Texas Instruments 9GS-4 High Concentration (0-5% Volume) Carbon Dioxide Sensor

Installation, Set-up and Calibration Manual

Application Note:

This manual specifically applies to the TI-9GS-4 series sensor only.

9GS-4 High Concentration Carbon Dioxide Gas Sensor Installation and Operation Overview

The 9GS-sensor product line was specifically designed to meet a variety of specialized OEM needs. Because there are several 9GS configurations available, there are also several ways in which the 9GS sensor could actually be applied and installed. As such, the following procedures will allow you to perform only a general field installation of the 9GS-4 Sensor. For more specific installation or application information, please consult the factory or your authorized servicing distributor.

READ THIS ENTIRE MANUAL BEFORE PROCEEDING. Failure to follow this procedure may cause unreliable sensor operation or may cause permanent damage to the unit.

Part Numbering System

Your 9GS Gas Sensor is available in a variety of standard configurations, each with any of several optional features. Each of the standard configurations and options are described in **Tables 1 & 2.** To confirm which configuration you have purchased, refer to the model number on the back of the sensor.

Table 1 9GS-4 Standard Configurations

Part Number	*Description*
9GS-4	**Standard High-Concentration configuration with PC board mounted sensing element, 0-5% volume range, voltage output, manual or auto-zero function.**

NOTE: The 9GS-4 model is offered with several optional features. To order this product in a configuration that will suit your application, please refer to **Table 2** and then consult the factory or your authorized distributor.

Table 2 9GS general part-numbering scheme.

9GS-4-5 Z C R

Product	Version	Output	Zeroing Mode	Packaging	Relay option
9GS	**4** – Non-probe (0-5% Vol.)	**5**- 0-5V	**Z**- Zeroing button	**C**- Case Please Consult the Factory	**R**- Relay
		A- 4-20mA	**Blank**- No Zero Button	**Blank**- No case	**Blank**- No relay

Table 3 Specifications

ITEM	CHARACTERISTICS
Sensing Method	NDIR - Non-Dispersive Infrared.
Sampling mode	Diffusion and/or pump capability.
Range	0-5% Volume CO_2.
Accuracy	± 0.1% Volume CO_2 or 5% of reading, whichever is greater.
Temperature effect	±0.02% Volume CO_2/°C from temperature of calibration
Warm-up	< 90 seconds.
Response time	< 35 seconds to 63% of step change @ 500 ml/min flow rate.
Zero Calibration	Push-button calibrates sensor.
Drift	<. 17% Vol. CO_2/month
Output voltage	Linearized 0-5V standard.
Available Outputs	• 4-20mA Current loop.
Input power	12 VDC ±5%.
Temperature range	• 0°C to +50°C (Operating). • -40°C to +70°C (Storage).
Humidity range	5-95%, non-condensing (operating).
Dimensions	3.5" x 3.5" x 1.36"
Patents	Patents pending

Sensor Installation

Overview of the Installation Process

This manual will show you how to perform these steps for installation:

- Identify a mounting location
- Identify the sensor model you are installing
- Prepare the wires for installation
- Terminate the wires to the sensor terminal strip

Step 1: Choosing a location

Your Texas Instruments 9GS CO_2 gas sensor has the capability to be mounted in a variety of ways depending on the application. Some important points to remember:

- If the application uses natural diffusion for sensing the target gas, elect a mounting location with good air circulation within the area to be monitored
- Select a location that experiences representative concentrations of the targeted carbon dioxide levels.

Your sensor has been designed for long life within a variety of environments. Extreme conditions could cause the performance to deteriorate. Avoid locations subject to the following conditions:

- Moisture condensing
- Liquid splashing or soaking
- Strong fumes from cleaning solutions or other chemicals
- High or low temperature extremes

Step 2: Preparing to Install the 9GS-4 Sensor

Assemble the following materials prior to beginning installation:

- 9GS-4 Sensor
- Mounting hardware (***Not Included*** – TI recommends using four #4-40 X ¼ screws and ½" metal or nylon standoffs)
- Hand tools as necessary (screwdriver, drill, wire strippers)
- Volt Ohm Meter (VOM)

Step 3: System Chassis or Wall Mounting Preparation

NOTE: Due to the exposed nature of the components on the 9GS-4 PCB, handling and ESD care should be exercised at all times.

When directly mounted to a system wall or chassis, the 9GS-4 should be mounted via the four corner-holes on the sensor PCB. It is recommended that four #4-40 X ¼ screws and four ½" metal or nylon standoffs be used for this type of installation (Not Included with sensor). Do not actually mount the PCB until noted within Step 4.

Step 4: Electrical Installation

IMPORTANT: Read these wiring instructions carefully. Make all electrical connections as illustrated. Wiring errors may cause permanent damage to your CO_2 Sensor.

- Electrical connection of your 9GS-4 sensor requires size 18 to 22 AWG wires. At a minimum, three wires are required: two wires are required for power and two wires to carry the signal from the sensor.
- Disconnect wiring electrical power. Trim all wires so 6" to 8" extends from the chassis or wall opening. Strip insulation from all wires so 1/4" of conductor is exposed. Label each wire for reference later.

CAUTION: Be sure all electricity is disconnected before attaching the wires to the sensor. Terminate the leads/ wires for input power and sensor outputs to the terminal strip on the sensor according to the chart below. **Note: Correct polarity must be maintained for the 12VDC input, reversed polarity will destroy the sensor.**

- Securely connect all wires according to **Table 4 & Figure 1**.

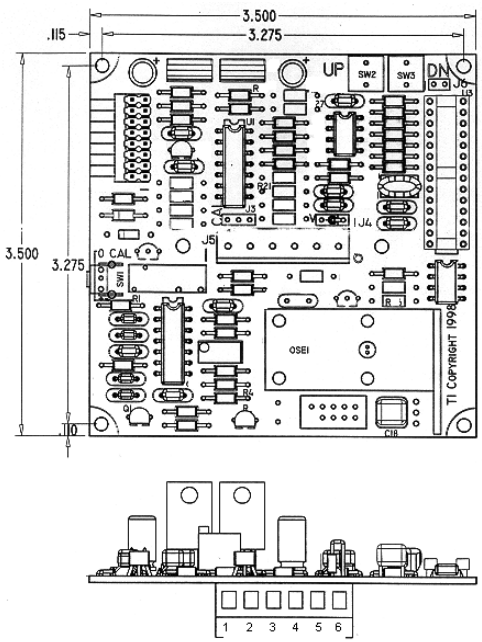

Figure 1: 9GS-4 PCB and Connector

Table 4: Connector Block Wiring

Position	Wire	Comments
1	12VDC In	Polarity sensitive.
2	12VDC Common	Polarity sensitive.
3	N/A	
4	N/A	
5	CO_2 Signal Output	Linearized voltage output, or optional 4-20mA current loop output.
6	CO_2 Signal Common	CO_2 Common, or optional 4-20 mA current loop return.

- Carefully screw the 9GS PCB to the standoffs at its mounting location. **CAUTION**: Mounting screws should be snug but not over-tightened. The PCB can be damaged by over-tight screws.

Mounting the 9GS with wall-mount case (Optional)

Step 1: Choosing a location

Your Texas Instruments 9GS-4 CO_2 gas sensor can also be configured with a case that allows for wall mounting. Some points to remember:

- Select a mounting location with good air circulation
- Select a mounting location that is not near ventilation inlets, doors, windows, or other fresh air entry points
- Select a location that experiences representative concentrations of air for the area.

Step 2: Preparing to Install the 9GS Sensor

Assemble the following materials prior to beginning installation:

- 9GS Sensor including wall mounting back plate
- Hand tools (screwdriver, drill with 2" hole saw, wire strippers)
- Volt Ohm Meter (VOM)
- 2 self tapping screws:

US Junction Box mount	#6 x 1/2"
European Junction Box mount	3.5 x 12mm
Drywall Mount	Match to wall anchors used

This procedure assumes that:

- Wiring that meets your system requirements and local codes has been run to the installation point
- The sensor will be mounted to a wall
- The sensor will be attached to a junction box, or by other adequate attachments to drywall, plaster or wood construction using appropriate mounting hardware.

Step 3: Wall Mounting Back Plate Installation

When directly wall mounted, **the 9GS requires a 2" diameter access hole** in the wall to which it is mounted. Alternatively, if the sensor is mounted to a standard junction box, the necessary clearance is provided by the junction box.

When appropriately configured, the 9GS sensor is shipped from the factory with the case front and back plate mated. They snap together and also have a small security screw installed. Remove the screw and retain for later use. Unsnap the case parts by gently prying apart.

For direct wall mount applications,

- Ensure that a 2” diameter hole is provided. The sensor wiring must be routed through this hole.
- Note the molded in arrows in the back plate. Ensure that either one is pointing up.
- Using the backplate as a template, mark the required screw holes to attach the sensor back plate. Drill these holes and use anchors or other appropriate means to securely mount the sensor back plate to the wall.
- Route the sensor wires through the center hole of the back-plate.
- Securely screw the back-plate in place.

For junction box mounting applications

- Choose the proper wall mounting back-plate for your application. Sizes to fit both European and US junction boxes are available.
- Route the sensor wires through the center hole of the back-plate.
- Note the molded in arrows in the back plate. Align the screw holes to the junction box while ensuring that one molded in arrow is pointing up.
- Securely screw the back plate to the junction box. **CAUTION**: Mounting screws should be snug. If backplate is bent by over-tight screws, front cover may not latch!

Step 4: Electrical Installation

IMPORTANT: Read these wiring instructions carefully. Make all electrical connections as illustrated. Wiring errors may cause permanent damage to your CO_2 Sensor.

- Refer to Table 4 and Drawing 1 for proper terminal wiring locations.
- Electrical connection of your 9GS sensor requires size 18 to 22 AWG wires. At a minimum, four wires are required: two wires are required for power and two wires to carry the signal from the sensor.
- Disconnect wiring electrical power. Trim all wires so 6” to 8” extends from the junction box or wall opening. Strip insulation from all wires so 1/4” of conductor is exposed. Label each wire for reference later.

CAUTION: Be sure all electricity is disconnected before attaching the wires to the sensor. Terminate the leads/ wires for input power and sensor outputs to the terminal strip on the sensor according to Table 4 & Drawing 1. **Note: Correct polarity must be maintained for the 12VDC input, reversed polarity will destroy the sensor.**

Step 5: Installing the Sensor Front Case

The 9GS sensor front case is a snap mount design. Additionally, there is a security screw that provides extra impact resistance.

- Orient the sensor so that the ventilation slots are facing the floor
- Snap the front cover onto the back plate
- Re-install the security screw

CALIBRATION/RE-ZEROING PROCEDURE

Overview

Developed for any one of a variety of OEM applications, the 9GS-4 Carbon Dioxide gas sensor is designed to require minimal maintenance. While calibrating and Re-Zeroing the 9GS is a simple process, its specific procedure is highly dependent on the actual 9GS rating being used and the particular application. Please consult the factory or your authorized distributor for related details.

GENERAL CALIBRATION PROCEDURE

Overview

This procedure will allow you to perform field calibration for the 9GS gas sensor. This procedure is conducted as part of a scheduled maintenance program. It is not intended as a repair or rework procedure.

- Warning: USE CAUTION WHEN WORKING WITH LIVE ELECTRICAL WIRING.

Violation of these warnings may void the unit’s warranty.

Getting Started

READ THIS ENTIRE MANUAL BEFORE BEGINNING THE CALIBRATION PROCEDURE. Incorrect calibration will cause unreliable sensor operation and may cause permanent damage to the unit.

If the sensor is not operating correctly after completing this procedure, repairs at an authorized repair location will be required.

NOTE: All 9GS units without the zero calibration button are designed for specific OEM applications and the following procedures do not apply.

Calibration: “quick-Zero” Zero Point Calibration

The 9GS zero calibration procedure is a quick and easy procedure to re-calibrate the sensor. No other calibration procedure is necessary. Any 9GS unit can be re-zeroed with this procedure, and all that is

required is room air at normal indoor air gas concentrations of 350 – 800 PPM (parts per million) of CO_2.

NOTE: For non-diffusion models of the 9GS the air sample must be pumped through the sensor (nitrogen can also be used for this procedure). For diffusion models, pumping the air/gas sample through the sensor is an optional procedure.

Step 1. Power up the unit and wait 90 seconds. If you are pumping the air sample through the sensor, locate the lower gas inlet nozzle protruding from the Optical Sensing Element and attach your air hose there. Allow the air or gas to flow through the sensor for at least one minute.

Step 2. Depress the 0 CAL button and hold it for at least 4 seconds. For wall-mount case models, locate the lower access hole on the left side of the case. Straighten a paper clip and insert into the access hole and depress the keyswitch inside and hold for at least 4 seconds.

Step 3. If necessary, turn off the air or gas and disconnect it from the CO_2 sensor. Your calibration procedure is now complete.

NOTE: For specific application assistance, technical information or to order Calibration Parts and Supplies, please call TI at (508) 236-3681, fax: TI at (508)-236-2349 or e-mail: tisensors@ti.com

Application Note

Important Notice: Texas Instruments (TI) reserves the right to make changes to or discontinue any product or service identified in this publication without notice. TI advises its customers to obtain the latest version of the relevant information to verify, before placing orders, that the information being relied upon is current.

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Questions regarding maintenance, care or replacement of parts for the TI 9GS-4 CO_2 sensor should be directed to (508) 236-3681, fax: (508) 236-2349 or e-mail: tisensors@ti.com. Be sure to visit our Web Site at: http://www.ti.com/snc/products/sensors/gas.htm.