the following alarm settings for R-123:

Low = 25 ppm
Main = 50 ppm
High = 150 ppm

These settings are based on the current acceptable exposure levels and short-term exposure levels on a time weighted average for refrigerants. SenTech recommends that under no circumstances should a refrigerant monitor be set above the short-term exposure level. These are recommended settings only. Refer to local codes and regulations for the appropriate settings for a given application.

Once the gas code, distance and alarm settings have been entered, press the “ABORT” key to return to the Setup Menu, and again to return to normal operation.

FINAL TESTS

At this point, the system should have all settings programmed and it should be monitoring in the Auto sample mode. There are four stages to the final checks: Correct Monitor Sequencing, Correct Integration with External devices, Response to Refrigerant and End-to-End System Test

Monitor Sequencing

Watch the unit as it measures the sample area. Make certain that it periodically switches from the Auto sample mode to the Auto zero mode, and back again. Make a note of the ppm reading in the sample area. The reading should be zero. It may periodically measure a transient level of between 10 and 15 ppm, but it should never stay above 10 ppm if no leak is present. If the reading is consistently higher than 10 ppm, or if it enters alarm, it is likely there is a leak present. A high reading may also result from the recent use of a chlorinated cleaning agent. Many industrial degreasers use chlorine based organic compounds. Examples are trichloroethylene, or perchloroethylene. If there is no leak and there are no other sources of halogen vapors in the room, contact SenTech technical support.

Integration with External Devices

Once a monitor has been connected to external alarms, fans and building systems, integration can be checked using the Alarm test function of the monitor. The Alarm test screen is found in the System Setup menus described previously in the start up and programming section of this manual.

The setup menu is accessed by pressing the “ENT” key. Press the “4” key to enter setup, followed by the password “999”. From the setup menu, press the “3” key to enter system setup. From the System setup menu, press the “3” key to enter the alarm test screen.

```
      Alarm Test
1)…Low   2)…Main
3)…HIGH  4)…All
 Press Key To Test
```

Key selections 1, 2, and 3 are used to energize the Low, Main and High alarm relays respectively. Key selection 4 will initiate a cycle that turns on the low relay, then the main relay, then the high relay, until all three relays are energized. If any relay has been energized, the fourth line of the display will change to instruct the user to press the “RESET” key to de-energize the relays.

```
      Alarm Test
1)…Low   2)…Main
3)…HIGH  4)…All
  RESET  To Clear
```

With the alarm relays energized, confirm that the monitor is correctly

integrated into the building systems. Once this test has been completed, press the “ABORT” key. The monitor will restore any alarms that existed prior to entering this test mode, and will return to the system setup screen. Press the “ABORT” key again to return to normal operation.

Response to Refrigerant

After checking the alarms, the next step is to check for a proper response to the presence of a refrigerant. This will be done by preparing a sample of refrigerant for testing, and then presenting it to the system to make certain it measures refrigerant. It is suggested the following steps are completely reviewed before starting. This test is best done after the monitor has been running normally for an hour or two.

Step 1: Remove the inlet tubing from the sample inlet.

Step 2: Prepare a refrigerant sample. Note that refrigerants can be Chlorofluorcarbons (CFC's), Hydrochlorofluorocarbons (HCFC's) or Hydrofluorocarbons (HFC's). HFC's are the only refrigerants considered to be truly "Ozone Friendly". Because of this, SenTech Corporation recommends use of an HFC, such as R134A for field-testing of the IR-SNIF series of monitors. Any field-testing of a refrigerant monitor, by its very nature, will release an amount of refrigerant into the environment through the exhaust port of the monitor.

Caution: Follow all national and local codes for safe handling of refrigerants.

Because the IR-SNIF-1,2,3 is factory calibrated, and no field calibration is necessary, the refrigerant sample is not required to be of a known level. A calibrated "test gas" kit is available from SenTech Corporation, should the user desire to perform the following tests with a sample of known PPM level. The following paragraphs describe a procedure for preparation of a refrigerant sample using pure refrigerant.

Three items are needed to prepare a sample:

A Refrigerant
A Container
A short piece of 1/4" Tube.

The Refrigerant should be available on-site, but if not, R-134A is readily available at local stores. Note that many local office supply stores sell a 'pressurized air duster'. Often, this product is simply pressurized Tetrafluoroethane, or R-134A. This is a cost effective, readily available source of pure test gas, as long as the contents have been verified to be Tetrafluoroethane.

The sample container may also be available on-site. Suitable sample containers range from lab quality sealed bags with twist valves to a simple plastic bag or even an open top jar or can. The container should be at least 4 liters, or about a gallon. The container should be able to be loosely closed, e.g. twisting a plastic bag, or closing a lid.

The 1/4 inch tubing should be long enough to connect to the sample inlet and extend into the bottom of the sample container. Because refrigerants are heavier than air, pulling the sample from the bottom of the container will ensure introduction of the refrigerant into the selected zone.

a) Gaseous Refrigerants: Insert a refrigerant fill hose into the container opening. Crack the valve for a second or less so that a small squirt of refrigerant enters. Keep in mind that the monitor reads in PPM (parts per million) and a tiny amount of gas will make a relatively high concentration sample. Pull out the hose, and loosely close the container.

b) Liquid Refrigerants: Open the container slightly and put in a few drops of liquid refrigerant. Loosely close the container and allow time for the refrigerant to gasify. A bag will expand some as the liquid evaporates.

Caution: Do not close a rigid sample container tightly, because refrigerants expand and can create pressure. Do not allow pressure to build up in the sample container.

Step 3: Manual measurement of sample. Switch the monitor to manual override. Manual Override is accessed by pressing the "ENT" (enter) key on the front panel display of the monitor. Press the "3" key to enter Manual Override. Place the 1/4 inch tube into the sample container and connect it to the sample inlet to simulate a concentration of refrigerant in the air.

Caution: Never connect a pressurized refrigerant bottle directly to the monitor. The unit is designed to operate only at atmospheric pressure. Doing so can damage the unit.

After approximately 5 seconds, the PPM reading should start to rise. Within 30 to 45 seconds, the PPM level should level off. A sample prepared as described in step 2 should easily contain more than 150 PPM. If the PPM reading does not rise above the highest alarm setting in the monitor, repeat the sample preparation procedure with a larger amount of refrigerant. Readings of 150 or higher indicate a successful test of the monitor's ability to sense refrigerant. Disconnect the sample from the monitor and save for the next step. The sample container should now have a measured concentration of refrigerant greater than the highest alarm level. This will be used to test the end-to-end performance of the system in the next step.

Once the sample tube has been disconnected from the monitor, the readings should fall slowly down to at or near zero PPM. When the PPM level reaches near zero, press the "ENT" (enter) key to exit Manual Override and return to normal operation.

End-to-End System Test

After manually verifying the operation of the monitor, and obtaining (creating) a sample known to have a PPM level higher than the highest alarm, the next step is to perform an end-to-end test of the system. This test will verify that the monitor will correctly trigger alarms and the external devices connected. This will be done by connecting the sample of refrigerant from the previous test to the sample inlet and observing the alarms. This test is best done after the monitor has run through at least two complete auto sample and auto zero cycles.

After approximately 5 seconds, the PPM reading should start to rise. When the monitor exceeds the alarm threshold, it will switch to "Leak Wait" mode. This mode ensures the presence of a leak before triggering an alarm. The leak wait period can be as short as 7 seconds and as long as 3 minutes. **Note: The more the reading exceeds the alarm trip point, the shorter the time to enter alarm.** The system should progress from Low alarm, through Main alarm and into High alarm. **Note: If the monitor exceeds high alarm while in leak wait, it will appear to trigger Main alarm and High alarm at the same time. This is normal, correct operation.**

When a relay is programmed for an audible alarm and energizes, the external horn should sound (if so equipped) and the bottom line of the display should change to "RESET to Silence". This instructs the operator to push the "RESET" key to silence the Horn.

If the Horn has been silenced, the fourth line of the display should change to "RESET to Clr Alarms". This instructs the operator to clear the alarms.

Remove the gas sample from the inlet and wait until the PPM reading drops back to normal. Push the "RESET" button. The System should clear the alarms and be back in normal Automatic operation.

Reconnect the sample inlet tube and dispose of the gas sample in an appropriate manner.

Documentation

Fill out the CTS/Warranty form completely and return it to SenTech in the envelope provided. This is an important step to establish warranty. Please use this opportunity to make any suggestions for improvements.

If you are part of the user organization, store this manual in a safe place. If you are an installing contractor, please turn over the manual to the user.

If you need any additional manuals, call SenTech and we will be pleased to provide them at no charge (make a note of the unit serial number when requesting a manual). Installation and Operation Manuals for every Monitor ever produced by SenTech Corporation are available at the SenTech website:

www.sentechcorp.com

Basic installation and start-up is now complete. The unit should be on line and monitoring.

The remainder of this manual includes further information on operational characteristics, programming, preventive maintenance, troubleshooting, parts lists, and a detailed wiring diagram.

PREVENTIVE MAINTENANCE & REPAIR

Preventive Maintenance

The recommended periodic preventative maintenance is as follows:

Perform Quarterly Filter Inspection and replace as necessary.

Perform Quarterly Performance Verification.

Filter Inspection and Replacement

Coarse Filters (Tube End Filters) are located in each sample zone and fresh air zone on the ends of the 1/4 inch tubes. The Coarse Filters are sintered brass or bronze, and will naturally discolor to a dark bronze color. Inspect the filter for obvious clogging or build up of dust. Replace, rather than clean the filters.

Quarterly Performance Check: Once per quarter, perform the End-to-End system test described in the Final Checks Procedure on page 12.

Commonly Ordered Parts

P/N	Description
422050	Filter, 1,2,3 Coarse Tube
410136-GRAY	Orifice, .016
410224	Diaphragm Pump

Monitor Repair

Most monitor repairs can be performed in the field by the typical service technician. Refer to the Troubleshooting Guide found at the end of this manual for assistance. Additionally, SenTech Corporation provides telephone technical support for all SenTech refrigerant monitors. If assistance is needed, call 888-248-1988 (317-248-1988 internationally).

Should a repair be beyond the normal scope of field service, contact SenTech Corporation for a Return Authorization number for factory repair.

APPENDIX A: Programming and Operator Interface

Summary

The operator interface is composed of three sets of screens:

START-UP SCREENS - Displayed when power is applied to the system.

OPERATIONAL SCREENS - Displayed for the multiple gas monitoring modes.

MENU SCREENS - Screens used to change the operational mode of the monitor, set the configuration of the refrigerant monitoring zones and change system parameters for the monitor.

Start-up Screens

When power is applied to the system, it will step through a series of start-up screens.

RESETTING DEFAULTS

restore from memory

Copyright: The Copyright screen will be displayed on completion memory initialization.

SenTech Corporation IR-SNIF-1,2,3 Gas Monitor Copyright (c) 2003

Contact Screens: The Contact Screens display the company name, phone number and website. After a short pause, a second screen is displayed to identify the Model, Version and Options installed in the software of the monitor.

SenTech Corporation Phone 1-888-248-1988 www.sentechcorp.com

Model IR-SNIF-1,2,3 Version 3017 Option Code 0 www.sentechcorp.com

Optics Warm-Up: The Optics Warm-Up Screen is displayed while the monitor is stabilizing internal temperature. Currently this is set at about 9 minutes.

Optics Warmup Timer 540 12:00 Press ENT for Menu

Operational Screens

When the monitor completes Start-Up, it will enter Auto zero, and then proceed to measure in Auto sample mode. Under normal circumstances the monitor will cycle from Auto sample to Auto zero, and back to Auto sample. If an alarm condition is detected the monitor will enter Leak Wait mode to ensure a leak is detected. If the operator manually overrides the auto sample operation, the monitor will display Manual Override until the operator exits manual operation or the monitor time outs and returns to normal operation.

Auto zero: Auto zero measures the fresh air (refrigerant free) zone between each zone. Auto zero takes approximately 24 seconds under normal conditions. If the monitor senses a high concentration of refrigerant, the Auto zero measurement time is extended to approximately 45 seconds.

```
** Auto  Zero**
Timer 24    12:00

Press ENT for Menu
```

Auto Sample: Auto sample mode is the normal measurement mode of the monitor. It displays the PPM level beings measured, the refrigerant and the current time. If the Horn relay has been energized, the fourth line will instruct the operator to press the "RESET" key to silence the horn. If the monitor is in alarm, the fourth line will instruct the operator to press the reset key to clear alarms.

```
Auto Sample AREA 1
PPM    0    12:00
R-134A
Press ENT for Menu
```

Leak Wait: When the monitor is in Auto sample mode and first senses a change in PPM, it enters Leak Wait mode. This ensures the monitor truly detects a leak before activating the Low Alarm relay and the Main Alarm relay. The length of the wait period depends upon the difference between the concentration level and the alarm trip point. The larger the difference, the shorter the wait time. If the concentration falls below the alarm trip point, the system will determine that it was a transient, and return to normal operation.

```
LEAK WAIT  AREA 1
PPM    0    12:00
R-134A
Press ENT for Menu
```

Fault Mode: When the monitor detects a fault condition, it will enter fault mode. The Main relay will energize and "Trouble Alarm" will be displayed in the third line of the display.

```
Auto Sample AREA 1
PPM    0    12:00
Trouble Alarm
Press ENT for Menu
```

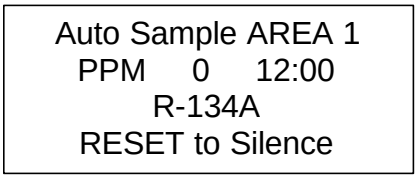
Alarm Modes: When the monitor has sensed concentrations above the alarm trip points, the associated relays will be energized. The Low,

Main and High relays will be energized if the measured ppm level has exceeded the corresponding alarm levels. The Horn relay will be energized depending on its programming. The monitor can be set up to energize the Horn relay when the Low alarm is activated, the Main alarm is activated or the High alarm is activated. This is programmed via the System Setup menus described later in this document.

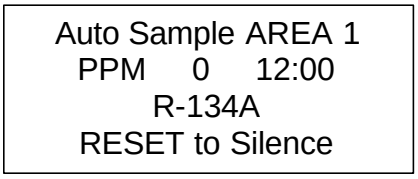
If an alarm is activated, the fourth line in the operational screens will change to instruct the operator how to clear the alarm. When the "RESET" is pressed, the monitor will switch directly to the Alarm Status screen described later in this appendix.

If the monitor has also energized the Horn relay, it can be silenced by pressing the "RESET" key. The fourth line in the operational screens will change to instruct the operator how to silence the Horn. When the alarm condition is cleared, the Horn is enabled and will be activated should another alarm occur.

Clear Alarm:



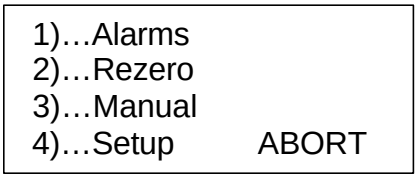
Silence Horn:



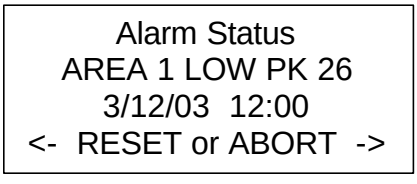
Manual Override: Manual Override mode is useful to temporarily measure without processing alarms. It displays the ppm level, the refrigerant and the current time. Alarm processing is suspended during Manual Override. Manual Override mode is entered by via the menus described later in this document.

Menu Screens

The Menu Screens can be accessed from any Operational Screen by pressing the "ENT" or enter key. In the first menu, the operator is given the choice to review Zone Alarms, manually perform an Auto zero, enter Manual Override mode or enter Setup.



Alarm Status: **T**he Alarm Status Screen is accessed by pressing the "1" key. If any zones are in alarm, the operator will have access to a series of screens formatted to show the alarm level, the peak ppm, and the time and date of the alarm. Additional alarm screens can be accessed by pressing the left and right arrow keys. If there are no alarms to display, or the last alarm has displayed, "No More Alarms". If the "RESET" or "ABORT" keys are pressed, the monitor will exit and return to normal operation.



Once all of the measurement alarms have been displayed, the Monitor will check for Trouble Alarms. Trouble Alarms will be generated if the monitor senses a fault in the Infrared Bench (sensor), a fault in the remote reset connection, a calibration fault and a flow related failure.

IR Bench Fault: The Bench Voltage trouble alarm will be displayed if the monitor senses a fault in the Infrared Sensor.

Trouble Alarm Bench Voltage Call Factory <- RESET or ABORT ->

Remote Reset Fault: The Remote reset trouble alarm will be displayed if the remote reset connection detects a shorted circuit. This is helpful to prevent malfunctions in the operation of the monitor caused by external connections.

Trouble Alarm Remote Reset Call Factory <- RESET or ABORT ->

The monitor will also generate a trouble alarm is it has never been calibrated, or if it has had a control failure that erased the calibration settings in read only memory.

Trouble Alarm Monitor Is Not Calibrated <- RESET or ABORT ->

The Pump Failure Possible trouble alarm will be displayed if the monitor detects a flow failure.

Trouble Alarm Pump Failure Possible <- RESET or ABORT ->

Rezero: The monitor can be switched into Auto zero Mode manually by pressing the "2" key. On completion of the manually initiated Auto zero, the unit will return to normal operation.

** Auto Zero** Timer 24 12:00 Press ENT for Menu

Manual Override: The monitor can be switched into Manual Override mode manually by pressing the "3" key. The unit will return to normal operation if the “ENT” (enter) key is pressed, or after approximately 15 minutes, whichever comes first.

Manual Override 1 PPM 0 12:00 R-134A Press ENT for Menu

Setup: The Setup Menus are accessed by pressing the "4" key. The operator will be asked to enter a password to continue into the Setup Menus. There are five passwords. Passwords 1 through 4 are user definable (default passwords are "111", "222", "333", "444"). The last password is permanently set at "999".

```
* SenTech Monitor *
ENTER PASSWORD
Followed By ENT
Code :    0
```

Setup Menu: If the correct password is entered, the unit will display the Setup Menu Screen. From the Setup Menu, the operator can access the refrigerant monitoring settings (Sample Setup), the gas code assigned to each refrigerant programmed in the monitor, system configurations settings and the contact screen.

```
 1)…IR Setup
 2)…N/A
 3)…System Setup
 4)…Contact        ABORT
```

IR Setup: Press the "1" key to enter Sample Setup. The sample setup screens allow the user to set the gas code for the refrigerant to be monitored, the distance of the tube used for the sample, and the Low, Main and high alarm thresholds. The first sample setup screen will display the gas code and the distance. The cursor can be moved by entering information, or if the information is correct, pressing the "ENT" key.

```
AREA        1
R-134A      8        <- ->
Distance   250
      ENT   or   ABORT
```

Press the left or right arrow keys to change from one gas type to another. The gasses are organized in numerical order, with refrigerants first, and fire suppression agents or blowing agents following refrigerants. Once the appropriate gas is displayed, press the "ENT" key to move the cursor from line two to line three.

As of January 1, 2003 the standard IR-SNIF monitor is capable of detecting and responding to the following list of refrigerants.

R-11, R-12, R-13, R-22, R-113, R-114, R-123, R-134A, R-401A, R-401B, R-402B-HP81, R-404A-HP62, R-407A-AC9000, R-408A, R-409A, R-410A-AZ20, R-500, R-502, R-503, R-507-AZ50

Enter the tube length, in feet, if the tube length is greater than 100 feet. If the tube is shorter than 100 feet, leave the setting at the factory default of 100. When the distance has been entered, press the "ENT" key to display the second sample setup screen.

```
Alarm Low          25  -
Alarm Main         50
Alarm High        500
     ENT   or   ABORT
```

Unless specified otherwise, SenTech Corporation recommends the following alarm settings for all refrigerants *except R-123*:

Low = 25 ppm
Main = 50 ppm
High = 500 ppm

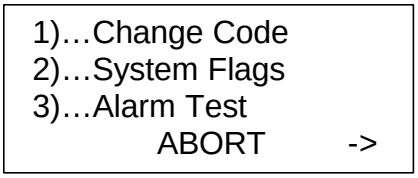
Unless specified otherwise, SenTech Corporation recommends the following alarm settings for R-123:

Low = 25 ppm

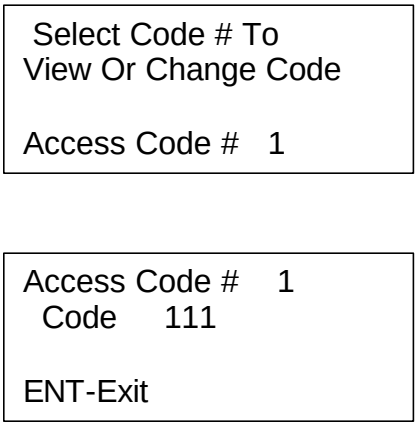
Main = 50 ppm
High = 150 ppm

These settings are based on the current acceptable exposure levels and short-term exposure levels on a time weighted average for refrigerants. SenTech recommends that under no circumstances should a refrigerant monitor be set above the short-term exposure level. These are recommended settings only. Refer to local codes and regulations for the appropriate settings for a given application.

System Setup: The System Setup menus are accessed from the Setup menu by pressing the "3" key. System setup consists of two screens that allow the user to change passwords, change system flags, test the alarm circuits and set the time and date. The user can toggle from one screen to the other by using the left and right arrow keys.



Change Code
The operator can change passwords 1 through 4 by pressing the "1" key. The operator then enters the code number (1-4) and is able to enter the new password.



System Flags: Press the “2” to enter the System Flags screen. The system flag screen will display information for two settings, and a cursor to the right of the password flag.

Password Flag: The password flag can be set to either 0 or 1. If a 1 is entered, the monitor will require the user to enter a password to perform any functions of the monitor. This feature is useful if the monitor is installed in a public area, and controlled access to the monitor is needed. This flag is set to 0 by default.

Horn Relay Flag: Press the “ENT” to move the cursor to the horn relay flag. The horn relay flag can be set to 0, 1, 2 or 3. This flag changes the function of one relay to control an audible alarm. With the flag set to the 0, the alarm relays will be energized so long as the monitor is in an alarm state. If the user **dedicates** one alarm level to energize an audible alarm, the monitor can be programmed to allow one relay to be de-energized while the monitor is still in alarm. This feature is useful when the user is

troubleshooting an alarm, and wants to work in silence. Set the horn relay flag to 1 to use the LOW relay as a dedicated horn relay. Set the horn relay flag to 2 to use the MAIN relay as a dedicated horn relay. Set the horn relay flag to 3 to use the HIGH relay as a dedicated horn relay. This flag is set to 0 by default.

Unit Number Flag: The unit number flag is used to identify the monitor on a RS-485 network, if that option has been purchased. This flag is set to 1 by default.

```
PASSWORD FLAG 0     -
HORN RELAY FLAG 0
UNIT NUMBER FLAG 1
```

Press the “ENT” key to move the cursor to the next entry. When all entries have been viewed, press the “ENT” key again to return to the previous menu. The monitor should again display the system setup menu.

Alarm Test: The Alarm Test screen is used to enable the installer to verify that the monitor is correctly integrated into the building systems.

```
      Alarm Test
 1)…Low   2)…Main
 3)…HIGH  4)…All
  Press Key To Test
```

Key selections 1, 2, and 3 are used to energize the Low, Main and High alarm relays respectively. Key selection 4 will initiate a cycle that turns on the low relay, then the main relay, then the high relay, until all three relays are energized. If any relay has been energized, the fourth line of the display will change to instruct the user to press the “RESET” key to de-energize the relays.

```
      Alarm Test
 1)…Low   2)…Main
 3)…HIGH  4)…All
   RESET  To Clear
```

With the alarm relays energized, confirm that the monitor is correctly integrated into the building systems. Once this test has been completed, press the “ABORT” key. The monitor will restore any alarms that existed prior to entering this test mode, and will return to the system setup screen. Press the “ABORT” key again to return to normal operation.

Date/Time: The Date/Time menu is accessed by pressing the "4" key. This menu will allow the operator to enter the Month, Date, Hour and Minute stored by the real time clock in the processor. Note that Time is based on a 24-hour clock, or military time. Pressing "ENT" (enter) enters the current information and moves the cursor to the next entry. Pressing "ABORT" saves the information and returns to the previous menu.

```
RTC Month      3    -
RTC Day       10
RTC Hour      12
RTC Min       31
```

APPENDIX B: SenTech Room Volume Considerations (English)

Normal industry practice has been to thin about refrigerant leans in terms of pounds of refrigerant per unit time, such as lbs/hr or oz/yr. This is a natural and logical way of looking at it. The system monitors the amount of refrigerant present in the air in parts per million (ppm) by volume or refrigerant molecules as compared to air molecules. In order to develop a correlation between the leak rate in weight per unit time and parts per million, there are a number of items that need to be considered. These are:

1. Room volume.
2. The weight of refrigerant per unit volume at ambient temperature and pressure.
3. The amount of time the refrigerant has been leaking.
4. The rate at which fresh air enters the room and existing air is exhausted.
5. The location of the inlet, relative to the leak, airflow in the room and the rate at which the refrigerant expands to fill the room.

For a specific application, items 1 through 4 can be calculated, or estimated. Item 5 is virtually unpredictable, therefore in all calculations; it is assumed that the leaking refrigerant will expand to fill the room with an even distribution of refrigerant. This assumption will yield safer, conservative calculations. If the monitor sample and reference locations have been appropriately chosen, the monitor will see a higher concentration than calculated from the ideal formulas.

Formula Definitions:

ppm – refrigerant concentration
LR – leak rate in cubic feet/hour
FA – fresh air into the room in cubic feet/hour
VOL – room volume in cubic feet
t – time in hours
R – volume of refrigerant in cubic feet
LRmin – minimum leak rate that will result in a given ppm
RD – refrigerant density in lbs/cubic foot

To be able to convert between ppm and leak rate in cubic feet/hour, the refrigerant density must be calculated. If the molecular weight of the refrigerant is known, the refrigerant density can be calculated.

[MolWt(gms)/1(mole)] x [1(mole)/22.4(l)] x [1(lb)/454(g)] x [28.32(l)/1(cuft)] x [273(K)/293(K)] = RD(lb/cuft)

Calculating for R-22, 86.48(g/mole),
RD22 = .22 lb/cuft and
1/RD22 = 4.46 cuft/lb

Other densities are as follows:

R-22	RD22 = .22 lb/cuft
R-12	RD12 = .31 lb/cuft
R-11	RD11 = .36 lb/cuft
R-502	RD502 = .29 lb/cuft
R-123	RD123 = .41 lb/cuft

Two examples have been developed to demonstrate the conversion. **Case I** is for a sealed room, with no air turnover. **Case II** is for a room with a known air turnover.

Case I: Sealed room 40 ft x 30 ft x 10 ft high

1. How much R-22 (in lbs) is necessary to cause a measurement of 25 ppm?

Given 25 ppm R-22 in the sealed room:

Volume of R-22 = parts per million / million x room volume

R(cuft) = [25(ppm)/1,000,000] x [40 x 30 x 10](cuft)

R(cuft) = .3 cuft of R-22 in the sealed room

Given .3 cuft R-22, calculate weight in lbs:

Weight = volume(cuft) x density(lb/cuft)

Weight = R(cuft) x RD22(lb/cuft)

Weight = .3(cuft) x .22(lb/cuft)

Weight = .066 lbs

2. If the leak rate is 300 lb/yr, how long will it take to reach 25 ppm?

Given the same refrigerant in the same room, 25 ppm weighs .066 lbs:

Time(hr) = weight of R-22(lb) / [weight(lb)/time(yr)] x [time(hr)/time(yr)]

Time(hr) = .066(lb) / [300(lb)/1(yr)] x [8760(hr)/1(yr)]

Time(hr) = 1.93 hrs

Case II: 40 ft x 30 ft x 10 ft high room with fresh air makeup of 100 cfm

1. How much R-22 (in lbs/yr) is necessary to cause a measurement of 25 ppm?

Given air turnover of 100cfm, calculate the fresh air volume in cuft/hr:

Air flow (cuft/hr) = air flow (cfm) x [60(min)/1(hr)]

Air flow(cuft/hr) = 100cfm x 60 min/hr = 6000 cuft/hr

Given 6000 cuft/hr, calculate the leak rate that is required to *maintain* a measurement of 25 ppm:

Leak rate min (cuft/hr) = parts per million/million x fresh volume(cuft/hr)

Leak rate min (cuft/hr) = [25(ppm)/1.000.000] x 6000(cuft/hr)

Leak rate min(cuft/hr) = .15 cuft/hr

Given .15 cuft/hr, calculate the leak rate in lb/yr needed to *reach* 25 ppm:

Leak rate(lb/yr) = leak rate(cuft/hr) x density(lb/cuft) x [8760(hr) / 1(yr)]

Leak rate(lb/yr) = .15(cuft/hr) x .22(lb/cuft) x 8760(hr/yr)

Leak rate(lb/yr) = 289 lb/yr, therefore the leak rate must be **GREATER THAN 289 lb/yr**.

2. If the leak rate is 500 lb/yr, how long will it take to reach 25 ppm?

Calculate LR in cuft/hr:

LR(cuft/hr) = [leak rate(lb/yr) / density(lb/cuft)] / 8760(hr/yr)

LR(cuft/yr) = 500(lb/yr) / .22(lb/cuft) / 8760(hr/yr)

LR(cuft/yr) = .26 cuft/hr

Calculate time in hr:

Time(hr) = [Room volume(cuft)/Air flow(cuft/hr)] x ln[LR(cuft/hr) / [LR(cuft/hr) – Leak rate min(cuft/hr)]]

Time(hr) = [12000(cuft)/6000(cuft/hr)] x ln[.26(cuft/hr)/[.26(cuft/hr)-.15(cuft/hr)]

Time(hr) = 2(hr) x ln[2.3636] **Time(hr) = 1.72 hr**

SenTech Room Volume Considerations (Metric)

Normal industry practice has been to thin about refrigerant leans in terms of pounds of refrigerant per unit time, such as lbs/hr or oz/yr. This is a natural and logical way of looking at it. The system monitors the amount of refrigerant present in the air in parts per million (ppm) by volume or refrigerant molecules as compared to air molecules. In order to develop a correlation between the leak rate in weight per unit time and parts per million, there are a number of items that need to be considered. These are:

1. Room volume.
2. The weight of refrigerant per unit volume at ambient temperature and pressure.
3. The amount of time the refrigerant has been leaking.
4. The rate at which fresh air enters the room and existing air is exhausted.
5. The location of the inlet, relative to the leak, airflow in the room and the rate at which the refrigerant expands to fill the room.

For a specific application, items 1 through 4 can be calculated, or estimated. Item 5 is virtually unpredictable, therefore in all calculations, it is assumed that the leaking refrigerant will expand to fill the room with an even distribution of refrigerant. This assumption will yield safer, conservative calculations. If the monitor sample and reference locations have been appropriately chosen, the monitor will see a higher concentration than calculated from the ideal formulas.

Formula Definitions:

ppm – refrigerant concentration
LR – leak rate in cubic meter/hour
FA – fresh air into the room in cubic meter/hour
VOL – room volume in cubic meter
t – time in hours
R – volume of refrigerant in cubic meter
LRmin – minimum leak rate that will result in a given ppm
RD – refrigerant density in kg/cubic meter

To be able to convert between ppm and leak rate in cubic meter/hour, the refrigerant density must be calculated. If the molecular weight of the refrigerant is known, the refrigerant density can be calculated.

[MolWt(gms)/1(mole)] x [1(mole)/22.4(l)] x [1(kg)/1000(g)] x [273(K)/293(K)] = RD(kg/cubic meter)

Calculating for R-22, 86.48(g/mole), RD22 = 3.59 kg/cubic meter and 1/RD22 = .28 cubic meter/kg

Other densities are as follows:
R-22 RD22 = 3.59 kg/cubic meter
R-12 RD12 = 4.96 kg/cubic meter
R-11 RD11 = 5.76 kg/cubic meter
R-502 RD502 = 4.64 kg/cubic meter
R-123 RD123 = 6.56 kg/cubic meter

Two examples have been developed to demonstrate the conversion. **Case I** is for a sealed room, with no air turnover. **Case II** is for a room with a known air turnover.

Case I: Sealed room 15 m x 10 m x 3 m high

1. How much R-22 (in kg) is necessary to cause a measurement of 25 ppm?

Given 25 ppm R-22 in the sealed room:

Volume of R-22 = parts per million / million x room volume

R(cubic meter) = [25(ppm)/1,000,000] x [15 x 10 x 3](cubic meter)

R(cuft) = .01125 cubic meter of R-22 in the sealed room

Given .01125 cubic meter R-22, calculate weight in kg:

Weight = volume(cubic meter) x density(kg/cubic meter)

Weight = R(cubic meter) x RD22(kg/cubic meter)

Weight = .01125(cubic meter) x 3.59(kg/cubic meter)

Weight = .040 kg

2. If the leak rate is 150 kg/yr, how long will it take to reach 25 ppm?

Given the same refrigerant in the same room, 25 ppm weighs .040 kg:

Time(hr) = weight of R-22(kg) / [weight(kg)/time(yr)] x [time(hr)/time(yr)]

Time(hr) = .040(kg) / [150(kg)/1(yr)] x [8760(hr)/1(yr)]

Time(hr) = 2.34 hrs

Case II: 10 m x 15 m x 3 m high room with fresh air makeup of 225 cubic meter/hr

1. How much R-22 (in kg/yr) is necessary to cause a measurement of 25 ppm?

Given air turnover of 225cubic meter/hr, calculate the leak rate that is required to *maintain* a measurement of 25 ppm:

Leak rate min (cubic meter/hr) = parts per million/million x fresh volume(cubic meter/hr)

Leak rate min (cubic meter/hr) = [25(ppm)/1.000.000] x 225(cubic meter/hr)

Leak rate min(cubic meter/hr) = .005625 cubic meter/hr

Given .005625 cubic meter/hr, calculate the leak rate in kg/yr needed to *reach* 25 ppm:

Leak rate(kg/yr) = leak rate(cubic meter/hr) x density(kg/cubic meter) x [8760(hr) / 1(yr)]

Leak rate(kg/yr) = .005625(cubic meter/hr) x 3.59(kg/cubic meter) x 8760(hr/yr)

Leak rate(kg/yr) = 176.9 kg/yr, therefore the leak rate must be **GREATER THAN 177 kg/yr**.

2. If the leak rate is 300 kg/yr, how long will it take to reach 25 ppm?

Calculate LR in cubic meter/hr:

LR(cubic meter/hr) = [leak rate(kg/yr) / density(kg/cubic meter)] / 8760(hr/yr)

LR(cubic meter/yr) = 300(kg/yr) / 3.59(kg/cubic meter) / 8760(hr/yr)

LR(cubic meter/yr) = .009539 cubic meter/hr

Calculate time in hr:

Time(hr) = [Room volume(cubic meter)/Air flow(cubic meter/hr)] x ln[LR(cubic mete/hr) / [LR(cubic meter/hr) – Leak rate min(cubic meter/hr)]]

Time(hr) = [450(cubic meter)/225(cubic meter/hr)] x ln[.009539(cubic meter/hr)/[.009539(cubic meter/hr)-.005625(cubic meter/hr)]

Time(hr) = 2(hr) x ln[2.437] **Time(hr) = 1.78 hr**

APPENDIX C: Parts List and Wire List

Parts List: Refer to figure C1 for approximate location of the following parts:

1. 422009, Door, IR-SNIF-1,2,3
2. 422015, Box, IR-SNIF-1,2,3
3. 422017, Backplate, IR-SNIF-1,2,3
4. 422050, Tube End Filter, IR-SNIF-1,2,3 (not shown)
5. 420053, Fitting, 1/8 Hose Barb to 1/8 NPT (not shown)
6. 422041, Manifold, IR-SNIF-1,2,3
7. 410224, Diaphragm Pump 110 vac (422224, Diaphragm Pump 240 vac)
8. 420038, Pressure Switch
9. 410136-Gray, Orifice .016 (not shown)
10. 422010, IR Bench, IR-SNIF-1,2,3
11. 422031, Control Board
12. 421036, Display (not shown)
13. 421031, Keypad, IR-SNIF-MCD and IR-SNIF-1,2,3 (not shown)
14. 422040, Socket, Relay, IR-SNIF-1,2,3
15. 422087, Relay, 24VDC, IR-SNIF-1,2,3
16. 421072, Terminal Board, 8 Position
17. 410033, Fuse Holder (not shown)
18. 410034, Fuse, 3A (not shown)
19. 422036, Power Supply, Triple Output

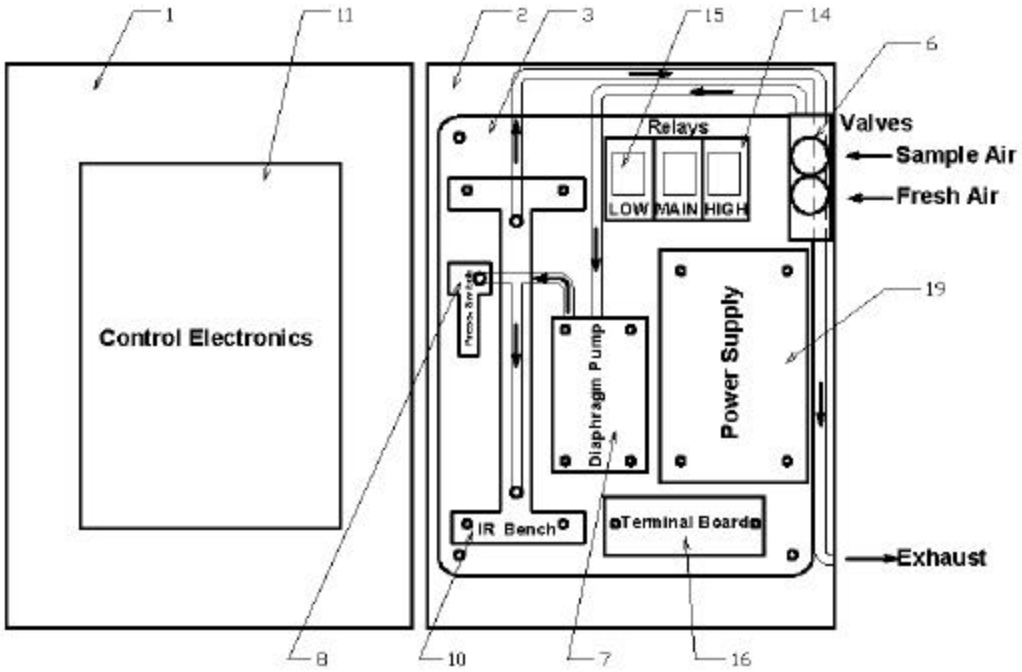


Figure C1. Parts Diagram

Wire List: The following list defines every wire in the monitor. Abbreviations are defined as follows:

PS = Power Supply
F1 = Fuse Holder
TB1 = Terminal Board
K1, K2, K3 = Relays
A1 = Control Board
A1-Px = Connector on Control Board A1

Wire #	From	To	Type	Description
1	Valve, Sample Air-1	A1-P5-1	24 AWG ,Black	Auto Sample GND
2	Valve, Sample Air-2	A1-P5-2	24 AWG ,Black	24Vdc
3	Valve, Fresh Air-1	A1-P5-3	24 AWG ,Black	Auto Zero GND
4	Valve, Fresh Air-2	A1-P5-4	24 AWG ,Black	24Vdc
5	PS P2-1	A1-P9-3	24 AWG ,Red	24Vdc
6	PS P2-2	SOURCE P1-2	24 AWG ,Blue	5Vdc
7	PS P2-4	A1-P9-1	24 AWG ,Black	DC Ground
8	PS P2-5	SOURCE P1-1	24 AWG ,Black	DC Ground
9	K3-A	A1-P4-5	24 AWG ,White	Switched Ground "High Alarm"
10	K3-B	A1-P4-6	24 AWG ,Red	24Vdc “High Alarm”
11	K2-A	A1-P4-3	24 AWG ,White	Switched Ground "Main Alarm"
12	K2-B	A1-P4-4	24 AWG ,Red	24Vdc “Main Alarm”
13	K1-A	A1-P4-1	24 AWG ,White	Switched Ground "Low Alarm"
14	K1-B	A1-P4-2	24 AWG ,Red	24Vdc “Low Alarm”
15	TB1-6	A1-P8-1	24 AWG ,White	Analog 1
15	*TB1-6*	*A1-P6-1*	*24 AWG, White*	*rs-485 Transmit(optional)*
16	TB1-7	A1-P8-3	24 AWG ,White	Analog 2
16	*TB1-7*	*A1-P6-3*	*24 AWG ,White*	*rs-485 Ground(optional)*
17	TB1-8	A1-P8-4	24 AWG ,White	Analog Ground
17	*TB1-8*	*A1-P6-4*	*24 AWG ,White*	*rs-485 Receive(optional)*
18a	TB1-1	BOX GND	22 AWG ,Green/Yellow	Earth Ground
18b	TB1-1	PS GND	22 AWG ,Green/Yellow	Earth Ground
19	TB1-2	F1-1	22 AWG ,Black	AC Line In
20	TB1-4	F1-2	22 AWG ,Black	Fused AC Line
21	TB1-3	PS P1-N	22 AWG ,White	AC Neutral
22	TB1-4	PS P1-L	24 AWG ,Black	Fused AC Line
23	TB1-1	Pump GND	22 AWG ,Green	Earth Ground
24	TB1-3	Pump Neutral	22 AWG ,White	AC Neutral
25	TB1-4	Pump Line In	22 AWG ,Black	Fused AC Line
26	DETECTOR P1-1	A1 P7-1	24 AWG, Red	12 Vdc Detector Power
27	DETECTOR P1-1	A1 P7-4	24 AWG, Black	Detector Ground
28	DETECTOR P2-1	A1 P7-2	24 AWG, White	Detector Signal
29	SW1 COM	A1 P7-4	24 AWG, Black	12 Vdc Detector Power
30	SW1 NC	A1 P7-3	24 AWG, Red	12 Vdc Detector Power
31	GND	Door GND	22 AWG ,Green/Yellow	Earth Ground

TROUBLESHOOTING GUIDE

This guide is written for a technician familiar with the operation and programming described previously in this manual. All procedures in this can be performed with simple hand tools and a volt-ohm meter. If at any time, additional assistance be required, call SenTech Corporation at 888-248-1988 for technical support.

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1. No Power	a) Check the fuse and replace if failed. b) Check incoming AC Power at TB1-2 and TB1-3.
2. No Display	a) Verify AC Power. b) Check for red lights on the control board. Two lights should be lit on the control board. A power light will be lit in the upper left area of the control board. Another light should be lit in the center right area of the board. This will be either the red light labeled "RYL5" or "RLY6". Following "Optics Warm-up", the controller will alternate between "RLY6" (fresh air) and "RLY5" (sample air), at approximate two-minute intervals. *If no power lights are lit, there is a DC power fault.* *If the power lights are lit, but the neither "RLY5" nor "RLY6" are lit, or the controller is not alternating between them, the control board has a fault.*
3. DC Power Fault	a) If there is AC power to the monitor, but there are no lights lit on the control board. Measure the DC voltage supplied to the control board. Identify the power connector, P9 and the power resistor, R53 on the lower left corner of the board. Measure the DC voltage between the left side of R53 and chassis ground. This measurement should read between 22vdc and 25vdc.

	If there is no DC voltage, turn off the monitor and remove one device at a time from the DC power circuit. The 24 vdc relays can be removed from the relay socket. The control board can be disconnected at the input terminal on the board. The solenoid valves can be disconnected at TB1-6. Note: the power supply must have a load to operate, so each item must be disconnected, then tested and replaced.
	b) If there is DC voltage on R53, check the 24 vdc terminals on the alarm relays. Using the wire-list from the previous section, isolate the fault to a wiring problem.
4. Pneumatics Failure	a) Check that the diaphragm pump is operating and replace if it has failed.
	b) Check that the tubing inside the monitor has not come loose from any fitting, or become kinked at any point.
	c) Check that the orifice or tube end filter have not become clogged or restricted.
	d) Check that the tubes connected to the sample air inlet and fresh air inlet have not become clogged or restricted.
	e) Check that the solenoid valves are switching. Verify that the lights labeled “RLY5” and “RLY6” are switching on and off. Temporarily block the air inlet and listen for the diaphragm pump to draw a vacuum. If the pump does not change tone, and is known to work, the valve is not switching.
5. Failure to Detect a Leak or Suspected Low Sensitivity	a) Alarm lights are on, but external alarm devices are not actuated. Repeat the “Integration with External Devices” from the Final test portion of this manual.
	b) Alarm light is not on, but a leak is suspected. Verify that the alarm settings are not set too high.

	Refer to “Startup and Programming” section of this manual for instructions. c) Repeat the complete procedures described in the “Final Tests” section of this manual. d) Verify that the sample air and fresh air pick up point locations are appropriate in accordance with the “Installation” section of this manual. e) If the monitor does not respond to refrigerant, contact SenTech Corporation technical support.
6. System Alarms when no Leak is Found	a) Verify that the alarm is not a “Trouble Alarm” as described in Appendix A. b) Verify that the alarm settings are not set too low. Refer to “Startup and Programming” section of this manual for instructions. c) Inspect the area for the presence of halogenated organic chemicals. Some degreasers and cleaning agents are made of organic chemicals containing chlorine, fluorine or bromine. Such chemicals might cause an alarm. d) Inspect the area for oil leaks. Oil can contain trace amounts of refrigerant, and will likely cause a transient alarm. e) Verify that there truly is no refrigerant leak in the area. This includes all machines and stored refrigerants. *If none of the above resolve the problem, the unit has likely failed. Contact SenTech Corporation technical support for assistance.*

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SenTech warrants to the original purchaser-user that its equipment, as originally supplied, is free from defects in materials and workmanship and will perform adequately under normal use and service, subject to the following conditions and limits:

If the equipment or any part or parts thereof prove to be defective in normal use, then such item or parts will be repaired or replaced at the option of **SenTech** by **SenTech**, provided that notice of such defect is given by original purchaser-user to **SenTech** within one (1) year from the date of original installation (Warranty Registration Must Be On File) or 15 months from the date of sale of the equipment to the original purchaser whichever comes first.

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