BACHARACH
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GDC•350

Instruction 5909-9000
Operation Manual

Rev. 1 - January 2012

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PURCHASED FROM: ______________________

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NOTICES

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1. OVERVIEW

1.1. General Description

The GDC-350 is an economical, self-contained gas detector for non-hazardous (non-explosion rated) commercial applications. It is available in two basic configurations: single-sensor models and dual-sensor models. The sensors can be configured as one of the following:

- one on-board (A type)
- one remote (B type)
- one on-board <u>and</u> one remote (D type)
- two on-board (E type).

A basic system provides LEDs to indicate Power, Fail, Low (Warning) Gas Alarm, and High Gas Alarm. Also included are an integral audible alarm with door-mounted silence push-button, audible time delay, field-settable relay time delays and two alarm relays.

Gas-specific electrochemical sensors for toxic gases and oxygen are available while MOS solid-state sensors for combustible gases, TVOCs, and refrigerants are also available. All GDC-350 on-board sensors are packaged as plug-in “smart” sensor modules to reduce field maintenance time.

1.2. Key Exterior Components

Figure 1-1. Standard GDC-350 Components

NOTE: Photos of the GDC-350 in this manual may show the optional LED digital display and/or the optional splash guard.

Figure 1-2. Water Tight GDC-350 Components

1.3. Key Interior Components

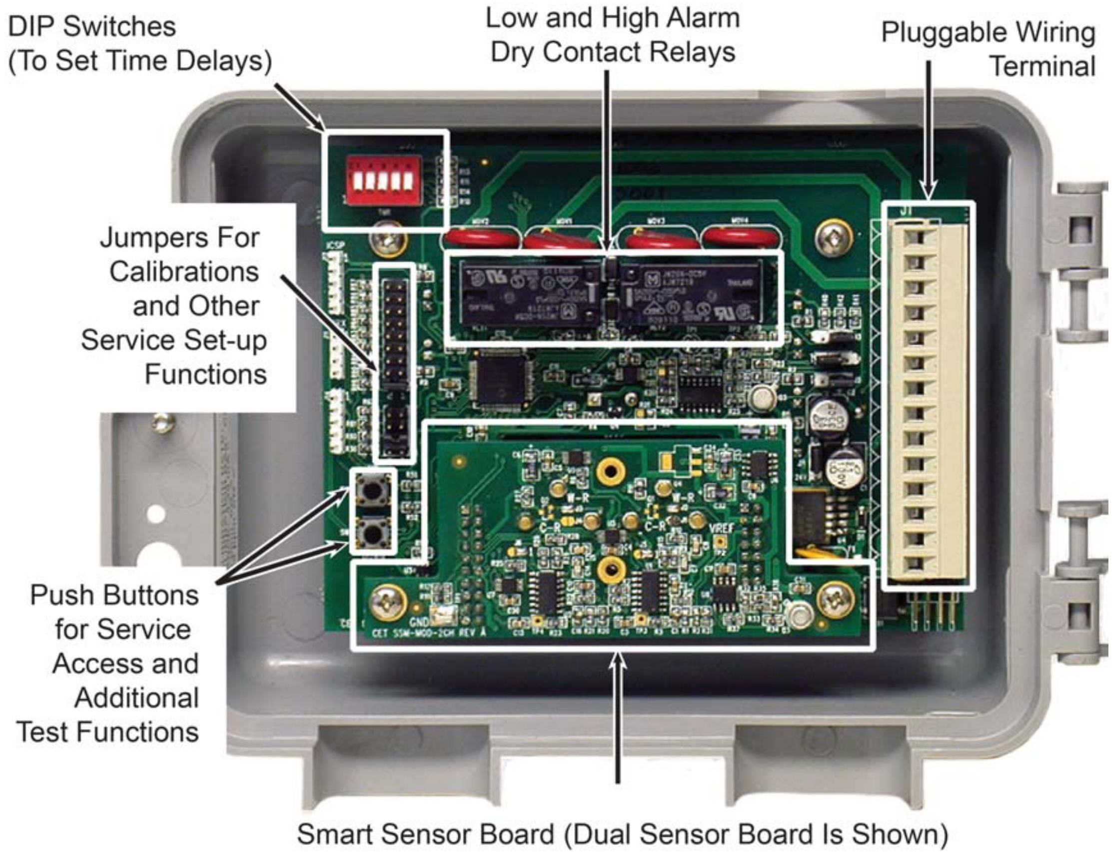


Figure 1-3. Interior Components of the GDC-350

1.4. Sensor Aging and Calibration Extending Firmware (CEF)

GDC-350 systems with on-board electrochemical sensors have been programmed with our CEF (Calibration Extending Firmware). This firmware takes into consideration the aging of the electrochemical CO, NO and NO_2 sensors so that less frequent calibrations are acceptable in non-critical applications such as parking garages. The system tracks the age of the sensor and automatically compensates for the degraded output of the sensor as it ages.

2. SPECIFICATIONS

2.1. Controller Specifications

Categories/Subcategories		Descriptions	
Enclosure	**Type**	Standard (NEMA 1X)	Water Tight (NEMA 4X)
	Dimensions H x W x D	5.25 x 6.75 x 2.63 (in) 133 x 172 x 67 (mm)	5.13 x 7.13 x 4.00 (in) 130 x 181 x 102 (mm)
	Weight	1.2 lbs (0.6 kg)	1.4 lbs (0.7 kg)
	Construction	Polycarbonate with hinged, secured door (drip resistant)	Polycarbonate with hinged, secured door (water tight)
Wiring	**Power**	24 V (nominal), DC or AC (50/60 Hz)	
	Remote Sensor	500’ maximum distance between controller and remote sensor using minimum 18 gauge wire	
User Interface	**Display**	Common set of LED indicators (4) for: Power, Fail, Low (Warning) Gas Alarm, High Gas Alarm Sensor indicators (2) for: Sensor 1, Sensor 2 4-digit 8-segment LED digital display (optional)	
	Audio	Integral alarm rated 80 dB @ 10’	
	Buttons	Push-button to silence audible alarm	
	Relays	Two DPDT dry-contact relays (rated 5 A @ 240 VAC)[1]	
Control Settings[2] (DIP Switch)	**Relays**	Low Gas Alarm “On” Delay (on “make”) 5 min Low Gas Alarm “Off” Delay[3] (on “break”) 10 min High Gas Alarm “On” Delay (on “make”) 5 min	
	Audio	Audible Alarm “On” Delay (on “make”) 5 min Audible Alarm Feature (on/off)	
Environ-mental	**Temperature**	0° to 40° C (32° to 104° F)	
	Humidity	0 to 95% RH non-condensing	

[1] System is configured such that all relays are “FAIL SAFE” (relay coils are always energized in non-alarm state). Relays are “common” to both channels (activated by either channel).

[2] May be set by user

[3] Also known as “minimum run time”

Figure 2-1. Standard Enclosure Dimensions

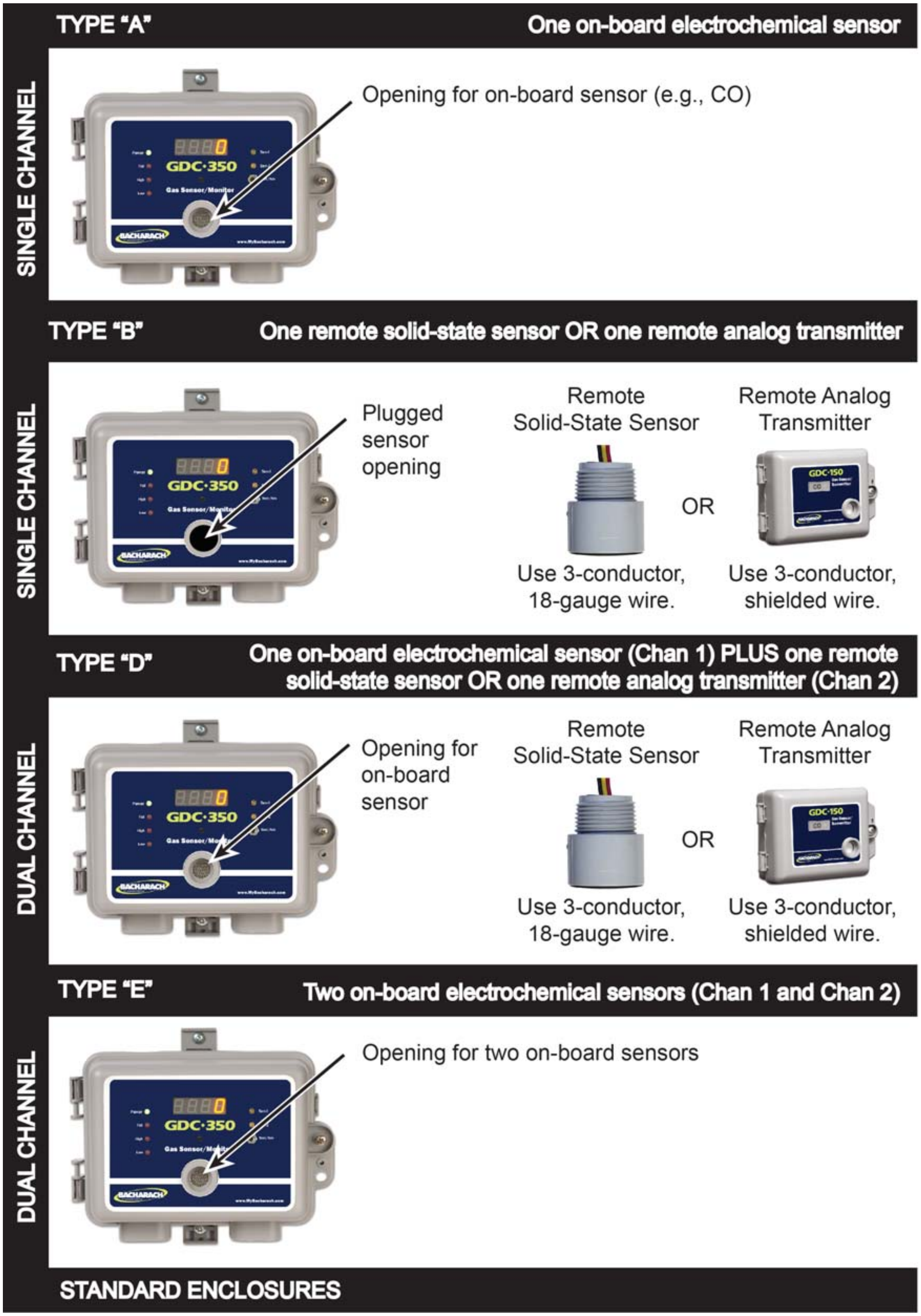
Figure 2-2. Water-Tight Enclosure Dimensions

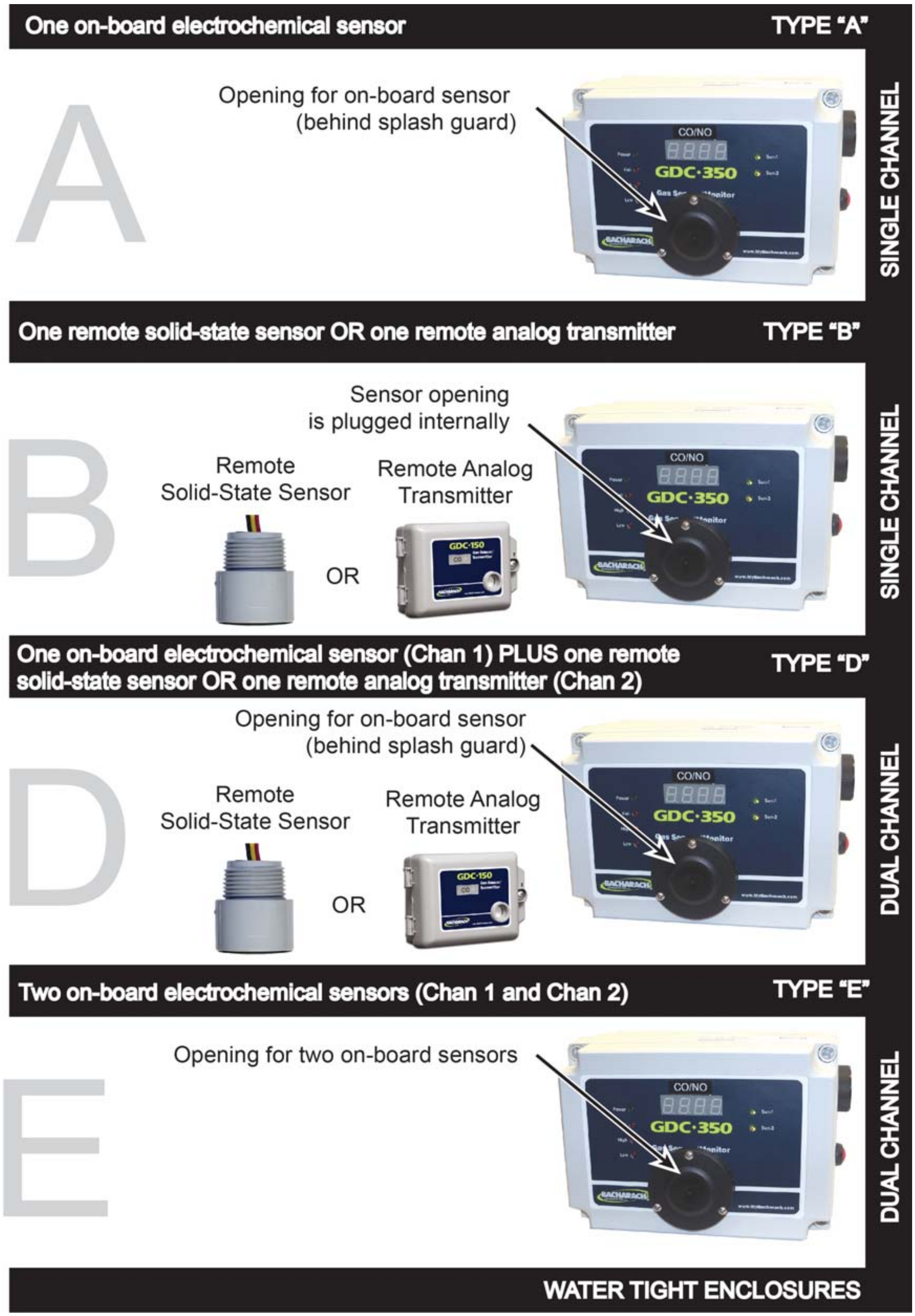
2.2. Sensor Specifications

Categories/Subcategories		Descriptions
On-Board Sensors	**Electrochemical**[1] **(Gas Specific)**	Response: <30 seconds to 90% of signal response Temp Range: 0° C to +50° C (operating) Repeatability: ±10% of set point Life Span: 2 to 3 years in air (under normal conditions) Gases: CO, NO, NO_2, SO_2 (gas-specific)
	Temperature	Range: -20° to 40° C (-4° to 104° F)
Remote Sensors	**Solid-state Combustibles (Non-specific)**	Response: <35 seconds to 90% of signal response Temp Range: 0° C to +40° C (operating) Repeatability: ±10% of set point Life Span: 5+ years in air (under normal conditions) Gases: E.g., Propane (C_3H_8), gasoline vapors, methane (CH_4) (non-specific combustibles)
	Solid-state Refrigerants (Non-specific)	Response: <120 seconds to 90% of signal response Temp Range: 0° C to +40° C (operating) Long Term Drift: < 5% signal loss / month at ambient temperatures Repeatability: ±10% of set point Life Span: 4-5+ years in air Typical Refrigerant Gas Sensors Available: R11, R12, R22, R123, R134A, R404A, R407C, R410A, R422A, R422D, R438A, and R507
	Analog transmitter[2]	4-20 mA signal

1 All integral electrochemical gas sensors are packaged as “Smart” sensor modules.
2 Supports any 4-20 mA analog transmitter manufactured by Bacharach.

2.3. Model Designations




One on-board electrochemical sensor
TYPE "A"
A
Opening for on-board sensor (behind splash guard)
CO/NO
GDC·350
SINGLE CHANNEL
One remote solid-state sensor OR one remote analog transmitter
TYPE "B"
B
Sensor opening is plugged internally
Remote Solid-State Sensor
OR
Remote Analog Transmitter
GDC-150
CO/NO
GDC·350
SINGLE CHANNEL
One on-board electrochemical sensor (Chan 1) PLUS one remote solid-state sensor OR one remote analog transmitter (Chan 2)
TYPE "D"
D
Opening for on-board sensor (behind splash guard)
Remote Solid-State Sensor
OR
Remote Analog Transmitter
GDC-150
CO/NO
GDC·350
DUAL CHANNEL
Two on-board electrochemical sensors (Chan 1 and Chan 2)
TYPE "E"
E
Opening for two on-board sensors
CO/NO
GDC·350
DUAL CHANNEL
WATER TIGHT ENCLOSURES

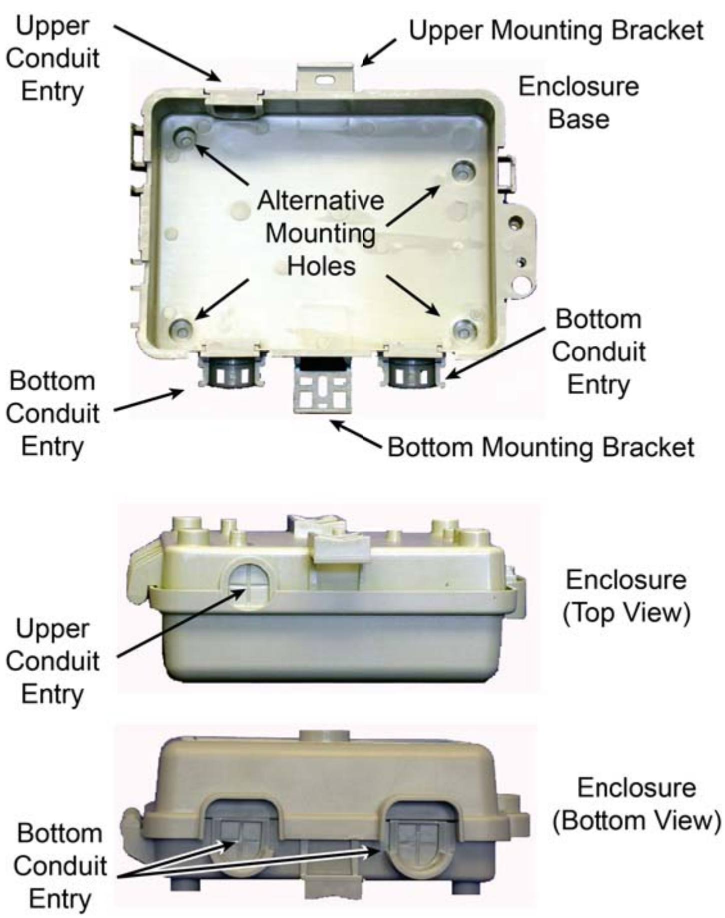
3. INSTALLATION

3.1. Sensor Mounting Heights

Gas	Applications / Types	Suggested Mountings
Carbon Monoxide	Gas engine exhaust	4' to 6' from the floor
Nitric Oxide	Diesel engine exhaust applications	4' to 6' from the floor
Nitrogen Dioxide	Diesel engine exhaust applications	4' to 6' from the floor
Sulfur Dioxide	All	6" from the floor or near likely spot for leakage
Refrigerants	All	6" from the floor or near likely spot for leakage
Combustibles	Propane	6" from the floor or near likely spot for leakage
Combustibles	Methane	On/near ceiling (within 12")
Combustibles	Hydrogen	On/near ceiling (within 12")

NOTE: Bacharach considers 4 to 6 feet from the floor as the "breathing zone" when it applies to sensors installed for vehicle exhaust applications.

3.2. Basic Enclosure



There are two exterior mounting brackets (one at the top and one at the bottom of the base of the enclosure). These may be used to mount the enclosure.

Alternatively, there are four corner mounting holes in the enclosure. Remove the screw securing the hinged door. Locate the four 3/16" diameter mounting holes located inside the system enclosure base. Secure the system to any flat surface through these mounting holes.

Figure 3-1. Basic Enclosure Mounting Components

3.3. Remote Sensor Housing for Solid-State Sensors

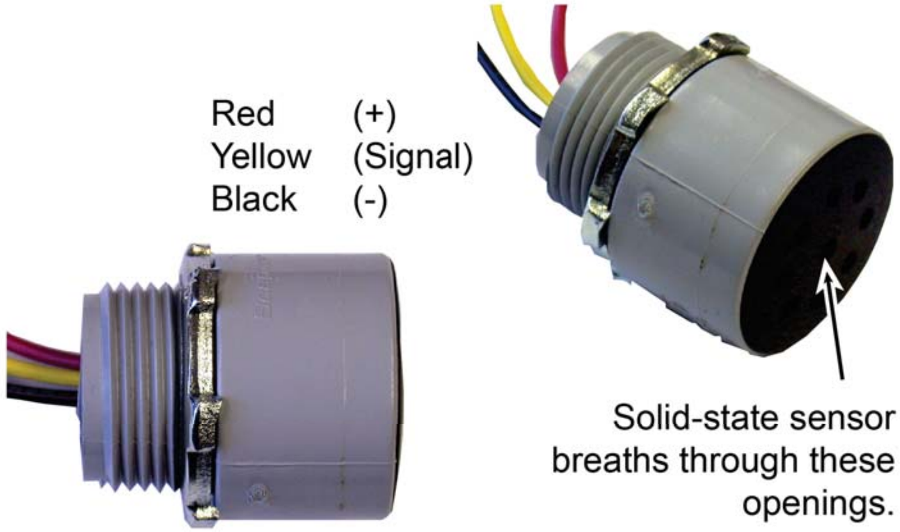


Figure 3-2. Remote Sensor Housing

3.4. Detailed Wiring Connections (Types A, B, and D)

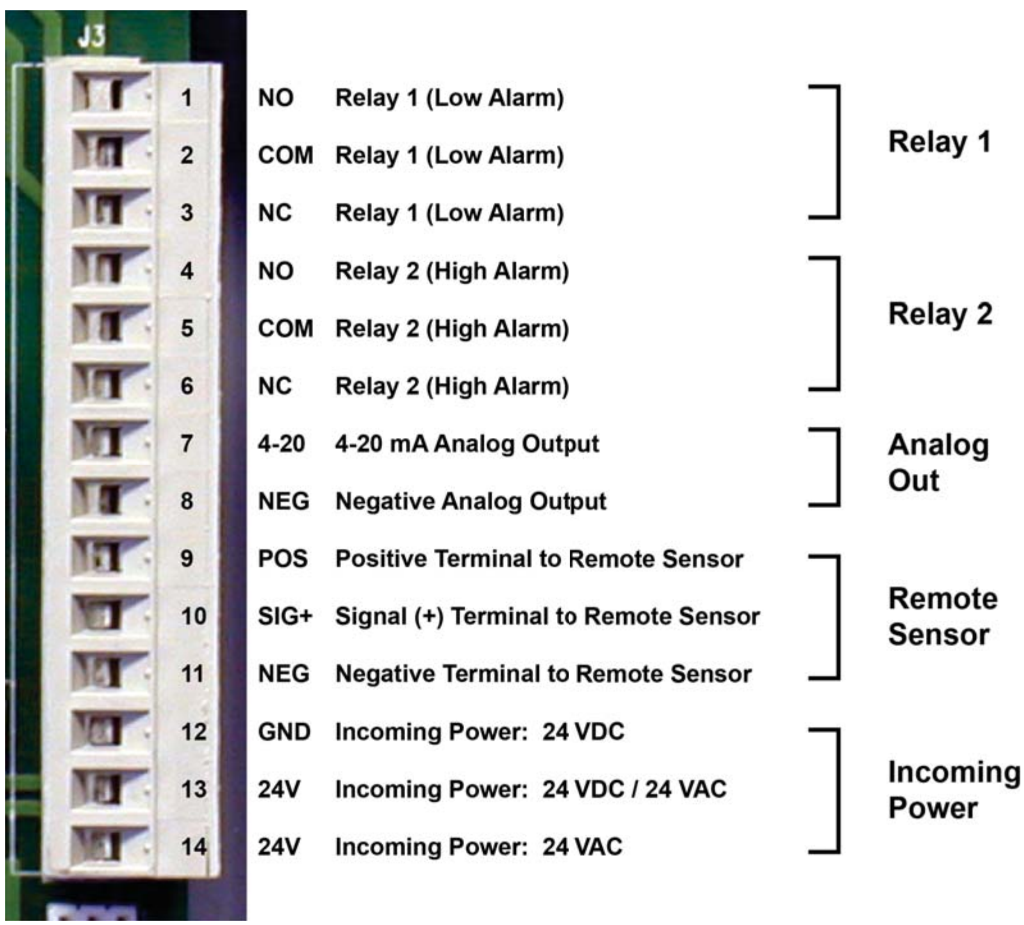
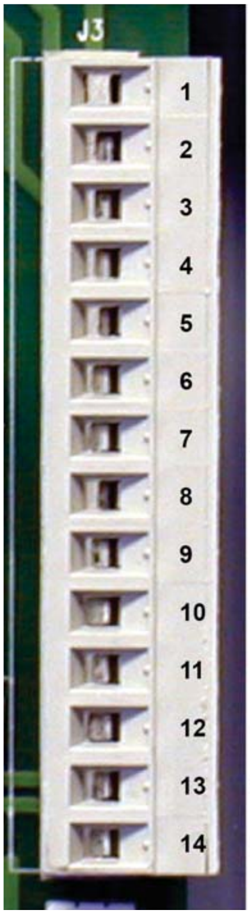


Figure 3-3. Wiring Connections for GDC-350 Types A, B, and D

3.5. Detailed Wiring Connections (Type E)



1	NO	Relay 1 (Low Alarm)	Relay 1
2	COM	Relay 1 (Low Alarm)	Relay 1
3	NC	Relay 1 (Low Alarm)	Relay 1
4	NO	Relay 2 (High Alarm)	Relay 2
5	COM	Relay 2 (High Alarm)	Relay 2
6	NC	Relay 2 (High Alarm)	Relay 2
7	4-20	4-20 mA Analog Output, Channel 1	Analog Out Ch 1
8	NEG	Negative Analog Output, Channel 1	Analog Out Ch 1
9	POS	Not Used	
10	SIG+	4-20 mA Analog Output, Channel 2	Analog Out Ch 2
11	NEG	Negative Analog Output, Channel 2	Analog Out Ch 2
12	GND	Incoming Power: 24 VDC	Incoming Power
13	24V	Incoming Power: 24 VDC / 24 VAC	Incoming Power
14	24V	Incoming Power: 24 VAC	Incoming Power

Figure 3-4. Wiring Connections for GDC-350 Type E

3.6. Wiring the GDC-350 for Power

Drill out one or more of the PVC conduit entry hole plugs located at bottom left or right or top left edge of system enclosure base. If supplying VAC operational power, pull two wires suitable for low voltage from power source to the terminals 13 and 14. If supplying VDC, wire to terminals 12 and 13 observing polarity.

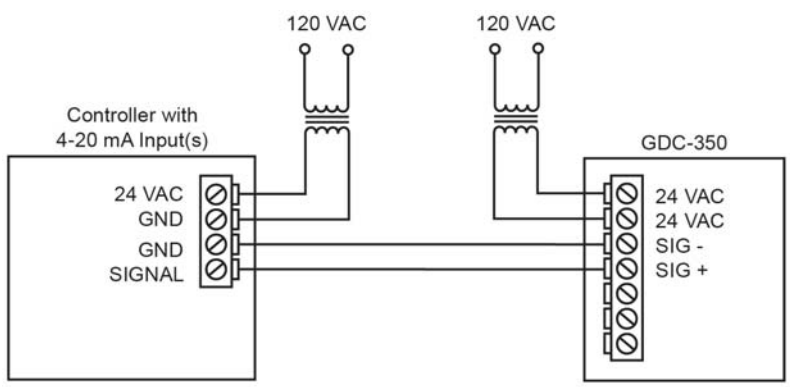


Figure 3-5. Proper Wiring Examples

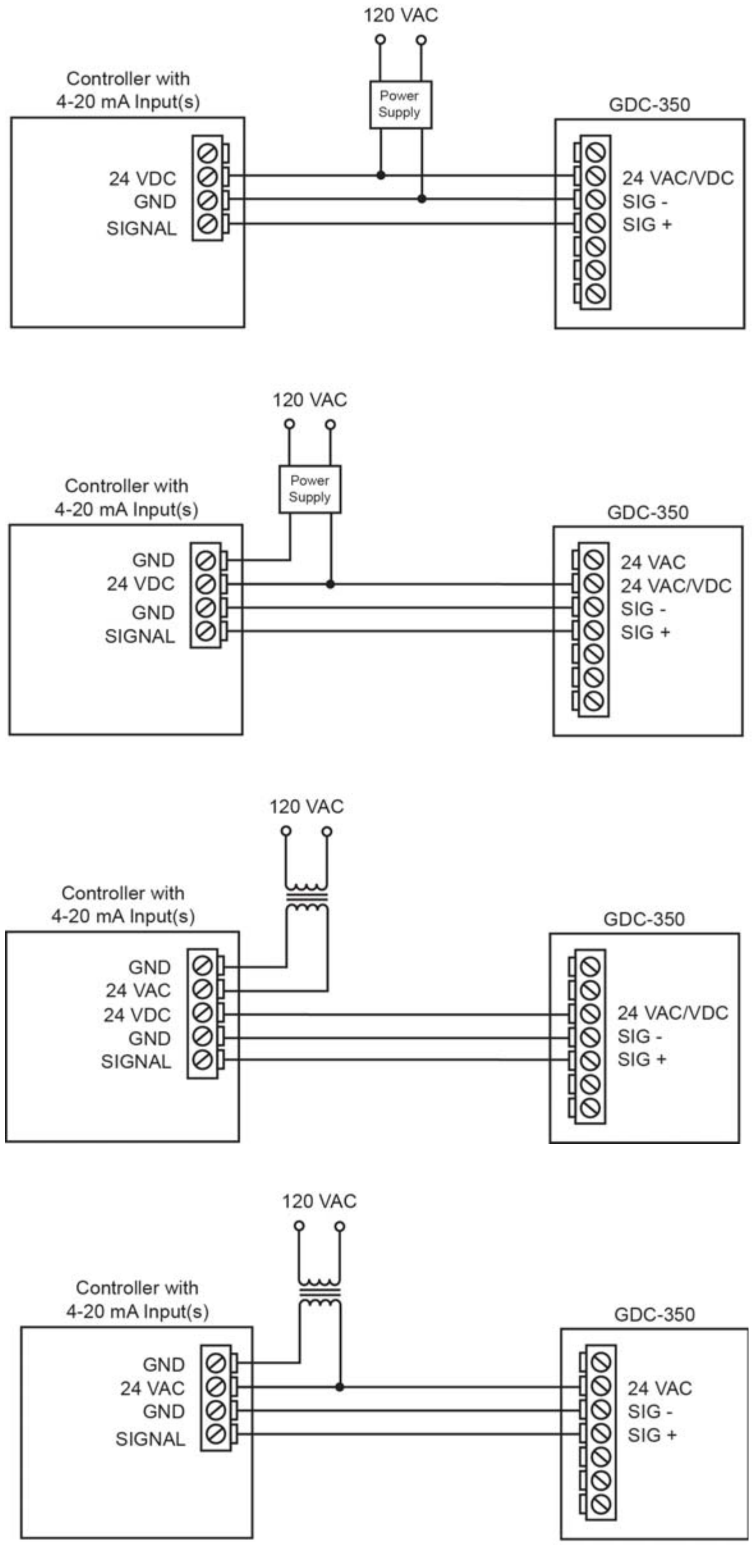


Figure 3-5. Proper Wiring Examples (Continued)

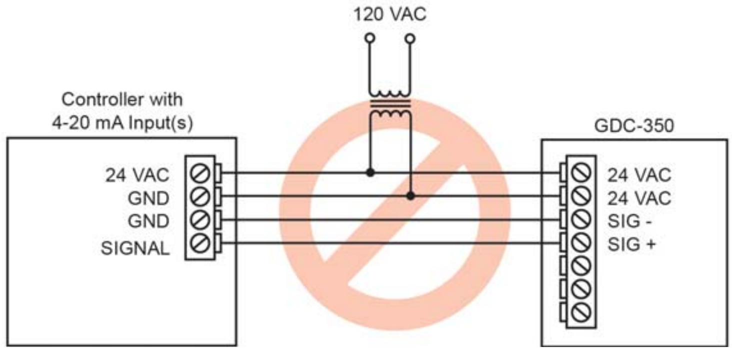


Figure 3-6. Improper Wiring Example

3.7. Wiring Remote Sensors (Voltage and Signal)

Three (3) conductor, 16 to 18 gauge, stranded wire is required between the control panel and the remote solid-state sensor. Under most local electrical codes, low voltage wires cannot not be run within the same conduit as line voltage wires. 3-conductor, 16 to 18-gauge wire/cable must be shielded when connecting to a remote analog transmitter. The remote analog transmitter enclosures have several conduit entry locations (general purpose enclosure).

NOTE: DO NOT use solid-core wire for connection to wiring terminal strip. Any damage caused by using solid-core wire will void warranty. Use stranded wire ONLY.

The voltage supplied by the controller to remote solid-state sensors should measure approximately 5.0 VDC ±2%, at the remote sensor. Voltage supplied by the controller to remote analog transmitters should measure approximately 24 VDC nominal. This voltage is factory set at time of manufacturing. If these voltages are not attained after installation, the wrong gauge wire may have been used or the wiring run is too long. The maximum distance between the GDC-350 and the remote sensor is 500 feet.

The remote solid-state sensor housing has a 3/4" conduit thread and nut to allow installation in any standard electrical junction box (to be supplied by the installer). Connect three low voltage wires between it and the controller and observe polarity.

3.8. Wiring Relay Connections

System relays are dry contacts and designed to operate fan starters or coils to control equipment that draws more than 5 amps start-up and/or operational current. The system does not provide any power from these terminals. Dry contacts operate like a switch to simply activate (switch on) or de-activate (switch off) equipment to be controlled, such as fan starters.

NOTE: System relays are SPDT (single pole, double throw) thereby providing one set of usable dry contacts for each relay. Because the GDC-350 series systems are designed to be fail-safe, any equipment to be controlled by the system relays should be wired to the "NC" Normally closed) and "COM" (Common) terminals. The relay coils are normally energized in non-alarm state for fail-safe operation.

3.9. Installation Example 1: Type "A" with Enclosed Transformer

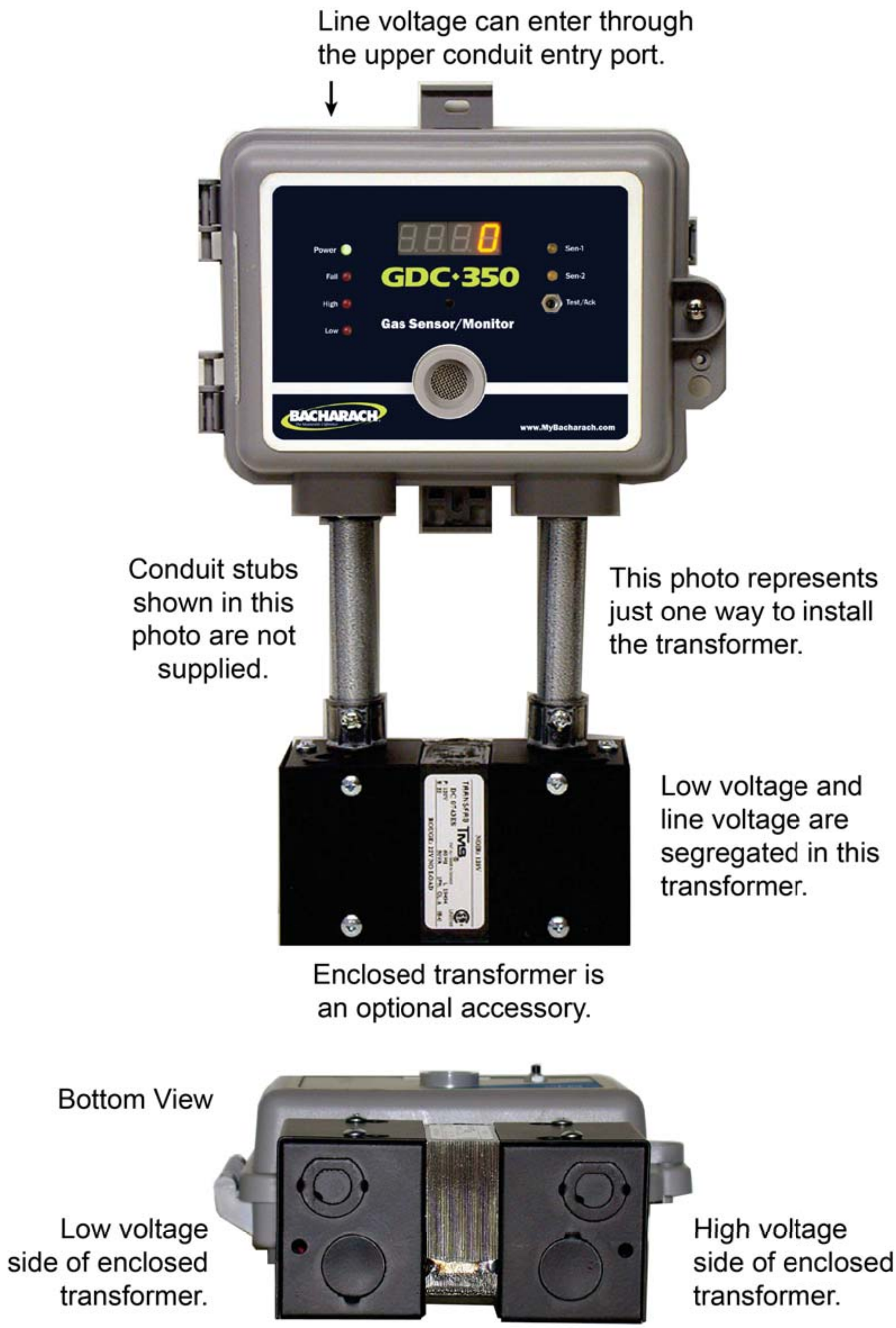


Figure 3-7. Sample Type "A" Installation

3.10. Installation Example 2: Type “B” with Remote Solid-State Sensor

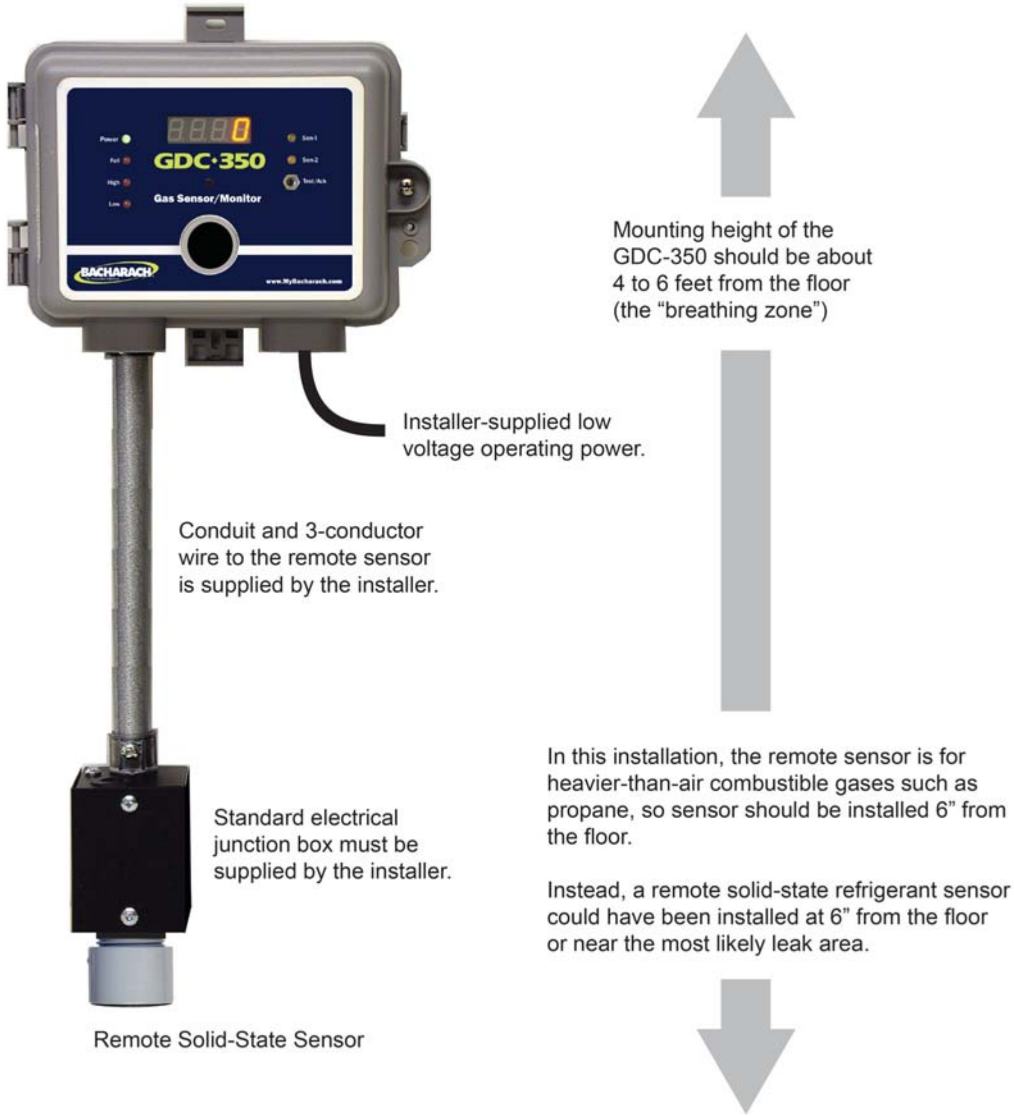


Figure 3-8. Sample Type “B” Installation

NOTE: Wiring between a GDC-350 and the remote sensor (indicated above) should be 3-conductor, 16 to 18-gauge shielded cable. Observe polarity because the GDC-350 supplies DC power to the remote sensor.

3.11. Installation Example 3: Type "D" with On-Board and Remote Sensors

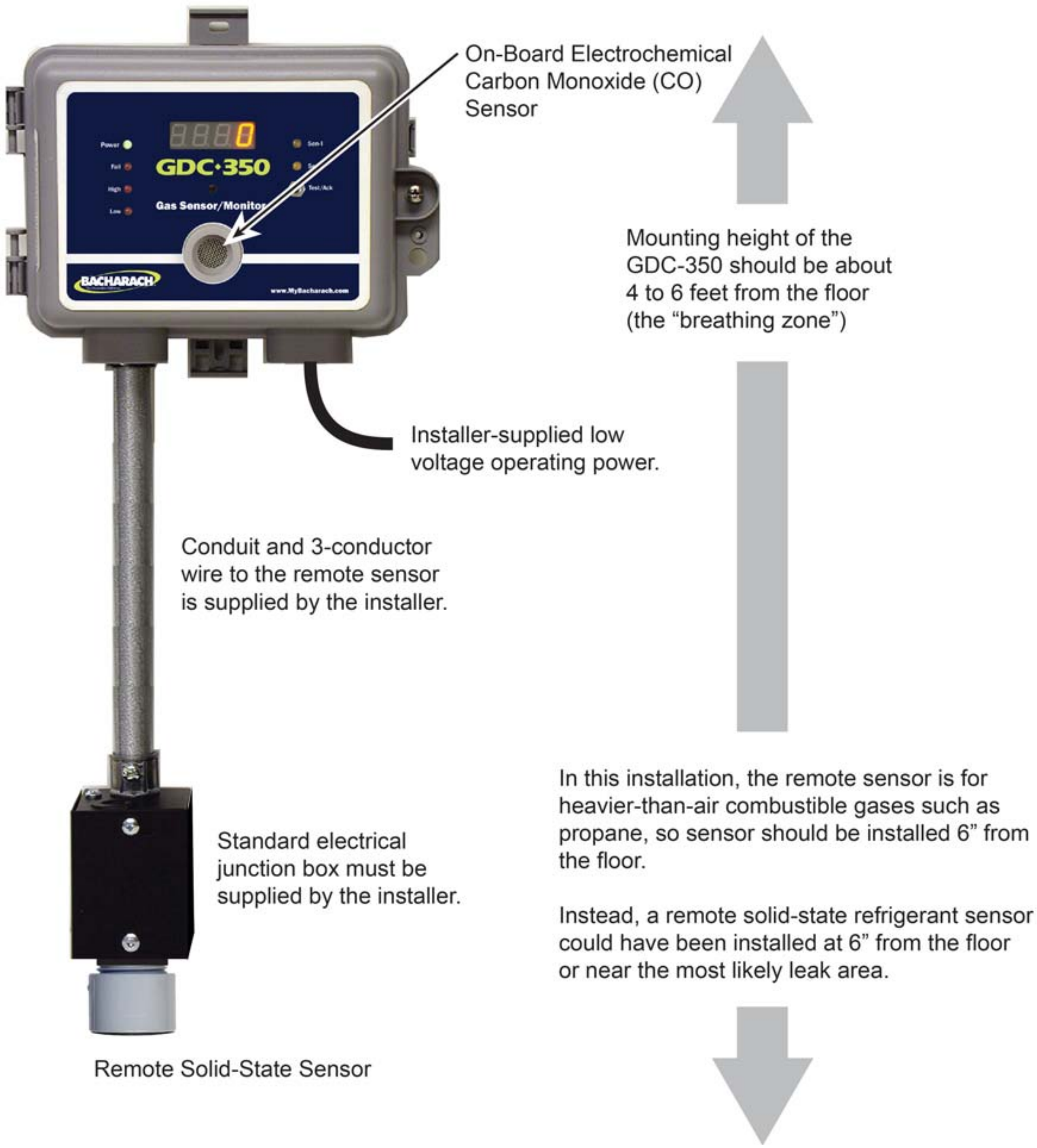


Figure 3-9. Sample Type "D" Installation

3.12. Installation Example 4: Type "E" with Two On-Board Sensors

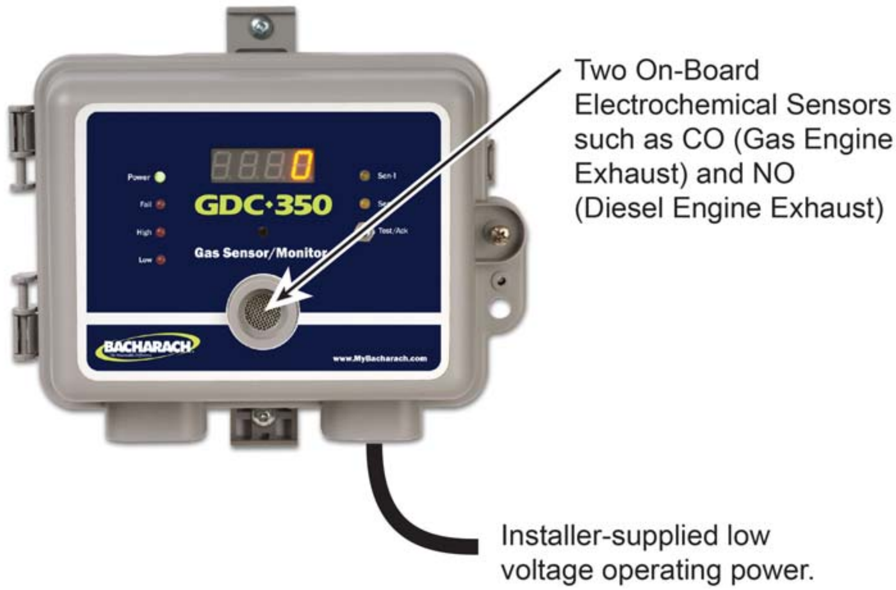


Figure 3-10. Sample Type "E" Installation

3.13. Powering On the GDC-350

Upon application of power, the green LED light indicator(s) will illuminate and the LED between CH-1 and CH-2 will be blinking but all alarms are disabled for 2 minutes for a system warm up period. After the warm up period, the system may exhibit gas alarm condition(s) if one or both of the sensors has not completely stabilized during the warm up period. This is normal and the length of time the gas alarms exist is dependent upon the length of time since the unit was last powered up and the state of the environment it is installed in. After warm up, only the green power LED illuminates indicating normal operation and the relays are energized indicating normal "Fail-safe" status.

4. CONFIGURATION AND OPERATION

4.1. General

In the event of a burned-out, damaged or missing solid-state sensor element, the controller will indicate fail condition on the front door by illumination of the red fail LED. At this point, both system relays will have reversed state (de-energized) and anything connected to them will be running continuously. Normal system operation will not occur until the fault condition has been rectified. The same condition will occur if the 4-20 mA signal from the remote transmitter is broken or interrupted.

NOTE: Fail condition overrides any system time delays that may have been set.

NOTE: Reference photo on page 1 for location of LEDs and test-buttons.

In the event of a gas build up beyond the preset low alarm trip point, the "Sen-1" LED illuminates, the "Low" alarm level LED illuminates and the low alarm relay de-energizes activating anything controlled by it. If a time delay "ON" has been set (internal DIP switches), then the "Low" alarm LED will "flash" indicating the time delay has been activated and the low alarm relay will not de-energize until the delay has timed out. Once the low alarm relay has de-energized, it will re-energize automatically once the gas alarm condition goes away, unless a time delay "OFF" (minimum run time - internal DIP switches) has been programmed. The same procedure applies to the second channel in the case of a two-channel (two-sensor) system.

In the event of a gas build up beyond the preset high alarm trip point, the "Sen-1" LED illuminates, the "High" alarm level LED illuminates and the high alarm relay de-energizes activating anything controlled by it. If a time delay "ON" has been set (internal DIP switches), then the "High" alarm LED will "flash" indicating the time delay has been activated and the high alarm relay will not de-energize until the delay has timed out. Once the high alarm relay has de-energized, it will re-energize automatically once the gas alarm condition has dispatched. The same procedure applies to the second channel in the case of a two channel (two sensor) system.

NOTE: No minimum run time delay is provided for the high alarm relay.

4.2. Test Functions

A momentary test feature is provided to allow the user to test basic functionality of the circuit. Press the UP push-button (internal) for 5 seconds, the audible alarm will beep once to indicate it is in the 5 second test function. Release the UP push-button after 5 seconds and an automatic test function will occur.

Alternatively, use the silence push-button on the front door to perform the same function.

The low alarm relay will de-energize and the low alarm LED on the front door will illuminate. The low alarm relay will then re-energize while the low alarm LED stays lit for 10 seconds.

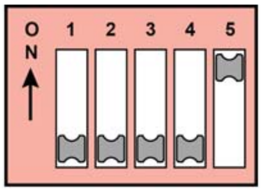
Next, the high alarm relay will de-energize, the high alarm LED on the front door will illuminate and the audible alarm will activate. The relay will then re-energize but the high alarm LED and the audible alarm will stay activated for 10 seconds. After 10 seconds, everything resets to normal operating condition.

If a longer test sequence is desired, hold down the UP push-button for 10 seconds to activate the low alarm relay, high alarm relay, low alarm LED, and high alarm LED for 15 minutes.

To abort this test, press the internal “UP” push-button or the exterior silence push-button and everything will reset to normal operating condition.

If the GDC-350 is equipped with a digital display, it will indicate “test” during this test period.

4.3. DIP Switch Settings



SW	Feature (“ON” to enable)	Default
1	Low Gas Alarm “On” Delay	2 min
2	Low Gas Alarm “Off” Delay	10 min
3	High Gas Alarm “On” Delay	5 min
4	Audible Alarm “On” Delay	5 min
5	Audible Alarm Feature	On

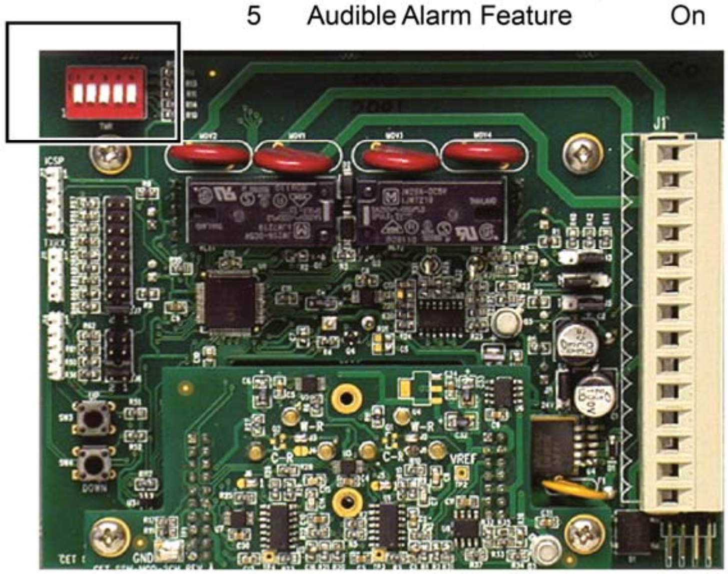


Figure 4-1. DIP Switch Settings for Alarms

DIP switches in the “UP” position are “ON”.

Fixed delay durations indicated above are factory default settings. Time delay durations can be changed by user. See page 23.

“On” delays are enforced upon alarm relay “make” conditions. “Off” delays are enforced upon alarm relay “break” conditions.

If DIP switch 5 is in the “up” position, the internal audible alarm responds to whatever commands it is given by the microprocessor in the circuit. If DIP switch 5 and DIP switch 4 are in the “up” position, the audible alarm responds after the user preset time delay function for the audible alarm has timed out. If DIP switch 5 is in the “down” position, the audible alarm does not respond at all.

The internal audible alarm normally activates with a steady tone when a “high” gas alarm condition exists. The internal audible alarm normally activates with a pulsing tone when a fault condition exists. A fault condition could consist of any of the following:

- Remote solid-state sensor failure (open loop)
- Analog signal from a remote 4-20 mA transmitter is not registering with the GDC-350.
- Smart sensor board is not plugged into the main board.

Fault conditions automatically override the ON/OFF DIP switch “5” if it has been set to the “DOWN” position to turn off the audible alarm.

4.4. System Jumpers

There are two banks of jumpers located directly below the DIP switches. One bank of nine (9) jumpers/18 pins (J7) and one bank of four (4) jumpers/8 pins (J6). These jumpers allow the user to perform a wide range of set up and calibration functions. The following table details the jumper settings for each bank of jumpers and explains the function enabled when these jumper positions are selected.

Always set J6 jumpers first, followed by J7 jumpers.

Jumper 4 (located on J6) is used to set custom time delays for relays and internal audible alarm. These functions are explained in Section 4.6.

NOTE: In Figure 4-2, the jumper tab for both banks is covering the “P1” position.

Functions	J6	J7
Resting (J7 jumpers are disabled)	P1	P1
Setting Span Gas Value (On-board Sensor)	P2	P2
Perform Zero (Null) Calibration (On-board Sensor)	P2	P3
Perform Span Calibration (On-board Sensor)	P2	P4
Adjust Low Gas Alarm Ascending Value (On-board Sensor)	P2	P5
Adjust High Gas Alarm Ascending Value (On-board Sensor)	P2	P6
Adjust Low Gas Alarm Descending Value (On-board Sensor)	P2	P7
Adjust High Gas Alarm Descending Value (On-board Sensor)	P2	P8
Enable/Disable Current Output	P2	P9
Setting Span Gas Value (Remote Sensor)	P3	P2
Perform Zero (Null) Calibration (Remote Sensor)	P3	P3
Perform Span Calibration (Remote Sensor)	P3	P4
Adjust Low Gas Alarm Ascending Value (Remote Sensor)	P3	P5
Adjust High Gas Alarm Ascending Value (Remote Sensor)	P3	P6
Adjust Low Gas Alarm Descending Value (Remote Sensor)	P3	P7
Adjust High Gas Alarm Descending Value (Remote Sensor)	P3	P8
Enable/Disable Current Output	P3	P9
Custom time delays for relays and internal audible alarm (see page 23)	P4	N/A

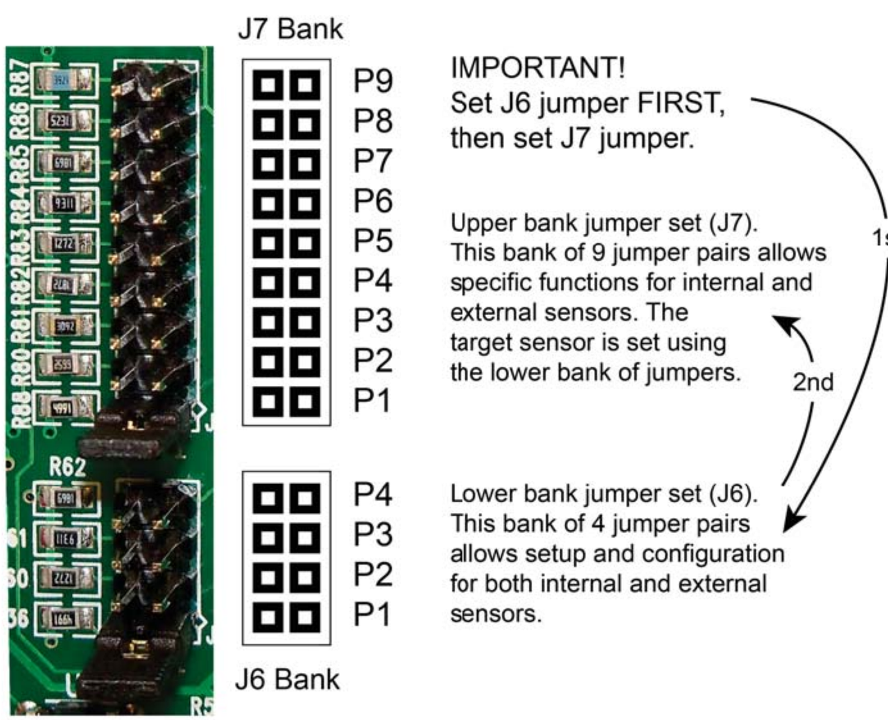


Figure 4-2. J7 (Top) and J6 (Bottom) Jumper Banks

4.5. Adjusting Alarm Setpoints

The GDC-350 is configurable as a single or dual channel detector as such there are two ascending gas alarm set points and two descending gas alarm set points. Almost all installations of the GDC-350 will use the factory default alarm set points. Default set points are as follows.

SENSOR	LOW ALARM	HIGH ALARM	RANGE
Caron Monoxide (CO)	25 ppm	100 ppm	200 ppm
Nitric Oxide (NO)	35 ppm	50 ppm	100 ppm
Nitrogen Dioxide (NO_2)	0.7 ppm	1.5 ppm	10 ppm
Sulfur Dioxide (SO_2)	1.0 ppm	5.0 ppm	20 ppm
Propane (C_3H_8)	10% LEL	20% LEL	50% LEL
Methane (CH_4)	10% LEL	20% LEL	50% LEL
Refrigerants	500 ppm	1000 ppm	2000 ppm
Temperature °C	30 °C	40 °C	60 °C
Temperature °F	75 °F	90 °F	100 °F

If the GDC-350 has been equipped with an LED digital display, set values according to what is displayed. If the GDC-350 does not have a digital display, you will need to attach volt meter leads to the two test points (TP1 and TP2) located just below the high alarm relay (RLY2) on the main circuit board.

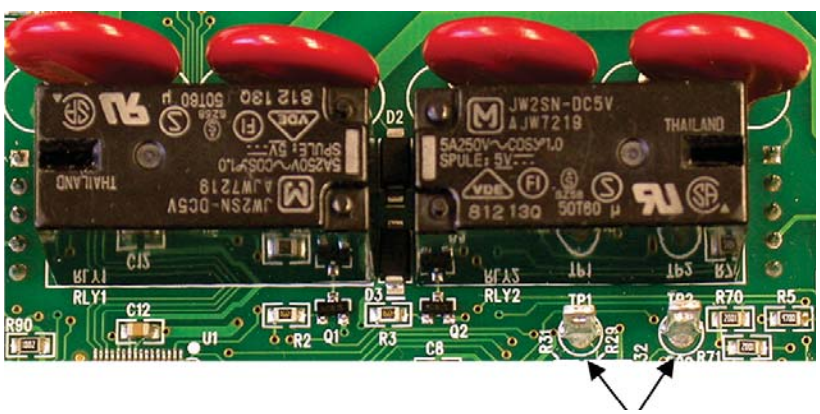


Figure 4-3. Locations of Test Points TP1 and TP2

Move the jumper on the lower bank (J6) from its resting position (P1) and place it on the appropriate jumper position as indicated in the table on the previous page. Next, move the J7 jumper from its resting position to the desired position. Then use the UP or DOWN push-buttons to set the desired alarm value.

To make additional changes to the sensor selected via J6, repeat the following steps:

- move J7 to the appropriate position
- use the UP or DOWN push-buttons to set the desired alarm value.

Once all alarm settings have been set to desired values, move J7 back to its resting position P1. Then move jumper J6 back to its resting position (P1) on the lower bank. All new values will be written to the EEPROM. Refer to the flowchart below.

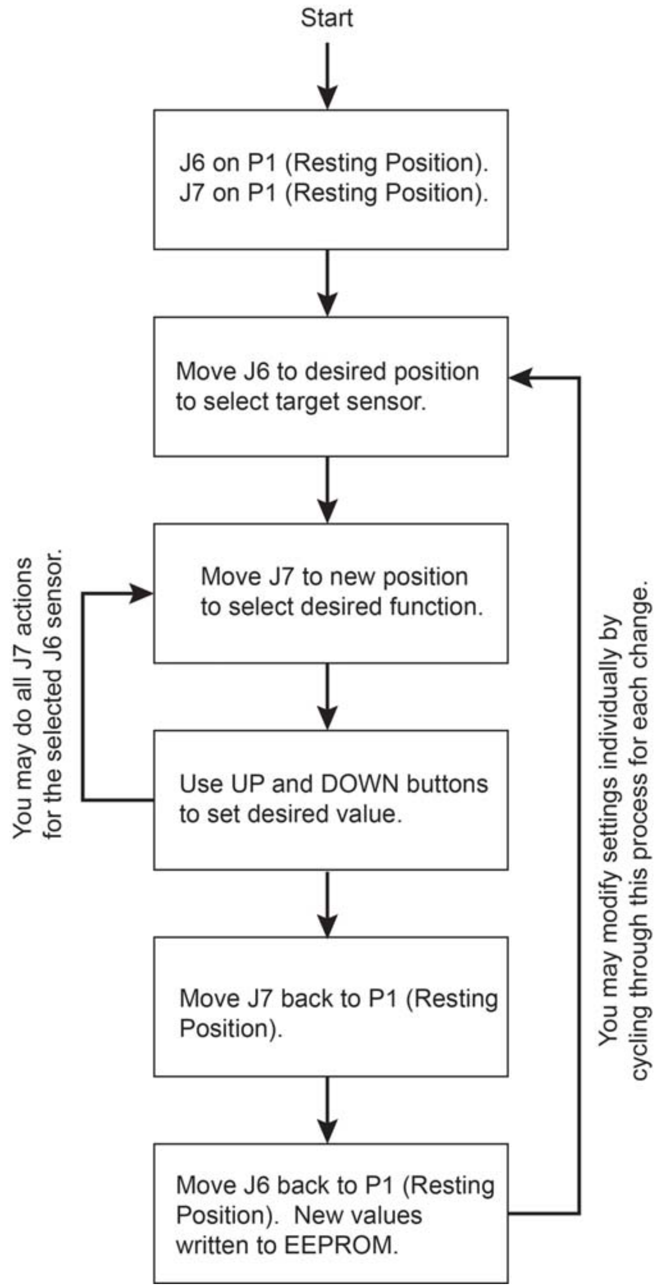


Figure 4-4. Jumper Settings J6 and J7

Alarm settings for GDC-350 detectors are voltage settings. The range of 0-4.0 VDC is equal to the full measurement range of the sensor. For example, a CO sensor has a standard measurement range of 0-200 ppm—therefore, 4.0 VDC = 200 ppm. Reference the formula below and the table on page 23.

$$\frac{\text{Desired Set Point}}{\text{Sensor Range}} \times 100 = \text{\% of Range}$$

$$\frac{\text{100 PPM}}{\text{200 PPM}} \times 100 = \text{50\% of Range}$$

$$\text{Full Range Of Sensor Output} \times \text{\% of Range} = \text{Required Alarm Voltage Setting}$$

$$4.0\text{ VDC} \times 50\% = 2.0\text{ VDC}$$

Therefore, in this example, the required voltage setting to achieve an alarm set point of 100 ppm is 2.0 VDC.

VOLTAGE REFERENCE TABLE FOR ALARM SETTINGS

SENSOR / GAS	MEASUREMENT RANGE	LOW ALARM SET VOLTAGE	HIGH ALARM SET VOLTAGE
CO	0-200 ppm	25 ppm / 0.50 VDC	100 ppm / 2.00 VDC
NO_2	0-10 ppm	0.7 ppm / 0.56 VDC	1.5 ppm / 1.20 VDC
O_2	0-25.0% Vol	19.5% Vol./ 3.12 VDC	23.0% Vol. / 3.68 VDC
NO	0-100 ppm	25 ppm / 1.00 VDC	50 ppm / 2.00 VDC
SO_2	0-20 ppm	2 ppm / 0.40 VDC	5 ppm / 1.00 VDC
Combustibles	0-50% LEL	20% LEL / 1.60 VDC	40% LEL / 3.20 VDC
Refrigerant Gases (R series)	0-2000 ppm	500 ppm / 1.00 VDC	1000 ppm / 2.00 VDC

4.6. Relay Time Delays

The GDC-350 offers a wide range of time delay settings that are user configurable. If the GDC-350 has been equipped with the LED digital display, read the values on the display as you change them to suit your application. If the GDC-350 does not have a digital display, you will need a volt meter. The voltage reference is 0-4 VDC.

Attach the volt meter leads to the two test points (TP1 and TP2) located just below the high alarm relay (RLY2) on the main circuit board.

VOLT READING AT TEST POINTS	TIME DELAY IN MINUTES	VOLT READING AT TEST POINTS	TIME DELAY IN MINUTES
0 V	N/A	0.58 V	2.9
0.02 V	0.1	0.60 V	3.0
0.04 V	0.2	0.62 V	3.1
0.06 V	0.3	0.64 V	3.2
0.08 V	0.4	0.66 V	3.3
0.10 V	0.5	0.68 V	3.4
0.12 V	0.6	0.70 V	3.5
0.14 V	0.7	0.72 V	3.6
0.16 V	0.8	0.74 V	3.7
0.18 V	0.9	0.76 V	3.8
0.20 V	1.0	0.78 V	3.9
0.22 V	1.1	0.80 V	4.0
0.24 V	1.2	:	:
0.26 V	1.3	1.0 V	5.0
0.28 V	1.4	1.2 V	6.0
0.30 V	1.5	1.4 V	7.0
0.32 V	1.6	1.6 V	8.0
0.34 V	1.7	1.8 V	9.0
0.36 V	1.8	2.0 V	10.0
0.38 V	1.9	2.2 V	11.0
0.40 V	2.0	2.4 V	12.0
0.42 V	2.1	2.6 V	13.0
0.44 V	2.2	2.8 V	14.0
0.46 V	2.3	3.0 V	15.0
0.48 V	2.4	3.2 V	16.0
0.50 V	2.5	3.4 V	17.0
0.52 V	2.6	3.6 V	18.0
0.54 V	2.7	3.8 V	19.0
0.56 V	2.8	4.0 V	20.0

Move the jumper on the lower bank (J6) from its resting position (P1) to P4. This is the system configuration position. Next, select the jumper position on upper bank J7 to achieve the desired function. Reference the table on page 20 for appropriate jumper position locations.

Once the desired jumper position has been achieved, use the UP or DOWN push-buttons to make changes. Once the desired time delays have been set, move jumper back to resting position (P1) of the upper bank (J7). If additional time delays are desired, move the jumper to the appropriate position and once again use the push-buttons to set desired voltage to achieve desired time delay.

Once all desired time delay settings have been achieved, move the jumper back to position 1 (P1) on jumper J7 and move the jumper back to position 1 (P1) on lower the lower bank (J6). At that point, all new settings will be written to the EEPROM.

FUNCTION	J6	J7
Low alarm “ON” time delay	P4	P2
Low alarm “OFF” time delay	P4	P3
High alarm “ON” time delay	P4	P4
Audible alarm “ON time delay	P4	P5

4.7. Temperature Display – Unit of Measure

The GDC-350 systems all have an on-board temperature chip from which information is used to temperature compensate certain sensors. This temperature chip can also be used as a second sensor in applications where the user requires both a gas measurement and a temperature measurement. To switch between Celsius and Fahrenheit displayed values, follow this procedure.

Move the jumper from the resting position (P1) on the lower bank (J6) to P4 and the jumper on J7 to P8. Pressing the UP push-button will display the temperature in Celsius and the output between test points TP1 and TP2 is 4.0 V. If the DOWN push-button is pressed, the temperature is displayed in Fahrenheit and the output between the test points is 0 V.

Once the desired unit of measure has been achieved, move the jumper back to P1 on the lower bank (J6). At that point, all new settings will be written to the EEPROM.

NOTE: The temperature sensor is always considered channel 2 (remote).

4.8. Latching Relay Function

The GDC-350 relays can be configured as “latching” for some applications.

To achieve this, move the jumper from resting position (P1) on the lower bank jumper set (J6) to P4. This is the system configuration position. Next, move the jumper to P9 on the upper bank (J7).

Pressing the UP push-button activates the latching function and the output between test points TP1 and TP2 is 4 V. Pressing the DOWN push-button de-activates the latching function and the output between test points TP1 and TP2 is 0 V.

Once the desired latching or non-latching function has been achieved, move the jumper back to P1 on upper bank (J7) and move the jumper back to P1 on lower bank (J6). At that point, all new settings will be written to the EEPROM.

4.9. LED Digital Display

The GDC-350 system allows for a limited amount of customization of the optional LED digital display using jumpers J3, J4, and J5.

- The display can be switched completely off.
- The display brightness level can be adjusted to low or high for best visibility in your application.
- The display can indicate the gas type only with no numerical value for some applications.

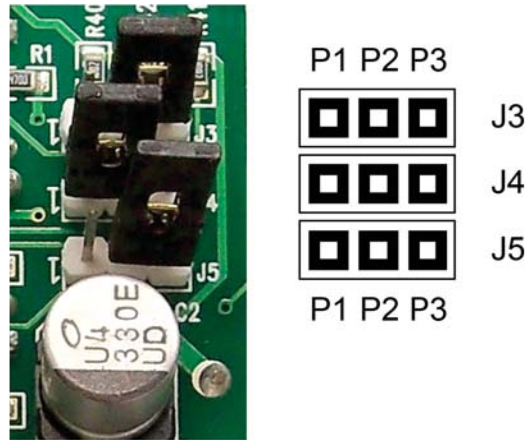


Figure 4-5. Jumpers J3, J4, and J5

FUNCTION	JUMPER	SETTING
Switch digital display ON	J3	Bridge P2 and P3
Switch digital display OFF	J3	Bridge P1 and P2
Low brightness level	J4	Bridge P1 and P2
High brightness level	J4	Bridge P2 and P3
Display only gas name (acronym)	J5	Bridge P1 and P2
Display gas value and gas name	J5	Bridge P2 and P3

NOTE: The factory default setting for detectors with an LED digital display are:

1) Display is ON
2) Brightness level is Low
3) Display indicates gas type and gas value

NOTE: Typically the LED digital display shows the gas name for 1 second, then the gas value is shown for 2 seconds. The sequence is the same for 1- or 2-channel systems.

5. CALIBRATION

NOTE: During any calibration procedure, if the instrument sounds with repetitive beeps, the sensor is not settling within tolerance (1% for catalytic and solid-state sensors, 20% for electrochemical sensors). Contact Bacharach support for additional information.

5.1. Calibration Specifications

Gas: Calibration span gases should be at least ±5% accuracy and have a current date stamp. Gas generators should have a current dated cell installed. Service personnel should flow zero emissions air or 20.9% volume oxygen before attempting to null adjust toxic gas sensors. In some cases N_2 (nitrogen) can be substituted for zero air. Nitrogen is required to null (zero) oxygen (O_2) and carbon dioxide (CO_2) sensors.

Exception: If the service person is confident of air quality and is careful (do not exhale in the direction of the oxygen sensor being serviced while span adjusting), oxygen in the breathing environment can be used as a fairly accurate source of span gas (20.9% volume). It is not recommended to use this procedure for span adjustments of oxygen sensors.

Regulators and Flow: Calibration gases that are lighter than or the same weight as air (CO, O_2, etc.) should be flowed at 0.5 LPM. Gases heavier than air (NO_2, etc.) should be flowed between 0.5 and 1.0 LPM. Fixed flow regulators provide more accuracy. Gases should be flowed over the sensor for at least 2.5 to 4.0 minutes. Carbon Monoxide sensors settle out very quickly, but sensors for reactive gases (NH_3, etc.) will take longer to stabilize to the calibration gas. All cylinder regulators supplied by Bacharach use a fixed flow orifice.

Adapters: The proper calibration adapter should be utilized to allow the gas to properly diffuse around the sensor. They are available from Bacharach. A humidification chamber must be utilized for all solid-state sensors except ammonia. This is also available form Bacharach. (See table on page 34 for ordering information.)

5.2. Frequency Recommendations

Sensor Types / Applications	Calibration Frequency
Parking garage detectors	Once every 12 months
OHS (Occupational Health and Safety) applications	Once every 6 months

For the purposes of safety in OHS applications, sensors should be gas tested (e.g., bump tested) once every month to confirm response.

IMPORTANT: In applications where life safety is critical, equipment should be calibrated quarterly or on a more frequent basis. Bacharach is not responsible for setting safety practices and policies. Safe work procedures including calibration policies are best determined by company policy, industry standards, and local codes.

NOTE: It is recommended that a calibration label should be applied after every calibration to confirm work performed and the date it was confirmed. If a controller is involved, the alarm set points should be indicated on a label on the front door of the enclosure.

Calibration is achieved at the GDC-350 controller if the sensor is on board. If the sensor is remote (i.e., a GDC-150 analog transmitter) the calibration is achieved at the transmitter using the procedure indicated in its operation manual.

Required Equipment:

- Volt meter
- Calibration kit
- Calibration gases.

Users can order the calibration kit, calibration accessories and/or gases from any Bacharach authorized distributor.

5.3. Calculating the Span Gas Value

To achieve calibration the user must first tell the GDC-350 what concentration of span he is going to flow over the sensor. Within the controller, this is a voltage setting. The range of 0-4 VDC is equal to the full measurement range of the sensor. Prior to attempting to calibrate, determine the voltage value required. Consult the table on page 23 for standard voltages. If the value desired is not indicated, use the following formula to calculate the voltage required.

$$\frac{\text{Calibration Span Gas Value}}{\text{Sensor Range}} \times 100 = \text{\% of Range}$$

$$\frac{100\ \text{PPM}}{200\ \text{PPM}} \times 100 = 50\%$$

$$\text{Full Range Of Sensor Output} \times \text{\% of Range} = \text{Required Calibration Voltage Setting}$$

$$4.0\ \text{V} \times 50\% = 2.0\ \text{V}$$

Therefore, in this example, the required voltage setting to calibrate a 0-200 ppm sensor with 100 ppm is 2.0 VDC.

NOTE: Values for **Calibration Span Gas** and **Sensor Range** in the above equations must have the same Engineering Units (e.g., PPM, % of LEL, % vol, etc.).

NOTE: When calibrating solid-state sensors for combustibles or refrigerants, the span gas must be humidified. The use of a humidification chamber is required. The humidification chamber sits in line between the cylinder of span gas and the calibration adapter. Remove the sponge inside the chamber and wet it under the tap. Squeeze out the excess water so it is not dripping wet and place it back inside the chamber. As gas flows through the chamber, it absorbs water which acts to humidify it and the humidified span gas flows over the sensor. (See table on page 34 for ordering information.)

5.4. Calibrating the On-Board Sensor

SETTING SPAN GAS VALUE

Step	Setting Span Gas Value Procedure
1	Move the jumper on J6 to P2 and move the jumper on J7 to P2.
2	The audible alarm beeps once for confirmation. The system is now waiting for the user to set the desired span value.
3	Attach the volt meter leads to test points TP1 and TP2.
4	Using the UP or DOWN push-buttons, achieve the calculated voltage on the volt meter.
5	Move the jumpers from J6 and J7 back to their P1 resting positions.

CALIBRATING THE NULL (ZERO)

Step	Calibrating the Null (Zero) Procedure
1	Attach a regulator to a cylinder of zero air (or nitrogen).
2	Insert the calibration adapter into the sensor opening on the front of the enclosure. Use a slight twisting motion as you gently push the calibration adapter into the sensor opening. If the calibration adapter is hard to insert, moisten the “O” ring seal slightly then try re-inserting it.
3	Open the regulator valve fully allowing zero air to flow over the sensor.
4	Move the jumper on J6 to P2 and move the jumper on J7 to P3. The audible alarm beeps once for confirmation. The system is now starting the zero calibration stabilization time (30 seconds).
5	If desired, attach the volt meter leads to test points TP1 and TP2. The reading should be 0.0 VDC.
6	The instrument will beep twice when the calibration begins. Leave the zero air flowing over the sensor until the GDC-350 beeps three times indicating the procedure is finished (1 minute).
7	Move the jumpers from J6 and J7 back to their P1 resting positions and remove the zero air (or nitrogen).

CALIBRATING THE SPAN

Step	Calibrating the Span Procedure
1	Attach a regulator to a cylinder of span gas.
2	Insert the calibration adapter into the sensor opening on the front of the enclosure. Use a slight twisting motion as you gently push the calibration adapter into the sensor opening. If the calibration adapter is hard to insert, moisten the "O" ring seal slightly then try re-inserting it.
3	Open regulator valve fully and allow span gas to flow over sensor.
4	Move the jumper on J6 to P2 and move the jumper on J7 to P4. The audible alarm beeps once for confirmation. The system is now starting the span calibration stabilization time (30 seconds).
5	If desired, attach volt meter leads to test points TP1 and TP2. The reading should start moving towards the voltage calculated for the span gas value.
6	The instrument will beep twice when the calibration begins. Leave the span gas flowing over the sensor until the GDC-350 beeps three times indicating the procedure is finished (2 minutes).
7	Move the jumpers from J6 and J7 back to their P1 resting positions and remove the span gas.

5.5. Calibrating a Second On-Board Sensor

Calibration of the second on-board sensor has only one difference from the first on-board sensor calibration. Move the jumper on J6 to P3 then follow the same procedure as in the previous section (Calibrating the On-board Sensor).

5.6. Calibrating a Remote Solid-State Sensor

SETTING SPAN GAS VALUE

Step	Setting the Span Gas Value Procedure
1	Move the jumper on J6 to P3 and move the jumper on J7 to P2.
2	The audible alarm beeps once for confirmation. The system is now waiting for the user to set the desired span value.
3	Attach volt meter leads to test points TP1 and TP2.
4	Using the UP or DOWN push-buttons, achieve the calculated voltage on the volt meter.
5	Move the jumpers from J6 and J7 back to their P1 resting positions.

CALIBRATING THE NULL (ZERO)

Step	Calibrating the Null (Zero) Procedure
1	Attach a regulator to a cylinder of zero air.
2	Attach the flow adapter and open the regulator valve fully to allow zero air to flow over sensor. Use a slight twisting motion as you gently push the calibration adapter into the sensor opening. If the calibration adapter is hard to insert, moisten the "O" ring seal slightly then try re-inserting it.
3	Move the jumper on J6 to P3 and move jumper on J7 to P3. The audible alarm beeps once for confirmation. The system is now starting the zero calibration stabilization time (30 seconds).
4	If desired, attach volt meter leads to test points TP1 and TP2. The voltage should be 0.0 VDC.
5	The instrument will beep twice when the calibration begins. Leave the zero air flowing over the sensor until the GDC-350 beeps three times indicating the procedure is finished (1 minute).
6	Move the jumpers from J6 and J7 back to their P1 resting positions and remove the zero air (or nitrogen).

CALIBRATING THE SPAN

Step	Calibrating the Span Procedure
1	Attach a regulator to a cylinder of span gas.
2	Insert the calibration adapter into the sensor opening on the front of the enclosure. Use a slight twisting motion as you gently push the calibration adapter into the sensor opening. If the calibration adapter is hard to insert, moisten the "O" ring seal slightly then try re-inserting it.
3	Open regulator valve fully and allow span gas to flow over sensor.
4	Move the jumper on J6 to P2 and move the jumper on J7 to P4. The audible alarm beeps once for confirmation. The system is now starting the span calibration stabilization time (30 seconds).
5	If desired, attach volt meter leads to TP1 and TP2. The reading should start moving towards the voltage calculated for the span gas value.
6	The instrument will beep twice when the calibration begins. Leave the span gas flowing over the sensor until the GDC-350 beeps three times indicating the procedure is finished (2 minutes).
7	Move the jumpers from J6 and J7 back to their P1 resting positions and remove the span gas.

5.7. Calibrating 4-20 mA Signal for Incoming Analog Transmitter

To perform this function you will need an accurate current source able to generate 4.0 mA and 20.0 mA current signals, or a Bacharach GDC-150.

USING A CURRENT SOURCE TO CALIBRATE THE NULL (ZERO)

Step	Using A Current Source to Calibrate the Null (Zero) Procedure
1	Connect the current source to pin 10 and ground to pin 11 on the wiring terminal block.
2	Set the current source to 4.0 mA.
3	Move the jumper on J6 to P3 and the jumper on J7 to P3.
4	The instrument will beep once for confirmation. The system is now starting the zero calibration stabilization time (30 seconds).
5	If desired, attach volt meter leads to test points TP1 and TP2. Monitor the voltage.
6	The instrument will beep twice when the calibration begins. The instrument beeps three times indicating the procedure is finished (2 minutes).
7	Move the jumpers from J6 and J7 back to their P1 resting positions.

USING A CURRENT SOURCE TO CALIBRATE THE SPAN

Step	Using a Current Source to Calibrate the Span Procedure
1	Connect current source to pin 10 and ground to pin 11 on the wiring terminal block.
2	Set the current source to 20.0 mA.
3	Move the jumper on J6 to P3 and the jumper on J7 to P4.
4	The instrument will beep once for confirmation. The system is now starting the span calibration stabilization time (30 seconds).
5	If desired, attach volt meter leads to test points TP1 and TP2. Monitor the voltage.
6	The instrument will beep twice when the calibration begins. The instrument beeps three times indicating the procedure is finished (2 minutes).
7	Move the jumpers from J6 and J7 back to their P1 resting positions and remove the current source.

USING A BACHARACH GDC-150 TO CALIBRATE THE NULL (ZERO)

Step	Using a Bacharach GDC-150 to Calibrate the Null (Zero) Procedure
1	At the GDC-150: For zero calibration on the GDC-150, move the jumper to P2 and set the voltage at TP1 and TP2 for 0 VDC. If transmitter has been calibrated, TP1 and TP2 should be reading 0 VDC.
2	At the GDC-350: Move the jumper from J6 to P3 and the jumper from J7 to P3.
3	The instrument will beep once for confirmation. The system is now starting the zero calibration stabilization time (30 seconds).
4	If desired, attach volt meter leads to test points TP1 and TP2. Monitor the voltage. It should start moving towards zero gas value 0 VDC.
5	The instrument will beep twice when the calibration begins. The instrument beeps three times indicating the procedure is finished (2 minutes).
6	Move the jumpers from J6 and J7 back to their P1 resting positions.

USING A BACHARACH GDC-150 TO CALIBRATE THE SPAN

Step	Using a Bacharach GDC-150 to Calibrate the Span Procedure
1	At the GDC-150: With the transmitter still connected, move the jumper to P2 and set voltage at TP1 and TP2 for 2.00 VDC.
2	At the GDC-350: Move jumper from J6 to P3 and the jumper from J7 to P2. Using the UP and DOWN push-buttons, set the voltage to 2.00 VDC.
3	Now, move jumper J7 to P4.
4	The instrument will beep once for confirmation. The system is now starting the span calibration stabilization time (30 seconds).
5	If desired, attach volt meter leads to test points TP1 and TP2. Monitor the voltage.
6	The instrument will beep twice when the calibration begins. The instrument beeps three times indicating the procedure is finished (2 minutes).
7	Move jumpers from J6 and J7 back to their P1 resting positions and remove the transmitter.

6. SYSTEM MAINTENANCE

The GDC-350 series system requires virtually no maintenance other than regular calibration of the integral and/or remote sensors and ensuring that excess water or dust is not somehow entering the enclosure and physically damaging the circuit board or internal components.

7. COMMON ACCESSORIES, OPTIONS, AND REPLACEMENT PARTS

Part Number	Description
5909-0001	LED digital display (must be selected when ordering)
5909-0002	Water/dust-tight enclosure (NEMA 4X)
5209-0004	Splash guard (NEMA 4X enclosures only)
5209-0006	Calibration adapter for all other sensors
5209-0016	Calibration adapter for catalytic sensors
5209-0017	Sample draw pump (24 VAC-powered)
5209-0018	Sample draw pump (24 VDC-powered)
5209-0021	Humidification Chamber (for calibration of solid-state sensors)
5909-0003	System guard (16 gauge galvanized metal)
5909-0004	Enclosed external transformer

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