GREYSTONE
ENERGY SYSTEMS INC

QIRF-II

REFRIGERANT GAS TRANSMITTER/SENSOR

INSTALLATION
OPERATION AND MAINTENANCE
MANUAL

Greystone Energy Systems Inc.
PHONE: +1 (506) 853-3057   Web: www.greystoneenergy.com

Table Of Contents

READ BEFORE OPERATING

All individuals who have or will have the responsibility of using, maintaining, or servicing this product must carefully read this manual. The product will perform as designed only if it is used, maintained, and serviced in accordance with the manufacturer's instructions.

1. General Information

1.1 Principle of Operation

The QIRF-II Smart Sensor is a microprocessor controlled Refrigerant gas Sensor or Transmitter using infrared sensing technology. The concentration of Refrigerant is measured by determining the amount of absorption of light in a specific frequency band.
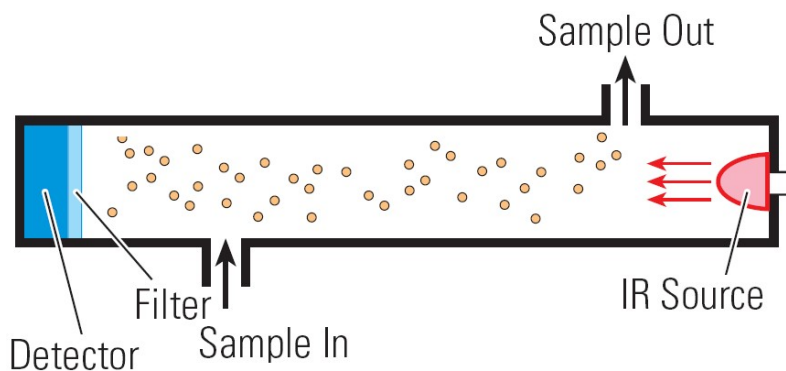
As most gases have their characteristic spectra in the infrared. Those spectra derive from the molecule's composition in such a way that no two molecular gases have the same IR spectrum. IR spectra are the fingerprints of gases, and thus allow gases to be uniquely identified.

By transmitting a beam of IR radiation through the air, or through any particular gas volume, and recording how much is transmitted at selected spectral lines, one may decide which gases are present and how much of each. This is a standard and well-proven principle, routinely used in laboratory analyses of chemical species, and is also the basis on which our sensors are made.

An IR detector is essentially a temperature sensor and is, therefore, potentially very sensitive to changes in the ambient temperature. However, our QIRF-II smart sensor modules do it better, faster, and more precisely. The QIRF-II smart sensors are entirely electronic with no moving parts, and are built around our unique QT Gas Sample Cell with constant temperature control integrated with IR Source and IR Detector together. This makes our IR smart sensors work from -45°C to 50°C without being susceptible to ambient temperature fluctuations.

Comparing with conventional gas detector, gases to be detected are often corrosive and reactive. With most sensor types, the sensor itself is directly exposed to the gas, often causing the sensor to drift or die prematurely. The main advantage of IR sensor or transmitter is that the detector does not directly interact with the gas (or gases) to be detected. In the QIRF-II Smart Sensor, the major functional components are protected with optical parts. In other words, gas molecules interact only with a light beam. The IR Source and IR Detector can be treated, making them resistant to corrosion, and are designed such that they are easily removable for maintenance or replacement.

1.2 Key Features

- Infrared Sensing Technology
- Constant Temperature QT Gas Sampling Cell
- Standard RS-485 Output with OptoMux protocol, Modbus RTU protocol and BACnet MS/TP master/slave protocol
- Standard 4-20mA Analog Output
- Diffusion Sampling module or Pump-thru module
- No moving parts in diffusion or pump-thru model
- Water and corrosion resistant PVC enclosure NEMA 4, 4X
- Addressable from 0 to 127
- 4x tactile & audible keypad
- 3 programmable Relays and programmable Buzzers
- 2 x 8 character LCD display c/w backlight
- Operation at 18-30VDC or 15–24VAC
- 3 Relay Status LED, TX Status LED and RX Status LED
- CSA/UL approval (pending)

1.3 Applications

The QIRF-II is designed to monitor for the loss of refrigerant gas in a variety of applications:
- Mechanical equipment rooms
- Propellant filling operations
- Solvent cleaning stations
- Cold storage and transport facilities
- Meat packing plants
- Supermarkets and refrigerant storage locations
- Other specialty applications using halocarbons

1.4 Specifications

NOTICE: Installing or using this equipment in a manner not specified by the manufacturer could cause electric shock, bodily injury, or risk of fire.

Specification:	
Power Supply:	Voltage: 24VDC nominal, range 18 to 30VDC 24VAC nominal, range 15 to 24VAC 50/60HZ **Note: QIRF-II has full-wave rectifier and half-wave rectifier circuit on board for flexibility. You will damage devices if you mix half wave and full wave rectifiers on the same AC source. Use extreme caution when sharing a common AC source. Sharing a common DC source is less problematic.** Current: QIRF-II: max. 1.00 A (fuse protected) **Note: No external over-current protection is required. Over-current protection is provided by means of fuses F1 and F2. See fuse specification below.**
Fuse:	F1: Polyswitch 750mA F2: Polyswitch 750mA Polyswitch device resets after the fault is cleared and power to the circuit is removed.
Sensor:	NDIR, Infrared Refrigerant
Gas Detected:	User selectable: R11, R12, R22, R23, R32, R114, R116, R123, R134A, R141B, R402A, R404A, R407A, R407B, R407C, R407D, R407E, R407F, R408A, R409A, R410A, R422A, R422B, R438A, R448A, R449A, R452A, R453A, R454B, R507A, R508B, R513A, R514A, R1233zd, R1234ze. Available on special order: R13, R14, R21, R31, R41, R113, R115, R125, R143a, R152, R161 …
Range:	0 to 100ppm for R123 0 to 1000ppm for others

|	
Accuracy: **Repeatability:**	+/- 3% of reading +/- 1% of full scale
Sampling:	Diffusion or Pump-through
Display:	2 x 8-character display c/w backlight
Panel Indicators:	5 Status LEDs • RS-485 port TX/RX Status LED for Sensor Network • 3 Relay Status LEDs
Keypad:	4x tactile & audible keypad
Relays:	3 Relays SPDT, Dry contacts, Relay1 to Relay3 Resistive load: 1.0A maximum at 30VDC 0.3A maximum at 125VAC
Buzzer:	Used for internal warning and alarm. 55dB at 10 feet 2700 Hz Continuous It's not used for Alarm-Sounding Appliance.
Output Signal:	Support below all protocols in one unit (Default: OptoMux) • RS-485 OptoMux for M-Controller, Q-Controller and Q4C • RS-485 with Modbus RTU protocol • RS-485 with BACnet MS/TP master/slave protocol • 4-20mA Analog Output
Enclosure:	IP66 & NEMA 4, 4X, 12 & 13 ratings Cover screws should be torqued to 2.5lbs-in (30cN-m) UL listed 508 listed (File # E65324)
Environmental conditions:	Temperature: -45 °C to 50 °C Relative Humidity: 5% to 95% RH (non-condensing) Storage Temperature: -45 °C to 55 °C
Size: **Weight:**	200mm x 120mm x 90mm Less than 1.5lbs (0.680kg)

2. Installation

2.1 Sensor Location

Several factors should be considered when selecting locations to install sensors. The following general suggestions should be considered to assure the detection of the target gas. Select the most suitable location for each sensor.

1. Air Currents: If there are fans, winds, or others sources of air movement, gases may tend to rise or collect in certain areas of a facility. The local air currents should be assessed to aid in selecting the sensor location. In outdoor situations considerations such as prevailing winds should be accounted for. Air convection can often be more important in determining gas concentrated areas than factors of Vapor Density.

2. Vapor Density: R11, R22, R123 and R134A are heavier than air. Detecting location should be 9 - 18 inch (0.23m to 0.46m) above the floor.

3. Gas Emission Sources: As a rule, at least one sensor should be located in close proximity to each point where a leak is likely to occur. This is particularly important when a liquid having a low volatility is monitored.

4. Environmental Factors: Designed to rugged outdoor use consider the following in selecting locations. Install sensors where they will be protected from wind, dust, snow, water, vibration, and shock.

2.2 Physical Dimensions

CAUTION:
SENSOR OPENING MUST BE PROTECTED IN HEAVY WASHDOWN SITUATION
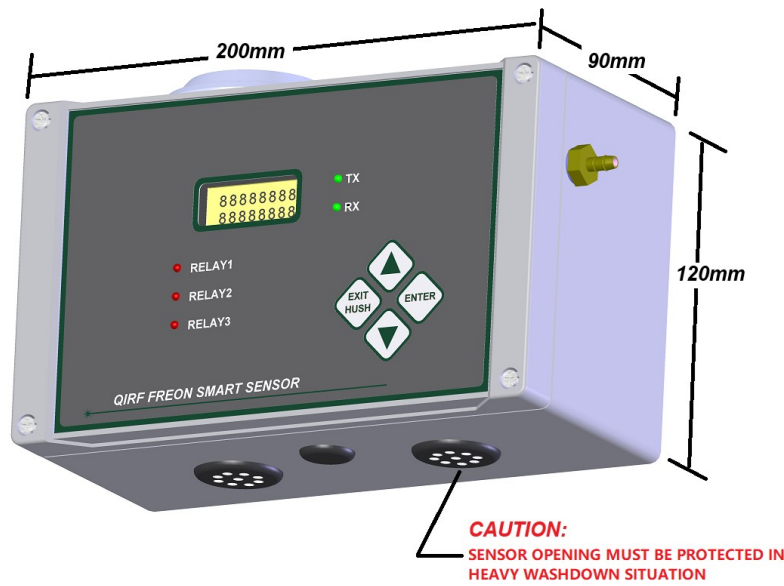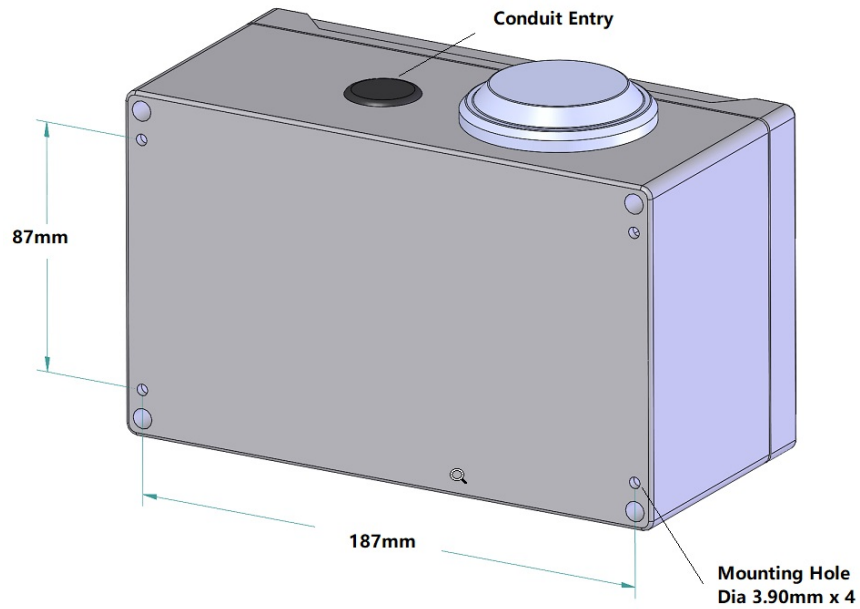
2.3 Gas Sampling

In Diffusion version QIRF-II, the gas sampling system is composed of a diffusion type gas sample chamber and two vent holes on the enclosure bottom. The gas flows in through the two vent plugs on the bottom of the QIRF-II enclosure and flows out through the top vent. See above picture.

In Pump-thru version QIRF-II, the sampling gas is pumped through the fitting on the bottom of the QIRF-II enclosure, and passed through the gas chamber, then exhausted out though the fitting on the right side of the enclosure. **Pump-thru version QIRF-II doesn't have pump inside**. For gas sampling and conditioning unit, we provide SCS-1 (One channel sampling and conditioning system).

2.4 Mounting and System Wiring

NOTE: The Diffusion version QIRF-II should be mounted 1 foot (30cm) from the floor.

2.4.1 Terminals

Note on Terminal Block: Remove the terminal block from the pin headers before wiring the terminal blocks. Torquing the terminal screws while attached to the pin header can damage the contact and can also cause loose connections. Don't over-torque the terminal block screws (0.4NM is recommended).
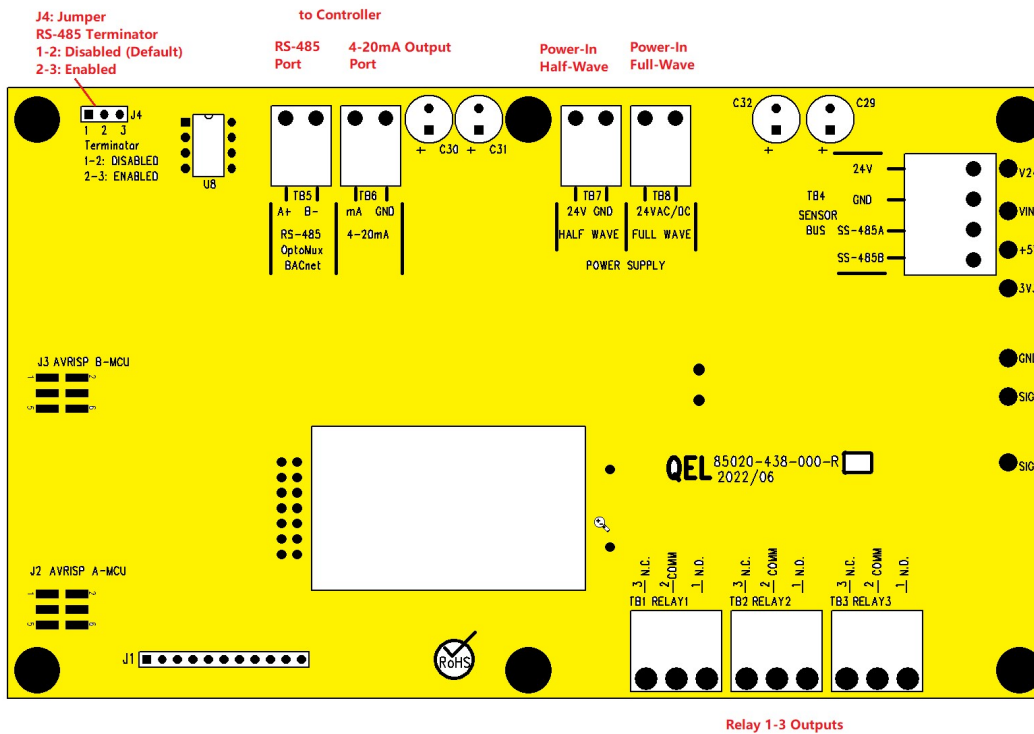
2.4.2 Power Supply

NOTICE: Installing or using this equipment in a manner not specified by the manufacturer could cause electric shock, bodily injury, or risk of fire.

NOTE: Q4-Controller II has full-wave rectifier and half-wave rectifier circuit on board for flexibility. You will damage devices if you mix half wave and full wave rectifiers on the same AC source. Use extreme caution when sharing a common AC source. Sharing a common DC source is less problematic.

Power Supply:

Voltage: 15-24VAC   50/60Hz   1.0A AC Total max.

18-30VDC   1.0A DC Total max.

Note: No external over-current protection is required. Over-current protection is provided by means of fuses F1 and F2.

2.4.3 Wire and Cable

The terminal blocks TB5 to TB8 accepts 12 AWG to 24 AWG wire, Use 16 AWG or 18 AWG wire for Power Supply in long wiring runs, which can be up to 1km (1,000 meters) long.

We recommend using BELDEN 9841 for communications. This wire has 120 ohm input impendence, which will eliminate RS-485 communication problems.

2.4.4 Digital Connection
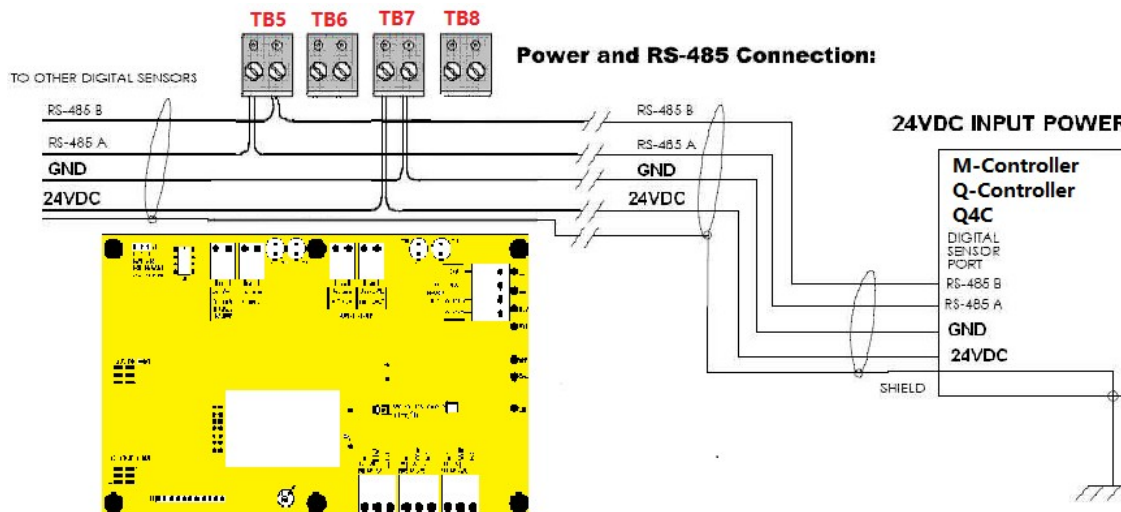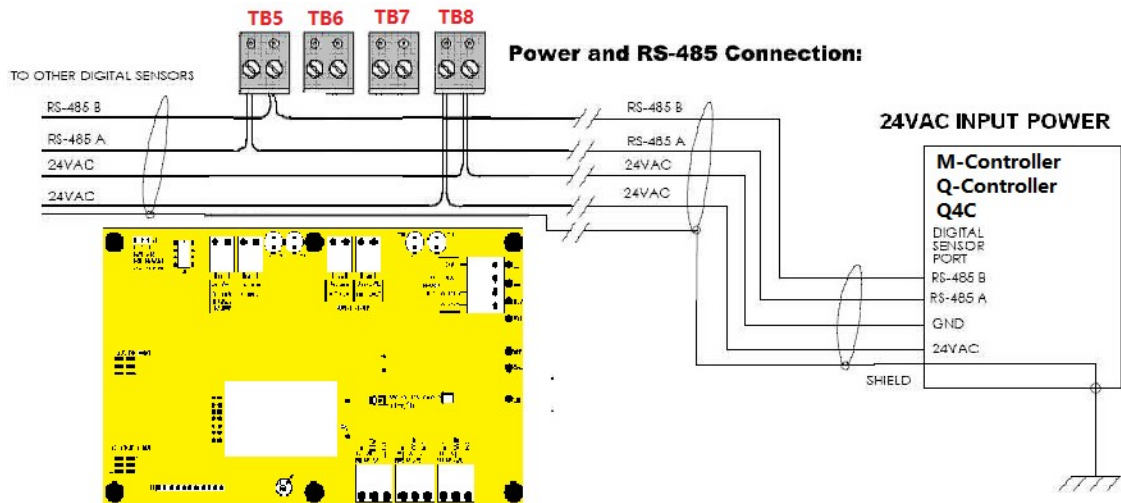
RS-485 Terminator: The terminator on each end of the RS485 loop is designed to match the electrical impedance characteristic of the twisted pair wire and will prevent signal echoes from corrupting the data on the line. The terminator should be enabled on BOTH ends of the RS485 loop. Short and medium length Modbus/485 loops can operate without the terminating resistor. Longer runs may require the terminating resistors. But adding terminator dramatically increases power consumption.

Factory default setting is disabled terminator.

The QIRF-II smart sensor supplies this resistor on the display board, and it is chosen using a jumper at J4.
- J4 1-2: Terminator Disabled / OFF (default)
- J4 2-3: Terminator Enabled / ON

RS-485 Driver Replacement: RS-485 lines in heavy industrial environments are sometimes subjected to magnetic disturbances causing sufficient inducted power surges to damage the driver integrated circuit (IC). This IC U8 has a socket on the circuit card for ease of replacement in the field.

2.4.5 Relays Output

The QIRF-II has three onboard programmable Single-Pole Double-Throw (SPDT) relays. These relays can be used to control other equipment, such as fans, lights, horns, etc. eliminating the need for a separate controller.

Three terminal blocks TB2, TB3 and TB4 are located on the Display Board. Each relay can be programmed individually.

Switching capability of each relay is:

- 1.0 A maximum resistive load at 30 VDC

- 0.3A maximum resistive load at 125VAC
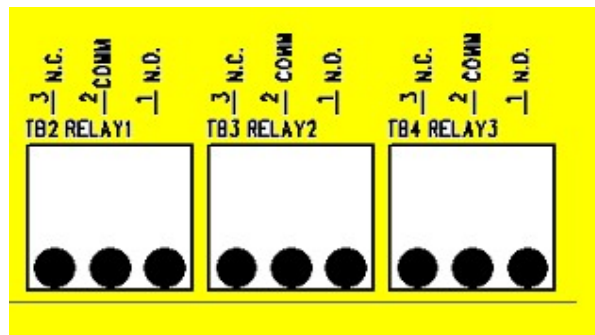
2.4.6 4-20mA Analog Output

QIRF-II can provide one channel 4-20 milliamp analog outputs. The maximum output impedance is 600 ohms.
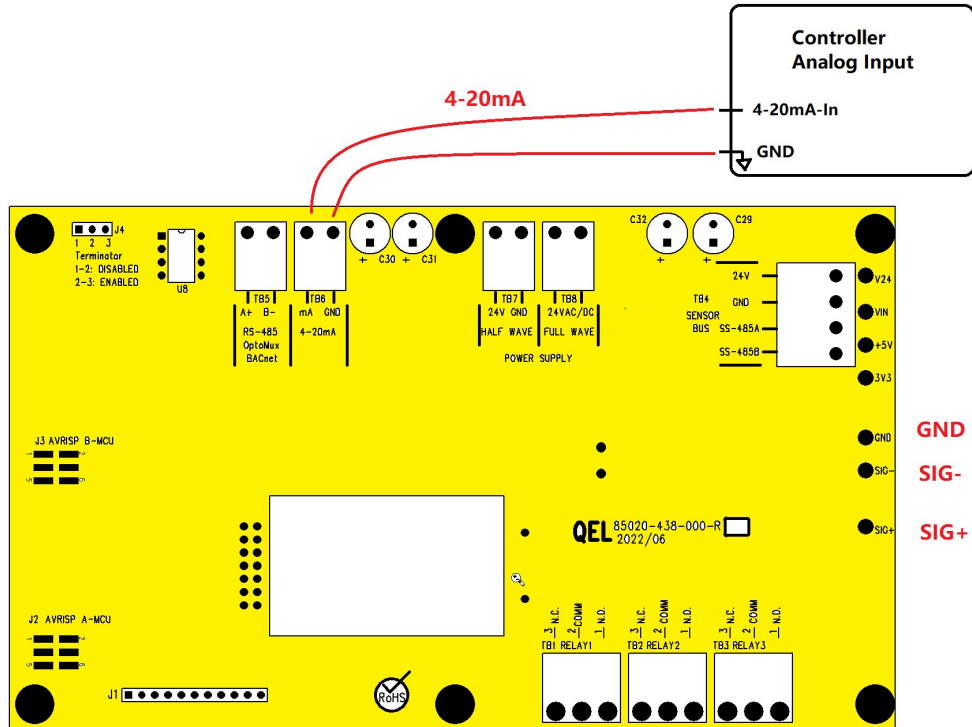
Test point SIG+ and SIG- are used to measure the current online when the QIRF-II is working in the field.

The analog output may be defined in complex ways allowing assignment of different values to both 4 milliamps and 20 milliamps. You may even assign a gas concentration to 4 mA, which is higher than the concentration assigned to 20 milliamps. The QIRF-II will draw a straight line between.

If there is any fault found in QIRF-II, it will output 2.5mA to indicate the fault.

3. Function and Configuration

3.1 QIRF-II Working Mode

QIRF-II has four kinds of working mode:

- Warm-up Mode: to heat up Optical Block and initialize components.
- Monitoring Mode: to measure the gas concentration and output signals.
- Zeroing Calibration Mode: QIRF-II is performing Zeroing Calibration.
- Span Calibration Mode: QIRF-II is performing Span Calibration.

3.2 System Initialization

When the QIRF-II smart sensor is turned on, it initializes hardware and software. As the transmitter is warming up, the optical block is heated to a constant temperature, the LCD will display the transmitter is in warming-up procedure.

In warming-up procedure, the reading of the transmitter will always be zero and the analog output will always be 4mA. Q-Controller, M-Controller and Q4 Controller will display "Warming up" in their LCD display panel. The time for stabilizing the optical block temperature depends on the ambient temperature and input power voltage. The lower the ambient temperature and input voltage are, the longer it takes. Normally, at 25°C and 24V input voltage, it takes 40 minutes for warming-up procedure to ensure the block temperature stabilization.

If the warming-up procedure is not aborted, when timeouts, the transmitter automatically starts zeroing calibration, then enters into monitoring mode. If there is an error, the LCD will display the error and the Analog 4-20A will output 2.5mA. An error message will display on the Q-Controller, M-Controller or Q4 Controller panel.

Note: After warming-up procedure, an error [PH-DIRTY] might appear which is caused by low ambient temperature or low input power voltage. The error will disappear when unit is fully stabilized. If not, see section 6. Troubleshooting.

Note: No adjustments or calibration should be performed within 24 hours.

3.3 Keypad

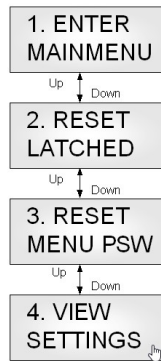QIRF-II has four keys on the front panel.

- Key [Up]: Scroll up and Hold.

- Key [Down]: Scroll down and Hold.

- Key [Exit/Hush]: Return to previous menu or Hush Buzzer.

- Key [Enter]: Enter Menu or Confirm answers.

3.4 Status LED

- RS485-TX/RX:
  When the QIRF-II is connected to a Controller System through RS-485, the traffic of the communication can be monitored visually through the two RS-485 indicators. One is RX LED, which indicates the data stream received in the Controller. The other is TX LED, which indicates the data stream out of the QIRF-II.
  Note: If the TX LED or the RX LED is always ON, that means the communication has a problem. See Troubleshooting for RS-485.
- Relay1-3 LED:
  Indicate the status of each relay. When the relay is actuated/closed, the Relay LED is ON. When the relay is de-actuated/open, the relay LED is OFF.
  Note: If you set the relay to be Normally Energized Relay (Fail Safe), the relay LED will turn ON at non-alarm state and turn OFF at alarm state, because the LED reflects the relay coil status.

3.5 Tool Menu Function

Press key [Enter] to enter tool menu functions that might be used frequently in the field.

```
1. ENTER
MAINMENU
   Up ↕ Down
2. RESET
LATCHED
   Up ↕ Down
3. RESET
MENU PSW
   Up ↕ Down
4. VIEW
SETTINGS
```

3.5.1 Enter Main Menu

Press key [Up] to browse previous item of the current menu.
Press key [Down] to browse next item of the current menu.
Press key [Enter] to enter the main menu for more configuration and settings.

3.5.2 Reset Latched or Hushed Relay and Buzzer

To acknowledge a latched condition or hushed condition, press key [Enter] to reset latched relays/buzzer and hushed relay/buzzer for which the alarm condition has been removed. If the alarm condition (e.g. high gas concentration) is still present the relay(s) and buzzer will not reset.

3.5.3 Reset MENU Password

If you forgot the main menu password, you can reset the menu password to default password "4321" by entering a correct active code. For the active code, contact GES.
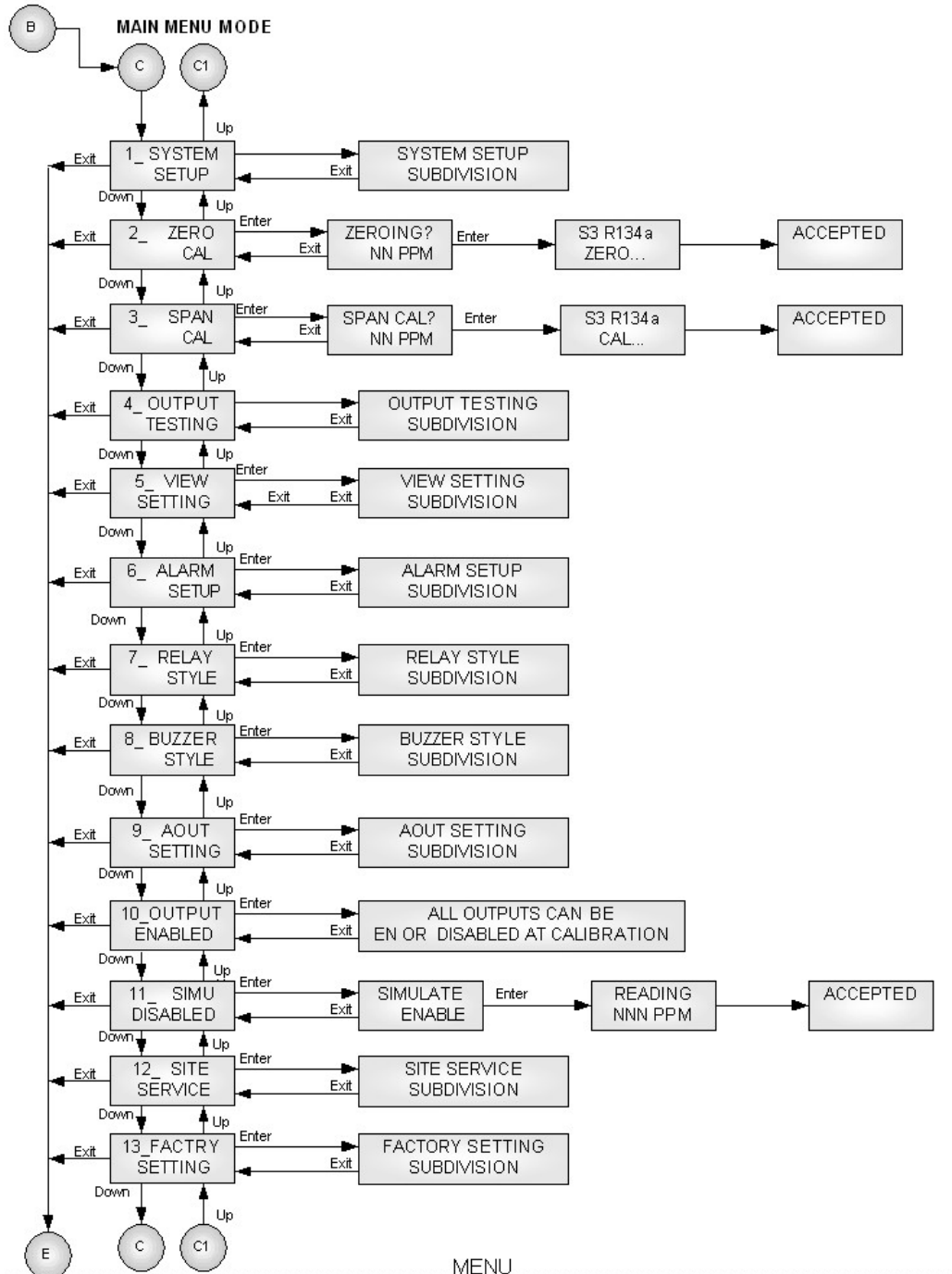
3.5.4 View Settings

Press key [Enter] to display the QIRF-II settings.

3.6 Main Menu Tree

The main menu is password protected. Once the password is accepted, you are allowed into the main menu tree.

Factory default password is 4321.

Note: While in the Menu Tree, all normal monitoring operations stop. The alarm status does not change.

3.6.1 Menu "1_System Setting"

System Setting Subdivision contains general settings for monitor operations, communications and 4-20mA calibrations.

Password:	Default password is 4321.
Address:	QIRF-II RS-485 address: 0 to 255. Default address is 3. Note: In Modbus protocol, the address 0 is for broadcast.
Baud rate:	Define baud rate for RS-485 communication with GES controller protocol, Modbus protocol and BACnet MS/TP protocol. Default baud rate is 4800 bps.
Scroll Rate:	In normal operation the sensor and relay status information scrolls automatically. Set the number of seconds for each item to be displayed. Default value is 3 seconds.
Backlight:	The LCD backlight can be set to Always Off, Always On and Auto Power Saving mode. In Auto Power Saving mode, the backlight will turn on for 10 seconds after any key has been pressed. Default setting is Auto.
4mA Cal 20mA Cal:	These values are established during factory calibration for the 4-20mA analog output and should not require recalibration in the field. Do not attempt to modify these settings in the field. Changing these values will change the analog output signal scale. **Warning: This procedure is part of factory setup. In most circumstances it will not be necessary to perform this procedure in the field. These functions require the use of precision reference instrumentation.**
Change Password:	The new password can be any combination of up to four digits. Default password is 4321. **Warning: Be sure that you record the new password in a safe and secure location!**

Protocol:	The QIRF-II Support protocol: • OptoMux (default) • Modbus RTU • BACnet MS/TP When it's set to Modbus, the parity bit can be defined as EVEN, ODD and No Parity. When the QIRF-II is connected to Q-Controller, M-Controller or Q4-Controller, the protocol should be set to "OptoMux".
Gas Type:	Default Gas Type is R134a. **Note: All units are gas calibrated using 1000ppm R134a in factory. You can change the Gas Type to the target gas type without using target gas to calibrate again, the unit will convert the cross-sensitivity to the target gas automatically. Zero Calibration is recommended after the gas type is changed.**
AutoZero:	When AutoZero is set to ON, the unit will gather the lowest reading in 7-day period and set the unit into Zeroing Calibration mode so that the lowest reading goes to zero. When AutoZero is set to OFF, the unit will not adjust its own zero and work off the last manual or factory calibration. Default value is OFF. **NOTE: "AutoZero" works best in situations where the facility is exposed to non-refrigerant-existing air at least four times in 7 days. In facilities that are continuously occupied for 24 hours per day, or where there could be significant sources of non-occupant related refrigerant gas, the Auto Zero should be turned OFF.**
Key Beeper:	ON / OFF: Beeping or no beeping when keypad is pressed.
Restore Default:	**Note: Don't do this if you don't have calibration gas and precision reference instrumentation to calibrate the unit.** To load defaults to factory settings, to restore the unit to correct operation. The settings will be restored to default values. The analog output 4-20mA must be recalibrated if needed. Zero and span calibrations are needed.

3.6.2 Menu "2_Zeroing Calibration"

Calibration should not vary significantly over a period of years; however, it is best to perform a verification calibration after installation, and at one-year intervals thereafter. All units are factory calibrated.

The QIRF-II uses full scale as its CAL GAS concentration:

Basically, QIRF-II full scale for all Refrigerant gases is 1000ppm except for R123, which is 100ppm.

The QIRF-II smart sensor is calibrated using a two-point calibration process. First, use a "Zero Gas", then use a "CAL Gas" containing a known concentration of a standard reference gas, to set the second point of reference.

3.6.2.1 Equipment Required
- A cylinder of Zero Gas: it can be clean room air or Zero Air (20.9% Oxygen in Nitrogen). **DO NOT USE PURE NITROGEN**.
- A cylinder of Cal Gas (balanced with air, **DO NOT USE BALANCED WITH NITROGEN**)
- Flow Limiting Regulator(s) **0.4 to 0.6 lpm**
- Tubing

3.6.2.2 Zeroing Calibration Procedure
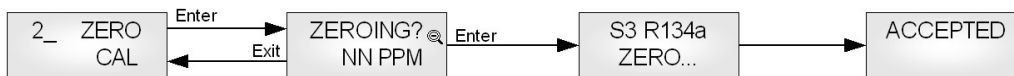
Zeroing Calibration Flow Chart

Note: No adjustments or calibration should be performed within 24 hours stabilization.

Note: Zeroing Calibration must be performed before Span Calibration.

1. Connect tubing to QIRF-II

   - For Diffusion Version: Connect the zero gas supply tubing to the fitting on the right side of enclosure

   - For Pump-through Version: Connect the zero gas supply tubing to the push-in fitting on the bottom side of enclosure

2. Turn on the gas flow and press Key [Enter] to display current reading

```
┌─────────────────┐          ┌─────────────────┐
│   Sx R134a      │ ◄──────► │   Calibrate     │
│   xxxPPM        │          │   YES?          │
└─────────────────┘          └─────────────────┘
```
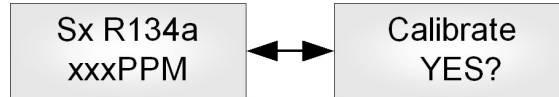
This screen is displaying the current reading and asking if you want to perform Zeroing Calibration.
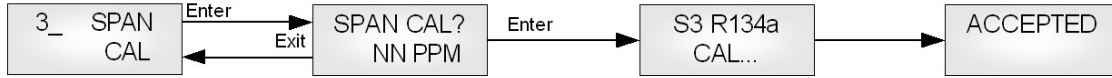
3. Waiting for about 3 minutes or till the reading is stable.

4. Press Key [Enter] to perform Zeroing Calibration.

5. During Zeroing Calibration, the LCD will display the digital pot positions and calibration statuses. It will take 1 to 3 minutes to perform Zeroing Calibration, then the zero-calibration data is saved, and LCD displays "Accepted".

6. If the LCD displays "Cal Error" that means something is wrong in the procedure, repeat procedure 4 to try again. If the "Cal Error" is still displayed in the end, the unit needs to be repaired in factory, otherwise, Zeroing Calibration has succeeded, go to next step.

7. Turn off the gas flow and remove it.
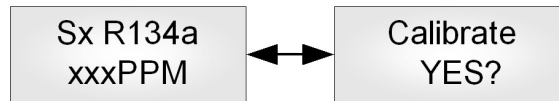
3.6.3 Menu "3_Span Calibration"

Note: If you don't have target CAL Gas in the field, you can always change the gas type back to R134a in the Menu "System Setting", and calibrate the unit with 1000ppm R134a, after the Span Calibration, then change the gas type back to the target gas.

Span Calibration Flow Chart

Span Calibration Procedure

1. Connect tubing to QIRF-II

   - For Diffusion Version: Connect the cal gas supply tubing to the fitting on the right side of enclosure.

   - For Pump-through Version: Connect the cal gas supply tubing to the push-in fitting on the bottom side of enclosure.

2. Turn on the gas flow and press Key [Enter] to display current reading

   This screen is displaying the current reading and asking if you want to perform Span Calibration.

3. Waiting for about 3 minutes or till the reading is stable.

4. Press Key [Enter] to perform Span Calibration.

5. During Span Calibration, the LCD will display the digital pot positions and calibration statuses. It will take about 1 minute to perform Span Calibration, then the span calibration data is saved, and LCD displays "Accepted".

6. If the LCD displays "Cal Error" that means something is wrong in the procedure, repeat procedure 4 to try again. If the "Cal Error" is still displayed in the end, the unit needs to be repaired in factory, otherwise, Span Calibration has succeeded, go to next step.

7. Turn off the gas flow and remove it.

3.6.4 Menu "4_Output Testing"

During system installation and testing, it may be necessary to force relays and buzzers on and off.

The Relay Testing feature allows the user to force the actuation of each relay. This function forces an Actuate vs. De-actuate action, not an energized vs. non-energized action. Therefore the user must be aware of these relays, which have been defined as normally energized or not normally energized.

The 4mA and 20mA outputs can be tested too.
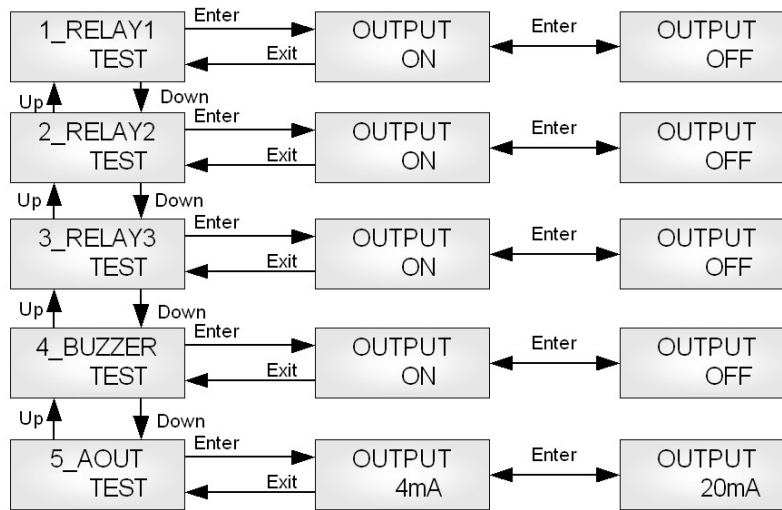
3.6.5 Menu "5_VIEW SETTING"
This function is to verify the settings for the alarms, relays, buzzers and analog outputs.
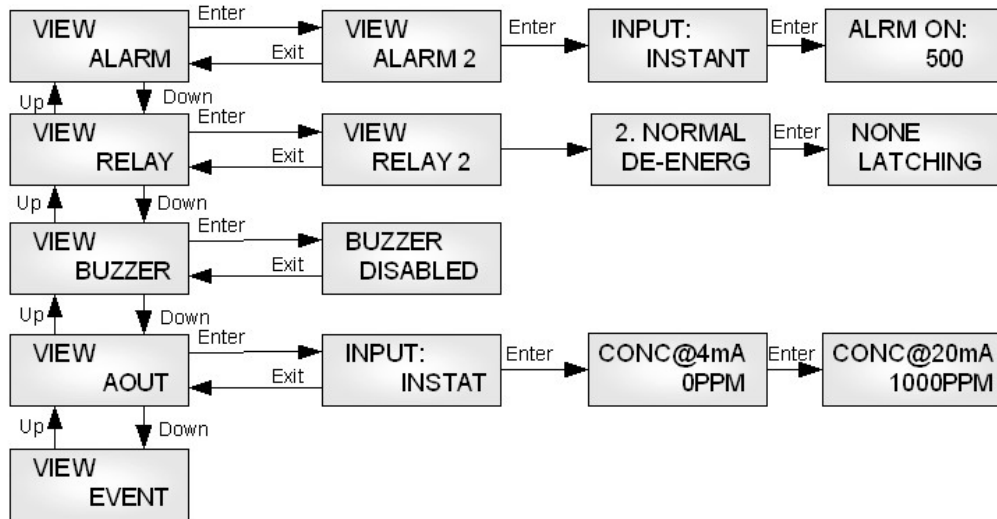
3.6.6 Menu "6_ALARM SETUP"

The QIRF-II supports alarm 1 to alarm 8.

Alarm is a programmable condition that can receive a selectable input and trigger relays and buzzers.

Disabled or Enabled:	Each alarm may be individually set to be enabled or disabled. If the alarm is disabled, the alarm will not be used to calculate or trigger anything. **Default: Alarm 1 to Alarm 4 is enabled. Alarm 5 to Alarm 8 is disabled.**
Input:	One of five inputs is selected to calculate the alarm condition status to trigger the selected outputs: • **INSTANT**: instantaneous gas reading. • **15 MIN AVG** (STEL): Short Term Exposure Limit, average reading over 15 minutes. • **8 HOURS AVG** (TWA): 8-hour Time Weighted Average, average reading over 8 hours. • **DAILY PEAK**: daily peak reading. • **FAULT**: If the unit reports any faults, no matter the gas concentration, it will trigger the selected outputs.
Alarm On and Alarm Off Reading:	*If Alarm On is greater than or equal to Alarm Off:* Alarm On: Sets the concentration at or above which the relay will actuate. Alarm Off: Sets the concentration at or below which the relay will de-actuate. *If Action On is less than Action Off:* Action On: Sets the concentration below that the relay will actuate. Action Off: Sets the concentration above that the relay will de-actuate.
Trigger:	Trigger Outputs: Relay 1, Relay 2, Relay 3, Buzzer 1, Buzzer 2, Buzzer 3

3.6.7 Menu "7_RELAY STYLE"

Enabled:	Each relay may be individually set to be enabled or disabled. If it's disabled, the relay will always de-actuate no matter what the current gas concentration. **Default is Enabled.**
Normally De-energized:	Each relay may be individually set to be normally energized or normally de-energized. **Default is normally de-energized.**
Latching:	Each relay may be set to latch in actuate status until acknowledged by a front-panel action. **Default is Non-Latching.**
ON Delay:	"Delay on Actuation" or "Delay on Make". For each relay a separate time delay may be set from 0 to 990 seconds before an alarm condition will cause the relay to actuate. **Default is 5 seconds.**
OFF Delay:	"Delay on De-Actuation" or "Delay on Break". For each relay a separate time delay may be set from 0 to 990 seconds before a return to a non-alarming signal condition will cause the relay to de-actuate. **Default is 5 seconds.**
Style:	Normal Relay Style: Work as normal relay. Buzzer Style Relay: When the relay is used to control a buzzer or horn. Working as a buzzer style will make the relay have the same function as the buzzer. It will be switched off when performing the Hush Buzzer/Relay function in the Tool Menu. **Default is OFF.**

3.6.8 Menu "8_BUZZER STYLE"

The buzzer style is almost identical to that of the relays.

3.6.9 Menu "9_AOUT SETTING"

The QIRF-II will compare the concentration at 4mA and the concentration at 20mA. You may assign a larger concentration for 4mA than for 20 mA; the QIRF-II will still stretch a straight line signal between the two points and then convert the selected gas reading to analog output.

Input:	One of four inputs is selected to calculate the analog outputs: • **INSTANT**: instantaneous gas reading. • **15 MIN AVG** (STEL): Short Term Exposure Limit, average reading over 15 minutes. • **8 HOURS AVG** (TWA): 8-hour Time Weighted Averages, average reading over 8 hours. • **DAILY PEAK**: daily peak reading.
Out 4mA at **Conc:**	Input the gas concentration at which 4mA is output.
Out 20mA at **Conc:**	Input the gas concentration at which 20mA is output.

Note: When the sensor has a fault, the output will be 2.5mA to indicate fault status.

3.6.10 Menu "10_OUTPUT ENABLE"

This function is for calibration, system testing etc. When the OUTPUT is Disabled, the status of the relay, buzzer, and analog output, etc., will freeze in their current state.

Default is Enabled.

3.6.11 Menu "11_SIMU DISABLED"

Simulation mode is used to assist in testing the installation before commissioning. When simulation is enabled, the unit will not detect gas concentrations; it will display the simulated value and use it to calculate the status of relays and buzzers, as well as the 4-20mA analog output. This feature is available for evaluating the user settings and testing the installation (e.g.: the activation of the valve, fan speed, relay set points, etc. can be verified.)

Any concentration between 0ppm and 9999ppm can be simulated.

3.6.12 Menu "12_SITE SERVICE"

Factory service staff access only. The customer has no need to operate it.

3.6.13 Menu "13_FACTROY SETTING"

Factory service staff access only. The customer has no need to operate it.

4. MODBUS Protocol Supported By QIRF-II

For Modbus protocol, please contact GES.

5. BACnet MS/TP Protocol Supported By QIRF-II

When the protocol is set to "BACnet" in Menu "System Setting", QIRF-II supports either BACnet mater (BACnet M) or BACnet slave (BACnet S), and their default settings will be set to:

- Protocol: BACnet /MSTP master/slave at 38.4kbps baud rate
- BACnet UTC Offset: 300
- Daylight Saving: Enabled
- Device Object ID: 4005
- BO/BV Output Priority: 12

Each QIRF-II on the MS/TP network must have a unique BACnet MAC address and unique Device Instance Number (Object ID).

- QIRF-II valid MAC addresses are 0-127 for master node, 0-254 for slave node.

- Default Device Instance Number (Object ID) is 4005.

Object ID:	BACnet Device Instance Number. Default is 4005.
UTC Offset	The QIRF-II supports the execution of the TimeSynchronization service and UTCTimeSynchronization service. It indicates the number of minutes (-780 to +780) offset between local standard time and Universal Time Coordinated. Default is +300 (US & Canada Eastern Time).
Daylight Saving	It indicates whether daylight saving time is in effect (Enabled) or not (Disabled) at the QIRF-II location in UTCTimeSynchronization service. Default is Enabled.
Output **Priority:**	Alarm output (BV) present_value and relay output (BO) present_value support command prioritization. The QIRF-II has priority #12 as default. The lower the priority umber the more critical the nature of the output. Priority #1 is considered the highest priority. Priority #16 is the lowest priority.

- **For BACnet PIC Statement, please contact GES.**

6. Maintenance

DVM Connection for 4-20mA measurement

- Interrupt the 4-20mA signal going from the QIRF-II to the controller (causing a fault):

  o Switch the DVM to measure DC current, on the main board plug the negative probe into GND and plug the positive probe into SIG -.

- Monitor the 4-20mA signal going from the QIRF-II to the controller (not causing a fault):

  o Switch the DVM to measure DC current, on the main board plug the negative probe into SIG - and plug the positive probe into SIG +.

4mA and 20mA Output Calibration

These values are established during factory 4-20mA output calibrations and should not require recalibration in the field. Do not attempt to modify these settings in the field.

Changing these values will change the analog output signal scale.

- Entry [Menu]-->[System Setting]

- Choose [4mA CAL]:

  1. Press Key [Enter] to output 4mA signal.

  2. Connect DVM to the unit as described above.

  3. Press Key [Up] and Key [Down] to adjust the current to 4.00mA to 4.05mA

  4. Press Key [Enter] again, then the settings will be accepted and saved.

- Choose [20mA CAL]:

  1. Press Key [Enter] to output 20mA signal.

  2. Connect DVM to the unit as described above.

  3. Press Key [Up] and Key [Down] to adjust the current to 20.00 to 20.05mA

  4. Press Key [Enter] again, then the settings will be accepted and saved.

7. Troubleshooting

This troubleshooting guide is intended as an aid in identifying the cause of unexpected behavior and determining whether the behavior is due to normal operation or an internal or external problem.

SYMPTOMS	PROBABLE CAUSE	SUGGESTED SOLUTION
RS-485 RX LED or TX LED constantly ON	• RS-485 bus connection has problem • RS-485 Driver U8 is damaged • Controller side RS-485 Driver has problem	• Disconnect the Cable to isolate the problem • Replace U8 IC on display board • Replace RS-485 Driver in Controller
In Warm Up Mode too long	• In Warming up process • Temperature sensor broken • Heater is broken	• Wait for the block to warm up • Check IR Block Assembly • Check IR Block Assembly
Error Report [PH-DIRTY] [LP-SHORT] /[LP-OPEN] [CAL-ERR]	• IR Source or Lamp Dirty • Gas Sample Cell Dirty • Signal Fault • Drift too much • Lamp Short/Open • Calibrating Error • Other Error	• Return to Factory • Return to Factory • Return to Factory • Re-zeroing calibration • Check IR Block Assembly • Recalibration or Adjust POTs or Check Gas Flow or Use different calibration gas or Replace weak IR Source Assembly or Replace Broken IR Detector Assembly • Return to Factory
IR Source LED is constant ON or OFF, not blinking	• Main Board has problem • Heater is short/Open	• Check Firmware and Driver • Check IR Block Assembly
Reading abnormally high or low or jumping around randomly	• Dirty Sensor Block • Excessive moisture • Weak IR Source • Temperature Sensor Loose	• Return to Factory • Add filter to gas inlet • Replace IR Source Assembly • Check IR Block Assembly

WARRANTY STATEMENT

The information contained in this manual is based upon data considered accurate; however, no warranty is expressed or implied regarding the accuracy of this data. All GES equipment is warranted against defects in material and workmanship for a period of two years from date of shipment with the following exceptions:

Electrochemical Sensors (Toxic)   Six Months
Catalytic Sensors (Combustible)   One Year

During the warranty period we will repair or replace, at our discretion, any components or complete units that prove, in our opinion, to be defective. We are not liable for consequential or incidental damage to auxiliary interfaced equipment.

A returned material authorization number should be obtained from the factory prior to returning any goods. All return shipments must be shipped freight prepaid and a copy of the maintenance records should accompany the unit concerned.

Warranty should be considered F.O.B. the factory. Labour and travel time are chargeable for any field site visits required for warranty work.

LIMITED LIABILITY

All GES systems shall be installed by a qualified technician/electrician and maintained in strict accordance with data provided for individual systems in the form of installation/maintenance manuals. GES assumes no responsibility for improper installation, maintenance, etc., and stresses the importance of reading all manuals. GES shall not be responsible for any liability arising from auxiliary interfaced equipment nor any damage resulting from the installation or operation of this equipment.

GES's total liability is contained as above with no other liability expressed or implied, as the purchaser is entirely responsible for installation and maintenance of systems.

This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for GES any liability in connection with the sales of our products other than that set forth herein.

NOTE: Due to on-going product development, GES reserves the right to change specifications without notice and will assume no responsibility for any costs as a result of modifications.

For further information or assistance, contact:

Greystone Energy Systems, Inc.
150 English Drive, Moncton,
New Brunswick, Canada E1E 4G7
5935 Ottawa Street, PO Box 749
Ph: +1 (506) 853-3057 Fax: +1 (506) 853-6014
North America: 1-800-561-5611
E-mail: mail@greystoneenergy.com