H25·IR PRO

INFRARED REFRIGERANT GAS LEAK DETECTOR

Service Manual

Instruction 3015-5679
Revision 3
September 2014

Product Leadership • Training • Service • Reliability

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Revision 0 of this manual corresponds to firmware version 1.07 or newer.
Revision 2 of this manual corresponds to firmware version 1.09 or newer.

Patent 6,590,690. Other patents pending.

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CHAPTER 1: INTRODUCTION

IN THIS SECTION

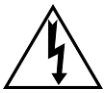
1.1. Intended Audience

This manual is intended to be used by factory-trained service personnel experienced in the operation and troubleshooting of the H25-IR PRO. It is a supplement to the H25-IR PRO User's Manual (P/N 3015-5678).

1.2. Conventions Used in This Manual

The following symbols and statements may be used within this manual.

WARNING: This symbol and/or the use of the word **WARNING** indicates a potential hazard associated with the use of this equipment. Failure to correctly perform or adhere to the procedure, practice, or condition could result in death or serious injury.



WARNING: This symbol and/or the use of the word **WARNING** indicates a potential hazard from **electrical shock**. Failure to correctly perform or adhere to the procedure, practice, or condition could result in death or serious injury from electrical shock.

CAUTION: This symbol and/or the use of the word **CAUTION** indicates a potential hazard associated with the use of this equipment. Failure to correctly perform or adhere to the procedure, practice, or condition could result in minor or moderate injury. This may also be used to alert readers of unsafe practices.

IMPORTANT: This symbol and the use of the word **IMPORTANT** calls attention to components that are sensitive to the effects of electro-static discharge (ESD). Equipment damage will likely occur if proper ESD mitigation procedures are not followed.

IMPORTANT: The use of the word **IMPORTANT** in this manual calls attention to a procedure, practice, condition, or the like, which if not correctly performed or adhered to, could result in incorrect performance of or damage to the equipment and may void the warranty.

NOTE: The use of the word **NOTE** in this manual provides emphasis of a feature, operation, etc. Notes are also useful to address potential service calls/issues.

1.3. Safety Precautions

To assure operator safety and the proper use of the leak detector, please read this manual. It provides important information on the configuration, operation, and maintenance of the leak detector.

HAZARDOUS AREA WARNING: This instrument has <u>not</u> been designed to be intrinsically safe for use in areas classified as hazardous locations. For your safety, **<u>DO NOT</u>** use it in hazardous (classified) locations.

COMBUSTIBLE/FLAMMABLE GAS WARNING: This is NOT a safety device. Some gases which this instrument can detect may be combustible/flammable. When properly configured, this instrument is designed to alarm at concentrations that are lower than the explosive limit of the gas. As such, it is the buyer's responsibility to initiate an immediate planned response to any gas leaks as soon as they are detected. This equipment should NEVER be used to measure or sample gases at or above their respective lower explosive limits.

WARNING: The leak detector must be operated with a connection to a protective ground. Failure to do poses a potential shock hazard and is also a violation of electrical safety standards applicable to this type of equipment.

WARNING: Do not operate this equipment in the presence of flammable liquids, vapors, or aerosols. Operation of any electrical instrument in such an environment constitutes a safety hazard.

WARNING: It is imperative that the exhaust port on this instrument be properly vented as described in this manual. Failure to do so may constitute a safety hazard.

WARNING: Extreme care should be exercised when accessing the interior of the leak detector. Only qualified electrical maintenance personnel should make connections and perform adjustments. Always remove AC power before opening the leak detector's enclosure.

WARNING: The protection provided by the leak detector may be impaired if the leak detector is used in a manner not specified by Bacharach, Inc. Modifications to this leak detector, not expressly approved, will void the warranty.

WARNING: Do not continue to use this equipment if there are any symptoms of malfunction or failure. In the case of such occurrence, de-energize the power supply and contact a qualified repair technician or the nearest Bacharach Service Center.

WARNING: This device uses type "F" fuses rated at 1.0 A, 250 VAC. Replace ONLY with Bacharach-approved fuses (see Spare Parts and Accessories on page 37 for the part number).

IMPORTANT: Operating this device above the altitude limit of 6,562 ft (2,000 m) will affect the expected results and specifications.

IMPORTANT: The leak detector uses a universal power supply that is capable of accepting inputs of 100 to 240 VAC, 50/60 Hz. The leak detector's power consumption is 16 Watts. It is highly recommended that the leak detector be connected directly to the AC power source, preferably on its own circuit with UPS or surge protection.

NOTE: Use ONLY the provided connectors for electrical and communications wiring. Drilling into the box will void the warranty.

NOTE: To clean the outside of the case use a dry cloth. To avoid shock hazard and/or equipment damage, DO NOT use soap and water.

1.4. Required Equipment

In order to provide factory-level service of H25-IR PRO instruments, qualified service personnel must have the following required equipment available.

Table 1-1. Required Equipment

#	Item Description
1.	Latest revisions of the Operator's Manual (P/N 3015-5678) and the Service Manual (P/N 3015-5679)
2.	H25-IR PRO and probe
3.	Spare parts as required
4.	Personal computer running Windows® 95/98/2000/NT/XP/Vista/7 and with open COM port
5.	Flash Utility Software and Latest Firmware Image File (download from website http://www.mybacharach.com/downloads.htm)
6.	9-pin-Female to 9-pin-Male Serial Cable (P/N 104-4027)
7.	Flat blade screwdriver
8.	Phillips head screwdriver
9.	Calibrated, precision, external gas mass flow meter (see Table 6-14 on page 31 for additional information)
10.	Tweezers or pin
11.	Wire cutters
12.	Needle nose pliers or equivalent (2 sets)
13.	Excess air flow setup (tubing, tee, and flow meter) (see Figure 6-7 on page 35 for more information)
14.	Calibration gas cylinder(s) (as required) with regulator(s) (see important notes on page 32)
15.	Removable thread locking compound (Loctite 242 or equivalent)

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CHAPTER 2: INSTRUMENT DESCRIPTION

IN THIS SECTION

2.1. Principles of Infrared Gas Detection

This instrument utilizes the principle of *infrared absorption* to measure the absolute concentration of a particular gas that is contained in the sample.

When infrared energy of a broad-spectral content is passed through an unknown gas, some of the infrared frequencies are absorbed while the rest are transmitted without attenuation. Those frequencies that are absorbed correspond to the natural frequencies of the vibration modes of the gas molecules. The amount of infrared energy absorbed is proportional to the concentration of the gas.

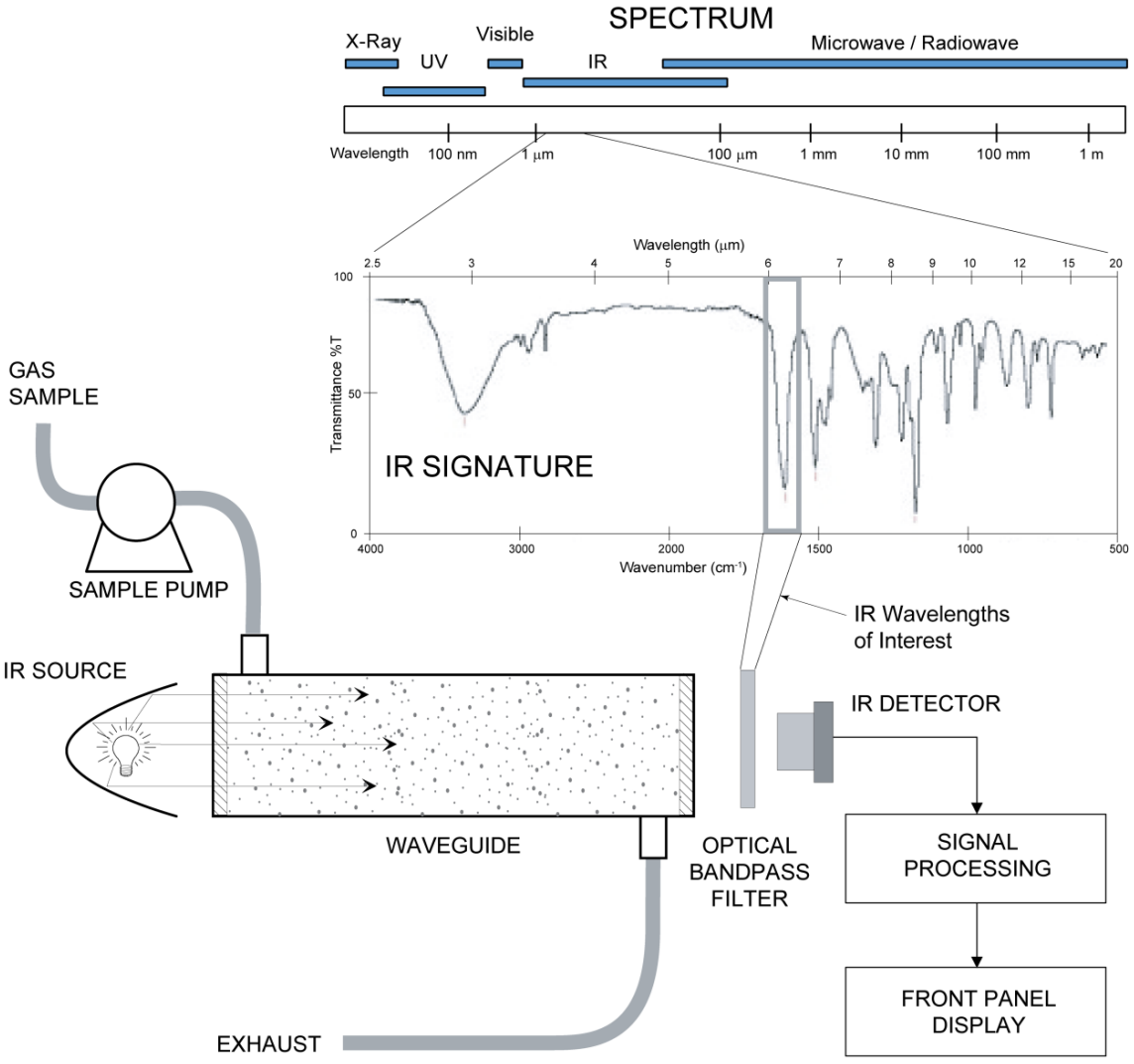

Figure 2-1. Principles of Infrared Gas Detection

2.1.1. Non-Dispersive Infrared (NDIR) Detector Construction

The infrared detector (refer to Figure 2-1 on page 5) consists of:

- a waveguide with gas inlet and outlet ports
- an IR source (emitter)
- an optical band pass filter
- an IR detector.

2.1.2. Infrared Energy Generation

Broadband infrared energy is generated by the IR source and pulsed ON and OFF at a frequency of 8 Hz to produce "dark" (no light hitting the detector) and "light" (full energy hitting the detector) signals. This is done to provide reference signals that are used by the processing circuitry to compensate for any drift in the IR-source or detector circuits.

2.1.3. Infrared Energy Transmission

The gas sample is pumped into the waveguide, where the infrared energy from the IR source is guided through the gas sample; passed through an optical band pass filter; and then applied to an IR detector.

2.1.4. Infrared Detection

An IR detector is positioned at the end of the infrared transmission path. An optical filter placed in front of the detector has a narrow pass band that corresponds to the absorption bandwidth of the gas molecules that the instrument is designed to detect. When the gas being monitored is present in the waveguide, the gas absorbs infrared energy, causing the detector to receive less energy than it normally would during the "light" phase. As more gas enters the waveguide, more infrared energy is absorbed; thereby lowering the amount of infrared energy that reaches the IR detector.

2.1.5. Signal Processing

The output signal of the IR detector is a sine wave with peak-to-peak amplitude that is a function of the amount of infrared energy striking the detector (dark to light). As the level of gas in the waveguide *increases*, the amount of infrared energy striking the IR detector *decreases* due to absorption at an exponential rate; thus lowering the amplitude of the detector's output. The detector's output is amplified and filtered, resulting in a DC signal that is inversely proportional to the concentration of gas contained in the waveguide.

2.1.6. Final Output

The instrument's microprocessor compares the IR detector's processed output signal to a stored calibration curve for the gas being monitored. Using signals from pressure and temperature sensors, and the ideal gas law, the level of gas is computed and displayed on the instrument's front panel.

2.2. Calculating the Leak Rate

The leak rate is measured by first capturing all the gas leaking from the component under test. Then, by accurately measuring the flow rate of the sampling stream and the gas concentration within that stream, the leak rate can be calculated using the equation listed below. The instrument then converts this data into the desired leak rate units of measure and displays the leak rate on the instrument's front panel.

$$\textbf{Leak Rate} = \textbf{Mass Flow Rate} \times \textbf{Gas Concentration}$$

where:

Leak Rate	=	Rate of gas leak from component under test
Mass Flow Rate	=	Sample mass flow rate
Gas Concentration	=	Concentration of gas in the sample (ppm)

2.3. Flow Rate (Search vs. Measure)

When searching for a leak, the instrument's gas-sampling system operates at a high flow rate, thus enabling the instrument to sense the gas from a leak as quickly as possible.

When measuring the leak rate, however, the instrument's flow rate is reduced. This is done to lower the dilution of the gas sample, thus maximizing the instrument's measurement sensitivity.

2.4. Component Functions

2.4.1. Front Panel Components

Front panel components are shown in Figure 2-1.

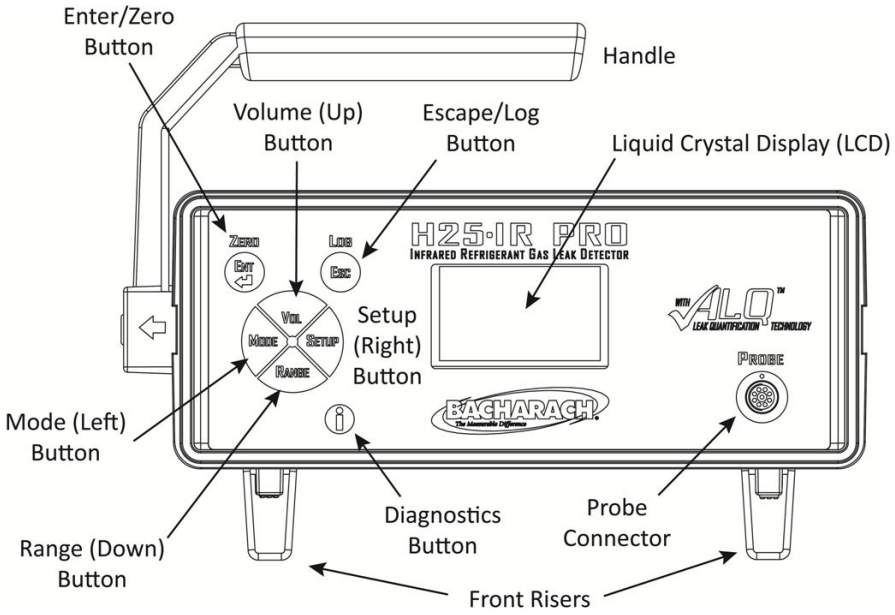

Figure 2-1. Front Panel Components of the H25-IR PRO

Front Panel Keypad Overlay – The operator controls the instrument by means of seven membrane pushbuttons. The keypad overlay is attached to the front plate, and electrically connects to the display board where the keypad signals are routed to the main board.

Probe Connector – Provides both the gas-sample-inlet and electrical connection for the probe and hose assembly. The gas sample is drawn from the probe tip through this connector's hose connection and into the IR optical bench by the sample draw pump, while this connector's electrical pins connect the probe's electronic circuitry to the main board.

LCD Display PCB Assembly and Display Board – The LCD provides the operator a visual display of the measured gas readings, along with displaying various instrument operating parameters. Power and the signals that control the LCD are routed from the main board through the display board, which is mounted directly behind the LCD.

2.4.2. Internal Components

Infrared Detector – Refer to Principles of Infrared Gas Detection on page 5.

Power Supply Board – A line voltage of between 100 and 240 VAC, 50/60 Hz is converted by the power supply board into outputs of +5 and +12 VDC. These DC voltages are applied to the main board where they are further distributed to the sample draw pump and display board.

Sample Draw Pump and Air-Hose Plumbing – A 12 VDC pump draws the gas sample into the instrument through the probe tip and then through an external coalescing particulate filter. The gas sample is next pumped into the NDIR optical sensor and out the instrument through a fitting mounted on the rear panel. The sample-flow rate is controlled by a solenoid valve that selects whether the gas sample flows through a straight-thru piece of tubing (high-flow rate), or through a flow-restrictor (low-flow rate). The high-flow rate is used when searching for leaks, while the low-flow rate is used when measuring the leak rate. A pressure transducer monitors the pressure at the inlet of the pump through a dampener, which smoothes out any pressure pulsations. The output of this pressure transducer is used in calculating the flow rate and leak rate, and also triggers a flow fault if the pressure either rises above or falls below preset limits as the result of the gas flow being blocked.

Figure 2-2. External Coalescing Particulates Filter

Figure 2-3. NDIR Optical Sensor

Main Board – This board performs the following functions:

- Interfaces the front panel keypad and display board to the CPU module.
- Powers the IR emitter while also chopping the emitter's output at a rate of 8 Hz.
- Amplifies, filters, and converts the output from the IR detector into a digital signal that is processed by the CPU module.
- Accepts inputs from temperature and pressure transducers, and converts these inputs to digital signals that are processed by the CPU module.
- Varies the sample-flow rate by controlling a valve that switches a flow-restrictor device in and out of the flow path.
- Controls 4 relays that can be programmed to energize under various different operating conditions.
- Controls operation of the sample-draw pump.
- Provides the RS-232 protocol necessary to interface the instrument to a personal computer for the purpose of flashing the main board's flash-memory chip with newer operating code.
- Provides a 4–20 mA output whose current level is a function of the detected gas level. This output can be used to control external monitoring devices (e.g., chart recorder).
- Provides regulated outputs of +3.3 volts (logic), +4.7 volts (analog), and +10 volts (IR emitter).
- Generates an audio signal that varies in pitch with changing gas levels. As the detected gas level rises, so does the pitch of the audio signal. This signal is applied to the audio board that, in turn, drives a speaker located on the rear panel.

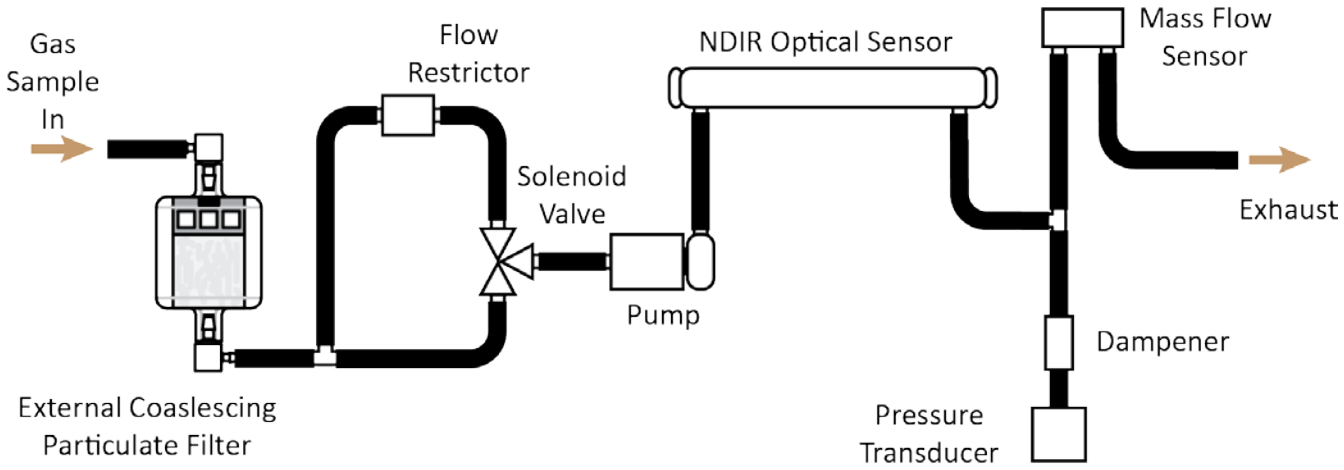

Figure 2-4. Gas Sample Flow Path (Air Hose Interconnections) for the H25-IR PRO

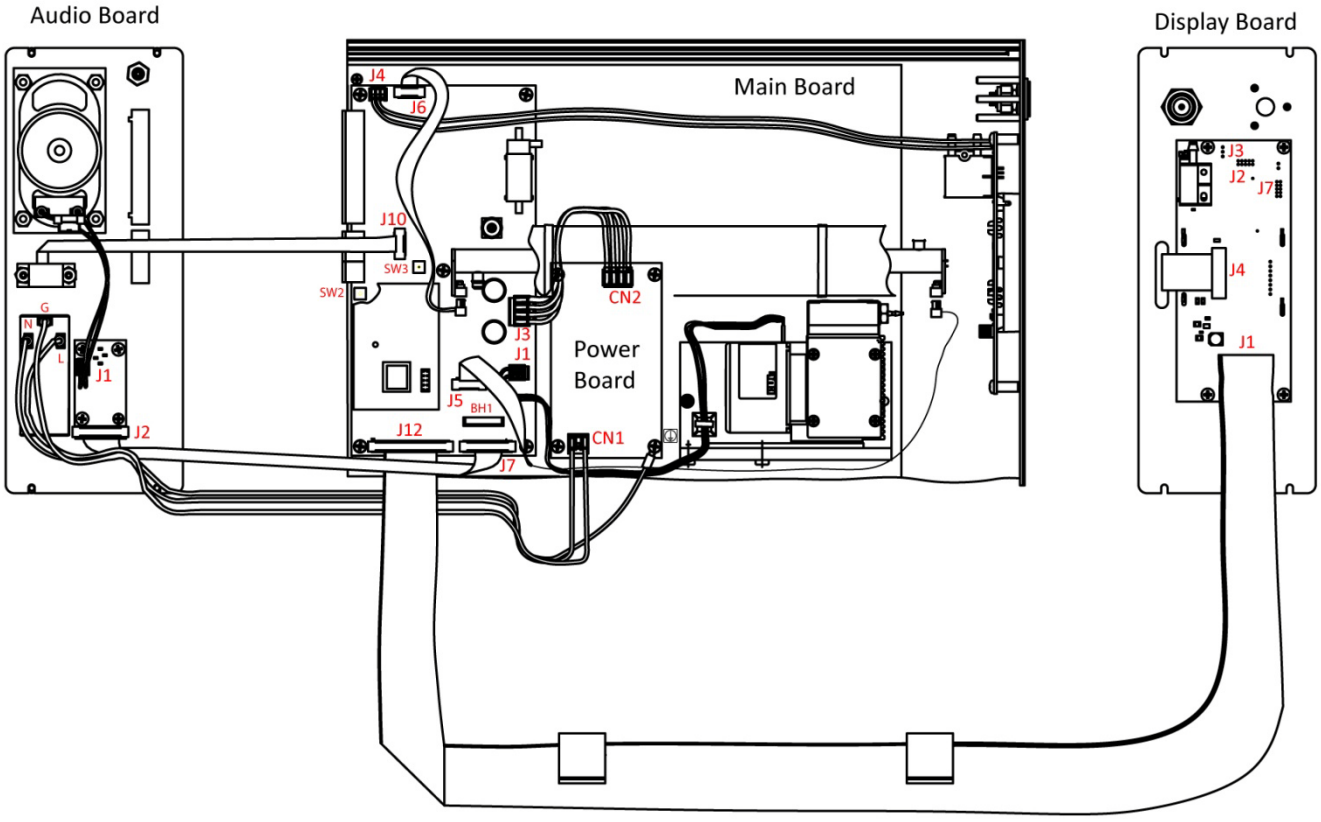

Figure 2-5. Interconnection Wiring Diagram

Table 2-1. Connector Descriptions

Board	Connector	Description
Audio	J1	Speaker Output
	J2	Audio Signal Input from Main Board
Power Supply	CN1	AC Power Input from Power Entry Module (Spade Connectors L, G, N)
	CN2	+5 and +12 VDC Output to Main Board
Display	J2	Probe Interface (Smart Probes)
	J3	Main Board Interface (Mass Flow)
	J4	Display Module Connector
	J7	Probe Interface (Standard Probes)
Main	J1	+12 VDC to Pump
	J3	+5 and +12 VDC Input from Power Supply Board
	J5	IR Emitter (Source) This
	J6	IR Detector
	J7	Audio Signal to Audio Board
	J10	RS-232 Interface (Flash Memory Programming)
	J12	Front Panel Keypad and Display Interface

2.4.3. Back Panel Components

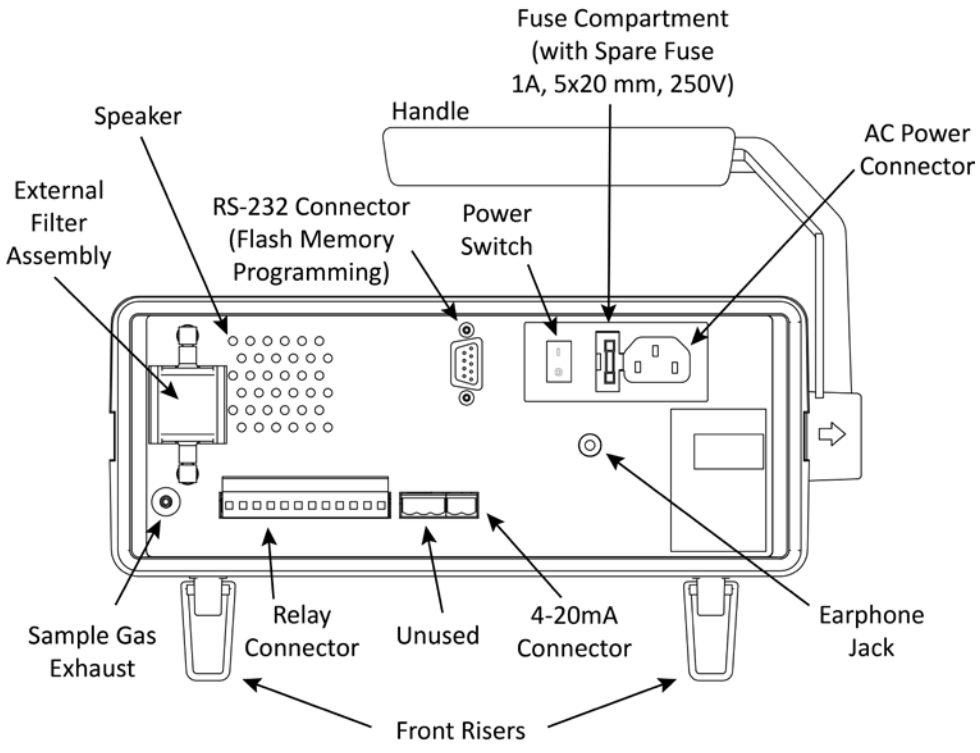

Figure 2-6. Back Panel Components of the H25-IR PRO

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CHAPTER 3: FIRMWARE UPGRADES

IN THIS SECTION

3.1. Overview

As updates to the instrument's firmware become available, the instrument can be upgraded by using the procedure below.

NOTE: The firmware upgrade procedure is sometimes referred to as *flashing memory*.

3.2. Items Required

Table 3-1. Items Required for Upgrading Firmware

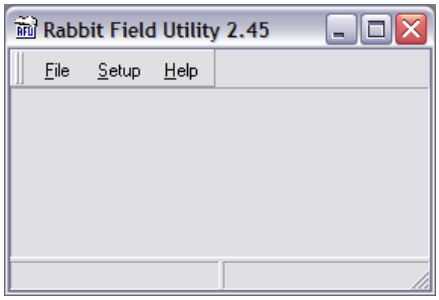
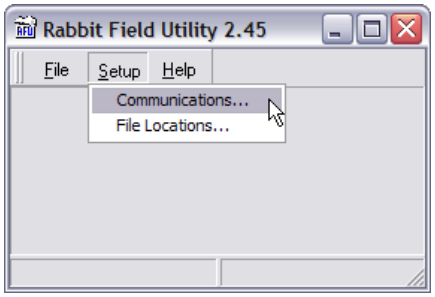
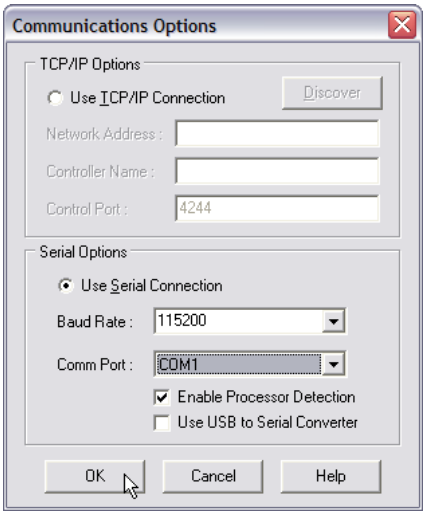
Item	Description
1	Flash Utility Software and Latest Firmware Image File (downloaded from Website http://www.mybacharach.com/downloads.htm).
2	Personal computer running Windows® 95/98/2000/NT/XP/Vista/7
3	An open COM port on the computer
4	9-pin-Female to 9-pin-Male Serial Cable (P/N 104-4027)

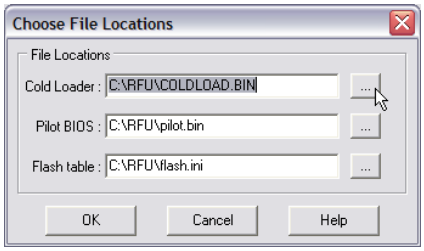
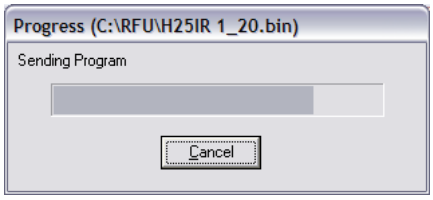
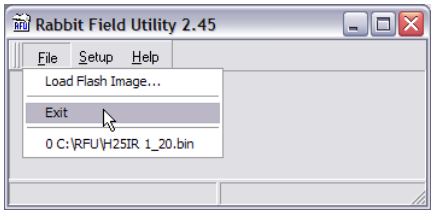
NOTE: USB-to-Serial adapters *may* work, but are unsupported.

3.3. Upgrade Procedure

Table 3-2. Firmware Upgrade Procedure

Step	Description
1	Connect one end of a "9-pin female to 9-pin male" serial cable to the instrument's RS-232 connector located at the back of the instrument.
2	Connect the other end of the cable to an open COM port connector on the computer (it may be necessary to use a 9-pin to 25-pin adapter to make the computer connection). **NOTE:** COM1 is the default port used by the Flash Memory Program. If COM1 is already in use by another device, then connect the instrument to the next available COM port. The software will need to be reconfigured as described in Step 8 to use this port.

Step	Description
3	Press and hold the ⓘ button on the front keypad and Turn ON the instrument. After the unit beeps quickly several times release the ⓘ button. Pressing the ENT key will place the instrument in firmware upgrade mode. **NOTE:** The following steps assume that the operator is familiar with the Windows Operating System, and is knowledgeable in creating folders, copying files, and navigating the file system using Windows Explorer. If necessary, refer to the Windows help files for information on performing these operations.
4	Create a folder on the computer's hard drive named "C:\RFU" (Rabbit Field Utility).
5	Copy the flash utility software and the latest firmware image file (*xxx.bin* – where "xxx" is the name and version number of the file) into the folder created in Step 4.
6	From the C:\RFU folder, run the flash memory program by double clicking the file *rfu.exe*. 
7	Select *Setup > Communications*. 
8	Under "Serial Options", select *Use Serial Connection.* Then set the Baud Rate to *115200*, and select *Enable Processor Detection*. **NOTE:** COM1 is the default COM port. If necessary, change the COM port to match the port that the instrument was connected to in Step 1. Click the OK button. 
9	Select *Setup > File Locations* and verify that the coldload.bin, pilot.bin, and flash.ini files are all located in the C:\RFU folder.

Step	Description
10	Click *OK* if these files are in the correct folder. If necessary, use the browse buttons in the Choose File Locations dialog box to locate each of these files.  
11	Drag and drop the firmware file onto the program window. A plus sign (+) indicates the file is ready to copy. Release the mouse and drop the firmware file onto the program window.
12	A progress-dialog box will appear during the flashing process, and will disappear when the flashing process is complete. 
13	When flashing is complete: • Exit the flash program • Turn OFF the instrument • Remove the serial cable. 
14	The new firmware will be active the next time the instrument is turned on. This can be confirmed by checking the firmware revision listed on the startup splash screen.

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CHAPTER 4: NOMINAL INSTRUMENT CONFIGURATION

IN THIS SECTION

4.1. Introduction

The following guidelines are used to demonstrate the instrument's nominal configuration as delivered to customers. The guidelines provide a reference if components are replaced.

4.2. DIP Switch Settings

Three DIP switches located on the instrument's main PCB assembly determine whether the instrument is in its Normal Operation or Flash Memory Programming mode.

NOTE: It is no longer necessary to set the DIP switches to update firmware. The following information is provided for reference purposes.

For normal operation, be sure that DIP switches 1, 2, and 3 are set to their DOWN positions.

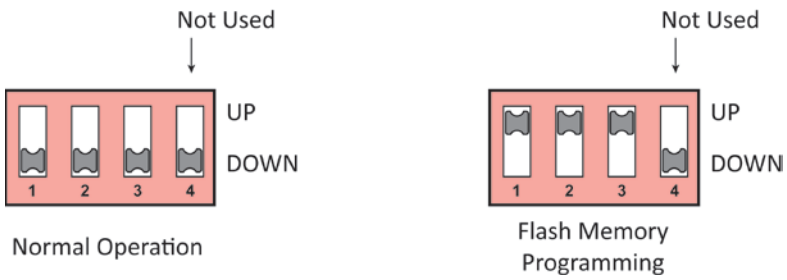

Figure 4-1. DIP Switch Settings

NOTE: DIP switch 4 is not used.

4.3. Standard vs. Smart Probe Wiring

When the H25-IR PRO is shipped from the factory, it has been configured to use the probe & hose assembly that was supplied with the instrument.

If a different probe style is used, then the ribbon cable from the front panel PROBE connector must be reconnected to either J2 or J7 of the LCD printed circuit board, located behind the front panel, as follows.

WARNING: SHOCK HAZARD. When performing this procedure, turn OFF the instrument and disconnect its AC power cord.

Table 4-3. Procedure to Change Factory-Set Probe Configuration

<table>
<tr><th>Step</th><th colspan="2">Description</th></tr>
<tr><td>1</td><td>Remove power cord from back panel.</td><td rowspan="4"> 

Figure 4-2. Removing the Top Cover</td></tr>
<tr><td>2</td><td>Remove both the front and rear bezels by first disengaging the plastic tabs on the right and left sides of the bezel, and then pulling the bezel straight out.</td></tr>
<tr><td>3</td><td>Remove the top two screws that secure the front panel, and the top two screws that secure the rear panel.</td></tr>
<tr><td>4</td><td>Find the seam at the side of the enclosure nearest the top. Using your fingers gently pry up on one side of the enclosure lid. The lid will disengage and swing upward, leaving the opposite side of the lid engaged. With the lid freely moving in the opposite side, gently lift up the front and rear edges of the lid to fully disengage it. Set it to one side and continue with the replacement.</td></tr>
<tr><td>5</td><td colspan="2">Connect the ribbon cable from the front panel PROBE connector to either J2 or J7 according to the probe to be connected:
J7 – Standard probe with LED and push button (and Standard probe with flex tubing)
J2 – Smart probe
IMPORTANT: Note the orientation of Pin 1 on both the ribbon cable and connectors J2 and J7. The red stripe on the ribbon cable denotes pin 1.</td></tr>
<tr><td>6</td><td colspan="2">Reassemble the case, then connect the power cord.</td></tr>
</table>

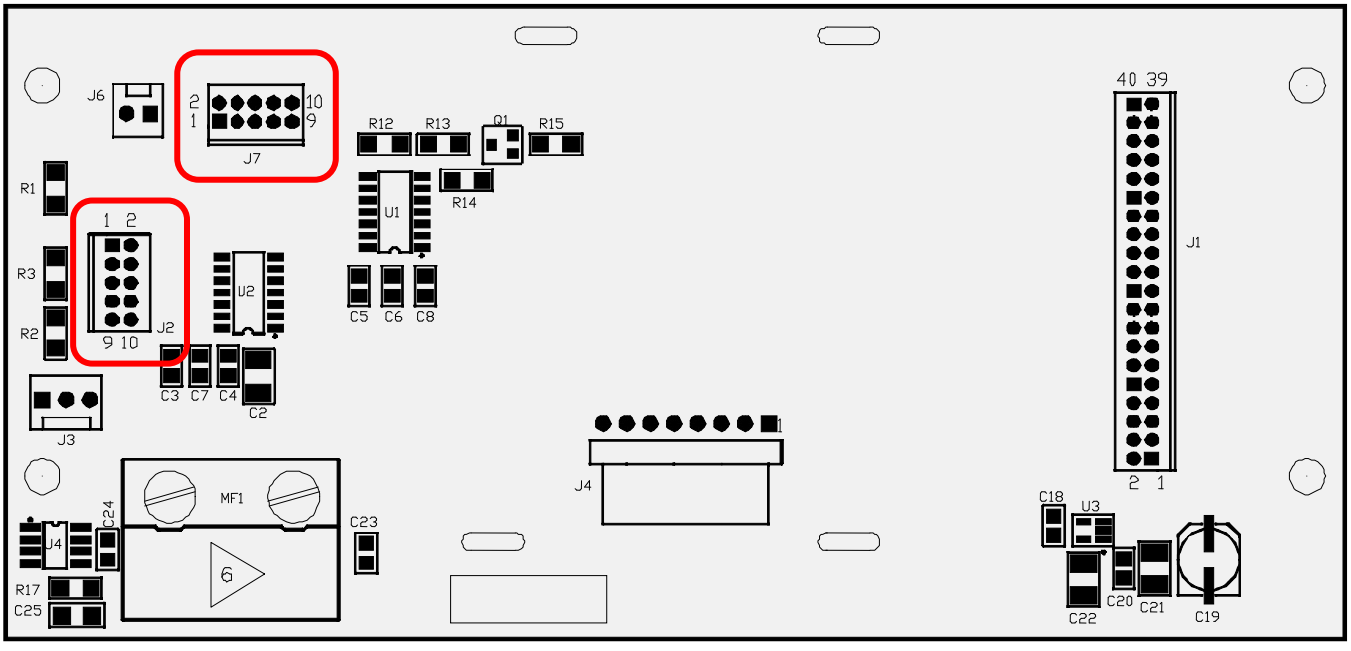

Figure 4-3. Front Panel Printed Circuit Board Containing Probe Connectors J2 and J7

4.4. Adjusting the IR Emitter (Power Level) and Detector

Table 4-4. Adjusting the IR Emitter Power Level

Step	Description
1	Turn the instrument ON while holding down the front panel ENT button to enable the Factory menu.
2	Wait until the instrument warms up and the User Display screen appears before proceeding (60 seconds).
3	Press the SETUP button to access the Basic menu, then press it again 3 more times to enter the Factory menu.
4	Select the emitter adjustment option using the front navigation keys and press ENT. Make the adjustment by using the VOL and RANGE buttons to change the power setting to the value presented in the table at the beginning of these instructions (± 10 mW). Press ENT to save the adjustment and return to the Factory menu.  **IMPORTANT:** The instrument will automatically adjust the NDIR Sensor detector at power up based on the IR Emitter setting. It is possible that the IR Emitter setting is too large or too small, which will prevent the automatic adjustment from succeeding. If a *0200 DigiPot Range* fault is reported by the instrument reduce the IR Emitter power setting by 25 mW. If a *4000 Zero Volts* fault is reported increase the IR Emitter power setting by 25 mW. Repeat if needed to lower or raise the IR Emitter power another 25 mW if required. It is more typical to lower the value than to raise it.
5	IR detector adjustment. After adjusting the IR Emitter select the Detector adjustment in the Factory menu and press ENT.  **IMPORTANT:** When performing the following step, the instrument **must** be sampling fresh air (zero gas) when adjusting the detector value.
6	Use the Up and Down Arrow buttons to adjust the value until the reading is 4.20 ±0.05 volts (count range of 130-240). Press ENT to save the new value.  **IMPORTANT:** If the adjustment does not reach 4.20 volts then return to step 3 to lower the IR Emitter setting as noted above; next, repeat the Detector adjustment.
7	Press ESC two times to return to the User Display screen. Confirm that no faults are indicated (top of display).
8	Turn OFF instrument and remove the AC power cord.  **NOTE:** Turning off the instrument returns the Factory menu to restricted access.
9	Once the AC power cord is reconnected and the unit is turned it back on. Allow it to complete the warm up (60 seconds) and confirm no faults are displayed. This completes the adjustment of the NDIR Sensor.

4.5. Establishing the Temperature Coefficient

The Temperature Coefficient value is used to compensate for drift as the instrument warms up.

NOTE: The instrument should ideally be OFF for a minimum of 4 hours before starting this routine. The routine relies on self-heating to induce a 5°C temperature rise to calculate the coefficient. If the instrument has been running longer than 10 minutes it may not be possible to achieve the required 5°C temperature rise. It is also required that the top cover be in place, and that a probe be connected and sampling clean (refrigerant free) air.

Table 4-5. Establishing the Temperature Coefficient

Step	Description
1	After a minimum 4-hour OFF time, turn the instrument ON while holding down the front panel ENT button to enable the Factory menu.
2	Wait until the instrument warms up and the User Display screen appears before proceeding (60 seconds).
3	Press the SETUP button to access the Basic menu, then press it again 3 more times to enter the Factory menu.
4	From the Factory menu, select NEW TEMPCO. The instrument will automatically begin to calculate the temperature coefficient, based on temperature rise. Target temperatures are displayed on the screen to indicate how much self-heating will be required to complete the routine. If the beginning temperature is more than 5°C above ambient temperatures the instrument is likely too warm to complete the routine. It is recommended that the instrument be turned off for a minimum of 4 hours, after which the routine may be started again.
5	After the routine completes, the new temperature coefficient will be displayed.
6	The Factory menu includes “EDIT TEMPCO” where the stored coefficient may be adjusted. This is a factory only option that should not be changed by the end user or the technician. If needed re-run the NEW TEMPCO routine to have the instrument re-establish the coefficient.

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CHAPTER 5: TROUBLESHOOTING

IN THIS SECTION

5.1. Diagnostics Menu

The Diagnostics screen contains advanced system details used for identifying faults, troubleshooting, and maintenance. To access the Diagnostics screen from the Search Mode screen or Measure Mode screen:

- Press the SETUP button once to reach the Basic Setup menu, then press the SETUP button two more times (as the Right Arrow button), or
- Press the Info (ⓘ) button.

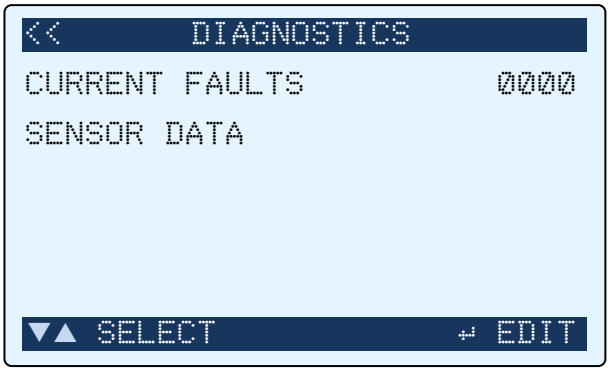

Figure 5-1. Diagnostics Screen

The Diagnostics screen contains the following options:

- Current Faults menu (lists currently active fault codes) with 4-digit fault code summary)
- Sensor Data menu (parameters for the NDIR sensor, used for troubleshooting and maintenance)
- Menu identifier located in the banner line (DIAGNOSTICS in this example)
- Left arrows in the banner line that indicate one or more additional menus (use the left arrow key to access)
- Command options in the footer line (in this case, the keys to press to select and edit menu items).

NOTE: Pressing the ENT button when the Current Faults menu item is selected interrogates the faults and provides you with fault details.

NOTE: The 4-digit fault code is an additive code that can represent multiple fault conditions. The first detected fault is shown on the Search/Measure screen. The Diagnostics screen shows the fault "total".

5.1.1. Fault Codes

Table 5-6. Fault Codes

Fault Code	Fault	Message	Cause(s)	Possible Solution(s) or Next Step(s)
0002	Box temp error	UNIT TEMPERATURE IS HIGH: MOVE UNIT AWAY FROM SOURCES OF HEAT	Temp >55	• Move unit away from sources of heat.
0004	PSIA sensor error	PRESSURE SENSOR OUTPUT IS OUT OF RANGE EXHAUST OR INLET MAY BE BLOCKED	Pressure <10.0 psia or Pressure >16.7 psia	• Replace filter (refer to Probe Tip Filter Replacement on page 24 and External Filter Replacement on page 25). • Ensure exhaust port is not clogged.
0008	Mass flow error	MF SENSOR VOLTAGE IS OUT OF RANGE CONTACT FACTORY FOR SERVICE	Sensor out < -0.1V or Sensor out >3.0V	• Contact factory for service.
0010	Loop open	4-20MA CURRENT LOOP IS OPEN OR CIRCUIT HAS HIGH RESISTANCE. CHECK JUMPER OR WIRES ON REAR OF UNIT	Loop is “open”	• Ensure that the wire jumper is in place on 4-20mA output connector.
0200	DigiPot range error	DIGIPOT RANGE ERROR ADJUST DIGIPOT PER MANUAL TO INCREASE DIGIPOT COUNT	DigiPot range < min value for gas type selected	• Adjust DigiPot (refer to NDIR Sensor Adjustment on page 29).
0400	A/D failure	A/D FAILURE CONSULT FACTORY FOR ASSISTANCE	No response from A/D converter	• Contact factory for service.
0800	Search flow fault	LOW AIR FLOW. CHECK TIP FILTER AND REPLACE, CHECK HOSES FOR BLOCKAGE	In search mode: Flow <550 sccm or Flow >1650 sccm	• Replace filter (refer to Probe Tip Filter Replacement on page 24 and External Filter Replacement on page 25). • Ensure exhaust port is not clogged.
1000	Measure flow fault	LOW AIR FLOW. CHECK TIP FILTER AND REPLACE, CHECK HOSES FOR BLOCKAGE	In measure mode: Flow <300 sccm or Flow >550 sccm	• Replace filter (refer to Probe Tip Filter Replacement on page 24 and External Filter Replacement on page 25). • Ensure exhaust port is not clogged.
4000	Zero volt error	SENSOR OUTPUT VOLTAGE IS OUT OF RANGE ADJUST TO 4.2V IN FACTORY MENU	Sensor out <3.9V or Sensor out >4.5V	• Adjust DigiPot (refer to NDIR Sensor Adjustment on page 29).
8000	A/D clipping error	SENSOR OUTPUT IS TOO HIGH, ADJUST TO 4.2V, IN FACTORY MENU SELECT DIGIPOT	Sensor out >4.55V	• Adjust DigiPot (refer to NDIR Sensor Adjustment on page 29).

5.1.2. Sensor Data Parameters

Table 5-7. Sensor Data Parameters and Sample Values

NEW H25-IR PRO On Screen Name	Sample Value	
SENSOR OUTPUT	4.224V	
SENSOR TEMP	24.38C	
NOISE FACTOR	+0.0002V	
UNIT TEMP	24.14C	
SYS PRESSURE	106.28Kpa	← See below
AMB PRESSURE	98.81Kpa	← See below
MASS FLOW	804SCCM	
ABSORBANCE	0.0000	
CONCENTRATION	0.00	
GAS PPM LEVEL	0.0	
LEAK RATE	0.00	
SYS PRESSURE	15.41PSIA	Represents English (Imperial) unit version of Metric equivalent above.
AMB PRESSURE	14.33PSIA	Represents English (Imperial) unit version of Metric equivalent above.

5.2. Status LED Indicators

The Main circuit board contains 6 LED status indicators that monitor the following circuits:

- LED 1: +5 VDC regulator output
- LED 2: +12 VDC regulator output
- LED 3: +4.7 VDC regulator output
- LED 4: +3.3 VDC regulator output
- LED 5: IR Emitter driver circuit, blinks at 8 Hz
- LED 6: +10 VDC regulator output

An LED that does not glow during normal operation indicates a problem with that circuit. Note that LED 5 will not blink when DIP switches 1, 2, and 3 located on the instrument's rear panel are set to their UP positions (flash memory programming enabled).

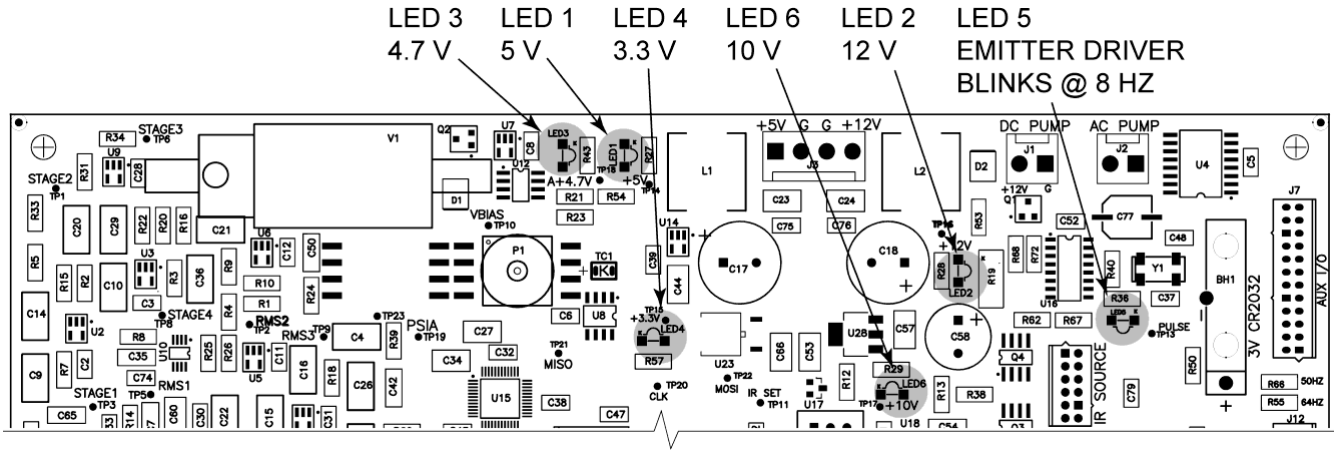

Figure 5-2. Main Board LED Status Indicators

5.3. Troubleshooting

Table 5-1. Common Concerns

Issue	Possible Solutions
Instrument won't turn on	• Check/ensure source power is active • Check power cord connections are secure • Check fuse
Gas probe won't fit in front panel connector	• Probe connector is keyed. Align red dots on probe connector and front panel connector.
Can't control H25-IsureR PRO from the Smart Probe keys	• Be Smart Probe is fully plugged in to the H25-IR PRO • Be sure the H25-IR PRO is configured for Smart Probe use (i.e., you should NOT see the "Probe Button" function in the Setup menu • Be sure the Smart Probe keys have not been inadvertently locked • Verify internal cable connections
Unable to Log Data to The Measurement Log	• Be sure the H25-IR PRO is in MEASURE mode (not SEARCH mode). • Be sure the leak rate of the sampled gas is non-zero.

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CHAPTER 6: PART REPLACEMENT

IN THIS SECTION

WARNING: Part replacement operations pose a shock hazard. Before performing any service work, remove the AC power cord to prevent electrical shock.

6.1. Fuse Replacement

Table 6-1. Items Required for Fuse Replacement

Item	Description
1	Small flat-blade screwdriver
2	Fuse

NOTE: A spare fuse is located in the fuse holder.

Table 6-2. Fuse Replacement Procedure

Step	Description
1	Remove power cord from back panel.
2	Locate fuse compartment.
3	Using a small, flat-blade screwdriver, carefully pry out the fuse holder from the fuse compartment.
4	Inspect the fuse for damage or check its continuity. Remove and discard blown fuse.
5	Use screwdriver to carefully slide out back-up fuse from storage compartment.
6	Move back-up fuse into fuse holder.
7	Replace fuse compartment (flush with back panel to ensure seated properly).

Step	Description
8	Replace power cord.
9	Supply power and turn on the unit to verify operation.
10	Replace the spare fuse as soon as possible with the same type and rating. Refer to Spare Parts and Accessories on page 37 for the part number.

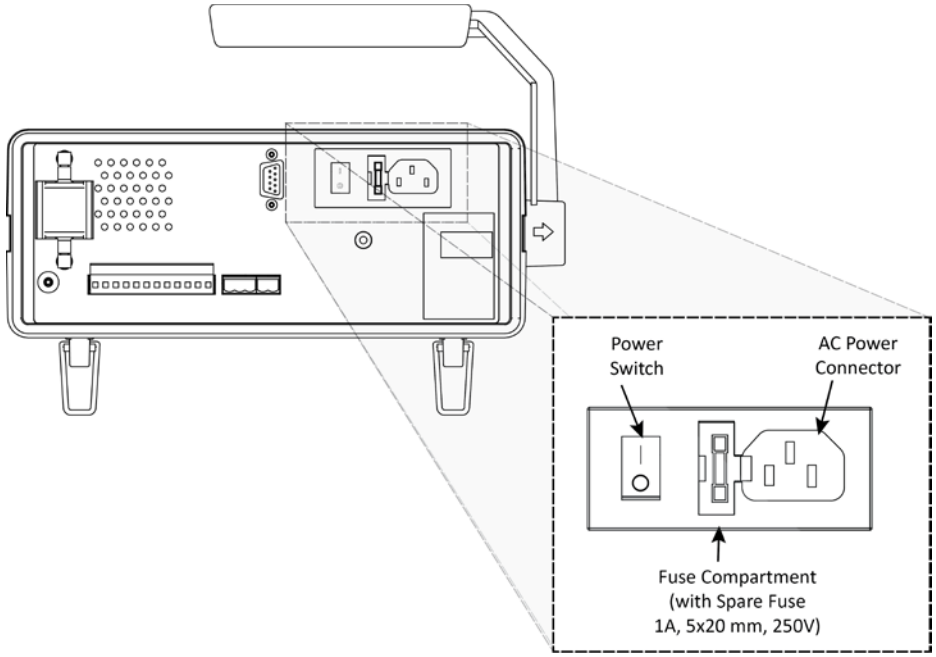


Figure 6-1. Location of Fuse Holder

6.2. Probe Tip Filter Replacement

Table 6-3. Items Required for Probe Tip Filter Replacement

Item	Description
1	Probe Tip Filter (diameter: 0.287 in. [7.2 mm]) (Available in bags of 50 from Bacharach. See Spare Parts and Accessories on page 37.)
2	Pin or tweezers

Table 6-4. Probe Tip Filter Replacement Procedure

Step	Description
1	Unscrew metal tip from flexible probe.
2	Remove filter from inside metal tip using pin or tweezers.
3	Insert new filter into probe tip.
4	Inspect “O" ring. Replace “O" ring if defective. (See Probe “O” Ring Replacement on page 25 for information.)
5	Replace metal tip onto flexible probe.

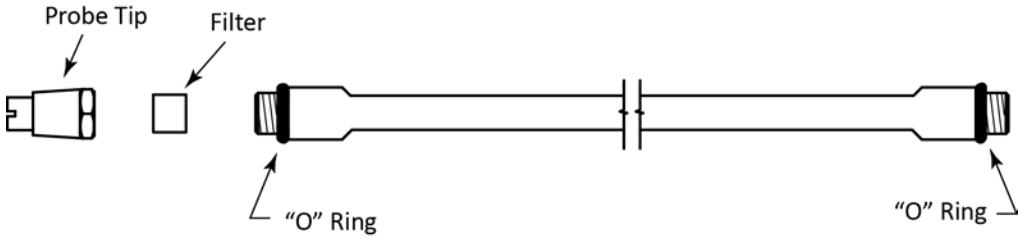


Figure 6-2. Probe Filter and "O" Ring Locations

6.3. Probe "O" Ring Replacement

Table 6-5. Items Required for "O" Ring Replacement

Item	Description
1	Probe Tube "O" Rings (2)

Table 6-6. Probe "O" Ring Replacement Procedure

Step	Description
1	Unscrew metal tip from flexible probe.
2	Inspect "O" ring and, if defective, remove and replace with new "O" ring.
3	Replace metal tip.
4	Unscrew flexible probe from probe housing.
5	Inspect "O" ring and, if defective, remove and replace with new "O" ring.
6	Re-attach flexible probe to probe housing.

6.4. External Filter Replacement

Table 6-7. Items Required for External Filter Replacement

Item	Description
1	Replacement filter

Table 6-8. External Filter Replacement Procedure

Step	Description
1	Turn off power.
2	Grasp the filter housing and rotate the top back and down, twisting the filter out of the mounting clip. Use caution as the clip has high force. Do not pull the filter away further than 2" (50 mm) from the back of the instrument. If the tubing becomes taut, move the filter closer to the instrument.
3	With the filter free of the clip, disconnect the top tubing from the fitting.
4	Noting its orientation, install the new filter for proper flow of sample gas (the internal white filter membrane is at the bottom of the filter assembly).

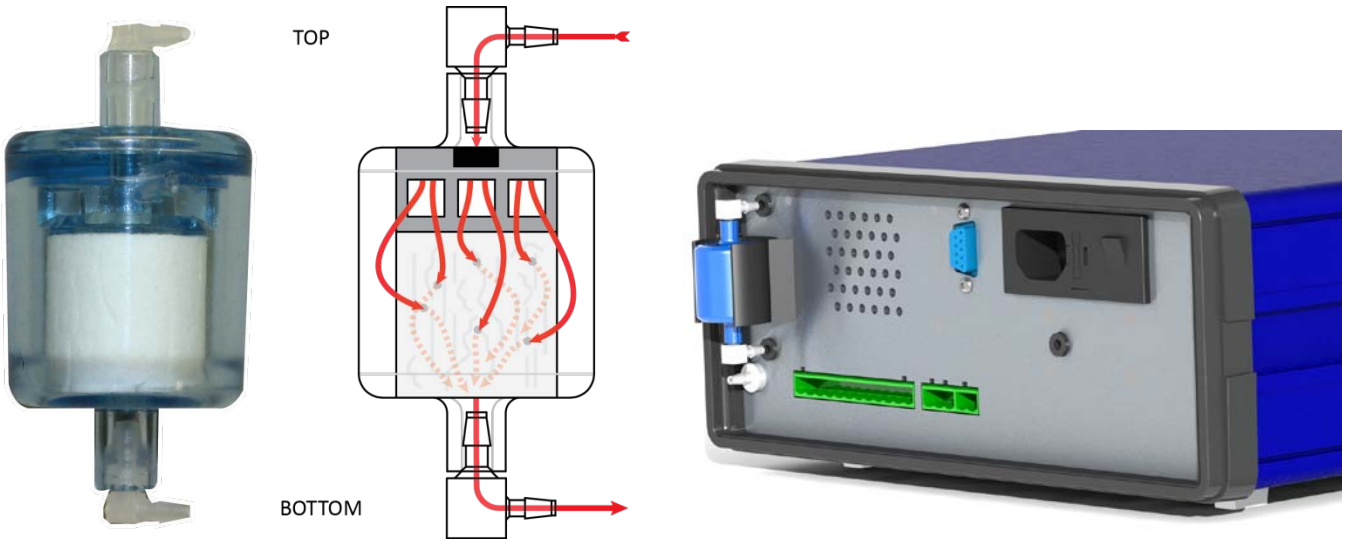


Figure 6-3. Back Panel of the H25-IR Pro Showing Proper Orientation of the External Filter

Step	Description
5	Repeat for the lower tubing.
6	Dispose of the used filter.
7	Install the filter in the opposite manner to removal. Start with the filter at an angle, with the lower part pressed into the clip.
8	Guide the tubing through the rear plate as needed to ensure the tubing isn't kinked.
9	Rotate the filter inward and upward into the clip. As the top of the filter enters the clip it will be strongly pulled in.
10	Double check the tubing, ensuring it is fully seated on the elbow fittings and is not kinked or pinched.

6.5. NDIR Sensor Replacement

These instructions describe how to replace the NDIR sensor in the H25-IR PRO Infrared Gas Leak Detector. It is assumed that the user is familiar with the operation and menu system of the H25-IR PRO.

Table 6-9. Items Required for NDIR Sensor Replacement

Item	Description
1	Replacement NDIR Sensor Kit which contains NDIR Sensor and 3 cable ties (see table below)
2	Medium Phillips head screwdriver
3	Wire cutter (for removing cable ties)
4	Two sets of needle nose pliers (or equivalent) to release and re-install the tubing clamp

Table 6-10. Replacement NDIR Sensor Kit

Model	Sensor Kit	Reference Sensor P/N	Nominal Emitter Power
CFC, HCFC, HFC, and Halogen gases	3015-4501	3015-5086	325 mW
R600, R290	3015-4502	3015-5089	540 mW
SF6	3015-4561	3015-5087	450 mW
CO_2	3015-4562	3015-5090	450 mW

NOTE: Only replacement sensor *kits* are available for sale, *not* individual sensors. As such, the reference sensor part numbers in the previous table are for identification purposes only. For example, to order a replacement kit for your sensor which is labeled model number 3015-5086, place order for kit number 3015-4501.

Table 6-11. NDIR Sensor Replacement Procedure

Step	Description
1	Remove both the front and rear bezels by first disengaging the plastic tabs on the right and left sides of the bezel, and then pulling the bezel straight out.
2	Remove the top two screws that secure the front panel, and the top two screws that secure the rear panel.
3	Find the seam at the side of the enclosure nearest the top. Using your fingers gently pry up on one side of the enclosure lid. The lid will disengage and swing upward, leaving the opposite side of the lid engaged. With the lid freely moving in the opposite side, gently lift up the front and rear edges of the lid to fully disengage it. Set it to one side and continue with the replacement.  **Figure 6-4. Removing the Top Cover**

Step	Description
4	Cut off the three cable ties that secure the NDIR sensor to the chassis, and remove the sensor from the instrument.  **Figure 6-5. NDIR Sensor (Three Cable Ties Removed)**
5	Carefully remove tubing and electrical connectors from old NDIR sensor. **NOTE:** The connection at the back of the NDIR sensor includes a reusable tubing clamp. The clamp is opened by gently prying the ratcheting jaws away from each other (side to side). **IMPORTANT:** Note the position of the cable ties around the NDIR sensor. The rear cable tie secures the NDIR sensor and the tubing. The cable tie passes over a tubing connector to prevent the tubing from being restricted. It is important that the replacement cable tie reproduce the condition at assembly. The middle cable tie is used to route the tubing and is also not fully tight. All three cable ties are not to be fully tightened – **DO NOT compress the foam insulation excessively**.
6	Place new NDIR sensor inside chassis, positioning its 10-pin electrical connector toward the rear of the instrument. Rotate the sensor so that its gas inlet and outlet fittings and its electrical connectors are positioned as shown in Figure 6-6.
7	Remove protective caps from the gas inlet and outlet fittings of the new NDIR sensor.
8	Connect the 12-conductor ribbon cable from IR SOURCE connector J5 on main board to IR SENSOR EMITTER connector (front of instrument).
9	Connect the 10-conductor ribbon cable from DET connector J6 on main board to IR SENSOR DETECTOR connector (rear of instrument).
10	Using the three supplied cable ties, secure the NDIR sensor to the chassis by threading the front and rear cable tie through its cable-tie mount; around the foam insulation that surrounds the NDIR sensor. Place the third cable

Step	Description
	tie near the middle of the NDIR Sensor, securing the tubing as before. Cut off the cable-tie excess.
11	Connect tubing from pump to the NDIR sensor gas inlet fitting, and connect the NDIR sensor gas outlet fitting to the tubing disconnected earlier. Re-install the tubing clamp by squeezing the jaws closed with pliers.
12	Perform the Adjusting the IR Emitter (Power Level) and Detector procedure located on page 17.
13	This completes replacing the NDIR Sensor. This is the last step in the

6.6. NDIR Sensor Adjustment

It may become necessary to adjust the emitter and detector components of the NDIR sensor without actually replacing the NDIR sensor. Such instances may present themselves as clipping faults (fault code 8000), DigiPot range errors (fault code 0200), and other faults. If you suspect a sensor adjustment may be in order, or if you are directed to adjust your NDIR sensor's DigiPot settings by a Bacharach service representative, then use the Adjusting the IR Emitter (Power Level) and Detector procedure located on page 17.

NOTE: "DigiPot" is a shortened version of *digital potentiometer*. The H25-IR PRO uses DigiPots to simplify certain configuration processes by integrating the manual tweaking process of an internal potentiometer into the user interface. If, for example, minor adjustments need to be made to the NDIR sensor power settings, the operator can use the front panel buttons and display panel to make the adjustments (versus opening the case, attaching a voltmeter to test points on the printed circuit board, and tweaking a potentiometer with a small screwdriver).

6.7. Circuit Board Replacement

The following circuit boards are available for replacement. Please contact Bacharach support if you have difficulty determining which PCB may need to be replaced.

Table 6-12. Items Required to Replace a Printed Circuit Board

Item	Description
1	The appropriate replacement board (see Figure 2-5 on page 9 for locations): • Main P/N 3015-5479 • Power Supply P/N 3015-5149 • Display PCB Assembly (with LCD) P/N 3015-5552 (includes mass flow sensor) • Audio P/N 3015-4292
2	Medium Phillips head screwdriver

Table 6-13. Circuit Board Replacement Procedure

Step	Description
1	Carefully remove all *mechanical (hose) connections* from the board being replaced. Refer to the interconnection information in Figure 2-4 on page 9.
2	Carefully remove all *electrical connections* from the board being replaced. Refer to the interconnection information in Figure 2-5 on page 9.
3	Using the medium Phillips screwdriver, remove the circuit board's mounting screws.
4	Carefully remove the board from the chassis.
5	Reverse this procedure to install a replacement board.

NOTE: With the exception of the main board, all boards can be replaced without needing to recalibrate the instrument. If the main board, display PCB, or pump are changed, the instrument's mass flow sensor must be re-calibrated.

NOTE: The mass flow sensor is an inseparable part of the display PCB. Replacement of the mass flow sensor requires replacement of the entire display PCB assembly.

6.8. Mass Flow Sensor Calibration

NOTE: The following steps are optional after replacing the NDIR sensor, but may be performed if desired.

IMPORTANT: Before calibrating, allow the instrument to warm up for at least 15 minutes.

Table 6-14. Items Required for Mass Flow Sensor Calibration

Item	Description
1	A calibrated external mass flow meter. The required resolution of the mass flow meter is as follows: • Calibrated to a traceable national standard (NIST, JIS, etc.) • Measurement Range: 0-1000 cubic centimeters per minute (or equivalent). • Air standard • High Accuracy: ± 0.5% of reading, ±0.2% of full scale • The recommended device is *model M-1SLPM-D-485/10M, C2M, GAS: Air, TOT, HC* available from: Alicat Scientific, Inc. 7641 N. Business Park Drive Tucson, AZ 85743 USA Ph: (520) 290-6060, Fax: (520) 290-0109, http://www.alicatscientific.com An equivalent calibrated reference that satisfies the accuracy requirement may be used.

Table 6-15. Mass Flow Sensor Calibration Procedure

Step	Description
1	With all covers in place, turn the instrument OFF and then turn the instrument back ON while holding down the front panel **ENT** button to enable the Factory menu.
2	Calibrate the mass flow sensor by attaching a calibrated external mass flow meter to the instrument exhaust port. The tubing must be leak free and as short as possible (no more than 6 inches or 150 mm).
3	Attach the sampling probe to the instrument that will normally be used. Replace the probe tip filter.
4	Press the **SETUP** button to access the Basic menu, then press it again 3 more times to enter the Factory menu.
5	Select the MASS FLOW option and press **ENT**. The instrument will automatically change to Measure mode (lower flow, faster pump sound). **Calibration MUST be performed in Measure mode**.
6	Make the adjustment by using the VOL and RANGE buttons to change the displayed mass flow value to match the attached calibrated reference (± 5 SCCM or standard cm^3/min.) The adjustment factor is displayed for reference. Press **ENT** to save the adjustment and return to the Factory menu.
7	Press **ESC** until the User Display screen appears.
8	Disconnect the calibrated mass flow meter.

6.9. PPM Calibration Adjustment

NOTE: The following gas PPM calibration MUST be done *after* the emitter, detector, and mass flow sensor have been calibrated, and the TEMPCO routine has been completed (including the required *warm-up* period of at least 30 minutes).

Any original Bacharach-provided NIST certificate is nullified after the replacement of any of the following:

- NDIR sensor
- Main PCB
- Display PCB.

IMPORTANT: To re-certify to NIST standards after replacing the NDIR sensor, main PCB or display PCB:

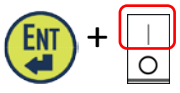
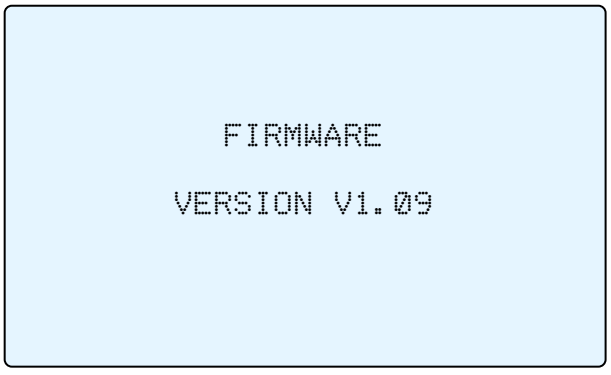
- A 100 ppm concentration of the required gas must be applied (per the procedure listed below). The applied gas must have a NIST (or equivalent) traceable certificate of analysis within +/- 1%.
- The instrument must be set to the same gas type as is being applied during adjustment.
- If NIST certification is desired *after* replacing these components *at the end user location*, the instrument may be returned to the service center or Bacharach for the NIST traceable adjustment service.

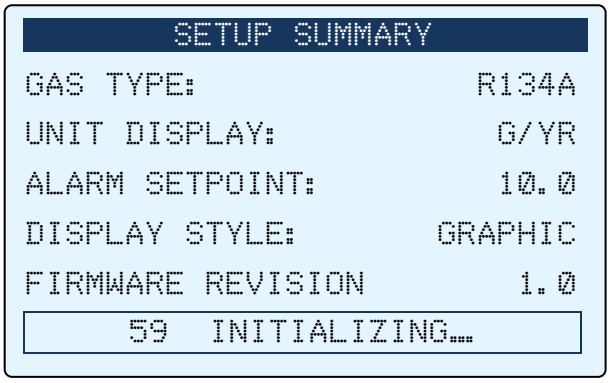
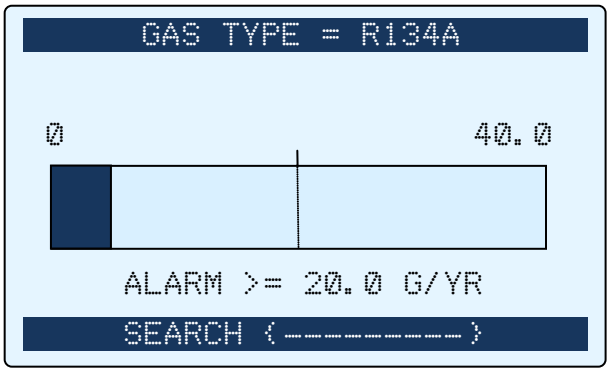
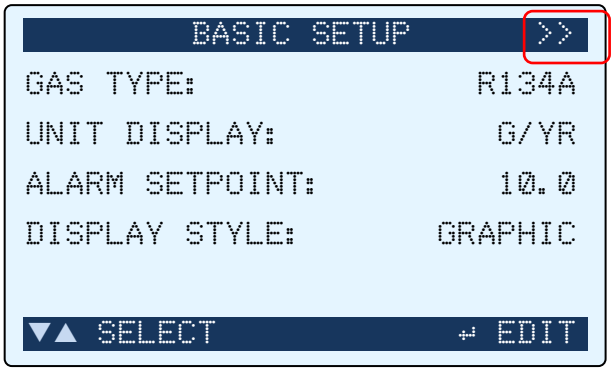
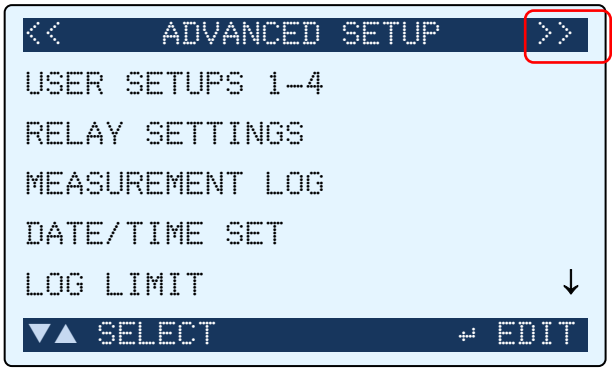
NOTE: If the gas ppm adjustment is not applied, it is recommended that the ppm gas adjustment value be reset to 1.00. This is done via the Factory GAS PPM menu option.

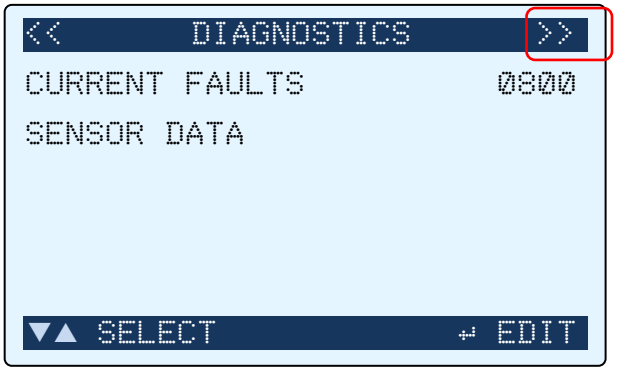
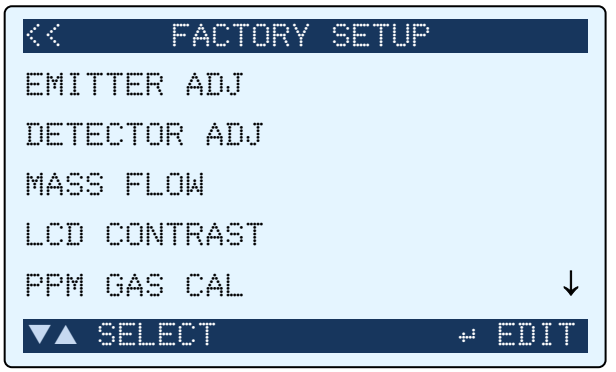
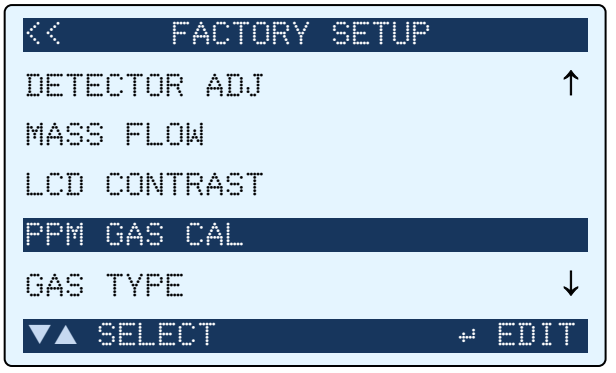
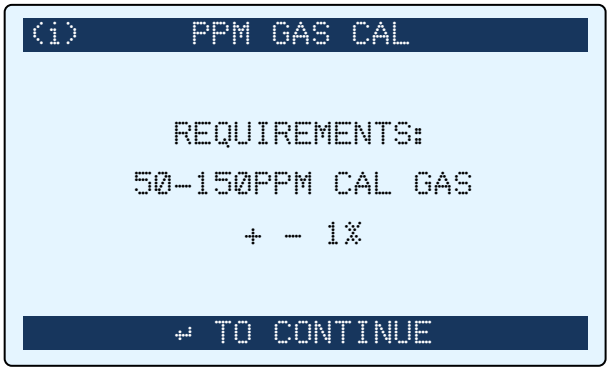
Table 6-16. Items Required for PPM Calibration Adjustment

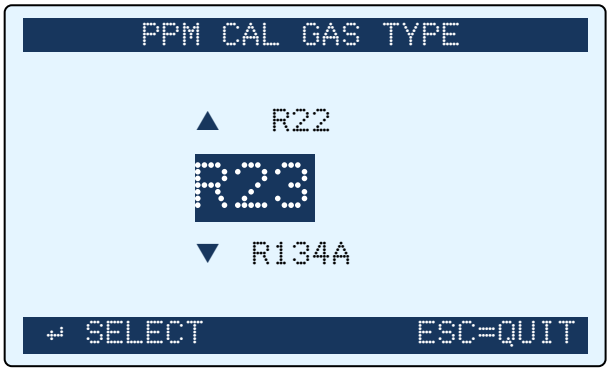
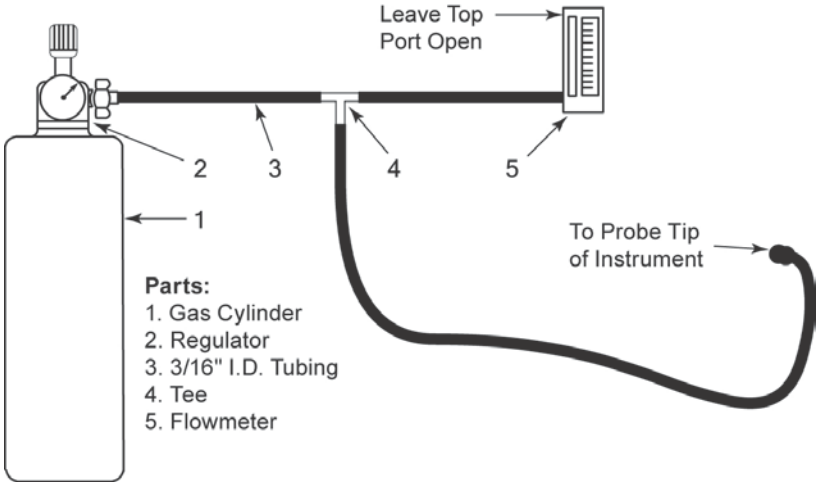
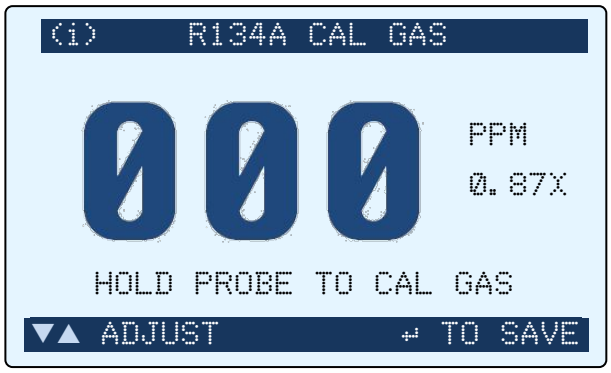
Item	Description
1	Appropriate calibration gas cylinder with regulator
2	Excess air flow setup (including tubing, tee, and flow meter)

Table 6-17. PPM Calibration Adjustment Procedure

Step	Description		
1	Ensure that the emitter, detector, and mass flow sensor have been calibrated, and the TEMPCO routine has been completed (including the required *warm-up* period of at least 30 minutes).		
2	Appropriately record gas cylinder and leak standard information.		
3		Enable the factory menu. With the instrument OFF, press and hold the ENT button while turning ON the instrument. You will hear a long beep, then the Firmware Version screen is displayed for approximately 15 seconds.	

Step		Description	
4	n/a	The Setup Summary screen is displayed automatically after the Firmware Version screen. This screen displays key setup information and a 60-second initialization countdown.	
5	n/a	After the 60-second countdown, the H25-IR PRO automatically displays the SEARCH MODE screen and is ready for operation with the Factory menu enabled.	
6		From the main Search screen or Measure screen, press the SETUP button once to access the Basic Setup screen. (Notice the right arrows in the header, indicating an additional menu.)	
7		Press the SETUP (Right Arrow) button again to access the Advanced Setup screen. (Notice the right arrows in the header, indicating an additional menu.)	

Step		Description	
8		Press the SETUP (Right Arrow) button again to access the Diagnostics screen. (Notice the right arrows in the header, indicating an additional menu.)	
9		Press the SETUP (Right Arrow) button again to access the Factory Setup screen.	
10		Press the RANGE (Down Arrow) button until you have highlighted the PPM GAS CAL option. Then press the ENTER button.	
11		Acknowledge the PPM GAS CAL requirements by pressing the ENTER button.	

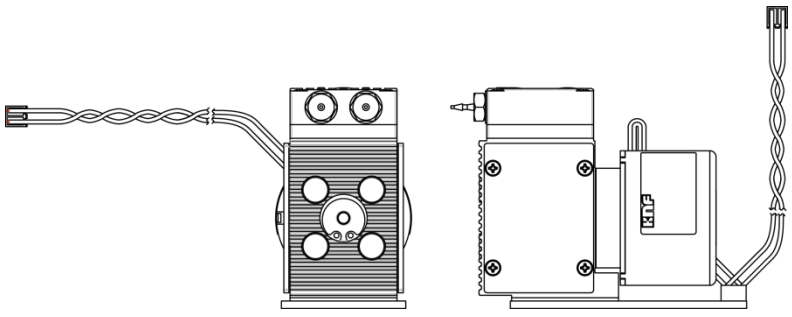
Step	Description		
12		Use the Up and Down arrow keys to highlight the desired PPM CAL GAS TYPE and press the ENTER key to select.	
13	Apply the calibration gas to the probe tip using an excess air flow setup which is adjusted for no more than 0.2 LPM excess gas flow. This is required to minimize the pressure affects upon the calibration, as excess pressure could shift the results.  **Figure 6-6. Excess Air Flow Setup for Applying Calibration Gas**		
14		After the reading has stabilized (approximately 1 – 2 minutes), record the “before” calibration PPM adjustment coefficient. The “before” value should be 1.00 for a newly commissioned instrument or as a starting point. It is okay to have a starting point other than 1.00. Using the Up and Down arrow keys, adjust the displayed PPM value to match the actual calibration gas cylinder PPM value. Record the after calibration PPM adjustment coefficient.	
15		Press Enter to save the calibration, and then use ESC to return to the main user screen. Turn off the gas cylinder and remove the tubing from the end of the probe. This concludes the adjustment.	

6.10. Pump Replacement

Table 6-18. Items Required for Pump Replacement

Item	Description
1	Pump Replacement Kit (P/N 3015-5328)
2	Screwdrivers: medium Phillips head and standard slotted
3	Removable thread locking compound (Loctite 242 or equivalent)

Table 6-19. Pump Replacement Procedure

Step	Description
1	Remove the top cover. Then remove tubing from pump, and unplug pump from connector J1 on main board.  **Figure 6-7. Removing the Top Cover**  **Figure 6-8. Removing the Pump**
2	Remove two screws that secure the pump bracket to the chassis, and then remove pump from instrument.
3	Install new pump, using bracket and screws removed in Step 2.  **Figure 6-9. Replacement Pump (Front and Side Views)**
4	Attach tubing to pump as shown above.
5	Connect pump wiring to connector J1 (DC PUMP) on the main board.
6	Reassemble the instrument.
7	Recalibrate using the Mass Flow Sensor Calibration procedure on page 31.

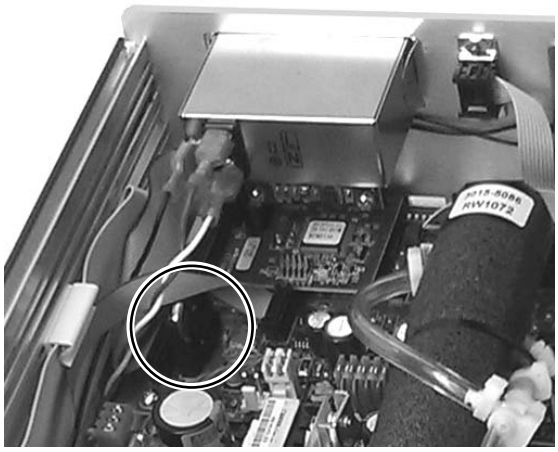
6.11. Clock Battery Replacement

The battery on the main board should last 3–5 years. When this battery becomes depleted, the unit's log data, time, and date will be lost, and a single long beep will be heard when the instrument is turned ON.

Table 6-20. Items Required for Battery Replacement

Item	Description
1	Medium Phillips head screwdriver
2	Battery (P/N 204-0020)

Table 6-21. Battery Replacement Procedure

Step	Description
1	After removing the top cover, locate battery on Main board and remove it.
	 **Figure 6-10. Removing the Top Cover**  **Figure 6-11. Battery Location (Left Rear Corner of Main Circuit Board**
2	Install new battery, observing correct polarity.
3	Reassemble instrument.
4	Configure the date and time from the Advanced Setup Screen.

6.12. Spare Parts and Accessories

Table 6-22. Spare Parts and Accessories (Customers)

Part Number	Description
3015-5668	O-Ring Kit, H25-IR PRO (5 pcs)
3015-5818	External Filter Kit, H25IR-Pro (Includes 5 coalescing filters)
3015-4670	Bezel, Case
3015-4501	NDIR Sensor Replacement Kit for CFC, HCFC, HFC and Halogen gases
3015-4502	NDIR Sensor Replacement Kit for R600a
3015-4561	NDIR Sensor Replacement Kit for SF_6

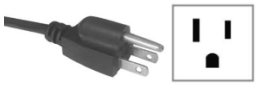
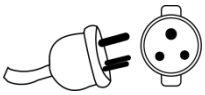
Part Number	Description
3015-4562	NDIR Sensor Replacement Kit for CO_2
3015-5275	Standard Probe w/ Pushbutton and LED Assembly: 1.8 m (6 ft) hose
3015-4640	Standard Probe w/ Pushbutton and LED Assembly: 3.7 m (12 ft) hose
0019-7132	Smart Probe w/ Pushbuttons and LCD Assembly: 1.8 m (6 ft) hose
0019-7114	Smart Probe w/ Pushbuttons and LCD Assembly: 3.7 m (12 ft) hose
3015-5135	Filters – Located in Probe Tip (50)
3015-5099	Replacement Probe Tip
3015-5137	Replacement 8" Flexible Probe Gooseneck Assembly
3015-5672	Probe Connector with Cable Assembly (Nut, Finish Washer, and Lock Washer)
4998-8986	Power Cord (Type B) For use in the United States and Canada. 
0304-3462	Power Cord (Type D) For use in India. 
3015-5636	Power Cord (Type G) For use in Bangladesh, Hong Kong, Ireland, Malaysia, Saudi Arabia, Singapore, United Kingdom, Vietnam. 
3015-5638	Power Cord (Type I) For use in Argentina, Australia, China, El Salvador, New Zealand, and Uruguay. 
0604-2611	Fuse, 1A, Slow Blow (each)

Table 6-23. Spare Parts and Accessories (Factory-Trained/Authorized Service Personnel)

Part Number	Description
0204-0020	Battery, Clock Backup
3015-5670	Replacement Pump Assembly
3015-5684	PCB Assembly: Main
3015-5149	PCB Assembly: Power Supply
3015-5552	PCB Assembly: Display
3015-4292	PCB Assembly: Audio Feedback
3015-5671	Speaker Kit

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CHAPTER 7: SPECIFICATIONS

IN THIS SECTION

7.1. Specifications

Table 7-1. Specifications

Category	Description
Gases Detected (GAS TYPE)	R12, R22, R23, R134a, R404A, R407C, R410A, H1234YF, R32, H1301, N1230, H1211, H2402, R124, R125, R227, R422a, R438a, R502, FC72, R407F, H1234ZE, N7100, N7200, N7300, and N7600. • Basic gas types • Halogen NDIR (non-dispersive infrared) sensor • Listed in the product Gas Type menu unless overridden by selecting a Factory Gas Option • Presented in the standard menu. • When equipped with the halogen NDIR sensor this list includes the most popular refrigerant gases; a “CUSTOM” refrigerant option is also shown.
	CUSTOM • Halogen NDIR (non-dispersive infrared) sensor • The user adjusts the instrument response to a known concentration via the “external reference” feature. • Presented in the standard menu.
	R21, R113, R114, R123, R236fa, R245fa, R401A, R402A, R402b, R407A, R408A, R409A, R422d,R424a, R426a, R427a, R500, R503, R507, R508B, HFP, and FA188. • Halogen NDIR (non-dispersive infrared) sensor • Refer to Factory Gas Type Configuration to set one of the gases listed above • Presented only in the Factory menu • When equipped with the halogen NDIR sensor, the instrument may be set to one of the gases in this extended gas list. The selected gas becomes the only gas listed in the standard Gas Type menu; no other gases will be listed.
	R600a, R290, CO_2, SF_6 • A dedicated NDIR (non-dispersive infrared) sensor is required • If so equipped, the instrument is dedicated to detect the gas shown in the GAS TYPE menu; no other gases will be listed. • Presented in the standard menu.
Detection Method	Non-Dispersive Infrared (NDIR)
Warm-Up Time	1 minute to begin use in Search Mode; 6 minutes for best accuracy in Measure Mode.
Measurement Units	oz/yr, g/yr, mL/s, PaM^3/s, ppm
Measurement Range	0.03 to 5.00 oz/yr 0.85 to 142 g/yr 0.08 x 10–5 to 100 x 10–5 mL/s 0.08 x 10–5 to 100 x 10–5 PaM3/s 0 to 999 ppm (or 0.0 to 99.9 with one decimal place)
Measurement Adjustment	Possible with a customer-supplied leak source of a known gas type and leak rate

Category	Description
Operating Modes	Search: Detects presence and location of gas leaks Measure: Calculates and displays leak rate
Response Time	Less than 1 second, typical (dependent on probe-hose length)
Sensitivity	0.03 oz/yr (0.9 g/yr) for all HFC refrigerants. For other gases, consult Bacharach.
Resolution	0.1 leak units
PPM Accuracy	±1 PPM ±10% of reading (or ±1% if recalibrated using a known concentration of refrigerant gas)
Temperature Drift	±0.3% of reading per °C
Relays	Four SPDT relays rated 2 A at 250 VAC (inductive) 5 A at 250 VAC (resistive) Programmable to energize under various operating conditions
Speaker	Audible indication of leak level
Dimensions	4.00 in x 10.75 in x 15.50 in (101.6 mm x 273.1 mm x 393.7 mm)
Weight	18 lb (8.2 kg)
Temperature	Operating: 32° to 122° F (0° to 50° C) Storage: –4° to 122° F (–20° to 50° C)
Ambient Humidity	5 to 90% RH, non-condensing
AC Power	100 to 240 VAC, 50/60 Hz
Power Consumption	16 Watts

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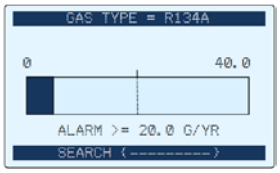
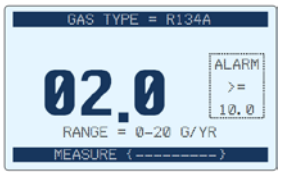
APPENDIX A: GLOSSARY OF TERMS

Table A-1. Glossary of Terms

Term	Description
alarm setpoint	A value of a measured quantity above which an alarm will occur. The H25-IR PRO has a programmable alarm setpoint for the default user (User Setup 0) and for each of the four custom users (User Setup 1-4). The alarm setpoint is a function of the measured gas reading. You set the alarm setpoint for User Setup 0 from the Basic Setup Menu. Alarm Setpoints for User Setups 1-4 are set from the Advanced Setup Menu. When the alarm setpoint is exceeded, the audible alarm will sound. In addition, output relays may be programmed to energize if the alarm setpoint is exceeded.
ALQ™	ALQ™ (Advanced Leak Quantification) is a technology that eliminates the need to periodically adjust the instrument to a calibrated reference leak source. The result is an instrument that maintains its accuracy in real time, even under changing conditions.
bar graph	See *graphic display*.
bump test	A bump test is a quick functional (not quantitative) test of the operation of a gas detector. It is also used to test the internal and external alarm capabilities of the system. Compared to a more complex *quantitative* test requiring a reference gas of precisely known quantity and certified quality, a bump test may be accomplished with sample gas ampoules, or using everyday items having similar molecular structure (therefore, recognized by the instrument's sensor). For example, depending on the type of gas sensor in your H25-IR PRO, you may be able to perform a simple bump test using an uncapped permanent marker, typing correction fluid, a can of aerosol spray used for dusting delicate computer components, or even a disposable lighter (by just releasing the gas—not lighting it).
fault	A fault is an error. The H25-IR PRO can identify various faults and provide the operator with feedback regarding the fault type and possible correction options.
graphic display	Graphic display (or *bar graph* mode) is one of two display styles from which the operator may choose for displaying the search mode screen. (The other display style is numeric mode.) This user preference is set from the Display Style option in the Basic Setup menu. 
IR emitter	The IR (infrared) emitter is a component of the NDIR sensor. The emitter generates a focused infrared beam through the gas sample and toward the detector. See *NDIR sensor* for more information.
IR detector	The IR (infrared) detector is a component of the NDIR sensor. The detector identifies how much light (from the emitter) is getting through the tube (i.e., the amount of light NOT being absorbed by the sample gas located in the tube). This is used to ultimately determine the leak rate. See *NDIR sensor* for more information.
loop factor	Loop factor is a coefficient used for scaling the 4-20mA output to the input reading range (of the sampled gas).
measure mode	Measure mode is one of two main operating modes of the H25-IR PRO. It is used to quantify a leak rate and is typically use *after* using search mode to locate a leak.

Term	Description
NDIR sensor	An NDIR sensor is a device that detects the presence of gas by measuring the amount of infrared light that is absorbed by a sample. The NDIR sensor is a cylindrical tube containing an emitter at one end and a highly sensitive detector at the other. The emitter generates a focused infrared beam through the gas sample and toward the detector. The light that is not absorbed by the gas drawn into the chamber strikes the detector. Comparing the amount of light emitted versus what was detected gives a differential that is then matched against the gas type setting and other values to determine the quantity and leak rate of the gas.
numeric display	Numeric display is one of two display styles from which the operator may choose for displaying the search mode screen. (The other display style is graphic display mode.) This user preference is set from the Display Style option in the Basic Setup menu. Note that the numeric display is also used exclusively in measure mode. 
log limit	The log limit is used in totalizer applications with the measurement log. It is an alarm setpoint based on the accumulated sum of logged data point values. Refer to *totalizer* for more information.
measurement log	The measurement log is a 50-element array into which the operator may store (or *log*) gas readings. Gas values and time/date stamps are stored sequentially when the operator chooses to log the data point. Menu options permit the clearing of individual data points or the entire measurement log.
search mode	Search mode is one of two main operating modes of the H25-IR PRO. It is used to locate a leak and is typically use *before* using measure mode.
totalizer	Totalizer is a unique gas detection/alarm application in which the leak rate of *multiple* sample points are logged and then summed. This summed leak rate is compared to a user-programmable setpoint (the Log Limit option of the Advanced Setup menu). If the summed leak rate exceeds the Log Limit setpoint, external alerts can be generated using the configurable relay outputs (e.g., horns, warning lights, etc.).
unit display	Unit display is a programmable option in the H25-IR PRO that defines the engineering units to be used by the instrument. The H25-IR PRO is used to locate and quantify refrigerant gas leak rates, so available engineering units include oz/yr, g/yr, mL/sec-5, Pa·M/sec-5, and PPM.

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APPENDIX B: ACRONYMS AND ABBREVIATIONS

Table B-1. Acronyms and Abbreviations

Acronym	Meaning
‘	feet
“	Inches
°	degrees
↵	enter
A	Amperes, Amps
A/D	analog/digital
AC	Alternating current
ALQ™	Advanced Leak Quantification
ASCII	American Standard Code for Information Interchange
AWG	American Wire Gauge
C	Centigrade
ccm	cubic centimeters (also see cm^3)
CFC	chlorofluorocarbon
cm	centimeter
cm^3	cubic centimeters (also see ccm)
COM	common (a relay terminal), communications (COM port)
CR	carriage return
DC	Direct current
dd	day
DigiPot	digital potentiometer
ENT	enter
ESC	escape
ESD	electrostatic discharge
F	Fahrenheit
ft	feet
g	gram
HCFC	hydrochlorofluorocarbon
HFC	hydrofluorocarbon
Hz	Hertz
i	information
in	inch
IR	infrared

Acronym	Meaning
lb	pound
LCD	liquid crystal display
LED	light emitting diode
LEL	lower explosive limit
LF	line feed
LOK	locked
m	meter
mA	milliamp, milliampere
mL	milliliter
mm	millimeter, month
NC	normally closed
NDIR	Non-dispersive Infrared
NIST	National Institute of Standards and Technology
NO	normally open
oz	ounce
P/N	part number
Pa	Pascal
PC	personal computer
ppm	parts per million
psia	pounds per square inch – absolute (including atmospheric pressure)
PTFE	polytetrafluoroethylene
rev	revision
RS-232	recommended standard 232
SCCM	standard cubic centimeters per minute
SPDT	single pole double throw
SRCH	search
UL	Underwriters Laboratories
USB	universal serial bus
V	Volts
VAC	Volts alternating current
VDC	Volts direct current
vol	volume
yr, yy	year

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APPENDIX C: SUPPORTED GAS TYPES

IN THIS SECTION

C.1. Basic Gas Types

NOTE: Basic gas types are those listed in the H25-IR PRO's GAS TYPE menu item, when equipped with the halogen NDIR sensor, unless overridden by selecting a factory gas option.

Table C-1. Basic (Primary) Gas Types

Gas Abbr		Formula	Gas Name/Description
R12		CCl_2F_2	Dichlorodifluoromethane
R22		$CHClF_2$	Chlorodifluoromethane
R23		CHF_3	Trifluoromethane
R134A		$C_2H_2F_4$	1,1,1,2-Tetrafluoroethane
R404A	R-125..... (44%) R-143a ..... (52%) R-134a ..... (4%)	C_2HF_5 $C_2H_3F_3O$ $C_2H_2F_4$	Pentafluoroethane 2,2,2-Trifluoroethyl methyl ether 1,1,1,2-Tetrafluoroethane
R407C	R-32..... (23%) R-125 ..... (25%) R-134a ..... (52%)	CH_2F_2 C_2HF_5 $C_2H_2F_4$	Difluoromethane Pentafluoroethane 1,1,1,2-Tetrafluoroethane
R410A	R-32..... (50%) R-125 ..... (50%)	CH_2F_2 C_2HF_5	Difluoromethane Pentafluoroethane
H1234YF		$C_3H_2F_4$	2,3,3,3-Tetrafluoropropene
R32		CH_2F_2	Difluoromethane
H1301		$CBrF_3$	Bromotrifluoromethane
N1230		$C_6F_{12}O$	Novec™ 1230
H1211		CF_2ClBr	Bromochlorodifluoromethane
H2402		$C_2Br_2F_4$	Dibromotetrafluoroethane
R124		C_2HF_4Cl	2-Chloro-1,1,1,2-tetrafluoroethane
R125		C_2HF_5	Pentafluoroethane
R227		C_3HF_7	Heptafluoropropane (F3C-CHF-CF3)
R422a	R-125..... (85.1%) R-134a... (11.5%) R-600a..... (3.4%)	Mix	See information on individual gases.
R438a	n/a	n/a	ISCEON® MO99™
R502	R-22..... (48.8%) R-115..... (51.2%)	Mix	See information on individual gases.
FC72		C_6F_{14}	Tetradecafluorohexane
R407F	CH_2F_2 ..... (30%) C_2HF_5 ..... (30%) $C_2H_2F_4$..... (40%)	Mix	Blend of HFC32,HFC125, and HFC134a
H1234ZE		$C_3H_2F_4$	1,3,3,3-Tetrafluoropropene

N7100	$C_4F_9OCH_3$	Novec ™ 7100 engineered fluid
N7200	$C_4F_9OC_2H_5$	Novec ™ 7200 engineered fluid
N7300	n/a	Novec ™ 7300 engineered fluid
N7600	n/a	Novec ™ 7600 engineered fluid
CUSTOM	Various	Custom gas type allows the user to adjust the instrument to a known concentration via the “external reference" feature.

C.2. Factory Gas Types

NOTE: With factory gas types, the selected gas becomes the only gas listed in the user GAS TYPE menu.

Table C-2. Factory (Secondary) Gas Types

Gas Abbr		Formula	Gas Name/Description
R21		$CHFCl_2$	Dichlorofluoromethane
R113		$C_2F_3Cl_3$	1,1,2-Trichlorotrifluoroethane
R114		$C_2F_4Cl_2$	1,2-Dichlorotetrafluoroethane
R123		$C_2HF_3Cl_2$	2,2-Dichloro-1,1,1-trifluoroethane
R236fa		$C_3H_2F_6$	1,1,1,3,3,3-Hexafluoropropane
R245fa		$C_3H_3F_5$	1,1,1,3,3-Pentafluoropropane
R401A	R-22.....(53%) R-152a .....(13%) R-124 .....(34%)	Mix	See information on individual gases.
R402A	R-125.....(60%) R-290 .....(2%) R-22.....(38%)	Mix	See information on individual gases.
R402b	R-125.....(38%) R-290 .....(2%) R-22.....(60%)	Mix	See information on individual gases.
R407A	R-32.....(20%) R-125.....(40%) R-134a.....(40%)	Mix	See information on individual gases.
R408A	R-125.....(7%) R-143a.....(46%) R-22.....(47%)	Mix	See information on individual gases.
R409A	R-22.....(60%) R-124.....(25%) R-142b .....(15%)	Mix	See information on individual gases.
R422d	R-125.....(65.1%) R-134a....(31.5%) R-600a.....(3.4%)	Mix	See information on individual gases.

Gas Abbr		Formula	Gas Name/Description
R424a	R-125 ..... (50.5%) R-134a ... (47.0%) R-600a ..... (0.9%) R-600 ..... (1.0%) R-601a ..... (0.6%)	Mix	See information on individual gases.
R426a	R-125 ..... (5.1%) R-134a ... (93.0%) R-600 ..... (1.3%) R-601a ..... (0.6%)	Mix	See information on individual gases.
R427a	R-32 ..... (15%) R-125 ..... (25%) R-143a ..... (10%) R-134a ..... (50%)	Mix	See information on individual gases.
R500	R-12 ..... (73.8%) R-152a ... (26.2%)	Mix	See information on individual gases.
R503	R-23 ..... (40.1%) R-13 ..... (59.9%)	Mix	See information on individual gases.
R507	R-125 ..... (50%) R-143a ..... (50%)	Mix	See information on individual gases.
R508B	R-23 ..... (46%) R-116 ..... (54%)	Mix	See information on individual gases.
HFP		C_3F_6	Hexafluropropylene
FA188		n/a	n/a
R600a**		C_4H_{10}	Isobutane or methylpropane
R290**		C_3H_8	Propane
CO2_A**		CO_2	Carbon dioxide
SF6**		F_6S	Sulfur hexafluoride

*** Requires a different NDIR sensor inside the instrument.*

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APPENDIX D: DECLARATION OF CONFORMITY

CE DECLARATION OF CONFORMITY

The manufacturer of the products covered by this declaration:	Bacharach, Inc. 621 Hunt Valley Circle New Kensington, PA 15068
Year conformity is declared:	2011
Product(s):	Refrigerant Monitor
Model(s):	H25-IR Pro

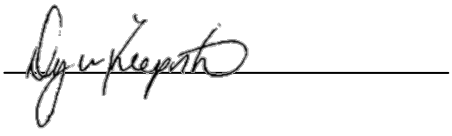
The undersigned hereby declares that the above referenced products are in conformity with the provisions of the following standard(s) and is in accordance with the following directive(s).

Standard(s):

EN 50270:2006	Electromagnetic Compatibility	Electrical Apparatus for the Detection and Measurement of Combustible Gases, Toxic Gases, or Oxygen
EN 55011:2009 /A1:2010	Radio Disturbance Characteristics	Limits and Methods of Measurements for Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment
EN 61010-1 / IEC 61010-1	Safety Standard	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use , Part 1
UL 61010-1 : 2001 / CSA 61010-1	Safety Standard	Second Edition, Standard for Safety Electrical Equipment for Measurement and Laboratory Equipment, Part 1 General Requirements

Directive(s):

2004/108/EC	EMC Directive
2006/95/EC	Low Voltage Directive

Signature: 

Name: Doug Keeports
Title: VP of Product Development
Date: 14 October 2011

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

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INDEX

To facilitate quick access to desired reference material, index locator page numbers are coded based on the nature of how the target material is displayed. Index reference page numbers that are given in standard face fonts refer to generic text references. Italic locator page numbers refer to reference material found within tables. Bold locator page numbers refer to pages containing references within illustrations. See the examples below.

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Bold: Referenced pages show related illustrations.
Standard: Referenced pages contain related text.
Italic: Referenced pages contain tables with related topics.

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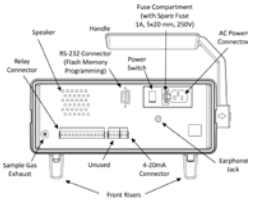

2.1. Principles of Infrared Gas Detection

This instrument utilizes the principle of *infrared absorption* to measure the absolute concentration of a particular gas that is contained in the sample.

7.1. Specifications

Table 7-1. Specifications

Category	Description
Gases Detected (GAS TYPE)	R12, R22, R134a, R404A, R407C, R410A, H1234YF, R32
	CUSTOM
	R600a, R290, CO_2, SF_6
	R21, R23, R113, R114, R123, R124, R125, R227, R236fa, R245fa, R401A, R402A, R402b, R407A, R408A, R409A, R422a, R422d, R424a, R426a, R427a, R438a, R500, R502, R503, R507, R508B, HFP, H1211, H1301, H2402, N1230, FA188, FC72
Detection Method	Non-Dispersive Infrared (NDIR)

Illustrations Text *Tables*

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