NEUTRONICS INC.

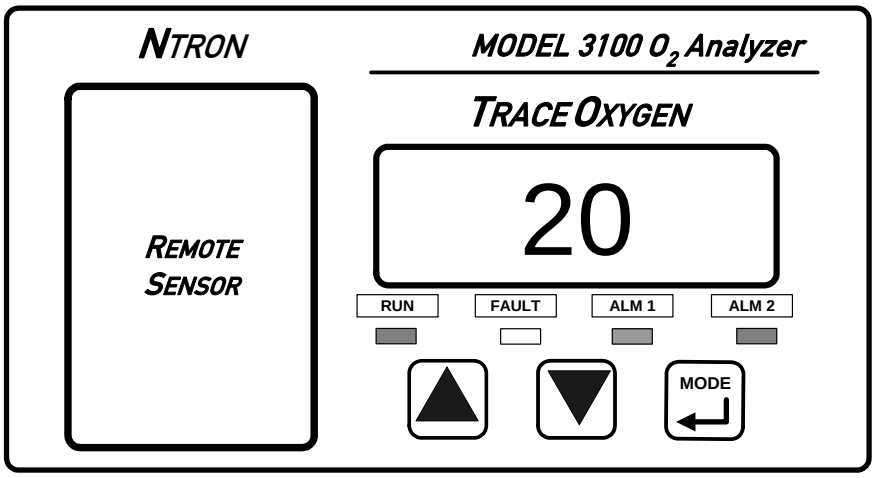
Engineered Solutions for Gas Detection and Analysis

High Purity Instruments

MODEL 3100

OXYGEN ANALYZER / CONTROLLER – PERCENT to PPM RANGE

OPERATIONS MANUAL



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For Your Safety:

PLEASE READ THIS MANUAL IN ITS ENTIRETY BEFORE ATTEMPTING INSTALLATION OR OPERATION! Attempting to operate the Model 3100 without fully understanding its features and functions may result in unsafe conditions

- Always use protective eye wear and observe proper safety procedures when working with pressurized gases.
- Always calibrate the model 3100 at an equivalent pressure and flow rate to the measured gas.
- Ensure the model 3100 has been properly calibrated before use.
- Never expose the model 3100 analyzer chassis to water, high humidity or moisture. The analyzer chassis is not watertight.
- Never expose the model 3100 or remote sensor module to flame or high temperatures.
- Never expose the model 3100 analyzer to flammable gases or vapors. The unit is not rated Explosion Proof, or Intrinsically Safe.
- Ensure the analyzer unit is mounted in an area of free airflow to prevent the chassis from exceeding the operating temperature specifications. Do not mount the analyzer or sensor against hot surfaces. Do not block the ventilation louver on the analyzer chassis.

WELCOME

Thank you for purchasing the Model 3100 Analyzer for 0.1 PPM to 100 % range Oxygen measurement.

The Model 3100 Compact Analyzer is a user friendly, microprocessor controlled Oxygen measuring instrument. It has many features to offer the user, which will be described in this manual. We recommend that all personnel who use the instrument read this manual to become more familiar with its proper operation.

For further detail regarding the maintenance and in-field service of the Model 3100 analyzer, please contact the Neutronics Inc. Customer Service Department. If you have questions or comments, we would like to hear from you.

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Equipment Serial Number: _____

(For faster service, please have this number ready if for any reason you need to contact us about your instrument)

1 CHAPTER 1 – INTRODUCTION AND OVERVIEW

1.1 General

The model 3100 ***Compact Series*** analyzer by Neutronics offers an efficient solution in a small package for oxygen measurement and control applications. The Model 3100 is a microprocessor-based instrument for measuring 0.1 PPM to 100 % oxygen.

The model 3100 analyzer is designed to operate in conjunction with a Neutronics Remote Sensor Module (RSM). At the heart of the remote sensor module is the Neutronics exclusive rapid – response" Zirconium Oxide oxygen sensor. The Zirconium Oxide sensor is a solid-state device, which assures reliability and fast response for critical measurements. Since the sensor is a solid-state device, it is unaffected by dry atmospheres, it is undamaged by extremely cold storage temperatures (or power down situations in cold environments), and it has indefinite storage life. The RSM is available in several configurations to work in a variety of applications.

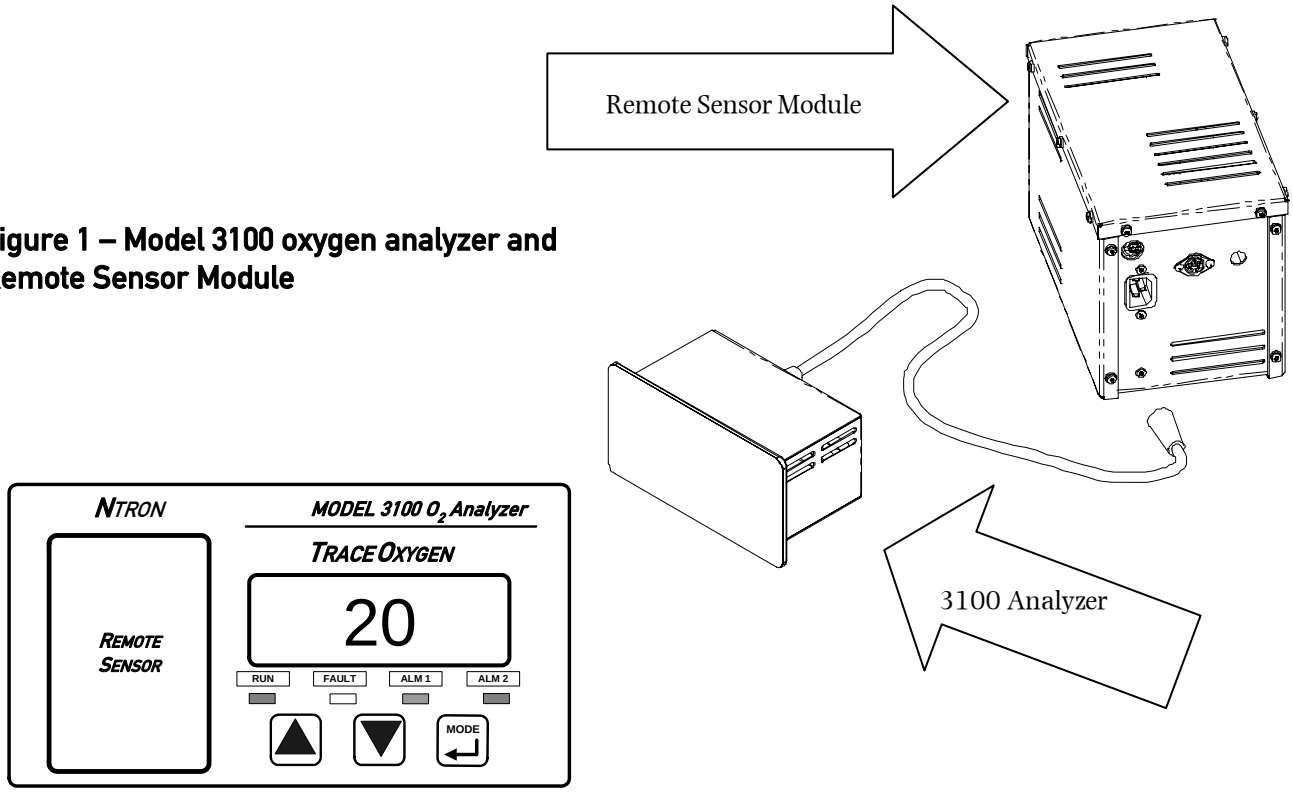


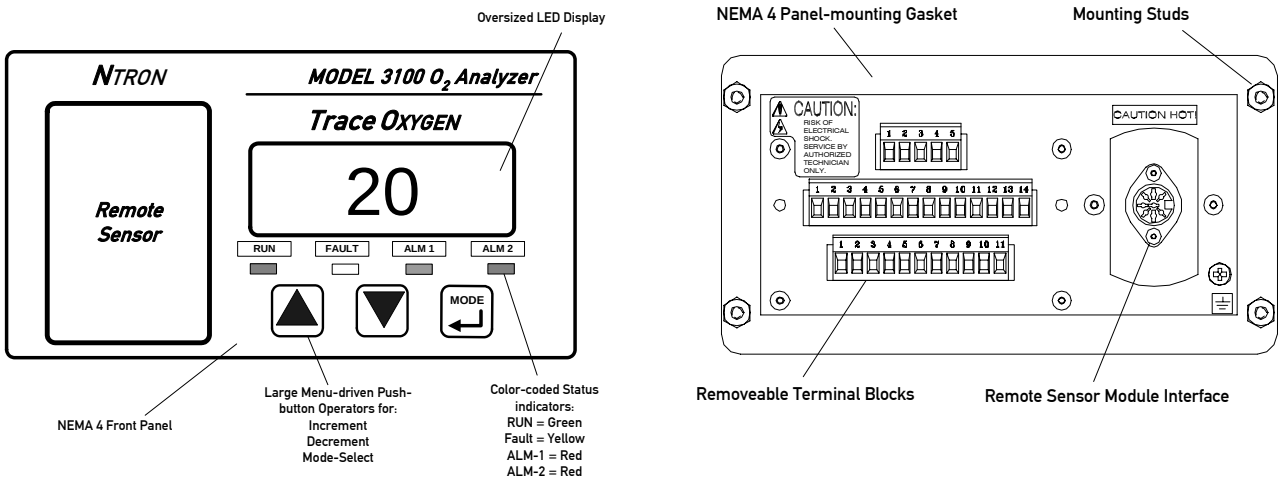
Figure 1 – Model 3100 oxygen analyzer and Remote Sensor Module

1.2 Features

The ***Compact Series*** analyzers are designed to be flush mounted to a panel or console. Because of the small size of the Model 3100 analyzer, it can be integrated into a variety of equipment or control panels. The Remote Sensor Module can be mounted close to the sampling point to assure the fastest response possible.

Other Features Include:

- Ultra-rapid response solid-state sensor
- Two User-adjustable Oxygen Alarms with configurable relay outputs for process control use
- Two Analog Outputs: 4-20 mA AND 0-1, 0-5, or 0-10 VDC
- Auto Ranging or Fixed Range Oxygen Measurement (VDC output provided for auto-range identification)
- Double Redundant Operating System, with automatic repair function
- Bi-directional RS-232 Serial Interface for connection to a PC, terminal, or printer



Front view **Rear view**

Figure 2 – Model 3100 oxygen analyzer front and rear view

1.3 System Hardware Overview

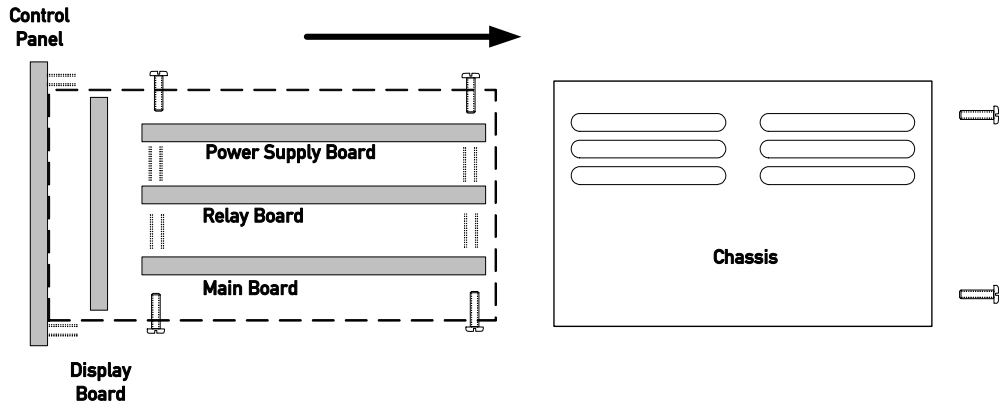


Figure 3 – Basic analyzer components

1.3.1 Main Board

The main board houses the microprocessor, and supporting electronics for controlling the operation of the Model 3100 Analyzer. The main board receives the sensor input, and provides the control and display functions of the analyzer.

1.3.2 Relay Board

The Relay Board houses relay contacts for all of the Alarm and Control features of the 3100. The relays are mapped discretely to each alarm to provide electrical outputs for reporting, and process control use.

1.3.3 Power Supply

The power supply board is designed to take 110/220 VAC, 50/60 Hz mains power input. The supply is fused directly on the board.

1.3.4 Display Board

The Display board is designed to generate a digital indication of the concentration of oxygen (Appendix E – range / output chart), and fault codes (section 4.3.1). The display is a 7-segment, ¾" alphanumeric LED.

1.3.5 Control Panel

The Control Panel serves as the main user interface. The Control Panel features the keypad (ramp-UP, ramp-DOWN, and MODE keys) and the status LED's. The control panel is designed to be splash and water-resistant. There are #8-32 threaded mounting studs at each of the four corners for flush mounting of the model 3100 to a stationary control or equipment panel. The gasketed panel is suitable for NEMA type 4 / IP20 environments when properly installed.

1.3.6 Sensor

The Neutronics Inc. ***Rapid-Response Zirconium Oxide*** sensor for measuring percent to parts-per-million (PPM) range oxygen is a cost effective solution for many applications. It is a solid-state device based on a Zirconium Oxide solid ceramic electrolyte sensor, and is responsive to changes in the partial pressure of oxygen of the sampled gas in the range from 0.1 PPM to 100 % concentration.

1.3.7 Remote Sensor Module (RSM)

The Remote Sensor Module (RSM) serves as both the receptacle for the sensor, and the delivery system for the gas sample being measured. Gas is directed in a continuous flow through the sampling system to the oxygen sensor. The sensor determines the oxygen concentration of the gas in real time. The RSM is available in two (2) configurations: Pump drive and Positive Pressure drive. The RSM also houses a heater for the oxygen sensor. The Zirconium oxide sensor operating temperature is maintained by the sensor heater. Refer to your Remote Sensor Module operations manual for more detailed descriptions.

1.3.8 Chassis

The chassis is manufactured of stainless steel. It is designed to provide a general level of protection against mechanical damage from the local environment. It is also an important component of the electrostatic discharge (ESD) shielding design. Since the model 3100 is a flush mounted system, the portion of the instrument housed in the chassis will be located behind the control panel or embedded within the customer equipment enclosure. The enclosure is general purpose and is not watertight.

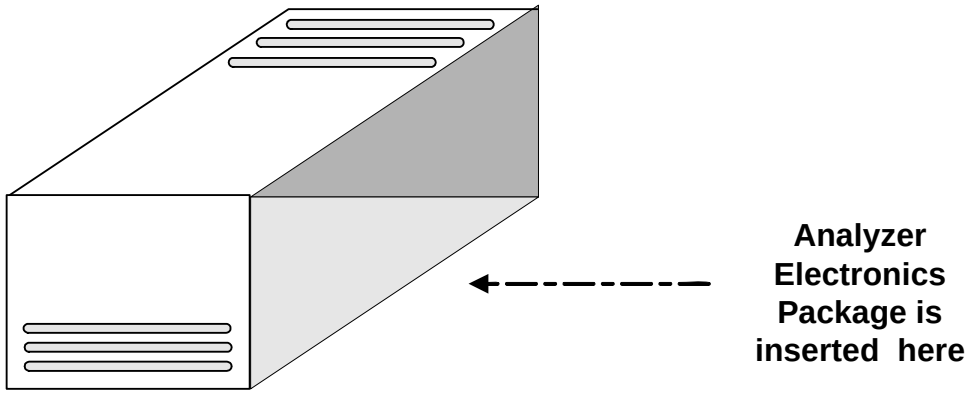


Figure 4 – Analyzer chassis

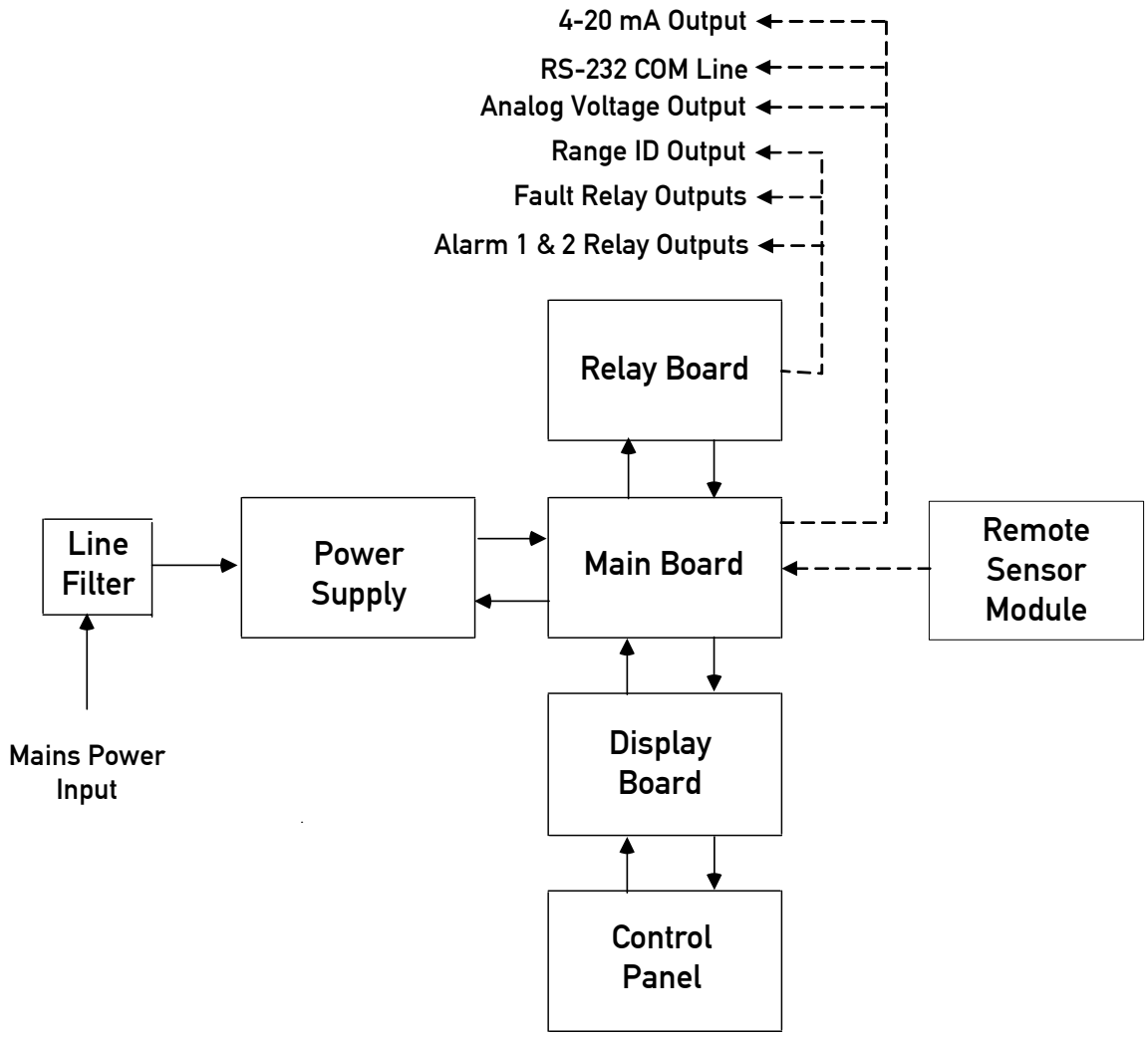


Figure 5 – Analyzer system configuration

1.4 Analyzer Inputs and Outputs

1.4.1 Remote Sensor Module Interface

The Remote Sensor Module Interface is a single multi-signal electrical connection to the model 3100 analyzer that interfaces the oxygen sensor and its supporting hardware with the analyzer. It includes the oxygen sensor input, the sensor heater thermocouple input, and the sensor heater control output.

1.4.1.1 The Oxygen Sensor Input

The Oxygen Sensor Input is an electrical interface used to indicate the oxygen concentration in the measured process, or in a test gas. It is proportional to the oxygen present in a sampled gas stream.

1.4.1.2 The Sensor Heater Thermocouple Input

The Sensor Heater Thermocouple Input feeds back a voltage to the model 3100 analyzer proportional to the sensor heater temperature. The model 3100 uses that electrical output to control the sensor heater temperature within $\pm$ 0.2°C.

1.4.1.3 Sensor Heater Control Output

The Sensor Heater Control Output is a variable frequency control signal, based on the sensor heater thermocouple input voltage. It controls the sensor heater to operating temperature by varying its average VAC mains power level continuously. This method of control maintains the oxygen sensor operating temperature to within its narrow specification at all times for reliable performance.

1.4.2 Alarm-1 Relay Output

The Alarm-1 relay is mapped to the Alarm-1 setpoint, and is provided for process control use. The user may set the oxygen level at which Alarm-1 activates (section 3.2.2). Alarm-1 may be configured as ascending (highest oxygen level allowable) or descending (lowest oxygen level allowable) activation. The relay output may be configured for fail-safe (relay coil de-energized in alarm state) or non fail-safe (relay coil energized in alarm state) activation. Factory default settings are ascending, and fail-safe (Appendix C, Factory Configuration). The Alarm-1 relay contacts are form C (DPDT), voltage-free.

1.4.3 Alarm-2 Relay Output

The Alarm-2 relay is mapped to the Alarm-2 setpoint, and is provided for process control use. The user may set the oxygen level at which Alarm-2 activates (section 3.2.3). Alarm-2 may be configured as ascending (highest oxygen level allowable) or descending (lowest oxygen level allowable) activation. The relay output may be configured for fail-safe (relay coil de-energized in alarm state) or non fail-safe (relay coil energized in alarm state) activation. Factory default settings are ascending, and fail-safe (Appendix C, Factory Configuration). The Alarm-2 relay contacts are form C (DPDT), voltage-free.

1.4.4 Fault Relay Output

The Fault relay output is used to indicate that there is at least one system fault active on the model 3100 analyzer (section 4.3.1). The relay output activation is non fail-safe, and is not configurable. The Fault relay contacts are Form B (SPST), voltage-free.

1.4.5 Heater OK Output

The Heater OK output relay is a system diagnostic used to indicate that the Model 3100 has detected a sensor heater temperature that is not within specification tolerance (section 4.3.1 – Fault Codes and Definitions). The relay output activation is non fail-safe, and is not configurable. The Heater OK relay contacts are Form B (SPST), voltage-free.

1.4.6 Analog Voltage Output

The Analog Voltage output is a dynamic potential used to indicate to a remote device the displayed oxygen concentration during normal analyzer operation and system maintenance. The Analog voltage output follows the oxygen readout displayed on the 7-segment LED display during all system and user modes except for user setup. For a complete listing of available output levels by analyzer range, refer to Appendix E – range / output chart.

The Analog voltage range can be adjusted by the user (section 4.1 – system setup). Available settings are 0-VDC for minimum-scale-deflection, to 1, 5 or 10-VDC full-scale. The factory default setting is 0-1 VDC (Appendix C, Factory Configuration). The Analog voltage output is scaled according to the analyzer's selected range, and must be used in conjunction with the Range ID voltage when the Analyzer is configured for auto-ranging (section 1.4.8).

1.4.7 Analog Current Output

The Analog Current output is a dynamic current flow used to indicate to a remote device the displayed oxygen concentration during normal analyzer operation and system maintenance. The Analog Current output follows the oxygen readout displayed on the 7-segment LED display during all system and user modes except for user setup. For a complete listing of output levels by analyzer range, refer to Appendix E – range / output chart.

The minimum scale deflection may be set to either 0 mA or 4 mA. Full-scale is fixed at 20 mA. The Analog current output is scaled according to the analyzer's selected range, and must be used in conjunction with the Range ID voltage when the Analyzer is configured for auto-ranging (section 1.4.8).

1.4.8 Range ID Output

The model 3100 can be configured by the user to automatically switch its measurement range, based on the concentration of oxygen measured while in-service, to provide the most accurate, and highest resolution outputs at all times. For a complete listing of analyzer ranges, refer to Appendix E – range / output chart.

Remote auxiliary devices designed to interpret the model 3100 Analog outputs over multiple output range scales require an indication of the analyzer's selected range at all times for accurate scaling. The model 3100 features a 0-10 VDC Auto-Range Identification output. The range ID output is used in conjunction with the Analog voltage and Analog current outputs when auto-ranging is used. It provides an indication of the Analog outputs' selected full-scale. There are four range ID voltage levels used in the 3100 to correspond with its four output ranges (Appendix E – range / output chart).

1.4.9 Service Port

The Service port provides a user-friendly means of digital communications with the Model 3100 Analyzer. Through this port, the unit may be configured, calibrated, and queried for most functions. The RS-232 port may also be programmed to send out information on a timed basis for users who prefer to use Digital instead of Analog interfacing with the analyzer. In addition, the service port may be used with a PC based computer (such as a portable notebook computer) over a standard bi-directional RS-232 serial interface.

1.5 Control panel User Interface

1.5.1 The "UP" Pushbutton

The "UP" pushbutton can be used to program the model 3100 via the control panel. This momentary push-button soft key is used to enter incremental information. Its function is menu-driven.

1.5.2 The "DOWN" Pushbutton

The "DOWN" pushbutton can be used to program the model 3100 via the control panel. This momentary push-button soft key is used to enter decremental information. Its function is menu-driven.

1.5.3 The "MODE" Pushbutton

The "MODE" pushbutton can be used to program the model 3100 via the control panel. This momentary push-button soft key is used to navigate the operational modes available through the control panel. Its function is menu-driven.

1.5.4 7-Segment Alphanumeric Display

The 7-Segment alphanumeric display feeds back information from the model 3100 to the user via the control panel. The primary purpose of the 7-Segment display is to show the oxygen concentration readout. It is also used for feedback of operational status, fault codes, and other information necessary to perform system setup and maintenance.

1.5.5 RUN Indicator LED

The purpose of the RUN Indicator LED is to inform the user via the control panel that the model 3100 is measuring the concentration of the sample gas and updating the display and outputs accordingly, and has not detected any alarm, or fault conditions.

1.5.6 Alarm-1 Indicator LED

The purpose of the Alarm-1 Indicator LED is to inform the user via the control panel that the measured oxygen concentration has exceeded the alarm-1 threshold; alarm-1 and its associated relay are in active mode.

1.5.7 Alarm-2 Indicator LED

The purpose of the Alarm-2 Indicator LED is to inform the user via the control panel that the measured oxygen concentration has exceeded the alarm-2 threshold; alarm-2 and its associated relay are in active mode.

1.5.8 Fault Indicator LED

The purpose if the Fault Indicator LED is to inform the user via the control panel that at least one system fault is active. Note that when the fault indicator LED is active, the fault relay will also be active.

2 CHAPTER 2 – SYSTEM INSTALLATION AND START-UP

2.1 Installing the Analyzer

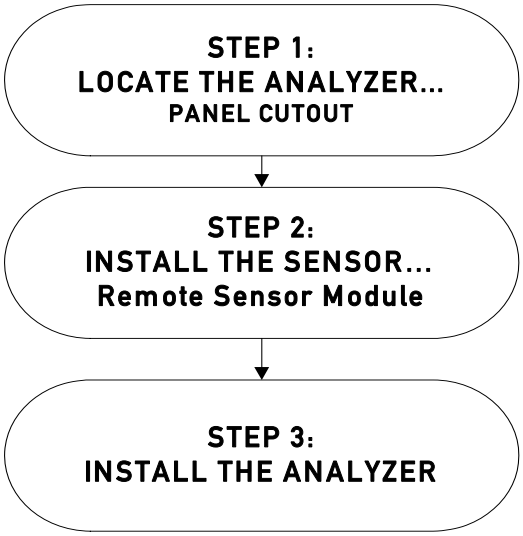


Figure 6 – Installation outline

2.1.1 Step 1 – Locate and Mount the Analyzer unit

The model 3100 is designed to be mounted flush to the surface of a stationary equipment control panel. Select a suitable location for the analyzer unit where the digital display and status LED's will be easy to read, and the interface buttons on the display panel will be easy to access.

Cut/drill the mounting panel to the specifications in figure-7. Clearance holes for the #8-32 threaded mounting studs do not need to be tapped. Hex nuts are included for securing the unit to a panel. Trim all burrs or sharp edges in the cutout or mounting-holes, which would interfere with or damage the gasket on the analyzer control panel.

Slide the analyzer unit into the cutout, rear-chassis first, and seat the control panel gasket on the mounting surface. The gasket on the analyzer control panel ensures a watertight seal around the control panel cutout. Secure the threaded mounting studs with the supplied hex-nuts, and studded lock-washers. The analyzer control panel is suitable for NEMA Type 4, IP20 environments when properly installed. The rear electronics chassis is suitable for NEMA Type 1, IP 20 environments.

The analyzer should not be exposed to water, adverse temperature, or shock. Ensure the analyzer unit is mounted in an area of free airflow to prevent the chassis from exceeding the operating temperature specifications. Do not mount the analyzer or sensor against hot surfaces. Do not block the ventilation louver on the analyzer chassis.

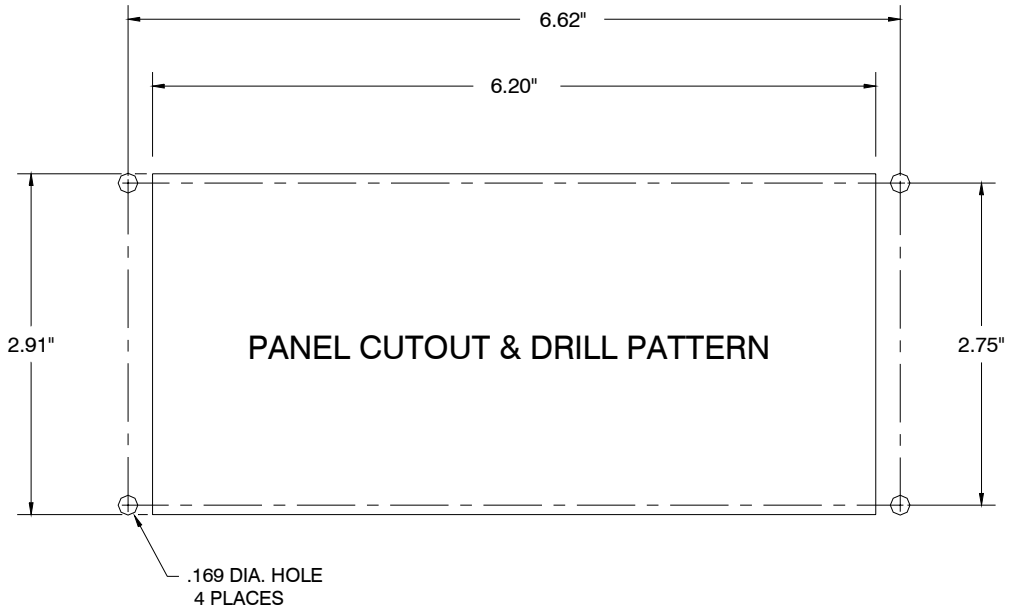


Figure 7 – Analyzer cutout

2.1.2 Step 2 – Install the Remote Sensor Module

For detailed instructions on Remote Sensor Module installation, please refer to the equipment manual.

CAUTION: Remember to verify / set the model 3100 analyzer software & RSM hardware switch to the proper operating voltage (section 4.1.2.17): 110 or 220 VAC. This must be set before operation of the remote sensor module. Failure to properly set the operating power will result in damage to the RSM components.

2.1.3 Step 3 – Install the Analyzer

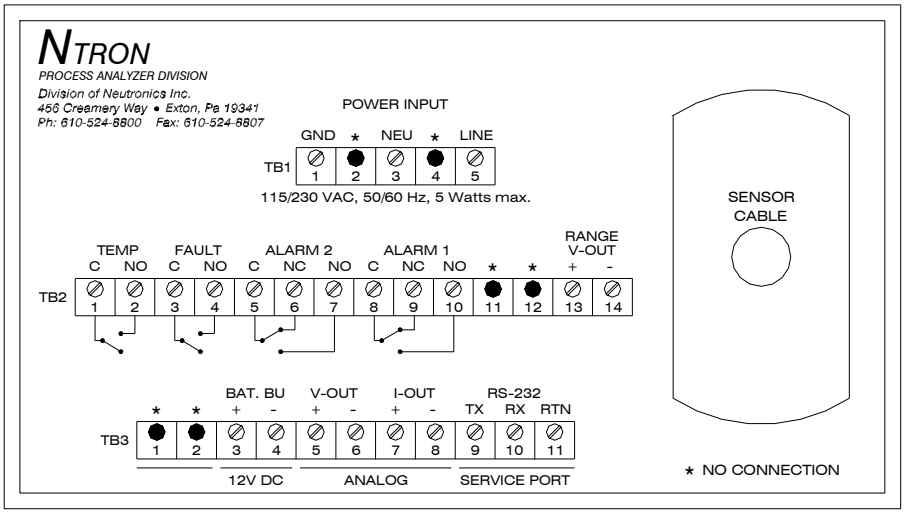
DANGER: Electrical connections on the rear of the Model 3100 Oxygen analyzer may have hazardous voltages present once power has been applied to the unit. High voltages may remain present for a short time even after power has been disconnected from the analyzer. Take care in observing standard electrical practices when making electrical connections to the Model 3100 Oxygen analyzer.

DANGER: The model 3100 analyzer is not rated intrinsically safe or explosion proof. Be certain that no flammable gases are present in the area where the Model 3100 analyzer will be installed.

CAUTION: The model 3100 housing is not rated waterproof. Do not mount the analyzer or the sensor in an area where it may contact water or other liquid elements.

WARNING: Be certain that all power is OFF to the analyzer and associated wiring (cables) before attempting installation. DO NOT WORK WITH LIVE WIRES! Do not leave any exposed wire at the terminal blocks. Before applying power, ensure terminal blocks are fully inserted into the mating connector at the analyzer.

A label depicting the terminal block arrangement is affixed to the top of the chassis for easy reference during installation and maintenance (VAC configuration shown below). The terminal blocks feature screwed terminals. The terminal blocks are also removable for ease of wiring or removal of the analyzer module. Please reference Figure 8.



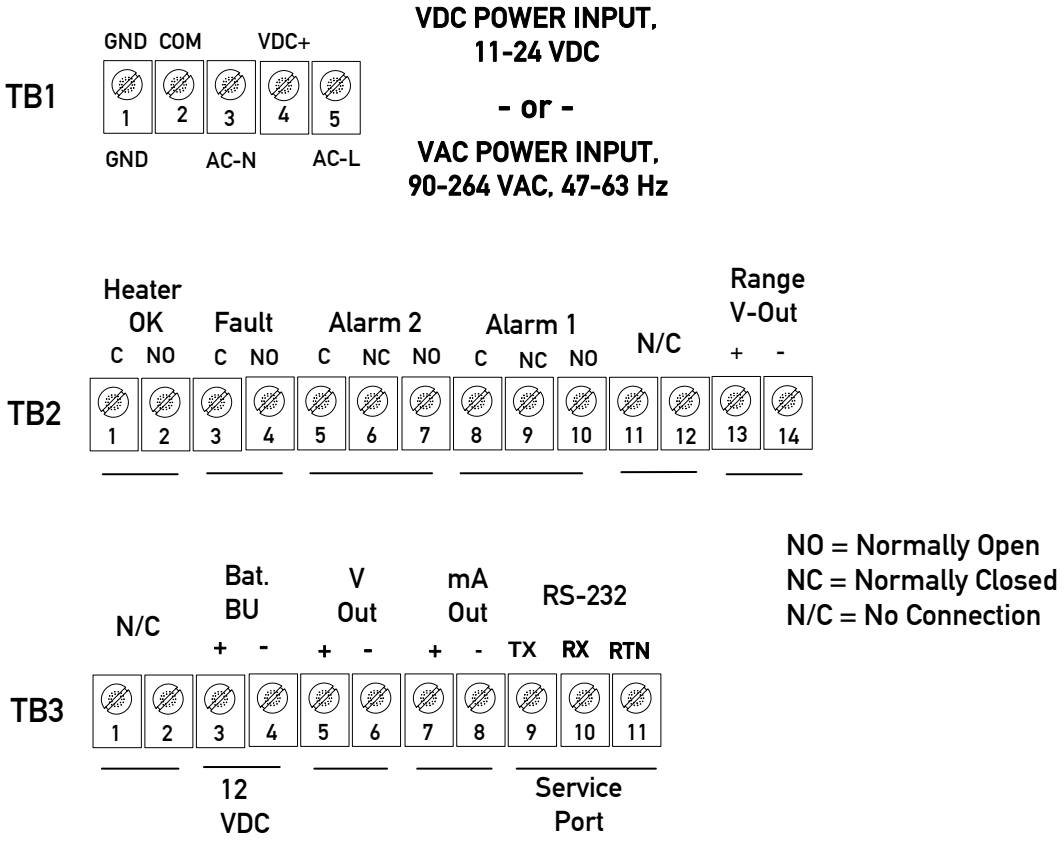


Figure 8 – Analyzer chassis electrical connections

2.1.3.1 Remote Sensor Module Input

All connections to the Remote Sensor Module (RSM) are made by connecting the supplied interface cable between the analyzer and the RSM. Plug the cable connectors into the mating receptacles at the analyzer chassis and at the RSM. Be certain to match the receptacle against the ID label on the top of the analyzer chassis.

2.1.3.2 Alarm-1 Relay Output

Connections from the Alarm-1 relay contacts to the user's process control equipment are made at terminal block TB2 on the rear of the analyzer chassis. The oxygen alarm relay contacts are voltage-free Form C relay contacts, SPDT, 5A @ 250 VAC, 5A @ 30 VDC. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.

2.1.3.3 Alarm-2 Relay Output

Connections from the Alarm-2 relay contacts to the user's process control equipment are made at terminal block TB2 on the rear of the analyzer chassis. The oxygen alarm relay contacts are voltage-free Form C relay contacts, SPDT, 5A @ 250 VAC, 5A @ 30 VDC. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.

2.1.3.4 Fault Relay Output

Connections from the Fault relay contacts to the user's process control equipment are made at terminal block TB2 on the rear of the analyzer chassis. The fault relay contacts are voltage-free Form B relay contacts, SPST, 5A @ 250 VAC, 5A @ 30 VDC. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.

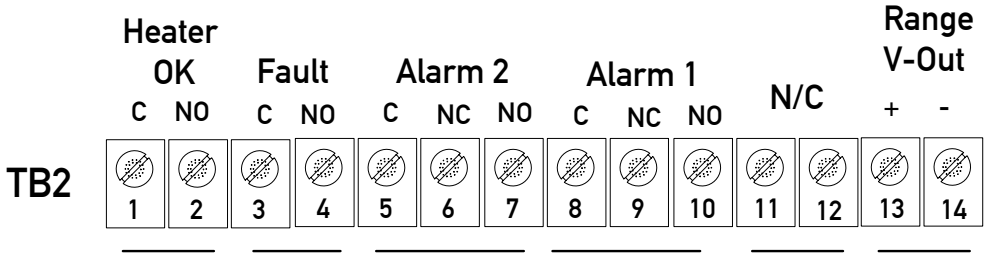
2.1.3.5 Heater OK Relay Output

Connections from the Heater OK relay contacts to the user's process control equipment are made at terminal block TB2 on the rear of the analyzer chassis. The heater OK relay contacts are voltage-free Form B relay contacts, SPST, 5A @ 250 VAC, 5A @ 30 VDC. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.

2.1.3.6 Range ID Output

Connections from the Range ID output to the user's auxiliary equipment are made at terminal block TB2 on the rear of the analyzer chassis. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.

Use 20-AWG, 2-conductor, stranded-wire, twisted pairs for the connections. It is not necessary to use shielded cable for the Range ID output, with or without electrical barriers. If shielded cable is used, it should be drained to dc ground at the auxiliary equipment.



2.1.3.7 Analog Voltage Output

Connections from the Analog Voltage output to the user's auxiliary equipment are made at terminal block TB3 on the rear of the analyzer chassis. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.

Use 20-AWG, 2-conductor, stranded-wire, twisted pairs for the connections. It is not necessary to use shielded cable for the Analog voltage output, with or without electrical barriers. If shielded cable is used, it should be drained to dc ground at the auxiliary equipment.

2.1.3.8 Analog Current Output

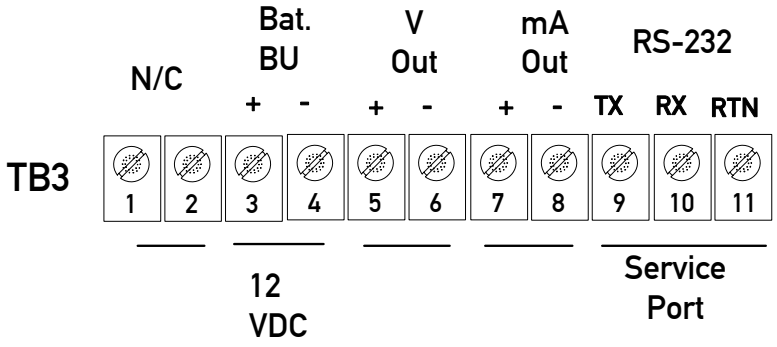
Connections from the Analog Current output to the user's auxiliary equipment are made at terminal block TB3 on the rear of the analyzer chassis. The Analog current output is a negative ground, non-isolated 0-20mA, or 4-20 mA current loop. 12 VDC Power is supplied internally by the model 3100 analyzer. Maximum electrical loading is 250 Ohms. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.

Use 20-AWG, 2-conductor, stranded-wire, twisted pairs for the connections. It is not necessary to use shielded cable for the Analog current output, with or without electrical barriers. If shielded cable is used, it should be drained to dc ground at the auxiliary equipment.

2.1.3.9 Battery Backup

12-volt DC Battery Backup terminals are provided at terminal block TB3 on the rear of the analyzer chassis. These terminals may be connected to a fixed 12 VDC power source to act as a back up in case mains power has been lost. The circuit will detect loss of the mains power and the VDC battery backup will maintain power to the system.

Connection to the battery backup is not required for normal operation of the analyzer. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.



2.1.3.10 RS-232 Service Port

Connections from the Range ID output to the user's auxiliary equipment are made at terminal block TB3 on the rear of the analyzer chassis. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.

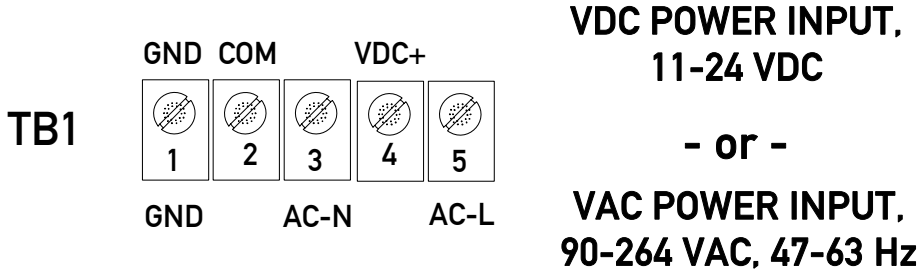
For interfacing with any standard PC computer via serial port, use 20-AWG, 3-conductor, shielded, stranded-wire, jacketed cable, terminated on one end with a female DB9 connector. The shielding should be drained to dc ground at the computer.

SIGNAL DESIGNATION AT ANALYZER	ANALYZER TB2 CONNECTION	SIGNAL DESIGNATION AT COMPUTER	COMPUTER DB9 SERIAL PORT CONNECTION
RX	Pin 9	TX	Pin 2
TX	Pin 10	RX	Pin 3
RTN	Pin 11	RTN	Pin 5

2.1.3.11 Mains Power

Connections for Mains Power input are made at terminal block TB1 on the rear of the analyzer chassis. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.

For VAC versions, use minimum16-AWG, 3-conductor, stranded-wire, for the connections. Supply single-phase 110/220 VAC, 50/60Hz to the unit. For VDC versions, use 18-AWG, 3-conductor, stranded-wire, for the connections. Supply 12/24 VDC to the unit.



2.2 Starting up and Commissioning the System

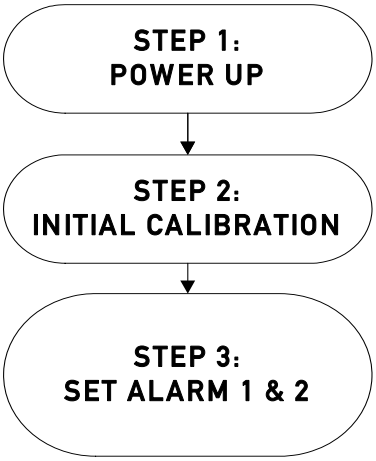


Figure 9 – Start-up outline

The Model 3100 is shipped ready to use, right from the carton. Factory default configuration settings are listed in Appendix C for your information. Review the factory default configuration settings before commissioning your system. If you wish to change any of the factory default settings, refer to sections 4.1.1 and 4.1.2.

POWER UP CHECK LIST

Have you:

- Mounted the analyzer and RSM in areas where there are no flammable vapors?
- Mounted the system away from exposure to rain, dripping water, or hose down?
- Correctly installed all of the wiring?
- Connected the sensor interface cable at both the RSM and Analyzer?
- Ensured gas tight plumbing at the RSM?
- Ensured that the local ambient temperature is 30° C or less at the RSM according to the RSM equipment manual?
- Regulated the sample pressure as instructed in the RSM equipment manual?
- Read both the analyzer and RSM manuals in their entireties?

2.2.1 STEP 1 – Power Up the unit

When the Model 3100 is powered-up, it will go through a 5-second self-test. The 7-segment alphanumeric display will show "8.8.8.8.", then XXXX (software build), and the power supply voltage setting. The Run, Alarm-1, Alarm-2 and Fault LED indicators will go through a display test sequence (Lamp Test), and then the analyzer will enable the Remote Sensor Module warm-up.

The RSM warm up takes approximately eight minutes. The digital display will alternately indicate `nr' (system not ready) and the temperature of the sensor heater until warm-up is complete.

After the warm up period is completed, the model 3100 will check the current sensor reading and update the digital display and status LED's. When configured for auto-ranging, the model 3100 analyzer will automatically display units in parts per million or in percent oxygen, according to the sensor output. When the analyzer is in percent range oxygen measurement, the display flashes the concentration in bright then dim illumination. When the analyzer is in parts-per-million range oxygen measurement, the display shows the concentration illuminated steadily bright.

Once the analyzer reading has stabilized (approx. 20 minutes for thermal equilibrium), the user may apply an instrument air source to the sample inlet port of the RSM (see RSM equipment manual) to check the unit. Allow the reading to stabilize. It should take about 30 seconds for the gas to sweep out the sample lines. Verify the 7-segment alphanumeric display shows 20.9 % oxygen.

2.2.2 STEP 2 – Calibrate the Unit

All units are shipped freshly calibrated at the Neutronics Inc. factory in Exton, PA USA. However, calibration is recommended during commissioning to adjust for differences in atmospheric pressure at the installation site. Refer to section 3.2.1 for detailed analyzer calibration instructions.

2.2.3 STEP 3 –Set Alarm-1 and Alarm-2

After the unit has been calibrated on a known gas source, set the alarm points according to process control requirements. Refer to Appendix C for factory settings.

2.2.3.1 Set Alarm-1

For process control applications, alarm-1 is used normally as the "primary" oxygen-level alarm, and is set to the highest or lowest level of oxygen allowable in your process, according to the application. Refer to Appendix C for factory settings. Refer to section 3.2.2 for information about setting the alarm-1 level.

2.2.3.2 Set Alarm-2

For process control applications, alarm-2 is used normally as the "secondary", or "warning" oxygen-level alarm, and is set just below to the highest, or just above the lowest level of oxygen allowable in your process, according to the application. Refer to section 3.2.3 for information about setting the alarm-2 level.

The Model 3100 should now be ready for commissioning. Neutronics Inc. offers commissioning, and Factory Acceptance Testing services by our qualified technicians. You may contact the Neutronics factory toll-free at (800) 378-2287 in the continental United States; elsewhere, call (610) 524-8800). Ask an Ntron Division Service Technician to schedule a service call.

3 CHAPTER 3 – ANALYZER OPERATION

3.1 System Organization

The Model 3100 has two types of operational modes – User-type, and System-type. User modes are initiated and controlled by the user, and are used to setup and maintain the analyzer. The User modes are: Calibration, Set/view Alarm-1, Set/view Alarm-2, View Active Faults, and Setup. Operating modes are accessed automatically by the model 3100 during normal operation, according to its programming, and its configuration parameters. The operating modes are: Self-Test & Warm-up, Run, Alarm-1 Active, Alarm-2 Active, and Fault Active.

3.2 USER Modes

At any time, the user can initiate any of the user modes either from the control panel or through the service port. Control panel access of the Calibration, Set/view Alarm-1, Set/view Alarm-2 and View Active Faults modes will be covered in this chapter. System setup mode and user access via the service port will be covered in section 4.1.

The user modes Calibration, Set/view Alarm-1, Set/view Alarm-2 and View Active Faults are accessed serially via the control panel, in the aforementioned order by repeatedly pressing and releasing the "MODE" key. When a user mode is accessed via the control panel, the model 3100 aborts any system mode active, and holds the state of Alarm-1, and Alarm-2 outputs until the user returns the unit to Run mode.

Note All Analog electrical outputs from the model 3100 analyzer follow the oxygen readout displayed on the 7-segment LED display during the calibrate, set/view alarm-1, and set/view alarm-2 modes.

3.2.1 CALIBRATE Mode & the Calibration Procedure

Calibration mode allows the oxygen sensor and analyzer to be aligned to gases of known oxygen concentration for the most accurate on-line readings. The model 3100 requires gas calibration at system commissioning. The model 3100 uses a non-depleting solid-state oxygen sensor. During the normal service life of the sensor (5-7 years), no additional calibration is required for performance compliant with system specifications,

Helpful Hint To ensure best ongoing system reliability, it is recommended that the display reading be validated against a known gas source annually, or according to company operating guidelines; per the periodic maintenance schedule Figure-12. Refer to section 4.2.2 for the display reading validation procedure.

3.2.1.1 Calibration System – Introduction

For best application-driven accuracy, the model 3100 is capable of a two-point calibration – this manual will refer to them as R***eference*** calibration, and S***pan*** calibration. ***Reference*** calibration is always performed using ambient oxygen concentration 20.9 %. ***Span*** calibration will use a gas that profiles the in-service oxygen measurement range. When gases are selected properly, the analyzer recognizes them as ***reference*** and ***span*** calibration gases automatically during the calibration sequence, and applies any user-entered correction factors accordingly.

3.2.1.2 Step-1; Select Calibration gases

The following calibration gas sources can be used to calibrate the model 3100:

Reference Calibration Gas Use Instrument grade compressed air (Dew-point < 35°, particulates < 3-micron, condensable hydrocarbons < 1-part-per-million), or Certified Standard grade bottled gas at 20.9 % oxygen concentration

Span Calibration Gas Use Certified Standard grade bottled calibration gas – 1 PPM to 17 % oxygen concentration, or 25 % to 100 % oxygen concentration. Select a gas between 80 % and 120 % of the expected maximum usable on-line measurement, and within the configured range of the model 3100.

3.2.1.3 Step-2; Remove the Oxygen Sensor from Online Service

Disconnect the Remote Sensor Module from the measured process. Refer to the Remote Sensor Module equipment manual for detailed instructions.

Warning Before opening any part of the sampling system to air, make sure that the sampling lines are not pressurized, and are clear of any gas that may create a personnel or environmental hazard.

3.2.1.4 Step-3; Apply Reference calibration gas to the Oxygen Sensor

Attach the Remote Sensor Module to the selected ***Reference*** Calibration Gas with oxygen concentration 20.9 %. Refer to the Remote Sensor Module equipment manual for detailed instructions on connecting and applying calibration gas to that apparatus. Be sure to flow calibration gas to the sensor until the analyzer display has stabilized to allow calibration gas to sweep out the sample lines.

Warning: Never apply an unregulated gas supply to the oxygen sensor. High or uncontrolled pressures may damage the oxygen sensor, and/or sampling system components.

3.2.1.5 Step-4; Calibrate Analyzer with Reference Gas

After a regulated stream of calibration gas has been applied to the sensor, press and release the "MODE" key once. The 7-segment alphanumeric display will show "CAL", then an oxygen concentration value. Adjust the displayed oxygen concentration value to read 20.9 % oxygen by pressing the "UP" or "DOWN" arrow key as required. Press and release the "MODE" key four times to return to Run mode.

3.2.1.6 Step-5; Apply Span calibration gas to the Oxygen Sensor

Attach the Remote Sensor Module to the selected ***Span*** Calibration Gas. Refer to the Remote Sensor Module equipment manual for detailed instructions on connecting and applying calibration gas to that apparatus. Be sure to flow calibration gas to the sensor until the analyzer display has stabilized to allow calibration gas to sweep out the sample lines.

Helpful Hint The ***Span*** calibration gas must have an oxygen concentration outside of the range 18 % to 24 % in order for the analyzer to operate properly. If the in-service oxygen sample range is within the 18 % to 24 % window under normal operating conditions, ***Span*** gas calibration is not necessary.

3.2.1.7 Step-5; Calibrate Analyzer with Span Gas

After a regulated stream of calibration gas has been applied to the sensor, press and release the "MODE" key once. The 7-segment alphanumeric display will show "CAL", then an oxygen concentration value. Adjust the displayed oxygen concentration to read the applied calibration gas oxygen concentration by pressing the "UP" or "DOWN" arrow key as required. Press and release the "MODE" key four times to return to RUN mode.

3.2.1.8 Step-6; Return the Oxygen Sensor to on-line service

Remove calibration gas from the Remote Sensor Module, and reconnect to the measured process. Refer to the Remote Sensor Module user manual for details on applying sample gas to that apparatus. Be sure to flow sample gas to the sensor until the analyzer display has stabilized to allow time to sweep the sample lines clear of calibration gas.

3.2.2 SET/VIEW ALARM-1 Mode

To enter Set Alarm-1 mode from run mode using the keypad; scroll through the user mode menu by pressing momentarily the "MODE" key two (2) times, until the 7-segment alphanumeric display reads "AL1" (set alarm-1 level), and the "ALM1" indicator LED flashes. The display will show momentarily "AL1" and then the current alarm-1 threshold level (an O_2 concentration). Use the "UP" and "DOWN" keys to adjust the alarm-1 setpoint level. Changed settings are automatically saved when the "MODE" key is pressed to enter the next mode.

3.2.3 SET/VIEW ALARM-2 Mode

To enter Set Alarm-2 mode from run mode using the keypad; scroll through the user mode menu by pressing momentarily the "MODE" key three (3) times, until the 7-segment alphanumeric display reads "AL2" (set alarm-2 level) and the "ALM2" indicator LED flashes. The display will show momentarily "AL2" and then the current alarm-2 threshold level (an O_2 concentration). Use the "UP" and "DOWN" keys to adjust the alarm-2 setpoint level. Changed settings are automatically saved when the "MODE" key is pressed to enter the next mode.

3.2.4 VIEW ACTIVE FAULTS Mode

To enter View Active Faults mode from run mode using the keypad; scroll through the user mode menu by pressing momentarily the "MODE" key four (4) times until the 7-segment alphanumeric display reads "FL", and the "FAULT" indicator LED flashes. The display will show momentarily "FL" and then the highest priority active system fault. Press and release the "UP" or "DOWN key to scroll through all active system faults. Refer to section 4.3.1 for a complete fault code listing, and troubleshooting guide. To exit, press and release the "MODE" key.

3.2.5 Return to RUN Mode

To exit to run mode from any user mode, using the keypad; scroll through the control panel user mode menu by pressing repeatedly the "MODE" key until the 7-segment alphanumeric display shows "run". The display will then show an oxygen concentration. The ALM1, ALM2, and FAULT LED's will flash for 120 seconds to indicate that the analyzer is in a stabilization period. This is to allow time to sweep the sample lines with sample gas before returning the unit to on-line service. During the stabilization period, alarm-1, and alarm-2 relays remain inactive, and held to their last state before the control panel user mode menu was accessed.

3.3 System Modes

The model 3100 has five System modes – Self-Test & Warm-up, Run, Alarm-1 Active, Alarm-2 Active, or Fault Active. Self-test & warm-up are fixed routines that are initiated upon each start-up. The remaining system modes, provided no valid manual input is received at the control panel or service port, are initiated automatically by the analyzer according to setup parameters entered by the user in Setup mode, compared against monitored inputs and other monitored system hardware in real time.

3.3.1 Self-Test & Warm-up Mode

When the model 3100 is started up, it enters into Self-Test & Warm-up mode automatically, followed by a sensor heater warm-up period (section 2.2.1). When the sensor heater reaches operating temperature, the analyzer aborts the warm up routine, checks the current sensor signal, updates the 7-segment LED display, status LED's, and Analog outputs, then enters into the appropriate system mode according to its programmed parameters.

3.3.2 RUN Mode

The model 3100 initiates Run mode when it is continuously measuring the oxygen concentration of the in-service sample gas, and updating the display and outputs accordingly, and it has not detected any valid user input. A solid lit or flashing "RUN" indicator LED indicates to the user that the instrument is on-line, and the system is operating properly.

When the measured process oxygen concentration falls outside of programmed alarm parameters, and/or the system experiences a fault condition, the model 3100 analyzer enters into Alarm-1 Active, Alarm-2 Active, and/or Fault Active mode accordingly. The system does not abort Run mode, and the "RUN" indicator LED stays lit. The appropriate indicator LED will light in addition to the "RUN" indicator LED.

When programmed alarm setpoints and/or fault conditions are cleared, the model 3100 analyzer aborts Alarm-1 Active, Alarm-2 Active, and/or Fault Active mode accordingly. The system does not abort Run mode, and the "RUN" indicator LED stays lit. Indicator LED's mapped to aborted modes go out.

When the model 3100 analyzer detects valid user-input, it enters into one of the user modes accordingly – Calibration, Set/view Alarm-1, Set/view Alarm-2, View Active Faults, or User Setup. The analyzer aborts Run mode and holds the state of Alarm-1, and Alarm-2 relay outputs The "RUN" indicator LED goes out, except in Calibrate mode, where it flashes.

When the user manually aborts all user modes by returning the system to Run mode, or no valid user input is detected for 120-seconds, the model 3100 checks the current sensor signal, updates the 7-segment LED display, status LED's, and Analog outputs, then enters into the appropriate system mode according to its programmed parameters. Alarm-1, and Alarm-2 relay outputs are released and the "RUN" indicator LED is lit.

3.3.3 ALARM-1 ACTIVE Mode

The model 3100 initiates Alarm-1 Active mode when it has detected that the measured oxygen concentration has exceed the set threshold value of Alarm-1 (section 3.2.2). The "ALM1" indicator LED will light, The "RUN" indicator LED will remain lit. The Alarm-1 relays will change state according to the analyzer configuration (Appendix C, Factory Setup). The Alarm status will be cleared automatically when the measured oxygen concentration is within the set threshold value of Alarm-1. The "ALM1" indicator LED will go out, and the Alarm-1 relays will return to their non-active state according to the analyzer configuration. The Alarm-1 Active mode is overridden by manual access to the user mode menu.

3.3.4 ALARM-2 ACTIVE Mode

The model 3100 initiates Alarm-2 Active mode when it has detected that the measured oxygen concentration has exceed the set threshold value of Alarm-2 (section 3.2.3). The "ALM2" indicator LED will light, The "RUN" indicator LED will remain lit. The Alarm-2 relays will change state according to the analyzer configuration (Appendix C, Factory Setup). The Alarm status will be cleared automatically when the measured oxygen concentration is within the set threshold value of Alarm-2. The "ALM2" indicator LED will go out, and the Alarm-2 relays will return to their non-active state according to the analyzer configuration. The Alarm-2 Active mode is overridden by manual access to the user mode menu.

3.3.5 FAULT ACTIVE Mode

The model 3100 initiates Fault Active mode when it has detected that one or more Fault criterion have been satisfied (section 4.3.1). The "FAULT" indicator LED will light and the Fault relays will change state. The Fault status will be cleared automatically when no Fault criterion have been satisfied. The "FAULT" indicator LED will go out and the Fault relays will return to their non-active state. The user may view active faults at any time from the control panel (section 3.2.4).

4 CHAPTER 4 – MAINTENANCE AND TROUBLESHOOTING

4.1 System Setup

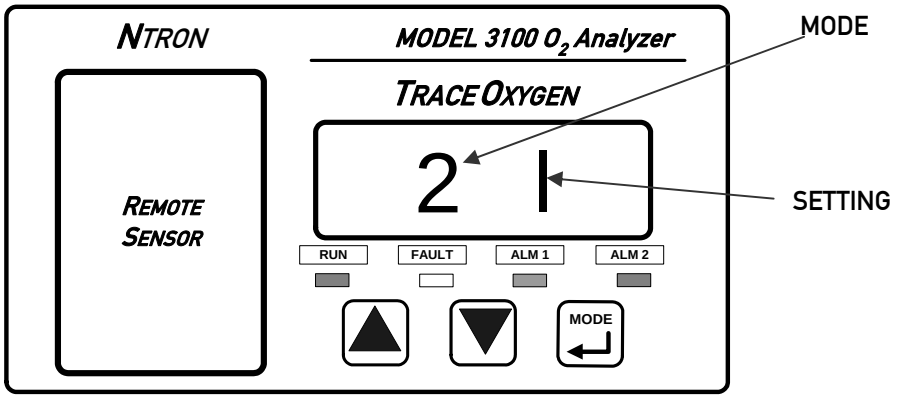
The model 3100 is shipped ready to install and operate with complete factory configuration already programmed and tested. The user may however wish to change the system configuration to suit the application of the analyzer. Some setup parameters may be changed by the user via the control panel keypad. All configuration parameters may be changed by the user via the Service Port.

Important: Before changing any of the model 3100 settings, refer to Appendix C – Factory Setup for reference. If the user has any questions before proceeding with changing analyzer settings, please contact the Neutronics Ntron division Service Department for assistance.

4.1.1 System Setup via Control panel Keypad

The Control panel User Setup menu may be accessed from the model 3100 control panel by pressing and holding the "MODE" key for at least 6-seconds until the 7-segment alphanumeric display shows"---" to indicate that the analyzer has accessed setup mode. Release the "MODE" key to activate setup mode. Once in setup mode, the user can access adjustable parameters sequentially by continuing to press and release the "MODE" key to scroll through the setup menu.

When you reach the mode that you wish to change, use the "UP" and "DOWN" keys to adjust the displayed setting. The modes are numerically identified by the number on the left side of the display. The current mode setting is identified by the number on the right side of the display. The new settings are automatically saved when the user advances to the next mode by pressing and releasing the "MODE" key. The user may exit the Setup menu at any time by pressing simultaneously the "UP" and "DOWN" keys (Appendix D, Control panel Hot-Key functions).



4.1.1.1 User Setup A: Display Range Select

This parameter allows the user to map the display and electrical output range scale of the model 3100 to suit the application (Appendix E – Range / Output Chart).

Valid Settings: 1 (0-10 PPM) • 2 (0-100 PPM) • 3 (0-1,000 PPM) • 4 (0-10,000 PPM) • 5 (0-10 %), 6 (0-100 %) • 8 (Auto-range)

4.1.1.2 User Setup 1: Alarm-1 Relays Ascending/Descending Action

This parameter allows the user to set the Alarm-1 relay action to ***ascending*** (the relay is set to its active state when the oxygen level is above the Alarm-1 level set point) or to ***descending*** (the relay is set to its active state when the oxygen level is below the Alarm-1 level set point).

Valid Settings: 0 (Descending) • 1 (Ascending)

4.1.1.3 User Setup 2: Alarm-2 Relays Ascending/Descending Action

This parameter allows the user to set the Alarm-2 relay action either ascending (the relay is set to its active state when the oxygen level is above the Alarm-2 level set point) or descending (the relay is set to its active state when the oxygen level is below the Alarm-2 level set point).

Valid Settings: 0 (Descending) • 1 (Ascending)

4.1.1.4 User Setup 3: Analog Voltage Output Setting

This parameter allows the user to set the Analog Output Voltage full scale to 1, 5, or 10 volts. Note that the software settings must match the RA and RB jumper settings on the Main CPU PCB (section 4.1.3).

Valid Settings: 0 (0-5V) • 1 (0-10V) • 2 (0-1V)

4.1.1.5 User Setup 4: Serial Output Format

This parameter allows the user to set the RS-232 communications timed output format.

Valid Settings: 0 (Output on Request) • 1 (Human Readable) • 2 (Machine Code) • 3 (Machine Code with Checksum) • 4 (Tab Delimited)

4.1.1.6 User Setup 7: Set Assume Low-End Calibration Range

The zero calibration range on the model 3100 is set at the factory, and it should not be adjusted by the user. If the user changes the zero calibration range, the Model 3100 will not operate properly.

Valid Settings: 9 (18 % to 24 % oxygen)

4.1.1.7 User Setup F: Alarm-1 and Alarm-2 Relays Failsafe/Non Failsafe Action

This parameter allows the user to set the Alarm-1 and Alarm-2 relays to either ***failsafe*** action (relay coils not powered in active alarm state) or ***non-failsafe*** (relay coils powered in active alarm state).

Valid Settings: 0 (Non-Failsafe) • 1 (Failsafe)

4.1.1.8 User Setup B: RS-232 Baud Rate

This parameter allows the user to set the RS-232 communications baud rate.

Valid Settings: 1 (300bps) • 2 (1200bps) • 3 (2400bps) • 4(4800bps) • 5 (9600bps) • 6 (19200bps) • 7 (38400bps)

4.1.1.9 User Setup C: Clean Mode Enable

This routine allows the user to enable a sensor self-cleaning cycle if the oxygen sensor has been exposed to chemicals or gases that may be affecting its performance. Before enabling clean mode, the RSM should be removed from on-line service, and the sampling system purged with either nitrogen or Instrument grade compressed air (Refer to the Remote Sensor Module equipment manual).

If enabled in the control panel user setup menu, Sensor Clean mode will initiate when the analyzer is returned to Run mode. Scroll through the control panel setup menu by pressing and releasing the "MODE" key repeatedly until the 7-segment alphanumeric display shows "run". The display will then alternately show "CLE" and the temperature of the sensor heater in degrees centigrade (Refer to the Remote Sensor Module equipment manual). After the sensor heater reaches the cleaning temperature, sensor clean should be left active for 24-hours.

Sensor clean mode will abort automatically, two minutes after the sensor heater reaches the cleaning temerature, if no additional user input is detected. To abort sensor clean mode manually, press the "UP" and "DOWN" keys on the analyzer control panel simultaneously. To verify that the analyzer has aborted sensor clean, return to setup mode C. The display should show "C 0".

Valid Settings: 0 (Disable Sensor Clean mode) • 1 (Enable Sensor Clean mode)

4.1.1.10 User Setup E: Remote Sensor Module Supply Voltage

This parameter allows the user to set the VAC supply voltage to the Remote Sensor Module. . Note that the software settings must match the VAC switch setting on the RSM module (refer to the equipment manual).

Valid Settings: 0 (110 VAC operation) • 1 (220 VAC operation)

4.1.1.11 User Setup 8: Factory Setup Restore.

This parameter allows the user to return the model 3100 to its initial factory-commissioned settings. Always perform a gas calibration after restoring factory settings.

Valid Settings: 88. A setting of 88 will activate the Factory Setup restore.

4.1.2 System Setup via Service Port

The model 3100 analyzer features a Service Port, which is accessible for programming the system, monitoring the analyzer output, and determining active fault codes for troubleshooting. The Service Port has been designed for communication with a PC based computer or other device capable of receiving and transmitting ASCII data packets over a standard RS-232 serial interface.

Access to the Serial Service Port may made through a terminal emulator program such as **HyperTerminal**, available in Microsoft Windows 95 or later:

4.1.2.1 RS-232 Service Port Interfacing with HyperTerminal in Microsoft Windows 95 or later

Turn off your PC computer, and remove power from the Model 3100. Complete the instructions for wiring and connecting the Model 3100 to a PC computer (section 2.1.3.10). Apply power to the Model 3100, and start up the PC computer.

On your PC computer, open HyperTerminal: Navigate from the Windows desktop – Select **Start → Programs → Accessories → Communications → HyperTerminal**

In HyperTerminal, create and configure a new connection – follow the prompts:

PROMPT	YOU ENTER
CONNECTION NAME	3100
CONNECT TO	COM1, or other available COM port

In HyperTerminal, select the correct COM port properties, to interface properly with the Model 3100:

PROPERTIES	YOU ENTER
BITS PER SECOND	9600
DATA BITS	8
PARITY	None
STOP BITS	1
FLOW CONTROL	None
TERMINAL EMULATION	VT 100 *

Figure 11 Not all versions of MS Windows prompt for this parameter.

Select "Apply" and "OK" as prompted. The Hyper Terminal program will immediately begin communicating with the model 3100, and the model 3100 will commence sending data via ASCII code dump to the PC. The information from the analyzer will be sent in ASCII strings, at 1-second intervals. Data will be sent in the factory default "Human Readable" format.

4.1.2.2 Troubleshooting Your HyperTerminal Interface

If serial communications with the model 3100 fails, isolate the problem by performing the following tests:

Disconnect the RS-232 cable from the model 3100 by removing the terminal block connector from TB3. Insert a jumper between pins 9 & 10 on the terminal block connector. Enter a few letters from the PC keyboard. The PC monitor should display the corresponding alpha-characters as they are typed. If the letters do not display on the monitor screen, there is a problem with the RS-232 cable, the PC serial COM port, or the HyperTerminal setup.

If the typed letters DO show on the monitor screen and serial communications with the model 3100 still has not been established, then PC COM port pins 2 & 3 (3100 pins 9 & 10) may be reversed. Verify the cable wiring (section 2.1.3.10). If no transmitted data from the model 3100 is seen on the monitor screen, call the Neutronics Inc. Service Department for further assistance.

4.1.2.3 Organization of RS-232 Serial Data

There are three levels of access through the service port that can be used for interfacing with the model 3100:

Standard Access: ASCII dump to a PC, printer, or DAQ, and provides basic operator access.

Advanced Level-1 Access: Allows user setup and configuration, such as alarms, and data format.

Advanced Level-2 Access: Allows access to vital control areas via password.

4.1.2.4 Standard Level Access

Standard Level Access is the default level of access to the model 3100 available to the user via a host computer or printer over a standard RS-232 serial interface. In Standard Level access, the user can make inquiries about oxygen concentration, sensor signal level, and other parameters for system servicing, and troubleshooting.

When communications are established between the model 3100 and a host computer, 2-way communication begins automatically in Standard Level access. Data is sent out the analyzer RS-232 Service Port to the host terminal once-per-second, in the factory-default Human Readable format (section 4.1.2.4.2). There are no commands necessary to begin viewing information transmitted by the model 3100 in Standard Level access.

To request and view specific information via the RS-232 interface, type the desired command key selected from he Standard Access level command chart below (It is not necessary to press return).

Helpful Hint: For viewing convenience, before requesting specific information from the model 3100, disable automatic 1-second updates from the model 3100 and allow access of information by-request-only (section 4.1.2.4.1), by typing "SSERFMT=0", followed by the Return key. To return to automatic 1-second updates of data from the analyzer in Human Readable format (section 4.1.2.4.2), type "SSERFMT=1", followed by the Return key.

The STANDARD ACCESS level commands

TYPED COMMAND	DESCRIPTION OF QUERIED FUNCTION
A	Short software version
C	Analyzer Model number
D	Sensor output in parts-per-million oxygen
E	Sensor output in percent oxygen
F	Oven temperature
G	Sensor output in Volts
H	Active Fault codes
I	Active Fault code descriptions
V	Long software version
@	Unit Serial Number

There are several data formats of the ASCII data dump available. They may be changed from Standard Level Access to suit the user's needs as follows:

TYPED COMMAND	DESCRIPTION OF QUERIED FUNCTION
SSERFMT=0	Disables RS-232 continuous periodic data-dump
SSERFMT=1	Enables RS-232 output in HUMAN READABLE format
SSERFMT=2	Enables RS-232 output in MACHINE format w/o Checksum
SSERFMT=3	Enables RS-232 output in MACHINE format w/Checksum
SSERFMT=4	Enables RS-232 output in TAB DELIMITED (Excel) format
SCALIBRATE=.XXXXXX	The user can send a calibration value in decimal format where 100 % Oxygen = 1. The number format entered must be 6-decimal places.

4.1.2.4.1 Disable RS 232 continuous output – SSERFMT=0

The factory default 1-second data-dump in Standard Level access can be disabled through the RS-232 interface in Standard Access level. While this setting is active, the user must request information by pressing the desired key according to the STANDARD ACCESS level commands chart.

4.1.2.4.2 Human Readable Data Format – SSERFMT=1

The factory default format is Human Readable and can be changed via the analyzer control panel, or through the RS-232 interface in Standard Level Access. Human Readable data is presented in dynamic columns (columns appear only when data is present). It is intended for most users, to aid in setup and maintenance of the unit. Column headings from left to right: **Mode • O_2 Concentration • Alarm-1 status • Alarm-1 status • list of Fault codes active**.

4.1.2.4.3 . Machine Data Format with NO Checksum

Machine format with NO checksum can be selected via the analyzer control panel, or through the RS-232 interface in Standard Access level. Machine format with NO checksum data is streamed in packets defined by start/stop transmit bits. The order of data in each packet is as follows: **Start Transmit • O_2 Concentration • Fault codes active • List of Fault Codes • Alarm-1 status • Alarm-1 status • End Transmit**. For detailed information on data formats, please contact the Neutronics Service Department.

4.1.2.4.4 Machine Data Format WITH Checksum

Machine format with checksum can be selected via the analyzer control panel, or through the RS-232 interface in Standard Access level. Machine format with checksum data is streamed in packets defined by start/stop transmit bits. The order of data in each packet is as follows: **Start Transmit • O_2 Concentration • Fault codes active • List of Fault Codes • Alarm-1 status • Alarm-2 status • Checksum • End Transmit**. For detailed information on data formats, please contact the Neutronics Service Department.

4.1.2.4.5 Tab delimited Data Format

Tab delimited format can be selected via the analyzer control panel, or through the RS-232 interface in Standard Access level. Tab delimited data is presented in static columns (the same number of columns is always transmitted in a complete data message). Column headings from left to right: **Time since last re-boot ^{tab} • Mode ^{tab} • O2 Concentration ^{tab} • Alarm-1 status ^{tab} • Alarm-2 status ^{tab} • list of Fault codes active ^{tab}**. For detailed information on data formats, please contact the Neutronics Service Department.

4.1.2.5 Advanced Level 1 Access

Advanced Level-1 access is the computer-interfaced user Setup mode. Access to Advanced Level-1 can be accomplished on a PC by typing "setup" when viewing the Human Readable ASCII output. The User Setup menu will be displayed on the PC screen allowing access for changing the system setup.

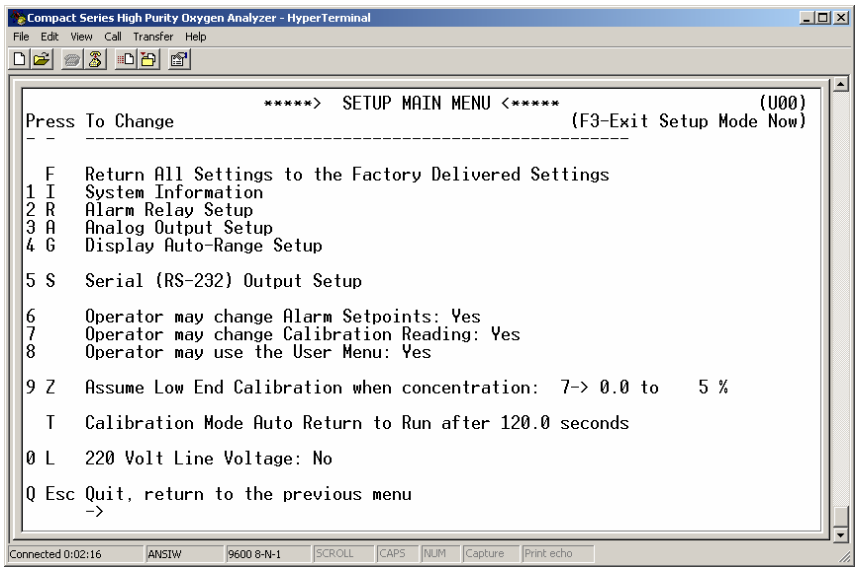


Figure 10 – Level-1 Access (SETUP) Mode Menu

4.1.2.6 Advanced Level-2 Access

Advanced Level-2 access is available to the user via a PC by use of a password. This level of access allows the manipulation of all code settings. Contact the Neutronics Inc. Service Department for support before attempting to use Advanced Level-2 access.

4.1.2.7 SETTING UP THE MODEL 3100 – The RS-232 User Setup Menu

The RS-232 User Setup menu **U00** is the "Home" screen in Advanced Level-1 access (section 4.1.2.5), and provides access to all the parameters that may need to be adjusted by the user. The interactive menu is initiated by typing "setup" and pressing the "Enter" key on the RS-232 terminal; as in entering Advanced Level-1 access. To navigate backwards, use the <Esc> or "Q" key on the RS-232 terminal.

4.1.2.8 Return all Settings to Factory Delivered Settings

In case of severe corruption of calibration and setting information, this setting will allow the user to restore the Model 3100 analyzer to its "out-of-box" setting. The user may type "Y" at the prompt to initiate a restore, or "N" and the prompt to bypass a restore. This setting is accessed from the Setup Main Menu by typing "F" on the RS-232 Terminal. To navigate backwards, use the <Esc> or "Q" key on the RS-232 terminal.

4.1.2.9 System Information Display

The System Information Display **U10** is a list of all the current settings for the 3100 analyzer. It is accessed from the Setup Main Menu by typing "1" or "I" on the RS-232 Terminal.

4.1.2.10 (U20) Alarm Relay Setup Menu

The RS-232 Alarm/Relay Setup menu **U20** provides access to all of the settings related to the Alarms, controls, and relays on the Model 3100 analyzer. It is accessed from the Setup Main Menu by typing "2" or "R" on the RS-232 Terminal. To navigate backwards, use the <Esc> or "Q" key on the RS-232 terminal.

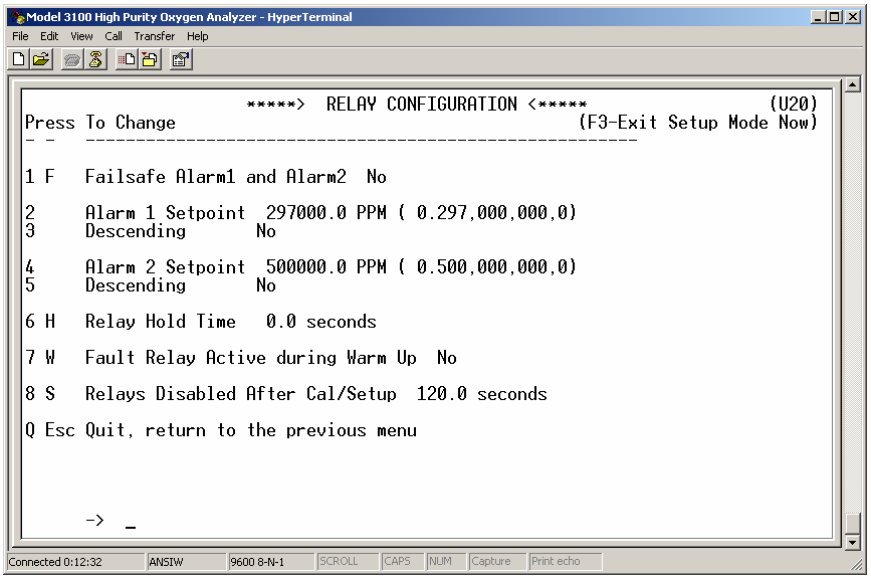


Figure 11 – Relay Configuration Menu

4.1.2.10.1 Alarm-1 and Alarm-2 Relays Failsafe

This parameter allows the user to set the Alarm-1 and Alarm-2 relays to either ***failsafe*** or ***non-failsafe*** action. ***Failsafe*** action is defined as; relay coils are not powered (contacts are in ***normal*** position) in active alarm state. ***Non-Failsafe*** action is defined as; relay coils are powered (contacts are in ***non-normal*** position) in active alarm state. The Alarm-1 and Alarm-2 Relays Failsafe setting may be set to "YES" or "NO". This setting is accessed from the Alarm and Relay Setup Menu by typing "1" or "F" on the RS-232 terminal.

4.1.2.10.2 Alarm-1 Level Setting (setpoint)

This setting sets the threshold level for Alarm-1. Depending on whether or not it is set to ascending or descending, Alarm-1 becomes active when the oxygen concentration is above or below this threshold level. The Alarm-1 setpoint may be set anywhere from 0 PPM to 1,000,000 PPM (100 %). This setting is accessed from the Alarm Relay Setup Menu by typing "2" on the RS-232 terminal.

4.1.2.10.3 Alarm-1 Descending

This setting configures Alarm-1 to either ascending or descending trip. Ascending is defined as Alarm-1 active when the oxygen concentration is above the Alarm-1 setpoint level. Descending is defined as; Alarm-1 active when the oxygen concentration is below the alarm-1 setpoint level. The descending setting may be set to "YES" or "NO". This setting is accessed from the Alarm and Relay Setup Menu by typing "3" on the RS-232 terminal.

4.1.2.10.4 Alarm-2 Level Setting (setpoint)

This setting sets the threshold level for Alarm-2. Depending on whether or not it is set to ascending or descending, Alarm-2 becomes active when the oxygen concentration is above or below this threshold level. The Alarm-2 setpoint may be set anywhere from 0 PPM to 1,000,000 PPM (100 %). This setting is accessed from the Alarm Relay Setup Menu by typing "4" on the RS-232 terminal.

4.1.2.10.5 Alarm-2 Descending

This setting configures Alarm-2 to either ascending or descending trip. Ascending is defined as Alarm-2 active when the oxygen concentration is above the Alarm-2 setpoint level. Descending is defined as; Alarm-2 active when the oxygen concentration is below the alarm-2 setpoint level. The descending setting may be set to "YES" or "NO". This setting is accessed from the Alarm and Relay Setup Menu by typing "5" on the RS-232 terminal.

4.1.2.10.6 Relay Hold Time

This setting determines the minimum time that Alarm-1 and Alarm-2 relays will hold their active state once the Alarm-1 and Alarm-2 setpoint levels have been exceeded, regardless of the actual Oxygen concentration after Alarm-1 and Alarm-2 have been activated. The Hold Time level may be set anywhere from 0 to 300 seconds. This setting is accessed from the Alarm Relay Setup Menu by typing "6" or "H" on the RS-232 terminal.

4.1.2.10.7 Fault Relay Active during Warm-up

This setting determines the active status of the Fault relay during the Model 3100 warm-up routine (section 4.3.1.2). The activate setting may be set to "YES" or "NO". This setting is accessed from the Alarm Relay Setup Menu by typing "7" or "W" on the RS-232 terminal.

4.1.2.10.8 Relays Disabled after CAL/Setup

This setting determines the time that relays will be held in their last state before returning to Run mode from the control panel or service port user menus. The relays disabled time may be set anywhere from 0 to 14,400 seconds. This setting is accessed from the Alarm Relay Setup Menu by typing "8" or "S" on the RS-232 terminal.

4.1.2.11 (U30) Analog Output Setup Menu

The RS-232 Analog Output Setup menu **U30** provides access to all of the settings related to the Analog Voltage Output (TB3-Pin5, TB3-Pin6) and Analog Current Output (TB3-Pin7, TB3-Pin8). It is accessed from the Setup Main Menu by typing "3" or "A" on the RS-232 terminal. To navigate backwards, use the <Esc> or "Q" key on the RS-232 terminal. Refer to figure 8 for terminal block details.

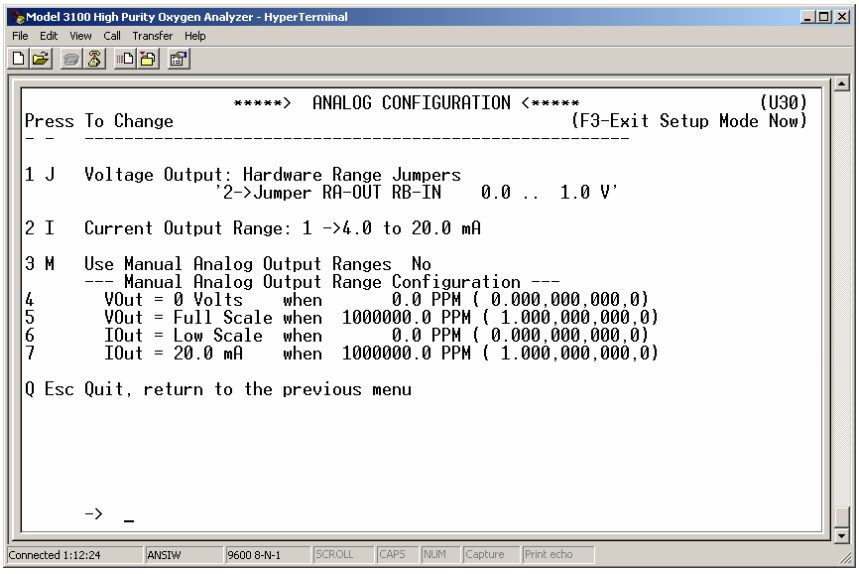


Figure 12 – Analog Output Configuration Menu

4.1.2.11.1 Analog Voltage Output Range

This menu sets the Analog Voltage Output full-scale value. It may be set to 0 (0-5 VDC minimum to full scale), 1 (0-10 VDC minimum to full scale) or 2 (0-1 VDC minimum to full scale). This setting must match the RA and RB hardware jumper settings on the bottom of the main CPU PCB (section 4.1.3). This menu is accessed from the Analog Output Setup menu by typing "1" or "J" on the RS-232 terminal.

4.1.2.11.2 Analog Current Output Range

This menu sets the Analog Current Output range. It may be set to 0 (0-20mA minimum to full scale), or 1 (4-20mA minimum to full scale). This menu is accessed from the Analog Output Setup menu by typing "2" or "I" on the RS-232 terminal.

4.1.2.11.3 Use Manual Analog Output Ranges

This menu is used to enable manual override of Analog output mapping to display range, and to force minimum and maximum Analog outputs to absolute Oxygen measurement values. This menu is accessed from the Analog Output Setup menu by typing "3" or "M" on the RS-232 terminal.

4.1.2.11.4 Force minimum Voltage Output to O_2 Concentration

This menu sets the Oxygen concentration at which the Analog Voltage output is at zero. This setting is entered in PPM increments, and can be anywhere from 0 PPM to 1,000,000 PPM (100 %). This menu is accessed from the Analog Output Setup menu by typing "4" on the RS-232 terminal.

4.1.2.11.5 Force Maximum Voltage to O_2 Concentration

This menu sets the Oxygen concentration at which the Analog Voltage output is at maximum range (section 4.1.2.11.1). This setting is entered in PPM increments and can be anywhere from 0 PPM to 1,000,000 PPM (100 %). This menu is accessed from the Analog Output Setup menu by typing "5" on the RS-232 terminal.

4.1.2.11.6 Force minimum Current Output to O_2 Concentration

This menu sets the Oxygen concentration at which the Analog Current output is at minimum range (section 4.1.2.11.2). This setting is entered in PPM increments and can be anywhere from 0 PPM to 1,000,000 PPM (100 %). This menu is accessed from the Analog Output Setup menu by typing "6" on the RS-232 terminal.

4.1.2.11.7 Force Maximum Current Output to O_2 Concentration

This menu sets the Oxygen concentration at which the Analog Current output is at maximum range (section 4.1.2.11.2). This setting is entered in PPM increments and can be anywhere from 0 to 1,000,000 (100 %). This menu is accessed from the Analog Output Setup menu by typing "7" on the RS-232 terminal.

4.1.2.12 (U14) Display/Auto-Range Setup

The RS-232 Display/Auto-Range Setup menu **U14** provides access for the user to map the display and Analog output range scale(s) of the Model 3100 to suit the application (Appendix E – Range / Analog output Chart). The Analog Output Range may be set to 1 (0-10 PPM), 2 (0-100 PPM), 3 (0-1,000 PPM), 4 (0-10,000 PPM), 5 (0-10 %), 6 (0-100 %), 8 (Auto-range). This menu is accessed from the Setup Main Menu by typing "4" or "G" on the RS-232 terminal. To navigate backwards, use the <Esc> or "Q" key on the RS-232 terminal.

4.1.2.13 (U50) RS-232 Serial Setup Menu

This menu provides access to set the RS-232 serial communications options. It is accessed from the Setup Main Menu by typing "5" or "S" on the RS-232 terminal. To navigate backwards, use the <Esc> or "Q" key on the RS-232 terminal.

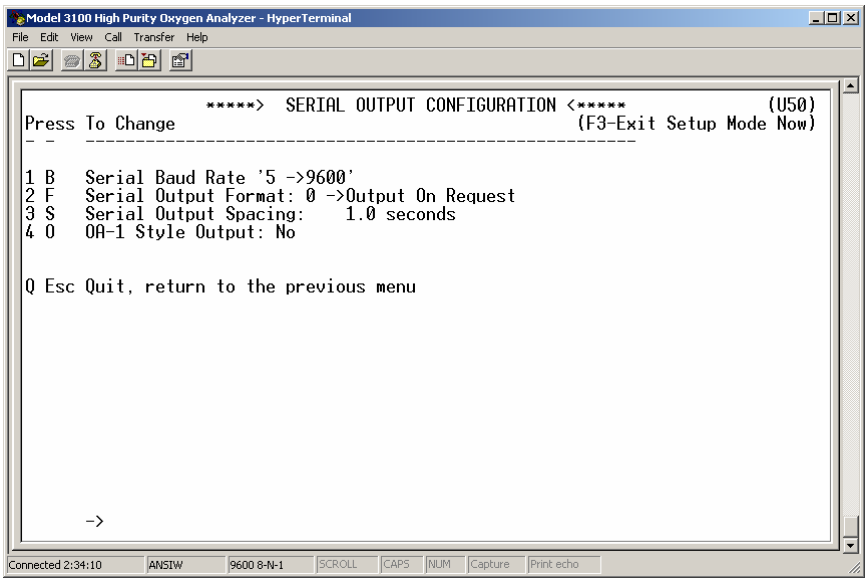


Figure 13 – Serial Output Configuration Menu

4.1.2.13.1 Baud Rate

This menu sets the RS-232 baud rate. The baud rate can be set to 1 (300bps), 2 (1200bps), 3 (2400bps), 4 (4800bps), 5 (9600bps), 6 (19200bps) or 7 (38400bps). This menu is accessed from the RS-232 Serial Setup menu by typing "1" or "B" on the RS-232 terminal.

4.1.2.13.2 Automatic Serial Output Format

This menu sets the format of the automatic timed RS-232 serial output (section 4.1.2.4). The timed serial output format may be set to 0 (Output on Request), 1 (Human Readable), 2 (Machine Code), 3 (Machine Code with Checksum), 4 (Tab delimited) 5 (Model OA1 style; not used). This menu is accessed from the RS-232 Serial Setup menu by typing "2" or "F" on the RS-232 terminal.

4.1.2.13.3 Serial Output Spacing

This menu sets the rate at which the RS-232 sends complete ASCII data packets to the Service Port. The send rate can be set anywhere from 0 to 86,400 seconds. This menu is accessed from the RS-232 Serial Setup menu by typing "3" or "S" on the RS-232 terminal.

4.1.2.13.4 OA1 Style Output – NOT USED

4.1.2.14 Alarm Setpoint Lockout

If the Alarm Setpoint Lockout is enabled, the user may not change, but only view the Alarm-1 and Alarm-2 level settings. The Alarm Lockout setting is accessed from the Setup Main Menu by typing "6" on the RS-232 terminal. To navigate backwards, use the <Esc> or "Q" key on the RS-232 terminal.

4.1.2.15 Gas Calibration Lockout

If the Gas Calibration Lockout is enabled, the user may not change, but only view the Gas Calibration value. The Gas Calibration Lockout setting is accessed from the Setup Main Menu by typing "7" on the RS-232 terminal. To navigate backwards, use the <Esc> or "Q" key on the RS-232 terminal.

4.1.2.15.1 User Menu Lockout

If the Front Menu Lockout is enabled the user may not manually initiate any User mode from the control panel. The User Menu Lockout setting is accessed from the Control panel Locks menu by typing "8" on the RS-232 terminal. To navigate backwards, use the <Esc> or "Q" key on the RS-232 terminal.

4.1.2.16 Assume Low end (Reference) Calibration

The model 3100 analyzer uses the Assume Low-End Calibration value (Zero Calibration Range in the setup menu) to recognize ***Reference*** Calibration gas (20.9 % oxygen) automatically, when applied to the oxygen sensor during calibration. When calibration gas applied outside of the factory-set Assume Low-End Calibration range 18 % to 24 % oxygen, the analyzer assumes that it is ***Span*** gas. Refer to section 3.2.1 for a detailed calibration procedure.

WARNING: The Assume Low-End Calibration value is set to 18 % to 24 % Oxygen at the factory, and it should not be adjusted by the user. If the user changes the Assume Low-End Calibration range, the Model 3100 will not operate properly.

4.1.2.16.1 Calibration Mode Auto Return to RUN

This setting determines the minimum time that the Model 3100 allows after exiting from control panel or service port user menus, before returning the unit to on-line status. The calibration mode auto return setting is accessed from the Control panel Locks menu by typing "T" on the RS-232 terminal. To navigate backwards, use the <Esc> or "Q" key on the RS-232 terminal.

4.1.2.17 220 Volt Line Voltage

The 220 Volt Line Voltage setting allows the user to set the AC supply voltage to the Remote Sensor Module. Note that the software settings must match the AC switch setting on the RSM module (refer to the equipment manual). The 220 Volt Line Voltage setting is accessed from the Control panel Locks menu by typing "L" on the RS-232 terminal. To navigate backwards, use the <Esc> or "Q" key on the RS-232 terminal.

4.1.3 Change factory settings via Hardware Jumpers

4.1.3.1 Analog Voltage Output

The Analog voltage output must be configured using the hardware settings. In addition, the software settings must match the jumper settings. Software changes are made via the Control panel User Setup menu (section 4.1.1), or the Service Port RS-232 User Setup menu (section 4.1.2.7).

4.1.3.1.1 Remove the unit from service

Make certain that all interfacing to the model 3100 is disabled at the user device. Make sure that interrupting alarms, outputs, etc... will not interfere with normal process monitoring or control. Disconnect power from the model 3100 unit. Disconnect the removable terminal blocks from the rear of the model 3100 chassis. Follow all lock-out/tag-out procedures.

4.1.3.1.2 Change jumper settings

Turn the model 3100 upside down to access the jumpers through the port provided. Identify the appropriate jumper position. Use an insulated jumper-puller to remove and replace jumpers (Figure 12).

4.1.3.1.3 Return to service

Replace cables, and terminal blocks. Reapply power. Change Analog Voltage Output setting from control panel or service port to match new hardware settings. Perform a calibration check. Check function of changes to ensure the new settings are recognized by the model 3100.

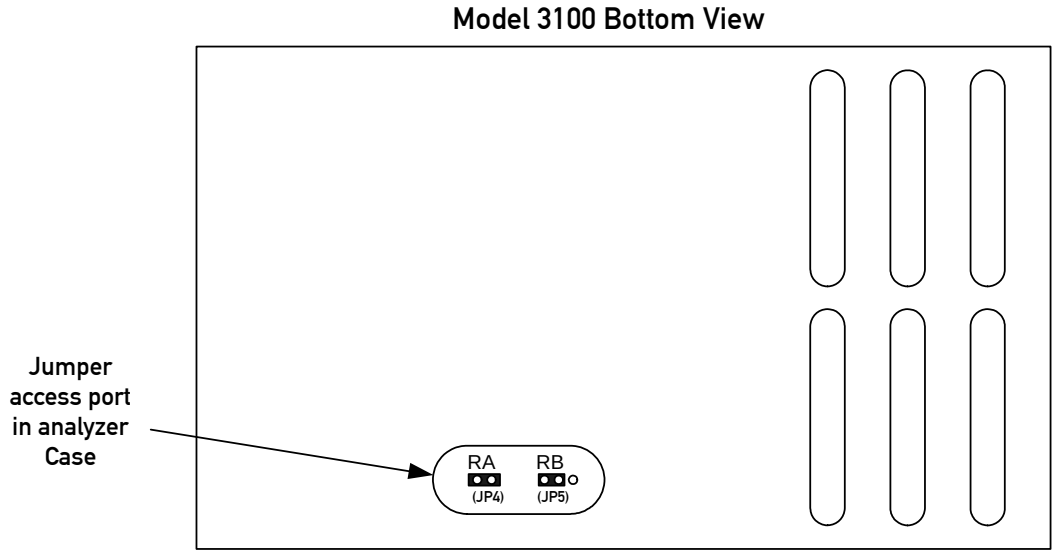


Figure 14 – Range select jumpers

JP4 / JP5 JUMPERS (1=SHORTED; 0=OPEN)		SELECT VOLTAGE OUTPUT RANGE
RA	RB	
0	1	V_{out}= 0-1 VDC
0	0	V_{out}= 0-5 VDC
1	0	V_{out}= 0-10 VDC

Figure 15 – Range select jumper settings

4.2 Routine Periodic Maintenance

Maintenance for the Model 3100 Oxygen analyzer is very simple. Apart from the normal maintenance for any instrument, such as cleaning the chassis, wiping the display, and replacing the sensor, the Model 3100 does not require any major periodic servicing. Calibration of the sensor on a known gas source should be performed on a regular basis. The chart below should serve as a general guide for maintenance personnel.

TASK	RECOMMENDED FREQUENCY		
	AT COMMISSIONING	EVERY YEAR	AS REQUIRED
Calibrate sensor	√		√
Clean the analyzer chassis and display panel with soft cloth. Make sure the ventilation ports are clear.		√	√
Configure alarms	√		√
Validate display to a known gas source		√	√
Replace Oxygen Sensor			√ Sensor life expectancy 5-7 years

Figure 16 –Maintenance schedule

4.2.1 Validate display to a known gas source

With the model 3100 analyzer in Run mode, apply a ***Certified Standard*** grade bottled gas to the RSM with oxygen concentration within the analyzer's configured range. Wait for the reading on the analyzer 7-segment LED display to stabilize. Record the reading and match it against the oxygen concentration indicated on the test gas bottle certification tag. Perform system calibration (section 3.2.1) if reading is out of accuracy tolerance. Refer to Appendix B Specifications.

4.3 Troubleshooting

4.3.1 Fault Codes

When trouble occurs during normal operation of the Model 3100, the user has several tools available to aid in isolating the cause(s) of given symptoms. As a starting point, the user may use the control panel to enter into "View Active Faults" mode (section 3.2.4). The user may also view active faults and other useful information via the Service Port (section 4.1.2). In addition, there are four system Hot-Keys available to perform special functions, and to gather important information quickly and easily (Appendix D).

Descriptions of faults are given below, with indication of common causes. Refer to the appropriate sections of this manual for more details as needed. The Neutronics Remote Sensor Module equipment manual may be helpful in troubleshooting casualties related to that apparatus.

4.3.1.1 Fault Code 1 – Oven or Sensor warming up

The "Oven or Sensor warming up" fault indicates that the oxygen sensor is being heated to its operating temperature after a fresh power up. The purpose of the alarm is to provide a control output to indicate that the sensor has not yet reached its operating temperature, and the model 3100 is not yet ready for in-service oxygen measurement.

4.3.1.2 Fault Code 2 – Relays are in Standby mode

The "Relays are in Standby mode" fault indicates that the user has aborted the control panel user mode menu properly (section 3.2.5), and the unit is in a stabilization period to allow time to sweep the sample lines with sample gas before returning the unit to on-line service. During the stabilization period, Alarm-1, Alarm-2, Fault, and Heater OK relays remain inactive, and held to their last state before the control panel user mode menu was accessed. The factory default setting for this period is 120-seconds. This setting is user-configurable (section 4.1.2.10.8).

4.3.1.3 Fault Code 3 – Device is in Setup mode – Service Port

The "Device is in Setup mode" fault indicates that the user has entered the user setup mode from the service port (section 4.1.2), and the model 3100 is not monitoring oxygen in the process. The 7-segment alphanumeric display will show "SU". The Device is in Setup Mode fault will clear when the user returns the unit to Run mode.

4.3.1.4 Fault Code 4 – Clean mode is active

The "Clean mode is active" mode indicates that the user has entered the sensor clean mode from the control panel (section 4.1.1.9). This parameter allows the user to enable a sensor self-cleaning cycle if the oxygen sensor has been exposed to chemicals or gases that could affect its performance. During sensor clean mode, the 7-segment alphanumeric display will alternately show "CLE" and the temperature of the sensor heater in degrees centigrade.

4.3.1.5 Fault Code 5 – Analog Output range overflow

The "Analog Output range overflow" fault indicates an oxygen reading that is above the range configuration entered in the model 3100 setup (section 4.1.2.12). Possible causes of fault code-5 may be: Incorrect calibration gases, contaminated calibration gases, or faulty calibration sampling lines/components, or faulty RSM sampling lines/components, system exposed to oxygen levels above the analyzer's configured range.

4.3.1.6 Fault Code 6 – Analog Output range underflow

The "Analog Output range overflow" fault indicates an oxygen reading that is below the range configuration entered in the model 3100 setup (section 4.1.2.12). Possible causes of fault code-6 may be: Analog Range lower limit set to a value greater than zero (section 4.1.2.11.1)

4.3.1.7 Fault Code 7 – A/D appears to be defective

The "A/D appears to be defective" fault is NOT ACTIVE for the current version of the model 3100.

4.3.1.8 Fault Code 8 – A concentration reading is not yet available

The "concentration reading is not yet available" fault is active when the model 3100 is not ready for online service. It is active during warm-up, calibration and during fault code-2 relay standby.

4.3.1.9 Fault Code 9 – Temperature sender appears to be open

The "Temperature sender appears to be open" fault is NOT ACTIVE for the current version of the model 3100.

4.3.1.10 Fault Code 11 – Non-native display range

The "non-native display range" fault indicates an oxygen reading that is above the range configuration entered in the model 3100 setup (section 4.1.2.12). Fault code-11 is active when fault code 5 is active. Possible causes of fault code-11 may be: Incorrect calibration gases, contaminated calibration gases, or faulty calibration sampling lines/components, faulty RSM sampling lines/components, faulty or failing sensor, system exposed to oxygen levels above the analyzer's configured range.

4.3.1.11 Fault Code 12 – User calibration too large – NOT USED

4.3.1.12 Fault Code 13 – User calibration too small – NOT USED

4.3.1.13 Fault Code 14 – Oven temperature error

The "oven temperature error" fault indicates that during normal operation, the Remote Sensor Module is consistently reporting unexpected temperatures from the Sensor Heater. Tolerance for the oven temperature error is $\pm$ 0.2°C. Fault code-14 is also active during analyzer warm-up. Possible causes of fault code-14 are: Sensor heater failing, sensor heater control interface failure, or erratic/incorrect sensor heater power supply voltage.

4.3.1.14 Fault Code 15 – Bad user calibration

The "bad user calibration" fault indicates that the user has attempted to calibrate what appears to the model 3100 as a faulty sensor. Possible causes of fault code 15 are: Incorrect calibration gases, contaminated calibration gases, or contaminated calibration sampling lines/components, faulty RSM sampling lines/components, faulty sensor.

4.3.1.15 Fault Code 16 – Heater Failure

The "heater failure" fault indicates that during warm-up, the sensor heater is not reaching expected temperatures within configured time tolerances set at the factory. Possible causes of fault code-14 are: Sensor heater hardware failure, failure in sensor heater control interface, or sensor heater power supply voltage incorrect or missing.

5 CHAPTER 5 – APPENDICES

5.1 Appendix A – Spare Parts List

PART NUMBER	DESCRIPTION
5-06-4900-16-0	Operations Manual
C1-11-1220-03-0	Vac Fuses for Power Supply Board (for Vac units only). – 1A, 250 VAC, Slo-Blo
C6-01-1000-73-0	RSM / Analyzer Interface Cable
C1-17-0052-00-0	Replacement terminal block – TB1
C1-17-0142-00-0	Replacement terminal block – TB2
C1-17-0112-00-0	Replacement terminal block – TB3

5.2 Appendix B - Specifications

OXYGEN SENSOR	External rapid-response Zirconium Oxide
DISPLAY	**0.75" 7-segment LED digital display, 4 characters** Displays Oxygen from 0.1 PPM to 100.0 percent. **Resolution:** 0.1 – 9.9 PPM X.X 10.0 – 99.9 PPM XX.X 100.0 – 999.9 PPM XXX.X 1000 – 9999 PPM XXXX 1 – 9.99 % X.XX 10 – 99.9 % XX.X 100 % XXX.X **Color -Coded LED's for system status:** **RUN:** Green **FAULT:** Yellow **ALARM-1:** Red **ALARM-2:** Red
SIGNAL INTERFACE	**Serial Service Port:** Bi-directional RS-232 **Analog Voltage Output:** 0–1, 0–5, or 0–10 VDC **Analog Current Output:** Non-isolated 4 – 20 mA, 12 VDC, negative ground, powered by analyzer, maximum electrical load 250 Ohms **Range ID Voltage:** 0.1 – 9.9 PPM 3.13 VDC ± 0.1VDC 10.0 – 99.9 PPM 3.75 VDC ± 0.1VDC 100.0 – 999.9 PPM 4.38 VDC ± 0.1VDC 1000 – 9999 PPM 5.00 VDC ± 0.1VDC 1 – 9.99 % 6.25 VDC ± 0.1VDC 10 – 99.9 % 8.13 VDC ± 0.1VDC
RELAY OUTPUTS	**Alarm-1:** Field Adjustable Form C (SPDT) Voltage-free, 5A @ 250 VAC, 5A @ 30 VDC. Configurable to fail-safe/non fail-safe and ascending/descending activation **Alarm-2:** Field Adjustable Form C (SPDT) Voltage-free, 5A @ 250 VAC, 5A @ 30 VDC. Configurable to fail-safe/non fail-safe and ascending/descending activation **Fault:** Non-adjustable Form B (SPST) Voltage-free, 5A @ 250 VAC, 5A @ 30 VDC, non Fail Safe activation, non-configurable. **Heater OK:** Non-adjustable Form B (SPST) Voltage-free, 5A @ 250 VAC, 5A @ 30 VDC, non Fail Safe activation, non-configurable.

Specifications are subject to change without notice.

RANGE	0-10 PPM • 0-100 PPM • 0-1000 PPM • 0-10,000 PPM 0-10 % 0-100 % oxygen	
ACCURACY	± 2.0 % of range @ calibrated temperature and pressure	
RESPONSE TIME	T_{90} < 5 seconds	
WARM UP TIME	None	
HUMIDITY	0-95 % non-condensing	
POWER	**VAC Unit:**	90–264 VAC, 47–63 Hz, Single Phase, 3 Watts
	VDC Unit:	11–30 VDC, 3 Watts
OPERATING TEMPERATURE	32° to 122° F (0° to 50° C)	
STORAGE TEMPERATURE	23° to 122° F (-5° to 50° C)	
WEIGHT	2 Lbs (0.9Kg)	
MECHANICAL	**Faceplate:**	Height 3.75"x Width 7.00" • NEMA 4 • IP66
	Panel Cut-out:	Height 2.91" x Width 6.20"
	Electronic Compartment:	Height 2.81" x Width 5.98" x 3.60" Depth • NEMA 1 • IP20
WARRANTY	12-months from date of shipment	

Specifications are subject to change without notice.

5.3 APPENDIX C – ANALYZER FACTORY CONFIGURATION SETTINGS

Alarm and Relay Setup Information

Alarm-1/Alarm-2 Relays Failsafe/Non-Failsafe	NON-FAILSAFE
Alarm-1/Alarm-2 Relay Ascending/Descending	ASCENDING
Alarm-1 Trigger Level	50 PPM
Alarm-2 Trigger Level	100 PPM

Display Range

0–10 PPM Fixed	
0–100 PPM Fixed	
0–1,000 PPM Fixed	
0–10,000 PPM Fixed	
0–10 % Fixed	
0–100 % Fixed	
Auto Ranging	X

Analog Voltage Range

0–1 VDC	X
0–5 VDC	
0–10 VDC	

Relay Disable after Cal/Setup

120-seconds	X

Rs-232 Baud Rate

300 BPS	
1200 BPS	
2400 BPS	
4800 BPS	
9600 BPS	X
19200 BPS	
38400 BPS	

Rs-232 Timed Output Format

Output on Request Only	
Human Readable Format	X
Machine Code	
Machine Code With Checksum	
Tab Delimited (Spreadsheet)	

Supply Voltage

90 – 264 VAC, 47 – 63 Hz	X
11 – 30 VDC	

RS-232 Dump Rate

1-second	X

5.4 APPENDIX D – Control panel Hot-Key Functions

For convenience in operating and troubleshooting, the Model 1100 has four Control panel Hot-Key functions that can be performed quickly via the control panel without entering the normal Control panel, or Service Port user menus.

KEYS PRESSED	DESCRIPTION OF FUNCTION
UP + **DOWN**	Return to "RUN" mode from any User mode
UP + **DOWN** (hold both keys for 10 seconds *)	Run Lamp Test
DOWN then **MODE** (hold both keys for 10 seconds *)	Show Sensor Voltage
UP then **MODE** (hold both keys for 10 seconds *)	Re-start Model 1100

* Hold all keys indicated until the 7-segment alphanumeric display shows "---" then release the pressed keys. To return to normal operation, press and release the same keys again.

5.5 APPENDIX E – Range / Output Chart

RANGE NAME	MEASURED RANGE	DISPLAY	ANALOG RANGE	RANGE ID VOLTAGE OUTPUT
AUTO RANGE	0.1–9.9 PPM 10.0–99.9 PPM 100.0–999.9 PPM 1000–9999 PPM 1–9.99 % 10–99.9 % 100 %	X.X XX.X XXX.X XXXX. X.XX XX.X XXX.	0–10 PPM 0–100 PPM 0–1,000 PPM 0–10,000 PPM 0–10 % 0–100 %	3.13 VDC 3.75 VDC 4.38 VDC 5.00 VDC 6.25 VDC 8.13 VDC
FIXED RANGE 0-10 PPM	0-9.9 PPM	X.X	0–10 PPM	3.13 VDC
FIXED RANGE 0-100 PPM	0-99.9 PPM	XX.X	0–100 PPM	3.75 VDC
FIXED RANGE 0-1000 PPM	0-999.9 PPM	XXX.X	0–1,000 PPM	4.38 VDC
FIXED RANGE 0-10,000 PPM	0-9999 PPM	XXXX.	0–10,000 PPM	5.00 VDC
FIXED RANGE 0-10 %	0-9.99 %	X.XX	0–10 %	6.25 VDC
FIXED RANGE 0-100 %	0-99.9 % 100.0 %	XX.X XXX.0	0–100 %	8.13 VDC

5.6 APPENDIX F – Warranty

Neutronics warrants to the original purchaser, that the Model 3100 Oxygen analyzer is free from defects in material and workmanship for a period of one (1) year from the date of shipment from Neutronics or from one of Neutronics' authorized dealers. Our liability will be limited to the repair or replacement, at our factory, of parts found to be defective within the warranty period, as determined by Neutronics. The parts will be repaired or replaced free of charge if shipped prepaid to the factory in the original shipping carton. This warranty is void if the product has been subject to misuse or abuse, including but not limited to: exposure to water, humidity, temperature, shock or pressure outside of the listed specifications, or has not been operated or installed in accordance with operating and maintenance instructions, for repairs which were not performed by Neutronics or by one of its authorized dealers, or if the identifying markings on the product label have been altered or removed.

The seller assumes no liability for consequential damages of any kind, and the buyer, by acceptance through purchase of this product, will assume all liability for the consequences of its use or misuse by the buyer, his employees, or others.

Neutronics reserves the right to use any materials in the manufacture, repair or service of the products and to modify the design as deemed suitable, in so far as these materials or modifications maintain the stated warranty.

It is the sole responsibility of the buyer / user to determine if this product is suitable for the intended application.

THESE WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, OR IMPLIED INCLUDING WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE.

Intended Use for the Model 3100

The model 3100 Oxygen analyzer was designed to provide the trained operator with useful information relating to the concentration of Oxygen. This information may be used in process control or to minimize possible hazardous conditions, which may be present in various processes. Before implementation, the user must fully understand the operation and limitations of this instrument as well as the application for its use. The responsibility for the proper application, operation, installation, and maintenance of the model 3100 Oxygen analyzer is the sole obligation of the trained operator. The purchaser is required to ensure operators are properly trained in the use of this unit as well as in the possible hazards associated with its use or with the intended application. The purchaser must ensure that all of the proper warnings, labels, instruction manuals, lock outs, redundant components, hazard analysis, and system validation have been completed and provided to the trained operator before implementation of the model 3100 instrument.