TRACE OXYGEN ANALYZER MODULE



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

This manual is based on the production version of the Trace Oxygen Analyzer Module. Hardware and/or software changes may have occurred since this printing.

Rosemount Analytical's NGA 2000 system of Modular Gas Analyzers and Controllers are patented, under U.S. Patent 5.787.015.

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PURPOSE/SAFETY SUMMARY

The purpose of this manual is to provide information concerning the components, functions, installation and maintenance of this particular NGA 2000 module.

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.



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

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

DANGER is used to indicate the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored

WARNING is used to indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if the warning is ignored.

CAUTION is used to indicate the presence of a hazard which will or can cause minor personal injury or property damage if the warning is ignored.

NOTE is used to indicate installation, operation, or maintenance information which is important but not hazard-related



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.



CAUTION: PARTS INTEGRITY

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



CAUTION: HIGH PRESSURE GAS CYLINDERS

This analyzer requires use of pressurized gas. See General Precautions for Handling and Storing High Pressure Cylinders, in the rear of this manual.



WARNING: CAUSTIC LIQUID

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



WARNING: POSSIBLE EXPLOSION HAZARD

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

GLOSSARY

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).

SPECIFICATIONS - GENERAL

Measurement Species	Trace Oxygen
RANGES	0 to 100 ppm (output scalable down to 0-2 ppm fullscale)
Accuracy	$\pm 3\%$ of reading or $\pm 0.02\%$ of range (except for ranges ≤ 100 ppm: $\pm 3\%$ of reading or $\pm 0.05\%$ of range)
SENSITIVITY	<10 ppb Oxygen
Noise	1% of fullscale, peak to peak
LINEARITY	±1% of fullscale
R ESPONSE 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	0.32% of reading per °F from 70°F
TEMPERATURE	(0.58% of reading per °C from 21°C)
EFFECT OF FLOW	\leq 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%

SPECIFICATIONS - 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

SPECIFICATIONS - 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)

SPECIFICATIONS - GAS CONNECTIONS

SAMPLE IN	1/4 inch O.D. tube fitting
SAMPLE OUT	1/4 inch O.D. tube fitting

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

CUSTOMER SERVICE, TECHNICAL ASSISTANCE AND FIELD 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

RETURNING PARTS TO THE FACTORY

Before returning parts, contact the Customer Service Center and request a Returned Materials Authorization (RMA) number. Please have the following information when you call: *Model Number, Serial Number, and Purchase Order Number or Sales Order Number.*

Prior authorization by the factory must be obtained before returned materials will be accepted. Unauthorized returns will be returned to the sender, freight collect.

When returning any product or component that has been exposed to a toxic, corrosive or other hazardous material or used in such a hazardous environment, the user must attach an appropriate Material Safety Data Sheet (M.S.D.S.) or a written certification that the material has been decontaminated, disinfected and/or detoxified.

Return to:

Rosemount Analytical Inc. 4125 East La Palma Avenue Anaheim, California 92807-1802

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

DOCUMENTATION

The following Trace Oxygen Analyzer Module instruction materials are available. Contact Customer Service or the local representative to order.

748420 Instruction Manual (this document)

COMPLIANCES

This product may carry approvals from several certifying agencies for use in nonhazardous, 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.

CE

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

NAMUR

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



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 THEORY OF TECHNOLOGY

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

(Cathode Reaction) $O_2 + 2 H_2O + 4 e^- \rightarrow 4 OH^-$ (Anode Reaction)

 $4 \text{ OH}^{\text{-}} \rightarrow \text{O2} + 2 \text{ H}_2\text{O} + 4 \text{ e}^{\text{-}}$

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

1.4 FEATURES

Among the features included in the TO2 Analyzer Module are:

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



FIGURE 1-1. TRACE OXYGEN DETECTOR TECHNOLOGY



FIGURE 1-2. TRACE OXYGEN ANALYZER MODULE - TOP VIEW

NOTES

2.1 UNPACKING

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

2.2 ASSEMBLY

Before installation of the TO2 Analyzer Module, electrolyte must be added to the Sensor. Follow the procedure described below under section 2.2.1.

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 Figures 2-1 and 2-4.)

2.2.1 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 4-2). 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 premeasured.

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

2.3 LOCATION

(See Figure 2.2) The TO2 Analyzer Module comes standard with mounting ears for easy installation on flat, horizontal surfaces. Install the TO2 Analyzer Module in a clean, weather-proofed, vibration-free location free from extreme temperature variations and moisture. For best results, install the instrument near the sample stream to minimize sample transport time.

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

2.4 GASES

2.4.1 REQUIREMENTS

The TO2 Analyzer Module requires only a standard of accurately known composition for use as a span gas. The span gas should be supplied from a cylinder equipped with a clean, metallic diaphragm, two-stage regulator. A shutoff valve is recommended.

Calibration Gases

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

Sample

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

Pressure

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

2.4.2 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 nonmetallic tubing can result in ambient oxygen permeation through the tubing causing higher than expected reading. Exhaust tubing should be 1/4 inch (6.3 mm) or larger, and can be metallic or non-metallic.



FIGURE 2-1. ANALYZER MODULE INTERCONNECTION WITH INSTRUMENT PLATFORM



FIGURE 2-2. OUTLINE AND MOUNTING DIMENSIONS



FIGURE 2-3. BACK PANEL CONNECTIONS



CAUTION: GAS OVERPRESSURE

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



CAUTION: SAMPLE FLOW

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

2.4.3 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.



FIGURE 2-4. TRACE OXYGEN ANALYZER FRONT PANEL

2.5 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.

3.1 OVERVIEW

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

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

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

3.2 DISPLAYS

Three kinds of Display screens are available to the user:

- Run Mode
- Menu
- Help

3.2.1 RUN MODE DISPLAY

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

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



FIGURE 3-1. RUN MODE DISPLAY

3.2.2 MENU DISPLAYS

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

Main Menu				
Basic cont	rols			
Expert controls and set up (Operational configuration) Technical level configuration (Diagnostic and manufacturing/service)				
DISPLAY	PARMS.	NEXT	EXT LOCK	INFO

FIGURE 3-2. MAIN MENU

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

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

The Basic controls menu is as follows:

Basic Controls Measurement range number: Range upper limit: Range and functional control:	CURRENTRNGHI CONTROL
Sleep Mode: Exit Sleep Mode! Initiate Quick Start! Quick Start:	
HOME ESCAPE	INFO

FIGURE 3-3. BASIC CONTROLS MENU

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

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

The Expert controls menu is as follows:

Expert contro Measurement range number: Range lower limit: Range upper limit:	ols CURRENTRNGHI
Range and functional control:	CONTROL
HOME ESCAPE	INFO

FIGURE 3-4. EXPERT CONTROLS MENU

This menu shows the current range number and range limits.

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

	Analyzer module set up	
Range se	ttings	
Displayed parameters Analyzer tag:		TAG
HOME	ESCAPE	INFO

FIGURE 3-5. ANALYZER MODULE SET-UP MENU

3.2.3 HELP DISPLAYS

The Help structure is intended to be an on-line "tutorial," context-sensitive and topicinterconnected, so that the user can practically operate NGA 2000 without the need of an instruction manual.

A typical help menu:



FIGURE 3-6. TYPICAL HELP MENU (SHOWN IS ZERO/SPAN CALIBRATION HELP)

This is the help screen for the calibration menus.

3.3 STARTUP PROCEDURE

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

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

Establish that sample flow rate is within specifications (see the Specifications page in this manual). Input security codes (see reference manual), calibrate, and begin routine operation as following subsections indicate.

3.4 QUICK START FEATURE

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

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

3.5 GAS SCALE FACTOR (GSF)

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

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

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

3.6 CALIBRATION

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

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

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

- 1. Move the cursor to Technical Level Configuration... and enter. Select Diagnostic Menus..., then Analyzer Module Diagnostics..., and then Calibration parameters... and enter.
- 2. Select the User zero calibration... to enter the User zero calibration menu.

Note:

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

- 3. Move the cursor to the Press the select key for user zero calibration now!
- 4. Press the \downarrow key. The new zero calibration will now be entered.

- 5. Press the \leftarrow key to return to the previous menu.
- 6. Introduce a suitable span gas into the SAMPLE INLET and allow reading to stabilize. Move the cursor to the *User span calibration...* line and press the ⊣ key.
- 7. Move the cursor to the *Span gas concentration:* line and press the \dashv key. Enter the correct span gas value by using the $\uparrow \downarrow$ keys to change value and the $\leftarrow \rightarrow$ keys to select position. Press the \dashv key to enter the new span gas value.
- 8. Move the cursor to the *Press the select key for user span calibration now!* and press the ⊣ key. The new span calibration will now be entered.
- 9. Press the \leftarrow arrow key to return to the previous menu.
- 10. You can view the new calibration data in the *Calibration data display* screen. To access this screen go to the *Expert controls and set up* sub-menu and select *Analyzer module set up*... From the *Analyzer module set up* sub-menu select *Calibration*... and from the *Advanced/Expert calibration* sub-menu select *Calibration data display*... This screen is a view only display and data cannot be edited from this screen.
- 11. If for any reason you want to restore the original factory calibration data, you can do so from the *Advanced/Expert calibration* sub-menu (see #9 above for directions to this sub-menu). Select *Restore factory calibration!* and the original values will be restored.

Note:

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

- 12. Press the HOME softkey to re-enter the Main Menu.
- 13. Press DISPLAY softkey for the Run Mode display.

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

3.7 ROUTINE OPERATION

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

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

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

3.8 ALARM INDICATION

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

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

TABLE 3-1. TRACE OXYGEN ANALYZER MODULE ALARMS

4.1 OVERVIEW



CAUTION: QUALIFIED PERSONNEL

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



WARNING: PARTS INTEGRITY

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

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

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

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

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



CAUTION: REFILLING SENSOR

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



FIGURE 4-1. TRACE OXYGEN ANALYZER SENSOR ASSEMBLY

4.1.1 WATER ADDITION

To add water:

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

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

Refer to section 4.3 for the proper procedure for replacing electrolyte.

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

4.2 FUSES

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

4.3 ELECTROLYTE REPLACEMENT

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

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

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

Refill the Sensor with electrolyte as instructed in Section 2.2.1. Reinstall the Sensor Assembly and reconnect J5 and J6 to the power board.

4.4 SENSOR REPLACEMENT

If the Sensor cannot be regenerated by the addition of water or the replacement of electrolyte, or if the Sensor shows signs of leakage, it may be necessary to replace the Sensor. To replace the Sensor, remove the Sensor Assembly and remove the electrolyte as described in section 4.3 above. Reinstall the black sensor cover to catch any residual electrolyte. Invert the Sensor Assembly and locate the four (4) mounting screws which hold the Sensor to the Sensor Assembly mounting plate. Remove and retain the four screws.

Install replacement Sensor in reverse order. Check Sensor for leaks and add electrolyte as described in section 2.2.1. Reinstall Sensor Assembly in Analyzer Module and reconnect J5 and J6 to the power board.

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

Load factory calibration data				
Concentrat	tion 1:			
Output 1:	Output 1:			
Temperature 1:				
Concentration 2:				
Output 2:				
Temperature 2:				
Concentration 3:				
Output 3:				
Temperature 3:				
HOME	ESCAPE		MORE	

FIGURE 4-2. LOAD FACTORY CALIBRATION DATA MENU

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

4.5 FLOW SENSOR REPLACEMENT

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

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

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

4.7 TROUBLESHOOTING

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

The TO2 analyzer fails to purge down to ppm levels.

Prior to conducting any changes to the system, try running a quick start sequence (see section 3.4) 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. Overpressurization of the sensor can result in damage.

The TO2 analyzer exhibits flow sensitivity.

Check to make sure that your vent line is not blocked. If you see a rise in reading with an increase in flow, you may be over-pressurizing the sensor due to a blocked vent. Since the sensor is a partial pressure measuring device, an increase in sample pressure will cause an increase in reading. If the reading drops with increased flow, conduct the leak check outlined in the troubleshooting tip above.

The TO2 analyzer gives erratic and very insensitive readings.

Check to see that the electrolyte level is within the limits indicated on the reservoir. Add distilled water as required. If the level is within limits, the electrolyte may have been contaminated. Refer to section 4.2 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.



WARNING: PARTS INTEGRITY

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

5.1 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

NOTES

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 12-position sales matrix identifier number appears on the analyzer name-rating plate.

Т	Α		NGA 2000 TO2 TRACE OXYGEN ANALYZER MODULE			
		Code			С	ONFIGURATION IDENTIFIER
		A20	RANG	GE: 0 -	100 ppm	1
		B20	20 RANGE: 0 - 100 ppm with X-GAS Sensor			with X-GAS Sensor
		X99	Speci	al Ran	ges	
			Code			CABLE SELECTION
			Α	Stand	Standard (3 ft LON and 3 ft interconnect AM to Platform)	
			В	Syste	System (10 ft LON and 10 ft interconnect AM to 25A PS)	
			Ζ	None		
	Code MOUNTING CONFIGURATION		MOUNTING CONFIGURATION			
				Α	Base Pla	ate Assembly
Z None (utilize mounting ears on AM)		tilize mounting ears on AM)				
				Code NO SELECTION		
ZZZZZ None		None				
Т	A	A20	В	Z	ZZZZZ (EXAMPLE)	

NOTES

B.1 INTRODUCTION

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

B.2 TO2 MENUS

		Main Menu		
Basic contro	ols			
Expert contr (Operational	ols and set configuration	up on)		
Technical le (Diagnostic	vel configur and manufa	ration cturing/servi	ce)	
DISPLAY	PARMS.	NEXT	LOCK	INFO

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

Basic Controls	
Measurement range number: Range upper limit:	CRÀNGE CURRENTRNGHI
Range and functional control:	CONTROL
Sleep mode: Exit sleep mode! Initiate quick start! Quick start:	SLEEP_MODE
HOME	<i>M∶4</i> INFO

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

Expert controls and set up				
Expert analyzer controls	F: 0, Param:			
Auxiliary module controls	F: 30, SAMPCONT_			
System set up Analyzer module set up Auxiliary module set up	M: 37, SYSSET2 F: 0, Param: F: 34, IOSETUP_			
M: 0 F: 2 F: 42 Home Escape Next	M: 54 INFO			

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

Expert Controls	\$
Measurement range number: Range lower limit: Range upper limit:	CRANGE CURRENTRNGLO CURRENTRNGHI
Range and functional control:	CONTROL
HOME	<i>M: 35</i> INFO

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

Analyzer Module Setup		
Range settings	M: 14, RANGESETAM	
Displayed parameters	M: 30, DISFLAY	
Analyzer tag: HOME ESCAPE	<i>M: 5</i> INFO	

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

Range Settin	gs
Minimum range:	NINRANGE
Maximum range:	MAXRANGE
Range 1 lower limit:	RNGL01
Range 1 upper limit:	RNGH/1
Range 2 lower limit:	RNGL02
Range 2 upper limit:	RNGHI2
Range 3 lower limit:	RNGLO3
Range 3 upper limit:	RNGHI3
Range 4 lower limit:	RNGL04
Range 4 upper limit:	
	M: 15
HOME ESCAPE	INFO

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

Displayed Parame	ters
First line's parameter:	SVNAMET
Second line's parameter: Third line's parameter:	SVNAMEZ SVNAMES
Fourth line's parameter:	SVNAME4
May be displayed on the appropriate li analyzer display screen.	ine of the single
HOME	M: 38 INFO

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

Technical configuration	n menu
System set up	N: 1, SYSSET
Service menus	M: 2, SERVICE
Diagnostic menus	F: 22, DIAGS_
Other module diagnostic menus	F: 23, 0THDIAGS_
M: 0 M: 0 F: 42	<i>M: 55</i>
HOME ESCAPE NEXT	INFO

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

Analyzer Manufacturing Da	ata
Analyzer module s/n:	
Manufacturing date code:	
Bench configuration code:	AMBC
Hardware revision number:	
Software revision number:	
Sensor Model:	SENSOR_M
Measured gas:	645
User tag number:	M: Z
HOME ESCAPE RESET	INFO

Analyzer Module Se	ervice History
Manufacturing date: In service date:	AMMFGDATE AMSERVDATE
Last service date:	ANLSDATE
List notes	M: 28, LISTNOTES
Add service date!	
HOME ESCAPE	<i>M: 52 M: 9</i> ManData INFO

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

Analyzer Diagr	nostics
Power supply voltages	M: 11, AMFWR
Primary variable parameters Calibration parameters	N: 12, AMTV M: 34, ADV_ CAL
Physical measurements	M: 19, AM2VA
Temperature parameters	M: 33, AM_ TMP
Software diagnostics Alarm messages valid for:	N: 32, SW_DIAG ALAFM_LVL
HOME ESCAPE REBOOT	M:13 Init info

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

Analyzer Diagnostics	
Power Supply Voltages	
+15V analog:	F15_VLTS
-15V analog:	N15_VLTS
+5¥ digital:	F <u>5</u> VLTS
+24V power:	F24 VLTS
Primary Electrode:	FELEC VLTS
Isolated 15V:	115 <u>-</u> VLTS
	N: 17
HOME ESCAPE	INFO

Primary Variable Parameters	
02 concentration: Sensor current:	FVA SENSOR_CUR
Sensor temperature: Sensor temperature current:	SENSOR_TMP STMP_CUR
Live zero: Sleep mode: Sleep mode timer: Quick start:	LIVE_ZERO SLEEP_MODE SM_TMR
HOME ESCAPE	<i>M: 18</i> INFO

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

Advanced / Expert Calibration	
User zero calibration User span calibration Restore factory calibration!	M: 23, SIMFLEZERO M: 2, SPAN
Load factory calibration data Calibration data display	M: 41, CAL_FACTORY M: 43, DISP_CAL
Gas scale factor	M: 36
HOME ESCAPE	INFO

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

User Zero Calibration	
Measurement:	FW
Press the select key for user zero calibration now!	
Status:	
HOME ESCAPE	<i>M:25</i> INFO

User Span Calibration		
Measurement:	FVA	
Span gas concentration:	USPAN_CON	
Press the select key for user span calibration now!		
0.		
Status:		
	N: 24	
HOME ESCAPE	INFO	

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

Load Factory Calibration	
Concentration 1:	FAC_CONC_LD1
Output 1:	FACT_OUT_LD1
Temperature 1:	FACT_TEMP1
Concentration 2:	FAC_CONC_LD2
Output 2:	FACT_OUT_LD2
Temperature 2:	FACT_TEMP2
Concentration 3:	FAC_CONC_LD3
Output 3:	FACT_OUT_LD3
Temperature 3:	FACT_ TEMP3
	M: 42
HOME ESCAPE	MORE

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

Load Factory Calibration - Continued	
Concentration 4:	FAC_CONC_LD4
Output 4:	FACT_OUT_LD4
Temperature 4:	FACT_ TEMP4
Concentration 5:	FAC_CONC_LD5
Output 5:	FACT_OUT_LD5
Temperature 5:	FACT_ TEMP5
Calibration gas scale factor:	CAL_GSF_LD
Sensor Model:	SENSOR_N_LD
Load calibration data!	
HOME ESCAPE	

Calibration Data Display screens look identical to the Load Factory Calibration screens except they are not editable.

Gas Scale Factor	
Ar background gas concentration:	AR_BGC
C2H4 background gas concentration:	C2H4_BGC
CU background gas concentration:	LL <u>I_</u> BGL
LH4 background gas concentration: N2 background gas concentration:	LH4_BGL N2_BGC
He background gas concentration: H2 background gas concentration:	HE_BGC H2_BGC
NH3 background gas concentration:	NH <u>3_</u> BGC
C2H6 background gas concentration:	C2H6_BGC
C3H6 background gas concentration:	
<u></u> <u>M</u> :	46
HOME ESCAPE MO	RE

Gas Scale Factor		
C4H10 background gas concentration: C6H14 background gas concentration:	C4H10_BGC C6H14_BGC	
Other background gas concentration: Other background gas factor:	OTHER_BGC OTHER_BGF	
Adjusted gas scale factor:	AGSF	
Compute new adjusted gas scale factor!		
HOME ESCAPE		

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

Physical Measurements	
Sample flow:	FLOW_IS
Electrolyte level:	ELEC_LVL
HOME ESCAPE	

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

Temperature Control		
Sensor temperature: Sensor temperature current:	SENSOR_TMP STMP_CUR	
Low temperature calibration	M: 39, AM_ TMP_LC	
High temperature calibration	N: 40, AM_ TMP_ HC	
	44. 27	
HOME ESCAPE	INFO	

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

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

NOTES

C.1 USER INTERFACE HELP INSTRUCTIONS

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

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

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

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

C.2 MENU ITEMS

ITEM	PATH	NOTES
Add a service date	Technical - Service menus - Service history - Analyzer module history - Add service date!	
Alarm enabling	Technical - Diagnostics – Analyzer module diagnostics - Select I/O module - Relay status	
Analyzer specific alarms	Expert - Auxiliary module setup - Select Analog output module – Alarm conditions	v 2.3 only
Analyzer diagnostics	Technical - Diagnostic menus - Analyzer module diagnostics	
Analyzer specific controls (remote)	Expert - Auxiliary module setup - Select Analog output module – Input line control	v 2.3 only
Binding	Technical - System setup – Module Binding	
Displayed parameters	Expert - Analyzer module setup - Displayed parameters	
Electrolyte level	Technical - Diagnostic menus - Analyzer module diagnostics - Physical measurements	

ITEM	PATH	NOTES
Exit sleep mode	Basic	
Gas scale factor	Technical - Diagnostic menus - Analyzer module diagnostics - Calibration parameters - Gas scale factor	
Initiate quick start	Basic	
Last service date	Technical – Service menus – Service history – Analyzer module history	User updated
List of detected NGA modules	Technical - Listing of all modules	Jumps from there into their diagnostic screens
Load factory calibration data	Technical - Diagnostic menus - Analyzer module diagnostics - Calibration parameters	Required when changing sensor
Manufacturing data	Technical – Service menus - Manufacturing data - Analyzer module data	
Maximum range	Expert - Analyzer module setup - Range settings	Maximum range upper limit
Minimum range	Expert - Analyzer module setup - Range settings	Minimum range upper limit
Power supply voltages	Technical – Diagnostic menus – Analyzer module diagnostics - Power supply voltages	
Quick start status	Basic	
Range number selection	Basic	
Range lower limits	Expert - Analyzer module setup - Range settings	
Range upper limits	Expert - Analyzer module setup - Range settings	
Record service codes	Technical - Service menus – Service history - Analyzer module history - List notes	
Reset system	Technical - System setup – System reset	
Resolution of main reading	Technical - System setup – Main display configuration - Display resolution	

ITEM	PATH	NOTES
Sensor current, temperature	Technical - Diagnostics menus - Analyzer module diagnostics - Primary variable parameters	
Sleep mode status	Basic	
Sleep mode timer	Technical - Diagnostics menus - Analyzer module diagnostics - Primary variable parameters	
Software diagnostics	Technical - Diagnostic menus - Control module diagnostics	
Software revision level	Technical - Service menus - Manufacturing data - Control module data	
Span calibration	Technical - Diagnostic menus - Analyzer module diagnostics - Calibration parameters - User span calibration	Highly recommend not to be conducted in the field
Tag number	Technical - Service menus - Manufacturing data - Analyzer module data	User editable
Test relay operation	Technical - Diagnostic menus - Select I/O Module - Relay status	
View sensor calibration data	Technical - Diagnostic menus - Analyzer module diagnostics - Calibration parameters - Calibration data display	
Zero calibration	Technical - Diagnostic menus - Analyzer module diagnostics - Calibration parameters - User zero calibration	Highly recommend not to be conducted in the field

NOTES

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.
- 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.

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WARRANTY

Goods and part(s) (excluding consumables) manufactured by Seller are warranted to be free from defects in workmanship and material under normal use and service for a period of twelve (12) months from the date of shipment by Seller. Consumables, glass electrodes, membranes, liquid junctions, electrolyte, o-rings, etc., are warranted to be free from defects in workmanship and material under normal use and service for a period of ninety (90) days from date of shipment by Seller. Goods, part(s) and consumables proven by Seller to be defective in workmanship and/or material shall be replaced or repaired, free of charge, F.O.B. Seller's factory provided that the goods, part(s) or consumables are returned to Seller's designated factory, transportation charges prepaid, within the twelve (12) month period of warranty in the case of goods and part(s), and in the case of consumables, within the ninety (90) day period of warranty. This warranty shall be in effect for replacement or repaired goods, part(s) and the remaining portion of the ninety (90) day warranty in the case of consumables. A defect in goods, part(s) and consumables of the commercial unit shall not operate to condemn such commercial unit when such goods, part(s) and consumables are capable of being renewed, repaired or replaced.

The Seller shall not be liable to the Buyer, or to any other person, for the loss or damage directly or indirectly, arising from the use of the equipment or goods, from breach of any warranty, or from any other cause. All other warranties, expressed or implied are hereby excluded.

IN CONSIDERATION OF THE HEREIN STATED PURCHASE PRICE OF THE GOODS, SELLER GRANTS ONLY THE ABOVE STATED EXPRESS WARRANTY. NO OTHER WARRANTIES ARE GRANTED INCLUDING, BUT NOT LIMITED TO, EXPRESS AND IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Limitations of Remedy. SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF WARRANTY SHALL BE LIMITED TO REPAIR OR REPLACEMENT UNDER THE STANDARD WARRANTY CLAUSE. IN NO CASE, REGARDLESS OF THE FORM OF THE CAUSE OF ACTION, SHALL SELLER'S LIABILITY EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED BY SELLER GIVING RISE TO THE CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY EXTEND TO INCLUDE INCIDENTAL OR CONSEQUENTIAL DAMAGES. CONSEQUENTIAL DAMAGES SHALL INCLUDE, BUT ARE NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS, LOSS OF USE, LOSS OF REVENUE, COST OF CAPITAL AND DAMAGE OR LOSS OF OTHER PROPERTY OR EQUIPMENT. IN NO EVENT SHALL SELLER BE OBLIGATED TO INDEMNIFY BUYER IN ANY MANNER NOR SHALL SELLER BE LIABLE FOR PROPERTY DAMAGE AND/OR THIRD PARTY CLAIMS COVERED BY UMBRELLA INSURANCE AND/OR INDEMNITY COVERAGE PROVIDED TO BUYER, ITS ASSIGNS, AND EACH SUCCESSOR INTEREST TO THE GOODS PROVIDED HEREUNDER.

<u>Force Majeure.</u> Seller shall not be liable for failure to perform due to labor strikes or acts beyond Seller's direct control.

Rosemount Analytical

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FIELD SERVICE AND REPAIR FACILITIES

Field service and repair facilities are located worldwide.

U.S.A.

To obtain field service on-site or assistance with a service problem, contact (24 hours, 7 days a week):

National Response Center 1-800-654-7768

INTERNATIONAL

Contact your local Rosemount Sales and Service office for service support.

FACTORY

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

RETURNING PARTS TO THE FACTORY

Before returning parts, contact the Customer Service Center and request a Returned Materials Authorization (RMA) number. Please have the following information when you call: *Model Number, Serial Number, and Purchase Order Number or Sales Order Number.*

Prior authorization by the factory must be obtained before returned materials will be accepted. Unauthorized returns will be returned to the sender, freight collect.

When returning any product or component that has been exposed to a toxic, corrosive or other hazardous material or used in such a hazardous environment, the user must attach an appropriate Material Safety Data Sheet (M.S.D.S.) or a written certification that the material has been decontaminated, disinfected and/or detoxified.

Return to:

Rosemount Analytical Inc. 4125 East La Palma Avenue Anaheim, California 92807-1802

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MATERIAL SAFETY DATA SHEET

Product : ELECTROLYTE ¹	
Part No.: 904676	
Distributor · Rosemount Analyti	cal Inc
Address: 4125 Fast La Palma	$\Delta Ve \Delta naheim C \Delta 92807-1802$
Telephone: (714) 986-7600	
24 HOUR EMERGENCY TE	LEPHONE NO.: CHEMTREC (800) 424-9300
SECTION I - GENERAL	
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 INGRED	ENTS COMPOSITION
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 (H ₂ O=1) :	1.15
% Volatile by volume :	NA
Evaporation rate (H ₂ O=1) :	NA
Solubility in water :	Complete
Appearance and odor :	Colorless liquid, no odor
SECTION IV - FIRE AND EXPLOSION	N 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 (materials to avoid) :	Acids, flammable liquids, organic halogens, metals (aluminum, lead, tin, zinc)
Hazardous decomposition or	Thermal decomposition products may include corrosive fumes of
byproducts :	Potassium Oxide and toxic Oxides of Carbon.
Hazardous polymerization :	Will not occur.

¹ Is contained in Model TO2 Ship Kit

SECTION VI - HEALTH HAZARE	D 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 PROTE	ECTION 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 PRECAU	JTIONS
Precautions to be taken in handling and storing :	Store away from incompatible substances.
Other precautions:	none
SECTION X. TRANSPORTATIO	N DATA
DOT Hazard Classification 49CFR17 II • Exceptions: When transported by • Exceptions: By Motor Vehicle or R	2.101: Potassium Hydroxide Solution, Class 8, UN1814, Packing Group Air 49CFR173.154 (b) (1) + (2) ail Car 49CFR173.154 (d) (1)

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

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Rosemount Analytical

ADDENDUM

TO2 INSTRUCTION MANUAL 748420

This addendum serves as an amendment to the TO2 Instruction Manual 748420. The following information should be considered part of the manual, and supersedes any conflicting information in the body of the manual.

Read this information and note the conflicts.

MENU DISPLAYS

Menu: 0 MAIN Expert Controls	
Measurement range number: Range lower limit: Range upper limit:	000.0 000.0 000.0
Range and functional control:	000.0
HOME ESCAPE	INFO

Menu: 1 ANALSET	
Analyzer Module Setup	
Range settings	
Concentration alarms	
Units	
Displayed parameters	
HOME ESCAPE	INFO

Menu: 2 SPAN	
User Span Calibration	
Massurament	000.0
	000.0
Span gas concentration:	000.0
Denne the select less for more series a difference of the	
Press the select key for user span calibration now!	
Поме	
HUME ESLAPE	INFU

Menu: 3 SPANI1
Span Calibration help
Use this screen to perform a span calibration.
Either directly adjust the reading with the up and down arrow keys, or press the
Select key when the span gas level
force the analyzer to adjust its span to make the reading the same as that
of the span gas. You should do a zero calibration before
HOME ESCAPE MORE INFO

Menu: 4 ANALOPI1	
Basic Controls Informati This screen selects immediately available Lines that are not editable refer to variab elsewhere.	on functions. les set up
HOME ESCAPE	INFO

Menu: 6 AMMAN	
Analyzer Manufacturing Data	
More	
Bench configuration code:	000.0
Sensor Model:	000.0
Measured gas:	000.0
NOME ESCADE DESET	INFO
HUME ESLAFE RESET	INFU

Menu: 7 AMMANI1	
Analyzer Manufacturing Data Information	
These show the analyzer's manufacturing information	n.
Generally these parameters should not be edited in t	he
field.	
The user tag is used to identify the analyzer over an	y
gateways installed, it may be set to any string up to 21 characters long.	
RESET erases ALL EEPROM data!	
HOME ESCAPE	NFO

Menu: 8 Analyzer Module	AMSVC Service History	
Manufacturing date: In service date:		000.0 000.0
Last service date:		000.0
List notes		
HOME ESCAPE	ManData	INFO

Monu 0	

Analyzer Module Service History	Information
Shows the analyzer service history. For de	etails on
service codes, see the control module's s	ervice
history help.	
HOME ESCAPE	INFO

	N	lenu: 10 ADI	AG	
	Ana	alyzer Diagno	stics	
Dowor our				
ruwei sut	ipiy voitages	-		
Primary va	ariable parame	eters		
Calibration	n parameters			
Physical n	neasurements.			
Temperatu	re parameters	\$		
Software (Alarm mes	diagnostics sages valid fo	Dr:		000.0
номе	ESCAPE	REBOOT	INIT	INFO

Menu: 11 AMPWR	
Analyzer Diagnostics	
Power Supply Voltages	
+15V analog:	000.0
-15V analog:	000.0
+5¥ digital:	000.0
+24V power:	000.0
Primary Electrode:	000.0
Isolated 15V:	000.0
HOME ESCAPE	INFO

Menu: 12 AM1V	
Primary Variable Parameters	
02 concentration:	000.0
Sensor current:	000.0
Sensor temperature:	000.0
Sensor temperature current:	000.0
Live zero:	000.0
Sleep mode:	000.0
Sleep mode timer:	000.0
HOME ESCAPE	INFO

Menu: 13 ADIAGI1	
Software Diagnostics Information	
The analyzer diagnostics are used to insure that	
the analyzer is operating correctly.	
HOME ESCAPE	INFO

Menu: 14 RANGESE Range Settings	ETAM
Minimum range: Maximum range: Range 1 lower limit: Range 1 upper limit: Range 2 lower limit: Range 2 upper limit: Range 3 lower limit: Range 3 upper limit: Range 4 lower limit:	000.0 000.0 000.0 000.0 000.0 000.0 000.0 000.0 000.0 000.0
HOME ESCAPE	INFO

Menu: 15 RANGESSETI1

Range Settings Information Set the upper and lower limits of the reportable ra These values are copied into the output module a used for calculating the analog output.	nges. nd
The minimum and maximum ranges can only be modified by changing the sensor model that is installed in the system.	
HOME ESCAPE	INFO

Menu: 16 SPANI2
Span Calibration help
The calibration is performed on the
range selected by the
range
If the calibration set up selected the
ranges to be calibrated together, all
the ranges will be calibrated at once
by the first calibration. Otherwise
they must be calibrated individually.
The line showing what the last zero gas
would read shows the effect of the most
HUME ESCAPE MURE BACK INFO
Menu: 17 AMPWRI1

Analyzer Diagnostics Information
Power Supply Voltages
This screen shows the current output of the power
supplies listed.
HOME ESCAPE

	Primary Variable Parameters Information	
Shows the	parameters used to calculate the primary	y .
reading.		
HOME	ESCAPE	INFO

Menu: 19 AM2	/A
Physical Measurem	ents
Sample flow: Flow lower limit:	000.0 000.0
Flow upper limit:	000.0
Electrolyte level:	000.0
HOME ESCAPE	

Menu: 20 ANALSIMP Basic Controls	
Measurement range number: Range upper limit:	000.0 000.0
Range and functional control:	000.0
Sleep mode: Exit sleep mode! Initiate quick start!	000.0
HOME ESCAPE	INFO

Menu: 21 LINSETI2

Measurement mode Use this function for changing the alarm lough and range limits on different	
sample streams; or for changing measurement modes together with the	
relevant alarm levels. NOte: this change may take a fe w	
seconds.	
HOME ESCAPE	INFO

Menu: 22 SPANI3			
Span Calibration help			
The MODE change the current rar	softkey is a conv e measurement mo nge.	venient way to ode, or the	
The effect of the current span on the last zero calibration is shown.			
номе	ESCAPE	BACK	INFO

Menu: 23 SIMPLEZERO	
User Zero Calibration	
Measurement:	000.0
Press the select key for user zero calibration now!	
HOME ESCAPE	INEO

Menu: 24 SIMPLESPANI1

User Span Calibration Information		
Enter the concentration of the span gas, as stated on the bottle label, in the appropriate menu item. Flow the span gas through the analyzer. Wait for the reading to stabilize, and initiate the calibration by selecting		
the appropriate menu item		
HOME ESCAPE	INFO	

Menu: 25 SIMPLEZEROI1 User Zero Calibration Information Flow zero gas through the analyzer. Wait for the 02 reading to stabilize, and initiate the calibration by selecting the appropriate item on the menu. shown on the calibration screen; press the select HOME ESCAPE

Menu: 26 AMHELPINDEX
Analyzer Module Information
The NGA2000 TO2 Analyzer measures trace amounts
of oxygen in a gas stream. Depending on the
model, the measurement range can be from 0 - 50ppm
to 0 - 25%.
HOME ESCAPE

Menu: 27 AMTRENDI1 Trend Display Control Information Through this menu a chart may be created showing the trends for two parameters over the time base specified. The parameters are recorded at a rate of 240 points per time base period. To display the chart, select HOME ESCAPE INFO

	Menu: 28 LISTNO	TES
	Analyzer Module Servic	ce Notes
You can w	rrite up to 22 characters in e	each line.
		000.0
		000.0
		000.0
		000.0
		000.0
		000.0
		000.0
		000 0
		000.0
HOME	ESCAPE	INFO

Menu: 29 MPARMS	
Current Measurement Parameters	
Measurement range number: Range change control:	000.0 000.0
Calibration status:	000.0
HOME ESCAPE	INFO

Menu: 30 DISPLAY	
Displayed Parameters	
First line's parameter	000.0
riist ine s parameter.	000.0
Second line's parameter:	000.0
Third line's parameter:	000.0
Fourth line's parameter:	000.0
May be displayed on the appropriate line of analyzer display screen.	the single
HOME ESCAPE	INFO

Menu: 31 MPARMSI1	
Current Measurement Parameters	Information
Shows the main measurement parameters.	
I hese can be controlled in the various	
set up menus.	
HOME ESCAPE	INFO

Menu: 32 SW_DIAG	
Software Diagnostics	
Last message:	000.0
And:	000.0
Edit to reset:	000.0
HOME ESCAPE	INFO

Menu: 33 AM_TMP Temperature Control	
Sensor temperature: Sensor temperature current:	000.0 000.0
Low temperature calibration	
High temperature calibration	
HOME ESCAPE	INFO

Menu: 34 ADV_CAL	
Advanced / Expert Calibration	
User zero calibration	
User span calibration	
Restore factory calibration!	
Load factory calibration data	
Calibration data display	
HOME ESCAPE	INFO

Menu: 35 EXPCTR	RLI1
Expert Controls Inform The measurement range number allows the analyzer is currently using to be ch range upper and lower limits are display not be changed on this screen.	nation the range that anged. The yed, but can
Range and functional control determine is controlled through the front panel, or inputs.	es if the analyzer through remote
HOME	INFO

Menu: 36 CALI2	
Advanced / Expert Calibration Information	1
Through this menu all of the calibration	
related parameters are accessible.	
	INIEO
HUME ESCAPE	INFU

Menu: 37 TEMPI1	
Temperature Control Information	
Through this menu all the parameters pertaining to	
temperature control for the different parts of the	
analyzer may be modified.	
HOME ESCAPE	INFO

Menu: 38 DISPLAYI1	
Displayed Parameters Information	
This menu allows the parameters displayed on the auxiliary lines of the main display to changed.	
HOME ESCAPE	

Menu: 39 AM_TMP_LC	
Sensor Temperature Low Calibration	
Sensor temperature:	000.0
Sensor temperature current:	000.0
Low temperature calibration temperature: Edit:	000.0 000.0
Low temperature calibration output:	000.0
Perform low temperature calibration!	
HOME ESCAPE	

Menu: 40 AM_TMP_HC

High Temperature Calibration	
Sensor temperature: Sensor temperature current:	000.0 000.0
High temperature calibration temperature:	000.0
Temperature calibration slope:	000.0
Perform high temperature calibration!	
HOME ESCAPE	

Load Factory Calibration	
Concentration 1: Output 1: Temperature 1: Concentration 2: Output 2: Temperature 2: Concentration 3: Output 3: Temperature 3:	000.0 000.0 000.0 000.0 000.0 000.0 000.0 000.0 000.0
HOME ESCAPE MORE	

Load Factory Calibration - Continued	
Concentration 4:	000.0
Output 4:	000.0
Temperature 4:	000.0
Concentration 5:	000.0
Output 5:	000.0
Temperature 5:	000.0
Calibration gas scale factor: Sensor Model:	000.0 000.0
HOME ESCAPE	

Menu: 43	DISP_CAL	
Calibration Data Display		
Concentration 1: Output 1: Temperature 1: Concentration 2: Output 2: Temperature 2:	000.0 000.0 000.0 000.0 000.0 000.0 000.0	
Concentration 3: Output 3: Temperature 3:	000.0 000.0 000.0	
HOME ESCAPE	MORE	

Menu: 44 DISP_CAL1	
Calibration Data Display - Continued	
Concentration 4: Output 4: Temperature 4: Concentration 5:	000.0 000.0 000.0 000.0
Output 5:	000.0
Temperature 5: Calibration gas scale factor:	000.0 000.0
Sensor Model: User calibration slope:	000.0 000.0
HOME ESCAPE	

Calibration Data Display - Continued	
oncentration 4:	000.0
utput 4:	000.0
emperature 4:	000.0
oncentration 5:	000.0
utput 5:	000.0
emperature 5:	000.0
alibration gas scale factor:	000.0
ensor Model:	000.0
ser calibration slope:	000.0
оме песелос	

Menu: 45 GSF	
Gas Scale Factor	
Ar background gas concentration:	000.0
C2H4 background gas concentration:	000.0
CO background gas concentration:	000.0
CH4 background gas concentration:	000.0
N2 background gas concentration:	000.0
He background gas concentration:	000.0
H2 background gas concentration:	000.0
NH3 background gas concentration:	000.0
C2H6 background gas concentration:	000.0
	_
HUME ESCAPE MURE	

Menu: 46 GSF1	
Gas Scale Factor	
C4H10 background gas concentration: C6H14 background gas concentration:	000.0 000.0
Other background gas concentration: Other background gas factor:	000.0 000.0
Adjusted gas scale factor:	000.0
Compute new adjusted gas scale factor!	
HOME ESCAPE	

Units	
Gas measurement units:	000.0
Temperature measurement units:	000.0
ppm to mg/Nm3 conversion factor:	000.0
Lower explosion limit (LEL): Upper explosion limit (UEL):	000.0 000.0
HOME ESCAPE	INFO

Menu: 48 UNITSI1		
Units		
Select the units in which you want the values to be		
displayed. This does not affect the variable contents,		
it merely affects how the control module displays them.		
	INFO	
TIOME ESCALE	INFU	

Menu: 49 ABOUT

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Manufactured by: Rosemount Analytical Inc. 4125 East La Palma Avenue Anaheim, CA 92807-1802 /USA Tel: (714) 986-7600 FAX: (714) 577-8739		
Measure	Back	More

Analyzer Module Version Information		
Serial number:		000.0
Manufacturing date:		000.0
Hardware revision:		000.0
Software revision:		000.0
Revision date:		000.0
Revision time:		000.0
Measure	Back	

Menu: 51 ALARM1	hus
Concentration Alaria Se	cup
Alarm generation is:	000.0
Level for Low-Low alarm:	000.0
Level for Low alarm:	000.0
Level for High alarm:	000.0
Level for High-High alarm:	000.0
Alarm delay:	000.0
Low-Low alarm:	000.6
Low alarm:	000.0
High alarm:	000.0
-	
HOME ESCAPE ACKN	

Menu: 52 MANDATA				
Select the	signal.	Signals		
Module Ta Module Ta Module Ta	ig ig ig			
Module Ta Module Ta Module Ta	ig ig ig			
Module Ta	ag			
номе	ESCAPE	MORE	BACK	INFO

Menu: 50 ABOUT1