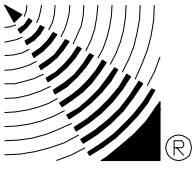
DESIGN MANUAL

Model GC801
Combustible Gas NOVA-Sensor

70017



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Quick Finder - Model GC801 NOVA-Sensor

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MODEL GC801 COMBUSTIBLE GAS NOVA-SENSOR

QUICK START

Apply Power

Apply + 24 volts DC to the labeled terminals (+ 24V, 24V RET). Normal operation begins after a 30 second countdown is displayed. The firmware revision (e.g. **"1.14"**) is displayed briefly at the end of the 30 second countdown. Then the decimal points will flash while the unit displays **"000"** to confirm to the user that unit is properly functioning. If **"000"** is not displayed, and there is no background gas, the sensor requires initial calibration.

Calibration

Calibration requires 50% test gas (50% LEL). Insure that no background gas is present before initiating calibration. Press the large MODE button on the outside of the sensor housing for 5 seconds. The sensor flashes **"000"** while sampling the zero gas condition (10 seconds). Apply 50% test gas when the 000 stops flashing. **"CAL"** will be flashed as the gas is sampled. When finished (approx. 40 seconds), the display will stop flashing - remove the gas now. The sensor begins normal operation once the gas level is safely below the LOW alarm setpoint.

Alarm Setpoints

Setting

Remove housing cover to access buttons labeled "UP" and "DOWN". Press the large externally mounted MODE button for 1 second, or press the UP/DOWN button. The LOW alarm LED will light as the setpoint is displayed. Use the UP/DOWN button to alter the value. After 5 seconds, the HIGH alarm LED and setpoint are displayed. Finally, after 5 seconds of button inactivity, the sensor will return to normal operation.

Confirming

To confirm or inspect the alarm setpoints without declassifying the area, simply press the large external MODE button for 1 second. Each alarm setting will be displayed for 5 seconds, along with its corresponding alarm LED (LOW or HIGH).

DIP Switch: Latch/No Latch Setting for LOW Alarm Output

DIP switch position 4 (of the 4-position DIP) in the UP (Open) position selects LATCHING mode for the LOW alarm. Placing the switch DOWN (Closed) configures the LOW alarm as NON-LATCHING. Power must be cycled to "read" the new DIP setting.

! The HIGH alarm is always latched due to code requirements. DIP switch positions 1, 2 and 3 are factory set to DOWN position. DO NOT CHANGE. **Other settings will damage the sensor!**

DESCRIPTION

The SST Model GC801 Combustible Gas NOVA-Sensor is a completely self-contained device that measures and displays the concentration of gas accumulated in a protected area, performs local control functions, and transmits this information to a central control point.

The SST sensors use the catalytic method of gas detection. Located inside a stainless steel flameproof housing, the sensing element is exposed to the detected gas through a sintered stainless steel flame arrestor. The actual detector consists of a matched pair of elements, each consisting of a fine platinum wire embedded in a bead of alumina material. Flammable gases in low concentrations will not burn by themselves, but when in contact with a suitable catalyst, it is possible to burn (or oxidize) any concentration of gas. One of the element pairs in the SST sensor is treated with such a catalyst, while the other element is protected with a similar, non-catalytic material. The platinum wires within the elements are heated by passing a suitable current through them. When the gas is oxidized on the surface of the catalyst, additional heat is released, which causes a temperature rise on the catalytic surface. This change in temperature is measured and converted to determine the amount of gas present. The SST Combustible Gas NOVA-Sensor has been designed with a special poison-resistant sensing material, and provides accurate measurements in atmospheres where traces of silicone or other poisoning agents may be present. Readings are unaffected by humidity or carbon dioxide.

Each SST NOVA-Sensor includes a high reliability microcontroller based transmitter/controller in the associated explosion proof junction box. A digital read-out is provided to continuously display operating status and the actual concentration of gas present in percentage of the Lower Explosive Limit (%LEL). The transmitter converts this reading to a standard 4-20 mA signal. This signal may be connected to a suitable SST NOVA-5000 Gas Detection Module, or to any other device with a standard 4-20 mA input. Connections between the transmitter and control device are normally made with 3 conductor cable [+ 24 VDC, 24 V return, 4-20 mA signal]. Dry contact relay outputs are provided for the LOW alarm, HIGH alarm, and fault. The LOW and HIGH relays operate at user adjustable alarm setpoints; the fault relay operates upon loss of power or internal failure of the unit. Relays are suitable for controlling local HVAC or equipment shutdown. An optional EIA-485 digital interface is also available.

The Model GC801 is suitable for the most demanding applications. A large body mass insures excellent vibrational characteristics when used offshore. Corrosion resistant materials permit uses in extreme environments.

GC801 NOVA-SENSOR, LOW-POWER VERSION

The NOVA-Sensor is available with special firmware that reduces the amount of current drawn from the power supply during normal, non-alarm operation. This version is intended primarily for use at unmanned locations where operating power is supplied by an associated SST Solar Power Unit. In the low-power version, the numerical readout and status LED's are completely blanked during normal operation. The displays and LED's are reactivated whenever the concentration of gas in the protected area reaches one-half of the LOW alarm setpoint.

The installation and operating instructions for the low-power version are identical to those for the standard version, except as noted below.

TECHNICAL SPECIFICATIONS

Power Supply	24 volts DC nominal, 180 mA standby, 240 mA when in alarm. Will operate within specifications at any supply voltage between 16 and 32 volts.
Power Supply (low-power version)	24 volts DC nominal, 90 mA standby, 125 mA with digital display on, 240 mA with display and alarm.
Response time	5 seconds typical. Time required for measured concentration to reach one half of the final concentration. Measured at 50% LEL.
Operating Temperature	-40 to + 200^{o} F. -40 to + 93^{o} C
Sensitivity	0.16 mA output per %LEL. Automatically adjusted during calibration and during CompTest™
Accuracy	Linear response between 0 and 100% LEL. Zero drift less than 5% per year.
Typical Gasses	Methane, Propane, Hydrogen. Almost all detectable combustible gasses produce a similar 4-20 mA output
Relay Contact Ratings	6 amps @ 28 VDC resistive 6 amps @ 300 VAC resistive 1/8 HP @ 120/240 VAC
Analog Output	Sensor will source 0 to 20 mA DC into a load of 600 ohms or less.

Optional Digital Output	Designed per EIA-485 to permit bi-directional communication between detectors and data acquisition system over shielded twisted pairs.

INSTALLATION

The GC801 Unit

A complete GC801 unit consists of the following components:

- explosion-proof housing with MODE button, gas sensor head, terminal blocks for field wiring and transparent lid used to observe the operational status of the numerical readout and LED's.
- electronics module consisting of a stack of 5 round printed circuit boards.

The field wiring is connected to the terminal blocks on the bottom of the enclosure. The terminal blocks are accessible after removing the enclosure lid and the electronics module.

The face plate (topmost printed circuit board) of the electronics module carries various displays and controls. These are:

- Three-digit seven-segment LED display (numerical readout) for the display of gas concentration and status.
- Four round LED's, labeled "FAULT" (yellow), "HIGH" (red), "LOW" (red) and "CAL" (green). These LED's are used to signalize alarms and operating modes.
- Two square pushbutton switches, labeled "UP" and "DOWN". These switches are accessible with a small screw driver or ball point pen and can be used to adjust the alarm trip points of the unit.

Installation Sequence

The electronics module contains parts that are delicate and potentially sensitive to electrostatic discharge (ESD). Thus, the electronics module should be plugged into the terminal blocks in the enclosure right before system start-up, after all drilling and wiring is completed. The recommended installation procedure is as follows:

- Mounting the enclosure
- Wiring of power and signal cables, and, if required, of remote sensor
- Setting the DIP switches and suitcase jumpers on the electronics module
- Checking the field wiring, plugging in the electronics module
- Applying 24VDC power
- Setting the alarm setpoints, if required
- Calibration and functional check out with CompTest, if required

Mounting the enclosure

The dimensional characteristics of the GC801 are shown in the figure below. It is preferable to attach the sensor to a wall or bracket, using bolts through the two mounting holes. However, these mountings may be omitted if the electrical conduit is sufficiently rigid to support the weight of the detector.

The location of the sensor is important. For lighter than air gasses, such as methane, the sensor should be located **above** the spot where a leak is likely. For heavier than air gasses, such as propane, locate the sensor **below** the expected leak. However, do not locate the sensors closer than 1 foot to a floor to prevent damage from water, dust, etc.

Preferred orientation of the sensor is with the screen pointing down, as shown in figure 801-1. If necessary, it may be installed at an angle or horizontally. The sensor must *never be installed pointing upwards.*

Remote Sensor Mounting Version

The standard Model GC801 NOVA-Sensor is shipped with the sensor preinstalled onto the electronics housing. A special version, SST order number 801-11, is used if the gas sensor is located in an inaccessible location. The wiring for the remote sensor is described in the section "Remote Sensor Version" at the end of this installation section.

Wiring

Power input and Analog Signal Output

A typical installation is shown in figure 801-2. This setup uses three wires between the NOVA-Sensor and the associated control modules. These wires carry the 24 VDC operating power for the sensor, and transmit the 20 mA signal to the controls. The wires should be shielded or installed in metal conduit to prevent undesirable noise pickup. To wire the NOVA-Sensor, carefully remove the electronics module from the

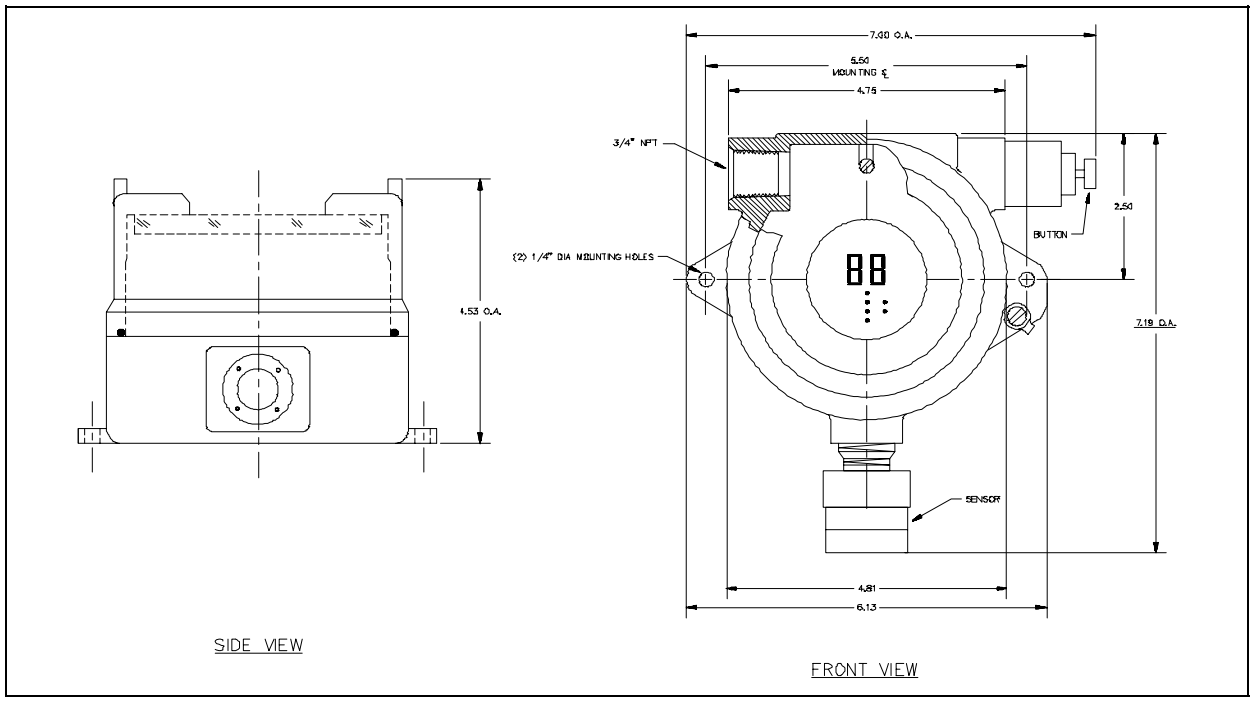

Figure 801-1 Mounting Dimensions

housing by pulling upward. Connect the three wires to the screw terminals in the housing. The terminals are marked as follows:

+ 24 V . . . . . .+ 24 volts DC power input
24V RET . . . . . .Common return for DC power and 4-20 mA signal
4-20 mA . . . . . .Analog signal source to control equipment

MODE Pushbutton and Remote RESET

The integral, external MODE push-button on the NOVA-Sensor housing can be used to clear any relays or alarms in the NOVA-Sensor which have been latched when activated. Pressing the button for less than 3 seconds (.5 second minimum) will cause the latched relays to clear and the alarm setpoints to be momentarily displayed.

An optional external, remotely located, push-button can be wired to the terminal marked RESET. This should be a normally open contact, and should connect the reset terminal to 24VRET (common) to reset the sensor. The remote RESET button, when active for between .5 and 3 seconds will clear any latched relays.

Electronics Module

The electronics module consists of four circuit boards and a faceplate provided as a single replaceable unit. The DIP switches are visible from the side of the module, the suitcase jumpers can be found at the lower board edge. The electronics module contains no user serviceable parts. The electronics module plugs onto the two terminal blocks located on the bottom of the enclosure.

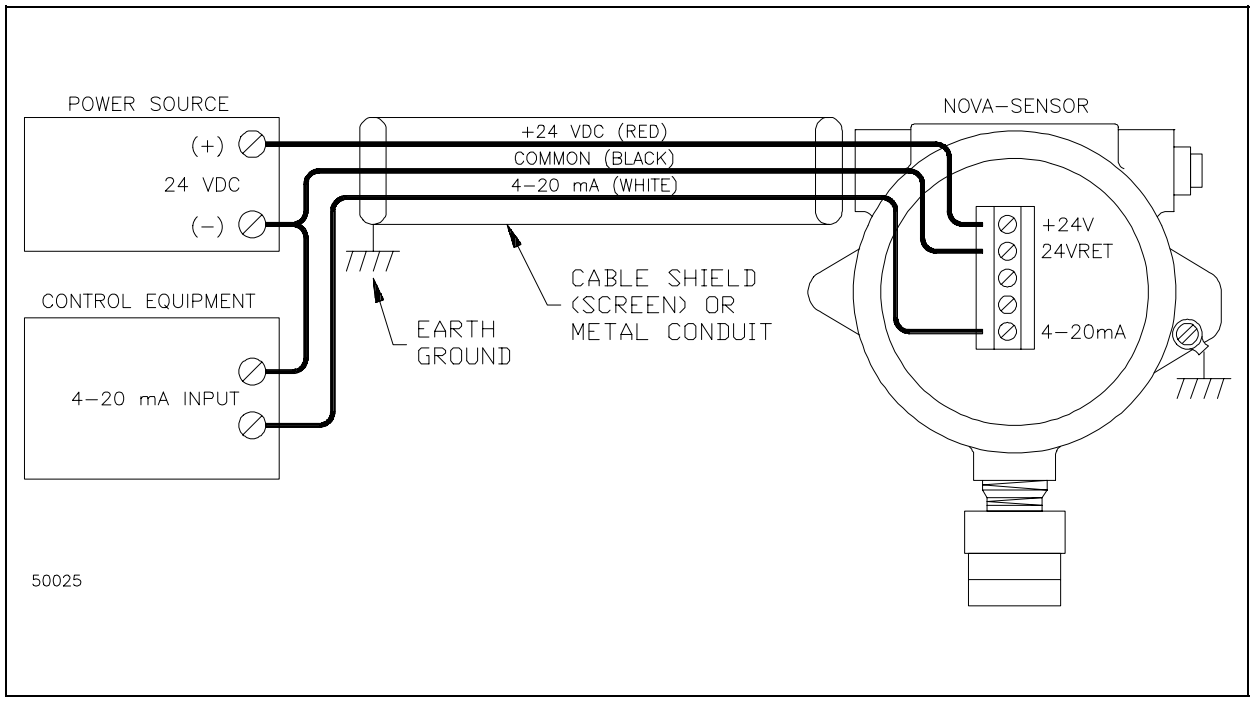

Figure 801-2 Typical Output Wiring

Relay Contacts

If the internal alarm and fault relay contacts are being used, additional wiring is required. The terminals for these are marked as follows:

HI ALM . . . . . .High alarm relay contact
HA COM . . . . . .Common contact for above
LOW ALM . . . . . .Low alarm relay contact
LA COM . . . . . .Common contact for above
FAULT . . . . . .Fault relay contact
FLT COM . . . . . .Common contact for above

Suitcase jumpers on the lower most circuit board allow relay configuration as normally open or closed. Factory settings are:

Alarms: . . . . . .Normally Open (N.O.)
Fault: . . . . . .Open on Fault

! The suitcase jumper positions labeled "TOX" must never be used. The required jumper is factory preset on position "C" and must never be removed or changed.

Digital Output

Connections to the optional EIA-485 digital output are made to the four terminals marked M-1A through M-2B.

DIP SWITCH SETTINGS

Two piano-type DIP switches are visible from the side of the electronics module. These switches set the electronics for the type of sensor head installed, and set the operating mode.

Four-Position DIP Switch

Switches 1, 2 and 3 must always be set to the DOWN position for use with combustible gas sensor heads.

! **Do not adjust these three switches. Serious damage to the sensor or electronics module may occur if these switches are incorrectly set.**

Switch position 4 selects the LOW alarm as latching or non-latching. The UP position selects LATCHING mode for the LOW alarm. The DOWN position selects NON-LATCHING mode for the LOW alarm. When latched, the associated relay and the analog signal output will remain in the alarm state until the NOVA-Sensor is manually reset with the MODE button or the remote reset signal.

NOTE: The HIGH alarm is always latched to conform to code requirements.

Five-Position DIP Switch

All five positions on this DIP switch are normally set in the DOWN position. However, if your NOVA-Sensor is a "low-power" version, all five positions on this switch must

be in the UP position to select the low-power mode. Any other setting will cause the NOVA-Sensor to operate in standard power mode.

Remote Sensor Version

The remote sensor version is the same as a standard version, except that it does not include the sensor head. A SST Model GC800 Combustible Gas Sensor is required for use with the GC801 electronics package. A second 3/4 inch conduit connection is provided to connect the sensor electronics to the remotely located sensor head. Figure 801-3 shows the recommended installation configuration.

Cable considerations

Three conductors are required between the Model GC800 Sensor and the GC801 electronics. These wires will be carrying approximately 300 mA at 2.0 volts DC to provide the required heater current to the sensor. In general, the following rules should be observed:

- Always use the same wire type and length for all connections between GC801 and the remote sensor, preferably twisted and shielded cable.
- If shielded cable is used, it must be grounded only at the GND terminal in the GC801 electronics enclosure. The GC801 enclosure must also be properly grounded. Insulate the shield at the sensor end so that it will not be grounded.
- Avoid running the cable close to high-powered cables or equipment or close to radio transmitters or antennas.

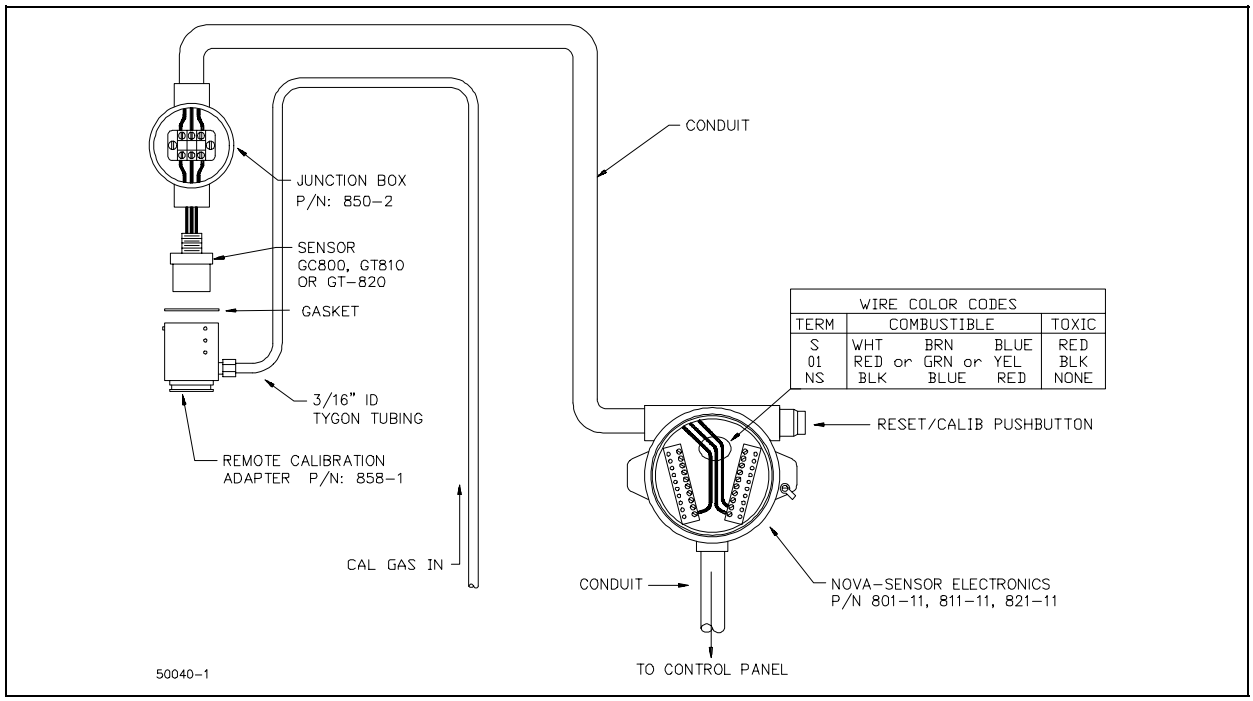

Figure 801-3 Installation with a Remote Sensor

Maximum Distance between a GC801 and a Remote Sensor

Practically, the distance should be restricted to 50'. This is due to noise, imbalance and other problems resulting from long cables (e.g. transients on the wires). If longer cables are necessary, the total DC resistance of the wires must be less than 3.0 ohms. The maximum cable lengths (for 3.0 ohms) for various wire sizes are listed below.

22 AWG (.35 mm^2):	197 ft (60m)
20 AWG (.50 mm^2):	281 ft (86m)
18 AWG (.75 mm^2):	422 ft (129m)
16 AWG (1.5 mm^2):	843 ft (254m)
14 AWG (2.5 mm^2):	1,406 ft (429m)
12 AWG (4.0 mm^2):	2,249 ft (686m)

Large distances will obviously invite noise. Shielded cable with identical wire types is a must. Also, transients must be kept off the cable. Though operation is not guaranteed, it may work well in not-so-harsh environments.

CableImbalance

Cable balance between the sensor and the electronics is critical because inserting asymmetric resistances into the 'S' or 'NS' wires can destroy the balance of the sensor load (Wheatstone bridge) as seen by the input circuitry of the GC801. Practical measurements show that a maximum imbalance of .2 Ohms on either 'S' or 'NS' wire can be tolerated by the GC801, as long as it does not change over time. Changing wire size, type or length or rewiring junction boxes will most likely result in imbalance, even if both 'S' and 'NS' wires are identical. Thus, any change to the rewiring requires that the GC801 be recalibrated. The calibration procedure takes care of slight imbalances that do not exceed the value stated above.

To avoid wire imbalance, the following rules should be observed:

- Always use the same wire type and length for all connections between GC801 and the remote sensor.
- Splices should be avoided and connections in junction boxes must be absolutely clean, preferably soldered.

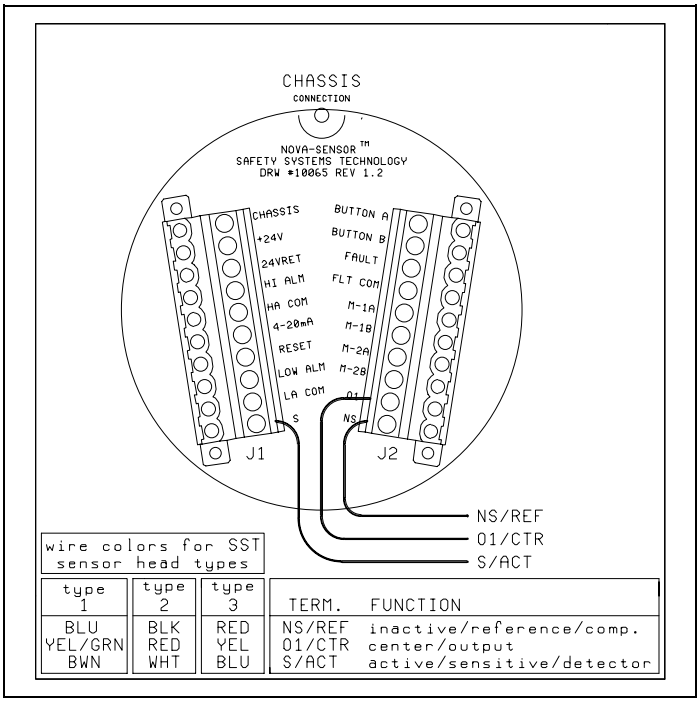

Figure 801-4 Sensor head color codes

! WARNING:
All sensor cable connections using crimp on terminals must be crimped and SOLDERED for stable operation. Improperly terminated cables will result in corrosion, resistance changes, drift, and inaccurate calibrations.

Cable Color Codes

The GC800 gas sensor head is supplied with three color coded wires which connect to the terminals S, 01 and NS in the GC801 electronics package. The color of these wires will vary, depending on the type of sensor provided. See figure 801-4 for hookup. If possible, use cable with the same color code as the supplied sensor to connect between the sensor and the electronics. If different colors are used, be extremely careful to connect each lead to the proper terminal. Interchanging two wires will almost always result in a burned out sensor.

OPERATION

Power-Up

When power is first applied, the microcontroller executes a built-in test (BIT), during which various internal components and parameters are checked. During the BIT, the indicator lights will be flashing. Upon successful completion of the BIT, the NOVA-Sensor begins a 30 second countdown period to allow time for proper temperature stabilization. The countdown is displayed on the digital read-out. At the end of the countdown, the NOVA-Sensor displays its firmware revision code (e.g. "1.16") on the numerical readout and begins normal **Protective Mode** operation. In protective mode, the digital read-out displays **"000"**. As a further verification that the unit is operating properly, the decimal points on the digital read-out slowly rotate from one digit to the next while displaying **"000")**. The NOVA-Sensor is now operating at the factory default calibration and alarm setpoints. After calibration, the most recent field calibration and alarm setpoint information will be stored in the NOVA-Sensor's non-volatile memory. This insures optimum performance even after power supply to the sensor has been temporarily interrupted.

Non-Volatile Memory

Calibration data and alarm setpoints are maintained in non-volatile memory to insure proper operation should the + 24 VDC supply be temporarily interrupted. No special care is required to maintain this memory.

Changing the Setpoints

Setpoints for HIGH alarm and LOW alarm are available for user modification. Factory defaults for the HIGH and LOW alarms are 50% LEL and 20% LEL, respectively.

To adjust either the HIGH or LOW setpoints, momentarily press either the UP or DOWN pushbutton on the face of the electronics module, using a small screwdriver or ballpoint pen. At this point, the LOW alarm LED will turn on, and the LOW alarm setpoint will be displayed. The user has 5 seconds to begin to adjust the LOW alarm setpoint by pressing the UP or DOWN button. Once the microcontroller has detected 5 seconds of inactivity (no button press), the unit will light the HIGH alarm LED and

display the previously stored setpoint value. The operator will again have 5 seconds to begin adjusting the HIGH alarm setpoint. After an additional 5 seconds of inactivity, the NOVA-Sensor will store the new values in non-volatile memory and return to normal operation.

Setpoints will "roll over" to zero at 100% LEL.

! Do not select setpoints below 5% LEL!

Calibration

The NOVA-Sensor has to be calibrated on installation/commissioning and then later at regular intervals. Calibration will take care of changes in detector performance and drift. During the calibration procedure, clean air as well as gas with a defined percentage of combustible gas are applied to the detector in order to provide the NOVA-Sensor with reference points needed to measure gas levels.

The presence of "clean" air, i.e. air without any combustible components, is absolutely necessary to provide the electronics module with a reference point for 0% LEL gas concentration. In locations where clean air cannot be assured, you may need to "purge" the sensor with clean air from a gas bottle before starting the calibration procedure. DO NOT USE nitrogen to purge the sensor, false readings may result!

The calibration can be performed by one person, and with the NOVA-Sensor operating in the classified area. No manual adjustments are required for calibration.

! NOTE: Calibration gas with a concentration corresponding to 50% LEL is needed for the calibration procedure.

The calibration procedure is initiated by depressing the large MODE pushbutton located on the side of the enclosure and holding it in for six to ten seconds. The calibration sequence is as follows:

1) The NOVA-Sensor acknowledges that the MODE button is pressed by lighting the three dots on the numerical readout. The current gas concentration will also be displayed.

2) Once the MODE button is released, the numerical readout will flash **"000"** and **"..."** for about ten seconds. During this time, the NOVA-Sensor is storing the zero reference point, based on clean air applied to the sensor.

3) The NOVA-Sensor then begins a 15-second count-down, during which it displays the numbers **"030"** through **"000"** on the read-out. During this time, the NOVA-Sensor is simply waiting for the calibration gas to be applied and conveyed to the sensor.

! In order to save gas it is recommended to apply calibration gas as soon as the 15-second count-down begins. Up to 3 minutes delay is tolerable for cases where the sensor head is at a remote location and the calibration gas must be applied through a long pipe.

4) While the gas level at the sensor is quickly ramping up, the read-out blinks **"CAL"** for three seconds in turn with the current gas concentration, relative to the previous calibration. Additionally the CAL LED blinks.

5) As the calibration gas at the sensor head approaches saturation level, the read-out displays the current gas value every second. This phase usually lasts 22 seconds.

6) As soon as no more significant changes in gas concentration are detected, the read-out displays **"050"** and stores the calibration gas level as the new reference for 50% LEL gas. At the same time the CAL LED changes from blinking to steady. Now the calibration gas should be removed from the sensor.

7) With the calibration gas removed, the read-out will decrease, as the residual gas is dissipated. Once the read-out is four points below the LOW alarm setpoint or at zero, the NOVA-Sensor returns to normal operation and the CAL LED is switched off.

The microcontroller in the NOVA-Sensor automatically stores the calibration it its internal non-volatile memory for use in subsequent measurements.

During the calibration process, the 4-20 mA output is set to 2mA and the relay outputs are suppressed. The NOVA-Sensor automatically returns to normal operation when the calibration is complete.

FailedorIncompleteCalibrations

If the calibration procedure is aborted (e.g. by not applying calibration gas), the NOVA-Sensor will return to normal operation after a time-out period of 3 1/2 minutes. In this case the NOVA-Sensor will use its original, pre-calibration data. Turning the power off will also abort the calibration procedure. Common causes for incomplete calibration are:

1) Calibration gas runs out during calibration. In this case, wait for the NOVA-Sensor to return to normal operation and repeat procedure with a fresh calibration gas bottle.

2) Calibration gas concentration too LOW. The NOVA-Sensor will not accept calibration gas with concentration below 20% LEL. Using gas cylinders with low pressure will often be interpreted by the NOVA-Sensor as low gas concentrations, especially when the gas flow cannot compensate for the gas consumption of the sensor head. In this case, wait for the NOVA-Sensor to return to normal operation and repeat procedure with fresh calibration gas bottle.

3) Gas applied at wrong time. Gas applied during step 2 above (too early, during clean air sampling) will result in negative displays and inaccurate readings. If the gas is applied too late (which may occur due to the pipe length when remote sensors are used) it may not reach significant levels before the 3 1/2 minute time-out and thus abort the calibration procedure.

Recalibration Schedule

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.

OPERATION IN THE LOW-POWER MODE

In this mode, the numeric display and the FAULT, HIGH, LOW and CAL LED's will be dark. The display and indicators will be energized if any one of the following conditions occurs:

- A gas concentration with a value equal to half of the LOW alarm setpoint is detected. The display will be on as long as the gas level is above this threshold. The display returns to dark when the level is below one half of the lower setpoint.
- The MODE button is pressed briefly. The current gas level is displayed, followed by the LOW and HIGH setpoints. Then the NOVA-Sensor is reset.
- The MODE button is pressed and held for five seconds to initiate a recalibration sequence. The display will be on during calibration, and then return to off after calibration is finished.
- The UP or DOWN button is pressed. The setpoints will be displayed. If no operator input occurs, the display will go dark.
- A latched alarm has been detected. The display and status LED's will be switched on and will remain on until the detector is reset.

NOVA-SENSOR OUTPUTS

The characteristics of the various NOVA-Sensor outputs are explained in more detail in the following sections.

0 to 20 mA Current Loop

The current loop output is normally between 4 and 20 mA, and is a direct linear read-out of gas concentration. Output is 4 mA when no gas being detected. Output is 20 mA when the full scale gas concentration of gas is being detected.

The 0 to 20 mA circuitry will reliably and accurately (.002% typical nonlinearity) drive a load resistance of between 100 and 800 ohms. The 0 to 20 mA circuitry is self calibrating and does not require adjustment. The Safety Systems **Trim-Not** technology, eliminates the requirement for field adjustable trim-pots.

Should a malfunction occur in the sensor or the current loop wiring, the output will, of course, be 0 mA. During calibration, the output will be 2.0 mA.

During normal operation, the loop current can be determined with the following formula:

I (mA) = 4 + 0.16 x %LEL

Relay Outputs

The NOVA-Sensor includes three (3) relays for connection to external devices. The LOW alarm and HIGH alarm relays operated when the concentration of gas measured exceeds the respective setpoints. The fault relay transfers on detection of a fault in the NOVA-Sensor.

Each relay can provide either a normally open or normally closed dry contact output. The **LOW alarm** relay can be set as either **latching** or **non-latching** - see section "DIP Switch Settings". The **fault relay** is always **non-latching** (self clearing).

Setting for Normally Open or Normally Closed operation

Three small suitcase jumper plugs located on the lower board of the electronics module determine the sense of the relay contacts. The mating header pins are labeled LO ALM, HI ALM, and FAULT.

When the jumper plug on LO ALM or HI ALM is across the two contacts on the NO side of the header, the respective relay contacts are NORMALLY OPEN. The relay contacts close on alarm.

When the jumper plug on LO ALM or HI ALM is across the two contacts on the NC side of the header, the respective relay contacts are NORMALLY CLOSED. The relay contacts open on alarm.

When the jumper plug on FAULT is across the two contacts on the **OF** side of the header, the relay contacts will **O**PEN ON **F**AULT. The relay contacts will be closed during normal operation.

When the jumper plug on FAULT is across the two contacts on the **CF** side of the header, the relay contacts will **C**LOSE ON **F**AULT. The relay contacts will be open during normal operation.

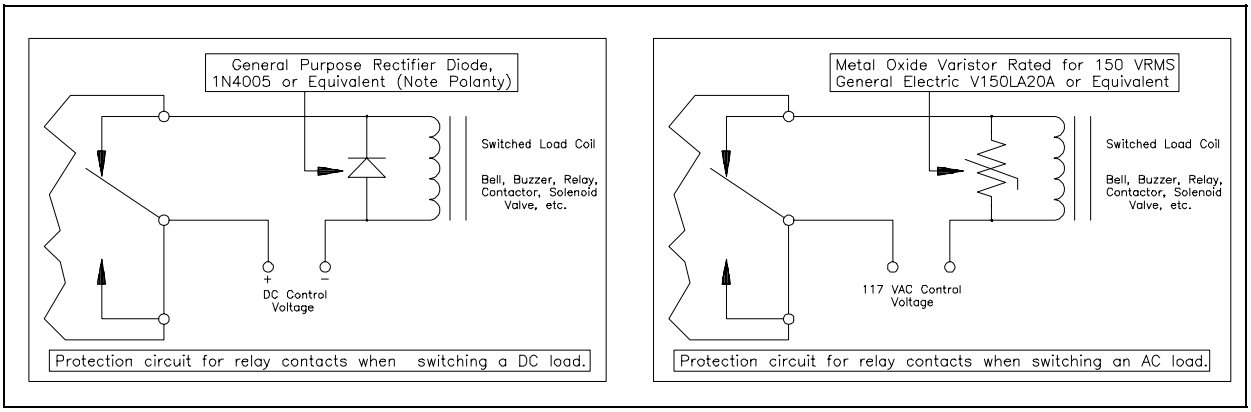

Figure 801-5 Relay Contact Protection Scheme

RelayProtectionCircuitry

Heavy duty relay contacts are provided in the NOVA-Sensor. These contacts are rated for resistive loads. If used for switching inductive loads, such as relay coils, lamps, beacons, etc., you must provide suitable suppression at the load. This will prevent burning the relay contacts, and also suppress harmful transients which can affect the operation of electronic equipment. The figures below show the recommended protection for DC and AC loads.

EIA-485 (M-LAN™)

The EIA-485 option allows reduced installation costs and increased communications and control between the NOVA-Sensor and the SST NOVA-5000 Detection and Control System. High speed digital communication and control is provided using the Safety Systems M-LAN™bus protocol. The EIA-485 communications interface also provides increased diagnostics and control functions. Reduced installation costs are realized by simplified wiring. All NOVA-Sensor detectors communicate with the central controller via two sets (buses) of twisted pair bus wires. Bus redundancy further increases reliability.

FINAL OPERATIONAL CHECK-OUT (CompTest™)

Once the NOVA-Sensor has entered normal operation, a final comprehensive output test (CompTest) of all detector inputs and outputs is available. The CompTest is a way to verify that the NOVA-Sensor relay outputs and 0 to 20 mA current loop are correctly operating. It can also be used to determine if the peripheral equipment is properly connected to the NOVA-Sensor.

The CompTest ramps the 0 to 20 mA current loop through each of its assigned values while changing the relay outputs as well. Each output state for the 0 to 20 mA loop and each of the three relays is held for about 2 seconds and repeated 3 times. The test lasts for approximately 1 minute. At the completion of the test, the built-in test (BIT) is executed and the unit is returned to normal PROTECTIVE MODE operation.

What keeps the CompTest from occurring during operation or by mistake?

Because the **CompTest** exercises all outputs, including **LOW ALARM** and **HIGH ALARM** states, there are several built-in safe guards against its inadvertent use. The button located on the side of the NOVA-Sensor (the Mode button) will not initiate a CompTest. The remote reset input on the NOVA-Sensor is used to initiate the test, based on a coded sequence of ON's and OFF's. Upon receiving the proper coded input (the CompTest Safety Code), the NOVA-Sensor begins the test. The NOVA-Sensor will only start the output tests if the proper Safety Code is entered. For additional security against inadvertent use, the Safety Code can only be entered **during the first 6 minutes** after the NOVA-Sensor has been returned to normal operation. Requiring a special **Safety Code** to be entered within 6 minutes of applying power, limits the **CompTest** to authorized personnel during system commissioning and periodic inspections.

How to Start the CompTest

WARNING:
Do not execute the CompTest until verifying that all systems connected to the NOVA-Sensor are properly configured to execute a test. Failure to do so may result in an unnecessary release of fire extinguishant or unnecessary dispatching of emergency personnel.

The CompTest must be started within 6 minutes of entering Protection Mode. The Safety-Code™is entered into the NOVA-Sensor by using the remote Reset button, not the MODE switch which is on the NOVA-Sensor housing.

You begin the test in either of the two ways described below.

To begin the Test if Power has just been applied

To begin the test wait at least 10 seconds after entering Protection Mode (but not more that 6 minutes). Then enter the **Safety-Code**™as described below.

To begin the test in an already operational system

It is not necessary to remove and reapply system power to initiate entry to **Protection Mode**. If the NOVA-Sensor is already powered up and in **Protection Mode**, press the Sensor **Reset** Button and hold it in (active) for 20 to 30 seconds, then release it. This causes the sensor to begin the normal power up sequence (as if power had been cycled). Wait for 5 seconds after releasing **Reset**, then enter the **Safety-Code** as described in the following section.

Entering the Safety-Code™

After following the previous instructions to insure that the NOVA-Sensor is ready to accept the Safety Code, press the **Reset** Button for three (3) **ON** cycles (5 to 10 seconds each, separated by 5 to 10 second pauses). This will cause the sensor to execute the **CompTest**™. The sequence is summarized as follows:

Action	Position:	Hold For Duration of:
1	**ON**	5 Seconds
2	OFF	5 Seconds
3	**ON**	5 Seconds
4	OFF	5 Seconds
5	**ON**	5 Seconds
6	OFF	

Upon accepting the **Safety Code,** the NOVA-Sensor will pause for 10 seconds and begin the CompTest.

If an incorrect code is entered, the NOVA-Sensor will pause 15 seconds and initiate a normal reset sequence prior to returning to normal operation.

CompTest™Operational Sequence

Upon receipt of the **Safety Code** within the first 6 minutes of entering Protection Mode, the following sequence is executed:

Fault Test

The following outputs are simultaneously toggled three (3) times, and are held in each state for approximately 2 seconds.

0 to 20 mA Loop	Alternates between 0 and 4 mA
Fault Relay	Toggles between Fault and no fault
LOW alarm relay	Inactive
HIGH alarm relay	Inactive

LOW Alarm Test

The following outputs are simultaneously toggled three (3) times, and are held in each state for approximately 2 seconds.

0 to 20 mA Loop	Alternates between 4 and 12 mA
Fault Relay	In Fault
LOW alarm Relay	Toggles between active and inactive
HIGH alarm	Inactive

HIGH Alarm Test

The following outputs are simultaneously toggled three (3) times, and are held in each state for approximately 2 seconds.

0 to 20 mA Loop	Alternates between 4 and 20 mA
Fault Relay	In Fault
LOW alarm Relay	Inactive
HIGH alarm Relay	Toggles between active and inactive

Upon completion of the CompTest, the built-in test (BIT) is executed and the system then returns to normal operation. If desired, the output test can be repeated by again entering the CompTest security code.

MAINTENANCE

Sensor Replacement

After extended use, the sensing element may age to the point where it will no longer be able to calibrate properly. This will be indicated by a FAULT after performing a calibration or by incomplete calibration. At this time, it is only necessary to replace the sensor element, then recalibrate.

When wiring the replacement sensor, follow the wiring instructions given in section "Remote Sensor Version".

Spare Parts

Installations which require on-site spare parts inventory should order from the below listed items:

Electronics Module, order no. 40801-02
Gas Sensor head, order no. 800-1

Electronics Module Replacement

If the electronics module ever has to be replaced, the new module must be calibrated to the sensor head installed on the enclosure.

TROUBLESHOOTING

Drifting/Shifting display

Drifting or shifting or otherwise inexplainable display (i.e. display of negative or positive gas values with no apparent cause) on GC801 NOVA-Sensors can have the following causes:

1) Bad contact between electronics module and terminal blocks in enclosure. This effect is noticeable when pressing on the installed electronics module from the top or when twisting it.

2) Loosened or contaminated suitcase jumper on relay board of electronics module.

3) If an electronics module that is not calibrated or that had been calibrated with a different sensor (in a different enclosure) is plugged into an enclosure, positive or negative gas values may be displayed. In this case, make sure that alarming devices are disconnected before plugging in, and that the unit is calibrated before re-connecting the alarming devices.

Bad contacts may be fixed with the following procedure:

1) Unplug the electronics module and clean the two green connectors on the back of the electronics module with a brush and alcohol. Clean the corresponding contacts on the green terminal blocks in the enclosure in the same way.

2) Unplug the suitcase jumper located on the header labeled 'C' on the lowermost PCB of the electronics module stack (note jumper position for later re-insertion). Clean contacts inside of jumper and on pin header. If possible, insert a new clean suitcase jumper with gold plated contacts. Alternatively, the two header contacts at 'C' may be connected by wire-wrap or soldering. When soldering, be careful to apply little heat in order not to loosen the pin strip header from the PCB.

Wiring of the CHASSIS Terminal

The original wiring scheme of the field wiring in the terminal block on the bottom of the GC801 detector enclosure must be changed, if one or several of the following conditions apply:

- the voltage at the local conduit or EARTH/GND is currently differing more than 2V from the voltage at the 0V/RETURN wire of the power supply, or is expected to do so in the future,
- the power supply used for the GC801 must be floating with respect to EARTH/GND.

The reason for the change is that so called "TVS (transient voltage suppressor)" diodes used in the GC801 are internally connected to the CHASSIS terminal. This could cause problems in installations where the 0V/RETURN cable is supposed to be floating with respect to EARTH/GND and/or where abnormal voltages on the conduit or local EARTH/GND are expected. The problems in those cases could result from the TVS diodes providing a conducting current path between the CHASSIS and the 0V/RETURN terminals.

The rewiring procedure will insulate the enclosure from the CHASSIS terminal and connect the CHASSIS terminal to the 0V/RET cable. The rewiring consists of the following steps:

1) Disconnect or shut off power to the GC801 detector(s).

2) Open the enclosure lid.

3) Carefully remove the electronics module from the enclosure.

4) Identify the revision of the electronics module. Look for the marking "REV" followed by a number on the topmost printed circuit board, in the clear space below the three digit numerical readout.

5) If the revision is 1.3 or later, no change is necessary. If it is 1.0, 1.1 or 1.2, proceed.

6) Remove the wire connecting the CHASSIS terminal and the internal grounding terminal in the enclosure.

7) Create a connection between the 24RET and the CHASSIS terminals with a wire about 1" long. If the 24RET terminal cannot be used due to too many wires, the connection can also go from CHASSIS to BUTTON B.

8) Recheck the wiring, carefully insert the electronics module and attach the lid of the enclosure.

9) Re-apply power and check for function. The modules do not have to be recalibrated.

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