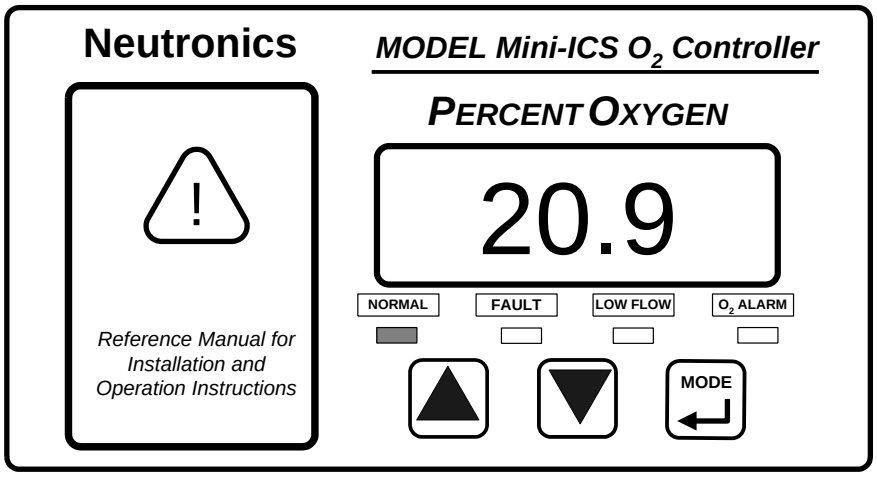
Neutronics
A BACHARACH. COMPANY

MODEL Mini-ICS

OXYGEN ANALYZER / CONTROLLER – PERCENT 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 1100 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.
- Properly dispose of the Oxygen sensor according to the MSDS and local policies when it has expired.
- Ensure the MODEL Mini-ICS has been properly calibrated before use.
- Never expose the analyzer chassis or sensor to water, high humidity or moisture. The analyzer chassis is not watertight.
- Never expose the MODEL Mini-ICS to flame or high temperatures. Never expose the Model Mini-ICS analyzer to flammable gases or vapors. The Mini-ICS is not rated Intrinsically Safe.
- Ensure the analyzer unit is mounted in an area with 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 Mini-ICS Analyzer for percent range Oxygen measurement.

The Model Mini-ICS 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 this 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 Mini-ICS analyzer, please contact the Neutronics Inc. Application Engineering 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)

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1 CHAPTER 1 – INTRODUCTION AND OVERVIEW

1.1 General

The Model Mini-ICS [Inert Gas Control System] analyzer by Neutronics offers a cost effective solution in a small package for industrial process Oxygen measurement and inert gas control applications for flash-fire/explosion prevention, or product quality. The Model Mini-ICS is a custom analytical instrument, designed to accurately measure 0.1 to 50.0% Oxygen, and provide direct control of Oxygen levels in your process by controlling inert gas purging.

At the heart of the analyzer is a remote-mounted Neutronics zero-maintenance, disposable galvanic Oxygen sensor. Remote mounting allows the sensor to be installed close to a process sampling point for the fastest response time possible. Neutronics also offers a variety of process sampling and sample conditioning solutions for sensor reliability and longevity.

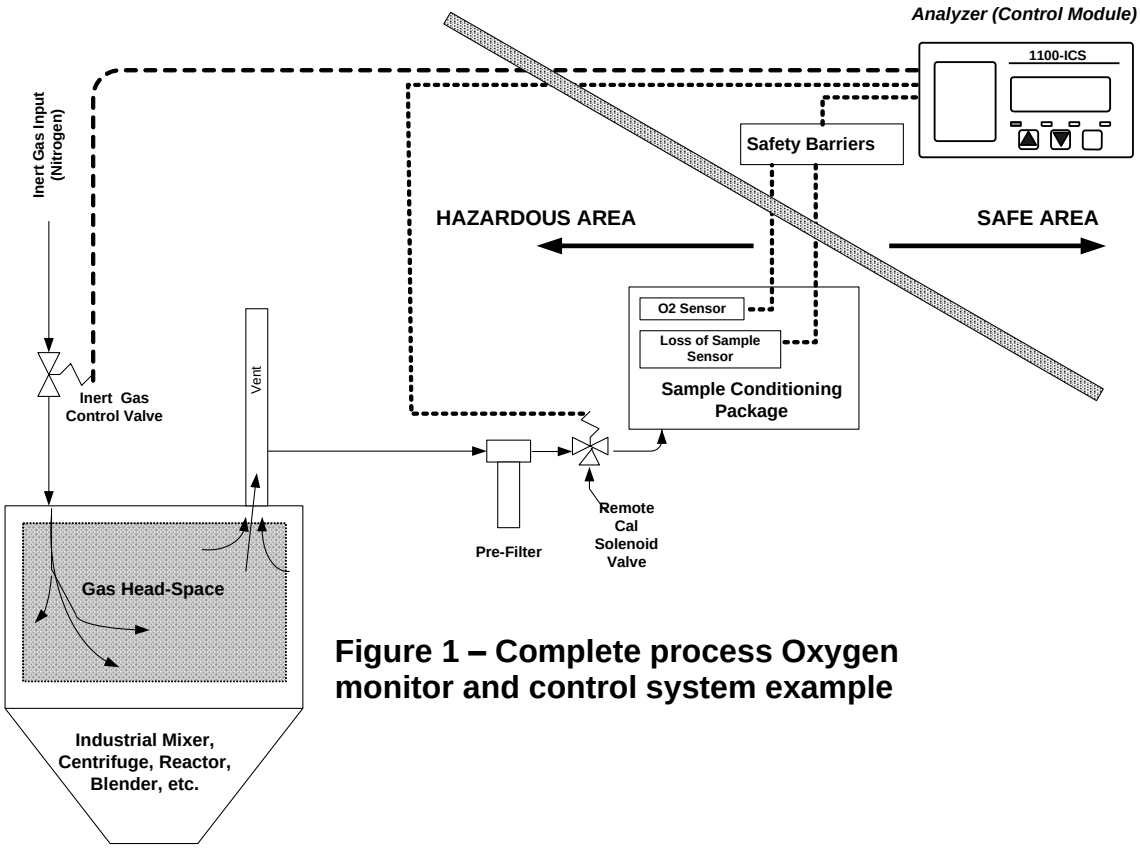
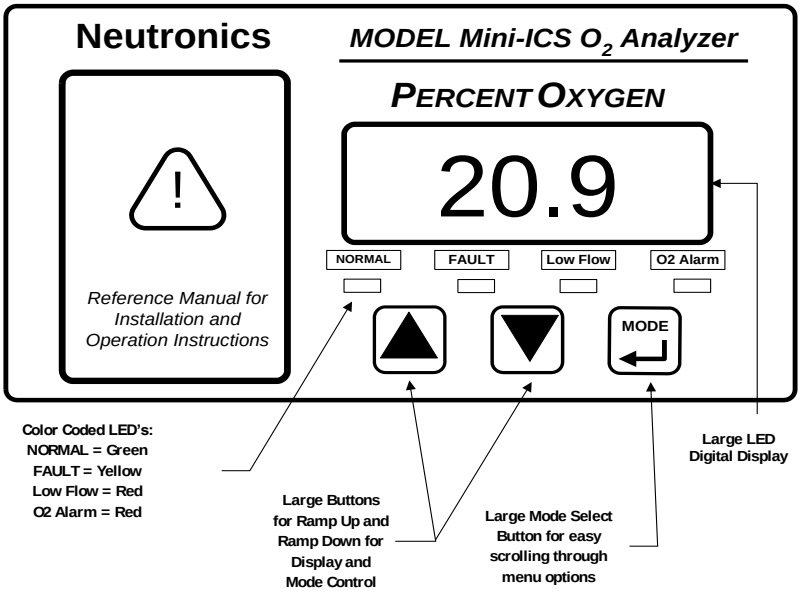


Figure 1 – Complete process Oxygen monitor and control system example

1.2 Features

The Model Mini-ICS analyzer module is designed to be flush mounted to a panel or console. Packaging options available from Neutronics Inc. include General Purpose and Explosion Proof surface-mount enclosures, and custom rack-mount designs. Because of the small size of the Model Mini-ICS analyzer, the basic panel-mount unit can be integrated into a variety of equipment or control panels.

Figure 2 – Analyzer features



Other Features Include:

- User-adjustable Oxygen Alarm with relay output for process control use
- User-adjustable Inert Gas Control function with relay output for process control use. Inert Gas Control features user-adjustable high and low set point hysteresis
- Loss of Flow indication for extractive process sampling applications
- Double Redundant system configuration backup file, with automatic repair function
- Convenient Remote calibration relay output for "one-man" calibration in applications where the Oxygen sensor is a long distance from the Mini-ICS Analyzer
- 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)
- Bi-directional RS-232 Serial Interface for connection to a PC, terminal, or printer

1.3 System Hardware Overview

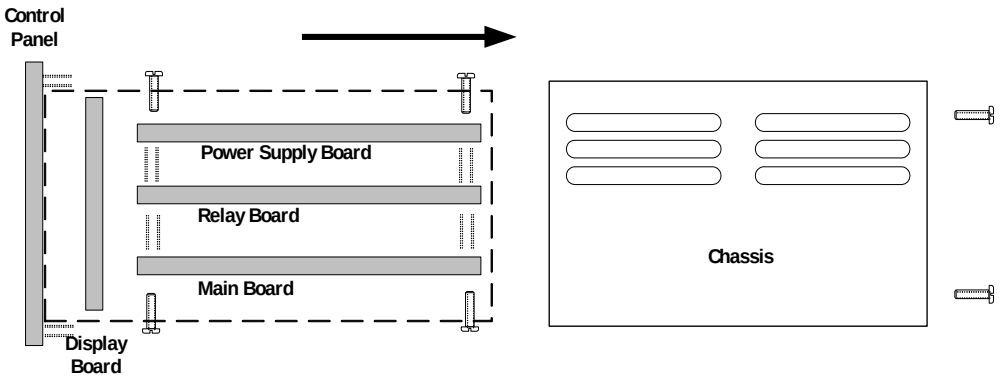


Figure 3 – Basic analyzer components

1.3.1 Main Board

The main board houses the microprocessor, and supporting electronics for controlling the operation of the Model Mini-ICS Analyzer. The main board receives the sensor signal and flow switch inputs, 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 Mini-ICS. The relays are mapped discretely to each alarm or control function 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 (90-264 VAC, 47-63Hz). as input. The supply is internally fused directly on the board. An optional 24VDC (10-30 VDC) power supply is available for installations where a DC voltage is required to power the Model Mini-ICS. A 12VDC battery-backup power input (battery not provided) is also provided to act as a backup in case of main power failure.

1.3.4 Display Board

The Display board is designed to generate a digital indication of the concentration of Oxygen, and error codes. The display is a 7-segment, ¾" Alphanumeric LED for easy viewing from a distance.

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. At the four corners of the panel are the #8-32 mounting studs, which allow flush mounting of the instrument to a control or equipment panel. The gasketed panel is suitable for NEMA type 4 / IP20 environments when properly installed.

1.3.6 Chassis

The chassis is manufactured of specially coated 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 ESD shielding design. Since the Model Mini-ICS 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 <u>not</u> watertight.

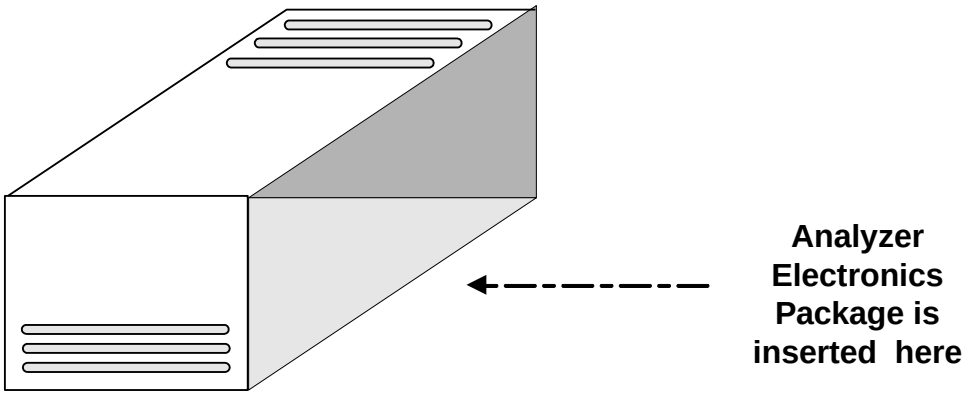


Figure 4 – Analyzer chassis

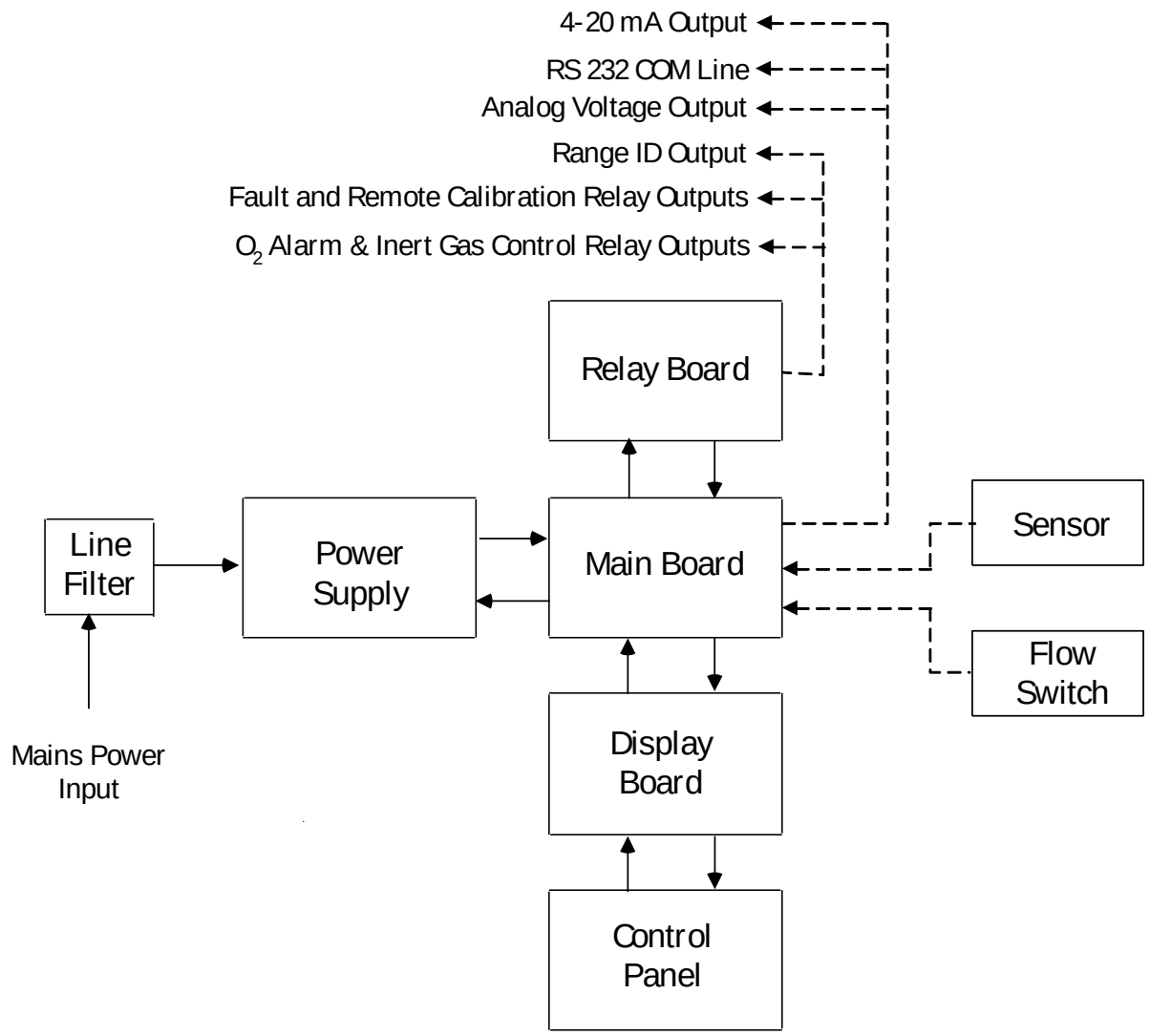


Figure 5 – Analyzer system configuration

1.4 System Inputs and Outputs

1.4.1 Oxygen Sensor Input

The Oxygen Sensor electrical input is used to indicate the Oxygen level concentration in a process vessel headspace, or a process gas stream. Sensors are available to measure the Oxygen concentration in percent by volume or partial pressure in the ranges from 0.1% to 25.0%, and 0.1% to 50.0%. All available Neutronics Inc. Sensors are Intrinsically Safe, remote-mounted devices, and may be interfaced through electrical safety barriers for hazardous applications,

1.4.2 Flow Switch Status Input

The Flow Switch Status electrical interface is used to indicate the flow status of sample gas from the process to the Oxygen Sensor, for extractive applications where a Neutronics Inc. Sampling System has been provided. A closed flow switch indicates sufficient sample flow. An open Flow Switch indicates that sample flow has dropped below the mechanical set point of the Flow Switch. In this flow condition, the Oxygen reading may not be representative of the process Oxygen level. Neutronics Inc. Flow Switches are Intrinsically Safe, and may be interfaced through electrical safety barriers for hazardous applications.

1.4.3 O_2 Alarm Relay Output

The Oxygen Alarm relay is mapped to the O_2 Alarm setpoint, and is provided for process control use. The user may set the level at which the O_2 Alarm activates (section 3.2.2). The O_2 Alarm 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 O_2 Alarm relay contacts are form C (DPDT), voltage-free.

1.4.4 Inert Gas Control Relay Output

The Inert Gas Control (ICS) relay is mapped to the Inert Gas Control high and low limit setpoints, and is provided for process control use. The user may set the levels at which Inert Gas Control activates (high limit setpoint), and de-activates (low limit setpoint). 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. The factory default setting is fail-safe (Appendix C, Factory Configuration). The ICS relay contacts are form C (DPDT), voltage-free.

The purpose of the ICS relay is to control the flow of inert gas to the process being monitored, to keep Oxygen levels in the process within an acceptable range at all times. Purging the process with inert gas lowers the Oxygen concentration in the process. The Mini-ICS Analyzer will activate the ICS relay when the Oxygen concentration rises to the High ICS limit setpoint. It will deactivate the ICS relay when the Oxygen concentration falls below the Low ICS limit (sections 3.2.3 and 3.2.4).

1.4.5 Fault Relay Output

The Fault relay output is used to indicate that there is at least one system fault active on the Model Mini-ICS Analyzer (section 4.3.1 – fault codes and definitions). The Fault relay contacts are Form B (SPST), voltage-free.

Note: The user can configure the ICS relay to activate on certain Fault conditions for process safety applications (sections 4.1.2.9, and Appendix C).

1.4.6 Remote Calibration Relay Output

The Remote Calibration relay is used to activate a valve that flows calibration gas to the sensor during gas calibration. This is a convenience item for applications where the sensor/sampling system is a long distance from the analyzer. The Calibration relay is mapped to the analyzer Calibration function. It activates whenever the user initiates a gas calibration routine by entering CAL mode (section 3.2.1), closing off the flow of process gas and introducing calibration gas to the Oxygen Sensor. The Remote Calibration relay contacts are Form B (SPST), voltage-free.

1.4.7 Analog Voltage Output

The Analog Voltage output is used to indicate to a remote device (user control system, chart-recorder, etc.), the displayed Oxygen concentration in dynamic electrical potential. The Analog voltage can vary from 0 volts for minimum-scale-deflection, to either 1, 5 or 10 volts full-scale. The Analog voltage output is scaled according to the analyzer's active range, and must be used in conjunction with the Range ID voltage when the Analyzer is configured for auto-ranging (section 1.4.9).

1.4.8 Analog Current Output:

The Analog Current output is used to indicate to a remote device (user control system, chart-recorder, etc.), the displayed Oxygen concentration in dynamic electrical current flow. 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 active range, and must be used in conjunction with the Range ID voltage when the Analyzer is configured for auto-ranging (section 1.4.9).

1.4.9 Range ID Output

To remotely detect the present range of Oxygen concentration, the Model Mini-ICS features a 0-10V 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' current full-scale. There are four voltage levels are used in the Mini-ICS:

- For a Full Scale of 1%, the Range ID output is 5.63 Volts
- For a Full Scale of 10%, the Range ID output is 6.25 Volts
- For a Full Scale of 25%, the Range ID output is 6.88 Volts
- For a Full Scale of 50%, the Range ID output is 7.50 Volts
- For a Manual Scale, the Range ID output is 9.30 Volts

1.4.10 Service Port

The Service port provides a user-friendly means of digital communications with the Model Mini-ICS 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 Front Panel User Interface

1.5.1 The “UP” Pushbutton

The “UP” pushbutton can be used to program the Mini-ICS Analyzer via the front 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 Mini-ICS Analyzer via the front 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 Mini-ICS Analyzer via the front panel. This momentary push-button soft key is used to navigate the operational modes available through the front panel. Its function is menu-driven.

1.5.4 7-Segment Alphanumeric Display

The 7-Segment alphanumeric display feeds back information from the Mini-ICS to the user via the front panel. The primary purpose of the 7-Segment display is to show the Oxygen concentration readout. It is also used for feedback information during modes of operation, Fault codes, and operational mode indications, such as setup and calibration.

1.5.5 Normal Indicator LED

The purpose of the NORMAL Indicator LED is to inform the user via the front panel that the Model Mini-ICS 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 O_2 Alarm Indicator LED

The purpose of the O_2 Alarm Indicator LED is to inform the user via the front panel that the O_2 Alarm and its associated relay are in active mode.

1.5.7 Low Flow Indicator LED

The purpose of the Low Flow Indicator LED is to inform the user via the front panel that the sample gas flow from the process to the Oxygen sensor is below the mechanical set point of the flow switch. Since Low Flow is considered a system Fault condition, when the Low Flow LED is active, the Fault relay will also be active.

1.5.8 Fault Indicator LED

The purpose if the Fault Indicator LED is to inform the user via the front panel that at least one system fault, other than the Low Flow 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

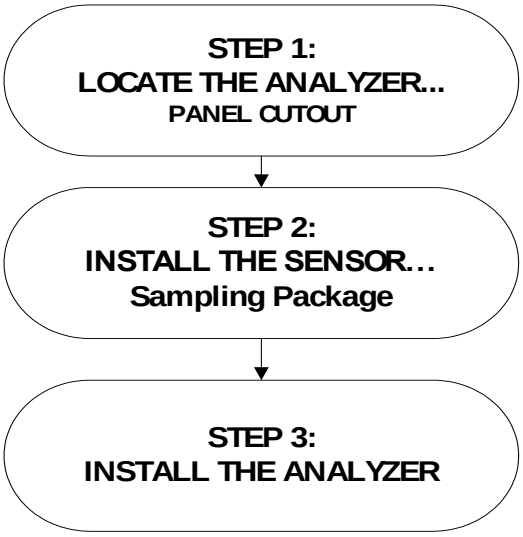


Figure 6 – Installation outline

2.1.1 Step 1 – Locate and Mount the Analyzer unit

The Model Mini-ICS is designed to be mounted flush to the surface of equipment or on a control panel. Select a suitable location for the Model Mini-ICS 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.

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.

To maintain a watertight seal on the control panel, ensure that all burrs and deformities at the cutout and mounting holes are removed before insertion of the analyzer unit into the cutout. Ensure that a proper seal is made at the gasket on the model Mini-ICS control panel.

Installation of the analyzer chassis requires four clearance holes for the #8-32 threaded studs and a cutout in the control panel to allow the chassis to slide flush to the panel. Make sure there are no burrs or sharp edges in the cutout or mounting-holes, which would interfere with the gasket on the analyzer control panel. The gasket ensures a watertight seal around the control panel. The control panel, when properly installed is suitable for NEMA Type 4, IP66 environments. The rear electronics enclosure is suitable for NEMA Type 1, IP 20 environments.

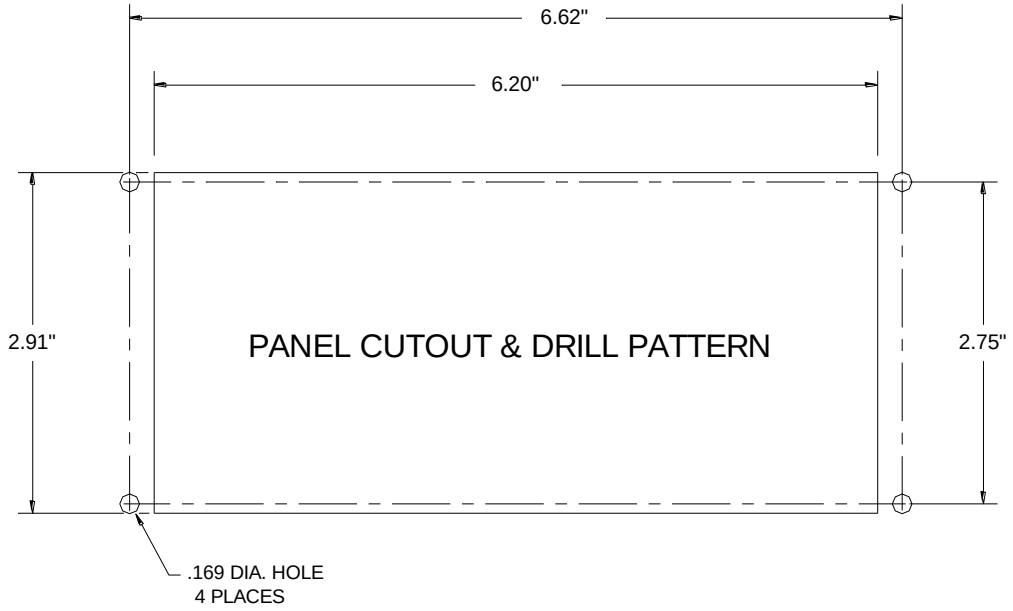


Figure 7 – analyzer

2.1.2 Step 2 – Install the Oxygen Sensor

The Model Mini-ICS will be supplied with the Model GP, the Model CAG-250, or the Model IT Oxygen sensor, depending on the application. In most cases, it will also be supplied with a Neutronics-specified Sampling system. For sensor installation and pneumatic connections for the Neutronics Inc. Sampling system, please refer to the Sampling System Manual.

2.1.3 Step 3 – Install the Analyzer

DANGER: Electrical connections on the rear of the Model Mini-ICS 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 Mini-ICS Oxygen analyzer.

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

CAUTION: The model Mini-ICS 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. The terminal blocks feature screwed terminals. The terminal blocks are also removable for ease of wiring or removal of the analyzer module. Please reference Figures 8 and 9 below, and drawing SP-E-1473, in the rear of this manual, showing the detail of the electrical interface terminals, and wiring connections.

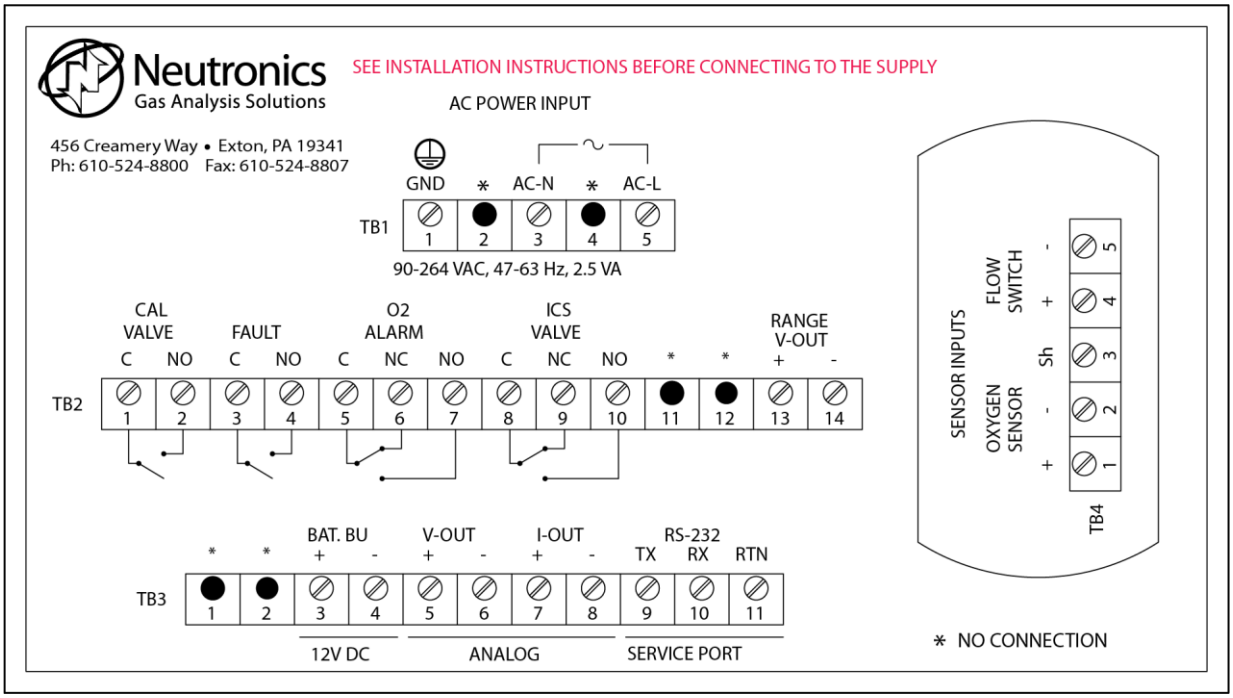
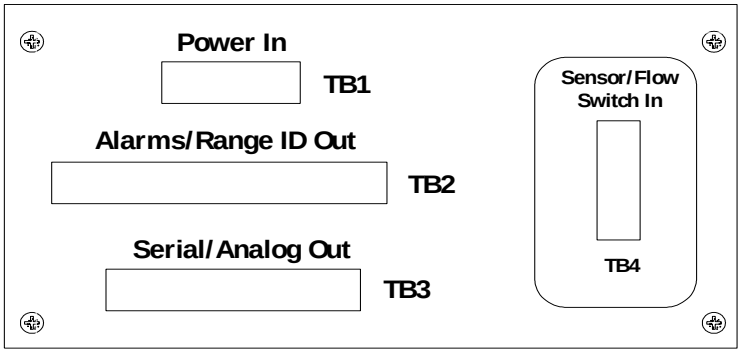


Figure 8 – analyzer electrical interface



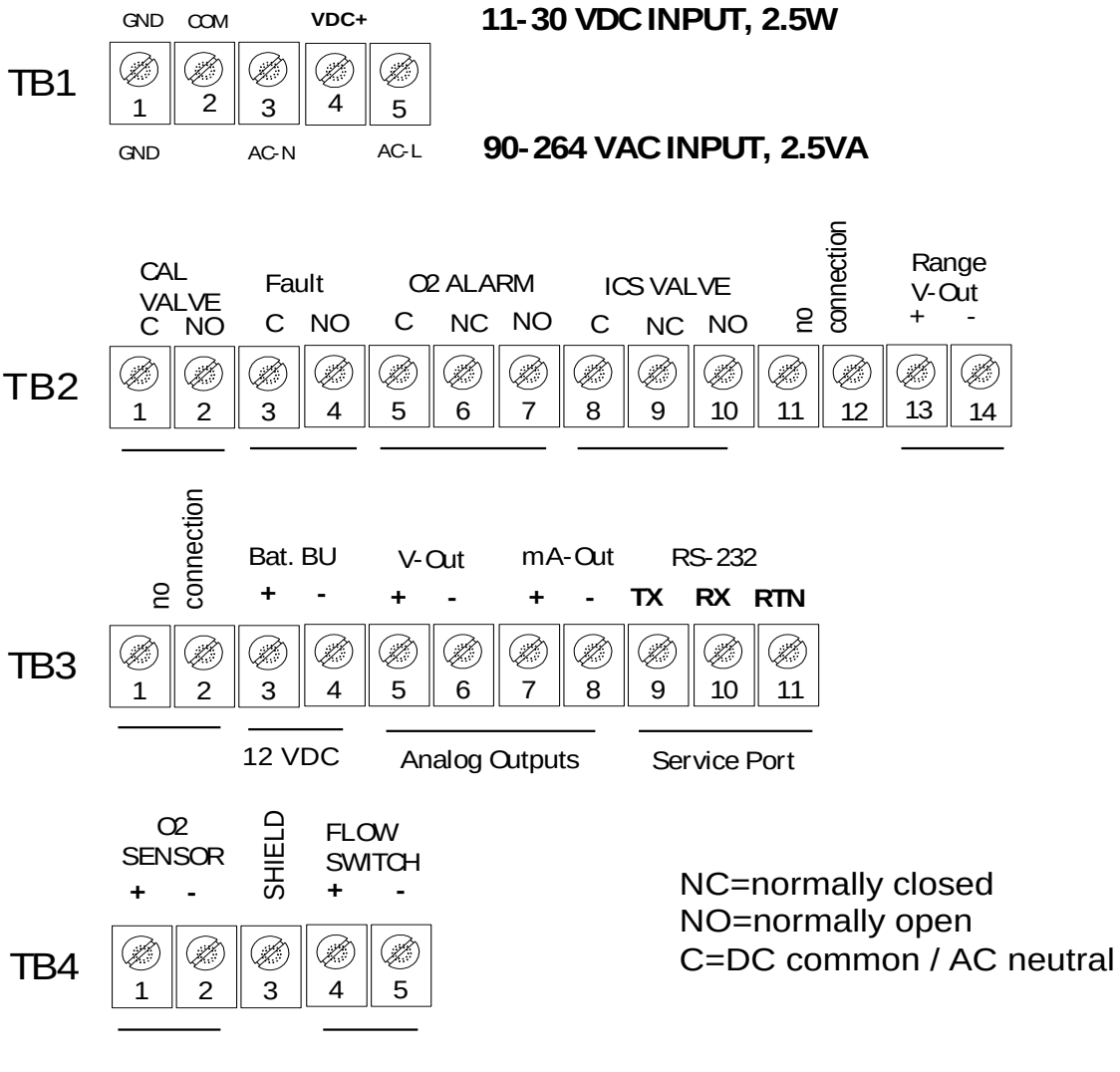


Figure 9 – analyzer electrical

2.1.3.1 Oxygen Sensor Input

Connections to the sensor are made at terminal block TB4 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. Refer to Appendix F – reference drawings.

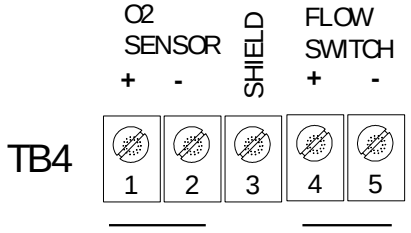
Use 20-AWG, 2-conductor, stranded-wire, twisted pairs for the connections. When interfacing directly to the sensor, use shielded cable, and drain the shield to dc earth-ground at the analyzer. When interfacing through passive (Zener type) safety barriers, use shielded cable, and drain the shield to dc earth-ground at the barriers. When interfacing through active (isolating) safety barriers, shielded cable is not necessary.

2.1.3.2 Flow Switch Status Input

Connections to the flow switch circuit are made at terminal block TB4 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. Refer to Appendix F – reference drawings.

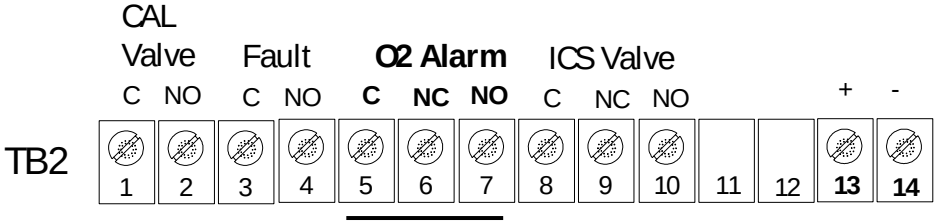
Use 20-AWG, 2-conductor, stranded-wire, twisted pairs for the connections. It is not necessary to use shielded cable for the Flow Switch interface, with or without electrical barriers.

Note a 4-conductor shielded cable may be used to wire both the sensor and flow switch in a single cable.



2.1.3.3 Oxygen Alarm Relay Outputs

Connections from the Oxygen Alarm 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@250VAC, 5A@30VDC. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis. Refer to Appendix F – reference drawings.



2.1.3.4 Inert Gas Control Relay Outputs

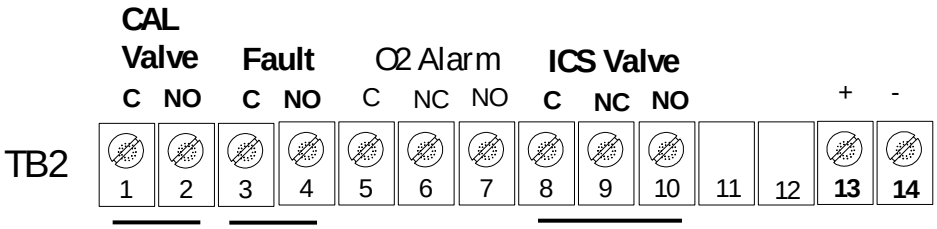
Connections from the Inert Gas Control relay contacts to a Neutronics Inc. Inert Gas Control solenoid valve are made at terminal block TB2 on the rear of the analyzer chassis, for stand-alone control of Oxygen in a process vessel or stream. They may be connected to other user-supplied process control devices in parallel, depending on the application needs. The Inert Gas Control relay contacts are voltage-free Form C relay contacts, SPDT, 5A@250VAC, 5A@30VDC. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis. Refer to Appendix F – reference drawings.

2.1.3.5 Fault Relay Outputs

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@250VAC, 5A@30VDC. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis. Refer to Appendix F – reference drawings.

2.1.3.6 Remote Calibration Relay Outputs

Connections from the Remote Calibration relay contacts to a Neutronics-supplied Calibration solenoid valve are made at terminal block TB2 on the rear of the analyzer chassis. The Remote Calibration relay contacts are voltage-free Form C relay contacts, SPDT, 5A@250VAC, 5A@30VDC. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis. Refer to Appendix F – reference drawings.



2.1.3.7 Analog Voltage Output

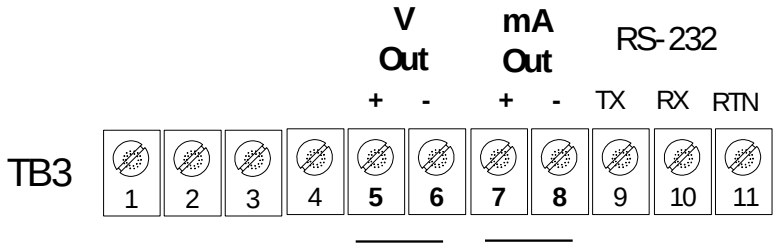
Connections from the Analog Voltage output to the user's auxiliary equipment are made at terminal block TB3 on the rear of the analyzer chassis. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.

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. Refer to Appendix F – reference drawings.

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. 24VDC Power is supplied by the Model Mini-ICS analyzer. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.

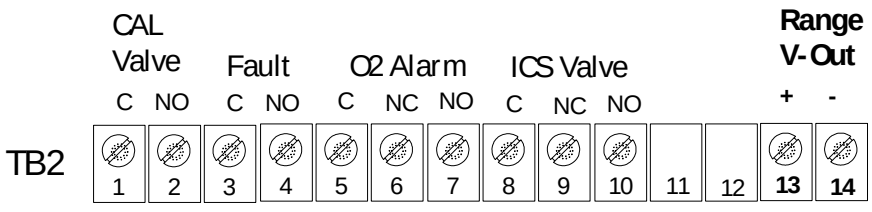
Use 20-AWG, 2-conductor, stranded-wire, twisted pairs for the connections. It is not necessary to use shielded cable for the Analog Current output, with or without electrical barriers. If shielded cable is used, it should be drained to dc ground at the auxiliary equipment. Refer to Appendix F – reference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



2.1.3.9 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. Refer to Appendix F – reference drawings.



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.

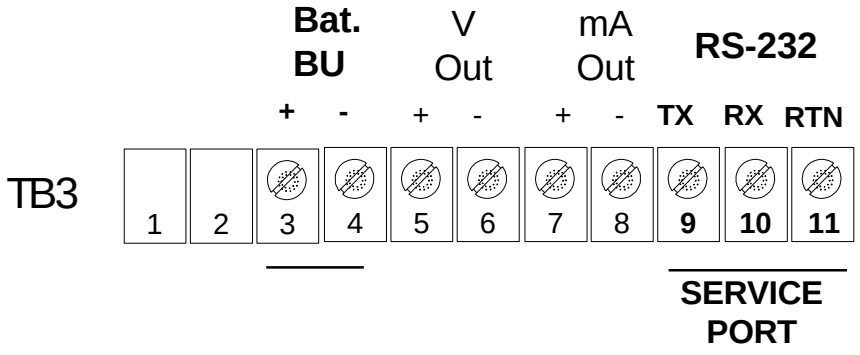
For interfacing with any standard PC computer via serial port, use 20-AWG, 3-conductor, shielded, stranded-wire, jacketed cable, terminated on one end with a female DB9 connector. The shielding should be drained to dc ground at the computer.

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 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 12vdc power source to act as a backup in case the main 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.

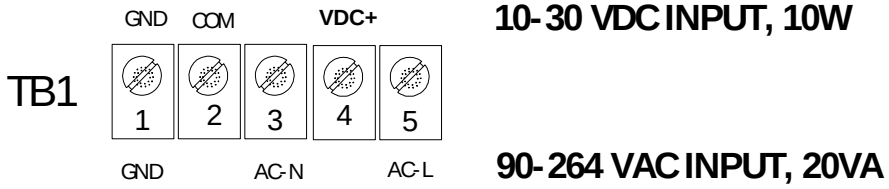
Connection to the Battery Backup is not required for normal operation of the analyzer. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.



2.1.3.12 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 110/220VAC, 50/60Hz to the unit. For VDC versions, use 18-AWG, 3-conductor, stranded-wire, for the connections. Supply 12/24VDC to the unit. Refer to Appendix F – reference drawings.



2.2 Starting up and Commissioning the System

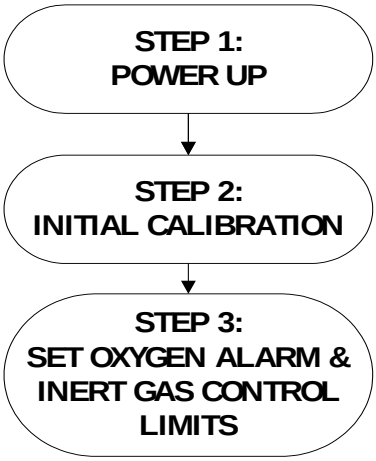


Figure 10 – start-up

The Model Mini-ICS is shipped ready to use, right from the carton. Factory default configuration settings are listed in Appendix C for your information. Those settings will be suitable for most applications. 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 sensor in an area where there are no flammable vapors?
- Mounted the analyzer and sensor away from exposure to rain, dripping water, or hose down?
- Correctly installed the sensor/sampling system?
- Correctly installed all of the analyzer wiring (Including barrier interfaces where required)?
- Read this manual in its entirety?

2.2.1 STEP 1 – Power Up the unit

When the Model Mini-ICS 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 version). The Normal, O_2 Alarm, Low Flow, and Fault LED indicators will go through a display test sequence (Lamp Test).

Following self-test, the analyzer will enter into one of its RUN modes (section 3.3). The analyzer will check its input reading and update the 7-segment alphanumeric display and status LED's accordingly. Though the unit can be immediately used after self-test, best stabilization of the sensor signal may be obtained after the instrument has been on for approximately 20 minutes. This will allow the sensor to stabilize and adjust to the ambient temperature.

2.2.2 STEP 2 – Calibrate the Unit

Refer to section 3.2.1 for detailed analyzer calibration instructions. All units are shipped freshly calibrated. If, however, the unit is stored for more than thirty days, a calibration may be required for best accuracy.

2.2.3 STEP 3 –Set Alarms, and Inert Gas Control Limits

WARNING: If your application is for explosion mitigation, you should use a calculated or tested Oxygen level necessary to propagate combustion in your process, given the process components, and conditions (Minimum Oxygen Concentration).

Refer to section 3.2 for information about setting alarms, and control levels. After the unit has been calibrated on a known gas source, it is desirable to set the control and alarm points according to the application.

2.2.3.1 Set Oxygen Alarm Level

For most Inert Gas Control applications, this should be set to the highest level of Oxygen allowable in your process. Refer to section 3.2.2 for information about setting the Oxygen Alarm level.

2.2.3.2 Set High Inert Gas Control limit

For Inert Gas Control applications, this is the highest Oxygen level that you want to maintain in your process. It should be at least 1% less than the High Oxygen Level Alarm setting. Refer to section 3.2.3 for information about setting the High Inert Gas Control Limit.

2.2.3.3 Set Low Inert Gas Control limit

For Inert Gas Control applications, this is the lowest level that you want to maintain in your process. It should be at least 1% lower than the High Inert Gas Control limit setting. Refer to section 3.2.4 for information about setting the Low Inert Gas Control Limit.

The Model Mini-ICS 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 (610)-524-8800 and ask a Service Technician to schedule service two (2) weeks in advance.

3 CHAPTER 3 – ANALYZER OPERATION

3.1 System Organization

The Model Mini-ICS has two types of operational modes – User-type, and Run-type. "User" modes are initiated and controlled by the user, and are used to setup and maintain the analyzer. "Run" modes are accessed automatically by the Model Mini-ICS during normal operation, according to its programming, and its configuration parameters.

3.2 USER Modes

The user can initiate User modes either from the front panel or through the Service Port (section 4.1.1 – 4.1.2). Gas Calibration, Set O_2 Alarm, Set High ICS Limit, Set Low ICS Limit, and View Active Faults modes will be covered in this chapter. System Configuration modes will be covered in section 4.1.

3.2.1 CALIBRATE Mode

Calibration mode allows the Oxygen Sensor to be tuned to a gas of known Oxygen concentration for the most accurate on-line reading at all times. As with all of the User modes of operation, you will enter the CAL mode at the front panel from any "Run" mode by pressing the "MODE" button.

3.2.1.1 When to calibrate

- Whenever the sensor is replaced
- At least once a month
- Whenever a FAULT condition is encountered
- After a POWER UP (wait 20 minutes to reach temperature equilibrium)
- Whenever you are unsure about an Oxygen concentration reading

3.2.1.2 What gases to use

- Ambient air
- Instrument grade compressed air (Dew-point < 35°, particulates < 3-micron, condensable hydrocarbons < 1-part-per-million)
- Certified bottled calibration gas – 1-21% O_2; background Nitrogen

3.2.1.3 Procedure for calibrating the Model Mini-ICS

3.2.1.3.1 Apply calibration gas to the Oxygen Sensor

Apply calibration gas to the Oxygen Sensor at a similar flow rate and pressure to that of the sampled gas. Be sure to flow calibration gas to the sensor until the display has stabilized to allow calibration gas to sweep out the sample lines. The analyzer includes an additional stabilization period of 30-seconds at the beginning of its Calibration routine (user configurable – section 4.1.2).

If you are using a Neutronics Process Sampling System, or Process Sample Conditioning Package, follow the instructions in the equipment manual for applying calibration gas to the apparatus. If you have been supplied a Remote Calibration solenoid valve with your system, and have installed it according to applicable instructions, manual application of calibration gas is not necessary. The calibration valve will automatically control the flow of calibration gas to the sensor when you enter CAL mode.

3.2.1.3.2 Enter CAL mode, and set calibration gas concentration

After a regulated stream of calibration gas has been applied to the sensor (or a Remote Calibration solenoid valve is being used), press and release the “MODE” button once. The 7-segment alphanumeric display will show “o” while depressed. When the “MODE” button is released, the display will show alternately “CAL”, then an Oxygen concentration value. Adjust the displayed Oxygen concentration value to read the applied calibration gas Oxygen concentration, or if you are using compressed or ambient air, 20.9% Oxygen, by pressing the “UP” or “DOWN” arrows as required.

3.2.1.3.3 Initiate Calibration routine

After you have set the calibration gas concentration, press and hold the “MODE” button for 3-seconds until the 7-segment alphanumeric display shows “----“. After the “MODE” button is released, the display will show alternately “ACAL”, and the Oxygen concentration value previously set to indicate that the analyzer has begun its calibration routine.

Once initiated, the Model Mini-ICS will complete the calibration routine in 90-seconds without additional input from the user. The analyzer will then resume RUN mode operation if no additional user-input is received.

3.2.1.3.4 Return the Oxygen Sensor to on-line service

Be sure to flow sample gas to the sensor until the display has stabilized to allow time to sweep the sample lines clear of calibration gas. The analyzer includes an additional stabilization period of 30-seconds at the end of its Calibration routine (user configurable – section 4.1.2).

If you are using a Neutronics Process Sampling System, or Process Sample Conditioning Package, follow the instructions in the equipment manual for removing calibration gas from the apparatus, and returning it to process sampling. If you have been supplied a Remote Calibration solenoid valve with your system, and have installed it according to applicable instructions, the calibration valve will automatically return the flow of sample gas to the sensor as part of the calibration routine.

3.2.2 SET O_2 ALARM Mode

To enter Set O_2 Alarm mode from any Run mode using the keypad; scroll through the User Mode menu by pressing momentarily the “MODE” button two (2) times, until the 7-segment alphanumeric display reads “AL” (Set O_2 Level). The display will rotate between “AL” and the current O_2 Alarm Level. Use the “UP” and “DOWN” key to adjust the O_2 Alarm level. To save settings, press the “MODE” key for 3 seconds until “---“ appears on the display. To exit without saving, press and release the “MODE” key.

3.2.3 SET HIGH INERT GAS CONTROL LIMIT Mode

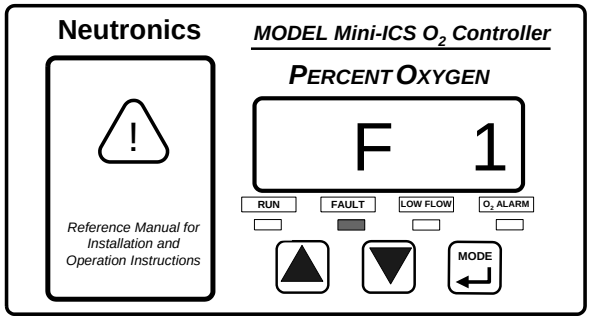
To enter Set High Inert Gas Control Limit mode from any Run mode using the keypad; scroll through the User Mode menu by pressing momentarily the “MODE” button three (3) times, until the 7-segment alphanumeric display reads “HIC” (Set High Inert Gas Control limit). The display will rotate between “HIC” and the current High Inert Gas Control Limit. Use the “UP” and “DOWN” key to adjust the displayed High Inert Gas Control Limit. To save settings, press the “MODE” key for 3 seconds until “---“ appears on the display. To exit without saving, press and release the “MODE” key.

3.2.4 SET LOW INERT GAS CONTROL LIMIT Mode

To enter Set Low Inert Gas Control Limit mode from any Run mode using the keypad; scroll through the User Mode menu by pressing momentarily the “MODE” button four (4) times, until the 7-segment alphanumeric display reads “LIC” (Set Low Inert Gas Control limit). The display will rotate between “LIC” and the current Low Inert Gas Control Limit. Use the “UP” and “DOWN” key to adjust the displayed High Inert Gas Control Limit. To save settings, press the “MODE” key for 3 seconds until “---“ appears on the display. To exit without saving, press and release the “MODE” key.

3.2.5 VIEW ACTIVE FAULTS Mode

To enter View Active Faults mode from any Run mode using the keypad; scroll through the User Mode menu by pressing momentarily the “MODE” button five (5) times. The 7-segment alphanumeric display will display active system faults in “F – x” format. Press and release the “UP” or “DOWN key to scroll through all active system faults. If no system faults are active, the 7-segment alphanumeric display will show “noF”. Refer to section 4.3.1 for a complete fault code listing, and troubleshooting guide. To exit, press and release the “MODE” key.



3.3 RUN Modes

After power-up and self-test, and analyzer immediately enters into one of its Run modes – Normal, O_2 Alarm Active, Inerting Control Active, or Fault Active. The Run mode active at any time, provided no manual input is received at the front panel or service port, is determined by the analyzer setup parameters entered at the factory, and by the user, compared against the analyzer's monitored inputs and other monitored hardware in real time.

3.3.1 NORMAL Mode

The Model Mini-ICS initiates NORMAL mode when it is continuously measuring the Oxygen concentration of the sample gas and updating the display and outputs accordingly, AND it has not detected any Alarm, or Fault conditions, AND it has not detected any user input. A solid lit "NORMAL" indicator LED indicates to the user that the instrument is on-line, the system is operating properly, and the measured process Oxygen levels are within the analyzer's programmed parameters.

When the measured process Oxygen concentration falls outside of programmed O_2 Alarm parameters, and/or the system experiences a fault condition, the Model 11000-ICS analyzer enters into O_2 Alarm Active, and/or Fault Active accordingly. The system aborts Normal mode, and the "NORMAL" indicator LED goes out.

When the Model 11000-ICS analyzer detects user-input, it enters into one of the USER modes accordingly – Gas Calibration, Set O_2 Alarm, Set High ICS Limit, Set Low ICS Limit, View Active Faults, (and User Setup, section 4.1). The analyzer does not abort Normal mode when user input is detected EXCEPT for Calibrate mode. In any User mode but Calibrate, the system continues to monitor the measured process. The "NORMAL" indicator LED flashes, to indicate to the user that the system is still on-line and operating normally.

3.3.2 O_2 ALARM ACTIVE Mode

The Model Mini-ICS initiates O_2 Alarm mode when it has detected that the measured Oxygen concentration has exceed the set threshold value of the O_2 Alarm (section 3.2.2). The "O_2 ALARM" indicator LED will light, the "NORMAL" indicator LED will go out. The O2 Alarm 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 the O_2 Alarm. The "O_2 ALARM" indicator LED will go out, and the O_2 Alarm relays will return to their non-active state according to the analyzer configuration. The O_2 Alarm Active mode is not affected by activation of any user mode EXCEPT Calibration.

3.3.3 INERTING CONTROL ACTIVE Mode

The Model Mini-ICS initiates Inerting Control Active mode when it has detected that the measured Oxygen concentration has exceed the set threshold value of the High Inerting Control Limit (section 3.2.3). It will also become active when the system is in Fault Active mode, according the analyzer configuration (Appendix C, Factory Setup). The Inerting Control Active mode is not affected by activation of any user mode.

The 7-segment alphanumeric display will flash and continue to display the measured Oxygen level. The “NORMAL” indicator LED will remain lit. The Inerting Control relays will change state according to the analyzer configuration. The Inerting Control function will be cleared automatically when measured Oxygen concentration falls below the set threshold value of the Low Inerting Control Limit. The Inerting Control relays will return to their non-active state according to their configuration.

3.3.4 FAULT ACTIVE Mode

The Model Mini-ICS 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 front panel (section 3.2.5). The Fault mode is not affected by activation of any user mode.

4 CHAPTER 4 – MAINTENANCE AND TROUBLESHOOTING

4.1 System Setup

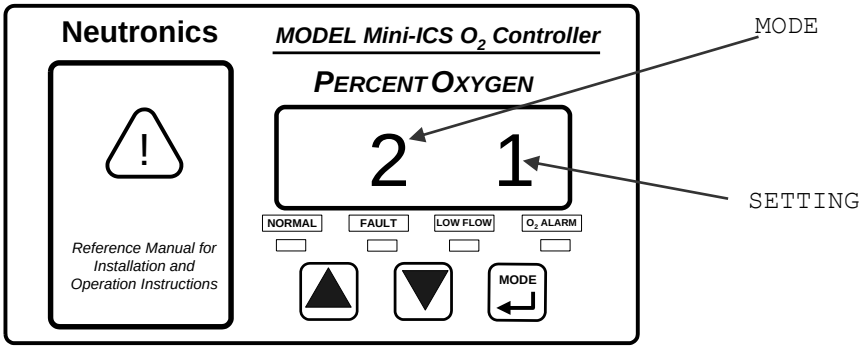
The Model Mini-ICS is shipped ready to install and operate with complete factory configuration already programmed and tested. The user may however wish to change the system configuration to suit the application of the analyzer. Some setup parameters may be changed by the user via the front panel keypad.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

Important: Before changing any of the Model Mini-ICS 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 Service Department for assistance.

4.1.1 System Setup via Front Panel Keypad

The Front Panel User Setup menu may be accessed from the Mini-ICS front 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" key to adjust the displayed setting. The modes are numerically identified by the flashing number on the left side of the display. The current setting is identified by the non-flashing 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, Front Panel Hot-Key functions).



4.1.1.1 User Setup 1: ICS and O2 Alarm Relays Failsafe/Non-Failsafe.

This parameter allows the user to set the ICS and O_2 Alarm relays to either failsafe or non-failsafe. Failsafe is defined as; the relay active mode is similar to when the Model Mini-ICS is not powered. Non-Failsafe mode is defined as; the relay active mode is opposite to when the Model Mini-ICS is not powered.

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

4.1.1.2 User Setup 2: O2 Alarm Relays Ascending Trip.

This parameter allows the user to set the O_2 Alarm relay to trip either ascending or descending. Ascending trip is defined as; the relay is set to active when the Oxygen level is above the O_2 Alarm level set point. Descending trip is defined as; the relay is set to active when the Oxygen level is below the O_2 Alarm level set point.

Valid Settings: 0 (Descending), 1 (Ascending).

4.1.1.3 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).

4.1.1.4 User Setup 4: Analog Current Output Setting.

This parameter allows the user to set the Analog Output Current range to either 0-20mA or 4-20mA.

Valid Settings: 16 (4-20mA), 20 (0-20mA).

4.1.1.5 User Setup 5: Display Range Setup.

This parameter allows the user to map the scale of both the Analog Voltage and Current outputs, based on the Oxygen concentration.

Valid Settings: 0 (0-1%), 1 (0-10%), 2 (0-25%), 3 (0-50%), 4(Auto-range), 5(Manual-Range)

4.1.1.6 User Setup 6: RS-232 Baud Rate.

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

Valid Settings: 0 (110bps), 1 (300bps), 2 (1200bps), 3 (2400bps), 4(4800bps), 5 (9600bps), 6 (19200bps), 7 (38400bps).

4.1.1.7 User Setup 7: 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).

4.1.1.8 User Setup 8: Sensor Disconnect Detection Test.

This parameter allows the user to enable or disable the sensor disconnect testing. Sensor disconnect is used to determine whether or not there the sensor is connected to the Model Mini-ICS analyzer.

Valid Settings: 0 (Disable Sensor Disconnect Detect), 1 (Enable Sensor Disconnect Detect).

4.1.1.9 User Setup 9: Minimum Analog Output Voltage Concentration

This parameter is only valid if Menu 5 is set to option 5 – Manual Range. This sets the oxygen concentration at which the Analog Voltage is at minimum output.

Valid Settings: Any oxygen concentration between 0 to 100%

4.1.1.10 User Setup 10: Maximum Analog Output Voltage Concentration

This parameter is only valid if Menu 5 is set to option 5 – Manual Range. This sets the oxygen concentration at which the Analog Voltage is at maximum output.

Valid Settings: Any oxygen concentration between 0 to 100%

Note: The Analog Output scale may be inverted if the voltage in User Setup 9 is set to be higher than voltage in User Setup 10.

4.1.1.11 User Setup 11: Minimum Analog Output Current Concentration

This parameter is only valid if Menu 5 is set to option 5 – Manual Range. This sets the oxygen concentration at which the Analog Current is at minimum output.

Valid Settings: Any oxygen concentration between 0 to 100%

4.1.1.12 User Setup 12: Analog Current Full Scale.

This parameter is only valid if Menu 5 is set to option 5 – Manual Range. This sets the oxygen concentration at which the Analog Current is at maximum output.

Valid Settings: Any oxygen concentration between 0 to 100%

Note: The Analog Output scale may be inverted if the voltage in User Setup 11 is set to be higher than voltage in User Setup 12.

4.1.1.13 User Setup 13: Set Current Year. ** NOT ACTIVE FOR THIS RELEASE**

4.1.1.14 User Setup 14: Set Current Month. ** NOT ACTIVE FOR THIS RELEASE**

4.1.1.15 User Setup 15: Set Current Day. ** NOT ACTIVE FOR THIS RELEASE**

4.1.1.16 User Setup 16: Set Current Hour. ** NOT ACTIVE FOR THIS RELEASE**

4.1.1.17 User Setup 17: Set Current Minute. ** NOT ACTIVE FOR THIS RELEASE**

4.1.1.18 User Setup 18: Factory Setup Restore.

This parameter allows the user to return the Mini-ICS to its initial factory-commissioned settings. This will activate if the user adjusts the setting number to 99, and pushes the “MODE” key. The 7-segment alphanumeric display will flash “Fr” before the unit returns to Run mode.

Valid Settings: 99. A setting of 99 will activate the Factory Setup restore.

4.1.2 System Setup via Service Port

The model Mini-ICS features a Service Port, which is accessible for programming the system, monitoring the analyzer output, and determining the 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 Mini-ICS. Complete the instructions for wiring and connecting the Model Mini-ICS to a PC computer (section 2.1.3.10). Apply power to the Model Mini-ICS, 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	1100ICS
CONNECT TO	COM1, or other available COM port

In HyperTerminal, select the correct COM port properties, to interface properly with the Model Mini-ICS:

PROPERTIES	YOU ENTER
BITS PER SECOND	9600
DATA BITS	8
PARITY	None
STOP BITS	1
FLOW CONTROL	None
TERMINAL EMULATION	VT100 *

* Not all versions of MS Windows prompt for this parameter.

Select “Apply” and “OK” as prompted. The Hyper Terminal program will immediately begin “listening” for information from the Model Mini-ICS. The Model Mini-ICS controller will commence sending data via ASCII code dump to the PC. The information from the controller 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 Mini-ICS fails, isolate the problem by performing the following tests:

Disconnect the RS-232 cable from the Model Mini-ICS by removing terminal board TB3 and insert a jumper between pins 9 & 10 on the terminal board. Then, 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 Mini-ICS controller still has not been established, then PC COM port pins 2 & 3 (Mini-ICS pins 9 & 10) may be reversed. Verify the cable wiring (section 2.1.3.10). If no transmitted data from the Model Mini-ICS 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 Mini-ICS:

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

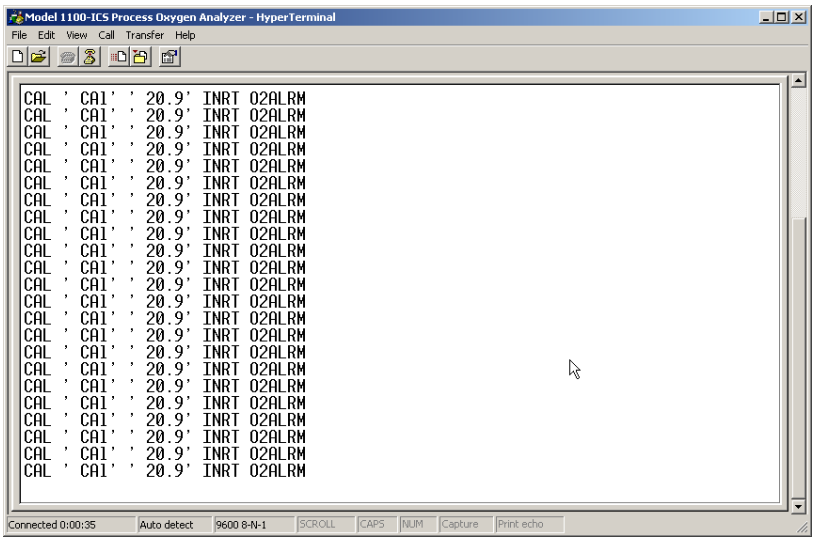
Advanced Level-1 Access: Allows user setup and configuration, such as alarms, and data format.

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

4.1.2.4 Standard Level Access

Standard Access level is the default level of access to the Model Mini-ICS 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 Mini-ICS and a host computer, 2-way communication begins automatically in Standard Level access. Data is sent out the analyzer RS232 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 Mini-ICS in Standard Level access.



To request and view specific information via the RS-232 interface, type the desired command key selected from the 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 Mini-ICS, disable automatic 1-second updates from the Model Mini-ICS 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
B	Software Build number
C	Oxygen sensor type
E	Sensor output in Percent Oxygen
G	Sensor output in Volts or Amperes

H	Active Fault codes
I	Active Fault code descriptions
V	Long software version
@	Unit Serial Number

STANDARD ACCESS level commands – continued:

TYPED COMMAND	**DESCRIPTION OF QUERIED FUNCTION**
1	Manual O_2 Alarm relay override
2	Manual Fault relay override
3	Manual Remote Calibration relay override
4	Manual Inert Gas Control relay override
5	Cancel all manual relay overrides

Helpful Hint: Standard Level Access commands 1 through 5 can be used to manually cycle valves, and controls for testing and troubleshooting the system and peripheral devices. Each time the command is entered, the relay toggles its state. If for example, the user suspects that the Calibration solenoid valve is sticking, that valve may be cycled manually by pressing “3” on the PC keyboard, and then pressing it again.

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

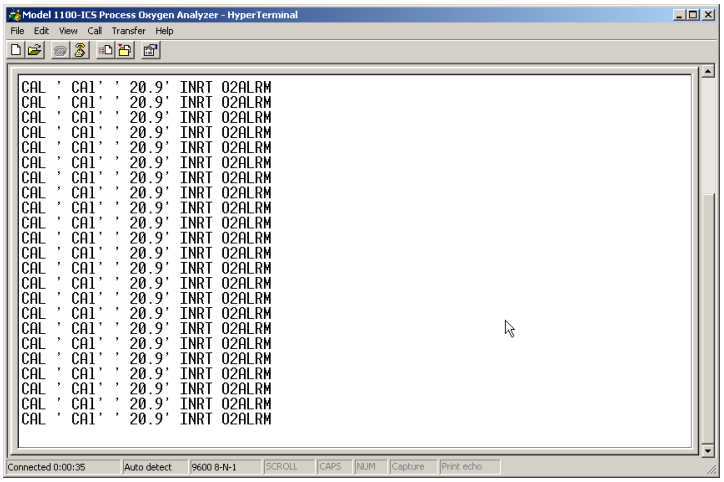
TYPED COMMAND	**DESCRIPTION OF QUERIED FUNCTION**
S SERFMT=0	Disables RS 232 continuous periodic data-dump
S SERFMT=1	Enables RS 232 output in HUMAN READABLE format
S SERFMT=2	Enables RS 232 output in MACHINE format w/o Checksum
S SERFMT=3	Enables RS 232 output in MACHINE format w/Checksum
S SERFMT=4	Enables RS 232 output in TAB DELIMITED (Excel) format

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 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 front panel, or through the RS-232 interface in Standard Access level. 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 • Display-1 (note) • Display-2 (note) • ICS status • Flow Fault status• O_2 Alarm status• list of Fault codes active.



Note The 7-segment alphanumeric display is capable of displaying two (2) messages simultaneously (e.g. during calibration, the display alternates between "CAL", and an O_2 concentration. If the user were to view the RS-232 during CAL mode, Display-1 column would show "CAL", and the Display-2 column would show an O_2 concentration).

4.1.2.4.3 Machine Data Format with NO Checksum

Machine format with NO checksum can be selected via the analyzer front 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 • Display-1 • Display-2 • Fault codes active • Fault Codes • ICS status • O_2 Alarm 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

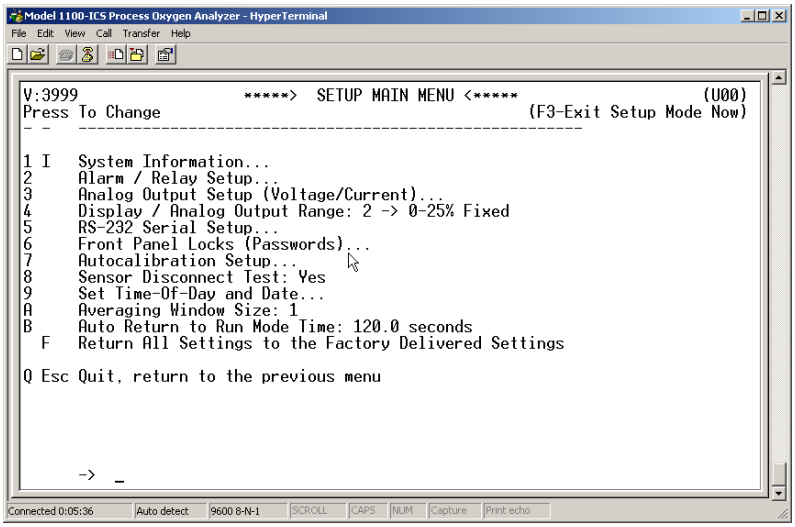
Machine format with checksum can be selected via the analyzer front panel, or through the RS-232 interface in Standard Access level. Machine format with checksum data is streamed in packets defined by start/stop transmit bits. The order of data in each packet is as follows: Start Transmit • O_2 Concentration • Display-1 • Display-2 • Fault codes active • Fault Codes • ICS status • O_2 Alarm 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 front 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] • ICS status [tab] • Flow Fault status [tab] • O_2 Alarm status [tab] • list of Fault codes active [tab].

4.1.2.5 Advanced Level 1 Access

Advanced Level-1 access is the user setup mode, and is available to the user via a PC or directly at the Model Mini-ICS analyzer control panel (section 14.1.1). 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.



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 Mini-ICS – The RS-232 User Setup Menu

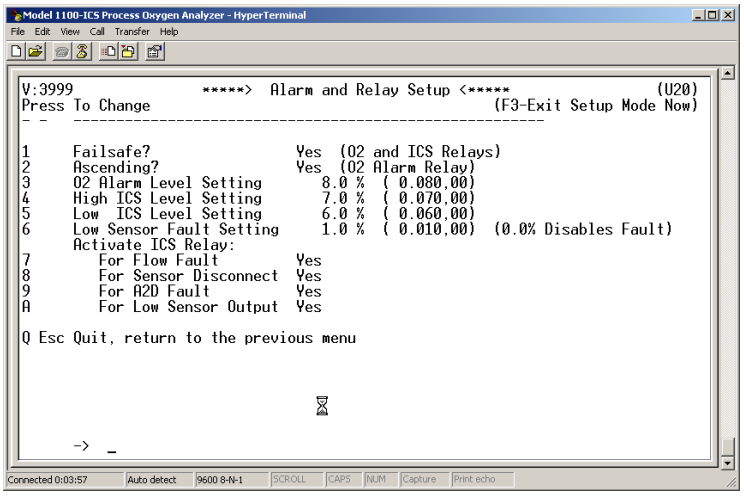
The RS-232 User Setup menu U00 is the “Home” screen in Advanced Level-1 access (section 4.1.2.5), and provides access to all the parameters that may need to be adjusted by the user. The interactive menu is initiated by typing “setup” and pressing the "Enter" key on the RS-232 terminal; as in entering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

4.1.2.8 System Information Display

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

4.1.2.9 (U20) Alarm and 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 Mini-ICS analyzer. It is accessed from the Setup Main Menu by typing “2” on the RS-232 Terminal. To navigate backwards, use the <Esc> or “Q” key on the RS-232 terminal.



4.1.2.9.1 O2 Alarm and ICS Relays Failsafe

This setting sets O_2 Alarm and ICS Relays to either Failsafe or Non-Failsafe. Failsafe is defined as; the active state of the relay is similar to the not powered state. Non-Failsafe is defined as; the active state is opposite to the not powered state. The failsafe setting may be set to “YES” or “NO”. This setting is accessed from the Alarm and Relay Setup Menu by typing “1” on the RS-232 terminal

4.1.2.9.2 O_2 Alarm Ascending

This setting sets the O_2 Alarm to either ascending or descending. Ascending is defined as O_2 Alarm relay active when the Oxygen concentration is above the O2 Alarm level. Descending is defined as; when as; O_2 Alarm relay active when the Oxygen concentration is below the O_2 Alarm Level. The ascending setting may be set to “YES” or “NO”. This setting is accessed from the Alarm and Relay Setup Menu by typing “2” on the RS-232 terminal.

4.1.2.9.3 O_2 Alarm Level Setting

This setting sets the threshold level for the O_2 Alarm relay. Depending on whether or not it is set to ascending or descending, the O_2 Alarm relay becomes active when the Oxygen concentration is above or below this threshold level. O_2 Alarm level may be set anywhere from 0.0 to 100.0%. This setting is accessed from the Alarm and Relay Setup Menu by typing “3” on the RS-232 terminal.

4.1.2.9.4 High ICS Level Setting

This setting sets the high threshold level for the ICS relay. The ICS relay becomes active when the Oxygen concentration is above this threshold level. The High ICS level may be set anywhere from 0.0 to 100.0%. This setting is accessed from the Alarm and Relay Setup Menu by typing “4” on the RS-232 terminal.

4.1.2.9.5 Low ICS Level Setting

This setting sets the low threshold level for the ICS relay. The ICS relay becomes disabled when the oxygen concentration is below this threshold level. The Low ICS level may be set anywhere from 0.0 to 100.0%. This setting is accessed from the Alarm and Relay Setup Menu by typing “5” on the RS-232 terminal.

4.1.2.9.6 Low Sensor Fault Setting

This setting sets the threshold level for fault 10: low sensor output. This fault is used to determine that the gas sensor may be disabled. The Low Sensor Fault level may be set anywhere from 0.0 to 100.0%. This setting is accessed from the Alarm and Relay Setup Menu by typing “6” on the RS-232 terminal.

4.1.2.9.7 Activate ICS Relay for Flow Fault

This setting is used to activate the ICS relay if fault 1 is active. Fault 1 is identified as Oxygen ample flow fault. This setting may be set to “YES” or “NO”. This setting is accessed from the Alarm and Relay Setup Menu by typing “7” on the RS-232 terminal.

4.1.2.9.8 Activate ICS Relay for Sensor Disconnect Fault

This setting is used to activate the ICS relay if fault 2 is active. Fault 2 is identified as Sensor Disconnected fault. This setting may be set to “YES” or “NO”. This setting is accessed from the Alarm and Relay Setup Menu by typing “8” on the RS-232 terminal.

4.1.2.9.9 Activate ICS Relay for A2D Fault

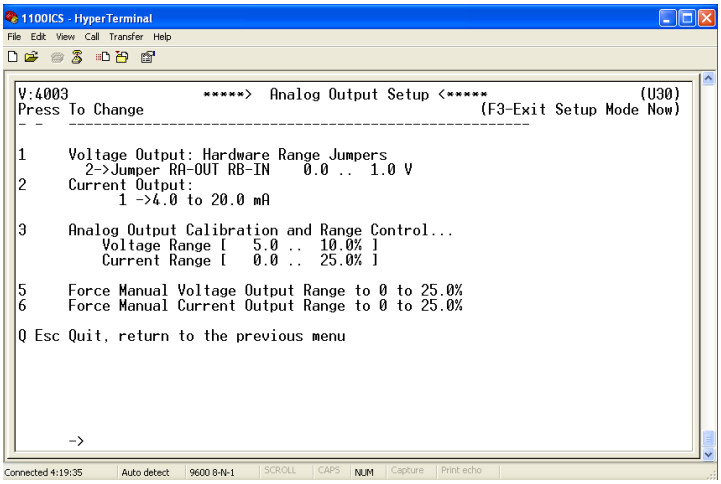
This setting is used to activate the ICS relay if fault 9 is active. Fault 9 is identified as Analog to Digital Converter Timeout fault. This setting may be set to “YES” or “NO”. This setting is accessed from the Alarm and Relay Setup Menu by typing “9” on the RS-232 terminal.

4.1.2.9.10 Activate ICS Relay for Low Sensor Fault

This setting is used to activate the ICS relay if fault 10 is active. Fault 10 is identified as Low Sensor Output fault. This setting may be set to “YES” or “NO”. This setting is accessed from the Alarm and Relay Setup Menu by typing “A” on the RS-232 terminal.

4.1.2.10 (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” on the RS-232 terminal. To navigate backwards, use the <Esc> or “Q” key on the RS-232 terminal.



4.1.2.10.1 Analog Voltage Output Range Jumpers

This menu sets the Analog Voltage Output full-scale value. It may be set to 0 (5V full scale), 1 (10V full scale) or 2 (1V 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” on the RS-232 terminal.

4.1.2.10.2 Analog Current Output

This menu is accessed from the Analog Voltage Output Setup menu by typing “2” on the RS-232 terminal. It is used to select the analog current output to either 0 (0-20mA) or 1 (4-20mA).

4.1.2.10.3 Analog Output Calibration and Range Control

This menu is used to test and calibrate the Analog Voltage Output and Analog Current Output. This menu also allows for the analog voltage and current ranges to be manually set to meet application requirements. It is accessed from the Analog Output Setup menu by typing “3” on the RS-232 terminal.

4.1.2.10.4 Calibrate 0 To 5 Volt Output

This menu calibrates the 0-5V Analog Voltage Output. A digital multi-meter set to measure volts must be attached to TB3-pin5 and TB3-pin6. Jumpers RA and RB must be open (section 4.1.3). Navigate from Analog Output Setup menu to the Analog Output Calibration menu by typing “3” on the RS-232 terminal. Type “2” to access the Calibrate 0 To 5 Volt Output menu.

4.1.2.10.5 Calibrate 0 To 10 Volt Output

This menu calibrates the 0-10V Analog Voltage Output. A digital multi-meter set to measure volts must be attached to TB3-pin5 and TB3-pin6. Jumper RA must be shorted and RB must be open (section 4.1.3).. Navigate from Analog Output Setup menu to the Analog Output Calibration menu by typing “3” on the RS-232 terminal. Then, type “3” to access the Calibrate 0 To 10 Volt Output menu.

4.1.2.10.6 Calibrate 0 To 1 Volt Output

This menu calibrates the 0-1V Analog Voltage Output. A digital multi-meter set to measure volts must be attached to TB3-pin5 and TB3-pin6. Jumper RA must be open and RB must be shorted (section 4.1.3). Navigate from Analog Output Setup menu to the Analog Output Calibration menu by typing “3” on the RS-232 terminal. Then, type “4” to access the Calibrate 0 To 1 Volt Output menu.

4.1.2.10.7 Calibrate 0 To 20 Milliamp Output

This menu calibrates the 0-20mA Analog Current Output. A digital multi-meter set to measure mA must be attached to TB3-pin7 and TB3-pin8. Navigate from Analog Output Setup menu to the Analog Output Calibration menu by typing “3” on the RS-232 terminal. Then, type “5” to access the Calibrate 0 To 20mA Output menu.

4.1.2.10.8 Oxygen Concentration at Voltage Manual Zero

This menu sets the oxygen concentration at which the analog voltage output is at minimum scale. This setting may be set anywhere from 0.0 to 100% oxygen. Navigate from Analog Output Setup menu to the Analog Output Calibration menu by typing “3” on the RS-232 terminal. Then, type “6” to access the O2 Concentration at Voltage Manual Zero.

4.1.2.10.9 Oxygen Concentration at Voltage Manual Full Scale

This menu sets the oxygen concentration at which the analog voltage output is at maximum scale. This setting may be set anywhere from 0.0 to 100.0% oxygen. The zero scale may be set higher than the full scale for the Analog Voltage so that the scale may be inverted. Navigate from Analog Output Setup menu to the Analog Output Calibration menu by typing “3” on the RS-232 terminal. Then, type “7” to access the Voltage at Display Range Full Scale menu.

4.1.2.10.10 Oxygen Concentration at Current Manual Zero

This menu sets the oxygen concentration at which the analog current output is at minimum scale. This option may be set anywhere from 0.0 to 100.0%. Navigate from Analog Output Setup menu to the Analog Output Calibration menu by typing “3” on the RS-232 terminal. Then, type “8” to access the Oxygen Concentration at Current Manual Zero menu.

4.1.2.10.11 Oxygen Concentration at Current Manual Full Scale

This menu sets the oxygen concentration at which the analog current output is a maximum scale. This option maybe set anywhere from 0.0 to 100.0% oxygen. The zero scale may be set higher than the full scale for the Analog Current so that the scale may be inverted. Navigate from Analog Output Setup menu to the Analog Output Calibration menu by typing “3” on the RS-232 terminal. Then, type “9” to access the Current at Display Range Full Scale menu.

4.1.2.10.12 Test Voltage Output Calibration

This menu may be used to test the Analog Voltage output. A digital multi-meter set to measure volts must connected to TB3-pin5 and TB3-pin6 to verify the output. Any voltage between 0.0 and 1.0/5.0/10.0V may be entered at the prompt. Use the digital multi-meter to verify the Analog Voltage output. Navigate from Analog Output Setup menu to the Analog Output Calibration menu by typing “3” on the RS-232 terminal. Then, type “V” to access the Test Voltage Output Calibration menu.

4.1.2.10.13 Test Current Output Calibration

This menu may be used to test the Analog Current output. A digital multi-meter set to measure current must connected to TB3-pin6 and TB3-pin7 to verify the output. Any current between 0.0 to 20mA may be entered at the prompt. Use the digital multi-meter to verify the Analog Current output. Navigate from Analog Output Setup menu to the Analog Output Calibration menu by typing “3” on the RS-232 terminal. Then, type “I” to access the Test Current Output Calibration menu.

4.1.2.10.14 Test with Percentage Full Scale

This menu may be used to test the Analog Current and Voltage output in terms of percentage full scale. Any percentage between 0.0 and 100.0 may be entered at the prompt. Navigate from Analog Output Setup menu to the Analog Output Calibration menu by typing “3” on the RS-232 terminal. Then, type “T” to access the Test with Percentage Full Scale menu.

4.1.2.10.15 Force Manual Voltage Output Range to 0 to 25%

This setting is used to reset the voltage output range to the default values, which are between 0 to 25% oxygen. Entering “Y” at the prompt resets the Analog Voltage zero to the default. Entering “N” at prompt retains the current setting. This menu is accessed from the Analog Output Setup menu by typing “5” on the RS-232 terminal

4.1.2.10.16 Force Manual Current Output Range to 0 to 25%

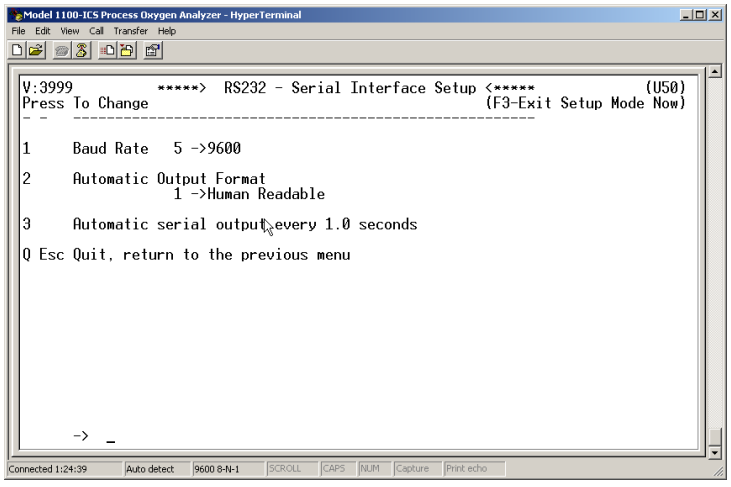
Thes menu forces the Manual Current Output Range to the default values, which are between 0 to 25%. Entering “Y” at the prompt resets the Analog current zero and full scale. Entering “N” at prompt retains the current setting. This menu is accessed from the Analog Output Setup menu by typing “6” on the RS-232 terminal

4.1.2.11 (U04) Display/Analog Output Range

The RS-232 Display/Analog Output Range menu U04 provides access to the Analog Output Range (Current and Voltage) settings. The Analog Output Range may be set to 0 (0-1% Fixed), 1 (0-10% Fixed), 2 (0-25% Fixed), 3 (0-50% Fixed), 4 (0-1/10/25/50% Auto-range) or 5(Manual-Range). This menu is accessed from the Setup Main Menu by typing “4” on the RS-232 terminal. To navigate backwards, use the <Esc> or “Q” key on the RS-232 terminal.

4.1.2.12 (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” on the RS-232 terminal. To navigate backwards, use the <Esc> or “Q” key on the RS-232 terminal.



4.1.2.12.1 Baud Rate

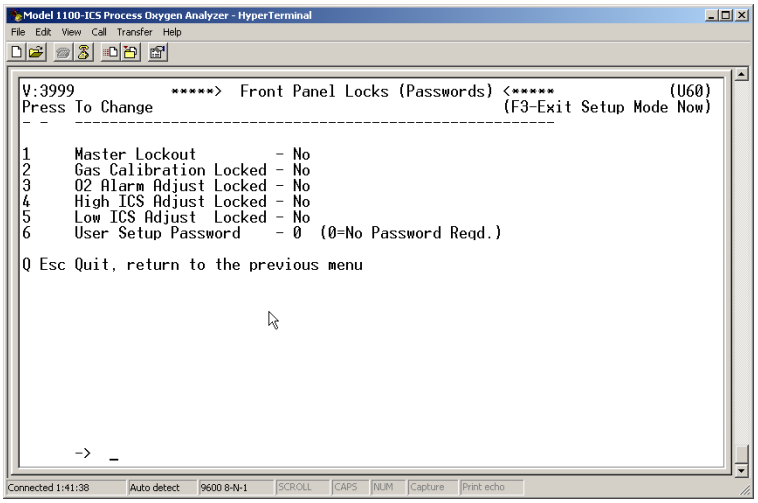
This menu sets the RS-232 baud rate. The baud rate can be set to 0 (110bps), 1 (300bps), 2 (1200bps), 3 (2400bps), 4 (4800bps), 5 (9600bps), 6 (19200bps) or 7 (38400bps). This menu is accessed from the RS-232 Serial Setup menu by typing “1” on the RS-232 terminal.

4.1.2.12.2 Automatic Serial Output Format

This menu sets the format of the automatic timed RS-232 serial output. 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). This menu is accessed from the RS-232 Serial Setup menu by typing “2” on the RS-232 terminal.

4.1.2.13 (U60) Front Panel Locks Menu

This menu enables and disables the features and settings that may be accessed from the Mini-ICS front panel keypads. This menu may be accessed from the Setup Main Menu by pressing “6” on the RS-232 terminal. To navigate backwards, use the <Esc> or “Q” key on the RS-232 terminal.



4.1.2.13.1 Master Lockout

If the Master Lockout is enabled, the user may only *view* the Calibration Gas value, O_2 Alarm setting, High ICS setting, and Low ICS setting. The user may not execute Gas Auto calibration or the Front Panel User Setup menu. The Master Lockout setting is accessed from the Front Panel Locks menu by typing “1” on the RS-232 terminal.

4.1.2.13.2 Gas Calibration Lockout

If the Gas Calibration Lockout is enabled, the user may only *view* the Gas Calibration value. The user may not execute the Gas Auto calibration. The Gas Calibration Lockout setting is accessed from the Front Panel Locks menu by typing “2” on the RS-232 terminal.

4.1.2.13.3 O_2 Alarm Lockout

If the O_2 Alarm Lockout is enabled, the user may only view the O2 Alarm level setting. The O_2 Alarm Lockout setting is accessed from the Front Panel Locks menu by typing “3” on the RS-232 terminal.

4.1.2.13.4 High ICS Lock-Out

If the High ICS Lockout is enabled, the user may only view the High ICS level setting. The High ICS Lockout setting is accessed from the Front Panel Locks menu by typing “4” on the RS-232 terminal.

4.1.2.13.5 Low ICS Lock-Out

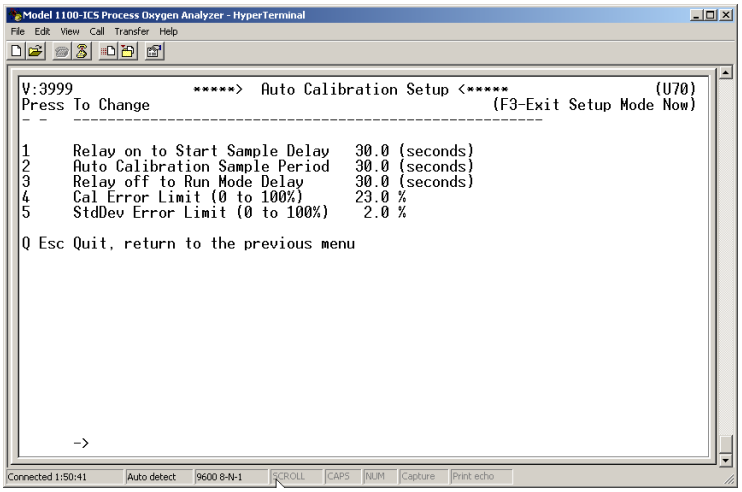
If the Low ICS Lockout is enabled, the user may only view the Low ICS level setting. The Low ICS Lockout setting is accessed from the Front Panel Locks menu by typing “5” on the RS-232 terminal.

4.1.2.13.6 User Setup Password

The Front Panel User Setup mode may be given limited access by setting up as password. The password may be a number between 1 and 9999. The user then enters this number from the front panel to initiate the Front Panel User Setup mode. A setting of 0 disables the password feature. The User Setup Password setting is accessed from the Front Panel Locks menu by typing “6” on the RS-232 terminal.

4.1.2.14 (U70) Auto Calibration Setup Menu

This menu provides access all the settings related to the gas auto calibration feature. It 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.



4.1.2.14.1 Relay on to Start Sample Delay

This setting determines the delay between the activation of the Calibration relay and the start of calibration gas sampling. The purpose of this delay is to give enough time for the calibration gas to propagate through to the sensor before the Model Mini-ICS starts reading the calibration gas. This delay may be set anywhere from 1.0 to 1000.0 seconds. This setting is accessed from the Auto Calibration Setup menu by typing “1” on the RS-232 terminal.

4.1.2.14.2 Calibration Sample Period

This setting determines the calibration gas sampling period. This period may be set anywhere from 2.0 to 1000.0 seconds. This setting is accessed from the Auto Calibration Setup menu by typing “2” on the RS-232 terminal.

4.1.2.14.3 Relay off to RUN Mode

This setting determines the delay between the end of calibration gas sampling and the return to RUN mode. The purpose of this delay is to give enough time for the calibration sample gas to be swept clear of the sensor before the Model Mini-ICS starts reading the on-line sample gas. This delay may be set anywhere from 1.0 to 1000.0 seconds. This setting is accessed from the Auto Calibration Setup menu by typing “3” on the RS-232 terminal.

4.1.2.14.4 Calibration Error Limit

This setting determines the maximum error of the average calibration gas readings allowable from the ideal sensor output at the calibration gas value. The Calibration Error Limit is used to determine the thresholds for fault code 7 – Sensor Calibration Signal High (section 4.2.1.7), and fault code 8 – Sensor Calibration Signal Low (section 4.2.1.8). This percentage error may be set anywhere from 0.0 to 100.0 percent. This setting is accessed from the Auto Calibration Setup menu by typing “3” on the RS-232 terminal.

Warning: It is not recommended that this setting be changed by the user except under special circumstances. Please contact the Neutronics Inc. Service Department.

4.1.2.14.5 Standard Deviation Error Limit

This setting determines the maximum standard deviation error of the samples obtained from the calibration gas reading. The standard deviation is used to determine if the sample calibration gas is stable. The standard deviation error may be set anywhere from 0.0 to 100.0 percent. This setting is accessed from the Auto Calibration Setup menu by typing “4” on the RS-232 terminal.

4.1.2.15 Sensor Disconnect Test

This setting enables or disables the feature where the Mini-ICS checks to see if the sensor is connected to the analyzer. It may be set to “YES” or “NO”. This setting is accessed from the Setup Main 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 Set Time-of-Day and Date ** NOT ACTIVE FOR THIS RELEASE**

4.1.2.17 Averaging Window Size

This sets the size of the Oxygen concentration-averaging window. The averaging window is used to damp the Oxygen concentration readout if the Oxygen gas sample is unstable and prone to concentration spikes. The averaging window size may be set anywhere between 1 and 255. This setting is accessed from the Setup Main Menu by typing “A” on the RS-232 terminal. To navigate backwards, use the <Esc> or “Q” key on the RS-232 terminal.

4.1.2.18 Auto Return to Run Mode Time

This setting sets the time that the Mini-ICS will stay in Front Panel Calibration mode or Front Panel User Setup mode without any user input. The purpose of this feature is that if a user enters either mode, and forgets to exit, the setting will automatically send the unit back to run mode. The Auto Return time may be set anywhere from 0.0 to 999.0 seconds. This setting is accessed from the Setup Main Menu by typing “B” on the RS-232 terminal. To navigate backwards, use the <Esc> or “Q” key on the RS-232 terminal.

4.1.2.19 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 Mini-ICS analyzer to the “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.

4.1.3 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 Front 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 Mini-ICS is disabled at the user device. Make sure that interrupting the alarms, outputs, etc… will not interfere with normal process monitoring or control. Disconnect power from the model Mini-ICS unit. Disconnect the removable terminal blocks from the rear of the model Mini-ICS chassis.

4.1.3.1.2 Change jumper settings

Turn the model Mini-ICS upside down to access the jumpers through the port provided. Identify the appropriate jumper position. Use an insulated jumper-puller, or needle nose pliers wrapped with electrical tape 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 front 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 Mini-ICS.

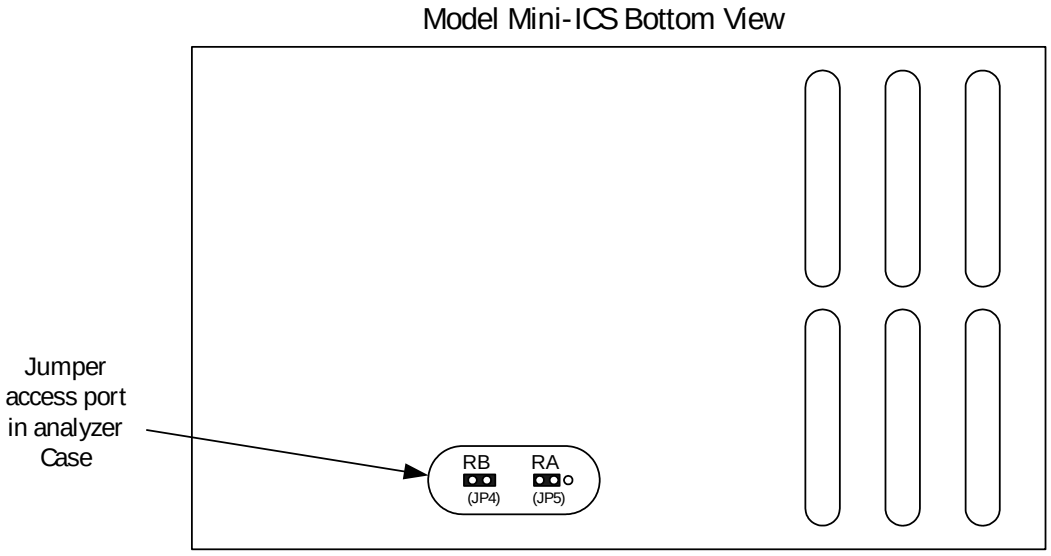


Figure 11 – Range select jumpers

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

Figure 12 – Range select jumper settings

4.2 Routine Periodic Maintenance

Maintenance for the Model Mini-ICS 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 Mini-ICS does not require any major servicing. Periodic calibration of the sensor on known gas should be performed on a regular basis (see section 4.2). The chart below should serve as a general guide for maintenance personnel.

TASK	RECOMMENDED FREQUENCY			
	COMMISSIONING	**MONTHLY**	**ANNUALLY**	**AS REQUIRED**
CALIBRATE SENSOR	√	√		√
CLEAN THE ANALYZER CHASSIS AND DISPLAY PANEL WITH SOFT CLOTH. MAKE SURE THE VENTILATION PORTS ARE CLEAR.			√	√
CONFIGURE ALARMS	√			√
CHECK THE ANALOG OUTPUTS AND RS-232 OUTPUT AGAINST DISPLAY	√		√	
INSTALL NEW OXYGEN SENSOR	√			√ • GP/IT Sensors 9-12 Mos. • CAG250 Sensors 2-3 Yrs.

Figure 13 – Maintenance schedule

4.3 Troubleshooting

4.3.1 Fault Codes

When trouble occurs during normal operation of the Model Mini-ICS, 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 front panel to enter into “View Active Faults” mode (section 3.2.5). 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. Other manuals may be helpful in troubleshooting casualties related to Neutronics Inc. Sampling systems and Sample Conditioning Packages.

4.3.1.1 Fault Code 0 – Constant Memory Error

The Constant Memory Error fault indicates that information in the Model Mini-ICS non-volatile operating system has been corrupted, and cannot be recovered. The 7-segment LED display will indicate “Er.0”. The Model Mini-ICS operating system storage area is double redundant, however; if a catastrophic failure causes all three system storage areas to become corrupt, the unit will not operate, and must be returned to the factory for repair.

4.3.1.2 Fault Code 1 – Low Flow

The Low Flow fault indicates that sample or calibration gas flow has dropped below the mechanical set point of the Flow Switch in you Neutronics Inc. Process Sampling system, or Sample Conditioning Package. In this flow condition, the Oxygen reading may not be representative of the process Oxygen level. Other possible causes may be an open condition in the Flow Switch interface, a fouled Flow Switch, or a faulty Intrinsic Safety Barrier (Hazardous applications only).

4.3.1.3 Fault Code 2 – Sensor disconnected

The Sensor disconnected fault indicates that there is not a continuous electrical circuit connecting the Model Mini-ICS and the Oxygen Sensor. This condition is different from a “Sensor Operating signal low” fault; it indicates an open condition in the connecting hardware. Possible causes may be an open in the Sensor interface wiring, or a faulty Intrinsic Safety Barrier (Hazardous applications only).

4.3.1.4 Fault Code 4 – Low Sensor Limit higher than Low ICS Limit

The Low Sensor Limit Higher than Low ICS Limit fault indicates a conflict in the analyzer setup between the Low ICS Limit setting (sections 3.2.4 and 4.1.2.9.5, and Appendix C, Factory Setup) and the Low Sensor Fault setting (section 4.1.2.9.6 and Appendix C, Factory Setup). The Low Sensor Fault setting cannot be set to a higher Oxygen concentration than the Low ICS Limit setting.

4.3.1.5 Fault Code 5 – High ICS Limit lower than Low ICS Limit

The High ICS Limit lower than Low ICS Limit fault indicates a conflict in the analyzer setup between the High ICS Limit setting (section 3.2.3, and 4.1.2.9.4, and Appendix C, Factory Setup), and the Low ICS Limit setting (sections 3.2.4, and 4.1.2.9.5, and Appendix C, Factory Setup). The High ICS Limit setting cannot be set to a higher Oxygen concentration than the Low ICS Limit setting.

4.3.1.6 Fault Code 6 – Unstable Calibration Sample

The Unstable Calibration Sample fault indicates that during the “relay on to start sample delay” (section 4.1.2.14.1, and Appendix C), plus the “calibration sample period” (section 4.1.2.14.2, and Appendix C), the analyzer detected a window of variation in the sensor output that exceeded the Standard Deviation Error Limit (section 4.1.2.14.5). Possible causes may be, pressure fluctuations from the sample exhaust (back-pressure), measured process not isolated from sensor during calibration, calibration gas not applied, incorrect calibration gas, “Relay on to Start Sample Delay” period not long enough.

4.3.1.7 Fault Code 7 – Sensor Calibration signal high

The Sensor Calibration Signal High fault indicates that during the Calibration Sample Period (section 4.1.2.14.2), the analyzer detected a variation in the sensor output higher than the Calibration Error Limit (section 4.1.2.14.4). Possible causes may be, pressure fluctuations from the sample exhaust (back-pressure), measured process not isolated from sensor during calibration, calibration gas not applied, incorrect calibration gas.

4.3.1.8 Fault Code 8– Sensor Calibration Signal Low

The Sensor Calibration Signal Low fault indicates that during the Calibration Sample Period (section 4.1.2.14.2), the analyzer detected a variation in the sensor output lower than the Calibration Error Limit (section 4.1.2.14.4). Possible causes may be, pressure fluctuations from the sample exhaust (back-pressure), measured process not isolated from sensor during calibration, calibration gas not applied, incorrect calibration gas, sensor nearing the end of its useful service period.

Helpful Hint: Fault Code 8 is an accurate measure for reliably determining that the Oxygen Sensor’s useful service period has expired if factory settings are retained (section 4.1.2.14.4).

4.3.1.9 Fault Code 9 – Sensor Analog-to-Digital Converter Time-Out

The Sensor Analog-to-Digital Converter Time-out fault indicates that the Model Mini-ICS analyzer has not received expected data signals from the Sensor Input Analog-to-Digital Converter. This condition is different from both a “Sensor Operating signal low” fault, and a “Sensor disconnected” fault; it indicates a possible failure in the analyzer Analog-to-Digital converter hardware.

4.3.1.10 Fault Code 10 – Sensor Operating Signal Low

The Sensor Operating Signal Low fault indicates that the Oxygen Sensor output has fallen below the “Low Sensor fault” setting (section 4.1.2.9.6 and Appendix C, Factory Setup). Possible causes may be, sensor damaged internally, sensor fouled, sampling lines or other Neutronics Inc. sampling components blocked (filters, heat-exchangers, scrubbers), measured process over-purged with inert gas.

Helpful Hint: The Low Sensor fault (section 4.1.2.9.6) setpoint is a system diagnostic to detect the possibility of premature sensor failure. It should be set at an Oxygen level that is known by the user never-to-be-reached in the measured process under normal circumstances.

4.3.1.11 Fault Code 11 – Calibration Period too Short

The Calibration Period Too Short fault indicates that the Model Mini-ICS analyzer has unexpectedly aborted the Calibration process, and has not received information to complete the routine. Please contact the Neutronics Inc. Service Department.

4.3.1.12 Fault Code 17 – Bad cell Calibration Coefficient

The Bad cell Calibration Coefficient indicates that during the calibration sample period (section 4.1.2.14.3), the analyzer cannot access all reference data necessary to perform the routine. The presence of this fault indicates corrupted non-volatile data. Please contact the Neutronics Inc. Service Department.

4.3.1.13 Fault Code 18 – Main-board EEPROM corrupted

The Constant Memory Error fault indicates that information in the Model Mini-ICS non-volatile operating system has been partially corrupted, and can be recovered. The Model Mini-ICS operating system storage area is double redundant. If one or two of the unit's system storage areas become corrupted, the non-corrupted area will be used to repair the corrupted area(s), and the unit will continue to operate normally. If the unit does not recover after re-starting (Appendix D, Hot Keys), please contact the Neutronics Inc. Service Department.

4.3.1.14 Fault Code 27 – Auto Calibration Mode active

The Auto Calibration Mode active fault indicates that the system is in a maintenance mode (Auto Calibration mode – Section 3.2.1), and is not monitoring the process.

4.3.1.15 Fault Code 28 – Calibration Mode active

The Calibration Mode active fault indicates that the system is in a maintenance mode (Calibration mode is *part of* the Auto Calibration mode – Section 3.2.1), and is not monitoring the process.

4.3.1.16 Fault Code 29 – Manual Relay Control active

The Manual Relay Control active fault indicates that the system is in a maintenance mode (Section 4.1.2.4 – Standard Level RS-232 Access; commands 1 through 5), and is not automatically controlling the process.

4.3.1.17 Fault Code 30 – User Setup Mode active

The User Setup Mode active fault indicates that the system is in a maintenance mode (Section 4.1.1 System Setup via Front-Panel Keypad, and 4.1.2 System Setup via Service Port). The 7-segment LED display will indicate "SU". During System Setup, the Model Mini-ICS continues to operate normally, updating its inputs, and controlling the process accordingly.

4.3.1.18 Fault Code 31 – Factory Setup Mode active

The Factory Setup Mode active fault indicates that the system is in a maintenance mode and is not monitoring, or controlling the process. The 7-segment LED display will indicate "FAC".

4.3.1.19 Fault Code 32 – Program Starting

The Program Starting fault indicates that the system is in a maintenance mode and is not monitoring, or controlling the process. The 7-segment LED display and Front-Panel LED indicators will cycle through the Lamp Test (section 2.2.1, and Appendix D.

5 CHAPTER 5 – APPENDICES

5.1 Appendix A – Spare Parts List

PART NUMBER	DESCRIPTION
C1-11-1220-03-0	Vac Fuses for Power Supply Board (for Vac units only). – 1A, 250Vac, Slo-Blo
8-01-1000-02-2	Oxygen Sensor Model GP: 0-25%
6-01-1001-91-0	Oxygen Sensor Model IT: 0-25%
C1-16-1000-01-1	Oxygen Sensor Model CAG-250N: 0-100%
5-06-4900-53-0	Operations Manual
C6-01-1000-02-0	Vac Power supply (for Vac units only)
6-01-1000-17-0	12/24 Vdc Power Supply (for Vdc units only)
C6-01-1000-13-0	Relay Board
C6-01-1000-12-0	Main CPU Board
C6-01-1000-11-0	Display Board
C1-08-0000-00-0	Front Panel
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
1-17-1052-00-0	Replacement terminal block – TB4

5.2 Appendix B - Specifications

MEASUREMENT:	0 – 1 / 0 – 10 / 0 – 25 / 0 – 50 % Oxygen – Fixed or Auto Range
DISPLAY:	**0.75" 7-segment LED digital display, 4 characters** Displays Oxygen from 0.0 to 50.0 Percent. Resolution: 0 – 9.9 %: X.X 0 – 50.0 %: XX.X **Color -Coded LED's for system status:** NORMAL: Green FAULT: Yellow LOW FLOW: Red O_2 ALARM: Red
SIGNAL INTERFACE:	Serial Service Port: RS-232 Analog Voltage Output: 0 – 1, 0 –5, 0 – 10V Analog Current Output: 0 – 20mA 4 – 20 mA Range ID Voltage: 0 – 1 % O_2: 5.63 V 0 – 10 % O_2: 6.25 V 0 – 25 % O_2: 6.88 V 0 – 50 % O_2: 7.50 V
RELAY OUTPUTS	O_2 Alarm: Field Adjustable Form C (DPDT) Voltage-free 5A@250Vac, 5A@30Vdc. Configurable to fail-safe/non-fail-safe and ascending/descending activation ICS: Field Adjustable Form C (DPDT) Voltage-free 5A@250Vac, 5A@30Vdc. Configurable to fail-safe/non-fail-safe and ascending/descending activation Calibration and Fault: Non-adjustable Form B (SPST) Voltage-free 5A@250Vac, 5A@30Vdc, non-Fail-Safe activation, non-configurable.
AVAILABLE SENSOR TYPES	Model GP Sensor Model CAG-250 Nylon Sensor Model IT Sensor
RESPONSE TIME	$T_{90} \leq 20$
ACCURACY	$\pm$ 2.0% FSD @ STP

OPERATING TEMPERATURE	31 - 104° F • 5° to 40° C
STORAGE TEMPERATURE	5 - 122° F • -15° to 50° C
HUMIDITY	0-95% non-condensing
WARM UP TIME	20 seconds to system stabilization
POWER	AC Unit: 90 – 264 VAC, 47 – 63 Hz, Single Phase, 2.5 Watts VDC Unit: 10 – 30VDC, 2.5 Watts
WARRANTY	**Analyzer:** 12 months from date of shipment **Sensor:** Model GP 6 months from date of shipment Model CAG-250 12 months from date of shipment Model IT 6 months from date of shipment
WEIGHT	Less than 2 Lbs
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

5.3 APPENDIX C – ANALYZER FACTORY CONFIGURATION SETTINGS

Supply Voltage

90 – 250 VAC, 50-60HZ	
12-36 VDC	

Sensor Type

GP Sensor (Part No: 8-01-1000-02-3)	
CAG-250 Nylon (Part No: C1-16-1000-01-1)	
IT (CR) Sensor (Part No: 6-01-1001-91-0)	

Safety Barrier Type

MTL (Passive)	
STAHL (Passive)	
PEPPERL & FUCHS (Active)	
None	

Alarm and Relay Setup Information

ICS And O_2 Alarm Relays Failsafe/Non-Failsafe:	FAIL-SAFE
O_2 Alarm Relay Ascending/Descending:	ASCENDING
O_2 Alarm Trigger Level (In %):	8%
High ICS (Start Inert) Level (In %):	7%
Low ICS (Stop Inert) Level (In %):	6%
Low Sensor Output Fault Level (In %):	1%

Inert on Fault Conditions Setup Information

Inert on Flow Fault Condition (Yes/No):	YES
Inert on Sensor Disconnect Fault Condition (Yes/No):	YES
Inert on Analog To Digital Converter Failure Fault Condition (Yes/No):	YES
Inert on Low Sensor Output Fault Condition (Yes/No):	YES

Analog Voltage Output Setting

0 – 1 Volts	X
0 – 5 Volts	
0 – 10 Volts	

Analog Current Output Setting

0 – 20 mA	
4 – 20 mA	X

Analog Output Range Setting

0 – 1 Percent Fixed	
0 – 10 Percent Fixed	
0 – 25 Percent Fixed	X
0 – 50 Percent Fixed	
Auto Ranging	

Rs-232 Baud Rate

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

Rs-232 Timed Output Format (Select One)

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

Rs-232 Delay Time Between Output

1-second	X

Auto Calibration Information

Delay Between Calibration Relay On To Start Of Calibration (Seconds):	30
Calibration Sample Period (Seconds):	30
Delay Between Calibration Relay Off To Run Mode (Seconds):	30

Front Panel Lockout Setup

Enable Master Lockout (Yes/No)	NO
Enable Gas Calibration Lockout (Yes/No)	NO
Enable O2 Alarm Adjust Lockout (Yes/No)	NO
Enable High Ics Adjust Lockout (Yes/No)	NO
Enable Low Ics Adjust Lockout (Yes/No)	NO
User Setup Password (0 – 9999) (Note: A Setting Of 0 Disables Password)	000

5.4 APPENDIX D – Front Panel Hot-Key Functions

For convenience in operating and troubleshooting, the Model Mini-ICS has four Front Panel Hot-Key Functions that can be performed quickly via the front panel without entering the normal Front Panel, or Service Port user menus.

To access the “Return to RUN mode”, press simultaneously and release the keys indicated in figure 14. To return to normal operation, press and release the same keys again.

To access the remaining available functions described in figure 14, press simultaneously and hold the 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.

KEYS PRESSED	DESCRIPTION OF FUNCTION
UP + DOWN	Return to “RUN” mode immediately (aborts any mode except Auto Calibration)
UP + DOWN	Run Lamp Test
DOWN + MODE	Show Sensor Voltage
UP + DOWN + MODE	Re-start Model Mini-ICS

Figure 14 – Hot Key functions

5.5 APPENDIX E – Warranty

Neutronics warrants to the original purchaser, that the Model Mini-ICS 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 Mini-ICS

The model Mini-ICS 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 Mini-ICS 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 Mini-ICS instrument.

5.6 APPENDIX F – Reference Drawings

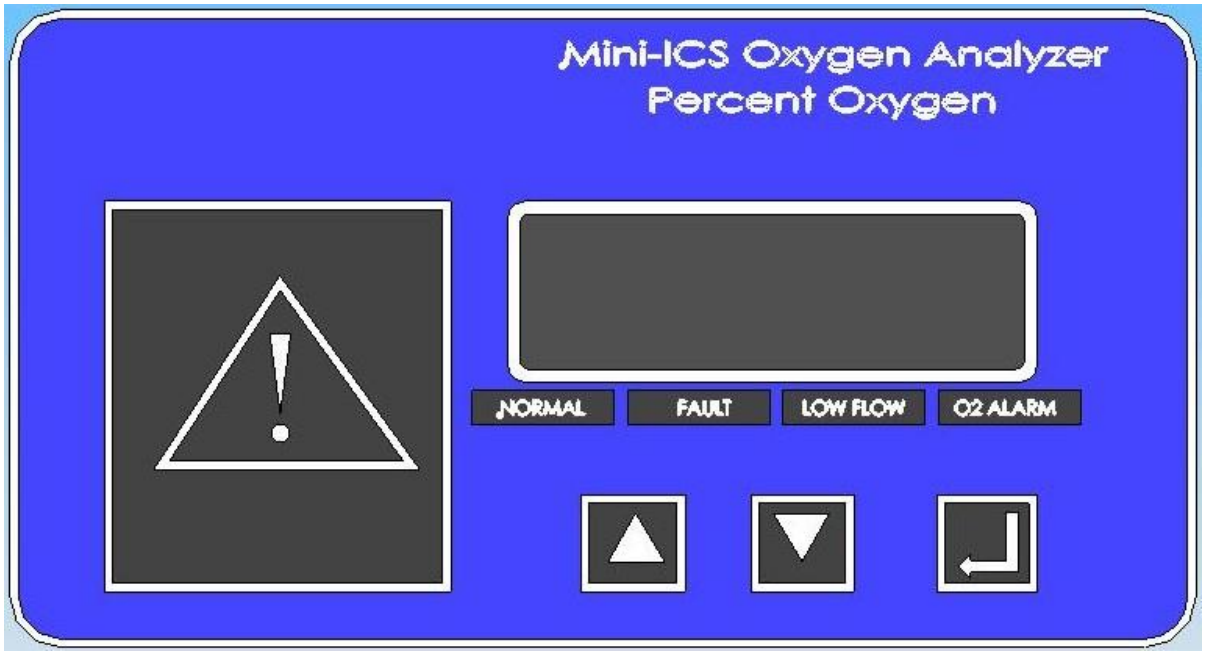
Refer to the attached drawings for supplemental equipment details and installation information.

5.7 APPENDIX G – Mounting Configurations

The enclosure requirement for the Model Mini-ICS will be determined by the area classification in which it will be installed. The enclosure type will also affect the user interface with the front panel. The following figures will depict how the interface changes with each enclosure type.

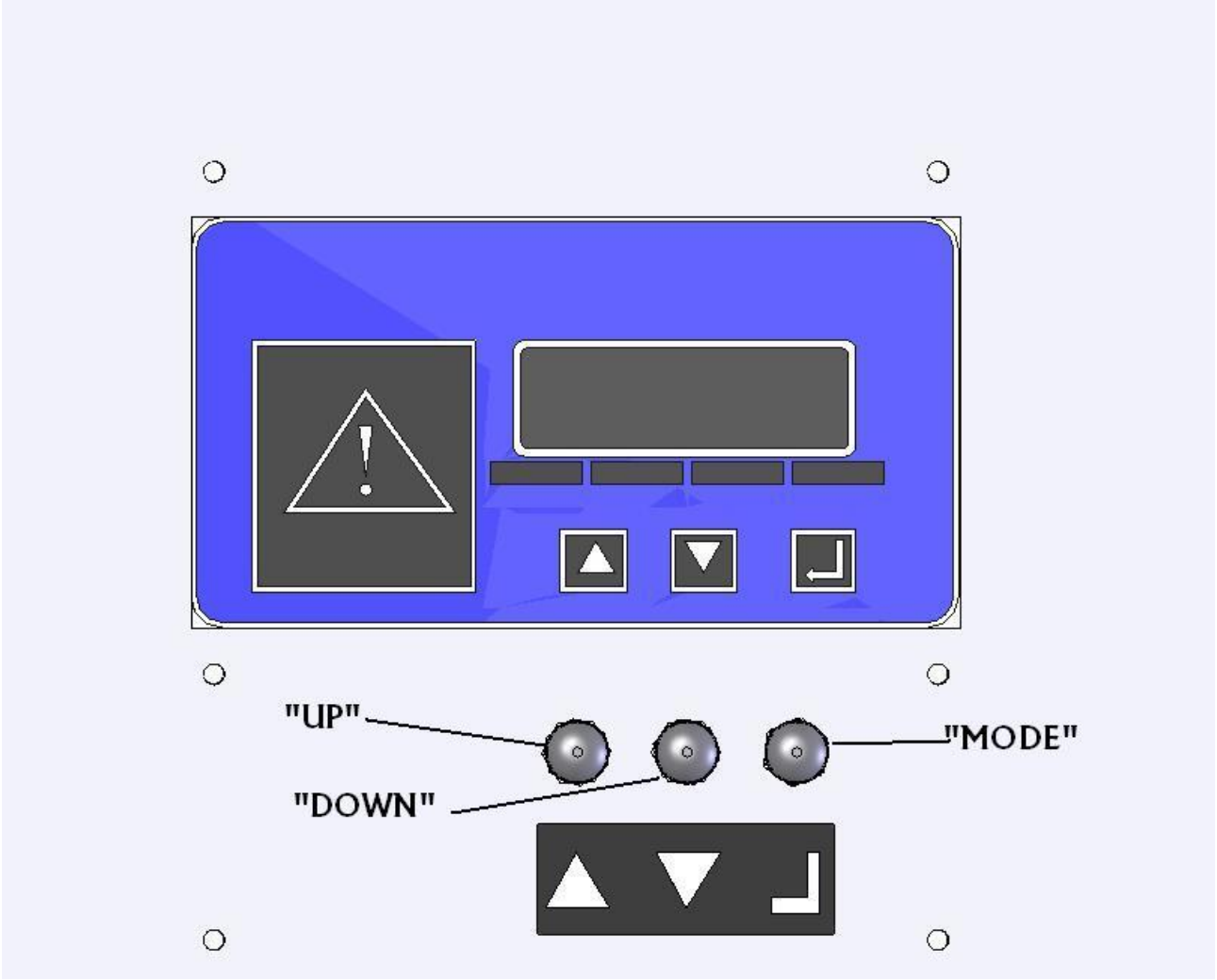
5.7.1 Wall Mount Enclosure

Users can access the front panel directly and use the interface as described in the manual.



5.7.2 Rack Mount Enclosure

Users will activate the three push buttons mounted on the enclosure door to interface with the module. Each button corresponds to one button on the front panel and is clearly labelled to indicate its function (“Up”, “Down”, or “Mode”) as shown below.



5.7.3 Explosion Proof Enclosure

Model Mini-ICS modules housed in explosion proof enclosures have only two switches to interface with the unit. The left side has a three-position spring return to center from left or right switch. Turning the switch counter clockwise (and releasing) corresponds to incremental up (“UP”), and turning it clockwise (and releasing) corresponds to incremental down (“DOWN”). The right side of the enclosure has a momentary push button, which corresponds to pressing the “MODE” button. The enclosure cover is removed for clarity purposes.