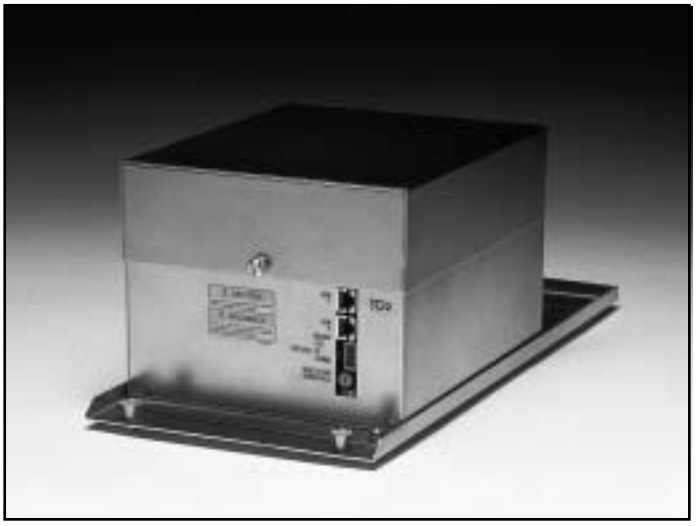
Instruction Manual
748374-F
March 2003

Model NGA2000 TO2

Trace Oxygen Analyzer



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ESSENTIAL INSTRUCTIONS
READ THIS PAGE BEFORE PROCEEDING!

Rosemount Analytical designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you **MUST properly install, use, and maintain them** to ensure they continue to operate within their normal specifications. The following instructions **MUST be adhered to** and integrated into your safety program when installing, using, and maintaining Rosemount Analytical products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- **Read all instructions** prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, **contact your Rosemount Analytical representative** for clarification.
- **Follow all warnings, cautions, and instructions** marked on and supplied with the product.
- **Inform and educate your personnel in the proper installation, operation, and maintenance of the product**.
- **Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes**. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, **use qualified personnel** to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Rosemount. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, **and VOID YOUR WARRANTY**. Look-alike substitutions may result in fire, electrical hazards, or improper operation.
- **Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury**.

The information contained in this document is subject to change without notice.

Emerson Process Management

Rosemount Analytical Inc.
Process Analytic Division
1201 N. Main St.
Orrville, OH 44667-0901
T (330) 682-9010
F (330) 684-4434
e-mail: gas.csc@EmersonProcess.com

http://www.processanalytic.com

EMERSON.
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PREFACE

INTENDED USE STATEMENT

The purpose of this manual is to provide information concerning the components, functions, installation and maintenance of the Model NGA2000 TO2 and the System Accessories of the NGA2000 System.

Some sections may describe equipment not used in your configuration. The user should become thoroughly familiar with the operation of this module before operating it. Read this instruction manual completely.

DEFINITIONS

The following definitions apply to DANGERS, WARNINGS, CAUTIONS and NOTES found throughout this publication.

DANGER

Highlights the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored.

WARNING

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in injury, death, or long-term health hazards of personnel.

CAUTION

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in damage to or destruction of equipment, or loss of effectiveness.

NOTE

Highlights an essential operating procedure, condition or statement.

SAFETY SUMMARY

If this equipment is used in a manner not specified in these instructions, protective systems may be impaired.

AUTHORIZED PERSONNEL

To avoid explosion, loss of life, personal injury and damage to this equipment and on-site property, all personnel authorized to install, operate and service the this equipment should be thoroughly familiar with and strictly follow the instructions in this manual. SAVE THESE INSTRUCTIONS.

WARNING

PARTS INTEGRITY

Tampering with or unauthorized substitution of components may adversely affect safety of this product. Use only factory-approved components for repair.

WARNING

PRESSURIZED GAS

This module requires periodic use of pressurized gas. See General Precautions For Handling And Storing High Pressure Gas Cylinders on page P-4.

WARNING

CAUSTIC LIQUID

Electrolyte is a caustic solution. Review the Material Safety Data Sheet in the rear of this manual.

WARNING

POSSIBLE EXPLOSION HAZARD

This equipment is not designed and should not be used in the analysis of flammable samples. Use of this equipment in this way could result in explosion and death.

NOTICE

Software compatibility is necessary for all NGA2000 components in your system to work together. The version of your Platform's software must be equal to or greater that the version of any other module(s) for successful compatibility. If it is not, contact Rosemount Analytical at 800-441-7245 to order software upgrade kit PN 657150 for the Platform.

You can locate the version of each NGA2000 component as follows:

Platform Controller Board
Turn power ON. The display will show "Control Module V2. ...". This is the software version.

Analyzer Module
Located on the right side of the Analyzer Module case.

I/O Module
Located on the backplane connector of the module. If no label is present, the module is Version 2.0.

GENERAL PRECAUTIONS FOR HANDLING AND STORING HIGH PRESSURE GAS CYLINDERS

Edited from selected paragraphs of the Compressed Gas Association's "Handbook of Compressed Gases" published in 1981

Compressed Gas Association
1235 Jefferson Davis Highway
Arlington, Virginia 22202

1. Never drop cylinders or permit them to strike each other violently.

2. Cylinders may be stored in the open, but in such cases, should be protected against extremes of weather and, to prevent rusting, from the dampness of the ground. Cylinders should be stored in the shade when located in areas where extreme temperatures are prevalent.

3. The valve protection cap should be left on each cylinder until it has been secured against a wall or bench, or placed in a cylinder stand, and is ready to be used.

4. Avoid dragging, rolling, or sliding cylinders, even for a short distance; they should be moved by using a suitable hand-truck.

5. Never tamper with safety devices in valves or cylinders.

6. Do not store full and empty cylinders together. Serious suckback can occur when an empty cylinder is attached to a pressurized system.

7. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). A flame should never be permitted to come in contact with any part of a compressed gas cylinder.

8. Do not place cylinders where they may become part of an electric circuit. When electric arc welding, precautions must be taken to prevent striking an arc against the cylinder.

DOCUMENTATION

The following NGA2000 Trace Oxygen Analyzer Module instruction materials are available. Contact Customer Service Center (page 6-1).

748374 Instruction Manual (this document)

COMPLIANCES

This product may carry approvals from several certifying agencies for use in non-hazardous, indoor locations. If so, the product will carry approval insignia on the product name-rating plate.

NRTL/C

Rosemount Analytical Inc. has satisfied all obligations from the European Legislation to harmonize the product requirements in Europe.

CE

These products comply with the standard level of NAMUR EMC. Recommendation (May 1993).

NAMUR

This product satisfies all obligations of all relevant standards of the EMC framework in Australia and New Zealand.

N96

GLOSSARY OF TERMS

Analyzer Module
The module that contains all sensor/detector components for development of a Primary Variable signal; includes all signal conditioning and temperature control circuitry.

Backplane
The interconnect circuit board which the Controller Board, Power Supply, Analyzer Module power and network cables, I/O Modules and Expansion Modules plug into.

Control Module
The Operator Interface plus the Controller Board.

Controller Board
The computer board that serves as the Network Manager and operates the Display and Keypad.

Distribution Assembly
The Backplane and the card cages that hold I/O and Expansion Modules.

Expansion Module
A circuit board that plugs into the Backplane from the front of the Platform and performs special features not related to I/O functions.

I/O Module
A circuit board that plugs into the Backplane from the rear of the Platform. Has a connector terminal for communication with external data acquisition devices and provides an input/output function.

Operator Interface
The Display and Keyboard.

Platform
Any workable collection of the following: Controller Board, Power Supply, Distribution Assembly, Enclosure and Operator Interface.

Power Supply
Any of a variety of components that provides conditioned power to other NGA2000 components, from the Power Supply Board that plugs into the front of the Backplane in a stand-alone instrument to several larger ones that can power larger collections of modules and components.

Primary Variable
The measured species concentration value from an Analyzer Module.

Secondary Variable
Data placed on the network by a module regarding current status, e.g., sample flow, source voltage and other diagnostic information.

System
Any collection of Analyzer Module(s), Platform (s), I/O Module(s) and Expansion Module(s)

SECTION 1
DESCRIPTION AND SPECIFICATIONS

1-1 OVERVIEW

This manual describes the Trace Oxygen (TO2) Analyzer Module of Rosemount Analytical's NGA2000 Series of gas analysis components.

The TO2 Analyzer Module is designed to continuously determine the concentration of trace oxygen in a flowing gaseous mixture. The concentration is expressed in parts-per-million.

The TO2 Analyzer Module is configured as a shelf-mount module, designed to be installed external from the platform on an associated shelf capable of holding two modules side-by-side, with gas connections made from the rear. All electronics relative to sample detection and conditioning are included in this module.

1-2 TYPICAL APPLICATIONS

The TO2 Analyzer Module has specific applications in the following areas:

- Trace oxygen in product nitrogen and argon streams from air separation plants
- Trace oxygen in inerting atmospheres for heat treat furnaces
- Trace oxygen in glove-box applications

1-3 THEORY OF TECHNOLOGY

The TO2 Analyzer Module uses the coulometric principle of oxygen detection. This technology is based on the fact that oxygen in the sample is reduced by an electrochemical reaction. This reduction occurs at the cathode and results in the generation of hydroxyl ions. These hydroxyl ions migrate to the anode where they are oxidized to reform oxygen. The oxidation reaction generates four electrons which in turn migrate to the anode to participate in the reduction reaction:

(Cathode Reaction)

$O_2 + 2\ H_2O + 4\ e^- \rightarrow\ 4\ OH^-$

(Anode Reaction)

$4\ OH^- \rightarrow O2 + 2\ H_2O + 4\ e^-$

A polarizing voltage of approximately 1.3 VDC is applied between the anode and cathode to drive the oxidation and reduction reactions. The resulting current flow produced by the flow of electrons is directly proportional to the oxygen content in the sample gas.

1-4 FEATURES

Among the features included in the TO2 Analyzer Module are:

- Quick start feature
- Electrolyte level alarm
- High oxygen protection circuit with alarm
- Sample flow indication.

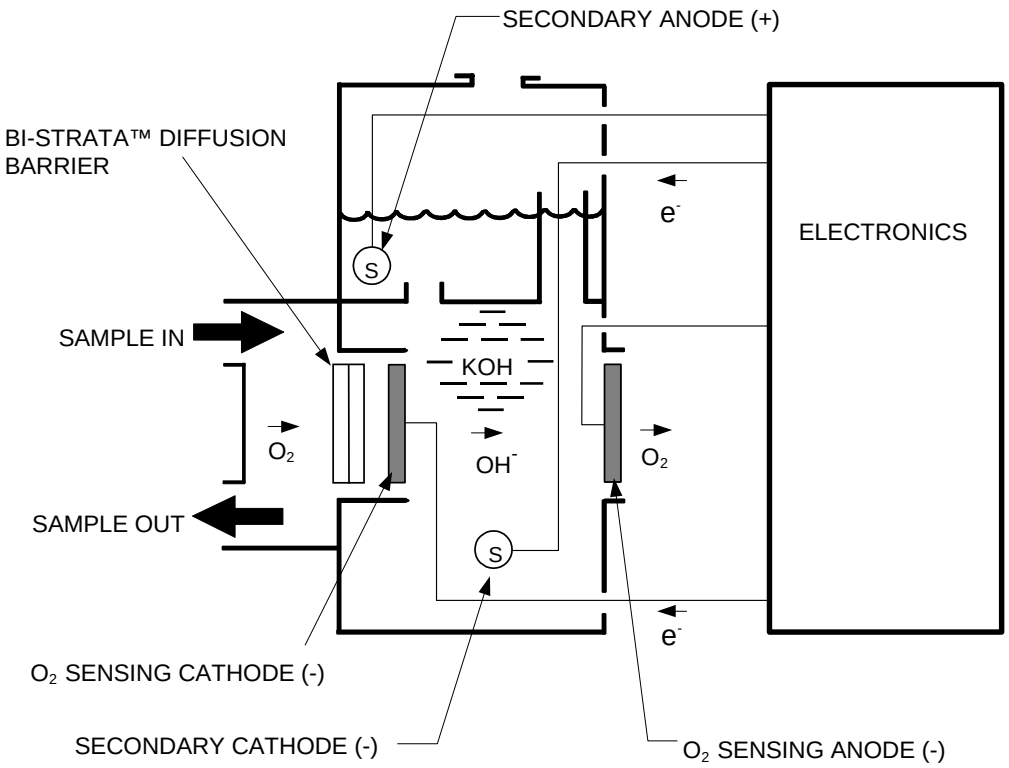


Figure 1-1. Trace Oxygen Detector Technology

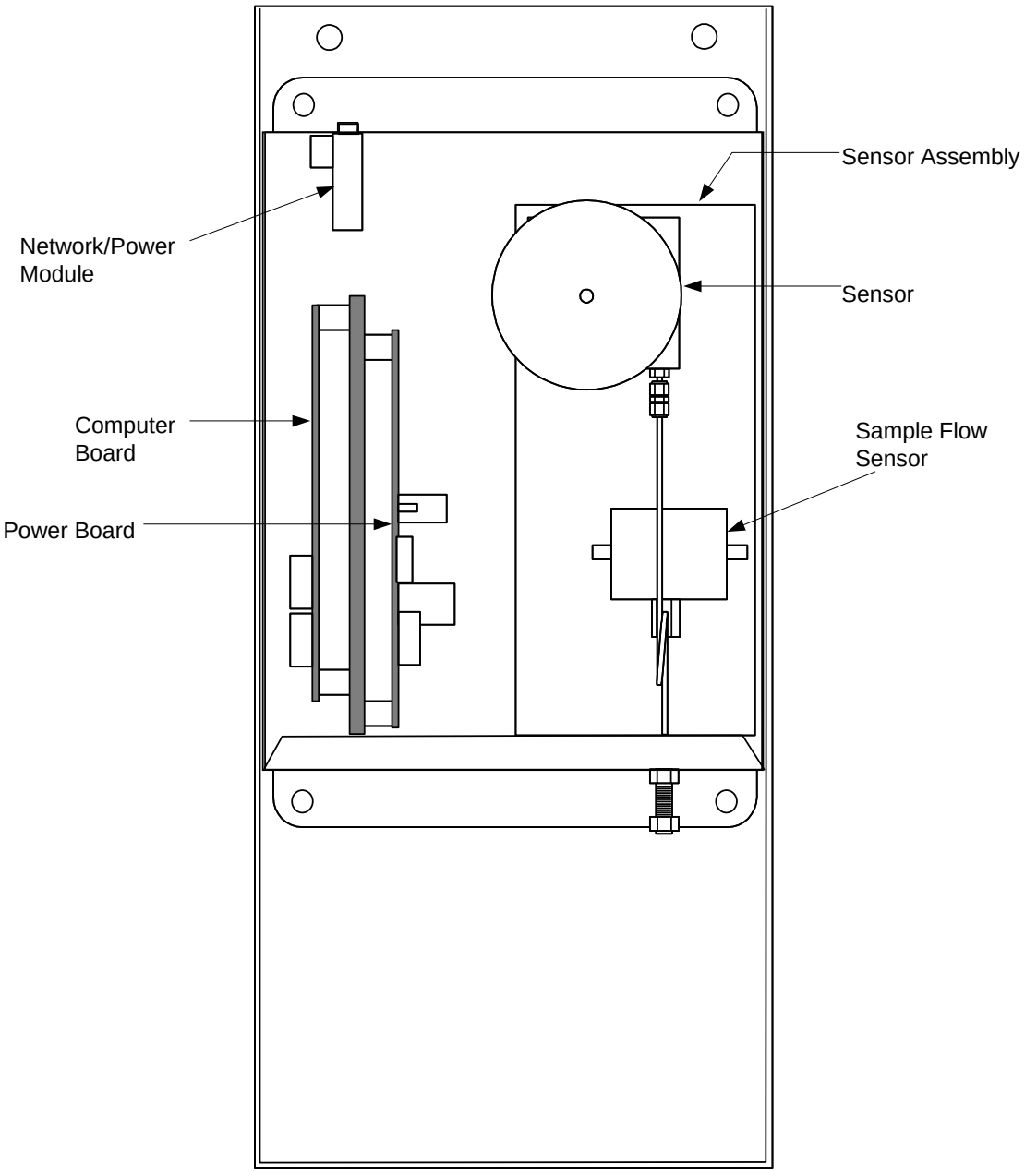


Figure 1-2. Trace Oxygen Analyzer Module – Top View

1-5 SPECIFICATIONS

a. General

Measurement Species	Trace Oxygen
Ranges	0 to 100 ppm (output scalable down to 0-2 ppm fullscale)
Accuracy	±3% of reading or ±0.02% of range (except for ranges ≤ 100 ppm: ±3% of reading or ±0.05% of range)
Sensitivity	<10 ppb Oxygen
Noise	1% of fullscale, peak to peak
Linearity	±1% of fullscale
Response Time	Typically 90% in less than 20 seconds
Zero Drift	≤±1% of fullscale/24 hours at constant temperature
Span Drift	≤±1% of fullscale/24 hours at constant temperature
Effect of Temperature	0.32% of reading per °F from 70°F (0.58% of reading per °C from 21°C)
Effect of Flow	≤2% of reading for a flow change of ±250 cc/min (0.5 SCFH)
Operating Temperature	32°F to 113°F (0°C to 45°C)
Power Requirements	+24 VDC ±5%, 10 W max. Ripple and Noise: <100 mV peak to peak Line and Load Regulations: <±1%

b. Sample

Sample	Non-flammable (below 100% of the LEL)
Flow Rate	0.5 to 1.5 L/min.
Supply Pressure	1027 to 1082 hPa - absolute (0.2 to 1.0 psig)
Temperature	32°F to 113°F (0°C to 45°C)
Particulates	filtered to <0.1 mg/L; non-condensing at ambient temperature
Sample Humidity	non-condensing at ambient temperatures

c. Physical

Materials in contact with sample	Stainless steel, Teflon, Delrin, neoprene
Dimensions	See Figure 2-2.Trace Oxygen Analyzer Outline and Mounting Dimensions on page 2-3
Weight	6.8 kg (15 lbs.)
Mounting	Horizontal, external to Platform or custom installed in a panel
Case Classification	General Purpose for installation in weather protected area
Max. Separation from Platform	1600 m (1 mile)

d. Gas Connections

Sample In	1/4 inch O.D. tube fitting
Sample Out	1/4 inch O.D. tube fitting

See the Preface Section of the Platform manual for specifications regarding Platform related components.

SECTION 2
INSTALLATION

2-1 UNPACKING

If the Trace Oxygen (TO2) Analyzer Module is received as a separate unit, carefully examine the shipping carton and contents for signs of damage. Immediately notify the shipping carrier if the carton or contents is damaged. Retain the carton and packing material until all components associated with the TO2 Analyzer Module are operational.

2-2 ASSEMBLY

Before installation of the TO2 Analyzer Module, electrolyte must be added to the Sensor. Follow the procedure described below under Section 2-2a below.

After addition of electrolyte, locate the analyzer module on an appropriate mounting surface and connect the network cable to either the NETWORK 1 or NETWORK 2 connection on the Analyzer Module, and the NETWORK connection on the Platform network I/O port. (See Figure 2-1 on page 2-2 and Figure 2-4 on page 2-5.)

a. Electrolyte Addition

Before adding electrolyte to the Sensor, it is recommended to check the Sensor for possible leakage caused by damage in shipment. To check the Sensor for leakage, remove the top cover of the Analyzer Module and locate and remove the 5 mounting screws which hold the Sensor Assembly (Sensor, flow meter, plumbing, inlet/outlet fittings) to the module (see Figure 4-1 on page 4-1). Be careful not to lose these screws as they have metric threads. Carefully lift out the Sensor assembly and remove from the analyzer module. Place on a flat surface and remove the black Sensor cover by unscrewing counterclockwise.

Add distilled or deionized water to the Sensor to the maximum level indication on the Sensor reservoir. Let Sensor stand for approximately 15 minutes and check for leaks around the base of the reservoir, and at the seams and corners. If a leak is found, contact the factory before proceeding. Drain the Sensor.

Fill the Sensor with one bottle of electrolyte supplied with the analyzer module. Use the entire contents of the bottle.

NOTE:

Do not add water. The volume and concentration of the bottled electrolyte is pre-measured.

Reinstall the black Sensor cover and carefully reinstall the Sensor Assembly inside the Analyzer Module. Do not the tilt the Sensor Assembly excessively as electrolyte may leak out.

2-3 LOCATION

(See Figure 2-2 on page 2-3) The TO2 Analyzer Module comes standard with mounting ears for easy installation on flat, horizontal surfaces. , Install the TO2 Analyzer Module in a clean, weather-proofed, vibration-free location free from extreme temperature variations and moisture. For best results, install the instrument near the sample stream to minimize sample transport time.

, Operating ambient temperature is 0 °C to 45 °C (32 °F to 81 °F). Temperature change should not exceed 10 °C (18 °F) per hour. The same temperature restrictions apply to the location of the zero and span gas cylinders.

2-4 GASES

a. Requirements

The TO2 Analyzer Module requires only a standard of accurately known composition for use as a span gas. The span gas should be supplied from a cylinder equipped

with a clean, metallic diaphragm, two-stage regulator. A shutoff valve is recommended.

Calibration Gases

The TO2 module does not require routine zero calibration. The zero is factory set and does not experience routine drift. Over long periods of time, the zero may experience minor drift. For low ppm range analyzers, you may wish to check the zero at one year intervals. Oxygen-free nitrogen is recommended for use as zero gas. This gas is certified to <0.5 ppm oxygen and can be improved by passing the zero gas through an oxygen scrubber such as Millipore™ Waferpure or Semigas Nanochem® resin purifiers. A mixture of trace oxygen in a background of nitrogen is recommended as span gas. For maximum accuracy, the concentration of trace oxygen in the span gas should be as high as possible for the range of measurement.

Sample

The sample must be clean and dry before entering the Analyzer Module. Sample should be filtered for particulates down to two microns, and should have a dewpoint at least 5 °C (13 °F) below the coldest expected ambient temperature.

Pressure

Constant between 13.8 and 69 hPa - gauge (0.2 and 1.0 psig) sample inlet pressure is recommended. If a needle valve is used upstream of the Analyzer Module to control flow, the inlet pressure to the needle valve should not exceed 345 hPa (5 psig). A constant sample flow rate between 1.0 to 3.0 SCFH (0.5 to 1.5 l/min) is recommended for best results. The Analyzer Module must vent to atmosphere to avoid back pressure influences on the oxygen reading.

b. Connections

(See Figure 2-3 on page 2-4) Connect inlet and outlet lines for sample to appropriately labeled fittings on the rear panel. SAMPLE IN and SAMPLE OUT are 1/4-inch ferrule-type compression fittings. Zero and span gases should be introduced at the SAMPLE IN fitting at normal sample inlet flow rate.

Metallic tubing is recommended for the sample line. The use of plastic, Teflon, or other non-metallic tubing can result in ambient oxygen permeation through the tubing causing higher than expected reading. Exhaust tubing should be 1/4 inch (6.3 mm) or larger, and can be metallic or non-metallic.

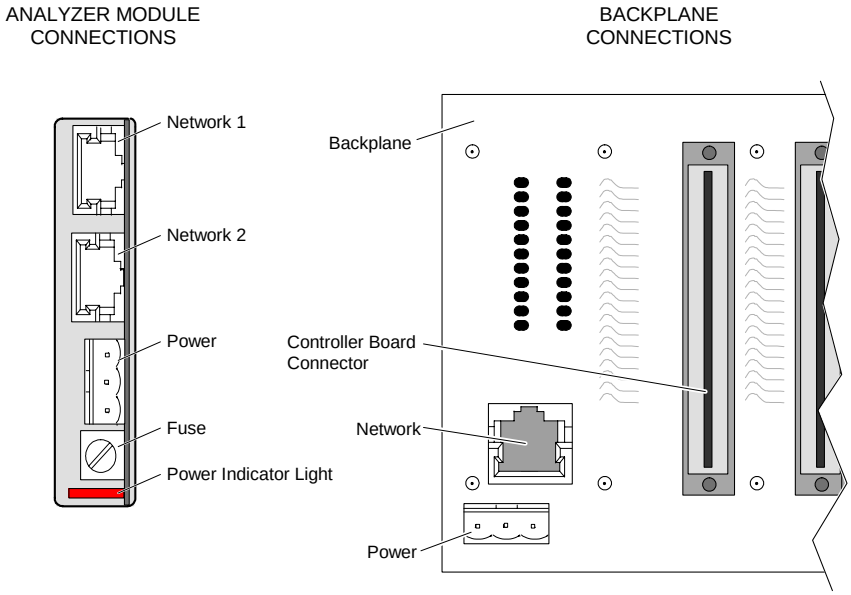


Figure 2-1. Analyzer Module Interconnection with Instrument Platform

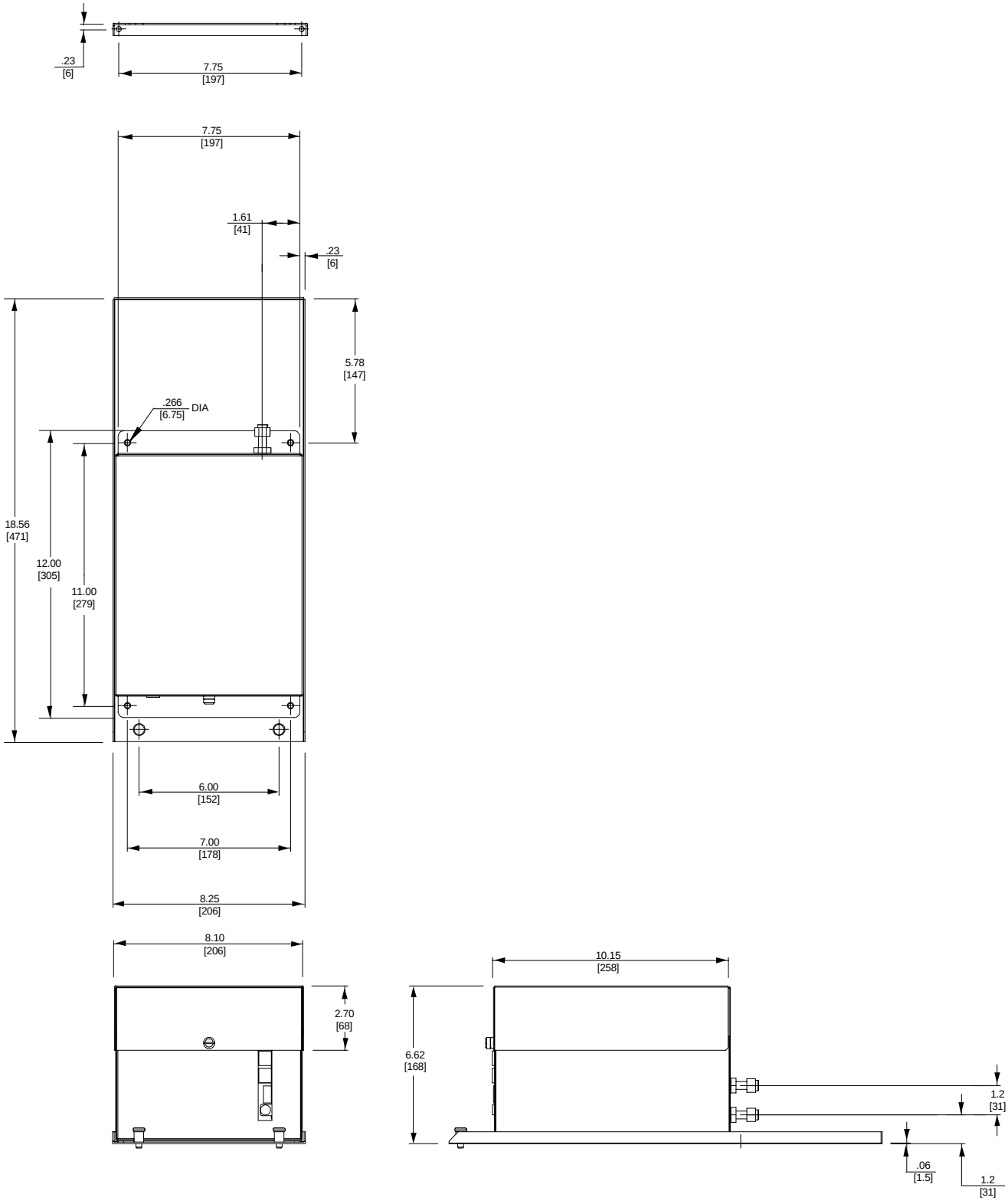


Figure 2-2. Trace Oxygen Analyzer Outline and Mounting Dimensions

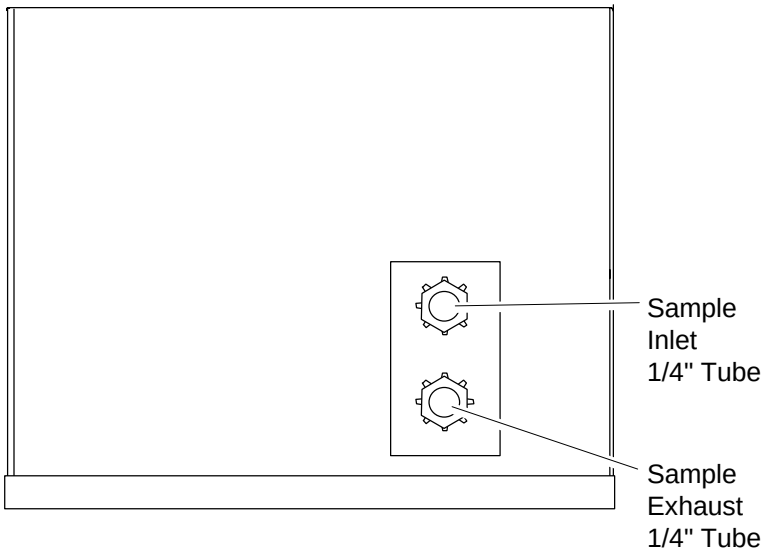


Figure 2-3. Trace Oxygen Analyzer Back Panel Connections

CAUTION

GAS OVERPRESSURE

At no time should sample, zero or span gas inlet pressure exceed 69 hPa - gauge (1.0 psig). Damage to the Sensor may occur if this pressure level is exceeded.

CAUTION

SAMPLE FLOW

Do not test the sample pressure by blocking the exhaust. When the pressure is released the sudden surge of flow will spin the internal flowmeter off its bearings and destroy it.

c. LEAK TEST

The TO2 Analyzer Module is completely tested at the factory for gas leakage. The user is responsible for testing for leakage only at the inlet and outlet fittings on the rear panel. **Caution: Do not expose the Sensor to pressure in excess of 1.0 psig as this may cause damage.**

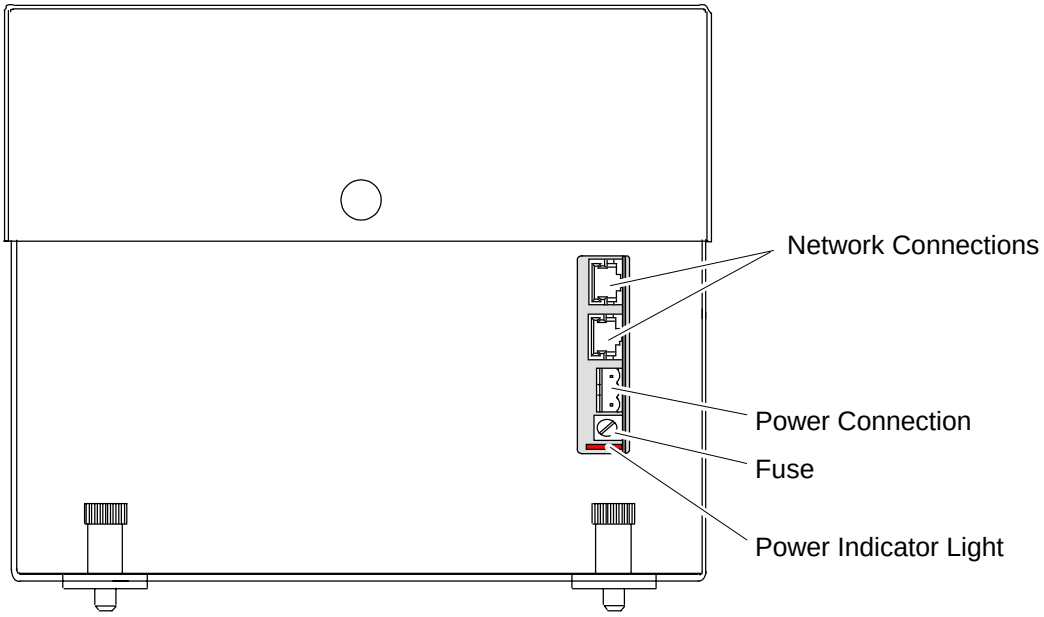


Figure 2-4. Trace Oxygen Analyzer Front Panel

2-5 ELECTRICAL CONNECTIONS

NOTE

Electrical connnections must be made in compliance with National Electrical Code (ANSI/NFPA 70) and/or any applicable national or electical codes.

Two electrical connections are required on the Analyzer Module: POWER and NETWORK (See Figure 2-4 above). On the Analyzer Module, two NETWORK connectors are available, either of which is appropriate for: 1) interconnection with the Backplane of the Platform or 2) "daisy-chaining" with other NGA2000 components (A star connection is acceptable for LON lengths under about 10 meters.)

Connect a source of 24 V 5A DC power to the power inlet. Make sure that the ground connection is made, and that this is separate from the power return lead. Failure to ensure a good ground may result in random noise and disturbance in the analyzer readings.

SECTION 3
STARTUP AND OPERATION

3-1 OVERVIEW

Prior to initial startup, the user should perform the leak test procedure outlined in Section 2.

For the remainder of this section, Analyzer Module interconnection with a Platform or some interfacing component will be assumed. Display and Keypad information refers to that which the user can expect to see and do with regard to the Front Panel of the Platform.

(For a complete description of Platform Front Panel controls and indicators, see the Platform instruction manual.

3-2 DISPLAYS

Three kinds of Display screens are available to the user:

- Run Mode
- Menu
- Help

a. Run Mode Display

The Run Mode is the normal mode of operation. In this mode, the Display will show the current gas measurement, the component of interest, the current operations of the softkeys, and several graphics: a bar representing the displayed concentration as a percent of fullscale and up to four lines showing user selectable secondary parameters from either the Analyzer Module or any IO module bound to it. See the Platform manual for information as to how to select these.

If more than one Analyzer Module is connected to the system, an additional Run Mode display will show as many as four (five for version 2.3 and later) gas measurements on screen.

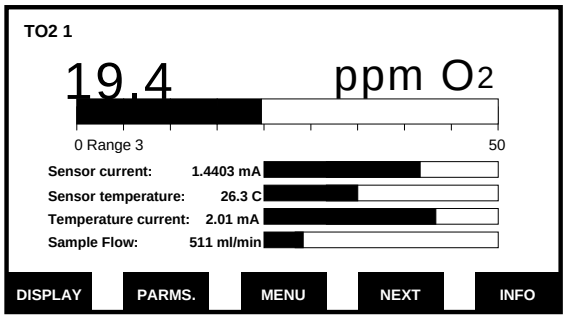


Figure 3-1. Run Mode Display

b. Menu Displays

The Menu structure enables the user to access data and functions, and put information onto the network. From the Run Mode display, press the MENUS softkey to gain access to the Main Menu.

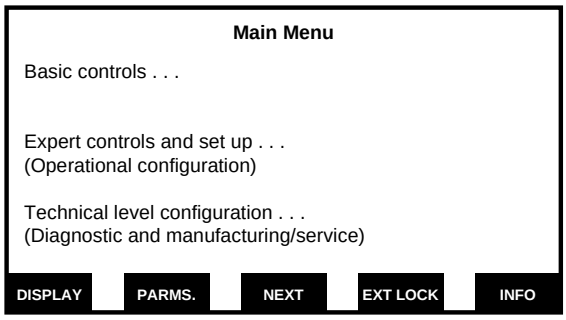


Figure 3-2. Main Menu

The Main Menu is subdivided into three levels of control based generally on which personnel is likely to use it: *Basic Controls* - Operators, *Expert Controls and set up* - System Engineers, and *Technical level configuration* - Analyzer technicians. Many layers of the menu structure are described at appropriate places throughout this manual.

From the Run Mode display, press the MENUS softkey to gain access to the Main Menu.

The Basic controls menu is as follows:

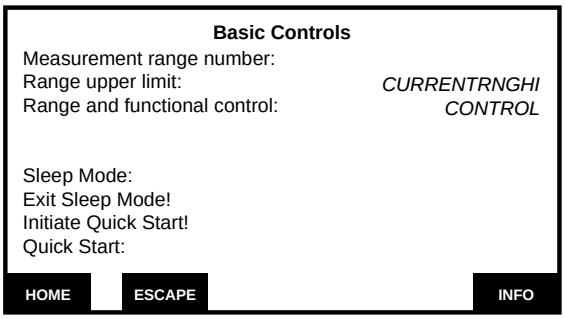


Figure 3-3. Basic Controls Menu

This menu allows the user to view the current range's upper limit, Sleep mode, and quick start status. It also allows quick start initiation or exit from sleep mode.

In the figure above, the words in *italics* are the names of the network variables whose values are in fact shown on the screen.

The Expert controls menu is as follows:

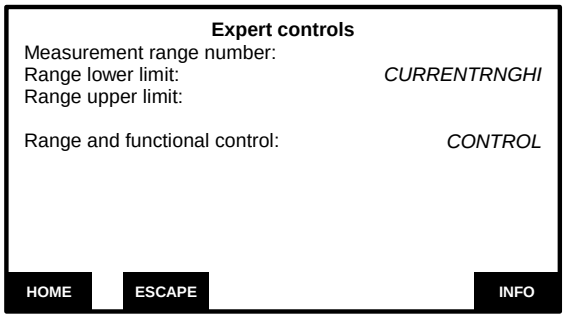


Figure 3-4. Expert Controls Menu

This menu shows the current range number and range limits.

The analyzer range settings may be configured through the *Analyzer Module set up* menu, under *Expert controls and set up*.

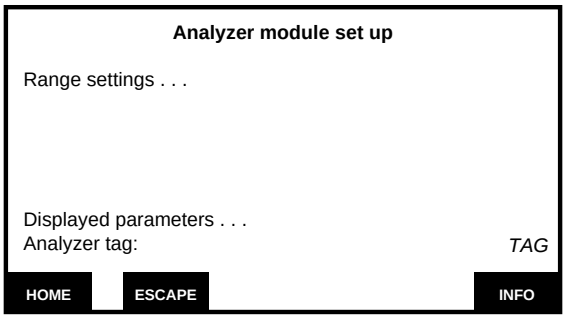


Figure 3-5. Analyzer Module Set-up Menu

c. Help Displays

The Help structure is intended to be an online "tutorial," context-sensitive and topic-interconnected, so that the user can practically operate NGA2000 without the need of an instruction manual.

A typical help menu:

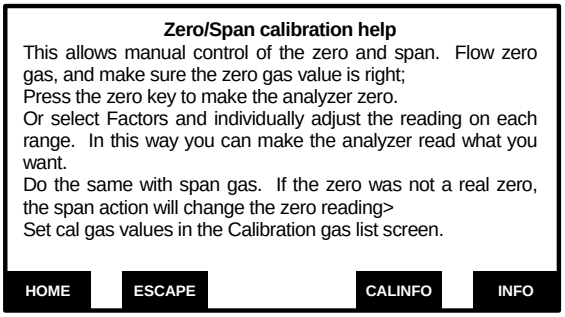


Figure 3-6. Typical Help Menu (shown is Zero/Span Calibration Help)

This is the help screen for the calibration menus.

3-3 STARTUP PROCEDURE

Establish sample or zero gas flow through the analyzer module at a nominal flow rate of 2 SCFH (1 l/min). Allow gas to flow for 15 to 30 seconds before applying power. Apply power to the TO2 Analyzer Module.

Upon initial startup, the separate modules, Controller Board and network "self-install." The display shows the progress of the automatic installation routine, together with a button marked RE_INIT. If the initialization hangs up, pressing the RE_INIT button will restart it, but will cause all the binding information to be erased. The Display will then appear as above. For details on binding, please consult the Platform instruction manual.

Establish that sample flow rate is within specifications (see Section 1-5 SPECIFICATIONS on page 1-4). Input security codes (see NGA Reference manual), calibrate, and begin routine operation as following subsections indicate.

3-4 QUICK START FEATURE

This analyzer module is equipped with a quick start feature which allows the sensor to begin measuring low ppm oxygen faster. This feature can be used when the analyzer is first turned on to decrease the time required for the sensor to reach equilibrium. This function is most effective for gas sample measurements below 100 ppm. To maintain sensor life, it is recommended that this feature be used no more than two times in any 24 hour period.

Under the Basic Controls sub-menu, move the cursor to *Initiate quick start!* and press the ↵ key. The unit will begin the quick start function immediately. This procedure will last for approximately 45 seconds. The last measured value is held for the duration of the procedure to prevent false reading fluctuations.

3-5 GAS SCALE FACTOR (GSF)

The Gas Scale Factor is used to correct for background gases other than nitrogen. When the background of the sample is other than nitrogen, the diffusion rate of oxygen into the sensor changes. By correcting for the background difference, the diffusion change can be compensated in software. The GSF can be entered manually or calculated automatically. Calculation of the GSF requires the user to enter the sample gas composition. In most applications, the GSF is not required. However, some backgrounds exhibit significantly different diffusion characteristics versus nitrogen (such as helium or hydrogen) and the GSF may improve performance.

Under the Technical Level Configuration sub-menu, select *Diagnostic menus...* and then select *Analyzer Module Diagnostics…*. In the Analyzer Module Diagnostics sub-menu select *Calibration Parameters...*. In the Advanced/Expert Calibration sub-menu select *Gas Scale Factor...*. To use the GSF, enter the volumetric percentages of each component present in the sample gas. To view more background components, press the MORE softkey. The total must add up to 100 or a new factor will not be computed. If you have a background component which is not shown in this menu, please consult the factory for assistance.

Once you have entered all the background composition information, move the cursor to *Compute new adjusted gas scale factor!* and press the ↵ key and the analyzer module will automatically calculate the new gas scale factor.

3-6 CALIBRATION

The TO2 analyzer module is fully factory calibrated using certified gas standards prior to shipment. If the analyzer is operated within its specified operating conditions, no calibration is required. The zero calibration is very stable and does not require checking more than once a year. Depending upon the nature of your application, it may be beneficial to verify the span calibration of the analyzer module every 3-4 months. The following procedure illustrates how to initiate a zero/span calibration.

Under the Expert Controls sub-menu select *Expert Analyzer Controls and Measurement…*, set the Range Number to the range that will be used during sample analysis. Return to the Main Menu by pressing the HOME softkey.

Introduce zero gas into the SAMPLE INLET, and, after a stable reading is reached, do the following:

1. Move the cursor to Technical Level Configuration... and enter. Select Diagnostic Menus…, then Analyzer Module Diagnostics…, and then Calibration parameters... and enter.

2. Select the User zero calibration... to enter the User zero calibration menu.

NOTE:

Before proceeding any further, be sure that the zero value is stable and valid. The zero may take 24 hours or longer to achieve stable zero for the low ranges.

3. Move the cursor to the Press the select key for user zero calibration now!

4. Press the ↵ key. The new zero calibration will now be entered.

5. Press the ← key to return to the previous menu.

6. Introduce a suitable span gas into the SAMPLE INLET and allow reading to stabilize. Move the cursor to the User span calibration... line and press the ↵ key.

7. Move the cursor to the Span gas concentration: line and press the ↵ key. Enter the correct span gas value by using the ↑↓ keys to change value and the ←→ keys to select position. Press the ↵ key to enter the new span gas value.

8. Move the cursor to the Press the select key for user span calibration now! and press the ↵ key. The new span calibration will now be entered.

9. Press the ← arrow key to return to the previous menu.

10. You can view the new calibration data in the Calibration data display screen. To access this screen go to the Expert controls and set up sub-menu and select Analyzer module set up... From the Analyzer module set up sub-menu select Calibration... and from the Advanced/Expert calibration sub-menu select Calibration data display... This screen is a view only display and data cannot be edited from this screen.

11. If for any reason you want to restore the original factory calibration data, you can do so from the Advanced/Expert calibration sub-menu (see step 9 above for directions to this sub-menu). Select Restore factory calibration! and the original values will be restored.

NOTE:

Do not alter data in the Load factory calibration data... sub-menu except when replacing sensors. Any changes made to this sub-menu will become the new default restore factory calibration! values.

12. Press the HOME softkey to re-enter the Main Menu.

13. Press DISPLAY softkey for the Run Mode display.

If you are unable to calibrate the module for some reason, see the NGA Reference manual for a list of possible causes and solutions. The most likely cause is the use of incorrect span gases.

3-7 ROUTINE OPERATION

The TO2 Analyzer Module is designed to analyze the sample stream continuously. Normally, it is never powered off except for servicing or for a prolonged shutdown.

Maximum permissible interval between calibration checks depends on the analytical accuracy required, and therefore cannot be specified. Initially, the instrument should be checked at least once every 3-4 months. This practice should continue until experience indicates that some other interval is more appropriate.

For details as to the general operation of the NGA analyzer module software, and the use of IO modules with the TO2 module, see the Platform Components manual.

3-8 ALARM INDICATION

NGA analyzer modules continuously monitor a number of internal parameters. It is possible to make the analyzer generate certain kinds of alarm indications if these parameters' values exceed or reduce below specified levels. The general alarm variable will have its value changed if an alarm occurs. See the NGA Reference manual for further details.

DESCRIPTION	TYPE
Low Electrolyte	WARNING
Low Sample Flow	WARNING
Sleep Mode	WARNING
Low Sensor Temperature	WARNING
High Sensor Temperature	WARNING
Software Error	FAILURE

Table 3-1. Trace Oxygen Analyzer Module Alarms

SECTION 4
MAINTENANCE AND TROUBLESHOOTING

4-1 OVERVIEW

CAUTION

QUALIFIED PERSONNEL

This equipment should not be adjusted or repaired by anyone except properly qualified service personnel.

WARNING

PARTS INTEGRITY

Tampering with or unauthorized substitution of components may adversely affect safety of this product. Use only factory-approved components for repair.

The TO2 Analyzer Module requires very little maintenance during normal operation.

The sensor in the TO2 utilizes a liquid electrolyte. When measuring dry gases, it may be necessary to replenish the liquid by adding distilled or deionized water.

The sensor is designed to hold at least 100 cc of electrolyte. Typically, bone dry sample gas can extract approximately 5-10 cc of water per month from the sensor. It is recommended to check the electrolyte level every 3-4 months to assure that the electrolyte level is within the acceptable operating limits as indicated by the label on the reservoir section of the sensor.

The TO2 analyzer module is equipped with a low electrolyte alarm which indicates when replenishment of the sensor is required. Please refer to the Platform manual for details on configuring alarms.

CAUTION

REFILLING SENSOR

When refilling the sensor, only use distilled or deionized water. Do not use electrolyte or tap water as they can cause damage to the sensor. Take care not to overfill.

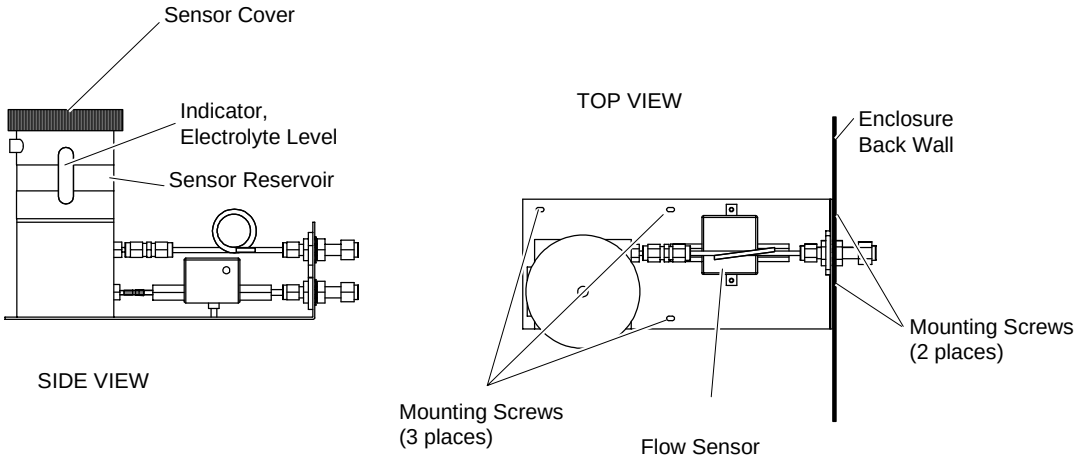


Figure 4-1. Trace Oxygen Analyzer Sensor Assembly

a. Water Addition

To add water:

1. Remove the top cover of the analyzer module.
2. Unscrew the black sensor cover.
3. Slide the cover back just enough to allow the neck of the fill bottle to fit into the sensor reservoir.
4. Add distilled or deionized water using the fill bottle provided with the analyzer module. Fill to approximately midway between the min and max level indicators on the sensor label. Be careful not to spill water, splash electrolyte or overfill sensor.
5. Replace the sensor cover securely.
6. Replace the top cover of the analyzer module.

If the electrolyte alarm is activated but the sensor shows sufficient electrolyte, the electrolyte may have been contaminated by substances present in the sample which are chemically incompatible with the sensor or electrolyte. If this should occur, the electrolyte must be drained and replaced with fresh electrolyte.

Refer to Section 4-3 below for the proper procedure for replacing electrolyte.

Several other components may require replacement. These are discussed in the following sections.

4-2 FUSES

Remove power to the Analyzer Module prior to fuse replacement. To replace the Power Fuse, locate the fuse cover on the front panel of the Analyzer Module, as shown partially in Figure 2-3 on page 2-4. Push and turn the fuseholder cover 1/4 turn counterclockwise. Remove and replace the fuse as required. There are no other fuses in the Analyzer Module.

4-3 ELECTROLYTE REPLACEMENT

Before replacing the electrolyte, be sure to turn off and disconnect all gas connections to the analyzer module. Turn off or disconnect the power to the analyzer module.

To replace the Sensor electrolyte, remove the Analyzer Module from its mounting location and place on a sturdy work surface. Be careful not to tilt the module from its horizontal position as the Sensor contains liquid that can spill. Remove the cover of the Analyzer Module and locate the 5 mounting screws that hold the Sensor Assembly onto the Analyzer Module chassis (see Figure 4-1 on page 4-1). Remove the 5 screws and retain. Do not lose the screws - they have metric threads.

Disconnect the Sensor signal connector (J5) and the Flow Sensor connector (J6) from the power board. Remove the complete Sensor Assembly from the Analyzer Module. Remove the black sensor cover and invert the Sensor Assembly over a suitable receptacle. Flush the Sensor twice with deionized water. Dispose of the discarded electrolyte and rinse water in accordance with National, Federal, State and Local regulations. (See MSDS in the rear of this manual.)

Refill the Sensor with electrolyte as instructed in Section 2-2a on page 2-1. Reinstall the Sensor Assembly and reconnect J5 and J6 to the power board.

4-4 SENSOR REPLACEMENT

If the Sensor cannot be regenerated by the addition of water or the replacement of electrolyte, or if the Sensor shows signs of leakage, it may be necessary to replace the Sensor. To replace the Sensor, remove the Sensor Assembly and remove the electrolyte as described in Section 4-3 above. Reinstall the black sensor cover to catch any residual electrolyte. Invert the Sensor Assembly and locate the four (4) mounting screws which hold the Sensor to the Sensor Assembly mounting plate. Remove and retain the four screws.

Install replacement Sensor in reverse order. Check Sensor for leaks and add electrolyte as described in Section 2-2a on page 2-1. Reinstall Sensor Assembly in Analyzer Module and reconnect J5 and J6 to the power board.

After installation of new Sensor, it will be necessary to load the new calibration data supplied with the Sensor. Enter the new calibration data by entering the *Load Factory Calibration Data* menu. You can get to this menu as follows: *Main Menu, Technical Level Configuration, Analyzer Module Diagnostics, Calibration Parameters, Load Factory Calibration Data.* This menu screen will look as follows:

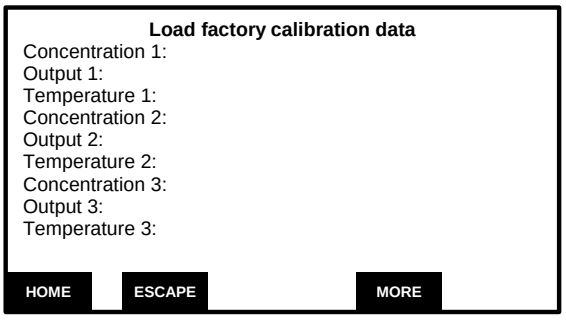


Figure 4-2. Load Factory Calibration Data Menu

The data is supplied with the new sensor and must be entered exactly as shown on the sensor data sheet. To enter the data for data points 4 & 5 and the sensor model, press the MORE soft key to access the next screen.

4-5 FLOW SENSOR REPLACEMENT

See Figure 1-2 on page 1-3 for Flow Sensor location. To replace Flow Sensor, remove all connecting hardware and undo connections to the sample line. The Flow Sensor is mounted to the Sensor Assembly mounting plate by two screws. Be sure to install the new Flow Sensor with the flow indication toward the outlet.

4-6 PRINTED CIRCUIT BOARDS

All three printed circuit boards can be replaced, if necessary. Refer to Figure 1-2 on page 1-3 for location of the Power, Network and Computer Boards.

To remove any PCB, disconnect the associated cables first. Tag each connector and its location before disconnecting any wiring. This helps in reassembly. The Power board and Computer board are located on a common bracket.

4-7 TROUBLESHOOTING

The following provides a short list of common troubleshooting tips. Additional information is contained in the Platform Manual.

The TO2 analyzer fails to purge down to ppm levels.

Prior to conducting any changes to the system, try running a quick start sequence (see Section 3-4 on page 3-3) to see if the oxygen reading goes lower. If the reading does decrease, the sensor has not been allowed sufficient time to consume the dissolved oxygen in the electrolyte. If the reading continues to read high a leak may exist in the sample lines. The number one problem associated with trace oxygen analyzer installation is the occurrence of leaks in your sample plumbing. If the oxygen reading will not come down to ppm levels or is reading higher than expected, the sample plumbing prior to the instrument may have a leak. A quick check can be conducted by observing the oxygen reading at two different flow levels; 0.5 and 2.0 scfh. If the oxygen reading drops significantly when the flow is increased from 0.5 to 2.0 scfh, this is a good indication that a leak exists.

To check for leaks prior to the sensor, disconnect the Analyzer Module and cap the inlet line. Pressurize the inlet line to 5 - 10 psig and check all connections with a soapy solution (SNOOP®) to identify leaks.

WARNING

SENSOR DAMAGE

Do not pressure check the sample line with the sensor connected. Over-pressurization of the sensor can result in damage.

The TO2 analyzer exhibits flow sensitivity.

Check to make sure that your vent line is not blocked. If you see a rise in reading with an increase in flow, you may be over-pressurizing the sensor due to a blocked vent. Since the

sensor is a partial pressure measuring device, an increase in sample pressure will cause an increase in reading. If the reading drops with increased flow, conduct the leak check outlined in the troubleshooting tip above.

The TO2 analyzer gives erratic and very insensitive readings.

Check to see that the electrolyte level is within the limits indicated on the reservoir. Add distilled water as required. If the level is within limits, the electrolyte may have been contaminated. Refer to Section 4-3 on page 4-2 above for proper procedure to replace electrolyte. If replacement of electrolyte does not improve the performance of the sensor, the sensor may have been damaged due to overpressurization or poisoning. Sensor replacement may be required as described in Section 4-4 on page 4-2.

SECTION 5
REPLACEMENT PARTS

WARNING

PARTS INTEGRITY

Tampering with or unauthorized substitution of components may adversely affect safety of this product. Use only factory-approved components for repair.

5-1 MATRIX

Each analyzer is configured per the customer sales order. Below is the TO2 sales matrix which lists the various configurations available.

To identify the configuration of an analyzer, locate the analyzer name-rating plate. The sales matrix identifier number appears on the analyzer name-rating plate.

TO2	NGA2000 TO2 TRACE OXYGEN ANALYZER MODULE

Code	Software version
01	Current version software
02	v2.4 Software
03	v3.X Software

Code	CONFIGURATION IDENTIFIER
A1	RANGE: 0 - 100 ppm
B1	RANGE: 0 - 100 ppm with X-GAS Sensor
X99	Special Ranges

Code	CABLE SELECTION
00	None (utilize mounting ears on analyzer module)
A1	Base Plate Assembly

TO2	01	A1	B1	(EXAMPLE)

5-2 REPLACEMENT PARTS

658350	Computer Analysis Board
657466	LON/Power Board
658300	Power Supply Board
902931	Sensor, Gas Flow
904675	Sensor, Oxygen 0-100 ppm
904676	Electrolyte Solution
903347	Fuse, Time-Delay 6A 250 VAC

SECTION 6
RETURN OF MATERIAL

6-1 RETURN OF MATERIAL

If factory repair of defective equipment is required, proceed as follows:

1. Secure a return authorization from a Rosemount Analytical Inc. Sales Office or Representative before returning the equipment. Equipment must be returned with complete identification in accordance with Rosemount instructions or it will not be accepted.
2. Rosemount CSC will provide the shipping address for your instrument.
3. In no event will Rosemount be responsible for equipment returned without proper authorization and identification.
4. Carefully pack the defective unit in a sturdy box with sufficient shock absorbing material to ensure no additional damage occurs during shipping.
5. In a cover letter, describe completely:
   - The symptoms that determined the equipment is faulty.
   - The environment in which the equipment was operating (housing, weather, vibration, dust, etc.).
   - Site from where the equipment was removed.
   - Whether warranty or non-warranty service is expected.
   - Complete shipping instructions for the return of the equipment.
6. Enclose a cover letter and purchase order and ship the defective equipment according to instructions provided in the Rosemount Return Authorization, prepaid, to the address provided by Rosemount CSC.

Rosemount Analytical Inc.
Process Analytical Division
Customer Service Center
1-800-433-6076

If warranty service is expected, the defective unit will be carefully inspected and tested at the factory. If the failure was due to the conditions listed in the standard Rosemount warranty, the defective unit will be repaired or replaced at Rosemount's option, and an operating unit will be returned to the customer in accordance with the shipping instructions furnished in the cover letter.

For equipment no longer under warranty, the equipment will be repaired at the factory and returned as directed by the purchase order and shipping instructions.

6-2 CUSTOMER SERVICE

For order administration, replacement Parts, application assistance, on-site or factory repair, service or maintenance contract information, contact:

Rosemount Analytical Inc.
Process Analytical Division
Customer Service Center
1-800-433-6076

6-3 TRAINING

A comprehensive Factory Training Program of operator and service classes is available. For a copy of the *Current Operator and Service Training Schedule* contact the Technical Services Department at:

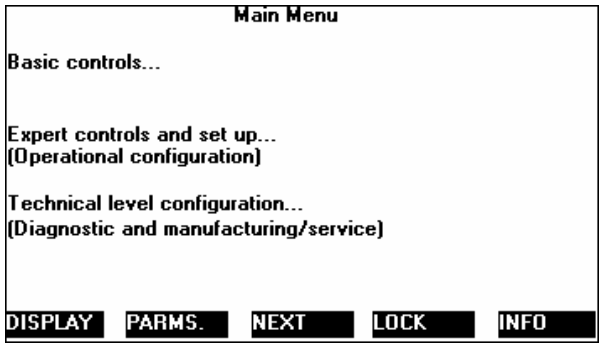
Rosemount Analytical Inc.
Customer Service Center
1-800-433-6076

SECTION 7
APPENDIX A. MENU STRUCTURE

7-1 NGA TO2 MENU STRUCTURE INTRODUCTION

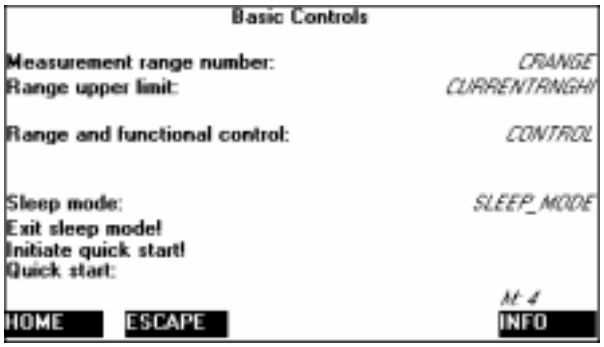
This Appendix contains a listing of the menus belonging to the TO2 Analyzer Module. It also lists the available configuration elements, and where they are to be found.

7-2 NGA TO2 ANALYZER MODULE MENUS

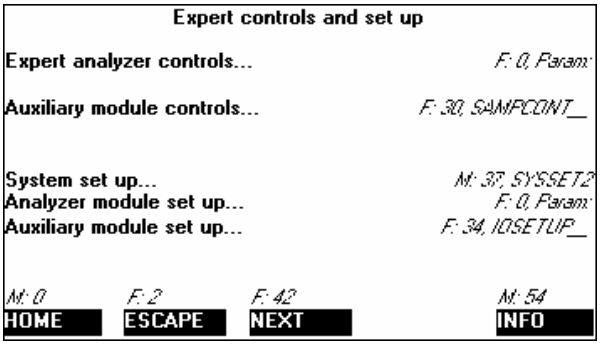


From the main menu, you can access the three major menu trees.

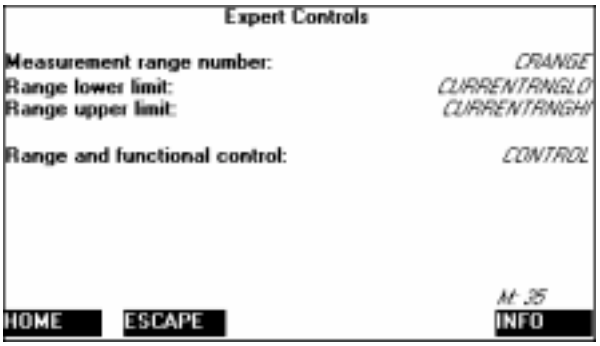
Basic controls… allows access to range number selection and range limit, Quick Start initiation and status, and Sleep Mode status and cancellation.



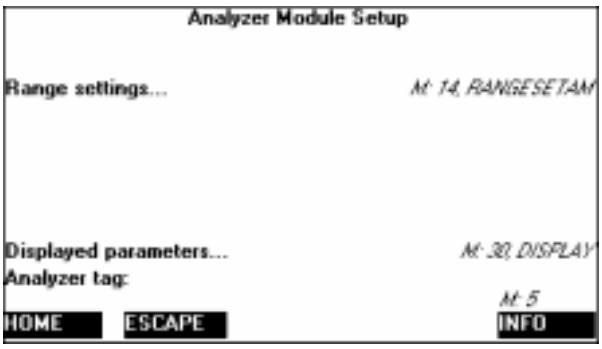
Expert Controls and set up … allows access to the Expert analyzer controls… and Analyzer module set up… sub menus.



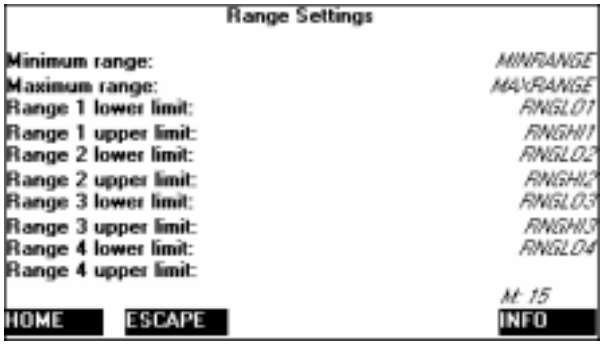
The ***Expert Controls*** menu allows range number and functional control selection. It also shows the range upper and lower limits.



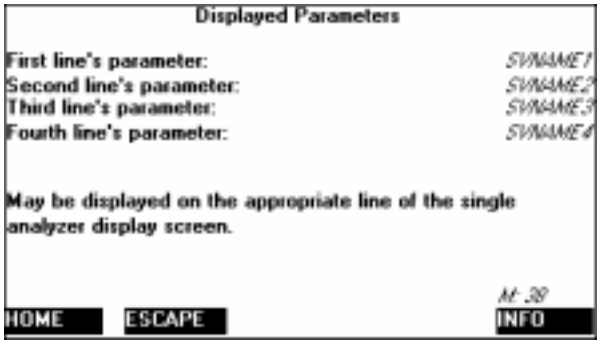
The ***Analyzer Module Setup*** menu allows access to the *Range settings…* and *Display parameters…* sub menus.



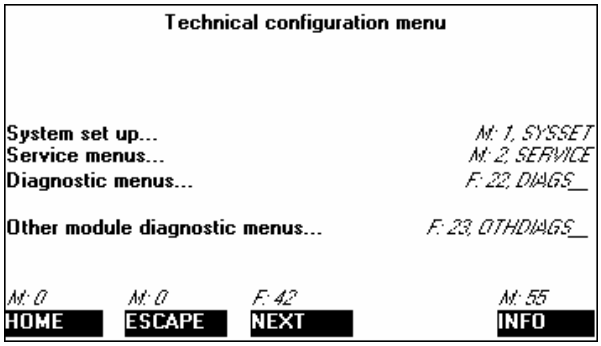
The ***Range Settings*** menu allows configuration of the upper and lower limit of the 4 ranges on the Analyzer Module. The maximum and minimum range limits are shown and adjustment beyond these limits is not allowed.



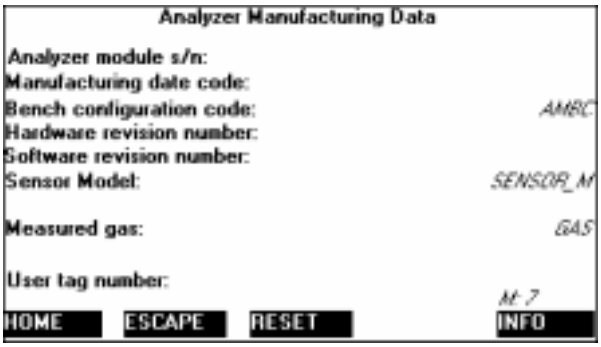
The ***Displayed parameters*** are the secondary parameters shown on the Display screen (see figure 3-1). The desired parameters can be selected from this menu.

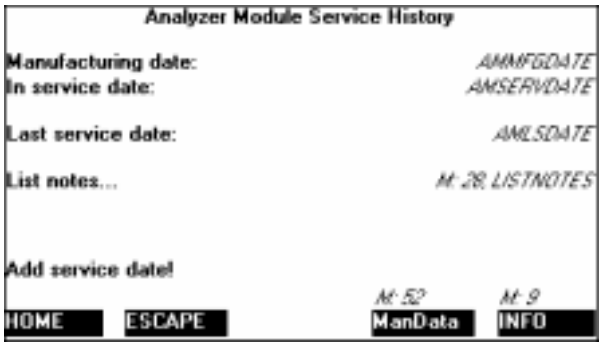


Technical level configuration… provides access to the service and diagnostic menus including calibration, gas scale factor, and sensor factory calibration data.

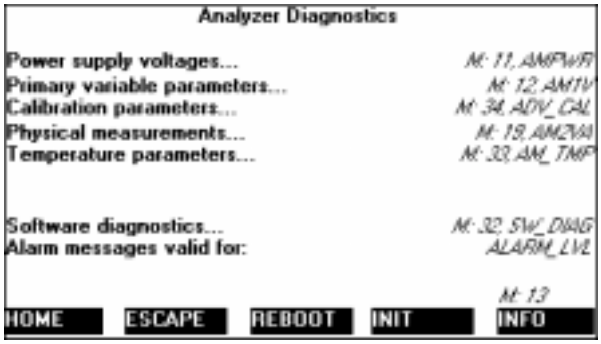


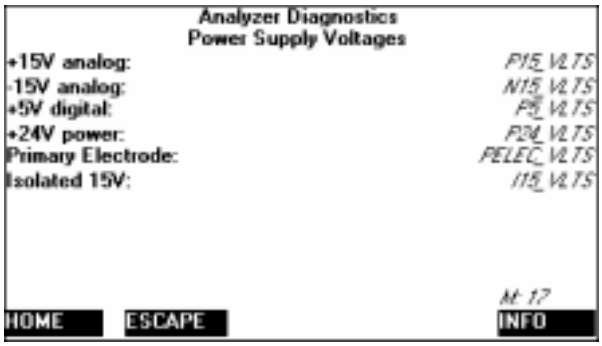
The ***Analyzer Manufacturing Data*** screen and Analyzer Module Service History screen are both accessible from the *Service menus…* sub menu. These screens provide factory set data concerning the configuration of the Analyzer Module.



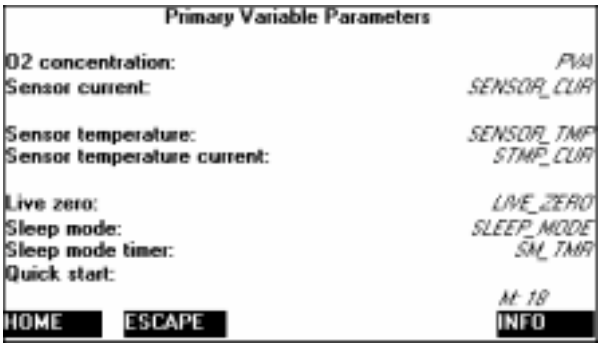


From the ***Analyzer Diagnostics*** menu, all analyzer health diagnostic information can be accessed. Calibration controls are also accessible from this menu.

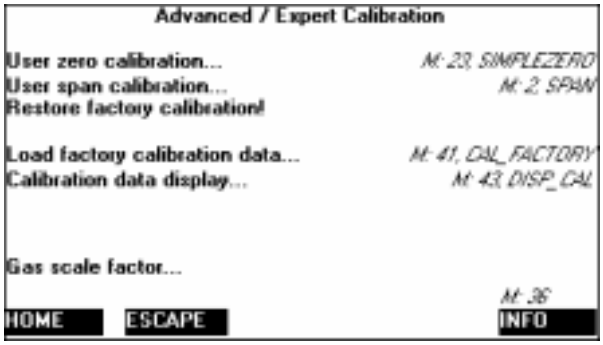




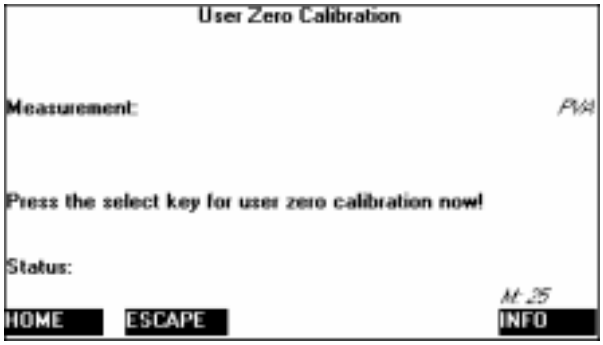
The ***Primary Variable Parameters*** screen provides details on the sensor, and advises the current status of the sleep mode. If the oxygen concentration exceeds 100 ppm, the sleep mode timer begins counting. At the end of 45 minutes, if the concentration has not dropped below 100 ppm, the Analyzer Module will go into sleep mode to protect the sensor from damage due to high oxygen exposure.

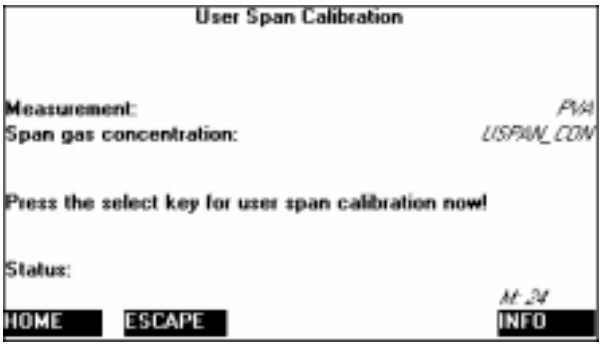


The ***Advanced / Expert Calibration*** menu allows access to user calibration screens, and the factory calibration data screens for viewing and data entry. The Gas Scale Factor menu is also accessed from this menu.

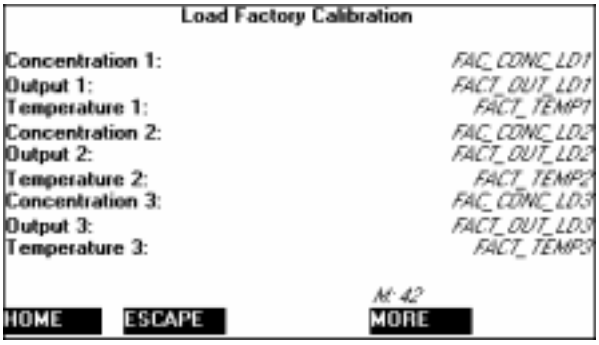


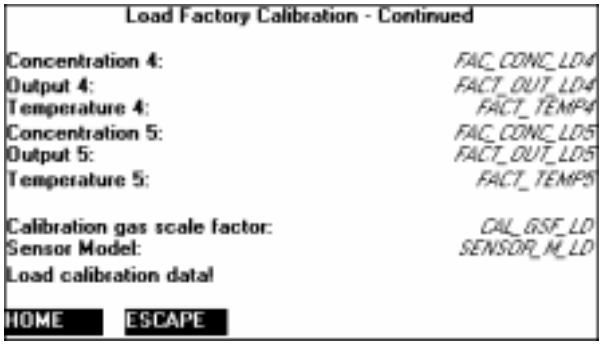
It is not recommended to conduct user zero and span calibration functions since the sensor is factory calibrated and does not exhibit detectable degradation of calibration over time. The risk of erroneous calibration due to inaccurate gases is greater than the potential of factory calibration change.



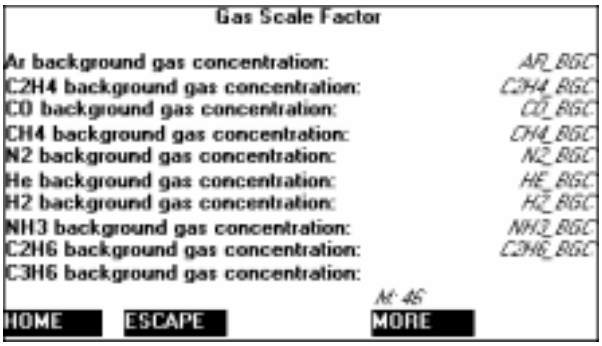


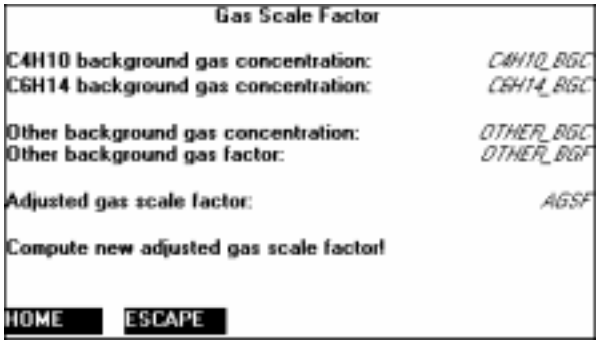
The ***Load Factory Calibration*** screens allow the user to enter the factory calibration data unique to the sensor in the Analyzer Module. If the sensor is replaced, this data must be entered from the data sheet provided with the replacement sensor. Additional data points can be accessed by pressing the MORE softkey.



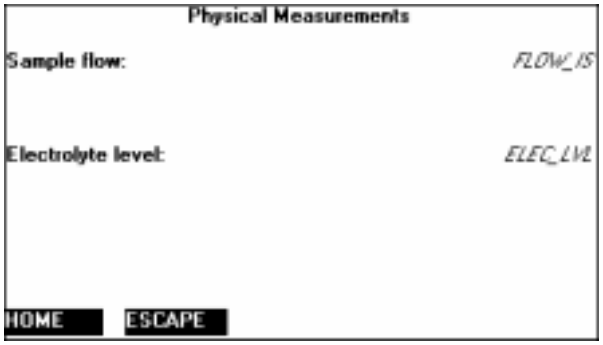


The ***Gas Scale Factor*** screens allow the user to enter in information relating to the background gas of the trace oxygen measurement. The total concentration of all entries must add up to 100 or the unit will not compute the new adjusted gas scale factor.

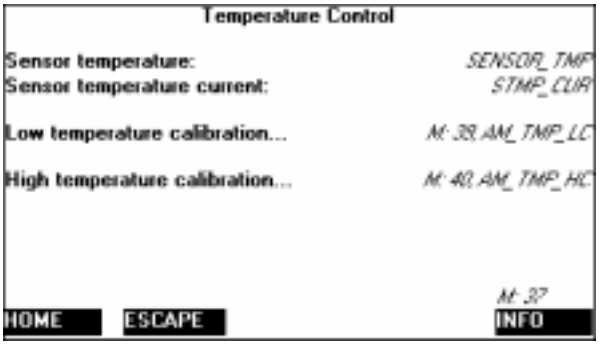




The ***Physical Measurements*** screen displays sample flow information as well as electrolyte level validity.



Temperature Parameters… selection directs the user to the sensor temperature information.



It is recommended that the user not conduct temperature calibration of the sensor in the field.

SECTION 8
APPENDIX B. USER INTERFACE HELP

This section provides a means of rapidly finding any desired function or configuration factor in the menu system.

The NGA menu system is necessarily complex due to the wide variety of configuration possibilities available with the NGA architecture.

This section consists of a series of titles describing the function or configuration desired, with a series of menu titles that show the path taken to that function.

The menu selections are sometimes abbreviated; *Basic Controls* is referred to as *Basic* for example, *Expert controls and setup* as *Expert*, and *Technical level as well as Technical.*

Menu Items

ITEM	PATH	NOTES
Add a service date	Technical - Service menus - Service history - Analyzer module history - Add service date!	
Alarm enabling	Technical – Listing of all modules – Analog I/O – Select I/O module - Relay status	
Analyzer specific alarms	Expert - Auxiliary module setup - Select Analog output module – Alarm conditions	v 2.3 only
Analyzer diagnostics	Technical - Diagnostic menus - Analyzer module diagnostics	
Analyzer specific controls (remote)	Expert - Auxiliary module setup - Select Analog output module – Input line control	v 2.3 only
Binding	Technical - System setup – Module Binding	
Displayed parameters	Expert - Analyzer module setup - Displayed parameters	
Electrolyte level	Technical - Diagnostic menus - Analyzer module diagnostics - Physical measurements	
Exit sleep mode	Basic	
Gas scale factor	Technical - Diagnostic menus - Analyzer module diagnostics - Calibration parameters - Gas scale factor	
Initiate quick start	Basic	
Last service date	Technical – Service menus – Service history – Analyzer module history	User updated
List of detected NGA modules	Technical - Listing of all modules	Jumps from there into their diagnostic screens
Load factory calibration data	Technical - Diagnostic menus - Analyzer module diagnostics - Calibration parameters	Required when changing sensor
Manufacturing data	Technical – Service menus - Manufacturing data - Analyzer module data	
Maximum range	Expert - Analyzer module setup - Range settings	Maximum range upper limit
Minimum range	Expert - Analyzer module setup - Range settings	Minimum range upper limit
Power supply voltages	Technical – Diagnostic menus – Analyzer module diagnostics - Power supply voltages	
Quick start status	Basic	

ITEM	PATH	NOTES
Range number selection	Basic	
Range lower limits	Expert - Analyzer module setup - Range settings	
Range upper limits	Expert - Analyzer module setup - Range settings	
Record service codes	Technical - Service menus – Service history - Analyzer module history - List notes	
Reset system	Technical - System setup – System reset	
Resolution of main reading	Technical - System setup – Main display configuration - Display resolution	
Sensor current, temperature	Technical - Diagnostics menus - Analyzer module diagnostics - Primary variable parameters	
Sleep mode status	Basic	
Sleep mode timer	Technical - Diagnostics menus - Analyzer module diagnostics - Primary variable parameters	
Software diagnostics	Technical - Diagnostic menus - Control module diagnostics	
Software revision level	Technical - Service menus - Manufacturing data - Control module data	
Span calibration	Technical - Diagnostic menus - Analyzer module diagnostics - Calibration parameters - User span calibration	Highly recommend not to be conducted in the field
Tag number	Technical - Service menus - Manufacturing data - Analyzer module data	User editable
Test relay operation	Technical – Listing of all modules – Analog I/O – Select I/O module - Relay status	
View sensor calibration data	Technical - Diagnostic menus - Analyzer module diagnostics - Calibration parameters - Calibration data display	
Zero calibration	Technical - Diagnostic menus - Analyzer module diagnostics - Calibration parameters - User zero calibration	Highly recommend not to be conducted in the field

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Model NGA2000 TO2

Emerson Process Management

Rosemount Analytical Inc.
Process Analytic Division
1201 N. Main St.
Orrville, OH 44667-0901
T (330) 682-9010
F (330) 684-4434
E gas.csc@emersonprocess.com

EUROPEAN TECHNOLOGY CENTER
Fisher-Rosemount GmbH & Co.
Industriestrasse 1
63594 Hasselroth
Germany
T 49-6055-884 0
F 49-6055-884209

ASIA - PACIFIC
Fisher-Rosemount
Singapore Private Ltd.
1 Pandan Crescent
Singapore 128461
Republic of Singapore
T 65-777-8211
F 65-777-0947

EUROPE, MIDDLE EAST, AFRICA
Fisher-Rosemount Ltd.
Heath Place
Bognor Regis
West Sussex PO22 9SH
England
T 44-1243-863121
F 44-1243-845354

LATIN AMERICA
Fisher - Rosemount
Av. das Americas
3333 sala 1004
Rio de Janeiro, RJ
Brazil 22631-003
T 55-21-2431-1882

http://www.processanalytic.com