MODEL 5026 OXYGEN DEFICIENCY/ENRICHMENT GAS DETECTION MODULE

DESCRIPTION

The SST Model 5026 Oxygen Deficiency/Enrichment Gas Detection Module is used to monitor the percentage of oxygen in the atmosphere in a protected area. These modules can be used with any oxygen sensor that provides a standard 4-20 Ma output signal. A 24 VDC output, derived from the redundant NOVA-5000 system power supplies, is provided for powering the field sensor. The module features a digital readout indicating the concentration of oxygen present, plus two alarm indicating circuits with adjustable alarm levels. Field wiring to the sensor is continuously supervised for open circuits between the module and the sensor.

Application Caution

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

LOGIC DIAGRAM

Figure 5026-1 shows, in simplified form, the internal logic in the Oxygen Detection module, and indicates the terminal number assigned with each.

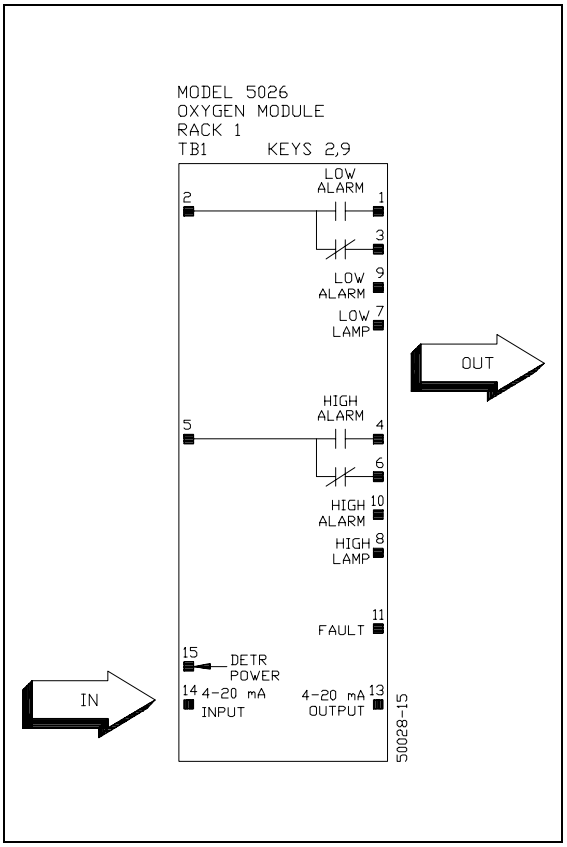

Figure 5026-1 Logic Diagram

INPUT/OUTPUT CONNECTIONS

Figure 5026-2 shows the physical arrangement of the 16 terminals associated with the Oxygen Detection Module. Each of the available signals is described below

Alarm Relay Outputs — terminals 1 through 6

These are NOVA-5000 Standard Relay Outputs that operate whenever the concentration of oxygen 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 will transfer when an oxygen deficiency at on below the low alarm trip point is detected. The High Alarm relay will transfer when oxygen enrichment at or above the high alarm trip point occurs. The alarms may optionally be set to latch until the module is reset by pushing the mode pushbutton on the module or the main system reset pushbutton.

Alarm Lamp Outputs — terminals 7 and 8

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.

Alarm Solid State Outputs — terminals 9 and 10

These are Standard Logic Outputs activated at the alarm level settings Low and High. They operate simultaneously with the alarm relay outputs.

Fault Output — terminal 11

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.

4-20 mA output — terminal 13

This is an optional output, only available on Model 5026 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% Oxygen is being detected and 20 mA with 25% Oxygen. Thus, the output loop will generate 17.37 mA at normal Oxygen levels of 20.9%. During normal operation, the loop current can be determined with the following formula:

I (mA) = 4 + 0.64 x %Oxygen

Should a malfunction occur in the sensor head, the output will be 4 mA (equivalent to 0% Oxygen). Faults of the electronics module or malfunction of the current loop wiring will result in 0 mA loop current (-6.25% Oxygen). During calibration, the output will be 2.0 mA.

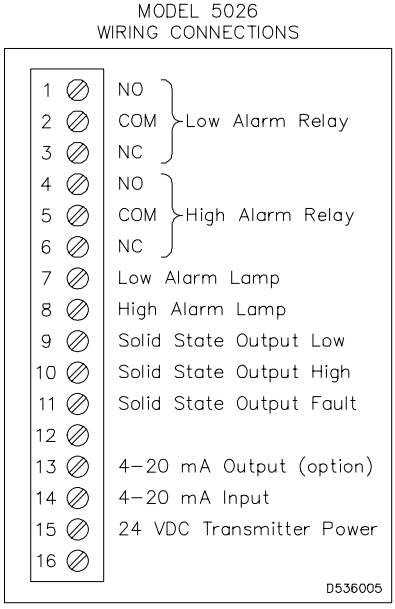

Figure 5026-2

Sensor 4-20 mA Input — terminals 14

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.

Sensor 24 VDC Transmitter Power — terminal 15

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.

Typical Wiring Diagrams

Figures 5026-4 and 5026-4A show the approved connections between the Model 5026 module and Safety Systems Technology Oxygen 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.

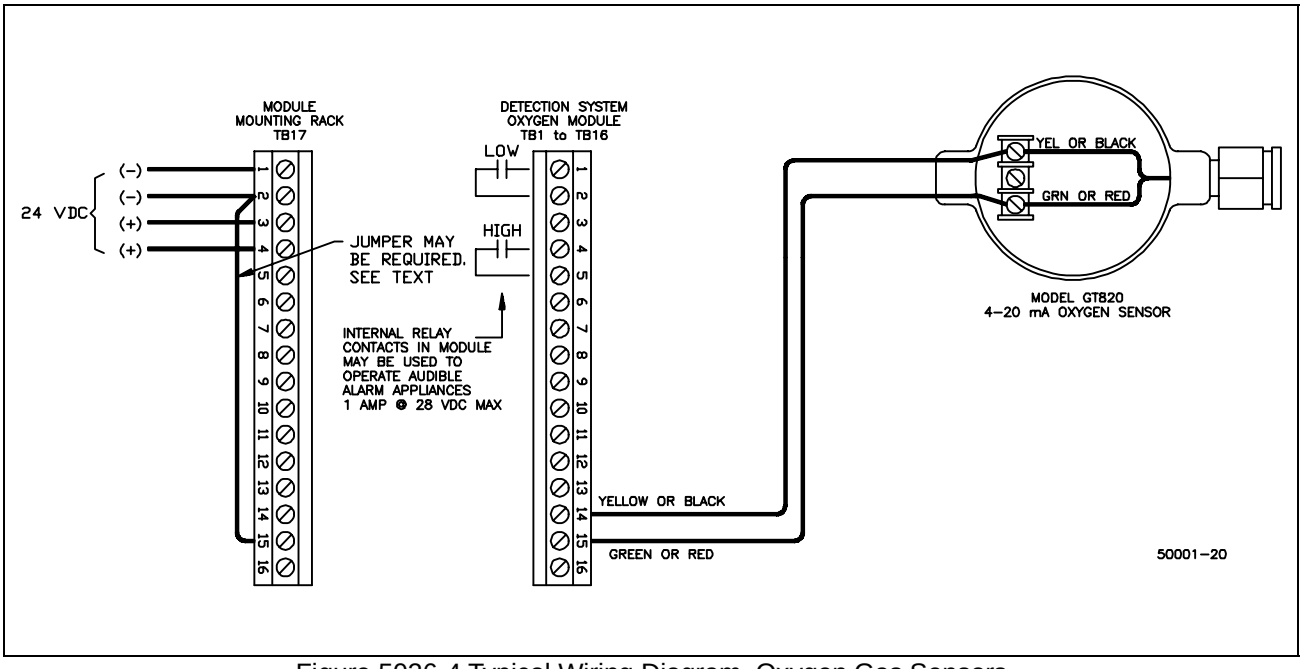

Figure 5026-4 Typical Wiring Diagram, Oxygen Gas Sensors

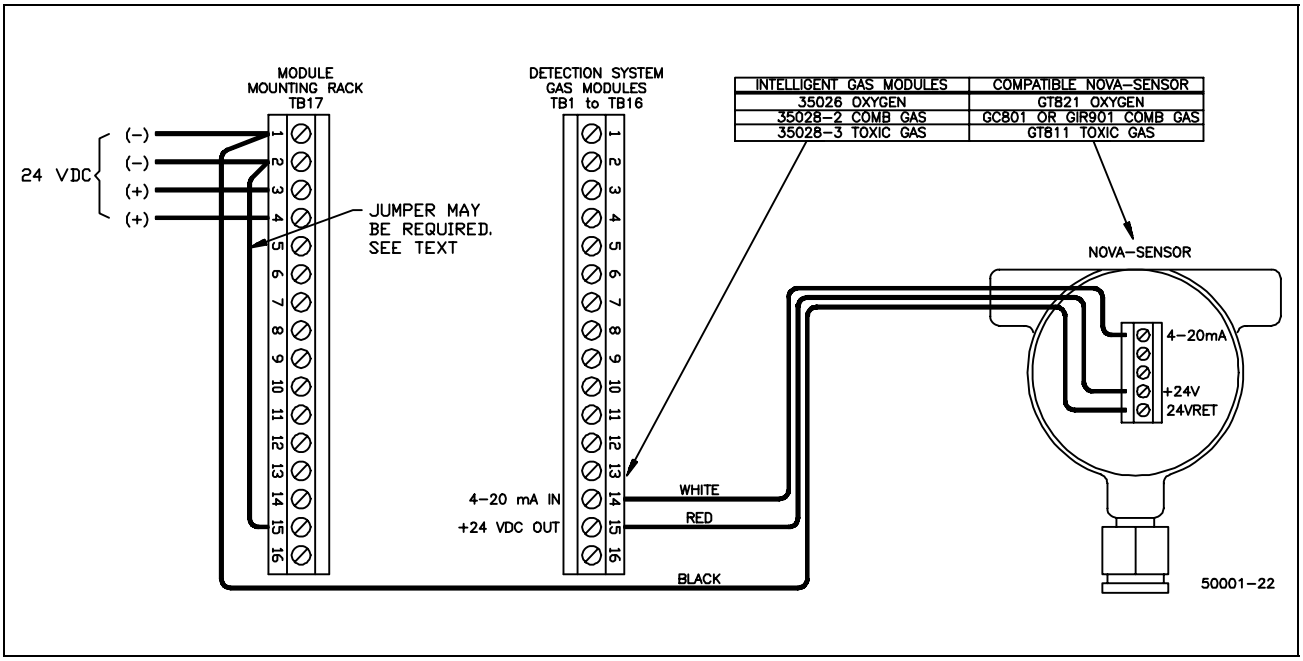

Figure 5026-4A Typical Wiring Diagram, Oxygen NOVA-Sensors

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 alarms 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 two alarm points to latching (e.g. to trip and hold a oxygen 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 “LOW” or “HIGH” 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 current 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 oxygen 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 current reaches the threshold, but if it subsequently changes to outside the alarm threshold range:

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

! The remaining sections of the DIP switch are used to configure the module for oxygen service, and must not be changed. Improper setting of this switches can result in dangerous operation. The required settings for the remaining switch sections are:

1 — On or closed
2 — Off or open
4 — Off or open
5 — On or closed
6 through 9 — Not used; setting does not matter

Module keying

Before installing each Model 5026 Oxygen Module into the wired slot in the mounting rack, be sure that the snap in covers have been installed at keying locations 2 and 9 of the rack keying strip. 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.

OPERATING INSTRUCTIONS

General

The Model 5026 modules have been designed to monitor the percentage of oxygen in atmospheric air signals generated by a suitable 4-20 mA oxygen sensor. The percentage 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 (i.e. 4 to 20 mA) range of input current.

Alarms and faults are indicated as follows:

- 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.

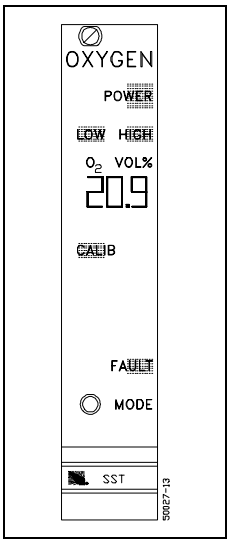

Figure 5026-6
Front Panel

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 (i.e. the input current rises above the preset threshold for the HIGH alarm or decreases below the LOW alarm level), 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 oxygen being monitored. The reading is scaled so that the 4-20 mA signal reads out in percentage of oxygen in air by volume. The display is calibrated to normally read 20.9%, which is the normal percentage of oxygen in air at sea level. Readings below 20.9 indicate an oxygen deficiency, while readings above 20.9 indicate an oxygen enrichment.

Calibrate Lamp (green)

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

Fault Lamp (yellow)

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.

Mode Pushbutton

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 low and high alarm trip points

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

Power-Up

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 Oxygen 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 Oxygen concentration. The module is now operating at the factory default calibration and alarm setpoints. After calibration, the most recent field 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.

Changing the Alarm Setpoints

Setpoints for high alarm and low alarm are available for user modification. Factory defaults for the Low and High alarms are 19.5% and 22%, respectively.

Note that setting setpoints above 20.9% will result in alarms being generated when the Oxygen level is above the setpoint, while setting setpoints below 20.9% will cause alarms being generated when the Oxygen level is below the setpoint.

! To change the setpoints, your 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 High or Low setpoints, press either the UP or DOWN button momentarily. 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 microprocessor has detected 5 seconds of inactivity (no button press), the unit will light the High Alarm LED and display the previously stored high setpoint value. The operator will again have 5 seconds to begin adjusting the high alarm setpoint. 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 automatic calibration must not be started when any background gas is present at the sensor. In locations where free "clean" air cannot be assured, you may need to purge the sensor with clean air before beginning calibration. The one-person automatic calibration sequence is initiated by depressing the pushbutton MODE switch located on the module and holding it in for 6 to 10 seconds, then release. During the calibration, the Oxygen Module automatically executes the following sequence:

1. The Oxygen Module acknowledges that the mode button has been pressed by displaying a steady 3 decimal points on the digital read-out.

2. The read-out will then flash 20.9 for approximately 10 seconds. During this time, the sensor is setting a "normal", based on the condition present (clean air) at the sensor.

3. The sensor returns to normal operation.

The microprocessor stores the results of the calibration in its permanent (non-volatile) memory for use in subsequent measurements.

During the calibration process, the optional 4-20 mA output of the module is set to 2 mA and the relay outputs from the sensor are normally suppressed. The sensor automatically returns to normal operation when the calibration is complete.

FINAL OPERATIONAL CHECK-OUT

Once the Oxygen Module 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 Oxygen Module relay outputs and 4-20 mA current loop are correctly operating. It can also be used to determine if the peripheral equipment is properly connected to the Oxygen Module.

The **CompTest** ramps the optional 4-20 mA output current loop through each of its assigned values while changing the relay outputs as well. Each output state for the 4-20 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 front of the Oxygen Module (the Mode button) **will not** initiate a CompTest. The reset input on the Oxygen Module mounting rack 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 Oxygen Module begins the test. The Oxygen Module 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 Oxygen Module 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 Oxygen Module 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 Oxygen Module by using the remote RESET button, not the MODE switch which is on the front panel.

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 Oxygen Module is already powered up and in **Protection Mode**, press the Remote **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 Oxygen Module is ready to accept the Safety Code, press the Remote **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 Oxygen Module will pause for 10 seconds and begin the CompTest.

If an incorrect code is entered, the Oxygen Module 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.

4-20 mA Output	**Alternates between 0 and 4 mA**
System Fault Loop	Toggles loop Open and Closed
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.

4-20 mA Output	**Alternates between 4 and 12 mA**
System Fault Loop	In Fault (open)

LOW Alarm Relay	Toggles between active and inactive
HIGH Alarm Relay	Inactive

HIGH Alarm Test

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

4-20 mA Output	Alternates between 4 and 20 mA
System Fault Loop	In Fault (open)
LOW Alarm Relay	Inactive
HIGH Alarm Relay	Toggles between active and inactive

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