# GA-170 Gas Detector

## Operation and Maintenance Manual

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# GA-170
# Gas Detector
# Operation Manual

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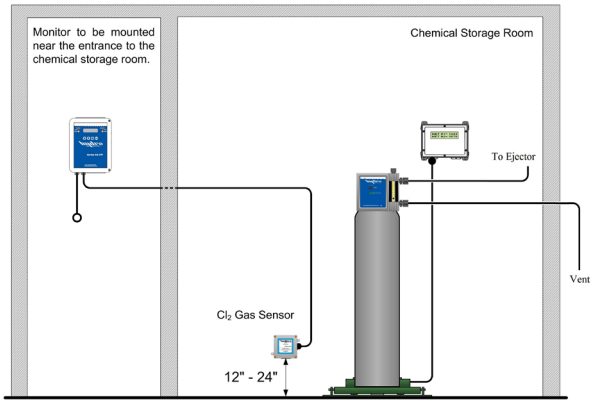
# I. INSTALLATION AND OPERATION

## A. Start Up and Installation

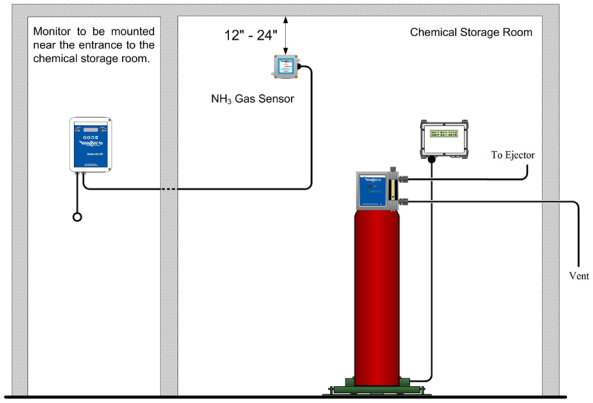
1. The GA-170 can be ordered for use with single phase A/C power of either 120 or 240 VAC at 50 to 60 Hz. When connecting A/C power to the instrument, it is imperative that the A/C source be well grounded. Insufficient A/C grounding will disrupt proper operation of the instrument.
2. **Sensor Monitor Communication:** Each monitor can be connected to one up to four sensors. The sensors are 24VDC loop powered by the monitor and the sensors provide a 4-20mA signal to the monitor. See Figure 13.
3. **Initial Power Up:** Each time the GA-170 power is turned on the alarms will be inactive for five minutes. A countdown will be shown on the display. This allows for the sensor(s) to stabilize.
4. **Gas Density:** For measured gases that are heavier than air, the gas sensor should be mounted 12" to 24" (30 to 60 cm) from the floor (Example: Figure 1a–Chlorine & Sulfur Dioxide). For measured gases that are lighter than air, the gas sensor should be mounted 12" to 24" (30 to 60 cm) from the ceiling (Example: Figure 1b–Ammonia).

**FIGURE 1a**




For gases heavier than air, sensor should be placed low.

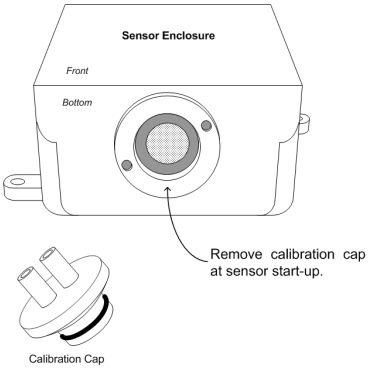
**FIGURE 1b**




For gases lighter than air, sensor should be placed high.

5. **Sensor Protection:** The sensor should not be exposed directly to extreme temperatures and/or conditions. It is very important not to allow the sensor element to get wet from rain or any other source because water will cause premature failure of the sensors.
6. **Sensor Start Up:** The sensor calibration cap must be removed upon start up. Upon removing the sensor cap, be sure to store it for later use. See Figure 2. The cap is used to protect the sensor during shipment and storage and the two ports on it are to be used for calibration with test gas.

**FIGURE 2**

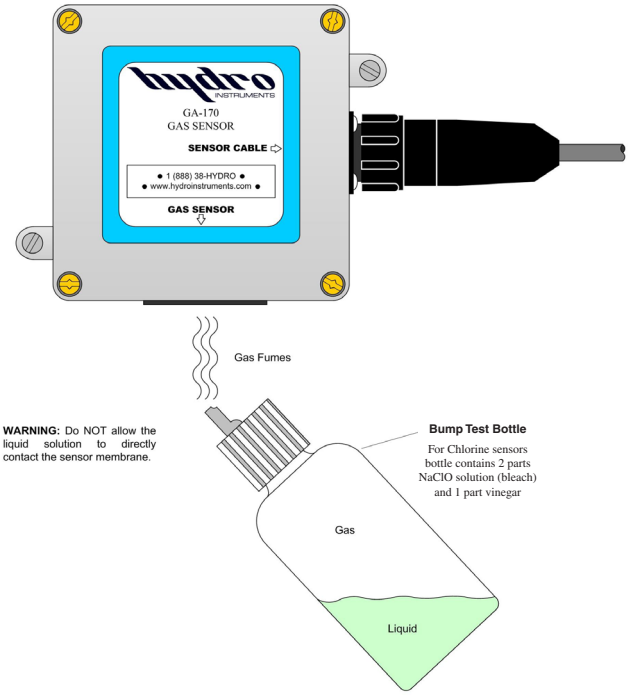


7. **Calibration:** The Model GA-170 Gas Detectors are factory calibrated and do not require any calibration at startup. With the use of the calibration cap, the span calibration can be carried out if required. Be sure to retain the sensor calibration cap for such calibrations.

8. **Response Checks (Bump Testing):** To verify responsiveness, the gas sensors can be bump tested (exposed to a small amount of the target gas) in order to test the reaction of the sensor. A plastic squeeze bottle is provided with each gas detector for this purpose. See Figure 3. It is suggested that bump testing can be done at quarterly intervals, however required frequency is determined by environment, conditions, number of and severity of leaks. Proper bump testing (exposing the sensor to a modest amount of the fumes) will not substantially degrade the sensor or shorten sensor life. Depending on the environment, sensors can reliably last more than 5 years.

   **WARNING: Do NOT allow the liquid solution to directly contact the sensor membrane.**

**FIGURE 3: Bump Testing (Chlorine Gas Example)**




9. **LED Indicators:** If the sensor reading remains below the low alarm set point, then neither LED will illuminate. If the reading rises above the low alarm set point, then the "DANGER" LED will illuminate. If the reading rises above the high alarm set point, then the "ALARM" LED will illuminate.

## B. Alarms and Output Signals

1. **Acknowledgement of Alarms:** If an alarm condition occurs, the alarm (red) LED will illuminate and the relay will be activated. To acknowledge an alarm (and thereby de-activate [open] the relay contact output) press the ⊖ key.

   *NOTE: Even after acknowledging the alarm, both LEDs will remain illuminated until the alarm condition has been removed.*

2. **4-20 mA output channels:** A 4-20 mA output signal can be obtained from each sensor according to the wiring diagram (Figure 12). See Figures 9 through 13.

3. **Alarm Relay:** The GA-170 has six alarm relay outputs. The non-powered relays offer both normally open and normally closed connections. See Figures 9 and 10. See suggested relay wiring diagram (Figure 11).

4. **Alarm Explanation: Rising and Falling Alarms**

   a. **Rising:** If the Danger (Low Level Alarm) is set to a lower value than the Alarm (High Level Alarm), then the GA-170 will automatically configure the channel as a Rising Alarm (i.e., if the sensor reading is higher than the Danger or Alarm settings, then the GA-170 will activate alarm conditions).

   b. **Falling:** If the Danger (Low Level Alarm) is set to a higher value than the Alarm (High Level Alarm), then the GA-170 will automatically configure the channel as a Falling Alarm (i.e., if the sensor reading is lower than the Danger or Alarm settings, then the GA-170 will activate alarm conditions).

   c. **Failsafe Alarms:** If a sensor channel is set to Failsafe, then the corresponding High Level alarm relay will normally be energized. This will cause to reverse the NC/NO connections. Therefore, the NC connections will be OPEN unless an alarm condition is present or power is lost.

5. **ALARM REFERENCE CHART** (For one or two sensor units)

   O – Inactive
   X – Active

| | **Alarm Relay** | | | | | |
|---|---|---|---|---|---|---|
| **Condition** | **1** | **2** | **3** | **4** | **5** | **6** |
| Lost A/C Power | O | O | O | O | X | O |
| Lost Battery Power | O | O | O | O | X | O |
| Lost Sensor 4-20mA | O | O | O | O | O | X |
| Low Level Alarm Sensor #1 | X | O | O | O | O | O |
| High Level Alarm Sensor #1 | O | X | O | O | O | O |
| Low Level Alarm Sensor #2 | O | O | X | O | O | O |
| High Level Alarm Sensor #2 | O | O | O | X | O | O |

6. **ALARM REFERENCE CHART:** (For three or four sensor units)

   O – Inactive
   X – Active

| | **Alarm Relay** | | | | | |
|---|---|---|---|---|---|---|
| **Condition** | **1** | **2** | **3** | **4** | **5** | **6** |
| Lost A/C Power | O | O | O | O | X | O |
| Lost Battery Power | O | O | O | O | X | O |
| Lost Sensor 4-20mA | O | O | O | O | O | X |
| High Level Alarm Sensor #1 | X | O | O | O | O | O |
| High Level Alarm Sensor #2 | O | X | O | O | O | O |
| High Level Alarm Sensor #3 | O | O | X | O | O | O |
| High Level Alarm Sensor #4 | O | O | O | X | O | O |

7. **RS-232 Output:** Digital data output.

   a. Use a standard "COM" cable with a DB9 connector and make the following connections:

| DB9 Connector | GA-170 Connections |
|---|---|
| 2 | TX |
| 3 | RX |
| 5 | GND |

   b. Run the Windows program "Hyperterminal" or any other terminal program. Set the COM communications as follows:

Flow Control: none
Baud: 19,200
Format: 8 data bits, 1 start bit, 1 stop bit, no parity

## C. Operation Screens

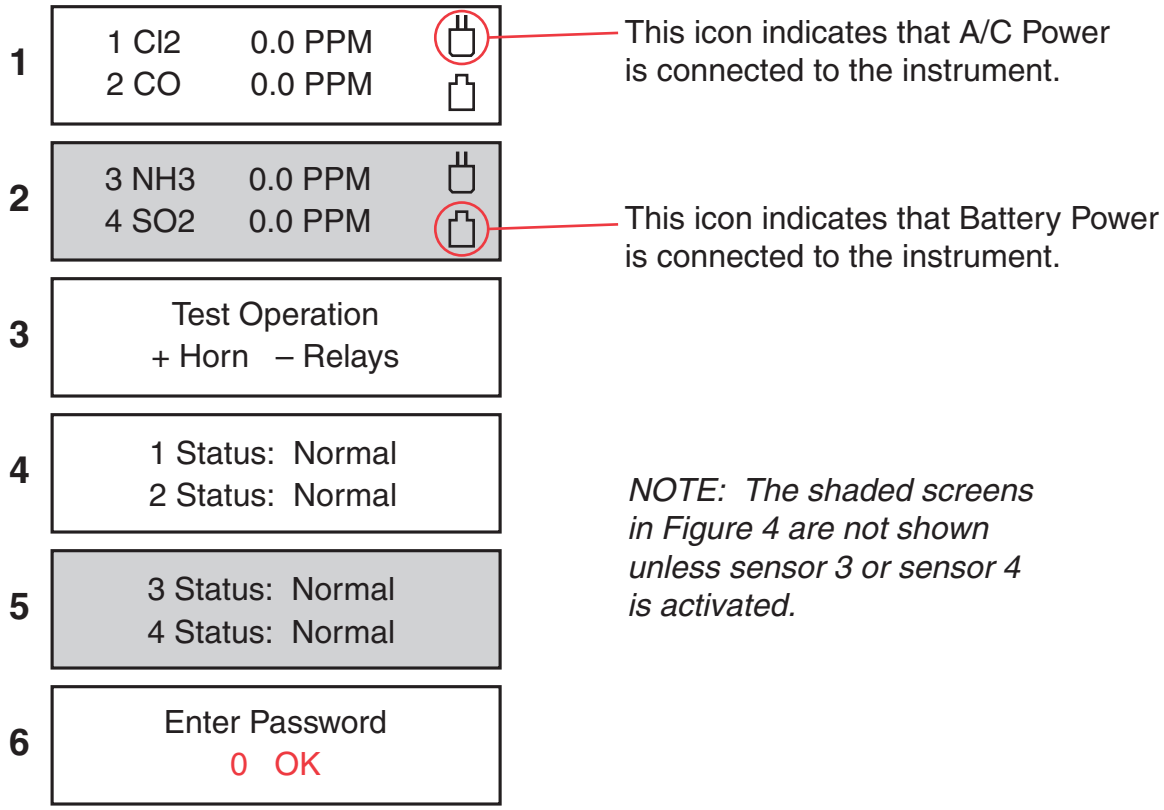
This section explains the features of the standard operating screens of the GA-170.

*NOTE: Navigate between the display screens below using the ⬆ and ⬇ keys. See Figure 4.*

1. **Home Screens (1 & 2):** These screens display the gas type and reading of the sensor(s).
2. **Test Operation (3):** This screen allows manual testing of the horn and relays. Pressing ⊕ will activate the horn. Pressing ⊖ will activate all relays.
3. **Status Screens (4 & 5):** These screens display all present alarm conditions.
4. **Password Screen (6):** See Section II.A for instructions on this screen and the configuration section.

**FIGURE 4**

**GA-170 Operation Mode Screens**




*NOTE: The shaded screens in Figure 4 are not shown unless sensor 3 or sensor 4 is activated.*

### Status messages

1. **Normal:** Indicates that the sensor reading is above 2 mA and below the alarm set point.
2. **Danger:** Indicates that the sensor reading exceeds the low alarm setting, but is lower than the high alarm setting. (Meaning that if the low alarm setting is at 1.0 PPM and the high alarm setting is at 2.0 PPM, then the status will be "Danger" if the reading is between 1.0 PPM and 2.0 PPM.)
3. **Alarm:** Indicates that the sensor reading exceeds the high alarm setting. (Meaning that if the high alarm setting is at 2.0 PPM, then status will be "Alarm" if the reading is 2.0 PPM or higher.)
4. **Error:** Indicates that the sensor signal is below 2 mA and usually indicates that the sensor is either damaged or not connected.

## D. Battery Backup

1. Disconnect the A/C Power before beginning this procedure.

2. The battery has Velcro strips attached. Remove the clear surface protection tape and place the battery into the bottom of the enclosure with the single strip against the rear of the box.

3. **WARNING!!!** Pay careful attention to which lead is – and which is + on the battery. The leads are marked on the battery. If you switch the leads to the circuit board you will damage the device. Connect the + of the battery to BAT+ and the – of the battery to BAT–.

4. Battery is now installed.

5. See configuration Section II.B of the manual to follow the procedure to activate the battery backup using the keypad and display.

6. The unit will keep the battery charged and ready for use. The battery will require approximately 12 hours to be fully charged.

   *NOTE: When the battery level falls below ~8.5 Volts it is automatically disconnected from the circuit board. After this has occurred, the unit can only be powered up by restoring A/C power.*

# II. CONFIGURATION OF PARAMETERS

## Configuration of Sensor Parameters & Calibration of Sensors

Each GA-170 Gas Detector will be set up from the factory as per the ordering instructions. However, settings and sensors can be changed using the following procedure.

### A. Entering Setup: All parameters are set in the password protected setup section.

1. Press the ⬇ key until the password screen is reached.
2. Use the ⊕ and ⊖ keys to set the password. The password is "170".
3. Press the ⬇ key so that "OK" is flashing and then press the ⊕ key.

### B. Configuring Each Channel

See Figure 5. The first screen allows selection of the display units (PPM or %) and whether or not to enable the battery back-up. Press the down arrow to come to the second screen where selection is made among which channel to configure. Move between the channels with the ⬆ and ⬇ keys. When the desired channel is flashing, press the ⊕ key to enter setup for that channel. Setup for each channel is identical.

1. **GAS TYPE:** This parameter adjusts the gas type to be displayed for this sensor. You can navigate through the list of gases using the ⊕ and ⊖ keys. Adjustment of this parameter is only required if the sensor type is being changed.
   *NOTE: The gas type must match what the sensor was designed to detect.*
   *PRESS ⬇ TO GO TO THE NEXT PARAMETER*

2. **DECIMAL POSITION:** Select the decimal position for display of the measured value.
   *PRESS ⬇ TO GO TO THE NEXT PARAMETER*

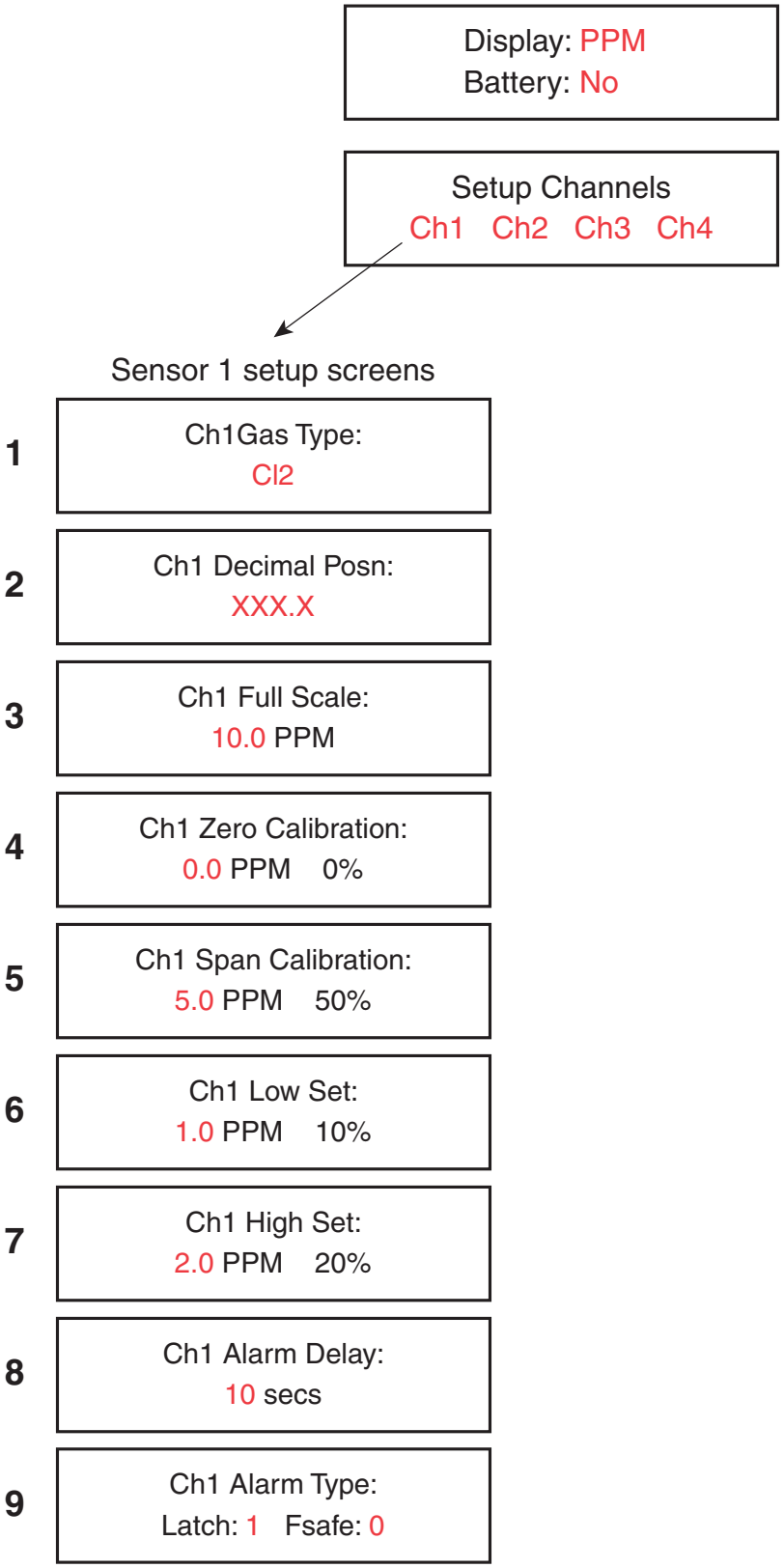
3. **FULL SCALE:** This parameter must be set to match the full scale of the sensor being used. (Example: If the sensor has a 0.0-10.0 PPM range, then this parameter must be set to 10.0 PPM. If this setting does not match the sensor range, then the GA-170 will not display the correct sensor reading.) Adjustment of this parameter is only required if the sensor type is being changed.
   *PRESS ⬇ TO GO TO THE NEXT PARAMETER*

4. **ZERO CALIBRATION:** After the sensor is installed with the calibration cap removed the display should read 0.0 ppm if no target gas is present. If the reading is not 0.0 PPM on this screen, then use the ⊕ key to increase the reading or the ⊖ key to reduce the reading. Press and release the keys each time. Do not press and hold the keys. After adjusting, wait 10 seconds to confirm that the reading is stable before proceeding to the next step.
   *PRESS ⬇ TO GO TO THE NEXT PARAMETER*

5. **SPAN CALIBRATION:** The gas detector system is factory calibrated and does not require calibration upon installation setup. Span calibration is rarely required, however, it may be required or desired to perform span calibrations periodically over the life of the sensor. If calibration is to be carried out, then the appropriate span gas calibration kit must be purchased. See Figures 6, 7, and 8. The calibration cap must be installed on the sensor and connected as indicated in figures 6 and 7. Span gas must be allowed to flow at 500 cc/min for at least 1 or 2 minutes until the displayed reading stabilizes. The reading on this screen should be adjusted to match the ppm value of the span gas being used. Use the ⊕ key to increase the reading or the

**FIGURE 5**

## GA-170 Setup Mode Screens



⊖ key to reduce the reading. Press and release the keys each time. Do not press and hold the keys. After adjusting, wait 10 seconds to confirm that the reading is stable before proceeding to the next step.

*PRESS ⊕ TO GO TO THE NEXT PARAMETER*

6. **LOW SET:** This is the sensor reading above which the Danger LED and relay will be activated. The GA-170 will be factory set at the recommended low alarm level. To adjust this parameter use the ⊕ and ⊖ keys.

   *PRESS ⊕ TO GO TO THE NEXT PARAMETER*

7. **HIGH SET:** This is the sensor reading above which the Alarm LED and relay will be activated. The GA-170 will be factory set at the recommended high alarm level. To adjust this parameter use the ⊕ and ⊖ keys.

   *PRESS ⊕ TO GO TO THE NEXT PARAMETER*

8. **ALARM DELAY:** This parameter allows for a delay in response to the alarm. The recommended setting is between 5 & 30 seconds. An alarm condition must be continuously present for the duration of a full delay time before the GA-170 will change to the ALARM state. *NOTE: Increasing the delay time may help to avoid false alarms caused by transient effects.*

   *PRESS ⊕ TO BEGIN THE CALIBRATION*

9. **ALARM TYPE:** The high alarm for each channel can be set to latching or non-latching. Selection is changed using the ⊕ and ⊖ keys. *NOTE: This only refers to the ALARM (high alarm) condition. If an alarm state is reached while in the latching mode the user must still acknowledge the alarm by pressing the ⊖ key after the alarm condition has already been alleviated in order for the red LED and relay to be de-activated.*

   *NOTE: Latch:1 = Latching, Latch:0 = Non-latching, Fsafe:1 = Failsafe, Fsafe:0 = Non-failsafe.*

**FIGURE 6: Calibration Cap**

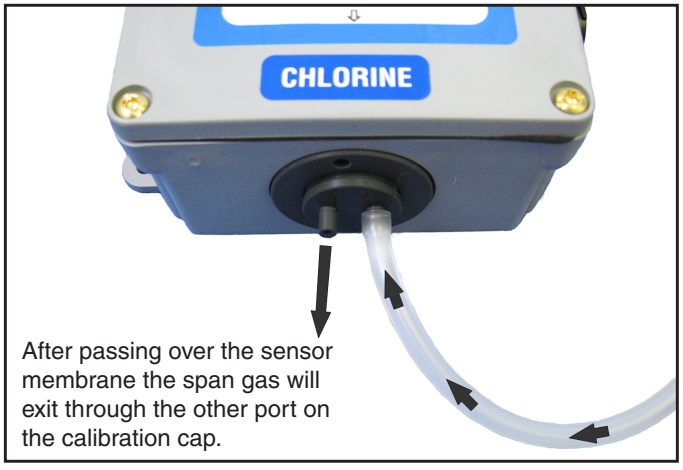



**FIGURE 7: Sensor and Calibration Kit**

**FIGURE 8**

## Ordering Information

| Product Number | Description |
|---|---|
| **GA-CK-CL2-05** | Calibration Kit – 5 PPM Chlorine Gas with Regulator |
| **GA-CRS-CL2-10** | Replacement Sensor – 0-10 PPM Chlorine |

***Note:*** *The sensor is shipped with the calibration cap already installed. After calibration the calibration cap should be removed for normal use. Do not dispose of the calibration cap as it will have to be reinstalled and used for any further sensor calibrations.*

# III. TROUBLESHOOTING

## A. Installation Check – Review each of the following points first.

1. **Sensor Installation:** Check the following points regarding the sensor installation.
   a. Sensor enclosure bolts must be securely fastened to protect against corrosion of the transmitter board etc.
   b. Sensor must be mounted at a height that is according to Figures 1a and 1b.
   c. Sensor must be mounted so that (rain) water cannot come into contact with the sensor element. Water coming into contact with the sensor element will damage the sensor and cause the need for sensor replacement. Generally, water damage will cause the sensor to have an above zero reading that will not return to zero.
   d. Ensure that the sensor calibration cap has been removed completely. See Figure 2.
2. **Monitor Installation:** Check the following points regarding monitor installation.
   a. Monitor should be installed at eye level in a location that is suitable for personnel to check the sensor status before entering the chemical storage room.
   b. Monitor should be mounted in a location that is protected from rain and it is recommended that it should not be mounted under direct sunlight.
   c. Monitor enclosure bolts must be securely fastened and wiring seal tights must be plugged if not used in order to protect against corrosion of the circuit boards etc.
   d. Ensure that the alarm relay output and/or 4-20mA outputs are wired according to Section I.B and Figures 9 through 12.

## B. Symptoms, Likely Causes, and Suggested Responses

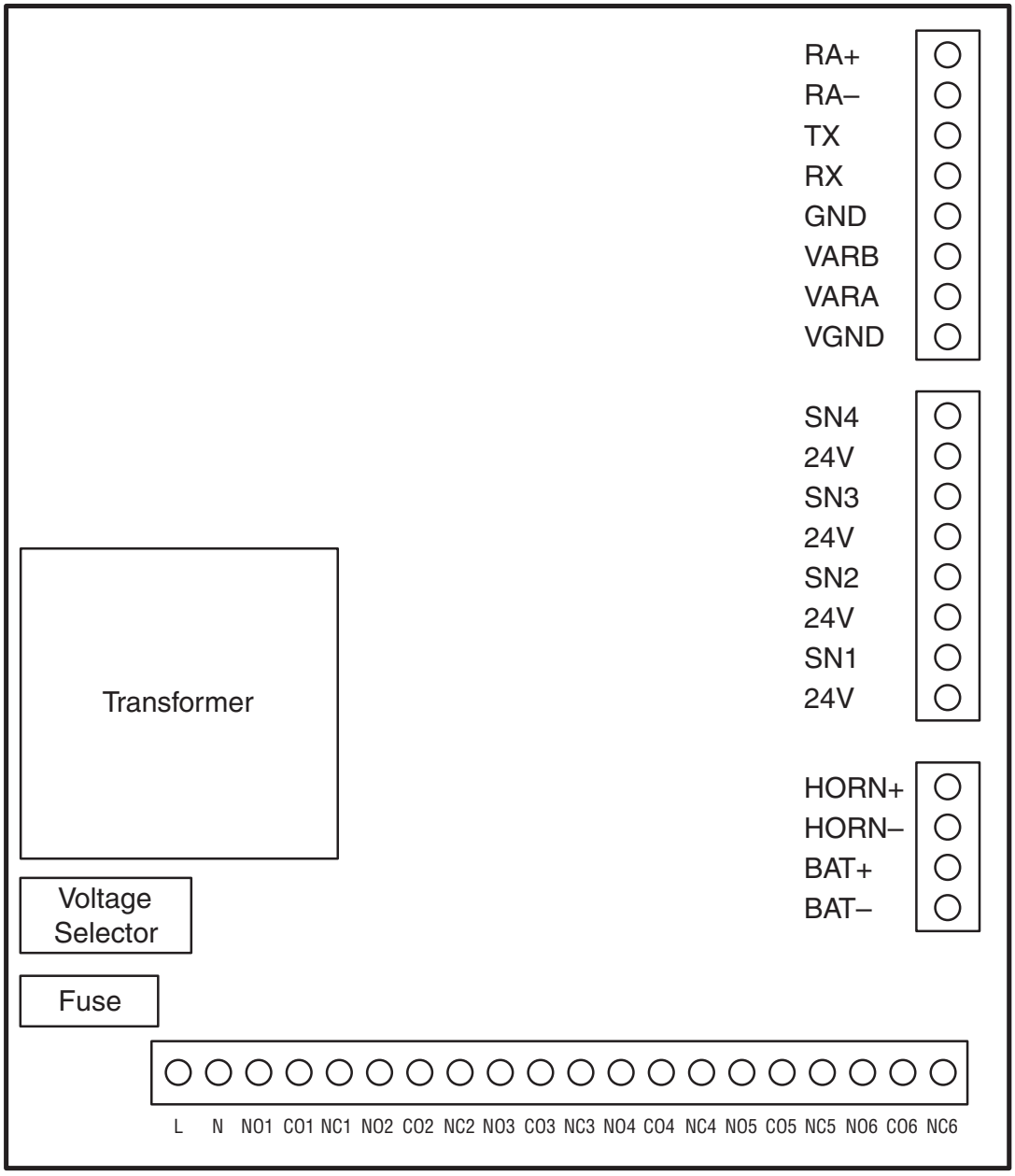
| Symptoms | Likely Causes | Suggested Responses* |
|---|---|---|
| Slightly off zero in air | Inaccurate zero calibration | Perform zero calibration |
| Zero & no response with Alarm Status: Normal | 1. Calibration cap not removed<br>2. Wrong span calibration | 1. Remove calibration cap<br>2. Correct span calibration |
| Negative reading & no response with Alarm Status: Error | 1. Sensor disconnected<br>2. Sensor damaged | 1. Check sensor wiring<br>2. Replace the sensor |
| High reading or reading that won't return to zero | Sensor damaged | Replace the sensor |
| Blank display | 1. Lost A/C power<br>2. Damaged circuit board<br>3. Blown fuse | 1. Check A/C Power<br>2. Replace circuit board<br>3. Replace fuse |

* See section III.C below for a more detailed explanation of the suggested responses.

## C. Explanation of Responses

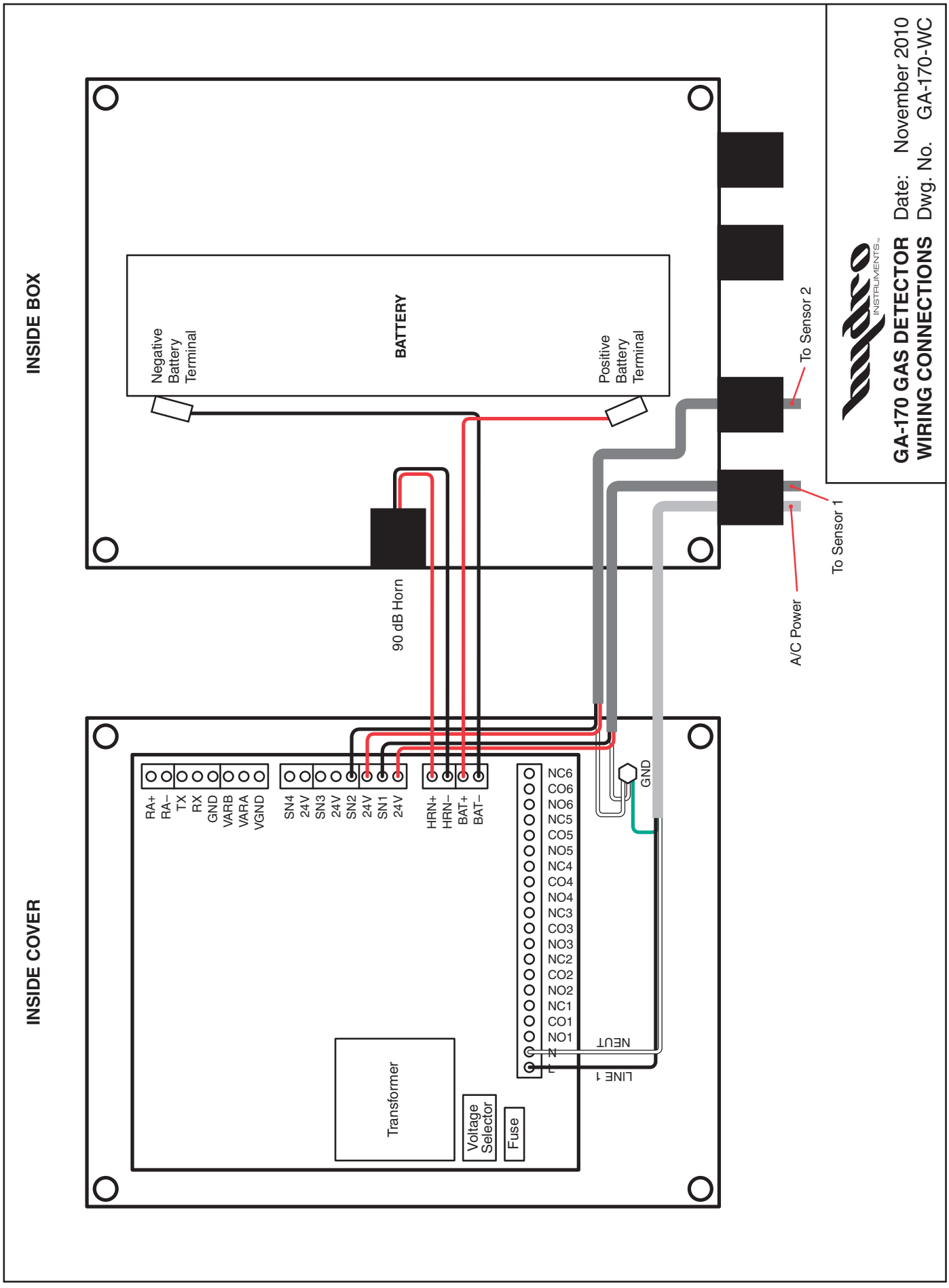
1. **Zero Calibration:** If the display is not reading 0.0 PPM in air, then adjust the zero calibration. Refer to Section II.B.4 and Figure 5.
2. **Calibration Cap:** The calibration cap is installed for protection of the sensor during shipping and storage, but must be removed upon installation. If the sensor cap is not removed, then there will be no response or a very slow response. Refer to Section I.A.6 and Figure 2.
3. **Span Calibration:** If the span calibration is performed incorrectly (usually accidentally done in air with zero target gas) then this will cause the readings to be inaccurate. Unless you intend to perform the span calibration and have a span gas calibration kit, do not touch the ⊕ and ⊖ keys if you enter the span calibration screen. See Section II.B.5 and Figures 6, 7, and 8.
4. **Sensor Wiring:** If the display is reading a negative value and giving an "Alarm Status: Error" message, then the sensor may not be connected to the monitor. Check the wiring at the circuit board in the monitor and inside the sensor enclosure. See Figures 9 and 10.
5. **Sensor Replacement:** Repeated or excessive exposure to the target gas will eventually cause failure of the sensor. If water is allowed to contact the sensor element this will also eventually cause failure of the sensor. Under normal circumstances a sensor life is typically 2 years or more. However, lightning, other power surges, chemical leaks, and contact with water can all cause sensor failure. Replacement sensors are easily installed with the quick disconnect fitting.
6. **Damaged Circuit Board:** The circuit boards can be damaged if high voltage is connected to the wrong terminals, by lightning, other power surges, or by corrosion. If you believe that the circuit board is damaged, then contact the factory and your local sales representative. Refer to Figures 9 and 10.
7. **Blown Fuse:** If the circuit board has no power, then always check to see if the fuse is blown and replace if necessary.

**FIGURE 9**




| | | |
|---|---|---|
| **GAS DETECTOR (GA-170) CIRCUIT BOARD** | Date: | October 2005 |
| | Scale: | Not to scale |
| | Dwg. No.: | GA170CB |

## FIGURE 10


INSIDE BOX
INSIDE COVER
GA-170 GAS DETECTOR
WIRING CONNECTIONS
Date: November 2010
Dwg. No. GA-170-WC
BATTERY
Negative Battery Terminal
Positive Battery Terminal
90 dB Horn
To Sensor 2
To Sensor 1
A/C Power
RA+
RA–
TX
RX
GND
VARB
VARA
VGND
SN4
24V
SN3
24V
SN2
24V
SN1
24V
HRN+
HRN–
BAT+
BAT–
GND
NC6
CO6
NO6
NC5
CO5
NO5
NC4
CO4
NO4
NC3
CO3
NO3
NC2
CO2
NO2
NC1
CO1
NO1
NEUT
LINE 1
Transformer
Voltage Selector
Fuse

## External Alarm Light and Horn

An external alarm light with combination audible horn is an electronic device designed to alert operators and other personnel both visually and audibly to a specific danger.

Most commonly an external alarm light and horn is used with a gas leak detector to warn of gas leaks before entering a structure or room.

**Features**

- Single compact unit for wall mounting
- Rotating strobe light with red housing
- Audible horn
- Weather resistant

Available in GA-AL-110 (110V AC) and GA-AL-220 (220V AC).

Optional accessory for use with the Hydro Instruments Series GA-170 and GA-171 gas leak detection equipment.

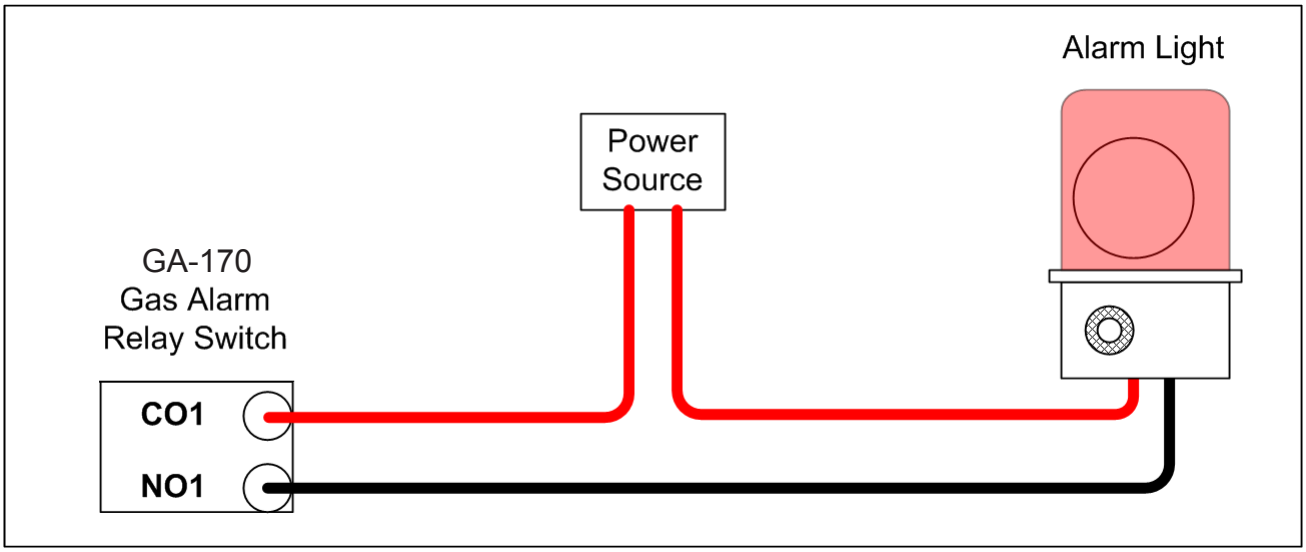


**FIGURE 12**

## GA-170 Gas Alarm 4-20 mA Output:

1. Remove the red sensor wire from the 24V circuit board terminal.
2. Splice the red sensor wire to the black wire in the signal cable.
3. Connect the red wire in the signal cable to the same 24V circuit board terminal that was being used.

*NOTE: If the 4-20 mA output is not connected to a device the circuit will not be complete and the sensor will not function. You may short the wires together to complete the circuit if not utilizing the 4-20 mA output.*

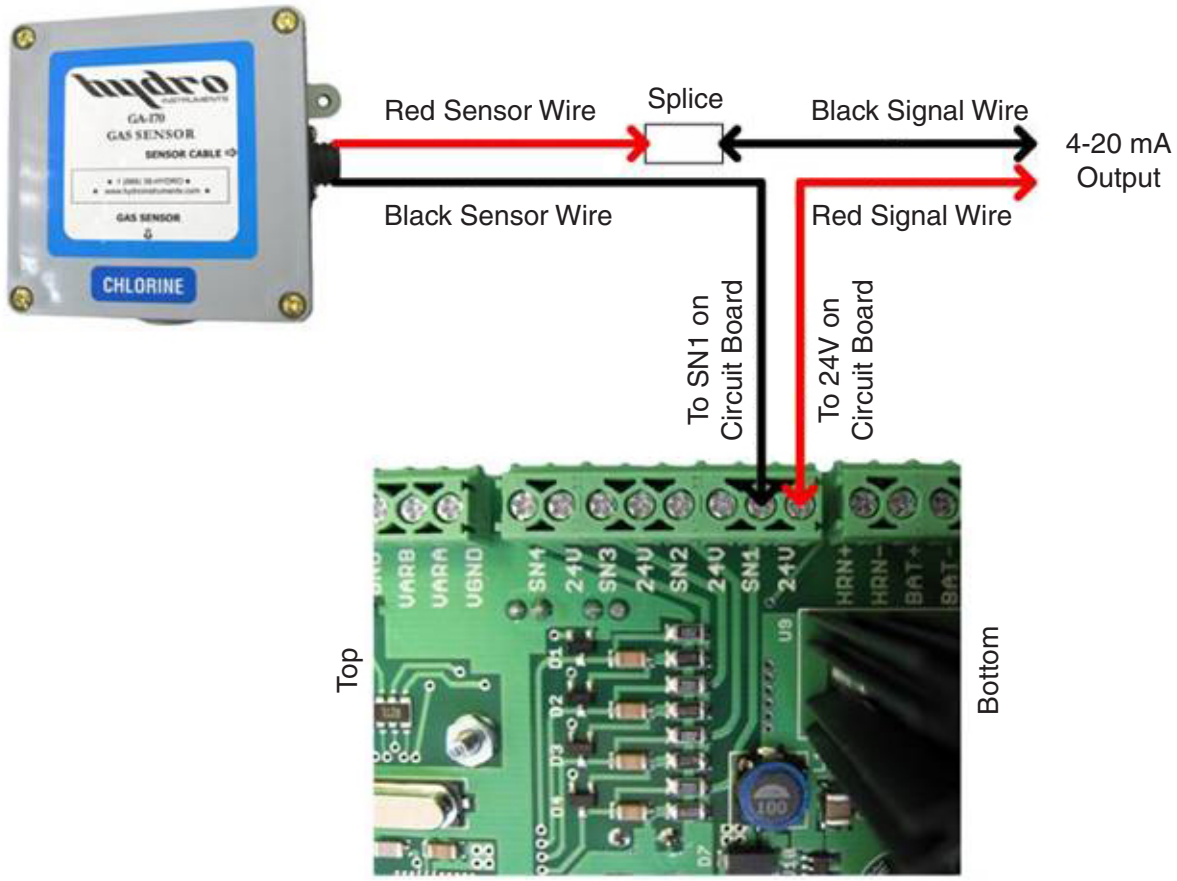
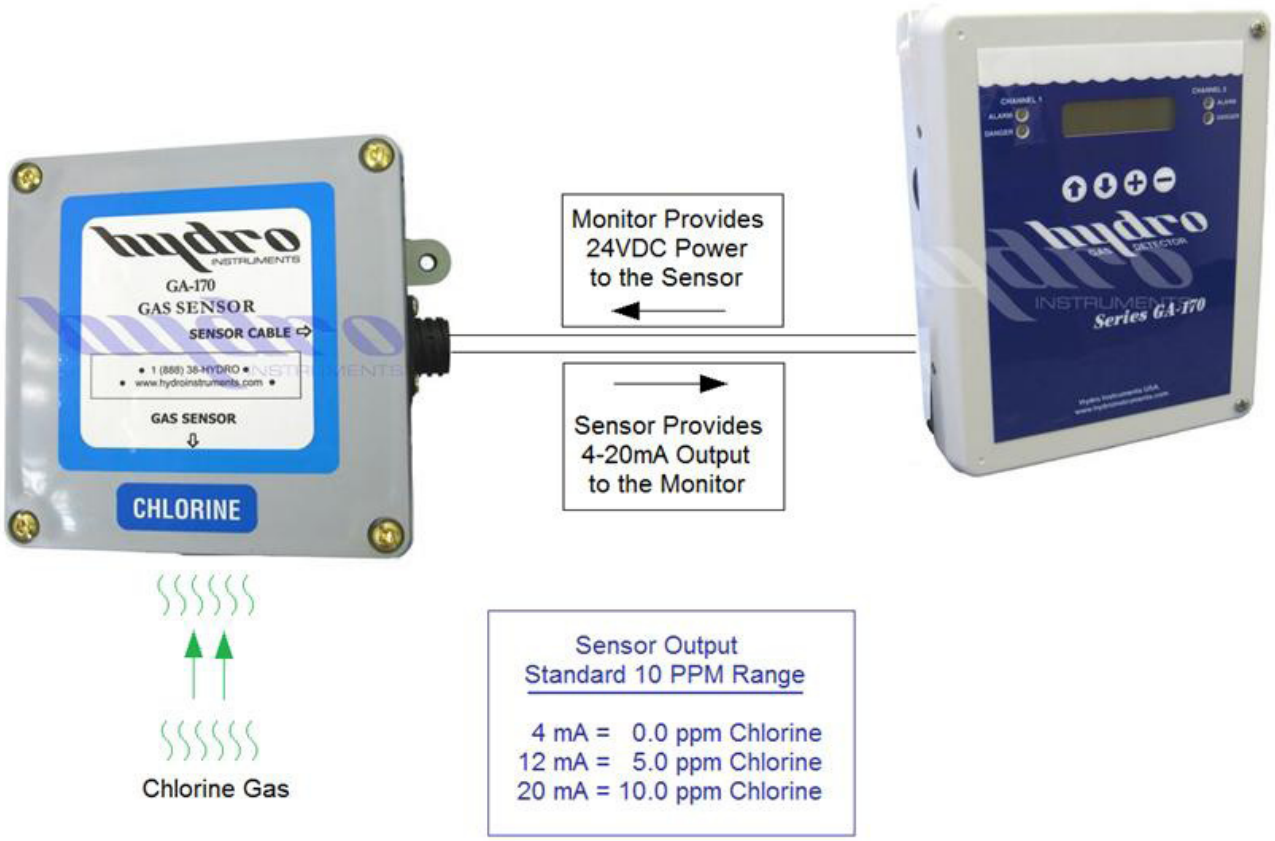


**FIGURE 13**


hydro
INSTRUMENTS
GA-170
GAS SENSOR
SENSOR CABLE
GAS SENSOR
CHLORINE
Monitor Provides
24VDC Power
to the Sensor
Sensor Provides
4-20mA Output
to the Monitor
Series GA-170
Chlorine Gas
Sensor Output
Standard 10 PPM Range
4 mA = 0.0 ppm Chlorine
12 mA = 5.0 ppm Chlorine
20 mA = 10.0 ppm Chlorine