Design Manual
Installation • Operation • Maintenance

Model GT824

NOVA-Sensor ELITE
Oxygen Monitoring Detector

70115

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Quick Finder

MODEL GT824 NOVA-Sensor *ELITE*™
Oxygen Monitoring Detector

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MODEL GT824
NOVA-Sensor *ELITE*™ *Oxygen Monitoring Detector*

DESCRIPTION

The NOVA-Sensor *ELITE* Oxygen Monitoring Detector measures the amount of oxygen contained within the air of an enclosed space. Air is a mixture of many gases and at sea level any volume of air contains 20.9% of Oxygen gas. The NOVA-Sensor *ELITE* when installed at any altitude will adjust to that altitude and will then display “20.9% Vol” when exposed to pure air. Use this detector to continuously monitor the percentage of oxygen in the present in a protected area. This detector uses an electrochemical fuel cell sensing element, and provides accurate measurements in all atmospheres. A high reserve of electrochemical activity insures a long life and excellent temperature stability. The performance is relatively unaffected by humidity, providing that conditions are non-condensing,

The display screen on the NOVA-Sensor *ELITE* continuously displays operating status and the actual concentration of oxygen gas. This reading is converted to a standard 4-20 mA signal, which may be connected to any remote device for remote display or logging. Relay contacts are provided which transfer when the oxygen concentration exceeds alarm set points. Typical set points are adjusted by the installer upon installation and may be reset later by authorized personnel. The relays are suitable for controlling local HVAC equipment, alarm signal devices or for equipment shutdown. Fault relay contacts are also available which operate upon loss of power or internal failure of the unit.

The automatic calibration sequence is initiated by activating the magnetic ▲MagPoint▲ located on the side of the enclosure. During calibration, step-by-step instructions are displayed on the NOVA-Sensor screen. There is no screwdriver or other manual adjustments required. The calibration is normally performed in the presence of known clean air, but can also be performed in air contaminated with gases.

TECHNICAL SPECIFICATIONS

System Specifications

Full scale measuring range	0 to 25% Oxygen by Volume
Maximum Overload	30% Oxygen
Display Resolution	0.1%
T_{90} Response time	5 seconds
Accuracy	Linear response between 0 and 25%
Output Drift:	Less than 2% signal loss per month, typically less than 10% over operating
Fuel Cell Life:	2 years typical. Plug-in replacement at end of life
Warranty	5 years

Electrical Specifications

Power Input	24 volts DC nominal, 80 mA standby, 140 mA alarm. Operates within specifications from 16 to 32 volts.
Analog Output	Sensor will source 0 to 20 mA DC into a load of 600 ohms or less
Output Sensitivity	4 to 20mA output corresponds to 0% to 25% Oxygen automatically adjusted during calibration
Relay Contact Ratings:	6 amps @ 28 VDC or 300 VAC resistive 1/8 HP @ 120/240 VAC
Relay Output Configuration	Three relays: Malfunction, High Alarm, Low Alarm Configurable as normally open or closed Alarms selectable: Latching or Non-Latching

Environmental Specifications

Operating Temperature	-4 to +131° F. -20 to +55° C continuous All sensors may be operated intermittently up to +150° F.
Relative Humidity	15% to 90% non-condensing; 0 to 100% intermittently
Ingress Protection:	IP40 to IP66. Depends on installed protection options.
Electronics Enclosure	Class I Division 1 Groups A,B,C,D Class II Division 1 Groups E,F,G; Class III Type 4X Class I Zone 1 AEx d IIC, IP66 Ex d II C; Class I Zone 1 IP66 Ex d IIC Gb, Ex tb IIIC Db, IECEx FTZU 12.0017U II 2G Ex d IIC Gb, II 2D Ex tb IIIC Db, FTZU 03 ATEX 0207U Ambient Temp -40°C to +85°C (-40°F to +185°F)

Mechanical Specifications

Conduit Connection:	¾ inch NPT thread.
Overall Size:	7 inches wide X 5 inches high X 4 inches deep 178 mm X 127 mm X 102 mm
Weight:	6.25 pounds (2.83 kg)

SELECTING A LOCATION FOR THE GAS DETECTOR

The Oxygen Detector is usually mounted on a wall or post at eye level, so that it is monitoring the air quality at the point were personnel are breathing the air. This is the preferred location for viewing the status of the detector on the screen. The oxygen sensor head can be removed from the electronics enclosure and mounted at other locations. If the protected area can be contaminated by leaking gases that are considerably lighter than air (vapor density less than 0.80) you can locate the sensor at the ceiling. For heavier than air gases (vapor density greater than 1.20) locate the sensor near the floor. However, do not locate the sensors closer than 1 foot to a floor to prevent damage from water, dust, etc.

Also consider the effect of forced air currents at the sensor location. The gas sensor will never respond if air currents blow the gas away from the sensor.

Preferred orientation of the sensor is with the porous face of the sensor pointing down, as shown in the pictures. If necessary, it may be installed at an angle or horizontally. The sensor must never be installed pointing upwards.

"ONE HOUR" INSTALLATION INSTRUCTIONS

The Model GT824 Oxygen Monitoring Detector is shipped fully assembled and pre-calibrated. It can be installed and be fully operational in less than one hour.

1. Mount the Detector Electronics Enclosure

Secure the electronics to a wall or bracket, using bolts through the two mounting holes. Locate the unit at a convenient place where the viewing screen and LED's can be easily seen through the window on the front of the enclosure. Most NOVA-Sensor *ELITE* detectors are shipped with the sensor preinstalled onto the electronics housing as shown here.

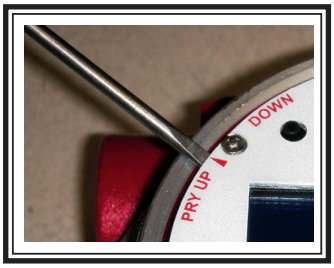
2. Mounting the Remote Gas Sensor Head

For 2-piece gas sensors only, mount the remote sensor in the location chosen for best and fastest response to leaking gas, as explained on the previous page. Lighter than air gases, sensor mounts on or near ceiling of enclosure. Heavier than air gases, sensor mounts about 1 foot (30 cm) above floor or ground. Preferred orientation is with the porous metal sensing face pointed downward. Never point the sensor face upward to insure that no moisture or dust collects on the sensor face to reduce sensitivity and damage the sensor.

3. Open the Detector Housing and remove Electronics Module

Loosen the hex head set screw on detector cover (a 7/64 inch hex wrench is required) and turn cover counter clockwise to remove.

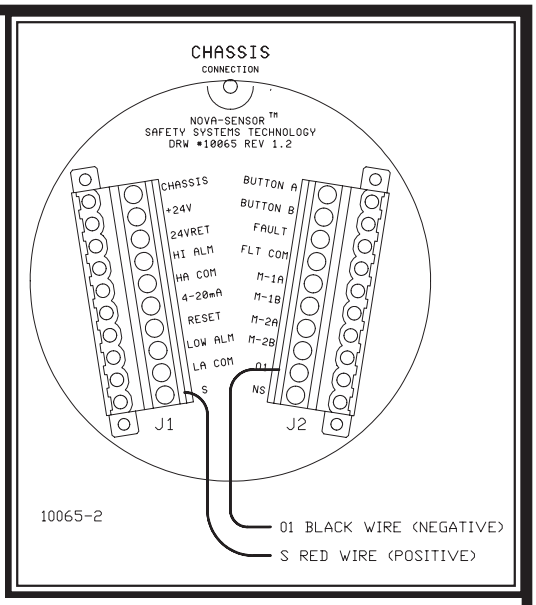
Grasp the edge of the electronics module face plate at any 2 of the 3 locations marked "PRY UP" and pull the electronics module out of the enclosure.



4. Connect external Sensor Head to the Detector

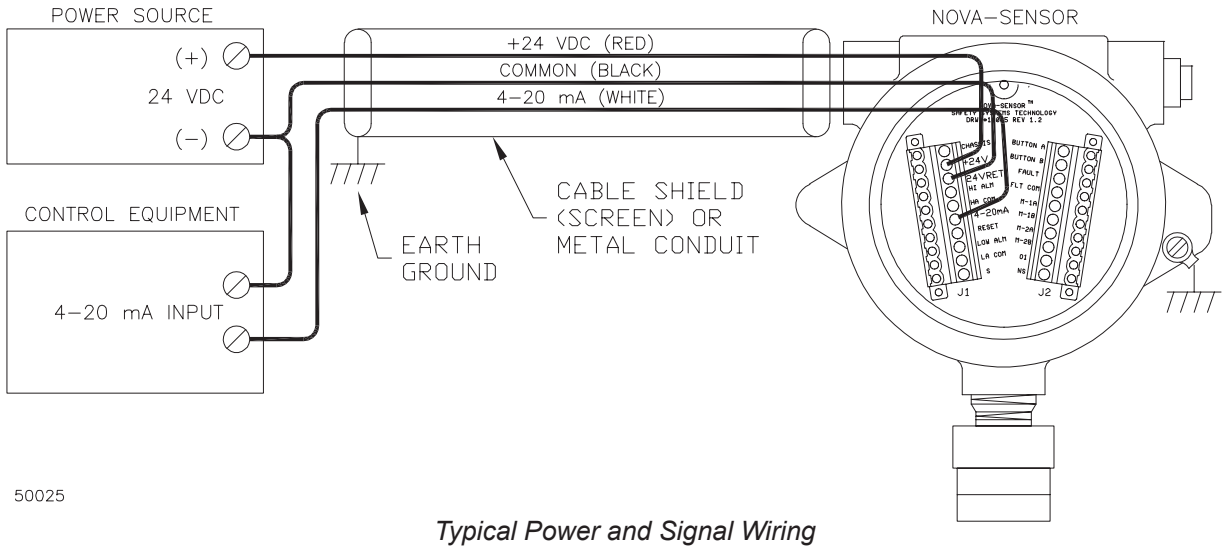
The sensor head, if installed on the electronics housing, is pre-wired to the NOVA-Sensor *ELITE* electronics by SST at the factory. If remote sensor is used, two conductors are required between the sensor and the electronics. These wires will carry a maximum of current of 20 mA at 32 volts DC, so large wires are not required. We recommend using size 22 AWG or 0.35 mm^2 conductors, colored red and black.

! IMPORTANT: Any electrical conduit connected to the NOVA-Sensor *ELITE* electronics enclosure must have a conduit seal installed within 18 inches (45.7 cm) of the enclosure.



5. Connect Power and Analog Signal Wiring

A typical installation is shown in this drawing. This setup uses three wires between the NOVA-Sensor *ELITE* 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 (screened) or installed in metal conduit to prevent undesirable noise pickup. Note that the black wire shown in the drawing provides the return path for both the 24 volt operating power and the 4-20 mA analog output.



Typical Power and Signal Wiring

! IMPORTANT: Any electrical conduit connected to the NOVA-Sensor *ELITE* electronics enclosure must have a conduit seal installed within 18 inches (45.7 cm) of the enclosure.

6. Connect optional Remote RESET Switch

The integral magnetically operated "▲MagPoint▲" on the NOVA-Sensor *ELITE* housing can be used to clear any relays or alarms in the NOVA-Sensor *ELITE* which have been latched when activated. Activating the ▲MagPoint▲ will cause the latched relays to clear. The alarm setpoints will also be momentarily displayed.

An optional remotely located pushbutton switch 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 detector when actuated. The remote RESET button, when active for 1 to 3 seconds will clear any latched relays.

7. Connect Relay Contacts to external equipment

The internal alarm and fault relay contacts can be used to provide signals to other pieces of equipment. Typical applications would be to activate audible and visual alarm signals to alert personnel in the local area. Or these contacts may be used to shut down critical equipment or to report conditions to a data logging system. These contacts may be set to be either normally open (NO) of normally closed as described below.

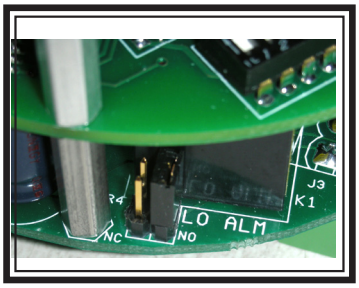
Connect 2 wires between external equipment and each of the below listed terminal pairs.

LOW ALM / LA COM	Contact transfers when LOW Alarm setpoint is reached
HI ALM / HA COM	Contact transfers when HIGH Alarm setpoint is reached
FAULT / FLT COM	Contact transfers detector is in a FAULT condition

8. Set Relay Contact Jumpers

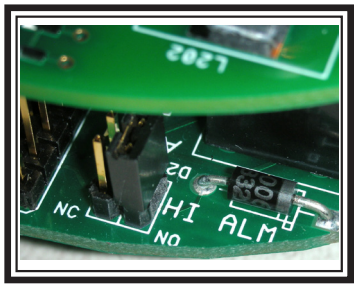
Jumpers on the detector electronics module lower most circuit board allow relay contacts to be set as normally open or normally closed.

Low and High Alarm Relay Contacts

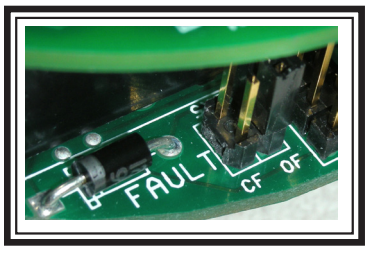


The factory jumpers are shipped connecting the 2 **NO** pins together. Contacts will be open when there is no gas alarm, and will close when a low or high gas alarm is detected.

Remove jumper plug from the NO pins and reinstall on NC pins to set this contact to be normally closed.



Fault Relay Contacts

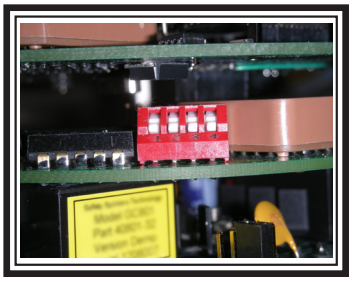


The factory jumper is shipped connecting the 2 **OF (Open on Fault)** pins together. The fault contact will be closed when there is no fault detected in the gas detector. The fault contact will open when any internal fault condition occurs in the gas detector. The fault contact will also open if the 24 volt DC power supply to the detector is interrupted.

Remove jumper plug from the OF pins and reinstall on **CF (Closed on Fault)** pins to set the fault contact to close when a fault or loss of power is detected.

There are two additional jumpers factory installed at the positions marked "**TOX**". Do not remove or change these jumpers nor move them, as they are required for proper operation of this detector.

9. Set Alarm Relay Contacts for Latching Operation



The User Option Switch number 4 sets the operation of the LOW and HIGH alarm LED's and relays.

Switch 4 DOWN sets Alarms NON-LATCHING. The alarms will automatically reset whenever the gas level falls below the set point.

Switch 4 UP selects LATCHING mode for the alarms. You must activate the ▲MagPoint▲ on the side of the detector housing or use the remote RESET input to clear the alarm.

User Options Switch 1, 2 and 3 are not used on your Oxygen NOVA-Sensor *ELITE*. Any changes to these switches will be ignored.

ROUTINE OPERATION OF THE NOVA-Sensor *ELITE*

The NOVA-Sensor *ELITE* is designed to provide protection of personnel and property from undesirable oxygen concentrations 24 hours a day, 7 days a week with no regular intervention required.

Using the ▲MagPoint▲ to Control the NOVA-Senor *ELITE* Oxygen Monitoring Detector

The ▲MagPoint▲ Key Fob shipped with the Oxygen NOVA-Sensor *ELITE* is used to control the electronics module inside the detector enclosure. Look through the window on the front of the enclosure and note the ▲MagPoint▲ marking at the upper edge of the viewing window. The ▲ symbol points to the side of the main housing where the magnet on the fob will signal the required actions from the electronics inside. Hold the magnet on the side of the enclosure and watch for the screen brightness to increase when the magnet is in the proper location for activation.

Protection Mode

This is the normal operating mode, and the NOVA-Sensor *ELITE* will be in this mode when all conditions are normal. The lighted blue background on the display screen will be dimmed to conserve power, but the digital display of the actual percentage concentration of Oxygen will be readable, even if the detector is located in areas with high brightness lighting. The green POWER indicator will be illuminated, and will occasionally blink as a confirmation that the microprocessor is continuing to check the area for unusual concentrations.

In protection mode, all relay contacts are in the normal, non-alarm and non-fault condition, The detector displays "20.9% Vol" Oxygen and the detector will transmit a 17.37 mA signal to any connected external equipment.

Activate the ▲MagPoint▲ on the side of the enclosure to:

- Restore the screen illumination to full brightness
- Display the Oxygen Percentage that will activate the LOW ALARM
- Display the Oxygen Percentage that will activate the HIGH ALARM
- The detector will then return to normal operation.

Low Gas Alarm Mode

When Oxygen concentration is starting to change from the normal 20.9% in the protected area, the following occur:

- The new oxygen concentration is displayed (The screen will remain at half brightness during this time)
- The 4-20 mA signal to external equipment changes to report the present gas concentration
- When gas concentration reaches the low alarm set point, the SCREEN FLASHES and the red LOW ALARM indicator also flashes.
- The low alarm relay is activated
- If gas concentration goes down below the low alarm set point, the red alarm indicator is extinguished and the screen stops flashing, but remains at full brightness until the gas concentration returns to 20.9%.

  ! If the red alarm indicator and the screen do not stop flashing when the gas concentration is below the low alarm set point, the detector has been configured with a latching low alarm. In that case, you must activate the ▲MagPoint▲ on the side of the detector to cancel the low alarm and return the detector to the protection mode. The low alarm may also be canceled from a remote location if the reset function has been installed in your detector.
- At 20.9% gas concentration, the screen returns to half brightness and the detector returns to normal protection operation.

High Gas Alarm Mode

The High Gas Alarm Mode performs exactly like the Low gas Alarm Mode, except that the red HIGH ALARM indicator flashes.

Fault Mode

The NOVA-Sensor *ELITE* is designed to continually monitor its own operation and to alert personnel when it is not functioning properly. This condition is reported as a FAULT. When a fault condition is active, the following occur:

- The SCREEN FLASHES and displays SYSTEM FAULT, and the yellow FAULT indicator flashes (if failure is not due to power source failed)
- The 4-20 mA signal to external equipment decreases to 2.0 mA or 0.0 mA
- The fault relay contact to external equipment changes state

! While in fault mode the NOVA-Sensor *ELITE* might not be able to report an alarm condition. The source of fault conditions should be corrected as soon as possible for safety reasons.

Possible causes of a Fault

- Electrochemical fuel cell in the sensor head is past the rated 2 year operating life
- Sensor head failure due to intrusion of moisture, dust, or silicones
- Sensor failure due to exposure to extremely high concentrations of oxygen for an extended period of time
- An open-circuit or short-circuit on the wiring going to a remote sensor
- 24 volt DC power source out of range or failed
- Failure of the electronic circuits inside the NOVA-Sensor *ELITE* itself

Maintenance Reminder Mode

We recommend a monthly test of the NOVA-Sensor *ELITE* as explained in the Maintenance section of this manual. The following reminders may be displayed when additional service is recommended:

- If the sensor display is continuously showing oxygen values less than 20.9%, CHECK CALIBRATION is displayed on the screen. (The screen illumination will remain dim during this display)
- If the sensor display is showing considerably lower than 20.9%, SYSTEM FAULT will display, the screen back light will flash and the yellow FAULT indicator will flash.
- 90 days after the last full calibration was made, CHECK CALIBRATION is displayed.
- After the sensor fuel cell element has been in service for 2 years, the detector will display REPLACE SENSOR CELL as a reminder that the cell is loosing sensitivity. After replacing the fuel cell with a new one, hold the UP button depressed for about 2 seconds. The display will read SERVICE ADVISORY CLEARED, and the unit is ready for another 2 years of operation. Because the sensor cell has been changed, you should now recalibrate the detector to the new sensor cell.

MAINTENANCE

Recalibration Schedule

The NOVA-Sensor *ELITE* has been pre-calibrated to the target gas at the factory, and no further calibration will normally be required when it is initially installed. 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 often the detector is exposed to higher concentrations of oxygen. 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 detector to the same calibration 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.

90 days after the last calibration of the detector was made, the message CHECK CALIBRATION will be displayed on the screen. This will not effect the normal operation, and the NOVA-Sensor will continue in normal protection mode using the existing calibration data. However, the calibration data should be refreshed as soon as practical, using the instructions below.

Recalibration Instructions

Calibration will take care of changes in sensor performance and drift. The automatic calibration procedure provides the NOVA-Sensor *ELITE* with reference points needed to accurately measure oxygen levels. The calibration procedure requires a small cylinder of 100% Nitrogen gas to purge any oxygen from the. Pure air is also required. If clean air cannot be assured, you may small cylinder of pure air. A calibration kit containing both Nitrogen and pure air is available from Safety Systems Technology.

The calibration can be performed by one person with the NOVA-Sensor *ELITE* operating in a hazardous area. It is not necessary to open the detector enclosure during calibration.

Calibration Procedure

To start the calibration procedure, hold the ▲MagPoint▲ key fob on the side of the detector enclosure until messages 1 and 2 are displayed:

1. **HOLD FOR CALIBRATION MODE** while ▲MagPoint▲ is in place

2. **START CALIBRATION --- REMOVE MAGNET NOW**.

3. **SETTING 20.9 ... WAIT** storing 20.9% reference point

   WARNING: Sensor must be exposed to pure air during this step. If the present location does not contain pure air, apply pure air from a cylinder using your calibration kit.

4. **CHECK GAS PRESSURE ... APPLY 100% NITROGEN** using your calibration test gas

WARNING: If calibration gas cylinder pressure is below 300 PSI [20 bars], there may not be enough gas in the cylinder to accurately calibrate the detector. Abort calibration immediately by activating the ▲MagPoint▲ two times. Calibration will not be correct if you continue calibration procedure with insufficient gas.

5. **GAS DETECTED...WAIT** measuring the Nitrogen concentration

6. **REMOVE GAS...WAIT** to allow test gas to dissipate from inside of sensor

7. **CALIBRATION COMPLETE** calibration data saved for use until next calibration

8. **20.9% Vol OXYGEN** NOVA-Sensor *ELITE* returns to normal operation

During the calibration process, the 4-20 mA output is set to 2 mA and the relay outputs will not be activated.

Failed or Incomplete Calibrations:

The NOVA-Sensor *ELITE* will wait for up to 5 minutes for gas to be applied during the calibration procedure. If no gas is detected within the 5 minutes, the calibration will be aborted and the message CALIBRATION FAILURE, USING PRIOR CALIBRATION DATA is displayed. The NOVA-Sensor *ELITE* will then return to normal operation.

You may abort or cancel a calibration procedure at any time by momentarily activating the ▲MagPoint▲ 2 times. The message CALIBRATION CANCELED, ORIGINAL VALUES WILL BE USED is displayed. You may also abort the calibration by interrupting the 24 VDC power to the detector.

Possible causes for incomplete calibration are:

1) Gas sensor head failure due to liquid intrusion.

2) Gas detector electrochemical fuel cell electrolyte may have been completely consumed by exposure to an extremely high concentration of oxygen gas over a very long time period.

3) Gas detector electrochemical fuel cell electrolyte may have been completely dried out by exposure to extremely low relative humidity over a very long time period.

4) Calibration gas applied at wrong time. Nitrogen gas applied during step 3 above (i.e. 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 5 minute time-out.

Replacing the Electrochemical Fuel Cell Sensor Element

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.

After the sensor fuel cell element has been in service for 2 years, the detector will display REPLACE SENSOR CELL as a reminder that the cell is loosing sensitivity. After replacing the fuel cell with a new one, hold the UP button depressed for about 2 seconds. The display will read SERVICE ADVISORY CLEARED, and the unit is ready for another 2 years of operation.

Replacement sensor elements are available from Safety Systems Technology. Ordering information is in the section headed SPARE Parts. The element is supplied preinstalled on a small circuit board and is calibrated at the factory to provide a 4-20 mA signal output at the proper sensitivity for your NOVA-Sensor.

To replace the sensor, loosen the set screw on the front of the sensor head housing and unscrew the cover from the sensor head. Note the location of the Red and Black wires connected to the terminal block on the existing sensor. Loosen the two screws on the terminal block and remove the two wires. If the power to the NOVA-Sensor *ELITE* is still on, be sure that the ends of the two wires do not touch each other or the metal housing.

Connect the red and black wires to the proper terminals on the new sensor, position the sensor inside of the housing and replace the sensor cover. Tighten the set screw.

Activate and hold the ▲MagPoint▲ on the NOVA-Sensor to start the calibration sequence. This will recalibrate the detector to the new sensor.

Spare Parts & Recommended Test Equipment

The most common spare or replacement parts, available from Safety Systems Technology are listed below. To purchase these parts, contact your local SST distributor, or contact us at sales@safetysys.com.

TROUBLESHOOTING

Check Calibration message

The sensor head has lost some sensitivity, resulting in display values of less then 20.9%. You must perform a recalibration procedure to correct this. If the recalibration does not result in a 20.9% reading, the sensor fuel cell has probably been damaged. Replace the fuel cell/ transmitter in the sensor head.

System Fault message

This message may appear when the existing electronics module in the detector is replaced with a different module. Perform a complete recalibration procedure to correct this problem.

The sensor head may have failed. One drop of water inside the sensor may destroy the sensor. The sensor can also be destroyed by exposure to extremely high concentrations of oxygen for long periods of time. A failed sensor head must have the fuel cell and transmitter replaced, followed by a recalibration of the detector.

The 24 volt DC power supplied to the detector may be less than 16 volts or greater than 32 volts. Replace or service the power supply.

Although not a regular occurrence, it is possible that an internal failure has occurred in the detector electronics module. We suggest you purchase a replacement electronics module, then return the failed electronics module to SST for repairs. The repaired module can then be placed in your stock for future use.

Drifting or unstable PPM readings

Check the 2 wires between the sensor head and the electronics module. Screw terminals, crimped connectors or wire nuts on these wires must be tight to maintain the low resistance connections between the head and the electronics.

Also check the jumper on the two “TOX” pins of the electronics module to be sure that the jumper plugs are securely seated on the pins.

False Alarms

If you are having an unreasonable number of alarms, try to verify the oxygen concentration near the detector using a personal gas monitor. If there is 20.9% oxygen present, recalibrate the NOVA-Sensor *ELITE.* If alarms still occur, the sensor head has probably lost sensitivity, and the detector has tried to compensate by increasing the amplifier sensitivity. In that case, the sensor fuel cell/transmitter should be replaced and a new calibration performed.

Transient Interference or Power Surges

Transient voltage suppressors in the NOVA-Sensor *ELITE* protect the electronics from transients that may be induced into the field wiring during operation. The terminal marked CHASSIS in the NOVA-Sensor is factory connected to the 24VRET terminal to complete the suppression path. In areas where there are severe high energy transients, including those caused by lightning, you may get more effective transient suppression by removing the factory jumper and connecting the CHASSIS terminal to the earth grounding screw in the detector enclosure.

! WARNING: The above change can be made only if the enclosure is firmly connected to earth ground and the voltage measured between the earth ground screw and the 24VRET terminal is not greater then 2.0 volts DC.

WARRANTY INFORMATION

Safety Systems Technology, Inc. warrants its gas detection products to be free of defects in materials or workmanship and will repair or replace without charge any detector that is found to be defective for five years after the date of manufacture. Oxygen detection elements that are damaged by exposure to continuous high levels of oxygen are not covered by this warranty. Further, detection elements that have failed due to incorrect hookup or have been subjected to an over current are not covered by this warranty.

For NOVA-Sensor ELITE Oxygen Detectors - Electronic Components ONLY

Safety Systems Technology, Inc. (SST) reserves the right to make the final determination of the nature of and responsibility for defective or damaged equipment. Equipment that has been repaired or modified by the user, damaged as the result of an accident, incorrectly installed, or used in an application or environment for which it was not intended is not covered by this warranty. Safety Systems Technology, Inc. (SST) responsibility under this warranty shall be limited to the repair or replacement of the defective equipment at its option when it is returned to the factory transportation prepaid. The defective unit will be repaired or replaced free of charge to the customer and returned transportation prepaid. In all cases, this warranty is limited to the cost of the equipment.

Please consult the Limited Warranty and Product Return Procedure certificate at http://www.safetysys.com/warranty.pdf for additional terms and conditions.

! WARRANTY EXPIRATION DATE: Look for the serial number (SN) visible through the viewing window on the electronics enclosure. The first 2 digits of the serial number are the year of manufacture, the next 2 digits are the week of manufacture. For number SN1242001, the product was manufactured in the 24th week of year 2012 (October 19, 2012). The warranty would expire 5 years from that date (October 18, 2017).

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