GREYSTONE
ENERGY SYSTEMS INC

MODEL: Q8 SERIES
NON-INTRUSIVE CALIBRATION
GAS TRANSMITTER/SENSOR

INSTALLATION
OPERATION AND MAINTENANCE
MANUAL

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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.

The Q8 is a state-of-the-art transmitter that can operate as an independent, stand-alone system or as part of an integrated system. The Q8 connects with analog and digital signals to virtually any controller, PLC, or DCS. Setup procedures are simplified with user-friendly push buttons and LCD menus.

1. Specifications

1.1 Electrical/Mechanical Specifications

Input Power:
24VDC nominal, range 18 to 30VDC, 0.3A DC Total Max.
24VAC nominal, range 15 to 24VAC, 0.3A AC Total Max.
(AC must not be grounded)

Fuse:
F2 on Main Board: Polyswitch 750mA
Polyswitch device resets after the fault is cleared and power to the circuit is removed

Sensor:
Combustible gases: Catalytic or NDIR
Toxic gases and Oxygen: Electrochemical
Carbon Dioxide: Non-Dispersive Infra-Red (NDIR)
Volatile Organic Compounds (VOC): Photoionization (PID)

Panel Indicators:
5 Status LED's
- RS-485 TX Status (Green)
- RS-485 RX Status (Green)
- Relay1 Status (Red)
- Relay2 Status (Red)
- Relay2 Status (Red)

Display:
LCD graphic display c/w backlight

Keypad:
3 magnetic switches: F1, F2, F3

Relays:
3 Relays SPDT, Dry contacts
- 1.0A maximum at 30 VDC (resistive load)
- 0.3A maximum at 125VAC (resistive load)

Output Signal:
RS-485 with GES Controller Protocol
- Available Controller: M-Controller, Q-Controller, Q4 Controller
RS-485 with ModBus protocol

4-20mA and 2-10VDC Analog Signal Output

Enclosure: Aluminium Pressure Die–Casting
                             Entries: 2X ¾ NPT

Operating Temperature: -40°C to 70°C, depends on sensor specification

Ambient Humidity: 5% to 95% RH (non-condensing)

Storage Temperature: 0°C to 40°C, depends on sensor specification

Size: 145mm X 190mm X 130mm

Weight: Less than 1.8kg

1.2 Sensor Specifications

Q8 O2 Top Assembly	Code	Gas	Symbol	Span	O2 Sensor SKU#
86330-002-000	0	Oxygen	O2	0-25%VOL	6300-0037

Q8 IR Top Assembly	Code	Gas	Symbol	Span	NDIR Sensor SKU#
86330-004-001	15	Carbon Dioxide	IR-CO2	0 – 5000ppm	6300-0066
86330-004-004	415	Carbon Dioxide	IR-CO2	0 – 5%VOL	6300-0066
86330-004-005	216	Methane	IR-CH4	0-100%LEL	6300-0067
86330-004-008	316	Methane	IR-CH4	0-100%VOL	6300-0067

Q8 PID VOC Top Assembly	Code	Gas	Symbol	Span	Sensor SKU#
86330-006-000	00	VOC	VOC	10ppb – 20ppm	6300-0062
86330-006-001	01	VOC	VOC	1ppm –2000ppm	6300-0061

Q8 LEL Top Assembly	Code	Gas	Symbol	Span	LEL Smart Sensor Assembly
86330-003-301	301	Methane	CH4	0-100%LEL	86330-013-301
86330-003-302	302	Acetic Acid	C2H4O	0-100%LEL	86330-013-302
86330-003-303	303	Acetone	C3H6O	0-100%LEL	86330-013-303
86330-003-304	304	Ammonia	NH3	0-100%LEL	86330-013-304
86330-003-305	305	Benzene	C6H6	0-100%LEL	86330-013-305
86330-003-306	306	Butyl Acetate	C6H12	0-100%LEL	86330-013-306
86330-003-307	307	Cyclo-hexane	C6H10	0-100%LEL	86330-013-307
86330-003-308	308	Cyclo-pentane	C5H10	0-100%LEL	86330-013-308
86330-003-309	309	Decane	C10H2	0-100%LEL	86330-013-309
86330-003-310	310	Dioxane	C4H8O	0-100%LEL	86330-013-310
86330-003-311	311	Ethane	C2H6	0-100%LEL	86330-013-311
86330-003-312	312	Ethanol	C2H6O	0-100%LEL	86330-013-312
86330-003-313	313	Ethyl Acetate	C4H8O	0-100%LEL	86330-013-313
86330-003-314	314	Ethylene	C2H4	0-100%LEL	86330-013-314
86330-003-315	315	Hydrogen	H2	0-100%LEL	86330-013-315
86330-003-316	316	Iso-Butyl Methyl Ketone (Iso-BMK)	C6H12	0-100%LEL	86330-013-316
86330-003-317	317	Iso-Butane	C4H10	0-100%LEL	86330-013-317
86330-003-318	318	Iso-Butyl Alcohol	C4H10	0-100%LEL	86330-013-318
86330-003-319	319	Iso-Octane	C8H18	0-100%LEL	86330-013-319
86330-003-320	320	Iso-Pentane	C5H12	0-100%LEL	86330-013-320
86330-003-321	321	Iso-Propyl Alcahol (IPA)	C3H8O	0-100%LEL	86330-013-321
86330-003-322	322	Methanol	CH4O	0-100%LEL	86330-013-322
86330-003-323	323	Methyl Ethyl Ketone (MEK)	C4H8O	0-100%LEL	86330-013-323
86330-003-324	324	n-Butane	C4H10	0-100%LEL	86330-013-324
86330-003-325	325	n-Heptane	C7H16	0-100%LEL	86330-013-325
86330-003-326	326	n-Hexane	C6H14	0-100%LEL	86330-013-326
86330-003-327	327	Nonane	C9H20	0-100%LEL	86330-013-327
86330-003-328	328	n-Pentane	C5H12	0-100%LEL	86330-013-328
86330-003-329	329	n-Propanol	C3H8O	0-100%LEL	86330-013-329
86330-003-330	330	n-Propyl Alcahol	C3H8	0-100%LEL	86330-013-330
86330-003-331	331	Propane	C3H8	0-100%LEL	86330-013-331
86330-003-332	332	Propylene	C3H6	0-100%LEL	86330-013-332
86330-003-333	333	Styrene Monomer	C8H8	0-100%LEL	86330-013-333
86330-003-334	334	Toluene	C7H8	0-100%LEL	86330-013-334
86330-003-999	999	Other	LEL	0-100%LEL	86330-013-999

Code	Gas	Symbol	Gas Density	Span	Operating Temperature
1	Carbon Monoxide	CO	Slightly Lighter	0 – 250ppm	-20°C to +50°C
1	Carbon Monoxide	CO	Slightly Lighter	0 – 1000ppm	-20°C to +50°C
2	Hydrogen Sulfide	H2S	Heavier	0 – 25ppm	-20°C to +50°C
2	Hydrogen Sulfide	H2S	Heavier	0 – 100ppm	-20°C to +50°C
3	Sulphur Dioxide	SO2	Heavier	0 – 6ppm	-20°C to +50°C
5	Nitrogen Dioxide	NO2	Heavier	0 – 10ppm	-20°C to +50°C
6	Hydrogen	H2	Lighter	0 – 1000ppm	-20°C to +50°C
6	Hydrogen	H2	Lighter	0 – 2000ppm	-20°C to +50°C
7	Hydrogen Cyanide	HCN	Lighter	0 – 50ppm	-20°C to +50°C
9	Ammonia	NH3	Lighter	0 – 100ppm	-30°C to +50°C
9	Ammonia	NH3	Lighter	0 – 1000ppm	-30°C to +50°C
11	Ozone	O3	Heavier	0 – 1ppm	-20°C to +40°C
13	Chlorine	Cl2	Heavier	0 – 5ppm	-20°C to +50°C
14	Chlorine Dioxide	ClO2	Heavier	0 – 2ppm	-20°C to +40°C
96	Arsine	AsH3	Heavier	0 – 1ppm	-20°C to +40°C
97	Phosphine	PH3	Heavier	0 – 5ppm	-20°C to +40°C
97	Phosphine	PH3	Heavier	0 – 1ppm	-20°C to +40°C
98	Silane	SiH4	Heavier	0 – 50ppm	-20°C to +40°C
99	Germane	GeH4	Heavier	0 – 2ppm	-20°C to +40°C
100	Diborane	B2H6	Slightly Lighter	0 – 2ppm	-20°C to +40°C
4	Nitric Oxide	NO	Slighter Heavier	0 –100ppm	-20°C to +50°C
8	Hydrogen Chloride	HCl	Heavier	0 – 30ppm	-20°C to +40°C
12	Ethylene Oxide	ETO	Heavier	0 – 20ppm	-20°C to +50°C
101	Hydrogen Bromide	HBr	Heavier	0 – 30ppm	-20°C to +40°C

*NOTE: Mounting Heights   - Low = 9-18 inches (0.25-0.5 meters) from floor
         - Mid = 4-6 feet (1.25-1.75 meters) from floor
         - High = 9-18 inches (0.25-0.5 meters) from ceiling

2. Installation

Warnings:

Q8 is designed for installation and use in Zone 1 or 2 hazardous areas in many countries including Europe and for Class 1 Division 1 or 2 area applications in North America. Installation must be in accordance with the recognized standards of the appropriate authority in the country concerned.

Access to the interior of the detector, when carrying out any work, must only be conducted by trained personnel.

Before carrying out any work ensure local regulations and site procedures are followed. Appropriate standards must be followed to maintain the overall certification of the detector.

For installations where conduit is used, and the sensor is mounted directly to the Q8, there must be a "Seal Fitting" installed for each of the cable gland entries within 18 inches of the Q8. For installations where the smart sensor head assembly will be mounted remotely from Q8, an additional "Seal Fittings" will be required: One at each of the conduit entries for the power/signal/relay contact outputs and one at the sensor wiring entrance. The total distance of the location of these Seal Fittings is 18 inches. (e.g. If all 3 gland entries are to be used, 3 Seal Fittings should be located, each within 6 inches of the wiring entrance).

If using an anti-seize compound, the threads should be thinly coated with an approved silicone free compound e.g. petroleum jelly.

To reduce the risk of ignition of hazardous atmosphere, de-classify the area or disconnect the equipment from the supply circuit before opening the detector enclosure. Keep assembly tightly closed during operation.

Never attempt to open a junction box/enclosure or replace/refit the sensor in potentially hazardous atmospheres while power is still applied to the transmitter.

The detector must be earthed/grounded for electrical safety and to limit the effects of radio frequency interference. Earth/ground points are provided inside and outside the unit. Ensure that all screens/instrument earth/clean earth wiring is earthed/grounded at a single point (either at the controller or detector - BUT NOT BOTH) to prevent false alarms due to earth/ground loops.

Take care when handling sensors as they may contain corrosive solutions.

This equipment is designed and constructed as to prevent ignition sources arising, even in the event of frequent disturbances or equipment operating faults.

The sensor head must be fitted with the supplied weather protection, and mounted so that the sinter is pointing downward to provide ingress protection IPX6.

2.1 Enclosures Physical Dimensions
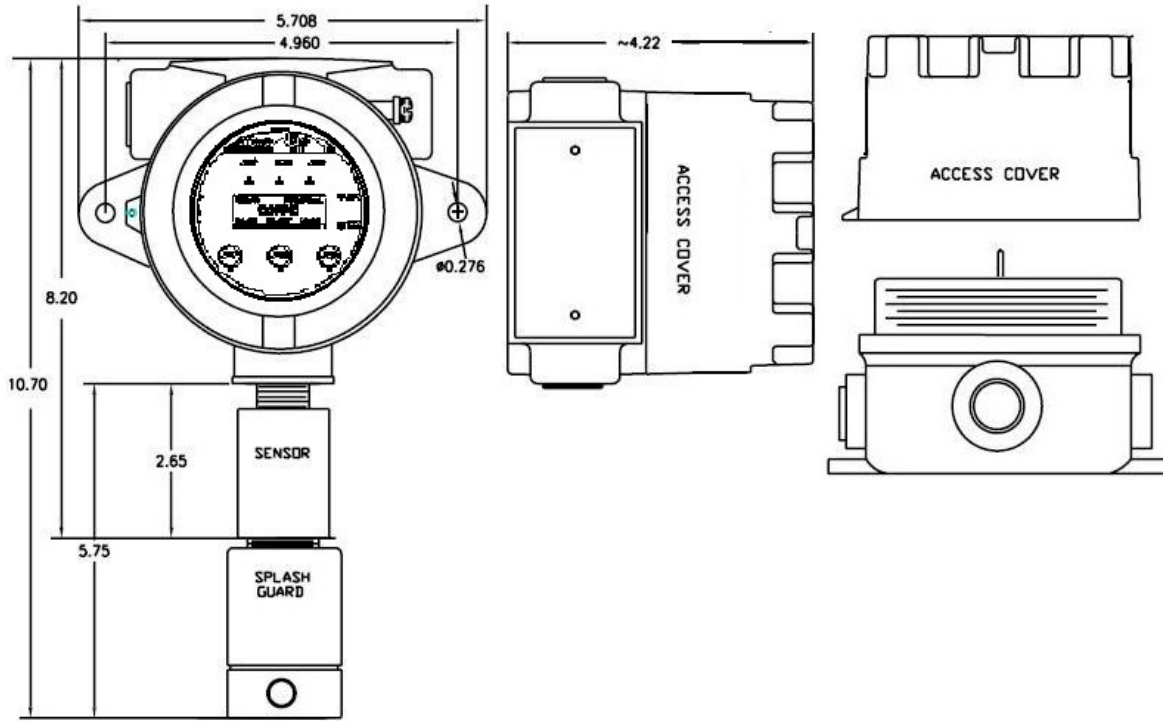
2.2 Mounting the transmitter

The Q8 transmitter has an integral mounting plate consisting of two mounting holes on the transmitter body. The transmitter may be fixed directly to a surface mounting.

The Q8 Sensor/Transmitter should be mounted where the gas to be measured is most likely to be present. This location will be dependent on the source of the target gas and whether that gas is lighter or heavier than air. Air circulation and mixture should also be taken into account.

3/4"NPT cable/conduit entries on UL/CSA versions.

Where possible, the sensor/transmitter should be mounted where it is accessible for the purposes of routine re-calibration and **periodic** sensor replacement. Sufficient room should be left to allow the enclosure cover to be removed and the connection of the calibration adapter to the sensor assembly. For sensor element replacement there will need to be enough room to reach into the sensor assembly.

NOTE: Avoid mounting the electronics near 600 VAC switchgear and other sources of radio frequency and/or electromagnetic interference. While RFI/EMI protection is built in to the electronics, excessive levels of interference may cause instability in the output signal.

Warning: GROUNDING - The industrial explosion-proof metal enclosure must be connected to a safety ground, either locally or back at the monitor, in order to provide immunity to Electromagnetic Interference.

## 2.3 Remote Mounting the Smart Sensor Head Assembly
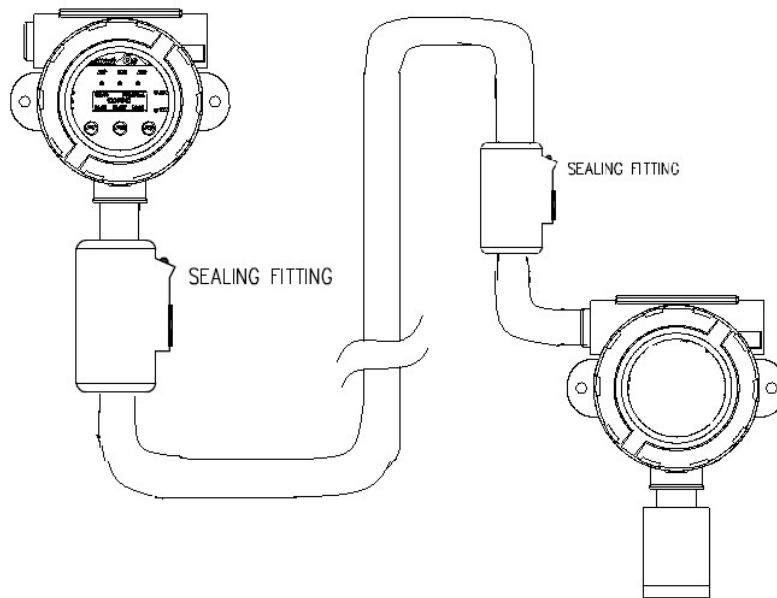
The Smart Sensor Head can be equipped with Q8 locally or remotely. For installations where the smart sensor head assembly will be mounted remotely from Q8, the max distance between Q8 and Remote Smart Sensor Head is 100 meters. The Remote Smart Sensor Head Assembly is not included in the Q8 standard package, it must be ordered separately.

NOTE:

- **Conduit or Approved Hazardous Location Cable connecting the remote sensor and Transmitter must have Sealing Fittings at both ends within total distance 18"(350mm).**
- **Hazardous Location Cable and Sealing Fittings must be approved for Class 1. Div 1 Group B,C,D Hazardous Locations.**

2.4 Terminals
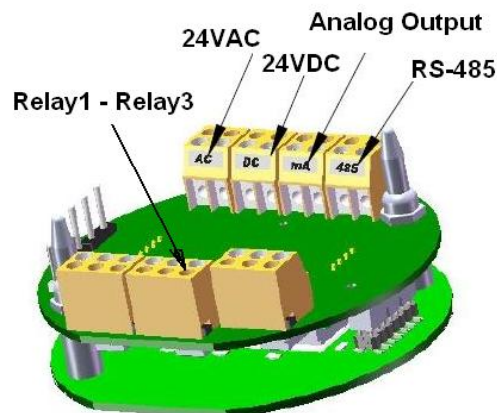
2.4.1 Wire and Cable

Terminal blocks TB1 to TB8 accept 12 AWG to 24 AWG wire, Use 16 AWG or 18 AWG wire for the 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.

2.4.2 Power Requirements

The Q8 power supply voltage requirements are nominally 24VAC or 24VDC.

The Q8 has full wave rectifier and half wave rectifier on board. If the Q8 connects to a controller, 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.

- GES Q-Controller uses half-wave rectifier only, M-Controller uses full-wave rectifier only, so the Q8 can work with both controllers

- When the Q8 shares a common AC source with a Q-Controller, use the half wave rectifier connector TB6 (24VDC)

- When the Q8 shares a common AC source with an M-Controller or Q4 Controller, use the full wave rectifier connector TB5 (24VAC)

2.4.3 Digital Connection

Power and RS-485 Connection:
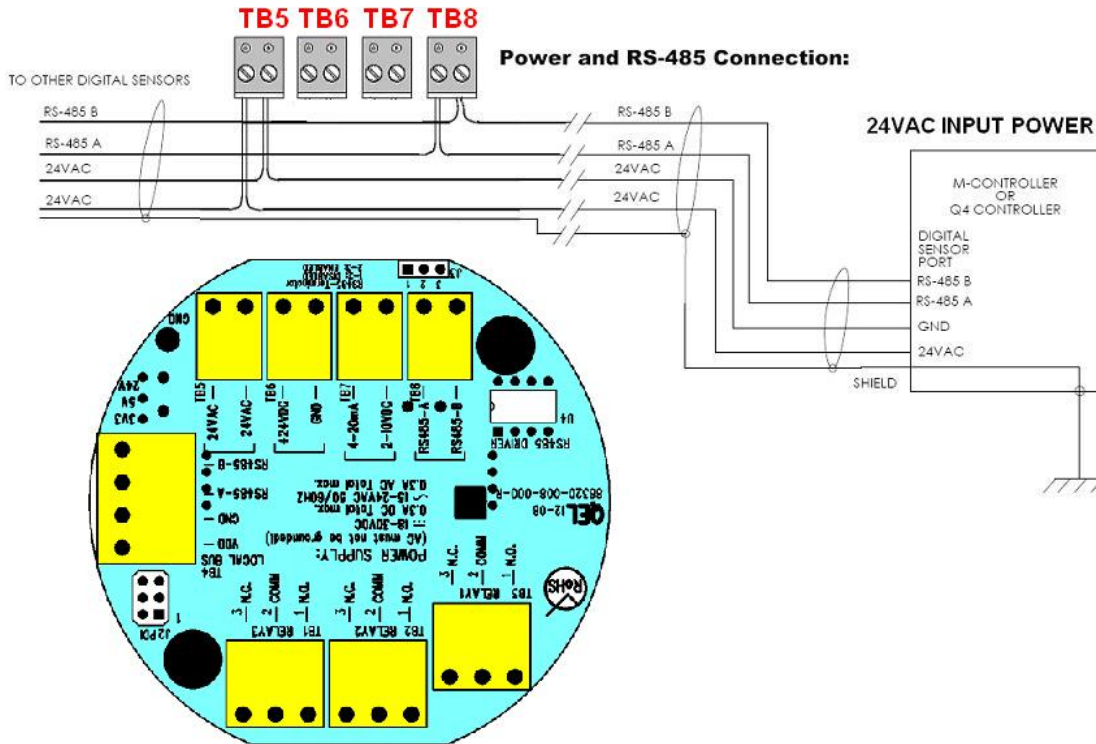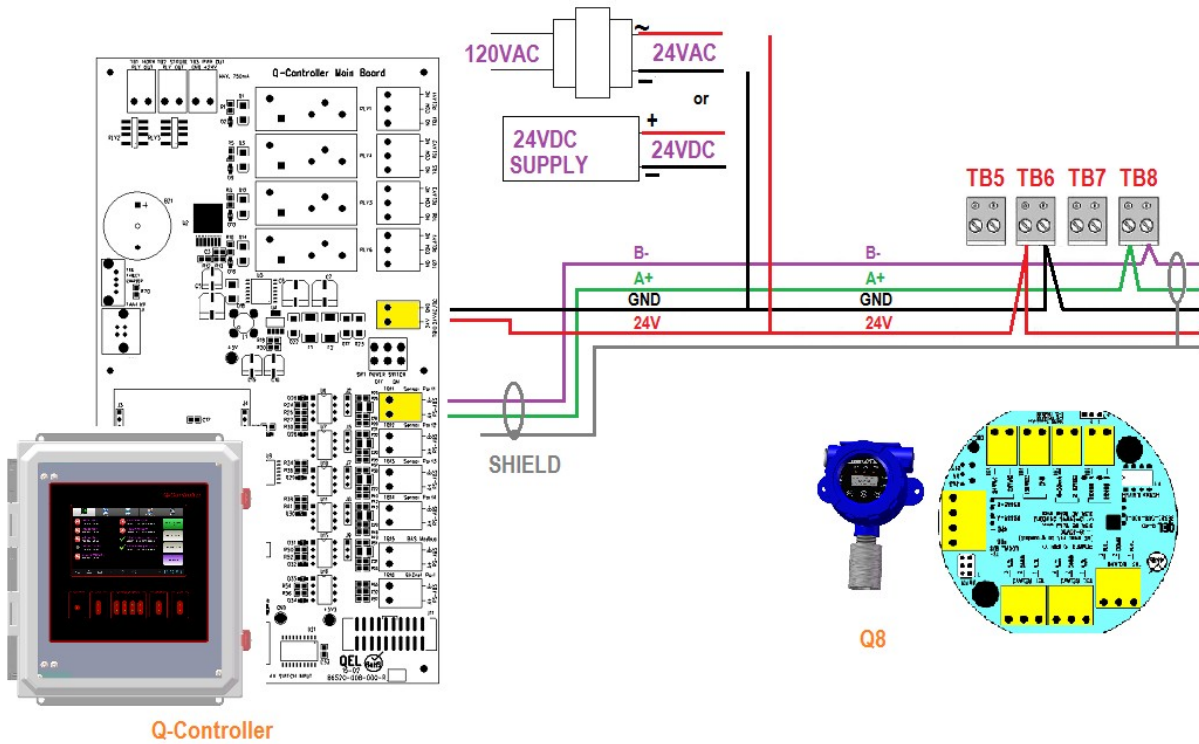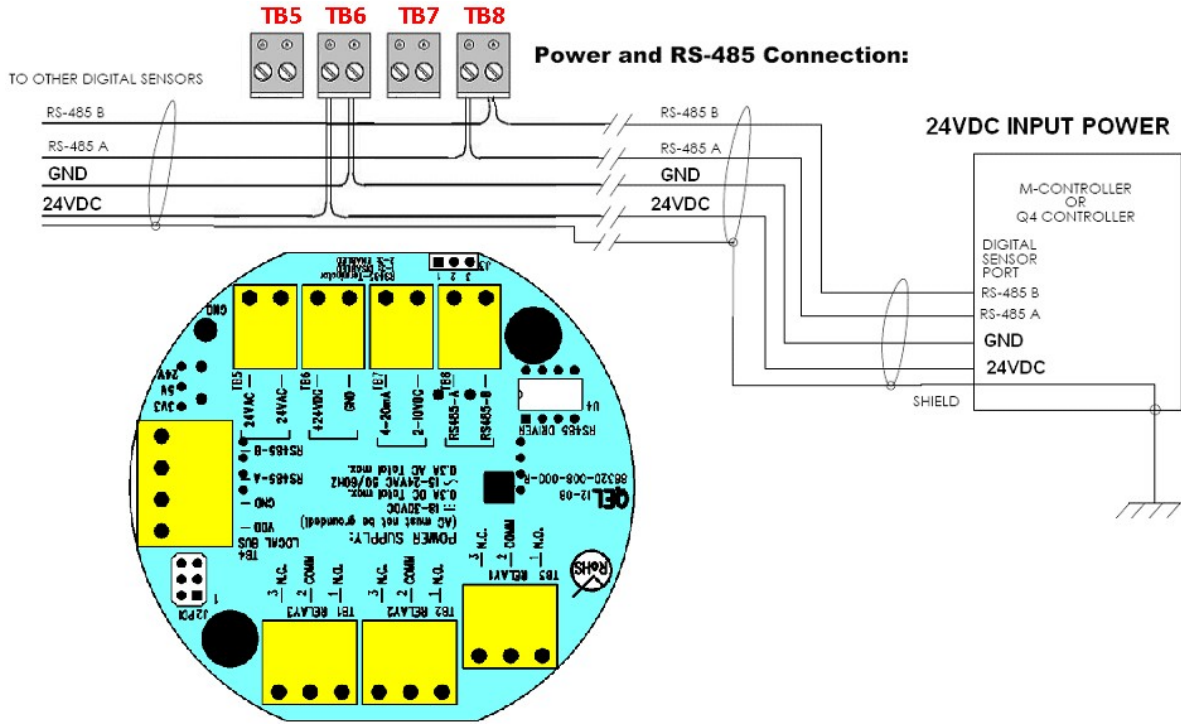
2.4.4 Remote Smart Sensor Connection
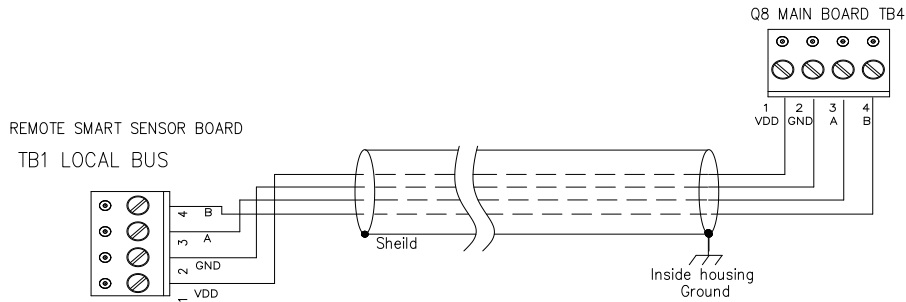
2.4.5 RS-485 Terminator and Driver Replacement

The terminator on each end of the RS485 run 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 run. Short and medium length ModBus/485 runs 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 Q8 supplies this resistor on the main board, and it is chosen using a jumper at J3.

- J3 1-2: Terminator Disabled / OFF (default)

- J3 2-3: Terminator Enabled / ON

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 (U4) has a socket on the circuit card for ease of replacement in the field.

2.4.6 4-20mA and 1-5VDC / 2-10VDC Analog Output

The Q8 provides one-channel 4-20 milliamp analog outputs and programmable 1-5VDC / 2-10VDC analog output at the same time. The maximum output impedance is 600 ohms for the 4-20mA output. The maximum output current is 10 mA for the 1-5VDC/2-10VDC output.
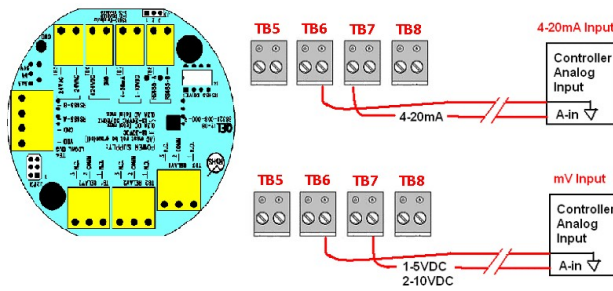
Test point mA+ and mA- on top plate board are used to measure the 4-20mA output current inline when the Q8 is working in the field.

The 1-5VDC/2-10VDC output can be selected through the menu. Default setting is 1-5VDC output.

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 Q8 will draw a straight line between them. There is no need to assign gas concentration to 1V-5VDC/2V-10VDC. When the Q8 outputs 4mA, it also outputs 1VDC or 2VDC. When the Q8 outputs 20mA, it also outputs 5VDC or 10VDC, which follows the 4-20mA output.

If there is any fault found in the Q8, it will output 2.5mA and 1VDC at 2-10V output or 0.5VDC at 1-5VDC output to indicate the fault.

2.4.7 Relays Output

The Q8 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 (TB1, TB2 and TB3) are located on the main 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

2.5 Note for Q8:

Avoid running communication wires or sensor input wires next to AC power wires or the relay output wires. These can be sources of noise that can affect signal quality.

When the Q8 input power is AC, the 24VAC must not be grounded. A dedicated floating 24VAC may be needed if other nodes on the network are grounded, otherwise a DC power supply is recommended.

3. Function and Configuration

3.1 Indicators

The indicators consist of five LED's – two to indicate RS-485 digital communication, three to indicate the status of relay1-3.
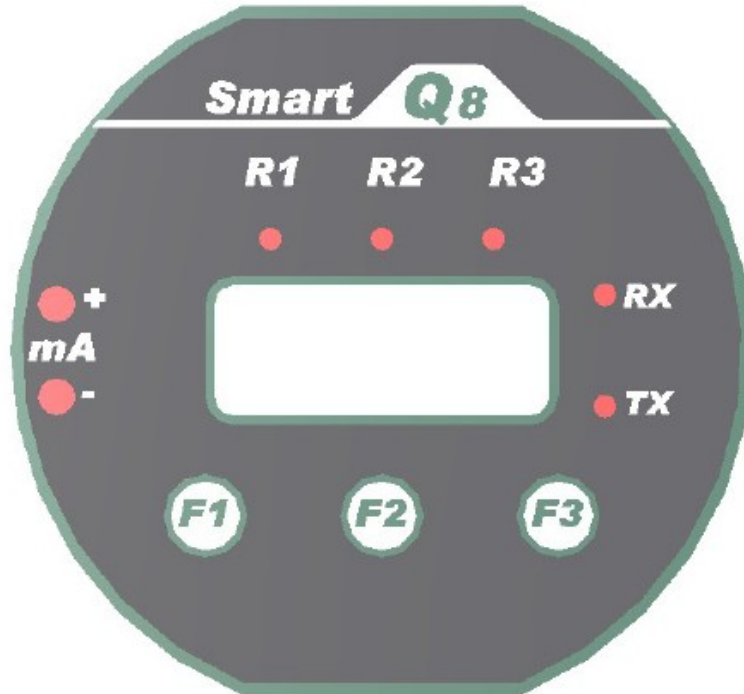
- **RS485-TX/RX**

When the Q8 is connected to a controller system via 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 from the controller. The other is TX LED, which indicates the data stream out of the Q8.

Note: If the TX LED or the RX LED is always ON, is indicative of a communication problem. See Troubleshooting for RS-485.
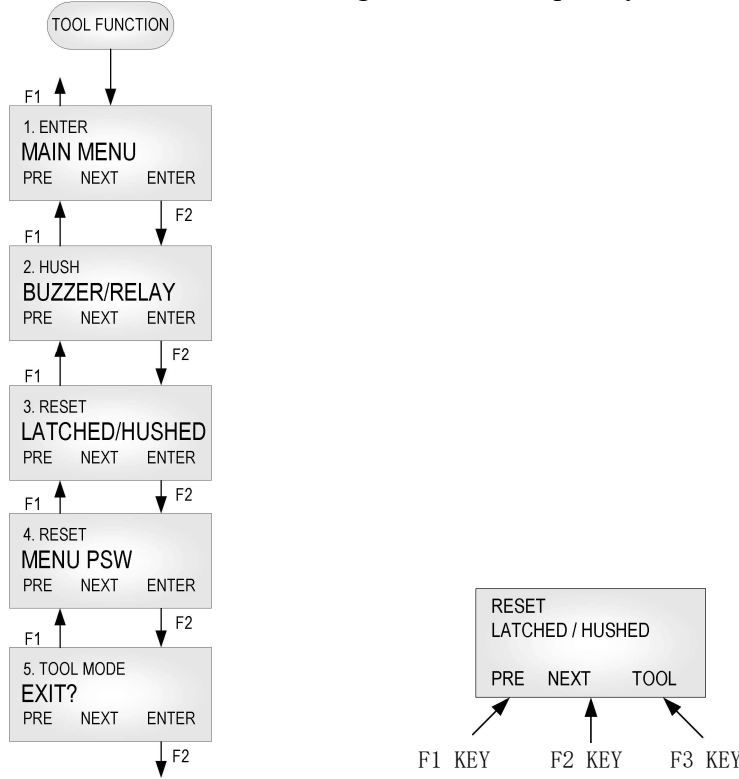
- **Relay 1-3 LED**

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 (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.

3.2 Tool Function

Press Key [F3] to enter Tool Function that might be used frequently in the field.

```
                    ┌─────────────────┐
                    │  TOOL FUNCTION  │
                    └─────────────────┘
            F1 ↑              │
       ┌──────────────┐       ▼
       │ 1. ENTER     │
       │ MAIN MENU    │
       │ PRE  NEXT  ENTER │
       └──────────────┘
                      │ F2
            F1 ↑      ▼
       ┌──────────────┐
       │ 2. HUSH      │
       │ BUZZER/RELAY │
       │ PRE  NEXT  ENTER │
       └──────────────┘
                      │ F2
            F1 ↑      ▼
       ┌──────────────┐
       │ 3. RESET     │
       │ LATCHED/HUSHED │
       │ PRE  NEXT  ENTER │
       └──────────────┘
                      │ F2
            F1 ↑      ▼
       ┌──────────────┐              ┌──────────────────┐
       │ 4. RESET     │              │ RESET            │
       │ MENU PSW     │              │ LATCHED / HUSHED │
       │ PRE  NEXT  ENTER │          │                  │
       └──────────────┘              │ PRE   NEXT   TOOL │
                      │ F2           └──────────────────┘
            F1 ↑      ▼                ↗       ↑       ↖
       ┌──────────────┐           F1 KEY   F2 KEY   F3 KEY
       │ 5. TOOL MODE │
       │ EXIT?        │
       │ PRE  NEXT  ENTER │
       └──────────────┘
                      │ F2
                      ▼
```

3.2.1 Enter Main Menu

Press key [F1] to browse previous item of the current menu.
Press key [F2] to browse next item of the current menu.
Press key [F3] to enter the main menu for more configuration and settings.

3.2.2 Hush Buzzer and Relay

Press key [F3] to silence the buzzer and buzzer-style relays.

3.2.3 Reset Latched/Hushed

To acknowledge a latched condition or a hushed condition, press key [F3] to reset latched relays and hushed buzzer if equipped for which the alarm condition has been removed. If the alarm condition (e.g. high gas concentration) is still present the relay(s) will not reset.

3.2.4 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.
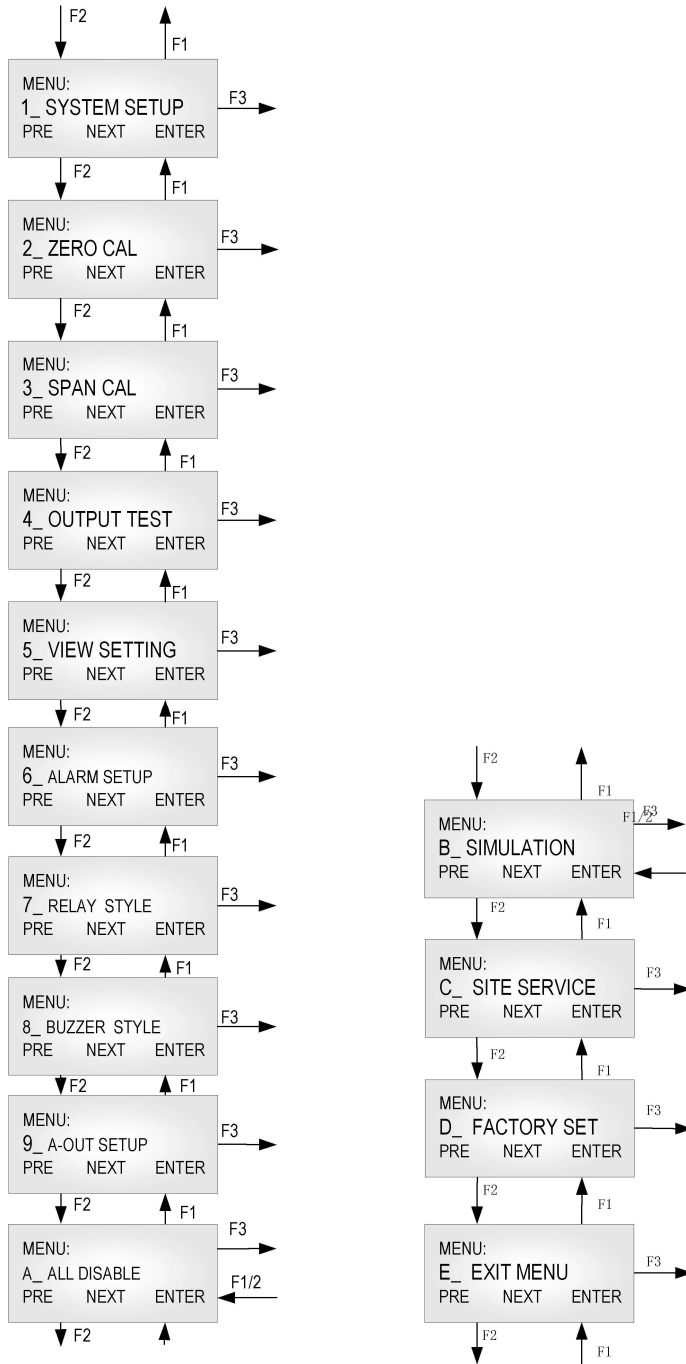
3.2.5 Exit Tool Mode

Press key [F3] to return to monitoring mode.

3.3 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.

3.4 Menu "1_SYSTEM SETUP"

The system setup subdivision contains general settings for monitor operations, communications and 4-20mA calibrations.

3.4.1 System Settings

Password:	Default password is 4321.
Address:	M-Controllers support RS-485 addressing from 0 to 31 for digital sensors. Q4 Controllers support RS-485 addressing from 0 to 3 for digital sensors. Q-Controllers support RS-485 addressing from 0 to 127 for digital sensors. The Q8 RS-485 address can be defined from 0 to 255. Default 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 or BACnet protocol. Q8 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 mode.
4mA Cal 20mA Cal 1V Cal 2V Cal 5V Cal 10V 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 the 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.**
New 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:	When Q8 is connected to an M-Controller or Q4C or Q-Controller, the protocol should be set to OptoMux. The Q8 Default protocol is OptoMux.
	The Q8 also supports ModBus protocol, responds as a ModBus Slave using RTU protocol. When it's set to ModBus, the parity bit can be defined as EVEN, ODD and No Parity.
Display Mode:	• Display Instant: displays instantaneous gas concentration • Display Average: 　○ Displays STEL (15min average reading) 　○ Displays TWA (8 hour average reading) 　○ Displays daily peak • Display Alarm: displays alarm 1-8 status • Display Relay: displays relay 1-3 status • Display Buzzer: displays buzzer 1-3 status (if equipped) • Display A-Out mA: displays current 4-20mA output • Display A-Out VDC: displays current VDC output • Display Clock: displays real time clock If there is nothing to display, the unit will display "Running…"
Auto Zero:	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 building will purge at night (or over a weekend) to a zero concentration of target gas.**
RESERVED:	TBD.
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 below will be restored to default values:

	-Baud rate, -Scroll rate, -Backlight, -Display mode, -LCD contrast, **-Gas type on the Sensor Board, -**Alarm settings, -Relay/Buzzer settings, and 4-20mA/1-5VDC settings.
	The unit needs to change the gas type if the sensor on the sensor board is not the default gas type: CO, CH4 or O2. Contact GES for instructions. The analog output 4-20mA/1-5VDC has to be calibrated if needed. Zero and span calibrations are needed. For IR-CO2 and IR-CH4, this function can reset all the variables into the Factory Defaults and erase all the custom settings that customer have changed like the calibration or the coefficients
ADJ Clock:	Adjust real time clock.
ADJ Contrast:	Adjust the LCD contrast. Valid values are between 10 (light) and 50 (dark). Default is 21.
RESERVED:	TBD.

3.5 Menu "2_ZERO CAL"

The Q8 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.

3.5.1 Equipment Required
- A cylinder of Zero Gas, (clean air or nitrogen).
- A cylinder of Cal Gas
- Flow Limiting Regulator(s) **0.2 to 1.0 lpm**
- Tubing

3.5.2 Zeroing Calibration Procedure
- "2_ ZERO CAL:"

```
┌─────────────────────────────┐
│       2_ ZERO CAL           │
│                             │
└─────────────────────────────┘
```

- Press key [F3] and the device will show the calibration notice and then ask if you want to continue. The middle line will display the current concentration.

```
┌─────────────────────────────┐
│  CONTINUE?                  │
│            XXPPM            │
└─────────────────────────────┘
```

- Apply the Zero Gas.

- Wait for about 3 minutes or until the reading is stable.

- Press key [F3] to confirm Zeroing Cal.

- When the device is in Zeroing CAL, it will take 3 seconds to 20 seconds to complete.

- When the zeroing CAL operation is over, the device will display "Accepted" and return to "2_ZERO CAL".

- Make sure there is no Cal Error displayed. If Cal Error is reported, repeat the procedures above. If the Cal Error is still showed up, the sensor may be expired.

- Remove the gas.

- Exit the menu to Monitoring Mode.

3.6 Menu "3_SPAN CAL"

- "3_ SPAN CAL"

```
        3_ SPAN CAL
```

- Press key [F3] and the device will ask for the CAL GAS, input the concentration of the calibration gas.

```
  CAL GAS:
  >                 XXX
```

- Press key [F3] and the device will show the calibration notice and then show the flow rate for the span calibration. Press any key to continue, and then the device will ask you if you want to continue. The middle line will display the current concentration.

```
  CONTINUE?
              XXPPM
```

- Apply the calibration gas.

- Wait for about 3 minutes or until the reading is stable.

- Press key [F3] to confirm SPAN CAL.

- When the device is in span cal, it will take 10 seconds to 1 minute to complete.

- When the span cal operation is over, the device will display "Accepted" and return to "3_SPAN CAL".

- Make sure there is no Cal Error displayed. If Cal Error is reported, repeat the procedures above. If the Cal Error is still showed up, the sensor maybe expired.

- Remove the gas.

- Exit menu to Monitoring Mode.

3.7 Menu "4_OUT TEST"

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 (1VDC/2VDC) and 20mA (5VDC/10VDC) outputs can be tested too.
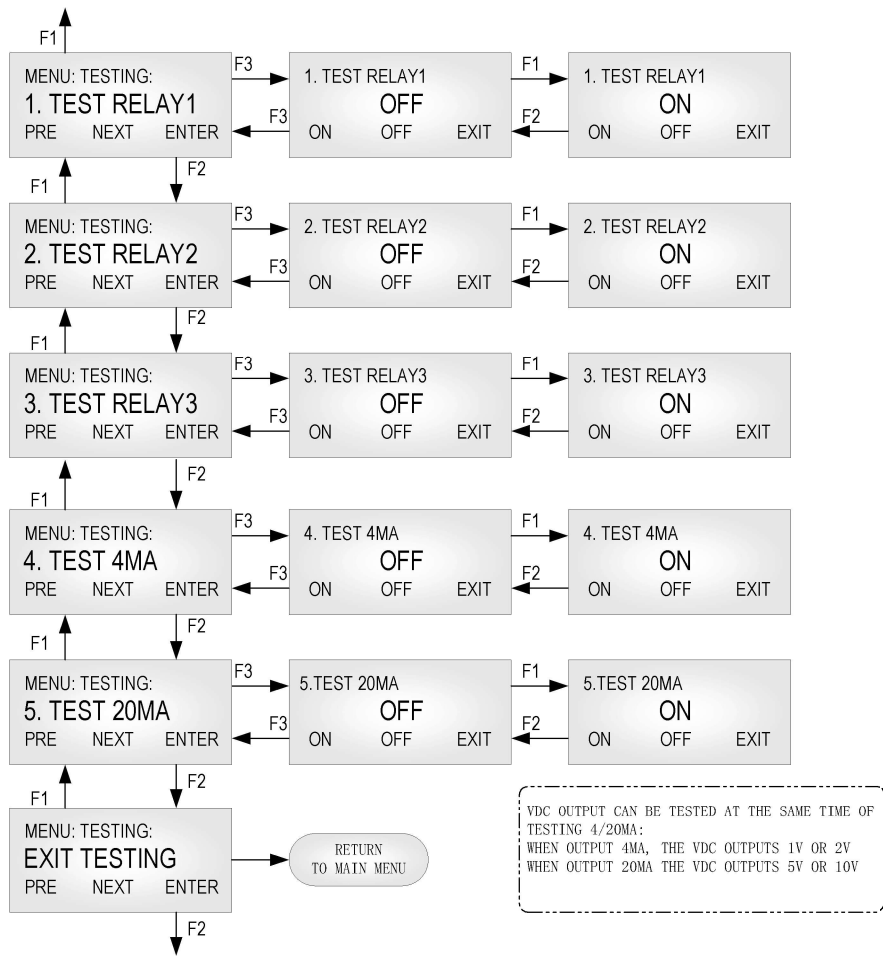
3.8 Menu "5_VIEW SETTING"

This function is to check the settings for Alarms, Relays, Buzzers and Analog Output.
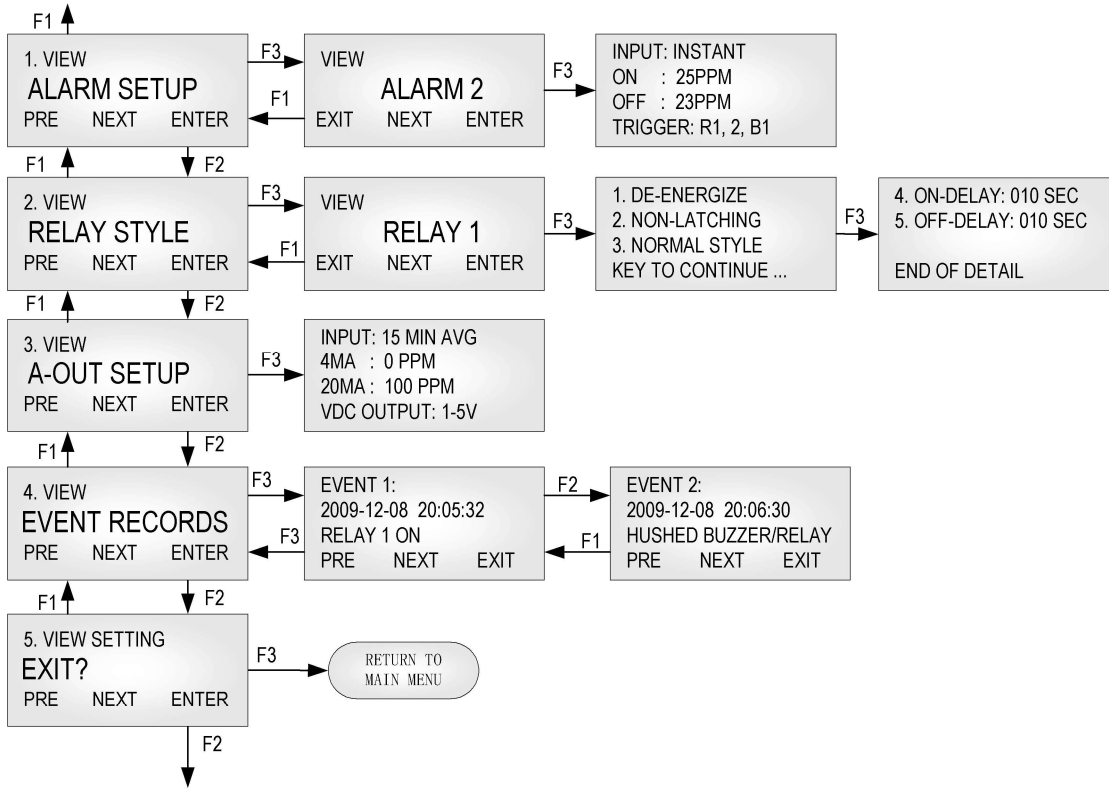
3.9 Menu "6_ALARM SETUP"

The Q8 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

3.10 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.**

3.11 Menu "8_BUZZER STYLE"

Not function in the Q8.

3.12 Menu "9_A-OUT SETUP"

The Q8 will compare the concentration at 4mA and the concentration at 20mA. You may assign a larger concentration for 4mA than for 20 mA; the Q8 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.
VDC Output:	VDC Output can be selected from:
	• 1-5VDC or 2-10VDC

Note: The analog output cannot be disabled.

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

3.13 Menu "A_ALL DISABLE"

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

Default is OFF.

3.14 Menu "B_SIMULATION"

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.

3.15 Menu "C_SITE SERVICE" and "D_FACTROY SET"

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

4. MODBUS Protocol Supported By Q8

For ModBus protocol, please contact GES.

5. Maintenance

5.1 DVM connection for 4-20mA measurement

- Interrupt the 4-20mA signal going from the Q8 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 mA-.

- Monitor the 4-20mA signal going from the Q8 to the controller (not causing a fault):

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

5.2 4mA and 20mA Output Calibration

These values are established during the 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 [Out 4mA CAL]:

    1. Press key [F3] to output the 4mA signal.

    2. Connect the DVM to the unit as described above.

    3. Press key [F1] or key [F2] to adjust the current to 4.00mA to 4.05mA.

    4. Press key [F3], then the settings will be accepted and saved.

- Choose [Out 20mA CAL]:

    1. Press key [F3] to output the 20mA signal.

    2. Connect the DVM to the unit as described above.

    3. Press key [F1] or key [F2] to adjust the current to 20.00 to 20.05mA.

    4. Press key [F3], then the settings will be accepted and saved

5.3 Smart Sensor Assembly Replacement
Disassembling

Observe all safety and electrical codes and regulations before removing enclosure lid.
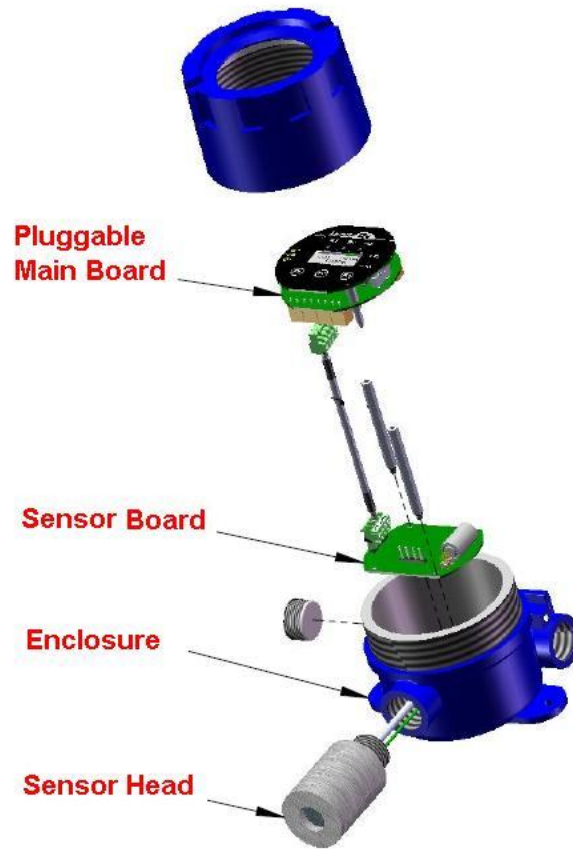
Important: Calibrate the transmitter whenever a component is replaced. But if you replace a smart sensor assembly with a sensor onboard from GES, you don't need to recalibrate the transmitter, as all the calibration information has been stored in the smart sensor board in factory process.

Replacement Procedure

To replace the entire smart sensor assembly, complete the following steps:

1. Power down the transmitter.

2. Unscrew the enclosure lid assembly from the base enclosure

3. Unplug the Main Board CCA

4. Disconnect the sensor cable from the Sensor Board CCA

5. Unscrew the two rods to release the smart sensor board from the base enclosure

6. Unscrew the sensor head from the base enclosure if the sensor head needs to replace too

7. If to only replace electrochemical sensor cell or NDIR sensor cell from the sensor head, unscrew the lid of the sensor head to unplug the sensor cell from the socket

8. Plug the new sensor or replace new sensor head

9. Screw new smart sensor assembly and secure with two rods. Ensure that the connectors are correctly matched each other. Incorrect connection may damage the sensor assembly and/or the Main Board.

10. Plug the Main Board to the two rods

11. Screw back the lid enclosure

6. 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 U4 is damaged • Controller side RS-485 Driver has problem	• Disconnect the Cable to isolate the problem • Replace U4 IC on main board • Replace RS-485 Driver in Controller
No response to gas	• Sensor screen dirty • Sensor is expired	• Clean sensor opening • Replace smart sensor assembly, see Replacement Parts
Apparent false alarm	• Puff of gas • Not properly calibrated • Solvent fumes or interference from high levels of interfering gas • Radio frequency interference	• Monitor is functioning • Recalibrate • Remove source • Check grounds and shielding are correct
No signal at controller	• Maximum distance reached • Controller does not operate	• Verify loop resistance, change wire AWG • Troubleshoot controller

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.

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