INSTRUCTION MANUAL

MODEL GC800

COMBUSTIBLE GAS SENSOR

70028

SST
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MODEL GC800 COMBUSTIBLE GAS SENSOR

DESCRIPTION

Model GC800 Combustible Gas Sensors measure the concentration of gas in a protected area and transmit this information to a central control point. The sensor uses the “Catalytic” method of gas detection. This sensor is used in conjunction with various “transmitters”, which converts the sensor output to a standard 4 20 mA signal. This signal may be connected to a suitable VulcanGuard Gas Detection Module, or to any other device with a standard 4-20 mA input.

PRINCIPLE OF OPERATION

The GC800 sensing elements are mounted inside a stainless steel flameproof housing. Gas is sensed through the porous metal flame arrestor in the front of the housing. There is a matched pair of elements, one of which is an active catalytic detector and the other a non active compensating element. Each element consists of a coil of very fine platinum wire embedded in a bead of alumina. The detecting element is treated with a catalytic mixture that will allow oxidation of combustible gasses. The compensating element is treated so that catalytic oxidation of gas does not occur. In operation, a constant DC current heats the detector element temperature to a value which allows an adequate rate of oxidation. The detector coil also functions as a resistance thermometer wire and when methane or other combustible gas is burning on the catalytic detector the resultant temperature rise increases the coil resistance. The associated transmitter senses this change in resistance and converts it to a standard 4-20 mA signal which is proportional to the gas concentration. The 4-20 mA signal, when connected to a control module in the VulcanGuard System, is used to display the gas concentration as a percent of the Lower Explosive Limit (% LEL).

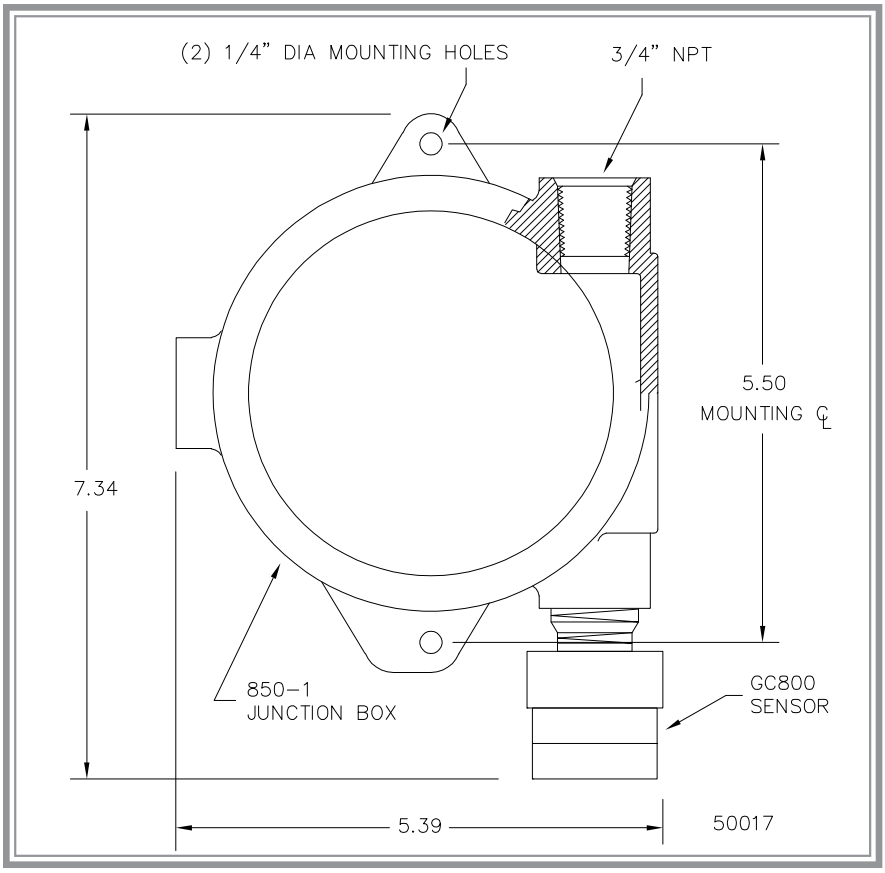

Figure 800-1 GC800 Sensor with 850-1 Junction Box and 860-1 Transmitter

ELECTRICAL SPECIFICATIONS

Recommended Sensor Current:	300 mA
Sensor Voltage:	2.0 ± 0.1 volts

ENVIRONMENTAL SPECIFICATIONS

High Gas Concentration

Detectors may be operated in high gas concentrations for short periods of time. For periods up to about 2 minutes, 10 second bursts of methane in excess of 100% LEL has no adverse effects. Prolonged exposure can result in zero drift which may be reversible by operation for a short period in air or low methane concentration (about 1%). Exposure to high concentration for longer periods will begin to destroy the detector surface, altering the zero reading and reducing the sensitivity. Whenever the sensor is exposed to high concentrations of combustible gas, the calibration should be rechecked as soon as possible.

Poisons and Inhibitors

The performance of the Model GC800 catalytic detectors may be temporarily impaired by operation in the presence of substances which are described as inhibitors. These are usually volatile substances containing halogens and the detectors may recover after a short period of operation in clean air.

Whenever the substance produces a permanent effect on the catalyst, with a catastrophic reduction in sensitivity, the detector is said to be poisoned. The GC800 Sensor is poison resistant. It can be used in atmospheres where traces of silicone oils, greases, phosphate esters, and sulphur based compounds may be present.

Ambient Temperature

Ambient temperature variation is in part equivalent to a variation in the heater current. The GC800 will operate in ambient temperatures from -20 to +80 °C, if calibrated regularly at the temperature extremes. For more stable operation, limit your ambient temperature range to -5 to +40 °C.

Mechanical Environment

Gas detection instruments may be required to withstand very severe working environments. The GC800 elements have been subjected to mechanical shock and vibration tests surviving 5 blows at 250 g in each of three mutually perpendicular axes and 24 cycles of swept frequency vibration at 20 g from 100 to 3200 Hz.

LOCATION OF DETECTORS

Location of the sensors is important. For lighter than air gasses (Methane), the sensor should be located **above** the spot where a leak is likely. For heavier than air gasses (Propane), locate the sensor **below** the expected leak. However, do not locate sensors closer than one foot to a floor to prevent damage from water, dust, etc. You must also consider air circulation, the pressure of leaking gases, and obstructions that could trap “pockets” of gas or air when locating sensors. Preferred orientation of sensor is with the face pointing down. If necessary, it may be installed at an angle or horizontally. The sensor must never be installed pointing upwards.

INSTALLING AND WIRING THE DETECTORS

There are several installation variations, depending on where the associated 4-20 mA transmitter will be located. The transmitter may be installed within the sensor mounting junction box, in another junction box at a near by location, or in the control room equipment cabinet.

GC800 with integral Model 860 4-20 mA transmitter

The Model 860 Transmitter will be installed in the same junction box that mounts the sensor. Refer to Figure 800-1. A junction box with ¾ inch hubs for the sensor and conduit connections, SST part number 850-1 is required for mounting and terminating the sensor. This junction box provides terminations for the sensor and space for the plug-in Model 860 Transmitter Card.

GC800 with Model 860 4-20 mA transmitter separation

If the sensor is mounted in an inconvenient location, such as on a high ceiling, the transmitter can be located separately from the sensor. Mount the transmitter junction box (850-1) at floor level. An 850-2 junction box provides terminals and mounting for the sensor. See Figure 800-2.

GC800 with Model 5400 4-20 mA Transmitter

The Model 5400 transmitter is located in the Control Room or other remote location. These is no field mounted transmitter; the three wires from the sensor wire directly to the control room. Install the sensor on an SST part number 850-2 junction box. Connect the sensor to the Model 5400 transmitter, per instructions provided with the transmitter.

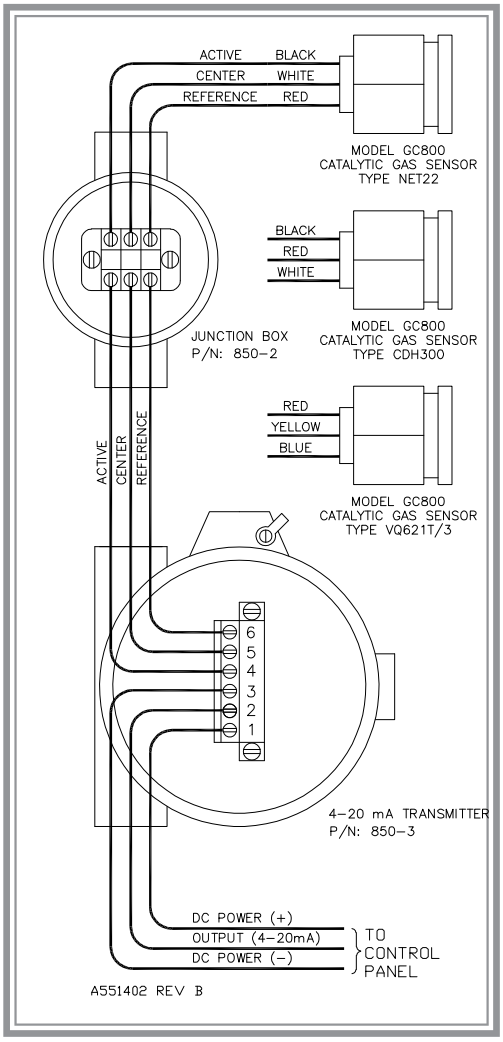

Figure 800-2 Installing Sensor Head seperate from the Transmitter

Wiring Requirements

Use three conductor shielded cable, or three wires installed in metal conduit to connect the GC800 or transmitter to the VulcanGuard Control System in the control room. These wires carry a nominal 24 volts DC, but must be large enough to supply the sensor heater current. The required wire size depends on the length or wires required:

Wire Size	Length	Wire Size	Length
22 AWG	700 ft	0,35 mm^2	200 m
20 AWG	1100 ft	0,50mm^2	330 m
18 AWG	1800 ft	0,75 mm^2	520 m
16 AWG	2900 ft	1,5 mm^2	875 m
14 AWG	4600 ft	2,5 mm^2	1400 m
12 AWG	7300 ft	4,0 mm^2	2200 m

DETECTOR ACCEPTANCE TESTS

Before power is applied to the transmitter, double check the sensor connections for proper wiring. Wrong connections here can burn out the sensor. With power applied, the transmitter output signal should be approximately 4.0 mA, assuming pure air at the sensor face. The transmitter must now be calibrated to match the sensor and the resistance of the field wiring. Final checkout should include application of test gas to the sensor. Refer to transmitter instructions for calibration procedures.

MAINTENANCE AND CALIBRATION

Under normal operating conditions, SST gas detectors should be recalibrated every 90 days. However, the change in calibration over time is a function of how much “background” gas is present during normal operation, and how often the sensor is exposed to higher concentrations. When the gas sensor is initially installed, we recommend that the calibration be checked on a more frequent basis to determine how much the calibration is changing. To check, expose the sensor to the same test gas as was used for the original calibration. Use the data taken over several tests to determine how often you should recalibrate the detector to keep the desired accuracy. All calibrations must be done using the proceedures provided with the associated transmitter.

MODEL 860 TRANSMITTER CARD FOR CATALYTIC GAS SENSORS

DESCRIPTION

The SST Model 860 Transmitter for Catalytic Gas Sensors converts the output from a standard catalytic sensor to a standard 4-20 mA signal. The transmitter connects to a Model 6020 Combustible Gas Detection Module, where the output is displayed. The input to the transmitter is a nominal 24 volt DC supply. The transmitter performs three critical functions:

- Sets the **Sensor drive current** to the manufacturer's specifications for any catalytic gas sensor. This circuit has an extremely high stability against any changes in detector circuit resistance and supply voltage.
- The output signal from the sensor, proportional to the concentration of combustible gas in the protected area in percentage of the Lower Explosive Limit (% LEL), is converted to a **standard 4-20 ma signal** for transmission to the Gas Detection Module.
- The **Field wiring** between the Sensor and the transmitter is continuously "supervised" for open or short circuits.

The Model 860 Catalytic Gas Transmitter is intended to be located in the field (factory floor, pipeline etc.) near the sensor. The associated Model 6020 Combustible Gas Detection Module or other types of 4-20 mA control equipment is installed in the central location (e.g. control room). The 860 is installed in an SST 850-1 Sensor/Transmitter Mounting Junction Box, which is an explosion proof aluminum enclosure, along with the SST Model GC800 Combustible Gas Sensor.

INPUT/OUTPUT CONNECTIONS

+24 Volts DC Power Input — terminal 1

This is the positive power connection to the unit. The voltage applied may vary over a wide range; the units are tested for compliance from 16V to 32V. Power consumption is typically 65 mA at 24V supply with a sensor load of 300 mA.

4-20 mA Output — terminal 2

This output draws 4-20 mA (current sink) from a positive supply, which should be between 3 and 32 volts. The input circuit of control equipment should be connected between this output and the positive supply.

Power Supply and Output Common — terminal 3

This is the common return for the 24V supply and the output current sink.

Active, Center and Reference Sensor Connections — terminals 4, 5, 6

These terminals connect directly to the corresponding wires on the gas detector. The gas sensor connections are internally grounded within the 860 transmitter circuitry; no other ground connections should be made to the sensor wires.

ELECTRICAL CHARACTERISTICS

The unit is set up so that with no combustible gas detected, the output circuit draws 4 mA, and with 100% LEL (lower explosive limit) of the calibration gas, the output circuit draws 20 mA. The sensitivity is therefore 0.16 mA per percentage point of LEL. The unit has sufficient gain to produce this output with detector sensitivities down to 0.5 mV per percent LEL, plus an allowance for detector ageing.

The detector circuit is monitored for open and short circuit conditions. If the detector voltage falls below 1.3 volts a short circuit is assumed, and the output current rises to between 25 mA and 45 mA. If the detector voltage exceeds 12 volts, an open circuit is assumed, and the output current is turned off. This enables the associated Model 6020 control module connected to the output of the 860 to detect and annunciate these faults.

PHYSICAL CHARACTERISTICS

Units are supplied as a preassembled printed circuit board which plugs directly into the terminal block plug mounted on the bottom of the 850-1 Sensor/Transmitter Mounting Junction Box. The 850-1 Sensor/Transmitter Mounting Junction Box is round, 4 1/2” high and 5 1/4” in diameter, and is rated for installation Class I Division 1 Groups B, C, D Hazardous Locations. The terminals will accept wires up to AWG 12 (2.5 mm^2).

INDICATORS AND CONTROLS

The green LED indicates that the transmitter is operational and that output current is flowing through the transmitter. The intensity of illumination is proportional to the output current. Thus, as calibrating gas is applied to the sensor, the LED will increase in brightness. Four test points and three potentiometers for output and heater current adjustment are provided. The test points permit a millivoltmeter to be connected to the sensor or output circuits without disrupting the operation of the unit. This permits routine checking and calibration without altering connections, or even taking power off the detector. This is a great time saver, as it is not necessary to wait for the detector to warm up after starting the calibration proceedure. The potentiometers permit the sensor excitation current, channel zero and channel span to be adjusted.

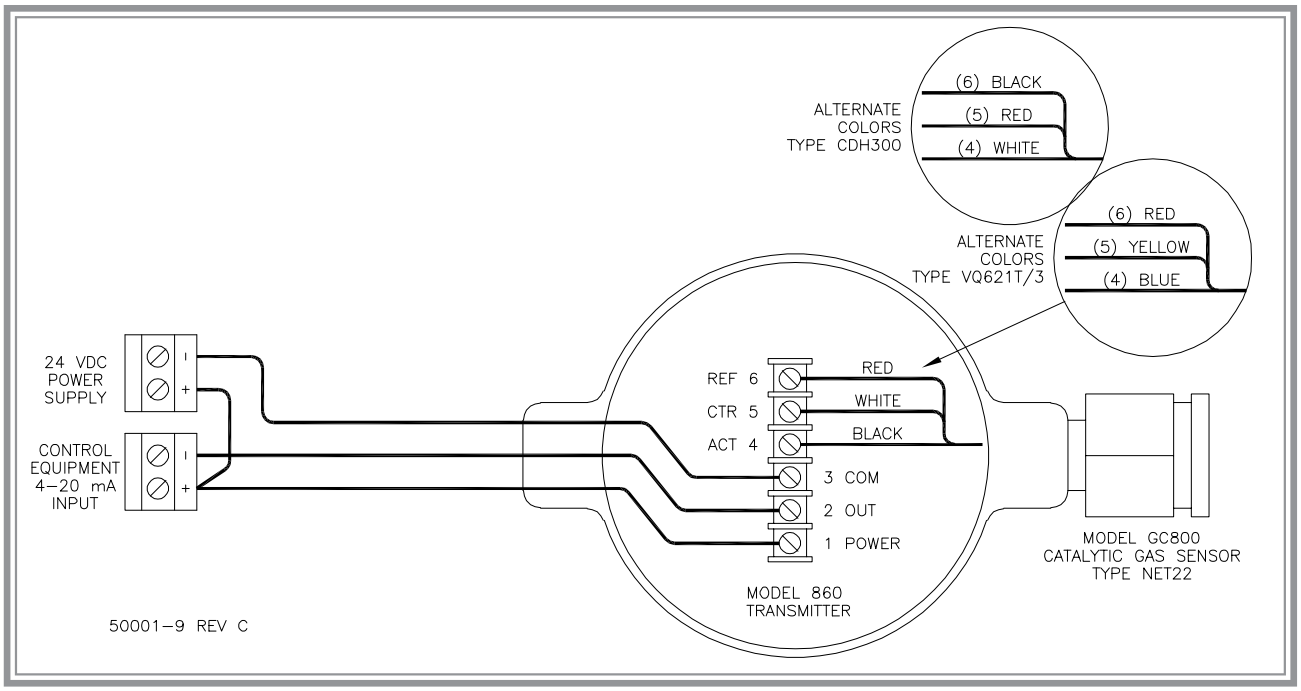

Figure 860-1 Typical Connections to the 860 Transmitter

INSTALLATION INSTRUCTIONS

IMPORTANT: The transmitter can be used with various sensors as shown in drawing above. Always check the marking on the sensor and use the wire colors as shown for the type of sensor you are using. Incorrect hook up will damage the sensor.

The SST Model 860 Transmitter card must be installed using part number 850-1 Sensor/ Transmitter Mounting Junction Box. This junction box should be mounted and connected to the conduit that carries the wires from the sensor to the control panel. Remove the box cover and connect the wires from the control panel and sensor to the terminals as shown in Figure 860-1

After completion of the wiring, insert the Model 860 transmitter card into the terminal block plug. The plug is keyed and prevents the 860 from being plugged in the wrong way.

SETUP AND CALIBRATION INSTRUCTIONS

The Model 860 Transmitter, when shipped preconnected to a Safety Systems Model GC800 Combustible Gas Sensor, has been calibrated at the factory for use with that sensor. No further calibration is required after the unit is installed.

For Model 860 transmitters that are installed with a different sensor, perform the initial calibration once installation is complete. This procedure can also be used for routine recalibrations during the lifetime of the sensor.

The Model 860 is preset at the factory to provide the 300 mA heater current required by the SST GC800 sensor. When installing the transmitter with a sensor that requires a lower current, set the “HEATER” current pot fully counter clockwise to adjust the sensor current to its minimum before turning on the 24 volt DC power to the transmitter. Excessive current will quickly burn out the sensor.

Equipment required

Voltmeter

A millivoltmeter (preferably digital) fitted with standard measuring tips is required.

Portable Purge Calibrator with Test Gas

A test gas kit containing means of directing gas to the sensors is required. Safety Systems Technology Model 857 is recommended. A cylinder of calibrated test gas is also required. If there is any possibility of “background” gas being present at the sensor location, you will also need a cylinder of pure Air Purge gas to properly set the zero pot on the transmitter.

Tools

A small screwdriver or alignment tuning tool with recessed tip is required for adjusting the potentiometers.

Location of Display LED, Test Points and Controls

! You must remove the cover from the Sensor/Transmitter Junction Box to perform the required calibration adjustments. Be sure that there is no combustible gas present before removing the cover.

Test Points and Controls are all located on the top side of the 860-1 transmitter printed circuit board. For measurement purposes, four test points are provided. The test points labeled **TP1** and **TP2** are used for the measurement of the **4-20 mA output (signal) current**. The test points labeled **TP3** and **TP4** are used for the measurement of the sensor **heater current**. The words **“OUTPUT”** and **“HEATER”** are marked on the edge of the circuit board near the test points to help aid in identification.

The green light emitting diode (LED) right next to test jack TP1 provides a status display. In normal sensor and transmitter operation it is lit, and the intensity increases as the output current increases.

The calibrating potentiometers are located opposite the test jacks on the printed circuit board of the 860 transmitter. The words **“SPAN”**, **“ZERO”** and HEATER **“CURRENT”** on the circuit board help identifying the potentiometers. The left hand potentiometer is used for the adjustment of the output current span, the center potentiometer is used for the adjustment of the output current zero (i.e. quiescent) point and the right hand potentiometer is used for the adjustment of the heater current.

Sensor Current Adjustment

Set the millivoltmeter to a suitable range corresponding to the sensor current range. The measuring resistor provides a 1:10 transformation of the heater current to the measured voltage. Thus for a heater current of 300 mA, a voltage of 30 mV will be measured. (The SST Model GC800 sensor should be set for 300 mA; see the manufacturer’s data sheet for the correct heater current for other brands). Touch the millivoltmeter tips into the heater current test points (TP3 and TP4).

The heater current potentiometer rotates clockwise to increase the heater current. If the potentiometer is rotated fully counter clockwise, the resulting heater current is virtually zero. This is a safe starting point. Adjust the pot for the required setting.

Output Current Zero Adjustment

Set the millivoltmeter to its 100 mV range. Touch the meter probes to the output current test jacks (TP1 and TP2).

If the sensor is in a known clean air environment (i.e. known that there is absolutely no combustible gas contamination), the zero potentiometer can be adjusted to give 4.0±0.05 mV output voltage immediately. If a clean air environment can not be assumed, apply bottled clean air or inert nitrogen to the sensor prior to carrying out this adjustment.

The green LED should be lit when the zero adjustment has been carried out.

Output Current Span Adjustment

The millivoltmeter should still be reading the output current test jacks.

The output voltage to be read on the meter depends on the concentration of test gas used.

The transmitter target output voltage needs to be calculated as
4 + (0.16 x p) mV
where p is the percentage of full range.

Example: The SST Model 6020 Combustible Gas Detection Module full range is 100% LEL. The sensor is being calibrated with 50% LEL Methane test gas. The target output voltage is 4 + (0.16 x 50) = 12.0 mV. (This output voltage corresponds to an actual output of 12 mA from the transmitter.

Apply the test gas to the sensor. The reading on the meter will increase as the sensor responds to the gas. When the reading has stabilized, adjust the span potentiometer until the meter reads 12 millivolts (or the calculated reading if not using 50% LEL test gas).

Stop the test gas supply and restore the “zero” gas condition (free atmosphere or bottled clean air). Recheck the zero adjustment. If a significant readjustment of the zero is necessary, the span procedure should be repeated.

! CAUTION: When calibrating the gas sensor, you must use the test gas corresponding to the gas to be detected, or calibration will not be accurate. For instance, if the expected gas to be detected is methane, you must calibrate with methane. If there is a posibility that several different gases could be present, always calibrate with the gas having the lowest LEL (lower explosive limit) rating.

When all adjustments are complete, disconnect the millivoltmeter from the Model 860 transmitter and replace the lid.

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