SCOTT HEALTH & SAFETY

Series 4600

GAS PLUS

Universal Toxic Gas Transmitter
Operation & Maintenance Manual

Rev: **4600 VerH**
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ECN#: **129032**
Part#: **087-0005**

Contents

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When storing the sensor "off-line", block the sensor gas hole by placing a small piece of electrical tape over the front of the sensor (***do not touch the membrane*** as this will cause damage the sensor) and store the sensor in a cool dry place (such as a refrigerator).

Should the sensor be kept off-line for a *cumulative* period of time *exceeding 9 months, the sensor will continue to operate!* Sensor battery failure does not mean the sensor has failed and will not operate, only that it will require a 4-8 hour warm-up time upon installation. Once the sensor has "warmed-up" and has become stable, calibration may occur as normal.

Gas Specificity

Sensor battery failure does not render the sensor useless - but it will require a 4-8 hour warm-up time upon installation.

Each gas sensor is engineered and designed to be gas specific; however, the very nature of electrochemical gas detection is such that the presence of certain gases may act as an interferant to certain sensors. Each sensor can have its own interferant(s), causing the sensor to respond electrochemically. Scott Health & Safety has tested and documented some of the known interferant. These are listed in an Addendum located in the back of the manual.

Sensor Accuracy

The accuracy of a toxic gas sensing system is limited by the accuracy of the standard used to calibrate the system. For many toxic gases, obtaining a high accuracy standard that is suitable for field calibration use may be difficult (about the best accuracy of gas concentration achievable is 5%, using a permeation system with good temperature control). For this reason, no fixed accuracy statement is possible. The accuracy of the GasPlus sensor cannot be better than the accuracy of the calibration gas. The best accuracy to be expected, assuming a perfect standard, is limited by the repeatability which is ±2% of span (full scale).

Sensor Response Times

Electrochemical gas sensors are optimized to give the fastest possible response time while maintaining excellent zero stability and minimum drift (approximate sensor response times are listed an Addendum in the back of the manual). If the response time appears to be slow, refer to the "*Weekly Operational Checks*" within the **SYSTEM OPERATION** section.

Sensor Life

Because applications are of such a variable nature, only experience on a given application can truly tell what the sensor life will be. GasPlus sensors will generally provide a minimum of 12 months of service in ambient air gas detection applications. Extremes of humidity and temperature, and exposure to dirty atmospheres containing particulate matter or oily vapors will decrease sensor life. In addition, extended exposure to target or other active gases may shorten sensor life.

In applications where only trace levels of target gas exist, except under leak conditions, sensor life will most likely be over 18 months. While sensors may have some, or even substantial life remaining, it is recommended that sensors be replaced at a convenient interval between 12 and 18 months. Experience in a given application or plant condition will determine the best replacement frequency.

Environmental Influences to the Scott Health & Safety Sensor

Although the GasPlus transmitter is designed to operate at temperatures from -40° to 140°F (-40° to 60°C), the operating temperature is dictated by which gas sensor has been installed. ***The GasPlus Operating Parameters Addenda (see back of manual)*** show the operating temperature ranges for each sensor type. Extreme temperatures and exposure to dirty atmospheres containing particulate matter or oily vapors can affect sensor response and decrease sensor life.

Humidity (%RH) has the potential to affect the performance of electrochemical sensors. Gas sensors are designed to provide stable output over a range of humidity conditions. Continuous exposure to relative humidity conditions from 25% to 90% non-condensing RH (70% RH nominal) will not affect operation of most sensors.

Extreme has the potential to adversely affect the operation of electrochemical sensors. At relative humidities continuously below 25%* or above 90%, sensors can exhibit an early loss of sensitivity after a few days to a week of operation. This is caused by a slow loss of water (dry air) or gain of water (moist air) from the internal sensor electrolyte. Suspending the sensor over a jar of water for 24 hours will usually restore sensitivity to a sensor that has "dried" out.

**The operation of H_2S and HCl sensors will be affected by continuous exposure to relative humidity conditions below 50%RH; therefore Models 4654 and 4671 low humidity sensors, respectively, are offered and should be used when operating under these conditions.*

Extremely humid or wet conditions can affect these sensors which rely on an unobstructed gas diffusion path into the sensor. If the gas stream or ambient air allows humidity to condense on the sensor, the water on the membrane will cause loss of sensitivity, or slow response, or both. Once the sensor has had a chance to dry out, normal operation should be restored. If the source of moisture is a result of water spray or rain, a rain shield may be installed on the sensor module to protect the sensing membrane. Keep in mind that the some gases may chemically react with water vapor and be converted to other species. (e.g., ammonia hydrolyzes to form ammonium hydroxide when exposed to water vapor). In addition, other gases such as hydrogen fluoride, are very reactive and may be absorbed on the inner surfaces of flow tubing before reaching the sensor during calibration. Such questions should be referred to chemists or industrial hygienists.

Sensor Oxygen Requirements

Scott Health & Safety "Traditional" and "Rock Solid Hydride and HCN" gas sensors require a minimum of 5% oxygen for continuous operation under ambient conditions (except the Model 80 Oxygen sensor). Sensors operating in conditions of less than 5% oxygen will provide erroneous or unstable concentration data.

Beyond the 5% minimum oxygen concentration requirement, all "Traditional" Hydride sensors (Arsine, Diborane, Germane, Hydrogen Selenide, Phosphine, Silane) require *constant* oxygen concentration when performing sensor calibration. Fluctuating oxygen concentration during calibration will result in erroneous concentration readings during system operation.

Note: The above does not apply to the Scott Health & Safety Rock Solid Acid, Cl_2, O_3 and ClO_2 sensors. Contact Scott Health & Safety for specific applications.

Sensor Intrinsic Safety

An intrinsically safe circuit is simply defined as "...an electrical circuit which does not contain, or store, enough energy to cause ignition of a given explosive atmosphere". GasPlus sensors are designed as intrinsically safe and, with the transmitter incorporating built-in safety barrier circuitry, can be removed from the transmitter housing within explosive environments.

Sensor Handling and Disposal

Do not attempt to disassemble the sensor in any way. The GasPlus sensor contains various chemicals/electrolytes. Skin and eye contact should be avoided and should be considered hazardous.

The GasPlus sensor can be disposed of as ordinary trash with no special precautions. Incineration in a municipal/commercial incinerator poses no hazard.

GasPlusInstallation

Location Considerations

Prior to installing GasPlus, consideration should be given to the following items when choosing its location:

1. ***Orientation*** - Always mount the sensor pointing downwards or horizontal with respect to the floor.

2. ***Gas Density*** - For gases heavier than air, it is recommended that the sensor be installed approximately 18" from floor level. In these applications care should be taken to protect the sensors from physical damage. For gases that are lighter than air, sensors should be installed at a high level or close to the potential leak source.

3. ***Potential Gas Sources*** - The location and nature of potential vapor/gas sources (e.g., pressure, amount, source, temperature, and distance) need to be assessed.

4. ***Ambient Temperature & Relative Humidity*** - Insure that the system is located within an area that complies with the specified operating temperature and humidity range.

5. ***Vibration*** - Mount the transmitter and sensor in a manner that minimizes vibration.

6. ***Accessibility*** - When determining mounting location, consider future maintenance and calibration requirements.

7. Avoid *water.* Droplets adhering to the outer membrane of the sensor will reduce or negate sensor performance. A rain shield is recommended for outdoor installations.

8. ***Avoid strong electromagnetic fields***. Mounting the gas transmitter near power transformers or other strong EM fields may cause undesirable results.

9. Avoid pressure and excessive air velocity. GasPlus sensors are designed to measure gas concentration under normal atmospheric conditions with up to 1 LPM air flow. High air velocities will result in inaccurate measurement and reduce sensor life.

10. Conduit Seals. Protect the transmitter electronics from moisture by thoroughly sealing the conduit entries and tightening the cover of the transmitter housing.

Physical Installation and Wiring

Installation of the GasPlus System requires the physical mounting of the enclosure (**see Figure 1**) and connection of the power/output lines (**see Figure 2A/2B**). The transmitter enclosure is provided with bolt holes in the mounting flange for mounting. When installing GasPlus, follow these guidelines ensuring that the area of installation is declassified if required:

STEP 1 - Make all physical connections (i.e., conduits, pipes, enclosure, plastic spacer block, junction box, etc.).

STEP 2 - Unscrew transmitter cover.

STEP 3 - Remove 2 "stack" transmitter boards (board assembly simply unplugs).

STEP 4 - Make wire connections (18 to 22 AWG wire is recommended for electrical connections) in accordance with **Figures 2A/2B**. Ensure that proper wire gauge is used and that all wire, electrical grounds, and sensor connections are secure and intact.

STEP 5 - Replace transmitter stack assembly.

STEP 6 - Screw transmitter cover on, ensuring a tight seal.

STEP 7 - Remove red label from the bottom of the sensor end cap.

Remote Sensor Junction Box Mounting

If the application requires that the sensor be mounted remote from the transmitter, care should be taken to insure that all code and regulatory requirements are met. In these applications, it is recommended that the sensor be separated from the transmitter **no more than 50'.** Additional items needed will be a junction box and sensor cable (see **Figure 2B**). These items can be ordered from Scott Health & Safety. Conduit must be obtained from your local vendor.

Remote Sensor Mounting without Junction Box

The sensor cannot be located more than 50 feet away from the transmitter and the stainless steel sensor housing must be electrically isolated. This installation is not rated for hazardous locations.

Typical Power Consumption

4-20 Loop	21mA
Control circuitry	8mA
Relays	20mA (each)
Total	89mA
	2.1 watts @ 24VDC

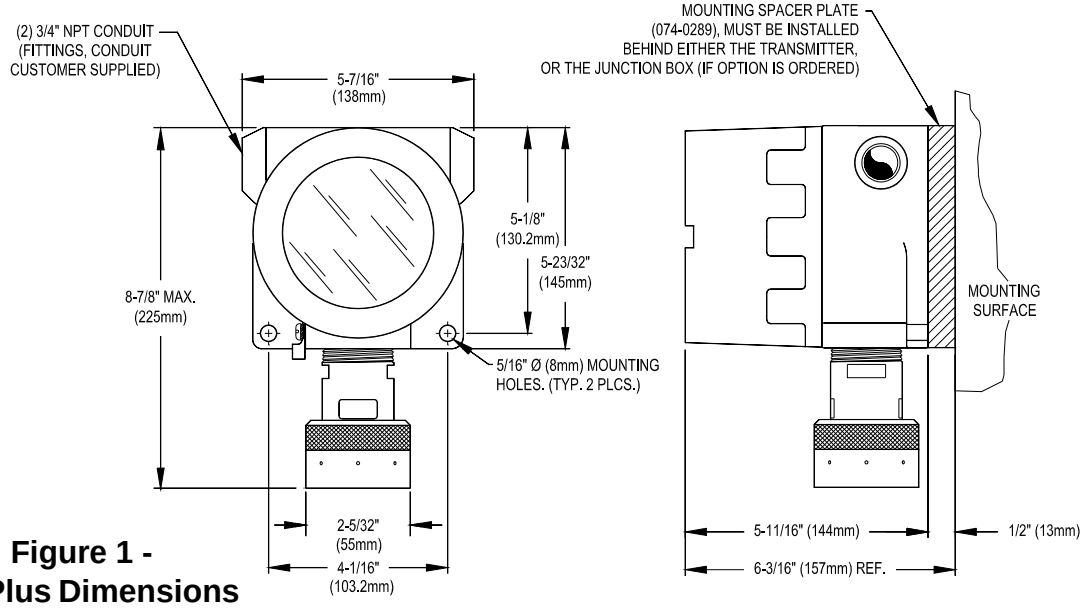
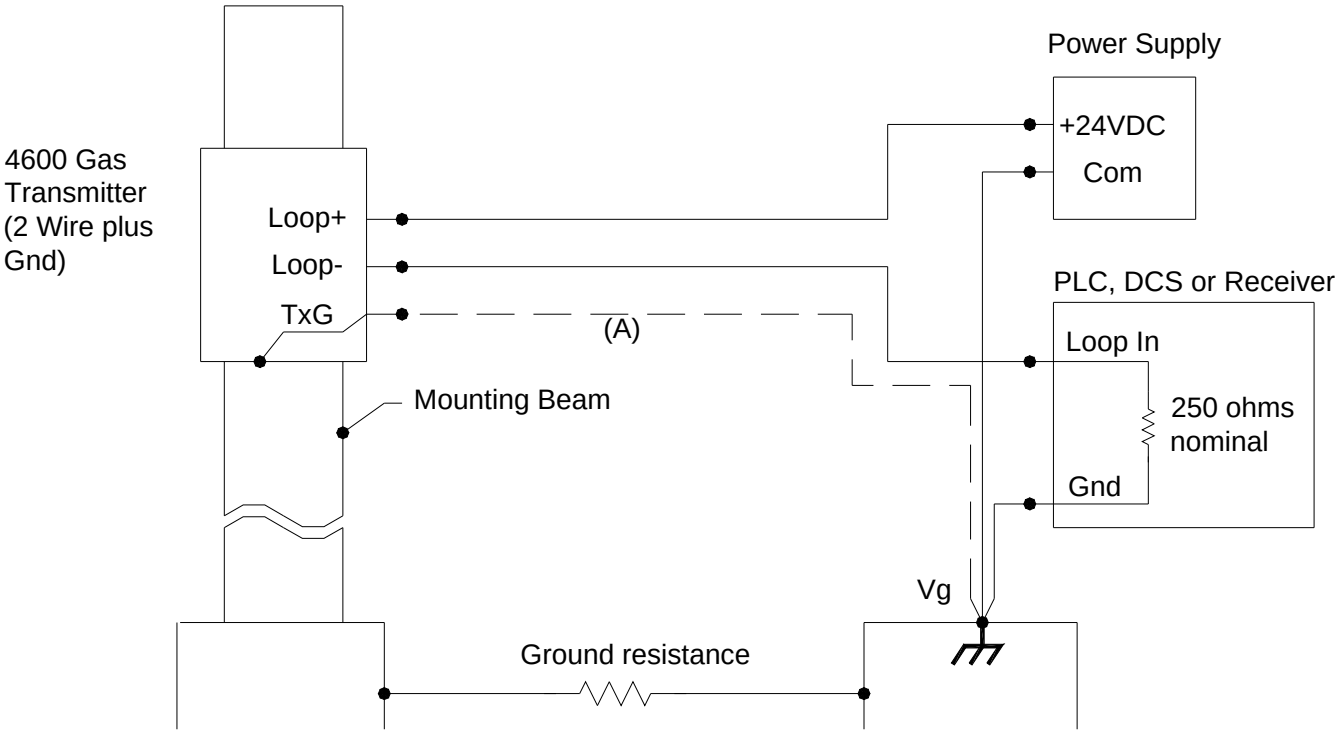


Figure 1 - GasPlus Dimensions

Typical Installation



Installation Notes:

At Installation as wired above but before applying power, measure the voltage at the transmitter between the "Loop -" terminal and the case (case terminal is negative meter lead). If this voltage (Vgd) falls between the range -0.5V<Vgd<8V than the installation is acceptable. If not, when power is applied barrier damage is likely to occur due to the difference in ground potentials.

Note: At all times the transmitter enclosure must be at earth potential to prevent a hazardous condition.

Remedies:

Improve the electrical connection between TxG and Vg until the above requirement is met (line marked "(A)" in diagram above). If this is not possible, electrically isolate the 4600 Transmitter enclosure from local earth ground and include the grounding wire from the TxG terminal to the Vg connection (line marked "(A)" in diagram above).

Terms:

TxG = Transmitter Ground

Vg = Power supply ground

Vgd = Voltage, ground differential (difference between power supply ground and transmitter ground.

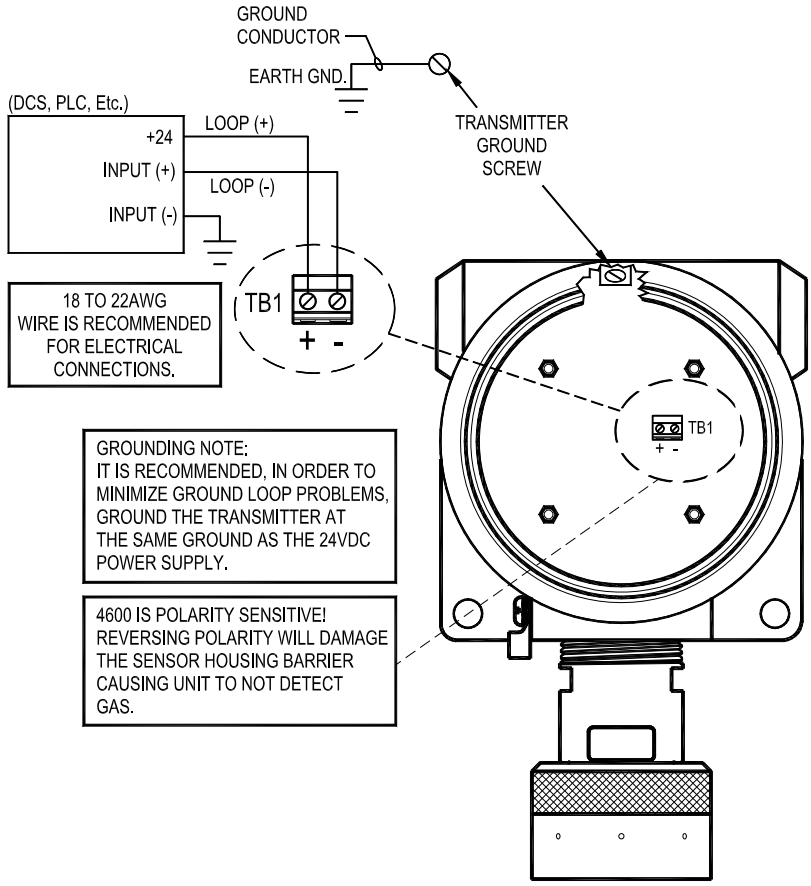
Application Note:

Split Power Supplies must not be used to provide instrument power. Any configuration which causes more than 8 VDC to be present on the loop(-) terminal relative to earth will damage the instrument.

! EMI/RFI ALERT !

When installing transmitters equipped with internal relays, all power lines should be shielded. The best practice is to run relay switched wiring in separate conduit from DC power and control wiring and away from other 110 VAC power lines or sources of EMI/RFI, such as variable speed drive controls.

2 Wire Configuration



3 or 4 Wire Configuration

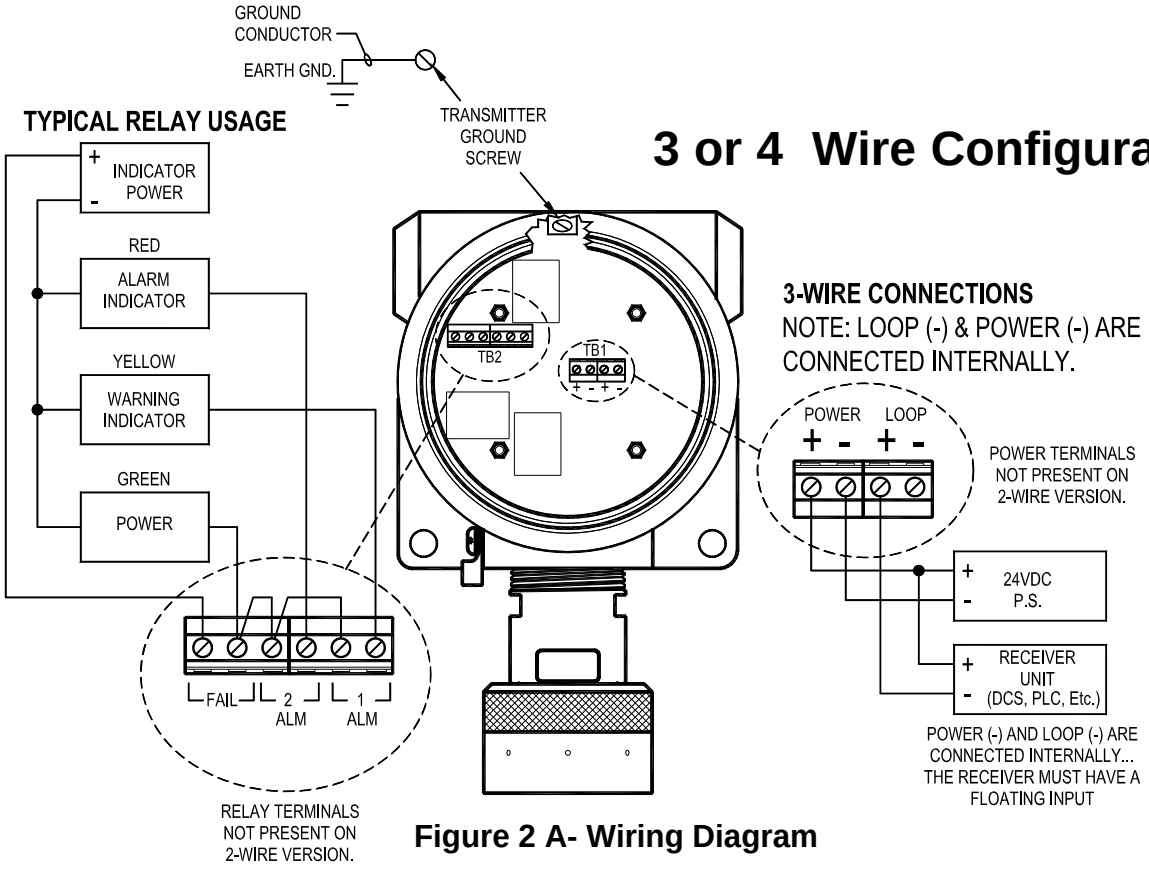
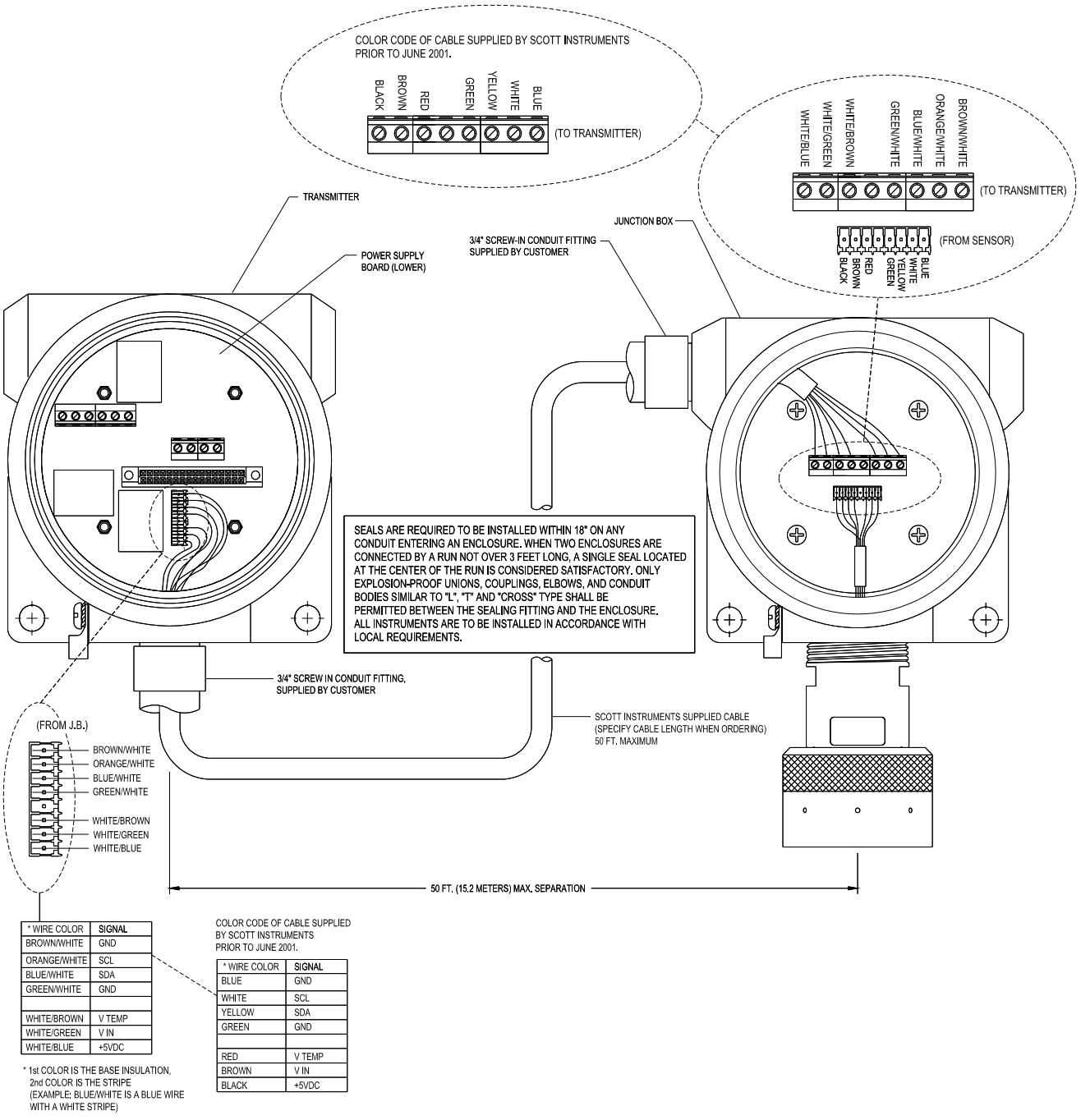


Figure 2 A- Wiring Diagram



* WIRE COLOR	SIGNAL
BROWN/WHITE	GND
ORANGE/WHITE	SCL
BLUE/WHITE	SDA
GREEN/WHITE	GND
WHITE/BROWN	V TEMP
WHITE/GREEN	V IN
WHITE/BLUE	+5VDC

* 1st COLOR IS THE BASE INSULATION, 2nd COLOR IS THE STRIPE (EXAMPLE: BLUE/WHITE IS A BLUE WIRE WITH A WHITE STRIPE)

COLOR CODE OF CABLE SUPPLIED BY SCOTT INSTRUMENTS PRIOR TO JUNE 2001.

* WIRE COLOR	SIGNAL
BLUE	GND
WHITE	SCL
YELLOW	SDA
GREEN	GND
RED	V TEMP
BROWN	V IN
BLACK	+5VDC

Figure 2B - Junction Box Electrical Installation

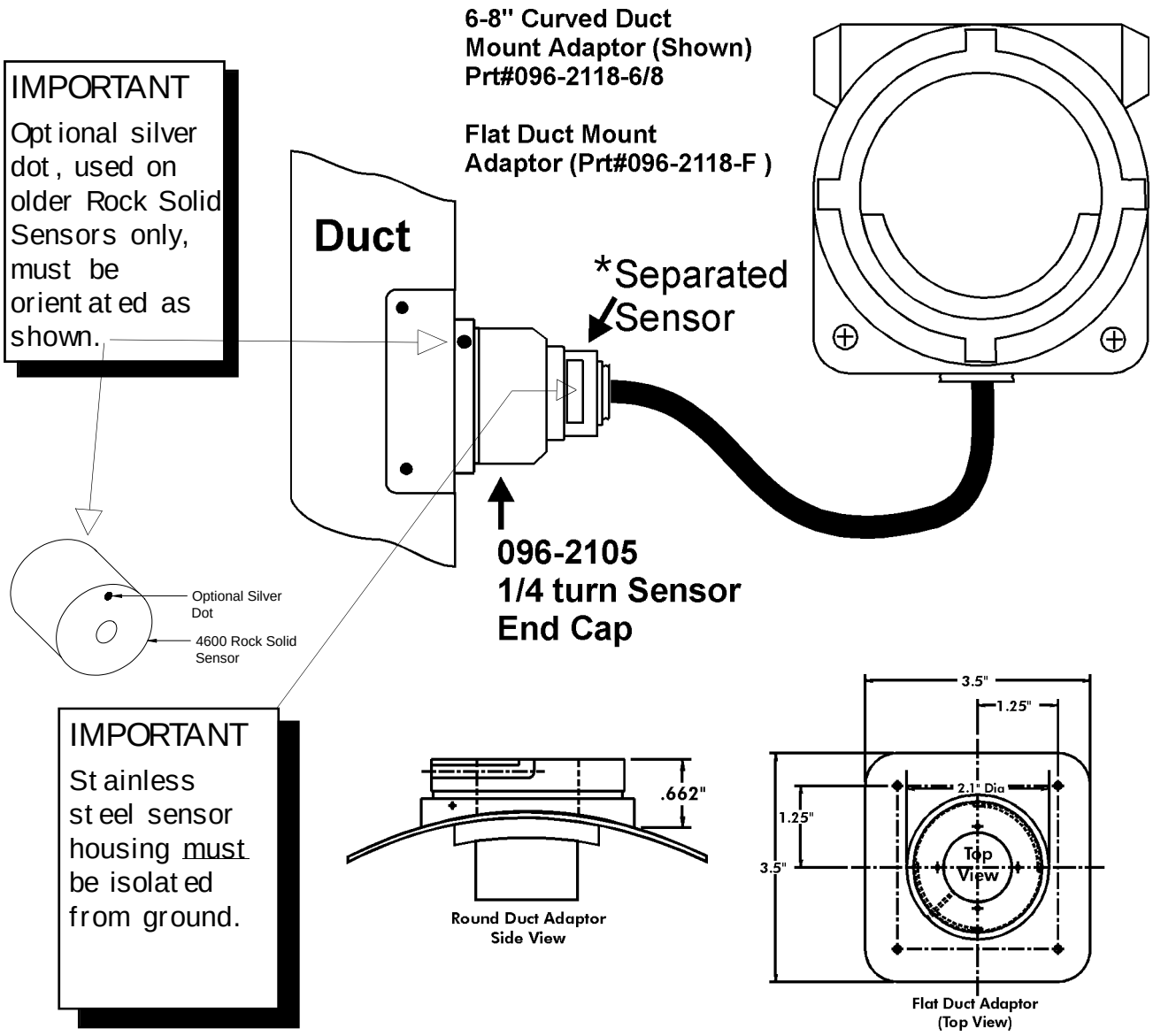
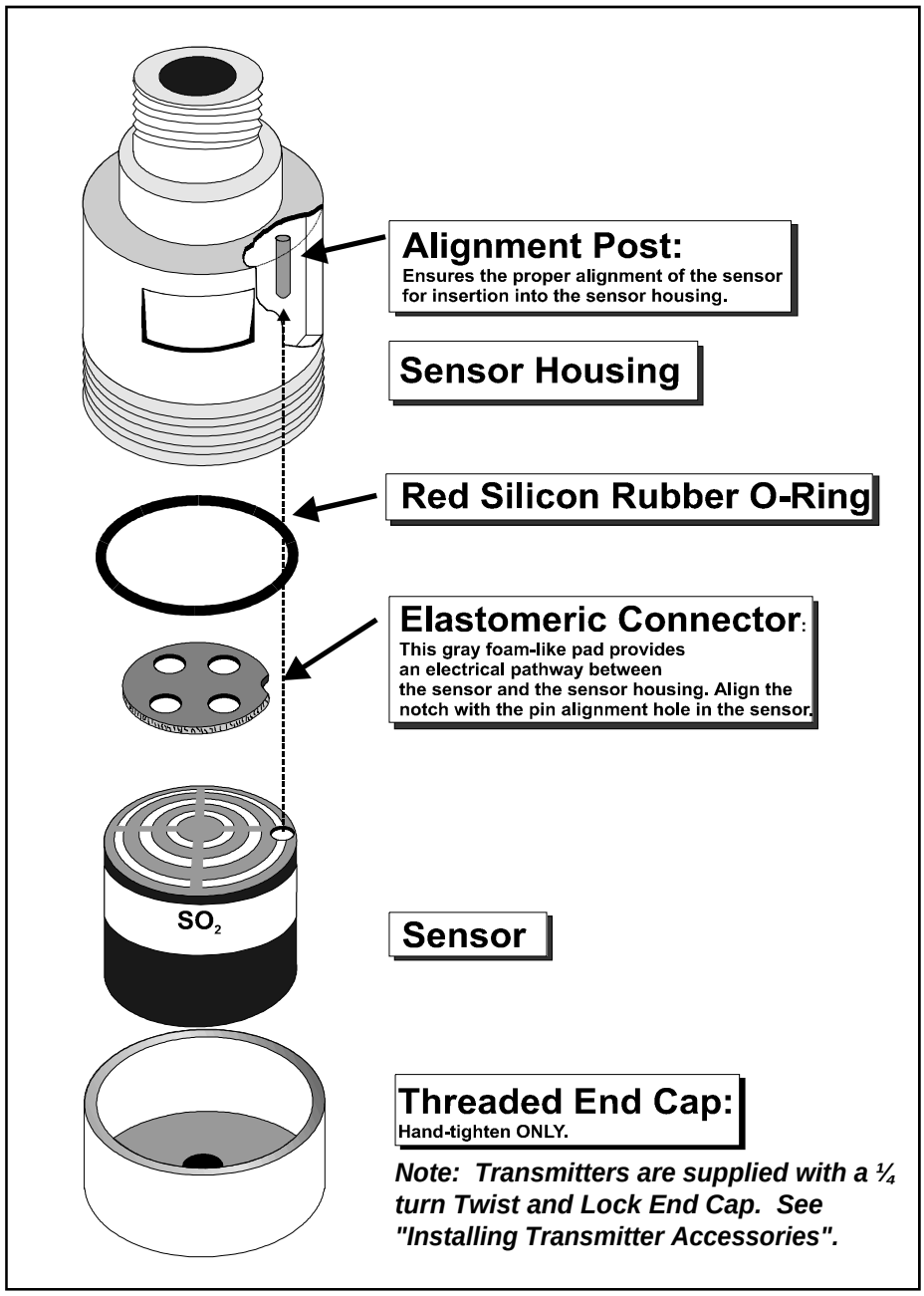


Figure 2C - Duct Adaptor Installation



IMPORTANT!

Sensor should always be facing downward or horizontal. Contact factory for other installations.

Sensors should never point up at any angle.

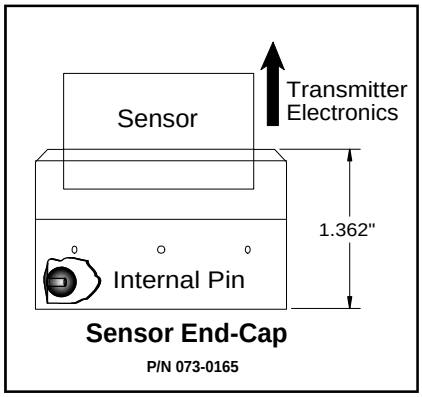
Figure 3 - Installing The GasPlus Sensor

Sensor Installation

Figure 3 depicts the GasPlus sensor installation. Be sure to include the elastomeric connection pad when installing the sensor into the sensor housing. Rotate the sensor until it locks into the alignment pin. The gas name/range will be visible through the housing front. To ensure proper connection between the sensor and the sensor housing, tighten the threaded sensor end cap hand tight - ***do not overtighten as this could damage the elastomeric connector or the sensor housing!***

Twist and Lock Accessories

Designed for quick, easy installation and removal from your GasPlus Universal Gas Transmitter, Twist-and-Lock accessories connect directly to the standard end cap and help make your gas detection system easier to use.



Sensor End-Cap
P/N 073-0165

Rain Shield/Splashguard (Part #074-0305)

Provides protection from wet weather and hose-downs. Teflon® construction permits use with both reactive (such as hydrogen fluoride, hydrogen chloride, and ammonia) and non-reactive gases. Lab tested hole geometry protects sensors from stray water droplets.

Calibration Adaptor (Part # 096-2101)

Delivers calibration gas directly to the sensor face without dilution from environmental interferences such as wind. Barb fitting provided for tube connection to the calibration gas source (gas cylinder, permeation device, generator).

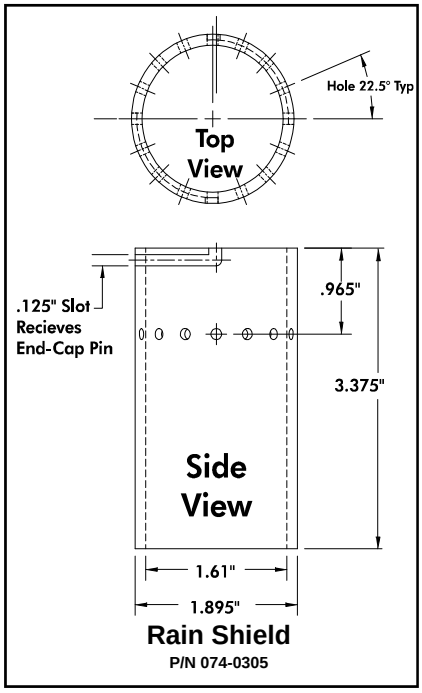
Duct-Mount Adaptor

(Part # 096-2118-6/8 (6' to 8" Duct) or #096-2118-F (Flat Duct)

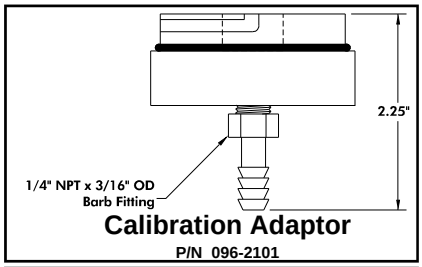
Monitors airflow in exhaust or ventilation ducts without drying out your Model 4600 sensor. Able to handle flow velocities from 350 to 1000 ft. per minute. Available for use on flat ducts or 6" to 8" diameter ducts (custom sizes also available). *For use only with transmitters configured for remote sensor and without junction-box.*

Flowcell (Part # 096-2102)

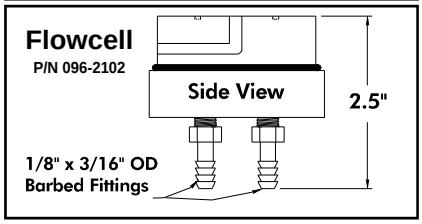
Use your Model 4600 in sample draw configurations. The Teflon® baffle prolongs sensor life by reducing air velocity past the sensor face.

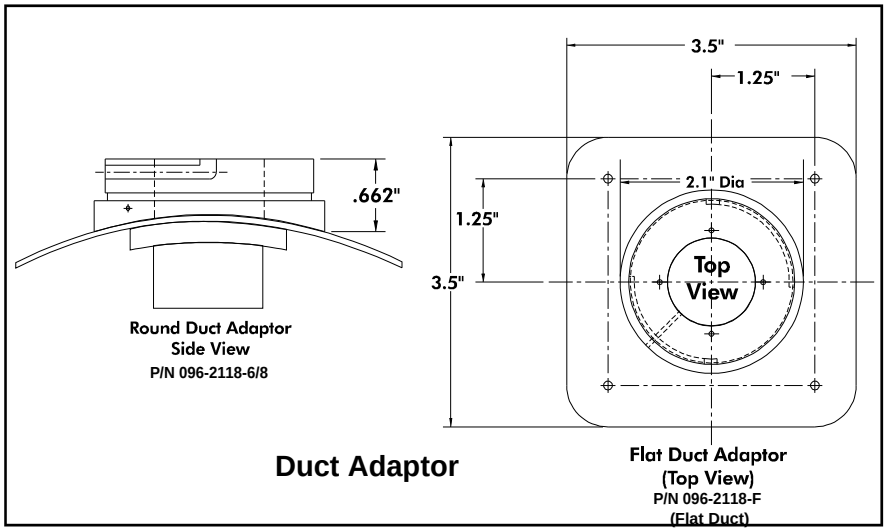


Rain Shield
P/N 074-0305



Calibration Adaptor
P/N 096-2101





Duct Adaptor

System Operation

Start-Up Note

If "FFF" appears after power has been applied, *the sensor may not be making electrical contact with the transmitter. Retighten the sensor end cap to ensure electrical continuity.*

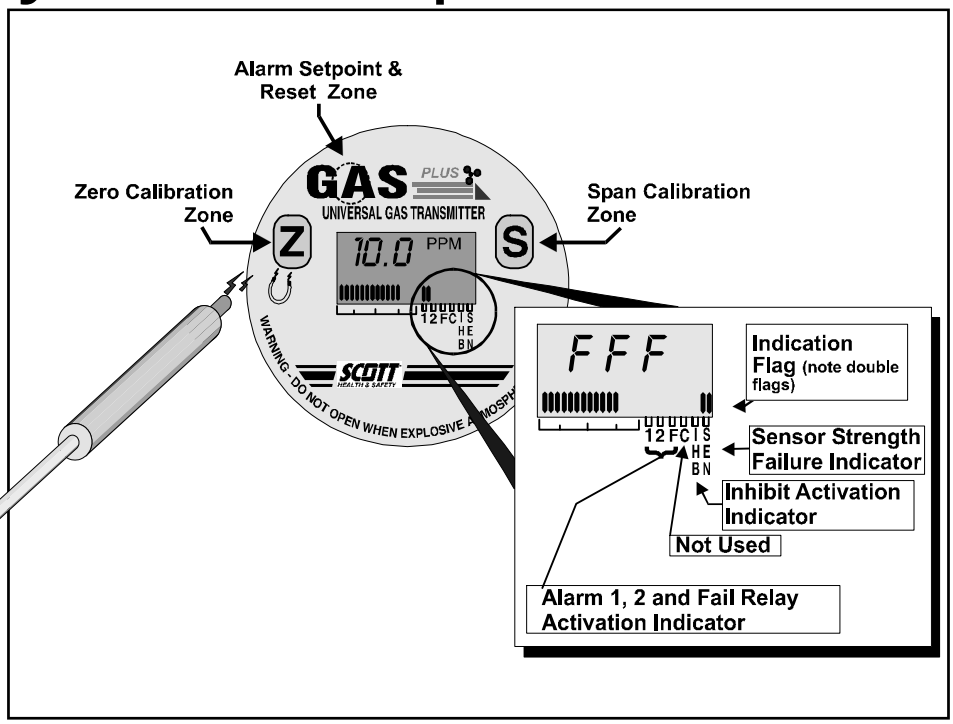


Figure 4 - Front Panel Operations and Indications

System Start-Up

Once all transmitters (sensor, rain shield, etc.) have been assembled and installation has been completed, recheck electrical connections to be sure wiring is correct. Once checked, the DC supply to GasPlus may be energized.

Once power is applied, GasPlus will initialize an LCD character display test routine. Verify that all character segments are displayed. In addition, the transmitter will detect and display sensor gas type (52=chlorine, 80=oxygen, etc.) and its full scale range. Once display information is completed, GasPlus alarm output is auto-inhibited and loop power is held at the user selected loop inhibit level (default 4 mA) for about 30 seconds to permit sensor stabilization.

Alarm and Loop-Power Inhibit

The GasPlus transmitter's inhibit function prevents activation of alarms in addition to holding loop power at the selected inhibit output level (see below) ***during calibration***. To activate (or deactivate) the inhibit function, use the magnet and momentarily place it over the **"Z"** (ZERO) calibration zone. Observe the LCD indicates the "IHB" function is active. The inhibit mode can be manually deselected by reapplying the magnet the **"Z"** (ZERO) calibration zone. GasPlus ***will automatically return to run mode about 9 minutes after the last adjustment OR after 30 seconds upon reinstallation of a sensor.***

Setting Inhibit Loop Current

Normally the GasPlus outputs a 4 mA current during inhibit mode. This may be changed from 3.5 mA to 20 mA on units wired in the 2-wire configuration, or 0 to 20 mA on units wired in the 4-wire configuration (wiring configuration is auto-sensed by the GasPlus). Inhibit outputs can be set in 0.1 mA increments.

To set the loop current output level during inhibit mode:

The GasPlus Programming Routine Sequence:
#1 1st Alarm Setpoint
#2 1st Relay Function
#3 2nd Alarm Setpoint
#4 2nd Relay Function
#5 Inhibit Output mA Level

STEP 1 - Place and hold the magnet over the Alarm Setpoint and Reset Zone. In approximately 5 seconds, the transmitter will enter program mode and display the value of the first alarm setpoint. Remove the magnet and allow the transmitter to scroll through the programming routine until "IHB" is displayed.

STEP 2 - Immediately following the "IHB" display message, a value (mA output setting) will appear on the display. By holding the magnet over the Alarm Setpoint and Reset Zone, the value will change. Momentarily remove the magnet then reapply to reverse the direction of change. When the desired output is displayed (i.e., 4.0 for 4 mA), remove the magnet. The new value will be permanently stored and the next time the inhibit function is activated, the transmitter will output at that value.

STEP 3 - After a period of a few seconds, the GasPlus will return to normal operation and the "IHB" flags will disappear.

Calibration Frequency

All GasPlus transmitters require calibration upon receipt from the factory, after which, the calibration interval for each transmitter should be independently established through a documented procedure which maintains a calibration log. Calibration frequencies will vary depending upon individual applications. Harsh environments will generally require more frequent calibration.

At a minimum, it is recommended that these calibration frequencies be followed:

Zero Calibration: Upon system power-up; every 30 days or less; upon (new or old) sensor re-connection to the transmitter. ***Oxygen Transmitter exception - every 90 days.***

Span Calibration: Upon system power-up (unless sensor has been pre-calibrated); every 90 days or less. ***Oxygen Transmitter exception*** - every 30 days.

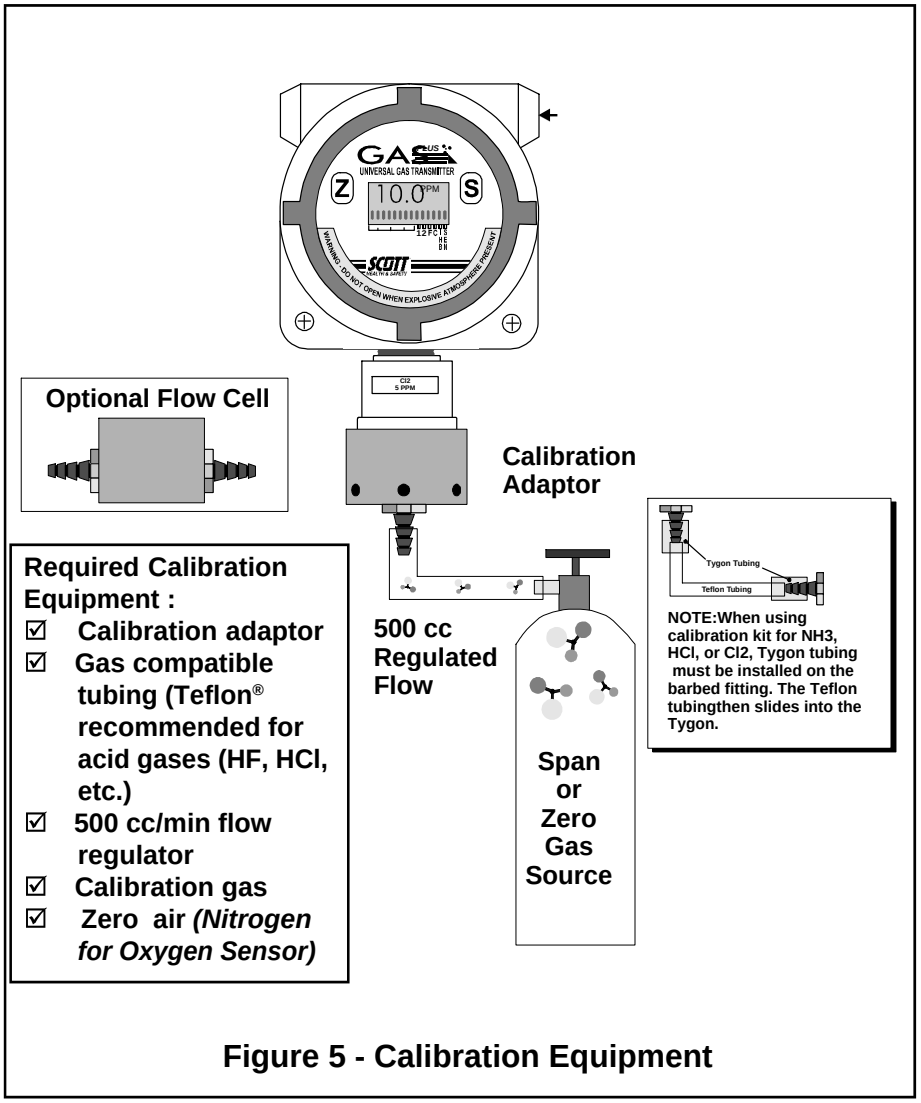


Figure 5 - Calibration Equipment

Calibration Reminder...

- **Document your calibration schedule requirements.**
- **Maintain an organized system to prevent confusion between calibrated and un-calibrated sensors.**
- **Properly store all spare sensors.**

Remote Sensor Calibration

The GasPlus is designed so the sensor may be removed from the transmitter and calibrated at a remote location. Fixed gas detection installations using this feature should utilize a documented calibration log (see "*Calibration Frequency*") to determine sensor rotation schedules. In addition, spare sensor(s) will be required so that continuous monitoring of the detection point

is assured and a spare "powered" transmitter will be required to conduct the calibration at a remote site. Prevent accidental installation of uncalibrated sensors by marking all calibrated sensors with their last calibration date or maintain them in an otherwise appropriate manner.

To remove and replace the GasPlus sensor:

STEP 1 - Inhibit the 4-20 mA output by momentarily placing the magnet over the Ⓩ (ZERO) calibration zone. Observe the LCD indicates the "IHB" function is active.

STEP 2 - Unscrew the sensor end-cap and remove the sensor requiring calibration. Removal of the sensor will drive the loop current to its Fail value (3.5 mA).

STEP 3 - Replace the sensor with a pre-calibrated sensor and reinstall the sensor end cap (**refer to Pages 2-5**). Ensure proper electrical connection between the sensor and the transmitter has been made (see "***System Start-Up***").

STEP 4 - Take the GasPlus out of inhibit mode by momentarily placing the magnet over the Ⓩ (ZERO). Observe the LCD indicates the "IHB" function is deactivated.

Storing Sensors

Proper storage of the pre-calibrated sensor is critical to ensure long term functionality of the (spare) sensor. It is important to remember that upon disconnection of the GasPlus sensor from the transmitter assembly, the bias potential (required by electrochemical sensors) across the sensor's electrodes will be maintained via the integral battery. The battery is capable of providing up to a total of 9 months of "off-line" power (because the battery is not rechargeable, "off-line" time is cumulative), providing proper storage procedures are followed.

When storing the sensor "off-line", block the sensor gas hole by placing a small piece of electrical tape over the front of the sensor (***do not touch the membrane*** as this will cause damage the sensor), and store the sensor in a cool dry place (a refrigerator for example).

Should the sensor be kept off-line for a cumulative period of time exceeding 9 months, the sensor will continue to operate! Battery failure of the sensor does not mean the overall sensor has failed and will not operate, only that it will require a 4-8 hour warm-up time upon installation. Once the sensor has "warmed-up" and has become stable, calibration may occur as normal.

Zero Calibration

The transmitter's zero is set by adjusting the loop output to 4 mA while the sensor is exposed to air which is free of the gas being detected (and any interferant gases which may be present).

Zero Calibration Using Ambient Air

Ambient air may only be used for the zeroing process if it is certain to be free of both the target gas and any possible interferants; ***otherwise, a source zero grade air should be used (except when zeroing an Oxygen transmitter, which uses Nitrogen for this procedure)***.

! IMPORTANT !

If using the transmitter with a Scott/Bacharach Hydrogen Sulfide scrubber (part# 096-2141), the scrubber MUST be in place prior to calibration!

Using A Permeation Tube Device

When using a permeation tube device during a calibration session, it is recommended that constant flow of zero air be established for at least 10 minutes before being hooked up to the calibration adaptor on the sensor. This ensures that any analyte gas which may have been present from a previous span calibration is flushed from the tubing and adaptor.

Optional Sensor Functional Test

These transmitters are designed to operate in many different environments. In some extreme conditions, the sensor may become unresponsive to the target gas due to continuous or excessive exposure to dust or dirt on the membrane, or very high/low humidity conditions.

To ensure a unit continues to function, a sensor test should be considered. Functional tests can be conducted by exposing the sensor to the target gas. Follow all necessary safety precautions while conducting this test. The frequency and necessity of this check is dependent upon the specific characteristics of the site in which the sensor is located and should be determined by the user.

Zero Calibration Procedure

To zero the GasPlus, proceed as follows:

STEP 1 - Inhibit the 4-20 mA output by momentarily placing the magnet over the Ⓩ (ZERO) calibration zone. Observe the LCD indicates the "IHB" function is active.

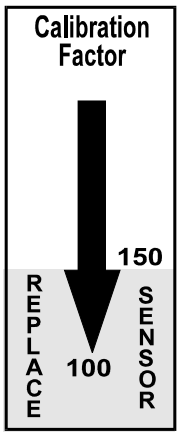
STEP 2 - Install the calibration adaptor or flow cell to the GasPlus transmitter (**see Figure 5**). Make all appropriate tubing connections per manufacturer recommendations. Turn on the air flow at a rate of 500 cc/min and let circulate over the sensor for 5 minutes.

! TUBING ALERT !

Ensure the proper tubing is used when performing span calibration. Teflon® tubing should be used when calibrating with hydrogen fluoride or acid gas.

STEP 3 - Zero the transmitter by using the magnet and placing it over the over the Ⓩ (ZERO) point on the transmitter body for approximately 5 seconds. Remove the magnet. The display will read "CAL" then "0.0" (the display will vary with range 0, 0.0, or 0.00).

STEP 4 - If spanning the instrument, proceed to ***"Span Calibration-STEP 2"*** OR take the GasPlus out of inhibit mode by momentarily placing the magnet over the Ⓩ (ZERO). Observe the LCD indicates the "IHB" function is deactivated (the transmitter will automatically deactivate inhibit mode after 9 minutes).



Span Calibration

When calibrating the transmitter span, the concentration of the span gas standard should be at least 50% (BUT NOT IN EXCESS OF 90%) of the transmitter's range. In addition, *if the calibration gas is not in an air balance (nitrogen for example), do not allow the gas to flow across the sensor for more than 5 minutes.* This will deplete oxygen in the sensor and cause erroneous readings and slow recovery to normal operation (most sensors require a minimum of 5% oxygen for proper operation).

Special Span Calibration Requirements

Hydrides Calibration: Hydride sensors (***AsH_3/Arsine, PH_3/Phosphine, B_2H_6 /Diborane, SiH_4/Silane, GeH_4/Germane***) exhibit a significant transient response to changes of oxygen concentration. This response will not effect the sensor's usefulness when operating in normal atmospheric breathing air.

However, when calibrating a hydride sensor, hydride gases bottled in backgrounds other than 20.9% oxygen ***should not be used***, as the sensor will see a change in oxygen background. For this reason, permeation tube devices are recommended with normal air as a diluent.

Ammonia (NH_3) Note: It is acceptable to use ammonia sensors in reduced oxygen environments (down to 2%) providing that the sensor is stored within the environment for 24 hours prior to calibration in the same environment.

Span Calibration Procedure

To span the GasPlus transmitter proceed as follows:

STEP 1 - Ensure that the transmitter inhibit feature is activated, and if using the hydrogen sulfide scrubber (part# 096-2141), that it is in place.

STEP 2 - Verify that the span gas being used has not exceeded its expiration date. Old or improperly stored calibrations gases can degrade causing inaccurate calibration. A minimum gas concentration of 15% of the full scale range is required; however, a gas concentration of a least 50% of the full scale range is recommended (BUT NOT IN EXCESS OF 90%).

STEP 3 - Assemble the specific calibration kit to be used (i.e., permeation tube device, bottled gas, gas generator, etc.), and make the appropriate connections to the transmitter's calibration adaptor. Attach the calibration adaptor to the transmitter's sensor assembly.

! IMPORTANT!
The operation response check is not intended to be a quantitative measurement of the transmitter's output signal.

STEP 4 - Initiate gas flow and allow the span gas to flow for approximately 5 minutes at a rate of 500 cc/min. *NOTE: When calibrating outdoors on a windy day, it will be necessary to temporarily cover the holes around the circumference of the rain shield. Otherwise, rapid air flow caused by wind will dilute the gas standard as it enters the sensor area. The holes need not be tightly sealed.* The transmitter should begin to respond to the calibration gas immediately. The indicated gas concentration should slowly level off to a value (usually close to that of the span gas concentration) and remain stable.

STEP 5 - Using the magnet, place the magnetic tip over the (S) (SPAN) point on the transmitter body and hold it there. The reading will start to slowly move either up or down. If this change in reading is moving in the wrong direction, remove the magnet for a moment, then replace it on the SPAN point and the reading will start to move in the opposite direction. After 15 counts the change in reading will become faster. Once the displayed concentration has reached the desired reading (the concentration of the span gas being used), remove the magnet. The GasPlus will then display the **span calibration factor** which has been applied to the sensor. The calibration factor has an inverse relationship to the amount of gain applied to derive the correct 4-20 mA output signal. **Sensors having a calibration factor of 150 or less are approaching the end of their useful life and should be replaced soon.**

STEP 6 - Take the transmitter out of inhibit mode by momentarily applying the magnet to the (Z) (ZERO) point. Observe that the (2) inhibit indication flags are no longer visible. (NOTE: The transmitter will automatically return to run mode about 9 minutes after the last adjustment). After calibration is complete, disconnect the calibration system. The unit should now be operating properly and displaying the current gas concentration.

Important Notes on Calibration of Sensors

Calibration of 0-1000 PPM Methyl Iodide Sensor (CH_3I)

Please note that as of March 30, 1999 Scott Health & Safety has released a new high range CH_3I sensor. There is an important calibration method that MUST be adhered to when calibrating this sensor. Upon multiple exposures to high concentrations of gas (>500 PPM) it begins to show increased sensitivity for a duration of approximately 5 days. In other words, it provides a higher output when exposed to the same concentration of gas. The increased sensitivity varies from sensor to sensor, but is typically on the order of 30%**.** After 5 days, the sensor once again shows the same sensitivity as that seen prior to the high gas exposure. This increased sensitivity does not occur for exposure concentrations less than or equal to 200 PPM. Therefore 3 recommendations are being made:

1. The 0-1000 PPM range sensor should not be calibrated any more frequently than once per week.
2. The sensor should be calibrated with actual methyl iodide with a concentration of less than 500 PPM.
3. If the sensor is exposed to a high concentration of gas it should be allowed a recovery period of 7 days before recalibration. Alternatively, it is suggested that a spare GasPlus sensor be kept to swap out any sensor exposed to concentrations greater than 500 PPM. This will allow the "exposed" sensor time to recover.

Keep in mind that exposure concentrations greater than 500 PPM methyl iodide will be unusual. Even if the sensor were to be exposed to a high concentration, the only side effect is increased sensitivity for 3-5 days. If another gas leak occurs, then the sensor will simply overrespond to the gas leak, which is safe-sided.

If you have any questions, please feel free to contact your local Regional Sales Manager or your inside sales support contact at Bacharach-EIT.

New Mandatory Calibration Method of HF Sensors

When spanning HF sensors, using a surrogate gas such as HCl and Cl_2 might be preferred by the operator. When doing this, keep in mind **that the cross-calibration factor used to adjust the span is an estimate based on the average response of several sensors.**

Cl_2 (an oxidizing gas) may be used to span an HF sensor, **but it is recommended to "bump" test it by exposing the sensors briefly to vinegar vapors to be sure its ability to respond to the acidic HF gas has not been exhausted.**

I. Using a gas generator:

STEP 1 - Attach the delivery tube from the generator to a calibration adapter. Use the delivery tube supplied by the manufacturer or a length of Teflon® or Tygon-clad Teflon®. Do not apply to sensor at this time.

STEP 2 - Start the generator, being sure the flow rate is set to 0.5 lpm and the gas concentration is set to the desired value.

STEP 3 - Allow the gas to flow through the delivery tube and calibration adapter to let them equilibrate with the gas before connecting to the

sensor. Depending on the local environment, this may take 5 to 15 minutes or longer.

STEP 4 - While waiting, check the sensor zero reading and zero it if necessary.

STEP 5 - After sufficient time has passed for the gas delivery tube and calibration adapter to equilibrate with the gas flowing through them, attach the calibration adapter to the 4600 sensor end-cap (remove the rain shield first, if there is one).

STEP 6 - After five minutes, adjust the span to agree with the concentration of gas coming after the generator.

STEP 7 - Remove the calibration adapter, and re-install the rain shield if necessary.

Note - Some generators[1] don't have air pumps with enough power to overcome the pressure drop of the porous diffuser plug in the calibration adapter. In this case the diffuser must be removed prior to starting the process:

STEP 1 - With pliers or a 9/16" wrench, remove the barbed hose fitting from the calibration adapter.

STEP 2 - Through the hole, push out the diffuser with a screwdriver or a pencil. Put the plug in a pocket or other safe place.

STEP 3 - Replace the hose fitting and tighten.

STEP 4 - When the calibration process is finished, put the diffuser plug back into its hole and press it until its face is flush with calibration adapter's face.

II. Using calibration gas cylinders

STEP 1 - Attach a regulator capable of delivering 0.5 lpm gas to the cylinder.

STEP 2 - Connect the regulator output to a calibration adapter using a length of Teflon® tubing or Tygon-clad Teflon®. Do not apply to the sensor at this time.

STEP 3 - Be sure the porous diffuser plug is in place in its hole in the calibration adapter.

STEP 4 - Allow the gas to flow through the delivery tube and calibration adapter to let them equilibrate with the gas before connecting to the sensor. Depending on the local environment, this may take 5 to 15 minutes or longer.

STEP 5 - While waiting, check the sensor zero reading and zero it if necessary.

STEP 6 - After the delivery tube and adapter have equilibrated with the gas, attach the adapter to the 4600 sensor end-cap (remove the rain shield first, if there is one.)

[1]ACD's (Advanced Calibration Designs) model 300 and EC Cal Cal-2000 do not have this problem. You may suspect your generator is one that has a weak pump if the sensor's response is "zero" or much lower than anticipated.

STEP 7 - Continue the gas flow and after five minutes, adjust the span to agree with cylinder label value.

STEP 8 - Shut off the gas, remove the calibration adapter from the end-cap, and reinstall the rain shield if there is one.

Note - Sometimes regulators require time to adjust after changing from one gas type to another. For example, a regulator that has been on an H_2S cylinder will have absorbed H_2S, especially when it is brass. The sulfided interior will destroy gasses such as Cl_2 until enough time and gas have passed to "clean out" the regulator. In extreme cases, it will probably be better to use a new regulator and then reserve it exclusively for use with the particular gas (i.e. chlorine).

Weekly Operational Response Checks

It is suggested that a sensor response test should be performed weekly to ensure the transmitter continues to respond to the target gas. It is recommended to briefly expose the transmitter to a dose of the calibration gas used to span the instrument. A 5 to 10 second gas stream directed at the base of the sensor should suffice in producing a response from the transmitter.

If response is slow (typical response time will be within 5 seconds), check the tip of the sensor for either dirt buildup or condensation on the membrane. Both can cause slower than normal operation. If an excessive dirt buildup is present, the sensor is generally not repairable. If there is excessive moisture present, the sensor may be removed to a dry area and permitted to dry. Under such conditions, the cause of the excessive moisture should be determined and prevented (condensing humidity, wash-downs, etc.)

Refer to the appendix for alternative methods of generating operational check gases.

NOTE !
When detecting oxygen deficiency, the ALARM 2 set point should be BELOW the ALARM 1 set point (a falling alarm).

GasPlus Alarms

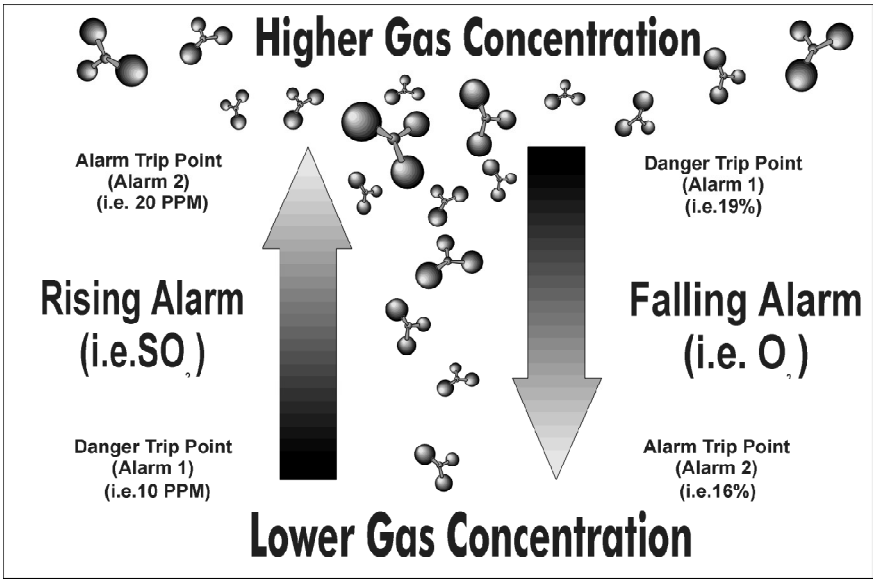
The GasPlus transmitter permits 2 alarm setpoints and relay operation (for those transmitters equipped with the relay option) to be specified. The program routine sequence is:

- **Present Alarm 1 setpoint**
- **Alarm 1 latching/non-latching status *(displayed as "_LA" or "nLA").***
- **Alarm 1 energize/non-energize relay status *(displayed as "_En" or "nEn")***
- **Present Alarm 2 setpoint**
- **Alarm 2 latching/non-latching status**
- **Alarm 2 energize/non-energize relay status**

To view or change alarm setpoints and relay latching function:

STEP 1 - Place and hold the magnet over the Alarm Setpoint and Reset Zone. In approximately 5 seconds, the transmitter will enter program mode and display the value of the first alarm setpoint.

STEP 2 - If the magnet is held in position for longer than ½ second, the Alarm 1 setpoint will begin to change. If the magnet is removed, the programming routine will scroll through each programmable parameter in the sequence listed above. To change any of these parameters, apply the magnet to the alarm setpoint zone while the parameter is being displayed. Alarm setpoints require the magnet be applied at the alarm setpoint zone and held in position until the alarm setpoint value is achieved (momentarily removing the magnet and reapplying will reverse the direction in which the values scroll). Changing alarm relay functions (latching/non-latching, energized/ non-energized) is accomplished by momentarily applying, then removing, the magnet to the alarm setpoint zone. All parameters will be displayed for 7 seconds after the last alarm (setpoint zone) activation.



Defining Alarm and Relay Characteristics

Rising Alarms are alarms which are activated whenever the gas concentration level is equal to, or above, the alarm setpoint. Rising alarms are assigned by setting the ALARM 2 trip point above the ALARM 1 trip point.

Falling Alarms are activated whenever a gas concentration level is equal to, or below the alarm setpoint. Falling alarms are assigned by setting the ALARM 2 setpoint below the ALARM 1 setpoint.

Latching Alarm ("**_LA**" on the LCD) designates the mode of operation for the GasPlus (or its relay if so equipped). Once the gas concentration no longer constitutes an alarm condition, the GasPlus (or its internal relay) has to be reset to its normal condition by applying the magnet to the alarm setpoint zone. Also can be know as "manual reset".

Non-Latching Alarm ("**nLA**" on the LCD). Transmitter must be equipped with internal alarm relays in order for this feature to be functional. Designates the mode of operation for GasPlus (or its relay if so equipped). Once the gas concentration no longer constitutes an alarm condition, the relay will reset to its normal condition automatically. Also can be known as "Auto Reset".

Normally energized ("**En**" on the LCD). Transmitter must be equipped with internal alarm relays in order for this feature to be functional. Designates a relay which operates so that, under normal conditions, its contacts to the terminal strip are closed. Such relay operation is also known as **fail-safe** because the contact will open if an alarm condition is met.

Normally not energized ("**nEn**" on the LCD). Transmitter must be equipped with internal alarm relays in order for this feature to be functional. Designates a relay which operates so that, under normal conditions, its contacts to the terminal strip are open. Such relay operation is also known as **normal or non-fail-safe** because the contact will close if an alarm condition is met.

Acknowledging Alarm Conditions

Transmitters whose alarm parameter has been designated as "*latching*" ("_LA") must be manually reset (acknowledged) once the concentration level of the target gas exceeds that of the designated alarm setpoint, and an alarm immunity period of 5 seconds is exceeded. To reset the transmitter, momentarily apply, then remove, the magnet to the alarm setpoint zone. Observe that the specific alarm (1, 2, or F) indication flag has cleared from the main display.

Failure/Alarm Indications

Alarm activation is indicated by flags on the GasPlus LCD. The following are conditions upon which alarm indications will be activated:

Alarms 1 and 2

Target gas concentration levels have exceeded those designated in the alarm 1 and/or 2 setpoints (see "*Designating Alarm Setpoints and Relay Operation*" section).

Fail Indication

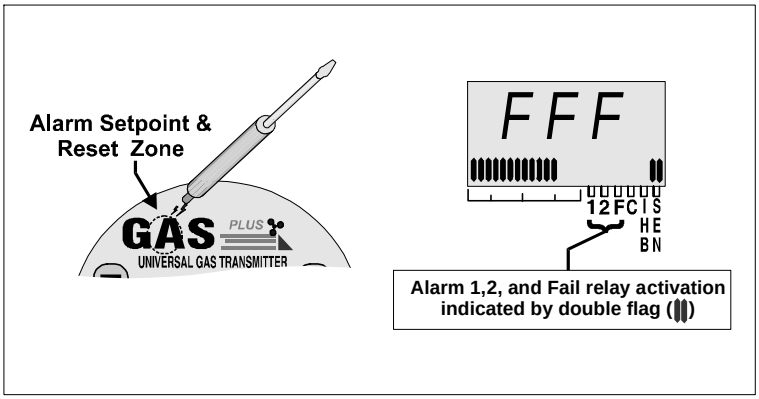
A fail indication will be displayed by both the "F" flag indicator and "FFF" on the LCD. A Fail indication is usually a result of either a removed or poor sensor-to-housing electrical connection or sensor failure discovered by the self-diagnostic routine. The self diagnostic routine interrogates transmitter and sensor memory transfer integrity and is continuously performed by the GasPlus. Should a failure occur, transmitter mA output goes to 3.55 mA ±.05mA.

Sensor Strength Failure Indication

This flag will only appear during system calibration where the transmitter has applied a calibration factor of less than 150. This helps indicate to the operator that the sensor requires replacement. The "SEN" flag will remain on until sensor is replaced. There is no effect on the transmitter's mA output.

"FFF" Indication (Missing Sensor Indicator)

This display combination is used to indicate a missing sensor or loss of continuity between the sensor and the transmitter. Should this occur, the transmitter's mA output goes to the Fail level (3.55 mA ±.05mA).



Contacting Scott Health & Safety

4320 Goldmine Road
Monroe, NC 28110
Scott Health & Safety may be contacted Monday through Friday
8:30 AM to 5:00 PM EST.
Phone 1-800-247-7257 • FAX 1-704-291-8340
e-mail • service@www.scotthealthsafety.com

Technical Specifications

Repeatability:	**±2% FS**
Linearity:	**±2% FS**
Output:	**4-20 mA**
Max Loop Load:	
2-Wire	**460 ohms at 24 VDC (25 mA based)**
4-Wire	**800 ohms at 24 VDC (25 mA based)**
Power:	**18-30 VDC, 0.6 W in basic configuration (nominal)**
	1.7 W max. in 4-wire w/relays 21 mA max (4-20 loop)
Display:	**3.5 digit LCD**
	0-100% concentration bargraph
	Alarm indication
	Inhibit indication
Temperature:	
Sensor	**See "Capabilities Chart"**
Transmitter	**-40° to 140°F (-40° to 60°C)**
LCD	**-22° to 140°F (-30° to 60°C)**
Humidity:	**Up to 99%RH, non-condensing**
Weight:	**5 lbs (2.25 Kg)**
Separated Sensor:	**Up to 50' (15.25m)**
Alarm Relays:	**(2) concentration,**
	(1) Fail 10 amp, SPDT rated @ 120 v (resistive load)
Self Diagnostic Routines:	**Weak sensor indication; Electronic faults; System memory; Missing sensor; Sensor configuration**
Approvals:	**UL& C-UL Classified Fire and Explosion Hazards Class I, Div. 1, Groups B, C, & D; Class II, Groups E, F, G; & Class III for Standard Configuration only, as shown in Figure 1 on Page 5.**
Sensor Life:	**9 months (unpowered)**
Warranties:	
Transmitter	**1 Year**
Sensor	**1 Year**

Troubleshooting

When the 4600 Gas Transmitter detects a fault it drives the analog output to 3.55mA ±.05mA. In addition the front screen will display "FFF". Note that some faults cannot be detected by the 4600 Gas Transmitter and therefore span gas calibration is required on a regular basis to determine proper operation. Refer to Troubleshooting Chart below for various problems that may occur during operation.

TROUBLESHOOTING CHART		
SYMPTOM	**POSSIBLE CAUSE**	**CORRECTIVE ACTION**
FFF Display	Missing Sensor	Tighten Endcap
	Bad Elastomeric Pad	Replace Pad
	Incorrect Endcap	Confirm correct endcap is being used.
Transmitter does not respond to Span Gas	Damaged Stainless Steel Sensor Housing	Replace Sensor Housing
	Bad Elastomeric Pad	Replace Pad
	Bad Sensor	Replace Sensor
	Bad or Weak Calibration Gas	Replace Gas Source
	Poor Gas Delivery - Wind	Cover holes on Endcap - Leave one hole open.
		Check Tubing for cuts.
		For Cl2 applications Confirm Regulator/ Tubing was not used with H2S.
		For sticky gases (HF, HCl, Cl2, SO2, BCl3, etc.) Confirm that Teflon Tubing is being used.
		Check Calibration Cup - Diffuser is not plugged.
Transmitter Zero Drifts	Interfering Gas Present	Place Zero Air on Sensor to determine if outside gas present.
	Rapid Temperature Changes	If possible, shield sensor from source of temperature changes.
	High Gain on Sensor	Recheck Sensor Calibration Factor. Sensors with Low Calibration Factors tend to drift more.

Making Operational Check Gases

The following methods can be used during operational response checks of the transmitter:

For transmitters detecting: Cl_2, ClO_2, O_3, Br_2, F_2

Place a teaspoon of powdered calcium hyporchlorite in a small plastic bottle and cap tightly. When you wish to test a sensor, simply remove the cap and hold the mouth of the bottle near the tip of the sensor.

For transmitters detecting: HCl

Observe Extreme Caution! Place about 10 cc of concentrated hydrochloric acid (approximately 38% HCl) into a small plastic (polyethylene) bottle. Unscrew the cap and hold the mouth of the bottle near the tip of the sensor.

For transmitters detecting: HF

Observe Extreme Caution! Line the bottom of a small plastic (polyethylene) bottle with 1 or 2 pieces of laboratory filter paper. Add 2-3 drops of concentrated hydrofluoric acid (49%) and cap tightly. Unscrew the cap and hold the mouth of the bottle near the tip of the sensor.

For transmitters detecting: HCN, SO_2, H_2S

Observe Extreme Caution! Place about 10 cc of 1N sulfuric acid into a small plastic (polyethylene) bottle. Add a few crystals of sodium sulfide to the acid just prior to testing the sensor, since the resulting SO_2 gas will quickly dissipate. Hold the mouth of the bottle near the tip of the sensor. ***CAUTION: DO NOT CAP THE BOTTLE UNTIL THE GENERATION OF GAS HAS STOPPED, OR THE BOTTLE MAY BURST.***

For transmitters detecting: NH_3

Use household liquid ammonia. Hold the mouth of the bottle near the tip of the sensor. Do not overexpose the sensor to ammonia or it will take a long time for it to recover to zero. Also, do not splash liquid ammonia solution onto the membrane.

! CAUTION !

USE APPROPRIATE SAFETY PRECAUTIONS WHEN HANDLING CHEMICALS. ONLY TRAINED PERSONNEL SHOULD HANDLE ACID COMPOUNDS.

Scott Health & Safety Warranty

GENERAL POLICY COVERAGE

The manufacturer warrants to the original purchaser and/or ultimate customer of the manufacturer's products that if any part(s) thereof (except for those listed below) prove(s) to be defective in material or workmanship within 18 months from the date of shipment or 12 months from the date of start-up, whichever comes first. Such defective part(s) will be repaired or replaced free of charge if shipped prepaid to the factory in a package equal to (or) original container.

Exceptions to this general warranty policy are:

Gas Sensors

Gas sensors which are part of certain products are covered by a 12-month warranty. Should a failure occur within 12 months of shipment, the sensor will be replaced at no charge, providing the sensor has been used and installed in accordance with the O&M Manual recommendations. The Phosgene ($COCl_2$) sensor has a warranty of six (6) months.

TERMS AND CONDITIONS

All product will be returned freight prepaid and allowed if it is determined by the manufacturer that the part(s) failed due to defective materials or workmanship.

The seller assumes no liability for consequential damages of any kind, and the buyer by acceptance of this equipment will assume all liability for the consequences of its use or misuse by the buyer, his employees, or others. A defect within the meaning of this warranty in any part of any piece of equipment shall not, when such part is capable of being renewed, repaired, or replaced, operate to condemn such piece of equipment.

This warranty does not cover consumable items, batteries, or wear items subject to periodic replacement including lamps and fuses.

This warranty is in lieu of all other warranties (including without limiting the generality of the foregoing warranties of merchantability and fitness for a particular purpose), guarantees, obligations, or liabilities expressed or implied by the seller or its representatives and by the statute or rule of law.

This warranty is void if the instrument has been subject to misuse or abuse, or has not been operated in accordance with instructions, or if the serial number has been removed.

SCOTT HEALTH & SAFETY MAKES NO OTHER WARRANTY EXPRESSED OR IMPLIED EXCEPT AS STATED ABOVE.

Year 2000 Compliance

The Model 4600 accepts all dates in the years after 1999 as valid dates. The instrument's functionality, performance, and accuracy will not be affected as a result of the run date or dates being processed, irrespective of the century.

Spare Parts

Call 800-247-7257 or Your Local Sales Representative

Miscellaneous

Part #	Description
096-2149	Separated sensor housing w/ 6 feet of cable, no junction box. ***For Duct Mount Adaptors***
096-2149-1	Same as 096-2149, but without window (for condensing humidity applications).
096-2118-6/8	6-8" Curved Duct Mount Adaptor
096-2118-F	Flat Duct Mount Adaptor
093-0097	Elastomeric Connector w/ O-Ring
096-2065	Heater Assembly ("P" models only)
077-0127	Pump Assembly ("P" models only)
077-0120	Scott Health & Safety Magnetic Screwdriver
096-1943	Sensor Rain Shield/Calibration Adaptor (used with S.S. End Caps 073-0165 & 073-0210)
096-1981	S.S. Sensor Housing-3/4" NPT (w/ window - does not include end cap)
096-1981-1	Same as 096-1981, but without window (for condensing humidity applications).
096-2170	S.S. Sensor Housing-1-1/4" NPT (with window - does not include end cap)
096-2213	S.S. Sensor Housing-1-1/4" NPT w/o window (for condensing humidity applications)
073-0165	S.S. End Cap
073-0210	S.S. End Cap (Rock Solid)
096-2249	Power Supply Board (MB) (w/o relays)
096-2202	Junction-Box (w/ 3/4" NPT bottom) & Blind Cover
096-2203	Junction-Box P.C.B. Assembly
096-2204	Junction-Box Assembly (1-1/4" Fitting w/ 50 Ft. cable)
096-1987-1	Standard 4-20 Spare Transmitter Assy. (3 board transmitter stack)
096-1987-3	Relay equipped Spare Transmitter Assy. (3 board transmitter stack)
096-1942-3	Power Supply Board w/ Relays
096-1942-1	Power Supply Board without Relays
096-1941-1	CPU Board
096-1940	Display Board
096-2104	Dust Filter (H2S & CO only) (Bag of Qty. 10)
096-2141	H_2S Filter for HCN, NH_3 & Hydride Sensors (Bag of Qty. 5)
096-2146	(5) Condensing Humidity Membranes (for end caps 096-2142 & 096-2276)

1/4 Turn Calibration Accessories

Part #	Description
074-0305	¼ Turn (Teflon) Rain Shield
096-2101	¼ Turn Calibration Plug Assembly (w/(1) ¼" NPT x 3/16" O.D. Barb Fitting)
096-2102	¼ Turn Flowcell Assembly (w/(2) 1/8" NPT x 3/16 O.D." Barb Fitting)
096-2105	¼ Turn Sensor End Cap Assembly
096-2140	¼ Turn Hydride Sensor End Cap Assembly w/ IPA Filter (096-2916)
096-2142	Condensing Humidity End Cap
096-2273	¼ Turn Sensor End Cap Assembly (Rock Solid)
096-2276	Condensing Humidity End Cap (Rock Solid)
096-2352	¼ Turn Methyl Mercaptan Sensor (4645) End Cap Assembly w/ Hydrogen Sulfide Getter Filter (096-2323)
096-2387	¼ Turn Phosgene Sensor (4650) End Cap Assembly w/ Hydrogen Cyanide Getter Filter (096-2386)

Spare Parts - Sensors

Traditional Sensors

Call 800-247-7257 or Your Local Sales Representative

Ammonia (NH_3)
Model 85
8-Digit Prefix...Suffix
#096-1965.....(-XXXX)
50 PPM.....-0050
100 PPM.....-0100*
150 PPM.....-0150
250 PPM.....-0250
300 PPM.....-0300
500 PPM.....-0500

Arsine (AsH_3)
Model 65
8-Digit Prefix...Suffix
#096-1953.....(-XXXX)
1000 PPB.....-1000*
3 PPM.....-0003
10 PPM.....-0010

Bromine (Br_2)
Model 61
8-Digit Prefix...Suffix
#096-1949.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
25 PPM.....-0025
30 PPM.....-0030
50 PPM.....-0050
100 PPM.....-0100

Carbon Monoxide (CO)
Model 82
8-Digit Prefix...Suffix
#096-1962.....(-XXXX)
50 PPM.....-0050
100 PPM.....-0100*
150 PPM.....-0150
200 PPM.....-0200
250 PPM.....-0250
300 PPM.....-0300
500 PPM.....-0500
1000 PPM.....-1000

Chlorine Oxidant (Cl_2)
Model 520X
8-Digit Prefix...Suffix
#096-2003.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010

Chlorine (Cl_2)
Model 52
8-Digit Prefix...Suffix
#096-1945.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010
15 PPM.....-0015
25 PPM.....-0025
30 PPM.....-0030
50 PPM.....-0050
100 PPM.....-0100
200 PPM.....-0200

Chlorine (Cl_2)
(<35% R-H)
Model 56
8-Digit Prefix...Suffix
#096-2257.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010
15 PPM.....-0015
25 PPM.....-0025
30 PPM.....-0030
50 PPM.....-0050
100 PPM.....-0100
200 PPM.....-0200

Chlorine Dioxide (ClO_2)
Model 53
8-Digit Prefix...Suffix
#096-1946.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
25 PPM.....-0025
30 PPM.....-0030
50 PPM.....-0050
100 PPM.....-0100

Diborane (B_2H_6)
Model 67
8-Digit Prefix...Suffix
#096-1955.....(-XXXX)
1000 PPB.....-1000*
2 PPM.....-0002
10 PPM.....-0010

Ethylene Oxide (ETO)
Model 15
8-Digit Prefix...Suffix
#096-2905.....(-XXXX)
10 PPM.....-0010

Fluorine (F_2)
Model 62
8-Digit Prefix...Suffix
#096-1950.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
25 PPM.....-0025
30 PPM.....-0030
50 PPM.....-0050
100 PPM.....-0100

Germane (GeH_4)
Model 69
8-Digit Prefix...Suffix
#096-1957.....(-XXXX)
1000 PPB.....-1000*
3 PPM.....-0003
10 PPM.....-0010

Hydrogen (H_2)
Low Humidity
Model 87
8-Digit Prefix...Suffix
#096-1967.....(-XXXX)
1 %.....-0001
4 %.....-0004*
5 %.....-0005
10 %.....-0010

Hydrogen (H_2)
High Humidity
Model 52
8-Digit Prefix...Suffix
#096-2712.....(-XXXX)
1 %.....-0001
4 %.....-0004*
5 %.....-0005
10 %.....-0010

Hydrogen Chloride (HCl)
Lo Humidity (<50 %)
Model 54
8-Digit Prefix...Suffix
#096-1947.....(-XXXX)
10 PPM.....-0010
25 PPM.....-0025*
50 PPM.....-0050
100 PPM.....-0100

Hydrogen Chloride (HCl)
Hi Humidity (>50 %)
Model 71
8-Digit Prefix...Suffix
#096-1958.....(-XXXX)
10 PPM.....-0010
25 PPM.....-0025*
50 PPM.....-0050
100 PPM.....-0100

Hydrogen Cyanide (HCN)
Model 64
8-Digit Prefix...Suffix
#096-1952.....(-XXXX)
10 PPM.....-0010*
25 PPM.....-0025
30 PPM.....-0030
50 PPM.....-0050
100 PPM.....-0100

Hydrogen Cyanide (HCN)
Low %RH
Model 16
8-Digit Prefix...Suffix
#096-2871.....(-XXXX)
10 PPM.....-0010*
25 PPM.....-0025
30 PPM.....-0030
50 PPM.....-0050
100 PPM.....-0100

Hydrogen Fluoride (HF)
Model 63
8-Digit Prefix...Suffix
#096-1951.....(-XXXX)
10 PPM.....-0010*
15 PPM.....-0015
25 PPM.....-0025
50 PPM.....-0050
100 PPM.....-0100

Hydrogen Fluoride (HF)
Hi % RH (>75 %)
Model 70
8-Digit Prefix...Suffix
#096-2185.....(-XXXX)
10 PPM.....-0010*
15 PPM.....-0015
25 PPM.....-0025
50 PPM.....-0050
100 PPM.....-0100

Hydrogen Selenide (H_2Se)
Model 89
8-Digit Prefix...Suffix
#096-1968.....(-XXXX)
1000 PPB.....-1000*
10 PPM.....-0010

Traditional Sensors continued:

Call 800-247-7257 or Your Local Sales Representative

Hydrogen Sulfide (H2S)
Hi Humidity (>50 %)
Model 81
8-Digit Prefix...Suffix
#096-1961.....(-XXXX)
10 PPM.....-0010
25 PPM.....-0025
50 PPM.....-0050*
100 PPM.....-0100
200 PPM.....-0200

Hydrogen Sulfide (H2S)
Lo Humidity (<50 %)
Model 72
8-Digit Prefix...Suffix
#096-1959.....(-XXXX)
10 PPM.....-0010
25 PPM.....-0025
50 PPM.....-0050*
100 PPM.....-0100
200 PPM.....-0200

Hydrogen Sulfide (H2S)
w/ Low Methanol Sensitivity
Model 21
8-Digit Prefix...Suffix
#096-2751.....(-XXXX)
25 PPM.....-0025
50 PPM.....-0050
100 PPM.....-0100
200 PPM.....-0200

Methanol (CH3OH)
Model 59
8-Digit Prefix...Suffix
#096-2148.....(-XXXX)
500 PPM.....-0500

Methyl Hydrazine (MMH)
Model 35
8-Digit Prefix...Suffix
#096-2423.....(-XXXX)
50 PPM.....-0050

Methyl Iodide (CH3 I)
Model 44
8-Digit Prefix...Suffix
#096-2188.....(-XXXX)
25 PPM.....-0025

Methylene Chloride (CH2 Cl2)
Model 34P
8-Digit Prefix...Suffix
#096-2189.....(-XXXX)
200 PPM.....-0200

Methyl Mercaptan (CH3SH)
Model 46
8-Digit Prefix...Suffix
#096-2348.....(-XXXX)
3 PPM.....-0003

Model 45 (w/ Getter)
#096-2348.....(-XXXX)
5 PPM.....-0005

Nitric Oxide (NO)
Model 86
8-Digit Prefix..Suffix
#096-1966.....(-XXXX)
25 PPM.....-0025
50 PPM.....-0050*
100 PPM.....-0100
500 PPM .....-0500

Nitrogen Dioxide (NO2)
Model 84
8-Digit Prefix..Suffix
#096-1964.....(-XXXX)
10 PPM.....-0010*
25 PPM.....-0025
50 PPM.....-0050
100 PPM.....-0100
250 PPM .....-0250

Nitrogen Trifluoride (NF3)
Model 33P
8-Digit Prefix..Suffix
#096-2099.....(-XXXX)
10 PPM.....-0010
20 PPM.....-0020

Ozone (O3)
Model 60
8-Digit Prefix..Suffix
#096-1948.....(-XXXX)
1 PPM.....-0001*
2 PPM.....-0002
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
25 PPM.....-0025
30 PPM.....-0030
50 PPM.....-0050
100 PPM.....-0100

Oxygen (O2)
Model 80
8-Digit Prefix...Suffix
#096-1960.....(-XXXX)
10 %.....-0010
25 %.....-0025*

Phosgene (COCl2)
Model 49
8-Digit Prefix..Suffix
#096-2235.....(-XXXX)
1 PPM.....-0001

Model 50 (w/ Getter)
8-Digit Prefix..Suffix
#096-2235.....(-XXXX)
2 PPM.....-0002

Phosphine (PH3)
Model 66
8-Digit Prefix..Suffix
#096-1954.....(-XXXX)
1000 PPB.....-1000*
3 PPM.....-0003
10 PPM.....-0010

Silane (SiH_4)
Model 68
8-Digit Prefix..Suffix
#096-1956.....(-XXXX)
1000 PPB.....-1000*
10 PPM.....-0010
25 PPM.....-0025

Sulfur Dioxide (SO_2)
High % RH
Model 83
8-Digit Prefix..Suffix
#096-1963.....(-XXXX)
10 PPM.....-0010*
15 PPM.....-0015
25 PPM.....-0025
50 PPM.....-0050
100 PPM.....-0100
200 PPM.....-0200
500 PPM.....-0500

Sulfur Dioxide (SO_2)
Low %R-H
Model 75
8-Digit Prefix..Suffix
#096-2359.....(-XXXX)
10 PPM.....-0010*
15 PPM.....-0015
25 PPM.....-0025
50 PPM.....-0050
100 PPM.....-0100
200 PPM.....-0200
500 PPM.....-0500

Tetraethoxysilane (TEOS)
Model 58
8-Digit Prefix..Suffix
#096-2381.....(-XXXX)
50 PPM.....-0050

Vinyl Chloride Monomer (VCM)
Model 73
#096-2404 (20 PPM)

Spare Parts - Sensors

Rock Solid Sensors

Call 800-247-7257 or Your Local Sales Representative

R.S. Arsine (AsH_3)
Low Humidity
Model 36
8-Digit Prefix...Suffix
#096-2457.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005
500 PPB.....-0500*

R.S.Boron Trichloride (BCl_3) Low Humidity
Model 26
8-Digit Prefix...Suffix
#096-2634.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010

R.S. Chlorine (CI_2)
Low Humidity
Model 22
8-Digit Prefix...Suffix
#096-2247.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S.Diborane (B_2H_6) Low Humidity
Model 42
8-Digit Prefix...Suffix
#096-2463.....(-XXXX)
1 PPM.....-0001*
2 PPM.....-0002
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
500 PPB.....-0500

R.S. Arsine (AsH_3)
High Humidity
Model 37
8-Digit Prefix...Suffix
#096-2458.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005
500 PPB.....-0500*

R.S.Boron Trichloride (BCl_3) High Humidity
Model 27
8-Digit Prefix...Suffix
#096-2635.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010

R.S. Chlorine (CI_2)
High Humidity
Model 24
8-Digit Prefix...Suffix
#096-2295.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S.Diborane (B_2H_6) High Humidity
Model 43
8-Digit Prefix...Suffix
#096-2464.....(-XXXX)
1 PPM.....-0001*
2 PPM.....-0002
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
500 PPB.....-0500

R.S. Bromine (Br_2)
Low Humidity
Model 98
8-Digit Prefix...Suffix
#096-2366.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S.Boron Trifluoride (BF_3) Low Humidity
Model 28
8-Digit Prefix...Suffix
#096-2636.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010

R.S. Chlorine Dioxide (CIO_2) Low Humidity
Model 57
8-Digit Prefix...Suffix
#096-2283.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S.Fluorine (F_2)
Low Humidity
Model 17
8-Digit Prefix...Suffix
#096-2846.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S. Bromine (Br_2)
High Humidity
Model 99
8-Digit Prefix...Suffix
#096-2367.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S.Boron Trifluoride (BF_3) High Humidity
Model 29
8-Digit Prefix...Suffix
#096-2637.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010

R.S. Chlorine Dioxide (CIO_2) High Humidity
Model 78
8-Digit Prefix...Suffix
#096-2315.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S.Fluorine (F_2)
High Humidity
Model 18
8-Digit Prefix...Suffix
#096-2847.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

Rock Solid Sensors continued:

Call 800-247-7257 or Your Local Sales Representative

R.S. Hydrogen Bromide (HBr) Low Humidity
Model 94
8-Digit Prefix...Suffix
#096-2334.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S. Hydrogen Bromide (HBr) High Humidity
Model 95
8-Digit Prefix...Suffix
#096-2335.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010
15 PMM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S. Hydrogen Chloride (HCl) Low Humidity
Model 92
8-Digit Prefix...Suffix
#096-2332.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025*
30 PPM.....-0030

R.S. Hydrogen Chloride (HCl) High Humidity
Model 93
8-Digit Prefix...Suffix
#096-2333.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025*
30 PPM.....-0030

R.S.Hydrogen Cyanide (HCN) Low Humidity
Model 20
8-Digit Prefix...Suffix
#096-2724.....(-XXXX)
1 PPM.....-0001
2 PPM.....-0002
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010*

R.S.Hydrogen Cyanide (HCN) High Humidity
Model 19
8-Digit Prefix...Suffix
#096-2785.....(-XXXX)
1 PPM.....-0001
2 PPM.....-0002
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010*

R.S.Hydrogen Fluoride (HF) Low Humidity
Model 90
8-Digit Prefix...Suffix
#096-2330.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S.Hydrogen Fluoride (HF) High Humidity
Model 91
8-Digit Prefix...Suffix
#096-2331.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005*
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S.Ozone (O_3) Low Humidity
Model 76
8-Digit Prefix...Suffix
#096-2377.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S.Ozone (O_3) High Humidity
Model 77
8-Digit Prefix...Suffix
#096-2378.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S. Phosphine (PH_3) Low Humidity
Model 38
8-Digit Prefix...Suffix
#096-2459.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005
500 PPB.....-0500*

R.S. Phosphine (PH_3) High Humidity
Model 39
8-Digit Prefix...Suffix
#096-2460.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005
500 PPB.....-0500*

R.S. Sulfur Dioxide (SO_2) Low Humidity
Model 96
8-Digit Prefix...Suffix
#096-2336.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010*
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S. Sulfur Dioxide (SO_2) High Humidity
Model 97
8-Digit Prefix...Suffix
#096-2337.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003
5 PPM.....-0005
10 PPM.....-0010*
15 PPM.....-0015
20 PPM.....-0020
25 PPM.....-0025
30 PPM.....-0030

R.S.Silicon Tetrafluoride (SiF_4) Low Humidity
Model 30
8-Digit Prefix...Suffix
#096-2638.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003*
5 PPM.....-0005

R.S.Silicon Tetrafluoride (SiF_4) High Humidity
Model 32
8-Digit Prefix...Suffix
#096-2639.....(-XXXX)
1 PPM.....-0001
3 PPM.....-0003*
5 PPM.....-0005

R.S.Tungsten Hexafluoride (WF_6), Low Humidity
Model 23
8-Digit Prefix...Suffix
#096-2632.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005

R.S.Tungsten Hexafluoride (WF_6), High Humidity
Model 25
8-Digit Prefix...Suffix
#096-2633.....(-XXXX)
1 PPM.....-0001*
3 PPM.....-0003
5 PPM.....-0005

Appendix 1

Relay Operation and Configuration

Summary

The 4600 and 4688-IR offer multiple relay configurations. Although this provides customers with a lot of flexibility, it has also caused some confusion. This tech tip defines and explains these configurations.

Position

Position describes the relay's state when it is inactivated. Normally open (NO) relays represent a break in the circuit; the circuit is completed when the relay is activated. In contrast, with a normally closed (NC) relay the circuit is broken when the relay is activated. Note that a relay's position (open or closed) is independent of its activation mechanism (energized or de-energized).

Normally Open *Normally Closed*

The 4600 and the 4688-IR can operate in either NO or NC configurations.

Activation Mechanism

Activation mechanism describes how the relay is activated (i.e., by removing power to the coil or by powering the coil). The coil of a normally energized relay (also called a fail-safe relay) is powered in the inactivated state; activation removes power to the coil. In contrast, the coil of a normally de-energized relay (also called a non-fail-safe relay) is not powered in the inactivated state. A normally energized, normally-closed relay provides a high level of security by opening either when it is activated or when the instrument loses power. The 4600 and 4688-IR allow users to choose an activation method for each relay.

Reset Mode

The reset mode describes how a relay is reset. A non-latching relay automatically resets itself when the condition that caused its activation ends. In contrast, a latching relay requires some form of operator acknowledgment before it can be reset. The 4600 and 4688-IR allow users to choose a reset mode for each alarm relay.

Single and Double Pole

The number of poles refers to the number of contacts available from a single relay. Single-pole (SP) relays provide 1 contact, while double-pole (DP) relays provide 2 contacts (that operate identically).

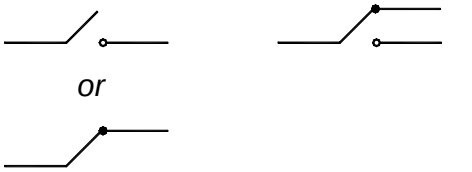
Single Pole *Double Pole*

The 4600 and 4688-IR relays are all single pole (note that the high alarm on the 5300 is a double-pole relay).

Single and Double Throw

The number of throws refers to the number of contact positions available. The contacts on single-throw (ST) relays operate in normally open mode or normally closed mode, but not both. The contacts on double-throw (DT) relays operate in both normally open and normally closed modes. Note that a single-throw relay only requires 2 terminal block positions (common and NC or NO output) whereas a double-throw relay requires 3 terminal block positions (common, NC output, NO output).

Single Throw *Double Throw*



Although the 4600 and 4688-IR relays are double-throw, only 2 positions are available on the terminal block (due to space limitations). Thus the relays are effectively single-throw, and must be ordered in NO or NC configuration.

Summary of 4600 and 4688-IR Features

The 4600 and 4688-IR provide 2 SPST alarm relays and 1 SPST fail relay. The relays can be either NO or NC; however, the position must be specified when the instrument is ordered. All relays can be set normally energized or normally de-energized at the instrument, and the relays can be set latching or non-latching.