

# MODEL 5028 INTELLIGENT GAS DETECTION MODULES

## DESCRIPTION

The SST Model 5028 series of Gas Detection Modules are used to monitor the concentration of combustible or toxic gases that may accumulate in a protected area. Versions of the module are available suitable for use with the following sensors:

- SST Model GC800 Catalytic type Combustible Gas Sensors
- Any self-powered sensor that provides a standard 4-20 Ma output signal, such as SST Model GIR900 Infrared Combustible Gas Sensors
- Any "loop powered" sensor that provides a standard 4-20 Ma output signal, such as SST Model GT810 Toxic Gas Sensors

Power to operate the field mounted sensor is derived from the redundant NOVA-5000 system power supplies. The module features a digital readout indicating the concentration of gas detected, plus two alarm indicating circuits with adjustable alarm levels. Field wiring to the sensor is continuously supervised.

- ! NOTE: The information in this section applies to all modules in this series. These modules are all basically the same, whether being used to detect combustible gases (methane, propane, etc.) or toxic gases (Hydrogen Sulfide, Ammonia, etc.). The only difference between the various models is the type of the gas marked on the front panel, and the maximum level displayed on the digital readout.

### Application Caution

The Gas Detection Module interfaces auxiliary functions to the NOVA-5000 Control System. An alarm condition on a gas module does not indicate a fire condition. The outputs of the gas module must not be used to activate any fire alarm signal devices. The gas modules should activate separate and distinct signals from the fire system.

## LOGIC DIAGRAM

Figure 5028-1 shows, in simplified form, the internal logic in the Gas Detection modules, and indicates the terminal number assigned with each.

## INPUT/OUTPUT CONNECTIONS

Figure 5028-2 shows the physical arrangement of the 16 terminals associated with the

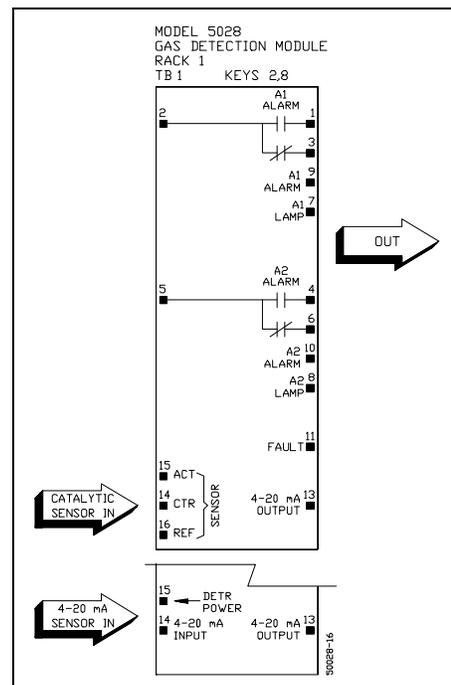


Figure 5028-1 Logic Diagram

Gas Detection Module. Each of the available signals is described below

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### **Alarm Relay Outputs — terminals 1 through 6**

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These are NOVA-5000 Standard Relay Outputs that operate whenever the concentration of gas detected exceeds the alarm levels programmed into the module. The normally open (NO) and normally closed (NC) contacts will be in that state with no alarm detected. The “Low” alarm relay A1 will transfer when the lower alarm level programmed into the module is reached, and may optionally be set to latch until the zone is reset by pushing the “Mode” pushbutton on the module or the main system reset pushbutton. The “High” alarm relay A2 will transfer when the higher alarm level programmed into the module is reached. The A2 alarm is always latching. These outputs will not be activated if the module is in the calibrate mode.

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### **Alarm Lamp Outputs — terminals 7 and 8**

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These are Standard Alarm Lamp Outputs activated by the Alarm state of the appropriate level. They exactly follow the state of the front panel alarm lamps, i.e. flash on initial detection of an alarm, steady when acknowledged, and switched off by reset.

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### **Alarm Solid State Outputs — terminals 9 and 10**

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These are Standard Logic Outputs activated at the alarm level settings A1 and A2. They operate simultaneously with the alarm relay outputs, and will not be activated if the Model 5028 Module is in the calibrate mode.

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### **Fault Output — terminal 11**

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This is a Standard Logic Output activated when the module detects a fault condition. Fault conditions include:

- A large negative value of the signal. This can be caused by a sensor out of calibration, wiring error, or failed sensor head.
- Microprocessor calculation error
- Electronics failure
- Reset signal always on (either the reset signal on the module mounting rack or the Mode pushbutton on the module is stuck on).

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### **4-20 mA output — terminal 13**

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This is an optional output, only available on Model 5028 modules ordered with this feature. This output exactly duplicates the 4-20 mA signal on the input terminals. It can be used to provide this signal to an external system, such as a PLC or DCS system.

The current loop output is normally between 4 mA and 20 mA, and is a direct linear read-out of gas concentration. The output is 4 mA when 0%LEL Combustible gas or 0 PPM Toxic Gas is being detected and 20 mA with 100% LEL or full scale toxic gas readings. Should a malfunction occur in the sensor head, the output will be 0 mA. During calibration, the output will be 2.0 mA.

**Catalytic Sensor Input — terminals 14, 15, 16  
(on Module part no. 35028-1 only)**

These connections apply to the catalytic combustible sensor version of the module only. The catalytic sensor should connect directly to these terminals. For accurate readings, it is important to have good low resistance connections between the catalytic sensor and the module. Be sure that all screw connections are tight. Use three-conductor shielded cable, or three wires installed in metal conduit. 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 <sup>2</sup>	200 m
20 AWG	1100 ft	0,50 mm <sup>2</sup>	330 m
18 AWG	1800 ft	0,75 mm <sup>2</sup>	520 m
16 AWG	2900 ft	1,5 mm <sup>2</sup>	875 m
14 AWG	4600 ft	2,5 mm <sup>2</sup>	1400 m
12 AWG	7300 ft	4,0 mm <sup>2</sup>	2200 m

**4-20 mA Sensor Input — terminals 14, 15, 16  
(on Module part no. 35028-2 or -3)**

These connections apply to the toxic and IR combustible versions of the module only.

**Terminal 14 — 4-20 mA Input**

This is the sensing input which is connected into the 4-20 mA loop. This terminal, in conjunction with terminal 15 below, provides the input for a standard “loop powered” transmitter.

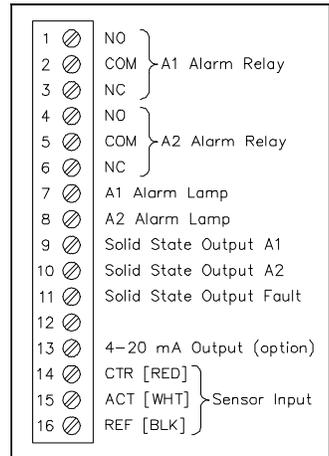
**Terminal 15 — Sensor 24 VDC Transmitter Power**

Because the actual signal output from any gas sensor is very low, an electronic circuit, typically referred to as a “transmitter”, is required to amplify the sensor signal to the 4-20 mA level required by the module. This output is a source of 24 volt DC operating power for the sensor transmitter. Transmitter power should always be taken from this source, rather than directly from a 24 VDC power supply, because this source utilizes the redundant power feeds to the module. This output can supply up to 400 mA @ 24 VDC.

**Terminal 16 — Internal Connection**

**!** This terminal used for internal connections within the module. Never make any connection to this terminal.

MODEL 5028 WIRING CONNECTIONS  
CATALYTIC SENSOR VERSION ONLY



MODEL 5028 WIRING CONNECTIONS  
4-20 mA SENSOR VERSIONS ONLY

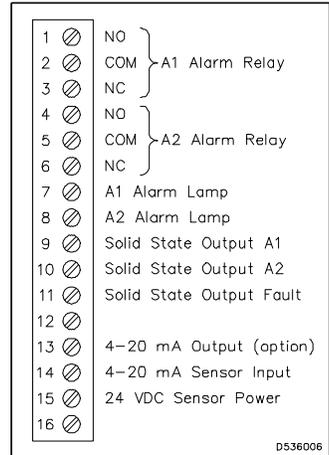


Figure 5028-2

**Typical Wiring Diagrams**

Figures 5028-3, 5028-4 and 5028-5 show the approved connections between the Model 5028 series modules and Safety Systems Technology Gas Sensors. All installations should be made in conformance with these drawings.

- ! When the Intelligent Gas Detection Modules are used in systems along with other NOVA-5000 modules, the Intelligent Modules lock on to the flash synchronization signals produced by these modules, so that the alarm LEDs on all modules will flash at the same rate. If the Intelligent modules are used in a system without any other NOVA-5000 modules, you must create a simulated synchronization signal by installing the optional jumper shown in the wiring diagrams between terminal number 2 and 15 on terminal block TB17.

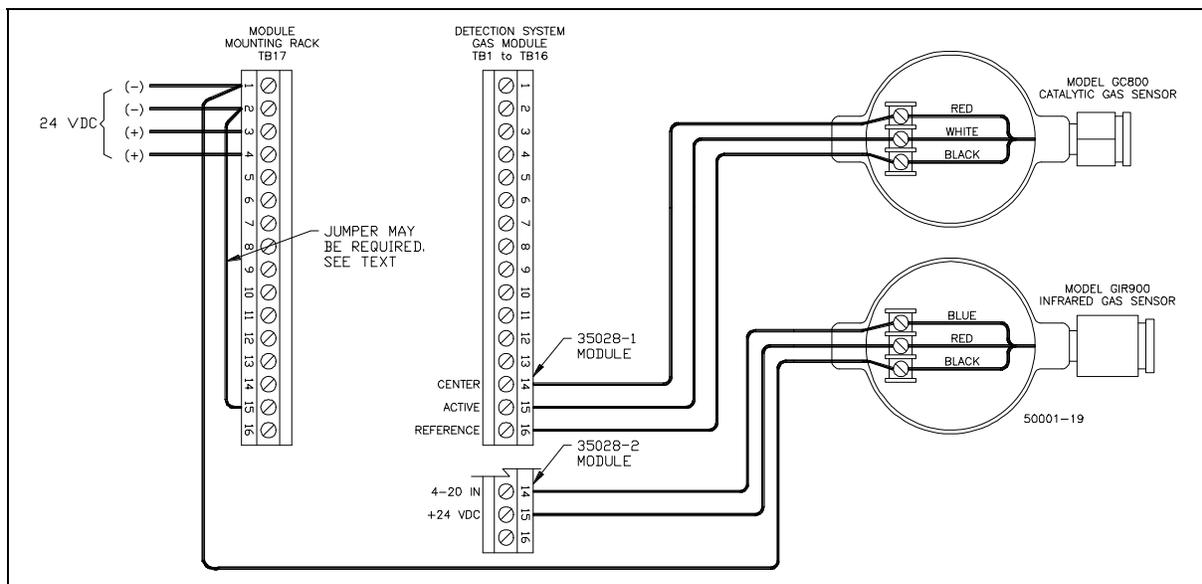


Fig. 5028-3 Typical Wiring Diagram, Combustible Gas Sensors

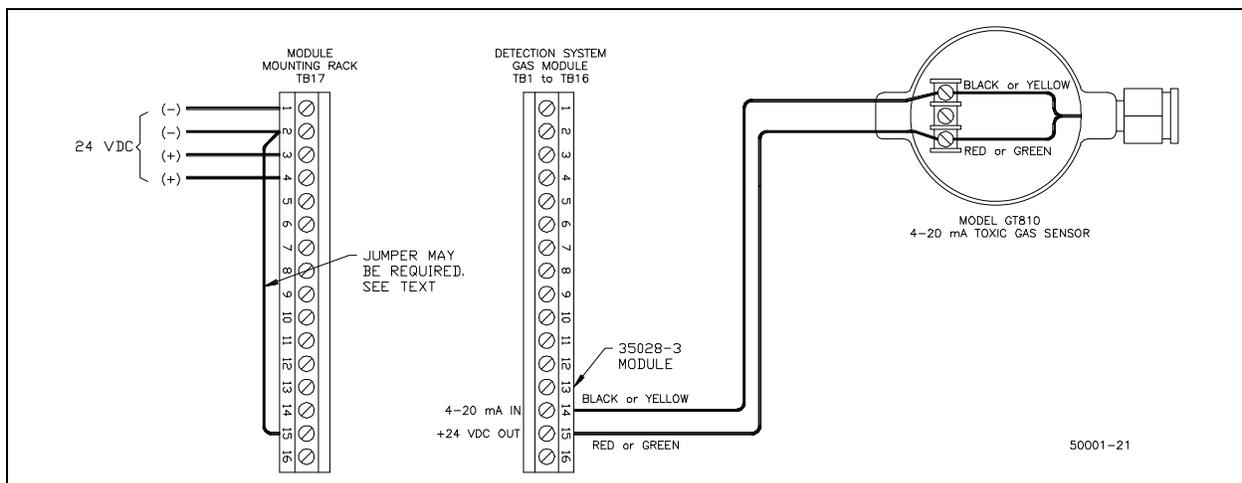


Figure 5028-4 Typical Wiring Diagram, Toxic Gas Sensors

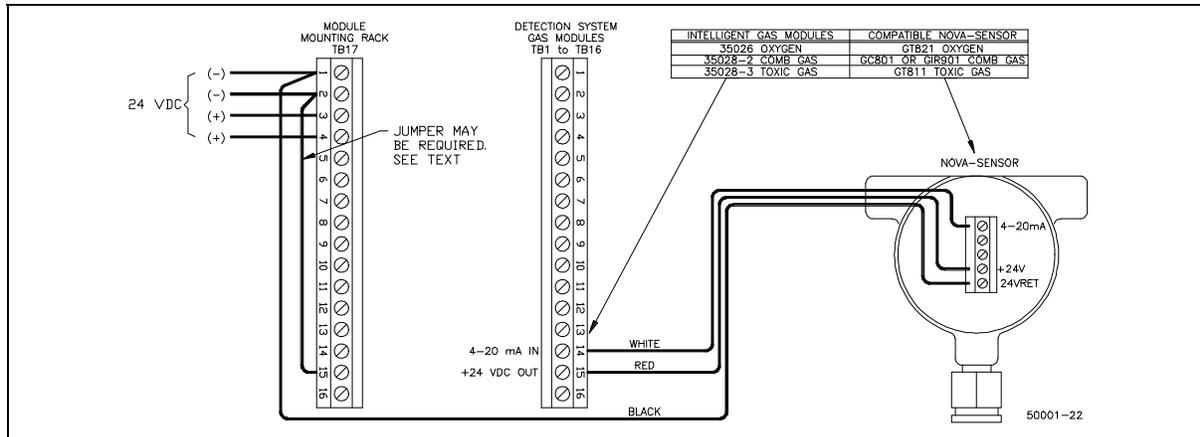


Fig. 5028-5 Typical Wiring Diagram, SST NOVA-Sensors

## MODULE SETUP INSTRUCTIONS

All NOVA-5000 modules are completely tested and calibrated at the factory before shipment. The following adjustments are the only ones necessary before installing the module.

### Setting low alarm A1 for Latching/Non-Latching operation

There is a “DIP” switch assembly on the module, marked SW5. Switch section 3 on SW5, Latch Enable, sets the A1 alarm point to latching (e.g. to trip and hold a gas detection alarm) or non-latching.

When the switch is OFF or OPEN, the alarm is set up to be *latching*, and the following actions will occur when the input current reaches the appropriate trip threshold:

- the red “A1” lamp on the front panel will illuminate
- the alarm lamp output of the module will activate
- the appropriate alarm solid state output will be activated
- the appropriate alarm relay contacts will transfer

If the input signal later changes to normal range, the latching function will cause the above listed outputs to remain as indicated until the module is reset. Note, however, that the digital display will continue to indicate the actual gas concentration in the protected area.

When the switch is ON or CLOSED, the alarm is set to be *non-latching*. The same actions as above occur when the input signal reaches the threshold, but if it subsequently changes to outside the alarm threshold range:

- The red “A1” or “A2” lamp and the lamp output will extinguish immediately
- the alarm relay and solid state outputs will return to their normal conditions

- ! The high alarm A2 is permanently set to be latching, regardless of the setting for the A1 alarm. It is always necessary to “reset” the module after a high alarm condition has been detected.

### Setting full scale reading on digital readout

Switch sections 1, 2, and 4 on SW5 determine the full scale setting for the digital readout. Set these switches per the following table. When selecting a new DIP switch setting, power must be cycled to “read” the new DIP configuration.

- !** The switch setting must exactly match the sensitivity rating of the sensor head.  
**YOU CANNOT CHANGE THE SENSITIVITY OF THE MODULE BY JUST CHANGING THE SWITCH SETTING.**

The required switch settings vary, depending on the type of Intelligent Gas Module you are using. Please refer to the part number marked on serial number label of the module and use the appropriate section below.

#### Combustible Gas Module - Model 5028 Part No. 35028-1

This module connects directly to a Model GC800 Combustible Gas Sensor. There is no “transmitter” required between the sensor and the module. The switches must be set as follows:

<b>Scale</b>	<b>1</b>	<b>2</b>	<b>4</b>
100%LEL	CLOSED	CLOSED	CLOSED

#### Combustible Gas Module - Model 5028 Part No. 35028-2

This model connects to the 4-20 mA output of a combustible gas sensor, such as SST Models GC801, GIR900, GIR901. This model may also be used with a Model GC800 sensor in combination with a Model 860 Transmitter. The switches must be set as follows:

<b>Scale</b>	<b>1</b>	<b>2</b>	<b>4</b>
100%LEL	CLOSED	OPEN	OPEN

#### Toxic Gas Module - Model 5028 Part No. 35028-3

This model connects to the 4-20 mA output of a toxic gas sensor, such as SST Model GT811 or Model GT810. The switches must be set as follows:

<b>Scale</b>	<b>1</b>	<b>2</b>	<b>4</b>
500 PPM	OPEN	OPEN	CLOSED
200 PPM	OPEN	OPEN	OPEN
100 PPM	CLOSED	OPEN	OPEN
50 PPM	CLOSED	CLOSED	OPEN
20 PPM	CLOSED	OPEN	CLOSED
10 PPM	OPEN	CLOSED	CLOSED

### Module keying

Before installing each Model 5028 series gas module into the wired slot in the mounting rack, be sure that the snap in covers have been installed at the proper keying locations of the rack keying strip. These covers must correspond to the two teeth that are removed from the red keying strip on the modules plug-in connector. See “Module Keying Instructions” in the mounting rack section of this manual for complete details.

- ! Installation of the keying system is very important. A module can be permanently damaged if it is plugged into a slot that is wired for a different type of module.

Modules may be inserted into or unplugged from the rack at any time, even with the power on. This will not damage the modules nor generate any false alarms, but will of course generate a fault alarm.

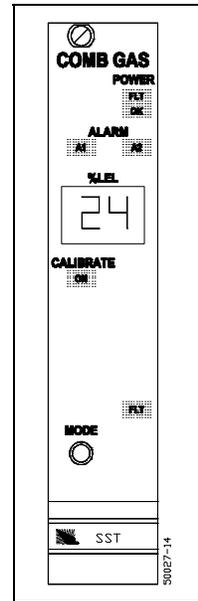


Figure 5028-6  
Front Panel

## OPERATING INSTRUCTIONS

### General

The Model 5028 series modules have been designed to monitor the signals generated by combustible gas and toxic gas sensors. The gas concentration is displayed on a 3-digit numeric display, and the module incorporates two independent trips which can be set to operate anywhere within the normal range of input signal.

When an alarm or fault indication is first detected, the relevant indicator lamp illuminates. Most systems are wired so that an audible alarm sounds at the same time. When the cause of an alarm or fault is removed, the indication will extinguish. Some faults and alarms are latched so that they can only be cleared by resetting the module.

### Power lamps (green and yellow)

The two lamps at the top of the panel indicate the status of the power supply to the module. A green lamp indicates that both of the dual 24 volt power feeds are within specification. If the yellow lamp is on or flashing, an out-of-tolerance power condition or power failure is indicated.

### Alarm lamps (red)

These lamps will normally be off. When an Alarm is detected, the appropriate lamp will light, and the appropriate module alarm outputs will be activated. If the alarm has been configured to be non-latching, an alarm will reset as soon as the input level goes below the programmed alarm trip threshold. For latching alarms, the module must be reset, either from the system reset pushbutton or from the front panel mode pushbutton to reset the alarm state to normal.

### Numeric Display

The 3-digit numeric display provides a digital readout of the gas concentration being monitored.

### Calibrate Lamp (green)

The green lamp will flash when the module is carrying out its calibration routine.

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### Fault Lamp (yellow)

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This lamp will be illuminated when any fault condition is detected as follows:

- A large negative value of the signal. This can be caused by a sensor out of calibration, wiring error, or failed sensor head.
- Microprocessor calculation error
- Electronics failure
- Reset signal always on (either the reset signal on the module mounting rack or the Mode pushbutton on the module is stuck on).

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### Mode Pushbutton

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This pushbutton performs the following functions:

- Resets any latched alarms
- A local lamp test occurs, i.e. all the lamps on the module are flashed momentarily and the Alarm Lamp outputs are energized.
- The module self-check routine is performed, followed by momentary display of the firmware version, and the A1 and A2 alarm trip points.

When the module is reset using an external system reset pushbutton, the same action as listed above occurs.

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### Power-Up

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When power is first applied, the microprocessor executes a built in test (BIT), during which various internal components are checked. During the BIT, the indicator lights will be flashing. Upon successful completion of the BIT, the Intelligent Module 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 module begins normal **Protective Mode** operation. In protective mode, the digital read-out displays the current gas concentration. The module is now operating at the factory default calibration and alarm set points.

- ! Until the module is calibrated to the installed gas sensor, the readings will not be accurate. It is not uncommon for the initial reading to be high enough to trip the A1 or A2 alarms. Or the reading may be a negative number, resulting in a fault indication. After calibration, the module will work normally, and the calibration and alarm set point information will be stored in non-volatile memory. This insures optimum performance even after power supply to the module has been temporarily interrupted.

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### Changing the Alarm Set points

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Set points for A2 alarm and A1 alarm are available for user modification

- ! To change the set points, you must access the UP and DOWN pushbuttons located on the module's printed circuit board while the module is operational.
- To do this, you will need a module test extender card, Safety Systems Technology part number 35360. This card, when attached to the module, extends the module outside of the rack so that the internal controls can be accessed for setup.

To adjust the A2 or A1 set points, press either the UP or DOWN button momentarily. At this point, the A1 alarm LED will turn on, and the A1 alarm set point will be displayed. The user has 5 seconds to begin to adjust the A1 Alarm set point by pressing the UP or DOWN button. Once the microprocessor has detected 5 seconds of inactivity (no button press), the unit will light the A2 Alarm LED and display the previously stored A2 set point value. The operator will again have 5 seconds to begin adjusting the A2 alarm set point. After an additional 5 seconds of inactivity, the module will store the new values in non-volatile memory and return to normal operation.

## Calibration

The Module 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 test gas are applied to the detector in order to provide the Module with reference points needed to measure gas levels.

The presence of “clean” air, i.e. air without any combustible or toxic components, is absolutely necessary to provide the electronics module with a reference point for zero 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!

**!** NOTE: Calibration gas with a concentration corresponding to 50% of the full scale reading on the module is needed for the calibration procedure.

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

- 1) The Module 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 Module is storing the zero reference point, based on clean air applied to the sensor.
- 3) The Module then begins a 15-second count-down, during which it displays the numbers “030” through “000” on the read-out. During this time, the Module 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” for combustible gases, or one-half of the full scale reading for other gasses, and stores the calibration gas level as the new reference. 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 set point or at zero, the Module returns to normal operation and the CAL LED is switched off.

The microcontroller in the Module automatically stores the calibration in 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 Module automatically returns to normal operation when the calibration is complete.

### **Calibrating the Module 4-20 mA output**

- ! To perform this calibration, you must access the UP, DOWN and MODE pushbuttons located on the module's printed circuit board while the module is operational. To do this, you will need a module test extender card, Safety Systems Technology part number 35360. This card, when attached to the module, extends the module outside of the rack so that the internal controls can be accessed for setup.

Immediately after plugging the module into the extender card, and while the display and LEDs are still blinking, simultaneously hold down the 'UP', 'DOWN' and 'MODE' buttons on the module printed circuit board. YOU MUST HOLD ALL THREE BUTTONS DEPRESSED UNTIL THE DIGITAL DISPLAY READS '004' and the module will set the output loop to 4 mA. The operator must watch the milliammeter connected to the output loop terminals and adjust the loop current as follows:

- If the output loop current is lower than 4 mA, pressing the 'UP' button will increase the current by 0.1 mA.
- If the output loop current is higher than 4 mA, pressing the 'DOWN' button will decrease the current by 0.1 mA.
- With no buttons being pressed for 5 consecutive seconds, the module will leave the 4-mA-calibration mode and switch to the adjustment mode for 12 mA.

In the adjustment mode for the 12-mA output loop, the display will read '012' and the module will set the output loop to 12 mA. Again, the output loop is adjusted to 12 mA by pressing 'UP' and/or 'DOWN'. With no buttons being pressed for 5 consecutive seconds, the module will leave the adjustment mode and return to normal operation, i.e. it will display the software release (e.g. '1.17') and start displaying the measured gas concentration.

### **Failed or Incomplete Calibrations**

If the calibration procedure is aborted (e.g. by not applying calibration gas), the Module will return to normal operation after a time-out period of 3 1/2 minutes. In this case the Module 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 Module to return to normal operation and repeat procedure with a fresh calibration gas bottle.
- 2) Calibration gas concentration too LOW. The Module will not accept calibration gas with concentration below 20% of full scale. Using gas cylinders with low pressure will often be interpreted by the Module 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 Module 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.

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## REPLACING OLDER MODULES WITH MODEL 5028

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A Model 5028 Intelligent Gas Detection Module may be used to replace an existing Gas Detection Module, Model 5020, 5021, 5022, 5023, 5024, 5025, or 5027. The wiring to terminal numbers 14, 15, and 16 of the associated terminal block on the Module Mounting Rack will need to be changed. (The connections to terminals 1 through 13 are identical for all modules, and so will not need to be changed.) To modify the wiring, refer to figures 5028-9 through 5028-10. These drawings show the original connections in solid lines and the new connections as dashed lines.

- ! Before inserting the new Model 5028 module into the module mounting rack, you must change the module keying plugs in the rack. The keying plugs are located in the red keying strip located to the right of the module connector inside the rack. The keying locations are numbered 1 through 12, with location 1 being at the top of the keying strip. You will find the keying plugs for the original module in locations 2 and 10. The key in location 2 should remain as is. **Remove the keying plug from location 10** by gripping the two sides of the plug with a pair of long nose pliers and pulling. Reinstall the plug into **location 6 for toxic** gas modules or **location 7 or 8 for combustible** gas modules.

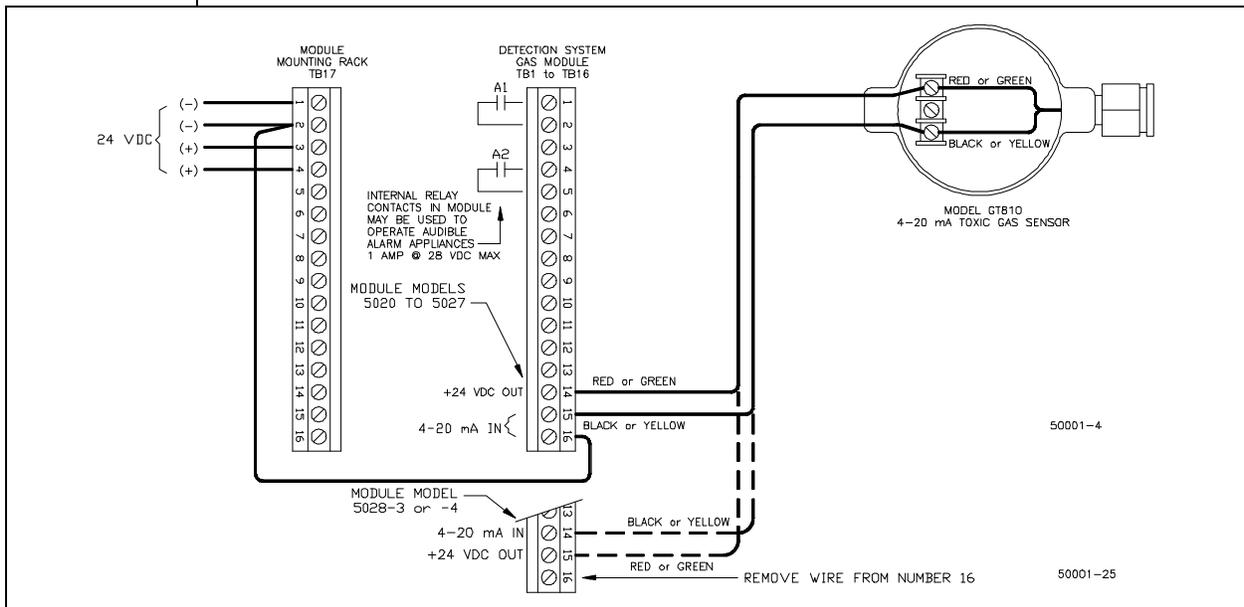


Figure 5028-9 Model GT810 Toxic Gas Sensor

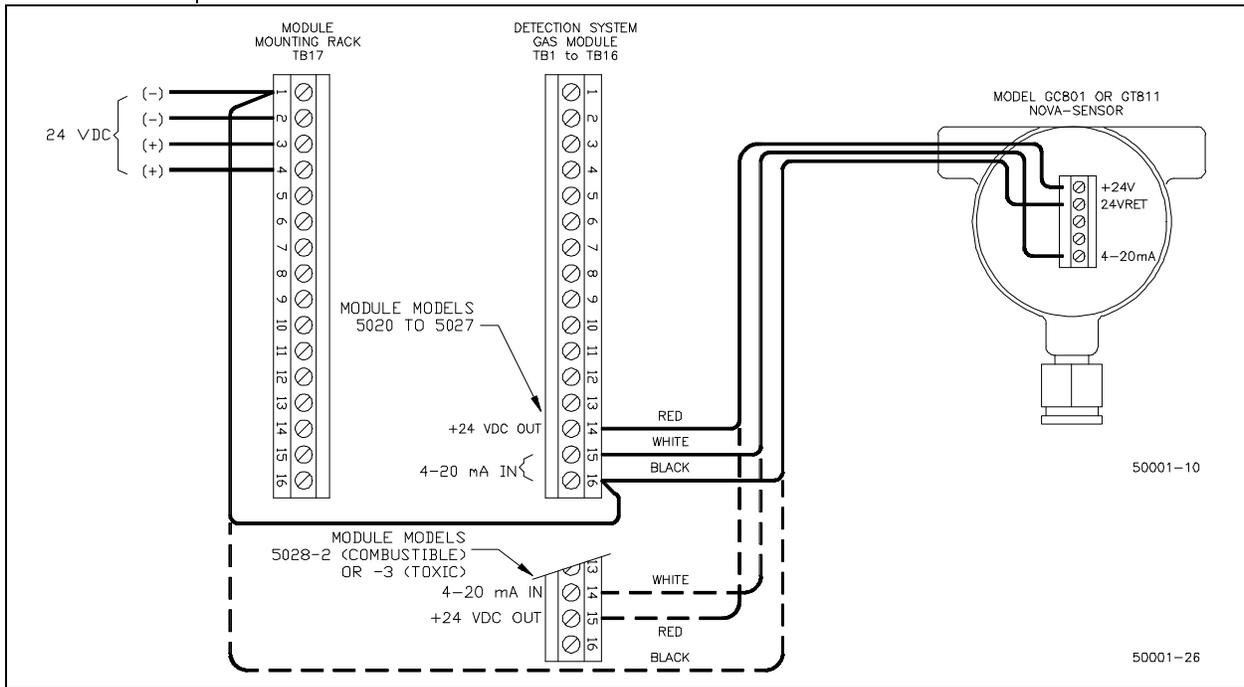


Figure 5028-10 GC801 Combustible or GT811 Toxic NOVA-Sensor