

Instruction Manual

748275-F

September 2003

Model NGA2000 I/O Modules



ROSEMOUNT[®]
Analytical

<http://www.processanalytic.com>


EMERSON.
Process Management

ESSENTIAL INSTRUCTIONS

READ THIS PAGE BEFORE PROCEEDING!

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

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

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

Emerson Process Management

Rosemount Analytical Inc. Process Analytic Division

1201 N. Main St.
Orrville, OH 44667-0901
T (330) 682-9010
F (330) 684-4434
e-mail: gas.csc@EmersonProcess.com
<http://www.processanalytic.com>



TABLE OF CONTENTS

PREFACE	P-1
Intended Use Statement.....	P-1
Definitions.....	P-1
Safety Summary.....	P-2
General Precautions For Handling And Storing High Pressure Gas Cylinders	P-3
Documentation.....	P-4
Glossary of Terms.....	P-5
1.0 DESCRIPTION AND SPECIFICATIONS	1-1
1-1 Overview.....	1-1
1-2 Basic Functions	1-2
1-3 Installation And Removal.....	1-2
1-4 Software Configuration.....	1-3
1-5 Connections.....	1-3
1-6 Specifications.....	1-5
2.0 ANALOG OUTPUT/3 ALARMS	2-1
2-1 Overview.....	2-1
2-2 Installation.....	2-3
3.0 AUTO CALIBRATION	3-1
3-1 Overview.....	3-1
3-2 Installation.....	3-3
4.0 SYSTEM AUTO CALIBRATION	4-1
4-1 Overview.....	4-1
4-2 Installation.....	4-2
5.0 RETURN OF MATERIAL	5-1
5-1 Return Of Material	5-1
5-2 Customer Service	5-1
5-3 Training.....	5-1

748336 ADDENDUM

LIST OF ILLUSTRATIONS

Figure 1-1.	I/O Modules Location in Platform (Instrument Configuration)	1-1
Figure 1-2.	I/O Modules Location in Platform – Rear Panel View	1-2
Figure 1-3.	Analog I/O Module Component Location/Dimensions.....	1-3
Figure 1-4.	Analog I/O Module Backplane Connector Pin Assignment	1-3
Figure 1-5.	Analog I/O Module Output Connector/Adapter Pin Assignments.....	1-4
Figure 2-1.	Software Displays Relative to Analog Output with 3 Alarms I/O Module	2-2
Figure 3-1.	Software Displays Relative to Auto Calibration I/O Module	3-2
Figure 4-1.	Software Displays Relative to System Auto Calibration I/O Module	4-3

LIST OF TABLES

Table 2-1.	Available Functions – Analog Output with 3 Alarms I/O Module	2-4
Table 3-1.	Available Functions – Auto Calibration I/O Module	3-4
Table 4-1.	Available Functions – System Auto Calibration I/O Module	4-4

PREFACE

INTENDED USE STATEMENT

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

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

DEFINITIONS

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

DANGER

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

WARNING

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

CAUTION

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

NOTE

Highlights an essential operating procedure, condition or statement.

SAFETY SUMMARY

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

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.

NOTICE

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

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

Platform Controller Board

Turn power ON.

The display will show "Control Module V2. ...". This is the software version.

Analyzer Module

Located on the right side of the Analyzer Module case.

I/O Module

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

GENERAL PRECAUTIONS FOR HANDLING AND STORING HIGH PRESSURE GAS CYLINDERS

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

**Compressed Gas Association
1235 Jefferson Davis Highway
Arlington, Virginia 22202**

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 NGA2000 I/O Modules instruction materials are available. Contact Customer Service Center or the local representative to order.

748275 Instruction Manual (this document)

GLOSSARY OF TERMS

Analyzer Module

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

Backplane

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

Control Module

The Operator Interface plus the Controller Board.

Controller Board

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

Distribution Assembly

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

Expansion Module

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

I/O Module

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

Operator Interface

The Display and Keyboard.

Platform

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

Power Supply

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

Primary Variable

The measured species concentration value from an Analyzer Module.

Secondary Variable

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

Softkeys

The five function softkeys 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

NGA2000 components communicate with external devices through Input/Output (I/O) Modules, printed circuit boards with two-way communication potential.

Each of these I/O Modules is a self-contained peer within the NGA2000 system. That is, it has a microprocessor, memory, distinct functionality and an identify addressable on the network. Any I/O Module can be disconnected and replaced with the same or a new I/O with no effect on the NGA2000 network. In such an instance, all other components on the network would remain functional.

If a Platform is used in a particular application, I/O Modules would be located in the rear left of the Platform enclosure. See Figures 1-1 and 1-2.

Up to five I/O Modules can be installed in the rear panel of the Platform. The sixth (far right) slot is reserved for the Network I/O Port, which can communicate with other NGA2000 components and any of several PC Interface I/O Modules.

A variety of analog and digital I/O Modules can communicate with chart recorders, distribution control systems (DCS), data acquisition systems (DAS) and other devices.

Among the available input and output functions are voltage output (0 to 5 VDC), current output (0 to 20 mA and 4 to 20 mA), alarms (3), auto calibration, remote range change and identification and gateway translations (for example, HART protocol).

I/O back panel connections include 25-pin and 9-pin (RS-232) sub-D connectors. Sub-D to standard analog terminal strip adapters are available.

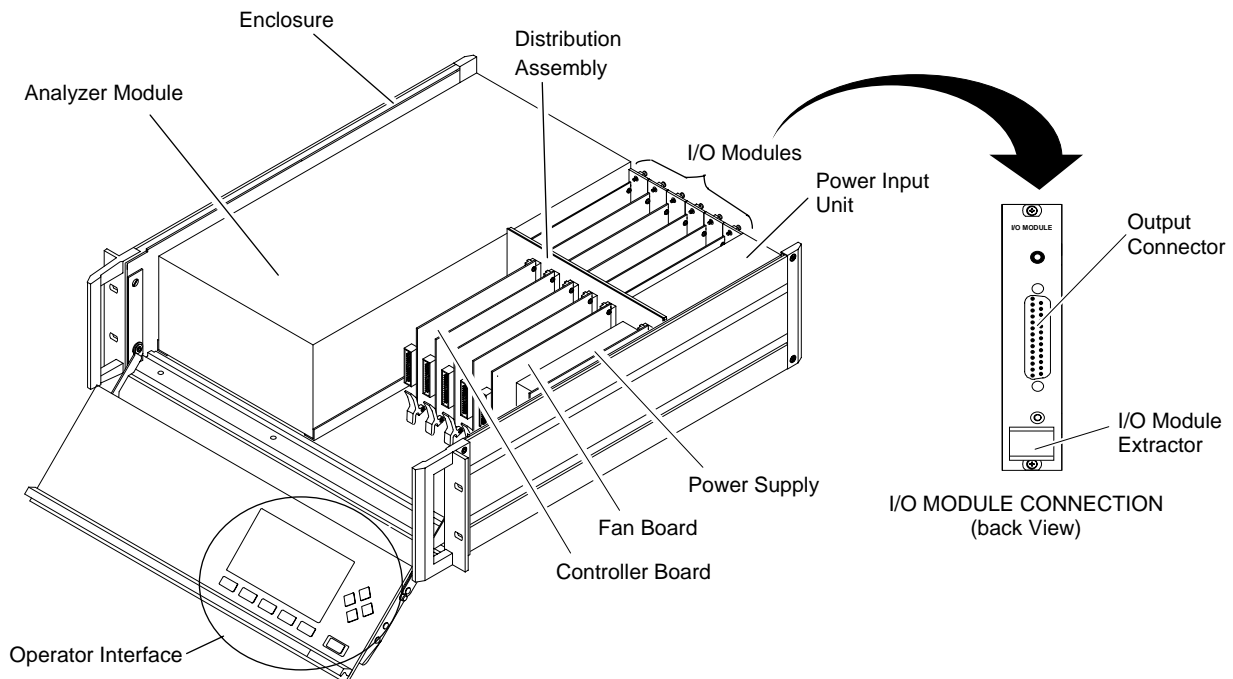


Figure 1-1. I/O Modules Location in Platform (Instrument Configuration)

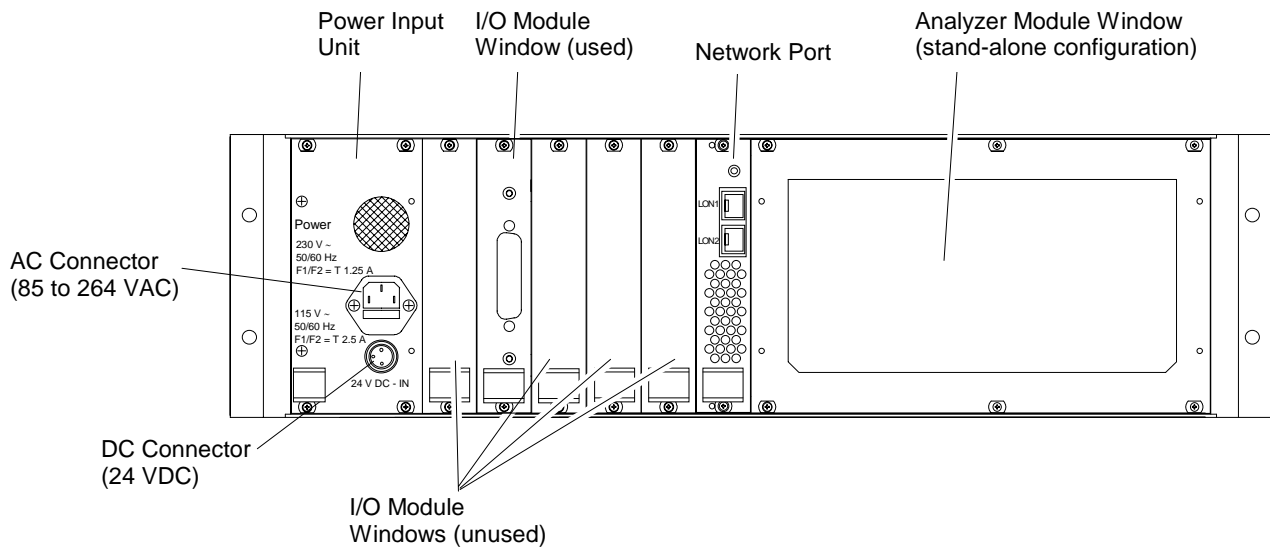


Figure 1-2. I/O Modules Location in Platform – Rear Panel View

1-2 BASIC FUNCTIONS

All Analog I/O Modules have three single-pole, double-throw (SPDT) relay outputs, four single-pole, single-throw (SPST) relay outputs (all 24 VDC, 1A resistive), one analog output and six digital inputs. These obtain their functions from operator selectable software configurations. Some of these input/output functions are not available on some I/O Modules, depending on their specific functional needs.

In fact, many functions are software configurable through the user's operator interface (either the Platform's front panel display and keypad or external control devices).

Besides providing basic output to external devices, Analog I/O Modules provide standard automatic range change between high and low ranges. A user adjustable time delay is available to prevent range switching in the case of spiking.

1-3 INSTALLATION AND REMOVAL

Before installing an I/O Module, power down the network. If the I/O Module is to be in-

stalled in an instrument, turn off the power to the entire instrument. If the user's system consists of separate, independently-powered components, power to the Analyzer Module(s) may be maintained while power to the other components is turned off. In such a case, disconnect the network connection to the Analyzer Modules.

See Figures 1-2 and 1-3. To install an I/O Module in a Platform, do the following:

1. Remove a blank panel from any one of the unused I/O Module slots in the rear of the enclosure.
2. Insert the I/O Module into the open slot with the printed circuit board oriented to the left. (Hold the I/O Module by the backplate; touching the PCB may damage electronic components.)
3. Seat the connector into the Backplane, ensuring a secure and proper fit.
4. Tighten the two screws on the I/O Module backplate.

- Turn power on to all appropriate components.

The network will initialize itself, thus recognizing and interacting with the new I/O Module.

To remove an I/O Module from the system, follow powering guidelines in the first paragraph of this section, unscrew and remove the I/O Module, secure the I/O slot with a blank panel and turn power on to all components.

1-4 SOFTWARE CONFIGURATION

See the following sections for instructions about configuring the specific I/O Module(s) in the user's system.

1-5 CONNECTIONS

See Figures 1-4 and 1-5 for pin assignments for the backplane connector and the output connector and adapter on all analog I/O Modules described in succeeding sections.

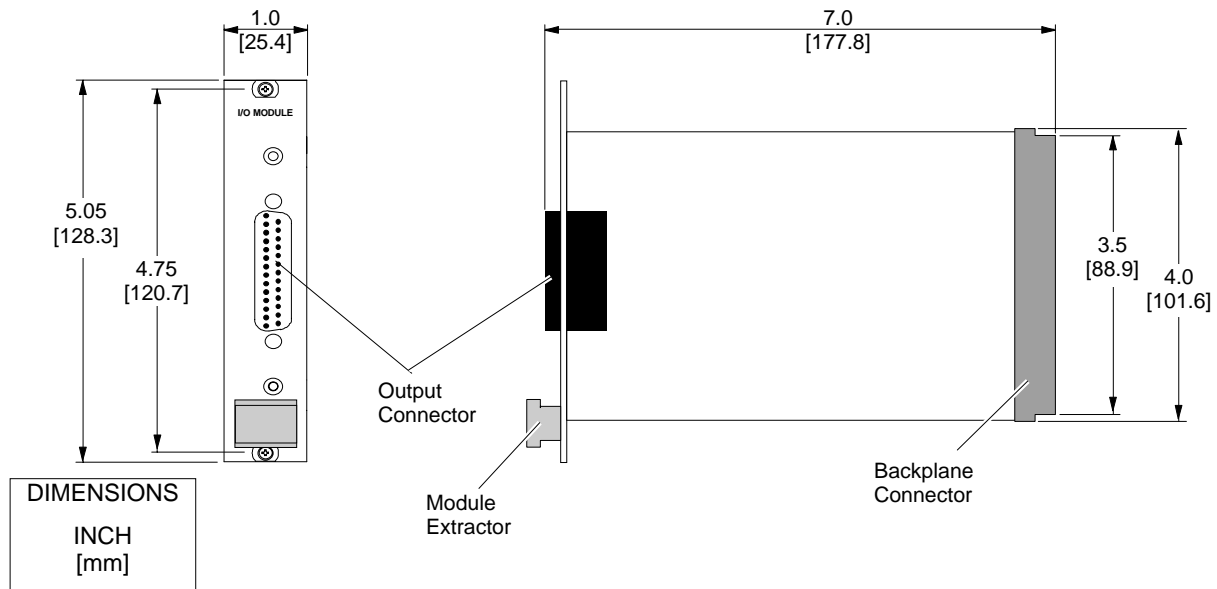


Figure 1-3. Analog I/O Module Component Location/Dimensions

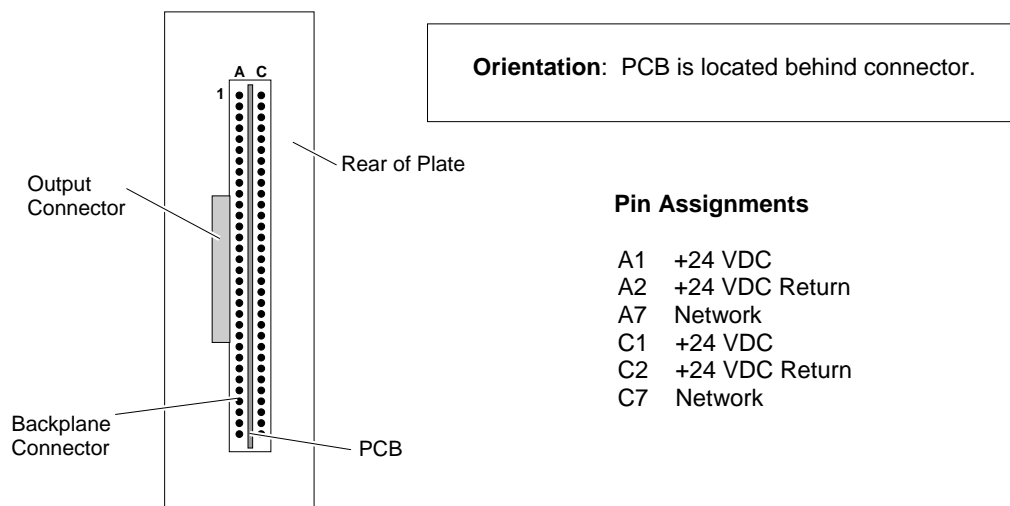
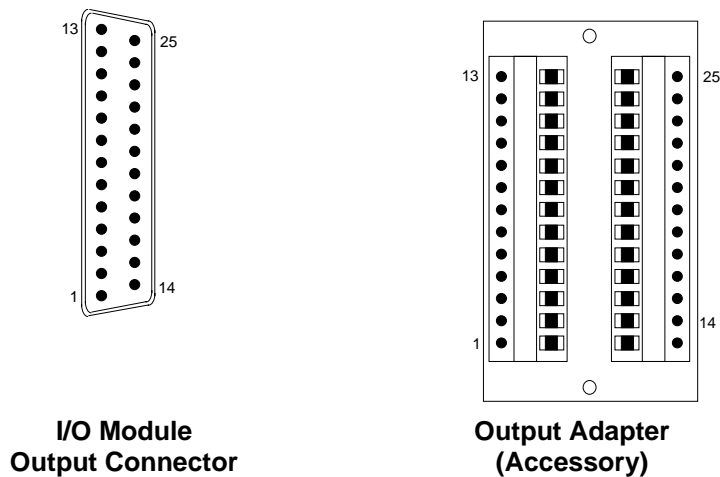


Figure 1-4. Analog I/O Module Backplane Connector Pin Assignment



PIN ASSIGNMENTS

- | | | | |
|----|-----------------------------|----|-------------------|
| 1 | Analog Current Output | 14 | SPST Relay 4 (NO) |
| 2 | Analog Voltage Output | 15 | SPST Relay 5 (NO) |
| 3 | Analog Return for Pins 1, 2 | 16 | SPST Relay 6 (NO) |
| 4 | Analog Chassis Ground | 17 | SPST Common |
| 5 | SPST Relay 1 (NC) | 18 | SPST Relay 7 (NO) |
| 6 | SPST Relay 1 (C) | 19 | Digital Input 1 |
| 7 | SPST Relay 1 (NO) | 20 | Digital Input 2 |
| 8 | SPST Relay 1 (NC) | 21 | Digital Input 3 |
| 9 | SPST Relay 1 (C) | 22 | Digital Input 4 |
| 10 | SPST Relay 1 (NO) | 23 | Digital Input 5 |
| 11 | SPST Relay 1 (NC) | 24 | Digital Input 6 |
| 12 | SPST Relay 1 (C) | 25 | Digital Common |
| 13 | SPST Relay 1 (NO) | | |

Figure 1-5. Analog I/O Module Output Connector/Adapter Pin Assignments

Model NGA2000 I/O Modules

1-6 SPECIFICATIONS

Output Relays.....	7 relay contacts (3 SPDT, 4 SPST)
Contact Rating.....	24VDC, 1A resistive
Input.....	6 digital inputs and 24 VDC Return, 5 mA resistive
Standard Output	0 to 5 VDC or 0/4 to 20 mA (isolated, software selectable)
Power Requirements.....	24 VDC; 3 W maximum

See Section 1 of the Platform manual for specifications regarding Platform related components.

SECTION 2 ANALOG OUTPUT/3 ALARMS

2-1 OVERVIEW

See Section 1 for information that applies to all I/O Modules.

The Analog Output with 3 Alarms I/O Module uses up to three of the SPDT relay outputs. These outputs are configured as common, normally open and normally closed.

Each of these alarms trips a relay to alert the user that some variable is outside of the desired range. Alarms can be set to trigger on high/low, high/high, low/low or just single high or low setpoints.

Alarm deadband is also a software programmable item with an upper limit of 20% of fullscale.

There are four alarm categories: Gas Concentration, Warning or Failure, Status and Validity.

Gas Concentration

Gas concentration can be expressed as a percentage of the current range or as an absolute value. Alarms can be set to alert the user of low concentration, high concentration and percent of range values.

Warning or Failure

Warning indicates one or more software configured limits on any network variable (other than gas concentration) has been exceeded. Examples of these secondary variables are flow rate and internal voltage. A software re-

set or other resolved software failure would also be reported.

Failure indicates an unrecoverable hardware or software failure (i.e., some component is not responding to network communications or a safety related failure such as lack of purge air in a Flame Ionization Detection Analyzer Module has been noted).

In the event of a Warning or Failure alarm, gas concentration values displayed on the Operator Interface or present on output lines are accurate.

Status

Status can describe either *Maintenance* or *Calibration Mode*.

Maintenance - a user enters the menu system; this can be used to alert the system of unauthorized entry.

Calibration Mode - alerts the user that the Analyzer Module is being calibrated.

Gas concentration values are accurate.

Validity

Validity describes a condition in which gas concentration values present on the Operator Interface or output lines should be considered invalid. The Analyzer Module alerts the system that an error in gas concentration is present.

See Figure 2-1 for a flowchart depicting menu screens related to this I/O Module.

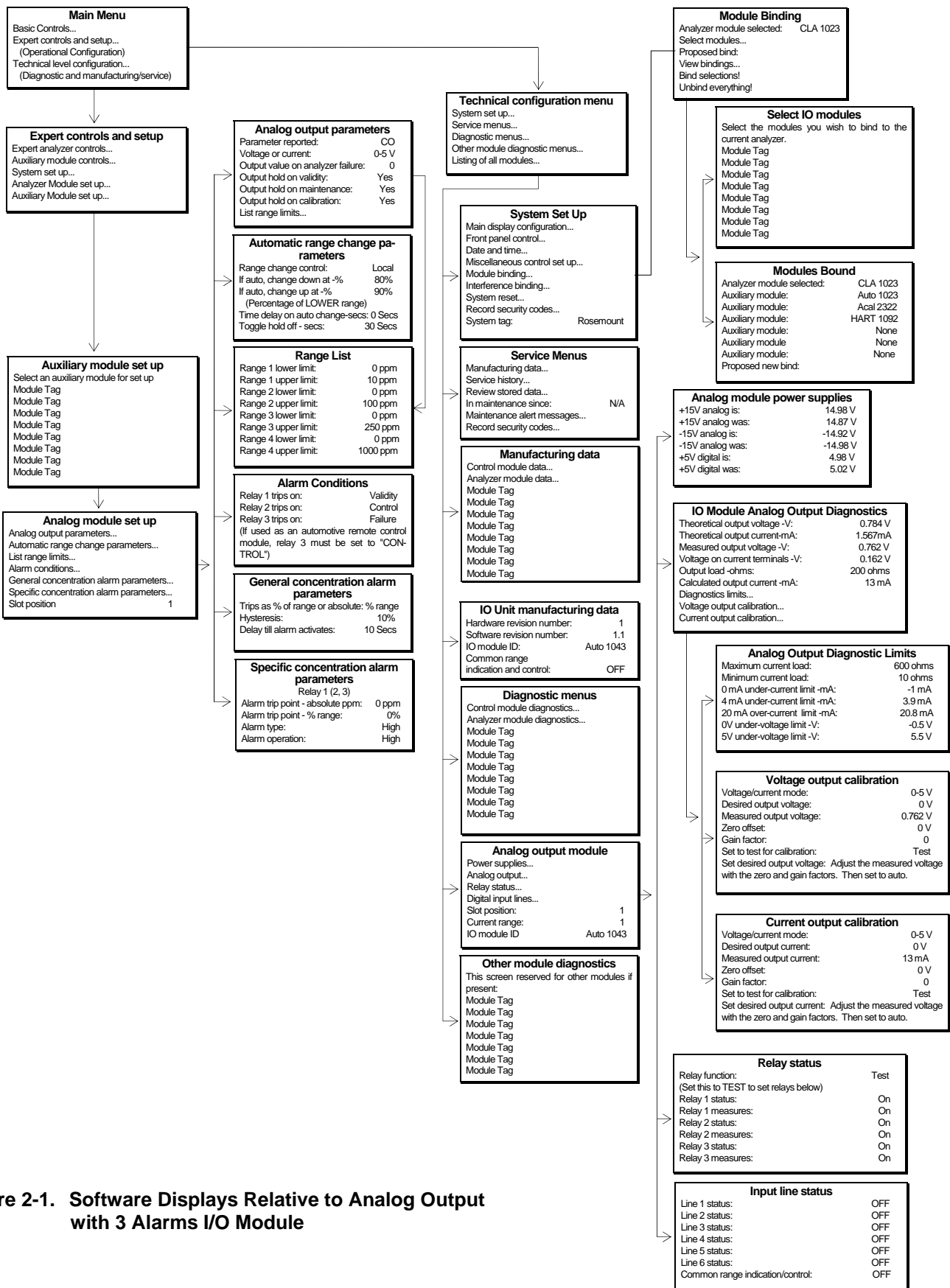


Figure 2-1. Software Displays Relative to Analog Output with 3 Alarms I/O Module

Model NGA2000 I/O Modules

2-2 INSTALLATION

If this I/O 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 are damaged. Retain the carton and packing materials until all components are operational.

To install the Analog Output with 3 Alarms I/O Module, follow general installation guidelines in Section 1, then do the following:

Perform a hardware zero/span calibration as follows:

1. Enter the Analog Output Parameters menu by making selection in the following path: Main Menu, Technical Level Configuration Menu, Diagnostic Menu, [choose] Analog/3 Alarms [module], I/O Module Analog Output Diagnostics Menu and either Voltage Output Calibration Menu or Current Output Calibration Menu. (See Figure 2-1 and refer to Section 3 of the Analyzer Module manual for fundamental menu structure help.)
2. To do both zero and span hardware calibrations, the operator must use either the Measured Output Voltage (or Measured Output Current) values in either output calibration menu or output values displayed by a calibrated digital voltmeter or other sensing device (e.g., a computer) connected to the I/O output line
3. In the I/O Module Analog Output Diagnostics Menu, choose Voltage Output Calibration or Current Output Calibration, depending on output requirements.
4. Choose Test on the Set to Test for Calibration line.
5. If the operator is doing a Voltage Output Calibration, follow steps f through i. If the operator is doing a Current Output Calibration, follow steps j through m.
6. First do the zero calibration. Set the Desired Output Voltage to 0.
7. Observe the output value discussed in step b..
8. Adjust, if necessary, the output value by scrolling the Zero Offset until the output value is 0.
9. Next, do the span calibration. Change the Desired Output Voltage to 5, and scroll the Gain Factor until the output value discussed in step 1 is 5.
10. First do the zero calibration. Set the Desired Output Current to 0 (if 0 to 20 mA output is desired) or 4 (if 4 to 20 mA output is desired).
11. Observe the output value discussed in step b.
12. Adjust, if necessary, the output value by scrolling the Zero Offset until the output value is the zero value (0 or 4).
13. Next do the span calibration. Change the Desired Output Current to 20, and scroll the Gain Factor until the output value discussed in step 1 is 20.

After spanning the hardware, the operator should recheck zero calibration values and repeat the procedure above if necessary.

Configure alarm setpoints and other parameters as follows:

1. Enter the Analog Output Module Menu by making selections in the following path: Main Menu, Expert Controls and Setup Menu, Auxiliary Module Setup Menu, [choose] Analog/3 Alarms [module] and Analog Output Module Menu. (See Figure 2-1 and refer to Section 3 of the Analyzer Module manual for fundamental menu structure help.
2. Select Voltage or Current Outputs in the Analog Output Parameters Menu.
3. Select Range Change Control (Local/Auto/Remote) in the Automatic Range Change Parameters Menu.

4. Set Desired relay designations in the Alarm Conditions Menu and other designations in the General Concentration Alarm Parameters Menu.
5. Select the Specific Concentration Alarm Parameters Menu for Relay 1. Use the MORE softkey to set Relay 2 and 3 parameters.

The I/O Module is now fully functional.

ITEM	FUNCTION	AVAILABLE
Output	Analog, 0 to 5 V, 0/4 to 20 mA	Yes
	Digital, RS-232	No
Relay Output (7 Total)	Alarm #1	Yes*
	Alarm #2	Yes*
	Alarm #3	Yes*
	Range #1 ID	Yes
	Range #2 ID	Yes
	Range #3 ID	Yes
	Range #4 ID	Yes
	Zero Valve Driver	No
	Bypass Valve Driver	No
	Range #1/Gas #1 Valve Driver	No
	Range #2/Gas #2 Valve Driver	No
	Range #3/Gas #3 Valve Driver	No
	Range #4/Gas #4 Valve Driver	No
Remote Input (6 Total)	Range Change 1	Yes
	Range Change 2	Yes
	Range Change 3	Yes
	Range Change 4	Yes
	Calibration Correction Select	No
	Zero Calibration	No
	Span Calibration on Current Range	No
	Span Calibration Cycle	No
Feature	Auto Calibration Timing Device	No
	Auto Range Change Select	Yes

*Selectable per alarm class.

Table 2-1. Available Functions – Analog Output with 3 Alarms I/O Module

SECTION 3 AUTO CALIBRATION

3-1 OVERVIEW

See Section 1 for information that applies to all I/O Modules. The calibration routine in the Analyzer Module menu structure is strictly manual: 1) Open zero/span gas valves manually, 2) wait for stabilization of displayed values, 3) initiate calibration routine.

The Auto Calibration I/O Module allows the user to "manually" or automatically initiate calibration routines for one Analyzer Module while solenoids handle gas valve manipulation. The actual calibration routine initiation can be manual or preset for timing, intervals and sequencing.

The Auto Cal I/O Module also provides analog signal output.

Up to four span solenoid valves and one zero solenoid valve (customer supplied) can be triggered at set time intervals. The frequency and duration of the calibration cycle is software programmable, allowing many varied sequences, a few of which follow:

- **zero** x times, then **span**
- **zero**, then **span**
- **zero**, check on **midpoint**, then **span**

Four SPST and two SPDT relays are used to drive solenoid valves that control the flow of zero and span calibration gases to the Analyzer Module. The seventh relay indicates an in-calibration condition on the network.

- Line 1 - do zero calibration
- Line 2 - do span calibration
- Line 3 - do a zero and a span as programmed
- Lines 4 & 5 - select the desired range in the following binary fashion (for Line 2 above ONLY):

Range	Line 4	Line 5
1	OFF	OFF
2	ON	OFF
3	OFF	ON
4	ON	ON

- Line 6 - disables calibration instruction and allows only a check to occur

Note the following:

These remote functions will apply only if the remote controls are enabled through this I/O Module.

Lines 4 and 5 control only the desired range of the span function as described in Line 2.

If the digital lines described above are not connected, the Line 2-related span function will only select Range 1; it will not calibrate any other range. However, the Line 3 function will span or check ranges as set up in the module's programming.

After calibration, the Analyzer Module will be returned to the range it was operating on previous to calibration.

Characterizations for pins 5 through 18 in Figure 1-5 (relative to SPDT or SPST and NC, C, NO or C) remain accurate, but pin assignments relative to specific relays are different for the Auto Cal I/O Module. Those pin assignments are as follows:

Pin 5 - Relay 7	Pin 12 - Relay 6
Pin 6 - Relay 7	Pin 13 - Relay 6
Pin 7 - Relay 7	Pin 14 - Relay 3
Pin 8 - Relay 5	Pin 15 - Relay 4
Pin 9 - Relay 5	Pin 16 - Relay 1
Pin 10 - Relay 5	Pin 17 - 1-4 COM
Pin 11 - Relay 6	Pin 18 - Relay 2

After calibration, the output signal is then corrected for zero and span. (See Figure 3-1 for a flowchart depicting menu screens related to this I/O Module.)

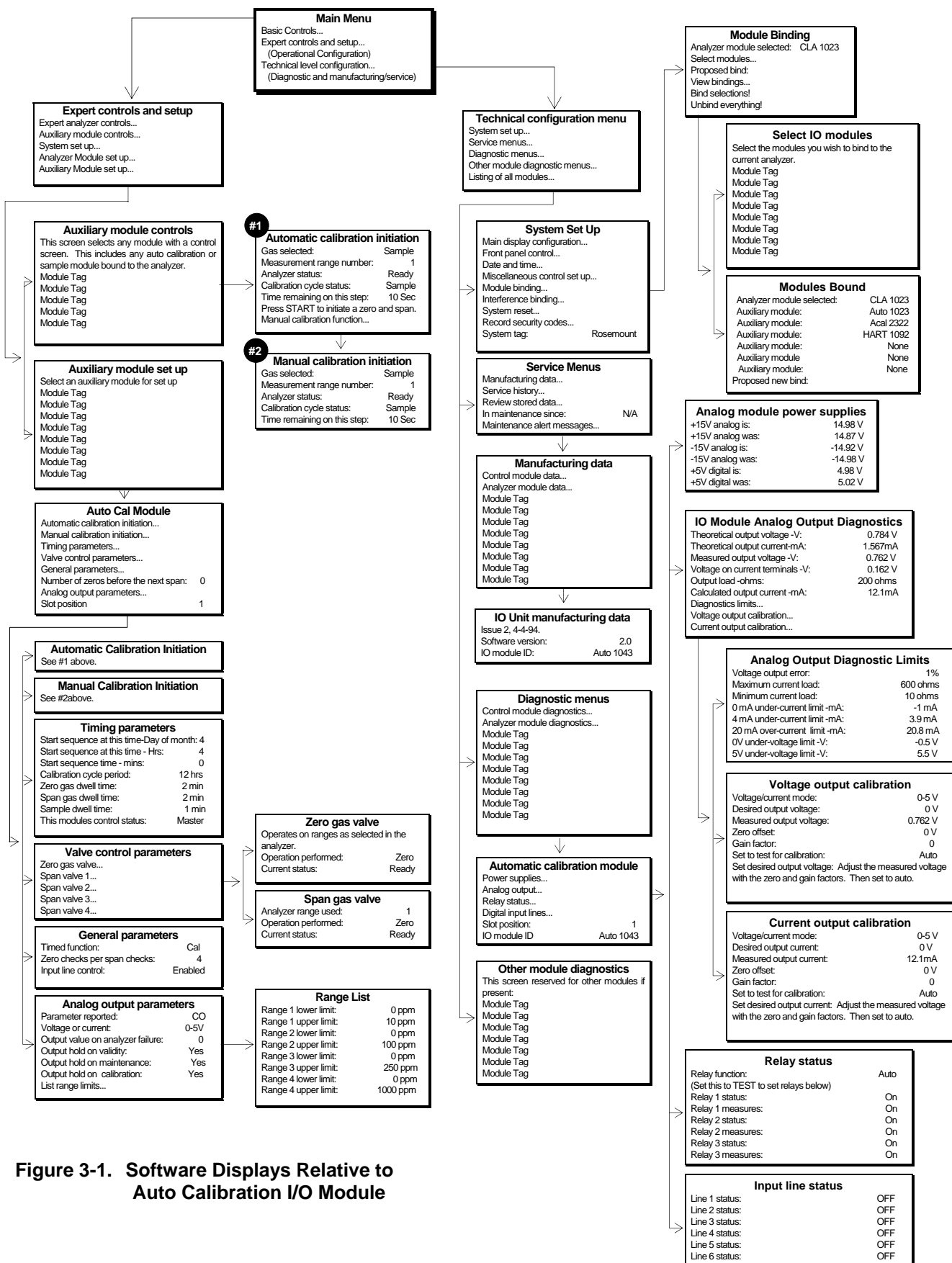


Figure 3-1. Software Displays Relative to Auto Calibration I/O Module

Model NGA2000 I/O Modules

3-2 INSTALLATION

If this I/O 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 its contents are damaged. Retain the carton and shipping material until all components are operational.

To install this I/O Module, follow general installation guidelines in Section 1 and then do the following:

Perform a hardware zero/span calibration as follows:

1. Enter the Analog Output Parameters menu by making selection in the following path: Main Menu, Technical Level Configuration Menu, Diagnostic Menu, [choose] Auto Cal [module], Analog Output Module Menu and I/O Module Analog Output Diagnostics Menu. (See Figure 3-1 and refer to Section 3 of the Analyzer Module manual for fundamental menu structure help.)
2. To do both zero and span hardware calibrations, the operator must use either the Measured Output Voltage (or Measured Output Current) values in either output calibration menu or output values displayed by a calibrated digital voltmeter or other sensing device (e.g., a computer) connected to the I/O output line
3. In the I/O Module Analog Output Diagnostics Menu, choose Voltage Output Calibration or Current Output Calibration, depending on output requirements.
4. Choose Test on the Set to Test for Calibration line.
5. If operator is doing a Voltage Output Calibration, follow steps f through i. If the operator is doing a Current Output Calibration, follow steps j through m.
6. First do the zero calibration. Set the Desired Output Voltage to 0.
7. Observe the output value discussed in step b.
8. Adjust, if necessary, the output value by scrolling the Zero Offset until the output value is 0.
9. Next, do the span calibration. Change the Desired Output Voltage to 5, and scroll the Gain Factor until the output value discussed in step 1 is 5.
10. First do the zero calibration. Set the Desired Output Current to 0 (if 0 to 20 mA output is desired) or 4 (if 4 to 20 mA output is desired).
11. Observe the output value discussed in step b.
12. Adjust, if necessary, the output value by scrolling the Zero Offset until the output value is the zero value (0 or 4).
13. Next do the span calibration. Change the Desired Output Current to 20, and scroll the Gain Factor until the output value discussed in step 1 is 20.

After spanning the hardware, the operator should recheck zero calibration values and repeat the procedure above if necessary.

Configure auto calibration parameters as follows:

1. Enter the Auto Cal Module Menu by making selections in the following path: Main Menu, Expert Controls and Setup Menu, Auxiliary Module Setup Menu, Auto Cal [module]. (See Figure 3-1 and refer to Section 3 of the Analyzer Module manual for fundamental menu structure information.)
2. Set all parameters included in sub-menus of the Auto Cal Module menu, as desired.

The Auto Calibration Module has the following functions:

- timed calibration

- manually initiated calibration cycle
- manually initiated zero and span cycles
- remotely initiated calibration

screens accessible in the Expert Setup sub-menus. See Figure 3-1.

The I/O Module is now fully functional.

All of these functions can be attained through the previously described setup

ITEM	FUNCTION	AVAILABLE
Output	Analog, 0 to 5 V, 0/4 to 20 mA	Yes
	Digital, RS-232	No
Relay Output (7 Total)	Alarm #1	Yes*
	Alarm #2	No
	Alarm #3	No
	Range #1 ID	No
	Range #2 ID	No
	Range #3 ID	No
	Range #4 ID	NO
	Zero Valve Driver	Yes
	Bypass Valve Driver	Yes
	Range #1/Gas #1 Valve Driver	Yes
	Range #2/Gas #2 Valve Driver	Yes
	Range #3/Gas #3 Valve Driver	Yes
Range #4/Gas #4 Valve Driver	Yes	
Remote Input (6 Total)	Range Change 1 & 2	Yes
	Range Change 3 & 4	Yes
	Calibration Correction Select	Yes
	Zero Calibration	Yes
	Span Calibration on Current Range	Yes
	Span Calibration Cycle	Yes
Feature	Auto Calibration Timing Device	Yes
	Auto Range Change Select	No

*Fixed in-calibration alarm.

Table 3-1. Available Functions – Auto Calibration I/O Module

SECTION 4 SYSTEM AUTO CALIBRATION

4-1 OVERVIEW

See Section 1 for information that applies to all I/O Modules.

The System Auto Calibration I/O Module allows the user to automatically calibrate up to four Analyzer Modules at once. A typical application would be a CEMS-type calibration for all Analyzer Modules at once, in sequence or in varied combinations.

Four calibration cycles (software configurable) can be executed:

- manually-initiated zero cycle
- manually-initiated span cycle
- manually-initiated auto calibration cycle (zero and up to four span functions)
- time-initiated auto calibration cycle (based on the network's clock)

Up to four span solenoid valves and one zero solenoid valve (customer supplied) can be triggered at set time intervals. The frequency and duration of the calibration cycle is software programmable, allowing many varied sequences, a few of which follow:

- **zero** x times, then **span**
- **zero**, then **span**
- **zero, span**, then check on a **midpoint**

Four SPST and two SPDT relays are used to drive solenoid valves that control the flow of zero and span calibration gases to the Analyzer Module. The seventh relay indicates an in-calibration condition on the network. Relay output definitions follow:

- Relay 1 - span gas 1: closed when span gas 1 should be flowing

- Relay 2- span gas 2 closed when span gas 2 should be flowing
- Relay 3 - span gas 3: closed when span gas 3 should be flowing
- Relay 4 - span gas 4: closed when span gas 4 should be flowing
- Relay 5 - span gas 5: closed when zero gas should be flowing
- Relay 6 - calibration in progress: closed when any zero, span or calibration cycle is being executed
- Relay 7- sample bypass: closed when the sample should **not** be flowing through the Analyzer Module

The System Auto Cal Module has six digital input lines for remotely initiated calibration. The function of each line is the following:

- Line 1 - do zero calibration on current range as set up in the Analyzer Module
- Line 2 - currently unused
- Line 3 - complete zero and span cycle as programmed
- Line 4 - local/remote selection: 0 = local, 1 = remote (used to set the dwell times for gases)
- Line 5 - currently unused
- Line 6 - Calibration or QC check: 0 = as setup in the Auto Cal Module, 1 = QC check only

Characterizations for pins 5 through 18 in Figure 1-5 (relative to SPDT or SPST and NC, C, NO or C) remain accurate, but pin assignments relative to specific relays are different

for the System Auto Cal Module. Those pin assignments are as follows:

Pin 5 - Relay 7	Pin 12 - Relay 6
Pin 6 - Relay 7	Pin 13 - Relay 6
Pin 7 - Relay 7	Pin 14 - Relay 3
Pin 8 - Relay 5	Pin 15 - Relay 4
Pin 9 - Relay 5	Pin 16 - Relay 1
Pin 10 - Relay 5	Pin 17 - 1-4 COM
Pin 11 - Relay 6	Pin 18 - Relay 2

After calibration, the output signal is then corrected for zero and span. The System Auto Cal I/O does not provide an analog signal output. (See Table 4-1 for a complete list of functions.)

4-2 INSTALLATION

If this I/O 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 its contents are damaged. Retain the carton and shipping material until all components are operational.

To install this I/O Module, follow general installation guidelines in Section 1 and then do the following:

Bind each Analyzer Module to the System Auto Cal I/O Module.

Do this through each Analyzer Module's menu structure. (See instruction manual for individual Analyzer Module for details.)

Configure System Auto Cal parameters as follows:

Enter the System Auto Cal Module menu by making selections in the following path: Main Menu, Expert Controls and Setup menu, Auxiliary Module Controls or Auxiliary Module Setup menus, and System Auto Cal [module]. (See Figure 4-1 and refer to Section 3 of any Analyzer Module manual for fundamental menu structure help.)

In the Auxiliary Module Controls menu and subsequent sub-menus, set parameters relative to calibration gas selection and calibration mode (local/remote/external). Local and remote selections allow the operator to switch between a local calibration gas injection point and a remote one. This choice sets the dwell time according to the distance that the calibration gas must travel. The external selection allows the use of an external digital signal carried by digital line 4 (for instance, from a simple front panel switch) to quickly set either local or remote mode.

In the Auxiliary Module Setup menu and subsequent sub-menus, set additional parameters such as sequencing cycles, valve control for zero and span gases, analyzer identification and range upper/lower limits, and zero vs. Span check ratio. (See Figure 4-1 for menu locations for each of these parameter sets.)

The System Auto Cal I/O Module is now fully functional.

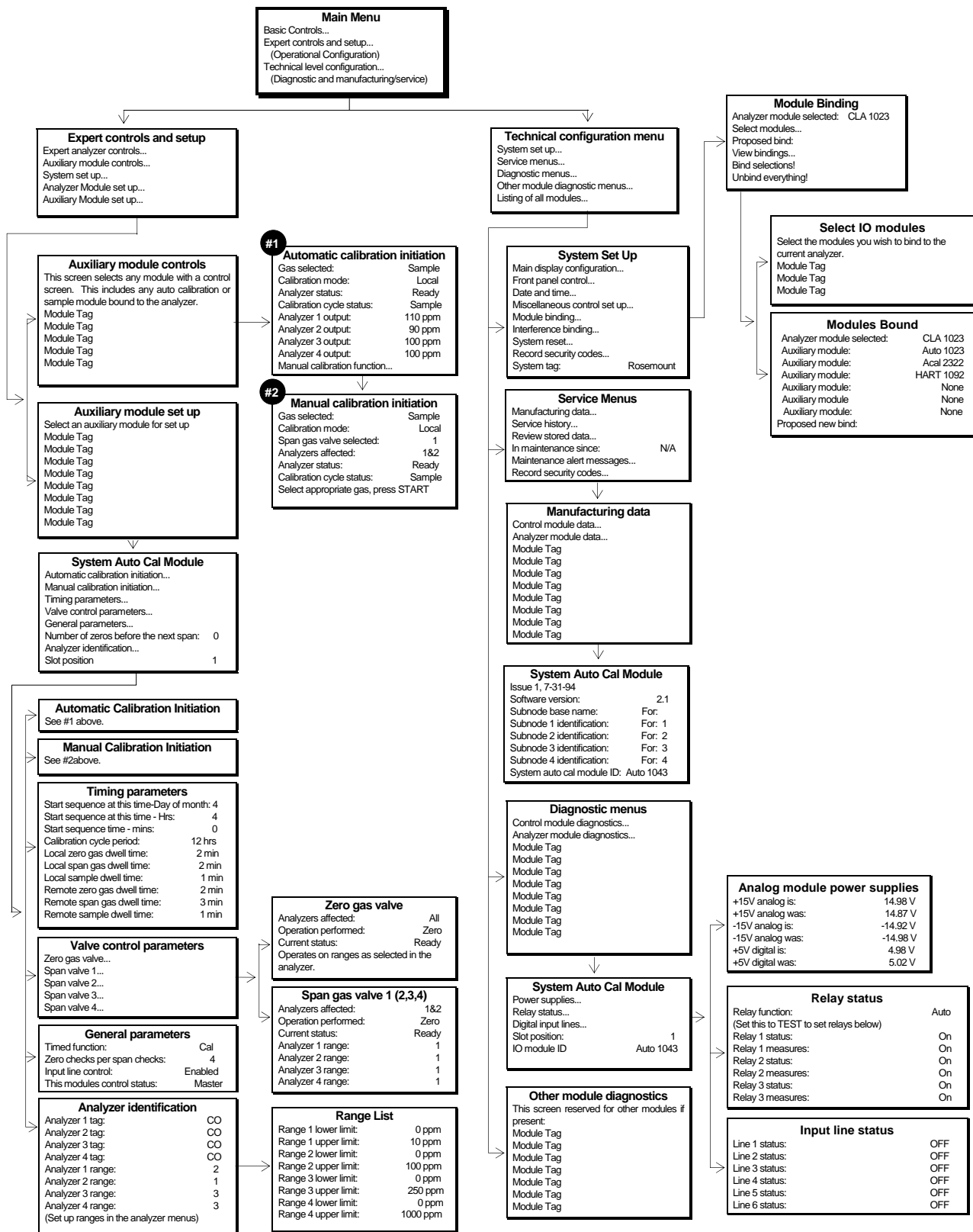


Figure 4-1. Software Displays Relative to System Auto Calibration I/O Module

ITEM	FUNCTION	AVAILABLE
Output	Analog, 0 to 5 V, 0/4 to 20 mA	No
	Digital, RS-232	No
Relay Output (7 Total)	Alarm #1	No
	Alarm #2	No
	Alarm #3	No
	Range #1 ID	No
	Range #2 ID	No
	Range #3 ID	No
	Range #4 ID	NO
	Zero Valve Driver	Yes
	Bypass Valve Driver	Yes
	Range #1/Gas #1 Valve Driver	Yes
	Range #2/Gas #2 Valve Driver	Yes
	Range #3/Gas #3 Valve Driver	Yes
Range #4/Gas #4 Valve Driver	Yes	
Remote Input (6 Total)	Range Change 1 & 2	No
	Range Change 3 & 4	No
	Calibration Correction Select	Yes
	Zero Calibration	Yes
	Span Calibration on Current Range	No
	Span Calibration Cycle	Yes
Feature	Auto Calibration Timing Device	Yes
	Auto Range Change Select	No

Table 4-1. Available Functions – System Auto Calibration I/O Module

SECTION 5 RETURN OF MATERIAL

5-1 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.

5-2 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**

5-3 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.
Process Analytical Division
Customer Service Center
1-800-433-6076**

Model NGA2000 I/O Module

ADDENDUM

1-0 OVERVIEW

This addendum serves as an amendment to the Input/Output (I/O) Modules instruction manual (PN 748275). The following information should be considered part of the I/O manual, and supersedes any conflicting information in the body of the manual.

READ THIS INFORMATION AND NOTE THE CONFLICTS.

2.0 DISPLAY SCREENS

The figures depicting display screen flow structures on pages 2-2 and 3-2 do not note the following menu:

Displayed parameters	
First line's parameter:	Flow
Second line's parameter:	Flow
Third line's parameter:	Flow
Fourth line's parameter:	Flow
May be displayed on the appropriate line of the single analyzer display screen.	
Select whether the IO module or the analyzer module lines are displayed in the control module set up menus.	

The menu above can be accessed by making the following selections from the **Main Menu**:

Expert controls and setup (input security code, if applicable), **Auxiliary module setup** (select appropriate module from the list), and **Displayed Parameters**.

As with other NGA 2000 components, certain parameters can be displayed (up to four at one time) on the Run Mode screen. The

menu above allows the user to do so for certain I/O-related parameters.

Another important item relating to display screens is selection in the **Expert Controls and Setup** menu entitled **Local I/O setup**.

This item, as well as the entire menu structure that branches from it, *does not refer* to any currently available I/O Modules (Analog with 3 Alarms, Auto Calibration, System Auto Calibration, and PC Interface). The term, Local I/O, refers to an as-yet-unavailable I/O component which will function somewhat differently from the current I/O Modules. All editable parameters in the **Local I/O setup** menu structure should remain at their factory-set default values, especially the selection **Module Installed**: (default value: No) in the display screen **Local I/O setup**. If **Module installed** is changed to **Yes**, network response time will slow down and data corruption could occur.

3.0 BINDING

The following section is to be added to the instruction manual as section **1.5 Binding**.

In an NGA 2000 system that contains only one Analyzer Module, binding between that module and any I/O Module(s) will be automatic upon startup. If the system contains multiple Analyzer Modules, the user must manually bind Analyzer Modules to the appropriate I/O Module(s).

First, verify that all NGA 2000 components (Analyzer Modules, I/O Modules and Platform) have been recognized during initialization of the network. Make the following selections from the Run Mode screen:

MENU softkey → Technical Level Configuration → Listing of All Modules.

The Listing of All Modules screen displays all components *recognized* during initialization. Any module *connected (or disconnected) after initialization will not be recognized* until the system is re-initialized. Verify that the network recognizes all modules. If module(s) are not recognized, the problem (e.g., cabling) must be isolated and corrected before continuing.

Module Tag Names

Before binding, the user must rename (assign a *Module Tag*) to all Analyzer and I/O Modules in the system, following a naming scheme of the user's choice. (The initial module tag names are set during factory test and in all probability are meaningless to the user.)

The only requirement for the naming scheme is: Analyzer Module; the names logically differentiate each Analyzer Module from the other(s); I/O Modules; include information relative to the Analyzer Module it will be bound to.

For example, in a system consisting of two NDIR Analyzer Modules, two FID Analyzer Modules and one CLD Analyzer Module, the *Module Tag* might be the following:

ANALYZER MODULE TAG	I/O MODULE TAG
NDIR-CO2	ANALOG I/O IR1-CO2
NDIR-CO	AUTOCAL I/O IR2-CO
FID-HIGH	ANALOG I/O THC1-HIGH
FID-LOW	ANALOG I/O THC2-LOW
CLD-NOX	AUTOCAL I/O NOX

Assigning Module Tag to Analyzer Modules

1. Go to the Run Mode screen by pressing the **<HOME>** and **<DISPLAY>** softkeys. Note which Analyzer Module measurement is being displayed (e.g., ppm CO, ppm NOx, or % O2).
2. Go to the Analyzer Tag screen by selecting **<MENU>** softkey, **Expert Controls and Setup** menu, **Analyzer Module Setup** menu and **Analyzer Tag**. On the right side of the screen, the default tag name will highlight (darken). The tag name can now be edited.
3. Editing the Module Tag: The arrow keys are used to scroll through a revolving set of alpha (upper and lower case), numeric (0 - 9), 82 special characters and a space (the space appears following the upper case "A"). The left and right arrows change cursor position, the up and down arrows scroll through the character sets. Tag names can be as long as 29 characters (including spaces).
4. When ready to store the module tag, press **ENTER** (tag stored in non-volatile memory). Press the **<HOME>** and **<DISPLAY>** softkeys to return to the Run Mode screen.

To enter Module Tags for all other Analyzer Modules, press **<NEXT>** softkey and repeat steps 1, 2, and 3 above.

Assigning Module Tag to I/O Modules

1. Remove all but one I/O Module from the Platform.
2. Go to the I/O Module ID screen by selecting **Main Menu, Technical Level Configuration, Listing of All Modules** (select I/O Module from list), and **I/O Module ID**. On the right side of the screen, the default tag name will highlight (darken). The tag name can now be edited.

Model NGA2000 I/O Module

- a. Editing the Module Tag: The arrow keys are used to scroll through a revolving set of alpha (upper and lower case), numeric (0 - 9), 82 special characters and a space (the space appears following the upper case "A"). The left and right arrows change cursor position, the up and down arrows scroll through the character sets. Tag names can be as long as 29 characters (including spaces).
3. When ready to store the Module Tag, press **ENTER** (tag stored in non-volatile memory). Press the **<HOME>** softkey.
 4. Label the rear panel of the I/O Module with its' *Module Tag* name. Noting each I/O Module's physical location for future reference can avoid some common problems with multiple module systems, such as the assumption that a module is not responding (e.g., no output response - voltage, current, alarms) when actually the wrong I/O Module is being accessed.
 5. Turn power OFF to the Platform, reinsert and secure another I/O Module (ensuring proper seating in the backplane).
 6. Turn power ON to the Platform. Repeat steps 1, 2, 3, and 4 above (steps 1, 2, and 3 if last I/O Module).

The user may have to use the **<MORE>** softkey to view all I/O Modules listed in the ***Listing of All Modules*** screen.

System Tag Name

The System Tag (which appears at the top of the ***Run Mode*** Screen) can be change by doing the following:

1. Go to the System Tag screen by selecting Main Menu, Technical Level Configuration, System Setup, and System Tag.
 - a. Editing the System Tag: The arrow keys are used to scroll through a revolving set of alpha (upper and lower case), numeric (0 - 9), 82 special characters and a space (the space appears following the upper case "A"). The left and right arrows change cursor position, the up and down arrows scroll through the character sets. Tag names can be as long as 29 characters (including spaces).
2. When ready to store the System Tag, press ENTER (tag stored in non-volatile memory).

NOTE:

Throughout the remaining steps of the binding procedure, **DO NOT** press the **<UNBIND>** or **<REINIT>** softkeys. Doing so will unbind all modules, requiring the user to redo the entire binding procedure.

If a binding mistake is made, the only way to correct the mistake is to press **<UNBIND>** and redo the entire binding procedure.

Binding Procedure

1. Go to the Run Mode screen by pressing the **<HOME>** and **<DISPLAY>** softkeys. Note which Analyzer Module is being displayed (the module tag appears at the top of the screen).
2. Select ***Technical Level Configurations, System Setup, and Module Binding***. The Module Binding screen ***Select Modules*** and ***View Bindings*** selections will be referenced in the remaining steps of this procedure.
 - a. From the ***Module Binding*** screen:
 - b. ***View Bindings***: Verify the ***Analyzer Module Selected*** is correct.
3. ***Select Modules***: Select the I/O Module(s) to be bound to the selected Analyzer Module.

Instruction Sheet

748336-C

April 1997

Model NGA2000 I/O Module

4. The screen will return to **Module Binding**, and the I/O Module(s) selected will appear as **Proposed New Bind**.
5. *If the I/O Module in Proposed New Bind is correct*, press the **<BIND>** softkey. (The system resets itself automatically when the Bind softkey is pressed.)
6. *If the I/O Module in Proposed New Bind is not correct*, return to **Select Modules** and select the correct I/O Module(s).
7. To bind additional Analyzer and I/O Modules, return to the Run Mode screen, press **<NEXT>** softkey, select another Analyzer Module and repeat steps 2, 3, and 4.

As I/O Modules are bound, they become unavailable for binding, and are automatically removed from the Select Modules screen. In a system consisting of one Analyzer Module, I/O Modules are automatically bound upon initialization of the system. Therefore no I/O Modules would appear in the Select Module screen.

A "miss-bound" module can lead to confusion and misdiagnosis of system problems. Verify all bindings by selecting Module Binding, View Bindings and using the **<NEXT>** softkey to toggle through Analyzer-I/O Module binding combinations.

At this point, all NGA 2000 system components are bound and fully coordinated.

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.

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

Instruction Manual

748275-F

September 2003

Model NGA2000 I/O Modules

EMERSON PROCESS MANAGEMENT

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

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

ASIA - PACIFIC
Fisher-Rosemount
Singapore Private Ltd.
1 Pandan Crescent
Singapore 128461
Republic of Singapore
T 65-777-8211
F 65-777-0947
<http://www.processanalytic.com>

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

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

