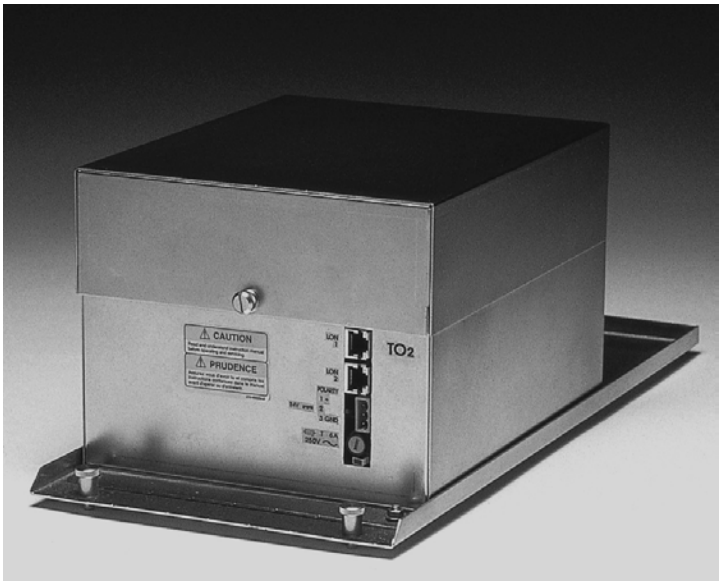
Instruction Manual
760008-A
September 2001

Model NGA 2000 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.

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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 NGA 2000 TO2 and the System Accessories of the NGA 2000 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.

DANGER

ELECTRICAL SHOCK HAZARD

Operate this equipment only when covers are secured. Servicing requires access to live parts which can cause death or serious injury. Refer servicing to qualified personnel. For safety and proper performance, this module must be connected to a properly grounded three-wire source of electrical power.

DANGER

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.

WARNING

HIGH PRESSURE GAS CYLINDERS

This analyzer requires use of pressurized gas. See General Precautions for Handling and Storing High Pressure Cylinders, page P-3.

WARNING

PARTS INTEGRITY

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

CAUTION

CAUSTIC LIQUID

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

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
Used by Permission

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 NGA 2000 TO2 instruction materials are available. Contact Customer Service Center or the local representative to order.

760008 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.

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

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.

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 NGA 2000 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.

Softkeys

The five function keys located below the front panel display; they assume the function displayed directly above each on the display, a function dictated by software.

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 NGA 2000 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 METHOD OF MEASUREMENT

Coulometric Principle

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)

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

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.

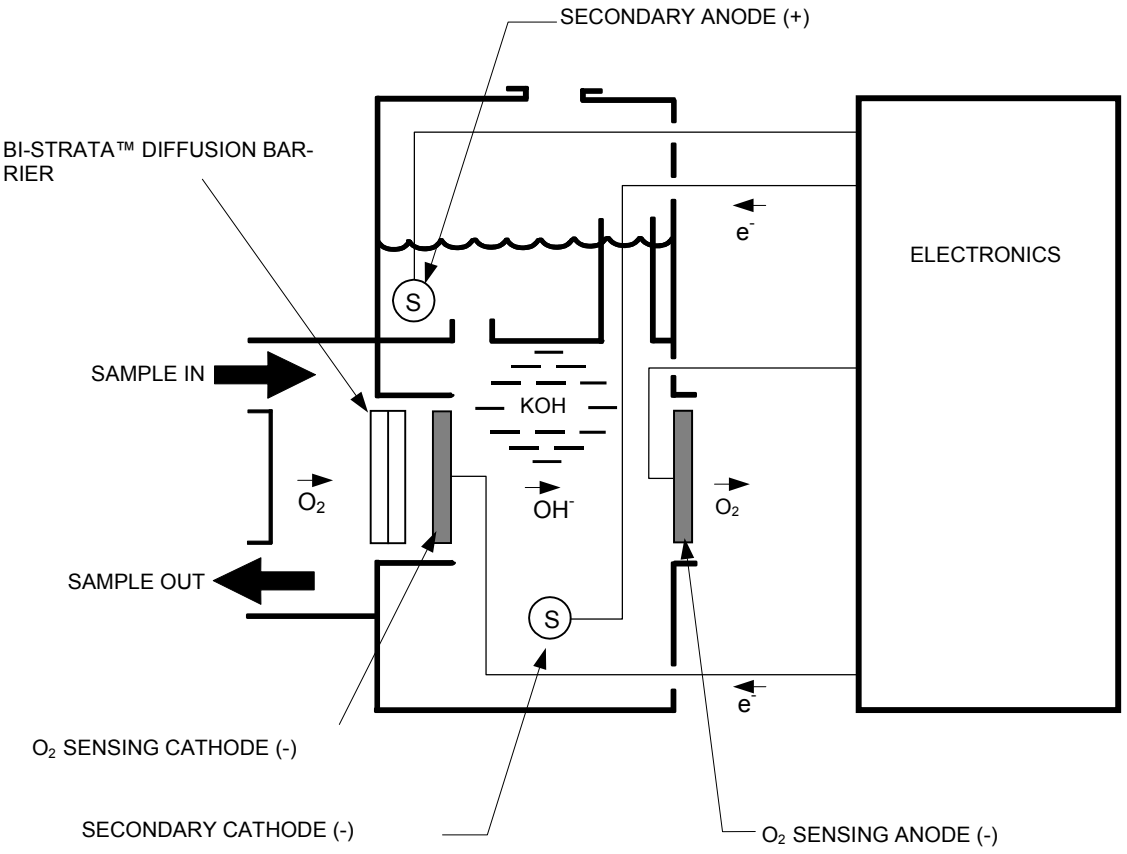


Figure 1-1. Trace Oxygen Detector Coulometric Principle

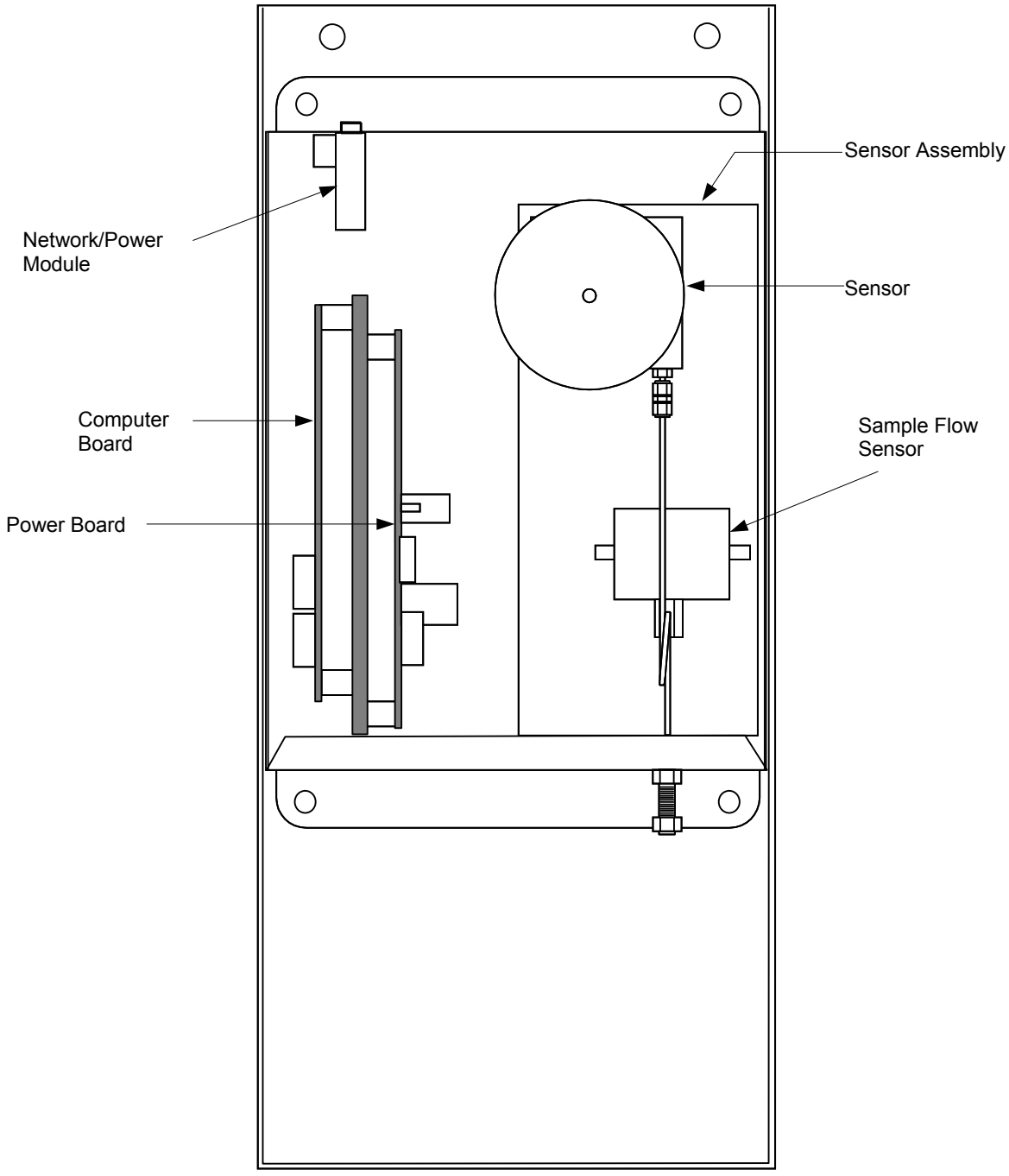


Figure 1-2. Trace Oxygen Analyzer Module - Top View

1-5 SPECIFICATIONS[1]

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, Outline and Mounting Dimensions
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)

[1] See the Platform manual for specifications regarding Platform related components.

d. Gas Connections

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

SECTION 2
INSTALLATION

WARNING

Before starting to install this equipment, read the Safety Summary in the Preface section of this manual. Failure to follow the safety instructions could result in serious injury or death.

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 ELECTROLYTE

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

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 and Figure 2-4.)

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). 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 tilt the Sensor Assembly excessively as electrolyte may leak out.

2-3 LOCATION

(See Figure 2-2) The TO2 Analyzer Module comes standard with mounting ears for easy installation on flat, horizontal surfaces. Install the TO2 Analyzer Module in a clean, weatherproofed, 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.

b. 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 dew point at least 5 °C (13 °F) below the coldest expected ambient temperature.

c. 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.

2-5 GAS CONNECTIONS

(See Figure 2-3.) 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.

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.

a. 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

SENSOR DAMAGE

Do not expose the Sensor to pressure in excess of 1.0 psig as this may cause damage.

Flow Indicator Method

Supply air or inert gas such as nitrogen, at 1 psig (6.8 hPa), to the analyzer through a flow indicator with a range of 0 to 250 cc/min. Install a shut-off valve at the sample gas outlet. Set the flow rate to 125 cc/min.

Close the outlet shut-off valve and notice that the flow reading drops to zero. If the flow reading does not drop to zero, the system is leaking and must be corrected before the introduction of sample gas or the application of power.

2-6 ELECTRICAL CONNECTIONS

WARNING

ELECTRICAL SHOCK HAZARD

Operate this equipment only when covers are secured. Servicing requires access to live parts which can cause death or serious injury. Refer servicing to qualified personnel. For safety and proper performance, this module must be connected to a properly grounded three-wire source of electrical power.

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

Two electrical connections are required on the Analyzer Module: POWER and NETWORK (See Figure 2-4). 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 NGA 2000 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.

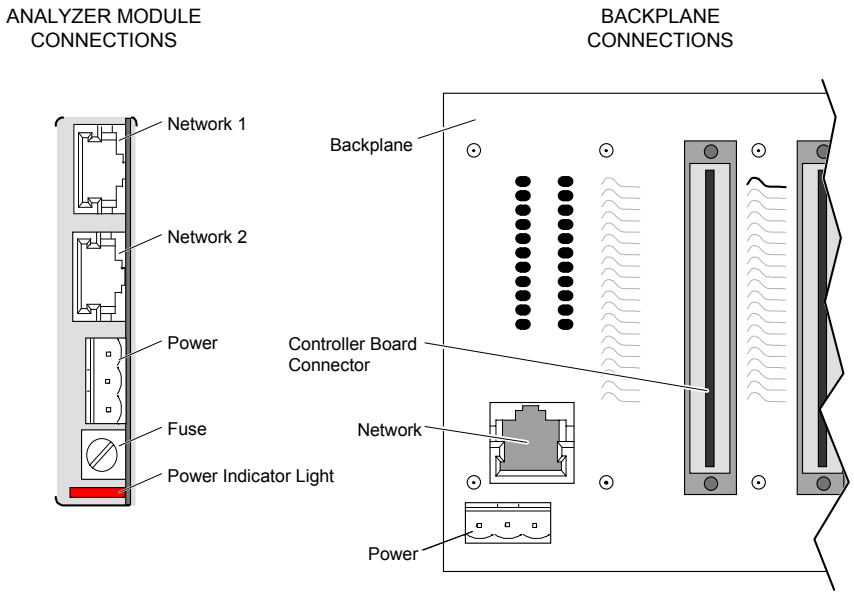


Figure 2-1. Analyzer Module Interconnection with Instrument Platform

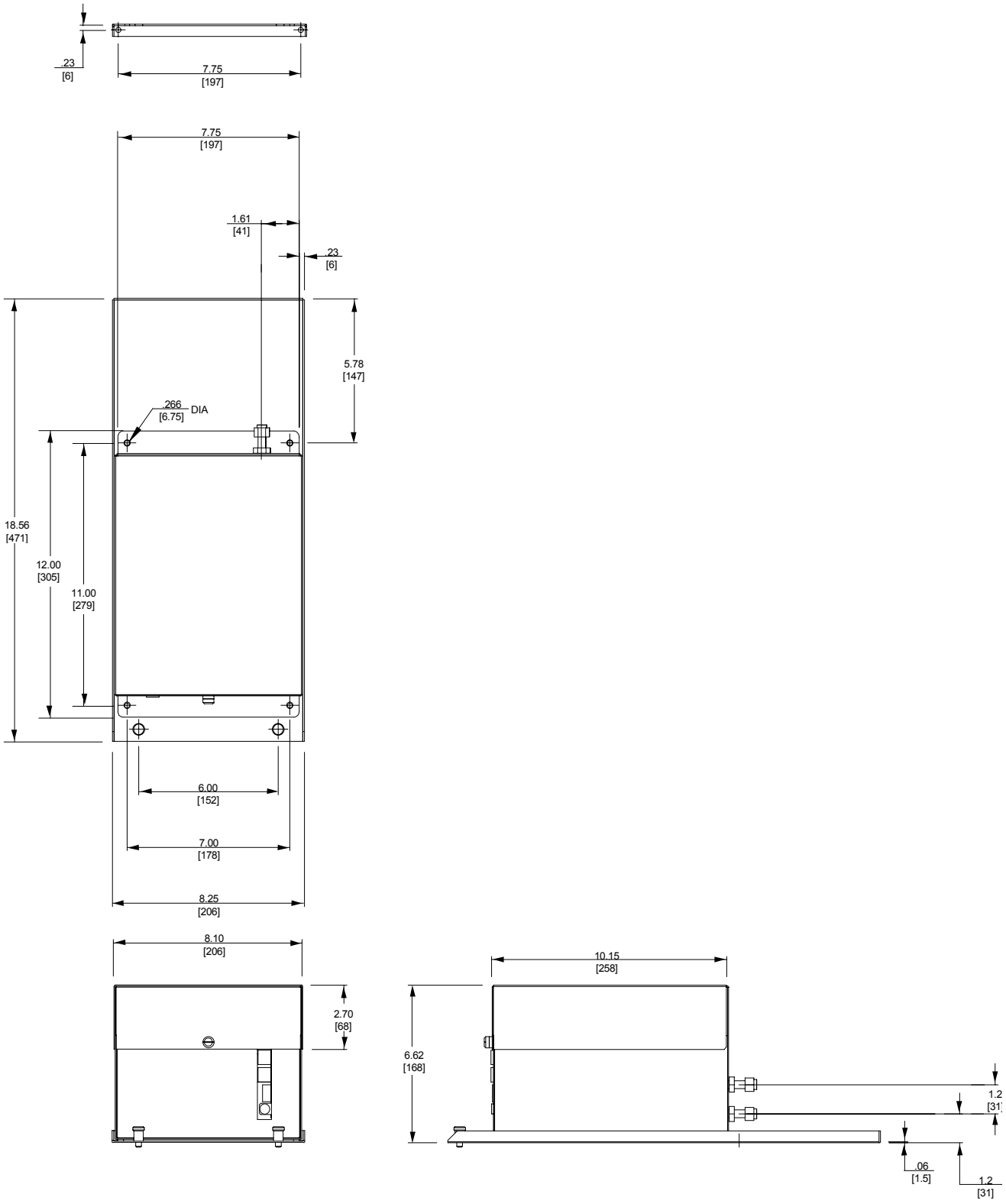


Figure 2-2. Outline and Mounting Dimensions

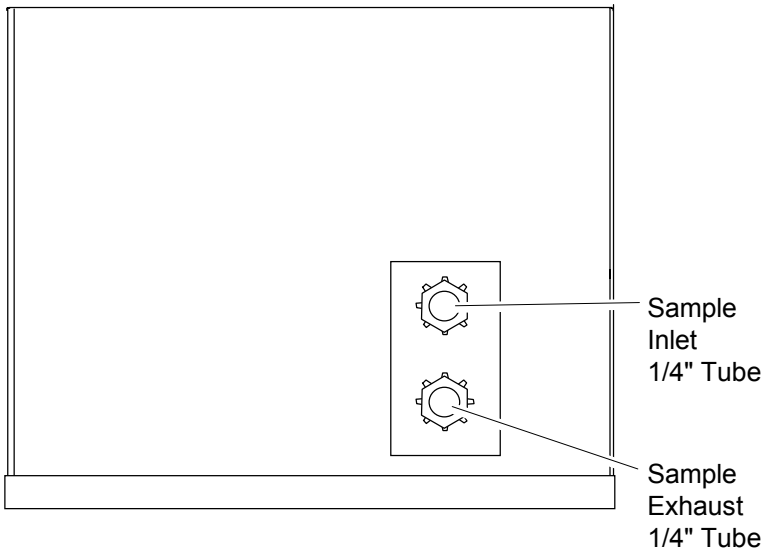


Figure 2-3. Back Panel Connections

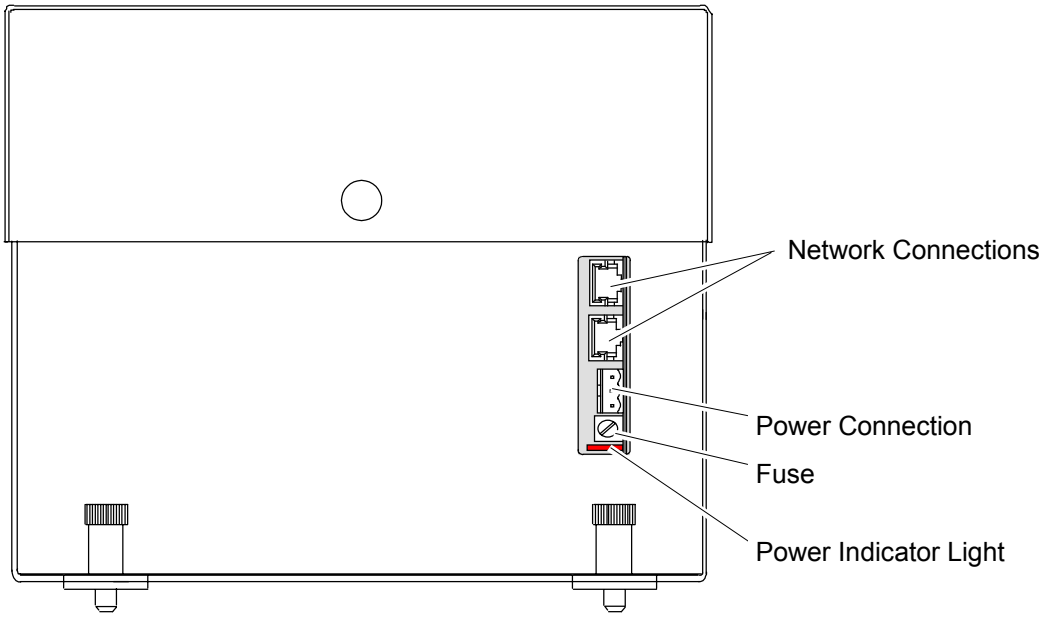


Figure 2-4. Trace Oxygen Analyzer Front Panel

SECTION 3
OPERATION

3-1 OVERVIEW

Once the TO2 has been correctly assembled and installed in accordance with the instructions in Section 2, the analyzer is ready for operation.

Before operating the system, verify that the Leak Checks have been performed in accordance with Section 2-5a.

For the remainder of this section, Analyzer Module interconnection with a Platform or some interfacing component is 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.

3-2 DISPLAYS & OPERATING KEYS

The LCD screen shows all measurement values of the Analyzer, status values and all user menu instructions. Operation is performed with five function keys, four arrow (cursor) keys and the enter key. The function of each key varies depending on the installed Analyzer module, any auxiliary modules installed, and the individual menu displayed.

In case of power failure, all user defined specific module parameters are saved by a battery powered memory.

The **Function Keys**, also called softkeys, are assigned values depending on the menu or screen being displayed. The legend is displayed above the keys.

The **Enter Key** is used to confirm a previously entered variable value, to start a selected function or to go to a submenu selected at a menu line as opposed to the Function Keys. As an alternate to using the Enter Key to start a function, the → key can be used.

The **Cursor Up/Down Keys** (↑ or ↓) are used to move up or down the lines within a menu or to increment and decrement number variables.

The **Cursor Left/Right Keys** (← or →) are used to move backwards or forwards between the pages of a menu or to select numeric digits for adjustment.

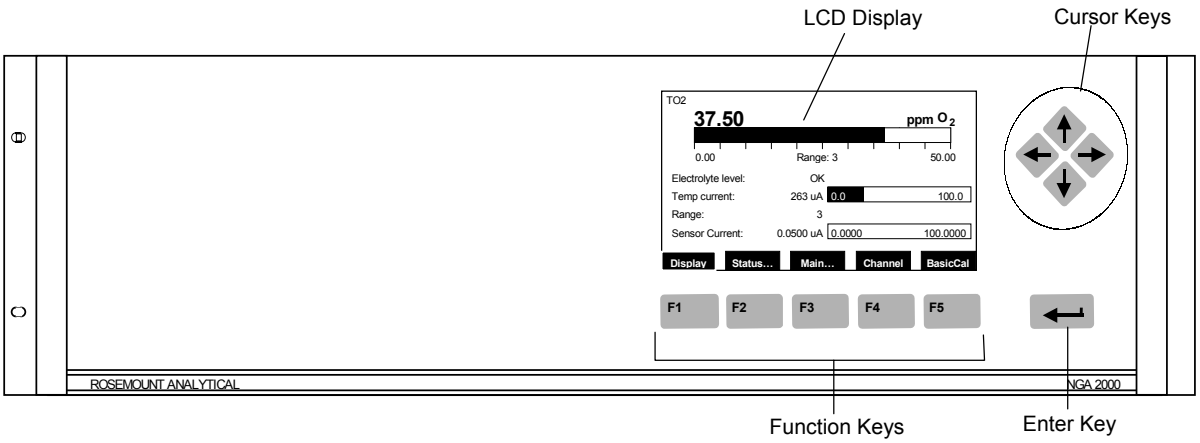


Figure 3-1. Platform Front Panel

a. Menu Lines & Softkey Functionality

Menu lines can be selected with the ↑ key or the ↓ key. The selected line is displayed as white lettering on a black background (reverse text). Menus can contain four different types of lines:

Menu Line – A line ending with three dots (…) indicates that it leads to a submenu. The submenu can be activated by pressing the ↵ key or the → key when the line is highlighted.

Function Line – A line ending with an exclamation point (!) indicates that it will start a function. The function can be activated by pressing the ↵ key or the → key when the line is highlighted.

Variable Line – A line ending with a colon (:) indicates that it displays a module variable parameter. Some parameters can be changed and some parameters display only a status and cannot be changed. Paramters that cannot be changed will be displayed below a line within the menu.

Text Line – A line without punctuation marks displays information.

Tag Line – At the top of each menu screen is the tag line of the current channel. To the right of the Tag is the value of the indicated channel.

The Function Keys (Softkeys) can sometimes be assigned as Functions (exclamation point) or Submenus (three dots) as shown in Figure 3-2.

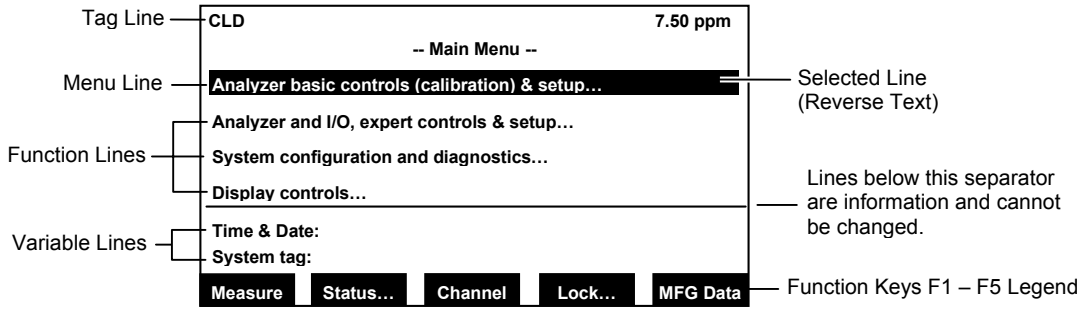


Figure 3-2. The Display Screen

b. Common Function Keys

The function keys are shown in Figure 3-1 And Figure 3-2.

Display – Change from the single component display to the multi-component display. F1 in the single component display.

Measure – Change from menus and submenus to the single component display of the selected channel. F1.

Status – Change to the menu “Current measurement parameters” which displays the most important parameters and information about the status of the current channel or module. F2 if available. (See Section 3-4)

Main – Change from single component display to the main menu. F3 in the single component display. (See Section 3-2e)

HOME – Change for various menus to the main menu. F1.

Channel – Scrolls through the channels in the same menu. In the main menu and the single component display menu it moves between the channels of the connected Analyzers and Analyzer modules. In the submenus it moves only between

the channels of the current Analyzer or Analyzer module. F3 if available, F4 in the single component display.

Lock – Changes to the main menu and locks all three operation levels, if a security code is enabled in the system configuration. F4 in the main menu.

BasicCal – Change from the single component display to the menu "Basic Controls and Setup." F5 in the single component display. (See Section 3-40)

MFG Data – Change from the main menu to the menu "Manufacturing Data" which displays further submenus with information about the control module and Analyzer module, such as address of the manufacturer, serial number of the modules and software and hardware versions. F5 in the main menu. (See Section 3-2e and Figure 3-7.)

More – Changes to an additional menu page of the current menu. F3 or F5 if available.

ESCAPE/Back – Returns to the previous menu. Usually F2 or F4. When changing a variable, the previous value is displayed above the Back button. Pressing the Back button restores the previous value.

INFO – Context sensitive help screens for the current menu.

c. Entering & Changing Variables

1. Select the variable line desired to be changed using the ↑ key or the ↓ key. The selected line will be highlighted white on black.

2. Press the ↵ key and the parameter will be selected for modification.

3. The F2 key changes to "Back…" and the previous value of the variable shows above it for easy reference. When the variable being changed is numeric, the F4 key changes to "+/-" to allow changing of the sign from positive to negative if applicable.

4. Use the ↑ key or the ↓ key change the entire value, scroll among the available variables or change the value of a selected digit or character.

5. Use the ← key or the → key to select digits within a number. For some variables the quantity of digits or characters can be changed.

6. Press the ↵ key again to confirm the new value.

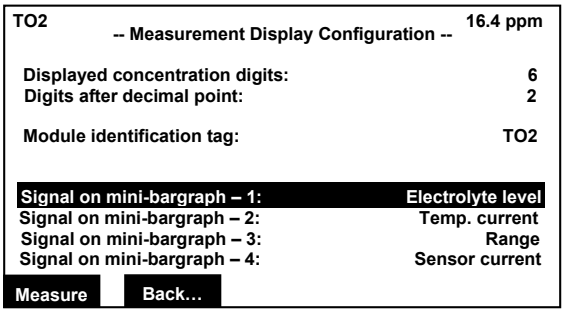


Figure 3-3. Changing Variables

d. Starting a Function

Pressing the ↵ key or the → key while a function line is highlighted will bring up a confirmation menu as shown below.

Pressing the F2 key will start the function immediately.

Pressing the F4 key will return to the previous menu page.

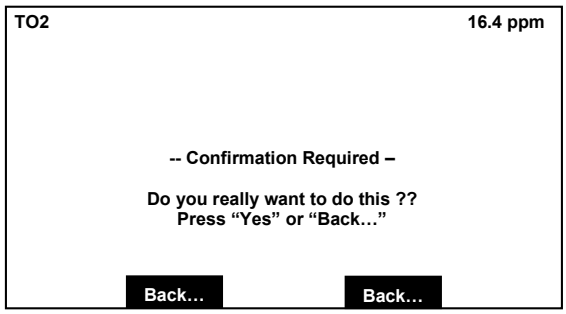


Figure 3-4. Function Confirmation

e. Measure Mode Display

The Measure 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 is shown as a percent of fullscale and up to four lines showing user selectable secondary parameters from either the Analyzer module or any I/O module bound to it. See the Platform manual for information as to how to select these. The Measure Mode display is shown in Figure 3-5.

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 the display screen.

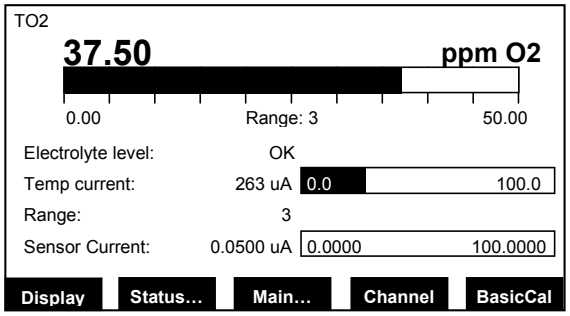


Figure 3-5. Measure Mode Display

f. Main Menu

Pressing Main… (F3) or the → key while in any single component display will bring up the Main Menu (Figure 3-6). From the Main menu it is possible to change all operating values of the Analyzer to set up and control the parameters of measurement, calibration and data transfer.

From the Main menu, the F5 key (MFG Data) will access several submenus showing the manufacturing and version data of the Analyzer as shown in Figure 3-7.

Selection from the Main menu:

Measure (F1) – Changes to the single component display of the current channel. See Section 3-40.

Status… (F2) – Changes to the "Current measurement parameters" menu of the current channel. See Section 3-4 .

Channel (F3) – Scrolls through all channels of the connected Analyzers and Analyzer modules.

Lock… (F4) – Locks any operating level by security code.

MFG Data (F5) – Changes to "Module Manufacturing Data" menu. See Figure 3-7.

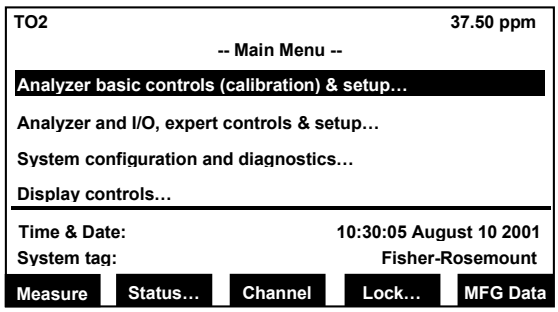


Figure 3-6. Main Menu Functions

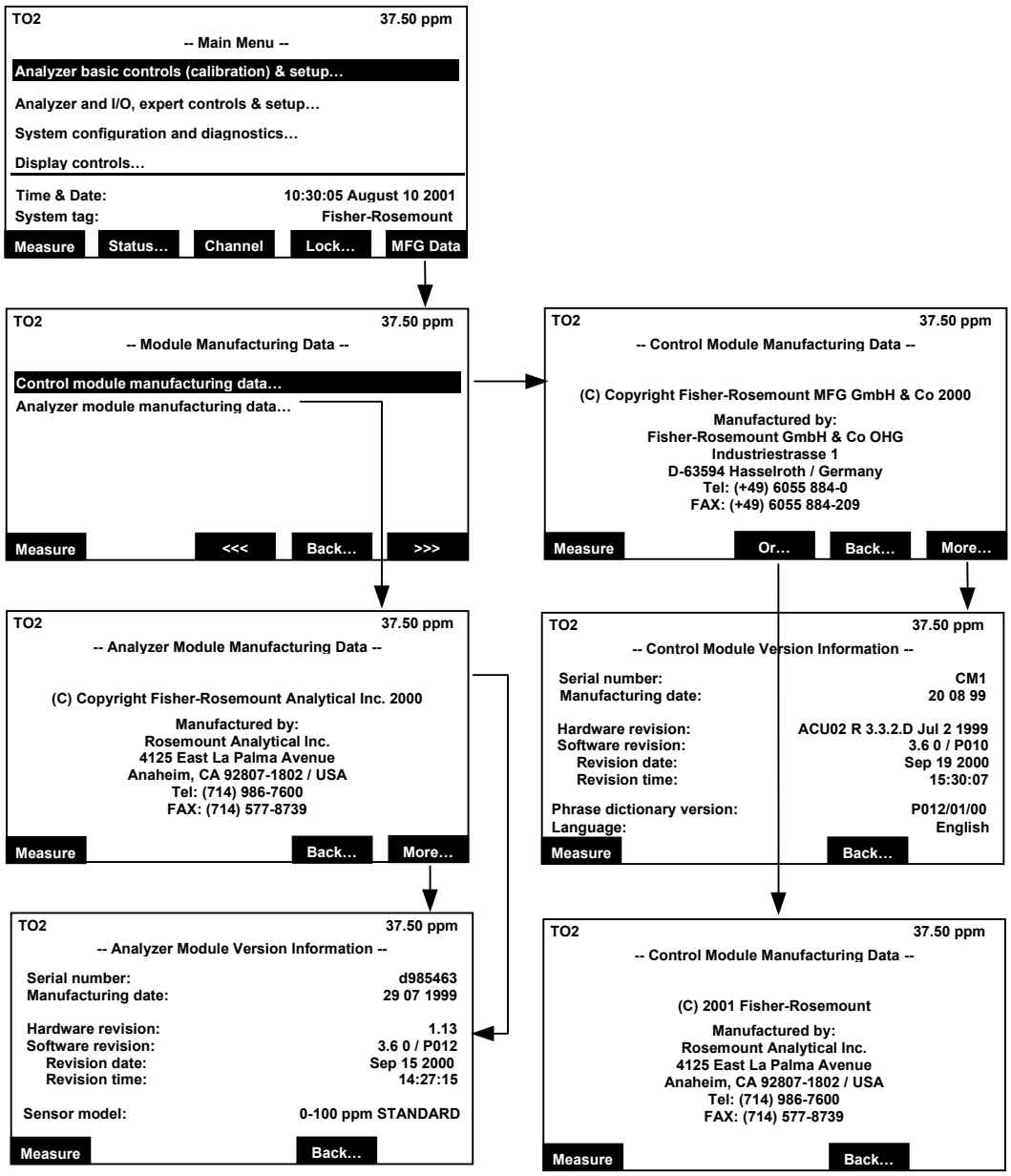


Figure 3-7. Module Manufacturing Data Displays

Selections from the “Module Manufacturing Data” menu (F5):

3-3 STARTUP & INITIALIZATION

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.

After switching on the TO2, the analyzer will begin its booting procedure which is apparent on the LCD screen. The first part of the initialization procedure is a self check of the software and analyzer components. Various displays will show the status of the initialization including revision notes, “Initializing network interface,” “Searching for nodes,” “Querying Module: TO2, 12% Complete,” and “Calculating bindings.”

Pressing the F1 key during initializing will reset the LCD brightness and contrast to factory settings (See Section 3-4e). Pressing the F3 key will abort the network initializing, aborting any connection to other analyzers. In that case, only the menus of the local analyzer will be available.

At the end of the initializing routine the “measure” screen will display as shown on the next page. This screen is the access to all other channels, menus and submenus. The actual display may differ from that shown depending on any custom configuration as described in Section 3-5e.

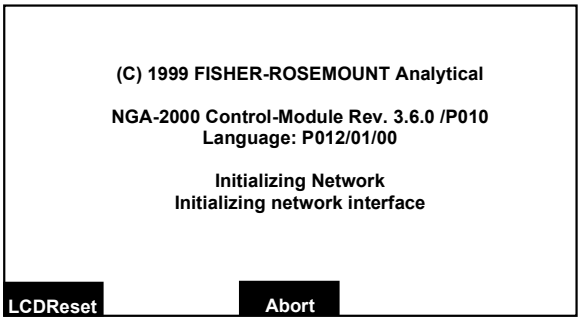


Figure 3-8. Startup Display

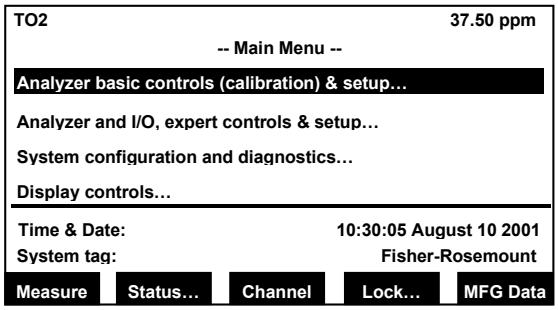
a. Quick Start

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.

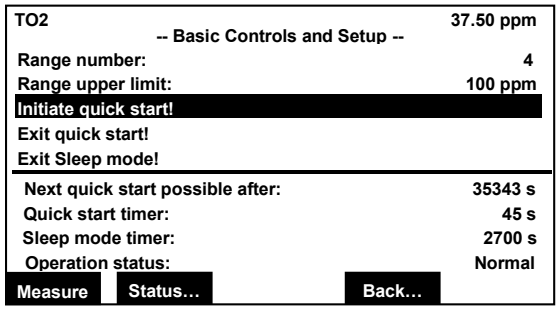
A normal start can take from 2 to 72 hours depending on the concentration being measured. The lower the oxygen concentration in the sample gas, the longer the analyzer will take to reach equilibrium.

To abort the quick start, move the cursor to the “Exit quick start!” line and press the ↵ key. The quick start process will cease but another quick start should not be attempted until the “Next quick start possible after:” timer reaches zero. This timer provides the means to avoid more than two quick starts in any 24 hour period.

The “Quick Start” function can be accessed from the “Measure” display by pressing F5 (BasicCal) or from the Main Menu as follows:



From the Main Menu, move the cursor to Analyzer basic controls (calibration) & setup…



In the Basic controls and Setup menu, move the cursor to the “Initiate quick start!” line and press the ↵ key. The analyzer will begin the quick start function immediately. This process will take about 45 seconds. The “Quick start timer” will count down this period.

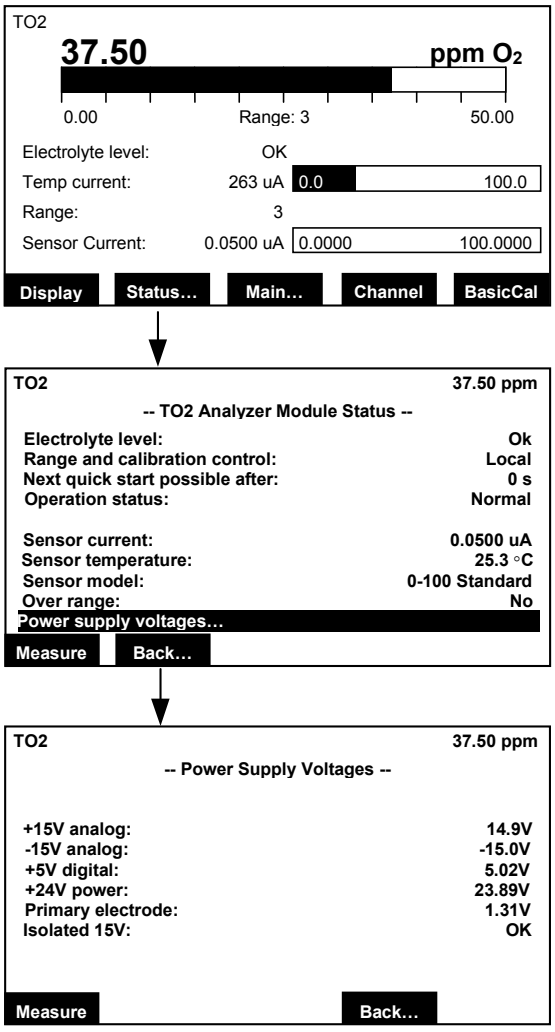
The last measured value is held for the duration of the process to prevent false reading fluctuations.

Figure 3-9. Initiate Quick Start

3-4 BASIC CONTROLS, SETUP AND STATUS

The following sections describe the basic control of the analyzer and the viewing of channel parameters. Examples of stepping through the menus are shown so that the user can become familiar with the operation, keeping in mind that displays and menu choices may be different depending on actual analyzer configuration and any customization of the menus.

a. Analyzer Channel Status



If necessary, from the Main menu press F1 “Measure.”

Press F2 to change to the “Analyzer Channel Status” menu.

Or, from the Main menu press F2 to the “Analyzer Channel Status” menu.

From the “Analyzer Module Status” menu an additional submenu is available for “Power supply voltages..." to check the various voltage levels in the analyzer.

Press the ↵ or → key to access the “Power supply voltages..." display screen. The tolerance for these voltage is ±10% of nominal.

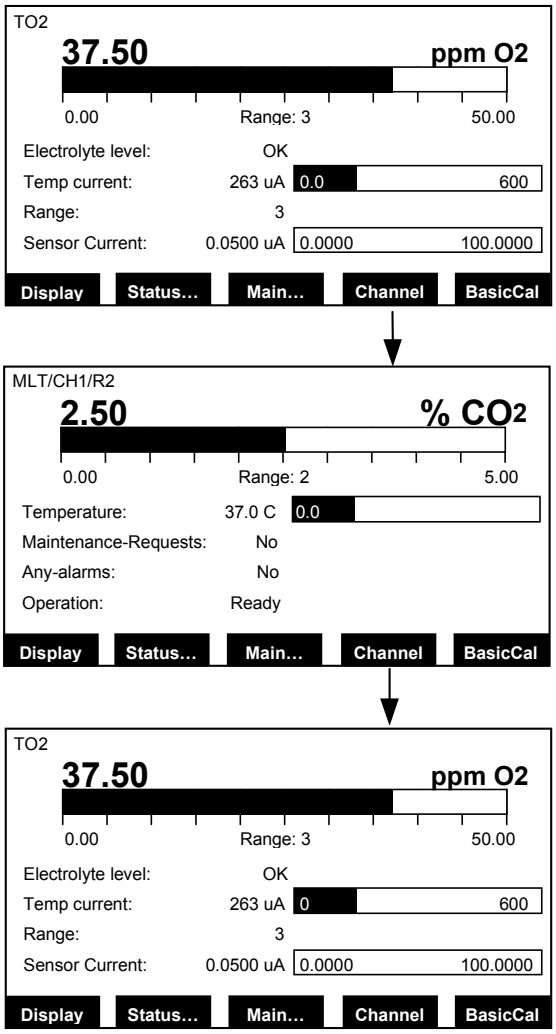
Press the F4 (Back…) button to return to the “Analyzer Module Status” menu or the F1 (Measure) button to return to the “Measure” display screen.

From the “Analyzer Module Status” menu, press the F2 (Back…) button to go to the “Main Menu” or press the F1 (Measure) button to return to the “Measure” display screen.

Figure 3-10. Analyzer Channel Status

b. Single Component Display

The Measure menu that displays after startup is the Single Component display of the analyzer. If other analyzer modules are connected to the Platform, it is possible to display them using the following steps to change the channel of the single component display:



Press F4 (Channel) to change to the Single Component Display of any other installed Analyzer Modules.

Example:
Changing from TO2 (channel 1) to CO_2 (channel 2).

Note: Display may look different depending on installed analyzers.

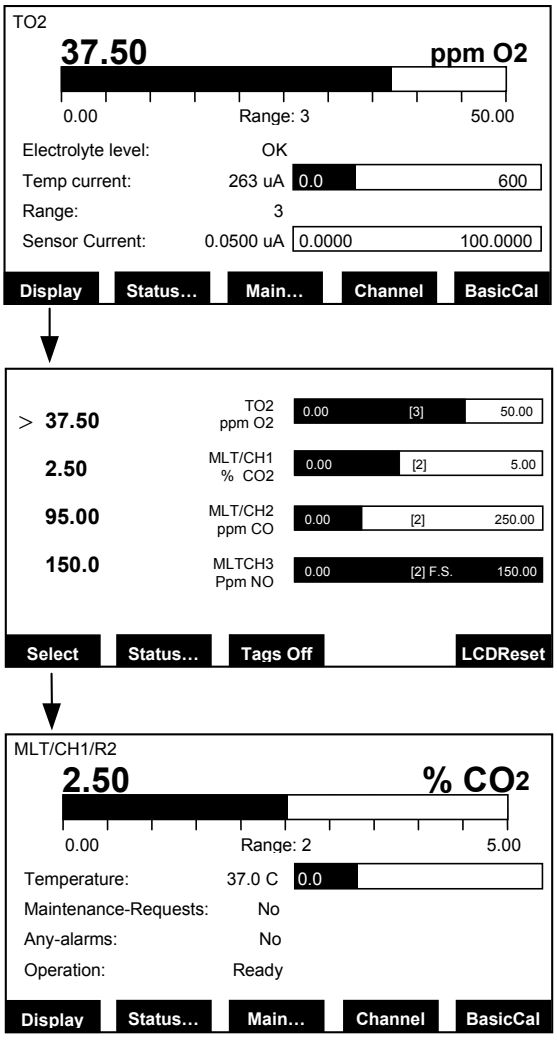
Continue pressing F4 to display the desired channel depending on the installed analyzer configuration, ultimately returning to the first channel.

Single component display of the starting channel.

Figure 3-11. Single Component Display

c. Multi Component Display

If other analyzer modules are connected to the Platform, it is possible to display up to five using the following steps to change from the single component display to the multi component display as follows:



From the single channel display (Measure) press F1 (Display) to change to the Multi Component Display of all other installed Analyzer Modules.

Note: Changing to the multi component display can be done from each single component display.

Each bargraph shows the start and end of the range for the respective channel. The number in parentheses indicates the number of the selected range for that channel. (F.S. = full scale)

Note: Display may look different depending on installed analyzers.

Use the F3 key (Tags Off) to turn the analyzer tags on or off.

To select a single channel display in the multi channel display, enable the select symbol (>) by pressing the F1 key of the ↓ key.

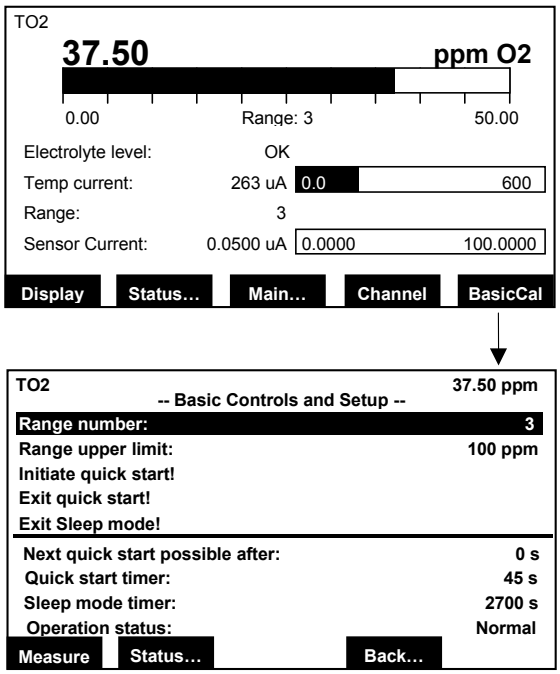
Then use the ↓ or ↑ key to select the line for the desired channel. When the desired channel is marked, select it for single component display by pressing the F1 key.

Figure 3-12. Multi Component Display

d. Basic Controls and Setup

The Basic Controls and Setup menu is used to set the range, initiate and exit a quick start and exit the sleep mode.

See section 0 to change the begin and end concentration values for each of the four ranges.



From the Measure menu press the F5 key (BasicCal) to reach the "Basic Controls and Setup" menu.

Alternately, from the Main menu select the "Analyzer basic controls (calibration) & setup" line.

See Section 1-1a for a description of the quick start process.

Range number:

To select one of the four ranges of the TO2 analyzer, Move the cursor to the "Range number:" line and press the ↵ key. Change the range number using the ↑ and ↓ keys and then press the ↵ key again to save the selection.

Move the cursor to the "Range upper limit:" line to see the full scale concentration limit for the selected range.

Figure 3-13. Basic Controls and Setup

Sleep Mode

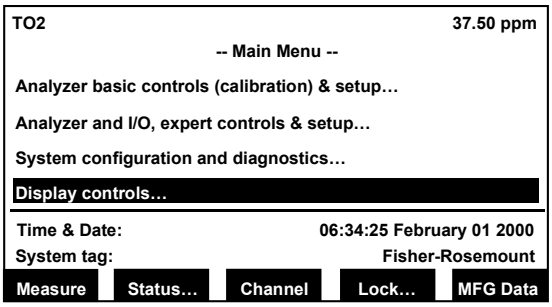
The TO2 analyzer goes into sleep mode if an over range condition occurs to protect the sensor. The "*Sleep mode timer:*" counts down after sleep mode starts for the duration of 2700 seconds (45 minutes). To exit sleep mode prematurely, move the cursor to the "*Exit sleep mode !*" function and press the ↵ key.

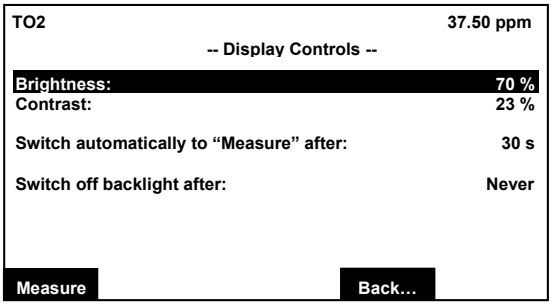
Operation Status

This NGS display variable is not functional on the TO2 analyzer and will remain on "*Normal*."

e. Display Controls

To adjust the display parameters, from the Main menu choose “Display controls…” as follows:





From the Main menu, move the cursor to the “Display controls…” line and press the ↵ key. The menu will display as shown below.

Brightness and Contrast:

These controls can be adjusted to accommodate the ambient lighting conditions. The range of values are 20-100% for brightness and 1-45% for contrast.

These values can be reset to the defaults from the Multi Channel display screen (F1 from the “Measure” screen) by pressing F5 (LCDReset). It can also be reset from the startup screen by pressing F1 (see Figure 3-8).

Figure 3-14. Display Controls

NOTE:

It is possible to change the brightness and contrast values do that the display is no longer visible. In such case, press the F1 key twice to change to the multi component display and then press the F5 key for LCDReset.

Switch automatically to “Measure” after:

This variable line allows setting of the delay time before any selected menu switches back to the Measure screen. The selectable values are:

5 sec

10 sec

30 sec

1 min

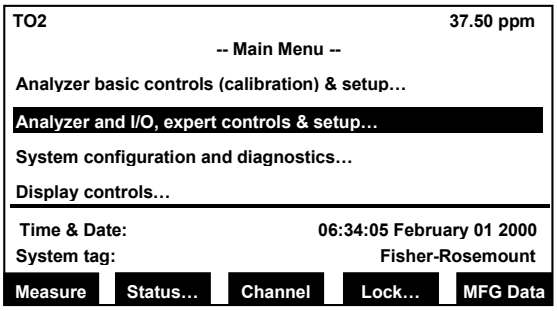
5 min

30 min

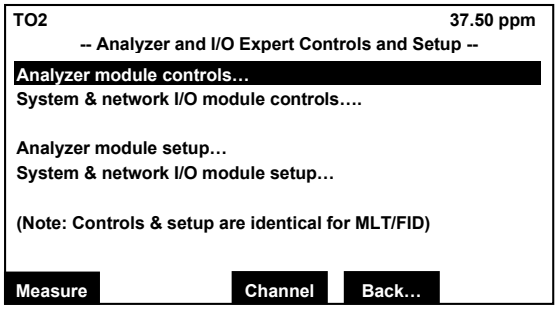
Never

3-5 EXPERT CONTROLS AND SETUP

The Expert Controls and Setup menus provide for the configuration of system and network I/O (SIO & DIO), and for the configuration of various functions on the TO2 analyzer module: To reach the analyzer setup and controls menu , use the following sequence from the main menu:

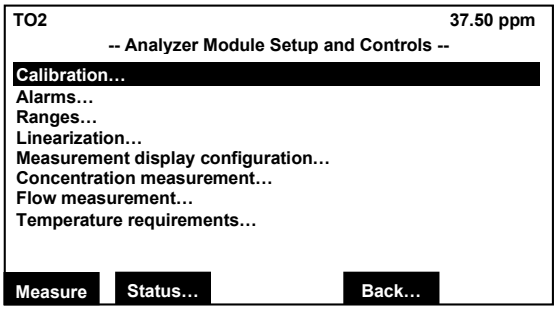


From the Main menu, move the cursor to the "Analyzer and I/O, expert controls & setup…" line and press the ↵ key. The menu will display as shown below.



Select the "Analyzer module control…" line and press the ↵ key. The "Analyzer Module Setup and Controls" menu will display as shown.

Note: Both the "Analyzer Module Controls…" and "Analyzer Module Setup…" lines activate the "Analyzer Module Setup and Controls" menu.



Note: Whenever the "Channel" tag appears above the F3 key, pressing F3 will switch to any other installed analyzer modules, one after the other and eventually back to the TO2 module. When activating any other installed module, the menus will be different depending on that module. See each module's manual for a description of those menus.

Figure 3-15. Expert Controls and Setup

a. Calibration Procedure

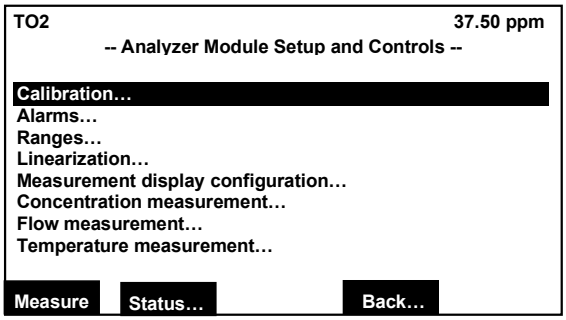
The TO2 analyzer module is fully factory calibrated prior to shipment using certified gas standards. If the analyzer is operated within its specified operating conditions, no regular calibration is required. The zero calibration is very stable and does not require checking more than once a year.

Gas Scale Factor

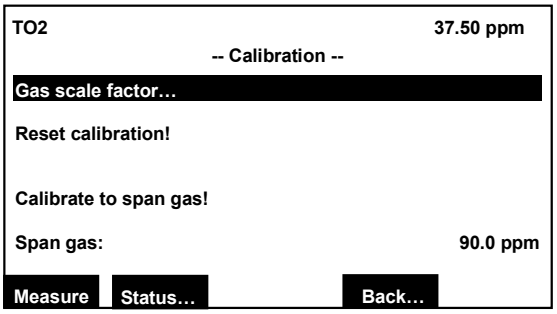
The Gas Scale Factor is used to correct for background gases other than nitrogen. When the background of the sample is other than nitrogen, the diffusion rate of oxygen into the sensor changes. By correcting for the background difference, the diffusion change can be compensated in software. The GSF can 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.

Set the Gas Scale Factor as follows:

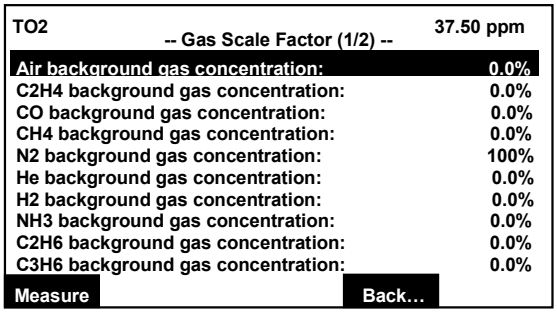
Main Menu
↓
Analyzer and I/O, expert controls and setup…
↓
Analyzer module controls… (Or Analyzer module setup…)
↓



Move the cursor to the "Calibration…" line and press the ↵ key. The "Calibration" menu will display as shown below.



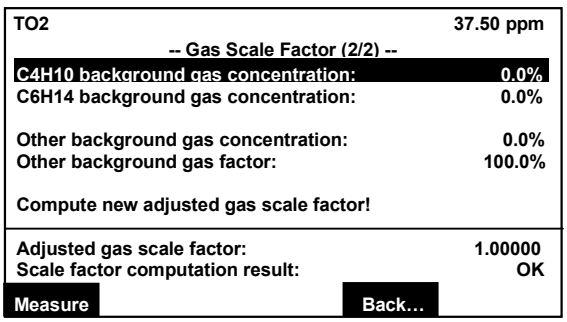
Move the cursor to the "Gas scale factor…" line and press the ↵ key. The "Gas Scale Factor 1/0" menu will display as shown on the next page.



Enter the volumetric percentages of each component present in the sample gas.

Move the cursor to the desired line and press the ↵ key. Then press the ↑ and ↓ keys to adjust the value and the ← and → keys to select the digit. Press the ↵ key again to save the value.

To view and adjust additional background gas components, press the F5 key to display the second menu.



After all the background gas concentrations have been entered, move the cursor to the "Compute new adjusted gas scale factor!" command and press the ↵ key. The analyzer will automatically calculate the new gas scale factor and display the result.

Figure 3-16. Calibration – Gas Scale Factor

Span Calibration

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 span calibration.

Main Menu

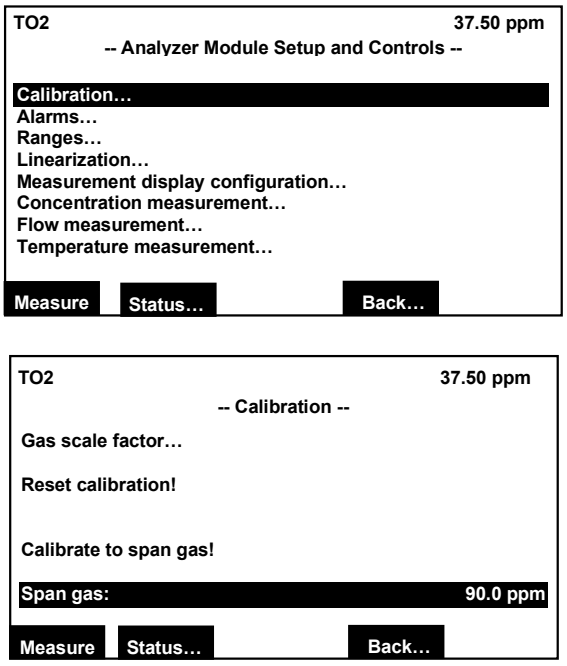
↓

Analyzer and I/O, expert controls and setup…

↓

Analyzer module controls… (Or Analyzer module setup…)

↓



Introduce a suitable span gas to the analyzer and allow the reading to stabilize.

Move the cursor to the “Span gas:” line and press the ↵ key. Enter the correct span gas value by using the ↑ and ↓ keys to adjust the value and the ← and → keys to select the digit. Press the ↵ key again to save the value.

Move the cursor to the “Calibrate to span gas!” line and press the ↵ key. The new span calibration will be calculated.

Figure 3-17. Span Calibration

b. Alarms

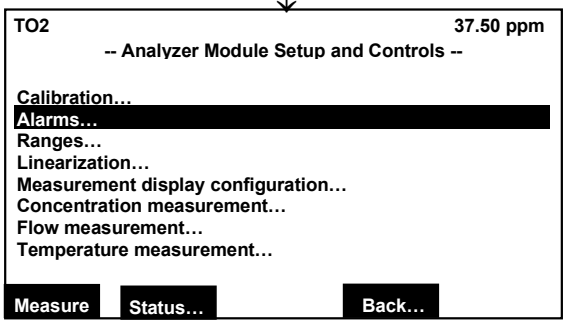
From the Analyzer Module Setup and Controls menu, choose Alarms as follows:

Main Menu

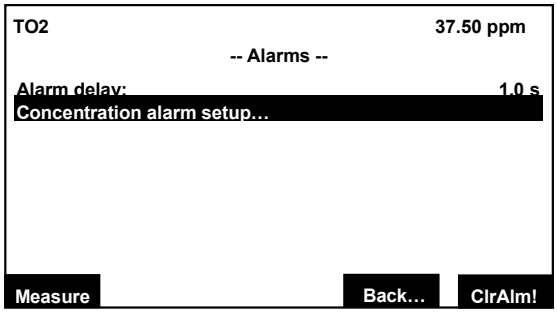
↓

Analyzer and I/O, expert controls and setup…

↓



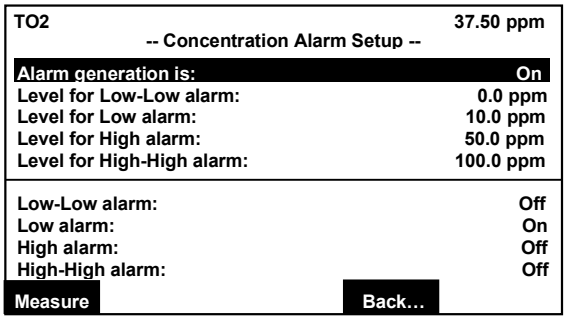
Move the cursor to the “Alarms…” line and press the ↵ key. The “Alarms” menu will display as shown below.



The “Alarm delay” function on the Alarms menu establishes the time between an exceedance and the triggering of the alarm. It is adjustable from 0.0 to 30.0 seconds. Move the cursor to the “Alarm delay:” line and press the ↵ key. Adjust the value using the ↑ and ↓ keys or select the digit using the ← and → keys.

Use the F5 (ClrAlm!) key to clear any activated alarms. This should be done only after the signal has returned to the allowed range to reset the alarm for new events.

Move the cursor to the “Concentration alarm setup..” line and press the ↵ key to reach the “Concentration Alarm Setup” menu as shown below.



To turn alarms on or off, select the “Alarm generation is:” line and toggle it between “On” or “Off.”

Four alarms are available. Select any alarm and adjust the concentration value for triggering that alarm. Setting an alarm concentration to 0.0 will deactivate that alarm.

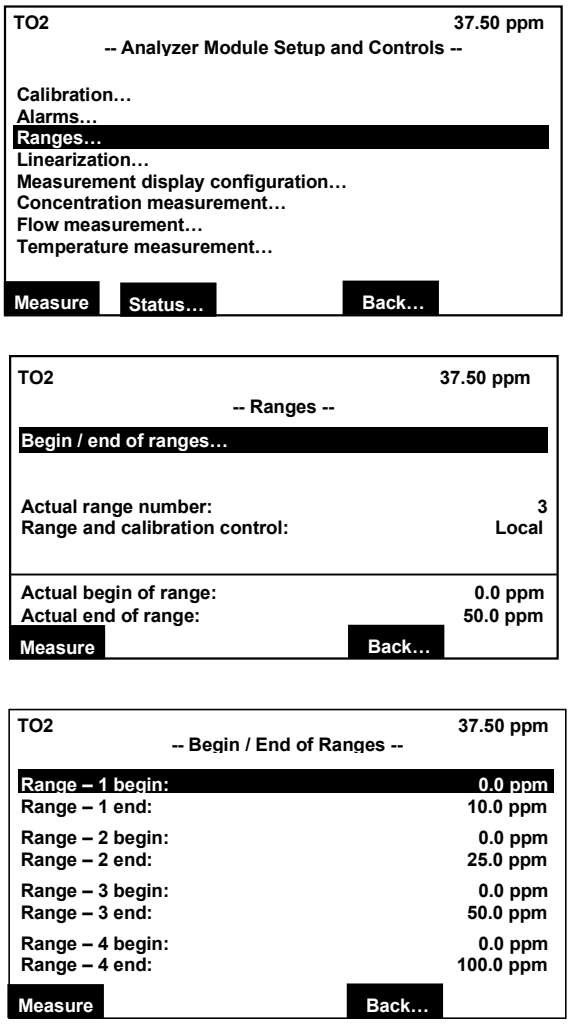
The status of the alarms displays below the line.

Figure 3-18. Alarms

c. Ranges

From the Analyzer Module Setup and Controls menu, choose Ranges as follows:

Main Menu
↓
Analyzer and I/O, expert controls and setup…



Move the cursor to the "Ranges…" line and press the ↵ key. The "Ranges" menu will display as shown below.

The "Actual range number:" line on the Ranges menu shows the current range number being used and allows changing of the range. The range values display below the line.

The "Range and calibration control:" function establishes the authority for setting the analyzer range and starting calibration. The choices are:

Local: The range and calibration are controlled from the local platform. This is the normal mode of operation using the menus.

Program I/O module: The range and calibration are controlled by the programmable I/O board.

Inputs I/O module: The range and calibration are controlled by the DIO digital inputs.

Move the cursor to the Begin/end of ranges.." line and press the ↵ key to reach the "Begin / End of Ranges" menu as shown.

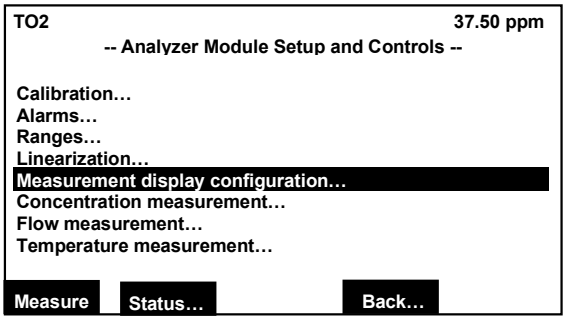
Select any desired line and press the ↵ key to change any of the values using the ↑ and ↓ keys or the ← and → keys to select a digit.

Figure 3-19. Ranges

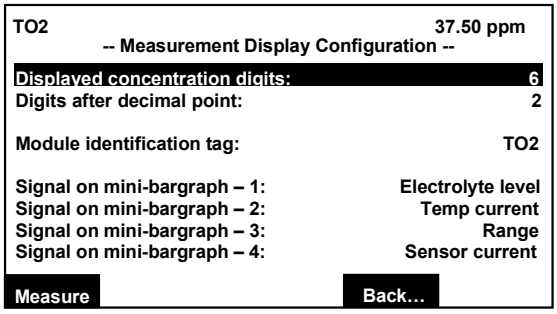
d. Linearization

Linearization is only performed when the sensor is changed. See section 4-3 below.

e. Measurement Display Configuration



Move the cursor to the "Measurement display configuration…" line and press the ↵ key. The "Measurement Display Configuration" menu will be displayed.



The first two lines allow for setting the concentration value displayed precision and number of digits.

The "Module identification tag:" line set the displayed neumonic for the analyzer on all display screens. Select the line and press the ↵ key to change the values using the ← and → keys to select a digit and then the ↑ and ↓ keys to change the value. The values will scroll through all numbers and upper and lowercase letters.

Figure 3-20. Measurement Display Configuration

The "Signal on mini-bargraph" lines are used to set various status values that can display on the four lines available on the single component (Measure) display. Select a line and press the ↵ key. To change the value use the ↑ and ↓ keys. The values will scroll through the allowable selections as follows:

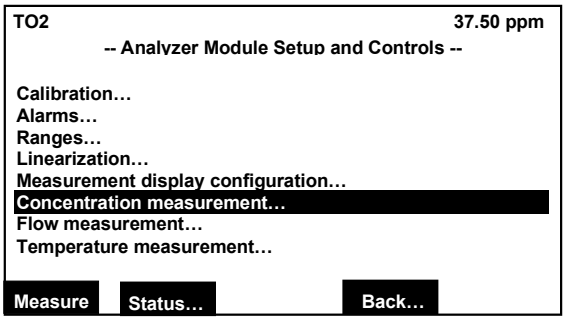
Electrolyte level	Displays "OK" or "Low."
Range	Displays the range number from 1 to 4.
Sample flow	Displays the sample flow rate in ml/min with a bargraph.
Sensor current	Displays the sensor current in uA with a bargraph.
Temp. current	Displays the heater current in uA with a bargraph.
Sensor temp.	Displays the sensor temperature in °C with a bargraph.
Validity	Not functional on the TO2.
Operation status	Not functional on the TO2.

f. Concentration Measurement

This menu establishes several features and parameters of the concentration measurement and display. The values on this menu are not usually changed.

Gas measurement units:	
ppm	Parts per million.
mg/Nm3	Reading adjusted by the conversion factor below.
ppb	Parts per billion.
%	Percent should only be used for higher range sensor models.

Main Menu
↓
Analyzer and I/O, expert controls and setup…



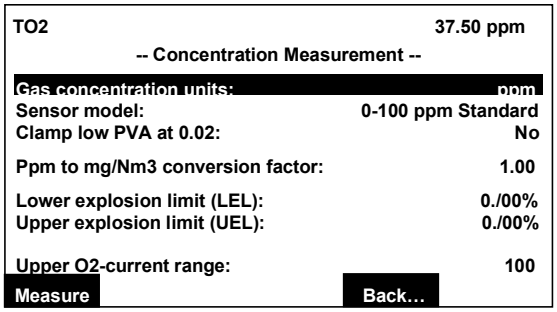


Figure 3-21. Concentration Measurement

Sensor model:

Adjustable for both “Standard” and “Stabel” models in the following ranges:

0-50 ppm

0-100 ppm

0-500 ppm

0-1000 ppm

0-5000 ppm

0-10000 ppm

0-5%

0-10%

0-25%

The “Stabel” sensor model contains a special electrolyte that is less susceptible to small concentrations of acids in the sample stream.

Clamp low PVA to 0.02:

This parameter is used for very low oxygen concentration levels where the sensor current may be unstable about zero. Normally this would be set to “No.”

ppm to mg/Nm3 conversion factor:

The ppm to mg/Nm^3 conversion factor in the range of 1 to 100000. The conversion factor depends on the sample gas used.

Lower [Upper] explosion limit (LEL) [UEL]:

The parameters are used for the CLD and PMD modules and do not apply to the TO2 They should both be set at 0.00%.

Temperature compensation at span gas:

This parameter is used to set the upper temperature limit for the sensor which can occur at the upper range of oxygen concentration. The range is 10-1000 and the default setting is 100. When the temperature exceeds this level the module goes into sleep mode.

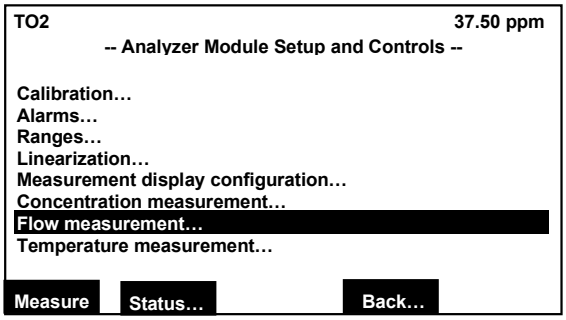
g. Flow Measurement

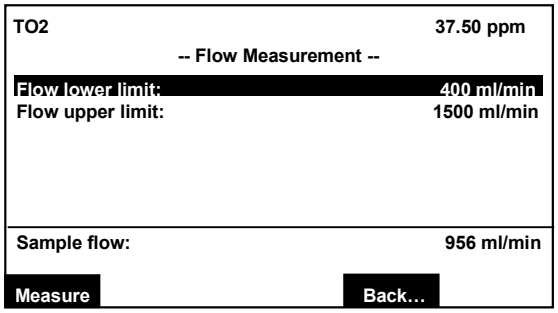
Sample flow should be maintained within a range suitable for the desired accuracy. See *Effect of Flow* in Section 1-5a.

Main Menu

↓

Analyzer and I/O, expert controls and setup…





Set the upper and lower alarm limits for sample flow as desired.

The actual flow rate displays below the line.

Figure 3-22. Flow Measurement

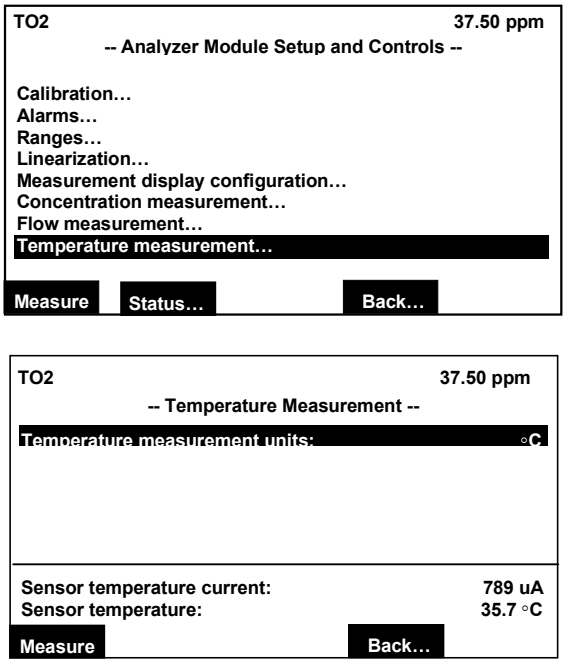
h. Temperature Measurement

Used to set the temperature display units.

Main Menu

↓

Analyzer and I/O, expert controls and setup…



Set the upper and lower alarm limits for sample flow as desired.

The actual flow rate displays below the line.

Figure 3-23. Temperature Measurement

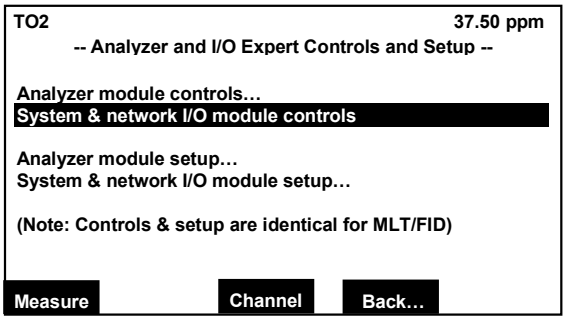
3-6 SYSTEM & NETWORK I/O MODULE CONTROLS (SETUP)

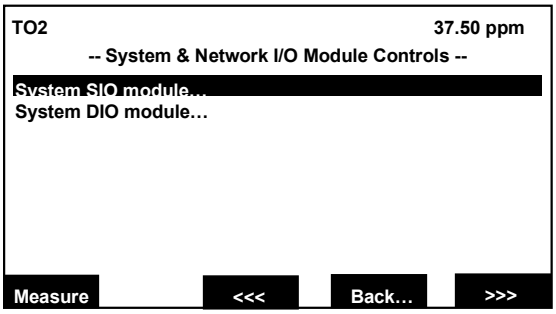
This menu provides access to several submenus for setting parameters of the SIO (Signal Input/Output) and DIO (Digital Input/Output) of the analyzer.

Main Menu

↓

Analyzer and I/O, expert controls and setup…





Press the ↵ or → keys to change to the desired submenu.

If there is no SIO module installed in the analyzer, a corresponding message will be displayed instead of the menu.

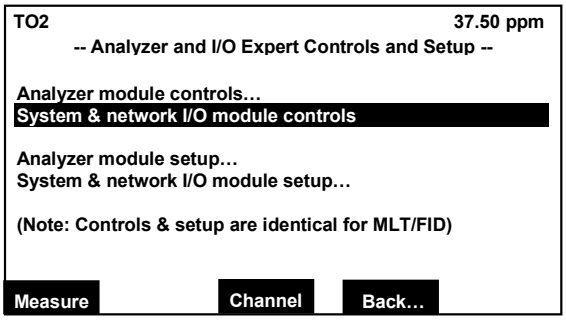
Figure 3-24. System & Network I/O Module Controls

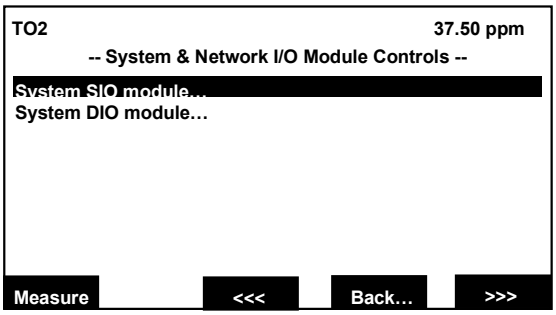
a. System SIO

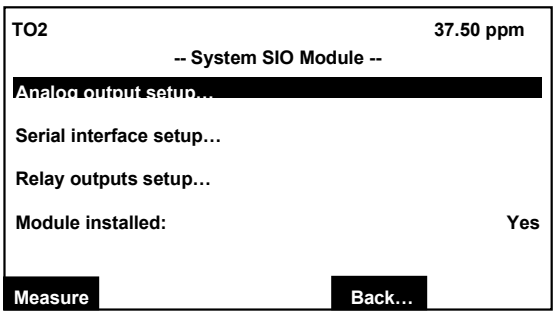
This menu provides submenus for setting up the output configurations of the SIO signals. The SIO board can contain 2 to 8 analog outputs, a serial interface (RS232 or RS485), and three relay outputs. General configuration of the SIO board is contained in its own manual.

If the SIO board is installed in the analyzer, the line “Module installed:” must be set to “Yes.”

Main Menu
↓
Analyzer and I/O expert controls and setup…







Select a line with the ↑ or ↓ keys.

Select the variable or change to the submenu with the ↵ or → keys.

Select the variable parameter with the ↑ or ↓ keys.

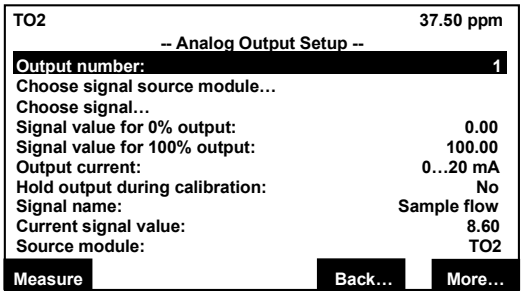
Confirm the new value with the Enter ↵ key or cancel and return to the last value with the F2 key.

The “Module installed:” parameter is set to “Yes” or “No” depending on whenter or not the SIO module is installed.

Figure 3-25. System SIO Module

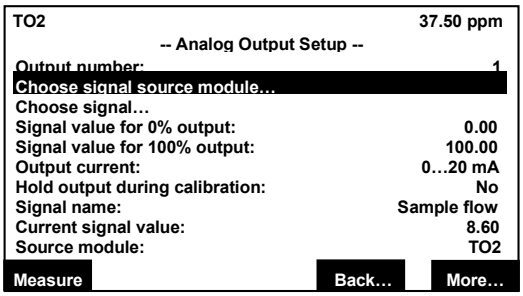
b. Analog Output Setup

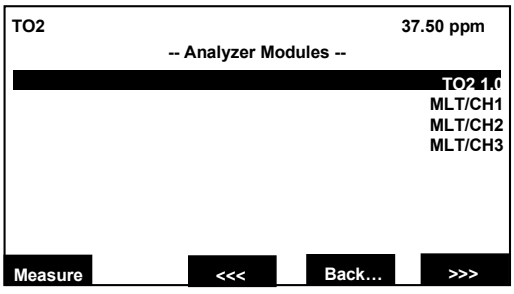
In the System SIO Module menu (Figure 3-25), select Analog output setup…



Select analog output number

Choose the desired analog output (1-8) to set the parameters. The number of outputs depends on the analyzer configuration as 2, 4, 6, or 8.





Choose the analyzer module

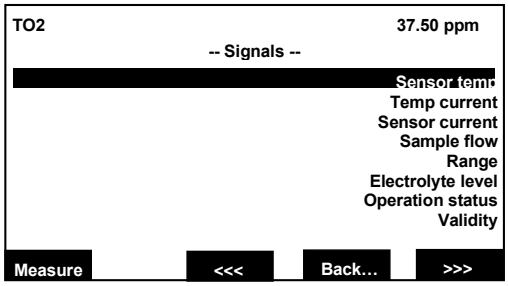
Select the “Analyzer Modules” submenu by selecting the “Choose signal source module…” line and pressing the ↵ key.

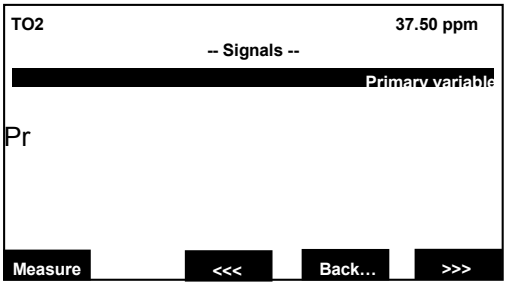
Select the tag of the desired reference channel with the ↑ or ↓ keys and then press the ↵ or → key. The display will return to the previous menu automatically and the selected reference channel will be displayed in the “Source module:” line.

Choose signal

Select the “Signals” submenu by selecting the “Choose signal…” line and pressing the ↵ key.

Note: the parameters “Operation status” and “Validity” are not functional on the TO2. The list of signals will depend on the module chosen.

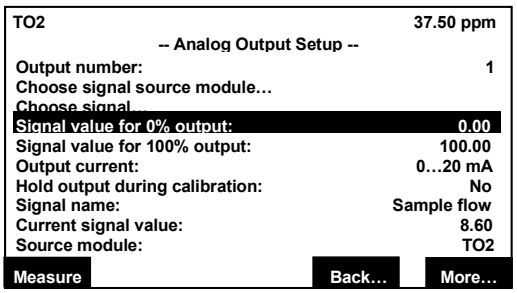




Press the F5 key to go to a further menu to choose the Primary Variable signal for the analog output. The Primary Variable is the actual oxygen concentration.

The signal chosen here will be applied to the analog output (1-8) chosen above.

Signal value for 0% (100%) output



It is possible to set the signal value for 0% output and for 100% output so as to output only a portion of the entire range.

Example:

Range from 0 to 1000 ppm

0% value to be 400 ppm, 100% value to be 700 ppm.

Analog output normally: 0V = 0 ppm, 10v = 1000 ppm

After changing the output scaling: 0V = 400 ppm, 10V = 700 ppm

Change to the “Signal value for 0% output:” line and adjust the value to 400. Then change to the “Signal value for 100% output:” line and adjust the value to 700.

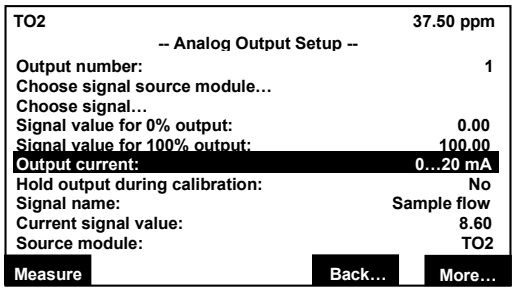
NOTE:

If the measurement range is changed, the settings done in this menu will revert back to the standard values of the range. The output values can be changed permanently in the menu “Begin and End of Ranges.” See section 0.

NOTE:

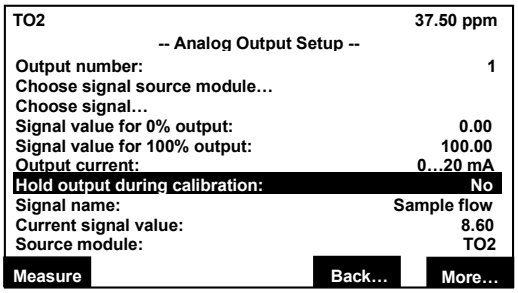
The signal range of the analog output should not be less than the smallest range of the channel. Otherwise the analog output may exhibit excessive noise.

Output current



Select the desired output range in the “Output current:” line. The options are 0…20 mA or 4…20 mA.

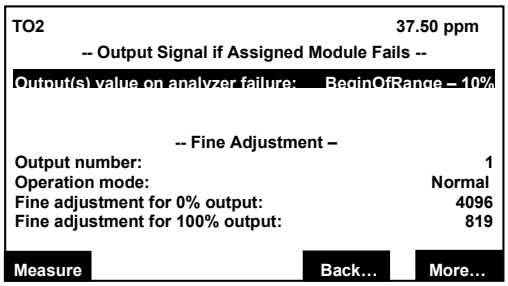
Hold output during calibration



Enable this option to hold the analog output to the last value during calibration.

Pressing the F5 (More…) key changes to the submenus “Output Signal if Assigned Module Fails” and “Fine Adjustment.”

Output(s) value on analyzer failure



Choose the desired signal level to cause a failure condition. The choices are:

Actual

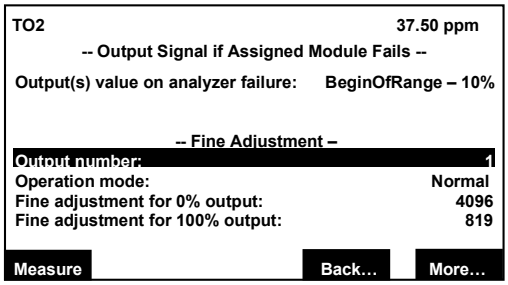
BeginOfRange

EndOfRange

BeginOfRange-10%

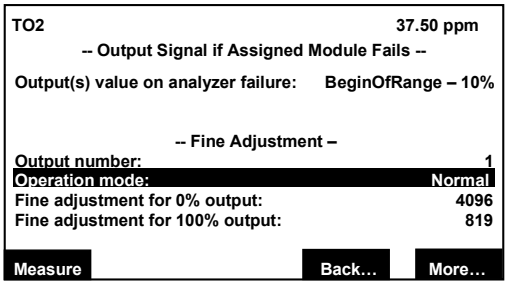
BeginOfRange+10%

Output number



Choose the output number (1-8) for setting the fine adjustment.

Operation mode



Normal: The absolute measurement signal will be sent to the analog output.

Adjust 0V: Used to set the display equal to the analog output for 0V and 0 mA. Life zero signals (4-20 mA and 2-10V) are set automatically and cannot be adjusted.

Adjust 10V: Used to set the display equal to the analog output for 10V and 20 mA.

Select the “Fine adjustment for 0% output” and/or “Fine adjustment for 100% output” lines with the ↵ or → key. Adjust to the desired value with the ↑ or ↓ key and confirm with the ↵ key. The range of values are:

3000 to 6000 for 0% (default 4096)

600 to 1000 for 100% (default 819)

The last three lines of the “Analog Output Setup” menu are display only for configuration values of the analog output.

Signal name: The name of the signal chosen in the “Choose signal” menu.

Current signal value: The current value of the variable.

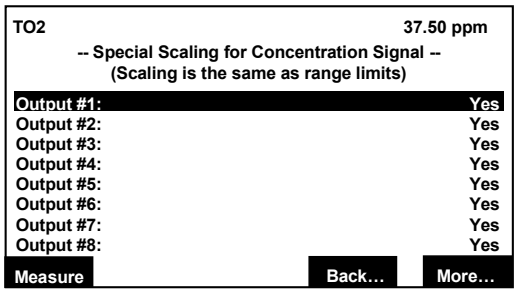
Source module: The name of the module chosen in the “Choose signal source module” menu.Pressing the F5 (More…) key changes to the submenu “Special Scaling for Concentration Signal.”

This menu allows for the setting of each of the 8 outputs to be the same as the range limits “Yes” or as set on the previous menus.

See section 3-5c for setting the range limits.

Pressing F5 (More…) changes to the submenu “Special Scaling for Concentration Signal”.

Special Scaling for Concentration Signal



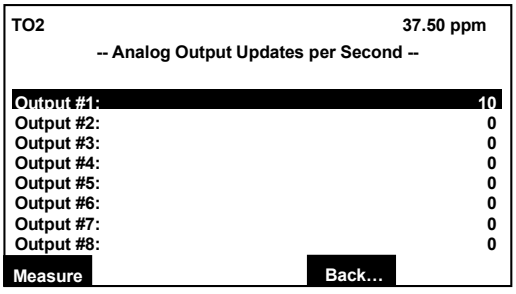
This menu allows for the setting of each of the 8 outputs to be the same as the range limit "Yes" or as set on the previous menus.

See Section 3-5c, Ranges for setting the range limits.

Pressing F5 (More…) changes to the submenu Analog Output Updates per Second.

Pressing the F5 (More…) key changes to the submenu "Analog Output Updates per Second."

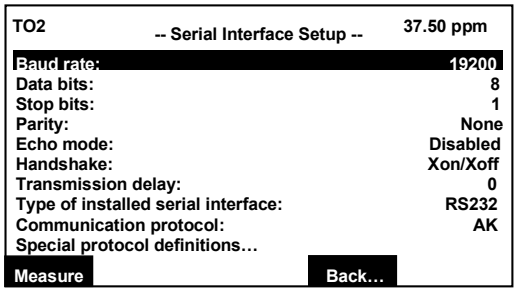
Analog Output Updates Per Second



This menu allows for the setting of the update rate for each of the 8 outputs.

c. Serial Interface Setup

From menu System SIO Module (Figure 3-25), select Serial interface setup…



In this menu, the parameters for data transfer between the analyzer and external devices are set. The choices in this menu depend on the configuration of the analyzer. The full specification of the serial interface is described in its own manual.

Options:

Baud rate: 300, 1200, 2400, 4800, 9600, 19200

Data bits: 7, 8

Stop bits: 1, 2

Parity: None, Even, Odd

Echo mode: Enabled, Disabled

Handshake: None, Xon/Xoff

Transmission delay: 0…100.

Type of installed serial interface:

RS232

RS485/2w

RS485/4w

RS485/4w bus

None

Communication protocol:

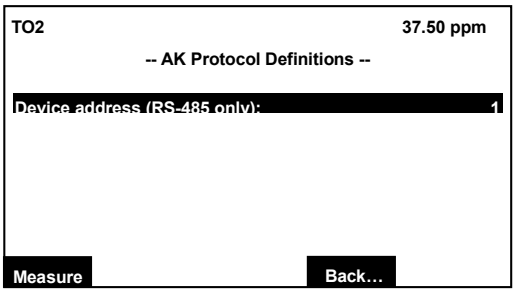
AK

MODBUS RTU

None (not applicable to TO2)

NOTE:

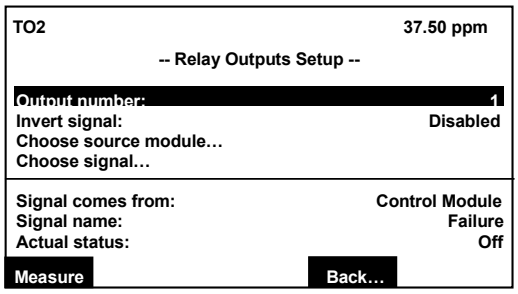
The "special protocol definitions…" line accesses a submenu for setting the parameters of the AK and MODBUS TRU communication protocols.



The value can range from 1 to 50.

d. Relay Outputs Setup

From menu System SIO Module (Figure 3-25), select Relay outputs setup…



Select the "Configuration of relay outputs…" line in the "Local SIO Configuration Parameters" menu to change to the submenu "Relay Output Setup" to attach signals to the relay outputs.

There are three relays on the SIO board. The contact logic can be set with a jumper on the SIO board to select NO (normally open) or NC (normally closed). Full details of the SIO board are contained in its own manual.

The three lines displayed at the bottom of the "Relay Outputs Setup" menu show the current status of the selected relay output.

Signal comes from: The module chosen from the "Choose Source Module" menu.

Signal name: The signal chosen from the "Choose Signal" menu.

Actual status: The current status of the singal; Off or On.

Output number:

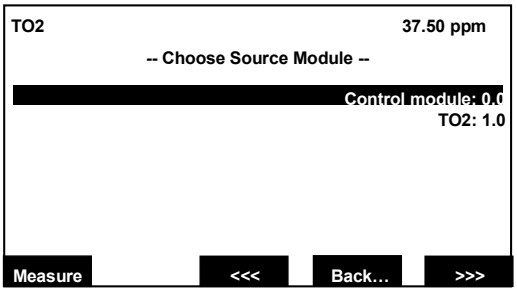
Corresponds to the relay number 1-3.

Invert signal:

"Disabled" signal is normal, "Enabled" signal is inverted.

Choose source module..

Brings up menu shown below.

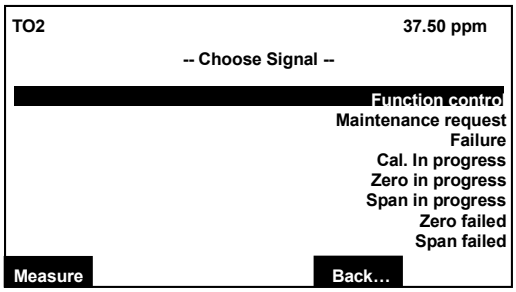


Choose desired source module for the relay output number (1-3) being configured.

The list of modules will depend on the installed modules.

Choose signal…

Brings up menu shown below.



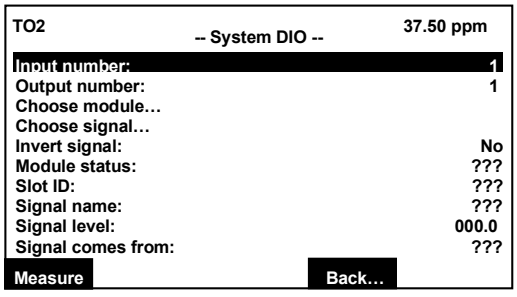
Choose desired source module for the relay output number (1-3) being configured.

The list of modules will depend on the installed modules.

e. System DIO

Selecting “System DIO module…” from the “System & Network I/O Module Controls” menu (Figure 3-25) provides submenus for setting up the output configurations of the DIO signals. The DIO board is comprised of 8 digital inputs and 24 digital outputs. Functions of supported analyzer modules can be attached to each input and a signal to each output. Further detailed information about the DIO board is contained in its own manual.

If there is no DIO module installed in the analyzer, a corresponding message will be displayed instead of the menu.



For detailed information on the installation and setup of the DIO module, see the NGA 2000 Platform manual p/n 760006.

3-7 SYSTEM CONFIGURATION AND DIAGNOSTICS

This menu and its submenus provides for setup of the system parameters for the platform. The menu is accessed from the Main Menu.

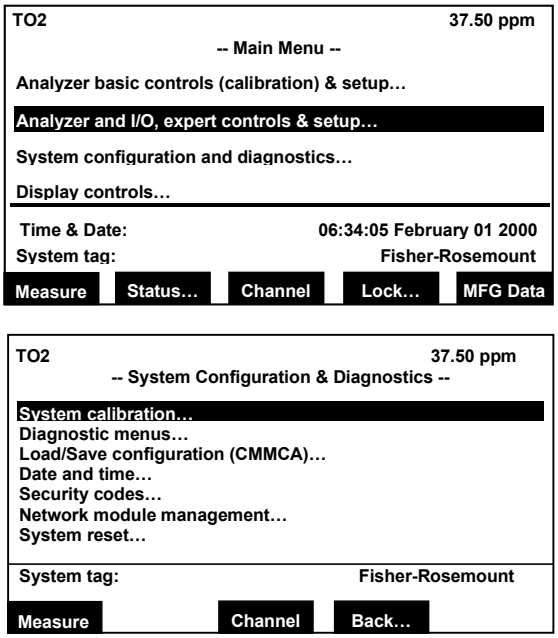


Figure 3-26. System Configuration and Diagnostics

The following is a short overview of the contents of the menus:

System calibration…

Not used in this module

Diagnostic menus…

Control module diagnostics…

Not used in this module

Analyzer module diagnostics…

Software error messages

Loading/saving configuration parameters…

Sending or loading of analyzer configuration data by the serial interface

Date and time…

Date and time setup of the analyzer

Security codes…

Setup of security codes for the different operating levels

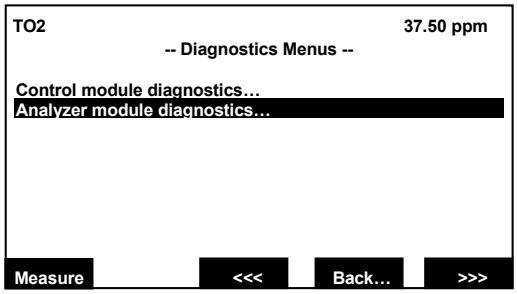
Network module management…

Not used in this module

System reset…

System reset and re-initializing of the analyzer

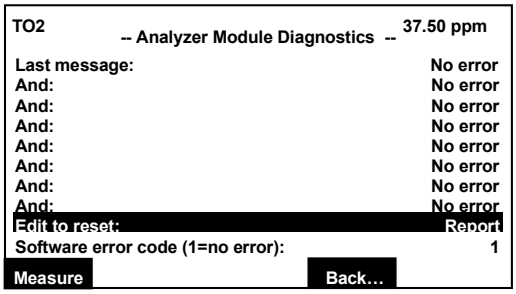
a. Diagnostic Menus



This menu has two submenus for viewing and resetting any software errors.

The “Control module diagnostics” menu is not applicable to this analyzer model.

Analyzer Module Diagnostics



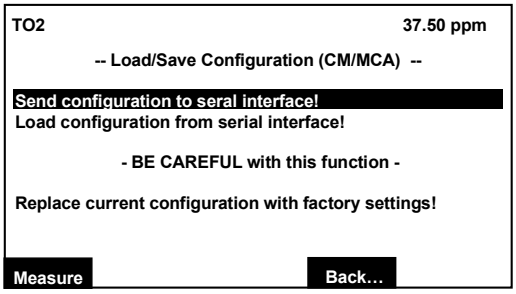
This menu displays any software error messages of the analyzer.

Options:

Make a note of the error message.

Reset the message: Press the ↵ or → key in the “Edit to reset:” line. Choose “Reset” with the ↑ or ↓ key and confirm with the ↵. The error messages will disappear if the cause of the error no longer exists and the tag “Report” will appear. If the error message remains, contact customer service.

Load/Save Module Configuration



This menu provides several functions to send or load configuration data of the analyzer through the serial interface. These functions are only available if an SIO with serial interface is installed.

NOTE:

When loading configuration data all of the current configuration in the memory will be overwritten.

This function allows the setting of flow units for the current channel and provides a display of the actual flow of the channel.

Send configuration to serial interface !

The configuration data in memory will be sent through the serial interface of the analyzer to an external computer or other device.

Load configuration data from serial interface !

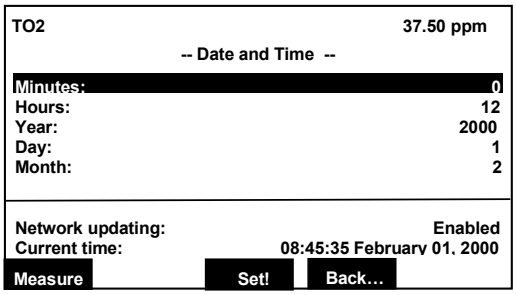
Configuration data will be loaded into memory from an external computer or other device through the serial interface of the analyzer. The current configuration in memory will be overwritten.

Replace current configuration with factory settings !

Deletes the configuration in memory and re-establishes the factory default setting from the Flash-EPROM.

Date and Time

This menu is used to set the date, time and format for the analyzer.



Select a line with the ↑ or ↓ keys.

Press the ↵ or → keys to select the parameter.

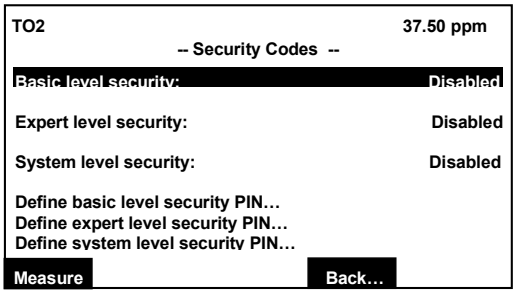
Select any digit with the ← or → key and set a new value with the ↑ or ↓ key.

Network updating:
Not used with this model.

Set up a new date or time:
Set the "Minutes," "Hours," "Year," "Day," or "Month" lines and make any desired adjustments. Press the F3 key to set the new time and date.

The "Current time" line will change to reflect the new time and date set.

Security Codes



This menu is used to set the security codes for the three levels of security.

CAUTION

If a security code is lost or forgotten, there is no possibility of entering the locked security level.

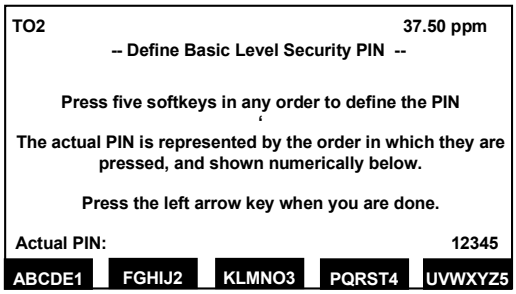
Setting the code numbers:

Enter the submenu for the desired security level to set the PIN. The default values are:

Basic level: 12345
Expert level: 54321
System level: 12345

Use the function keys F1 to F5 to enter the numerical security code in the desired sequence. The numbers will appear in the "Actual PIN" line as they are entered. The characters displayed on the function keys cannot be entered as code numbers.

Example:



Press the ← key to return to the "Security setup" menu.

Enable the security code

Select the desired security level line to enable. Change the parameter to "Enabled."

CAUTION

If System level is enabled, it will not be possible to re-enter the Security Setup and change back to Disabled without the code.

Entering a level locked by security code

For example, return to the Main Menu by pressing the F4 key twice.

Attempt to enter an enabled level by choosing the menu line. A new menu will appear requesting entry of the security code. Enter the correct code using the correct sequence of function keys. The asterisk (*) symbol will appear for each entry.

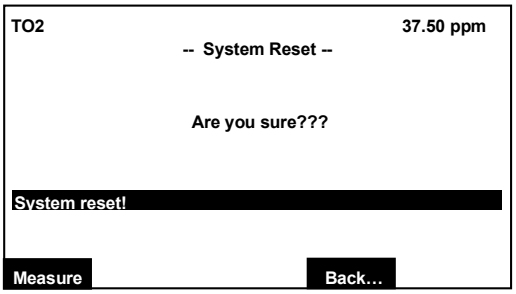
If the code is incorrect, the message "Ready" will appear in the line and access to the locked level is prevented. If the code is correct, the display will change to the locked level after the last digit of the correct code is entered.

NOTE

Once a locked security level has been entered, it will remain unlocked even after exiting to a different security level. To protect the level, press the F4 (Lock..) key in the Main Menu after returning from the locked level.

System Reset

Resets the analyzer to the initializing mode which is the same as switching the power off and then on.



SECTION 4
MAINTENANCE AND SERVICE

4-1 OVERVIEW

DANGER

ELECTRICAL SHOCK HAZARD

Operate this equipment only when covers are secured. Servicing requires access to live parts which can cause death or serious injury. Refer servicing to qualified personnel. For safety and proper performance, this module must be connected to a properly grounded three-wire source of electrical power.

DANGER

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.

WARNING

HIGH PRESSURE GAS CYLINDERS

This analyzer requires use of pressurized gas. See General Precautions for Handling and Storing High Pressure Cylinders page P-3.

WARNING

PARTS INTEGRITY

Tampering or unauthorized substitution of components may adversely affect safety of this product. Use only factory documented 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.

4-2 SENSOR

CAUTION

CAUSTIC LIQUID

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

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.

a. Refilling

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 4-2b for the proper procedure for replacing electrolyte.

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

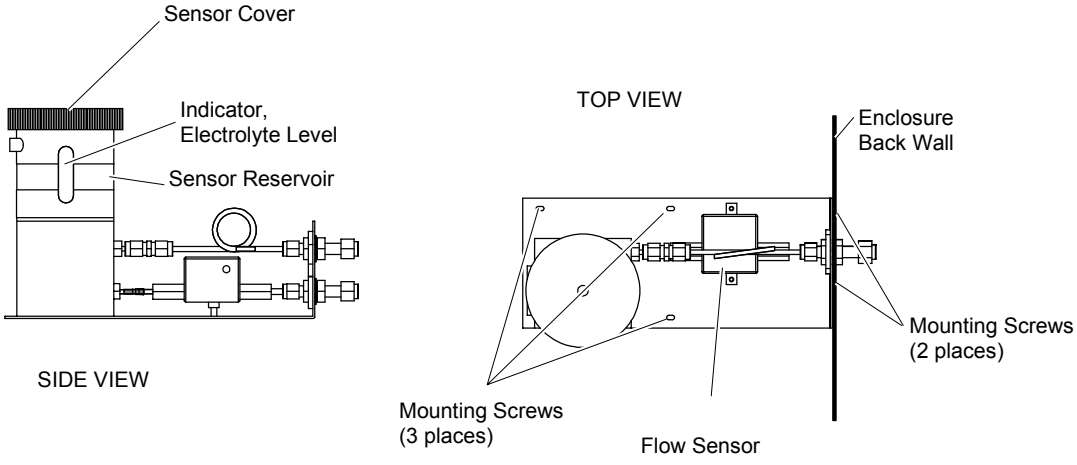


Figure 4-1. Sensor Assembly

b. 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:

CAUTION

CAUSTIC LIQUID

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

1. 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.

2. 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). Remove the 5 screws and retain. Do not lose the screws - they have metric threads.

3. Disconnect the Sensor signal connector (J5) and the Flow Sensor connector (J6) from the power board.

4. Remove the complete Sensor Assembly from the Analyzer Module.

5. Remove the black sensor cover and invert the Sensor Assembly over a suitable receptacle.

6. Flush the Sensor twice with deionized water. Dispose of the discarded electrolyte and rinse water in accordance with National, Federal, State and Local regulations.

7. Refill the Sensor with electrolyte as instructed in Section 4-2b.

8. Reinstall the Sensor Assembly and reconnect J5 and J6 to the power board.

c. 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. Obtain a replacement sensor from the factory. Prior to installation of a new Sensor, perform the leak check described in Section 4-2d.

To replace the Sensor:

1. Remove the Sensor Assembly and remove the electrolyte as described in Section 4-2b.

2. Reinstall the black sensor cover to catch any residual electrolyte.

3. 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.

4. Install replacement Sensor in reverse order.

5. Check Sensor for leaks and add electrolyte as described in Section 3-5d.

6. 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 new linearization data as described in Section 4-3**.**

d. Sensor Lleak Check

Before adding electrolyte to the Sensor, it is recommended to check the Sensor for

possible leakage caused by damage in shipment.

1. If not already removed from the analyzer, remove the top cover of the analyzer module and locate and remove the five mounting screws which hold the Sensor Assembly (Sensor, flowmeter, plumbing) to the module. Care should be taken not to lose the screws as they have metric threads.

2. Carefully lift out the Sensor Assembly. Place on a flat surface and remove the black Sensor cover by unscrewing clockwise.

3. Refill the the Sensor per Section 4-2a, steps 2 through 5.

4. Allow the Sensor to stand for approximately 15 minutes, then check for leaks around the base of the reservoir, at seams and corners.

5. If a leak is found, drain the Sensor. Contact the factory before proceeding.

6. If no leaks are detected drain the Sensor, refill with one bottle of electrolyte. Use the entire contents of the bottle.

NOTE

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

7. Reinstall the black Sensor cover and carefully install the Sensor into the Analyzer Module.

NOTE

Do not tilt Sensor excessively as electrolyte may leak.

4-3 LINEARIZATION

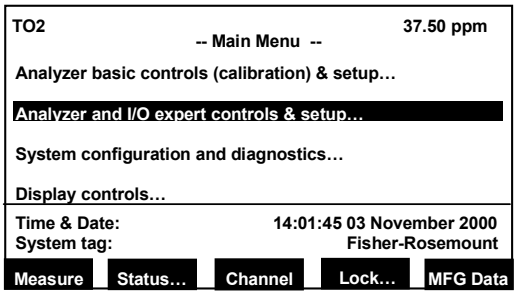
After installation of a new Sensor, it will be necessary to load the new calibration data supplied with the Sensor.

NOTE

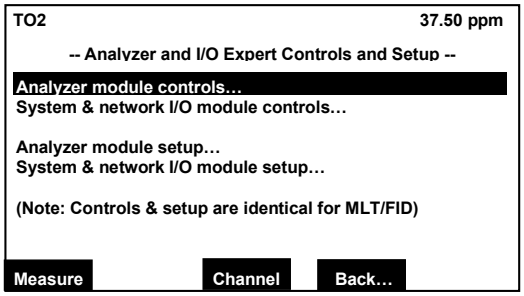
It is not necessary to load linearization data on a new analyzer which has been filled with electrolyte. The data is pre-loaded at the factory.

The data supplied with the new Sensor and must be entered exactly as shown the the Senosr data sheet.

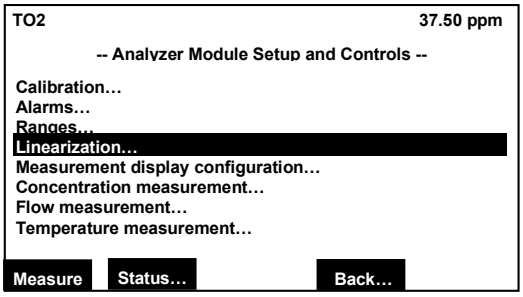
From the Main Menu



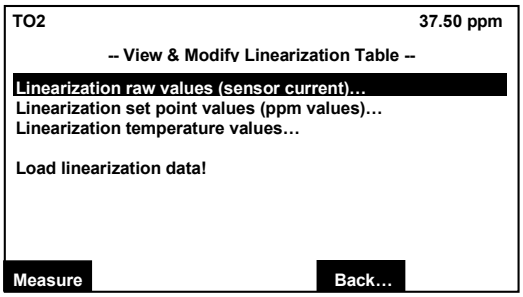
Slect Analyzer and I/O expert controls & setup…



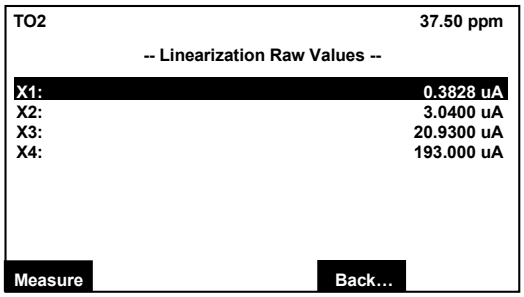
Select Analyzer module controls… or Analyzer module setup…



Select Linearization…

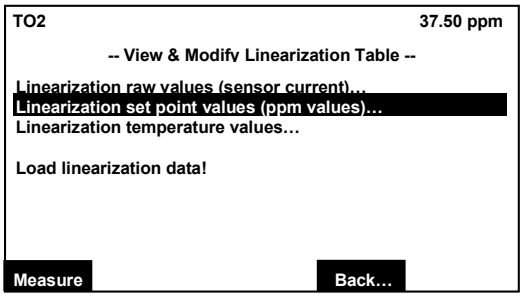


Select Linearization raw values (sensor current)…

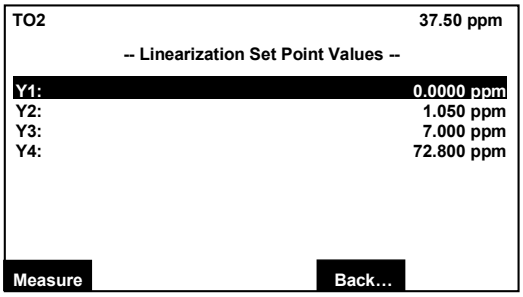


Enter the data for each raw value point.

Return to the previous menu (Back…)

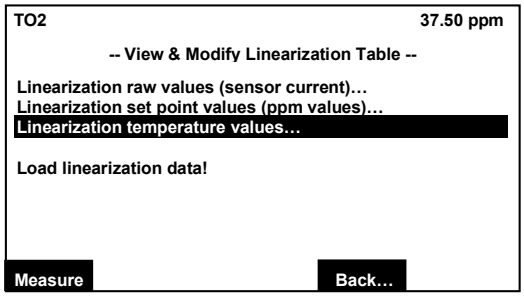


Select Linearization set point values (ppm values)…

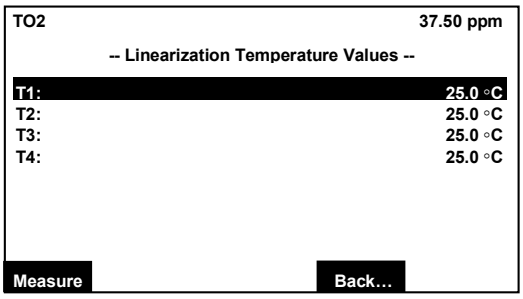


Enter the data for each set point value.

Return to the previous menu (Back…)

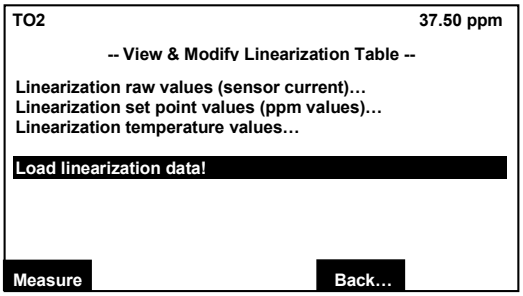


Select Linearization temperature values…



Enter the data for each temperature value point..

Return the the previous menu (Back…)



Select Load linearization data! press enter. The new data is now loaded into the analyzer and accurate measurements can be obtained.

4-4 FLOW SENSOR REPLACEMENT

See Figure 1-2 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.

4-5 ELECTRONIC COMPONENTS

a. 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 2-4. 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.

b. Printed Circuit Boards

All three printed circuit boards can be replaced, if necessary. Refer to Figure 1-2 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.

SECTION 5
TROUBLESHOOTING

5-1 TROUBLESHOOTING

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

a. Failure to purge down to ppm levels

Prior to conducting any changes to the system, try running a quick start sequence (see section 3.4) 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.

b. 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.

c. 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 4.2 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 over-pressurization or poisoning. Sensor replacement may be required as described in section 4.3 above.

SECTION 6
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.

6-1 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	NGA 2000 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)

6-2 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 7
RETURN OF MATERIAL

7-1 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.

   Rosemount CSC will provide the shipping address for your instrument.

   In no event will Rosemount be responsible for equipment returned without proper authorization and identification.
2. Carefully pack the defective unit in a sturdy box with sufficient shock absorbing material to ensure no additional damage occurs during shipping.
3. 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.
4. 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.

7-2 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

7-3 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.
Phone: 1-714-986-7600
FAX: 1-714-577-8006

SECTION 8
INDEX

Q

R

S

Material Safety Data Sheet

PRODUCT: **ELECTROLYTE**[1]
PART NUMBER: **904676**

24 HOUR EMERGENCY TELEPHONE NUMBER: CHEMTREC (800) 424-9300

SECTION I - GENERAL

Distributor: **Rosemount Analytical Inc.**
4125 East La Palma Avenue, CA 92807-1802
714-986-7600

Chemical name and synonyms	Potassium Hydroxide Solution, 1N
Trade name and synonyms	DF-E05
Chemical family	Inorganic Base
Formula	KOH (5%-6% by weight in water and inorganic salts)
CAS Number	na

SECTION II – HAZARDOUS INGREDIENTS

Hazardous mixtures of other liquids, solids or gases	none

SECTION III – PHYSICAL DATA

Boiling point	104.5°C
Melting point	-3.5°C
Vapor pressure	16.1mm Hg @ 20°C
Vapor density (air=1)	NA
Specific gravity (H2O=1)	1.15
% Volatile by volume	NA
Evaporation rate (H2O=1)	NA
Solubility in water	Complete
Appearance and odor	Colorless liquid, no odor

SECTION IV – FIRE AND EXPLOSION HAZARD DATA

Flash point	Non-combustible
Extinguishing media	Dry chemical, carbon dioxide, water spray or foam
Special fire fighting procedures	Extinguish using agents indicated, do not use water directly on material.
Unusual fire and explosion hazards	Not combustible. Highly corrosive. Contact with some metals may generate hydrogen gas.

SECTION V – REACTIVITY DATA

Stability	Unstable
Conditions to avoid	May ignite combustibles (wood, paper, oil, etc.)
Incompatibility (material to avoid)	Acids, flammable liquids, organic halogens, metals (aluminum, lead, tin, zinc)
Hazardous decomposition or by-products	Thermal decomposition products may include corrosive fumes of Potassium Oxide and toxic Oxides of Carbon.
Hazardous polymerization	Will not occur.

[1] Is contained in Model TO2 Ship Kit

SECTION VI – HEALTH HAZARD DATA

Threshold limit value	NA
Routes of entry	Inhalation, eyes, skin, ingestion
Effects of overexposure	Corrosive to tissue. Inhalation of mist may cause respiratory tract damage,
Emergency & first aid procedures	*Eyes - Corrosive*, immediately flush with water for at least 15 minutes. Call a physician. *Skin - Corrosive*, remove contaminated clothing. Wash with soap or mild detergent and large amounts of water at least 15 minutes. Call a physician. *Inhalation - Corrosive*, remove to fresh air immediately. Get medical attention immediately. *Ingestion - Corrosive/toxic*, give water or milk immediately and allow vomiting to occur, keeping head below hips to prevent aspiration. Get medical attention immediately.

SECTION VII – SPILL OR LEAK PROCEDURE

Steps to be taken in case material is released or spilled	Neutralize with dilute acid, take up with sand or other absorbent material and place in container for disposal.
Waste disposal method	Disposal must be in accordance with standards applicable to generators of hazardous waste, 40CFR262. EPA Hazardous waste number D002.

SECTION VIII – SPECIAL PROTECTION INFORMATION

Respiratory protection	NA
Ventilation	mechanical (general)
Protective gloves	rubber gloves
Eye protection	splash proof or dust-resistant safety goggles with face shield
Other protective equipment	appropriate protective clothing and equipment to prevent possibility of skin contact. Eye wash fountain, safety shower.

SECTION IX – SPECIAL PRECAUTIONS

Precautions to be taken in handling and storing	Store away from incompatible substances.
Other precautions	none

SECTION X – TRANSPORTATION

DOT Hazard Classification 49CFR172.101: Potassium Hydroxide Solution, Class 8, UN1814, Packing Group II

- Exceptions: When transported by Air 49CFR173.154 (b) (1) + (2)
- Exceptions: By Motor Vehicle or Rail Car 49CFR173.154 (d) (1)

IATA Hazard Classification 4.2: Potassium Hydroxide Solution, Class 8, UN1814, Packing Group II
Exceptions: 2.8 (Ltd. Qty.)

ROSEMOUNT WARRANTY

Rosemount warrants that the equipment manufactured and sold by it will, upon shipment, be free of defects in workmanship or material. Should any failure to conform to this warranty become apparent during a period of one year after the date of shipment, Rosemount shall, upon prompt written notice from the purchaser, correct such nonconformity by repair or replacement, F.O.B. factory of the defective part or parts. Correction in the manner provided above shall constitute a fulfillment of all liabilities of Rosemount with respect to the quality of the equipment.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF QUALITY WHETHER WRITTEN, ORAL, OR IMPLIED (INCLUDING ANY WARRANTY OF MERCHANTABILITY OF FITNESS FOR PURPOSE).

The remedy(ies) provided above shall be purchaser's sole remedy(ies) for any failure of Rosemount to comply with the warranty provisions, whether claims by the purchaser are based in contract or in tort (including negligence).

Rosemount does not warrant equipment against normal deterioration due to environment. Factors such as corrosive gases and solid particulates can be detrimental and can create the need for repair or replacement as part of normal wear and tear during the warranty period.

Equipment supplied by Rosemount Analytical Inc. but not manufactured by it will be subject to the same warranty as is extended to Rosemount by the original manufacturer.

At the time of installation it is important that the required services are supplied to the system and that the electronic controller is set up at least to the point where it is controlling the sensor heater. This will ensure, that should there be a delay between installation and full commissioning that the sensor being supplied with ac power and reference air will not be subjected to component deterioration.

Instruction Manual
760008-A
September 2001

Model NGA 2000 TO2

Emerson Process Management

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EMERSON
Process Management