NOA-332
Net Oil Analyzer

User Manual

Manual No. 9A-100079514, Rev. 02

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Table of Contents

Section 1—Features of the NOA-332 Net Oil Analyzer 1
About this Manual—Introduction 1
Operational Overview 1
Specific Features 3
Specifications 6

Section 2—Setup Instructions 11
Introduction 11
Operating System 11
Scan Data Display 13
Timing Out 14
Start-Up Procedure 15
Well Test Procedure 18
Additional Information 19

Section 3—The Well Test Status Menu 21
Introduction 21
Accessing the Well Test Status Menu 21
Accessing the Timers Menu 23
Accessing the Current Totals Menu 23
Accessing the Continuous Totals Menu 25
Accessing the Prorated Totals Menu 26
Accessing the Previous Test Totals Menu 27

Section 4—The Flow Data Menu 29
Introduction 29
Accessing the Flow Data Menu 29
Reading the Gas Orifice Meter Flow Data 30
Reading the Gas Turbine Meter Flow Data 32
Reading the Emulsion, Free Water, and Gross Volume Flow Data 33

Section 5—The Site Data Menu 35
Introduction 35
Accessing the Site Data Menu 35
Reading and Entering Site Data Parameters 36

Section 6—The Alarm Data Menu 43
Introduction 43
Accessing the Analog Input Alarm Data Submenu 43
Analog Input Alarm Data Parameters 43
Analog Input Alarm Status Indicators 45
Accessing the Multivariable Transmitter Input Alarm Data Submenu 46
Multivariable Transmitter Input Alarm Status Data Parameters 47

Multivariable Transmitter Input Alarm Status Indicators 47
Accessing the Digital Input Alarm Data Submenu 48
Digital Input Alarm Data Parameters 48
Digital Input Alarm Status Indicators 48
Accessing the Rate/Volume Alarm Submenu 49
Rate/Volume Alarm Data Parameters 49
Rate/Volume Alarm Status Indicators 49

Section 7—The Multivariable Transmitter Menu 51
Introduction 51
Accessing the Multivariable Transmitter menu 52
Multivariable Transmitter Parameters 53

Section 8—The Time Data Menu 57
Introduction 57
Accessing the Time Data Menu 57
Setting the System Time 57
Setting the System Date 58

Section 9—The Configuration/Setup Menu 59
Introduction 59
Accessing the Configuration/Setup Menu 59

Section 9a—The System Setup Menu 61
Introduction 61
Accessing the System Setup Menu 61
Warm Restart 65

Section 9b—The Well Test Setup Menu 67
Introduction 67
Accessing the Well Test Setup Menu 67

Section 9c—The Flow Setup Menu - Gas Orifice Meter 77
Introduction 77
Accessing the Flow Setup Menu 77
Accessing the Gas Orifice Setup Menu 78
Stacked Differential Pressure (DP) Menu 87
Orifice Alarm Setup Menu 88
Accessing the Orifice Alarm Setup Menu 89
Orifice Alarm Parameters 89

Section 9d—The Flow Setup Menu - Gas Turbine Meter 95
Introduction 95
Accessing the Flow Setup Menu 95
Accessing the Gas Turbine Setup Menu 96
Gas Components Menu 100

Turbine Alarm Setup Menu 101
Accessing the Turbine Alarm Setup Menu 101
Turbine Alarm Parameters 102
Calibrate Turbine Menu 106

Section 9e—The Flow Setup Menu - Liquid Turbine Meter 109
Introduction 109
Accessing the Flow Setup Menu 109
Accessing the Liquid Turbine Meter Setup Menu 110
Turbine Alarm Setup Menu 118
Accessing the Turbine Alarm Setup Menu 118
Turbine Alarm Parameters 119
Calibrate Turbine Menu 123

Section 9f—The Security Setup Menu 127
Introduction 127
Accessing the Security Setup Menu 128
Setting Up the Security Information 131
Setting Up Other Operator Codes and Security Levels 132

Section 9g—The Alarm Setup Menu 133
Introduction 133
Accessing the Alarm Setup Menu 133
Accessing the Analog Input Alarm Setup Submenu 133
Analog Input Alarm Parameters 134
Accessing the Digital Input Alarm Setup Submenu 137
Digital Input Alarm Parameters 138
Accessing the Rate and Volume Alarm Setup Submenus 139
Rate/Volume Alarm Parameters 140
Accessing the Multivariable Transmitter Input Alarm Setup Submenu 143
Multivariable Transmitter Input Alarm Parameters 143

Section 9h—The Calibration Menu 147
Introduction 147
Accessing the Calibration Menu 148
Analog Input Multipoint Calibration Routine 149
Analog Input Zero/Span Scale Routine 152
Analog Input Calibration Checkpoint Routine 154
Review Calibration Routine 157

Section 9i—The Communications Setup Menu 159
Introduction 159
Accessing the Comm Ports Setup Menu 159
Communications Parameters 160

Section 9j—The I/O Config Menu 165
Introduction 165
Accessing the I/O Configuration Menu 165
The Analog Input Menu 165
Accessing the Analog Configuration Menu 165
Default Source and Units for Analog Input Channels 168
The Digital Input Menu 168
Accessing the Digital Input Configuration Menu 168
The Digital Output Menu 169
Accessing the Digital Output Configuration Menu 169

Section 9k—The Pulse Output Menu 171
Introduction 171
Accessing the Pulse Output Menu 171

Appendix A—General Installation Instructions— Weatherproof Unit A-1
Introduction A-1
Mounting the Enclosure A-4
NOA-332 Power Wiring Connections A-6
Analog Circuit Board Transmitter Wiring and Jumper Configuration A-7
Analog Circuit Board Frequency Flowmeter Wiring and Jumper Configuration A-17
Analog Circuit Board Ground Jumper Configuration A-19
Analog Circuit Board Wiring Diagrams A-19
Digital Circuit Board Setup and Jumper Configuration A-29
Upgrading NOA-332 System Firmware A-30

Appendix B—General Installation Instructions— Rack/Panel Mount Unit B-1
Introduction B-1
Mounting the Instrument B-4
NOA-332 Power Wiring Connections B-6
Analog Circuit Board Transmitter Wiring and Jumper Configuration B-7
Analog Circuit Board Frequency Flowmeter Wiring and Jumper Configuration B-16
Analog Circuit Board Ground Jumper Configuration B-17
Digital Circuit Board Setup and Jumper Configuration B-20
Upgrading NOA-332 System Firmware B-21

Appendix C—Menu and Submenu Organizational Charts C-1

Appendix D—Spare Parts List D-1

Appendix E—NuFlo Capacitance Probe & Capacitance Probe Interface Board E-1
Introduction E-1
Capacitance Probe E-1
Capacitance Probe Interface Board E-2

Selecting Probe Size E-5
Configuring the Voltage Output E-6
Configuring Current Output E-8
Setting a Security Code E-10
Accessing with a Security Code E-11

Appendix F—Digital Input Output Option – Eight-Input/Eight-Output F-1
General F-1
Digital Inputs F-1
Digital Outputs F-1

Appendix G—Digital Input Output Option - Four-Input/Four Output G-1
General G-1
Digital Inputs G-1
Digital Outputs G-1

Appendix H—Digital Communications H-1
General H-1
Modem Use with the NOA-332 ..... H-6
RS-232 / RS-485 Converters H-7

Section 1

Features of the NOA-332 Net Oil Analyzer

About this Manual—Introduction

This manual serves as a guide to the installation, configuration, and operation of the NuFlo Model NOA-332 Net Oil Analyzer. This Section describes the features and specifications of the NOA-332 informing the user of the capabilities of this instrument. Section 2 describes the operating system of the NOA-332 and gives a step-by-step procedure to install, configure, and operate the NOA-332. This is accomplished by referring the user to the rest of this manual as it applies to the user's application. Several appendices are included at the back of this manual as supplementary information. The NOA-332 is available in both a weatherproof version and rack/panel mount version. Refer to Appendix A for installation and maintenance of the weatherproof model. Refer to Appendix B for installation and maintenance of the rack/panel mount model.

Important—Read Sections 1 and 2 of this manual before attempting to use the NOA-332. The rest of this manual may be read as needed.

Operational Overview

The NuFlo Net Oil Analyzer, Model NOA-332, is an electronic readout instrument designed for use with an emulsion separator to determine quantities of produced gas, oil, and water without requiring the physical separation of the fluids. The NOA-332 may be used with two-phase separators (gas/emulsion) or three-phase separators (gas/emulsion/free water) and provides real-time analysis of an emulsion stream determining the amount of water in the emulsion fluid. Signals from turbine meters, orifice meters, and positive-displacement meters determine the volume of each fluid while a watercut sensor placed in the emulsion line of the separator determines the percent of water in the emulsion stream. These signals are read ten times each second and volumes calculated once each second allowing the NOA-332 to determine well test volumes more accurately than RTUs, PLCs, or other computing devices.

The NOA-332 provides the user with well test information while providing automatic well test capabilities, alarm on-off control, and SCADA communications. It may be used with a single well or where several wells are brought into a common header system to feed into a well test separator. The NOA-332 allows the operator to program up to sixty-four (64) well names and will associate the well test data with the name selected, making well test accounting simple. The NOA-332 has three user selectable operating modes: (1) timed well test, (2) cycled well test, and (3) continuous well test. Each well name is programmed with a corresponding purge time, test time, and an output action (optional). The well names and related information are kept in a well test table within the NOA-332 memory.

Operation

In the Timed well test mode, the NOA-332 performs a manual test well function for a single well. The operator selects the name of the well to be tested and initiates the test by pushing the 'START' button. After the purge timer times out, the NOA-332 begins to accumulate well test volumes until the test timer counts down to zero. During the test, all flow parameters may be viewed via the LCD on the front panel. At any time, the operator can push the 'STOP' button to end the test. While the test is running, both the raw (actual) volumes and prorated 24-hour volumes (based on the elapsed time of the test timer) are displayed. When the test timer reaches zero or the 'STOP' button is pushed, the volumes are logged into memory and the instrument ceases gathering data. The logged volumes are associated by the well name. If the optional DIO board is installed, the operator can configure the NOA-332 to latch an output signal during the test (purge time plus the test time) or provide a momentary output signal at the end of the test cycle.

In the Cycled well test mode, the NOA-332 permits automatic well testing. This mode requires the use of the optional DIO board to switch wells in and out of test. The operator selects the first well to be tested and presses the 'START' button. The NOA-332 will operate as if in the Timed well test mode counting down the purge timer and then the test timer, with an associated output signal if so configured. At the end of the test cycle, the NOA-332 will log into memory the well test data, initiate either a momentary output signal or deactivate the latched output signal (depending upon how configured), and automatically repeat this process with the next well name listed in the Well Test Table. The NOA-332 will step down the list of names, testing each well; when the end of the list is reached, the process will continue starting at the top of the Well Test Table. The operator can push the 'STOP' button at any time to end the testing process and can start anywhere on the list of well names to start the process. Additionally, the operator can set the test time to zero for a particular well if this well is to be skipped in the testing sequence. The NOA-332 supports both solenoid-based systems and step-switched systems.

In the Continuous well test mode, the NOA-332 permits long term well testing (e.g. monitoring of pipeline fluid from a gathering station). The operator manually starts and stops this test cycle. In this mode, the test timer is fixed at 24 hours and the well test data is logged into memory at the end of each 24-hour period. The operator selects the well name and presses the 'START' button. After the purge timer times out, the well test volumes are accumulated on a daily basis. The 24-hour period defining one day begins when the purge timer reaches zero. During the test, all flow parameters may be viewed via the LCD on the front panel. At any time, the operator can push the 'STOP' button to end the test. While the test is running, both the raw (actual) volumes and prorated 24-hour volumes (based on the elapsed time of the test timer) are displayed. Additionally, the operator may view the accumulated totals which accumulate for the duration of the test period up to a maximum of 366 days. When the test timer reaches zero, the 24-hour volumes are logged into memory, the test timer is reset to 24, and the test continues indefinitely until the 'STOP' button is pushed. The logged volumes are associated by the well name.

All flow volume calculations are per the most recent revisions of the American Petroleum Institute (API) and American Gas Association (AGA). This information is stored in non-volatile memory and can be downloaded via industry standard SCADA software. Should a power outage occur during a well test, the well test is concluded with all data safely stored and the display will indicate that the power outage occurred.

Two auxiliary inputs are available to monitor process parameters. The NOA-332 will maintain a rolling average of these inputs and maintains these values in memory with the well test data. In addition to flow parameter data, the NOA-332 stores information related to alarm conditions and

event information related to overall operation of the instrument. The NOA-332 maintains an internal record of the most recent 256 events and 256 alarms.

Specific Features

Local Readout

The NOA-332 allows the operator to monitor all flowline parameters, well test activity, and alarms on its 4-Line by 20-character/line Liquid Crystal Display (LCD).

Continuous Volumetric Totals

The NOA-332 continuously updates the volume totals as fluid dumping occurs during the test cycle. Due to changes in emulsion characteristics between dumps, no watercut signal is used in the calculations until the emulsion meter registers flow. Emulsion meter pulses are accumulated and compared against the percent BS&W ten times each second to determine the proportional volumes of oil and water. This assures the best possible accuracy in well test totals. The gas and free water meters are monitored continuously. Gross Volume measurement can be accomplished by the use of a Gross Volume flowmeter. If a meter is not used, Gross Volume is defined as the sum of net oil and total water.

Communications

The NOA-332 supports off-the-shelf SCADA software using Modbus or Square D RNIM protocols. Three independent communications ports are available to provide maximum flexibility. All three communications ports are protected from high-voltage transients.

Data Security

The NOA-332 provides four levels of security for entering setup information and for retrieving well test data, alarm logs and event logs. Level 1 is limited read-only. Level 2 is full read-only. Level 3 is full read with limited write and Level 4 is full read and full write access. All data stored in memory is protected by Cameron's patented internal circuitry which ensures that flow and configuration data are not altered in the event of a temporary loss of primary power. The battery-backed memory allows all well test records, alarm logs, and event logs to be available for 5 years.

The communications ports access data in the NOA-332 via register tables. As is customary in SCADA applications which utilize this method of communication, the user is required to provide security for data access via the register table. There is no security restriction placed on reading data or writing data via the communications ports.

Sensor Inputs

The NOA-332 allows for a variety of flowmeter and transmitter inputs to measure flow parameters specific to net oil computers. The flows measured by the NOA-332 are as follows:

Gas - Orifice Meter, Turbine Meter, or PD Meter. Inputs available for frequency, differential pressure, line pressure, and line temperature. In addition, differential pressure, line pressure, and line temperature may be obtained from a multivariable transmitter via the COM3 RS-485 port.

Emulsion - Turbine Meter or PD Meter. Inputs available for frequency, watercut sensor, flowing pressure, and flowing temperature. The NOA-332 is compatible with the NuFlo Capacitance Probe or the NuFlo Watercut Monitor.

Free Water - Turbine Meter or PD Meter. Input available for frequency.

Gross Volume - Turbine Meter or PD Meter. Input available for frequency.

Auxiliary 1 - Analog signal from a process transmitter. A rolling average of this input is maintained throughout the well test.

Auxiliary 2 - Analog signal from a process transmitter. A rolling average of this input is maintained throughout the well test.

Optional Digital Input / Output (DIO) Board

The Model NOA-332 contains provision to add an optional circuit board that contains discrete switch inputs and discrete switch (digital) output signals. Two configurations are available consisting of four switch inputs and four relay outputs or eight switch inputs and eight transistor (FET) outputs. The switch inputs are configurable and can be used in conjunction with the digital outputs to provide on/off control features. All switch inputs are protected from high-voltage transients.

The digital outputs operate either as alarm outputs, volumetric pulse outputs, well test outputs, or any combination thereof:

- In the alarm output mode, the output may be activated by flowrate, temperature, pressure, volume, or switch inputs.

- In the volumetric pulse output mode, the operator defines the pulse width and volume per pulse for use with remote incremental counters to register gas volume, water volume, oil volume and gross volume. Incremental flows are calculated once each second, so the volume per pulse rate must exceed one second.

- In the well test mode, the operator can configure a specific output for each well name or combine outputs to produce a binary number representation of the well number (1 to 64) being tested (especially useful in PLC based switching systems). In latched mode, the output becomes active when the purge timer starts and deactivates when the test timer counts down to zero or the 'STOP' button is pushed. In momentary mode, the output is used to signal the end of the test cycle when the test timer counts down to zero or the 'STOP' button is pushed. The output signal duration is operator configured from 0.1 to 1.0 seconds. When the operator wishes to skip a well on the list by setting the test time to zero for that particular well, a momentary output signal will still occur to automatically switch to the next well to be tested.

CAUTION: The digital outputs are fully configurable allowing all three modes (alarm output, volumetric pulse output, or well test output) to be intermingled which could cause some interesting results. All digital outputs are protected from high-voltage transients.

Well Test Table

The NOA-332 maintains an internal table of well names and a corresponding purge time, test time, and output action (if using the optional DIO board). The table is numbered from 1 thru 64 and the operator is required to enter well names and associated values in this table. The well names may be up to 20 characters long. The purge timer is programmable from 0 to 1440 minutes and the well test timer is programmable from 0 to 72 hours. If the optional DIO board is installed and if the operator wishes to use the digital outputs as well test outputs, then the operator is required to configure the DIO option for each well entry. This consists of defining the DO action (none, latched, or momentary), DO number (1 to 255), and DO width (0.1 to 1.0 second – momentary action only). The DO number defines which outputs are active when used as well test outputs.

Well Test Data

The NOA-332 internally maintains a log of well test data for each well tested. This log consists of the following:

- well name / number
- operator / location
- time / date of test
- length of well test (hours)
- actual test volume of oil (Bbls)
- 24 hour volume of oil (Bbls)
- actual test volume of total water (Bbls)
- 24 hour volume of total water (Bbls)
- actual test volume of gas (MCF)
- 24 hour volume of gas (MCF)
- actual test volume of gross fluid (Bbls)
- 24 hour volume of gross fluid (Bbls)
- continuous volume of oil (Bbls)
- continuous volume of total water (Bbls)
- continuous volume of gas (MCF)
- continuous volume of gross fluid (Bbls)
- percent watercut of gross fluid (%)
- average flowing value of auxiliary 1 analog input
- average flowing value of auxiliary 2 analog input

The most recent well test log can be viewed from the NOA-332 via the LCD display.

Optional Capacitance Probe Interface Board

The venerable NuFlo Capacitance Probe may be used with the NOA-332 via an optional board that provides power for the Probe and accepts the frequency signal from the Probe. An output signal of 1 to 5 volts DC goes to the NOA-332 Analog Board while an additional 4 to 20 mA signal representing percent watercut is available for customer use. This board is calibrated independently of the NOA-332 system using its own on-board display.

Specifications

Housing

12 inch by 10 inch by 6-inch fiberglass, NEMA 4 enclosure. Two-inch pole mount or bulkhead mount. Optional stainless steel weatherproof enclosure or rack mount enclosure available. See Appendix A for details.

Optional rack/panel mount enclosure for control room environment, fits in 10 ½-inch by 19-in. industry standard rack or control panel cutout. See Appendix B for details.

Environmental

Operating Temperature Range

- external power supply: -40° C to +85° C (-40° F to +185° F)
- LCD & integral power supply: -20° C to +70° C (-4° F to +160° F)

Humidity

- 0 - 90% Non-condensing

System Power

The NOA-332 circuitry, voltage transmitters, and the NuFlo Capacitance Probe operate on 12 volt DC power. Current output transmitters and the NuFlo Watercut Monitor operate on 24 volt DC power. Therefore, depending upon the transmitters used with the NOA-332, both 12 and 24 volt power may be required.

External Power Supply

Optional power supply with the following features:

- permits operation up to 85° C (185° F)
- accepts either 230 volt AC or 115 volt AC power and provides both 12 and 24 volt DC power to operate the NOA-332
- housed in a NEMA 4 weatherproof enclosure. Suitable for pole mount or bulkhead mount.
- solar power system available – consult factory

Integral Power Supply

- AC power module and/or a dc power board mount inside the NOA-332 enclosure and permit the NOA-332 to be operated by 100 to 240 volts AC or 10 to 30 volts DC.

Analog Inputs

3 wire type: 0 to 5 VDC (includes 1 to 5 volts), 0 to 20 mA (includes 4 to 20 mA), 100 ohm RTD selectable for two channels. 0.1% full scale (FS) accuracy - 0.007% FS per °C drift - 0.5% repeatability.

MVT Input

Compatible with the Rosemount Model 3095FB Multivariable™ Gage Pressure Transmitter with Modbus™ Protocol via the COM3 RS-485 port.

Display

4-line by 20-character/line alphanumeric liquid crystal display (LCD)

Keypad

24-key membrane switch, tactile response keypad; provides parameter viewing and setup/calibration

Memory

512 KB static RAM with lithium battery backup, 5-year data retention

Frequency Inputs

Four (4) independent inputs each configurable as:

- NuFlo line amplifier (frequency: 1 to 3,000 Hz)
- low level (frequency: 1 to 3,000 Hz, amplitude: 20 mV to 10 V)
- positive displacement (PD) meter (dry-contact closure)

Communication

Selectable baud rate, each com port independent (1200, 2400, 4800, 9600, and 19200), Modbus and Square D RNIM protocols, jumper selectable RS-485 termination, supports pre and post radio delay, all ports protected from high voltage transients

- COM1 - RS-232 DCE
- COM2 – jumper selectable, RS-232 DTE or RS-485. Modbus slave port
- COM3 - RS-485. Modbus slave or Modbus master

DIO Board

Optional circuit boards with the following features:

Four (4) Channel Board

- Four relays (dry contact) – 1 Amp @ 30 volts DC – form C contacts
- Four Optoisolators – 40 mA @ 12 volts DC – form A
- Four switch inputs – 12 mA @ 12 volts DC max ‘on’ current, 650 us minimum pulse width

Eight (8) Channel Board

- Eight Transistor (FET) – 1 Amp @ 30 volts DC, not to exceed 4 amps total ‘on’ current
- Eight switch inputs – 12 mA @ 12 volts DC max ‘on’ current, 650 us minimum pulse width

Capacitance Probe

Optional circuit board that provides power and accepts frequency signal from the NuFlo Capacitance Probe. Two analog output signals: 1 to 5 volts DC goes to the NOA-332 Analog Board; 4 to 20 mA signal representing Percent Watercut available for customer use. Calibration is separate from the NOA-332.

Calculations

Gas Compressibility

- PAR Research Project NX-19 (3 component & 20 component versions)
- American Gas Association (AGA) Report #8-1985, AGA Report #8 (3 component & 20 component versions)
- User-entered constant

Gas Flow

- American Gas Association (AGA) Report #3 (1985 & 1992 versions)

Liquid Flow Compensation

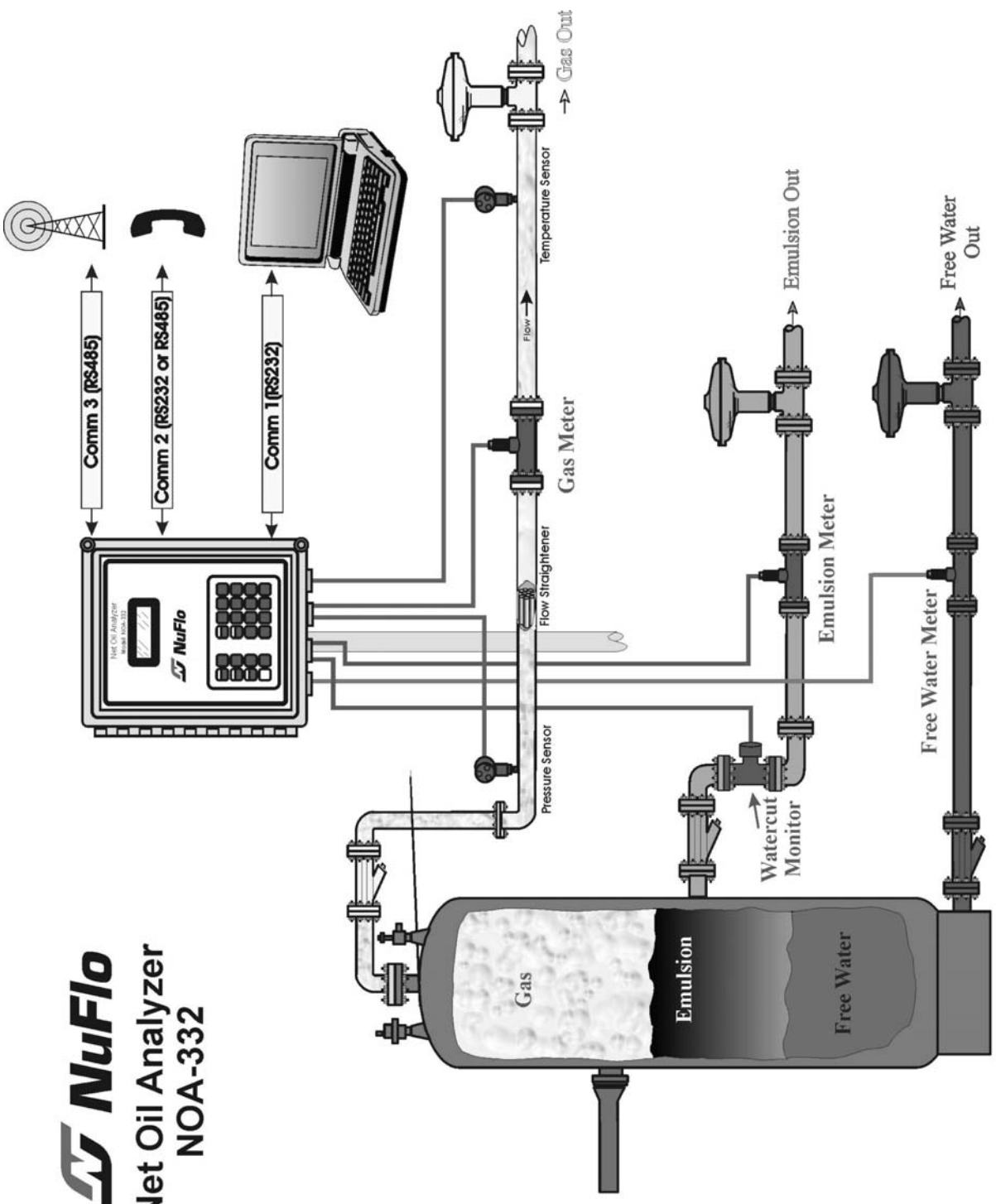
- Temperature-compensated according to API MPMS Chapter 11.1, Table 6A, 6B, 6C, 24A, 24B, or 24C.
- Pressure compensated according to API MPMS Chapter 11.2.1 or Chapter 11.2.2.

Gas Turbine / PD Flow

- American Gas Association (AGA) Report #7

Liquid Turbine / PD Flow

- API MPMS Chapter 5.3 & Chapter 12.2


NuFlo
Net Oil Analyzer
NOA-332
Comm 3 (RS485)
Comm 2 (RS232 or RS485)
Comm 1 (RS232)
Gas Out
Temperature Sensor
Flow
Gas Meter
Flow Straightener
Pressure Sensor
Emulsion Out
Emulsion Meter
Watercut Monitor
Free Water Out
Free Water Meter
Gas
Emulsion
Free Water

Notes

Section 2

Setup Instructions

Introduction

The NOA-332 is designed to be easy to install and operate. However, the NOA-332 is a powerful flow computer with fully configurable hardware and operating system, giving the user dozens of choices and options to fit the NOA-332 to any test / monitoring application. While the number of choices can easily be overwhelming, several shortcuts have been added to ease the setup procedure for the typical well test application or pipeline monitoring application.

Operating System

The NOA-332 is a stand-alone instrument that provides the operator access to all features and data via the front keypad and LCD display. The NOA-332 groups the operation of the analyzer into nine categories. Appendix C illustrates the main menu and submenus for the NOA-332. Table 2.1 lists the nine menu categories, descriptions of their functions, and the Section of this manual that provides detailed instructions for accessing functions and data in the submenus.

From the Main menu, you can select a specific category and access submenus to perform a specific function. Use the ↑ and ↓ keys while in a menu to move to a menu selection above or below the current selection. Common functions also have shortcut keys to allow quick access to these functions without sorting through the menus.

Table 2.1—Menu Information

Main Menu Choice	Use this submenu to	Find more information about this submenu in
Test Status	View test status information including timer values, totals, and previous test values	Section 3
Flow Data	View the flow parameters for all flow volumes being accumulated	Section 4
Site Data	Read and set site specific parameters	Section 5
Alarm Data	Read the status of all alarms in the system	Section 6
Multivariable Transmitter Data	Enable use of MVT and monitor the data from the MVT	Section 7
Time Data	Read or set the current time and date	Section 8
Config/Setup...	Operating system configuration	Section 9
Diagnostics...	Test system operation and locate problems	Section 10
Logout...	Cancels the current security access	Section 11

Types of Parameters

Some parameters in the submenus can only be read; others can be read and changed. The following terms are used throughout this manual to describe the read/write status of parameters:

R/W (Read/Write)—This term means that the parameter described can be read from or written to (modified) in the menu.

RO (Read Only)—This term means that the parameter described can be read but not altered in the menu.

WO (Write Only)—This term means that the parameter described can be written to but not read. The Write-Only provision is used in the Security Setup menu to prevent a person's security code or security level from being displayed.

Alphanumeric—Alphabetical or numerical characters can be read and or written in this location.

Navigating Through the Menus

While navigating through the menus, you can press the ESCAPE key to return to the previous menu. Repeatedly pressing the ESCAPE key will eventually return you to the Main Menu. This feature is also useful if you are in a menu that requests a change to data that does not require changing. Pressing the ESCAPE key before pressing the ENTER key allows you to exit the menu without making changes to the existing data.

Dual-Function Keys

Several keys have two functions. These keys, with the exception of the Well Test Status key, have a combination of white-on-red lettering and black-on-white lettering. The black-on-white lettering corresponds to the SHIFT key, which also has black-on-white lettering. To activate the feature identified by the black lettering, press the SHIFT key and then release it before pushing the key with the alternate function. For example, press the SHIFT and then the HOME key to go to the first selection of the current menu. Press the SHIFT and then the END key to go to the last selection of the current menu. Table 2.2 lists the dual-function keys.

Table 2.2—Dual-Function Keys

First Key Function	Secondary Key Function
Config Test	Diagnostics
Plate	Communications
Start Test	Stop Test
↑	Home (beginning selection of menu)
↓	End (end selection of menu)
Well Test Status	Scan

Enhanced Mode Display

Due to the limitations of the LCD display, sometimes a description of a particular menu item is unclear or the data value is too large to be fully seen. When this happens, position the pointer next to that menu item and press ENTER. This action will display the item in **enhanced mode**, which shows the selected item individually on the LCD so that there is room for more specific information about the selected item. This function is useful with large data values and alphanumeric data items.

The enhanced mode is also useful whenever you need to input data into the NOA-332. Once you put the system in enhanced mode, you can scroll through parameters and enter data without having to exit the enhanced mode.

Alphanumeric Data Entry

Alphanumeric data can be entered from the keypad. This feature is used for entering security data, wellsite data, and well name information. The number keys have a secondary set of labels listed on each key under the number. These labels represent additional characters, such as letters of the alphabet, that are available for the key. Table 2.3 lists the additional characters available for each key.

Table 2.3—Available Characters

Number Key	Characters Available
1	+ - ! @ # $ % ^ & * ( ) _ = { }[ ] | : ; < > , . ? / →
2	A B C
3	D E F
4	G H I
5	J K L
6	M N O
7	P R S
8	T U V
9	W X Y
0	Q Z (space)

To enter alphanumeric data, follow this procedure:

1. Press the number key.
2. Press the ↑ or ↓ key until the desired character is displayed.
3. Repeat Steps 1 and 2 until the data is completely entered. (Pressing the next number automatically enters the previous choice.)

   If you make a mistake, use the backspace key to back up and erase the error.
4. Press ENTER when finished.

Scan Data Display

Sometimes, certain parameters must be made available to field technicians and other company personnel who do not have access to a NOA-332 security code. The NOA-332 can be set up so that it will repeatedly display pre-selected parameters in sequence on the LCD display. This feature is called Scan Mode.

Note—The Site Identification, Gas Volume, Net Oil Volume, Total Water Volume, and Average Water Cut parameters are default selected to be displayed in scan mode in the NOA-332. These can be deselected with the exception of Site Identification.

A maximum of 20 parameters can be displayed in scan mode. Items from any menu can be added to or removed from the scan sequence.

The default scan time, which determines how long each parameter is displayed, is 2 seconds.

Setting Up the Scan Parameters

1. Select the parameter to be placed in the scan sequence in the same way that you would select it for viewing in the menu structure:
    a. Press ESCAPE until the Main Menu is displayed.
    b. Align the pointer with the appropriate submenu and press ENTER. (For example, choose the Site Data Menu if you want to set the location ["Loc"] parameter to be displayed during scan mode.)
    c. Align the pointer with the parameter and press ENTER to display the parameter in enhanced mode.
2. Press the SHIFT key followed by the WELL TEST STATUS key. An SC icon will appear at the lower right corner of the LCD display, indicating that this parameter is selected for scanning.

Note—To deselect a parameter for scanning, press the SHIFT key followed by the WELL TEST STATUS KEY; the SC icon will disappear to indicate that the parameter is no longer selected.

Activating Scan Mode

Once you have set the scan parameters, set the computer to scan by first pressing the ESCAPE key if in the enhanced mode. Then press the SHIFT key followed by the WELL TEST STATUS key, which will start the scan mode regardless of where you are located in the menu structure. However, if you press the SHIFT key followed by the WELL TEST STATUS key while in enhanced mode, you will be selecting or deselecting a parameter to be scanned instead of activating scan mode.

After the NOA-332 is in the scan mode, you can leave the instrument unattended while it is displaying these parameters.

Deactivating Scan Mode

Press ESCAPE or one of the eight function keys on the left side of the NOA-332 keypad.

Timing Out

The NOA-332 has a time-out feature. The way this feature works depends on whether or not the scan mode is active when time-out occurs. When the computer is not in scan mode, the time-out feature cancels the security level if a key is not pressed within a certain time limit, and begins scrolling the scan data or the logo message. The information scrolled depends on the display mode setting in the Security Setup Menu. See Section 9f for more information about the display mode. If the NOA-332 is in scan mode when it times out, the LCD will continue to scan through the scan data. In either case, a password is required to perform any function after the NOA-332 has timed out.

Start-Up Procedure

Starting the NOA-332 Program

The NOA-332 uses a password scheme with four levels of security that permit various levels of access to the system parameters. Follow this procedure to start operating the program:

1. Power-up the NOA-332. When power is initially applied (first-time operation), the display will be in the Scan Data mode. In this mode the Site Identification, Gas Volume, Net Oil Volume, Total Water Volume, and Average Water Cut parameters will repeatedly appear in sequence on the display.
2. Press any key. The display will show "Please Enter Password: _ ".
3. Enter your six-digit security code (333333 is the factory-default code) and press ENTER to gain access. The security code will appear as "******" on the display.
4. If the security code is approved, the display will show the Scan Data screen. Press the ESCAPE key one time. The display will show the "NOA-332 Main Menu" or revert back to the most recently selected menu item. Press the ESCAPE key one or more times to back out of the submenus to the Main Menu (if the security code is not approved, the display will return to the Scan Data screen….. verify that you have a correct password).
5. In the Main Menu, press the ↑ or ↓ key on the keypad to position the pointer symbol next to the submenu that you want to access. Press ENTER. Also note the nine function keys. These act as shortcuts and can be used anytime.
6. To continue, follow the instructions provided in the section of this manual that covers the submenu that you have accessed. Table 2.1 lists the submenus and the sections that contain information about them.

To install and operate the NOA-332, several tasks must be completed as listed below:

1. Mount the NOA-332 in a suitable location non-hazardous location. Connect field wiring to the NOA-332. This includes a suitable power source, flowmeters, transmitters, and communications. If the NuFlo Capacitance Probe is being used as the Watercut Sensor, the optional Capacitance Probe Interface Board is required.
2. Configure the NOA-332 circuitry for the types of flowmeters, transmitters, and communications method being used.
3. Configure the NOA-332 operating system for the types of flowmeters, transmitters, and communications being used.
4. Configure the NOA-332 operating system for site parameters and well test parameters.

Items 1, 2, and 3 are discussed in Appendix A of this manual. Please refer to the information in Appendix A to complete the physical installation of the NOA-332. Items 4 and 5 are discussed below in a step-by-step format.

Configuration

Once the NOA-332 has been mounted with power, transmitter and flowmeter wiring installed and the circuitry jumpers configured for the type of flowmeters and transmitters used as described in

Appendix A, the instrument should be turned on. The instructions that follow describe use of the keypad to enter data into the NOA-332.

CAUTION: As with any computational device, the answers are valid only when accurate information is provided by the user. "Garbage in – garbage out" applies particularly to flow computers. The mathematics required by API and AGA algorithms is complex and requires several parameters. When entering required numbers into the NOA-332 operating system, make every effort to provide accurate data entry.

- Follow the instructions listed above under the section Starting the NOA-332 Program. This will give access to the operating system. While navigating the menu structure, remember that pressing the ESCAPE key will back the user out of the submenus and ultimately to the Main Menu (identified by the title 'NET OIL ANALYZER' at the top of the display).

- Determine security assignments. The default password allows the user to remove the default password and reassign new passwords and associated security levels. Use the ESCAPE key to return to the Main Menu. Press the SETUP key. Scroll down to the Security Setup submenu. Press ENTER and configure the security codes and security time-out. See Section 9f of this manual for instructions.

- Enter the location data (time, date, and site location info).

  STEP 1: Press the TIME key to set the time and date. See Section 8 of this manual for instructions.

  STEP 2: Starting from the Main Menu, scroll down to the Site Data submenu. Press ENTER and configure the site data (instrument identification, location, latitude, elevation, base temp & base pressure used in calculations, and average barometric pressure). See Section 5 of this manual for instructions.

- Enter the NOA system data (system config and well test info).

  STEP 1: Use the ESCAPE key to return to the Main Menu. Press the SETUP key. The pointer will be at the System Setup submenu. Press ENTER and configure the unit identification, system voltage, test mode, type of gas meter, use of a Gross Volume meter, and the input channels for the auxiliary inputs. See Section 9a of this manual for instructions.

  STEP 2: Press the CONFIG TEST shortcut key. Align the pointer with the well index number group and press ENTER to configure the test parameters for a particular well. These parameters are the well name, purge time, test time, and output actions. The NOA-332 allows setup for 1 thru 64 separate wells. See Section 9b of this manual for instructions.

- Calibrate the transmitters.

  STEP 1: Using the Transmitter Assignment Worksheet located at the end of Appendix A, note the analog channel assignments for each of the transmitter inputs used. Refer back to Appendix A if necessary to determine this. Use the ESCAPE key to return to the Main Menu. Press the SETUP key. Scroll down to the I/O Config submenu and select Analog Input. Set the transmitter name and unit label for each analog input channel being used. It is recommended that unused inputs be renamed to Spare to identify which inputs are not being used. If a Multivariable

transmitter is being used, refer to step 4 below. Refer to Section 9j of this manual for instructions.

STEP 2: Use the ESCAPE key to return to the Main Menu. Press the SETUP key. Scroll down to the Calibration submenu. Press ENTER. Calibrate the analog inputs by selecting the device from the menu. It is recommended that unused inputs be forced to a calibrated value of zero. See Section 9h of this manual for instructions.

STEP 3: If the NuFlo Capacitance Probe is being used as the Watercut Sensor, the optional Capacitance Probe Interface Board is required. Refer to Appendix E. Once the Capacitance Probe is wired to the Capacitance Probe Interface Board, do the following:

(1) Calibrate the Capacitance Probe to the emulsion fluid it is measuring. See Appendix E for instructions.

(2) Calibrate the Capacitance Probe to the Capacitance Probe Interface Board. See Appendix E for instructions.

(3) Calibrate the Capacitance Probe Interface Board to Analog Input #3. The Capacitance Probe Interface Board has a voltage output feature that makes this easy. See Appendix E for instructions.

STEP 4: If a Multivariable Transmitter is being used with a gas meter instead of analog transmitters, the MVT must be configured correctly to operate. Use the ESCAPE key to return to the Main Menu. Scroll down to the MultiVarTrans submenu. Press ENTER and configure the multivariable transmitter. Refer to Section 7 of this manual for instructions.

- Enter the flowmeter calibration information.

  STEP 1: Use the ESCAPE key to return to the Main Menu. Press the SETUP key. Scroll down to the Flow Setup submenu. Press ENTER and select the flowmeters that are being used by scrolling to the meter type and pressing ENTER. Gas, free water, and gross volumes meters are optional and may not be used in all applications. Each flow can be named and must be configured before it will calculate volumes. See Sections 9c, 9d, and 9e (as they apply) of this manual for instructions.

- Configure the system alarms (Optional).

  STEP 1: Use the ESCAPE key to return to the Main Menu. Press the SETUP key. Scroll down to the Alarm Setup submenu. Press ENTER and configure the alarms as desired. See Section 6 and Section 9g of this manual for instructions.

- Configure the communications parameters (Optional).

  STEP 1: Use the ESCAPE key to return to the Main Menu. Press the SETUP key. Scroll down to the Comm Setup submenu. Press ENTER and select the communications port(s) you wish to configure. See Section 9i of this manual for instructions. Detailed information regarding the digital communications is contained in Appendix H.

- Configure the input/output parameters (Optional).

  STEP 1: Use the ESCAPE key to return to the Main Menu. Press the SETUP key. Scroll down to the I/O Config submenu. Press ENTER and select the digital inputs or digital outputs to configure. See Section 9j of this manual for instructions.

CAUTION: As stated in Section 1, the Model NOA-332 contains provision to add an optional circuit board that contains either four relay outputs or eight transistor (FET) outputs. These are referred to as Digital Outputs in this manual and may be configured as alarm outputs (Section 9g), volumetric pulse outputs (Section 9k), or well test outputs (Section 9b). In the alarm output mode, the Digital Outputs may be activated by flowrate, temperature, pressure, volume, or switch inputs. In the volumetric pulse output mode, the operator defines the pulse width and volume per pulse for use with remote incremental counters to register gas volume, water volume, oil volume and gross volume. In the well test mode, the operator can configure a specific output for each well name or combine outputs to produce a binary number representation of the well number (1 to 64) being tested. The user is cautioned to take note as to how the digital outputs are configured so as to not create unwanted interactions.

Well Test Procedure

After the Startup Procedure has been completed, the NOA-332 is ready to commission.

STEP 1: If the gas meter being used is an orifice meter, press the PLATE shortcut key and verify that the plate bore size and meter tube I.D. is correct. These parameters can be changed from this menu using the SETUP key.

STEP 2: Press the START key and align the pointer with the group of well index numbers you wish to choose from. Press ENTER and align the pointer with the well name you wish to test. Press ENTER twice to start the well test. All totals will be initialized to zero and the status of the well test will be indicated. This same menu is accessible by pressing the WELL TEST STATUS key to view the status of a test.

NOTE: If the NOA-332 is operating in Timed Test Mode, the system will stop recording volumes when the timer has counted down to zero. If the NOA-332 is operating in Continuous Test Mode, the test will run continually until the STOP key is pressed. If the NOA-332 is operating in the Cycle Test mode, the NOA-332 will complete the current test and then continue testing the remaining wells. See Section 1 of this manual for a detailed description of how the test modes operate.

STEP 3: The Well Test Status menu lists real-time data of the current well in test or the last well tested. The information included under this menu consists of the timer values, test totals, and previous well test totals. This menu is accessed from the NOA-332 Main Menu and is listed as “Test Status…”. Additionally, pressing the WELL TEST STATUS shortcut key brings the user to this menu.

NOTE: Pressing the START key while a test is in progress will not abort the test. A message will appear on the display instructing the user to first stop the current test before trying to initiate a new test. Whenever a test is initiated, all flow totals are zeroed. When a test is completed, the flow data is logged into the Previous Test Totals menu as explained the Section 3 of this manual. If a power

outage occurs, the NOA-332 will abort the test, save the existing totals, and indicate 'Power Failed' as explained in Section 3 of this manual.

Additional Information

Several Sections of this manual are not listed in the instructions above. The user may benefit from browsing these Sections as described below:

- Section 4 - This Section allows the user to view the flow parameters and configuration for each flow for diagnostic purposes. Some applications operate with intermittent flow, so take note of the process when viewing the flow parameters.
- Section 9 - This Section provides an overview for all of the Sections used to enter data into the NOA-332.
- Section 9k - This Section allows the user to configure the optional Digital Output parameters.
- Section 10 - This Section provides full diagnostic access to the NOA-332 operating system and is very useful for troubleshooting activities.
- Section 11 - This section allows the user to quickly cancel the current security access.
- Appendix C - This Section gives the full menu mapping of the keypad system.
- Appendix D - This Section provides the Spare Parts List for the NOA-332.
- Appendix F - This Section provides setup information and wiring diagrams for using the eight-channel Digital Output Board. This circuit board is optional.
- Appendix G - This Section provides setup information and wiring diagrams for using the four-channel Digital Output Board. This circuit board is optional.

Notes

Section 3

The Well Test Status Menu

Introduction

The Well Test Status menu lists real-time data of the current well in test or the last well tested. The information included under this menu consists of the timer values, test totals, and previous well test totals. This menu is accessed from the NOA-332 Main Menu and is listed as "Test Status…". Additionally, pressing the WELL TEST STATUS shortcut key brings the user to the menu listed in Table 3.1. A listing of this menu and its submenus are available in Appendix C, page C-2.

NOTE—**A level 1 or higher password authorization is required to view the Well Test Status Menu and its submenus.**

Accessing the Well Test Status Menu

1. Press the WELL TEST STATUS key on the keypad.
2. The menu items of table 3.1 are as follows:

Table 3.1—Well Test Status Menu Parameters

Parameters	Description	Read/Write Status
Well Name & Status	Current well name and test status	RO
Mode	Current well testing mode	RO
Timers…	Access to the well test timer values	Menu
Current Totals…	Access to the well test totals. These numbers reset to zero and the end of each test period	Menu
Cont Totals…	Access to the non-resettable test total for Continuous mode testing.	Menu
Prorated Totals….	Access to the prorated Days Totals	Menu
Prv Test Totals….	Access to the previous well test totals	Menu

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Well Name & Status

The first line of this menu shows the current well name being tested and the well test status. The following choices for well test status may appear:

Power Failed -	This message appears when a power failure has occurred.
Purge In-Progress -	This message appears when the purge cycle is in progress.
Test In-Progress -	This message appears when the test cycle is in progress.
Test Complete -	This message appears when the well test has completed.
Test Aborted -	This message appears when the STOP key has been used to complete the well test cycle.
Alarm -	This message appears when the well test has been halted due to alarm action 25.

Mode

This will be Timed, Continuous, or Cycled depending upon how the instrument was setup by the user (see Section 2). See Section 1 for an explanation of the operational modes for the NOA-332.

Timers…

The Timers menu contains all of the system timers used for well test purposes. This menu is listed below under Table 3.2.

Current Totals…

The Current Totals menu contains the accumulated volumes of the well test period. These volumes are zeroed at the start of each test. In the continuous test mode these volumes are zeroed at the end of each 24-hour period, based on when the test started. This menu is listed below under Table 3.3.

Cont Totals…

The Cont Totals menu is primarily used with the Continuous Test mode and contains the continuous accumulated volumes of the well test. The Continuous Totals are not zeroed at the end of each 24-hour period as is the case with the Current Totals. The Continuous Totals are zeroed at the start of each new well test. This menu is listed below under Table 3.4.

Prorated Totals…

The Prorated Totals menu contains the accumulated volumes of the well test prorated to a 24-hour period. These volumes are zeroed at the start of each test. This menu is listed below under Table 3.5.

Previous Test Totals…

The Previous Test Totals menu contains the accumulated volumes of the previous well test. In the Timed Test Mode and Cycled Test Mode this menu shows the well name and lists the associated well test totals. In the Continuous Test Mode, this menu shows the well test totals for the previous 24-hour period. This menu is listed below under Table 3.6.

Accessing the Timers Menu

1. Press the WELL TEST STATUS key on the keypad.
2. Press the ↑ or ↓ key to align the pointer with the menu item "Timers…" and press ENTER.
3. The menu items of table 3.2 are as follows:

Table 3.2—Well Test Timers Menu Parameters

Parameters	Description	Read/Write Status
PurgLeft	Current time left until the end of the purge cycle	RO
TestLeft	Current time left until the end of the test cycle	RO
ElpsTime	Current elapsed time of the test cycle	RO

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Purge Left

This item shows the amount of time left in the purge cycle. The time is shown in whole minutes.

TestLeft

This item shows the amount of time left in the test cycle. The time is shown in hours with two decimal place accuracy.

ElpsTime

This item shows the amount of elapsed time since the start of the test cycle. The time is shown in hours with two decimal place accuracy.

Accessing the Current Totals Menu

1. Press the WELL TEST STATUS key on the keypad.
2. Press the ↑ or ↓ key to align the pointer with the menu item "Current Totals…" and press ENTER.
3. The menu items of table 3.3 are as follows:

Table 3.3—Well Test Totals Menu Parameters

Parameters	Description	Read/Write Status
Gas Vol	Accumulated gas volume	RO
Net Oil	Accumulated emulsion oil volume	RO
Net Wtr	Accumulated emulsion water volume	RO
Free Wtr	Accumulated free water volume	RO
TotalWtr	Accumulated total water volume	RO
GrossVol	Accumulated gross volume	RO
%Grs Wtr	Percent watercut of the gross liquid volume	RO
%Eml Wtr	Percent watercut of the emulsion volume	RO
AvAux 1	Current average value of the Aux #1 input	RO
AvAux 2	Current average value of the Aux #2 input	RO

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Gas Vol

This item shows the total accumulated gas volume during the well test cycle. The volume is shown in MCF with two decimal place accuracy.

Net Oil

This item shows the total accumulated oil volume from the emulsion stream during the well test cycle. The volume is shown in Barrels with two decimal place accuracy.

Net Water

This item shows the total accumulated water volume from the emulsion stream during the well test cycle. The volume is shown in Barrels with two decimal place accuracy.

Free Water

This item shows the total accumulated free water volume during the well test cycle when a free water flowmeter is used. The volume is shown in Barrels with two decimal place accuracy.

Total Water

This item shows the total accumulated water volume during the well test cycle. The volume is shown in Barrels with two decimal place accuracy.

Gross Volume

This item shows the total accumulated water and oil volumes during the well test cycle. This volume is the addition of the net oil, net water, and free water volumes unless a separate gross volume flowmeter is used. The volume is shown in Barrels with two decimal place accuracy.

% Gross Wtr Cut

This item shows the value of percent watercut determined by the total water volume compared to the total gross volume during the well test cycle. This represents the watercut of the well being tested. The value is shown in Percent with two decimal place accuracy.

% Emulsion Wtr Cut

This item shows the value of percent watercut determined by the net water volume compared to the emulsion volume during the well test cycle. This represents the watercut of the emulsion stream only and is useful with three-phase separators to give an indication of how well the separator is working. The value is shown in Percent with two decimal place accuracy.

AvAux 1

This item shows the instantaneous value for the Auxiliary 1 analog input (if the NOA-332 is so configured) during the well test cycle. The value is shown with two decimal place accuracy.

AvAux 2

This item shows the instantaneous value for the Auxiliary 2 analog input (if the NOA-332 is so configured) during the well test cycle. The value is shown with two decimal place accuracy.

Accessing the Continuous Totals Menu

1. Press the WELL TEST STATUS key on the keypad.
2. Press the ↑ or ↓ key to align the pointer with the menu item "Cont Totals…" and press ENTER.
3. The menu items of table 3.4 are as follows:

Table 3.4—Cont Test Totals Menu Parameters

Parameters	Description	Read/Write Status
Gas Vol	Accumulated gas volume	RO
Net Oil	Accumulated emulsion oil volume	RO
Net Wtr	Accumulated emulsion water volume	RO
Free Wtr	Accumulated free water volume	RO
TotalWtr	Accumulated total water volume	RO
GrossVol	Accumulated gross volume	RO

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Gas Vol

This item shows the total accumulated gas volume. The volume is shown in MCF rounded to the nearest whole unit.

Net Oil

This item shows the total accumulated oil volume from the emulsion stream. The volume is shown in Barrels rounded to the nearest whole unit.

Net Water

This item shows the total accumulated water volume from the emulsion stream. The volume is shown in Barrels rounded to the nearest whole unit.

Free Water

This item shows the total accumulated free water volume when a free water flowmeter is used. The volume is shown in Barrels rounded to the nearest whole unit.

Total Water

This item shows the total accumulated water volume. The volume is shown in Barrels rounded to the nearest whole unit.

Gross Volume

This item shows the total accumulated water and oil volumes. This volume is the addition of the net oil, net water, and free water volumes unless a separate gross volume flowmeter is used. The volume is shown in Barrels rounded to the nearest whole unit.

Accessing the Prorated Totals Menu

1. Press the WELL TEST STATUS key on the keypad.
2. Press the ↑ or ↓ key to align the pointer with the menu item "Prorated Totals…" and press ENTER.
3. The menu items of table 3.5 are as follows:

Table 3.5—24 Hour Totals Menu Parameters

Parameters	Description	Read/Write Status
Gas Vol	Accumulated prorated gas volume	RO
Net Oil	Accumulated prorated emulsion oil volume	RO
Net Wtr	Accumulated prorated emulsion water volume	RO
Free Wtr	Accumulated prorated free water volume	RO
TotalWtr	Accumulated prorated total water volume	RO
GrossVol	Accumulated prorated gross volume	RO

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Gas Vol

This item shows the total accumulated gas volume during the well test cycle prorated to a 24 hour time period. The volume is shown in MCF with one decimal place accuracy.

Net Oil

This item shows the total accumulated oil volume from the emulsion stream during the well test cycle prorated to a 24 hour time period. The volume is shown in Barrels with one decimal place accuracy.

Net Water

This item shows the total accumulated water volume from the emulsion stream during the well test cycle prorated to a 24 hour time period. The volume is shown in Barrels with one decimal place accuracy.

Free Water

This item shows the total accumulated free water volume during the well test cycle prorated to a 24 hour time period when a free water flowmeter is used. The volume is shown in Barrels with one decimal place accuracy.

Total Water

This item shows the total accumulated water volume during the well test cycle prorated to a 24 hour time period. The volume is shown in Barrels with one decimal place accuracy.

Gross Volume

This item shows the total accumulated water and oil volumes during the well test cycle prorated to a 24 hour time period. This volume is the addition of the net oil, net water, and free water volumes unless a separate gross volume flowmeter is used. The volume is shown in Barrels with one decimal place accuracy.

Accessing the Previous Test Totals Menu

1. Press the WELL TEST STATUS key on the keypad.
2. Press the ↑ or ↓ key to align the pointer with the menu item "Prv Test Totals…" and press ENTER.
3. The menu items of table 3.6 are as follows:

Table 3.6—Prev Test Totals Menu Parameters

Parameters	Description	Read/Write Status
Name	Name of well that was tested	RO
Gas Vol	Accumulated gas volume	RO
Net Oil	Accumulated emulsion oil volume	RO
Net Wtr	Accumulated emulsion water volume	RO
Free Wtr	Accumulated free water volume	RO
TotalWtr	Accumulated total water volume	RO
GrossVol	Accumulated gross volume	RO
%Wtr Cut	Percent watercut based on the net oil volume and the total water volume	RO
AvAux 1	Current average value of the Aux #1 input	RO
AvAux 2	Current average value of the Aux #2 input	RO

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Name

This item is the name of the well that was previously tested. The volumes shown in the rest of this menu are associated with this well name.

Gas Vol

This item shows the total accumulated gas volume during the well test cycle. The volume is shown in MCF with two decimal place accuracy.

Net Oil

This item shows the total accumulated oil volume from the emulsion stream during the well test cycle. The volume is shown in Barrels with two decimal place accuracy.

Net Water

This item shows the total accumulated water volume from the emulsion stream during the well test cycle. The volume is shown in Barrels with two decimal place accuracy.

Free Water

This item shows the total accumulated free water volume during the well test cycle when a free water flowmeter is used. The volume is shown in Barrels with two decimal place accuracy.

Total Water

This item shows the total accumulated water volume during the well test cycle. The volume is shown in Barrels with two decimal place accuracy.

Gross Volume

This item shows the total accumulated water and oil volumes during the well test cycle. This volume is the addition of the net oil, net water, and free water volumes unless a separate gross volume flowmeter is used. The volume is shown in Barrels with two decimal place accuracy.

% Wtr Cut

This item shows the value of percent watercut for the well being tested and is based on the net oil volume compared to the total water volume during the well test cycle. The value is shown in Percent with two decimal place accuracy.

AvAux 1

This item shows the average value for the Auxiliary 1 analog input (if the NOA-332 is so configured) during the well test cycle. The value is shown with two decimal place accuracy.

AvAux 2

This item shows the average value for the Auxiliary 2 analog input (if the NOA-332 is so configured) during the well test cycle. The value is shown with two decimal place accuracy.

Section 4

The Flow Data Menu

Introduction

The Flow Data menu lists real-time data and frequently accessed parameters for each of the four (4) flows available in the NOA-332. The keypad has a shortcut key that directly accesses this menu. Pressing the FLOW DATA key brings up the list of flows available. Each flow has a user configurable name that is listed. Table 4.1 shows the Flow Data menu. A listing of this menu and its submenus are available in Appendix C, page C-2.

NOTE—**A level 1 or higher password authorization is required to view the Flow Data Menu and its submenus.**

Accessing the Flow Data Menu

1. Press the FLOW DATA key on the keypad.
2. Align the pointer with the flow name wanted and press ENTER.
3. The menu items of table 4.1 appear:

Table 4.1—Flow Data Menu Parameters

Parameters	Description	Read/Write Status
FlowID	Meter identification	R/O
Mtr Typ	Meter type	R/O
Meter #	Flow number tracked by the system	R/O
Fluid Type	Fluid type	R/O
Data Display….	Displays flow parameters	R/O

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

FlowID

FlowID is a read-only display of the name of the flow selected. This name can be changed by the user under the Flow Setup menu (Sections 9c, 9d, and 9e).

Meter Type

The meter type is a read-only display of the type of meter being used for the flow selected. This can be either orifice or turbine.

Meter

The meter number is a read-only display of the flow number for the flow selected. This is the flow number that the system uses to accumulate volumes. This number is important for diagnostic purposes but otherwise can be ignored.

Fluid Type

The fluid type is a read-only display of the type of fluid for the flow selected. It can be either gas or liquid.

Data Display….

The data display menu contains the submenu for the flow selected. When data display is selected, the name of the flow will be shown at the top of the display. **Table 4.2** lists the items that apply to a gas orifice meter. **Table 4.3** lists the items that apply to a gas turbine meter. **Table 4.4** lists the items that apply to liquid meters (emulsion, free water, and gross volume).

Reading the Gas Orifice Meter Flow Data

Table 4.2—Gas Orifice Meter Parameters

Parameters	Description	Read/Write Status
FlRate	Current flow rate	R/O
DiffPr	Current differential pressure	R/O
FlPres	Current flowing pressure	R/O
FlTemp	Current flowing temperature	R/O
SpGrav	Current value of specific gravity being used in gas volume calculations	R/O
Fpv	Current value of compressibility factor being used in gas volume calculations	R/O
OrfDia	Current value of the orifice plate bore diameter	R/O
Tube ID	Current value of the inside diameter of the orifice meter tube.	R/O

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Gas Flow Rate

The gas flow rate (“FlRate”) is the current instantaneous flow rate in MCF/D. It is a read-only parameter.

Differential Pressure

The differential pressure ("DiffPr") is the current differential pressure read from the differential pressure transducer and is used to determine gas volume. It is a read-only parameter and is measured in inches of H_2O.

Flowing Pressure

The flowing pressure ("FlPres") is the flowline pressure expressed in psig which is used in determining the gas volume. It is a read-only parameter.

Flowing Temperature

The gas temperature ("FlTemp") is the flowline temperature expressed in degrees F and is used in determining gas volume. It is a read-only parameter.

Specific Gravity

The specific gravity ("SpGrav") is a constant value entered in the Flow Setup menu (Section 9c) and is used in determining gas volume. It is a read-only parameter.

Compressibility Factor

The gas compressibility factor ("Fpv") is the calculated value for gas compressibility used in determining gas volume. It is a read-only parameter.

Orifice Plate Bore Diameter

The orifice diameter ("OrfDia") is the diameter of the orifice plate bore expressed in inches. It is a read-only parameter.

Orifice Meter Tube Diameter

The orifice tube internal diameter ("TubeID") is the internal diameter of the orifice meter tube expressed in inches. It is a read-only parameter.

Reading the Gas Turbine Meter Flow Data

Table 4.3—Gas Turbine Meter Parameters

Parameters	Description	Read/Write Status
FlRate	Current flow rate	R/O
FlPres	Current flowing pressure	R/O
FlTemp	Current flowing temperature	R/O
Freq	Current frequency of the flowmeter	R/O
K-Fact	Current value of k-factor being used in gas volume calculations	R/O
MF	Current value of meter factor being used in gas volume calculations	R/O
SpGrav	Current value of specific gravity being used in gas volume calculations	R/O
Fpv	Current value of compressibility factor being used in gas volume calculations	R/O

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Gas Flow Rate

The gas flow rate ("FlRate") is the current instantaneous flow rate in MCF/D. It is a read-only parameter.

Flowing Pressure

The flowing pressure ("FlPres") is the flowline pressure expressed in psig which is used in determining the gas volume. It is a read-only parameter.

Flowing Temperature

The gas temperature ("FlTemp") is the flowline temperature expressed in degrees F and is used in determining gas volume. It is a read-only parameter.

Frequency

The frequency ("Freq") of the flowmeter expressed in Hertz. It is a read-only parameter.

K-Factor

The current K-Factor ("K-Fact") of the flowmeter expressed in pulses per ACF. It is a read-only parameter.

Meter Factor

The meter factor ("MF") of the flowmeter used in determining gas volume. It is a read-only parameter.

Specific Gravity

The specific gravity ("SpGrav") is a constant value entered in the Flow Setup menu (Section 9d) and is used in determining gas volume. It is a read-only parameter.

Compressibility Factor

The gas compressibility factor ("Fpv") is the calculated value for gas compressibility used in determining gas volume. It is a read-only parameter.

Reading the Emulsion, Free Water, and Gross Volume Flow Data

Table 4.4—Liquid Meter Parameters

Parameters	Description	Read/Write Status
FlRate	Current flow rate	R/O
FlPres	Current flowing pressure	R/O
FlTemp	Current flowing temperature	R/O
Freq	Current frequency of the flowmeter	
K-Fact	Current value of k-factor being used in liquid volume calculations	R/O
MF	Current value of meter factor being used in liquid volume calculations	R/O
RelDen	Current value of the relative density used in liquid volume calculations	R/O
DegAPI	Current value of API gravity being used in liquid volume calculations	R/O
CPL	Current pressure correction factor for liquid volume	R/O
CTL	Current temperature correction factor for liquid volume	R/O

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Flow Rate

The liquid flow rate ("FlRate") is the current instantaneous flow rate in Bbls per Day. It is a read-only parameter.

Flowing Pressure

The flowing pressure ("FlPres") is the flowline pressure expressed in psig which is used in determining liquid volume. This is often not used. It is a read-only parameter.

Flowing Temperature

The flowing temperature ("FlTemp") is the flowline temperature expressed in degrees F and is used in determining liquid volume. This is often not used. It is a read-only parameter.

Frequency

The frequency ("Freq") of the flowmeter expressed in Hertz. It is a read-only parameter.

K-Factor

The current K-Factor (“K-Fact”) of the flowmeter expressed in pulses per Gallon. It is a read-only parameter.

Meter Factor

The meter factor (“MF”) of the flowmeter used in determining volume. It is a read-only parameter.

Relative Density

The relative density (“RelDen”) of the liquid is a constant value entered in the Flow Setup menu (Section 9e) and is used in determining liquid volume. It is a read-only parameter.

API Gravity

The API gravity (“DegAPI”) of the liquid is a constant value entered in the Flow Setup menu (Section 9e) and is used in determining liquid volume. It is a read-only parameter.

CPL

The pressure correction factor (“CPL”) of the liquid used in determining liquid volume. It is a read-only parameter.

CTL

The temperature correction factor (“CTL”) of the liquid used in determining liquid volume. It is a read-only parameter.

Section 5

The Site Data Menu

Introduction

The Site Data menu allows you to read and enter parameters into the computer that provide information about the physical location of the NOA-332. Table 5.1 lists the fourteen (14) menu items in the Site Data menu. A listing of this menu is available in Appendix C, page C-2.

NOTE—**A level 2 or higher password authorization is required to view the items in the Site Data Menu. A level 4 password is required to change the items in the Site Data Menu.**

Accessing the Site Data Menu

1. Starting from the 'Main Menu', press the ↑ or ↓ key until the pointer is at "Site Data" and press ENTER.
2. The Site Data menu items will appear:

Table 5.1--Site Data Menu Parameters

Parameters	Description	Read/Write Status
SiteId	Site identification, alphanumeric	R/W
Loc	Site location, alphanumeric	R/W
Oper	Operator name, alphanumeric	R/O
Lat	Site latitude	R/W
Elev	Site elevation	R/W
Tbase	Base temperature used in gas/liquid calculation	R/W
Pbase	Base pressure used in gas/liquid calculation	R/W
Pbar	Average barometric pressure used in gas/liquid calculation	R/W
UnitId	Instrument identification number	R/O
SysPwr	System power	R/O
BrdTmp	System ambient temperature	R/O
ROMVer	Firmware version level	R/O
SerNum*	Instrument serial number	R/O
Model	Indicates model of computer	R/O

* The default serial number displayed is NOA-9999. The operator can change this number to the actual serial number of the NOA-332. Once the number is changed from the default number, it cannot be changed again.

Reading and Entering Site Data Parameters

The following sections describe site data parameters and procedures for entering the site data from the Site Data menu. These procedures are similar to the ones that you will use to read and enter parameters in other submenus.

Note—To enter parameters, put the system in enhanced mode. Then you can scroll down to other parameters and enter data without having to press ESCAPE to return to the Site Data menu.

SiteId

The site identification ("SiteId") is used to identify where the NOA-332 is located. This entry can have a maximum of 20 alphanumeric characters and often consists of a station name, tank farm name, etc.

1. While the LCD is displaying the Site Data menu, press the ↑ or ↓ key until the pointer is located next to the "SiteId" position.
2. Press ENTER to display the site identification in enhanced mode. In enhanced mode, you can press ESCAPE to exit enhanced mode or press the ↑ or ↓ key to display other Site Data information in enhanced mode.

   To change the site identification, leave the display in enhanced mode. (For more information on enhanced mode, see Section 2.)
3. To change the site identification, press the SETUP key. The LCD will display "Please Enter" with the current site identification.
4. Enter the new site identification information and press ENTER. See the example on the following page. For more information about alphanumeric data entry, see Section 2.

Important—Do not press ENTER until the "SiteId" is completely displayed. If you press ENTER before completely entering the ID, you must start the procedure from the beginning.

5. After entering the SiteId, follow one of the guidelines below:
   - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.
   - If you have finished entering parameters, press ESCAPE to return to the Site Data menu.

Example: Alphanumeric Entry of a Site ID

The new site identification is LAKE #1. This entry is made up of four letters, a space, a symbol, and then a number. If you have already displayed the parameter in enhanced mode and you have pressed the SETUP key, perform the following steps to enter this site ID:

1. Press 5, since the L character is available from this key. Press the ↓ key three times so that the pointer selects the L.

Hint—Pressing the ↑ key once will also select the L.

2. Press 2. Press the ↓ key one time. “LA” will be displayed.
3. Press 5. Press the ↓ key twice. “LAK” will be displayed.
4. Press 3. Press the ↓ key twice. “LAKE” will be displayed.
5. Press 0. Press the ↓ key three times. “LAKE ” with a space after the E will be displayed.
6. Press 1. Press the ↓ key five times. “LAKE #” will be displayed.
7. Press 1. “LAKE #1” will be displayed.
8. Press ENTER to complete the entry of the SiteId.

Site Location

The site location (“Loc”) is used to describe the site where the NOA-332 is located. This entry can have a maximum of 20 alphanumeric characters and often consists of city, state, or county names.

1. Select the site location parameter in one of the following ways:
    - If the Site Data menu is displayed, press the ↑ or ↓ key to select “Loc” and press ENTER to display the site location in enhanced mode.
    - If the system is already in enhanced mode, scroll to the site location parameter.
2. To change the site location, press the SETUP key.
3. Enter the site location with the alphanumeric keys and press ENTER. (See the Example above.)
4. After entering the site location, follow one of the guidelines below:
    - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.
    - If you have finished entering parameters, press ESCAPE to return to the Site Data menu.

Local Operator

The local operator (“Oper”) parameter displays the identification of the individual whose security code was entered. It is a read-only item. If the local operator needs to be changed, modify it in the Security Setup menu described in Section 9f.

To view the local operator ID, follow these steps:

1. Select the local operator parameter in one of the following ways:
    - Press the ↑ or ↓ key until the pointer is aligned with the "Oper" position and press ENTER to view the local operator ID in enhanced mode.
    - If the system is already in enhanced mode, scroll to the local operator parameter.
2. After reading the local operator parameter, follow one of the guidelines below:
    - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.
    - If you have finished entering and reading parameters, press ESCAPE to return to the Site Data menu.

Latitude

The site latitude ("Lat") is the number of degrees north of the equator the instrument is located. Since the latitude is used in flow calculations, it is important that this value be entered. The range of values allowable is from 0.0° to 90.0°, and the value can be entered to the nearest one tenth of a degree.

1. Select the latitude parameter in one of the following ways:
    - If the Site Data menu is displayed, press the key until the pointer is aligned with the "Lat" position and press ENTER to view the latitude in enhanced mode.
    - If the system is already in enhanced mode, scroll to the latitude parameter.
2. To change the latitude value, press SETUP. The display will show "Please Enter" with the current entered latitude. The minimum and maximum values that can be entered are shown on the bottom line of the display.
3. Enter the new value from the keypad using the number keys and the decimal point key.
4. Once the correct latitude is displayed, press ENTER to complete the entry.
5. After entering the site location, follow one of the guidelines below:
    - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.
    - If you have finished entering parameters, press ESCAPE to return to the Site Data menu.

Elevation

The site elevation ("Elev") is the instrument's elevation above sea level, measured in feet. Accurate entry of this parameter is vital since it is used in the flow calculations. The range of acceptable entries is from 0.0 to 10,000.0 ft.

1. Select the elevation parameter in one of the following ways:
    - If the Site Data menu is displayed, press the ↑ or ↓ key until the pointer is aligned with the "Elev" position and press ENTER to view the parameter in enhanced mode.
    - If the system is already in enhanced mode, scroll to the elevation parameter.
2. To change the elevation, press the SETUP key.
3. Enter the elevation with the 0 to 9 number keys and the decimal point key.

4. After the correct elevation is displayed, press ENTER to complete the entry.
5. After entering the elevation, follow one of the guidelines below:
    - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.
    - If you have finished entering parameters, press ESCAPE to return to the Site Data menu.

Base Temperature

The base temperature ("Tbase") is the temperature standard to which the gas volume is corrected for obtaining the standard gas volume. The range of valid entries is from -40.00 to 185.0.

To change or read the base temperature from the Site Data menu, follow these steps:

1. Select the elevation parameter in one of the following ways:
    - If the Site Data menu is displayed, press the ↑ or ↓ key until the pointer is aligned with the "Tbase" position and press ENTER to view the parameter in enhanced mode.
    - If the system is already in enhanced mode, scroll to the "Base Temperature xx.x Deg F" parameter.
2. To change the base temperature, press the SETUP key.
3. With the number keys and decimal point key, enter the temperature.
4. After the correct base temperature is displayed, press ENTER to complete the entry.
5. After entering the base temperature, follow one of the guidelines below:
    - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.
    - If you have finished entering parameters, press ESCAPE to return to the Site Data menu.

Base Pressure

The base pressure ("Pbase") is the pressure standard to which the gas volume is corrected to obtain the standard gas volume. The range of valid entries is from 0.000 to 20.00.

To change or read the base pressure from the Site Data menu, follow these steps:

1. Select the base pressure parameter in one of the following ways:
    - If the Site Data menu is displayed, press the ↑ or ↓ key until the pointer is aligned with the "Pbase" position and press ENTER to view the parameter in enhanced mode.
    - If the system is already in enhanced mode, scroll to the "Base Pressure xx.xxx PSIA" parameter.
3. To change the base pressure, press the SETUP key.
4. With the 0 to 9 numerical keys and the decimal point key, enter the pressure.
5. After the correct pressure is displayed, press the ENTER key.
6. After entering the base pressure, follow one of the guidelines below:
    - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.

- If you have finished entering parameters, press ESCAPE to return to the Site Data menu.

Barometric Pressure

The barometric pressure ("Pbar") is the user-entered value of the average local barometric pressure. Barometric pressure is an important parameter used in all flow calculations for determining absolute pressure from gauge pressure. The range of valid entries is from 0.000 to 20.00.

To change or read the barometric pressure from the Site Data menu, follow these steps:

1. Select the barometric pressure parameter in one of the following ways:
    - If the Site Data menu is displayed, press the ↑ or ↓ key until the pointer is aligned with the "Pbar" position and press ENTER to view the parameter in enhanced mode.
    - If the system is already in enhanced mode, scroll to the "Barometric Pressure xx.xxx PSIA" parameter.
3. To change the barometric pressure, press the SETUP key.
4. With the 0 to 9 numerical keys and the decimal point key, enter the barometric pressure.
5. After the correct barometric pressure is displayed, press ENTER to complete the entry.
6. After entering the barometric pressure, follow one of the guidelines below:
    - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.
    - If you have finished entering parameters, press ESCAPE to return to the Site Data menu.

Unit Identification

The unit identification ("Unit Id") is an identification number for RS-485 and radio communications to distinguish this unit from other NOA-332s communicating on the same line or radio frequency. The unit identification is a read-only parameter. This number is set via dip switch on the digital circuit assembly (see Appendix A). The range of valid numbers is from 0 to 255.

To read the unit identification from the Site Data menu, follow these steps:

1. Select the Unit ID parameter in one of the following ways:
    - If the Site Data menu is displayed, press the ↑ or ↓ key until the pointer is aligned with the "Unit ID" position and press ENTER to view the parameter in enhanced mode.
    - If the system is already in enhanced mode, scroll to the "Unit Identification xxx" parameter.
2. After reading the unit identification, follow one of the guidelines below:
    - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.
    - If you have finished entering parameters, press ESCAPE to return to the Site Data menu.

System Power

The system power ("SysPwr") is the actual voltage read at the NOA-332 power supply input which is mapped to Analog Input Channel #1. This is a read-only parameter. The measured system power voltage may be calibrated in the System Setup menu (Section 9a).

To read the system power voltage from the Site Data menu, follow these steps:

1. Select the system power parameter in one of the following ways:
    - If the Site Data menu is displayed, press the ↑ or ↓ key until the pointer is aligned with the “SysPwr” position and press ENTER to view the parameter in enhanced mode.
    - If the system is already in enhanced mode, scroll to the “System Voltage xx.xx Volts.”
2. After reading the system voltage, follow one of the guidelines below:
    - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.
    - If you have finished entering parameters, press ESCAPE to return to the Site Data menu.

Board Temperature

The board temperature (“BrdTmp”) is the temperature of the analog circuit assembly as measured by a temperature sensor on the analog circuit assembly. This is a read-only parameter.

To read the board temperature from the Site Data menu, follow these steps:

1. Select the board temperature parameter in one of the following ways:
    - If the Site Data menu is displayed, press the ↑ key or the ↓ key until the pointer is aligned with the “BrdTmp” position and press ENTER to view the parameter in enhanced mode.
    - If the system is already in enhanced mode, scroll to the “Board Temperature xx.x Deg F.”
2. After reading the board temperature, follow one of the guidelines below:
    - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.
    - If you have finished entering parameters, press ESCAPE to return to the Site Data menu.

Firmware Revision

The firmware revision (“ROMVer”) allows the user to determine the version of firmware in the NOA-332. The firmware revision number is embedded in the EPROMs, and is not alterable from any menu in the NOA-332 .

To read the firmware version from the Site Data menu, follow these steps:

1. Select the firmware revision parameter in one of the following ways:
    - If the Site Data menu is displayed, press the ↑ or ↓ key until the pointer is aligned with the “ROMVer” position and press ENTER to view the parameter in enhanced mode.
    - If the system is already in enhanced mode, scroll to the “Firmware Revision x.xx” parameter.
2. After finding the version, follow one of the guidelines below:
    - If you have additional parameters to enter, scroll to the next parameter using the ↑ and ↓ keys and follow the appropriate instructions for entering the parameter.
    - If you have finished entering parameters, press ESCAPE to return to the Site Data menu.

NOA Serial Number

The NOA-332 serial number ("SerNum") displays the serial number of the NOA-332. On a NOA-332 sent from the factory, this number is preprogrammed into the system's memory and does not require user configuration. However, if a digital circuit board is replaced in the unit, the serial number must be reprogrammed into the NOA-332 .

To read the serial number, select the serial number parameter in one of the following ways:

- If the Site Data menu is displayed, press the ↑ or ↓ key until the pointer is aligned with the "SerNum" position and press ENTER to view the parameter in enhanced mode.
- If the system is already in enhanced mode, scroll to the serial number parameter.

If the number is NOA-9999, it can be changed to the serial number of the NOA-332 .

To enter a serial number in place of the default value, follow these steps:

1. Record the serial number of the NOA-332 (the serial number plate is below the analog circuit assembly).
2. While the system is in the enhanced mode, press SETUP.
3. Enter the alphanumeric serial number. See the example in this section on how to enter alphanumeric data. Press ENTER.

Caution—Do not press ENTER until you have verified the accuracy of the information typed. Once ENTER has been pressed, the number is embedded in the system and cannot be changed.

4. When you are sure that the number is correct, press ENTER.
5. Press ESCAPE to return to the Site Data menu.

NOA Model Type

The NOA Model Type ("Model") displays the type of computer as determined by the firmware in the E-proms. Model types include, but are not limited to: GFC-332, IQV-332, WCU-332, & FC-332. To read the Model Type, select the model parameter in one of the following ways:

- If the Site Data menu is displayed, press the ↑ or ↓ key until the pointer is aligned with the "Model" position and press ENTER to view the parameter in enhanced mode.
- If the system is already in enhanced mode, scroll to the model parameter.

Section 6

The Alarm Data Menu

Introduction

The Alarm Data menu consists of four submenus: (1) Analog Input Alarm Data submenu, (2) Multivariable Transmitter Input Alarm Data submenu, (3) Digital Input Alarm Data submenu, and (4) Rate/Volume Alarm Data submenu. Each submenu consists of alarm parameters which are configured in either the Config/Alarm Data menu or the Config/Flow Setup menu. All parameters in the Alarm Data menu are read-only. A listing of this menu and its submenus are available in Appendix C, page C-3.

NOTE**—A level 2 or higher password authorization is required to view the Alarm Data Menu and its submenus.**

Accessing the Analog Input Alarm Data Submenu

1. To enter the Alarm Data menu, press ESCAPE until the NOA-332 Main Menu is displayed.
2. From the Main Menu press the ↑ or ↓ key until the pointer selects "Alarm Data." Press ENTER.
3. Press the ↑ or ↓ key until the pointer is aligned with "Analog Input...". Press ENTER.

The alarm status will be displayed to the right of each alarm data parameter. To view the enhanced mode of each alarm data parameter and its individual status, press the ↑ or ↓ key until the pointer is aligned with the required selection, and then press ENTER.

Analog Input Alarm Data Parameters

The following section provides information about the parameters in the Analog Input Alarm Data submenu. The parameters shown are the source names for the analog inputs. Table 6.1 lists the sixteen available analog inputs as they are configured by **default** in the NOA-332. However, as this is configurable by the user, the source names may be different and some of the analog channels may not be in use. The analog input alarms are not active unless an actual device is connected to the analog input.

Table 6.1—Analog Alarm Input Description

Input	Description
Analog Input #1	(SysPwr) System Power
Analog Input #2	(BrdTmp) Board Temperature
Analog Input #3	(Wtrcut) Percent Watercut
Analog Input #4	(EmulPr) Emulsion Flowing Pressure
Analog Input #5	(EmulTm) Emulsion Flowing Temperature
Analog Input #6	(DiffPr) Gas Orifice Differential Pressure
Analog Input #7	(GasPr) Gas Meter Flowing Pressure
Analog Input #8	(GasTmp) Gas Meter Flowing Temperature
Analog Input #9	Spare Input / (Aux1) Auxiliary Input #1
Analog Input #10	Spare Input / (Aux2) Auxiliary Input #2
Analog Input #11	Spare Input / Differential Pressure Hi
Analog Input #12	Spare Input
Analog Input #13	Spare Input
Analog Input #14	Spare Input
Analog Input #15	Spare Input
Analog Input #16	Spare Input

System Voltage

The System Voltage alarm (“SysPwr”) monitors the power supply voltage entering the 12Vdc Power Input terminals on the Analog Circuit Assembly.

Board Temperature

The Board Temperature alarm (“BrdTmp”) monitors the ambient temperature of the Analog circuit board.

Watercut

The Watercut alarm (“Wtrcut”) monitors the percent watercut indicated by the watercut probe.

Emulsion Pressure

The Emulsion Pressure alarm (“EmulPr”) monitors the line pressure on the emulsion meter run.

Emulsion Temperature

The Emulsion Temperature alarm (“EmulTm”) monitors the line temperature on the emulsion meter run.

Differential Pressure

The Differential Pressure alarm (“DiffPr”) monitors the differential pressure on the orifice meter run.

Gas Pressure

The Gas Pressure alarm (“GasPr”) monitors the gas line pressure.

Gas Temperature

The Gas Temperature alarm ("GasTmp") monitors the gas temperature.

Auxiliary Input Channels

The Auxiliary Input Channels alarms ("Aux1" and "Aux2") monitors the transmitters connected to these inputs. If these inputs are not defined for the system (see Section 9a), the these will appear as Spare Inputs.

Differential Pressure Hi

The Differential Pressure Hi alarm ("DiffPr") monitors the high range differential pressure on the orifice meter run if a transmitter is connected to this input. If this input is not defined for the system (see Section 9a), this will appear as a Spare Input.

Analog Input Alarm Status Indicators

The alarm status indicators for the Analog Input Alarms are:

- HiHi Alarm
- High (Warning) Alarm
- Low (Warning) Alarm
- LoLo Alarm
- Not Active

HiHi Alarm

"HiHi" is the High High Alarm Trip Point parameter. If the monitored analog parameter rises above this value plus the deadband, a HiHi Alarm is indicated. Each time a HiHi alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a HiHi Alarm causes a HiHi Alarm Action. The type of action depends on the HiHi Action parameter.

High (Warning) Alarm

"High" is the High (Warning) Alarm Trip Point parameter. If the monitored analog parameter rises above this value plus the deadband, a High (Warning) Alarm is indicated. Each time a High (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is triggered by this alarm.

Low (Warning) Alarm

"Low" is the Low (Warning) Alarm Trip Point parameter. If the monitored analog parameter falls below this value minus the deadband, a Low (Warning) Alarm is indicated. Each time a Low (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is triggered by this alarm.

LoLo Alarm

"LoLo" is the Low Low Alarm Trip Point parameter. If the monitored analog parameter falls below this value minus the deadband, a LoLo Alarm is indicated. Each time a LoLo alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a LoLo Alarm causes a LoLo Alarm Action. The type of action depends on the LoLo Alarm Action parameter.

Not Active

"Not Active" status indicates that no alarm condition is present.

Example: Assume that the alarm limits set for the static pressure parameter in the Analog Input Alarm Setup menu are:

- High High Alarm Trip Point: 1500 PSIG
- High (Warning) Alarm Trip Point: 1000 PSIG
- Low (Warning) Alarm Trip Point: 200 PSIG
- Low Low Alarm Trip Point: 100 PSIG
- Deadband: 20 PSIG

Using the numbers above, the HiHi alarm condition exists when the static pressure is above 1520 PSIG. The high (warning) alarm condition exists when the static pressure is above 1020 PSIG and below 1480 PSIG. The low (warning) alarm condition exists when the static pressure is above 120 PSIG and below 180 PSIG. The LoLo alarm condition exists when the static pressure is below 80 PSIG. The "Not Active" condition is present when the static pressure is above 200 PSIG and below 1000 PSIG.

Accessing the Multivariable Transmitter Input Alarm Data Submenu

1. To enter the Alarm Data menu, press ESCAPE until the NOA-332 Main Menu is displayed.
2. From the Main Menu press the ↑ or ↓ key until the pointer selects "Alarm Data." Press ENTER.
3. Press the ↑ or ↓ key until the pointer is aligned with "MVT AI...". Press ENTER.
4. Press the ↑ or ↓ key until the pointer is aligned with "MVT 1 to 8 Status...". Press ENTER.

The Multivariable Transmitter Input Alarm Data Menu contains eight submenus: MVT 1 Status… through MVT 8 …status. Each submenu represents the alarms status from each of the MVT sources. Within each submenu the alarm status will be displayed to the right of each alarm data parameter. To view the enhanced mode of each alarm data parameter and its individual status, press the ↑ or ↓ key until the pointer is aligned with the required selection, and then press ENTER.

Multivariable Transmitter Input Alarm Status Data Parameters

The following section provides information about the parameters available in the Multivariable Transmitter Status Alarm Data submenus. The parameters are the same for all eight of the MVT Status selections. For information about setting the limits for these alarms, see Section 9g. There are three parameters listed in each of the MVT Status submenus. These are StPres, StTemp, and DiffPr.

Static Pressure

The Static Pressure alarm ("StPres") monitors the gas line pressure reported from the MVT via communications with the NOA-332 COM3 communications port.

Temperature

The Gas Temperature alarm ("StTemp") monitors the gas temperature reported from the MVT via communications with the NOA-332 COM3 communications port.

Differential Pressure

The Differential Pressure alarm ("DiffPr") monitors the differential pressure on the orifice meter run reported from the MVT via communications with the NOA-332 COM3 communications port.

Multivariable Transmitter Input Alarm Status Indicators

The alarm status indicators for the Multivariable Transmitter Input Alarms are:

- HiHi Alarm
- High (Warning) Alarm
- Low (Warning) Alarm
- LoLo Alarm
- Not Active

HiHi Alarm

"HiHi" is the High High Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a HiHi Alarm is indicated. Each time a HiHi alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a HiHi Alarm causes a HiHi Alarm Action. The type of action depends on the HiHi Action parameter.

High (Warning) Alarm

"High" is the High (Warning) Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a High (Warning) Alarm is indicated. Each time a High (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is triggered by this alarm.

Low (Warning) Alarm

"Low" is the Low (Warning) Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a Low (Warning) Alarm is indicated. Each time a Low (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is triggered by this alarm.

LoLo Alarm

"LoLo" is the Low Low Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a LoLo Alarm is indicated. Each time a LoLo alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a LoLo Alarm causes a LoLo Alarm Action. The type of action depends on the LoLo Alarm Action parameter.

Not Active

"Not Active" status indicates that no alarm condition is present.

Accessing the Digital Input Alarm Data Submenu

To enter the Alarm Data menu, press ESCAPE until the NOA-332 Main Menu is displayed.

From the Main Menu press the ↑ or ↓ key until the pointer selects "Alarm Data." Press ENTER.

Press the ↑ or ↓ key until the pointer is aligned with "Digital Input...". Press ENTER.

The alarm status will be displayed to the right of each alarm data parameter. To view the enhanced mode of each alarm data parameter and its individual status, press the ↑ or ↓ key until the pointer is aligned with the required selection, and then press ENTER.

Digital Input Alarm Data Parameters

The parameters listed in the Digital Input Alarm Data submenu are all "Spare DI". These are the source names assigned by default to the 8 digital inputs. The source names can be changed by following the procedures in Section 9j and requires the optional Digital I/O circuit board.

Digital Input Alarm Status Indicators

The alarm status indicators for the Digital Inputs Alarms are:

- No Alarm
- Not Valid
- Switch Closed
- Switch Open

No Alarm

"No Alarm" indicates that there is no alarm condition present.

Not Valid

"Not Valid" indicates that there is no alarm configured for the specified digital input.

Switch Closed

"Switch Closed" indicates that a switch closed alarm condition exists.

Switch Open

"Switch Open" indicates that a switch open alarm condition exists.

Accessing the Rate/Volume Alarm Submenu

To enter the Alarm Data menu, press ESCAPE until the NOA-332 Main Menu is displayed.

From the Main Menu press the ↑ or ↓ key until the pointer selects "Alarm Data." Press ENTER.

Press the ↑ or ↓ key until the pointer is aligned with "Rate/Volume...". Press ENTER.

The pointer will point to the meter id ("Mtr Id") and display the associated alarm status for Rate and Volume. Press the SETUP key and use the ↑ or ↓ key to display the flow of choice, then press ENTER.

Rate/Volume Alarm Data Parameters

The following section provides information about the parameters available in the Rate/Volume Alarm Data submenu. For information about setting the limits for these alarms, see Section 9g.

Rate

The Flow Rate alarms ("Rate") monitor the flow rate of each meter.

Volume

The Volume alarms ("Volume") monitor the volume of each meter.

Rate/Volume Alarm Status Indicators

The alarm status indicators for the Rate/Volume Alarms are:

- HiHi Alarm
- High (Warning) Alarm
- Low (Warning) Alarm
- LoLo Alarm
- Not Active

HiHi Alarm

"HiHi" is the High Alarm Trip Point parameter. If the monitored rate/volume parameter rises above this value plus the deadband, a HiHi Alarm is indicated. Each time a HiHi alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a HiHi Alarm causes a HiHi Alarm Action. The type of action depends on the HiHi Action parameter.

High (Warning) Alarm

"High" is the High (Warning) Alarm Trip Point parameter. If the monitored rate/volume parameter rises above this value plus the deadband, a High (Warning) Alarm is indicated. Each time a High (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is tied to this alarm.

Low (Warning) Alarm

"Low" is the Low (Warning) Alarm Trip Point parameter. If the monitored rate/volume parameter falls below this value minus the deadband, a Low (Warning) Alarm is indicated. Each time a Low (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is tied to this alarm.

LoLo Alarm

"LoLo" is the Low Low Alarm Trip Point parameter. If the monitored rate/volume parameter falls below this value minus the deadband, a LoLo Alarm is indicated. Each time a LoLo alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a LoLo Alarm causes a LoLo Alarm Action. The type of action depends on the LoLo Alarm Action parameter.

Not Active

"Not Active" status indicates that no alarm condition is present.

Example: Assume that the alarm limits for the gas flow rate are:

- High High Alarm Trip Point: 1200 MCF/D
- High (Warning) Alarm Trip Point: 900 MCF/D
- Low Low Alarm Trip Point: 100 MCF/D
- Low (Warning) Alarm Trip Point: 300 MCF/D
- Deadband: 50 MCF/D

Using the numbers above, the HiHi alarm condition exists when the gas flow rate is above 1250 MCF/D. The High (warning) alarm condition exists when the gas flow rate is above 950 MCF/D and below 1150 MCF/D. The Low (warning) alarm condition exists when the gas flow rate is above 150 MCF/D and below 250 MCF/D. The LoLo alarm condition exists when the gas flow rate is below 50 MCF/D. The "Not Active" status indicator is present when the gas flow rate is above 300 MCF/D and below 900 MCF/D.

Section 7

The Multivariable Transmitter Menu

Introduction

The NOA-332 can accommodate the use of a Multivariable Transmitter (MVT) to obtain Static Pressure, Differential Pressure, and Temperature. While these parameters are usually associated with gas measurement, the NOA-332 allows the assignment of these parameters to gas or emulsion flow. A listing of this menu and its submenus are available in Appendix C, page C-4.

NOTE**—A level 3 or higher password authorization is required to edit the Multivariable Transmitter override parameters and to enable polling .**

Because the MVT is a digital transmitter instead of the usual analog type transmitter, the setup of the MVT is different. A maximum of eight (8) MVTs may be used with the NOA-332. For each MVT, the parameters of Differential Pressure, Static Pressure, and Temperature are assigned Input Channel numbers. The MVT inputs are associated with input channel numbers 25 thru 48 as shown as shown in Table 7.1 below. These channels numbers are used in the same manner as the analog transmitter input channel numbers (associated with input channel numbers 1 thru 16) to assign flow parameters to gas measurement (see Sections 9a, 9c, and 9d), emulsion measurement (see Section 9e), and the Auxiliary Inputs (see Section 9a).

Table 7.1—MVT Input Channel Assignment

MVT "source" Input	Input Channel Assignment
MVT 1 Differential Pressure	25
MVT 1 Static Pressure	26
MVT 1 Temperature	27
MVT 2 Differential Pressure	28
MVT 2 Static Pressure	29
MVT 2 Temperature	30
MVT 3 Differential Pressure	31
MVT 3 Static Pressure	32
MVT 3 Temperature	33
MVT 4 Differential Pressure	34
MVT 4 Static Pressure	35
MVT 4 Temperature	36
MVT 5 Differential Pressure	37
MVT 5 Static Pressure	38
MVT 5 Temperature	39
MVT 6 Differential Pressure	40
MVT 6 Static Pressure	41
MVT 6 Temperature	42

MVT "source" Input	Input Channel Assignment
MVT 7 Differential Pressure	43
MVT 7 Static Pressure	44
MVT 7 Temperature	45
MVT 8 Differential Pressure	46
MVT 8 Static Pressure	47
MVT 8 Temperature	48

The following steps are required to configure the NOA-332 for using a MVT:

1. Connect the MVT RS-485 wiring to COM3 on the NOA-332 Analog board. See Appendix A of this manual for an illustration of the wiring connections to COM3.

2. Connect power to the MVT. See Appendix A of this manual for information on power connections for the MVT.

3. Using the NOA-332 front keypad and LCD user interface, access the operating system by logging in with a Level 3 or higher password.

4. From the NOA Main menu scroll down to the MultiVarTrans submenu. Each MVT is configured via a corresponding Data menu as shown in Table 7.2 below. Within each submenu is a list of parameters used to enable the MVT polling, select the address of the MVT to be polled, observe the values being read from the MVT, observe the communication statistics of the MVT polling, and set override values for the MVT.

5. Scroll to MVT ID# parameter and enter the correct MVT Id# (Modbus address) for the MVT to communicate with. Knowledge of the MVT Id# (Modbus address) set in the MVT is required in order to do this step.

6. In the MVT Data menu scroll down to the Polling parameter. Select "Enable" to start communications with the MVT. Observe the communications statistic parameters to verify communications with the MVT are working.

7. Assign the appropriate MVT input channel number (25 thru 48) to gas measurement (see Sections 9a, 9c, and 9d), emulsion measurement (see Section 9e), or the Auxiliary Inputs (see Section 9a).

Accessing the Multivariable Transmitter menu

1. To enter the Multivariable Transmitter menu, press ESCAPE until the NOA-332 Main Menu is displayed.
2. From the Main Menu press the ↑ or ↓ key until the pointer selects "MultiVarTrans." Press ENTER.
3. Press the ↑ or ↓ key until the pointer is aligned with "MVT 1 to 8 Data...". Press ENTER.
4. The MVT data will be displayed to the right of each Multivariable Transmitter parameter. To view the enhanced mode of each Multivariable Transmitter parameter and its individual status, press the ↑ or ↓ key until the pointer is aligned with the required selection, and then press ENTER.

Multivariable Transmitter Parameters

The following section provides information about the parameters in the MVT Data submenus. Table 7.2 lists the parameters contained in the MVT Data submenus.

Table 7.2—Multivariable Transmitter Parameters

Parameters	Description	Read/Write Status
DPLive	Current Differential Pressure reading from the MVT	R/O
PrLive	Current Static Pressure reading from the MVT	R/O
TmLive	Current flowing temperature reading from the MVT	R/O
OvrdDPVal	Differential Pressure value used to override the live reading	R/W
OvrdPrVal	Static Pressure value used to override the live reading	R/W
OvrdTmVal	Temperature value used to override the live reading	R/W
OvrdDP	Yes or No setting to use the override Differential Pressure value instead of the live value	R/W
OvrdPr	Yes or No setting to use the override Static Pressure value instead of the live value	R/W
OvrdTm	Yes or No setting to use the override Temperature value instead of the live value	R/W
good	Percentage of good communications with the MVT	R/O
Totl	Total number of communications attempted with the MVT	R/O
Fail	Number of failed communications with the MVT	R/O
CRC	Number of CRC errors during communications with the MVT	R/O
MVT Id#	Modbus address of the MVT to poll	R/W
Clear All Data…	Clears the “good” percentage, Total number of communications and Failed number of communications statistics	R/W
Polling	Enables or Disables communications with the MVT	R/W

DPLive

This is the last read value for Differential Pressure from the MVT. This unit of measure for this item is Inches of H2O.

PrLive

This is the last read value for Static Pressure from the MVT. The unit of measure for this item is PSIG.

TmLive

This is the last read value for Temperature from the MVT. The unit of measure for this item is Degrees Fahrenheit.

OvrdDPVal

This is the Differential Pressure value used to override the live reading. This value is used by the system only if the “OvrdDP” override parameter is set to “yes”. This item is intended to be used only as a temporary measure when there is a problem with the MVT or the MVT is temporarily out of service.

OvrdPrVal

Static Pressure value used to override the live reading. This value is used by the system only if the "OvrdPr" override parameter is set to "yes". This item is intended to be used only as a temporary measure when there is a problem with the MVT or the MVT is temporarily out of service

OvrdTmVal

Temperature value used to override the live reading. This value is used by the system only if the "OvrdTm" override parameter is set to "yes". This item is intended to be used only as a temporary measure when there is a problem with the MVT or the MVT is temporarily out of service

OvrdDP

This is a "Yes" or "No" setting that determines whether to use the override Differential Pressure value instead of the live value.

OvrdPr

This is a "Yes" or "No" setting that determines whether to use the override Static Pressure value instead of the live value.

OvrdTm

This is a "Yes" or "No' setting that determines whether to use the override Temperature value instead of the live value.

good

This is a statistic of the percentage of good communications the NOA-332 has had with the MVT.

Totl

This is the total number of communications the NOA-332 has attempted with the MVT.

Fail

This is the number of failed communications the NOA-332 has had with the MVT.

CRC

This is the number of CRC errors that have occurred during the communications between the NOA-332 and the MVT.

MVT Id#

This is the Modbus address of the MVT that the NOA-332 will communicate with. Prior knowledge of the address set in the MVT is required in order to set this parameter correctly. The address of the MVT is usually set and stored in the MVT through the use a of separate MVT configuration program.

Clear All Data…

This parameter clears the communication statistic parameters. The items cleared when this operation is performed are: the "good" percentage, total number of communications, and failed number of communications.

Polling

This parameter Enables or Disables the communications with the MVT.

Notes

Section 8

The Time Data Menu

Introduction

The Time Data menu is a read/write (R/W) menu that allows the user to read the current time and date and to enter, or correct, the current time and date. The Time Data menu choices are listed in Table 8.1. A listing of this menu is available in Appendix C, page C-4.

NOTE—**A level 1 or higher password authorization is required to view the items in the Time Data Menu. A level 4 password is required to change the items in the Time Data Menu.**

Accessing the Time Data Menu

1. To enter this menu, press ESCAPE until the NOA-332 Main Menu is displayed.
2. Press the ↑ or ↓ key until the pointer is aligned with the Time Data menu selection.
3. Press ENTER to display the time and date.

Hint—A faster way to enter the Time Data menu is to press the TIME key which will access the menu regardless of where you are located in the menu structure.

4. To view the time and date individually in enhanced mode, press the ↑ or ↓ key until the pointer is aligned with the selection, and then press ENTER. The selection will be displayed as "System Time" or "System Date."

Table 8.1—Time Data Menu Parameters

Parameters	Description	Read/Write Status
Time	Current time of day (HH:MM:SS)	R/W
Date	Current date (MM/DD/YYYY)	R/W

Setting the System Time

1. Display the time in the enhanced mode.
2. Press the SETUP key. The LCD will display "Please Enter" and the current system time.
3. Enter the time in the 24-hour format of **hh:mm:ss,** where hh is the hours, mm is the minutes and ss is the seconds.

Note—Each of the entries has to be in double digits; any number less than ten requires a zero in front of it. The NOA-332 will automatically place the colons (:) during entry.

4. After entering the time data, press ENTER.

Setting the System Date

1. Display the date in the enhanced mode.
2. Press the SETUP key. The LCD will display “Please Enter” and the current system date.
3. Enter the date in the format of mm/dd/yyyy, where mm is the numerical value of the month, dd is the current day of the month, and yyyy is the four digits of the current year.

Note—Each of the entries has to be in double digits; any number less than ten requires a zero in front of it. The NOA-332 will place the forward slash (/) during entry.

4. After entering the date data, press ENTER.

Example: Setting the Time to 3:06:25 PM

1. Display the time in enhanced mode.
2. Press the SETUP key.
3. Enter 150625.
4. Press ENTER at **exactly** 3:06:25 PM. The display will show “System Time 15:06:25” with the last two digits incrementing once per second.
5. Press ESCAPE once to display the Time Data menu.

Example: Setting the Date to October 3, 1996

1. Display the date in enhanced mode.
2. Press SETUP.
3. Enter 10031996.
4. Press ENTER. The LCD will display “System Date 10/03/1996.”
5. Press ESCAPE once to display the Time Data menu.

Section 9

The Configuration/Setup Menu

Introduction

The Configuration/Setup menu allows you to set up parameters that define the operation of the NOA-332. Table 9.1 lists the choices available in the Configuration/Setup menu. These choices provide access to submenus, which allow the configuration of the operating parameters. Because these setup submenus have many options within them, this section of the manual is separated into eleven parts as listed below. A listing of this menu is available in Appendix C, page C-5.

Part 9a - System Setup Menu

Part 9b - Well Test Setup Menu

Part 9c - Flow Setup Menu - Gas Orifice Meter

Part 9d - Flow Setup Menu - Gas Turbine Meter

Part 9e - Flow Setup Menu - Liquid Turbine Meter

Part 9f - Security Setup Menu

Part 9g - Alarm Setup Menu

Part 9h- Calibration Menu

Part 9i - Communications Setup Menu

Part 9j - I/O Configuration Menu

Part 9k- Pulse Output Option Menu

Accessing the Configuration/Setup Menu

To access the Configuration/Setup menu, perform the following procedure:

1. Starting from the Main Menu, press the SETUP key.
2. Position the pointer next to the menu item wanted and press ENTER. See the part of this section (Part 9a through 9k) that contains information about the menu you have chosen.

Table 9.1—Config/Setup Menu Parameters

Parameters	Description
System Setup Menu	Sets unit ID, system voltage, test mode, gas meter type, use of gross volume meter, analog channel assignments for the watercut probe and auxiliary inputs, and allows system restart.
Well Test Setup Menu	Sets the well test parameters for 64 wells. These include the well name, purge and test times, and optional output actions.
Flow Setup Menu	Sets the calculation parameters, analog input assignments, flow related alarms, and turbine meter calibration for gas and liquid flowmeters.
Security Setup Menu	Sets security information for up to 20 operators
Alarm Setup Menu	Sets all system alarms – analog inputs, digital inputs, flow rates, and volumes.
Calibration Menu	Sets calibration parameters for the analog inputs.
Comm Setup Menu	Sets communication parameters for the three communications ports.
I/O Config Menu	Sets the names and units for the analog inputs, digital inputs, and digital outputs.
Pulse Output Menu	Sets the source, pulse width, and volume per count parameters for the optional pulse outputs.

Section 9a

The System Setup Menu

Introduction

The NOA-332 requires specific information on how the user wants to configure the instrument for well testing. For this reason, it is necessary to configure the System Setup menu prior to calibrating the analog inputs or entering calibration factors for the flowmeters. To permit out-of-the-box operation, several default values have been programmed into the NOA-332 at the factory and are usually not changed. However, these parameters may require modification if the computer is relocated to a new wellsite or if a cold-boot occurs. The System Setup menu contains the parameters listed in Table 9a.1. A listing of this menu is available in Appendix C, page C-5

NOTE—**A level 2 or higher password authorization is required to view the items in the System Setup Menu. A level 3 or higher password is required to change the items in the System Setup Menu.**

Accessing the System Setup Menu

In the Config/Setup menu, align the pointer with "Systems Setup" and press ENTER.

Table 9a.1—System Setup Menu Parameters

Parameters	Description	Read/Write Status
Set Unit Id	Unit identification number	R/W
Voltage	System voltage	R/W
Test mode	System well test mode	R/W
Gas Meter	Type of gas flowmeter used	R/W
Gross Vol Mtr	Tells the system if a gross volume flowmeter is being used	R/W
Aux-1 AI #	Analog input channel assignment for the auxiliary input #1	R/W
Aux-2 AI #	Analog input channel assignment for the auxiliary input #2	R/W
Warm Restart	Restarts the computer (reboot)	N/A
Cold Restart	Complete re-boot of entire system	N/A

To access, press the ↑ or ↓ key to align the pointer with the menu selection and then press ENTER

Setting the Unit Id

The unit identification number ("Set Unit Id") is a unique number that distinguishes a particular NOA-332 from other instruments connected to a communication system.

The communication protocols (see Section 9i) used in the NOA-332 for acquiring archived data, runtime data, etc. require a unique identification number to access the NOA-332.

The NOA-332 unit ID is set with the DIP switch, SW2, on the digital circuit assembly as described in Appendix A. The DIP switch is an eight-position switch providing unit IDs in the range of 0 to 255. Each switch position has a value when turned ON that, when added together, form the value of the unit ID.

The following are the values of each position for the DIP switch:

- Position 1 = 1
- Position 2 = 2
- Position 3 = 4
- Position 4 = 8
- Position 5 = 16
- Position 6 = 32
- Position 7 = 64
- Position 8 = 128

If the switch position is OFF, the value of that position is zero. Thus, if all switches are ON, the value would be

1+2+4+8+16+32+64+128 = 255.

To set the NOA-332 unit ID, perform the following procedures:

1. Align the pointer with “Set Unit Id” and press ENTER.
2. Locate the switch position that has a value as close to the desired unit ID, but not greater.
3. Set that switch position to ON.
4. Subtract the value of that switch position from the required unit ID and locate the next switch position using this number, as described in Step 2.
5. Repeat Steps 3 and 4 until the unit ID has been set.

Note—The value of the unit ID is displayed in the upper right corner of the LCD as the DIP switch positions are changed.

6. Press ENTER when the corrected value of the unit ID is displayed.
7. Press ESCAPE to return to the System Setup menu.

Example: Setting Unit Identification

The required unit identification number is 23. The following procedure outlines how to set this unit ID:

1. The switch position with the value closest to 23, but not greater, is 5 (value = 16)

   Set the Position 5 switch ON.

2. 23 - 16 = 7. The closest position value is 4 (Switch Position 3).

   Set the Position 3 switch ON.

3. 7 - 4 = 3. The closest position value is 2 (Switch Position 2).

   Set the Position 2 switch ON.

4. 3 - 2 = 1. This corresponds to Switch Position 1.

   Set the Position 1 switch ON.

5. The value of the unit ID for Switch Positions 1, 2, 3, and 5 is 1+2+4+16 = 23. This unit ID is correct.

   Press ENTER to set the unit ID equal to 23.

6. Press ESCAPE to return to the System Setup menu.

Caution—When changing DIP switch settings, use a light amount of pressure to change the switch position and avoid adding flex to the circuit assembly. Be careful not to damage the circuit assembly.

Calibrating the System Voltage Input

The system voltage monitor uses analog input channel 1 and is described in Appendix A. To calibrate the system voltage input, perform the following procedures:

1. Align the pointer with the “Voltage” parameter.
2. Press ENTER to view the system voltage in enhanced mode.
3. To calibrate the system voltage input, press SETUP. The display will show “Please Enter” with the current system voltage displayed and the minimum and maximum values that can be entered.
4. Using the number keys and the decimal point key, enter the voltage measured between Terminals 1 and 2 of terminal block TB1 of the analog circuit assembly shown in Appendix A (Terminal 1 = +12V nominal; Terminal 2 = Ground). If using the external input, measure the voltage being applied to the system (e.g. 12 volt solar power feed, 24 volt feed).
5. Once the correct voltage is displayed, press ENTER to complete the calibration.
6. Press ESCAPE to return to the System Setup menu.

Test Mode

The NOA-332 has three modes of operation, (1) timed mode, (2) continuous mode, and (3) cycled mode. See Section 1 for a description of the operation of these modes. To summarize, the timed test mode uses the test timer to end a well test whereas the continuous test mode runs "forever" until the 'STOP' key is used to end the well test. The cycle mode is an "automatic" timed mode where the system stops and starts the test using the well test table. The default mode is "Timed". To change the mode of operation:

1. Align the pointer with "Test Mode" and press ENTER (enhanced mode display).
2. Press SETUP and use ↑ and ↓ keys to select the wanted mode.
3. Press ENTER to validate your choice. The display will remain in enhanced mode.
4. Press ESCAPE to return to the System Setup menu.

Gas Meter

The NOA-332 allows only one gas meter, but can utilize either an orifice meter or turbine/PD meter to calculate gas flow. The default meter is turbine. To change the meter type, do the following:

1. Align the pointer with "Gas Meter" and press ENTER (enhanced mode display).
2. Press SETUP and use ↑ and ↓ keys to select the wanted meter type.
3. Press ENTER to validate your choice. The display will remain in enhanced mode.
4. Press ESCAPE to return to the System Setup menu.

Gross Volume Meter

The NOA-332 allows a Gross Volume flowmeter input for measurement of total liquids using a turbine or positive displacement flowmeter. If a flowmeter is not used, the Gross Volume totals indicated by the system will be the arithmetic sum of the liquid totals (net oil, net water, and free water). To tell the system if a Gross Volume flowmeter is being used, the user must indicate either "Yes" or "No". The default is "No". To change the Gross Volume Meter setting, do the following:

1. Align the pointer with "Gross Vol Mtr" and press ENTER (enhanced mode display).
2. Press SETUP and use ↑ and ↓ keys to select "Yes" or "No".
3. Press ENTER to validate your choice. The display will remain in enhanced mode.
4. Press ESCAPE to return to the System Setup menu.

Aux1 & Aux2 Analog Input

The NOA-332 allows two auxiliary inputs as described in Section 1 of this manual. Appendix A recommends that the Aux 1 input device be connected to analog input number 9 and the Aux 2 input device be connected to analog input number 10. The default analog input for both Aux 1 and Aux 2 is zero, which tells the system that these inputs are not being used. In addition to the analog input channel assignment, the MVT channel assignments can be used (see Section 7).

Warm Restart

A warm restart performs a similar function as a RESET button on a personal computer; it restarts the NOA-332 operating system. Although a warm restart will cause the NOA-332 to begin operation from an initial state, it will not lose any archived data, volume totals, or configuration data. However, if a well test is in progress, the test will be aborted as if a power failure occurred. Warm restart is useful if problems exist with the communication system in the NOA-332 or if operation problems are suspected. To perform a warm restart of the NOA-332, perform the following procedures:

1. Align the pointer with "Warm Restart" and press ENTER. The display will show "Warm Boot will reset all hardware...*** <Enter> = OK ***".
2. To restart the NOA-332, press ENTER. If you do not want to restart the NOA-332 at this time, press ESCAPE.

After the NOA-332 is restarted, the screen will display the same scrolling message shown when it was initially put in service.

Cold Restart

A cold restart performs a complete system re-boot erasing everything from memory and reinitializing all default parameters. In the event that the NOA-332 is operating incorrectly, the system memory may be corrupted causing erroneous information to be displayed. Although this is very rare, the only "cure" is to erase all of the system memory. This requires that all calibration data be reentered, so this action should only be taken as a last resort. When performing a cold restart, refer to Section 2 for the start-up procedure. To perform a cold restart of the NOA-332, perform the following procedures:

1. Align the pointer with "Cold Restart" and press ENTER. The display will show "Cold Boot will RESET all hardware AND Data Logs*** <Enter> = OK ***".
2. To restart the NOA-332, press ENTER. If you do not want to restart the NOA-332 at this time, press ESCAPE.

After the NOA-332 is restarted, the screen will display the same scrolling message shown when it was initially put in service.

Notes

Section 9b

The Well Test Setup Menu

Introduction

The Well Test Setup menu provides the NOA-332 with necessary information on how the user wants to configure the NOA-332 to test each well. A maximum of 64 wells can be configured, each with it's own name, purge and test times, and optional actions. A listing of this menu is available in Appendix C, page C-5.

NOTE**—A level 2 or higher password authorization is required to view the items in the Well Test Setup Menu. A level 3 or higher password is required to change the items in the Well Test Setup Menu.**

Accessing the Well Test Setup Menu

To access the Well Test Setup menu, press the CONFIG TEST key on the keypad or perform the following procedure:

1. From the Main Menu, align the pointer with "Config/Setup..." and press ENTER.
2. Align the pointer with "Well Test Setup..." and press ENTER.

The NOA-332 will now display a grouping of index numbers ranging from 1 to 64 as shown in Table 9b.1:

Table 9b.1—Select Setup Well Menu Parameters

Parameters	Description	Read/Write Status
Wells 01 - 16…	Access to data for the first 16 wells	Menu
Wells 17 - 32…	Access to data for the next set of 16 wells	Menu
Wells 33 - 48…	Access to data for the next set of 16 wells	Menu
Wells 49 - 64…	Access to data for the next set of 16 wells	Menu

The NOA-332 can be configured for a maximum of 64 wells which are selected in groups of 16 to allow users with large numbers of wells quick access without having to scroll down scores of well names. If the user is unsure of the well index number of a particular well, the well names may be viewed in groups of 16 as identified in Table 9b.1.

The index numbers ranges from 01 to 64 and the default well names are listed as Well 1, Well 2, Well 3, and so on. Use the ↑ or ↓ key to align the pointer with the group of index numbers wanted and press ENTER.

The NOA-332 will now display a list of well names with an index number. The index number ranges per the selection made from Table 9b.1. Use the ↑ or ↓ key to align the pointer with the well number wanted and press ENTER. The following menu items will appear for each of the sixteen wells:

Table 9b.2—Well Test Setup Menu Parameters

Parameters	Description	Read/Write Status
Name	Name of the well	R/W
Purge Time	Number of minutes for purge timer	R/W
Test Time	Number of hours for well test timer	R/W
DO Action	Type of action performed during the well test (optional)	R/W
DO Number	Number of digital output channel (optional)	R/W
DO Width	Width of momentary digital output (optional)	R/W

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Name

The NOA-332 maintains a user configurable name for each well. The name can consist of any character and can be up to 20 characters long. To enter a well name, perform the following:

1. Align the pointer with "Name" and press ENTER (enhanced mode display).
2. Press SETUP and enter a well name up to 20 characters and press ENTER.
3. Press ESCAPE to return to the Well Test setup menu.

Purge Time

The NOA-332 has a count-down purge timer that may be set from 0 minutes to 1440 minutes in whole minute increments. During this time, no volume accumulation occurs. Zero is allowed as an entry if no purge time is needed. When the purge timer reaches zero, the Well Test Timer begins to count down. To set the Purge Timer, do the following:

1. Align the pointer with "Purge Time" and press ENTER (enhanced mode display).
2. Press SETUP and enter a number from 0 to 1440.
3. Press ENTER to validate your choice. The display will remain in enhanced mode.
4. Press ESCAPE to return to the Well Test setup menu.

Test Time

The NOA-332 has a count-down test timer that may be set from 0 to 72 hours in whole hour increments when the NOA-332 is being operated in the Timed test mode or the Cycled test mode. When in the Continuous test mode, the system will ignore the test time listed in the Well Test Table and use a 24 hour test time. Flow volumes are accumulated until the Test Timer reaches zero or the test is aborted with the 'STOP' key. Zero is allowed as a valid entry in the Cycled test mode to skip a well in the well testing sequence (see Section 1).

To set the test time, do the following:

1. Align the pointer with “Test Time” and press ENTER (enhanced mode display).

2. Press SETUP and enter a number from 0 to 72.

3. Press ENTER to validate your choice. The display will remain in enhanced mode.

4. Press ESCAPE to return to the Well Test setup menu.

DO Action

This parameter is optional and is only operational when a Digital I/O circuit board is installed in the NOA-332. The choices are None, Latched, or Momentary. The default is None. The Latched action causes the selected digital output channel to become active when the Test Timer begins to count down and remain active until the Test Timer reaches zero. The Momentary action causes the selected digital output channel to become active for a specified number of seconds when the Test Timer reaches zero. The digital output channel number and specified number of seconds are set in the following menu items. To set the DO Action, do the following:

1. Align the pointer with “DO Action” and press ENTER (enhanced mode display).

2. Press SETUP and use ↑ and ↓ keys to select the action wanted.

3. Press ENTER to validate your choice. The display will remain in enhanced mode.

4. Press ESCAPE to return to the Well Test setup menu.

DO Number

This parameter is optional and is only operational when a Digital I/O circuit board is installed in the NOA-332. Depending upon the type of Digital I/O circuit board installed, there may be 4 relay channels or 8 FET channels available. The DO Number is a value from 1 to 255 and is defined in Table 9b.3. To enter the DO Number, do the following:

1. Align the pointer with “DO Number” and press ENTER (enhanced mode display).

2. Press SETUP and enter a number from 1 to 255.

3. Press ENTER to validate your choice. The display will remain in enhanced mode.

4. Press ESCAPE to return to the Well Test setup menu.

DO Width

This parameter is optional and is only operational when a Digital I/O circuit board is installed in the NOA-332. When using a Momentary DO Action, this parameter tells the system how long to keep the digital output active. The entry can vary from 0.1 to 1.0 seconds. To enter the DO Width, do the following:

1. Align the pointer with “DO Width” and press ENTER (enhanced mode display).

2. Press SETUP and enter a number from 0.1 to 1.0.

3. Press ENTER to validate your choice. The display will remain in enhanced mode.

4. Press ESCAPE to return to the Well Test setup menu.

Table 9b.3—DO Number Definition

NOTE: The symbol ☼ indicates an active output. The Digital Output option is available in a four channel relay version or an eight channel FET (transistor) version. The digital outputs can be configured to activate one output at a time or represent a binary value (such as the index number of the well in test) by selecting the appropriate DO Number from the chart below.

(Single Output Action)

DO Number	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8
1	☼							
2		☼						
4			☼					
8				☼				
16					☼			
32						☼		
64							☼	
128								☼

(Binary Output Action)

DO Number	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8
1	☼	–	–	–	–	–	–	–
2	–	☼	–	–	–	–	–	–
3	☼	☼	–	–	–	–	–	–
4	–	–	☼	–	–	–	–	–
5	☼	–	☼	–	–	–	–	–
6	–	☼	☼	–	–	–	–	–
7	☼	☼	☼	–	–	–	–	–
8	–	–	–	☼	–	–	–	–
9	☼	–	–	☼	–	–	–	–
10	–	☼	–	☼	–	–	–	–
11	☼	☼	–	☼	–	–	–	–
12	–	–	☼	☼	–	–	–	–
13	☼	–	☼	☼	–	–	–	–
14	–	☼	☼	☼	–	–	–	–
15	☼	☼	☼	☼	–	–	–	–
16	–	–	–	–	☼	–	–	–
17	☼	–	–	–	☼	–	–	–
18	–	☼	–	–	☼	–	–	–
19	☼	☼	–	–	☼	–	–	–
20	–	–	☼	–	☼	–	–	–
21	☼	–	☼	–	☼	–	–	–
22	–	☼	☼	–	☼	–	–	–
23	☼	☼	☼	–	☼	–	–	–
24	–	–	–	☼	☼	–	–	–
25	☼	–	–	☼	☼	–	–	–

DO Number	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8
26	–	☼	–	☼	☼	–	–	–
27	☼	☼	–	☼	☼	–	–	–
28	–	–	☼	☼	☼	–	–	–
29	☼	–	☼	☼	☼	–	–	–
30	–	☼	☼	☼	☼	–	–	–
31	☼	☼	☼	☼	☼	–	–	–
32	–	–	–	–	–	☼	–	–
33	☼	–	–	–	–	☼	–	–
34	–	☼	–	–	–	☼	–	–
35	☼	☼	–	–	–	☼	–	–
36	–	–	☼	–	–	☼	–	–
37	☼	–	☼	–	–	☼	–	–
38	–	☼	☼	–	–	☼	–	–
39	☼	☼	☼	–	–	☼	–	–
40	–	–	–	☼	–	☼	–	–
41	☼	–	–	☼	–	☼	–	–
42	–	☼	–	☼	–	☼	–	–
43	☼	☼	–	☼	–	☼	–	–
44	–	–	☼	☼	–	☼	–	–
45	☼	–	☼	☼	–	☼	–	–
46	–	☼	☼	☼	–	☼	–	–
47	☼	☼	☼	☼	–	☼	–	–
48	–	–	–	–	☼	☼	–	–
49	☼	–	–	–	☼	☼	–	–
50	–	☼	–	–	☼	☼	–	–
51	☼	☼	–	–	☼	☼	–	–
52	–	–	☼	–	☼	☼	–	–
53	☼	–	☼	–	☼	☼	–	–
54	–	☼	☼	–	☼	☼	–	–
55	☼	☼	☼	–	☼	☼	–	–
56	–	–	–	☼	☼	☼	–	–
57	☼	–	–	☼	☼	☼	–	–
58	–	☼	–	☼	☼	☼	–	–
59	☼	☼	–	☼	☼	☼	–	–
60	–	–	☼	☼	☼	☼	–	–
61	☼	–	☼	☼	☼	☼	–	–
62	–	☼	☼	☼	☼	☼	–	–
63	☼	☼	☼	☼	☼	☼	–	–
64	–	–	–	–	–	–	☼	–
65	☼	–	–	–	–	–	☼	–
66	–	☼	–	–	–	–	☼	–
67	☼	☼	–	–	–	–	☼	–

DO Number	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8
68	–	–	☼	–	–	–	☼	–
69	☼	–	☼	–	–	–	☼	–
70	–	☼	☼	–	–	–	☼	–
71	☼	☼	☼	–	–	–	☼	–
72	–	–	–	☼	–	–	☼	–
73	☼	–	–	☼	–	–	☼	–
74	–	☼	–	☼	–	–	☼	–
75	☼	☼	–	☼	–	–	☼	–
76	–	–	☼	☼	–	–	☼	–
77	☼	–	☼	☼	–	–	☼	–
78	–	☼	☼	☼	–	–	☼	–
79	☼	☼	☼	☼	–	–	☼	–
80	–	–	–	–	☼	–	☼	–
81	☼	–	–	–	☼	–	☼	–
82	–	☼	–	–	☼	–	☼	–
83	☼	☼	–	–	☼	–	☼	–
84	–	–	☼	–	☼	–	☼	–
85	☼	–	☼	–	☼	–	☼	–
86	–	☼	☼	–	☼	–	☼	–
87	☼	☼	☼	–	☼	–	☼	–
88	–	–	–	☼	☼	–	☼	–
89	☼	–	–	☼	☼	–	☼	–
90	–	☼	–	☼	☼	–	☼	–
91	☼	☼	–	☼	☼	–	☼	–
92	–	–	☼	☼	☼	–	☼	–
93	☼	–	☼	☼	☼	–	☼	–
94	–	☼	☼	☼	☼	–	☼	–
95	☼	☼	☼	☼	☼	–	☼	–
96	–	–	–	–	–	☼	☼	–
97	☼	–	–	–	–	☼	☼	–
98	–	☼	–	–	–	☼	☼	–
99	☼	☼	–	–	–	☼	☼	–
100	–	–	☼	–	–	☼	☼	–
101	☼	–	☼	–	–	☼	☼	–
102	–	☼	☼	–	–	☼	☼	–
103	☼	☼	☼	–	–	☼	☼	–
104	–	–	–	☼	–	☼	☼	–
105	☼	–	–	☼	–	☼	☼	–
106	–	☼	–	☼	–	☼	☼	–
107	☼	☼	–	☼	–	☼	☼	–
108	–	–	☼	☼	–	☼	☼	–
109	☼	–	☼	☼	–	☼	☼	–

DO Number	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8
110	–	☼	☼	☼	–	☼	☼	–
111	☼	☼	☼	☼	–	☼	☼	–
112	–	–	–	–	☼	☼	☼	–
113	☼	–	–	–	☼	☼	☼	–
114	–	☼	–	–	☼	☼	☼	–
115	☼	☼	–	–	☼	☼	☼	–
116	–	–	☼	–	☼	☼	☼	–
117	☼	–	☼	–	☼	☼	☼	–
118	–	☼	☼	–	☼	☼	☼	–
119	☼	☼	☼	–	☼	☼	☼	–
120	–	–	–	☼	☼	☼	☼	–
121	☼	–	–	☼	☼	☼	☼	–
122	–	☼	–	☼	☼	☼	☼	–
123	☼	☼	–	☼	☼	☼	☼	–
124	–	–	☼	☼	☼	☼	☼	–
125	☼	–	☼	☼	☼	☼	☼	–
126	–	☼	☼	☼	☼	☼	☼	–
127	☼	☼	☼	☼	☼	☼	☼	–
128	–	–	–	–	–	–	–	☼
129	☼	–	–	–	–	–	–	☼
130	–	☼	–	–	–	–	–	☼
131	☼	☼	–	–	–	–	–	☼
132	–	–	☼	–	–	–	–	☼
133	☼	–	☼	–	–	–	–	☼
134	–	☼	☼	–	–	–	–	☼
135	☼	☼	☼	–	–	–	–	☼
136	–	–	–	☼	–	–	–	☼
137	☼	–	–	☼	–	–	–	☼
138	–	☼	–	☼	–	–	–	☼
139	☼	☼	–	☼	–	–	–	☼
140	–	–	☼	☼	–	–	–	☼
141	☼	–	☼	☼	–	–	–	☼
142	–	☼	☼	☼	–	–	–	☼
143	☼	☼	☼	☼	–	–	–	☼
144	–	–	–	–	☼	–	–	☼
145	☼	–	–	–	☼	–	–	☼
146	–	☼	–	–	☼	–	–	☼
147	☼	☼	–	–	☼	–	–	☼
148	–	–	☼	–	☼	–	–	☼
149	☼	–	☼	–	☼	–	–	☼
150	–	☼	☼	–	☼	–	–	☼
151	☼	☼	☼	–	☼	–	–	☼

DO Number	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8
152	–	–	–	☼	☼	–	–	☼
153	☼	–	–	☼	☼	–	–	☼
154	–	☼	–	☼	☼	–	–	☼
155	☼	☼	–	☼	☼	–	–	☼
156	–	–	☼	☼	☼	–	–	☼
157	☼	–	☼	☼	☼	–	–	☼
158	–	☼	☼	☼	☼	–	–	☼
159	☼	☼	☼	☼	☼	–	–	☼
160	–	–	–	–	–	☼	–	☼
161	☼	–	–	–	–	☼	–	☼
162	–	☼	–	–	–	☼	–	☼
163	☼	☼	–	–	–	☼	–	☼
164	–	–	☼	–	–	☼	–	☼
165	☼	–	☼	–	–	☼	–	☼
166	–	☼	☼	–	–	☼	–	☼
167	☼	☼	☼	–	–	☼	–	☼
168	–	–	–	☼	–	☼	–	☼
169	☼	–	–	☼	–	☼	–	☼
170	–	☼	–	☼	–	☼	–	☼
171	☼	☼	–	☼	–	☼	–	☼
172	–	–	☼	☼	–	☼	–	☼
173	☼	–	☼	☼	–	☼	–	☼
174	–	☼	☼	☼	–	☼	–	☼
175	☼	☼	☼	☼	–	☼	–	☼
176	–	–	–	–	☼	☼	–	☼
177	☼	–	–	–	☼	☼	–	☼
178	–	☼	–	–	☼	☼	–	☼
179	☼	☼	–	–	☼	☼	–	☼
180	–	–	☼	–	☼	☼	–	☼
181	☼	–	☼	–	☼	☼	–	☼
182	–	☼	☼	–	☼	☼	–	☼
183	☼	☼	☼	–	☼	☼	–	☼
184	–	–	–	☼	☼	☼	–	☼
185	☼	–	–	☼	☼	☼	–	☼
186	–	☼	–	☼	☼	☼	–	☼
187	☼	☼	–	☼	☼	☼	–	☼
188	–	–	☼	☼	☼	☼	–	☼
189	☼	–	☼	☼	☼	☼	–	☼
190	–	☼	☼	☼	☼	☼	–	☼
191	☼	☼	☼	☼	☼	☼	–	☼
192	–	–	–	–	–	–	☼	☼
193	☼	–	–	–	–	–	☼	☼

DO Number	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8
194	–	☼	–	–	–	–	☼	☼
195	☼	☼	–	–	–	–	☼	☼
196	–	–	☼	–	–	–	☼	☼
197	☼	–	☼	–	–	–	☼	☼
198	–	☼	☼	–	–	–	☼	☼
199	☼	☼	☼	–	–	–	☼	☼
200	–	–	–	☼	–	–	☼	☼
201	☼	–	–	☼	–	–	☼	☼
202	–	☼	–	☼	–	–	☼	☼
203	☼	☼	–	☼	–	–	☼	☼
204	–	–	☼	☼	–	–	☼	☼
205	☼	–	☼	☼	–	–	☼	☼
206	–	☼	☼	☼	–	–	☼	☼
207	☼	☼	☼	☼	–	–	☼	☼
208	–	–	–	–	☼	–	☼	☼
209	☼	–	–	–	☼	–	☼	☼
210	–	☼	–	–	☼	–	☼	☼
211	☼	☼	–	–	☼	–	☼	☼
212	–	–	☼	–	☼	–	☼	☼
213	☼	–	☼	–	☼	–	☼	☼
214	–	☼	☼	–	☼	–	☼	☼
215	☼	☼	☼	–	☼	–	☼	☼
216	–	–	–	☼	☼	–	☼	☼
217	☼	–	–	☼	☼	–	☼	☼
218	–	☼	–	☼	☼	–	☼	☼
219	☼	☼	–	☼	☼	–	☼	☼
220	–	–	☼	☼	☼	–	☼	☼
221	☼	–	☼	☼	☼	–	☼	☼
222	–	☼	☼	☼	☼	–	☼	☼
223	☼	☼	☼	☼	☼	–	☼	☼
224	–	–	–	–	–	☼	☼	☼
225	☼	–	–	–	–	☼	☼	☼
226	–	☼	–	–	–	☼	☼	☼
227	☼	☼	–	–	–	☼	☼	☼
228	–	–	☼	–	–	☼	☼	☼
229	☼	-	☼	-	-	☼	☼	☼
230	–	☼	☼	–	–	☼	☼	☼
231	☼	☼	☼	–	–	☼	☼	☼
232	–	–	–	☼	–	☼	☼	☼
233	☼	–	–	☼	–	☼	☼	☼
234	–	☼	–	☼	–	☼	☼	☼
235	☼	☼	–	☼	–	☼	☼	☼

DO Number	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8
236	–	–	☼	☼	–	☼	☼	☼
237	☼	–	☼	☼	–	☼	☼	☼
238	–	☼	☼	☼	–	☼	☼	☼
239	☼	☼	☼	☼	–	☼	☼	☼
240	–	–	–	–	☼	☼	☼	☼
241	☼	–	–	–	☼	☼	☼	☼
242	–	☼	–	–	☼	☼	☼	☼
243	☼	☼	–	–	☼	☼	☼	☼
244	–	–	☼	–	☼	☼	☼	☼
245	☼	–	☼	–	☼	☼	☼	☼
246	–	☼	☼	–	☼	☼	☼	☼
247	☼	☼	☼	–	☼	☼	☼	☼
248	–	–	–	☼	☼	☼	☼	☼
249	☼	–	–	☼	☼	☼	☼	☼
250	–	☼	–	☼	☼	☼	☼	☼
251	☼	☼	–	☼	☼	☼	☼	☼
252	–	–	☼	☼	☼	☼	☼	☼
253	☼	–	☼	☼	☼	☼	☼	☼
254	–	☼	☼	☼	☼	☼	☼	☼
255	☼	☼	☼	☼	☼	☼	☼	☼

Section 9c

The Flow Setup Menu - Gas Orifice Meter

Introduction

The Flow Setup menu in this section allows the user to access the configuration parameters for the gas orifice meter. This menu will not be accessible unless the gas meter type has previously been set to Orifice in the System Setup menu (see Section 9a). The Flow Setup menu is critical for accurate calculations within the NOA-332, so the user is cautioned to use the utmost care to be certain that the data entered is valid and accurate. A listing of this menu is available in Appendix C, pages C-9 thru C-11.

NOTE—**A level 2 or higher password authorization is required to view the items in the Flow Setup Menu. The other submenus listed below have their own security requirements.**

Accessing the Flow Setup Menu

To access the Flow Setup menu, perform the following procedures:

1. From the Main Menu, align the pointer with "Config/Setup..." and press ENTER or press the SETUP key.
2. Align the pointer with "Flow Setup..." and press ENTER.
3. Align the pointer with the Gas Orifice and press ENTER.
4. The menu in Table 9c.1 will be displayed:

Table 9c.1—Flow Setup Menu Parameters

Parameters	Description	Read/Write Status
FlowID	Name of the Gas Orifice flow	R/O
MtrType	Type of meter – Orifice	R/O
Meter #	Number of flow – 1	R/O
Fluid Type	Type of fluid – Gas	R/O
Param Setup…	Selected flow parameters submenu	N/A

Accessing the Gas Orifice Setup Menu

NOTE—**A level 2 or higher password authorization is required to view the items in the Orifice Setup submenu. A level 4 password is required to change the items in the Orifice Setup submenu.**

To access the Gas Orifice Setup menu, do the following:

1. From the Flow Setup menu, align the pointer with "Param Setup…" and press ENTER.
2. The display will show "ORIFICE SETUP" and the following parameters in Table 9c.2 will be listed:

Table 9c.2—Gas Orifice Setup Menu

Parameters	Description	Read/Write Status
FlowID	Name of the Gas Orifice flow	R/W
Ser #	Serial number of the orifice meter	R/W
OrfDia	Orifice plate bore internal diameter	R/W
TubeID	Orifice meter tube internal diameter	R/W
SPTap	Location of the static pressure tap	R/W
Type	Type of differential pressure tap for the orifice meter	R/W
Fmeth	Compressibility calculation method	R/W
Rmeth	Flow-rate calculation method	R/W
MinDP	Low differential pressure cutoff value	R/W
Fpv	Override compressibility value for Fmeth	R/W
Rate	Not Available	R/W
AnnMF	Annubar Meter factor	R/W
ExpPl	Orifice plate material expansion coefficient	R/W
ExpMt	Orifice meter tube expansion coefficient	R/W
DPlo AI#	Analog input channel for low DP transmitter (stacked DP)	R/W
DPhi AI#	Analog input channel for high DP transmitter (stacked DP)	R/W
Flpr AI#	Analog input channel for static pressure	R/W
Temp AI#	Analog input channel for temperature	R/W
Fl Press	Override static pressure value	R/W
Temp Value	Override flowing temperature value	R/W
Hvalue	Heating value of gas	R/W
SG	Specific gravity of gas	R/W
Gas Comp…	Gas components submenu	N/A
Stacked DP...	Stacked DP submenu	N/A
Orif Alarm Setup...	Orifice alarm submenu	N/A

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Flow Id (FlowID)

The gas orifice meter identification name is a 20 character alphanumeric parameter. The default name is Gas Orifice. To change the name, do the following:

1. From the Orifice Setup menu, align the pointer with “FlowID” and press ENTER (enhanced mode display).
2. Press SETUP and use the number keys (and the ↑ key and the ↓ key if needed) to enter the orifice meter identification name.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Orifice Setup menu.

Serial Number (Ser #)

The orifice serial number is a 20 character alphanumeric serial number provided to trace the operation of the orifice meter run throughout the lifetime of the meter. The default serial number is Gas Orifice. Together with the orifice identification name, the orifice meter run can be easily identified. To enter the orifice serial number, do the following:

1. From the Orifice Setup menu, align the pointer with “Ser #” and press ENTER (enhanced mode display).
2. Press SETUP and use the number keys (and the ↑ key and the ↓ key if needed) to enter the orifice serial number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Orifice Diameter (OrfDia)

The orifice diameter is the internal diameter of the bore in the orifice plate measured in inches. The range of acceptable entries is from 0 to 10.000 inches. To enter the diameter, do the following:

1. From the Orifice Setup menu, align the pointer with “OrfDia” and press ENTER (enhanced mode display).
2. Press SETUP and use the number keys to enter the diameter.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Orifice Meter Tube Id (Pipe)

The orifice meter tube Id is the internal diameter of the orifice meter tube measured in inches. The range of acceptable entries is from 0 to 20.000 inches. To enter the diameter, do the following:

1. From the Orifice Setup menu, align the pointer with “TubeID” and press ENTER (enhanced mode display).
2. Press SETUP and use the number keys to enter the diameter.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Note—If the beta ratio (orifice bore size ÷ meter tube internal diameter) is less than 0.15 or greater than 0.70, the system will display the message "Beta ratio out of range. Press any key." The system will prompt you to modify the other parameter in the beta equation (i.e., either meter tube internal

diameter if entering orifice bore size or orifice bore size if entering meter tube internal diameter). Press any key and make the requested modification.

Static Pressure Tap Location (SPTap)

The static-pressure tap location (Upstream or Downstream) identifies the location of the static pressure sensor in relation to the orifice plate. The NOA-332 allows use of either an upstream pressure tap or a downstream pressure tap. The default is Downstream. To enter the pressure tap information, do the following:

1. From the Orifice Setup menu, align the pointer with "SPTap" and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key to select "Upstream" or "Downstream".
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Differential Pressure Tap Type (Type)

The differential pressure tap type parameter (flange, pipe, or corner) defines the location of the differential pressure connections at the orifice meter. The default is Flange. To enter the type of tap that the differential pressure is connected to, do the following:

1. From the Orifice Setup menu, align the pointer with "Type" and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key to select the appropriate tap location (flange, pipe, or corner).
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Compressibility Calculation Method (FMeth)

The compressibility calculation method lists the following methods of calculating the compressibility factor:

- AGA8 (1985)
- AGA8 (analysis of 20 constituent gases)
- NX19 (analysis of specific gravity, carbon dioxide, and nitrogen)
- NX19 (analysis of 20 constituent gases)
- User-entered constant
- AGA8 (analysis of HV, SG, CO2)
- AGA8 (analysis of specific gravity, carbon dioxide, and nitrogen)

The default method is NX-19 (SG, CO2, N). To select the compressibility calculation method, do the following:

1. From the Orifice Setup menu, align the pointer with "FMeth" and press ENTER (enhanced mode display).

2. Press SETUP and use the ↑ or ↓ key to select the appropriate calculation method.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

NOTE: If the "User-Entered Constant" is selected as the calculation method, the user must enter the constant value under the "Fpv" menu item described below.

Rate Calculation Method (RMeth)

The flow rate calculation method lists the following methods of calculating totals:

- ~~*Lock Current Rate*~~ (**Not Valid – for future use**)
- AGA3 (1985 American Gas Association standard for orifice meters)
- AGA7 (AGA standard for turbine flowmeters)
- ~~*ISO 5167*~~ (**Not Valid – for future use**)
- Annubar meter
- AGA3 (equation) The 1992 version of AGA Report #3 requires pressure measured at the Upstream Tap. The downstream tap will produce slightly different results than the upstream tap, but can be used.
- AGA3 (factors)

The default is AGA-3, 1985 method. The user should not select "Lock Curr Rate" as this will cause inaccurate well test totals to occur. To select the gas flow rate calculation method, do the following:

1. From the Orifice Setup menu, align the pointer with "RMeth" and press ENTER (enhanced mode display).
5. Press SETUP and use the ↑ or ↓ key to select the appropriate calculation method.
2. Press ENTER to validate your entry.
3. Press ESCAPE to return to the Orifice Setup menu.

Minimum Differential Pressure (MinDP)

The minimum differential pressure parameter sets a DP threshold that allows the computer to calculate totals and flow rates only after the differential pressure reaches a certain amount (the default value is 0.5 Inches of Water). If you want the computer to calculate totals and flow rates regardless of differential pressure, enter a value of zero. The range of acceptable entries is from 0 to 100.0 inches. If the differential pressure is less than the minimum, the gas flow rate is assumed to be zero.

To set the minimum differential pressure value, do the following:

1. From the Orifice Setup menu, align the pointer with “MinDP” and press ENTER (enhanced mode display).
2. Press SETUP and enter the minimum differential pressure value in Inches of Water.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Constant Supercompressibility Factor (Fpv)

The NOA-332 allows a constant supercompressibility parameter to be entered in lieu of calculating this parameter. The range of acceptable entries is from 0.800 to 2.000 . If you selected “User-Entered Constant” as the compressibility calculation method (FMeth) earlier, enter the value for the constant by doing the following:

1. From the Orifice Setup menu, align the pointer with “Fpv” and press ENTER (enhanced mode display).
2. Press SETUP and enter the supercompressibility value.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Constant Flow Rate (Rate)

This parameter is not valid for the NOA-332.

Annubar Meter Factor (AnnMF)

The Annubar meter factor, together with a temperature correction factor and a relative density correction factor, provides annubar meter measurement capability in the NOA-332. The annubar meter factor provides the equivalent of the basic orifice factor for annubar meters. The range of acceptable entries is from 0.5 to 2.0 with a default value of 1.0. To enter the Annubar meter factor, do the following:

1. From the Orifice Setup menu, align the pointer with “MF” and press ENTER (enhanced mode display).
2. Press SETUP and enter the meter factor.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Orifice Plate Expansion Coefficient (ExpPl)

The orifice plate expansion coefficient is a number representing the change in the orifice plate dimensions with respect to changes in temperature. Expansion coefficients for commonly used orifice plates are listed in Table 9c.3 . The default value is set for stainless steel. To change the orifice expansion coefficient, do the following:

1. From the Orifice Setup menu, align the pointer with “ExpPl” and press ENTER (enhanced mode display).

2. Press SETUP and enter the expansion coefficient value.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Orifice Meter Tube Expansion Coefficient (ExpMt)

The orifice meter tube expansion coefficient is a number representing the change in meter tube dimensions with respect to changes in temperature. Expansion coefficients for commonly used pipe materials are listed in Table 9c.3 . The default value is for carbon steel. To set the orifice meter tube expansion coefficient, do the following:

1. From the Orifice Setup menu, align the pointer with "ExpMt" and press ENTER (enhanced mode display).
2. Press SETUP and enter the expansion coefficient value.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Table 9c.3—Expansion Coefficients for Pipe and Orifice Plate Material

Plate or Pipe Material	Coefficient
304 Stainless steel	0.00000925
316 Stainless steel	0.00000925
Monel	0.00000795
Carbon Steel	0.00000620

Differential Pressure Analog Input Assignment (DPlo AI#)

The NOA-332 allows for any of its 16 on board analog input channels to be designated for the differential pressure transmitter required for orifice meter measurement, except channels 1, 2, and 3 which are reserved. The NOA-332 also allows the selection of multivariable transmitter (MVT) inputs to be designated for differential pressure. The range of acceptable entries is from 4 to 46 with the default configuration set to analog input number 6. It is strongly recommended that this value not be changed unless an MVT is used. If an MVT is used refer to Table 7.1 of Section 7 of this manual to select the correct MVT Differential Pressure Input Channel Assignment number. For the Differential Pressure, this number will be 25, 28, 31, 34, 37, 40, 43, or 46 depending on the MVT source that has been configured.

When using stacked differential pressure transmitters, this parameter (Dplo AI#) is the low DP transmitter analog input channel. To reduce confusion, it is strongly recommended that this number remain set to a value of 6.

Stacked Differential Pressure Analog Input Assignment (DPhi AI#)

When the user has stacked differential pressure transmitters, this parameter tells the system where the high DP transmitter is connected. While any of the 16 on board analog input channels can be used except for channels 1, 2, and 3 which are reserved for on-board parameters, it is strongly recommended that the user select analog input channel 11. The range of acceptable entries is from 4 to 46 and the default analog input channel assignment is 6 (no stacked DP). If an MVT is used refer to Table 7.1 of Section 7 of this manual to select the correct MVT Differential Pressure Input Channel

Assignment number. For the Differential Pressure, this number will be 25, 28, 31, 34, 37, 40, 43, or 46 depending on the MVT source that has been configured. If stacked DP transmitters are not used, DPlo AI# and DPhi AI# should be set to the same channel number. To change the high DP transmitter input channel assignment, do the following:

1. From the Orifice Setup menu, align the pointer with "DPhi" and press ENTER (enhanced mode display).
2. Press SETUP and enter the analog input channel number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Static Pressure Analog Input Assignment (Flpr AI#)

The NOA-332 allows for any of its 16 on board analog input channels to be designated for the flowing pressure (static pressure) transmitter required for orifice meter measurement except for channels 1, 2, and 3 which are reserved for on-board parameters. The NOA-332 also allows the selection of multivariable transmitter (MVT) inputs to be designated for static pressure. The range of acceptable entries is 0 and 4 to 47 with the default configuration set to analog input channel number 7. It is strongly recommended that this value not be changed unless an MVT is used. If an MVT is used refer to Table 7.1 of Section 7 of this manual to select the correct MVT Static Pressure Input Channel Assignment number. For the Static Pressure, this number will be 26, 29, 32, 35, 38, 41, 44, or 47 depending on the MVT source that has been configured.

The user may elect to use a constant value for the static pressure rather than read a transmitter. In these cases, the analog input channel number should be changed to zero and the constant value be entered under the "Fl Press" menu item. To change the analog input channel number, do the following:

1. From the Orifice Setup menu, align the pointer with "Flpr AI#" and press ENTER (enhanced mode display).
2. Press SETUP and enter the analog input channel number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Temperature Analog Input Assignment (Temp AI#)

The NOA-332 allows for any of its 16 on board analog input channels to be designated for the flowing temperature transmitter required for orifice meter measurement except for channels 1, 2, and 3 which are reserved. The NOA-332 also allows the selection of multivariable transmitter (MVT) inputs to be designated for flowing temperature. The range of acceptable entries is 0 and 4 to 48 with the default configuration set to analog input number 8. It is strongly recommended that this value not be changed unless an MVT is used. If an MVT is used refer to Table 7.1 of Section 7 of this manual to select the correct MVT Temperature Input Channel Assignment number. For the Temperature, this number will be 27, 30, 33, 36, 39, 42, 45, or 48 depending on the MVT source that has been configured.

The user may elect to use a constant value for the temperature rather than read a transmitter. In these cases, the analog input channel number should be changed to zero and the constant value be entered under the "TempValue" menu item. To change the analog input channel number, do the following:

1. From the Orifice Setup menu, align the pointer with “Temp AI#” and press ENTER (enhanced mode display).
2. Press SETUP and enter the analog input channel number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Constant Static Pressure (Fl Press)

The NOA-332 allows a constant static pressure parameter to be entered in lieu of reading a static pressure transmitter (see the Flpr AI# menu item). The range of acceptable entries is from 0 to 5,000 psig. Enter the constant pressure value by doing the following:

1. From the Orifice Setup menu, align the pointer with “Fl Press” and press ENTER (enhanced mode display).
2. Press SETUP and enter the pressure value in psig.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Constant Temperature (TempValue)

The NOA-332 allows a constant flowing temperature parameter to be entered in lieu of reading a temperature transmitter (see the Temp AI# menu item). The range of acceptable entries is minus 50 to 500 degrees F. Enter the constant temperature value by doing the following:

1. From the Orifice Setup menu, align the pointer with “TempValue” and press ENTER (enhanced mode display).
2. Press SETUP and enter the temperature value in degrees F.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Heating Value (Hvalue)

The heating value is expressed in Btu/scf of gas. The range of acceptable entries is from 0 to 2000.0 with the default set to 1400. To enter the heating value, do the following:

1. From the Orifice Setup menu, align the pointer with “Hvalue” and press ENTER (enhanced mode display).
2. Press SETUP and enter the value in Btu/scf .
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Specific Gravity (SG)

The specific gravity of a gas is the ratio of the density of the gas to the density of air, both being measured at “standard” pressure and temperature. The range of acceptable entries is from 0 to 2.000 with the default set to 0.602 . To change the specific-gravity value, do the following:

1. From the Orifice Setup menu, align the pointer with “SG” and press ENTER (enhanced mode display).
2. Press SETUP and enter the value.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Orifice Setup menu.

Gas Components Menu

A listing of the Gas Components submenu is available in Appendix C, page C-9.

NOTE—**A level 2 or higher password authorization is required to view the items in the Gas Components submenu. A level 3 or higher password is required to change the items in the Gas Components submenu.**

This submenu provides access to the composition of the produced gas. The list of constituent gases is as follows:

- nitrogen
- carbon dioxide
- hydrogen sulfide
- water vapor
- helium
- methane
- ethane
- propane
- normal butane
- iso butane
- normal pentane
- iso pentane
- hexane
- heptane
- octane
- nonane
- decane
- oxygen
- carbon monoxide
- hydrogen

The composition of each constituent gas is entered as a percentage of the total gas composition. The range of values is different for each constituent gas and depends on the valid range of each constituent as required by the various calculation methods. To change the gas composition percent, do the following:

1. From the Orifice Setup menu, align the pointer with “Gas Components…” and press ENTER.
2. Use the ↑ or ↓ key to align the pointer with the desired constituent gas and press ENTER (display in enhanced mode).
3. Press SETUP and enter the value. Use the number keys and the decimal point key to enter the percentage of the gas constituent.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the Gas Components menu.
6. When finished, press ESCAPE to return to the Orifice Setup menu.

Note—The NOA-332 will use only the information required for calculating parameters, such as compressibility. For instance, if the selected compressibility calculation method is “AGA8 (SG, CO_2,

N_2),” then the entry of the Methane percentage will have no effect on the calculation of compressibility.

Stacked Differential Pressure (DP) Menu

A listing of the Stacked DP submenu is available in Appendix C, page C-9.

NOTE—**A level 2 or higher password authorization is required to view the items in the Stacked DP submenu. A level 3 or higher password is required to change the items in the Stacked DP submenu.**

Two differential pressure transmitters are often connected to the same orifice meter to form a “Stacked DP” configuration. The advantage of using stacked differential pressure transmitters is that the overall accuracy of the measurement of differential pressure is improved across a wider range of flow rates.

The NOA-332 allows two differential pressure transmitters to be stacked. The analog inputs to be used for the differential pressure transmitters must be set up as described in the DPlo AI# and DPhi AI# sections of this chapter. Typically, a low-range transmitter (0 to 50 in. H_2O) and a wide-range transmitter (0 to 150 in. H_2O) are used. The NOA-332 will measure the differential pressure value from both transmitters. If the differential pressure falls in the range of the low-range transmitter, the value obtained from the low-range transmitter will be used. If the differential pressure falls outside the range of the low-range transmitter, the value obtained from the wide-range transmitter will be used. A deadband is incorporated so that a value close to the limit of the low-range transmitter will not cause a continual switch between the use of the values obtained from the two transmitters.

For example, one transmitter has a range of 0 to 50 in. of water. The other has a range of 0 to 200 in. of water. In a stacked DP application, if the measured differential pressure is greater than the cutoff value plus the deadband, the NOA-332 will use the value obtained from the 0 to 200 in. transmitter for differential pressure. If the measure differential pressure is less than the cutoff value minus the deadband value, the value obtained from the 0 to 50 in. transmitter will be used.

The Stacked DP menu provides for the following three parameters:

- Status (Enabled or Disabled)
- Cutoff Value (10.0 to 750.0 in. of water)
- Deadband (0.0 to 100.0 in. of water)

Status

The default value for the status is “Disabled” To change the stacked DP operation, do the following:

1. From the Orifice Setup menu, align the pointer with “Stacked DP…” and press ENTER.
2. Align the pointer with the “Status” menu item and press ENTER (display in enhanced mode).
3. Press SETUP and use the ↑ or ↓ key to select the desired status.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the Stacked DP menu.
6. When finished, press ESCAPE to return to the Orifice Setup menu.

Cutoff Point (Cutoff)

The cutoff point, together with the deadband, defines the differential pressure value that will switch the selection of the differential pressure transmitter. This value should be less than the maximum range of the low range transmitter. To set the cutoff point, do the following:

1. From the Orifice Setup menu, align the pointer with "Stacked DP…" and press ENTER.
2. Align the pointer with the "Cutoff" menu item and press ENTER (display in enhanced mode).
3. Press SETUP and enter the value in Inches of Water.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the Stacked DP menu.
6. When finished, press ESCAPE to return to the Orifice Setup menu.

Deadband (Dead)

The deadband, together with the cutoff value, defines the differential pressure value that will switch selection of differential pressure transmitter. This value should be less than the maximum range of the low-range transmitter minus the cutoff value. To set the deadband, do the following:

1. From the Orifice Setup menu, align the pointer with "Stacked DP…" and press ENTER.
2. Align the pointer with the "Dead" menu item and press ENTER (display in enhanced mode).
3. Press SETUP and enter the value in Inches of Water.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the Stacked DP menu.
6. When finished, press ESCAPE to return to the Orifice Setup menu.

Orifice Alarm Setup Menu

A listing of the Orifice Alarm Setup submenu and its submenus are available in Appendix C, pages C-10 and C-11.

NOTE—**A level 2 or higher password authorization is required to view the items in the Orifice Alarm Setup submenus. A level 3 or higher password is required to change the items in the Orifice Alarm Setup submenus.**

The Orifice Alarm Setup Menu allows the configuration of all the alarms associated with the gas orifice run. Note that all changes made to the parameters in the submenus are automatically made to the corresponding parameters in the Configuration/Setup Alarm Setup menu and vice versa. When an alarm is activated, an entry is added to the alarm data log. An additional entry is added when the alarm is deactivated.

Table 9c.4 lists the parameters that can be configured in the Orifice Alarm Setup menu.

Accessing the Orifice Alarm Setup Menu

1. From the Orifice Setup menu, align the pointer with "Orif Alarm Setup…" and press ENTER.
2. The following menu items are listed:
   - Gas Pressure (Static Pressure) submenu
   - Low Differential Pressure submenu
   - High Differential Pressure submenu
   - Gas Temperature submenu
   - Gas Flow Rate submenu
   - Gas Volume Accumulation submenu.

Use the ↑ or ↓ key to align the pointer with the desired menu item and press ENTER. The menu item listed in Table 9c.4 appear:

Table 9c.4—Orifice Alarm Setup Menu Parameters

Parameters	Description	Read/Write Status
Enable	Alarm enable (yes or no)	R/W
LoLo	Low low alarm trip point	R/W
Low	Low (warning) alarm trip point	R/W
High	High (warning) alarm trip point	R/W
HiHi	High high alarm trip point	R/W
Dead	Alarm deadband setting	R/W
LoLo Action	LoLo alarm action	R/W
HiHi Action	HiHi alarm action	R/W
Reset Alarm	Resets alarm activity count	W/O

Use the ↑ or ↓ key to align the pointer with the desired menu item and press ENTER.

Orifice Alarm Parameters

Enable

"Yes" enables or "No" disables the selected alarm. To change the alarm, do the following:

1. From the Orifice Setup menu, align the pointer with "Orif Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "Enable" and press ENTER (display in enhanced mode).
4. Press SETUP and use the ↑ or ↓ key to select the desired status.

5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Orifice Alarm Setup menu.
7. When finished, press ESCAPE to return to the Orifice Setup menu.

LoLo

"LoLo" is the Low Low Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a LoLo Alarm is generated. Each time a LoLo alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a LoLo Alarm causes a LoLo Alarm Action. The type of action depends on the LoLo Alarm Action parameter. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Orifice Setup menu, align the pointer with "Orif Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "LoLo" and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Orifice Alarm Setup menu.
7. When finished, press ESCAPE to return to the Orifice Setup menu.

Low

"Low" is the Low (Warning) Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a Low (Warning) Alarm is generated. Each time a Low (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is triggered by this alarm. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Orifice Setup menu, align the pointer with "Orif Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "Low" and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Orifice Alarm Setup menu.
7. When finished, press ESCAPE to return to the Orifice Setup menu.

High

"High" is the High (Warning) Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a High (Warning) Alarm is generated. Each time a High (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is triggered by this alarm. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Orifice Setup menu, align the pointer with "Orif Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.

3. Align the pointer with the menu item “High” and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Orifice Alarm Setup menu.
7. When finished, press ESCAPE to return to the Orifice Setup menu.

HiHi

“HiHi” is the High High Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a HiHi Alarm is generated. Each time a HiHi alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a HiHi Alarm causes a HiHi Alarm Action. The type of action depends on the HiHi Action parameter. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Orifice Setup menu, align the pointer with “Orif Alarm Setup…” and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item “HiHi” and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Orifice Alarm Setup menu.
7. When finished, press ESCAPE to return to the Orifice Setup menu.

Dead

“Dead” is the Alarm Deadband Setting parameter. The deadband value provides variance for the alarm, preventing a value slightly above the high set point or slightly below the low set point from activating the alarm. The alarm will activate when the value is less than the low set point minus the deadband, or greater than the high set point plus the deadband. The alarm will deactivate when the value is higher than the low setpoint plus the deadband or lower than the high setpoint minus the deadband. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the deadband limit, do the following:

From the Orifice Setup menu, align the pointer with “Orif Alarm Setup…” and press ENTER.

1. Align the pointer with the menu item wanted and press ENTER.
2. Align the pointer with the menu item “Dead” and press ENTER (display in enhanced mode).
3. Press SETUP and enter the deadband limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the Orifice Alarm Setup menu.
6. When finished, press ESCAPE to return to the Orifice Setup menu.

LoLo Action

“LoLo” is the Low Low Alarm Action parameter. This action is triggered when a Low Low Alarm is generated. The range of acceptable entries is from 0 to 25. The LoLo action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25

causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9c.5 for the alarm action parameters noting that the digital I/O board may be 4 channel or 8 channel depending upon which board is supplied with the NOA-332.

HiHi Action

"HiHi" is the High High Alarm Action parameter. This action is triggered when a High High Alarm is generated. The range of acceptable entries is from 0 to 25. The HiHi Action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9c.5 for the alarm action parameters noting that the digital I/O board may be 4 channel or 8 channel depending upon which board is supplied with the NOA-332.

Reset Alarm

This resets the activation count of the alarm, which is the number of times the alarm has been activated, and sets the current status to "Not Active".

Table 9c.5—Alarm Action Menu Parameters

Alarm Action #	Four Channel Input / Output Digital Board	Eight Channel Input / Output Digital Board
0	No Action	No Action
1	Normally Open action Channel 1	Normally Open action Channel 1
2	Normally Open action Channel 2	Normally Open action Channel 2
3	Normally Open action Channel 3	Normally Open action Channel 3
4	Normally Open action Channel 4	Normally Open action Channel 4
5	**Invalid Operation**	Normally Open action Channel 5
6	**Invalid Operation**	Normally Open action Channel 6
7	**Invalid Operation**	Normally Open action Channel 7
8	**Invalid Operation**	Normally Open action Channel 8
9	Momentary Action Channel 1	Momentary Action Channel 1
10	Momentary Action Channel 2	Momentary Action Channel 2
11	Momentary Action Channel 3	Momentary Action Channel 3
12	Momentary Action Channel 4	Momentary Action Channel 4
13	**Invalid Operation**	Momentary Action Channel 5
14	**Invalid Operation**	Momentary Action Channel 6
15	**Invalid Operation**	Momentary Action Channel 7
16	**Invalid Operation**	Momentary Action Channel 8
17	Normally Closed action Channel 1	Normally Closed action Channel 1
18	Normally Closed action Channel 2	Normally Closed action Channel 2
19	Normally Closed action Channel 3	Normally Closed action Channel 3
20	Normally Closed action Channel 4	Normally Closed action Channel 4
21	**Invalid Operation**	Normally Closed action Channel 5
22	**Invalid Operation**	Normally Closed action Channel 6
23	**Invalid Operation**	Normally Closed action Channel 7
24	**Invalid Operation**	Normally Closed action Channel 8
25	Halts current well test	Halts current well test

Note—Alarm actions 1 thru 8 cause an “ON” action for the duration of the alarm. Alarm actions 9 thru 16 cause a momentary “ON” action of one second duration. Alarm actions 17 thru 24 cause an “OFF” action for the duration of the alarm.

The NOA-332 is available with an optional 4 channel relay board and an optional 8 channel FET driver board to provide alarm action features.

Notes

Section 9d

The Flow Setup Menu - Gas Turbine Meter

Introduction

The Flow Setup menu in this section allows the user to access the configuration parameters for the gas turbine/PD meter only. This menu will not be accessible unless the gas meter type has previously been set to Turbine in the System Setup menu (see Section 9a). The Flow Setup menu is critical for accurate calculations within the NOA-332, so the user is cautioned to use the utmost care to be certain that the data entered is valid and accurate. A listing of this menu is available in Appendix C, pages C-6, C-8 and C-14.

Note that the Rate Calculation Method is defaulted to AGA7 for gas turbine meters. Therefore, Rmeth is not shown as a menu item in the Flow Setup Menu for the Gas Turbine Meter.

NOTE—**A level 2 or higher password authorization is required to view the items in the Flow Setup Menu. The other submenus listed below have their own security requirements.**

Accessing the Flow Setup Menu

To access the Flow Setup menu, perform the following procedures:

1. From the Main Menu, align the pointer with "Config/Setup..." and press ENTER or press the SETUP key.
2. Align the pointer with "Flow Setup..." and press ENTER.
3. Align the pointer with "Gas Turbine..." and press ENTER
4. The menu in Table 9d.1 will be displayed:

Table 9d.1—Flow Setup Menu Parameters

Parameters	Description	Read/Write Status
FlowID	Name of the gas Turbine/PD flow	R/O
MtrType	Type of meter – Turbine	R/O
Meter #	Number of the flow – 1	R/O
Fluid Type	Type of fluid – Gas	R/O
Param Setup…	Selected flow parameters submenu	N/A

Accessing the Gas Turbine Setup Menu

NOTE—**A level 2 or higher password authorization is required to view the items in the Gas Turbine Setup submenu. A level 4 password is required to change the items in the Gas Turbine Setup submenu.**

To access the Gas Turbine Setup menu, do the following:

1. From the Flow Setup menu, align the pointer with "Param Setup…" and press ENTER.
2. The display will show "GAS TURB SETUP" and the following parameters in Table 9d.2 will be listed:

Table 9d.2—Gas Turbine Setup Menu

Parameters	Description	Read/Write Status
FlowID	Name of the Gas Turbine flow	R/W
Ser #	Serial number of the turbine meter	R/W
Fmeth	Compressibility calculation method	R/W
Fpv	Override compressibility value for Fmeth	R/W
Spec Grav	Specific gravity of gas	R/W
Hvalue	Heating value of gas	R/W
MF	Meter factor	R/W
Flprs AI#	Analog input channel for line pressure	R/W
FlTmp AI#	Analog input channel for temperature	R/W
Press Ovrd	Override static pressure value	R/W
Temp Ovrd	Override flowing temperature value	R/W
Gas Components...	Gas components submenu	N/A
Turb Alarm Setup...	Turbine alarm submenu	N/A
Calibrate Turb...	Turbine calibration submenu	N/A

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Flow Id (FlowID)

The gas turbine meter identification name is a 20 character alphanumeric parameter. The default name is Gas Turbine. To change the name, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Meter Id" and press ENTER (enhanced mode display).
2. Press SETUP and use the number keys (and the ↑ key and the ↓ key if needed) to enter the gas turbine meter identification name.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Gas Turbine Setup menu.

Serial Number (Ser #)

The gas turbine meter serial number is a 20 character alphanumeric serial number provided to trace the operation of the turbine meter throughout the lifetime of the meter. The default serial number is

Gas Turbine. Together with the gas turbine meter identification name, the gas turbine meter run can be easily identified. To enter the gas turbine serial number, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Ser #" and press ENTER (enhanced mode display).
2. Press SETUP and use the number keys (and the ↑ key and the ↓ key if needed) to enter the gas turbine meter serial number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Gas Turbine Setup menu.

Compressibility Calculation Method (FMeth)

The compressibility calculation method lists the following methods of calculating the compressibility factor:

- AGA8 (1985)
- AGA8 (analysis of 20 constituent gases)
- NX19 (analysis of specific gravity, carbon dioxide, and nitrogen)
- NX19 (analysis of 20 constituent gases)
- User-entered constant
- AGA8 (analysis of HV, SG, CO2)
- AGA8 (analysis of specific gravity, carbon dioxide, and nitrogen)

The default method is NX-19 (SG, CO2, N). To select the compressibility calculation method, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "FMeth" and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key to select the appropriate calculation method.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Gas Turbine Setup menu.

NOTE: If the "User-Entered Constant" is selected as the calculation method, the user must enter the constant value under the "Fpv" menu item described below.

Constant Supercompressibility Factor (Fpv)

The NOA-332 allows a constant supercompressibility parameter to be entered in lieu of calculating this parameter. The range of acceptable entries is from 0.800 to 2.000. If you selected "User-Entered Constant" as the compressibility calculation method (FMeth) earlier, enter the value for the constant by doing the following:

1. From the Gas Turbine Setup menu, align the pointer with "Fpv" and press ENTER (enhanced mode display).
2. Press SETUP and enter the supercompressibility value.

3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Gas Turbine Setup menu.

Specific Gravity (Spec Grav)

The specific gravity of a gas is the ratio of the density of the gas to the density of air, both being measured at "standard" pressure and temperature. The range of acceptable entries is from 0 to 2.000 with the default set at 0.602. To change the specific-gravity value, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Spec Grav" and press ENTER (enhanced mode display).
2. Press SETUP and enter the value.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Gas Turbine Setup menu.

Heating Value (HValue)

The heating value is expressed in Btu/scf of gas. The range of acceptable entries is from 0 to 2000.0 with the default set at 1400. To enter the heating value, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "HValue" and press ENTER (enhanced mode display).
2. Press SETUP and enter the value in Btu/scf.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Gas Turbine Setup menu.

Meter Factor (MF)

The meter factor is a number obtained by dividing the quantity of liquid measured by a master meter by the quantity indicated by the liquid turbine meter during calibration. The range of acceptable entries is from 0.5 to 2.0 with a default value of 1.0. To enter the meter factor, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "MF" and press ENTER (enhanced mode display).
2. Press SETUP and enter the meter factor.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Gas Turbine Setup menu.

Flowing Pressure Analog Input Assignment (Flprs AI#)

The NOA-332 allows for any of its 16 on board analog input channels to be designated for the flowing pressure transmitter required for gas turbine meter measurement except for channels 1, 2, and 3 which are reserved for on-board parameters. The NOA-332 also allows the selection of multivariable transmitter (MVT) inputs to be designated for static pressure. The range of acceptable entries is 0 and 4 to 47 with the default configuration set to analog input channel number 7. It is strongly recommended that this value not be changed unless an MVT is used. If an MVT is used refer to Table 7.1 of Section 7 of this manual to select the correct MVT Static Pressure Input Channel Assignment number. For the Static Pressure, this number will be 26, 29, 32, 35, 38, 41, 44, or 47 depending on the MVT source that has been configured.

The user may elect to use a constant value for the static pressure rather than read a transmitter. In these cases, the analog input channel number should be changed to zero and the constant value be entered under the "Press Ovrd" menu item. To change the analog input channel number, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Flprs AI#" and press ENTER (enhanced mode display).
2. Press SETUP and enter the analog input channel number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Gas Turbine Setup menu.

Temperature Analog Input Assignment (FlTmp AI#)

The NOA-332 allows for any of its 16 on board analog input channels to be designated for the flowing temperature transmitter required for gas turbine meter measurement except for channels 1, 2, and 3 which are reserved. The NOA-332 also allows the selection of multivariable transmitter (MVT) inputs to be designated for flowing temperature. The range of acceptable entries is 0 and 4 to 48 with the default configuration set to analog input number 8. It is strongly recommended that this value not be changed unless an MVT is used. If an MVT is used refer to Table 7.1 of Section 7 of this manual to select the correct MVT Temperature Input Channel Assignment number. For the Temperature, this number will be 27, 30, 33, 36, 39, 42, 45, or 48 depending on the MVT source that has been configured.

The user may elect to use a constant value for the flowing temperature rather than read a transmitter. In these cases, the analog input channel number should be changed to zero and the constant value be entered under the "Temp Ovrd" menu item. To change the analog input channel number, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "FlTmp AI#)" and press ENTER (enhanced mode display).
2. Press SETUP and enter the analog input channel number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Gas Turbine Setup menu.

Constant Flowing Pressure (Press Ovrd)

The NOA-332 allows a constant static pressure parameter to be entered in lieu of reading the flowing pressure transmitter (see the Flprs AI# menu item). The range of acceptable entries is from 0 to 5,000 psig. If you set the Flprs AI# to zero, enter the value for the constant pressure by doing the following:

1. From the Gas Turbine Setup menu, align the pointer with "Press Ovrd" and press ENTER (enhanced mode display).
2. Press SETUP and enter the pressure value in psig.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Gas Turbine Setup menu.

Constant Temperature (Temp Ovrd)

The NOA-332 allows a constant flowing temperature parameter to be entered in lieu of reading the temperature transmitter (see the FlTmp AI# menu item). The range of acceptable entries is from minus 50 to 500 degrees F. If you set the FlTmp AI# to zero, enter the value for the constant temperature by doing the following:

1. From the Gas Turbine Setup menu, align the pointer with "Temp Ovrd" and press ENTER (enhanced mode display).
2. Press SETUP and enter the temperature value in degrees F.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Gas Turbine Setup menu.

Gas Components Menu

A listing of the Gas Components submenu is available in Appendix C, page C-6.

NOTE**—A level 2 or higher password authorization is required to view the items in the Gas Components submenu. A level 3 or higher password is required to change the items in the Gas Components submenu.**

This submenu provides access to the composition of the produced gas. The list of constituent gases is as follows:

- nitrogen
- carbon dioxide
- hydrogen sulfide
- water vapor
- helium
- methane
- ethane
- propane
- normal butane
- iso butane
- normal pentane
- iso pentane
- hexane
- heptane
- octane
- nonane
- decane
- oxygen
- carbon monoxide
- hydrogen

The composition of each constituent gas is entered as a percentage of the total gas composition. The range of values is different for each constituent gas and depends on the valid range of each constituent as required by the various calculation methods. To change the gas composition percent, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Gas Components…" and press ENTER.
2. Use the ↑ or ↓ key to align the pointer with the desired constituent gas and press ENTER (display in enhanced mode).
3. Press SETUP and enter the value. Use the number keys and the decimal point key to enter the percentage of the gas constituent.
4. Press ENTER to validate your entry.

5. Press ESCAPE to return to the Gas Components menu.
6. When finished, press ESCAPE to return to the Gas Turbine Setup menu.

Note—The NOA-332 will use only the information required for calculating parameters, such as compressibility. For instance, if the selected compressibility calculation method is "AGA8 (SG, CO_2, N_2)," then the entry of the Methane percentage will have no effect on the calculation of compressibility.

Turbine Alarm Setup Menu

A listing of the Turbine Alarm Setup submenu and its submenus are available in Appendix C, page C-8.

NOTE**—A level 2 or higher password authorization is required to view the items in the Turbine Alarm Setup submenus. A level 3 or higher password authorization is required to change the items in the Turbine Alarm Setup submenus.**

The Turbine Alarm Setup Menu allows the configuration of all the alarms associated with a gas turbine meter. Note that all changes made to the parameters in this menu are automatically made to the corresponding parameters in the Configuration/Setup Alarm Setup menu and vice versa. When an alarm is activated, an entry is added to the alarm data log. An additional entry is added when the alarm is deactivated. Table 9d.4 lists the parameters that can be configured in the Turbine Alarm Setup menu.

Accessing the Turbine Alarm Setup Menu

1. From the Gas Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. The following menu items are listed:
   - Flowing Pressure submenu
   - Flowing Temperature submenu
   - Flow Rate submenu
   - Volume Accumulation submenu

Use the ↑ or ↓ key to align the pointer with the desired menu item and press ENTER. The menu items listed in Table 9d.4 appear as follows:

Table 9d.4—Turbine Alarm Setup Menu

Parameters	Description	Read/Write Status
Enable	Alarm enable (yes or no)	R/W
LoLo	Low low alarm trip point	R/W
Low	Low (warning) alarm trip point	R/W
High	High (warning) alarm trip point	R/W
HiHi	High high alarm trip point	R/W
Dead	Alarm deadband setting	R/W
LoLo Action	LoLo alarm action	R/W
HiHi Action	HiHi alarm action	R/W
Reset Alarm	Resets alarm activity count	W/O

Use the ↑ or ↓ key to align the pointer with the desired menu item and press ENTER.

Turbine Alarm Parameters

Enable

"Yes" enables or "No" disables the selected alarm. To change the alarm, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "Enable" and press ENTER (display in enhanced mode).
4. Press SETUP and use the ↑ or ↓ key to select the desired status.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Gas Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Gas Turbine Setup menu.

LoLo

"LoLo" is the Low Low Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a LoLo Alarm is generated. Each time a LoLo alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a LoLo Alarm causes a LoLo Alarm Action. The type of action depends on the LoLo Alarm Action parameter. The range of acceptable entries is from 0 to 10,000 with the default being 0.

To set the alarm limit, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "LoLo" and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.
5. Press ENTER to validate your entry.

6. Press ESCAPE to return to the Gas Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Gas Turbine Setup menu.

Low

"Low" is the Low (Warning) Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a Low (Warning) Alarm is generated. Each time a Low (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is triggered by this alarm. The range of acceptable entries is from 0 to 10,000 with the default being zero. To set the alarm limit, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "Low" and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Gas Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Gas Turbine Setup menu.

High

"High" is the High (Warning) Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a High (Warning) Alarm is generated. Each time a High (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is triggered by this alarm. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "High" and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Gas Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Gas Turbine Setup menu.

HiHi

"HiHi" is the High High Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a HiHi Alarm is generated. Each time a HiHi alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a HiHi Alarm causes a HiHi Alarm Action. The type of action depends on the HiHi Action parameter. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.

2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item “HiHi” and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Gas Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Gas Turbine Setup menu.

Dead

“Dead” is the Alarm Deadband Setting parameter. The deadband value provides variance for the alarm, preventing a value slightly above the high set point or slightly below the low set point from activating the alarm. The alarm will activate when the value is less than the low set point minus the deadband, or greater than the high set point plus the deadband. The alarm will deactivate when the value is higher than the low setpoint plus the deadband or lower than the high setpoint minus the deadband. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the deadband limit, do the following:

1. From the Gas Turbine Setup menu, align the pointer with “Turb Alarm Setup…” and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item “Dead” and press ENTER (display in enhanced mode).
4. Press SETUP and enter the deadband limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Gas Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Gas Turbine Setup menu.

LoLo Action

“LoLo” is the Low Low Alarm Action parameter. This action is triggered when a Low Low Alarm is generated. The range of acceptable entries is from 0 to 25. The LoLo action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9d.5 for the alarm action parameters noting that the digital I/O board may be 4 channel or 8 channel depending upon which board is supplied with the NOA-332.

HiHi Action

“HiHi” is the High High Alarm Action parameter. This action is triggered when a High High Alarm is generated. The range of acceptable entries is from 0 to 25. The HiHi Action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the

alarm became active. See Table 9d.5 for the alarm action parameters noting that the digital I/O board may be 4 channel or 8 channel depending upon which board is supplied with the NOA-332.

Reset Alarm

This resets the activation count of the alarm, which is the number of times the alarm has been activated, and sets the current status to "Not Active".

Table 9d.5—Alarm Action Parameters

Alarm Action #	Four Channel Input / Output Digital Board	Eight Channel Input / Output Digital Board
0	No Action	No Action
1	Normally Open action Channel 1	Normally Open action Channel 1
2	Normally Open action Channel 2	Normally Open action Channel 2
3	Normally Open action Channel 3	Normally Open action Channel 3
4	Normally Open action Channel 4	Normally Open action Channel 4
5	**Invalid Operation**	Normally Open action Channel 5
6	**Invalid Operation**	Normally Open action Channel 6
7	**Invalid Operation**	Normally Open action Channel 7
8	**Invalid Operation**	Normally Open action Channel 8
9	Momentary Action Channel 1	Momentary Action Channel 1
10	Momentary Action Channel 2	Momentary Action Channel 2
11	Momentary Action Channel 3	Momentary Action Channel 3
12	Momentary Action Channel 4	Momentary Action Channel 4
13	**Invalid Operation**	Momentary Action Channel 5
14	**Invalid Operation**	Momentary Action Channel 6
15	**Invalid Operation**	Momentary Action Channel 7
16	**Invalid Operation**	Momentary Action Channel 8
17	Normally Closed action Channel 1	Normally Closed action Channel 1
18	Normally Closed action Channel 2	Normally Closed action Channel 2
19	Normally Closed action Channel 3	Normally Closed action Channel 3
20	Normally Closed action Channel 4	Normally Closed action Channel 4
21	**Invalid Operation**	Normally Closed action Channel 5
22	**Invalid Operation**	Normally Closed action Channel 6
23	**Invalid Operation**	Normally Closed action Channel 7
24	**Invalid Operation**	Normally Closed action Channel 8
25	Halts current well test	Halts current well test

NOTE—Alarm actions 1 thru 8 cause an "ON" action for the duration of the alarm. Alarm actions 9 thru 16 cause a momentary "ON" action of one second duration. Alarm actions 17 thru 24 cause an "OFF" action for the duration of the alarm. The NOA-332 is available with an optional 4 channel relay board and an optional 8 channel FET driver board to provide alarm action features.

Calibrate Turbine Menu

A listing of the Calibrate Turbine submenu and its submenus are available in Appendix C, page C-14.

NOTE—**A level 2 or higher password authorization is required to view the items in the Calibrate Turbine submenus. A level 4 password is required to change the items in the Calibrate Turbine submenus.**

The Calibrate Turbine Menu allows the entry of calibration information for the gas turbine meter. The NOA-332 allows up to ten calibration points for the gas turbine meter and does a point-to-point fitting of the calibration factor entries to provide optimum accuracy. A single constant factor can also be entered. Additionally, a meter factor can be entered to correct the k-factor entries where a master meter proving has been performed.

Accessing the Calibrate Turbine Menu

1. From the Gas Turbine Setup menu, align the pointer with "Calibrate Turb…" and press ENTER.
2. The top of the display will show Gas Turbine flow name and the menu items of Table 9d.6 will be listed. Use the ↑ or ↓ key to align the pointer with the desired menu item and press ENTER.

Table 9d.6—Gas Turbine Calibration Menu

Calibration Selection	Description
Multipoint Calibration	Perform 1 to10 point linearization of the flowmeter calibration factor
ACFConstant Override Value	Enter a constant override flowmeter calibration factor in terms of pulses per Actual Cubic Feet
Prover Meter Factor	Enter the prover meter factor

Turbine Meter Multipoint Calibration Routine

The multipoint calibration procedure for a flowmeter relates the flowmeter calibration factor with flowmeter frequency. Both numbers, the flowmeter frequency and the associated calibration factor, are entered to form the calibration point. For example, if the flowmeter has a calibration factor of 127 pulses/gallon at 250 Hz, enter "250" for the frequency and "127" for the calibration factor.

The NOA-332 allows you to enter up to 10 calibration points to linearize the flowmeter calibration factor curve. Calibration points can be entered in ascending, descending, or alternating order. The NOA-332 uses the input values for flowmeter frequency and calibration factor to form an equation used to calculate calibration factor based on the current operating flowmeter frequency. To enter the multipoint calibration procedure, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Turb Calib…" and press ENTER.
2. Align the pointer with the menu item "MultiPt" and press ENTER.
3. Press SETUP and enter the number of calibration points (1 to 10)

4. Press ENTER to validate your entry.
5. The NOA-332 now begins the calibration process. Each calibration point will require entry of the flowmeter frequency and the associated calibration factor. The NOA-332 asks for entry of the flowmeter frequency, followed by entry of the associated calibration factor, for each calibration point entered in step 3. Thus, the first item the NOA-332 requests is the flowmeter frequency for the first calibration point.
6. Enter the value of the flowmeter frequency and press ENTER. The NOA-332 next requests entry of the calibration factor associated with the flowmeter frequency just entered. Enter this value and press ENTER.
7. If additional calibration points are required, the NOA-332 will ask for the next calibration point beginning with the next flowmeter frequency. Repeat step 6 as necessary to enter all of the calibration points.
8. When the last calibration point is entered, the NOA-332 Run will display the message "Accept data points...<Escape> = Cancel...<Enter> = Continue." If the calibration points have all been entered properly, press ENTER to accept the calibration. If a mistake was made at any point in the calibration process, press ESCAPE to cancel the calibration and retry. The NOA-332 will display the Flowmeter Calibration Procedure menu.
9. Press ESCAPE to return to the Gas Turbine Setup menu.

Flowmeter Override Value

The flowmeter override value can be used in any application where a constant calibration factor is acceptable. For example, most frequency-generating flowmeters are delivered from the manufacturer with an average calibration factor over a stated operating range. If the flow rate is within the operating range of the flowmeter, then this calibration factor will be valid.

The use of the override calibration factor can save time and is useful if the characteristic data needed for a multipoint calibration is not available. To enter a constant calibration factor for a flowmeter, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Turb Calib…" and press ENTER.
2. Use the ↑ or ↓ key to align the pointer with the menu item "ACFConst" and press ENTER (enhanced mode display)
3. Press SETUP and enter the constant calibration factor.
4. Press ENTER to validate your entry.
5. Press ESCAPE twice to return to the Gas Turbine Setup menu.

Prover Meter Factor

The prover meter factor is a number entered to adjust the measured volume to the total volume measured by a master meter and is obtained by dividing the quantity of liquid measured by a master meter by the quantity indicated by the liquid turbine meter during calibration. The range of acceptable entries is from 0.5 to 2.0 with a default value of 1.0. To change the prover meter factor, do the following:

1. From the Gas Turbine Setup menu, align the pointer with "Turb Calib…" and press ENTER.

2. Use the ↑ or ↓ key to align the pointer with the menu item “Factor” and press ENTER (enhanced mode display)
3. Press SETUP and enter the meter factor.
4. Press ENTER to validate your entry.
5. Press ESCAPE twice to return to the Gas Turbine Setup menu.

Note—If no adjustment is required for the volume total, set the prover meter factor value equal to 1.000.

Section 9e

The Flow Setup Menu - Liquid Turbine Meter

Introduction

The Flow Setup menu in this section allows the user to access the configuration parameters for the liquid turbine & PD meters. This menu is used specifically for the Emulsion, Free Water, and Gross Volume flowmeters. The Gross Volume selection is optional and will not be accessible unless the Gross Volume meter has previously been enabled in the System Setup menu (see Section 9a). The Flow Setup menu is critical for accurate calculations within the NOA-332, so the user is cautioned to use the utmost care to be certain that the data entered is valid and accurate. A listing of this menu is available in Appendix C, pages C-7, C-8, and C-14.

NOTE—**A level 2 or higher password authorization is required to view the items in the Flow Setup Menu. The other submenus listed below have their own security requirements.**

Accessing the Flow Setup Menu

To access the Flow Setup menu, perform the following procedures:

1. From the Main Menu, align the pointer with "Config/Setup..." and press ENTER or press the SETUP key.
2. Align the pointer with "Flow Setup..." and press ENTER.
3. A listing of the liquid flows under "Well Test Setup" will appear as follows:
   - Emulsion Turbine
   - Free Water Turbine
   - Gross Volume Turbine or NONE
4. Using the ↑ or ↓ key, select the flow to be configured and press ENTER.
5. The menu in Table 9e.1 will be displayed:

Table 9e.1—Flow Setup Menu Parameters

Parameters	Description	Read/Write Status
FlowID	Name of the liquid flow selected	R/O
MtrType	Type of meter – Turbine	R/O
Meter #	Number of the flow selected – 2, 3, or 4	R/O
Fluid Type	Type of fluid – Liquid	R/O
Param Setup…	Selected flow parameters submenu	N/A

Accessing the Liquid Turbine Meter Setup Menu

A listing of the Liquid Turbine Setup submenu is available in Appendix C, page C-7.

NOTE—**A level 2 or higher password authorization is required to view the items in the Liquid Turbine Setup submenu. A level 4 password is required to change the items in the Liquid Turbine Setup submenu.**

To access the Liquid Turbine Setup menu, do the following:

1. From the Flow Setup menu, align the pointer with "Param Setup…" and press ENTER.
2. The display will show "LIQUID TURBINE" and the following parameters in Table 9e.2 will be listed:

Table 9e.2—Liquid Turbine Menu

Parameters	Description	Read/Write Status
FlowID	Name of the liquid flow selected	R/W
Ser #	Serial number of the liquid meter	R/W
Temperature Corr...	Temperature Correction submenu	R/W
Pressure Corr...	Pressure Correction submenu	R/W
Fluid	Type of liquid being measured	R/W
Therm	Coefficient of thermal expansion for the liquid	R/W
Pe	Equilibrium pressure value of the liquid	R/W
DegAPI	API gravity value of the liquid	R/W
RelDen	Relative density value of the liquid	R/W
Flpres AI#	Analog input channel for line pressure	R/W
FlTmp AI#	Analog input channel for line temperature	R/W
Pres Ovrd	Override temperature	R/W
Temp Ovrd	Override pressure	R/W
MF	Meter factor	R/W
Turb Alarm Setup…	Turbine alarm submenu	N/A
Calibrate Turb…	Turbine calibration submenu	N/A

Press the ↑ or ↓ key to align the pointer with the menu item wanted and press ENTER.

Flow Id (FlowID)

The liquid meters can each be identified by a 20 character alphanumeric name. The default names are Emulsion Turbine, Free Wtr Turbine, or Gross Vol Turbine. To change the name, do the following:

1. From the Liquid Turbine menu, align the pointer with "FlowID" and press ENTER (enhanced mode display).
2. Press SETUP and use the number keys (and the ↑ key and the ↓ key if needed) to enter the liquid meter identification name.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Liquid Turbine menu.

Serial Number (Ser #)

The liquid meter serial number is a 20 character alphanumeric serial number provided to trace the operation of the meter throughout it's lifetime. The default serial number is the same as the default flow names. Together with the liquid meter identification name, the liquid meter run can be easily identified. To enter the liquid meter serial number, do the following:

1. From the Liquid Turbine menu, align the pointer with "Ser #" and press ENTER (enhanced mode display).
2. Press SETUP and use the number keys (and the ↑ key and the ↓ key if needed) to enter the liquid turbine meter serial number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Liquid Turbine menu.

Temperature Correction Menu

A listing of the Temperature Correction submenu is available in Appendix C, page C-7.

NOTE**—A level 2 or higher password authorization is required to view the items in the Temperature Correction submenu. A level 4 password is required to change the items in the Temperature Correction submenu.**

The NOA-332 compensates for the effects of temperature on the measured liquid volume. The NOA-332 uses values entered for the temperature correction method, fluid type, thermal expansion coefficient, API gravity, relative density, and flowing temperature to determine the correction factor for temperature effects on the liquid volume.

The temperature-compensation methods provided in the NOA-332 are obtained from equations found in the American Petroleum Institute (API) Manual of Petroleum Measurement Standards (MPMS) Section 11.1. The following are the temperature-compensation methods provided by the NOA-332 and the criteria to choose the correct table:

- API MPMS Section 11.1—Table 6A and 6B if given API gravity of the liquid. Table 6A is for Crude Oil and Table 6B is for other fluids.
- API MPMS Section 11.1—Table 24A and 24B if given the relative density of the liquid. Table 24A is for Crude Oil and Table 24B is for other fluids.
- API MPMS Section 11.1—Table 6C and 24C if given the thermal expansion coefficient of the liquid for any fluid.
- User-Entered Constant

The default is User-Entered Constant with the constant value set to 1. The following tables of required values and limits should be used when selecting the temperature correction method:

Table 9e.3—Temperature Correction Tables:

API Chapter 11.1 Table 6A

Parameter	Required Values & Limits -
API Gravity	0 < API Gravity < 100 Degrees API
Flowing Temperature	0 Deg F < Temperature < 300 Deg F
Base Temperature	0 Deg F < Base Temperature < 185 Deg F
Fluid Type	Crude Oil

The data limits for Table 6A are as follows:

A. 0 °API < API Gravity < 40 °API; 0 °F < Temperature < 250 °F
B. 0 °API < API Gravity < 50 °API; 0 °F < Temperature < 200 °F
C. 0 °API < API Gravity < 55 °API; 0 °F < Temperature < 150 °F

API Chapter 11.1 Table 6B

Parameter	Required Values & Limits -
API Gravity	0 < API Gravity < 85 Degrees API
Flowing Temperature	0 Deg F < Temperature < 300 Deg F
Base Temperature	0 Deg F < Base Temperature < 185 Deg F
Fluid Type	Any Fluid

The data limits for Table 6B are as follows:

A. 0 °API < API Gravity < 40 °API; 0 °F < Temperature < 250 °F
B. 0 °API < API Gravity < 50 °API; 0 °F < Temperature < 200 °F
C. 0 °API < API Gravity < 85 °API; 0 °F < Temperature < 150 °F

API Chapter 11.1 Table 6C

Parameter	Required Values & Limits -
Thermal Expansion Coefficient	270 E-06 < a < 930 E-06
Flowing Temperature	0 Deg F < Temperature < 300 Deg F
Base Temperature	0 Deg F < Base Temperature < 185 Deg F
Fluid Type	Any Fluid

The data limits for Table 6C are as follows:

A. 270E-06 $°F^{-1}$ < Thermal Exp Coefficient < 510E-06 $°F^{-1}$; 0 °F < Temperature < 250 °F
B. 270E-06 $°F^{-1}$ < Thermal Exp Coefficient < 530E-06 $°F^{-1}$; 0 °F < Temperature < 200 °F
C. 270E-06 $°F^{-1}$ < Thermal Exp Coefficient < 930E-06 $°F^{-1}$; 0 °F < Temperature < 150 °F

API Chapter 11.1 Table 24A

Parameter	Required Values & Limits -
Relative Density (Spec. Grav.)	0.6110 < SG < 1.0760
Flowing Temperature	0 Deg F < Temperature < 300 Deg F
Base Temperature	0 Deg F < Base Temperature < 185 Deg F
Fluid Type	Crude Oil

The data limits for Table 24A are as follows:

A. 1.0760 > Relative Density > 0.8250; 0 °F < Temperature < 250 °F
B. 1.0760 > Relative Density > 0.7795; 0 °F < Temperature < 200 °F
C. 1.0760 > Relative Density > 0.7585; 0 °F < Temperature < 150 °F

API Chapter 11.1 Table 24B

Parameter	Required Values & Limits -
Relative Density (Spec. Grav.)	0.6110 < SG < 1.0760
Flowing Temperature	0 Deg F < Temperature < 300 Deg F
Base Temperature	0 Deg F < Base Temperature < 185 Deg F
Fluid Type	Any Fluid

The data limits for Table 24B are as follows:

A. 1.0760 > Relative Density > 0.8250; 0 °F < Temperature < 250 °F
B. 1.0760 > Relative Density > 0.7795; 0 °F < Temperature < 200 °F
C. 1.0760 > Relative Density > 0.6535; 0 °F < Temperature < 150 °F

API Chapter 11.1 Table 24C

Parameter	Required Values & Limits -
Thermal Expansion Coefficient	270 E-06 < a < 930 E-06
Flowing Temperature	0 Deg F < Temperature < 300 Deg F
Base Temperature	0 Deg F < Base Temperature < 185 Deg F
Fluid Type	Any Fluid

The data limits for Table 24C are as follows:

A. 270E-06 $°F^{-1}$ < Thermal Exp Coefficient < 510E-06 $°F^{-1}$; 0 °F < Temperature < 250 °F
B. 270E-06 $°F^{-1}$ < Thermal Exp Coefficient < 530E-06 $°F^{-1}$; 0 °F < Temperature < 200 °F
C. 270E-06 $°F^{-1}$ < Thermal Exp Coefficient < 930E-06 $°F^{-1}$; 0 °F < Temperature < 150 °F

Note: If the values or limits go out of range for the selected temperature correction method the correction factor will be equal to 1.00 as long as the values are out of range.

To select a compensation calculation, perform the following procedure:

1. From the Liquid Setup menu, align the pointer with “Temp Corr...” and press ENTER.
2. Align the pointer with “Method” and press ENTER to display the currently selected calculation method in enhanced mode.
3. To select the calculation method, press SETUP.
4. Using the ↑ or ↓ key, select the desired calculation method and press ENTER.

If the calculation method chosen is “User-Entered Constant,” proceed with the following three steps. Otherwise, proceed with Step 8.

5. Press the ↓ key to display the constant temperature correction factor in enhanced mode.
6. Press SETUP to enter the constant factor.
7. Using the number keys and decimal point key, enter the constant temperature correction factor and press ENTER.
8. Press ESCAPE to return to the Temperature Correction Method menu.
9. Press ESCAPE to return to the Liquid Setup menu.

Pressure Correction Menu

A listing of the Pressure Correction submenu is available in Appendix C, page C-7.

NOTE—**A level 2 or higher password authorization is required to view the items in the Pressure Correction submenu. A level 4 password is required to change the items in the Pressure Correction submenu.**

The NOA-332 compensates for the effects of pressure on the measured liquid volume. The NOA-332 uses values entered for the pressure-correction method, API gravity, relative density, equilibrium vapor pressure, temperature, and pressure to determine a correction factor for pressure effects on the liquid volume.

The pressure-compensation methods provided in the NOA-332 are obtained from equations found in the American Petroleum Institute (API) Manual of Petroleum Measurement Standards (MPMS) Section 11.2. The following are the pressure-compensation methods available:

- API MPMS Section 11.2.1 if given API gravity of the liquid
- API MPMS Section 11.2.2 if given the relative density of the liquid
- User-Entered Constant

The default is User-Entered Constant with the constant value set to 1. The following table of required values and limits should be used when selecting a pressure correction method:

Table 9e.4—Pressure Correction Tables:

API Chapter 11.2.1

Parameter	Required Values & Limits -
API Gravity	0 < API Gravity < 90 Degrees API
Flowing Temperature	-20 Deg F < Temperature < 200 Deg F
Pressure	0 PSIA < Pressure < 1500 PSIA
Equilibrium Vapor Pressure (Pe)	(PSIA)

API Chapter 11.2.2

Parameter	Required Values & Limits -
Relative Density (Spec. Grav.)	0.350 < Spec. Gravity < 0.637
Flowing Temperature	-50 Deg F < Temperature < 140 Deg F
Pressure	Pe < Pressure < Pe + 2200 PSIA
Equilibrium Vapor Pressure (Pe)	(PSIA)

Note: If the values or limits go out of range for the selected pressure correction method the correction factor will be equal to 1.00 as long as the values are out of range.

To select a compensation calculation, perform the following procedure:

1. From the Liquid Setup menu, align the pointer with “Press Corr...” and press ENTER.
2. Align the pointer with “Method” and press ENTER to display the currently selected calculation method in enhanced mode.
3. To select the calculation method, press SETUP.

4. Using the ↑ key or ↓ key, select the desired calculation method and press ENTER.

If the calculation method chosen is "User-Entered Constant," proceed with the following three steps. Otherwise, proceed with step 8.

5. Press the ↓ key to display the constant pressure-correction factor in enhanced mode.
6. Press SETUP to enter the constant factor.
7. Using the number keys and decimal point key, enter the constant pressure-correction factor and press ENTER.
8. Press ESCAPE to return to the pressure-correction method menu.
9. Press ESCAPE to return to the Liquid Setup menu.

Fluid Type

The Fluid Type parameter affects the volume calculations and is used in conjunction with API MPMS Section 11.1 Tables 6A, 6B, 6C, 24A, 24B, and 24C. To enter the type of fluid flowing through the liquid meter, perform the following procedures:

1. Align the pointer with "Fluid" and press ENTER.

   The following types of fluids are listed:

   - Crude Oil
   - Gasoline
   - Jet Fuel
   - Fuel Oil
   - Lubricating Oil
   - Non-Hydrocarbon (e.g. Water)
2. Press SETUP.
3. Select the appropriate fluid and press ENTER.
4. Press ESCAPE to return to the Liquid Turbine menu.

Thermal Expansion Coefficient (Therm)

The thermal expansion coefficient affects the volume calculations and is used in conjunction with API MPMS Section 11.1 Tables 6C and 24C. Its value is obtained from analysis of the liquid. The thermal expansion coefficient has a valid range of 0 to 0.001. To enter the thermal expansion coefficient, perform the following procedure:

1. From the Liquid Turbine menu, align the pointer with "Therm" and press ENTER to display the thermal expansion coefficient in enhanced mode.
2. To change the thermal expansion coefficient, press SETUP.
3. Using the number keys and decimal point key, enter the thermal expansion coefficient and press ENTER.
4. Press ESCAPE to return to the Liquid Turbine menu.

Equilibrium Pressure (Pe)

Equilibrium pressure (Pe) of the liquid affects the volume calculations and is used in conjunction with API MPMS Sections 11.2.1 and 11.2.2 . Its value is obtained from analysis of the liquid. The equilibrium pressure has a valid range of 0 to 100.0 PSIA. To enter the equilibrium pressure, follow these steps:

1. From the Liquid Turbine menu, align the pointer with “Pe” and press ENTER.
2. Press SETUP.
3. Enter the numerical value of the equilibrium pressure and press ENTER.
4. Press ESCAPE to return to the Liquid Turbine menu.

API Gravity (DegAPI)

The API Gravity (DegAPI) of the liquid affects the volume calculations and is used in conjunction with API MPMS Sections 11.1 Tables 6A and 6B and Section 11.2.1 . Its value is obtained from analysis of the liquid. The API Gravity has a valid range of 0 to 200.0 degrees. To enter the API Gravity, follow these steps:

1. From the Liquid Turbine menu, align the pointer with “DegAPI” and press ENTER.
2. Press SETUP.
3. Enter the numerical value of the API Gravity and press ENTER.
4. Press ESCAPE to return to the Liquid Turbine menu.

Relative Density (RelDen)

The relative density is a measure of the liquid's density in relation to the density of water. This parameter affects the volume calculations and is used in conjunction with API MPMS Section 11.1 Tables 24A and 24B and Section 11.2.2 . It is a measured parameter obtained from analysis of the liquid. The valid range of relative density is 0 to 2.00 . To enter the liquid relative density, perform the following procedure:

1. From the Liquid Turbine menu, align the pointer with “RelDen” and press ENTER to display the relative density in enhanced mode.
2. To change the relative density, press SETUP.
3. Using the number keys and decimal point key, enter the relative density and press ENTER.
4. Press ESCAPE to return to the Liquid Setup menu.

Flowing Pressure Analog Input Channel (Flprs AI#) – **For Emulsion Meter Only**

The NOA-332 allows for any of its 16 on board analog input channels to be designated for the flowing pressure transmitter for the emulsion meter except for channels 1, 2, and 3 which are reserved for on-board parameters. The NOA-332 also allows the selection of multivariable transmitter (MVT) inputs to be designated for static pressure. The range of acceptable entries is 0 and 4 to 47 with the default configuration set to analog input channel number 4. It is strongly recommended that this value not be changed unless an MVT is used. If an MVT is used refer to Table 7.1 of Section 7 of this manual to select the correct MVT Static Pressure Input Channel Assignment number. For the Static Pressure, this number will be 26, 29, 32, 35, 38, 41, 44, or 47 depending on the MVT source that has been configured.

The user may elect to use a constant value for the flowing pressure rather than read a transmitter. In these cases, the analog input channel number should be changed to zero and the constant value be entered under the "Press Ovrd" menu item. To change the analog input channel number, do the following:

1. From the Liquid Turbine menu, align the pointer with "Flprs AI#)" and press ENTER (enhanced mode display).
2. Press SETUP and enter the analog input channel number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Liquid Turbine menu.

Temperature Analog Input Channel (FlTmp AI#) – **For Emulsion Meter Only**

The NOA-332 allows for any of its 16 on board analog input channels to be designated for the flowing temperature transmitter required for gas turbine meter measurement except for channels 1, 2, and 3 which are reserved. The NOA-332 also allows the selection of multivariable transmitter (MVT) inputs to be designated for flowing temperature. The range of acceptable entries is 0 and 4 to 48 with the default configuration set to analog input number 5. It is strongly recommended that this value not be changed unless an MVT is used. If an MVT is used refer to Table 7.1 of Section 7 of this manual to select the correct MVT Temperature Input Channel Assignment number. For the Temperature, this number will be 27, 30, 33, 36, 39, 42, 45, or 48 depending on the MVT source that has been configured.

The user may elect to use a constant value for the flowing temperature rather than read a transmitter. In these cases, the analog input channel number should be changed to zero and the constant value be entered under the "Temp Ovrd" menu item. To change the analog input channel number, do the following:

1. From the Liquid Turbine Setup menu, align the pointer with "FlTmp AI#" and press ENTER (enhanced mode display).
2. Press SETUP and enter the analog input channel number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Liquid Turbine menu.

Constant Flowing Pressure (Press Ovrd)

The NOA-332 allows a constant static pressure parameter to be entered in lieu of reading the flowing pressure transmitter. The range of acceptable entries is from 0 to 5,000 psig. The default value is zero. If you set the Flprs AI# to zero, enter the value for the constant by doing the following:

1. From the Liquid Turbine menu, align the pointer with "Press Ovrd" and press ENTER (enhanced mode display).
2. Press SETUP and enter the pressure value in psig.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Liquid Turbine menu.

Constant Temperature (Temp Ovrd)

The NOA-332 allows a constant flowing temperature parameter to be entered in lieu of reading the temperature transmitter. The range of acceptable entries is from -50 to 500 degrees F. The default

value is zero. If you set the FlTmp AI# to zero, enter the value for the constant by doing the following:

1. From the Liquid Turbine menu, align the pointer with "Temp Ovrd" and press ENTER (enhanced mode display).
2. Press SETUP and enter the temperature value in degrees F.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Liquid Turbine Setup menu.

Meter Factor (MF)

The meter factor is a number obtained by dividing the quantity of liquid measured by a master meter by the quantity indicated by the liquid turbine meter during calibration. The range of acceptable entries is from 0.5 to 2.0 with a default value of 1.0. To enter the meter factor, do the following:

1. From the Liquid Turbine menu, align the pointer with "MF" and press ENTER (enhanced mode display).
2. Press SETUP and enter the meter factor.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Liquid Turbine menu.

Turbine Alarm Setup Menu

A listing of the Turbine Alarm Setup submenu is available in Appendix C, page C-8.

NOTE**—A level 2 or higher password authorization is required to view the items in the Turbine Alarm Setup submenu. A level 3 or higher password is required to change the items in the Turbine Alarm Setup submenu.**

The Turbine Alarm Setup Menu allows the configuration of all the alarms associated with a liquid meter. Note that all changes made to the parameters in this menu are automatically made to the corresponding parameters in the Configuration/Setup Alarm Setup menu and vice versa. When an alarm is activated, an entry is added to the alarm data log. An additional entry is added when the alarm is deactivated. Table 9e.5 lists the parameters that can be configured in the Turbine Alarm Setup menu.

Accessing the Turbine Alarm Setup Menu

1. From the Liquid Turbine menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. The following menu items are listed:
   - Flowing Pressure submenu
   - Flowing Temperature submenu
   - Flow Rate submenu
   - Volume Accumulation submenu

The menu items listed in Table 9d.5 appear as follows:

Table 9e.5—Turbine Alarm Setup Menu

Parameters	Description	Read/Write Status
Enable	Alarm enable (yes or no)	R/W
LoLo	Low low alarm trip point	R/W
Low	Low (warning) alarm trip point	R/W
High	High (warning) alarm trip point	R/W
HiHi	High high alarm trip point	R/W
Dead	Alarm deadband setting	R/W
LoLo Action	LoLo alarm action	R/W
HiHi Action	HiHi alarm action	R/W
Reset Alarm	Resets alarm activity count	W/O

Use the ↑ or ↓ key to align the pointer with the desired menu item and press ENTER.

Turbine Alarm Parameters

Enable

"Yes" enables or "No" disables the selected alarm. To change the alarm, do the following:

1. From the Liquid Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "Enable" and press ENTER (display in enhanced mode).
4. Press SETUP and use the ↑ or ↓ key to select the desired status.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Liquid Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Liquid Turbine Setup menu.

LoLo

"LoLo" is the Low Low Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a LoLo Alarm is generated. Each time a LoLo alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a LoLo Alarm causes a LoLo Alarm Action. The type of action depends on the LoLo Alarm Action parameter. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Liquid Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "LoLo" and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Liquid Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Liquid Turbine Setup menu.

Low

"Low" is the Low (Warning) Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a Low (Warning) Alarm is generated. Each time a Low (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is triggered by this alarm. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Liquid Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "Low" and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Liquid Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Liquid Turbine Setup menu.

High

"High" is the High (Warning) Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a High (Warning) Alarm is generated. Each time a High (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. No action is triggered by this alarm. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Liquid Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "High" and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Liquid Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Liquid Turbine Setup menu.

HiHi

"HiHi" is the High High Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a HiHi Alarm is generated. Each time a HiHi alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a HiHi Alarm causes a HiHi Alarm Action. The type of action depends on the HiHi Action parameter. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Liquid Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "HiHi" and press ENTER (display in enhanced mode).
4. Press SETUP and enter the alarm limit.

5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Liquid Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Liquid Turbine Setup menu.

Dead

"Dead" is the Alarm Deadband Setting parameter. The deadband value provides variance for the alarm, preventing a value slightly above the high set point or slightly below the low set point from activating the alarm. The alarm will activate when the value is less than the low set point minus the deadband, or greater than the high set point plus the deadband. The alarm will deactivate when the value is higher than the low setpoint plus the deadband or lower than the high setpoint minus the deadband. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the deadband limit, do the following:

1. From the Liquid Turbine Setup menu, align the pointer with "Turb Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item wanted and press ENTER.
3. Align the pointer with the menu item "Dead" and press ENTER (display in enhanced mode).
4. Press SETUP and enter the deadband limit.
5. Press ENTER to validate your entry.
6. Press ESCAPE to return to the Liquid Turbine Alarm Setup menu.
7. When finished, press ESCAPE to return to the Liquid Turbine Setup menu.

LoLo Action

"LoLo" is the Low Low Alarm Action parameter. This action is triggered when a Low Low Alarm is generated. The range of acceptable entries is from 0 to 25. The LoLo action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9e.6 for the alarm action parameters noting that the digital I/O board may be 4 channel or 8 channel depending upon which board is supplied with the NOA-332.

HiHi Action

"HiHi" is the High High Alarm Action parameter. This action is triggered when a High High Alarm is generated. The range of acceptable entries is from 0 to 25. The HiHi Action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9e.6 for the alarm action parameters noting that the digital I/O board may be 4 channel or 8 channel depending upon which board is supplied with the NOA-332.

Reset Alarm

This resets the activation count of the alarm, which is the number of times the alarm has been activated, and sets the current status to “Not Active”.

Table 9e.6—Alarm Action Parameters

Alarm Action #	Four Channel Input / Output Digital Board	Eight Channel Input / Output Digital Board
0	No Action	No Action
1	Normally Open action Channel 1	Normally Open action Channel 1
2	Normally Open action Channel 2	Normally Open action Channel 2
3	Normally Open action Channel 3	Normally Open action Channel 3
4	Normally Open action Channel 4	Normally Open action Channel 4
5	**Invalid Operation**	Normally Open action Channel 5
6	**Invalid Operation**	Normally Open action Channel 6
7	**Invalid Operation**	Normally Open action Channel 7
8	**Invalid Operation**	Normally Open action Channel 8
9	Momentary Action Channel 1	Momentary Action Channel 1
10	Momentary Action Channel 2	Momentary Action Channel 2
11	Momentary Action Channel 3	Momentary Action Channel 3
12	Momentary Action Channel 4	Momentary Action Channel 4
13	**Invalid Operation**	Momentary Action Channel 5
14	**Invalid Operation**	Momentary Action Channel 6
15	**Invalid Operation**	Momentary Action Channel 7
16	**Invalid Operation**	Momentary Action Channel 8
17	Normally Closed action Channel 1	Normally Closed action Channel 1
18	Normally Closed action Channel 2	Normally Closed action Channel 2
19	Normally Closed action Channel 3	Normally Closed action Channel 3
20	Normally Closed action Channel 4	Normally Closed action Channel 4
21	**Invalid Operation**	Normally Closed action Channel 5
22	**Invalid Operation**	Normally Closed action Channel 6
23	**Invalid Operation**	Normally Closed action Channel 7
24	**Invalid Operation**	Normally Closed action Channel 8
25	Halts current well test	Halts current well test

Note—Alarm actions 1 thru 8 cause an “ON” action for the duration of the alarm. Alarm actions 9 thru 16 cause a momentary “ON” action of one second duration. Alarm actions 17 thru 24 cause an “OFF” action for the duration of the alarm.

The NOA-332 is available with an optional 4 channel relay board and an optional 8 channel FET driver board to provide alarm action features.

Calibrate Turbine Menu

A listing of the Calibrate Turbine submenu and its submenus are available in Appendix C, page C-14.

NOTE—**A level 2 or higher password authorization is required to view the items in the Calibrate Turbine submenus. A level 4 password is required to change the items in the Calibrate Turbine submenus.**

The Calibrate Turbine Menu allows the entry of calibration information for the liquid meter. The NOA-332 allows up to ten calibration points for the liquid meter and does a point-to-point fitting of the calibration factors entries to provide optimum accuracy. A single constant factor can also be entered. Additionally, a meter factor is can be entered to correct the k-factor entries where a master meter proving has been performed.

Accessing the Calibrate Turbine Menu

1. From the Liquid Turbine menu, align the pointer with "Calibrate Turb…" and press ENTER.

2. The top of the display will show Liquid Turbine and the menu items of Table 9d.7 will be listed. Use the ↑ or ↓ key to align the pointer with the desired menu item and press ENTER.

Table 9e.7—Liquid Turbine Calibration Menu Parameters

Calibration Selection	Description
Multipoint Calibration	Perform 1 to10 point linearization of the flowmeter calibration factor
GalConst Override Value	Enter a constant override flowmeter calibration factor in terms of pulses per gallon
BblConst Override Value	Enter a constant override flowmeter calibration factor in terms of pulses per barrel
Prover Meter Factor	Enter the prover meter factor

Turbine Meter Multipoint Calibration Routine

The multipoint calibration procedure for a flowmeter relates the flowmeter calibration factor with flowmeter frequency. Both numbers, the flowmeter frequency and the associated calibration factor, are entered to form the calibration point. For example, if the flowmeter has a calibration factor of 127 pulses/gallon at 250 Hz, enter "250" for the frequency and "127" for the calibration factor.

The NOA-332 allows you to enter up to 10 calibration points to linearize the flowmeter calibration factor curve. Calibration points can be entered in ascending, descending, or alternating order. The NOA-332 uses the input values for flowmeter frequency and calibration factor to form an equation used to calculate calibration factor based on the current operating flowmeter frequency. To enter the multipoint calibration procedure, do the following:

1. From the Liquid Turbine menu, align the pointer with "Turb Calib…" and press ENTER.
2. Align the pointer with the menu item "MultiPt" and press ENTER.
3. Press SETUP and enter the number of calibration points (1 to 10)
4. Press ENTER to validate your entry.

5. The NOA-332 now begins the calibration process. Each calibration point will require entry of the flowmeter frequency and the associated calibration factor. The NOA-332 asks for entry of the flowmeter frequency, followed by entry of the associated calibration factor, for each calibration point entered in step 3. Thus, the first item the NOA-332 requests is the flowmeter frequency for the first calibration point
6. Enter the value of the flowmeter frequency and press ENTER The NOA-332 next requests entry of the calibration factor associated with the flowmeter frequency just entered. Enter this value and press ENTER.
7. If additional calibration points are required, the NOA-332 will ask for the next calibration point beginning with the next flowmeter frequency. Repeat step 6 as necessary to enter all of the calibration points.
8. When the last calibration point is entered, the NOA-332 Run will display the message "Accept data points...<Escape> = Cancel...<Enter> = Continue." If the calibration points have all been entered properly, press ENTER to accept the calibration. If a mistake was made at any point in the calibration process, press ESCAPE to cancel the calibration and retry. The NOA-332 Dual Run will display the Flowmeter Calibration Procedure menu.
9. Press ESCAPE to return to the Liquid Turbine menu.

Flowmeter Override Value

The flowmeter override value can be used in any application where a constant calibration factor is acceptable. For example, most frequency-generating flowmeters are delivered from the manufacturer with an average calibration factor over a stated operating range. If the flow rate is within the operating range of the flowmeter, then this calibration factor will be valid.

The use of the override calibration factor can save time and is useful if the characteristic data needed for a multipoint calibration is not available. The override calibration factor can be entered in terms of pulses per gallon or pulses per barrel as provided by the meter manufacturer. To enter a constant calibration factor for a flowmeter, do the following:

1. From the Liquid Turbine menu, align the pointer with "Turb Calib…" and press ENTER.
2. Use the ↑ or ↓ key to align the pointer with the menu item "GalConst" or "BblConst" (depending upon which value is supplied with the meter) and press ENTER (enhanced mode display).
3. Press SETUP and enter the constant calibration factor in terms of pulses per gallon or pulses per barrel according to the selection in the previous step.
4. Press ENTER to validate your entry.
5. Press ESCAPE twice to return to the Liquid Turbine menu.

Prover Meter Factor

The prover meter factor is a number entered to adjust the measured volume to the total volume measured by a master meter. It is a factor with a value nearly equal to 1.000 that can be used to account for effects of viscosity, shrinkage, watercut, etc. on the accuracy of the flowmeter. To change the prover meter factor, do the following:

1. From the Liquid Turbine Setup menu, align the pointer with "Turb Calib…" and press ENTER.
2. Use the ↑ or ↓ key to align the pointer with the menu item "Factor" and press ENTER (enhanced mode display)

3. Press SETUP and enter the meter factor.
4. Press ENTER to validate your entry.
5. Press ESCAPE twice to return to the Liquid Turbine Setup menu.

Note—If no adjustment is required for the volume total, set the prover meter factor value equal to 1.000.

Notes

Section 9f

The Security Setup Menu

Introduction

The instructions in Section 2 provided access to the NOA-332 system using the default security code programmed at the factory. The Security Setup menu provides the user with a maximum of 20 operators, each with a unique security code and authorization level for accessing data from the NOA-332. The NOA-332 allows two levels of read/write access resulting in four levels of security. The user may choose according to the specific installation of the NOA-332 as to which of these four levels are appropriate to insure the integrity of the NOA-332 data. The levels of security are arranged as follows:

Level 1 - Low Level Read Access

Level 2 - High Level Read Access

Level 3 - Low level Write Access

Level 4 - High Level Write Access

The security levels operate in a hierarchical manner; levels 1 and 2 allow the user to selectively "read" data but change nothing while levels 3 and 4 allow the user to read everything but selectively change ("write") data. As an example, the NOA-332 comes factory-set with one operator, named "Operator 20," with a default security code of "333333." To set up security information for the NOA-332, an Authorization-Level-4 security code is required. "Operator 20," the default operator, is programmed for Level-4 access.

The user is encouraged to select a single person to program the security codes into the NOA-332. This ensures that security code information cannot be changed by more than one user.

Important—The designated operator should reprogram the default operator, named "Operator 20," to his or her own name as the operator and change the security code. The default security code is provided to allow first-time access only and should be reprogrammed.

A listing of the Security Setup Menu is available in Appendix C, page C-12.

NOTE**—A level 2 or higher password authorization is required to view the items in the Security Setup Menu. A level 4 password is required to change the items in the Security Setup Menu.**

Table 9f.1 lists the choices within the Security Setup menu.

Accessing the Security Setup Menu

To access the Security Setup menu, perform the following procedure:

1. From the Main Menu, align the pointer with "Config/Setup..." and press ENTER.
2. Align the pointer with "Security Setup..." and press ENTER.

Table 9f.1--Security Setup Menu Parameters

Parameters	Description	Read/Write Status
Entry	Operator number selection (1 to 20)	R/W
Oper	Operator's name (alphanumeric)	R/W
Code	Security code (alphanumeric, suppressed)	WO
Level	Security level (1 to 4)	WO
Time-out	Security time-out (1 to 1440 min)	R/W
Display Mode	Time-out display (scan or scroll of NuFlo logo)	R/W
Cancel Security	Cancel current authorization and return to scrolling mode	N/A

The following parameters outline procedures for setting each parameter within the Security Setup menu:

Selecting the Operator Entry

To select the operator security access to setup, perform the following procedure:

1. Align the pointer with "Entry."
2. Press ENTER to display the entry selection parameter in enhanced mode.
3. Press SETUP.
4. Press the ↑ or ↓ key until the desired entry selection is displayed and press ENTER.
5. Press ESCAPE to return to the Security Setup menu or the ↓ key to change the operator name.

Entering the Operator Name

The operator name is limited to 20 alphanumeric characters. To change the operator name for the current entry selection, perform the following procedure:

1. From the Security Setup menu, align the pointer with "Oper" and press ENTER to display the operator in enhanced mode.
2. To change the current operator name, press SETUP.
3. Using the number keys, the ↑ key, and the ↓ key, enter the alphanumeric operator name.
4. When the correct operator name is displayed, press ENTER.
5. Press ESCAPE to return to the Security Setup menu or the ↓ key to change the security code.

Setting the Security Code

The security code can be changed by the operator associated with the security code, if logged in, and any operator with a Level-4 authorization. The security code must be between 4 and 10 charters long. To change your own security code, enter your present code first.

To change the selected operator's security code, perform the following procedure:

1. From the Security Setup menu, align the pointer with "Code" and press ENTER to display the security code in enhanced mode.

Note—The display is suppressed.

2. To change the security code, press SETUP.
3. Using the number keys, the ↑ key, and the ↓ key, enter the alphanumeric security code.

Caution—The NOA-332 allows entry of an alphanumeric characters for the security code. However, entry of alpha characters requires good knowledge of how many times to press the ↑ or ↓ key to get the desired letter. Therefore, it is recommended that only numbers be used for the security code.

4. Press ENTER after the security code has been typed.
5. Press ESCAPE to return to the Security Setup menu or the ↓ key to change the authorization level.

Setting the Authorization Level

The security authorization level limits access by operators without proper authority to sensitive parameters that define operation of the NOA-332. The NOA-332 provides four levels of security access:

Level 1 for read-only, often used information such as well test status, flow data, alarm status, and date/time. This level permits limited-read, no-write system access.

Level 2 for read-only, critical information such as site data, alarm settings, and configuration parameters. This level permits full-read, no-write system access

Level 3 for read-write, often used information such as well test setup, test start and stop functions, orifice plate changes, alarm setup, and system setup. This level permits full-read, limited-write system access

Level 4 for read-write, total system access for system configuration, calibration, I/O assignments, communications, security code entry, and diagnostics. This level permits full-read, full-write system access

Important—Provide Level-4 access to only a few operators, since this level provides access to all system parameters, including security codes and operator names.

To set the selected operator's authorization level, perform the following procedure:

1. From the Security Setup menu, align the pointer with "Level" and press ENTER to display the security authorization level in enhanced mode.
2. To change the authorization level, press SETUP.

Note—The display shows an '*' for the authorization level.

3. Using the number keys, enter the authorization level (1 thru 4).
4. Press ENTER after the authorization level is typed.
5. Press ESCAPE to return to the Security Setup menu or press the ↓ key to change the keypad security time-out period.

Setting the Keypad Security Time-out

After the keypad has been inactive for a set amount of time, the security level is set to "No Security" and the display begins scrolling. If the computer "times out" while you are entering data for any parameter, press ENTER, enter your security code, and press ENTER again. The computer will revert to the last menu in which you were working.

The time-out feature keeps unauthorized personnel from changing computer parameters if an authorized operator failed to log off and left the immediate area. The time-out period can be programmed from 1 to 1440 minutes, and the designated time-out is the same no matter which operator is logged on.

To change the keypad security time-out period, perform the following procedure:

1. From the Security Setup menu, align the pointer with "Time-out" and press ENTER to display the security time-out period in enhanced mode.
2. To change the time-out period, press SETUP.
3. Using the number keys, enter the security time-out period (1 thru 1440).
4. Press ENTER after the time-out period is displayed.
5. Press ESCAPE to return to the Security Setup menu.

Setting the Display Mode

After the computer "times out" due to keypad inactivity, the display begins scrolling. Scrolling can be set to one of two modes; (1) Scan, or (2) Logo.

When set to "Scan", the display will scroll the Site Id, Gas Volume, Net Oil Volume, Total Water Volume, Average Water Cut, and any other parameters previously selected as scan items up to a maximum of 20 parameters. When set to "Logo", the display will scroll "NuFlo NOA-332, Net Oil Analyzer ... Press any key to continue..." and will also display the time.

Canceling the Current Security Access

Canceling the current security access will log the current operator off and display the scrolling message. This feature will prevent other personnel from accessing the NOA-332 and potentially modifying parameters affecting operation.

Important—The NOA-332 logs events every time a parameter is modified that affects operation. If an unauthorized operator changes system parameters while an authorized operator is logged in to the NOA-332 , the authorized operator is responsible for the changes made. Therefore, each operator must log off by canceling the security authorization before leaving the NOA-332 unattended.

To cancel the current security authorization and log off the NOA-332, align the pointer with "Cancel Security" in the Security Setup menu and press ENTER.

Hint—A quicker method of canceling the security authorization is to press the SHIFT key, followed by the ESCAPE key. This will perform the same function as selecting "Cancel Security" in the Security Setup menu.

Setting Up the Security Information

To set up a new operator, perform the following procedure:

1. From the Security Setup menu, align the pointer with "Entry."
2. Press ENTER to display the operator entry selection parameter in enhanced mode.
3. To select the operator information to modify, press SETUP.
4. Using the ↑ and ↓ keys, select the operator to modify and press ENTER.

   The entry selections are the actual operator names that have been programmed into the NOA-332 security system. When an operator name is changed for a particular entry selection, the corresponding entry selection will be changed to the new operator name. For example, if the default operator, named "Operator 20," is reprogrammed with a new operator name of "John Doe," then the entry selection will also be changed from "Operator 20" to "John Doe." The next time modification is required for this operator, select the entry parameter for "John Doe."
5. Press the ↓ key to display the operator name in enhanced mode.
6. To change the operator name, press SETUP.
7. Using the number keys, the ↑ key, and the ↓ key, enter the alphanumeric operator name.
8. Press ENTER when the operator name is displayed.
9. Press the ↓ key to display the security code in enhanced mode.

Note—The display is suppressed (It shows an '*' for each character of the security code to hide the actual code.)

10. To change the security code, press SETUP.
11. Using the number keys, the ↑ key, and the ↓ key, enter the alphanumeric security code.

    Asterisks (*) for each key pressed are displayed to preserve security.

Important—The NOA-332 allows entry of an alphanumeric security code of 5 to 10 characters. However, entry of alpha characters requires good knowledge of how many times to press the ↑ or ↓ key to get the desired letter. Therefore, use only numbers for the security code.

12. Press ENTER after typing the security code.
13. Press the ↓ key to display the authorization level in enhanced mode.

Note—The display shows '****' for the authorization level.

14. To change the authorization level, press SETUP.
15. Using the number keys, enter the authorization level. An '*' is displayed.

16. Press ENTER after the authorization level is typed.
17. Press ESCAPE to return to the Security Setup menu.

Setting Up Other Operator Codes and Security Levels

1. Align the pointer with “Entry” and press ENTER.
2. Align the pointer with the next operator number and press ENTER.
3. Press SETUP.
4. Type the operator’s name and press ENTER.
5. Press ESCAPE to return to the Security Setup menu.
6. Scroll down to “Security Code” and press ENTER.
7. Press SETUP.
8. Enter the security code.
9. Press ESCAPE to return to the Security Setup menu.
10. Scroll down to Security Level and type in the level assigned.
11. Press SHIFT/ESCAPE to return to scrolling mode.

Section 9g

The Alarm Setup Menu

Introduction

The Alarm Setup menu provides access to the parameters for all the alarms. The Alarm Setup menu contains five submenus: (1) Analog Input Alarm Setup submenu, (2) Digital Input Alarm Setup submenu, (3) Rate Alarm Setup submenu, (4) Volume Alarm Setup submenu, and (5) Multivariable Transmitter Input Alarm Setup submenu. Through these submenus the parameters for the alarms may be viewed and edited.

When an alarm is activated, an entry is added to the alarm data log. An additional entry is added to the alarm data log when the alarm is deactivated. A listing of this menu is available in Appendix C, page C-12.

NOTE**—A level 2 or higher password authorization is required to view the items in the Alarm Setup Menu and its submenus. A level 3 or higher password is required to change the items in the Alarm Setup Menu and its submenus.**

Accessing the Alarm Setup Menu

1. From the Main Menu, align the pointer with “Config/Setup...”, and press ENTER.
2. From the Config/Setup menu, align the pointer with “Alarm Setup...” and press ENTER.

Accessing the Analog Input Alarm Setup Submenu

The Analog Input Alarm Setup submenu allows the user to configure alarms for specific analog input channels.

1. From the Alarm Setup menu, align the pointer with “AI Alarm Setup...” and press ENTER.
2. The display will show “AI ALARM SETUP” at the top of the display and the menu items shown in Table 9g.1 will be listed.

Table 9g.1—Analog Input Alarm Setup Menu Parameters

Parameters	Description	Read/Write Status
Input AI#	Analog input channel #	R/W
Source	Type of analog input	R/O
Enable	Enable (yes, no)	R/W
HH	High high alarm trip point	R/W
High	High alarm trip point	R/W
Low	Low alarm trip point	R/W
LL	Low low alarm trip point	R/W
DB	Alarm deadband setting	R/W
LoLo Action	Low low alarm action	R/W
HiHi Action	High high alarm action	R/W
Reset Alarm	Resets alarm activity count	W/O

Use the ↑ or ↓ key to align the pointer with the menu item wanted.

Analog Input Alarm Parameters

Input AI#

The NOA-332 has 16 analog input channels available. As defined in Appendix A, only some of these are used. To select which analog input channel to set alarm features for, do the following:

1. From the Alarm Setup menu, align the pointer with "AI Alarm Setup…" and press ENTER.
2. Align the pointer with "Input AI#" and press ENTER (enhanced mode display).
3. Press SETUP and enter the analog channel number you wish to set alarm limits for.
4. Press ENTER to validate your choice.
5. Press ESCAPE to return to the AI Alarm Setup menu.

Source

Each analog input channel has a name associated with it. This parameter lets the user see the name of the channel to confirm that a correct analog channel number was selected. This is a read-only parameter and is modified in Section 9j.

Enable

This parameter allows the alarm to enabled or disabled. "Yes" enables the alarm for the selected analog input channel. "No" disables the selected alarm. To set this parameter, do the following:

1. From the Alarm Setup menu, align the pointer with "AI Alarm Setup…" and press ENTER.
2. Align the pointer with "Enable" and press ENTER (enhanced mode display).
3. Press SETUP and use the ↑ or ↓ key to select 'Yes" or "No".
4. Press ENTER to validate your choice.
5. Press ESCAPE to return to the AI Alarm Setup menu.

HiHi Alarm Setting (HH)

The High High Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a HiHi Alarm is generated. Each time a HiHi alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a HiHi Alarm causes a HiHi Alarm Action. The type of action depends on the HiHi Action parameter. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "AI Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item "HH" and press ENTER.
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the AI Alarm Setup menu.

High Alarm Setting (High)

This is the High (Warning) Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a High (Warning) Alarm is generated. Each time a High (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. There is no action triggered by this alarm. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "AI Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item "High" and press ENTER.
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the AI Alarm Setup menu.

Low Alarm Setting (Low)

This is the Low (Warning) Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a Low (Warning) Alarm is generated. Each time a Low (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. There is no action triggered by this alarm. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "AI Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item "Low" and press ENTER.
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the AI Alarm Setup menu.

Low-Low Alarm Setting (LL)

This is the Low Low Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a LoLo Alarm is generated. Each time a LoLo alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a LoLo Alarm causes a LoLo Alarm Action. The

type of action depends on the LoLo Alarm Action parameter. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "AI Alarm Setup…" and press ENTER.
2. Align the pointer with "LL" and press ENTER (enhanced mode display).
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the AI Alarm Setup menu.

Deadband Alarm Setting (DB)

This is the Alarm Deadband Setting parameter. The deadband value provides variance for the alarm, preventing a value slightly above the high set point or slightly below the low set point from activating the alarm. The alarm will activate when the value is less than the low set point minus the deadband, or greater than the high set point plus the deadband. The alarm will deactivate when the value is higher than the low setpoint plus the deadband or lower than the high setpoint minus the deadband. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the deadband limit, do the following:

1. From the Alarm Setup menu, align the pointer with "AI Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item "DB" and press ENTER.
3. Press SETUP and enter the deadband limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the AI Alarm Setup menu.

Low-Low Alarm Action (LoLoAction)

This is the Low Low Alarm Action parameter. This action is triggered when a Low Low Alarm is generated. The range of acceptable entries is from 0 to 25. The LoLo action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9g.2 for the alarm action parameters.

Hi-Hi- Alarm Action (HiHiAction)

This is the High High Alarm Action parameter. This action is triggered when a High High Alarm is generated. The range of acceptable entries is from 0 to 25. The HiHi Action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9g.2 for the alarm action parameters.

Reset Alarm

This resets the activation count of the alarm, which is the number of times the alarm has been activated, and sets the current status to “Not Active”.

Table 9g.2—Alarm Action Parameters

Alarm Action #	Four Channel Input / Output Digital Board	Eight Channel Input / Output Digital Board
0	No Action	No Action
1	Normally Open action Channel 1	Normally Open action Channel 1
2	Normally Open action Channel 2	Normally Open action Channel 2
3	Normally Open action Channel 3	Normally Open action Channel 3
4	Normally Open action Channel 4	Normally Open action Channel 4
5	**Invalid Operation**	Normally Open action Channel 5
6	**Invalid Operation**	Normally Open action Channel 6
7	**Invalid Operation**	Normally Open action Channel 7
8	**Invalid Operation**	Normally Open action Channel 8
9	Momentary Action Channel 1	Momentary Action Channel 1
10	Momentary Action Channel 2	Momentary Action Channel 2
11	Momentary Action Channel 3	Momentary Action Channel 3
12	Momentary Action Channel 4	Momentary Action Channel 4
13	**Invalid Operation**	Momentary Action Channel 5
14	**Invalid Operation**	Momentary Action Channel 6
15	**Invalid Operation**	Momentary Action Channel 7
16	**Invalid Operation**	Momentary Action Channel 8
17	Normally Closed action Channel 1	Normally Closed action Channel 1
18	Normally Closed action Channel 2	Normally Closed action Channel 2
19	Normally Closed action Channel 3	Normally Closed action Channel 3
20	Normally Closed action Channel 4	Normally Closed action Channel 4
21	**Invalid Operation**	Normally Closed action Channel 5
22	**Invalid Operation**	Normally Closed action Channel 6
23	**Invalid Operation**	Normally Closed action Channel 7
24	**Invalid Operation**	Normally Closed action Channel 8
25	Halts current well test	Halts current well test

Note—Alarm actions 1 thru 8 cause an “ON” action for the duration of the alarm. Alarm actions 9 thru 16 cause a momentary “ON” action of one second duration. Alarm actions 17 thru 24 cause an “OFF” action for the duration of the alarm.

The NOA-332 is available with an optional 4 channel relay board and an optional 8 channel FET driver board to provide alarm action features.

Accessing the Digital Input Alarm Setup Submenu

The Digital Input Alarm Setup submenu allows the user to configure alarms for specific digital input channels. The digital inputs are optional features. If the NOA-332 does not have the optional Digital I/O board installed, no alarm action will occur.

1. From the Alarm Setup menu, align the pointer with “DI Alarm Setup...” and press ENTER.

2. The display will show “DI ALARM SETUP” at the top of the display and the menu items shown in Table 9g.3 will be listed.

Table 9g.3—Digital Input Alarm Menu Parameters

Parameters	Description	Read/Write Status
Input DI#	Digital input channel #	R/W
Source	Type of digital input	R/O
Type	Type of alarm	R/W
LoLo Action	Low low alarm action	R/W
HiHi Action	High high alarm action	R/W
Reset Alarm	Resets alarm activity count	W/O

Use the ↑ or ↓ key to align the pointer with the menu item wanted.

Digital Input Alarm Parameters

Input DI#

The NOA-332 has 8 digital input channels available. To select which digital input channel to set alarm features for, do the following:

1. From the Alarm Setup menu, align the pointer with “DI Alarm Setup…” and press ENTER.
2. Align the pointer with “Input DI#” and press ENTER (enhanced mode display).
3. Press SETUP and enter the digital channel number you wish to set alarm limits for.
4. Press ENTER to validate your choice.
5. Press ESCAPE to return to the DI Alarm Setup menu.

Source

Each digital input channel has a name associated with it. This parameter lets the user see the name of the channel to confirm that a correct digital channel number was selected. This is a read-only parameter and can be modified in Section 9j.

Type

This parameter determines the action needed to trip the alarm. The choices are “No Alarm”, “Not Valid”, “Switch Open”, and “Switch Closed”. When the type is set to “Switch Open” and this condition is met the Hi-Hi Alarm Action will occur. ”. When the type is set to “Switch Closed” and this condition is met the Low-Low Alarm Action will occur. To set the type parameter, do the following:

1. From the Alarm Setup menu, align the pointer with “DI Alarm Setup…” and press ENTER.
2. Align the pointer with “Type” and press ENTER (enhanced mode display).
3. Press ‘SETUP” and use the ↑ or ↓ key to select the digital input action.
4. Press ENTER to validate your choice.
5. Press ESCAPE to return to the DI Alarm Setup menu.

Low-Low Alarm Action (LoLoAction)

This is the Low Low Alarm Action parameter. When the "Switch Closed" type condition is met, a Low Low Alarm is generated. The range of acceptable entries is from 0 to 25. The LoLo action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9g.2 for the alarm action parameters.

Hi-Hi- Alarm Action (HiHiAction)

This is the High High Alarm Action parameter. When the "Switch Open" type condition is met, a High High Alarm is generated. The range of acceptable entries is from 0 to 25. The HiHi Action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9g.2 for the alarm action parameters.

Reset Alarm

This resets the activation count of the alarm, which is the number of times the alarm has been activated, and sets the current status to "Not Active".

Accessing the Rate and Volume Alarm Setup Submenus

The Rate Alarm submenu and the Volume Alarm submenu are two identical submenus that allow alarm triggering on flow rate values or accumulated volumes for each of the flows in the NOA-332. To access these submenus, do the following:

1. From the Alarm Setup menu, align the pointer with "FlowRate Setup…" or "Flow Vol Setup…" and press ENTER.
2. The display will show either "RATE SETUP" or "VOLUME SETUP" depending upon your choice. In both cases, the menu items shown in Table 9g.4 will be listed.

Table 9g.4—Rate/Volume Alarm Setup Menu Parameters

Parameters	Description	Read/Write Status
FlowID	Rate or Volume flow name	R/W
Enable	Enable (yes or no)	R/W
HH	High high alarm trip point	R/W
High	High alarm trip point	R/W
Low	Low alarm trip point	R/W
LL	Low low alarm trip point	R/W
DB	Deadband	R/W
LoLoAction	Low low alarm action	R/W
HiHiAction	High high alarm action	R/W
Reset Alarm	Resets alarm activity count	W/O

Use the ↑ or ↓ key to align the pointer with the menu item wanted.

Rate/Volume Alarm Parameters

Flow Id (FlowID)

This is the meter identification name of the four flows allowed in the NOA-332. To set alarm parameters for the rate or volume of a particular flow, the user must first select that flow. The default names are Gas Orifice, Gas Turbine, Emulsion Turbine, Free Water Turbine, and Gross Volume Turbine, although the NOA-332 allows these name to be changed by the user. To select the flow to set alarms for, do the following:

1. From the Alarm Setup menu, align the pointer with "FlowRate Setup…" or "Flow Vol Setup…" and press ENTER.
2. Align the pointer with "Meter Id" and press ENTER (enhanced mode display).
3. Press SETUP and use the ↑ key and the ↓ key to select the flow name.
4. Press ENTER to validate your choice.
5. Press ESCAPE to return to the with "FlowRate Setup…" or "Flow Vol Setup…" menu..

Enable

This parameter allows the alarm to enabled or disabled. "Yes" enables the alarm for the selected analog input channel. "No" disables the selected alarm. To set this parameter, do the following:

1. From the Alarm Setup menu, align the pointer with "FlowRate Setup…" or "Flow Vol Setup…" and press ENTER.
2. Align the pointer with "Enable" and press ENTER (enhanced mode display).
3. Press 'SETUP" and use the ↑ or ↓ key to select 'Yes" or "No".
4. Press ENTER to validate your choice.
5. Press ESCAPE to return to the with "FlowRate Setup…" or "Flow Vol Setup…" menu..

HiHi Alarm Setting (HH)

The High High Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a HiHi Alarm is generated. Each time a HiHi alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a HiHi Alarm causes a HiHi Alarm Action. The type of action depends on the HiHi Action parameter. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "FlowRate Setup…" or "Flow Vol Setup…" and press ENTER.
2. Align the pointer with the menu item "HH" and press ENTER.
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the with "FlowRate Setup…" or "Flow Vol Setup…" menu..

High Alarm Setting (High)

This is the High (Warning) Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a High (Warning) Alarm is generated. Each time a High (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. This alarm triggers no action. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "FlowRate Setup…" or "Flow Vol Setup…" and press ENTER.
2. Align the pointer with the menu item "High" and press ENTER.
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the with "FlowRate Setup…" or "Flow Vol Setup…" menu..

Low Alarm Setting (Low)

This is the Low (Warning) Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a Low (Warning) Alarm is generated. Each time a Low (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. This alarm triggers no action. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "FlowRate Setup…" or "Flow Vol Setup…" and press ENTER.
2. Align the pointer with the menu item "Low" and press ENTER.
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the with "FlowRate Setup…" or "Flow Vol Setup…" menu..

Low-Low Alarm Setting (LL)

This is the Low Low Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a LoLo Alarm is generated. Each time a LoLo alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a LoLo Alarm causes a LoLo Alarm Action. The type of action depends on the LoLo Alarm Action parameter. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "FlowRate Setup…" or "Flow Vol Setup…" and press ENTER.
2. Align the pointer with "LL" and press ENTER (enhanced mode display).
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the with "FlowRate Setup…" or "Flow Vol Setup…" menu..

Deadband Alarm Setting (DB)

This is the Alarm Deadband Setting parameter. The deadband value provides variance for the alarm, preventing a value slightly above the high set point or slightly below the low set point from activating the alarm. The alarm will activate when the value is less than the low set point minus the deadband, or greater than the high set point plus the deadband. The alarm will deactivate when the value is higher than the low setpoint plus the deadband or lower than the high setpoint minus the deadband. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the deadband limit, do the following:

1. From the Alarm Setup menu, align the pointer with "FlowRate Setup…" or "Flow Vol Setup…" and press ENTER.
2. Align the pointer with the menu item "DB" and press ENTER.
3. Press SETUP and enter the deadband limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the with "FlowRate Setup…" or "Flow Vol Setup…" menu..

Low-Low Alarm Action (LoLoAction)

This is the Low Low Alarm Action parameter. This action is triggered when a Low Low Alarm is generated. The range of acceptable entries is from 0 to 25. The LoLo action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9g.2 for the alarm action parameters.

Hi-Hi- Alarm Action (HiHiAction)

This is the High High Alarm Action parameter. This action is triggered when a High High Alarm is generated. The range of acceptable entries is from 0 to 25. The HiHi Action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25

causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9g.2 for the alarm action parameters.

Reset Alarm

This resets the activation count of the alarm, which is the number of times the alarm has been activated, and sets the current status to "Not Active".

Accessing the Multivariable Transmitter Input Alarm Setup Submenu

The Multivariable Transmitter Input Alarm Setup submenu allows the user to configure alarms for specific MVT sources.

1. From the Alarm Setup menu, align the pointer with "MVT AI Setup..." and press ENTER.
2. The display will show "MVT AI SETUP" at the top of the display and the menu items shown in Table 9g.5 will be listed.

Table 9g.5—Multivariable Input Alarm Setup Menu Parameters

Parameters	Description	Read/Write Status
MVT ID	MVT Input source #	R/W
Alrm ID	Type of MVT input	R/W
Enable	Enable (yes, no)	R/W
HH	High high alarm trip point	R/W
High	High alarm trip point	R/W
Low	Low alarm trip point	R/W
LL	Low low alarm trip point	R/W
DB	Alarm deadband setting	R/W
LoLo Action	Low low alarm action	R/W
HiHi Action	High high alarm action	R/W
Reset Alarm	Resets alarm activity count	W/O

Use the ↑ or ↓ key to align the pointer with the menu item wanted.

Multivariable Transmitter Input Alarm Parameters

MVT Id

The NOA-332 has 8 Multivariable Transmitter input source channels available. To select which Multivariable Transmitter input source channel to set alarm features for, do the following:

1. From the Alarm Setup menu, align the pointer with "MVT AI Setup…" and press ENTER.
2. Align the pointer with "MVT Id" and press ENTER (enhanced mode display).
3. Press SETUP and enter the MVT source channel number you wish to set alarm limits for.

4. Press ENTER to validate your choice.
5. Press ESCAPE to return to the MVT AI Alarm Setup menu.

Alrm ID

Each MVT source channel has three process parameters associated with it. These are StPres, StTemp, and DiffPr. The parameters are the same for all eight of the MVT Input source channel selections. This menu allows the selection of any of the three items (Alrm IDs) for alarm configuration. These are read-only parameters.

Enable

This parameter allows the alarm to be enabled or disabled. "Yes" enables the alarm for the selected input channel. "No" disables the selected alarm. To set this parameter, do the following:

1. From the Alarm Setup menu, align the pointer with "MVT AI Setup…" and press ENTER.
2. Align the pointer with "Enable" and press ENTER (enhanced mode display).
3. Press SETUP and use the ↑ or ↓ key to select 'Yes" or "No".
4. Press ENTER to validate your choice.
5. Press ESCAPE to return to the MVT AI Setup menu.

HiHi Alarm Setting (HH)

The High High Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a HiHi Alarm is generated. Each time a HiHi alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a HiHi Alarm causes a HiHi Alarm Action. The type of action depends on the HiHi Action parameter. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "MVT AI Setup…" and press ENTER.
2. Align the pointer with the menu item "HH" and press ENTER.
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the MVT AI Setup menu.

High Alarm Setting (High)

This is the High (Warning) Alarm Trip Point parameter. If the monitored parameter rises above this value plus the deadband, a High (Warning) Alarm is generated. Each time a High (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. There is no action triggered by this alarm. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "AI Alarm Setup…" and press ENTER.
2. Align the pointer with the menu item "High" and press ENTER.
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the AI Alarm Setup menu.

Low Alarm Setting (Low)

This is the Low (Warning) Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a Low (Warning) Alarm is generated. Each time a Low (Warning) Alarm is activated or deactivated an entry is recorded in the alarm log. There is no action triggered by this alarm. The range of acceptable entries is from -500 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "MVT AI Setup…" and press ENTER.
2. Align the pointer with the menu item "Low" and press ENTER.
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the MVT AI Setup menu.

Low-Low Alarm Setting (LL)

This is the Low Low Alarm Trip Point parameter. If the monitored parameter falls below this value minus the deadband, a LoLo Alarm is generated. Each time a LoLo alarm is activated or deactivated an entry is recorded in the alarm log. In addition, a LoLo Alarm causes a LoLo Alarm Action. The type of action depends on the LoLo Alarm Action parameter. The range of acceptable entries is from -500 to 10,000 with the default being 0. To set the alarm limit, do the following:

1. From the Alarm Setup menu, align the pointer with "MVT AI Setup…" and press ENTER.
2. Align the pointer with "LL" and press ENTER (enhanced mode display).
3. Press SETUP and enter the alarm limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the MVT AI Setup menu.

Deadband Alarm Setting (DB)

This is the Alarm Deadband Setting parameter. The deadband value provides variance for the alarm, preventing a value slightly above the high set point or slightly below the low set point from activating the alarm. The alarm will activate when the value is less than the low set point minus the deadband, or greater than the high set point plus the deadband. The alarm will deactivate when the value is higher than the low setpoint plus the deadband or lower than the high setpoint minus the deadband. The range of acceptable entries is from 0 to 10,000 with the default being 0. To set the deadband limit, do the following:

1. From the Alarm Setup menu, align the pointer with "MVT AI Setup…" and press ENTER.
2. Align the pointer with the menu item "DB" and press ENTER.
3. Press SETUP and enter the deadband limit.
4. Press ENTER to validate your entry.
5. Press ESCAPE to return to the MVT AI Setup menu.

Low-Low Alarm Action (LoLoAction)

This is the Low Low Alarm Action parameter. This action is triggered when a Low Low Alarm is generated. The range of acceptable entries is from 0 to 25. The LoLo action feature requires that the

optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9g.2 for the alarm action parameters.

Hi-Hi- Alarm Action (HiHiAction)

This is the High High Alarm Action parameter. This action is triggered when a High High Alarm is generated. The range of acceptable entries is from 0 to 25. The HiHi Action feature requires that the optional digital I/O circuit board be installed for actions 1 through 24. Alarm action 25 is an internal alarm action that halts the current test. In the Timed mode and Continuous mode alarm action 25 causes the test to be halted and requires restarting to resume testing. In the Cycled mode alarm action 25 causes the test to be halted as long as the conditions causing the alarm are present. When the alarm conditions clear, testing will resume starting with the well that was current when the alarm became active. See Table 9g.2 for the alarm action parameters.

Reset Alarm

This resets the activation count of the alarm, which is the number of times the alarm has been activated, and sets the current status to “Not Active”.

Section 9h

The Calibration Menu

Introduction

The Calibration menu allows users to calibrate the analog input channels in the NOA-332. The NOA-332 allows three methods of calibrating the analog input channels. The choice of which method to use should be based on the type of transmitter used. This menu also allows the user to view existing calibration points for the analog inputs.

NOTICE: The default Source and Units for the analog input channels for the NOA-332 are per the defaults listed in Appendix A (analog input channels 1 thru 9). Whenever a channel assignment is made for the Aux1, Aux2, or DP Hi inputs or the default channel assignment is reassigned (e.g. RTD use), the name and units must be changed from 'Spare'. See Section 9j of this manual to make this change if necessary.

Appendix A discusses the types of transmitters to be used with the NOA-332. Analog transmitters can be calibrated with a simple two-point linear interpolation, a two-to-five point curve-fit calibration, or an override value for a constant input. The two-point linear interpolation method provides accurate results when the transmitter itself is very linear, which is the case for the Smart type transmitters. For general transmitters where accurate calibration standards are available, the five-point curve-fit calibration provides the best calibration. An override value can be entered in place of a true calibration if a transmitter is temporarily out of service and an estimated constant value can be used. In this case, the calibration data is retained by the NOA-332 and is restored when the override value is no longer necessary. An override value of zero should be entered for unused inputs.

CAUTION: The calibration of the analog inputs consists of entering a process parameter value and a corresponding engineering value. For instance, if calibrating the static pressure input at 100 psig, apply 100 psig to the transmitter and enter "100" as the value of the calibration point. If 98 psig is applied to a transmitter and the user tells the NOA-332 that 100 psig is being applied to the transmitter, the NOA-332 calculations will be inaccurate. It is the responsibility of the user to have accurate standards of measurement for pressure, differential pressure, temperature, and percent watercut.

If the transmitter value exceeds the maximum calibration value for an analog input (e.g. applying 700 psi to a 1000 psi transmitter that has been calibrated from 0 to 600 psi), the NOA-332 will extrapolate beyond the calibrated range of the transmitter. The Transmitter Check feature allows the NOA-332 to compare the measured analog transmitter input with the minimum and maximum calibrated values to verify that the transmitter is operating within it's calibrated range.

NOTE—**This is a write-only security access menu. A level 4 password is required to change the items in the Calibration Menu and its submenus.**

Accessing the Calibration Menu

A listing of this menu is available in Appendix C, page C-13.

1. From the Main Menu, align the pointer with "Config/Setup...", and press ENTER.
2. From the Config/Setup menu, align the pointer with "Calibration..." and press ENTER.
3. The NOA-332 will display the following:

   <1> Lock

   <2> Do Not Lock

   <3> No Volume Calculation

   To select one of the above options, press the number corresponding to the selection. For example, press the number 2 to select "Do Not Lock."

   The correct choice depends upon the activity as follows:

   - Lock - This selection "locks" all analog inputs at their current value and continues volume calculations. This is useful in continuous flow applications where a transmitter is temporarily bypassed for maintenance.
   - Do Not Lock - This selection allows the analog inputs to be read as if in normal operation. Volumes will continue to be calculated based on the transmitter values, which may change during calibration.
   - No Vol Calculation – This selection allows the analog transmitter values to change according to the calibration but the calculated volumes will be disabled until the calibration procedure is complete.
4. The Calibration submenu automatically appears after one of the three selections is made. The display will show "ANALOG CALIB" at the top and analog input channels 3 through 16 will be identified by their names.

   NOTE: Analog input channel 1 is the Voltage Monitor input and is calibrated per instructions in Appendix A and Section 9a of this manual. Analog input channel 2 is the on-board temperature indicator and is not calibrated by the user.

5. Align the pointer next to the analog input channel you wish to calibrate and press ENTER. The top of the display will show the name of the analog input channel and the menu of Table 9h.1 will show the menu items listed:

Table 9h.1—Analog Input Calibration Menu

Parameters	Description
Change Calib…	Submenu to perform calibration
Review Calib…	Submenu to view existing calibration points

Use the ↑ or ↓ key to align the pointer with the menu item wanted.

Change Calibration Routine

This submenu allows the calibration of the analog inputs. The top of the display will show the name of the analog input channel and the menu of Table 9h.2 will show the menu items listed:

Table 9h.2—Analog Input Calibration Menu Parameters

Parameters	Description	Read/Write Status
Multipoint Calibration…	Submenu to perform 1 to 5 point calibration	N/A
Zero/Span Scale Factors…	Submenu to perform zero and span calibration	N/A
Override Value	Constant value assigned to analog input.	R/W
Calibration Check	Check validity of the current calibration of the selected analog input	R/W
Transmitter Fail Check Enable	Enable (or disable) check of analog input to verify operation within its calibrated range	R/W

Use the ↑ or ↓ key to align the pointer with the menu item wanted.

Analog Input Multipoint Calibration Routine

The multipoint calibration procedure provides for the most reliable, accurate method of calibrating the analog transmitter inputs for the NOA-332. The NOA-332 allows entry of up to five calibration points in any order; calibration points can be entered in ascending, descending, or alternating order. The NOA-332 takes the user input and relates it to the measured value to form an equation used to calculate future values for any applied input.

Hint—For best results during calibration, calibrate five points with the maximum input first, followed by the four remaining values. The choice of points should correspond with the actual use of the transmitter. This will help to minimize hysteresis effects associated with some transmitters and ensure the highest possible accuracy in the measurement.

The multipoint calibration procedure is as follows:

1. Starting with the Analog Calibration menu, align the pointer with the analog input channel to be calibrated and press ENTER.
2. Select "Change Calib…" and press ENTER.
3. Use the ↑ or ↓ keys to align the pointer with the menu item "Multi Pnt Calib…" and press ENTER.
4. Press SETUP and enter the number of points (1 to 5) to be calibrated.
5. Press ENTER to validate your entry.

The NOA-332 now begins the calibration process. Each calibration point will require application of a measured process parameter (pressure, temperature, differential pressure, etc.) to the transmitter and entry of the value of the applied input. The display will show the value of the calibration point for the previous calibration and a stabilization indicator on the bottom of the display to provide notification of when to press ENTER to accept the calibration point.

6. Type the value associated with the applied input.

   The stabilization bar first displays the message “Stabilizing Input!”. When the input begins to stabilize, an indicator bar will be displayed across the bottom of the LCD. When the bottom line of the display shows the message “Input Stable!,” press ENTER to accept the calibration point.

7. If additional calibration points are required, the NOA-332 will prompt you to enter the next calibration point with a new stabilization bar.

8. Steps 6 and 7 repeat until all calibration points are entered based on step 4.

   When the last calibration point is entered, the NOA-332 will display the message “Accept data points...<Escape> = Cancel...<Enter> = Continue.” If the calibration points have all been entered properly, press ENTER to accept the calibration. If a mistake was made at any point in the calibration process, press ESCAPE to cancel the calibration. The NOA-332 will display the Analog Calibration menu allowing the user to repeat steps 1 through 8 above.

Example: Analog Transmitter Multipoint Calibration

Configure a static pressure input (analog input #7) for use with a transmitter that has a range of 0 to 1,000 psig. The users process actually operates between 250 and 650 psig. Therefore, use the multipoint calibration method with five calibration points: 0, 250, 450, 650, and 1,000 psig.

1. From the Main Menu, align the pointer with "Config/Setup..." and press ENTER.
2. Align the pointer with "Calibration..." and press ENTER. The NOA-332 will request selection of "Lock", "Do not lock", or "No Vol Calc."

Important—It is recommended that either "Lock" or "No Vol Calc." is selected, since selecting "Do not lock" will corrupt the calculated volume.

3. The Analog Calibration menu will appear on the display. Align the pointer with "07-Gas Pressure" and press ENTER.
4. Align the pointer with "Change Calib…" and press ENTER.
5. Align the pointer with "Multi Pnt Calib…" and press ENTER to display the current number of calibration points in enhanced mode.
6. Press SETUP to change the number of calibration points.
7. Type "5" and press ENTER. The NOA-332 will ask for entry of the first calibration point.
8. Apply 1000 psig to the static pressure transmitter. When the LCD displays the message "Input Stable!" on the bottom line, type "1000" for the value and press ENTER. The NOA-332 will ask for entry of the second calibration point.
9. Vent the static pressure transmitter so that its output is for 0 psig. When the LCD displays the message "Input Stable!" on the bottom line, type "0" for the value and press ENTER. The NOA-332 will ask for entry of the third calibration point.
10. Apply 250 psig to the static pressure transmitter. When the LCD displays the message "Input Stable!" on the bottom line, type "250" for the value and press ENTER. The NOA-332 will ask for entry of the fourth calibration point.
11. Apply 450 psig to the static pressure transmitter. When the LCD displays the message "Input Stable!" on the bottom line, type "500" for the value and press ENTER. The NOA-332 will ask for entry of the fifth calibration point.
12. Apply 650 psig to the static pressure transmitter. When the LCD displays the message "Input Stable!" on the bottom line, type "750" for the value and press ENTER. The NOA-332 will display the message "Accept data points...<Escape> = Cancel...<Enter> = Continue." If the calibration points have all been entered properly, press ENTER to accept the calibration. If a mistake was made at any point in the calibration process, press ESCAPE to cancel the calibration and retry. The NOA-332 will display the Analog Calibration menu. Press ESCAPE three times to return to the Main Menu.

Analog Input Zero/Span Scale Routine

The zero/span scale calibration is a two point "electronic" calibration of the analog input channel. By simulating the current or voltage signal that the transmitter produces at zero and full scale, a "bench" calibration can be performed without having the NOA-332 on-site or flowing process fluids. The zero and span parameters form a line, shown in Figure 9h.1, that is used to determine the process parameter value at various values of input current or voltage. The zero/span scale calibration method is specifically for the configuration of transmitters with 4 to 20 mA (or 1 to 5 volts) outputs. The success of this method depends upon the accuracy of the transmitter itself. Therefore, it is recommended that this method be used with "Smart" type transmitters where non-linearity is compensated for within the transmitter. These transmitters are often very linear and typically are factory calibrated to a higher degree of accuracy than can be attained under field conditions.

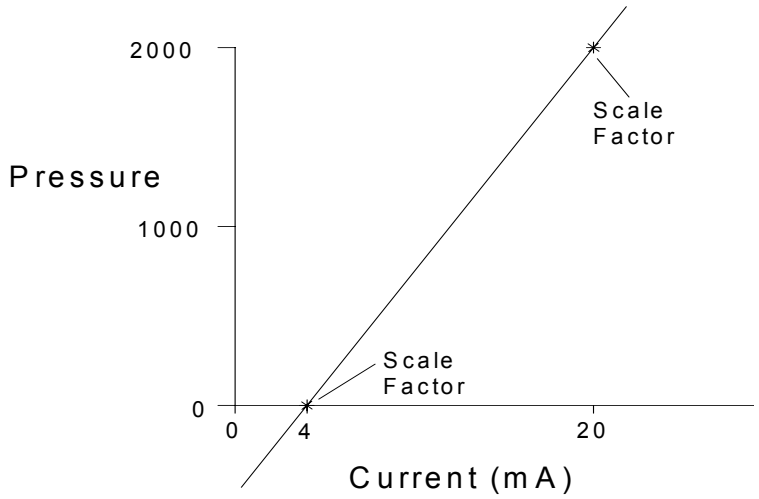


Figure 9h.1—Illustration of the zero/span scale's linear interpolation

The zero/span calibration procedure is as follows:

1. Starting with the Analog Calibration menu, align the pointer with the analog input channel to be calibrated and press ENTER.
2. Select "Change Calib…" and press ENTER.
3. Use the ↑ or ↓ keys to align the pointer with the menu item "Zero/Span Scale…" and press ENTER. The name of the analog input selected will show at the top of the display.
4. The zero value and span value will be shown on the display. Align the pointer with "Zero" and press ENTER (enhanced mode display)
5. Press SETUP to change the zero value.
6. Enter the process value for 4 mA or 1 volt (e.g. 0 psig) press ENTER.
7. Press the ↓ key to align the pointer with "Span."

8. Press SETUP to change the span value.
9. Type the process parameter value for 20 mA or 5 volts (e.g. 1000 psig) and press ENTER.
10. Press ESCAPE to return to the Analog Input Calibration menu.

Example: Zero/Span Scale Calibration

To configure the static pressure input (analog channel #7) for use with a range of 0 to 300 psig using the zero/span calibration method, perform the following procedure:

1. From the Main Menu, align the pointer with "Config/Setup..." and press ENTER.
2. Align the pointer with "Calibration..." and press ENTER. The NOA-332 will request selection of "Lock," "Do not lock," or "No Vol Calc."
3. Press "3" to discontinue totalizing. The Analog Calibration menu will appear on the display.
4. Align the pointer with "07-Gas Pressure " and press ENTER.
5. Align the pointer with "Change Calib…" and press ENTER.
6. Align the pointer with "Zero/Span Scale..." and press ENTER.
7. Align the pointer with "Zero" and press ENTER to display the current zero value in enhanced mode.
8. Press SETUP to change the zero value.
9. Type '0' and press ENTER.
10. Press the ↓ key once to display the current span value in enhanced mode.
11. Press SETUP to change the span value.
12. Type "300" and press ENTER.
13. Press ESCAPE five times to return to the Main Menu.

Transmitter Override Value

The transmitter override value is used to simulate a fixed input value while performing maintenance on a transmitter without affecting volume calculations or in cases where for diagnostic purposes the analog input channel needs to be set to a constant value. It is also used to force an unused input to zero. When a non-zero number is entered for the transmitter override parameter, this value overrides the existing calibration points. However, entering a zero for the transmitter override value restores the use of the existing calibration points. Therefore, to force an unused input to zero, enter the value of 0.0001. To enter a constant value for an analog input, use the following procedure:

1. Starting with the Analog Calibration menu, align the pointer with the analog input channel to be calibrated and press ENTER.
2. Select "Change Calib…" and press ENTER.
3. Use the ↑ or ↓ keys to align the pointer with the menu item "Overrd" and press ENTER to display the override value in enhanced mode.
4. Press SETUP to change the override value.
5. Enter the override value and press ENTER.

6. Press ESCAPE twice to return to the Calibration menu.

Example: Entering a Transmitter Override Value

To enter a constant gas temperature of 130°F, use the following procedure:

1. From the Main Menu, align the pointer with "Config/Setup..." and press ENTER.
2. Align the pointer with "Calibration..." and press ENTER. The NOA-332 will request selection of "Lock", "Do not lock", or "No Vol Calc."
3. Press "2" to select "Do not lock." The Calibration menu will appear on the display.
4. Align the pointer with "08-Gas Temperature" and press ENTER.
5. Align the pointer with "Change Calib…" and press ENTER.
6. Align the pointer with "Overrd" and press ENTER to display the gas temperature override value in enhanced mode.
7. Press SETUP to change the gas temperature override value.
8. Type "130" and press ENTER.
9. Press ESCAPE four times to return to the Main Menu.

Analog Input Calibration Checkpoint Routine

The calibration check feature allows an operator to check the validity of the calibration for a selected analog input for one to five points. The procedure for performing a calibration check is similar to the multipoint calibration; the number of checkpoints must be entered and each checkpoint requires a process input applied to the transmitter.

For each calibration checkpoint, an entry is placed into the Event Data Log with the measured value of the applied input, as determined by the NOA-332, and the value entered by the operator denoting the actual value of the applied input. For example, if the static pressure transmitter calibration is checked by applying exactly 1000 psig to the transmitter, the NOA-332 might determine the value to be 992 psig. The Event Data Log would have an entry stating that the static pressure transmitter input calibration was checked and read 992 psig, but should have read 1000 psig. It is essential that the user have accurate standards of measurement for pressure, differential pressure, temperature, and percent watercut when applying these parameters to the field transmitters.

The calibration check routine is useful for verifying that the NOA-332 is calibrated correctly. The calibration check procedure is as follows:

1. From the Analog Input Calibration menu, align the pointer with "Check" and press ENTER to display the number of calibration checkpoints in enhanced mode.
2. Type the maximum number of checkpoints (1 to 5) you will record and press ENTER.

   The NOA-332 now begins the calibration check. Each calibration checkpoint will require application of pressure (temperature, differential pressure, etc.) and entry of the value of the applied input. The display will show the measured value of the applied input, as determined by the NOA-332 , on the bottom of the display.

Note—If you enter "5," you don't have to actually record five checkpoints. To complete the calibration check without checking all points, press ESCAPE when the NOA-332 asks for the next point.

3. When the value displayed on the bottom line of the LCD is stable, type the value of the applied input ENTER.

   If additional calibration checkpoints are required, the NOA-332 will ask for the next calibration checkpoint.

4. Repeat Steps 3 and 4 until all calibration checkpoints are entered.

When the last calibration checkpoint is entered, the NOA-332 will display the message "Calibration check has been completed...Press any key." Press any key. The NOA-332 will display the Analog Input Calibration Procedure menu.

Example: Performing a Calibration Check

To check the validity of the static pressure transmitter calibration using 4 points at 0 psig, 250 psig, 400 psig, and 1200 psig, use the following procedure:

1. From the Main Menu, align the pointer with "Config/Setup..." and press ENTER.
2. Align the pointer with "Calibration..." and press ENTER. The NOA-332 will request selection of "Lock," "Do not lock," or "No Vol Calc."

Important—Select either "Lock" or "No Vol Calc." Selecting "Do not lock" will corrupt the calculated volume.

3. The Analog Calibration menu will appear on the display.
4. Align the pointer with "07-Gas Pressure " and press ENTER.
5. Align the pointer with "Change Calib…" and press ENTER.
6. Align the pointer with "Check" and press ENTER to display the current number of calibration checkpoints in enhanced mode.
7. Press SETUP to enter the number of calibration checkpoints.
8. Type "4" and press ENTER. The NOA-332 will ask for entry of the first calibration checkpoint.
9. Vent the static pressure transmitter so that its output is for 0 psig. The NOA-332 displays the measured value on the bottom line of the LCD.
10. When the measured value is stable, type "0" and press ENTER to enter the checkpoint into the Event Data Log. The NOA-332 will ask for entry of the second calibration checkpoint.
11. Apply 250 psig to the static pressure transmitter. The NOA-332 will display the measured value on the bottom line of the LCD.
12. When the measured value is stable, type "250" and press ENTER to enter the checkpoint into the Event Data Log. The NOA-332 will ask for entry of the third calibration checkpoint.
13. Apply 400 psig to the static pressure transmitter. The NOA-332 will display the measured value on the bottom line of the LCD.
14. When the measured value is stable, type "400" and press ENTER to enter the checkpoint into the Event Data Log. The NOA-332 will ask for entry of the fourth calibration checkpoint.
15. Apply 1,200 psig to the static pressure transmitter. The NOA-332 will display the measured value on the bottom line of the LCD.
16. When the measured value is stable, type "1200" and press ENTER to enter the checkpoint into the Event Data Log. The NOA-332 will display the message "Calibration check has been completed...Press any key."
17. Press any key to return to the Analog Input Calibration menu.
18. Press ESCAPE three times to return to the Main Menu.

Transmitter Check Enable/Disable

The transmitter check allows the operator to enable or disable the "Transmitter out of calibrated range" check within the NOA-332 . Each calibration of an analog input provides a minimum calibrated value and a maximum calibrated value. The NOA-332 has the capability of comparing the measured analog transmitter input with the minimum and maximum calibrated values to verify the transmitter is operating within it's calibrated range.

Measurements outside the calibrated range of a transmitter cannot be verified for accuracy, since the NOA-332 has no means of extrapolating outside the calibrated limits. If a measurement falls outside the calibrated range, an entry is entered into the Event Data Log, providing notification of a possible invalid measurement. When the measured input is back within the calibrated limits, a second entry is entered into the Event Data Log, providing notification of return to valid measurement.

This feature should be disabled when using in-line calibration of transmitters. For example, if calibration equipment is not available, the static pressure transmitter input can be calibrated using two points by venting the transmitter for 0 psig and using the operating pressure for a second calibration point. The transmitter check should be disabled, since the operating pressure can rise above the calibrated maximum and fall back within the calibrated range many times during normal operation. This would fill the Event Data Log with several entries for "Out of Calibrated Range" and "Back in Calibrated Range."

Note—The NOA-332 incorporates a built-in deadband to minimize much of this, but the best practice is to disable the transmitter check feature when using in-line calibration.

Use the following procedure to enable (or disable) the transmitter check feature:

1. From the Analog Input Calibration menu, align the pointer with "XdcrChk" and press ENTER to display the current status of the transmitter check feature in enhanced mode.
2. Using the ↑ or ↓ key, select "Enable" or "Disable" and press ENTER.
3. Press ESCAPE twice to return to the Analog Input Calibration menu.

Review Calibration Routine

This submenu allows the display of existing calibration points for all of the analog inputs. If when performing the above calibration methods the NOA-332 determines that the data points are not valid (e.g. duplicate raw counts for two different engineering unit values), the NOA-332 will ignore the calibration. This menu allows the user to review the calibration points existing in memory and verify that the calibration is valid by showing the real-time engineering unit value based on the selected analog input. The top of the display will show the name of the selected analog input channel and the menu of Table 9h.3 will show the menu items listed:

Table 9h.3—Review of Analog Input Calibration Points

Parameters	Description	Read/Write Status
Cur EU	Current engineering unit reading of the selected input channel.	R/O
# Pnts	Number of calibration points (1 to 5) for the selected analog input.	R/O
Raw # 1	Number of raw counts for point # 1.	R/O
EU # 1	Engineering Unit value for point # 1.	R/O
Raw # 2	Number of raw counts for point # 2.	R/O
EU # 2	Engineering Unit value for point # 2.	R/O
Raw # 3	Number of raw counts for point # 3.	R/O
EU # 3	Engineering Unit value for point # 3.	R/O
Raw # 4	Number of raw counts for point # 4.	R/O
EU # 4	Engineering Unit value for point # 4.	R/O
Raw # 5	Number of raw counts for point # 5.	R/O
EU # 5	Engineering Unit value for point # 5.	R/O

The above table items are viewed by using the ↑ or ↓ key to scroll the display as needed.

Current Engineering Unit Value (Cur EU)

The Current Engineering Unit value is a display of the calculated value of the selected analog input channel. Depending upon the input selected, this value would be pressure, temperature, etc.

Number of Calibration Points (# Pnts)

The Number of Calibration Points is a display of the number of calibration points entered for the selected analog input channel. The number of points can vary between 1 to 5.

Number of Raw Counts for Calibration Points (Raw # 1 thru # 5)

Each calibration point is associated with an internal bit count that varies from 0 to 4095 (12 Bits).

Engineering Unit Value for Calibration Points (EU # 1 thru # 5)

Each calibration point is associated with an engineering unit value. This value varies from 0 to 9000 and represents pressure, temperature, etc.

Section 9i

The Communications Setup Menu

Introduction

Three communications ports are available in the NOA-332:

- Comm 1—RS-232
- Comm 2—RS-232 DTE / RS-485
- Comm 3—RS-485

The Comm Ports Setup menu allows you to set up the communications parameters for the three communications ports. A listing of this menu is available in Appendix C, page C-15. The wiring of the Comm ports can be found in Appendix A.

NOTE**—A level 2 or higher password authorization is required to view the items in the Communications Setup Menu and its submenus. A level 4 password is required to change the items in the Communications Setup Menu and its submenus.**

Accessing the Comm Ports Setup Menu

1. From the Main Menu, align the pointer with “Config/setup....”
2. Press ENTER.
3. Align the pointer with “Comm Setup...” and press ENTER.
4. The display will show “COMM PORT SETUP” at the top of the display and the following menu items will appear:
   - COM1 (Local)…
   - COM2 (Remote)…
   - COM3 (Local)…
5. Align the pointer with the communications port you wish to configure and press ENTER. The menu items shown in Table 9i.1 will be listed.

Table 9i.1—Comm Parameters Menu

Parameters	Description	Read/Write Status
Modem Comm...	Modem option control submenu	N/A
Rate	Baud rate	R/W
Parity	Parity	R/W
Data	Number of data bits	R/W
Stop	Number of stop bits	R/W
Radio	Identification number, link ID	R/W
Prot	Protocol	R/W
Oper	Mode of operation	R/W
Xmt	Transmitter mode	R/W
Rcvr	Receiver mode	R/W
Reset Rcvr	Reset receiver	R/W
Reset Transmitter	Reset transmitter	R/W
Pre	Push-to-talk (PTT) pre-transmission delay	R/W
Post	PTT post-transmission delay	R/W
Timeout	Transmission timeout	R/W

Use the ↑ or ↓ key to align the pointer with the menu item wanted.

Communications Parameters

Modem Connection Submenu

The modem communications option is <u>not</u> currently offered on the NOA-332.

Rate

The communications data rate as defined in baud (Bd) or bits per second of information. The baud rates available are 1200, 2400, 4800, 9600, and 19200. To set the baud rate, do the following:

1. After selecting a communications port to configure, align the pointer with “Rate” and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key until the correct baud setting appears.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Com Parameters menu.

Parity

The “Parity” parameter is a bit added to communications bytes to provide error detection. The parity bit selections available are “None”, “Odd”, and “Even”. To set the parity, do the following:

1. After selecting a communications port to configure, align the pointer with “Parity” and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key until the correct parity setting appears.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Com Parameters menu.

Data

The “Data” parameter is the number of bits assigned to each data byte. The data bit selections are 7 bits and 8 bits. To set the data bits, do the following:

1. After selecting a communications port to configure, align the pointer with “Data” and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key until the correct data setting appears.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Com Parameters menu.

Stop

The “Stop” parameter is the number of stop bits that are used to frame the end of each data byte. The stop bit selections are 1 bit, 1.5 bits, and 2 bits. To set the stop bits, do the following:

1. After selecting a communications port to configure, align the pointer with “Stop” and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key until the correct stop bit setting appears.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Com Parameters menu.

Radio Link ID

The radio link ID parameter permits you to establish a specific identification number for the NOA-332 for use in radio transmitting and receiving. A radio ID number between 000 and 255 can be selected. This parameter requires numeric keypad entry. To set the radio identification number, do the following:

1. After selecting a communications port to configure, align the pointer with “Rate” and press ENTER (enhanced mode display).
2. Press SETUP and enter the identification number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Com Parameters menu.

Communications Protocol

The communications protocol parameter allows you to select one of three methods of controlling the orderly transfer of information between the NOA-332 and another device. The protocols available are Modbus-AEG, Modbus-Alt, and RNIM.

Modbus-AEG follows the IEEE four-byte format for floating point data (mantissa / exponent). Some manufacturers reverse this data format (exponent / mantissa) and the Modbus-Alt protocol accommodates systems that utilize this ordering. Square D supports the RNIM protocol. All three protocols are in binary data format. To set the protocol, do the following:

1. After selecting a communications port to configure, align the pointer with “Prot” and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key until the correct protocol setting appears.

3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Com Parameters menu.

Communications Operations

The communications operations parameter offers two choices of operation:

- The “Full Duplex” parameter allows simultaneous two-way communications.
- The “Half Duplex” parameter allows two-way communications, but communicates in only one direction at a time. To set the operation parameter, do the following:

1. After selecting a communications port to configure, align the pointer with “Oper” and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key until the correct setting appears.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Com Parameters menu.

Transmitter Status

The Transmitter Status parameter disables or enables the transmission function. To change the status, do the following:

1. After selecting a communications port to configure, align the pointer with “Xmit” and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key until the correct setting appears.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Com Parameters menu.

Receiver Status

The Receiver Status menu disables or enables the receiving function. To change the status, do the following:

1. After selecting a communications port to configure, align the pointer with “Rcvr” and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key until the correct setting appears.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Com Parameters menu.

Reset Receiver

The “Reset Receiver” feature allows you to reset the receiver. To reset the receiver, press ENTER.

Reset Transmitter

The “Reset Transmitter” feature allows you to reset the transmitter. To reset the transmitter, press ENTER.

Pre-Transmission Delay

The pretransmission delay parameter provides for radio SETUP time in push-to-talk (PTT) communication systems. The transmitter will activate the PTT mechanism, wait for the pre-transmission delay period, and then begin the transmission of the message. The length of the delay may be set from 0 to 5000 milliseconds. To set the pre-delay, do the following:

1. After selecting a communications port to configure, align the pointer with “Pre” and press ENTER (enhanced mode display).
2. Press SETUP and enter the delay value.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Com Parameters menu.

Post-Transmission Delay

The post-transmission delay parameter is similar to the pretransmission delay except that the transmitter keeps the PTT mechanism activated for the post-transmission delay period after the message is transmitted. The length of the delay may be set from 0 to 5000 milliseconds. To set the post-delay, do the following:

1. After selecting a communications port to configure, align the pointer with “Post” and press ENTER (enhanced mode display).
2. Press SETUP and enter the delay value.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Com Parameters menu.

Security Timeout

The security timeout allows you to set the amount of time that elapses before the NOA-332 automatically cancels the security code entry for the communication port. This feature is currently disabled.

Notes

Section 9j

The I/O Config Menu

Introduction

The I/O Configuration menu is used to assign labels for the analog input channels, optional digital input channels, and the optional digital output channels. Each of these are configured in separate submenus. Through these submenus the user can assign different names to the inputs or outputs and change the units label for the analog input channels.

The digital inputs and digital outputs are optional features and require a Digital I/O Board assembly to be installed in the NOA-332. If this circuit board is not installed, the user should not configure these features. A listing of this menu is available in Appendix C, page C-16.

NOTE—**A level 2 or higher password authorization is required to view the items in the I/O Configuration Menu and its submenus. A level 4 password is required to change the items in the I/O Configuration Menu and its submenus.**

Accessing the I/O Configuration Menu

1. From the Main Menu, align the pointer with "Config/Setup...." and press ENTER
2. Align the pointer with "I/O Config..." and press ENTER.
3. The top of the display will show "I/O CONFIG".
4. Use the ↑ or ↓ key to align the pointer with the wanted submenu (Analog Input, Digital Input, or Digital Output) and press ENTER.
5. Depending upon your choice, one of the three submenus listed below will appear. Refer to the appropriate submenu below for instructions.

The Analog Input Menu

The NOA-332 has 16 analog input channels which may be configured with a source name and engineering units label. The list of available names and units contained within the NOA-332 are accessible through the Analog Configuration menu. The NOA-332 comes with the default configuration shown in Table 9j.2 below.

Accessing the Analog Configuration Menu

1. From the I/O Config menu, align the pointer with "Analog Input…" and press ENTER
2. The top of the display will show "ANALOG CONFIG" and the menu items of Table 9j.1 will appear:

Table 9j.1—Analog Configuration Menu

Parameters	Description	Read/Write Status
Enter AI#	The analog input channel number	R/W
Source	The analog channel source name	R/W
Units	The analog channel engineering units	R/W

Use the ↑ or ↓ key to align the pointer with the menu item wanted.

Analog Input Number (Enter AI#)

The analog input channel number ranges from 1 to 16, but the NOA-332 default configuration does not use all of these inputs as described in Appendix A. Each analog input channel corresponds to specific terminals on the analog board as shown in Appendix A. To select an analog input channel to change the source name or engineering units label, do the following:

1. Starting with the Analog Configuration menu, align the pointer with "Enter AI#" and press ENTER (enhanced mode display).
2. Press SETUP and enter the analog input channel number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Analog Configuration menu.

Source

A name is assigned to each analog input channel. This name is indicative of the type of device connected to the analog input channel. Because of the two modes of the display, a long name and short name are linked to the analog input channel and these are displayed together under the Source menu item. Additionally, any analog input channel that is not being used should be set to the name "SPARE" and the channel set to an override value of 0.0001.

To select a source name for an analog input channel, do the following:

1. After selecting the appropriate analog input channel number, starting with the Analog Configuration menu, align the pointer with "Source" and press ENTER (enhanced mode display). The long name will appear.
2. Press SETUP and use the ↑ or ↓ key to choose the desired source name.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Analog Configuration menu. The long source name will appear with the short version directly under it in parentheses.

The following source names are preprogrammed into the NOA-332 and may be selected:

Long Name	(Short Name)	Long Name	(Short Name)
Spare Analog	Spr AI	Watercut	Wtrcut
Spare AI02	spr 02	Tubing Pres 2	TubPr2
Spare AI03	spr 03	Flow Pres 2	FlPrs2
Spare AI04	spr 04	Flow Temp 2	FlTmp2
Spare AI05	spr 05	Hydraulic Pres	HydPrs
Spare AI06	spr 06	Annulus Pres	Annuls
Tubing Pressure	Tubing	Wellhead Pres	Whead
System Power	SysPwr	Wellhead Temp	WhTemp
Board Temperature	BrdTmp	Tubing Temp	TbTemp
Gas Pressure	GasPrs	Tubing Temp 2	TbTmp2
Gas Temp	GasTmp	Diff Pres 1	DP #1
Static Pressure	StPres	Flow Pres1	FlPrs1
Diff Pressure	DiffPr	Flow Temp 1	FlTmp1
Emul Pressure	EmulPr	Water Cut	WtrCut
Emulsion Temp	EmulTm	Gas Flow Rate	FlRate
Casing Pressure	Casing	Gas Volume	GasVol
Gas Supply Pres	GasSup	Static Pres 1	StPrs1
		Static Pres 2	StPrs2

Units

Engineering units labels corresponding to the source name are assigned to each analog input. The NOA does not alter it's calculations based on these selections; the units selection is only a label. Additionally, any analog input greater than channel 8 that is active must not use the label "SPARE" or the system will not allow that channel to be calibrated.

To select the units for an analog input channel, do the following:

1. After selecting the appropriate analog input channel number, starting with the Analog Configuration menu, align the pointer with "Units" and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key to choose the desired units.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Analog Configuration menu.

The following units are preprogrammed into the NOA-332 and may be selected:

- PSIG
- Deg C
- Deg F
- In H2O
- Ohm
- Volts
- MCFD
- MCF
- BPD
- Bbl
- 1/64th
- %
- CFD
- CF
- Spare

Default Source and Units for Analog Input Channels

The default Source and Units for the analog input channels for the NOA-332 are shown below in Table 9j.2 . Whenever a channel assignment is made for the Aux1, Aux2, or DP Hi Stacked inputs or the default channel assignment is changed, the name and units must be changed from "Spare" before the channel can be calibrated. Note that the RTD inputs are analog channels 15 and 16 (not defaulted). Appendix A of this manual will list the defaults assuming that Aux 1, Aux 2, and DP Hi Stacked inputs are active.

Table 9j.2—Default Configuration Analog Input Channels

Analog Input Channel #	Analog Source Name	Units
1	System Power (SysPwr)	Volts
2	Board Temperature (BrdTmp)	Deg F
3	Watercut (Wtrcut)	%
4	Emul Pressure (EmulPr)	PSIG
5	Emulsion Temp (EmulTm)	Deg F
6	Diff Pressure (DiffPr)	In H2O
7	Gas Pressure (GasPr)	PSIG
8	Gas Temperature (GasTmp)	Deg F
9	Spare Analog (Spr AI)	
10	Spare Analog (Spr AI)	
11	Spare Analog (Spr AI)	
12	Spare Analog (Spr AI)	
13	Spare Analog (Spr AI)	
14	Spare Analog (Spr AI)	
15	Spare Analog (Spr AI)	
16	Spare Analog (Spr AI)	

The Digital Input Menu

The digital input submenu is for use with NOA-332 units supplied with the optional Digital I/O Board. A maximum of 8 discrete switch inputs are available with the optional Digital I/O Board. Each of the digital inputs can be assigned a source name. The list of available names are contained within the NOA-332 and accessible through the Digital Input Configuration menu. See Section 9g of this manual for instructions on how to configure the digital inputs as alarms.

Accessing the Digital Input Configuration Menu

1. From the I/O Config menu, align the pointer with "Digital Input…" and press ENTER
2. The top of the display will show "DI CONFIG" and the menu items of Table 9j.3 will appear:

Table 9j.3—Digital Input Configuration Menu

Parameters	Description	Read/Write Status
Enter DI#	The digital input channel number	R/W
Source	The digital input channel source name	R/W

Use the ↑ or ↓ key to align the pointer with the menu item wanted.

Digital Input Number (Enter DI#)

The digital input channel number ranges from 1 to 8. Each digital input channel corresponds to specific terminals on the Digital I/O Board. To select a digital input channel to change the source name, do the following:

1. Starting with the DI Configuration menu, align the pointer with "Enter DI#" and press ENTER (enhanced mode display).
2. Press SETUP and enter the channel number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the DI Configuration menu.

Source

A name is assigned to each digital input channel. This name is indicative of the type of device connected to the digital input channel. To select a source name for a digital input channel, do the following:

1. After selecting the wanted digital input channel number, starting with the DI Configuration menu, align the pointer with "Source" and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key to choose the desired source name.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the DI Configuration menu.

The following source names are preprogrammed into the NOA-332 and may be selected:

Spare DI01	SSV Switch
Spare DI02	SSSV Hydr Relay
Spare DI03	SSV 2 Switch
Spare DI04	Gas Pres High
Spare DI05	Gas Supply High
Spare DI06	ESD Status Input
Door Switch	Spare Input

The Digital Output Menu

The digital output submenu is for use with NOA-332 units supplied with the optional Digital I/O Board. A maximum of 8 discrete outputs are available with the optional Digital I/O Board. Each of the digital outputs are assigned a source name. The list of available names are contained within the NOA-332 and accessible through the Digital Output Configuration menu. See Section 9g of this manual for instructions on how to configure the digital outputs as alarms actions.

Accessing the Digital Output Configuration Menu

1. From the I/O Config menu, align the pointer with "Digital Output…" and press ENTER
2. The top of the display will show "DO CONFIG" and the menu items of Table 9j.4 will appear:

Table 9j.4—Digital Output Configuration Menu

Parameters	Description	Read/Write Status
Enter DO#	The digital output channel number	R/W
Source	The digital output channel source name	R/W

Use the ↑ or ↓ key to align the pointer with the menu item wanted.

Digital Output Number (Enter DO#)

The digital output channel number ranges from 1 to 8. Each digital output channel corresponds to specific terminals on the Digital I/O Board. To select a digital output channel to change the source name, do the following:

1. Starting with the DO Configuration menu, align the pointer with "Enter DO#" and press ENTER (enhanced mode display).
2. Press SETUP and enter the channel number.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the DO Configuration menu.

Source

A name is assigned to each digital output channel. This name is indicative of the type of device connected to the digital output channel. To select a source name for a digital output channel, do the following:

1. After selecting the wanted digital output channel number, starting with the DO Configuration menu, align the pointer with "Source" and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key to choose the desired source name.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the DO Configuration menu.

The following source names are preprogrammed into the NOA-332 and may be selected:

Spare DO01
Spare DO02
Spare DO03
Spare DO04
Spare DO05
Spare DO06
Open Choke
Close Choke
ESD Solenoid
Open SSV
Open SSSV
Open Wing Valve
Open Main Valve
Spare Output
Spare Output
Spare Output
Spare Output

Section 9k

The Pulse Output Menu

Introduction

The Pulse Output menu is used to configure the digital outputs as volumetric pulse outputs where the user assigns a source name, sets the pulse width (amount of "on" time), and sets the volume needed to initiate a pulse. The pulse output is an optional feature and requires a Digital I/O Board assembly to be installed in the NOA-332. If this circuit board is not installed, the user should not configure the pulse output feature. A listing of this menu is available in Appendix C, page C-16.

NOTE—**A level 2 or higher password authorization is required to view the items in the Pulse Output Menu. A level 4 password is required to change the items in the Pulse Output Menu.**

Accessing the Pulse Output Menu

1. From the Main Menu, align the pointer with "Config/Setup...." and press ENTER
2. Align the pointer with "Pulse Output..." and press ENTER.
3. The top of the display will show "PULSE OUTPUT". The top of the display will show "PULSE OUTPUT" and the menu items of Table 9k.1 will appear:

Table 9k.1—Pulse Output Menu

Parameters	Description	Read/Write Status
Select DO#	The digital output channel number	R/W
Source	The digital output channel source name	R/W
PulseWidth	The amount of time the output is active	R/W
Volm/Pulse	The volume each pulse represents	R/W
PulseCount	Zeros the accumulated number of pulses	W/O

Use the ↑ or ↓ key to align the pointer with the menu item wanted.

Digital Output Number (Select DO#)

The digital output channel number ranges from 1 to 8. Each digital output channel corresponds to specific terminals on the Digital I/O Board. To select a digital output channel to change the source name, do the following:

1. Starting with the Pulse Output menu, align the pointer with "Select DO#" and press ENTER (enhanced mode display).
2. Press SETUP and enter the channel number.

3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Pulse Output menu.

Source

A name is assigned to each digital output channel being used for pulse output. Since the pulse output is tied to volume, flow names are used to indicate that the digital output channel is being used as a pulse output function. To select a source name for a digital output channel, do the following:

1. After selecting the wanted digital output channel number, starting with the Pulse Output menu, align the pointer with "Source" and press ENTER (enhanced mode display).
2. Press SETUP and use the ↑ or ↓ key to choose the desired source name.
3. Press ENTER to validate your choice.
4. Press ESCAPE to return to the Pulse Output menu.

The following source names are preprogrammed into the NOA-332 and may be selected:

None
Gas Meter
Emul turb
Water Turb
Gross Vol
Net Oil
Net Water
Total Water

Pulse Width

The pulse width parameter defines the amount of "on-time" for the digital output. The range of acceptable entries is from 0.1 to 9.0 seconds. Setting this parameter to 0 will disable the pulse output feature. To set the pulse width parameter, do the following:

1. After selecting the wanted digital output channel number, starting with the Pulse Output menu, align the pointer with "Pulsewidth" and press ENTER (enhanced mode display).
2. Press SETUP and enter the pulse width value in seconds.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Pulse Output menu.

Volume per Pulse (Volm/Pulse)

The volume per pulse parameter defines the amount of flow volume that needs to accumulate before activating a digital output channel. The range of acceptable entries is from 0.001 to 5000 with the units being equal to the flow volume units. This allows the pulse output to represent a fraction of the volume (e.g. gas volume in MCF, pulse output in SCF).

CAUTION—**The NOA-332 operating system updates it internal volume once per second. Therefore, the volume per pulse value cannot drive the output faster than once per second.**

Setting this parameter to 0 will disable the pulse output feature. To set the volume per pulse parameter, do the following:

1. After selecting the wanted digital output channel number, starting with the Pulse Output menu, align the pointer with “Volm/Pulse” and press ENTER (enhanced mode display).
2. Press SETUP and enter the volume.
3. Press ENTER to validate your entry.
4. Press ESCAPE to return to the Pulse Output menu.

NOTE—**A common mistake is to set the pulse width value and the volume per pulse value such that output pulses cannot occur as quickly as programmed by the user. An example would be a 2 second pulse width with a 1.5 second pulse output rate. The NOA-332 will accumulate the extra pulses, but there is a risk that some pulses will be lost. The user is cautioned to evaluate the maximum possible count rate when determining these values.**

Pulse Counter (PulseCount)

The pulse counter is a parameter that accumulates the number of times the pulse output has been active. This feature is generally used for diagnostic purposes. To zero the number of pulse counts, do the following:

1. After selecting the wanted digital output channel number, starting with the Pulse Output menu, align the pointer with “PulseCount” and press ENTER (enhanced mode display).
2. Press SETUP and press ENTER to zero the counts.
3. Press ESCAPE to return to the Pulse Output menu.

Notes

Appendix A

General Installation Instructions—Weatherproof Unit

Introduction

The NOA-332 is available in either of two styles—a weatherproof unit with a fiberglass enclosure, or a unit designed especially for mounting on a rack or in an instrument panel. This appendix discusses installation of the weatherproof version. See Appendix B for instructions on installing the rack/panel mount analyzer.

The Weatherproof NOA-332 Net Oil Analyzer is available with several optional enclosures and circuit boards. Wiring instructions are provided for each of these various configurations.

The configuration that is right for a specific application depends on the power available, the type of transmitters used, the type of watercut sensing device used, optional features desired, and communication requirements. A complete list of specifications for the Weatherproof NOA-332 is provided in Section 1, page 6.

Benefits of the NOA-332 include:

- The Weatherproof NOA-332 may be operated with 100 to 240 volts AC, 10 to 30 volts DC using an integral power supply, or with 12 and 24 volts fed externally to the NOA-332 when used in 85°C (185°F) environments. Cameron's Measurement Systems Division offers an optional power supply for this purpose.

- The transmitter inputs may be voltage inputs (0-5 VDC including 1-5 VDC), current inputs (0-20mA including 4-20mA), or multivariable transmitters (via COM3) and may be mixed. Transmitters provide temperature, pressure, and watercut information to the NOA-332, enabling automated flow calculations. The NOA-332 supports the use of 100-ohm RTDs.

- Two analog input channels may be designated as auxiliary inputs. The transmitter values are averaged during the well test period and the average value is recorded in memory as a part of the well test record.

- Two optional circuit boards (4-channel and 8-channel) provide alarm indication, pulse output, and control outputs, plus discrete switch inputs. The switch inputs can be used to trigger an alarm or emergency shutdown of a well test cycle.

- An optional circuit board permits use of the NuFlo Capacitance Probe. This watercut sensing device produces a frequency output proportional to the percent watercut in an emulsion stream. This circuit board is calibrated independently of the NOA-332.

- The gas flowmeter may be an orifice or turbine type. When using an orifice meter, do not attempt to use Frequency Input #1.

Table A.1 identifies the various possible configurations of the Weatherproof NOA-332, and categorizes them by the type of user-supplied power. For each configuration (identified by part number), the emulsion sensor type, optional digital input/output circuit board type, transmitter type, and operating power requirements are listed.

Table A.1 – NOA-332 Configuration Chart Hardware Configuration

Part No.	Emulsion Sensor Type	Optional Input/Output Board	Transmitter Type	Maximum Power Required
Integral Power Supply - user provides 100 to 240 volts AC power				
101243667	Analog	None	Voltage & Current	20 Watts
101227668	Analog	8 Channel	Voltage & Current	20 Watts
101227486	Analog	4 Channel	Voltage & Current	20 Watts
101245317	Cap Probe	None	Voltage & Current	12 Watts
101247142	Cap Probe	8 Channel	Voltage & Current	12 Watts
101247144	Cap Probe	4 Channel	Voltage & Current	12 Watts
101243715	Cap Probe	None	Voltage Only	6 Watts
101247145	Cap Probe	8 Channel	Voltage Only	6 Watts
101247164	Cap Probe	4 Channel	Voltage Only	6 Watts
Integral Power Supply - user provides 14 to 30 VDC transmitter power (nominal 24 VDC)				
101243673	Analog	None	Voltage & Current	14 Watts
101227838	Analog	8 Channel	Voltage & Current	16 Watts
101214888	Analog	4 Channel	Voltage & Current	16 Watts
101245490	Cap Probe	None	Voltage & Current	13 Watts
101247172	Cap Probe	8 Channel	Voltage & Current	13 Watts
101247199	Cap Probe	4 Channel	Voltage & Current	13 Watts
Integral Power Supply - user provides 10 to 14 VDC system power (nominal 12 VDC)				
101245211	Analog	None	Voltage & Current	14 Watts
101246672	Analog	8 Channel	Voltage & Current	14 Watts
101246675	Analog	4 Channel	Voltage & Current	14 Watts
101246150	Cap Probe	None	Voltage & Current	14 Watts
101247202	Cap Probe	8 Channel	Voltage & Current	14 Watts
101247207	Cap Probe	4 Channel	Voltage & Current	14 Watts
External Power Supply - user provides system power & transmitter power				
101246676 **(see note 1)**	Analog	None	Voltage & Current	12 Volts - 4 Watts 24 Volts - 11 Watts
101246678 **(see note 1)**	Analog	8 Channel	Voltage & Current	12 Volts - 5 Watts 24 Volts - 11 Watts
101246679 **(see note 1)**	Analog	4 Channel	Voltage & Current	12 Volts - 5 Watts 24 Volts - 11 Watts
101246877 **(see note 2)**	Cap Probe	None	Voltage & Current	12 Volts - 5 Watts 24 Volts - 7 Watts
101247209 **(see note 2)**	Cap Probe	8 Channel	Voltage & Current	12 Volts - 5 Watts 24 Volts - 7 Watts
101247211 **(see note 2)**	Cap Probe	4 Channel	Voltage & Current	12 Volts - 5 Watts 24 Volts - 7 Watts

Note 1: Requires both 12 and 24 volt power

Note 2: Requires only 12 volt power if using voltage output transmitters

Before the NOA-332 can be programmed for operation, the following tasks must be completed.

1. Mount the NOA-332 in a suitable non-hazardous location.
2. Connect field wiring to the NOA-332. This includes a suitable power source, flowmeters, transmitters, and communications. If the NuFlo Capacitance Probe is being used as the watercut sensor, the optional capacitance probe interface board is required.
3. Configure the NOA-332 circuitry for the types of flowmeters, transmitters, and communications method being used. The analog board uses jumpers to alter circuitry to permit voltage or current-type transmitters. The digital board uses jumpers to configure communications options. Additionally, optional pulse output boards or the optional capacitance probe interface board will require some configuration.

None of these steps are especially difficult or highly technical. However, to help ensure success, proceed slowly and follow the instructions step by step.

Mounting the Enclosure

To mount the Weatherproof NOA-332, follow these guidelines:

- Mount the enclosure on a 2-in. pipe pole using the pole bracket provided or on a flat surface using the "ears" provided with the instrument. Figures A1 and A2 illustrate the bulkhead and pole-mounting arrangements.
- Be sure that there is enough space to fully open the front door for access to the field wiring terminal blocks.
- Mount the enclosure so that the height of the instrument allows easy viewing of the LCD display.
- Insure that the NOA-332 is installed in a safe area. The instrument is not certified for use in hazardous locations.

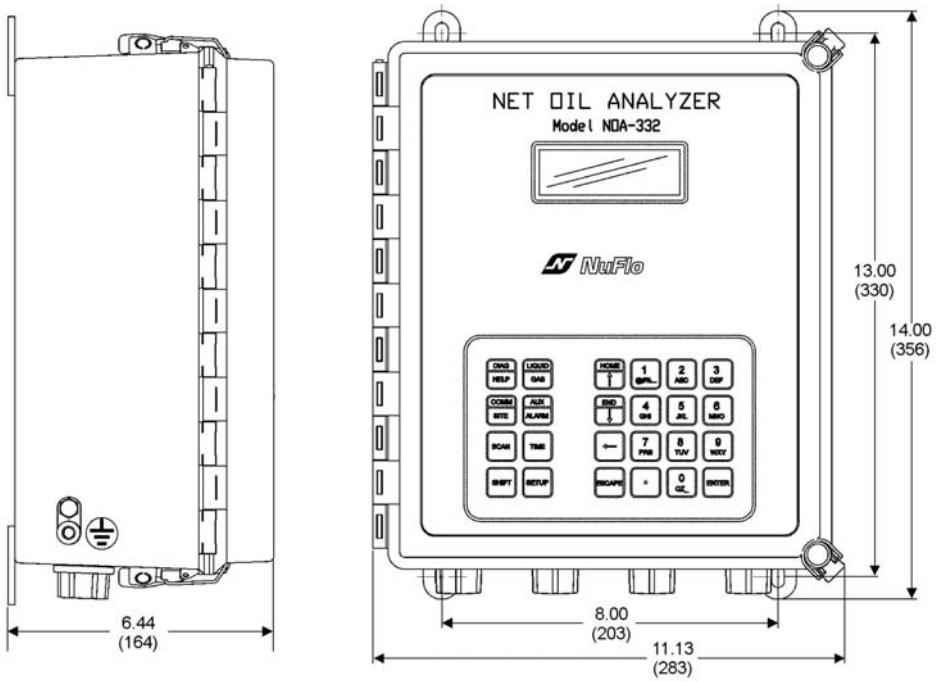


Figure A.1—Bulkhead mount

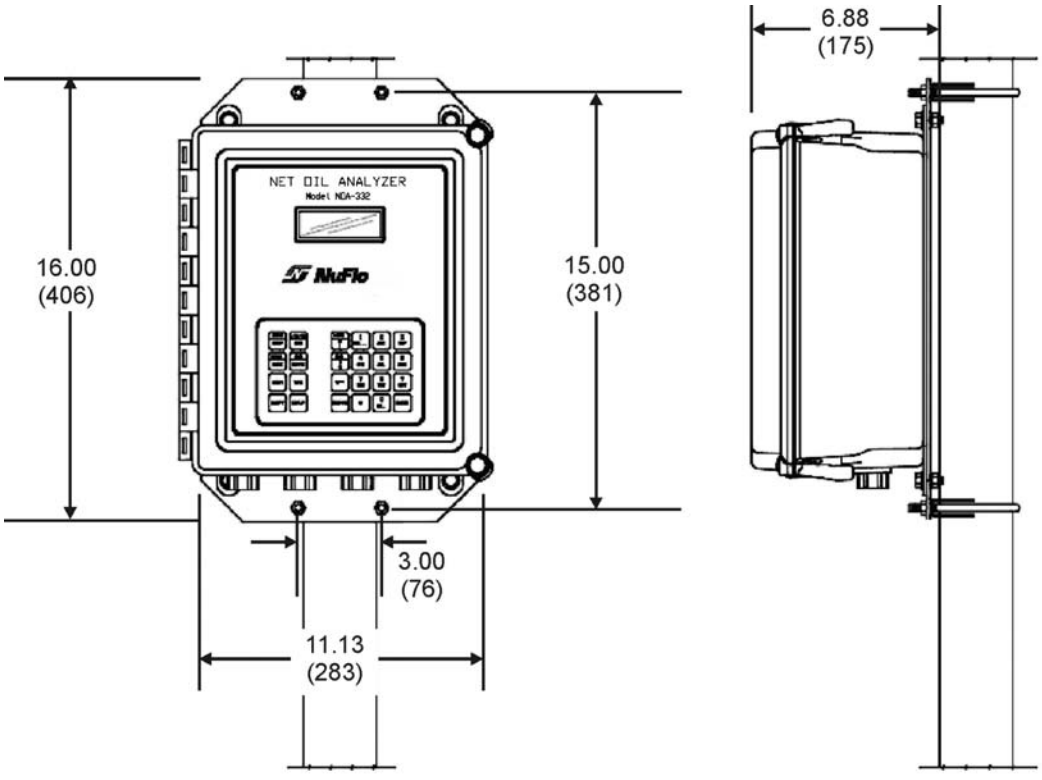


Figure A.2—Pole mount

NOA-332 Power Wiring Connections

The NOA-332 requires power, transmitters, and flowmeters for proper operation. Optional features may also require communications and sensor wiring. All field wiring enters the NOA-332 enclosure through conduit hubs in the bottom of the enclosure and connects to the terminal blocks located on the analog circuit board.

Important—Never connect field wiring to the NOA-332 unless the power switch in the lower left corner of the analog circuit board is in the OFF position (Figure A4).

Earth Ground

A solid earth ground connection is essential to provide a proper earth ground path for the internal components that provide transient protection for the NOA-332 circuitry. The fiberglass weatherproof enclosure includes a mounting lug for this purpose. The rack-mount enclosures do not have a lug due to their metal construction.

CAUTION - All field wiring must conform to the *National Electric Code,* NFPA 70, Article 501-4(b) for installations within the United States or the *Canadian Electric Code* for installations within Canada. Local wiring ordinances may also apply. All field wiring must have a wire range of 22 to 14 AWG and terminal block screws must be tightened to a minimum torque of 5 to 7 in-lbs. to secure the wiring within the terminal block. Only personnel who are experienced with field wiring should perform these procedures.

Main Power

The operating power for the NOA-332 is protected by three separate fuses (Figure A.3):

1. Fuse F2 (1 amp) provides circuit protection for the 12 VDC used to power the analog circuit board, which powers all analog and digital circuits within the NOA-332. The field wiring connection is made to TB1 terminal block positions 1 and 2 as shown below.
2. Fuse F3 (500 mA) provides circuit protection to all 4 to 20 mA transmitters, which are connected to the NOA-332 analog circuit board. The excitation voltage for the transmitters cannot exceed 30 VDC. The field wiring connection is made to TB1 terminal block positions 3 and 4 as shown below.
3. Fuse F1 (5 amp) provides circuit protection to the external power output voltage at TB1 terminal block position 5. Terminal block position 6 is the common field connection for the external power output voltage.

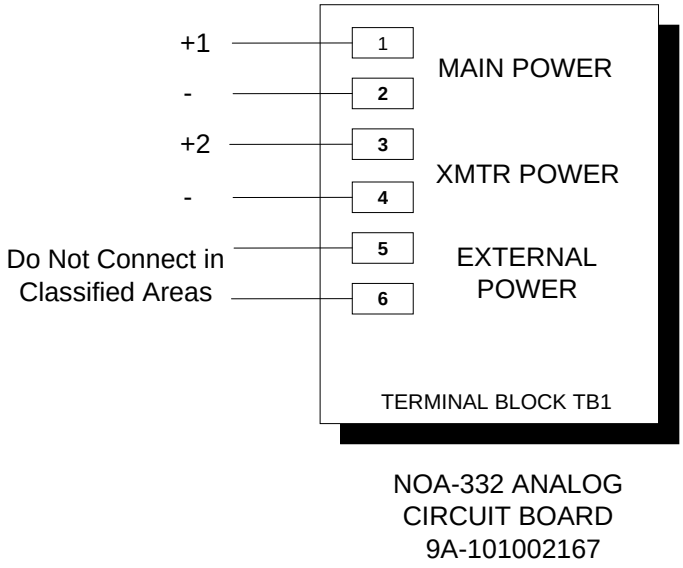


Figure A.3—Analog circuit board, terminal block 1

AC and DC Power Options

The NOA-332 can operate with a 12-VDC power supply when using an MVT transmitter for gas pressures, an RTD for temperature, a capacitance probe for watercut sensor (requires optional interface board), and turbine meters for liquid measurement. This configuration is especially suitable for solar power operation.

An optional 100- to 240-VAC power module is available. Also available is a DC/DC board that converts 12-VDC power to 24-VDC power and 24-VDC power to 12-VDC power. These options give the NOA-332 complete flexibility to conform to the user's requirements.

Analog Circuit Board Transmitter Wiring and Jumper Configuration

The NOA-332 operating system supports a total of nine discrete transmitters. Not all of these inputs are required. The default assigned input channels listed below should be followed when connecting the field transmitters and flowmeters to the NOA-332.

The default channel assignments are as follows:

- Analog Input #1 - System Power
- Analog Input #2 - Internal Temperature
- Analog Input #3 - Watercut Probe / Sensor
- Analog Input #4 - Emulsion Flowing Pressure
- Analog Input #5 - Emulsion Flowing Temperature
- Analog Input #6 - Gas Orifice Differential Pressure

- Analog Input #7 - Gas Orifice Static Pressure / Gas Turbine Flowing Pressure
- Analog Input #8 - Gas Orifice Static Temperature / Gas Turbine Flowing Temp
- Analog Input #9 - Auxiliary #1
- Analog Input #10 - Auxiliary #2
- Analog Input #11 – Gas Orifice Stacked High Differential Pressure
- Frequency Input #1 - Gas Meter
- Frequency Input #2 - Emulsion Meter
- Frequency Input #3 - Free Water Meter
- Frequency Input #4 - Gross Volume Meter

Important—If an RTD is being used in your application, analog input channels #5 or #8 must be reassigned. If the RTD is used for emulsion flowing temperature, analog input #5 will be reassigned to input #15. If the RTD is used for gas turbine flowing temperature, analog input channel #8 will be reassigned to input #16.

Analog input channel #3 is dedicated to receiving the analog signal from the watercut sensor. This input channel should only be used for the watercut sensor.

Analog input channels #1 and #2 and all four frequency input channel assignments are fixed as listed above and cannot be changed.

The NOA-332 permits the use of voltage output transmitters (0 to 5 V including 1 to 5 V), current output transmitters (0 to 20 mA including 4 to 20 mA), or multivariable transmitters (via COM3 RS-485 communications port). Voltage output transmitters may be mixed with current output transmitters, as each analog input channel is independent and configurable. The analog circuit board contains jumpers for each of the analog inputs for configuring the analog input channels. Connecting combinations of pins routes the analog signals through the analog board circuitry. Each pin header is numbered, with a small white circle on the analog circuit board representing pin number 1. The user must correctly set these jumpers; if he fails, the transmitter or the NOA-332 circuitry could be damaged. All analog inputs that are not used should be set for 4 to 20 mA transmitter input to provide optimal anti-static protection.

Important—The wiring instructions in this section are applicable only when the default configuration is being used.

Two worksheets at the end of this appendix aid the user in identifying jumper settings for the analog inputs, and recording transmitter information and wiring identification. One worksheet covers current output transmitters; the other worksheet covers voltage output transmitters. These worksheets should be completed as appropriate, used to configure the hardware and operating system, and stored inside the NOA-332 for future reference.

The analog board is shown in Figure A.4 for reference.

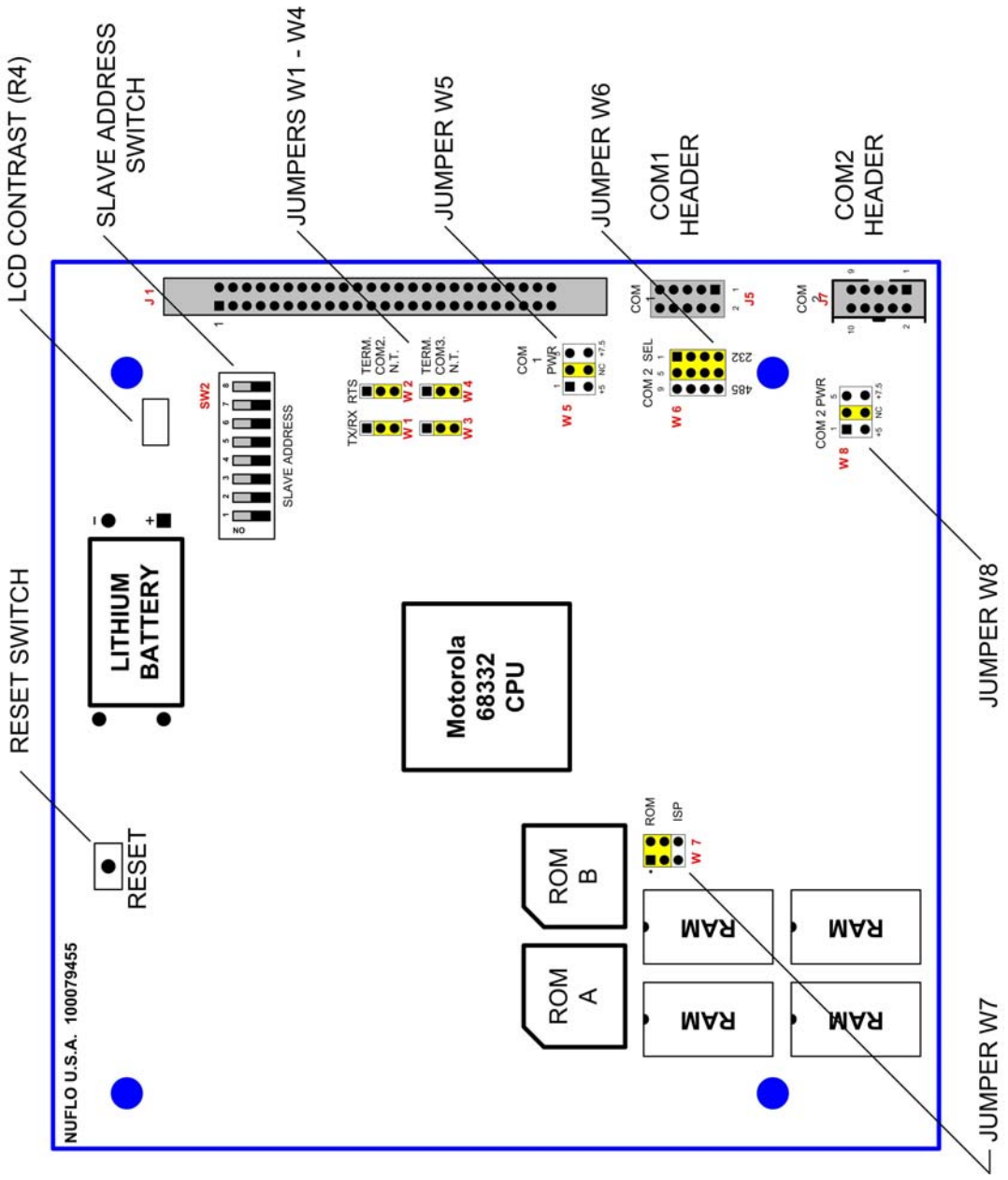


Figure A.4—Analog circuit board nomenclature

Field Wiring for Voltage Output Transmitters

Voltage output transmitters are typically three-wire devices that operate on less current than current-output type transmitters and are susceptible to signal loss and noise. For these reasons, relatively short lengths of shielded signal cable must be used between the transmitter and the NOA-332. The NOA-332 provides either 7.5 V or 5.0 V to power voltage output transmitters, as determined by jumper setting. The following voltage output transmitters are recommended:

- Differential pressure: Rosemount Model 2024D2M; Rosemount Model 1151DP.

- Line pressure: Foxboro I.C.T. Model 1123-L1052; Rosemount Model 2088GxM (where x is the range of the transmitter).

Other voltage output transmitters may be used with the NOA-332.
If the NOA-332 contains the optional capacitance probe interface circuit board, this circuit board will be pre-wired to analog input channel #3 as a voltage-type transmitter. The default voltage output transmitter terminal block connections are defined as follows:

Watercut Probe (Analog Channel #3)	Terminal 19 - POWER Terminal 20 - SIGNAL Terminal 21 – COMMON
Emulsion Flowing Pressure (Analog Channel #4)	Terminal 22 - POWER Terminal 23 - SIGNAL Terminal 24 - COMMON
Emulsion Flowing Temperature (Analog Channel #5)	Terminal 25 - POWER Terminal 26 - SIGNAL Terminal 27 - COMMON
Gas Orifice Differential Pressure (Analog Channel #6)	Terminal 28 - POWER Terminal 29 - SIGNAL Terminal 30 - COMMON
Gas Flowing Pressure (Analog Channel #7)	Terminal 31 - POWER Terminal 32 - SIGNAL Terminal 33 - COMMON
Gas Flowing Temperature (Analog Channel #8)	Terminal 34 - POWER Terminal 35 - SIGNAL Terminal 36 - COMMON
Auxiliary Input #1 (Analog Channel #9)	Terminal 37 - POWER Terminal 38 - SIGNAL Terminal 39 - COMMON
Auxiliary Input #2 (Analog Channel #10)	Terminal 40 - POWER Terminal 41 - SIGNAL Terminal 42 - COMMON
Gas Diff Pressure High (Analog Channel #11)	Terminal 43 - POWER Terminal 44 - SIGNAL Terminal 45 - COMMON

Note that analog channels #7 and #8 are used with a gas meter, either orifice or turbine type. Refer to Figures A.13 through A.21.

Note—Some voltage output transmitters do not require power from the NOA-332. In these cases, simply feed the transmitter signal to the SIGNAL and COMMON terminal positions as indicated above.

Field Wiring for Current-Output Transmitters

Current-output transmitters are often used because they output a noise-immune analog signal and do not experience signal loss over long distances of wire. The NOA-332 is designed for use with two-wire transmitters where the return path to circuit ground is completed within the NOA-332 circuitry via a 249-ohm resistor.

The following current-output transmitters are recommended:

- Differential pressure: Rosemount Model 3051CD and Model 2024D2A
- Static (line) pressure: Rosemount Model 3051CG and Model 2088GxA where x is the range of the transmitter
- Temperature: Rosemount Model 3144D with integral RTD
- NuFlo Watercut Monitor

Other current-output transmitters may be used with the NOA-332.

As is common with two-wire transmitters, the maximum loop load is based upon the excitation voltage to the loop. The NOA-332 inserts 249 ohms into the current loop. The NOA-332 provides a separate power supply feed for current loop excitation (the integral power supply option supplies 24 volts to this input). The user must keep this is mind when selecting the current output transmitters.

The default current output transmitter terminal block connections are defined as follows:

Watercut Probe *	Terminal 19 - POSITIVE
(Analog Channel #3)	Terminal 20 - NEGATIVE

* See “Installation of NuFlo Watercut Monitor” in this appendix if the NuFlo Watercut Monitor is to be used.

Emulsion Flowing Pressure	Terminal 22 - POSITIVE
(Analog Channel #4)	Terminal 23 - NEGATIVE
Emulsion Flowing Temperature	Terminal 25 - POSITIVE
(Analog Channel #5)	Terminal 26 - NEGATIVE
Gas Orifice Differential Pressure	Terminal 28 - POSITIVE
(Analog Channel #6)	Terminal 29 - NEGATIVE
Gas Flowing Pressure	Terminal 31 - POSITIVE
(Analog Channel #7)	Terminal 32 - NEGATIVE
Gas Flowing Temperature	Terminal 34 - POSITIVE
(Analog Channel #8)	Terminal 35 - NEGATIVE
Auxiliary Input #1	Terminal 37 - POSITIVE
(Analog Channel #9)	Terminal 38 - NEGATIVE
Auxiliary Input #2	Terminal 40 - POSITIVE
(Analog Channel #10)	Terminal 41 - NEGATIVE
Gas Diff Pressure High	Terminal 43 - POSITIVE
(Analog Channel #11)	Terminal 44 - NEGATIVE

Note that analog channels #7 and #8 are used with a gas meter, either orifice or turbine type. Refer to Figures A.5 through A.13.

Note—Some current output transmitters are four-wire types and do not require power from the NOA-332, but instead feed a current signal to the NOA-332. In these cases, connect the POSITIVE transmitter signal to the SIGNAL terminal and the NEGATIVE transmitter signal to the COMMON terminal as indicated above for the voltage output transmitters, making certain that the jumpers remain set for a 4 to 20 mA transmitter.

Jumper Configuration for the Voltage and Current Transmitters

The chart below depicts the jumper settings for current and voltage analog signals (Analog Input Mode Selection). Note the position of the jumper and the jumper designation. Because different analog transmitters require different operating voltages, the NOA-332 allows the user to route different power to each transmitter as required. This is shown as Analog Input Power Supply Selection.

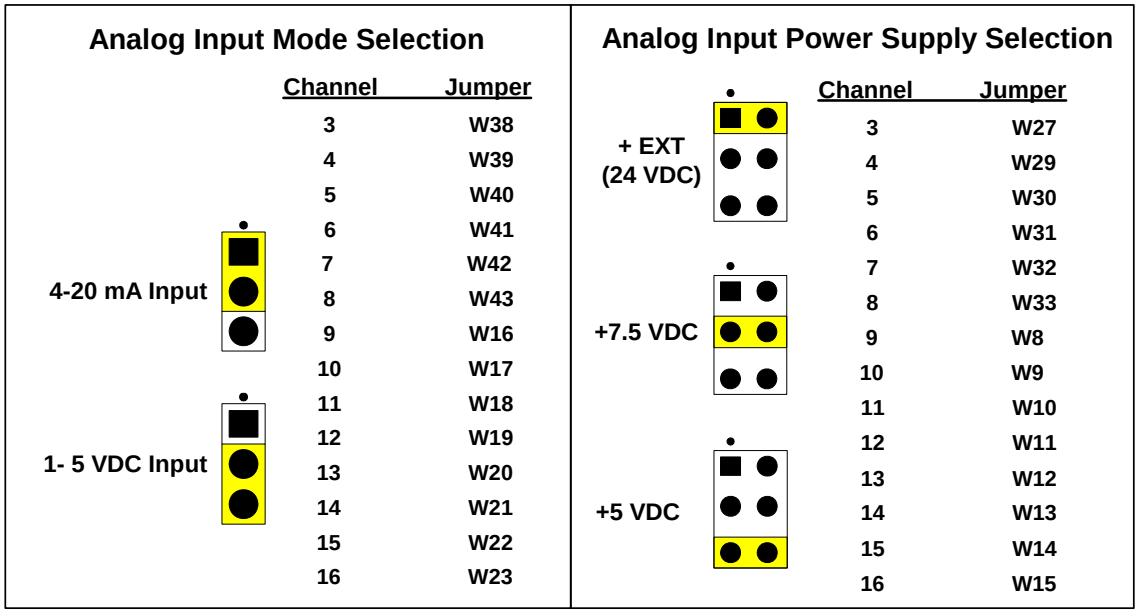


Figure A.5—Jumper settings for current and voltage analog signals

Table A.2 provides an overview of each analog input and the related jumper configuration.

Table A.2—Analog Board Jumper Configuration Chart

			VOLTAGE TRANSMITTERS			CURRENT TRANSMITTERS		100 OHM RTD	
Input	Term. Blk. #	Term. Blk. I.D.	Connections	7.5V Pwr	5V Pwr	Connections	Settings	Connections	Settings
Analog	13	+Pwr	Not Available	W24: 5-6*	W24: 5-6*	Not Available	W24: 5-6*	Not Available	None
Input	14	+In	Not Available	W34: 1-2*	W34: 1-2*	Not Available	W34: 1-2*	Not Available	None
#1	15	Com	Not Available	W25: 5-6*	W25: 5-6*	Not Available	W25: 5-6*	Not Available	None
*(See Note 1)	------	------	------	W35: 2-3*	W35: 2-3*	------	W35: 2-3*	Not Available	None
Analog	16	+Pwr	Not Available	W26: 5-6*	W26: 5-6*	Not Available	W26: 5-6*	Not Available	None
Input #2	17	+In	Not Available	W36: 2-3*	W36: 2-3*	Not Available	W36: 2-3*	Not Available	None
*(See Note 2)	18	Com	Not Available	W37: 2-3*	W37: 2-3*	Not Available	W37: 2-3*	Not Available	None
Analog	19	+Pwr	Power	W27: 3-4	W27: 5-6	4-20mA +	W27: 1-2	Not Available	None
Input	20	+In	Signal	W28: 1-2	W28: 1-2	4-20mA -	W28: 1-2	Not Available	None
#3	21	Com	Common	W38: 2-3	W38: 2-3	None	W38: 1-2	Not Available	None
Analog	22	+Pwr	Power	W29: 3-4	W29: 5-6	4-20mA +	W29: 1-2	Not Available	None
Input	23	+In	Signal	W39: 2-3	W39: 2-3	4-20mA -	W39: 1-2	Not Available	None
#4	24	Com	Common	------	------	None	------	Not Available	None
Analog	25	+Pwr	Power	W30: 3-4	W30: 5-6	4-20mA +	W30: 1-2	Not Available	None
Input	26	+In	Signal	W40:2-3	W40: 2-3	4-20mA -	W40: 1-2	Not Available	None
#5	27	Com	Common	------	------	None	------	Not Available	None
Analog	28	+Pwr	Power	W31: 3-4	W31: 5-6	4-20mA +	W31: 1-2	Not Available	None
Input	29	+In	Signal	W41: 2-3	W41: 2-3	4-20mA -	W41: 1-2	Not Available	None
#6	30	Com	Common	------	------	None	------	Not Available	None
Analog	31	+Pwr	Power	W32: 3-4	W32: 5-6	4-20mA +	W32: 1-2	Not Available	None
Input	32	+In	Signal	W42: 2-3	W42: 2-3	4-20mA -	W42: 1-2	Not Available	None
#7	33	Com	Common	------	------	None	------	Not Available	None
Analog	34	+Pwr	Power	W33: 3-4	W33: 5-6	4-20mA +	W33: 1-2	Not Available	None
Input	35	+In	Signal	W43: 2-3	W43: 2-3	4-20mA -	W43: 1-2	Not Available	None
#8	36	Com	Common	------	------	None	------	Not Available	None
Analog	37	+Pwr	Power	W8: 3-4	W8: 5-6	4-20mA +	W8: 1-2	Not Available	None
Input	38	+In	Signal	W16: 2-3	W16: 2-3	4-20mA -	W16: 1-2	Not Available	None
#9	39	Com	Common	------	------	None	------	Not Available	None
Analog	40	+Pwr	Power	W9: 3-4	W9: 5-6	4-20mA +	W9: 1-2	Not Available	None
Input	41	+In	Signal	W17: 2-3	W17: 2-3	4-20mA -	W17: 1-2	Not Available	None
#10	42	Com	Common	------	------	None	------	Not Available	None
Analog	43	+Pwr	Power	W10: 3-4	W10: 5-6	4-20mA +	W10: 1-2	Not Available	None
Input	44	+In	Signal	W18: 2-3	W18: 2-3	4-20mA -	W18: 1-2	Not Available	None
#11	45	Com	Common	------	------	None	------	Not Available	None
Analog	46	+Pwr	Power	W11: 3-4	W11: 5-6	4-20mA +	W11: 1-2	Not Available	None
Input	47	+In	Signal	W19: 2-3	W19: 2-3	4-20mA -	W19: 1-2	Not Available	None
#12	48	Com	Common	------	------	None	------	Not Available	None
Analog	49	+Pwr	Power	W12: 3-4	W12: 5-6	4-20mA +	W12: 1-2	Not Available	None
Input	50	+In	Signal	W20: 2-3	W20: 2-3	4-20mA -	W20: 1-2	Not Available	None
#13	51	Com	Common	------	------	None	------	Not Available	None
Analog	52	+Pwr	Power	W13: 3-4	W13: 5-6	4-20mA +	W13: 1-2	Not Available	None
Input	53	+In	Signal	W21: 2-3	W21: 2-3	4-20mA -	W21: 1-2	Not Available	None
#14	54	Com	Common	------	------	None	------	Not Available	None
Analog	55	+Pwr	Power	W14: 3-4	W14: 5-6	4-20mA +	W14: 1-2	A	W14: 5-6
Input	56	+In	Signal	W5: 1-2	W5: 1-2	4-20mA -	W5: 1-2	B	W5: 2-3
#15	57	-In	Common	W22: 2-3	W22: 2-3	None	W22: 1-2	C	W22: 2-3
(See Note 3)	58	-Pwr	Common	------	------	None	------	D	
Analog	59	+Pwr	Power	W15: 3-4	W15: 5-6	4-20mA +	W15: 1-2	A	W15: 5-6
Input	60	+In	Signal	W6: 1-2	W6: 1-2	4-20mA -	W6: 1-2	B	W6: 2-3
#16	61	-In	Common	W23: 2-3	W23: 2-3	None	W23: 1-2	C	W23: 2-3
(See Note 3)	62	-Pwr	Common	------	------	None	------	D	

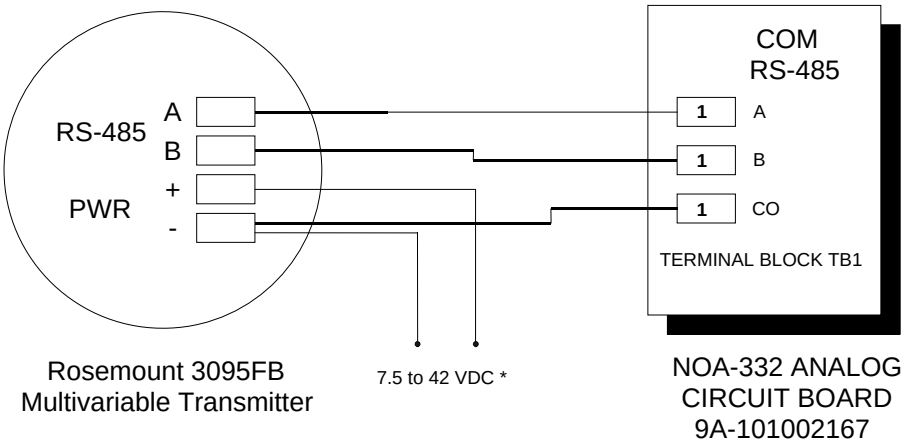
NOTE 1: Analog input #1 is configured as an internal voltage monitor by setting W24 to position 5-6, W25 to position 5-6, W34 to position 1-2, and W35 to position 2-3. No connection is made at the Analog input #1 terminal block.

NOTE 2: Analog input #2 is configured to monitor on-board temperature by setting W26 to position 5-6, W36 to position 2-3, and W37 to position 2-3. No connection is made at the Analog #2 terminbal block.

NOTE 3: Refer to the section "RTD Temperature Detectors" for the connection of 2, 3, or 4 wire RTDs.

Field Wiring for the Multivariable Transmitter

The installation of the multivariable transmitter to the NOA-332 is illustrated below. The multivariable transmitter option can be used with any of the configurations listed in Table A.2. A three-conductor cable is required for the RS-485 communications and power must be connected to the MVT.



* On integral AC powered models, power MVT from 12 VDC of AC/DC module. On user provided 24 VDC modules, power MVT from 24 VDC. On user provided 12 VDC models, power MVT from 12 VDC.

Figure A.6—Wiring of MVT to NOA-332

Field Wiring for the NuFlo Watercut Monitor

Installation of the NuFlo Watercut Monitor (a 4 to 20 mA output device) to the NOA-332, is illustrated below. A three-conductor cable is required to provide power to the monitor and power to the current loop. The jumpers on the analog circuit board are set for 4 to 20mA operation as follows (Analog Channel #3):

W27: 1-2 W28: 1-2 W38: 1-2

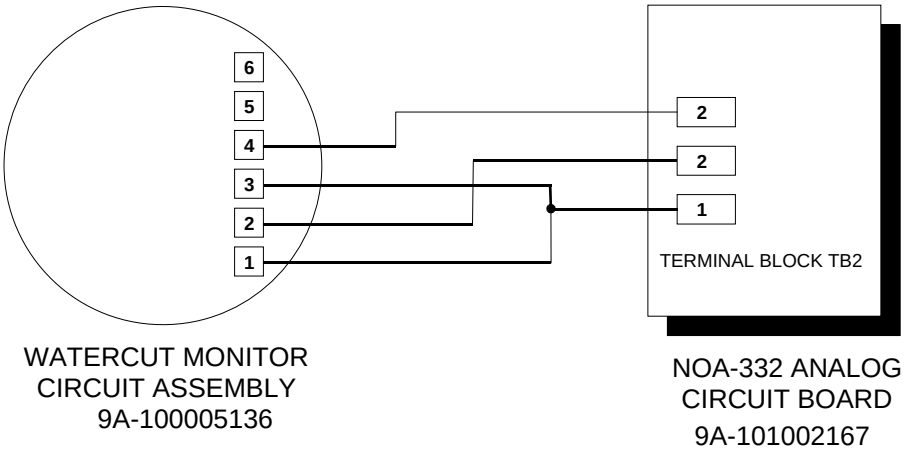


Figure A.7—Wiring of NuFlo Watercut Monitor to NOA-332

System Power Indicator – Analog Input Channel #1

Analog input channel #1 (Figure A.8) is designated as a voltage monitor and is not used as a transmitter analog input. The default configuration for analog input channel #1 is to monitor the 12-volt system voltage via internal circuits on the analog circuit board. No wiring to analog input channel #1 is used.

For installations that use solar power or 24-volt power, analog input channel #1 may be reconfigured as an external voltage input to monitor the voltage feed to the NOA-332 and utilize the alarm features of the NOA-332. The maximum voltage via the external input is 30 VDC and requires the voltage to be connected to analog input channel #1. The jumpers should be set per the chart below:

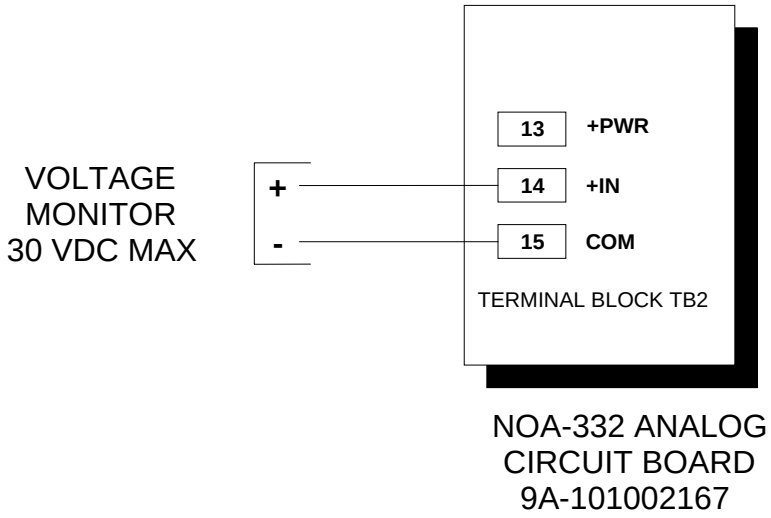


Figure A.8—Voltage monitor

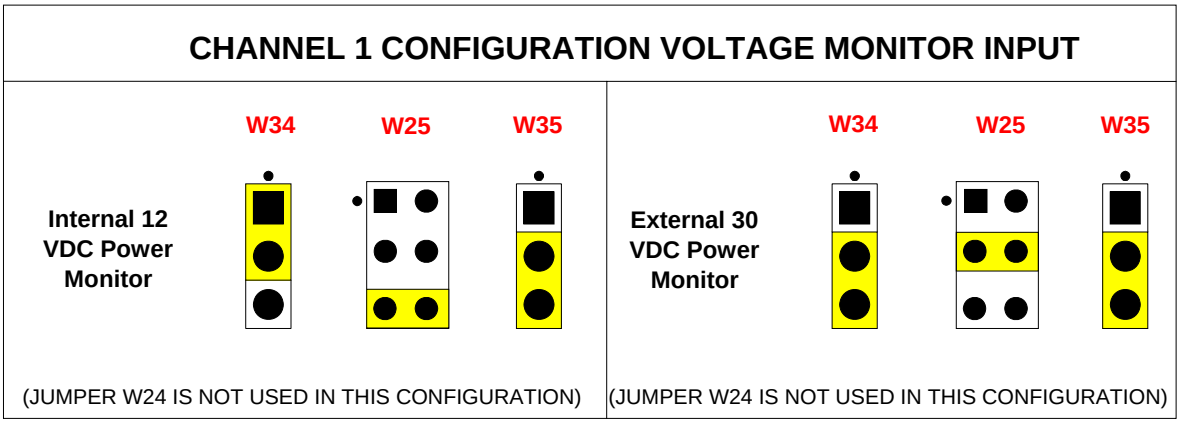


Figure A.9—Configuration of analog input channel 1 for voltage monitoring

RTD Temperature Detectors

Analog input channels #15 and #16 are dual-function inputs that can be configured as transmitter analog inputs (see Table A.2) or as 100-ohm Platinum RTD inputs for sensing temperature. These inputs accept 2, 3, and 4 wire RTDs as shown in Figure A.10 below. When using 2-or 3-wire RTDs, a jumper wire must be installed at the terminal block as indicated in Figure A.11. Analog input channels #15 and #16 are not included in the default setup. When using RTDs to sense temperature, input channel(s) #15 or #16 must have the jumpers set as depicted in Figure A.11, and the appropriate channel must be assigned to the temperature AI# for a given flow (see Section 2 for more information).

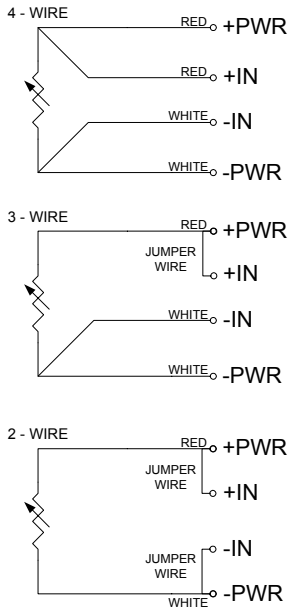


Figure A.10—RTD connections for 2-wire, 3-wire, and 4-wire types

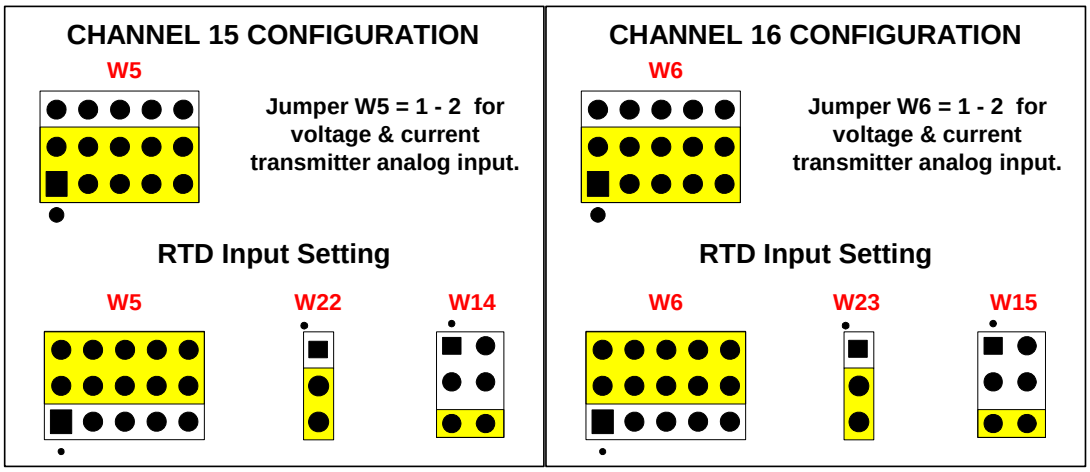


Figure A.11—Jumper and RTD input settings for current and voltage analog signals

Analog Circuit Board Frequency Flowmeter Wiring and Jumper Configuration

The NOA-332 has four frequency inputs designed for use with low-level sine wave (e.g. turbine meter) signals, amplified square wave signals from the NuFlo Low-Power Amplifier, and dry contact closure (e.g. reed switch) signals common to positive displacement flowmeters. The wiring diagrams at the end of this section depict the wiring for the frequency inputs. The frequency input assignments are fixed by the NOA-332 operating system and cannot be changed.

A user-selectable jumper for each frequency input determines the type of frequency signal used with each frequency input channel (see Table A.3). The jumpers are designated as W1, W2, W3 and W4. The frequency inputs are designated as Flowmeters 1 through 4 and correspond to terminal block positions 63 through 70. Each of the four frequency inputs has a COMMON and a SIGNAL input. The COMMON input is signal common.

Turbine Flowmeters

When using turbine flowmeters with the NOA-332, set the jumper to short positions 1 and 2. This input configuration assumes the load of 1200 ohms, commonly the DC resistance of a magnetic pickup. The allowable signal amplitude ranges from 20mV peak-to-peak to 10 V RMS. All four frequency inputs have adjustable input sensitivity potentiometers for optimum setting of signal-noise-level (see Figure A4). The threshold is variable from 15mV to 150mV. The adjustment is factory-set at 25mV. Typically, the wires from the magnetic pickup can be connected to the terminal block without regard to polarity, provided neither wire is connected to earth or chassis ground.

Low-Power Line Amplifier

When using the NuFlo Low-Power Line Amplifier with the NOA-332, set the jumper to short positions 3 and 4 as shown below. In this configuration, the NOA circuitry provides the operating power for the amplifier as well as signal conditioning to extract the flowmeter signal. The amplifier uses a two output wires labeled OUT and GND. The OUT wire should be connected to the SIGNAL input terminal on the analog circuit board and the GND wire should be connected to the COMMON terminal on the analog circuit board. The LPLA output signal is 8V, so no adjustment of the input sensitivity potentiometers is necessary.

Positive Displacement Flowmeter

When using a positive displacement flowmeter with a switch output with the NOA-332, set the jumper to short positions 5 and 6. In this configuration, the NOA circuitry provides a current limited voltage to pass through the switch contacts as well as signal conditioning to extract the flowmeter signal. For this reason, the switch must be a dry contact type, electrically floating with no power applied to the switch contacts. The wires from the switch can be connected to the SIGNAL and COMMON positions without regard to polarity. Additionally, no adjustment of the input sensitivity potentiometers is necessary.

The flowmeter terminal block connections are defined as follows:

Gas Turbine Meter	Terminal 63 - SIGNAL
(Frequency Input #1)	Terminal 64 - COMMON

Emulsion Turbine Meter (Frequency Input #2)	Terminal 65 - SIGNAL Terminal 66 - COMMON
Free Water Turbine Meter (Frequency Input #3)	Terminal 67 - SIGNAL Terminal 68 - COMMON
Gross Volume Turbine Meter (Frequency Input #4)	Terminal 69 - SIGNAL Terminal 70 – COMMON

Note—Frequency input #1 is designated exclusively for use with a gas turbine meter. If an orifice meter is being used to measure gas, frequency input #1 is void and should not be used.

Table A.3—Frequency Input Configuration Chart

Input	Term. Blk #	Diagram Term Blk ID	Connections	Jumper Settings	Connections	Jumper Settings	Connections (See Note 1)	Jumper Settings
Meter	63	A	Pin A	W4: 1-2	OUT	W4: 3-4	Signal	W4: 5-6
#1	64	B	Pin B	------	GND	------	Common	------
Meter	65	A	Pin A	W3: 1-2	OUT	W3: 3-4	Signal	W3: 5-6
#2	66	B	Pin B	------	GND	------	Common	------
Meter	67	A	Pin A	W2: 1-2	OUT	W2: 3-4	Signal	W2: 5-6
#3	68	B	Pin B	------	GND	------	Common	------
Meter	69	A	Pin A	W1: 1-2	OUT	W1: 3-4	Signal	W1: 5-6
#4	70	B	Pin B	------	GND	------	Common	------

NOTE 1: Switch contacts such as used with PD meters do not have polarity.

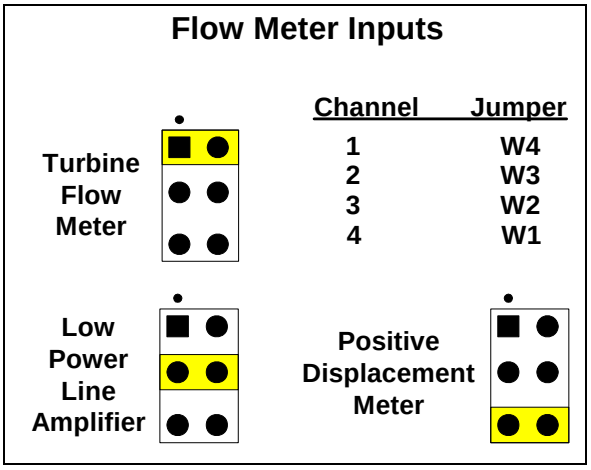


Figure A.12—Frequency input configuration chart

Analog Circuit Board Ground Jumper Configuration

The RS-485 ground select jumper (Jumper W 7) alternates between connecting the digital ground directly to chassis ground or connecting digital ground to chassis ground through a 100-ohm resistor. The 100-ohm resistor on Jumper W7 is provided to limit the circulation of currents through the RS-485 common conductor that results from ground potential differences between NOA-332 and the master (host) computer. If a common conductor with low resistance interconnects the units, the ground select should be set for the 100-ohm position (position 1-2). If there is substantial resistance in the common conductor between units (in the 100-ohm range), the 0-ohm position on W7 (position 2-3) should be selected, since the resistance in the common conductor is limiting current. If no common conductor is installed between the units, W7 should be set to the 100-ohm position (position 1-2). The RS-485 Standard recommends installation of the common conductor at all times. Omission of the common conductor is, therefore, discouraged.

Analog Circuit Board Wiring Diagrams

The following wiring diagrams illustrate the wiring combinations available when using the NOA-332:

Figure No.	Watercut Sensor	Power	Transmitter Description
A.13	Watercut Monitor	100-240 VAC	Voltage & 24VDC Current
A.14	Watercut Monitor	14-30 VDC	Voltage & 14-30 VDC Current
A.15	Watercut Monitor	10-14 VDC	Voltage & 24 VDC Current
A.16	Watercut Monitor	10-14 VDC and 14-30 VDC	Voltage & 14-30 VDC Current
A.17	Capacitance Probe	100-240 VAC	Voltage & 24VDC Current
A.18	Capacitance Probe	100-240 VAC	Voltage only
A.19	Capacitance Probe	14-30 VDC	Voltage & 14-30 VDC Current
A.20	Capacitance Probe	10-14 VDC	Voltage & 24 VDC Current
A.21	Capacitance Probe	10-14 VDC and 14-30 VDC	Voltage & 14-30 VDC Current

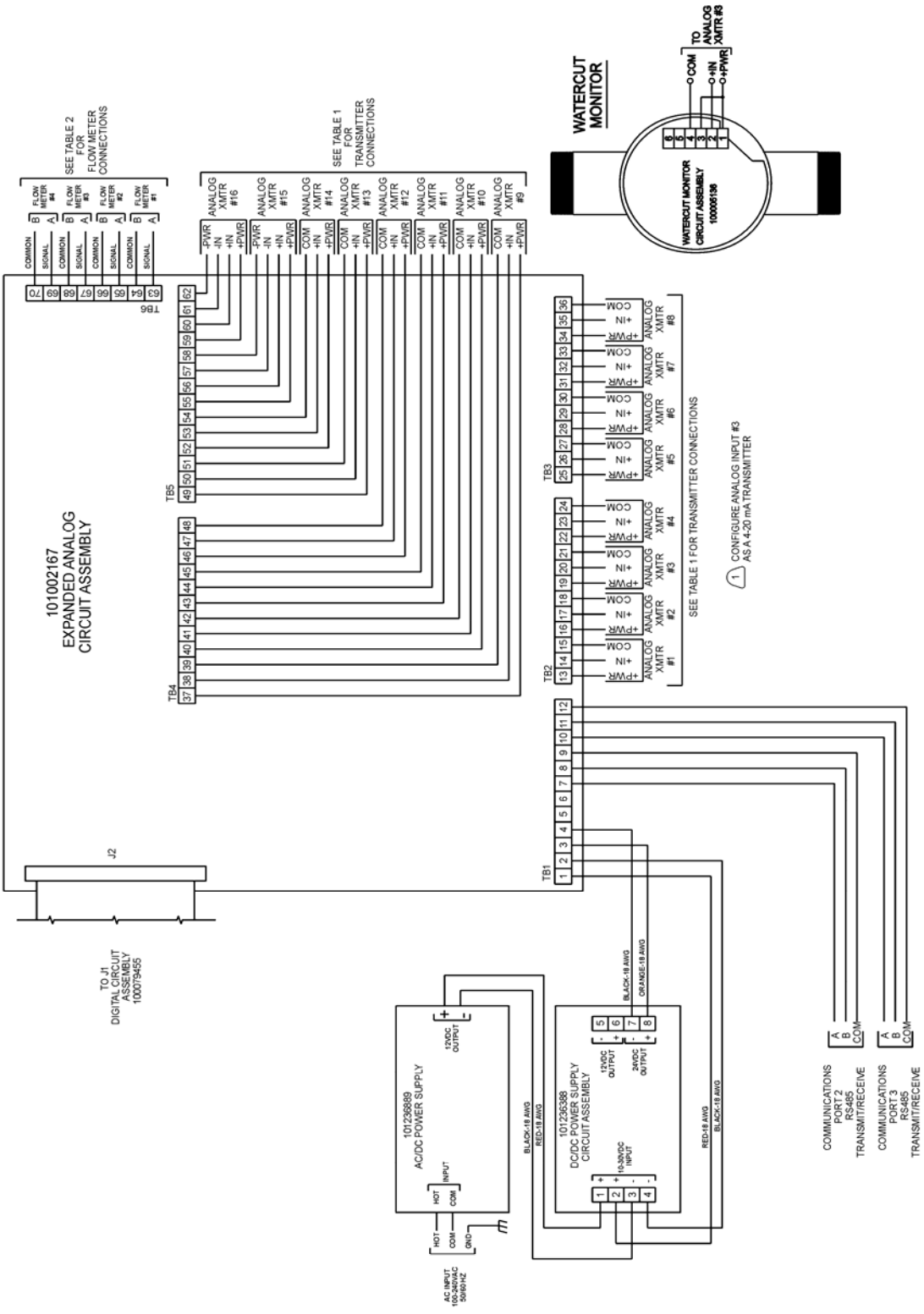


Figure A.13—Watercut monitor / 100-240 VAC power / voltage & 24VDC current transmitters

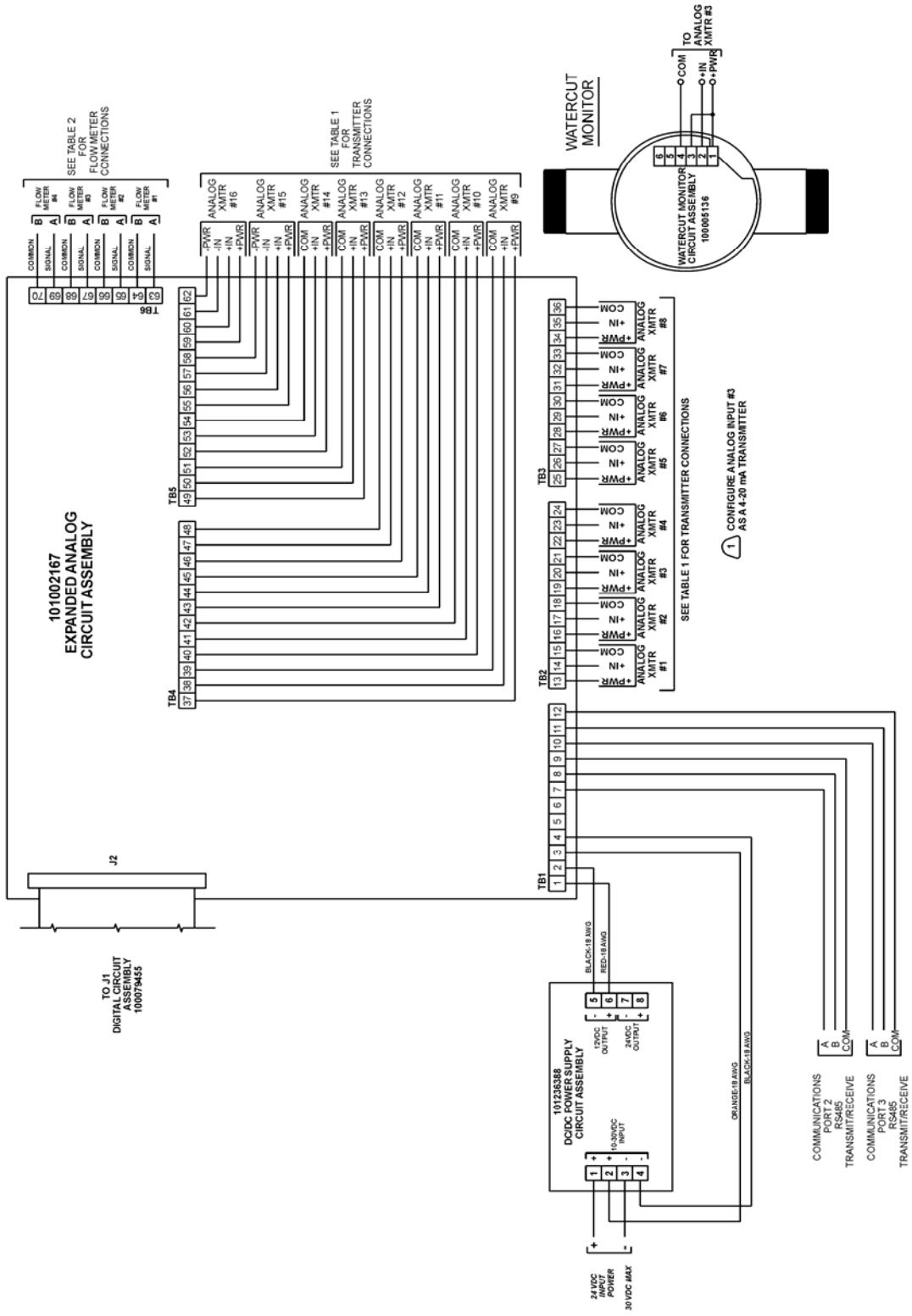


Figure A.14—Watercut monitor / 14-30 VDC power / voltage & 14-30 VDC current transmitters

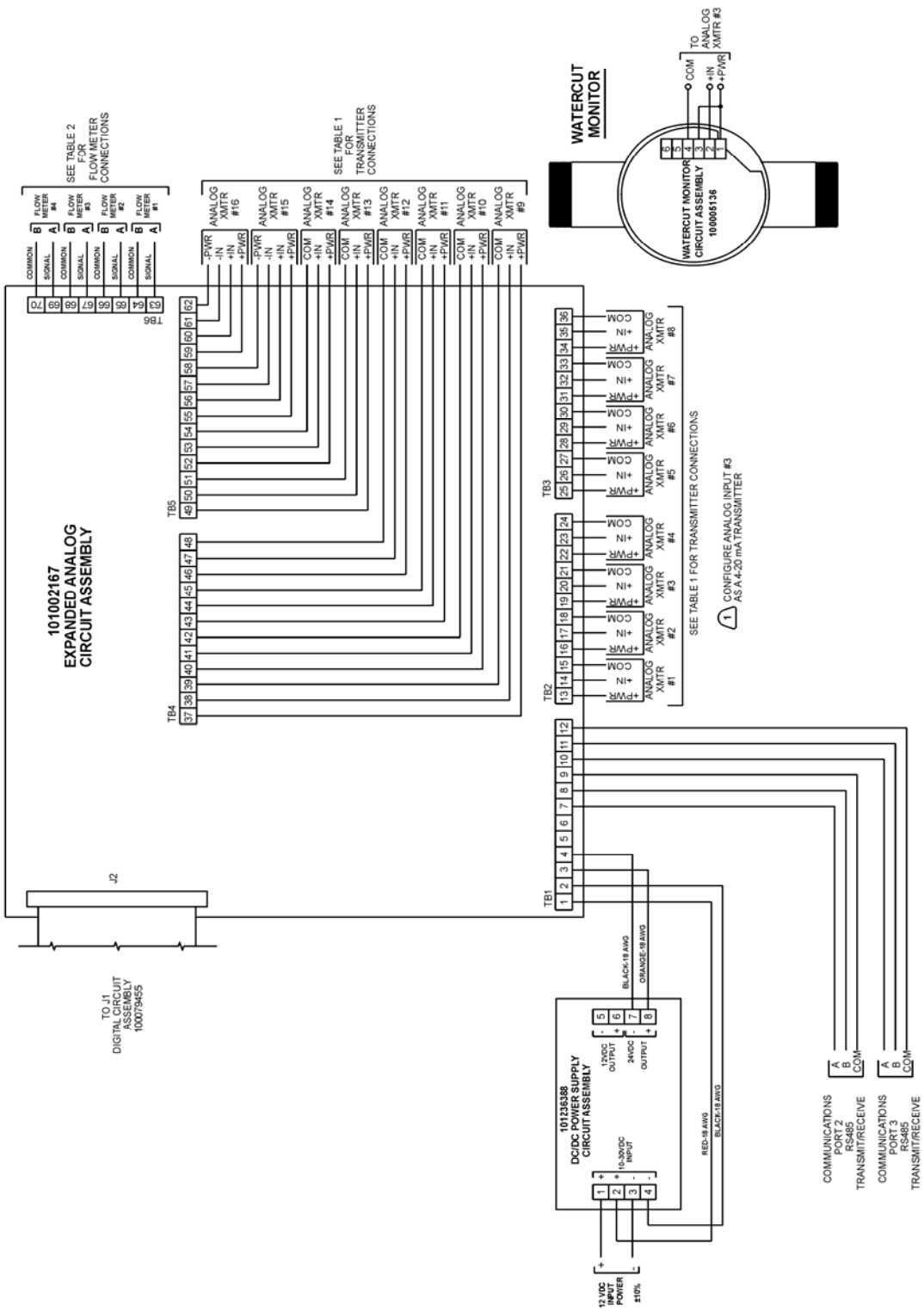


Figure A.15—Watercut monitor / 10-14 VDC power / voltage & 24 VDC current transmitters

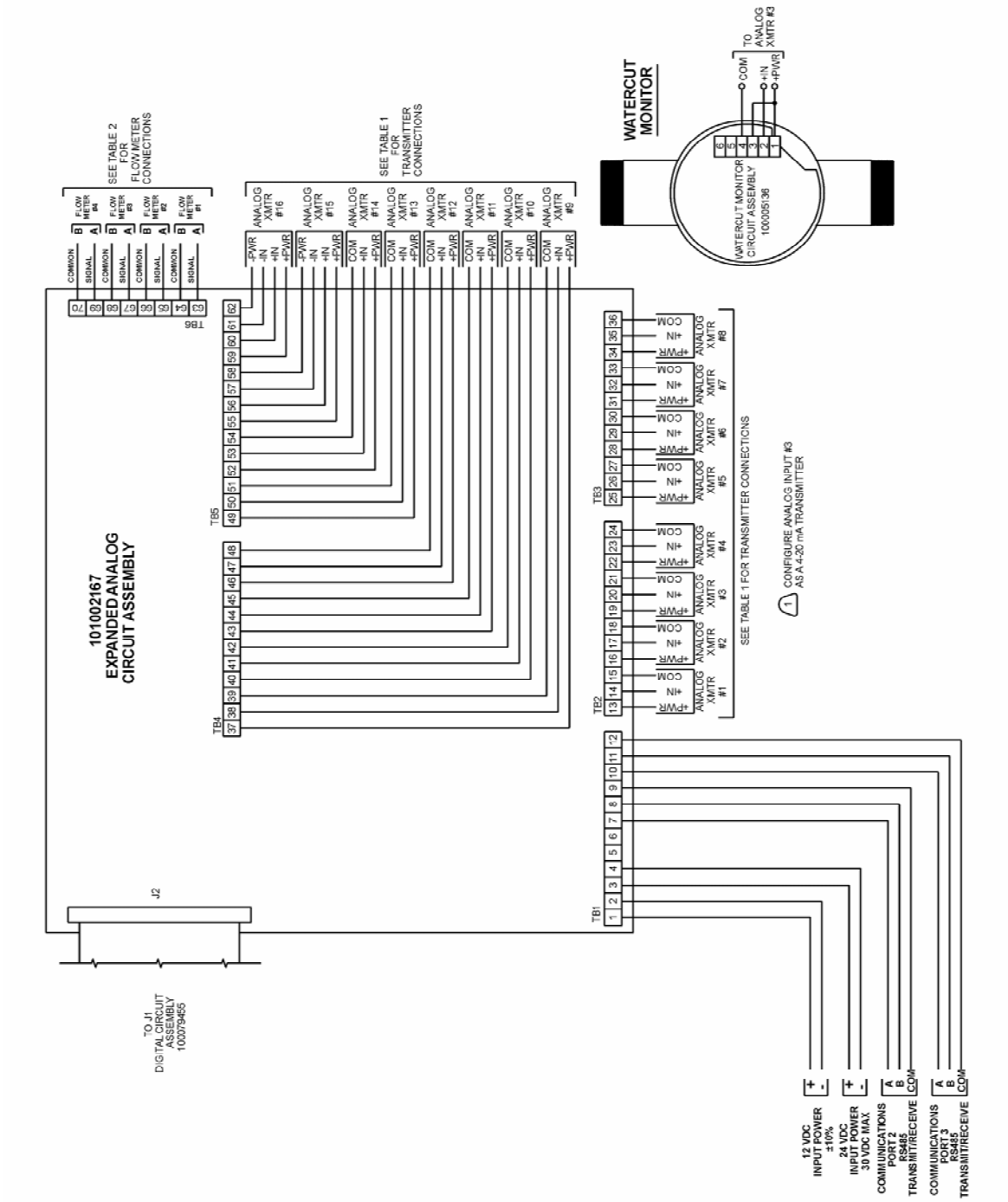


Figure A.16—Watercut monitor / 10-14 & 14-30 VDC power / voltage & 14-30 VDC current transmitters

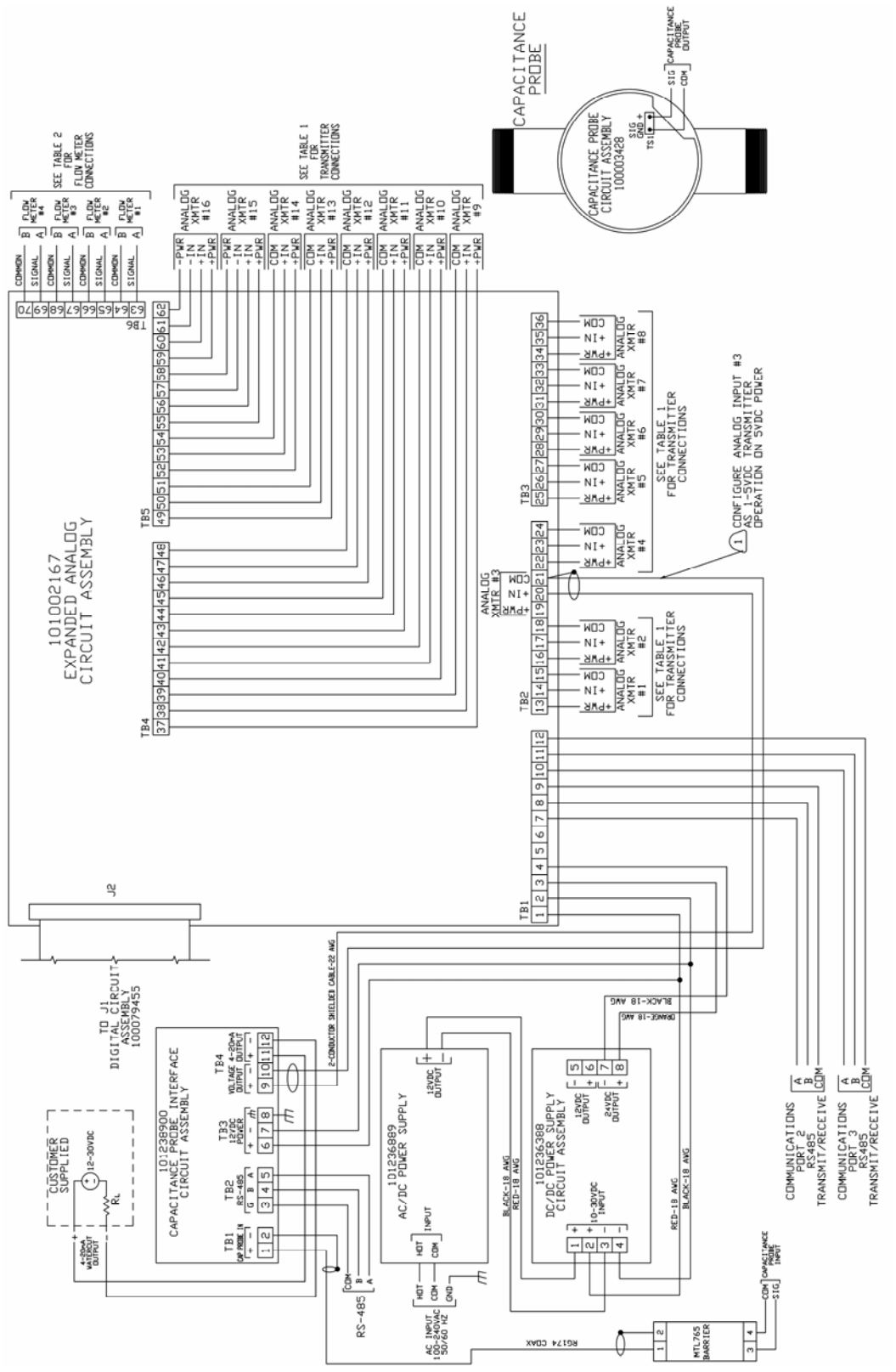


Figure A.17—Capacitance probe / 100-240 VAC power / voltage & 24VDC current transmitters

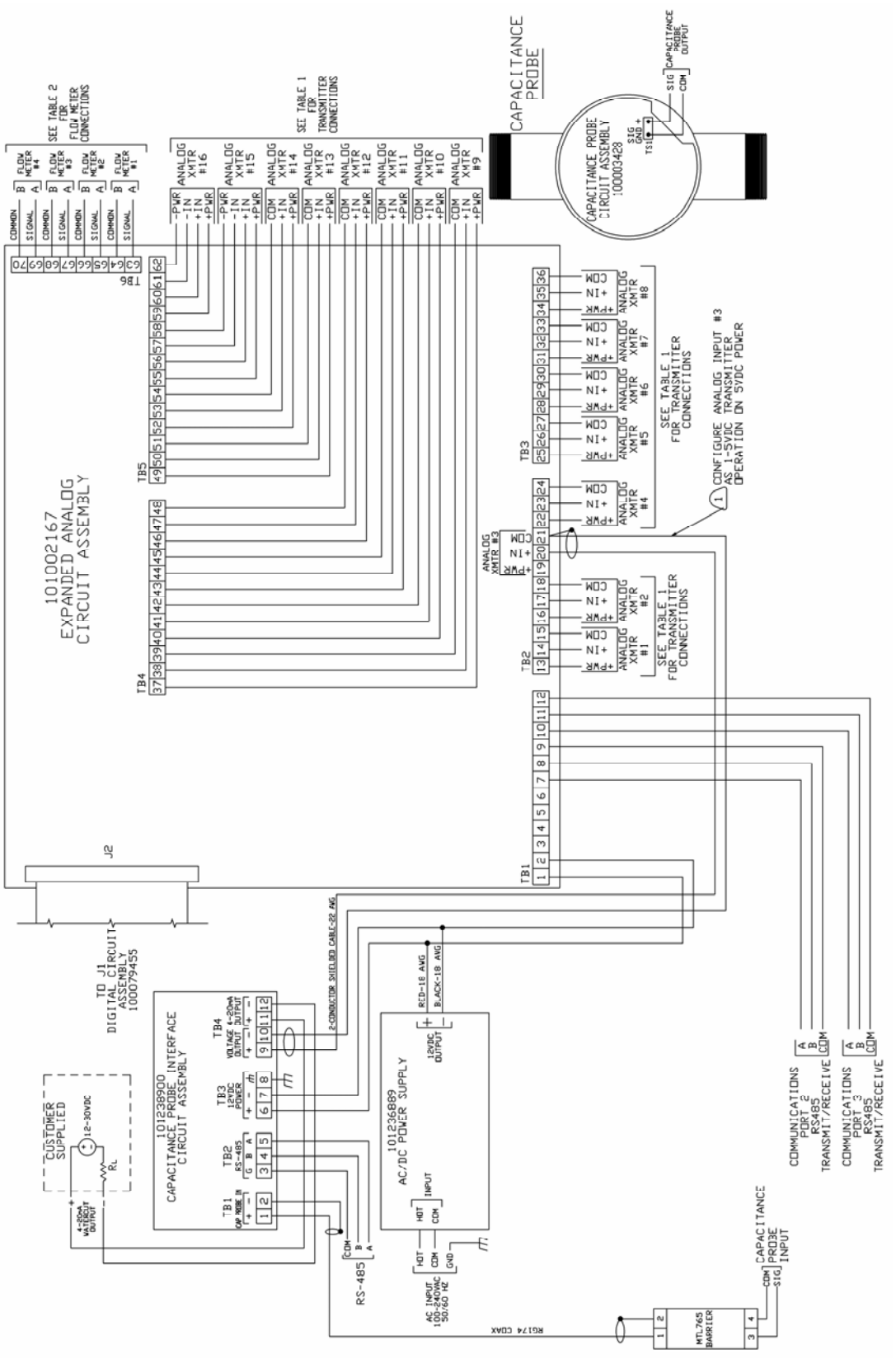


Figure A.18—Capacitance probe / 100-240 VAC power / voltage transmitters

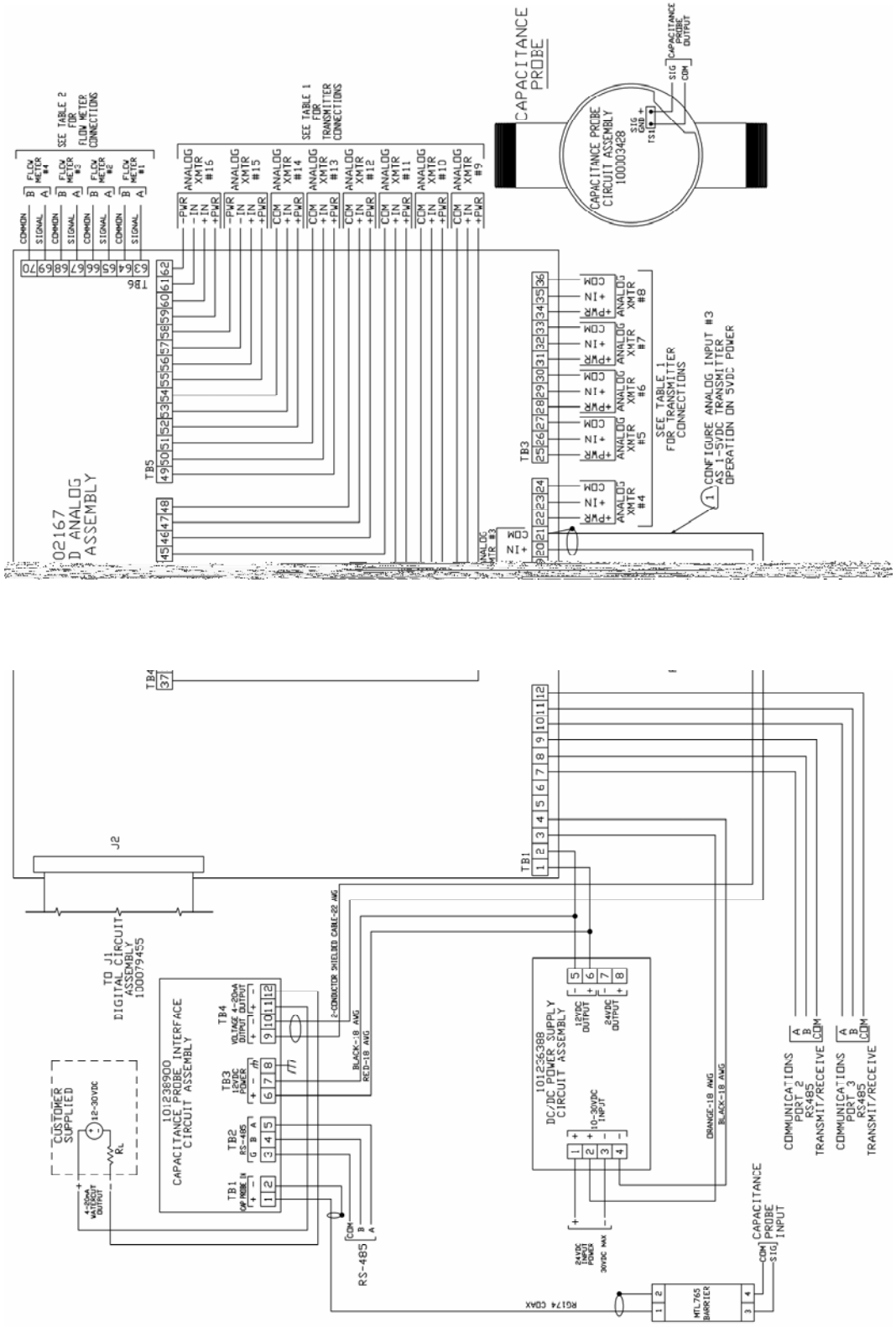


Figure A.19—Capacitance probe / 14-30 VDC power / voltage & 14-30 VDC current transmitters

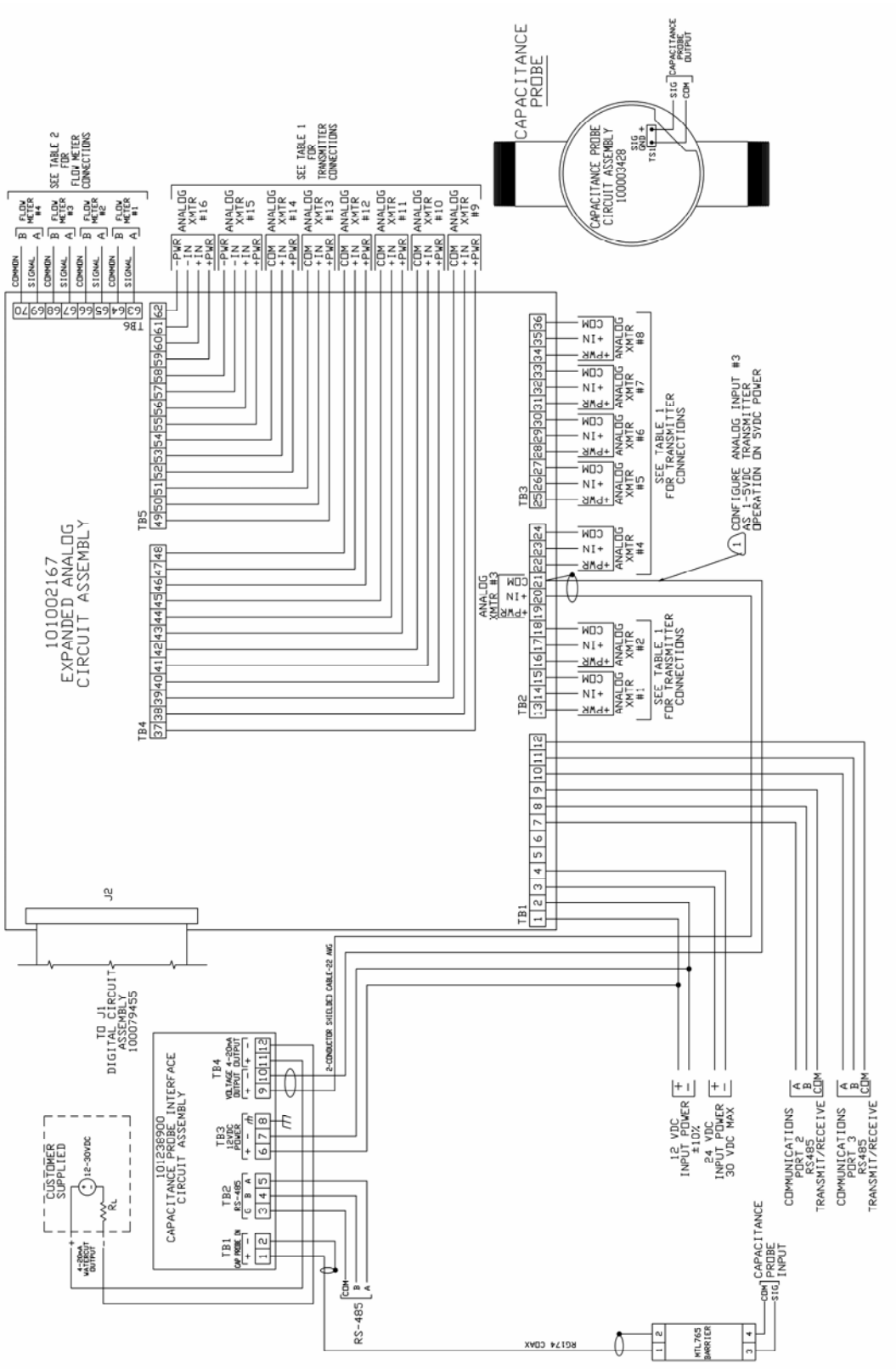


Figure A.21—Capacitance probe / 10-14 & 14-30 VDC power / voltage & 14-30 VDC current transmitters

Digital Circuit Board Setup and Jumper Configuration

The Digital circuit board accepts signals from the keypad and analog circuit board and processes the information that is displayed. The digital circuit board (P/N 9A-100079455) is the "brain" of the NOA-332. Figure A-22 shows an outline of the digital circuit board with some smaller components removed for clarity. The jumpers on the digital circuit board control the size of the memory chip and the operation of the communications ports. The communications features of the NOA-332 are covered in Appendix H.

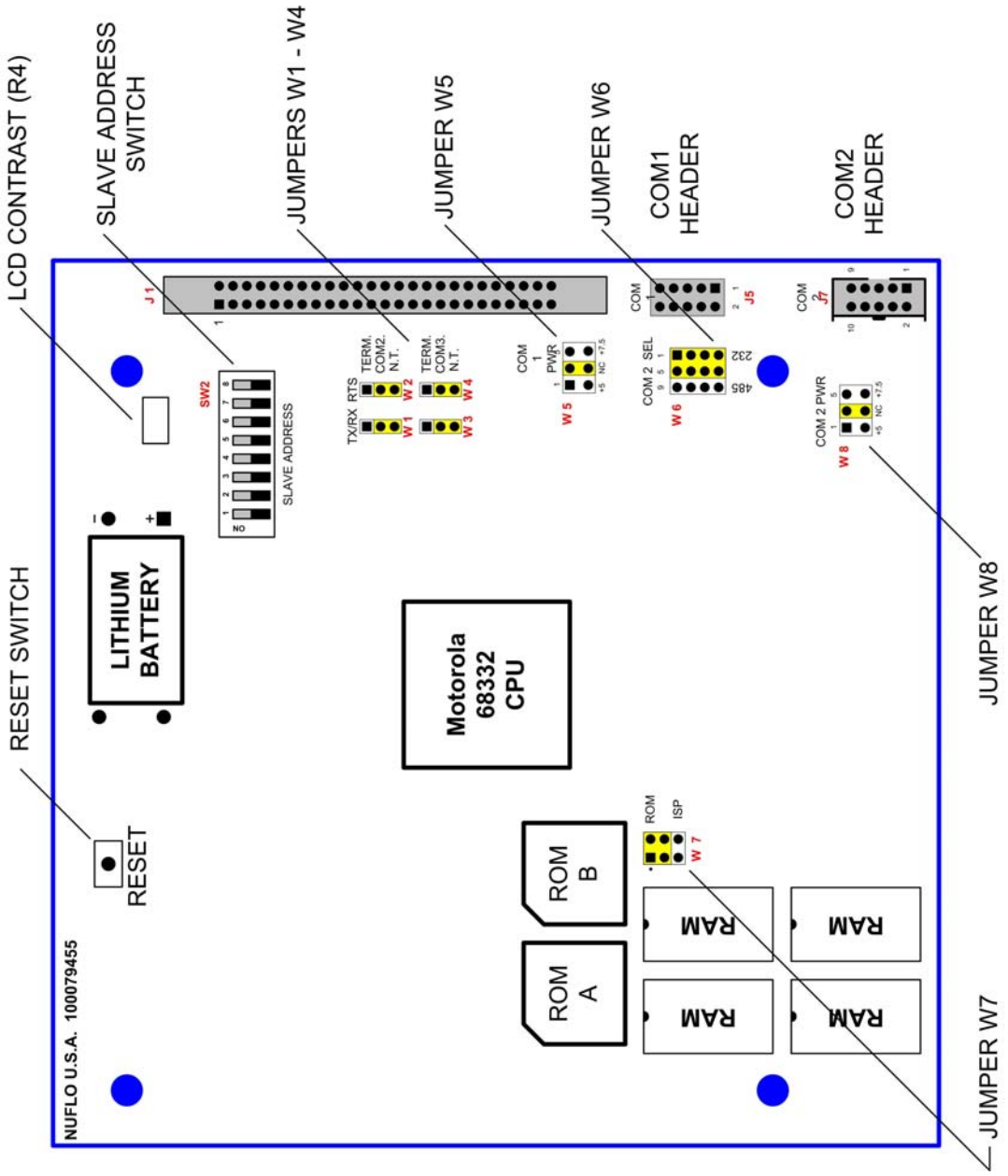


Figure A.22—Digital board nomenclature

Jumper W7

Jumper W7 should be set to the upper (ROM) setting, which is the default setting.

Setting the Identification Address

The communication protocols require that an identification address be set in the NOA-332. Set the identification address with the DIP switch (slave address switch, SW2) located above jumpers W1 through W4 on the upper right side of the digital circuit board (Figure A.22). The switch is an eight-section binary DIP switch, allowing an address value of 1 to 255. Refer to Section 9a in this manual for complete instructions on setting the value of this switch and Appendix H for use of the communications protocols.

Display Contrast Adjustment

The Liquid Crystal Display has a user-adjustable contrast adjustment, labeled LCD CONTRAST R4, located on the digital circuit board above the slave address switch in the upper-right corner of the circuit board (Figure A.22). Although this potentiometer is factory-set, temperature extremes, user preference, and viewing angle may require re-adjustment. Turning the potentiometer clockwise increases the contrast, and turning it counterclockwise reduces the contrast.

Upgrading NOA-332 System Firmware

The NOA-332 is shipped from the factory with the most up-to-date firmware available. Periodically, firmware enhancements which add features to the NOA-332 operating system may be available which will require replacement of the EPROMs (U31 and U32) located on the digital circuit board (Figure A.22). Use of an extraction tool specially designed for removal of this type of EPROM is highly recommended.

CAUTION —Handling of circuit boards requires care as microelectronics are sensitive to *electrostatic discharge,* which can cause failure of high-speed electronic components. Be careful to properly ground yourself prior to / while handling the circuit board to replace the EPROMs.

Important—Before changing EPROMs, manually record configuration and calibration data from the NOA-332. This information will have to be manually reentered after installation of the replacement EPROMS.

To change the EPROMS, follow the steps below:

1. Remove power from the NOA-332.
2. Remove battery BT1 from the digital circuit board.

CAUTION—Do not set the battery on a conductive surface (e.g. metal toolbox, puddle of water) where the leads of the battery are electrically shorted together.

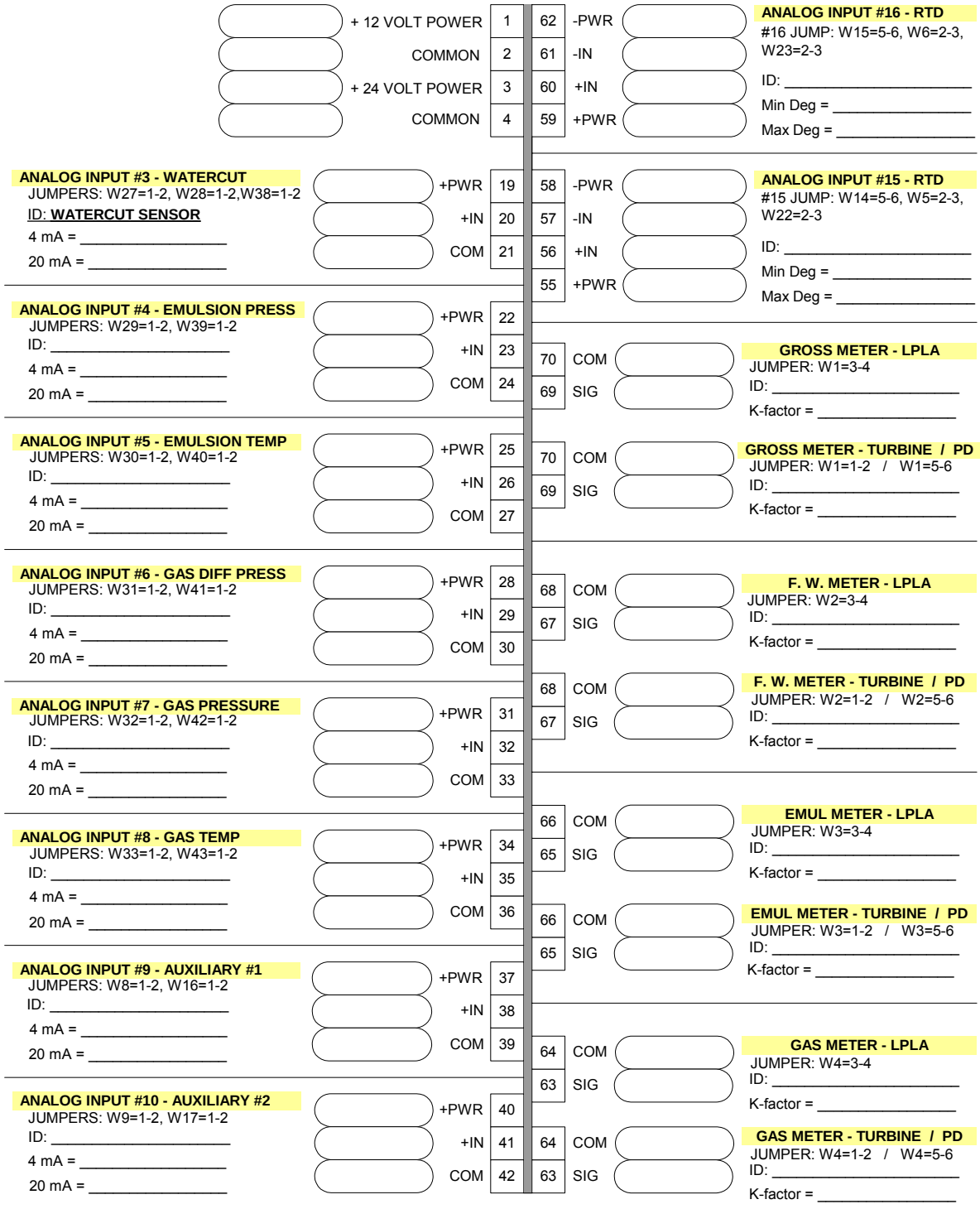
3. Remove the EPROMs.
4. Install the new EPROMs, ensuring that the EPROM labeled A is installed in the ROM A socket and the EPROM labeled B is installed in the ROM B socket. Also verify that the beveled corner

of each EPROM is placed in the beveled corner of each socket. Be careful not to bend the EPROM pins during insertion into the socket.

5. Note the date of battery BT1. These batteries are rated for a 5-year life span. If the battery life has exceeded several years, replace the battery to assure the integrity of the data stored in memory. The battery part number is 9A-100012666.
6. Install battery BT1, noting the spacing of the leads. Use caution to fully insert the leads into the pin sockets without bending the battery leads.
7. Restore power to the NOA-332.
8. Reenter the configuration and calibration information that you recorded before replacing the EPROMs and verify all configuration information. The NOA-332 is ready to be restored to service.

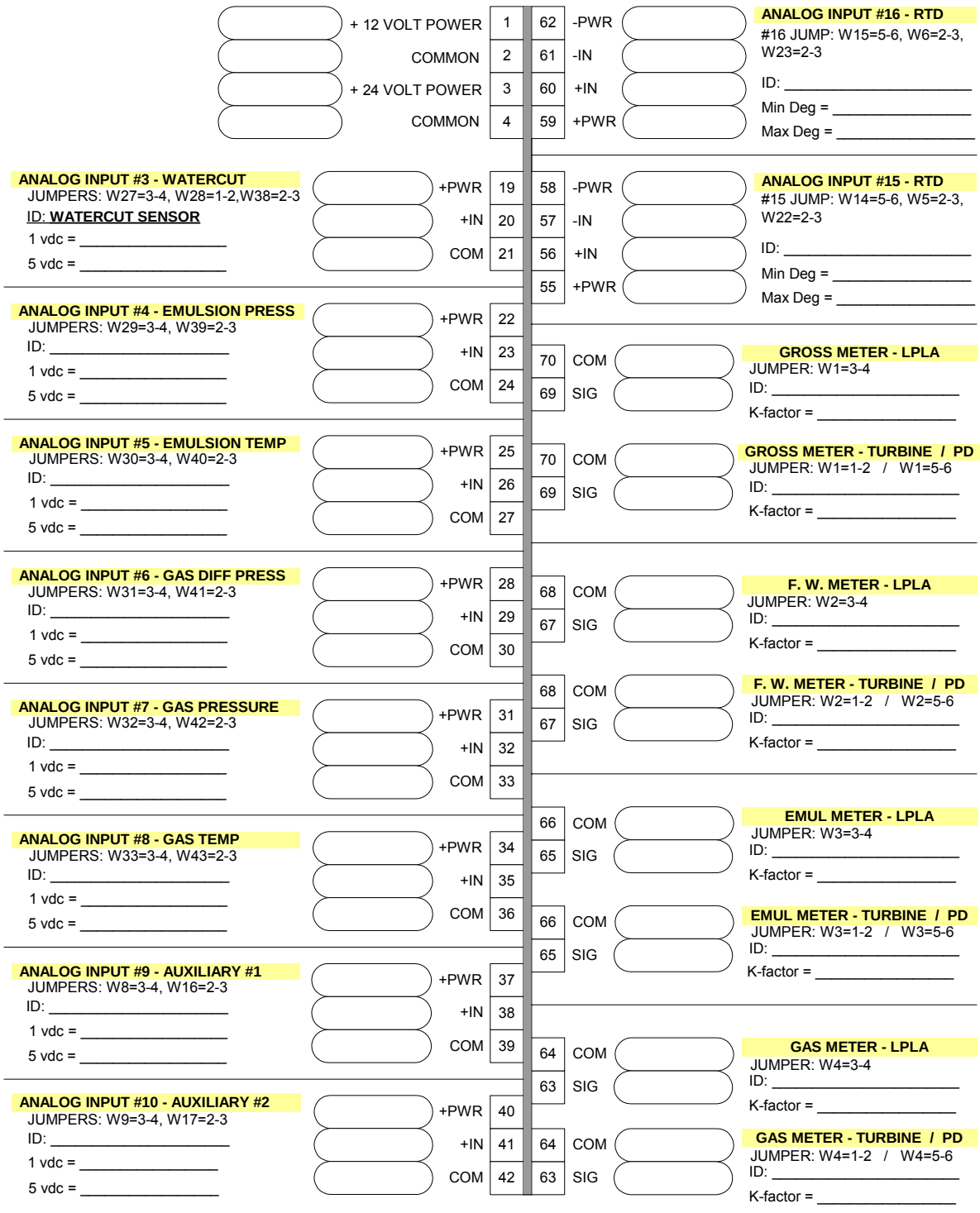
NOA-332 WIRING ASSIGNMENT WORKSHEET

CURRENT TYPE TRANSMITTERS / RTD



NOA-332 WIRING ASSIGNMENT WORKSHEET

VOLTAGE TYPE TRANSMITTERS / RTD



Notes

Appendix B

General Installation Instructions— Rack/Panel Mount Unit

Introduction

The NOA-332 is available in either of two styles—a weatherproof unit with a fiberglass enclosure, or a unit designed especially for mounting on a rack or in an instrument panel. This appendix contains instructions for installing the rack/panel mount version (Figures B.1 through B.4). Refer to Appendix A for installation of the weatherproof analyzer.

Benefits of the NOA-332 include:

- The transmitter inputs may be voltage inputs (0 to 5 VDC including 1 to 5 VDC), current inputs (0 to 20 mA including 4 to 20 mA), or multivariable transmitters (via COM3) and may be mixed. Transmitters provide temperature, pressure, and watercut information to the NOA-332, resulting in temperature- and pressure-compensated flow calculations. The NOA-332 supports the use of 100-ohm RTDs.

- Two analog input channels may be designated as auxiliary. The transmitter values are averaged during the well test period and the average value is recorded in memory as a part of the well test record.

- Two four-channel digital input/output circuits provide alarm indication, pulse output, and control outputs plus discrete switch inputs. The switch inputs can be used to trigger an alarm or emergency shutdown of a well test cycle.

- The capacitance probe interface circuit permits use of the NuFlo Capacitance Probe. This watercut sensing device produces a frequency output proportional to the percent watercut in an emulsion stream. This circuit board is calibrated independently of the NOA-332.

- The gas flow meter may be an orifice or turbine type. When using an orifice meter, do not attempt to use frequency input #1.

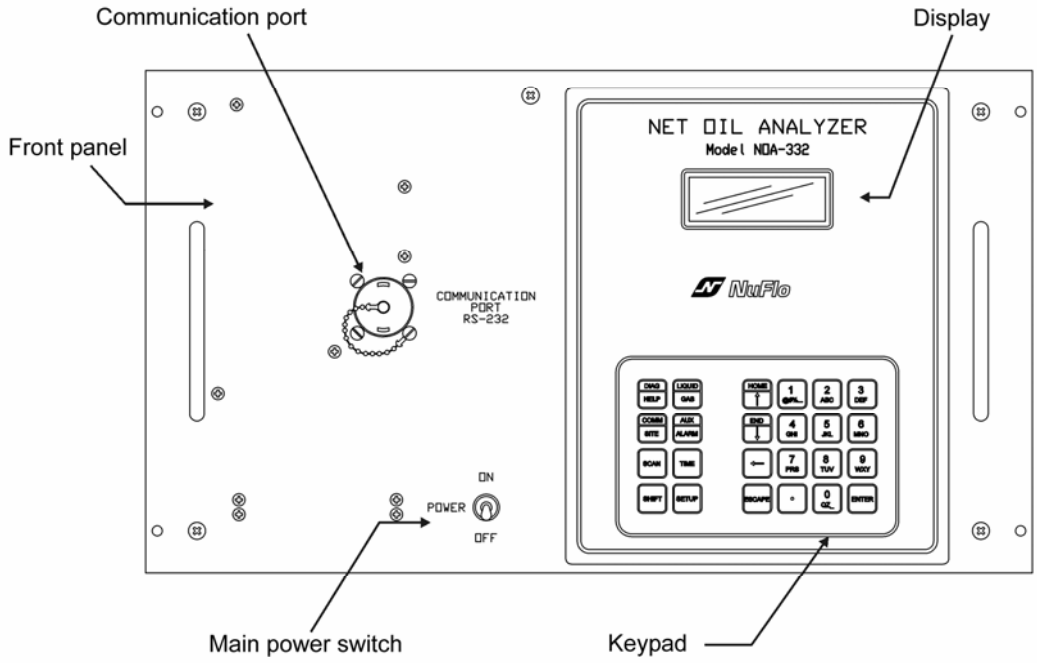


Figure B.1—Rack/panel mount of NOA-332, nomenclature, front view

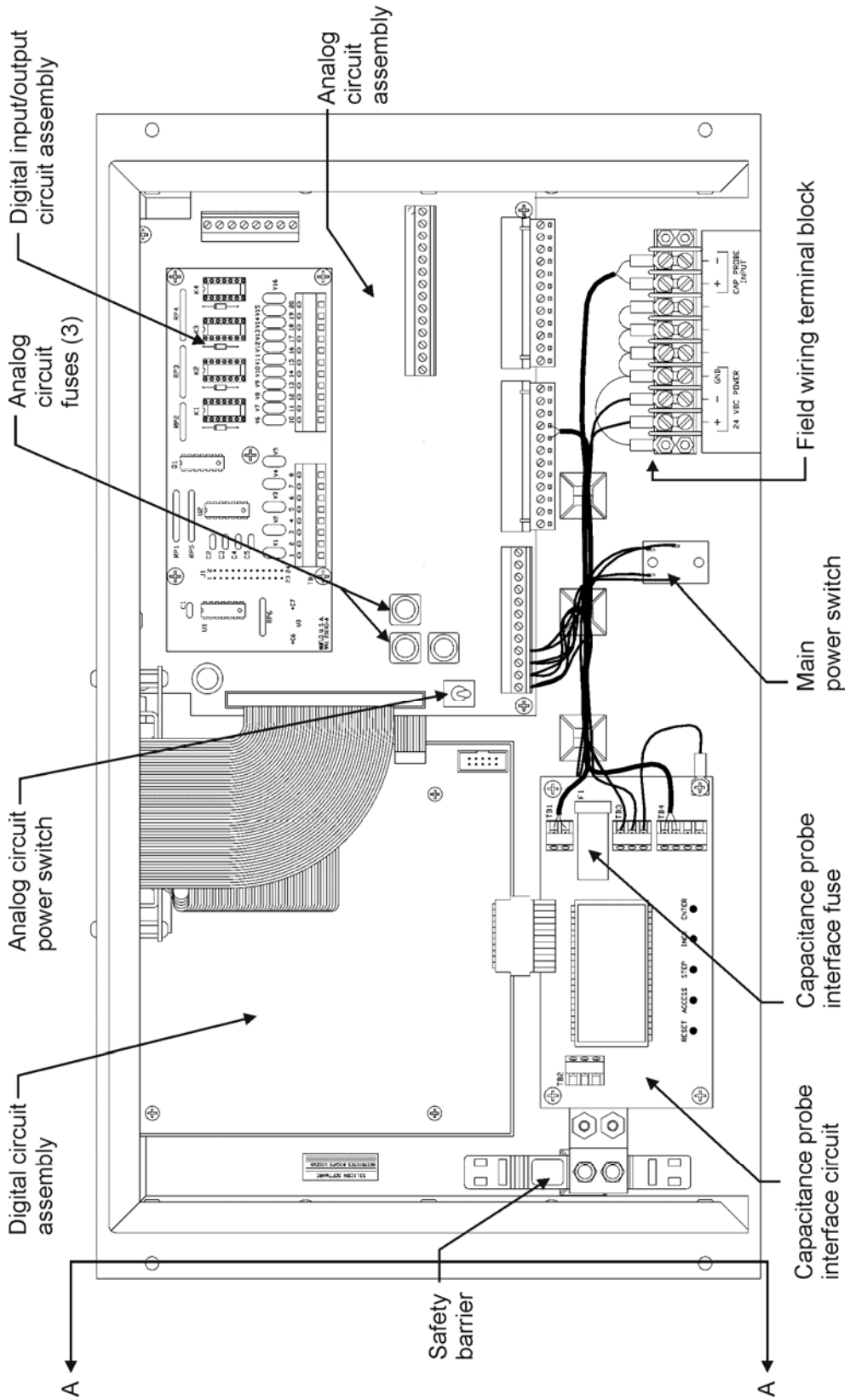


Figure B.2—Rack/panel mount of NOA-332, nomenclature, back view

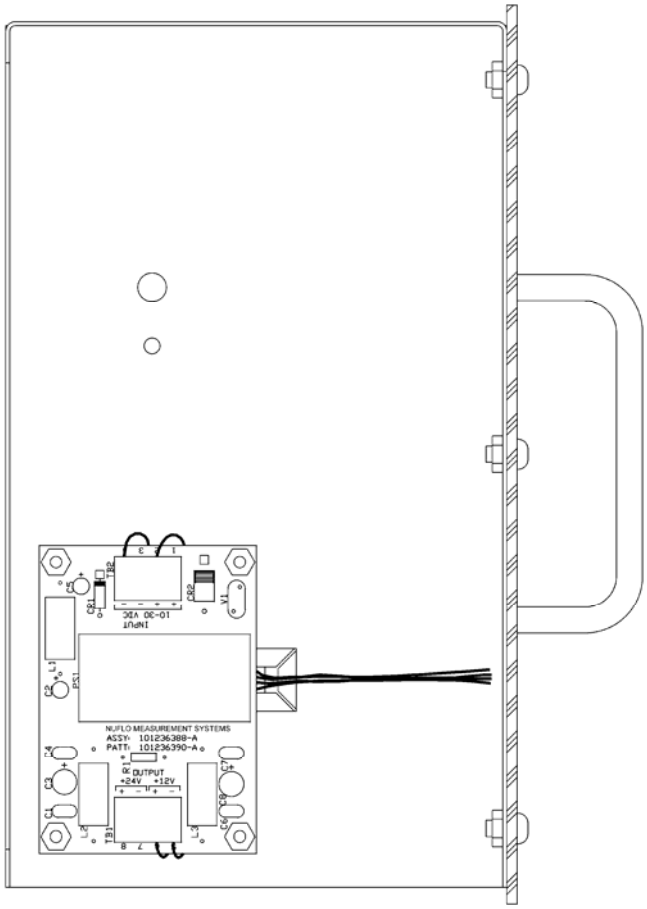


Figure B.3—DC-to-DC converter (Section A-A in Figure B.2)

Mounting the Instrument

The NOA-332 rack/panel mount version is designed for installation indoors, such as a control room environment. It may be installed in an industry standard 10 ½-in. by 19-in. rack or in a panel with the appropriate cutout (Figure B.4).

Caution— Never install the NOA-332 in a hazardous location.

- Mount the instrument in the rack or panel cutout with the appropriate fasteners.
- Be sure to allow sufficient space behind the rack or panel for accessing the field wiring terminal blocks.
- Mount the instrument at a height that allows easy viewing of the LCD display.

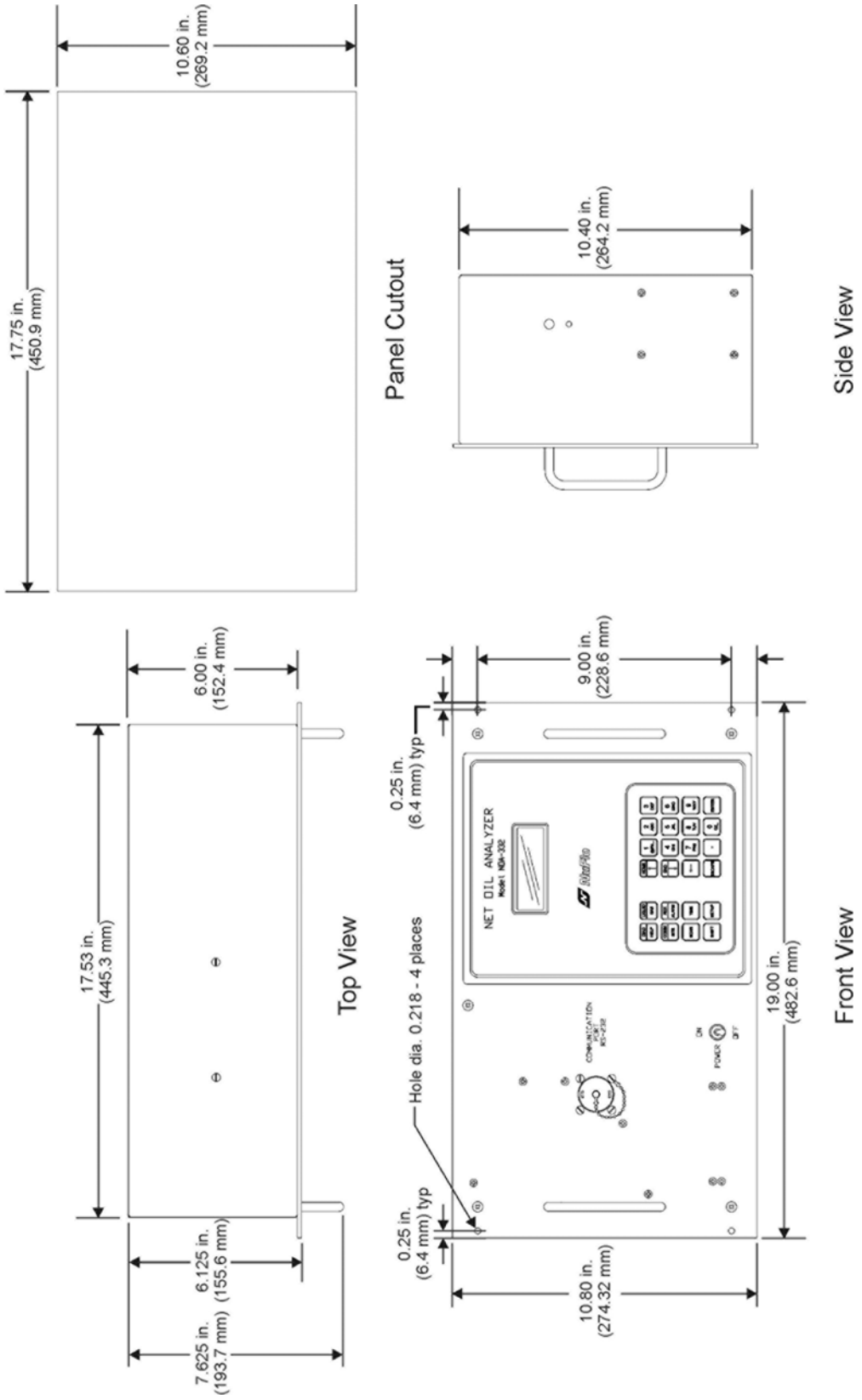


Figure B.4—Panel cutout and mounting dimensions

NOA-332 Power Wiring Connections

The power feed to the Rack Mount NOA-332 is 24 VDC nominal (30 VDC maximum) at a maximum current of 300 mA, depending on the communications options and the number of 4-to-20 mA transmitters being used.

The NOA-332 requires power, transmitters, and flowmeters for proper operation. All field wiring enters the NOA-332 through the back side of the instrument and connects to the terminal blocks on the analog circuit board and power terminal block below the analog circuit board. Before making any wiring changes or modifying the settings, place the power switch and the master power switch in the OFF position. The power switch is located in the lower left corner of the circuit board and the master power switch is located on the front panel (see Figures B.1 and B.2).

Earth Ground

A solid cable shield and earth ground connection to the metal enclosure is essential for optimal transient protection of the NOA-332 circuitry. These connections are shown in Figures B.2, page B-3, and B.12, page B-19.

Caution—All field wiring must conform to the National Electric Code, NFPA 70, Article 501-4(b) for installations within the United States or the Canadian Electric Code for installations within Canada. Local wiring ordinances may also apply. All field wiring must have a wire range of 22 to 14 AWG and terminal block screws must be tightened to a minimum torque of 5 to 7 in-lbs. to secure the wiring within the terminal block. Only personnel who are experienced with field wiring should perform these procedures.

Main Power

The operating power for the NOA-332 is protected by three separate fuses:

1. Fuse F2 (1 amp) provides circuit protection for the 12 VDC used to power the analog circuit board, which powers all analog and digital circuits within the NOA-332. The field wiring connection is made to TB1 terminal block positions 1 and 2 as shown below.
2. Fuse F3 (500 mA) provides circuit protection to all 4 to 20 mA transmitters, which are connected to the NOA-332 analog circuit board. The excitation voltage for the transmitters cannot exceed 30 VDC. The field wiring connection is made to TB1 terminal block positions 3 and 4 as shown below.
3. Fuse F1 (5 amps) provides circuit protection to the external power output voltage at terminal block position 5. Terminal block position 6 is the common field connection for the external power output voltage.

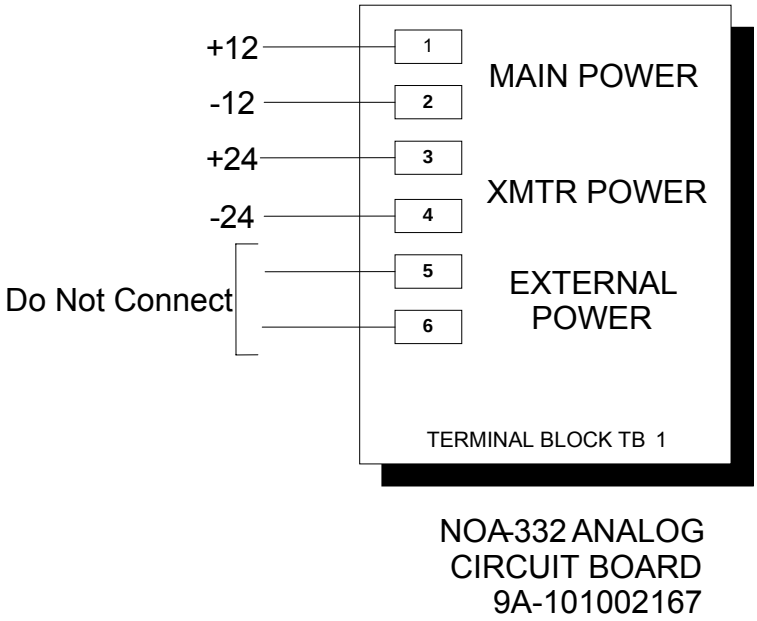


Figure B.5—Analog circuit board, terminal block 1

Analog Circuit Board Transmitter Wiring and Jumper Configuration

The NOA-332 operating system supports a total of nine (9) discrete transmitters. Not all of these inputs are required. The default assigned input channels listed below should be followed when connecting the field transmitters and flowmeters to the NOA-332.

The default channel assignments are as follows:

- Analog Input #1 - System Power
- Analog Input #2 - Internal Temperature
- Analog Input #3 - Watercut Probe / Sensor
- Analog Input #4 - Emulsion Flowing Pressure
- Analog Input #5 - Emulsion Flowing Temperature
- Analog Input #6 - Gas Orifice Differential Pressure
- Analog Input #7 - Gas Orifice Static Pressure / Gas Turbine Flowing Pressure
- Analog Input #8 - Gas Orifice Static Temperature / Gas Turbine Flowing Temp
- Analog Input #9 - Auxiliary #1
- Analog Input #10 - Auxiliary #2
- Analog Input #11 – Gas Orifice Stacked High Differential Pressure
- Frequency Input #1 - Gas Meter
- Frequency Input #2 - Emulsion Meter
- Frequency Input #3 - Free Water Meter
- Frequency Input #4 - Gross Volume Meter

Important—If an RTD is being used in your application, analog input channels #5 or #8 must be reassigned. If the RTD is used for emulsion flowing temperature, analog input #5 will be reassigned to input #15. If the RTD is used for gas turbine flowing temperature, analog input channel #8 will be reassigned to input #16.

Analog input channel #3 is dedicated to receiving the analog signal from the watercut sensor. This input channel should only be used for the watercut sensor.

Analog input channels #1 and #2 and all four frequency input channel assignments are fixed as listed above and cannot be changed.

The NOA-332 permits the use of voltage output transmitters (0 to 5 V including 1 to 5 V), current output transmitters (0 to 20 mA including 4 to 20 mA), or multivariable transmitters (via COM3 RS-485 communications port). Voltage output transmitters may be mixed with current output transmitters, as each analog input channel is independent and configurable. The Analog circuit board contains jumpers for each of the analog inputs to configure the analog input channels. Connecting combinations of pins routes the analog signals through the Analog board circuitry. Each pin header is numbered, with a small white circle on the Analog circuit board, representing pin number 1. The user must be certain to correctly set these jumpers or damage may occur to the transmitter or the NOA-332 circuitry. All analog inputs that are not used should be set for 4 to 20 mA transmitter input to provide optimal anti-static protection.

Important—The instructions in this section assume the user is following the default configuration when wiring transmitters to the NOA-332.

Two worksheets are provided at the end of this appendix to assist the user in identifying the jumper settings for the analog inputs, and recording transmitter information and wiring identification. One worksheet covers current output transmitters; the other covers voltage output transmitters. These worksheets should be filled out as appropriate, used to configure the hardware and operating system, and stored inside the NOA-332.

The analog board is shown in Figure B.6 for reference.

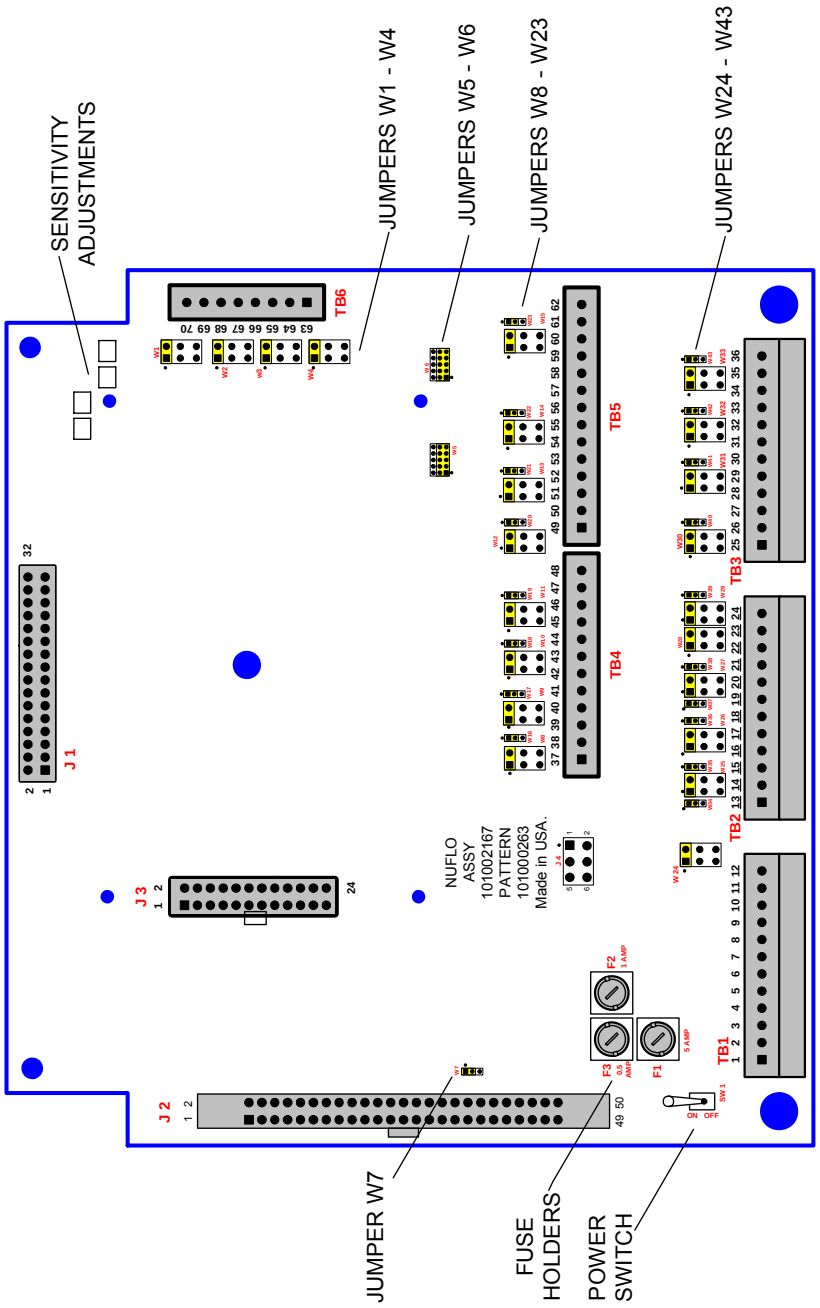


Figure B.6—Analog circuit board, nomenclature

Field Wiring for Voltage Output Transmitters

Voltage output transmitters are typically three-wire devices, operate on less current than current output type transmitters, and are susceptible to signal loss and noise. For these reasons, voltage output transmitters must use relatively short lengths of shielded signal cable between the transmitter and the NOA-332. The NOA-332 provides either 7.5 V or 5.0 V to power voltage output transmitters, as determined by jumper setting.

The Rack/Panel Mount NOA-332 contains the optional Capacitance Probe Interface circuit board. This circuit board comes pre-wired to Analog Input Channel #3 as a voltage type transmitter. The default voltage output transmitter terminal block connections are defined as follows:

Emulsion Flowing Pressure (Analog Channel #4)	Terminal 22 - POWER Terminal 23 - SIGNAL Terminal 24 - COMMON
Emulsion Flowing Temperature (Analog Channel #5)	Terminal 25 – POWER Terminal 26 - SIGNAL Terminal 27 - COMMON
Gas Orifice Differential Pressure (Analog Channel #6)	Terminal 28 - POWER Terminal 29 - SIGNAL Terminal 30 - COMMON
Gas Flowing Pressure (Analog Channel #7)	Terminal 31 - POWER Terminal 32 - SIGNAL Terminal 33 - COMMON
Gas Flowing Temperature (Analog Channel #8)	Terminal 34 - POWER Terminal 35 - SIGNAL Terminal 36 - COMMON
Auxiliary Input #1 (Analog Channel #9)	Terminal 37 – POWER Terminal 38 - SIGNAL Terminal 39 - COMMON
Auxiliary Input #2 (Analog Channel #10)	Terminal 40 - POWER Terminal 41 - SIGNAL Terminal 42 - COMMON
Gas Diff Pressure High (Analog Channel #11)	Terminal 43 – POWER Terminal 44 - SIGNAL Terminal 45 - COMMON

Note that analog channels #6 and #7 are used with a gas meter, either orifice or turbine. Refer to Figure B.12 for a wiring diagram.

Note—Some voltage output transmitters do not require power from the NOA-332. In these cases, simply feed the transmitter signal to the SIGNAL and COMMON terminal positions as indicated above.

Field Wiring for Current Output Transmitters

Current output transmitters are often used because they output a noise immune analog signal and do not experience signal loss over long distances of wire. The NOA-332 is designed for use with 2-wire transmitters where the return path to circuit ground is completed within the NOA-332 circuitry via a 249 ohm resistor.

As is common with two-wire transmitters, the maximum loop load is based upon the excitation voltage to the loop. The NOA-332 inserts 249 ohms into the current loop. The NOA-332 power supply feed for current loop excitation is the user-supplied 24VDC nominal (30VDC maximum) power supply. The user must keep this is mind when selecting the current output transmitters.

The default current output transmitter terminal block connections are defined as follows:

Emulsion Flowing Pressure (Analog Channel #4)	Terminal 22 - POSITIVE Terminal 23 - NEGATIVE
Emulsion Flowing Temperature (Analog Channel #5)	Terminal 25 - POSITIVE Terminal 26 - NEGATIVE
Gas Orifice Differential Pressure (Analog Channel #6)	Terminal 28 - POSITIVE Terminal 29 - NEGATIVE
Gas Flowing Pressure (Analog Channel #7)	Terminal 31 - POSITIVE Terminal 32 - NEGATIVE
Gas Flowing Temperature (Analog Channel #8)	Terminal 34 - POSITIVE Terminal 35 - NEGATIVE
Auxiliary Input #1 (Analog Channel #9)	Terminal 37 – POSITIVE Terminal 38 - NEGATIVE
Auxiliary Input #2 (Analog Channel #10)	Terminal 40 - POSITIVE Terminal 41 - NEGATIVE
Gas Diff Pressure High (Analog Channel #11)	Terminal 43 - POSITIVE Terminal 44 - NEGATIVE

Note that analog channels #6 and #7 are used with a gas meter, either orifice or turbine. Refer to Figure B.12 for a wiring diagram.

Note—Some current output transmitters are four-wire types and do not require power from the NOA-332, but instead feed a current signal to the NOA-332. In these cases, connect the POSITIVE transmitter signal to the SIGNAL terminal and the NEGATIVE transmitter signal to the COMMON terminal as indicated above for the voltage output transmitters, making certain that the jumpers remain set for a 4 to 20 mA transmitter.

Jumper Configuration for the Voltage and Current Transmitters

Figure B.7 depicts the jumper settings for current and voltage analog signals (Analog Input Mode Selection). Note the position of he jumper and the jumper designation. Because different analog transmitters require different operating voltages, the NOA-332 allows the user to route different power to teach transmitter as required. This is shown as Analog Input Power Supply Selection.

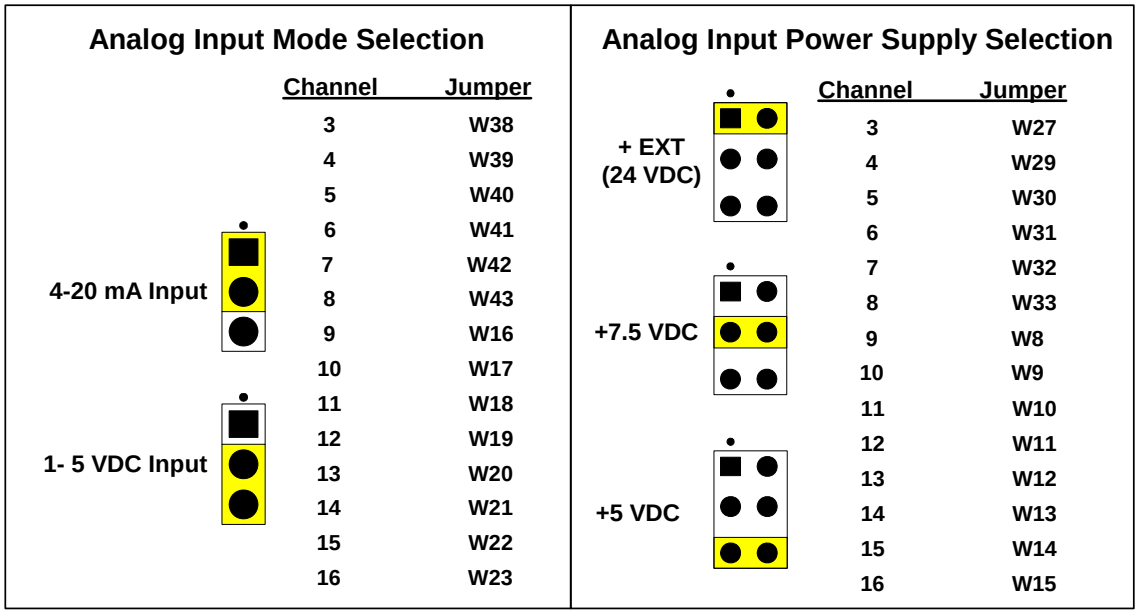


Figure B.7—Jumper settings for current and voltage analog signals

Table B.1 gives the user an overview of each analog input and the related jumper configuration.

Table B.1—Analog Board Jumper Configuration Chart

			VOLTAGE TRANSMITTERS			CURRENT TRANSMITTERS		100 OHM RTD	
Input	**Term. Blk. #**	**Term. Blk. I.D.**	**Connections**	**7.5V Pwr**	**5V Pwr**	**Connections**	**Settings**	**Connections**	**Settings**
Analog	13	+Pwr	Not Available	W24: 5-6*	W24: 5-6*	Not Available	W24: 5-6*	Not Available	None
Input	14	+In	Not Available	W34: 1-2*	W34: 1-2*	Not Available	W34: 1-2*	Not Available	None
#1	15	Com	Not Available	W25: 5-6*	W25: 5-6*	Not Available	W25: 5-6*	Not Available	None
*(See Note 1)	------	------	------	W35: 2-3*	W35: 2-3*	------	W35: 2-3*	Not Available	None
Analog	16	+Pwr	Not Available	W26: 5-6*	W26: 5-6*	Not Available	W26: 5-6*	Not Available	None
Input #2	17	+In	Not Available	W36: 2-3*	W36: 2-3*	Not Available	W36: 2-3*	Not Available	None
*(See Note 2)	18	Com	Not Available	W37: 2-3*	W37: 2-3*	Not Available	W37: 2-3*	Not Available	None
Analog	19	+Pwr	Power	W27: 3-4	W27: 5-6	4-20mA +	W27: 1-2	Not Available	None
Input	20	+In	Signal	W28: 1-2	W28: 1-2	4-20mA -	W28: 1-2	Not Available	None
#3	21	Com	Common	W38: 2-3	W38: 2-3	None	W38: 1-2	Not Available	None
Analog	22	+Pwr	Power	W29: 3-4	W29: 5-6	4-20mA +	W29: 1-2	Not Available	None
Input	23	+In	Signal	W39: 2-3	W39: 2-3	4-20mA -	W39: 1-2	Not Available	None
#4	24	Com	Common	------	------	None	------	Not Available	None
Analog	25	+Pwr	Power	W30: 3-4	W30: 5-6	4-20mA +	W30: 1-2	Not Available	None
Input	26	+In	Signal	W40:2-3	W40: 2-3	4-20mA -	W40: 1-2	Not Available	None
#5	27	Com	Common	------	------	None	------	Not Available	None
Analog	28	+Pwr	Power	W31: 3-4	W31: 5-6	4-20mA +	W31: 1-2	Not Available	None
Input	29	+In	Signal	W41: 2-3	W41: 2-3	4-20mA -	W41: 1-2	Not Available	None
#6	30	Com	Common	------	------	None	------	Not Available	None
Analog	31	+Pwr	Power	W32: 3-4	W32: 5-6	4-20mA +	W32: 1-2	Not Available	None
Input	32	+In	Signal	W42: 2-3	W42: 2-3	4-20mA -	W42: 1-2	Not Available	None
#7	33	Com	Common	------	------	None	------	Not Available	None
Analog	34	+Pwr	Power	W33: 3-4	W33: 5-6	4-20mA +	W33: 1-2	Not Available	None
Input	35	+In	Signal	W43: 2-3	W43: 2-3	4-20mA -	W43: 1-2	Not Available	None
#8	36	Com	Common	------	------	None	------	Not Available	None
Analog	37	+Pwr	Power	W8: 3-4	W8: 5-6	4-20mA +	W8: 1-2	Not Available	None
Input	38	+In	Signal	W16: 2-3	W16: 2-3	4-20mA -	W16: 1-2	Not Available	None
#9	39	Com	Common	------	------	None	------	Not Available	None
Analog	40	+Pwr	Power	W9: 3-4	W9: 5-6	4-20mA +	W9: 1-2	Not Available	None
Input	41	+In	Signal	W17: 2-3	W17: 2-3	4-20mA -	W17: 1-2	Not Available	None
#10	42	Com	Common	------	------	None	------	Not Available	None
Analog	43	+Pwr	Power	W10: 3-4	W10: 5-6	4-20mA +	W10: 1-2	Not Available	None
Input	44	+In	Signal	W18: 2-3	W18: 2-3	4-20mA -	W18: 1-2	Not Available	None
#11	45	Com	Common	------	------	None	------	Not Available	None
Analog	46	+Pwr	Power	W11: 3-4	W11: 5-6	4-20mA +	W11: 1-2	Not Available	None
Input	47	+In	Signal	W19: 2-3	W19: 2-3	4-20mA -	W19: 1-2	Not Available	None
#12	48	Com	Common	------	------	None	------	Not Available	None
Analog	49	+Pwr	Power	W12: 3-4	W12: 5-6	4-20mA +	W12: 1-2	Not Available	None
Input	50	+In	Signal	W20: 2-3	W20: 2-3	4-20mA -	W20: 1-2	Not Available	None
#13	51	Com	Common	------	------	None	------	Not Available	None
Analog	52	+Pwr	Power	W13: 3-4	W13: 5-6	4-20mA +	W13: 1-2	Not Available	None
Input	53	+In	Signal	W21: 2-3	W21: 2-3	4-20mA -	W21: 1-2	Not Available	None
#14	54	Com	Common	------	------	None	------	Not Available	None
Analog	55	+Pwr	Power	W14: 3-4	W14: 5-6	4-20mA +	W14: 1-2	A	W14: 5-6
Input	56	+In	Signal	W5: 1-2	W5: 1-2	4-20mA -	W5: 1-2	B	W5: 2-3
#15	57	-In	Common	W22: 2-3	W22: 2-3	None	W22: 1-2	C	W22: 2-3
(See Note 3)	58	-Pwr	Common	------	------	None	------	D	
Analog	59	+Pwr	Power	W15: 3-4	W15: 5-6	4-20mA +	W15: 1-2	A	W15: 5-6
Input	60	+In	Signal	W6: 1-2	W6: 1-2	4-20mA -	W6: 1-2	B	W6: 2-3
#16	61	-In	Common	W23: 2-3	W23: 2-3	None	W23: 1-2	C	W23: 2-3
(See Note 3)	62	-Pwr	Common	------	------	None	------	D	

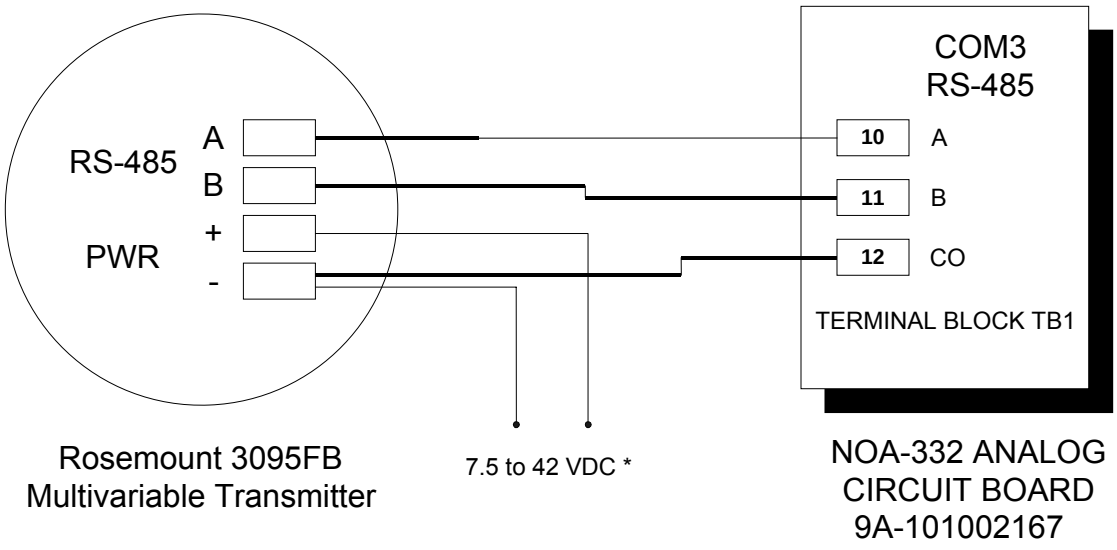
NOTE 1: Analog input #1 is configured as an internal voltage monitor by setting W24 to position 5-6, W25 to position 5-6, W34 to position 1-2, and W35 to position 2-3. No connection is made at the Analog input #1 terminal block.

NOTE 2: Analog input #2 is configured to monitor on-board temperature by setting W26 to position 5-6, W36 to position 2-3, and W37 to position 2-3. No connection is made at the Analog #2 terminbal block.

NOTE 3: Refer to the section "RTD Temperature Detectors" for the connection of 2, 3, or 4 wire RTDs.

Field Wiring for the Multivariable Transmitter

The installation of the multivariable transmitter to the NOA-332 is illustrated below. The multivariable transmitter option can be used with any of the configurations listed in Table B.1. A three-conductor cable is required for the RS-485 communications and power must be connected to the MVT.



* On integral AC powered models, power MVT from 12 VDC of AC/DC module. On user provided 24 VDC modules, power MVT from 24 VDC. On user provided 12 VDC models, power MVT from 12 VDC.

Figure B.8—Wiring of MVT to NOA-332

RTD Temperature Detectors

Analog input channels #15 and #16 are dual-function inputs which can be configured as transmitter analog inputs (see Table B.1) or as 100-ohm Platinum RTD inputs to sense temperature. These inputs accept 2, 3, and 4 wire types as shown in Figure B.9 below. When using 2 or 3 wire RTDs, a jumper wire must be installed at the terminal block as indicated in Figure B.10. Analog input channels #15 and #16 are not included in the default setup. When using RTDs to sense temperature, input channel(s) #15 or #16 must have the jumpers set as depicted in Figure B.10, and the appropriate channel must be assigned to the temperature AI# for a given flow (see Section 2 of this manual).

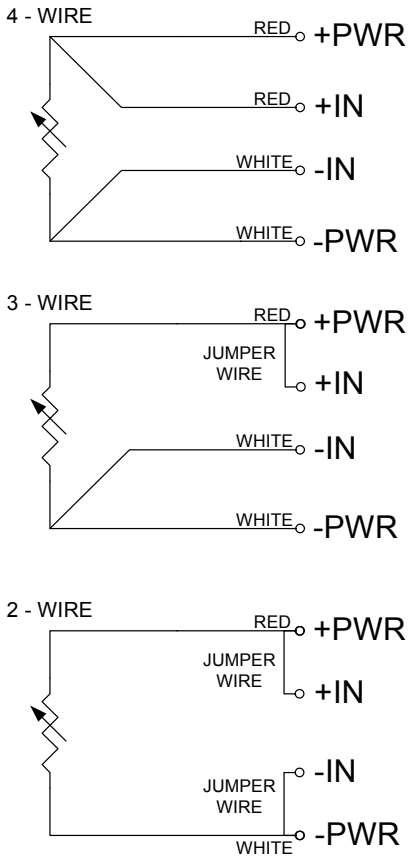


Figure B.9—RTD connections for 2-wire, 3-wire, and 4-wire types

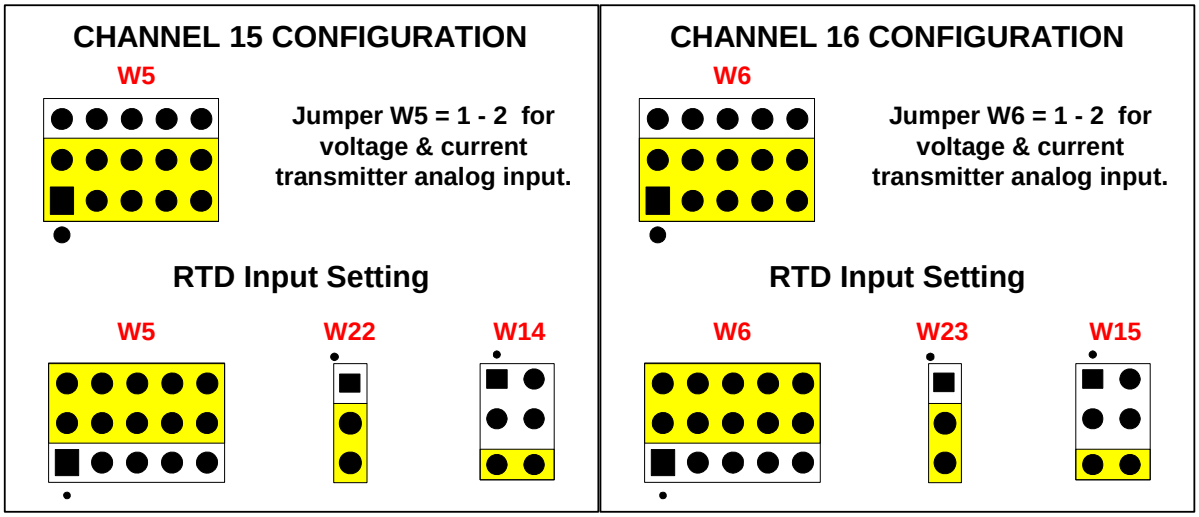


Figure B.10— Jumper and RTD input settings for current and voltage analog signals

Analog Circuit Board Frequency Flowmeter Wiring and Jumper Configuration

The NOA-332 has four frequency inputs designed for use with low-level sine wave (e.g. turbine meter) signals, amplified square wave signals from the NuFlo Low-Power Amplifier, and dry contact closure (e.g. reed switch) signals common to positive displacement flowmeters. The wiring diagrams at the end of this section depict the wiring for the frequency inputs. The frequency input assignments are fixed by the NOA-332 operating system and cannot be changed.

A user-selectable jumper for each frequency input determines the type of frequency signal used with each frequency input channel (see Table B.2). The jumpers are designated as W1, W2, W3 and W4. The frequency inputs are designated as Flowmeters 1 through 4 and correspond to terminal block positions 63 through 70. Each of the four frequency inputs has a COMMON and a SIGNAL input. The COMMON input is signal common. When using turbine flowmeters with the NOA-332, the jumper must be set to short positions 1 and 2. This input configuration assumes the load of 1200 ohms, commonly the DC resistance of a magnetic pickup. The allowable signal amplitude ranges from 20mV peak to peak to 10 V RMS. All four frequency inputs have adjustable input sensitivity potentiometers for optimum setting of signal-noise-level (see Figure B.6). The threshold is variable from 15mV to 150mV. The adjustment is factory set at 25mV. Typically the wires from the magnetic pickup can be connected to the terminal block without regard to polarity provided neither wire is connected to earth or chassis ground.

When using the NuFlo Low-Power Line Amplifier with the NOA-332, the jumper must be set to short positions 3 and 4 as shown below. In this configuration, the NOA circuitry provides the operating power for the amplifier as well as signal conditioning to extract the flowmeter signal. The amplifier uses a two-wire output labeled OUT and GND. The OUT wire should be connected to the SIGNAL input terminal on the Analog circuit board and the GND wire should be connected to the COMMON terminal on the Analog circuit board. The LPLA output signal is 8V, so no adjustment of the input sensitivity potentiometers is necessary.

When using a positive displacement flowmeter with a switch output with the NOA-332, the jumper must be set to short positions 5 and 6. In this configuration, the NOA circuitry provides a current limited voltage to pass through the switch contacts as well as signal conditioning to extract the flowmeter signal. For this reason the switch must be a dry contact type, electrically floating with no power applied to the switch contacts. The wires from the switch can be connected to the SIGNAL and COMMON positions without regard to polarity. Additionally, no adjustment of the input sensitivity potentiometers is necessary.

The flowmeter terminal block connections are defined as follows:

Gas Turbine Meter (Frequency Input #1)	Terminal 63 – SIGNAL Terminal 64 – COMMON
Emulsion Turbine Meter (Frequency Input #2)	Terminal 65 – SIGNAL Terminal 66 – COMMON
Free Water Turbine Meter (Frequency Input #3)	Terminal 67 – SIGNAL Terminal 68 – COMMON
Gross Volume Turbine Meter (Frequency Input #4)	Terminal 69 – SIGNAL Terminal 70 – COMMON

Note—Frequency Input #1 is designated for use with a gas turbine meter. If an orifice meter is being used to measure gas, frequency input #1 is void and should not be used.

Table B.2 – Frequency Input Configuration Chart

Input	Term. Blk #	Diagram Term Blk ID	Connections	Jumper Settings	Connections	Jumper Settings	Connections (See Note 1)	Jumper Settings
Meter #1	63 64	A B	Pin A Pin B	W4: 1-2 ------	OUT GND	W4: 3-4 ------	Signal Common	W4: 5-6 ------
Meter #2	65 66	A B	Pin A Pin B	W3: 1-2 ------	OUT GND	W3: 3-4 ------	Signal Common	W3: 5-6 ------
Meter #3	67 68	A B	Pin A Pin B	W2: 1-2 ------	OUT GND	W2: 3-4 ------	Signal Common	W2: 5-6 ------
Meter #4	69 70	A B	Pin A Pin B	W1: 1-2 ------	OUT GND	W1: 3-4 ------	Signal Common	W1: 5-6 ------

NOTE 1: Switch contacts such as used with PD meters do not have polarity.

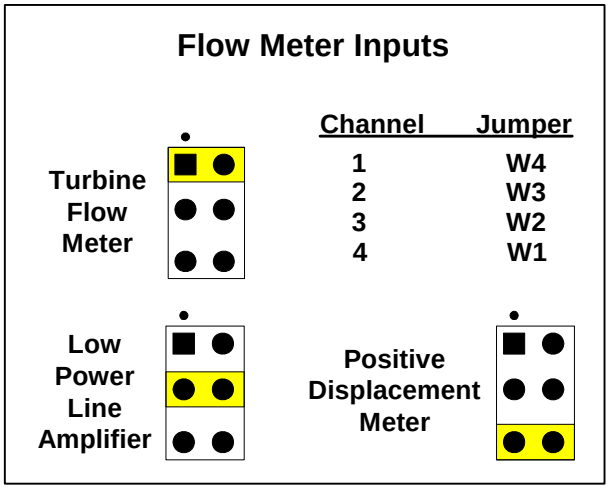


Figure B.11—Jumper settings for NOA-332 used with Low Power Line Amplifier

Analog Circuit Board Ground Jumper Configuration

The RS-485 ground select jumper (Jumper W7) selects between connecting the digital ground directly to chassis ground or connecting digital ground to chassis ground through a 100-ohm resistor. The 100-ohm resistor on Jumper W7 is provided to limit circulating currents through the RS-485 common conductor that results from ground potential differences between NOA-332 and the master (host) computer. If a common conductor with low resistance interconnects the units, then the ground select should be set for the 100-ohm position (position 1-2). If there is substantial resistance in the common conductor between units (in the 100-ohm range), the 0-ohm position on W7 (position 2-3) should be selected, since current limiting is provided by the resistance in the common conductor

itself. If there is no common conductor installed between the units, W7 should be set to the 100-ohm position (position 1-2). The RS-485 Standard recommends installation of the common conductor at all times. Omission of the common conductor is therefore not recommended.

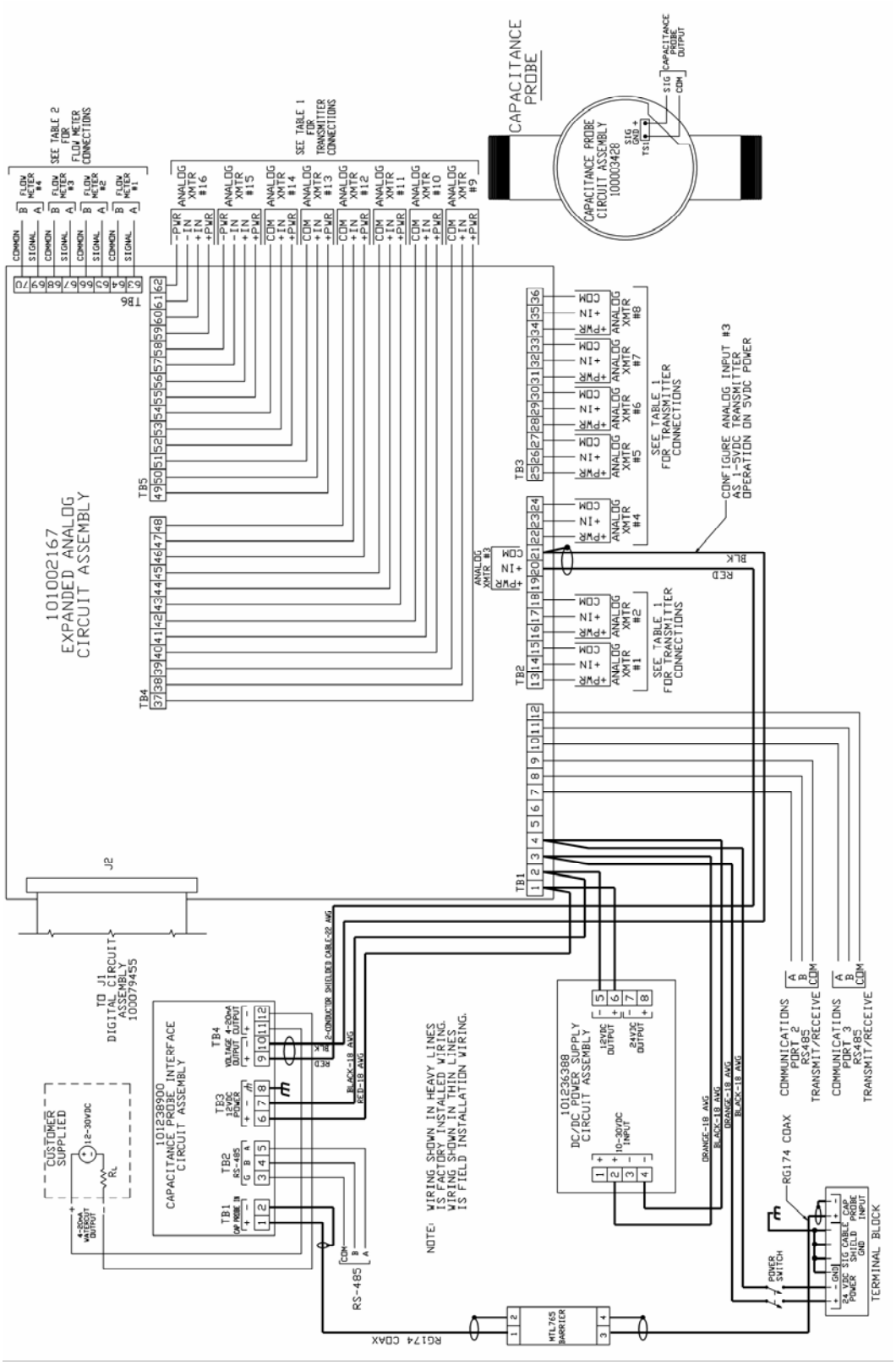


Figure B.12—Field wiring diagram for rack/panel mount NOA-332

Digital Circuit Board Setup and Jumper Configuration

The Digital circuit board accepts signals from the keypad and Analog circuit board and processes the information that is then displayed. The Digital circuit board (P/N 9A-100079455) is the "brain" of the NOA-332. Figure B.13 shows an outline of the digital circuit board with some smaller components removed for clarity. The jumpers on the Digital circuit board control the size of the memory chip and the operation of the communications ports. The communications features of the NOA-332 are covered in Appendix H.

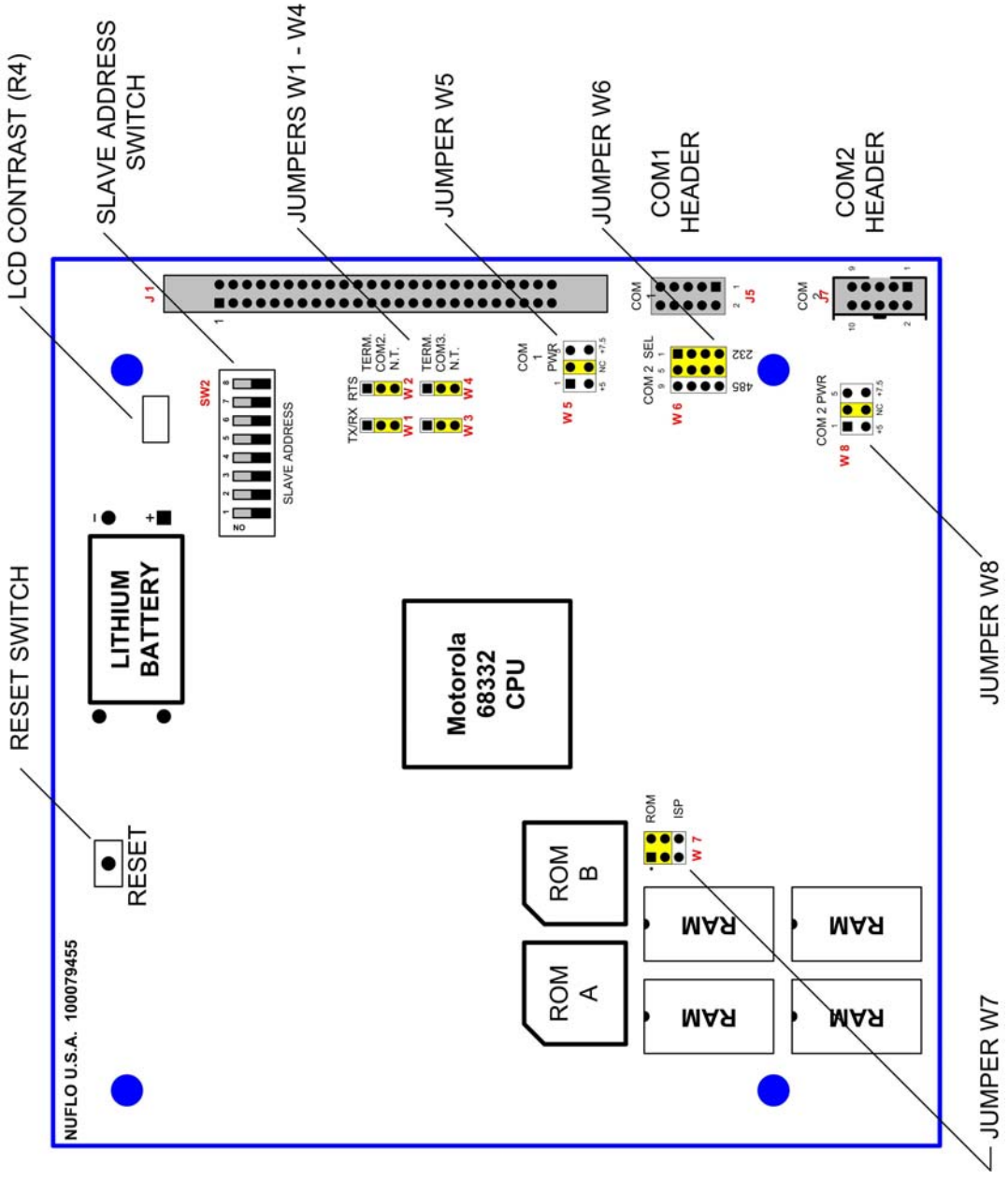


Figure B.13—Digital board nomenclature

Jumper W7

Jumper W7 should be set to the upper (ROM) setting, which is the default setting.

Setting the Identification Address

The communication protocols require that an identification address be set in the NOA-332. Set the identification address with the DIP switch (slave address switch, SW2) located above jumpers W1 through W4 on the upper right side of the Digital circuit board (see Figure B.13). The switch is an eight-section binary DIP switch allowing an address value of 1 to 255. Refer to Section 9a in this manual for complete instructions on setting the value of this switch and Appendix H for use of the communications protocols.

Display Contrast Adjustment

The Liquid Crystal Display has a user-adjustable contrast adjustment, labeled LCD CONTRAST R4, located on the Digital circuit board above the slave address switch in the upper-right corner of the circuit board. Figure B.13 shows the location of R4. Although this potentiometer is factory set, temperature extremes, user preference and viewing angle may require re-adjustment. Turning the potentiometer clockwise increases the contrast, and turning it counterclockwise reduces the contrast.

Upgrading NOA-332 System Firmware

The NOA-332 is shipped from the factory with the most up to date firmware available. Periodically, firmware enhancements which add features to the NOA-332 operating system may be available which will require replacement of the EPROMs (U31 and U32) located on the Digital circuit board (see Figure B.13). Use of an extraction tool designed for removal of this type of EPROM is highly recommended.

Caution—Handling of circuit boards requires care as microelectronics are sensitive to *electrostatic discharge* which can cause failure of high speed electronic components. Be careful to properly ground yourself prior to / while handling the circuit board to replace the EPROMs.

Follow the below listed steps when changing the EPROMs:

Manually record the configuration and calibration data from the NOA-332. This step is necessary to save configuration and calibration information in the NOA-332 since it will be erased from the memory during the upgrade procedure.

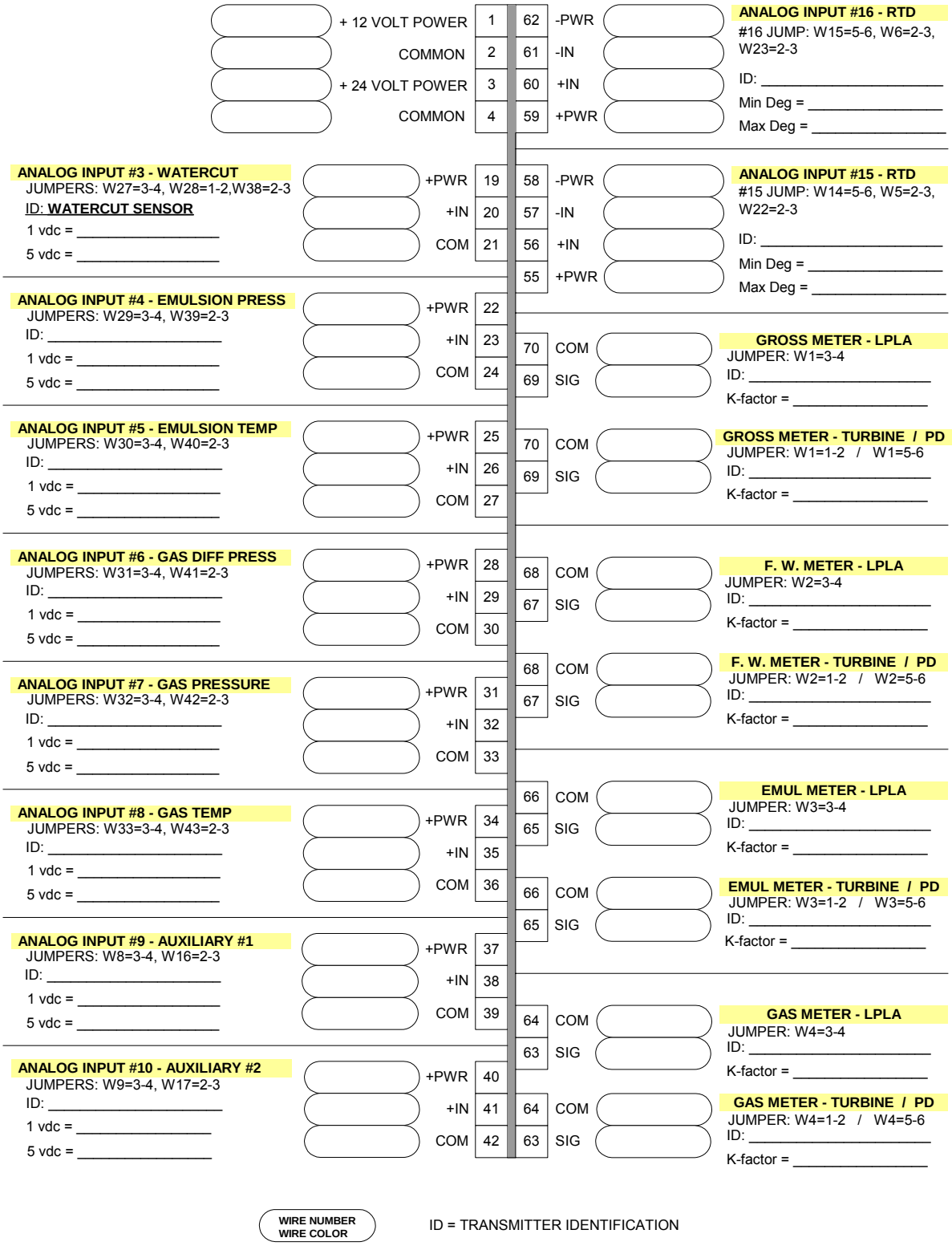
1. Remove power from the NOA-332.
2. Remove battery BT1 from the Digital circuit board.

Caution: Do not set the battery on a conductive surface (e.g. metal toolbox, puddle of water) where the leads of the battery are electrically shorted together.

3. Remove the EPROMs. Install the new EPROMs ensuring that the EPROM labeled A is installed in the ROM A socket and the EPROM labeled B is installed in the ROM B socket. Also verify that the beveled corner of each EPROM is placed in the beveled corner of each socket. Be careful not to bend the EPROM pins during insertion into the socket.
4. Note the date of battery BT1. These batteries are rated for a 5 year life span. If the battery life has exceeded several years, it is recommended that the battery be replaced to assure the integrity of the data stored in memory. The battery part number is 9A-100012666.
5. Install battery BT1 noting the spacing of the leads. Use caution to fully insert the leads into the pin sockets without bending the battery leads.
6. Restore power to the NOA-332. Manually reenter the configuration and calibration information previously recorded back into the NOA-332 and verify all configuration information. The NOA-332 is ready to be restored to service.

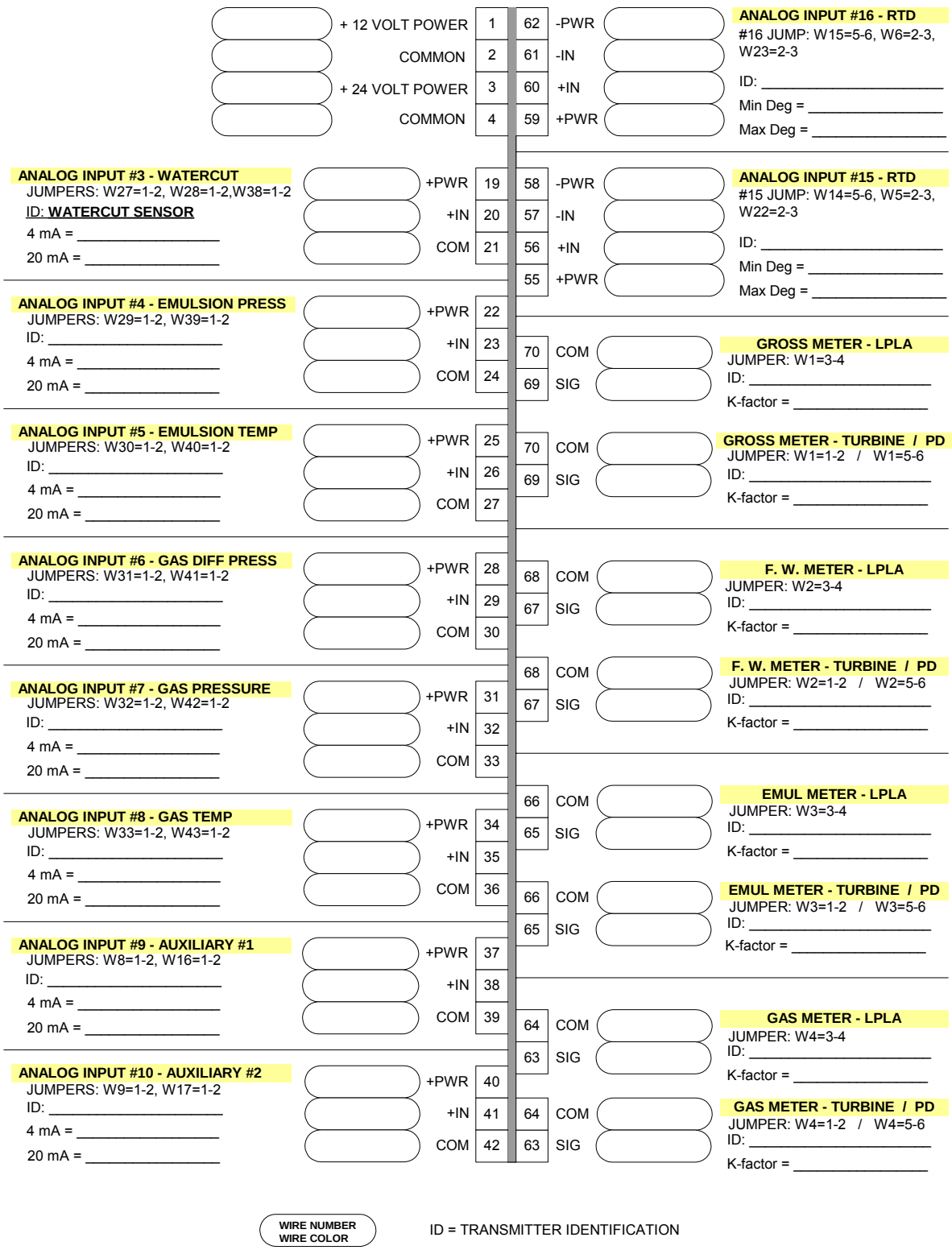
NOA-332 WIRING ASSIGNMENT WORKSHEET

VOLTAGE TYPE TRANSMITTERS / RTD



NOA-332 WIRING ASSIGNMENT WORKSHEET

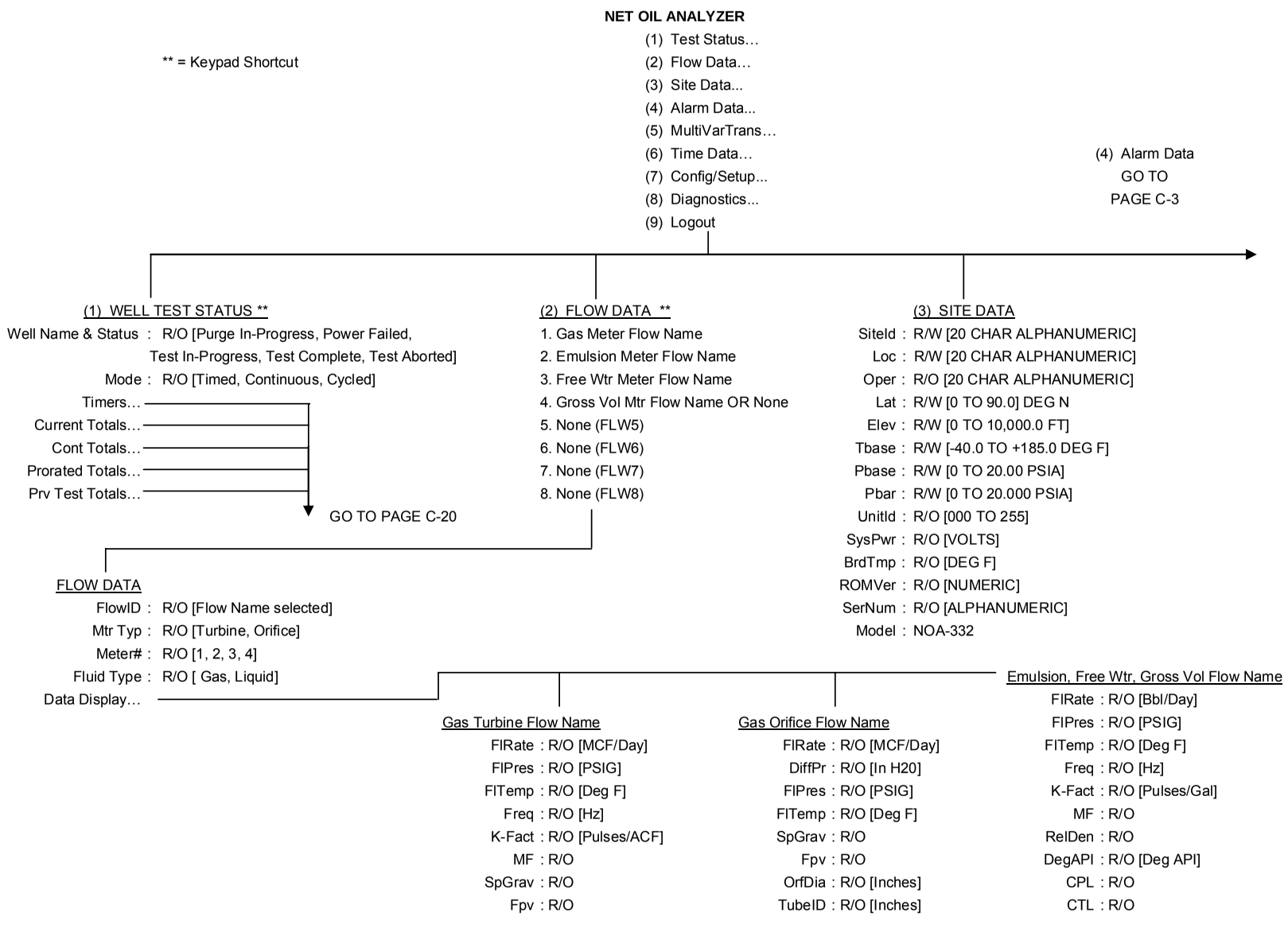
CURRENT TYPE TRANSMITTERS / RTD



Appendix C

Menu and Submenu Organizational Charts

The following flow charts specify the structure of the front panel menu.


** = Keypad Shortcut
NET OIL ANALYZER
(1) Test Status…
(2) Flow Data…
(3) Site Data...
(4) Alarm Data...
(5) MultiVarTrans…
(6) Time Data…
(7) Config/Setup...
(8) Diagnostics...
(9) Logout
(4) Alarm Data
GO TO
PAGE C-3
(1) WELL TEST STATUS **
Well Name & Status : R/O [Purge In-Progress, Power Failed,
Test In-Progress, Test Complete, Test Aborted]
Mode : R/O [Timed, Continuous, Cycled]
Timers…
Current Totals…
Cont Totals…
Prorated Totals…
Prv Test Totals…
GO TO PAGE C-20
(2) FLOW DATA **
1. Gas Meter Flow Name
2. Emulsion Meter Flow Name
3. Free Wtr Meter Flow Name
4. Gross Vol Mtr Flow Name OR None
5. None (FLW5)
6. None (FLW6)
7. None (FLW7)
8. None (FLW8)
(3) SITE DATA
SiteId : R/W [20 CHAR ALPHANUMERIC]
Loc : R/W [20 CHAR ALPHANUMERIC]
Oper : R/O [20 CHAR ALPHANUMERIC]
Lat : R/W [0 TO 90.0] DEG N
Elev : R/W [0 TO 10,000.0 FT]
Tbase : R/W [-40.0 TO +185.0 DEG F]
Pbase : R/W [0 TO 20.00 PSIA]
Pbar : R/W [0 TO 20.000 PSIA]
UnitId : R/O [000 TO 255]
SysPwr : R/O [VOLTS]
BrdTmp : R/O [DEG F]
ROMVer : R/O [NUMERIC]
SerNum : R/O [ALPHANUMERIC]
Model : NOA-332
FLOW DATA
FlowID : R/O [Flow Name selected]
Mtr Typ : R/O [Turbine, Orifice]
Meter# : R/O [1, 2, 3, 4]
Fluid Type : R/O [Gas, Liquid]
Data Display…
Gas Turbine Flow Name
FlRate : R/O [MCF/Day]
FlPres : R/O [PSIG]
FlTemp : R/O [Deg F]
Freq : R/O [Hz]
K-Fact : R/O [Pulses/ACF]
MF : R/O
SpGrav : R/O
Fpv : R/O
Gas Orifice Flow Name
FlRate : R/O [MCF/Day]
DiffPr : R/O [In H20]
FlPres : R/O [PSIG]
FlTemp : R/O [Deg F]
SpGrav : R/O
Fpv : R/O
OrfDia : R/O [Inches]
TubeID : R/O [Inches]
Emulsion, Free Wtr, Gross Vol Flow Name
FlRate : R/O [Bbl/Day]
FlPres : R/O [PSIG]
FlTemp : R/O [Deg F]
Freq : R/O [Hz]
K-Fact : R/O [Pulses/Gal]
MF : R/O
RelDen : R/O
DegAPI : R/O [Deg API]
CPL : R/O
CTL : R/O

** = Keypad Shortcut

NET OIL ANALYZER
(1) Test Status…
(2) Flow Data...
(3) Site Data...
(4) Alarm Data...
(5) MultiVarTrans...
(6) Time Data…
(7) Config/Setup...
(8) Diagnostics...
(9) Logout

(1) NOA Data thru (3) Site Data GO TO PAGE C-2

(4) ALARM DATA MENU
Analog Input…
MVT AI…
Digital Input…
Rate/Volume…

(5) MultiVarTrans GO TO PAGE C-4

AI ALARM DATA
SysPwr : R/O [ALARM STATUS]
BrdTmp : R/O [ALARM STATUS]
Wtrcut : R/O [ALARM STATUS]
EmulPr : R/O [ALARM STATUS]
EmulTm : R/O [ALARM STATUS]
DiffPr : R/O [ALARM STATUS]
GasPr : R/O [ALARM STATUS]
GasTmp : R/O [ALARM STATUS]
Spr AI : R/O [ALARM STATUS]
Spr AI : R/O [ALARM STATUS]
Spr AI : R/O [ALARM STATUS]
Spr AI : R/O [ALARM STATUS]
Spr AI : R/O [ALARM STATUS]
Spr AI : R/O [ALARM STATUS]
Spr AI : R/O [ALARM STATUS]
Spr AI : R/O [ALARM STATUS]

MVT 1 Status…
MVT 2 Status…
MVT 3 Status…
MVT 4 Status…
MVT 5 Status…
MVT 6 Status…
MVT 7 Status…
MVT 8 Status…
StPres : R/O [ALARM STATUS]
StTemp : R/O [ALARM STATUS]
DiffPr : R/O [ALARM STATUS]

DI ALARM DATA
Spare DI : R/O [ALARM STATUS]
Spare DI : R/O [ALARM STATUS]
Spare DI : R/O [ALARM STATUS]
Spare DI : R/O [ALARM STATUS]
Spare DI : R/O [ALARM STATUS]
Spare DI : R/O [ALARM STATUS]
Spare DI : R/O [ALARM STATUS]
Spare DI : R/O [ALARM STATUS]

Rate/Vol ALARM
FlowID : R/W [Gas, Emulsion, Free Wtr, Gross Vol, Meter Flow Name]
Rate : R/O [ALARM STATUS]
Volume : R/O [ALARM STATUS]

** = Keypad Shortcut

NET OIL ANALYZER

(1) Test Status…
(2) Flow Data...
(3) Site Data...
(4) Alarm Data...
(5) MultiVarTrans...
(6) Time Data…
(7) Config/Setup...
(8) Diagnostics...
(9) Logout

(4) Alarm Data
GO TO
PAGE C-3

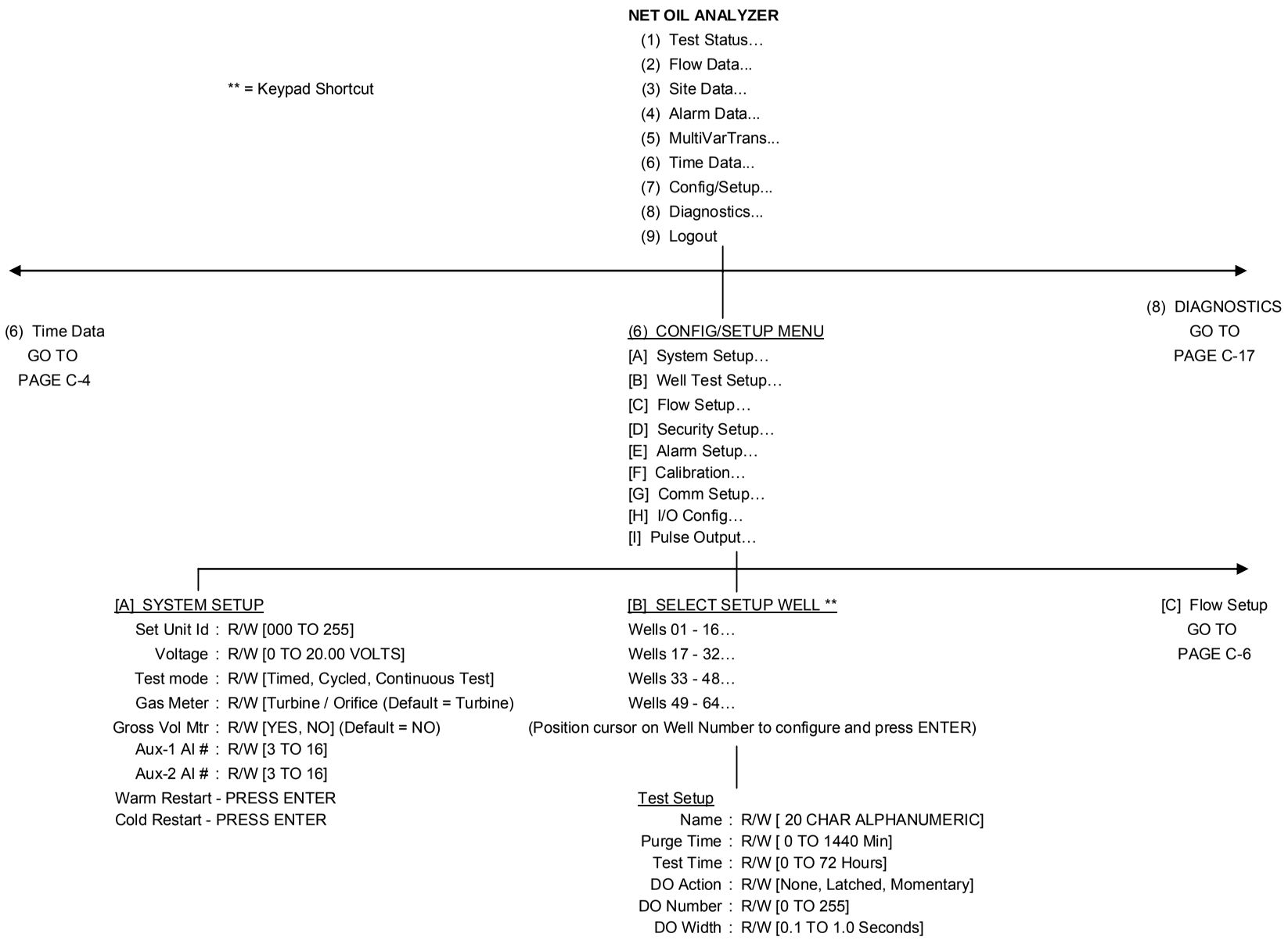
(5) MULTIVARIABLE TRANSMITTER MENU
MVT 1 Data…
MVT 2 Data…
MVT 3 Data…
MVT 4 Data…
MVT 5 Data…
MVT 6 Data…
MVT 7 Data…
MVT 8 Data…

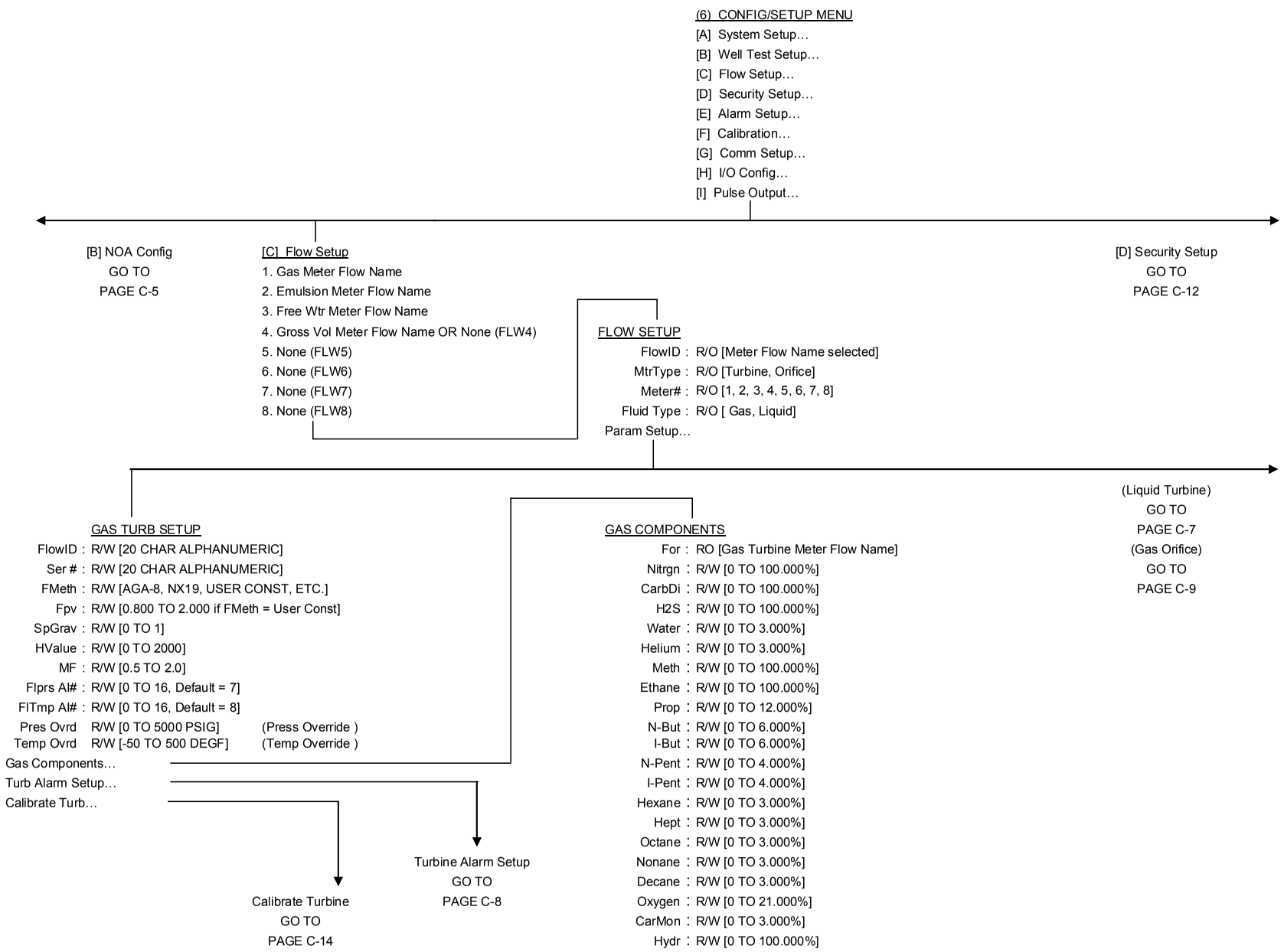
MVT (1-8) DATA
DPLive : R/O [In H20]
PrLive : R/O [PSIG, PSIA]
TmLive : R/O [Deg F]
OvrdDPVal : R/W [-50 TO 500 In H2O]
OvrdPrVal : R/W [-500 TO 9999 PSIG]
OvrdTmVal : R/W [-50 TO 300 DEG F]
OvrdDP : R/W [YES OR NO]
OvrdPr : R/W [YES OR NO]
OvrdTm : R/W [YES OR NO]
good : R/O [O TO 100 PERCENT]
Totl : R/O [NUMERIC]
Fail : R/O [NUMERIC]
CRC : R/O [NUMERIC]
MVT Id# : R/W [1 TO 247]
Clear all Data…
Polling : R/W [ENABLED OR DISABLED]

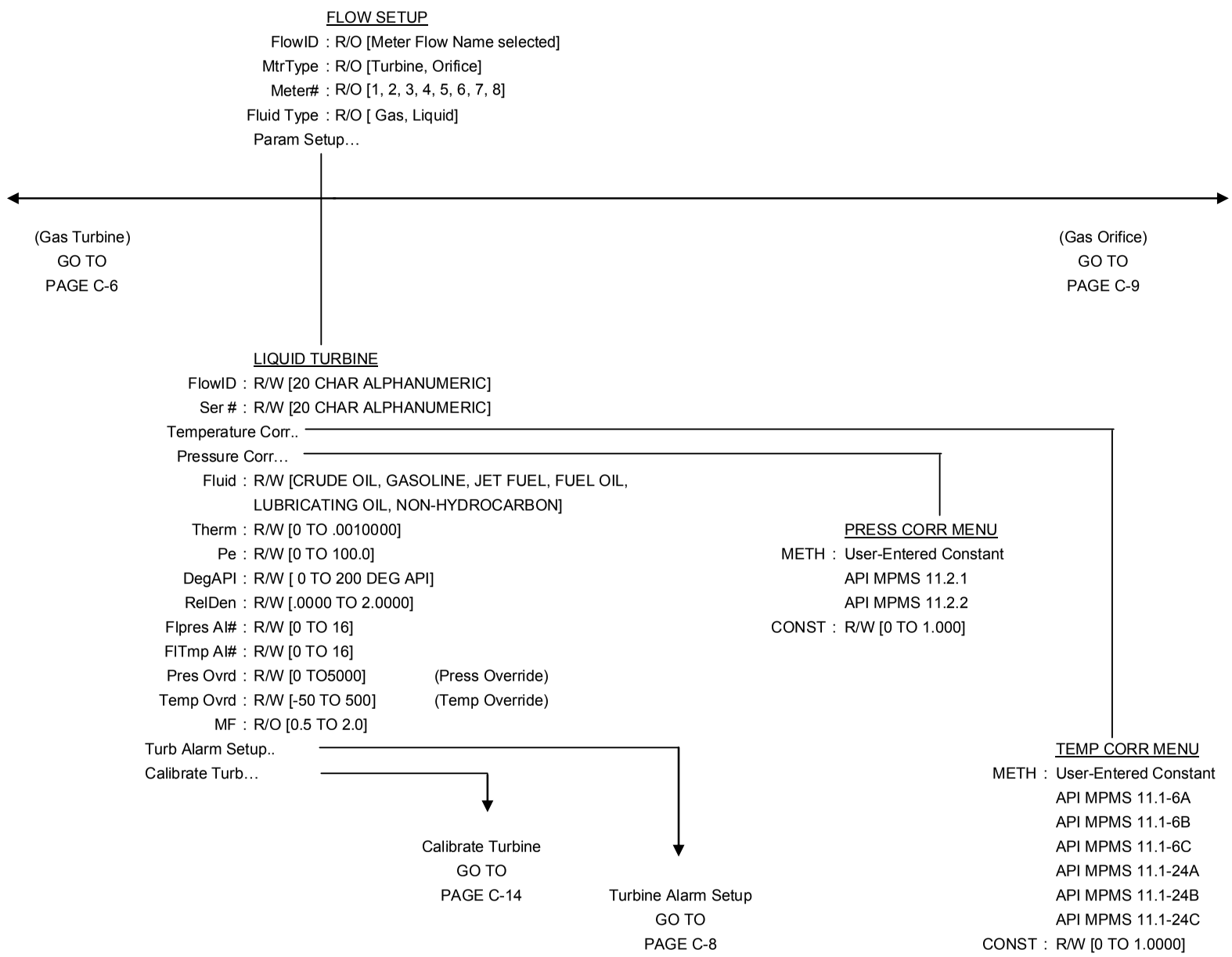
(6) TIME/DATE **
Time : R/W[HH:MM:SS]
Date : R/W[MM/DD/YYYY]

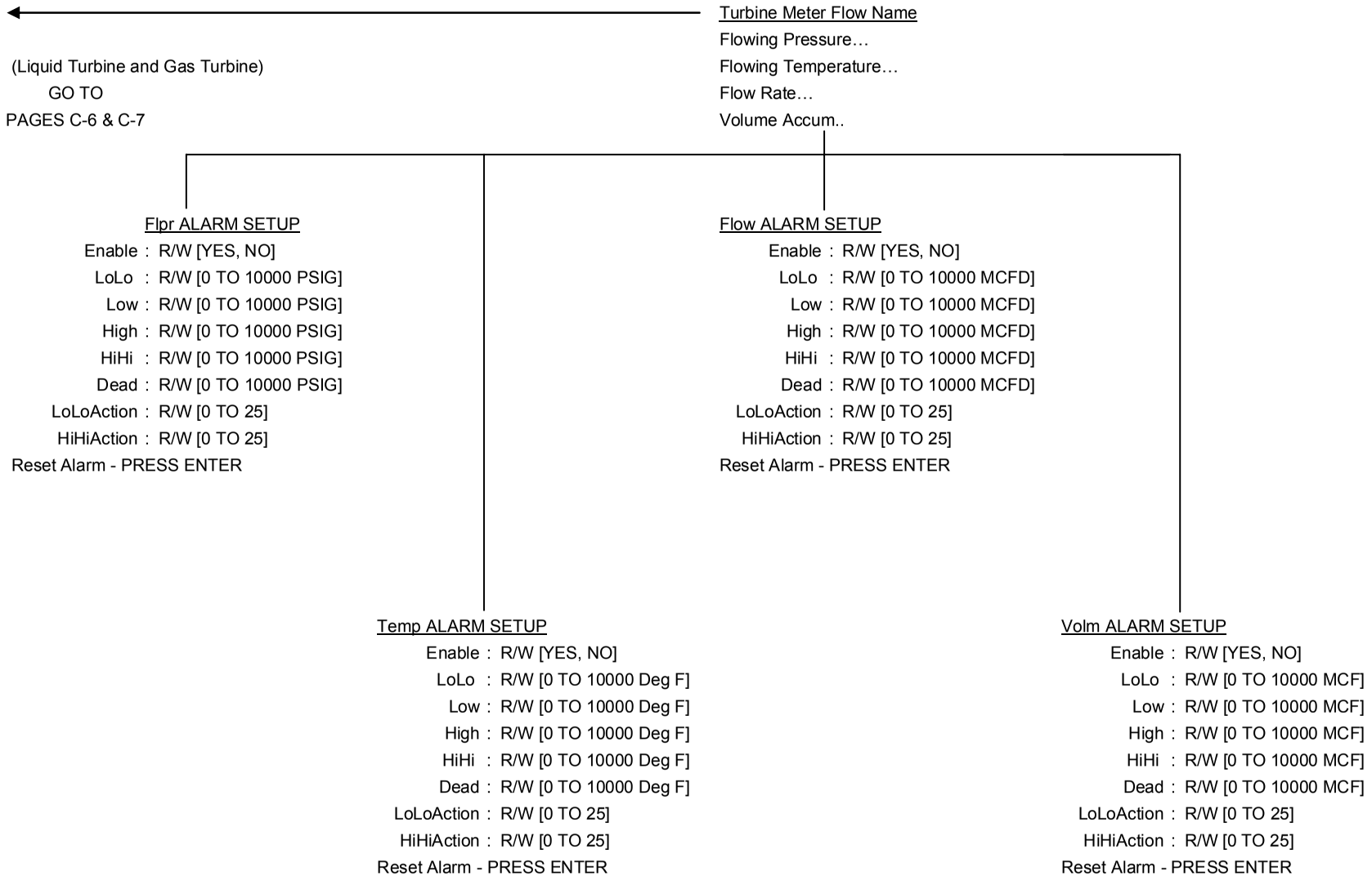
Clear All data ?
Press <ENTER> to
Clear Data.
<Escape> to Cancel

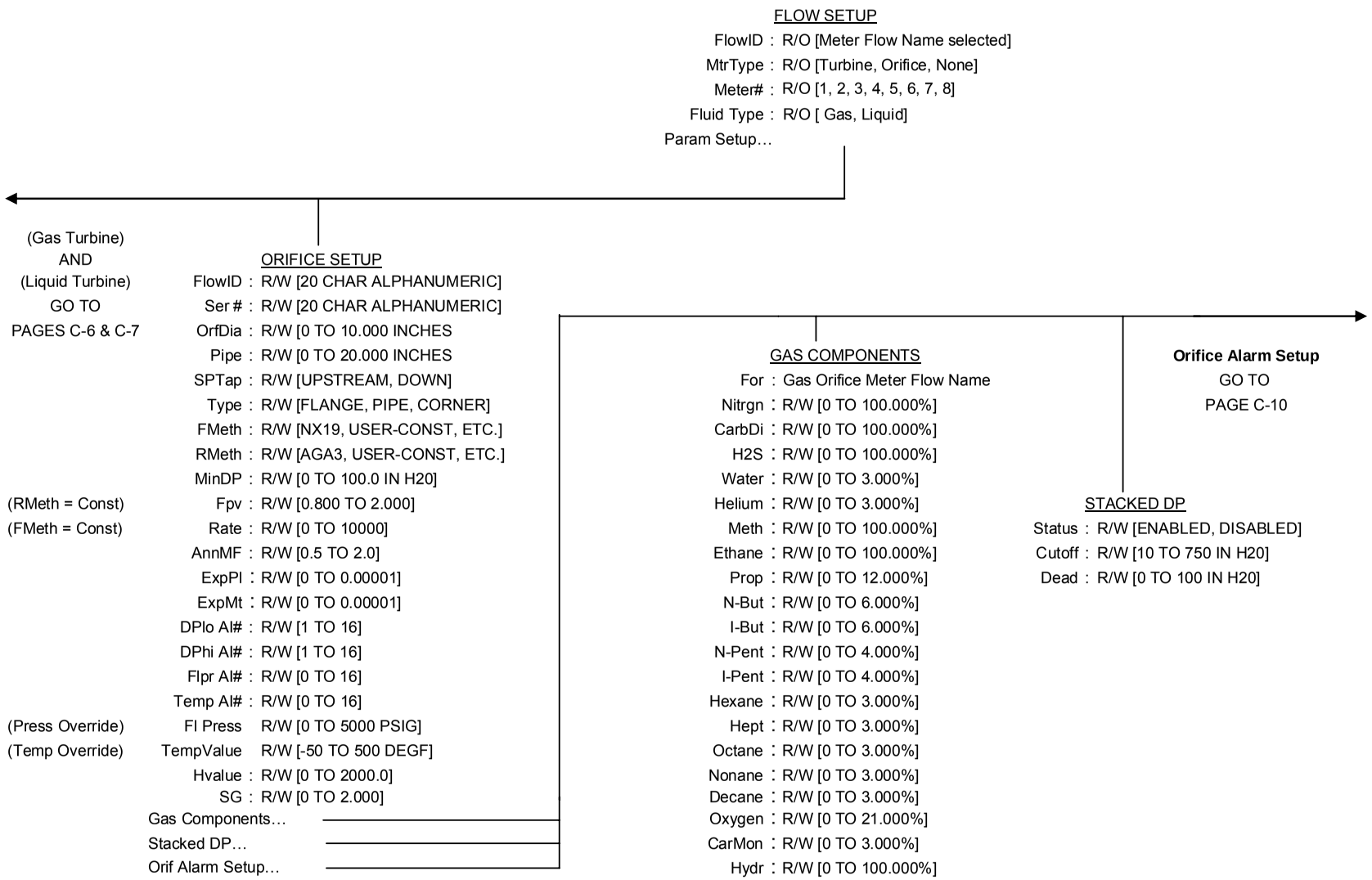
(7) Config/Setup
GO TO
PAGE C-5

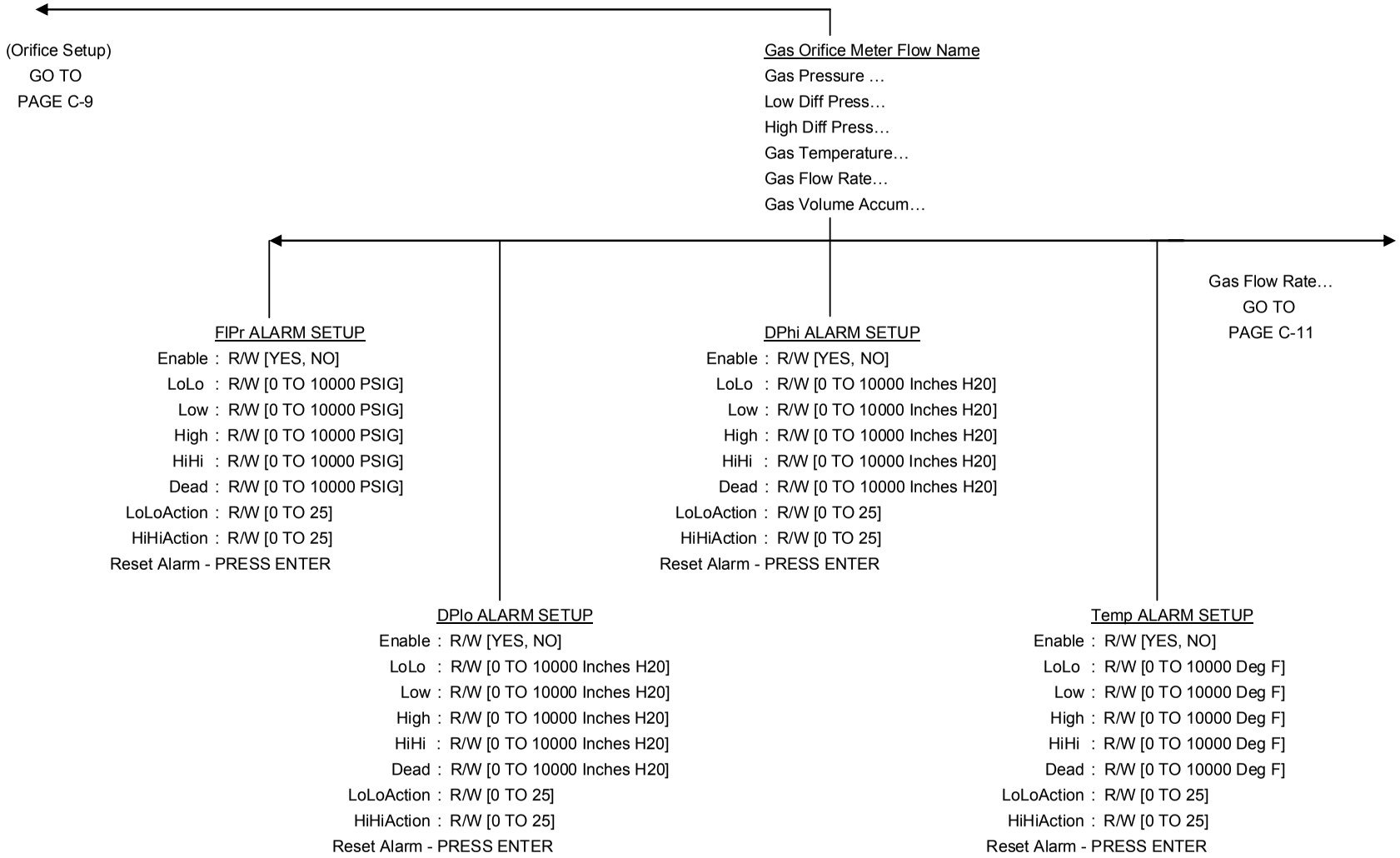

** = Keypad Shortcut
NET OIL ANALYZER
(1) Test Status…
(2) Flow Data...
(3) Site Data...
(4) Alarm Data...
(5) MultiVarTrans...
(6) Time Data...
(7) Config/Setup...
(8) Diagnostics...
(9) Logout
(6) Time Data
GO TO
PAGE C-4
(6) CONFIG/SETUP MENU
[A] System Setup…
[B] Well Test Setup…
[C] Flow Setup…
[D] Security Setup…
[E] Alarm Setup…
[F] Calibration…
[G] Comm Setup…
[H] I/O Config…
[I] Pulse Output…
(8) DIAGNOSTICS
GO TO
PAGE C-17
[A] SYSTEM SETUP
Set Unit Id : R/W [000 TO 255]
Voltage : R/W [0 TO 20.00 VOLTS]
Test mode : R/W [Timed, Cycled, Continuous Test]
Gas Meter : R/W [Turbine / Orifice (Default = Turbine)
Gross Vol Mtr : R/W [YES, NO] (Default = NO)
Aux-1 AI # : R/W [3 TO 16]
Aux-2 AI # : R/W [3 TO 16]
Warm Restart - PRESS ENTER
Cold Restart - PRESS ENTER
[B] SELECT SETUP WELL **
Wells 01 - 16…
Wells 17 - 32…
Wells 33 - 48…
Wells 49 - 64…
(Position cursor on Well Number to configure and press ENTER)
Test Setup
Name : R/W [20 CHAR ALPHANUMERIC]
Purge Time : R/W [0 TO 1440 Min]
Test Time : R/W [0 TO 72 Hours]
DO Action : R/W [None, Latched, Momentary]
DO Number : R/W [0 TO 255]
DO Width : R/W [0.1 TO 1.0 Seconds]
[C] Flow Setup
GO TO
PAGE C-6

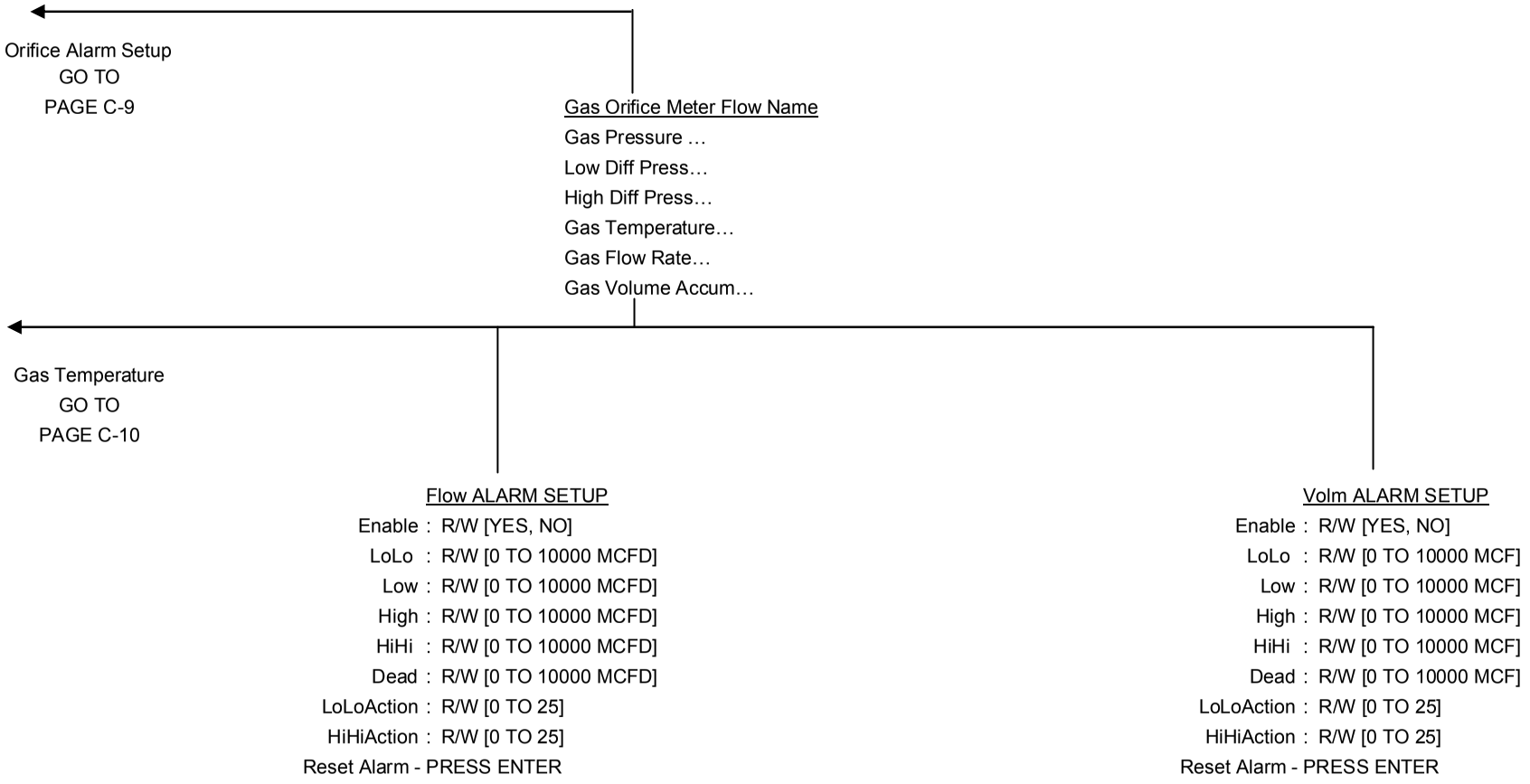

(6) CONFIG/SETUP MENU
[A] System Setup…
[B] Well Test Setup…
[C] Flow Setup…
[D] Security Setup…
[E] Alarm Setup…
[F] Calibration…
[G] Comm Setup…
[H] I/O Config…
[I] Pulse Output…
[B] NOA Config
GO TO
PAGE C-5
[C] Flow Setup
1. Gas Meter Flow Name
2. Emulsion Meter Flow Name
3. Free Wtr Meter Flow Name
4. Gross Vol Meter Flow Name OR None (FLW4)
5. None (FLW5)
6. None (FLW6)
7. None (FLW7)
8. None (FLW8)
[D] Security Setup
GO TO
PAGE C-12
FLOW SETUP
FlowID : R/O [Meter Flow Name selected]
MtrType : R/O [Turbine, Orifice]
Meter# : R/O [1, 2, 3, 4, 5, 6, 7, 8]
Fluid Type : R/O [Gas, Liquid]
Param Setup…
(Liquid Turbine)
GO TO
PAGE C-7
(Gas Orifice)
GO TO
PAGE C-9
GAS TURB SETUP
FlowID : R/W [20 CHAR ALPHANUMERIC]
Ser # : R/W [20 CHAR ALPHANUMERIC]
FMeth : R/W [AGA-8, NX19, USER CONST, ETC.]
Fpv : R/W [0.800 TO 2.000 if FMeth = User Const]
SpGrav : R/W [0 TO 1]
HValue : R/W [0 TO 2000]
MF : R/W [0.5 TO 2.0]
Flprs AI# : R/W [0 TO 16, Default = 7]
FlTmp AI# : R/W [0 TO 16, Default = 8]
Pres Ovrd R/W [0 TO 5000 PSIG] (Press Override)
Temp Ovrd R/W [-50 TO 500 DEGF] (Temp Override)
Gas Components…
Turb Alarm Setup…
Calibrate Turb…
GAS COMPONENTS
For : RO [Gas Turbine Meter Flow Name]
Nitrgn : R/W [0 TO 100.000%]
CarbDi : R/W [0 TO 100.000%]
H2S : R/W [0 TO 100.000%]
Water : R/W [0 TO 3.000%]
Helium : R/W [0 TO 3.000%]
Meth : R/W [0 TO 100.000%]
Ethane : R/W [0 TO 100.000%]
Prop : R/W [0 TO 12.000%]
N-But : R/W [0 TO 6.000%]
I-But : R/W [0 TO 6.000%]
N-Pent : R/W [0 TO 4.000%]
I-Pent : R/W [0 TO 4.000%]
Hexane : R/W [0 TO 3.000%]
Hept : R/W [0 TO 3.000%]
Octane : R/W [0 TO 3.000%]
Nonane : R/W [0 TO 3.000%]
Decane : R/W [0 TO 3.000%]
Oxygen : R/W [0 TO 21.000%]
CarMon : R/W [0 TO 3.000%]
Hydr : R/W [0 TO 100.000%]
Turbine Alarm Setup
GO TO
PAGE C-8
Calibrate Turbine
GO TO
PAGE C-14

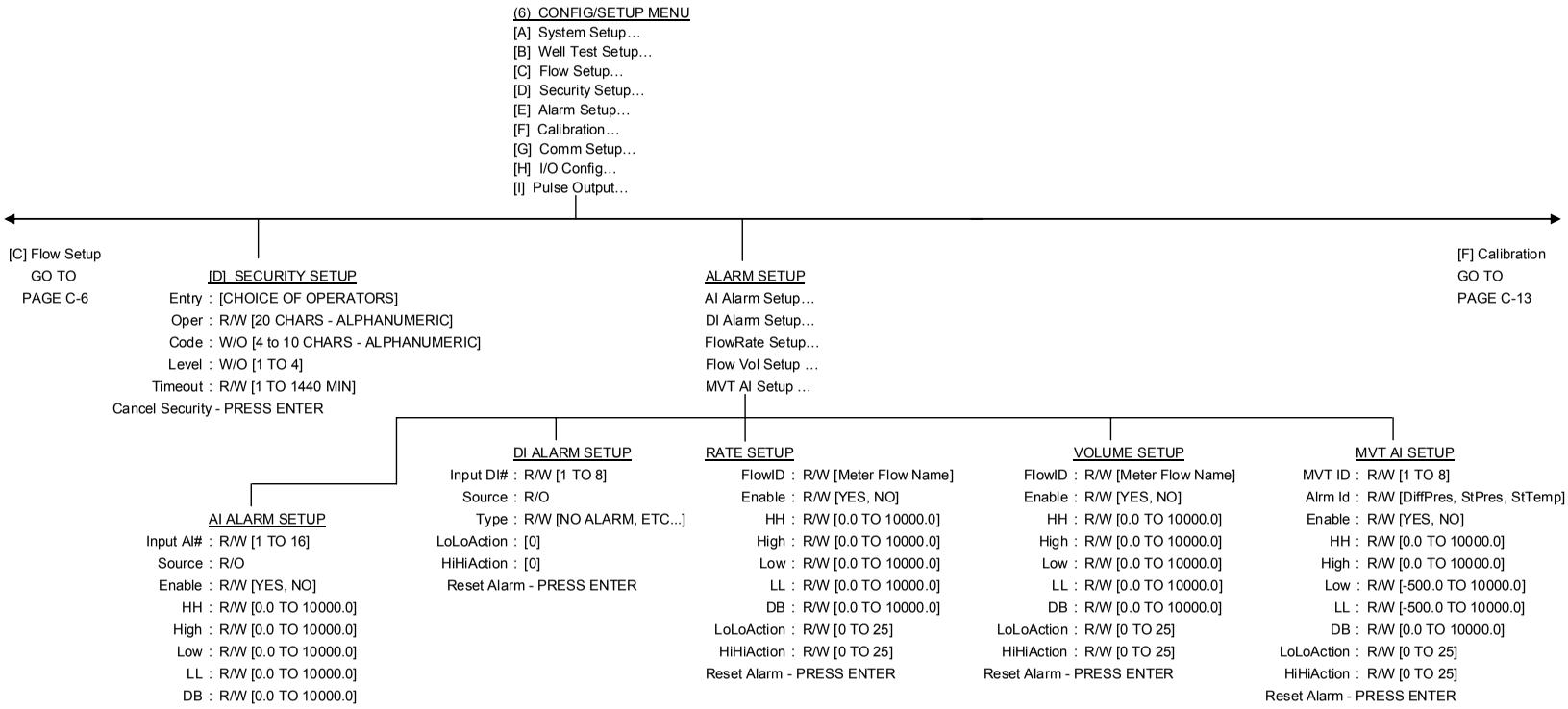

FLOW SETUP
FlowID : R/O [Meter Flow Name selected]
MtrType : R/O [Turbine, Orifice]
Meter# : R/O [1, 2, 3, 4, 5, 6, 7, 8]
Fluid Type : R/O [Gas, Liquid]
Param Setup…
(Gas Turbine)
GO TO
PAGE C-6
(Gas Orifice)
GO TO
PAGE C-9
LIQUID TURBINE
FlowID : R/W [20 CHAR ALPHANUMERIC]
Ser # : R/W [20 CHAR ALPHANUMERIC]
Temperature Corr..
Pressure Corr…
Fluid : R/W [CRUDE OIL, GASOLINE, JET FUEL, FUEL OIL,
LUBRICATING OIL, NON-HYDROCARBON]
Therm : R/W [0 TO .0010000]
Pe : R/W [0 TO 100.0]
DegAPI : R/W [0 TO 200 DEG API]
RelDen : R/W [.0000 TO 2.0000]
FIpres AI# : R/W [0 TO 16]
FITmp AI# : R/W [0 TO 16]
Pres Ovrd : R/W [0 TO5000] (Press Override)
Temp Ovrd : R/W [-50 TO 500] (Temp Override)
MF : R/O [0.5 TO 2.0]
Turb Alarm Setup..
Calibrate Turb…
PRESS CORR MENU
METH : User-Entered Constant
API MPMS 11.2.1
API MPMS 11.2.2
CONST : R/W [0 TO 1.000]
TEMP CORR MENU
METH : User-Entered Constant
API MPMS 11.1-6A
API MPMS 11.1-6B
API MPMS 11.1-6C
API MPMS 11.1-24A
API MPMS 11.1-24B
API MPMS 11.1-24C
CONST : R/W [0 TO 1.0000]
Calibrate Turbine
GO TO
PAGE C-14
Turbine Alarm Setup
GO TO
PAGE C-8

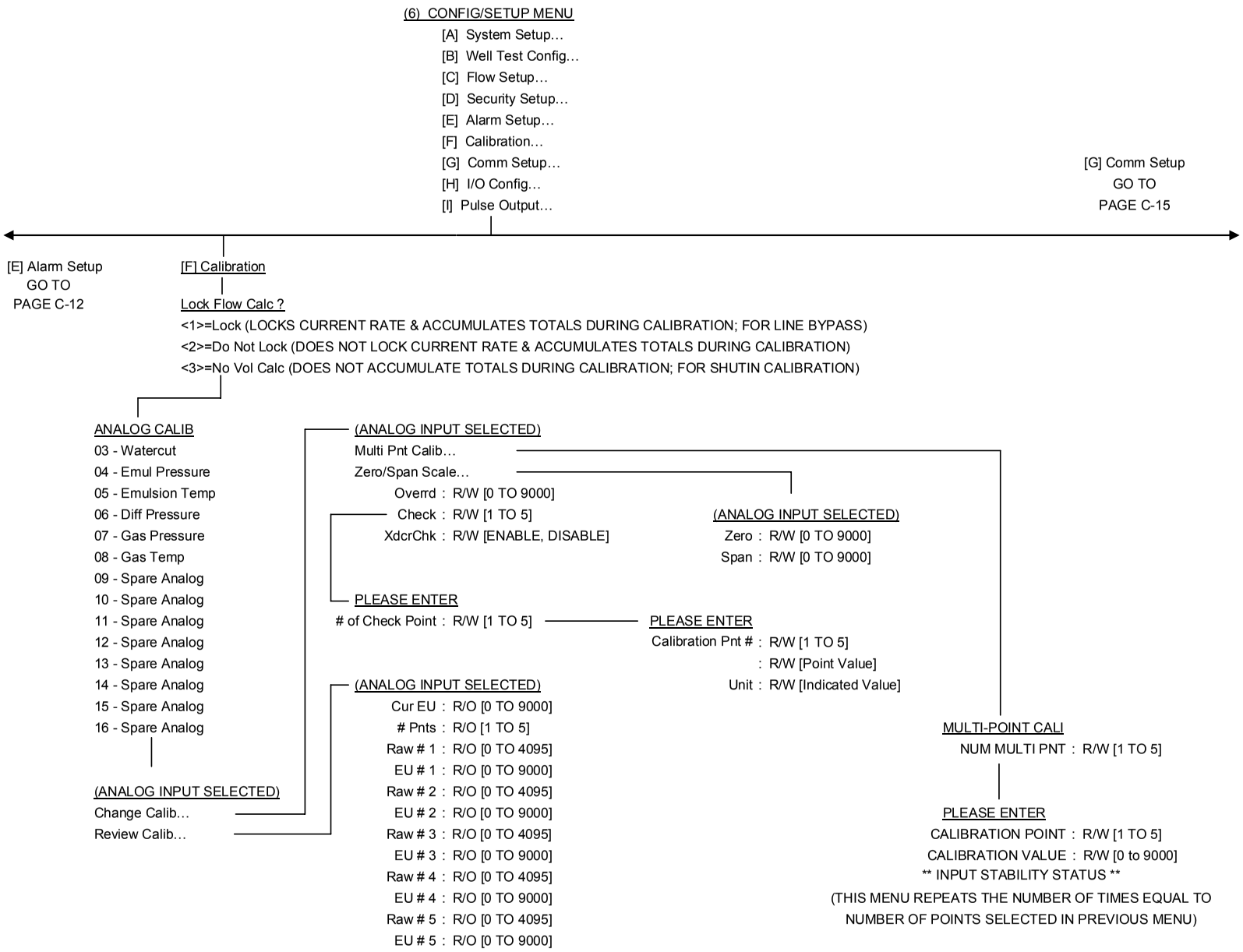

Turbine Meter Flow Name
Flowing Pressure…
Flowing Temperature…
Flow Rate…
Volume Accum..
(Liquid Turbine and Gas Turbine)
GO TO
PAGES C-6 & C-7
Flpr ALARM SETUP
Enable : R/W [YES, NO]
LoLo : R/W [0 TO 10000 PSIG]
Low : R/W [0 TO 10000 PSIG]
High : R/W [0 TO 10000 PSIG]
HiHi : R/W [0 TO 10000 PSIG]
Dead : R/W [0 TO 10000 PSIG]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER
Flow ALARM SETUP
Enable : R/W [YES, NO]
LoLo : R/W [0 TO 10000 MCFD]
Low : R/W [0 TO 10000 MCFD]
High : R/W [0 TO 10000 MCFD]
HiHi : R/W [0 TO 10000 MCFD]
Dead : R/W [0 TO 10000 MCFD]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER
Temp ALARM SETUP
Enable : R/W [YES, NO]
LoLo : R/W [0 TO 10000 Deg F]
Low : R/W [0 TO 10000 Deg F]
High : R/W [0 TO 10000 Deg F]
HiHi : R/W [0 TO 10000 Deg F]
Dead : R/W [0 TO 10000 Deg F]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER
Volm ALARM SETUP
Enable : R/W [YES, NO]
LoLo : R/W [0 TO 10000 MCF]
Low : R/W [0 TO 10000 MCF]
High : R/W [0 TO 10000 MCF]
HiHi : R/W [0 TO 10000 MCF]
Dead : R/W [0 TO 10000 MCF]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER

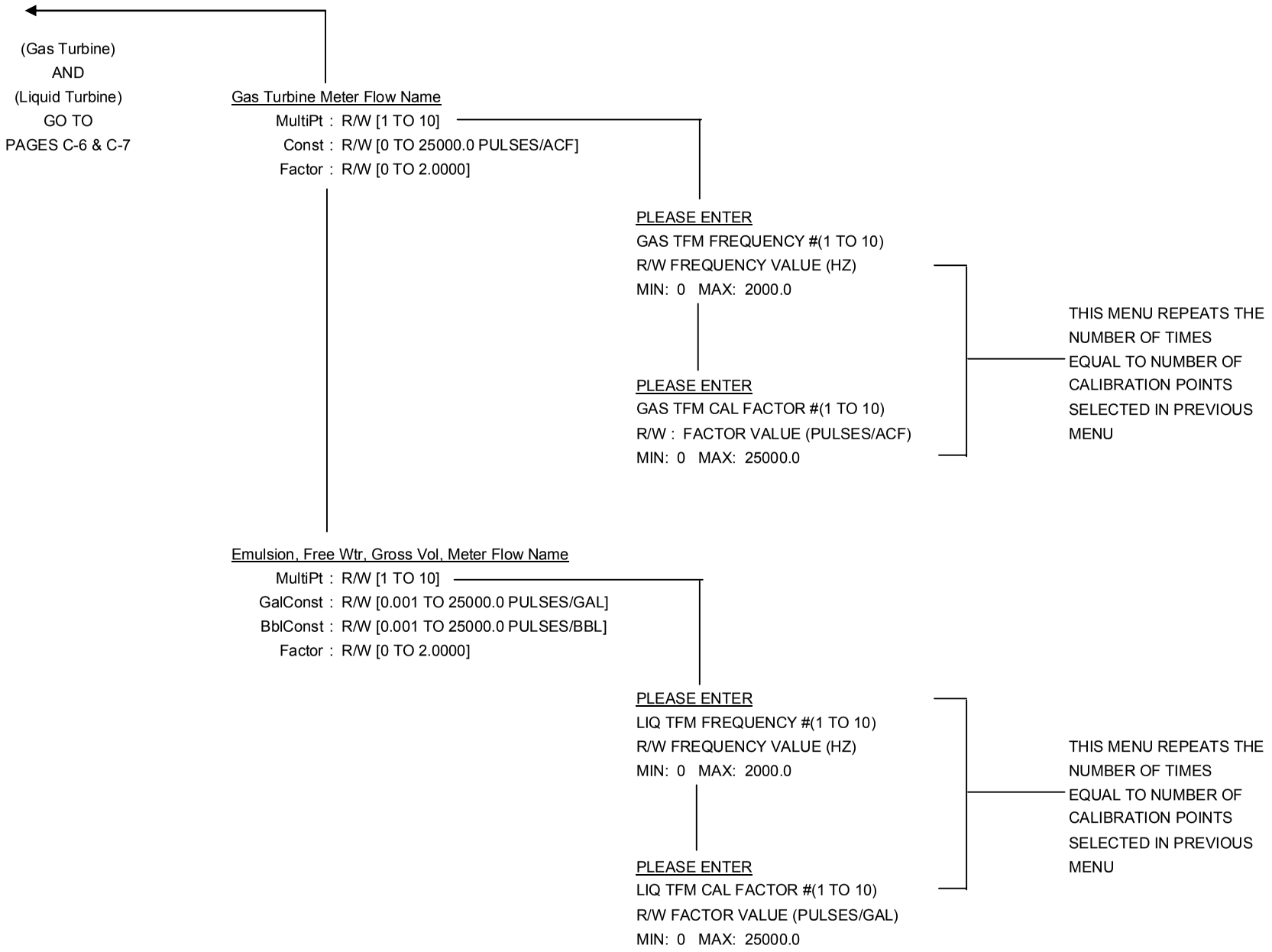

FLOW SETUP
FlowID : R/O [Meter Flow Name selected]
MtrType : R/O [Turbine, Orifice, None]
Meter# : R/O [1, 2, 3, 4, 5, 6, 7, 8]
Fluid Type : R/O [Gas, Liquid]
Param Setup…
(Gas Turbine)
AND
(Liquid Turbine)
GO TO
PAGES C-6 & C-7
ORIFICE SETUP
FlowID : R/W [20 CHAR ALPHANUMERIC]
Ser # : R/W [20 CHAR ALPHANUMERIC]
OrfDia : R/W [0 TO 10.000 INCHES
Pipe : R/W [0 TO 20.000 INCHES
SPTap : R/W [UPSTREAM, DOWN]
Type : R/W [FLANGE, PIPE, CORNER]
FMeth : R/W [NX19, USER-CONST, ETC.]
RMeth : R/W [AGA3, USER-CONST, ETC.]
MinDP : R/W [0 TO 100.0 IN H20]
(RMeth = Const)
Fpv : R/W [0.800 TO 2.000]
(FMeth = Const)
Rate : R/W [0 TO 10000]
AnnMF : R/W [0.5 TO 2.0]
ExpPl : R/W [0 TO 0.00001]
ExpMt : R/W [0 TO 0.00001]
DPlo Al# : R/W [1 TO 16]
DPhi Al# : R/W [1 TO 16]
Flpr Al# : R/W [0 TO 16]
Temp Al# : R/W [0 TO 16]
(Press Override)
Fl Press R/W [0 TO 5000 PSIG]
(Temp Override)
TempValue R/W [-50 TO 500 DEGF]
Hvalue : R/W [0 TO 2000.0]
SG : R/W [0 TO 2.000]
Gas Components…
Stacked DP…
Orif Alarm Setup…
GAS COMPONENTS
For : Gas Orifice Meter Flow Name
Nitrgn : R/W [0 TO 100.000%]
CarbDi : R/W [0 TO 100.000%]
H2S : R/W [0 TO 100.000%]
Water : R/W [0 TO 3.000%]
Helium : R/W [0 TO 3.000%]
Meth : R/W [0 TO 100.000%]
Ethane : R/W [0 TO 100.000%]
Prop : R/W [0 TO 12.000%]
N-But : R/W [0 TO 6.000%]
I-But : R/W [0 TO 6.000%]
N-Pent : R/W [0 TO 4.000%]
I-Pent : R/W [0 TO 4.000%]
Hexane : R/W [0 TO 3.000%]
Hept : R/W [0 TO 3.000%]
Octane : R/W [0 TO 3.000%]
Nonane : R/W [0 TO 3.000%]
Decane : R/W [0 TO 3.000%]
Oxygen : R/W [0 TO 21.000%]
CarMon : R/W [0 TO 3.000%]
Hydr : R/W [0 TO 100.000%]
Orifice Alarm Setup
GO TO
PAGE C-10
STACKED DP
Status : R/W [ENABLED, DISABLED]
Cutoff : R/W [10 TO 750 IN H20]
Dead : R/W [0 TO 100 IN H20]

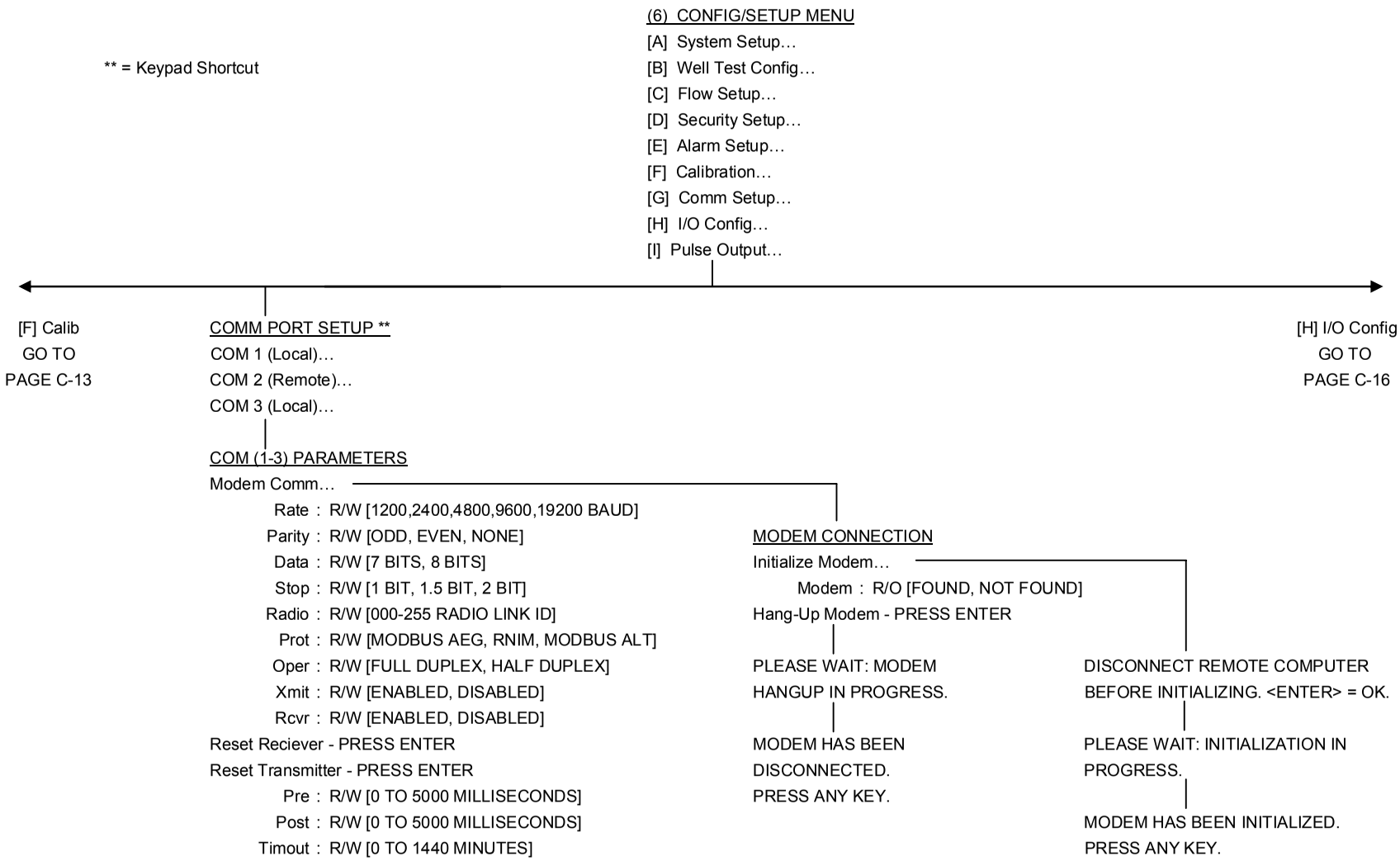

(Orifice Setup)
GO TO
PAGE C-9
Gas Orifice Meter Flow Name
Gas Pressure …
Low Diff Press…
High Diff Press…
Gas Temperature…
Gas Flow Rate…
Gas Volume Accum…
Gas Flow Rate…
GO TO
PAGE C-11
FlPr ALARM SETUP
Enable : R/W [YES, NO]
LoLo : R/W [0 TO 10000 PSIG]
Low : R/W [0 TO 10000 PSIG]
High : R/W [0 TO 10000 PSIG]
HiHi : R/W [0 TO 10000 PSIG]
Dead : R/W [0 TO 10000 PSIG]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER
DPhi ALARM SETUP
Enable : R/W [YES, NO]
LoLo : R/W [0 TO 10000 Inches H20]
Low : R/W [0 TO 10000 Inches H20]
High : R/W [0 TO 10000 Inches H20]
HiHi : R/W [0 TO 10000 Inches H20]
Dead : R/W [0 TO 10000 Inches H20]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER
DPlo ALARM SETUP
Enable : R/W [YES, NO]
LoLo : R/W [0 TO 10000 Inches H20]
Low : R/W [0 TO 10000 Inches H20]
High : R/W [0 TO 10000 Inches H20]
HiHi : R/W [0 TO 10000 Inches H20]
Dead : R/W [0 TO 10000 Inches H20]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER
Temp ALARM SETUP
Enable : R/W [YES, NO]
LoLo : R/W [0 TO 10000 Deg F]
Low : R/W [0 TO 10000 Deg F]
High : R/W [0 TO 10000 Deg F]
HiHi : R/W [0 TO 10000 Deg F]
Dead : R/W [0 TO 10000 Deg F]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER

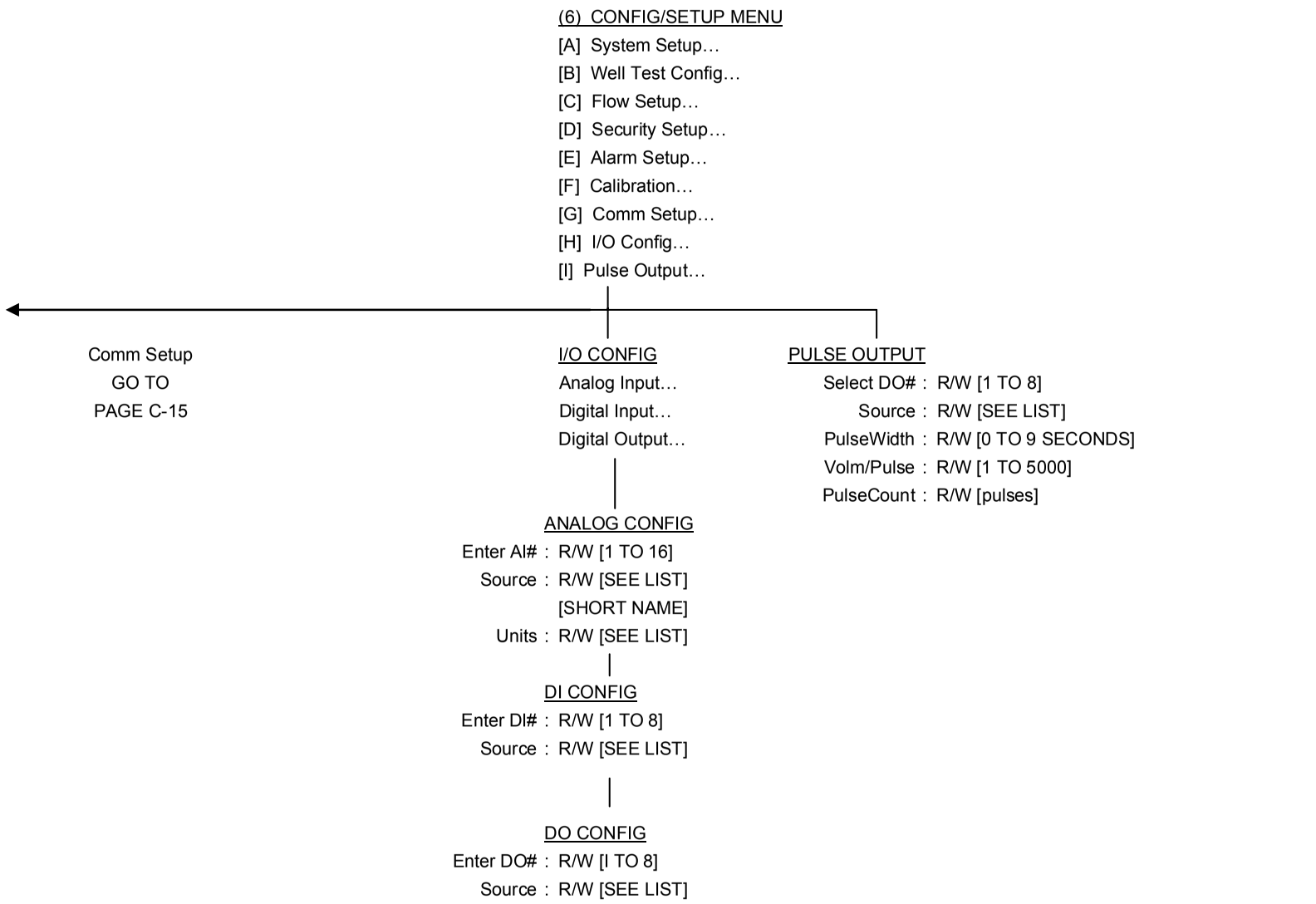

Orifice Alarm Setup
GO TO
PAGE C-9
Gas Orifice Meter Flow Name
Gas Pressure …
Low Diff Press…
High Diff Press…
Gas Temperature…
Gas Flow Rate…
Gas Volume Accum…
Gas Temperature
GO TO
PAGE C-10
Flow ALARM SETUP
Enable : R/W [YES, NO]
LoLo : R/W [0 TO 10000 MCFD]
Low : R/W [0 TO 10000 MCFD]
High : R/W [0 TO 10000 MCFD]
HiHi : R/W [0 TO 10000 MCFD]
Dead : R/W [0 TO 10000 MCFD]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER
Volm ALARM SETUP
Enable : R/W [YES, NO]
LoLo : R/W [0 TO 10000 MCF]
Low : R/W [0 TO 10000 MCF]
High : R/W [0 TO 10000 MCF]
HiHi : R/W [0 TO 10000 MCF]
Dead : R/W [0 TO 10000 MCF]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER


(6) CONFIG/SETUP MENU
[A] System Setup…
[B] Well Test Setup…
[C] Flow Setup…
[D] Security Setup…
[E] Alarm Setup…
[F] Calibration…
[G] Comm Setup…
[H] I/O Config…
[I] Pulse Output…
[C] Flow Setup
GO TO
PAGE C-6
[D] SECURITY SETUP
Entry : [CHOICE OF OPERATORS]
Oper : R/W [20 CHARS - ALPHANUMERIC]
Code : W/O [4 to 10 CHARS - ALPHANUMERIC]
Level : W/O [1 TO 4]
Timeout : R/W [1 TO 1440 MIN]
Cancel Security - PRESS ENTER
ALARM SETUP
AI Alarm Setup…
DI Alarm Setup…
FlowRate Setup…
Flow Vol Setup …
MVT AI Setup …
[F] Calibration
GO TO
PAGE C-13
AI ALARM SETUP
Input AI# : R/W [1 TO 16]
Source : R/O
Enable : R/W [YES, NO]
HH : R/W [0.0 TO 10000.0]
High : R/W [0.0 TO 10000.0]
Low : R/W [0.0 TO 10000.0]
LL : R/W [0.0 TO 10000.0]
DB : R/W [0.0 TO 10000.0]
DI ALARM SETUP
Input DI# : R/W [1 TO 8]
Source : R/O
Type : R/W [NO ALARM, ETC...]
LoLoAction : [0]
HiHiAction : [0]
Reset Alarm - PRESS ENTER
RATE SETUP
FlowID : R/W [Meter Flow Name]
Enable : R/W [YES, NO]
HH : R/W [0.0 TO 10000.0]
High : R/W [0.0 TO 10000.0]
Low : R/W [0.0 TO 10000.0]
LL : R/W [0.0 TO 10000.0]
DB : R/W [0.0 TO 10000.0]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER
VOLUME SETUP
FlowID : R/W [Meter Flow Name]
Enable : R/W [YES, NO]
HH : R/W [0.0 TO 10000.0]
High : R/W [0.0 TO 10000.0]
Low : R/W [0.0 TO 10000.0]
LL : R/W [0.0 TO 10000.0]
DB : R/W [0.0 TO 10000.0]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER
MVT AI SETUP
MVT ID : R/W [1 TO 8]
Alrm Id : R/W [DiffPres, StPres, StTemp]
Enable : R/W [YES, NO]
HH : R/W [0.0 TO 10000.0]
High : R/W [0.0 TO 10000.0]
Low : R/W [-500.0 TO 10000.0]
LL : R/W [-500.0 TO 10000.0]
DB : R/W [0.0 TO 10000.0]
LoLoAction : R/W [0 TO 25]
HiHiAction : R/W [0 TO 25]
Reset Alarm - PRESS ENTER

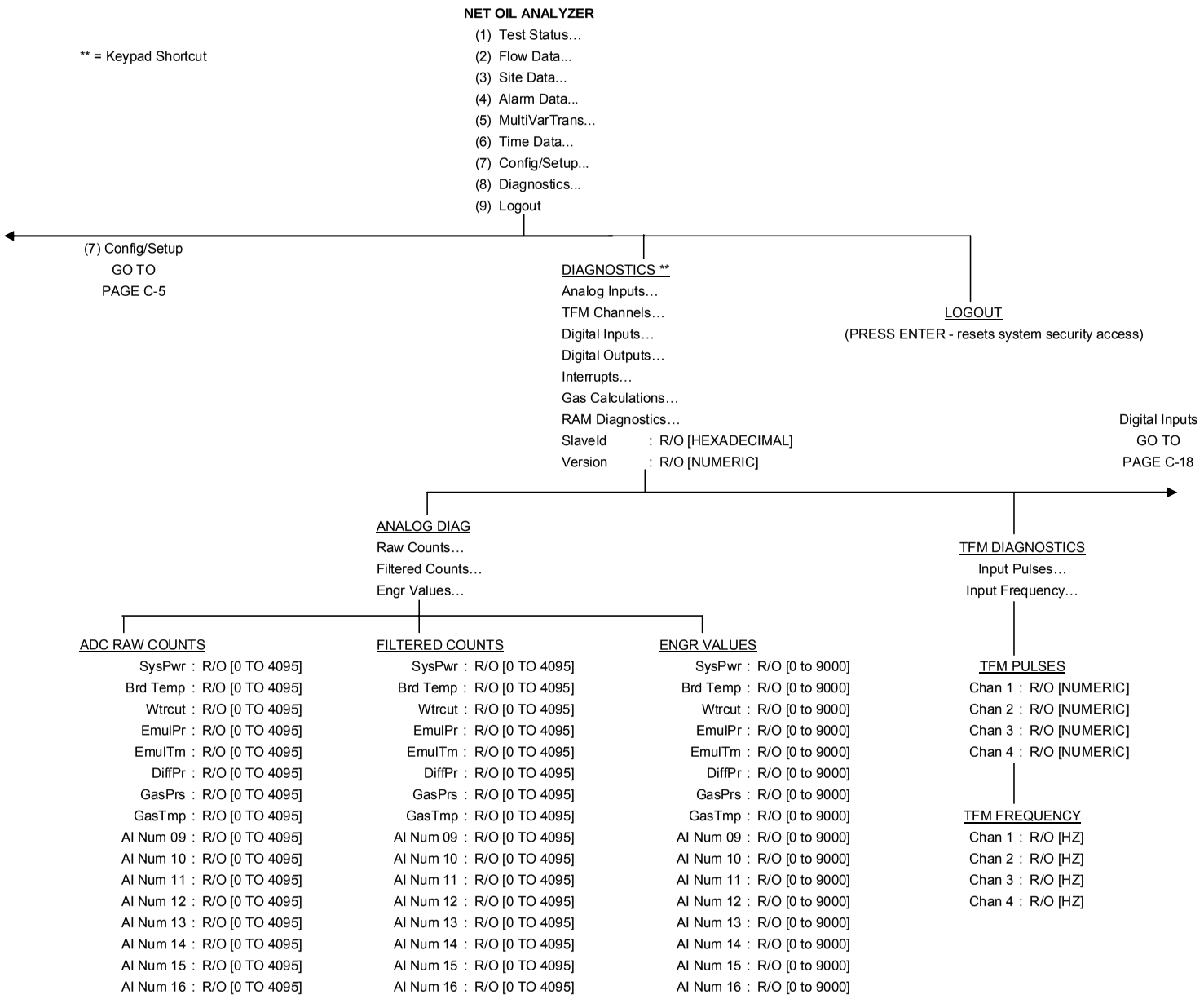

(6) CONFIG/SETUP MENU
[A] System Setup…
[B] Well Test Config…
[C] Flow Setup…
[D] Security Setup…
[E] Alarm Setup…
[F] Calibration…
[G] Comm Setup…
[H] I/O Config…
[I] Pulse Output…
[G] Comm Setup GO TO PAGE C-15
[E] Alarm Setup GO TO PAGE C-12
[F] Calibration
Lock Flow Calc ?
<1>=Lock (LOCKS CURRENT RATE & ACCUMULATES TOTALS DURING CALIBRATION; FOR LINE BYPASS)
<2>=Do Not Lock (DOES NOT LOCK CURRENT RATE & ACCUMULATES TOTALS DURING CALIBRATION)
<3>=No Vol Calc (DOES NOT ACCUMULATE TOTALS DURING CALIBRATION; FOR SHUTIN CALIBRATION)
ANALOG CALIB
03 - Watercut
04 - Emul Pressure
05 - Emulsion Temp
06 - Diff Pressure
07 - Gas Pressure
08 - Gas Temp
09 - Spare Analog
10 - Spare Analog
11 - Spare Analog
12 - Spare Analog
13 - Spare Analog
14 - Spare Analog
15 - Spare Analog
16 - Spare Analog
(ANALOG INPUT SELECTED)
Change Calib…
Review Calib…
(ANALOG INPUT SELECTED)
Multi Pnt Calib…
Zero/Span Scale…
Overrd : R/W [0 TO 9000]
Check : R/W [1 TO 5]
XdcrChk : R/W [ENABLE, DISABLE]
(ANALOG INPUT SELECTED)
Zero : R/W [0 TO 9000]
Span : R/W [0 TO 9000]
PLEASE ENTER
# of Check Point : R/W [1 TO 5]
PLEASE ENTER
Calibration Pnt # : R/W [1 TO 5]
: R/W [Point Value]
Unit : R/W [Indicated Value]
(ANALOG INPUT SELECTED)
Cur EU : R/O [0 TO 9000]
Pnts : R/O [1 TO 5]
Raw # 1 : R/O [0 TO 4095]
EU # 1 : R/O [0 TO 9000]
Raw # 2 : R/O [0 TO 4095]
EU # 2 : R/O [0 TO 9000]
Raw # 3 : R/O [0 TO 4095]
EU # 3 : R/O [0 TO 9000]
Raw # 4 : R/O [0 TO 4095]
EU # 4 : R/O [0 TO 9000]
Raw # 5 : R/O [0 TO 4095]
EU # 5 : R/O [0 TO 9000]
MULTI-POINT CALI
NUM MULTI PNT : R/W [1 TO 5]
PLEASE ENTER
CALIBRATION POINT : R/W [1 TO 5]
CALIBRATION VALUE : R/W [0 to 9000]
** INPUT STABILITY STATUS **
(THIS MENU REPEATS THE NUMBER OF TIMES EQUAL TO NUMBER OF POINTS SELECTED IN PREVIOUS MENU)

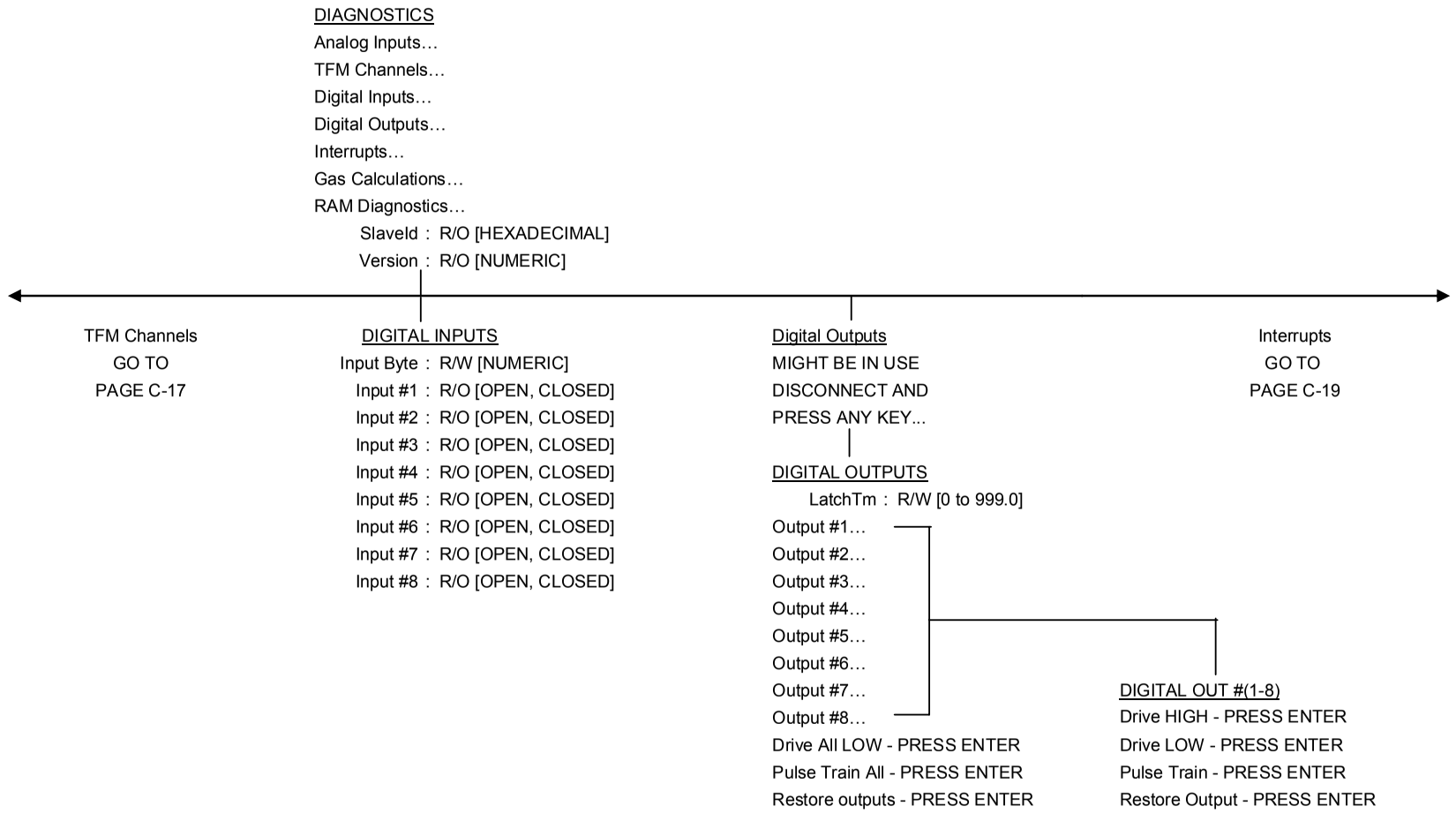

(Gas Turbine)
AND
(Liquid Turbine)
GO TO
PAGES C-6 & C-7
Gas Turbine Meter Flow Name
MultiPt : R/W [1 TO 10]
Const : R/W [0 TO 25000.0 PULSES/ACF]
Factor : R/W [0 TO 2.0000]
PLEASE ENTER
GAS TFM FREQUENCY #(1 TO 10)
R/W FREQUENCY VALUE (HZ)
MIN: 0 MAX: 2000.0
PLEASE ENTER
GAS TFM CAL FACTOR #(1 TO 10)
R/W : FACTOR VALUE (PULSES/ACF)
MIN: 0 MAX: 25000.0
THIS MENU REPEATS THE NUMBER OF TIMES EQUAL TO NUMBER OF CALIBRATION POINTS SELECTED IN PREVIOUS MENU
Emulsion, Free Wtr, Gross Vol, Meter Flow Name
MultiPt : R/W [1 TO 10]
GalConst : R/W [0.001 TO 25000.0 PULSES/GAL]
BblConst : R/W [0.001 TO 25000.0 PULSES/BBL]
Factor : R/W [0 TO 2.0000]
PLEASE ENTER
LIQ TFM FREQUENCY #(1 TO 10)
R/W FREQUENCY VALUE (HZ)
MIN: 0 MAX: 2000.0
PLEASE ENTER
LIQ TFM CAL FACTOR #(1 TO 10)
R/W FACTOR VALUE (PULSES/GAL)
MIN: 0 MAX: 25000.0
THIS MENU REPEATS THE NUMBER OF TIMES EQUAL TO NUMBER OF CALIBRATION POINTS SELECTED IN PREVIOUS MENU

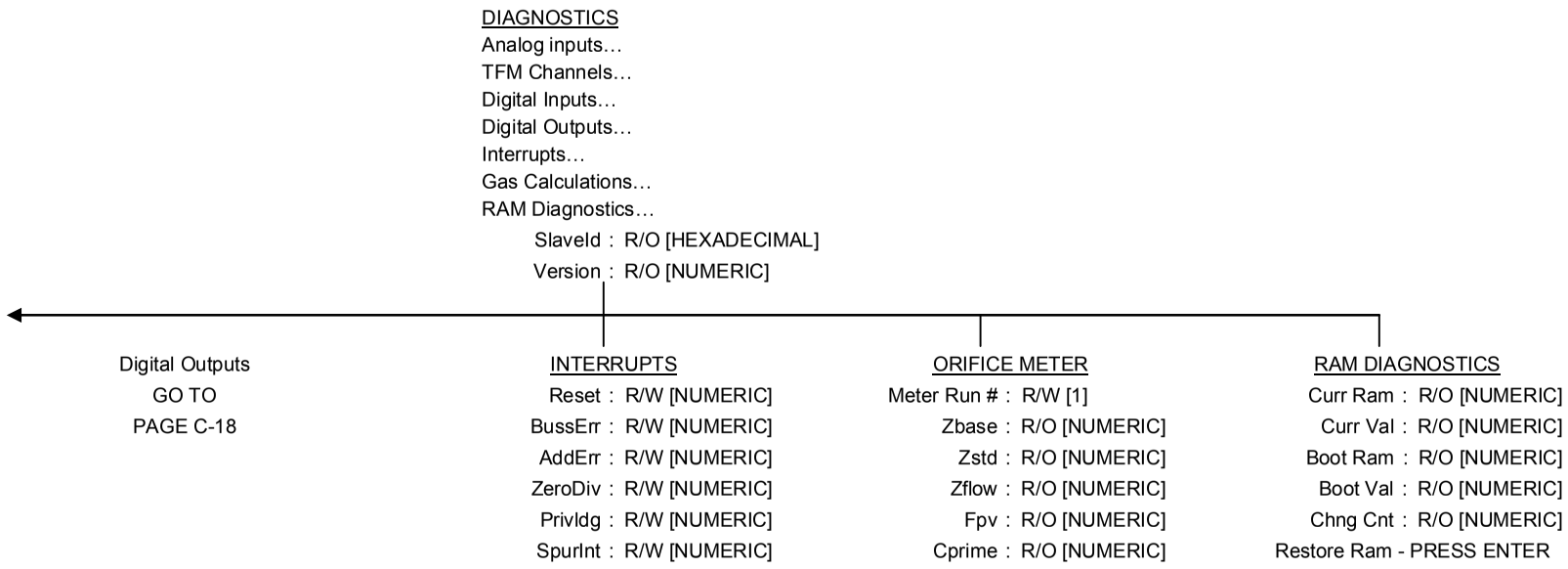

** = Keypad Shortcut
(6) CONFIG/SETUP MENU
[A] System Setup…
[B] Well Test Config…
[C] Flow Setup…
[D] Security Setup…
[E] Alarm Setup…
[F] Calibration…
[G] Comm Setup…
[H] I/O Config…
[I] Pulse Output…
[F] Calib
GO TO
PAGE C-13
COMM PORT SETUP **
COM 1 (Local)…
COM 2 (Remote)…
COM 3 (Local)…
[H] I/O Config
GO TO
PAGE C-16
COM (1-3) PARAMETERS
Modem Comm…
Rate : R/W [1200,2400,4800,9600,19200 BAUD]
Parity : R/W [ODD, EVEN, NONE]
Data : R/W [7 BITS, 8 BITS]
Stop : R/W [1 BIT, 1.5 BIT, 2 BIT]
Radio : R/W [000-255 RADIO LINK ID]
Prot : R/W [MODBUS AEG, RNIM, MODBUS ALT]
Oper : R/W [FULL DUPLEX, HALF DUPLEX]
Xmit : R/W [ENABLED, DISABLED]
Rcvr : R/W [ENABLED, DISABLED]
Reset Reciever - PRESS ENTER
Reset Transmitter - PRESS ENTER
Pre : R/W [0 TO 5000 MILLISECONDS]
Post : R/W [0 TO 5000 MILLISECONDS]
Timout : R/W [0 TO 1440 MINUTES]
MODEM CONNECTION
Initialize Modem…
Modem : R/O [FOUND, NOT FOUND]
Hang-Up Modem - PRESS ENTER
PLEASE WAIT: MODEM
HANGUP IN PROGRESS.
MODEM HAS BEEN
DISCONNECTED.
PRESS ANY KEY.
DISCONNECT REMOTE COMPUTER
BEFORE INITIALIZING. <ENTER> = OK.
PLEASE WAIT: INITIALIZATION IN
PROGRESS.
MODEM HAS BEEN INITIALIZED.
PRESS ANY KEY.

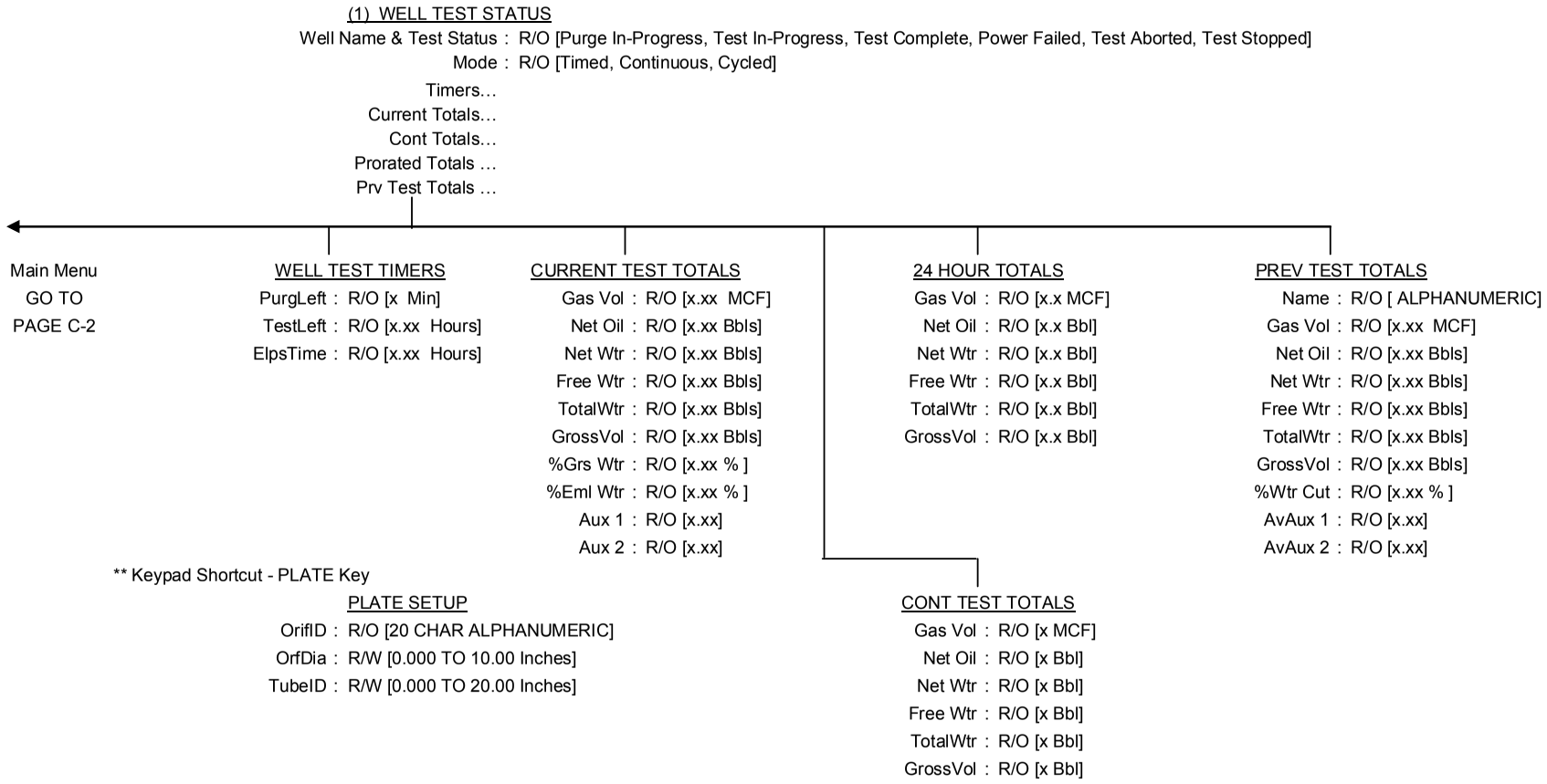


* Source List located in NOA-332 Instruction Manual


** = Keypad Shortcut
NET OIL ANALYZER
(1) Test Status…
(2) Flow Data...
(3) Site Data...
(4) Alarm Data...
(5) MultiVarTrans...
(6) Time Data...
(7) Config/Setup...
(8) Diagnostics...
(9) Logout
(7) Config/Setup
GO TO
PAGE C-5
DIAGNOSTICS **
Analog Inputs…
TFM Channels…
Digital Inputs…
Digital Outputs…
Interrupts…
Gas Calculations…
RAM Diagnostics…
SlaveId : R/O [HEXADECIMAL]
Version : R/O [NUMERIC]
LOGOUT
(PRESS ENTER - resets system security access)
Digital Inputs
GO TO
PAGE C-18
ANALOG DIAG
Raw Counts…
Filtered Counts…
Engr Values…
TFM DIAGNOSTICS
Input Pulses…
Input Frequency…
ADC RAW COUNTS
SysPwr : R/O [0 TO 4095]
Brd Temp : R/O [0 TO 4095]
Wtrcut : R/O [0 TO 4095]
EmulPr : R/O [0 TO 4095]
EmulTm : R/O [0 TO 4095]
DiffPr : R/O [0 TO 4095]
GasPrs : R/O [0 TO 4095]
GasTmp : R/O [0 TO 4095]
AI Num 09 : R/O [0 TO 4095]
AI Num 10 : R/O [0 TO 4095]
AI Num 11 : R/O [0 TO 4095]
AI Num 12 : R/O [0 TO 4095]
AI Num 13 : R/O [0 TO 4095]
AI Num 14 : R/O [0 TO 4095]
AI Num 15 : R/O [0 TO 4095]
AI Num 16 : R/O [0 TO 4095]
FILTERED COUNTS
SysPwr : R/O [0 TO 4095]
Brd Temp : R/O [0 TO 4095]
Wtrcut : R/O [0 TO 4095]
EmulPr : R/O [0 TO 4095]
EmulTm : R/O [0 TO 4095]
DiffPr : R/O [0 TO 4095]
GasPrs : R/O [0 TO 4095]
GasTmp : R/O [0 TO 4095]
AI Num 09 : R/O [0 TO 4095]
AI Num 10 : R/O [0 TO 4095]
AI Num 11 : R/O [0 TO 4095]
AI Num 12 : R/O [0 TO 4095]
AI Num 13 : R/O [0 TO 4095]
AI Num 14 : R/O [0 TO 4095]
AI Num 15 : R/O [0 TO 4095]
AI Num 16 : R/O [0 TO 4095]
ENGR VALUES
SysPwr : R/O [0 to 9000]
Brd Temp : R/O [0 to 9000]
Wtrcut : R/O [0 to 9000]
EmulPr : R/O [0 to 9000]
EmulTm : R/O [0 to 9000]
DiffPr : R/O [0 to 9000]
GasPrs : R/O [0 to 9000]
GasTmp : R/O [0 to 9000]
AI Num 09 : R/O [0 to 9000]
AI Num 10 : R/O [0 to 9000]
AI Num 11 : R/O [0 to 9000]
AI Num 12 : R/O [0 to 9000]
AI Num 13 : R/O [0 to 9000]
AI Num 14 : R/O [0 to 9000]
AI Num 15 : R/O [0 to 9000]
AI Num 16 : R/O [0 to 9000]
TFM PULSES
Chan 1 : R/O [NUMERIC]
Chan 2 : R/O [NUMERIC]
Chan 3 : R/O [NUMERIC]
Chan 4 : R/O [NUMERIC]
TFM FREQUENCY
Chan 1 : R/O [HZ]
Chan 2 : R/O [HZ]
Chan 3 : R/O [HZ]
Chan 4 : R/O [HZ]


DIAGNOSTICS
Analog Inputs…
TFM Channels…
Digital Inputs…
Digital Outputs…
Interrupts…
Gas Calculations…
RAM Diagnostics…
SlaveId : R/O [HEXADECIMAL]
Version : R/O [NUMERIC]
TFM Channels
GO TO
PAGE C-17
DIGITAL INPUTS
Input Byte : R/W [NUMERIC]
Input #1 : R/O [OPEN, CLOSED]
Input #2 : R/O [OPEN, CLOSED]
Input #3 : R/O [OPEN, CLOSED]
Input #4 : R/O [OPEN, CLOSED]
Input #5 : R/O [OPEN, CLOSED]
Input #6 : R/O [OPEN, CLOSED]
Input #7 : R/O [OPEN, CLOSED]
Input #8 : R/O [OPEN, CLOSED]
Digital Outputs
MIGHT BE IN USE
DISCONNECT AND
PRESS ANY KEY...
DIGITAL OUTPUTS
LatchTm : R/W [0 to 999.0]
Output #1…
Output #2…
Output #3…
Output #4…
Output #5…
Output #6…
Output #7…
Output #8…
Drive All LOW - PRESS ENTER
Pulse Train All - PRESS ENTER
Restore outputs - PRESS ENTER
DIGITAL OUT #(1-8)
Drive HIGH - PRESS ENTER
Drive LOW - PRESS ENTER
Pulse Train - PRESS ENTER
Restore Output - PRESS ENTER
Interrupts
GO TO
PAGE C-19


DIAGNOSTICS
Analog inputs…
TFM Channels…
Digital Inputs…
Digital Outputs…
Interrupts…
Gas Calculations…
RAM Diagnostics…
SlaveId : R/O [HEXADECIMAL]
Version : R/O [NUMERIC]
Digital Outputs
GO TO
PAGE C-18
INTERRUPTS
Reset : R/W [NUMERIC]
BussErr : R/W [NUMERIC]
AddErr : R/W [NUMERIC]
ZeroDiv : R/W [NUMERIC]
PrivIdg : R/W [NUMERIC]
SpurInt : R/W [NUMERIC]
ORIFICE METER
Meter Run # : R/W [1]
Zbase : R/O [NUMERIC]
Zstd : R/O [NUMERIC]
Zflow : R/O [NUMERIC]
Fpv : R/O [NUMERIC]
Cprime : R/O [NUMERIC]
RAM DIAGNOSTICS
Curr Ram : R/O [NUMERIC]
Curr Val : R/O [NUMERIC]
Boot Ram : R/O [NUMERIC]
Boot Val : R/O [NUMERIC]
Chng Cnt : R/O [NUMERIC]
Restore Ram - PRESS ENTER


(1) WELL TEST STATUS
Well Name & Test Status : R/O [Purge In-Progress, Test In-Progress, Test Complete, Power Failed, Test Aborted, Test Stopped]
Mode : R/O [Timed, Continuous, Cycled]
Timers...
Current Totals...
Cont Totals...
Prorated Totals ...
Prv Test Totals ...
Main Menu
GO TO
PAGE C-2
WELL TEST TIMERS
PurgLeft : R/O [x Min]
TestLeft : R/O [x.xx Hours]
ElpsTime : R/O [x.xx Hours]
CURRENT TEST TOTALS
Gas Vol : R/O [x.xx MCF]
Net Oil : R/O [x.xx Bbls]
Net Wtr : R/O [x.xx Bbls]
Free Wtr : R/O [x.xx Bbls]
TotalWtr : R/O [x.xx Bbls]
GrossVol : R/O [x.xx Bbls]
%Grs Wtr : R/O [x.xx %]
%Eml Wtr : R/O [x.xx %]
Aux 1 : R/O [x.xx]
Aux 2 : R/O [x.xx]
24 HOUR TOTALS
Gas Vol : R/O [x.x MCF]
Net Oil : R/O [x.x Bbl]
Net Wtr : R/O [x.x Bbl]
Free Wtr : R/O [x.x Bbl]
TotalWtr : R/O [x.x Bbl]
GrossVol : R/O [x.x Bbl]
PREV TEST TOTALS
Name : R/O [ALPHANUMERIC]
Gas Vol : R/O [x.xx MCF]
Net Oil : R/O [x.xx Bbls]
Net Wtr : R/O [x.xx Bbls]
Free Wtr : R/O [x.xx Bbls]
TotalWtr : R/O [x.xx Bbls]
GrossVol : R/O [x.xx Bbls]
%Wtr Cut : R/O [x.xx %]
AvAux 1 : R/O [x.xx]
AvAux 2 : R/O [x.xx]
** Keypad Shortcut - PLATE Key
PLATE SETUP
OrifID : R/O [20 CHAR ALPHANUMERIC]
OrfDia : R/W [0.000 TO 10.00 Inches]
TubeID : R/W [0.000 TO 20.00 Inches]
CONT TEST TOTALS
Gas Vol : R/O [x MCF]
Net Oil : R/O [x Bbl]
Net Wtr : R/O [x Bbl]
Free Wtr : R/O [x Bbl]
TotalWtr : R/O [x Bbl]
GrossVol : R/O [x Bbl]

Appendix D

Spare Parts List

Tables D.1 through D.8 include spare parts needed for various types of NOA-332 Net Oil Analyzers.

Table D.1—Spare Parts Common to All NOA-332s

Qty.	Part Number	Description
1	9A-101282995	Circuit Assembly – Digital Board c/w firmware
1	9A-101002167	Circuit Assembly – Analog
1	9A-100079397	Circuit Assembly - CPC Adapter
5	9A-100025092	Fuse – 5 Amp
5	9A-100025091	Fuse – 1 Amp
5	9A-100025090	Fuse – 0.5 Amp
1	9A-100079514	Instruction Manual on CD ROM
1	9A-100012666	Battery, Memory Backup for Digital Circuit Assembly

Table D.2—Spare Parts for all AC Powered NOA-332s

Qty.	Part Number	Description
1	9A-101236889	Power Module – AC Input

Table D.3—Spare Parts for all NOA-332s that are 24VDC powered, AC powered with Watercut Monitor or Current Transmitters or 12VDC powered with Watercut Monitor or Current Transmitters (excludes External Powered Models)

Qty.	Part Number	Description
1	9A-101236388	DC to DC Power Supply Board

Table D.4—Spare Parts for all NOA-332s with Four Channel Digital Input/Output

Qty.	Part Number	Description
1	9A-100079456	4 Channel Digital Input/Output Circuit Board – Relay

Table D.5—Spare Parts for all NOA-332s with Eight Channel Digital Input/Output

Qty.	Part Number	Description
1	9A-100079587	8 Channel Digital Input/Output Circuit Board – FET

Table D.6—Spare Parts for all NOA-332s using NuFlo Capacitance Probe

Qty.	Part Number	Description
5	9A-101239754	Fuse – 0.25 Amp
1	9A-101238900	Capacitance Probe Interface Circuit Board

Table D.7—Spare Parts for all NOA-332s using RS-232 and/or RS-485 Communications (Select only parts necessary for application)

Qty.	Part Number	Description
1	9A-100025195	RS-232 to RS-485 Converter – 25 pin
1	9A-101283116	RS-232 to RS-485 Converter – 9 pin
1	9A-100079793	Interface Cable – CPC Connector to DB-9 Computer – 6 Ft.
1	9A-100079794	Interface Cable – CPC Connector to DB-25 Computer – 6 Ft.
1	9A-100079815	Interface Cable – CPC Connector to DB-9 Computer – 25 Ft.
1	9A-100079816	Interface Cable – CPC Connector to DB-25 Computer – 25 Ft.

Table D.8—Spare Parts for Pole Mount NOA-332

Qty.	Part Number	Description
1	9A-100005090	2 Inch Pole Mount Kit

Appendix E

NuFlo Capacitance Probe & Capacitance Probe Interface Board

Introduction

The Capacitance Probe Interface Board is designed to be used with the NuFlo Capacitance Probe to provide an analog signal representing percent watercut. The NuFlo Capacitance Probe generates a frequency that varies with the percent of water in an emulsion using the dielectric properties of the emulsion to determine percent watercut. The Capacitance Probe Interface Board receives the frequency signal from the NuFlo Capacitance Probe and converts the frequency into two (2) analog outputs. The conversion is based on frequency verses percent watercut response curves for the various probe sizes (see Figure 4). The analog outputs are a 4 to 20 mA signal and a 1 to 5 volt DC signal. The voltage output signal is connected to the NuFlo NOA-332 and is used by the NOA-332 in determining the percent watercut of an emulsion stream. The 4 to 20 mA output signal is available to the user to provide a representation of percent watercut to other equipment.

The Capacitance Probe Interface Board is configured using pushbuttons and a LCD mounted on the circuit assembly. The LCD displays the percent watercut while the unit is operating and user prompts while in the configure mode. A security access code prevents unauthorized personnel from altering the configuration data in the instrument. The security code may be disabled if this feature is not required. The circuitry contains an EEPROM, which saves the configuration data in the event of a power failure.

Capacitance Probe

Overview

The Capacitance Probe consists of a tube of metal approximately 10 inches long ranging in diameter sizes of 2 inch, 3 inch, 4 inch, and 6 inch with various end connections. An antenna assembly consisting of a coated metal rod is suspended in the center of the tube and is insulated from the body, forming a coaxial capacitance cell. An electronic circuit board is mounted atop the tube and is electrically connected to the antenna and the body of the Probe. The circuit board contains an oscillator used to generate a frequency. As a homogenous emulsion of oil and water flows through the Probe body, the frequency of the oscillator varies proportionally with the percent of water in the emulsion due to the dielectric property of the emulsion. The dielectric constant of the emulsion is directly proportional to the percent of water contained within the emulsion. Due to the physical and chemical properties of the emulsion which vary with temperature and emulsion constituents, the accuracy of the instrument is best at lower percentages of water and decreases as the percentage of water increases. The Capacitance Probe is less accurate at water percentages above 50 percent

because the oil/water emulsion develops into a water-external phase and shorts out the capacitance cell formed between the antenna and the body of the Probe.

The variance of emulsion constituents usually require that the Capacitance Probe be calibrated in the field using the actual oil for optimum accuracy. The Capacitance Probe circuitry facilitates this calibration by providing a variable trimmer capacitor to adjust the oscillator frequency.

The Capacitance Probe must be installed vertically. It may be installed with either end up. In a separator application, it must be upstream of the dump valve and should be as close to the separator as the practical aspects of the installation permit.

Calibration

Checkout and calibration of the Capacitance Probe involves filling the Capacitance Probe with a sample of clean, dry crude oil from the location (less than 1% WC) and observing the output frequency. This adjustment may be made with the Capacitance Probe removed from the flow line, however optimal results are achieved when the Probe is adjusted while at operating temperature. For proper calibration, the Capacitance Probe must be completely liquid filled.

Once the Capacitance Probe has been connected to the Capacitance Probe Interface Board and filled with oil, turn the NOA-332 power on. Monitor the frequency generated by the Capacitance Probe with a frequency counter. If the Capacitance Probe frequency is not between 1024 and 1026 kHz, adjustment of the Capacitance Probe is required. Unscrew the pipe plug in the trimmer capacitor access hole and adjust the trimmer capacitor on the Capacitance Probe circuit assembly until the output is 1025 kHz, +/- 0.1 kHz. This is the only adjustment required to calibrate the Capacitance Probe. Once this calibration adjustment is complete, replace the pipe plug in the trimmer capacitor access hole.

If a frequency counter is not available, the Capacitance Probe (while filled with dry oil) can be adjusted using the Capacitance Probe Interface Board percent watercut indication on the LCD. Adjust the Capacitance Probe trimmer capacitor clockwise until a watercut greater than 0 percent is indicated. Turn the trimmer counter-clockwise just until a watercut of 0 percent is indicated. The calibration is complete, no further adjustment should be made.

Capacitance Probe Interface Board

Overview

The Capacitance Probe Interface Board has two modes of operation, Run Mode and Configure Mode.

In the Run Mode, the Capacitance Probe Interface Board displays the percent watercut. If the Capacitance Probe Interface Board has not been configured, it will have to be configured before being placed in service. The *Configuration* section within this appendix provides a step-by-step procedure for configuring the Capacitance Probe Interface Board.

The Configure Mode of the Capacitance Probe Interface Board allows entry of configuration data into the instrument. While in the Configure Mode, the upper line of the display will have prompts consisting of abbreviated words with each letter formed with a 7-segment character. Due to the limitations of a 7-segment character, some of the letters will be upper case and some will be lower case. On the lower line of the display, the configuration data is entered. While in Configure Mode, each digit is changed one at a time. The digit selected to be changed will be blinking on and off.

In the following operation and configuration examples, display prompts and pushbutton names will be shown in **BOLD** type. The prompts will be shown in upper and lower case letters to illustrate approximately the way that they will appear on the display.

The pushbutton switches operate as follows:

ACCESS: If **ACCESS** is pressed while in the Run Mode, the instrument will be placed in the Configure Mode. Pressing **ACCESS** while in the Configure Mode will return the instrument to the Run Mode. When returning to Run Mode by pressing the **ACCESS**, any data that has been input with the **ENTER** being pressed afterward will be saved to memory. Any data that has been input without **ENTER** being pressed afterward will not be saved, and the data entered from a previous configuration will be retained.

STEP: Pressing **STEP** advances the digit to be changed to the left. If the left-most digit is selected, pressing **STEP** again advances the digit to be changed to the right-most digit. **STEP** is also used to toggle between selections.

INCR: While entering numbers, **INCR** advances the value of the digit to be changed by one from its initial value each time it is pressed. If **INCR** is pressed when the digit is nine, the value rolls over to zero. **INCR** is also used to toggle between selections.

ENTER: Pressing **ENTER** saves the displayed data for the current configuration function and advances to the next configuration function.

RESET: Pressing **RESET** causes a system reset and all configuration data is set to defaults.

Error Detection

The Capacitance Probe Interface Board will inform the operator of detected errors while in the Run Mode. The **Error** message will be displayed to the operator in the form of the word **Error** displayed on the lower line of the display every other time that the percent watercut value is updated. When the **Error** message is displayed, press **INCR** or **STEP** and the first error will be shown on the upper line of the display. Press **INCR** or **STEP** to check for additional errors. Each time **INCR** or **STEP** is pressed, the next error will be displayed. After the last error is displayed, pressing **INCR** or **STEP** again will display the first error again and the process will be repeated. It is recommended that the **INCR** or **STEP** keys be pressed repeatedly to display all **Error** messages. The **ENTER** key may be pressed to return to the Run Mode or the **ACCESS** key may be pressed to enter the Configure Mode to correct the errors as shown below.

If more than one **Error** condition exists, and one of these errors is corrected, the next **Error** will be displayed. If all **Error** conditions cease to exist, the Capacitance Probe Interface Board will automatically return to the Run Mode.

There are four **Error** messages in the current version of firmware: **voLt.oUt/Err Hi, voLt.oUt/Err Lo**, **4-20.oUt/Err Hi** and **4-20.oUt/Err Lo**.

The **voLt.oUt/Err Hi** error message indicates the percent watercut has exceeded the high engineering value set for the voltage output to the point that the voltage output has exceeded 4.8 Volts. The **Error** message appears on the lower line of the display only during the time that the condition exists. When **INCR** or **STEP** are pressed during the error condition, the **voLt.oUt** message appears on the

upper line of the display and the **Err Hi** message appears on the lower line of the display. This error may be caused by the high engineering value being set too low for normal operating conditions. This error may be corrected by changing the high engineering value for the voltage output as covered in the *Configuring the Voltage Output* section of this appendix.

The **voLt.oUt/Err Lo** error message indicates the percent watercut is below the low engineering value set for the voltage output to the point that the voltage output has fallen below 0.2 Volt. The **Error** message appears on the lower line of the display only during the time that the condition exists. When **INCR** or **STEP** are pressed during the error condition, the **voLt.oUt** message appears on the upper line of the display and the **Err Lo** message appears on the lower line of the display. This error may be caused by the low engineering value being set too high for normal operating conditions. This error may be corrected by changing the low engineering value for the voltage output as covered in the *Configuring the Voltage Output* section of this appendix.

The **4-20.oUt/Err Hi** error message indicates the percent watercut has exceeded the high engineering value set for the 4-20 mA output to the point that the current output has exceeded 22.0 mA. The **Error** message appears on the lower line of the display only during the time that the condition exists. When **INCR** or **STEP** are pressed during the error condition, the **4-20.oUt** message appears on the upper line of the display and the **Err Hi** message appears on the lower line of the display. This error may be caused by the high engineering value being set too low for normal operating conditions. This error may be corrected by changing the high engineering value for the 4-20 mA output as covered in the *Configuring the 4-20 mA Output* section of this appendix.

The **4-20.oUt/Err Lo** error message indicates the percent watercut is below the low engineering value set for the 4-20 mA output to the point that the output current has fallen below 4.0 mA. The **Error** message appears on the lower line of the display only during the time that the condition exists. When **INCR** or **STEP** are pressed during the error condition, the **4-20.oUt** message appears on the upper line of the display and the **Err Lo** message appears on the lower line of the display. This error may be caused by the low engineering value being set too high for normal operating conditions. This error may be corrected by changing the low engineering value for the 4-20 mA output as covered in the *Configuring the 4-20 mA Output* section of this appendix.

Configuration

1. The steps required to configure the Capacitance Probe Interface Board are:

2. Press **ACCESS** to enter the Configure Mode.

3. A segment test will be performed and the ROM version will then be displayed. If a security code has been programmed, **SEC.CodE** will be displayed. See the section *Accessing with a Security Code*. If no security code was programmed, the prompt **ProbE** will be displayed.

4. At the prompt **ProbE**, press **INCR** to select **2, 3, 4, 6**, or **oriG** for the probe size. Press **ENTER**. See the section *Selecting Probe Size* for more information on probe selection

5. At the prompt **voLt.oUt**, press **INCR** to select **oFF** or **on** for the voltage output feature. If **oFF** is selected, press **Enter**. If **on** is selected, see the section *Configuring Voltage Output.*

6. At the prompt **4-20.oUt**, press **INCR** to select **oFF** or **on** for the 4-20 mA output feature. If **oFF** is selected, press **ENTER**. If **on** is selected, see the section *Configuring the 4-20 mA Output.*

7. At the prompt **CodE**, press **INCR** to select **oFF** or **on** for the security code feature. If **oFF** is selected, press **ENTER**. If **on** is selected, see the section *Setting a Security Code*.

Selecting Probe Size

Each size Capacitance Probe (2 inch, 3 inch, 4 inch, and 6 inch) has a different response curve for the frequency versus percent watercut. For this reason the Capacitance Probe Interface Board is internally programmed with the response curves of each of these probes. The correct response curve for the probe connected to the Capacitance Probe Interface Board must be selected to provide accurate results.

The curves to be selected are:

- 2 Inch – This curve is to be selected for 2 inch sized probes with LCP coated antennas and Teflon bushings. (Probes manufactured after 5/86)
- 3 Inch – This curve is to be selected for 3 inch sized probes with LCP coated antennas and Teflon bushings. (Probes manufactured after 5/86)
- 4 Inch – This curve is to be selected for 4 inch sized probes with LCP coated antennas and Teflon bushings. (Probes manufactured after 5/86)
- 6 Inch – This curve is to be selected for 6 inch sized probes with LCP coated antennas and Teflon bushings. (Probes manufactured after 5/86)
- Original – This curve is to be selected for all size NuFlo Capacitance Probes that have Delrin, ceramic, or Ryton bushings and Ryton coated antennas. (Probes manufactured before 5/86)

To determine what internals are in the probe if dates are not available the following applies:

- Antennas - If the antenna is black or brown in color and 6” long, it is Ryton. Use the “original” curve. If the antenna is tan in color and 7” long it is LCP. Use the diameter of the probe body to determine the correct size of the curve to input.
- Bushings – If the bushing is brown or black, it is Ryton. Use the “original” curve. If the bushing is yellow or cream in color, smooth and hard, its Delrin. Use the “original” curve. If the bushing is white or cream in color, hard and brittle, it is ceramic. Use the “original” curve. If the bushing is white, soft, and yielding to fingernail penetration, it is Teflon. For identification purposes, all Teflon bushings made after late 1986 will have a circular groove on the top surface. Use the diameter of the probe to determine the correct size of the curve to input.

The diameter of the probe can easily be determined by the first number in the serial number prefix. For example, the serial number 3SFP-844 denotes a 3 inch probe.

Configuring the Voltage Output

The Capacitance Probe Interface Board has a voltage output feature that represents percent watercut. This feature can be configured to represent any percent watercut range from 0 to 100 percent as long as the low engineering value and the high engineering value differ by at least 25 percent. The low engineering value though typically configured for 0 percent watercut, may be configured for a minimum desired percent watercut. A watercut equal to the low engineering value will result in an output of 0.3 Volts. If the percent watercut falls below the low engineering value, the voltage output will go as low as 0.2 Volts and the **voLt.oUt/Err Lo** error message will be displayed. The high engineering value though typically configured for 100 percent watercut, may be configured to any percent watercut that is at least 25 more than the low engineering value. A percent watercut equal to the high engineering value will result in an output of 4.7 Volts. If the percent watercut rises above the high engineering value, the voltage will go as high as 4.8 Volts and the **voLt.oUt/Err Hi** error message will be displayed. Watercut percentages in between the low and the high engineering values will result in a voltage output between 0.3 and 4.7 Volts according to the following calculation:

$$V_{OUT} = \left[\frac{V_{MAX} - V_{MIN}}{WATERCUT_{HIGH} - WATERCUT_{LOW}} \right] \times \left[WATERCUT_{CURR} - WATERCUT_{LOW} \right] + V_{MIN}$$

Where:

V_{OUT} = *The output voltage*

V_{MAX} = *The maximum voltage output which is 4.7 Volts*

V_{MIN} = *The minimum voltage output which is 0.3 Volt*

$WATERCUT_{HIGH}$ = *The percent watercut high engineering value*

$WATERCUT_{LOW}$ = *The percent watercut low engineering value*

$WATERCUT_{CURR}$ = *The percent watercut*

Not only are the low and high engineering values for percent watercut programmed into the Capacitance Probe Interface Board, but the 0.3 and 4.7 Volt output points are keypad adjustable for hardware calibration of the system insuring maximum output accuracy. Figure E.1 is a chart illustrating the operation of the voltage output.

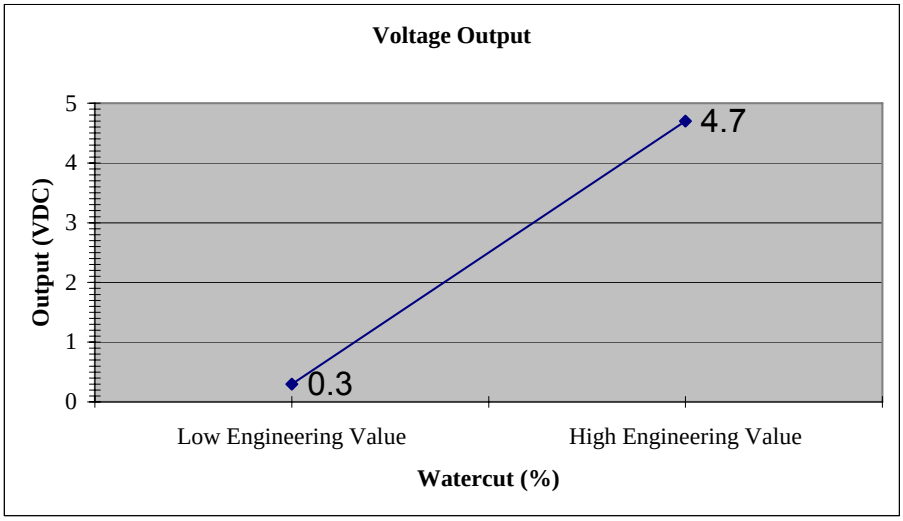


Figure E.1—Voltage output

CAUTION! – Before performing any voltage calibration, ensure that all peripheral equipment connected to the voltage output is either disconnected or disabled. Calibrating and testing the voltage output feature on the Capacitance Probe Interface Board with the peripheral equipment in operation may cause false alarms or erroneous operation of the peripheral device or associated equipment. This is due to the fact that during calibration, the Capacitance Probe Interface Board outputs a value close to 0.3 Volt to calibrate the zero point and a value close to 4.7 Volts to calibrate the full scale.

Important: Configuring the voltage output requires the use of a voltmeter. The accuracy and resolution of the voltmeter directly determines the accuracy of the voltage output calibration of the Capacitance Probe Interface Board. The user is cautioned to use a recently calibrated voltmeter traceable to NIST with a minimum resolution of two decimal places.

The steps required to configure the Voltage output are:

1. Enter the Configure Mode by pressing ACCESS.
2. A segment test will be performed and the ROM version will then be displayed. If a security code has been programmed, SEC.CodE will be displayed. See the section *Accessing with a Security Code* in this appendix. If no security code was programmed, the prompt ProbE will be displayed.
3. Accept the current settings by pressing ENTER until the voLt.oUt prompt appears.
4. Press INCR to toggle the bottom line to on in order to enable the feature. If the output is not used, press INCR until oFF is displayed on the bottom line. Press ENTER.
5. For this step and the next step of the calibration, a Voltmeter has to be connected to the Voltage output terminals and set to the highest resolution possible in the 0.3 to 4.7 Volt range. At the v CAL.Lo prompt, use INCR and STEP to enter the voltage reading of the meter into the lower line of the display. The lower line of the display will show the previous value (factory default 0.300). If hardware calibration is not required, the previous value can be accepted. In this event, the Voltmeter is not required. Press ENTER.

5. At the v CAL.Hi prompt, use INCR and STEP to enter the Voltage reading of the meter into the lower line of the display. The lower line of the display will show the previous high value (factory default 4.700). If hardware calibration is not required, the previous value can be accepted. In this event, the Voltmeter is not required. Press ENTER.
6. At the v Eng.Lo prompt, use INCR and STEP to enter the low engineering value for the percent watercut that is represented by 0.3 Volts. Press ENTER.

Note: During Step 6 there will be 0.3 Volts present on the voltage output terminals. If the Voltage output is connected to the NOA-332, the NOA-332 can be calibrated using this voltage and the low engineering value that is being entered into the Capacitance Probe Interface Board.

7. At the **v Eng.Hi** prompt, use **INCR** and **STEP** to enter the high engineering value for the percent watercut that is represented by 4.7 Volts. Press **ENTER**.

Note: During Step 7 there will be 4.7 Volts present on the voltage output terminals. If the Voltage output is connected to the NOA-332, the NOA-332 can be calibrated using this voltage and the high engineering value that is being entered into the Capacitance Probe Interface Board.

8. At this point, the Voltage output has been calibrated. Pressing ACCESS exits the Configure Mode without making any further changes, or the remaining steps may be implemented.

See Appendix A for wiring diagrams illustrating the wiring of the voltage output feature.

Configuring Current Output

The Capacitance Probe Interface Board has a 4-20 mA output feature that represents percent watercut. This feature can be configured to represent any watercut range from 0 to 100 percent as long as the low engineering value and the high engineering value differ by at least 25. The low engineering value though typically configured for 0 percent watercut, may be configured for a minimum desired percent watercut. A watercut equal to the low engineering value will result in an output of 4 mA. If the percent watercut falls below the low engineering value, the current output will remain at 4.0 mA and the **4-20.oUt/Err Lo** error message will be displayed. The high engineering value though typically configured for 100 percent watercut, may be configured to any percent watercut that is at least 25 more than the low engineering value. A percent watercut equal to the high engineering value will result in an output of 20 mA. If the percent watercut rises above the high engineering value, the current output will go as high as 22 mA and the **4-20.oUt/Err Hi** error message will be displayed. Watercut percentages in between the low and high engineering values will result in an output of current between 4 mA and 20 mA according to the following calculation:

$$I_{OUT} = \left[\frac{I_{MAX} - I_{MIN}}{WATERCUT_{HIGH} - WATERCUT_{LOW}} \right] \times \left[WATERCUT_{CURR} - WATERCUT_{LOW} \right] + I_{MIN}$$

Where:

I_{OUT} = *The output current*

I_{MAX} = *The maximum current output which is 20 mA*

I_{MIN} = *The minimum current output which is 4 mA*

$WATERCUT_{HIGH}$ = *The percent watercut high engineering value*

$WATERCUT_{LOW}$ = *The percent watercut low engineering value*

$WATERCUT_{CURR}$ = *The percent watercut*

Not only are the low and high engineering values for percent watercut programmed into the Capacitance Probe Interface Board, but the 4 mA and 20 mA outputs are keypad adjustable for hardware calibration of the system insuring maximum output accuracy. Figure 2 is a chart illustrating the operation of the 4-20 mA output.

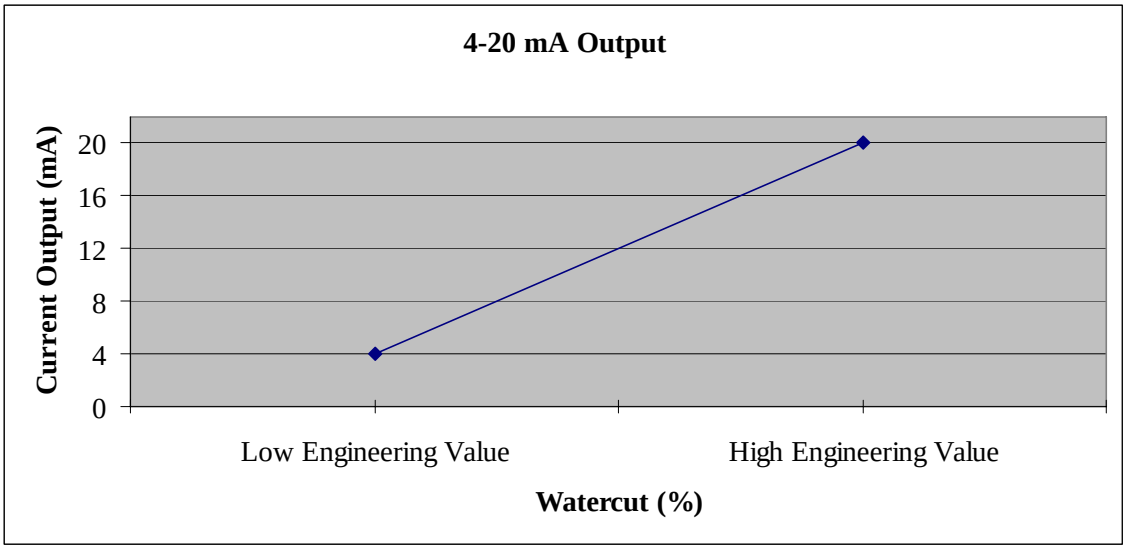


Figure E.2—4-20 mA output

CAUTION! – Before performing any 4-20 mA calibration, ensure that all peripheral equipment connected to the 4-20 mA current loop is either disconnected or disabled. Calibrating and testing the 4-20 mA output feature on the Capacitance Probe Interface Board with the peripheral equipment in operation may cause false alarms or erroneous operation of the peripheral device or associated equipment. This is due to the fact that during calibration, the Capacitance Probe Interface Board outputs a value close to 4.000 mA to calibrate the zero point and a value close to 20.000 mA to calibrate the full scale.

Important: Configuring the voltage output requires the use of a ammeter. The accuracy and resolution of the ammeter directly determines the accuracy of the current output calibration of the Capacitance Probe Interface Board. The user is cautioned to use a recently calibrated ammeter traceable to NIST with a minimum resolution of two decimal places.

The steps required to configure the 4-20 mA output are:

1. Enter the Calibrate Mode by pressing the ACCESS key.
2. A segment test will be performed and the rom version will then be displayed. If a security code has been programmed, SEC.CodE will be displayed. See the section Accessing with a Security Code in this appendix. If no security code was programmed, the prompt ProbE will be displayed.
3. Accept the current settings by pressing ENTER until the 4-20.oUt prompt appears.
4. Press INCR to toggle the bottom line to on in order to enable the feature. If the output is not used, press INCR until oFF is displayed on the bottom line. Press ENTER.
5. For this step and the next step of the calibration, a milliamp meter has to be inserted in series with the 4-20 mA current loop and set to the highest resolution possible in the 4-20 mA range. At the i CAL.Lo prompt, use INCR and STEP to enter the milliamp reading of the meter into the lower line of the display. The lower line of the display will show the previous low value (factory default 4.000). If hardware calibration is not required, the previous value can be accepted. In this event, the milliamp meter is not required. Press ENTER.
6. At the i CAL.Hi prompt, use INCR and STEP to enter the milliamp reading of the meter into the lower line of the display. The lower line of the display will show the previous high value (factory default 20.000). If hardware calibration is not required, the previous value can be accepted. In this event, the milliamp meter is not required. Press ENTER.
7. At the i Eng.Lo prompt, use INCR and STEP to enter the low engineering value for the percent watercut that is represented by 4 mA. Press ENTER.
8. At the i Eng.Hi prompt, use INCR and STEP to enter the high engineering value for the percent watercut that is represented by 20 mA. Press ENTER.
9. At this point, the 4-20 mA output has been calibrated. Pressing ACCESS exits the Configure Mode without making any further changes, or the remaining steps may be implemented.

The 4-20 mA circuit is a two-wire current loop where the user provides loop power based on total loop load resistance. See Appendix A for wiring diagrams illustrating the wiring of the 4-20 mA feature. See the Specifications chart in this appendix for operating parameters.

Setting a Security Code

Setting a security code will prevent altering of configuration data by unauthorized personnel and is recommended to preserve data integrity. Any 4-digit number may be selected for the security code. (It is recommended that 0000 not be selected as the security code since it is the default. If 0000 is set as the security code, simply pressing **ENTER** will access the Configure Mode.) Select a number that will be easy to remember, but do not use a number that will be easy for unauthorized personnel to determine.

WARNING: Once a security code is set, it cannot be retrieved or erased should the user accidentally misplace or forget the security code. If the security code is misplaced or forgotten, contact your local Cameron's Measurement System Division sales representative.

1. Enter the Configure Mode by pressing the **ACCESS** key.

2. Accept the current settings by pressing **ENTER** until the **CodE** prompt appears. The lower line of the display will show **oFF** or **on** (factory default is **oFF**). Press **INCR** until **on** is displayed to enable the feature. Press **ENTER**.
3. At the **Ent.CodE** prompt, use **INCR** and **STEP** to enter a 4-digit security code. The lower line of the display will show the previously entered code (factory default code is 0000). Press **ENTER** to return to Run Mode.

Accessing with a Security Code

Accessing the Configure Mode of a Capacitance Probe Interface Board with a security code requires knowledge of the security code.

1. Press the **ACCESS** key to enter the Configure Mode.
2. At the **SEC.CodE** prompt, use **INCR** and **STEP** keys to enter the security code. Press **ENTER**. If the correct security code is entered, the user will be granted configuration access. If the security code is incorrect, the device returns to Run Mode.

Table E.1— Capacitance Probe Interface Board Specifications

Watercut range	0 to 100 percent
Input Power	100 mA @ 12 VDC +/- 10%
Operating Temperature	-40°C to 75°C (-40°F to 167°F) LCD: -30°C to 75°C (-22°F to 167°F)
LCD Display	Percent Watercut, 0.3" character height Update Period: 1 second
Keypad	5 board mounted momentary pushbutton switches
Inputs	Frequency signal from NuFlo Capacitance Probe
Outputs	Isolated 4-20 mA, 2 wire loop representing watercut - 16 bit resolution, 0.05% of full scale @ 25°C 50 PPM/°C temperature drift Update period: 0.5 seconds DAC calibration via keypad. Compliance Voltage: 8.5 VDC Max Load @ 24VDC Loop Supply: 775Ω Voltage Output, 0.3 VDC to 4.7 VDC representing watercut - 13 bit resolution, 0.05% of full scale @ 25°C 50 PPM/°C temperature drift Update Period: 0.5 seconds DAC calibration via Keypad. Load: 100 k minimum
Communications	RS-485, Contact Factory for Protocols Supported

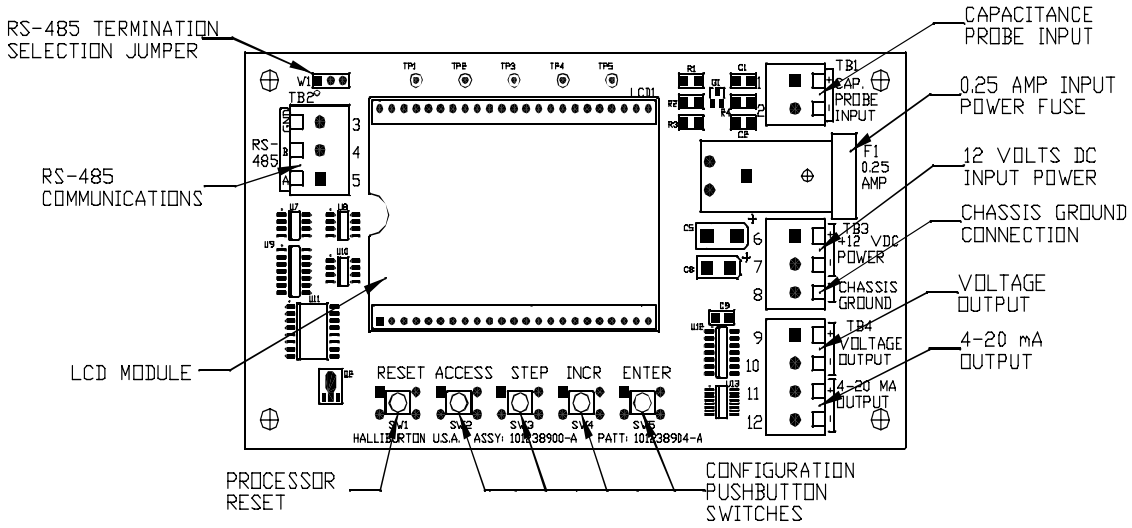


Figure E.3—Capacitance probe interface board nomenclature

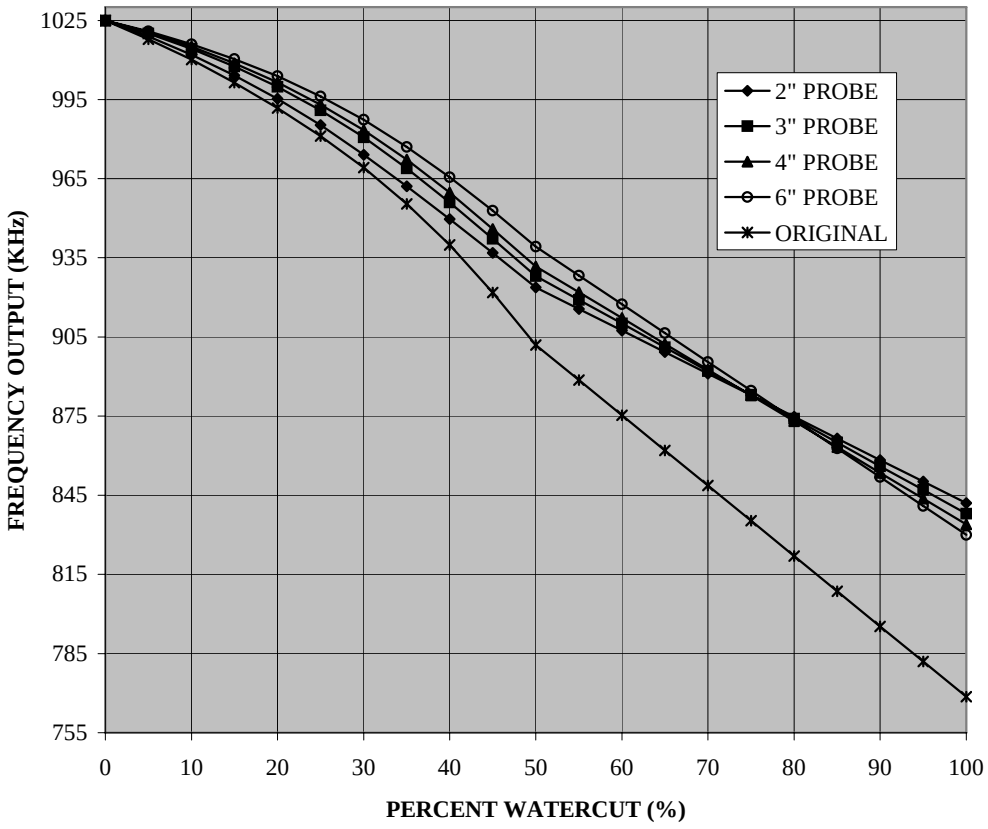


Figure E.4—Capacitance probe output frequency vs. percent watercut

Appendix F

Digital Input Output Option – Eight-Input/Eight-Output

General

The Eight Input/Eight Output Digital I/O option is used with the NuFlo 332 family of products. The option is based on the 9A-100079587 circuit board and has 8 discrete digital inputs and 8 discrete digital outputs. The specifications for the 9A-100079587 are given in Table F.1 on page F-2. The board is mounted on top of the analog board (Part No. 9A-101002167) and connects to header J3. Installation requires 4 standoffs to connect the digital I/O board to the analog board on each corner and one metal standoff in the center of the digital I/O board that passes through the analog board to connect to the backplate in the instrument enclosure. This standoff provides an earth ground connection to the digital I/O board.

Digital Inputs

The digital inputs may be discrete contact closures connected in a source or sink mode configuration or an open drain FET or transistor sink configuration. The versatility of the 9A-100079587 circuit board also allows the discrete contacts or solid state sink configurations to switch the internal 12VDC voltage of the NOA-332 or an external voltage supply up to 30VDC. This provides six different optional means of connecting the digital inputs as illustrated in pages F-3 through F-6. Figures on pages F-3 and F-4 illustrate 4 modes of discrete contact closure configurations. Figures on page F-5 illustrate two modes of using solid state devices to perform the switching function for the digital inputs.

The digital input configuration is discussed in Section 9j of this manual, Digital Input Configuration Menu. In this menu, descriptive source names can be assigned to each input. These inputs can be used with the digital outputs to provide on/off control features. Testing of the digital inputs is discussed in the Digital Input Diagnostics portion of Section 10, The Diagnostics Menu.

Digital Outputs

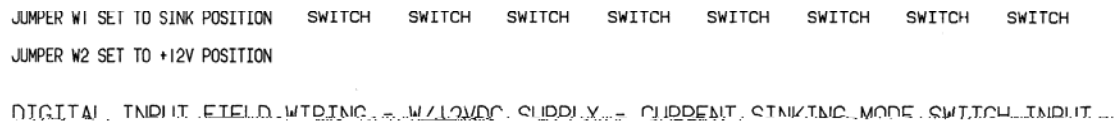
The digital outputs are field effect power transistors connected in a current sinking configuration. These outputs are connected to the external load to be switched through a positive voltage input as shown in the Digital Output Field Wiring diagram in the figure on page F-6.

NOTE: The +V power supply for the Digital Outputs is to be user supplied and the NOA-332 internal power supply is not to be used for this purpose. Caution should be used to connect the common from this power supply to the ground terminal (Terminal 2) of the Digital Input Output Circuit Assembly. Maximum voltage of this power supply is 30VDC

The digital output configuration is discussed in Section 9j of this manual, Digital Output Configuration Menu. In this menu, descriptive source names can be assigned to each output. The outputs operate as either alarm output actions or volumetric pulse outputs. In the alarm output mode they are used to acknowledge alarms and to provide on/off control. In the volumetric pulse output mode, discussed in Section 9k, the user defines the pulse width and volume per pulse of the digital output for use with remote incremental counters or samplers. Testing of the digital outputs is discussed in the Digital Output Diagnostics portion of Section 10, The Diagnostics Menu.

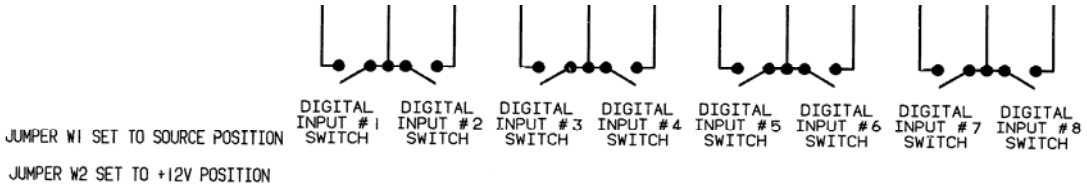
Table F.1—9A-100079587 Digital I/O Board Specifications

Operating Temperature	-40°C to +85°C (-40°F to +185°F)
Digital Input Contact Current	Minimum: 6mA to Maximum: 16mA
Digital Input Supply Voltage (12VDC Configuration)	Minimum: 10VDC to Maximum: 15VDC
Digital Input Supply Voltage (External Configuration)	Minimum: 22VDC to Maximum: 30 VDC
Digital Input Contact Voltage (12VDC Configuration)	Maximum: 10VDC
Digital Input Contact Voltage (External Configuration)	Maximum: 12VDC
Digital Output ON Resistance	0.16 ohms
Digital Output Voltage Maximum	30 VDC
Digital Output Current Maximum Per Output	1A (continuous)
Digital Output Current Maximum Total all Outputs	4A (continuous)

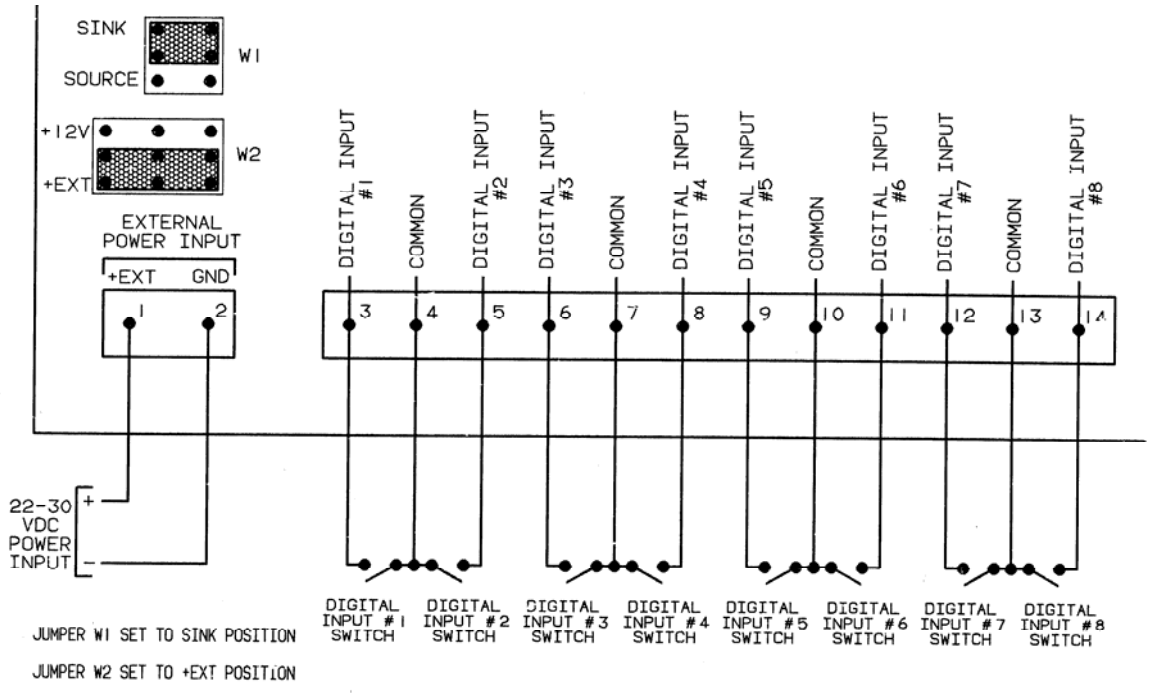


DIGITAL INPUT FIELD WIRING - W/12VDC SUPPLY - CURRENT SINKING MODE SWITCH INPUT

9A-100079587 DIGITAL INPUT OUTPUT CIRCUIT BOARD

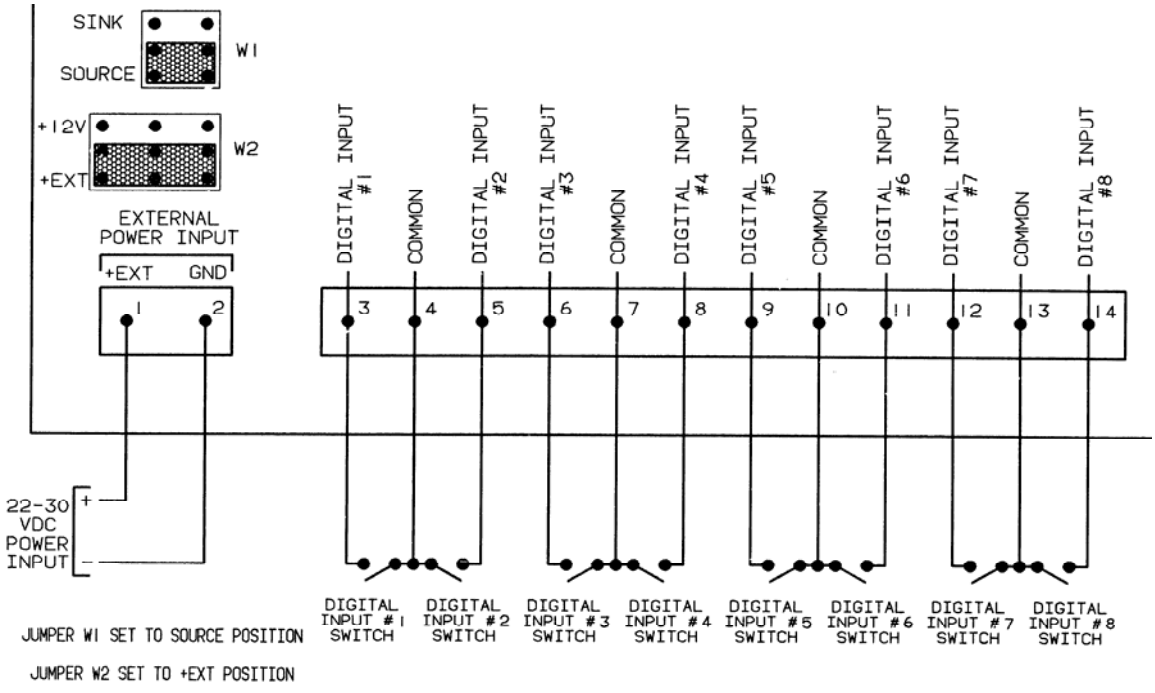


DIGITAL INPUT FIELD WIRING - W/12VDC SUPPLY - CURRENT SOURCE MODE SWITCH INPUT

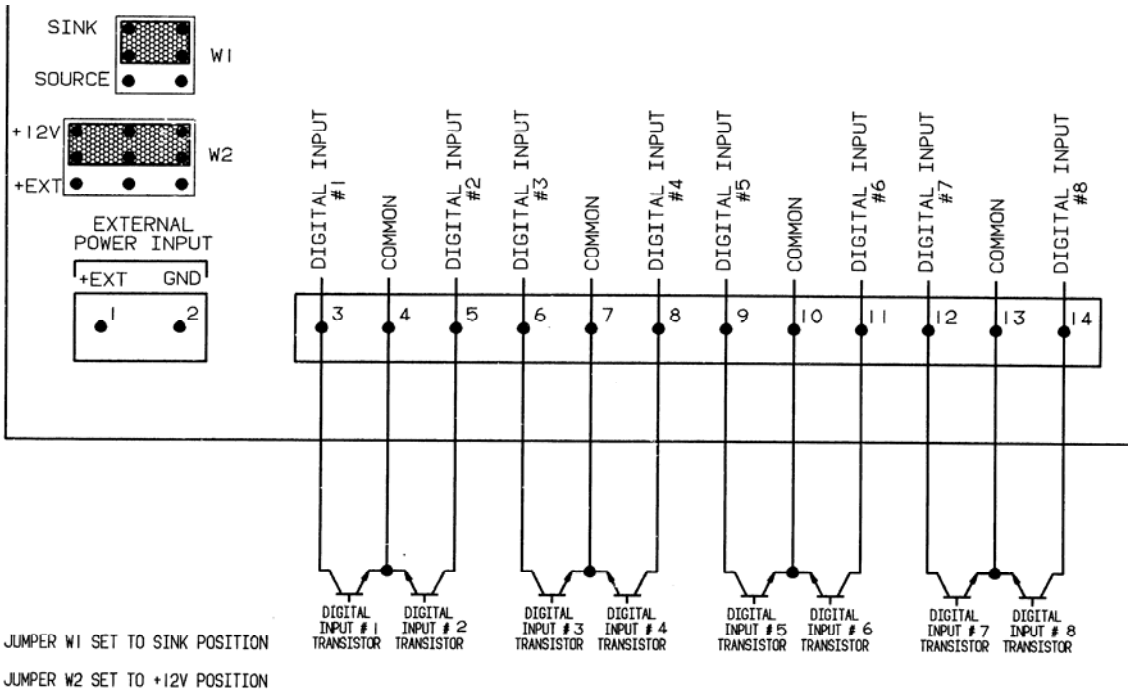


DIGITAL INPUT FIELD WIRING - W/EXTERNAL POWER SUPPLY - CURRENT SINKING MODE SWITCH INPUT

9A-100079587 DIGITAL INPUT OUTPUT CIRCUIT BOARD

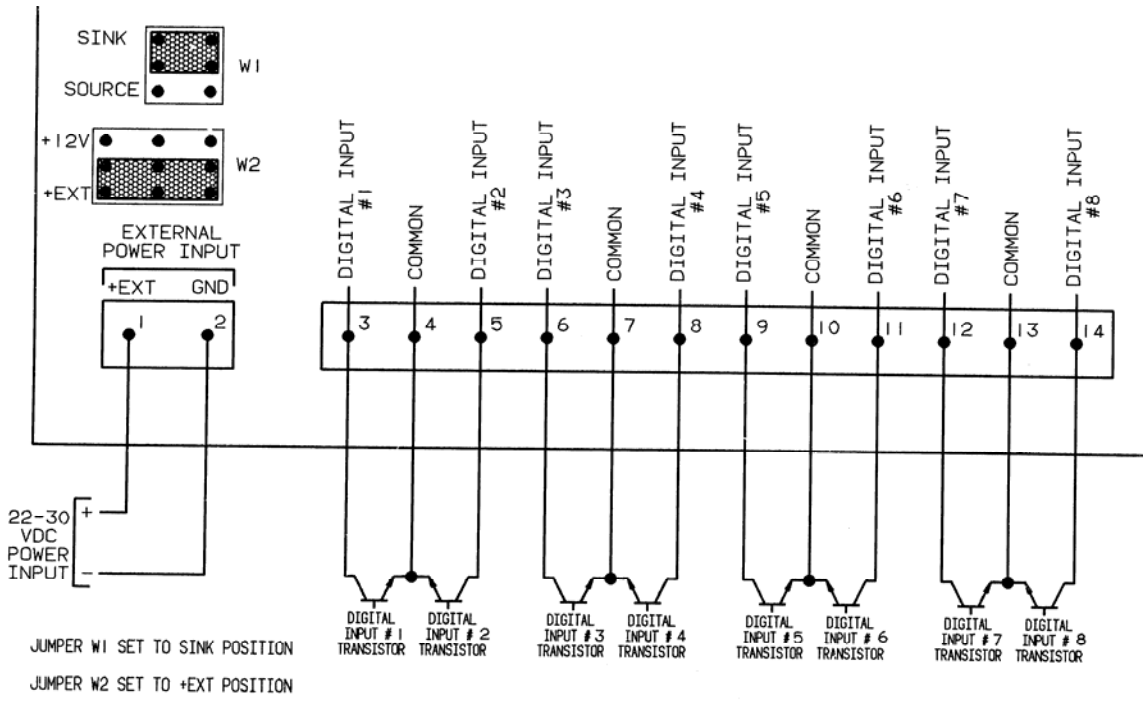


DIGITAL INPUT FIELD WIRING - W/EXTERNAL POWER SUPPLY - CURRENT SOURCE MODE SWITCH INPUT

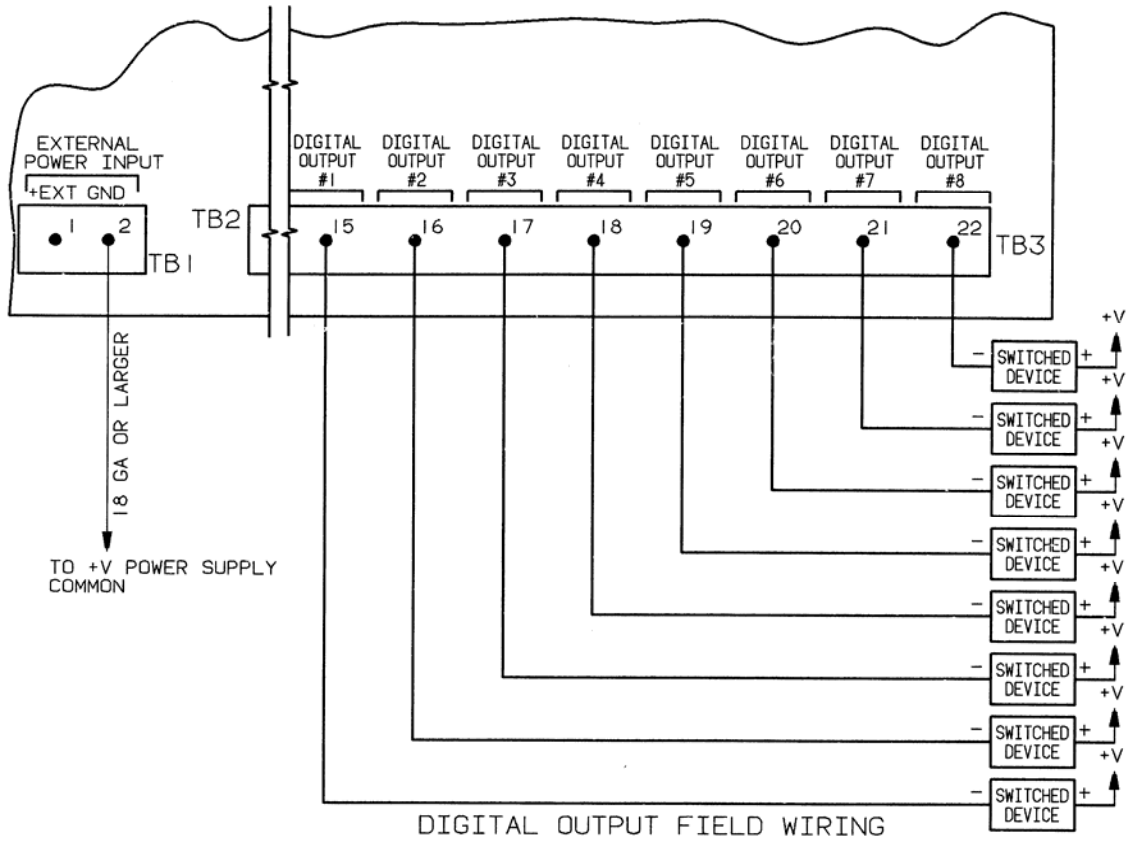


DIGITAL INPUT FIELD WIRING - W/12VDC SUPPLY - CURRENT SINKING MODE - TRANSISTOR INPUT

9A-100079587 DIGITAL INPUT OUTPUT CIRCUIT



DIGITAL INPUT FIELD WIRING - W/EXTERNAL POWER SUPPLY - CURRENT SINKING MODE - TRANSISTOR INPUT



NOTE: The +V power supply for the Digital Outputs is to be user supplied and the NOA-332 internal power supply is not to be used for this purpose. Caution should be used to connect the common from this power supply to the ground terminal (Terminal 2) of the Digital Input Output Circuit Assembly. Maximum voltage of this power supply is 30VDC. See Digital Outputs section in this addendum.

Appendix G

Digital Input Output Option - Four-Input/Four Output

General

The Four Input/Four Output Digital I/O option is used with the NuFlo 332 family of products. The option is based on the 9A-100079456 circuit board and has 4 discrete digital inputs and 4 discrete digital outputs. The specifications for the 9A-100079456 are given in Table G.1 on page G-2. The board is mounted on top of the analog board (Part No. 9A-101002167) and connects to header J3. Installation requires 4 standoffs to connect the digital I/O board to the analog board on each corner and one metal standoff in the center of the digital I/O board that passes through the analog board to connect to the backplate in the instrument enclosure. This standoff provides an earth ground connection to the digital I/O board.

Digital Inputs

The digital inputs are discrete switch inputs. The illustration on page G-4 shows the digital input field wiring using four dry contact switches. The digital input configuration is discussed in Section 9j of this manual, Digital Input Configuration Menu. In this menu, descriptive source names can be assigned to each input. These inputs can be used with the digital outputs to provide on/off control features. Testing of the digital inputs is discussed in the Digital Input Diagnostics portion of Section 10, The Diagnostics Menu.

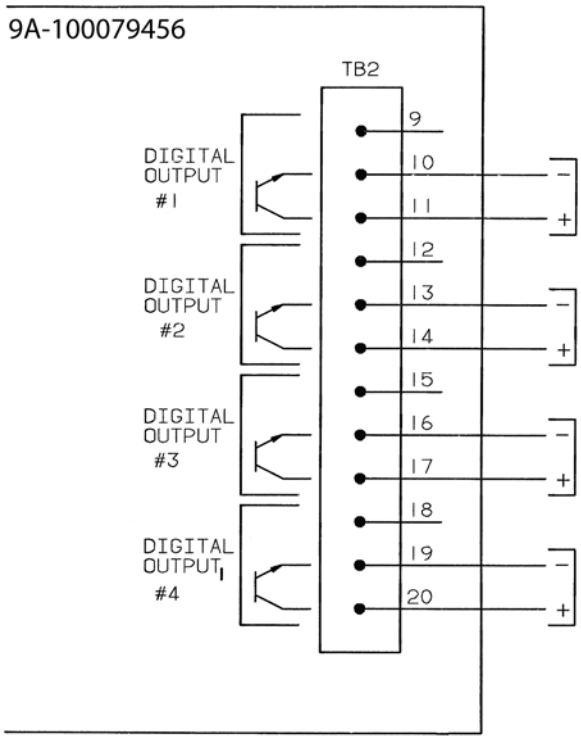
Digital Outputs

The digital outputs can be discrete relay outputs or optoisolator outputs. The type of output is determined by the type of device installed in sockets K1-K4. An example installation of a relay (Part No. 9A-100024920) and an optoisolator (Part No. 9A-100034874) is shown on page G-4. The field connections for an optoisolator digital output are shown on page G-3. The field connections for a relay digital output are shown on page G-3.

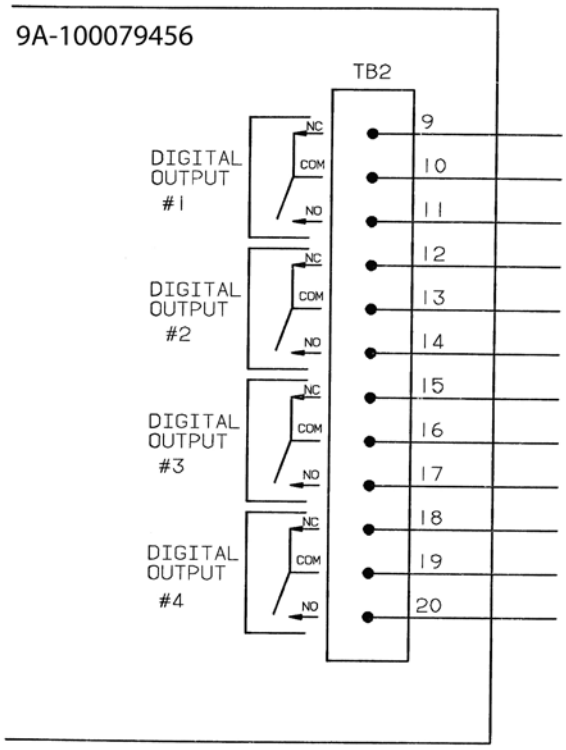
The digital output configuration is discussed in Section 9j of this manual, Digital Input Configuration Menu. In this menu, descriptive source names can be assigned to each output. The outputs operate as either alarm output actions or volumetric pulse outputs. In the alarm output mode they are used to acknowledge alarms and to provide on/off control. In the volumetric pulse output mode, discussed in Section 9k, the user defines the pulse width and volume per pulse of the digital output for use with remote incremental counters or samplers. Testing of the digital outputs is covered in the Digital Output Diagnostics portion of Section 10, The Diagnostics Menu.

Table G.1—9A-100079456 Digital I/O Board Specifications

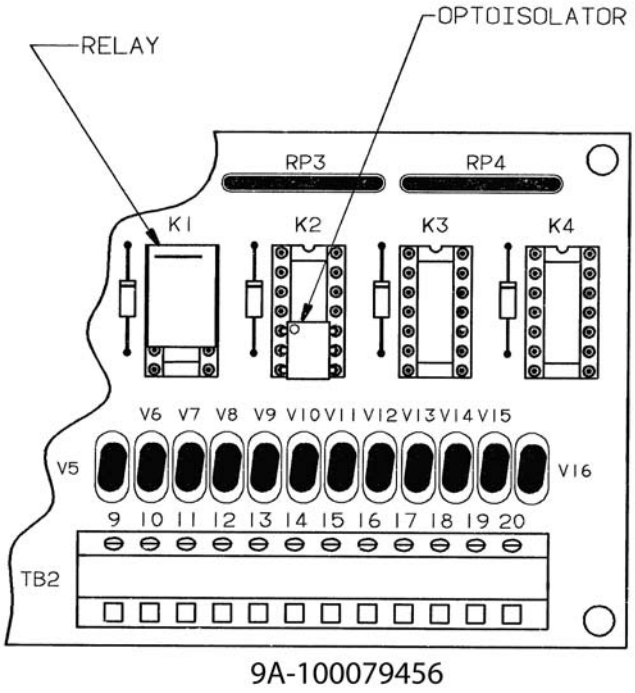
Operating Temperature	-40°C to 85°C
Digital Input "On" Current	Minimum: 6mA @ 12 V DC Maximum: 12 mA @ 12 V DC
Digital Input "Off" Current	Maximum leakage current that will maintain an off condition - 185 uA
Digital Input Response Time	Off to On: 45 us On to Off: 600 us
Digital Input Pulse Width	Minimum: 650 us (Contacts must be open at least 650 us before next closure)
Digital Input External Contact Resistance	Maximum resistance of external contact - 200 Ohms
Digital Output Current	Minimum: Relay (2 Form C) - 10 uA @ 10 mV DC Maximum: Form C Relay - 1 A @ 30 V DC, Optoisolator - 40mA @ 12 V DC Optoisolator Leakage Current - 100 mA
Digital Output Voltage	Maximum: Relay (2 Form C) – 30 V DC Optoisolator - 12 V DC
Optoisolator Voltage Drop	1 volt @ 40 mA
Optoisolator Isolation Rating	2500 VAC, 60 Hz, 1 sec Duration



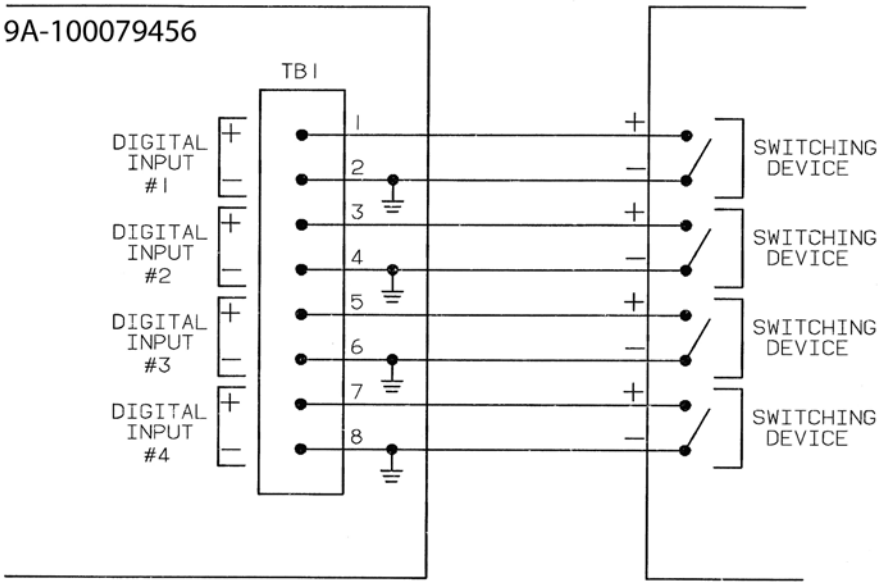
Opto-isolator Digital Output Field Wiring



Relay Digital Output Field Wiring



Relay and Optoisolator Installation Example



Digital Input Field Wiring

Appendix H

Digital Communications

General

The NOA-332 supports digital serial communications using EIA-RS-232 and EIA-RS-485 hardware with AEG Modbus and Square D RNIM protocols. Three independent communications ports, fully configurable as separate communications devices, are available. Each com port has a selectable baud rate (1200, 2400, 4800, 9600, and 19200) and protocol. COM2 & COM3 also have jumper selectable RS-485 termination, pre and post radio delay, and each port is protected from high voltage transients. These are wired as:

- **COM1**: RS-232C DCE. An Interface Cable is required to use this COM port. Refer to Appendix D of this manual.
- **COM2**: Jumper selectable for either RS-232C DTE for MODEM or RS-485. This is a Modbus slave port.
- **COM3**: RS-485. This can be configured as a Modus Master or Modbus slave port.

The setup and calibration parameters for the NOA-332 may be accessed through the communication ports using addressed register software. Additionally, the user can monitor the flow data on a real-time basis and retrieve the data logs via the communication ports. A Protocol Manual (Part No. 9A-101007298) listing the register addresses and functions is available from your local Cameron's Measurement Systems sales representative. Refer to Section 9i of this Manual for instructions on how to configure and use the communications ports.

Setting the Identification Address

The communication protocols require that an identification address be set in the NOA-332. While RS-232 hardware connection is typically used with a single communications device, the RS-485 hardware connection allows several NOA-332s to be connected via a two-wire loop. It is especially important that each NOA-332 on the RS-485 communications loop have a different identification address, defined by the operator, to prevent communications conflicts between units. Do not use Address 0 for the Modbus communications protocol. Do not use address 0 or 1 for RNIM protocol.

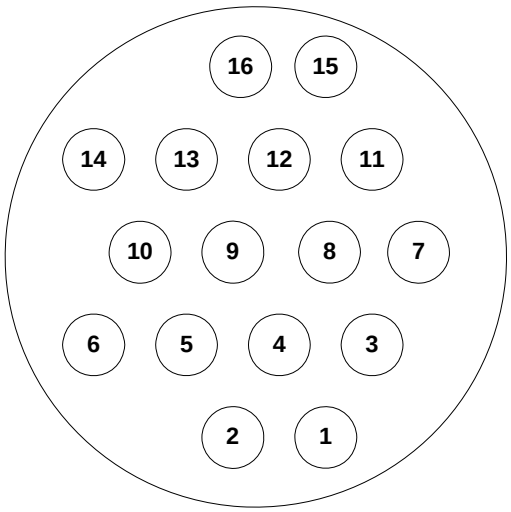
Set the identification address with the DIP switch (slave address switch, SW2) located above jumpers W1 through W4 on the upper right side of the Digital board. The switch is an eight-section binary DIP switch allowing an address value of 1 to 255. Refer to Section 9a in this manual for complete instructions on setting the value of this switch.

Communications Port #1

Communications port #1 is dedicated for RS-232 communications. It is wired as a DCE port allowing direct connection to a computer serial port. This communications port does not employ hardware handshaking but instead relies upon the protocol to control data timing and flow control. However, the hardware handshaking lines plus an addition pin are powered for use with modems and RS-232 to RS-485 adapters. Connection to COM 1 is via a CPC connector which connects to Header J5 on the Digital circuit board. The following table shows the pinout and indicates which handshaking lines are not controlled by the firmware:

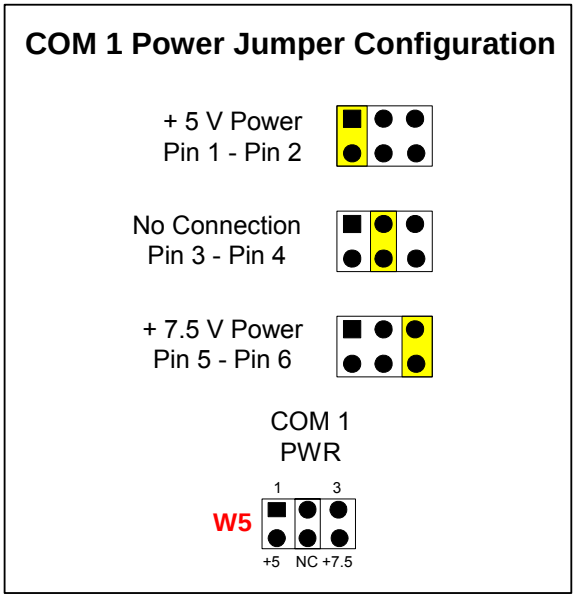
COMPUTER SERIAL PORT (DTE)			NOA-332 Connector	Digital Board COM1 (DCE)
Function	**D25**	**D9**	**CPC**	**Header J5**
~~CD~~	~~8~~	~~1~~	~~15~~	~~1~~
RXD	3	2	2	3
TXD	2	3	1	5
~~DTR~~	~~20~~	~~4~~	~~6~~	~~7~~
GND	7	5	7	9
~~DSR~~	~~6~~	~~6~~	~~5~~	~~2~~
~~RTS~~	~~4~~	~~7~~	~~4~~	~~4~~
~~CTS~~	~~5~~	~~8~~	~~3~~	~~6~~
~~RI~~	~~22~~	~~9~~	~~16~~	~~8~~
-	-	-	-	10

Below is the pinout of the CPC connector as mounted on the side of the NOA-332, facing the user.



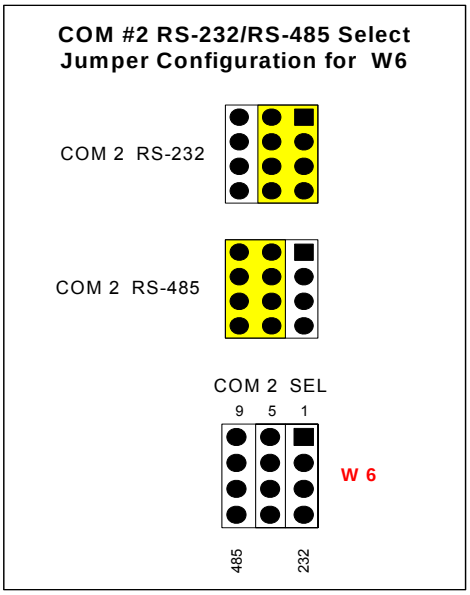
CPC Connector - Front View

Jumper W5 configures the COM1 RS-232 port for three different modem power configurations. The left-hand setting, +5 marking on the silk screen, (position 1-2) sets the modem power to +5 volts. The middle setting, NC on the silk screen, (position 3-4) sets the modem power to a not connected state where the power pin floats and no power is applied. The right hand setting, +7.5 on the silk screen, (position 5-6) sets the modem power to +7.5 volts. The modem power connection is to pin 10 of Header J5. The default setting is NC, the middle position. See the chart below for Jumper W5 positions.



Communications Port #2

Communications port #2 is user selectable to operate as RS-232 port or RS-485. Jumper W6, located near the lower right corner of the Digital circuit board, determines the operation. The right hand position (232 on the silkscreen) selects the RS-232 setting and routes the COM2 serial port connection to Header J7 on the Digital Board. The left-hand position (485 on the silkscreen) selects the RS-485 setting and routes the COM2 serial port connection to the COM2 terminal block on the Analog circuit board. The RS-485 setting is the default setting.



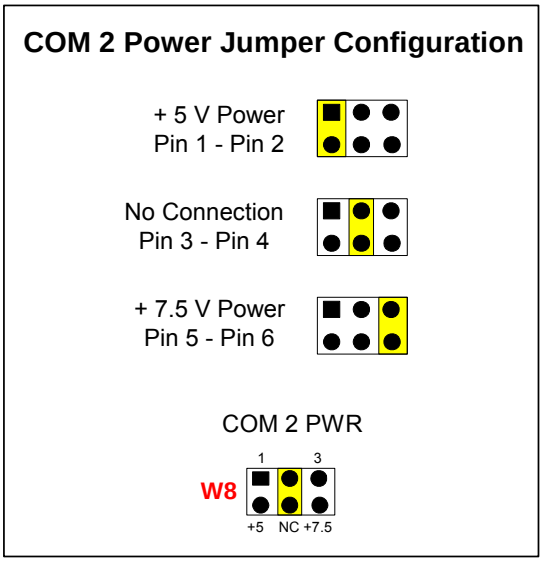
COM2 RS-232 Communications

Access to COM2 for RS-232 use is via Header J7 on the Digital circuit board. This communications port does not employ hardware handshaking but instead relies upon the protocol to control data timing and flow control. However, the hardware handshaking lines plus an addition pin are powered for use with modems and RS-232 to RS-485 adapters. The following table shows the pinout and indicates which handshaking lines are not controlled by the NOA-332 operating system:

Digital Board COM2 (DTE)	
Header J7	**Function**
~~1~~	~~CD~~
3	RXD
5	TXD
~~7~~	~~DTR~~
9	GND
~~2~~	~~DSR~~
4	~~RTS~~
~~6~~	~~CTS~~
~~8~~	~~RI~~
10	+ PWR

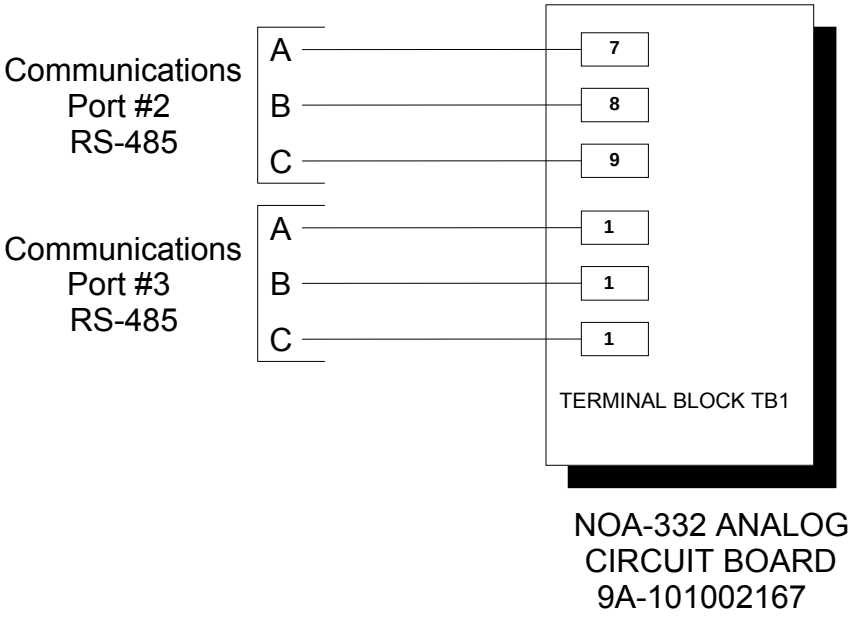
Jumper W8 configures the COM2 RS-232 port for three different modem power configurations. The left-hand setting, +5 marking on the silk screen, (position 1-2) sets the modem power to +5 volts. The middle setting, NC on the silk screen, (position 3-4) sets the modem power to a not connected state where the power pin floats and no power is applied. The right hand setting, +7.5 on the silk

screen, (position 5-6) sets the modem power to +7.5 volts. The modem power connection is to pin 10 of Header J7. The default setting is NC, the middle position.



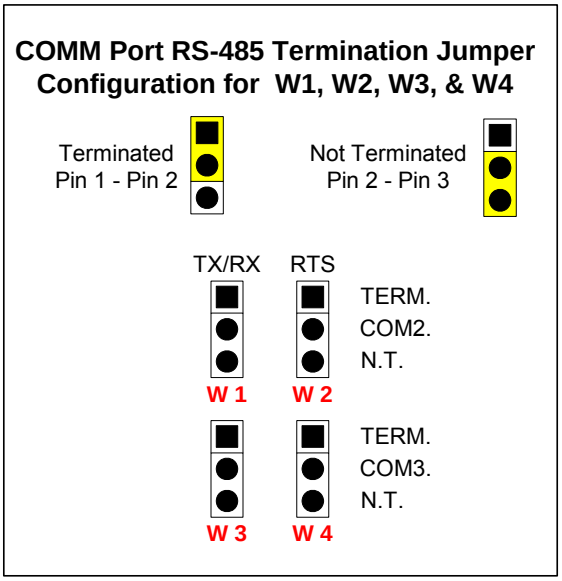
COM2 RS-485 Communications & Communications Port #3

Both COM2 and COM3 RS-485 communications ports are routed to terminal strip TB1 on the Analog circuit board as shown below:



Jumpers W1 through W4 located on the Digital circuit board affect the COM2 and COM3 communications port termination for the RS-485 communications. The NOA-332 provides both the transmit lines (labeled A and B per the EIA-RS-485 Standard). The Digital Board has RS-485 termination built on-board and the jumpers select whether to add the termination or not; selecting the TERM position will add the termination components and selecting the N.T. position will provide no termination. RS-485 communication loops require termination at the beginning and at the end of the loop. Therefore, all NOA-332s within the loop should have the jumpers set in the N.T. position.

When an NOA-332 is located at the end of the loop, the jumpers should be set to the TERM position. The default position is set to the N.T. position. Jumpers W1 thru W4 are shown below:



Important—When routing the electrical cable for the communications port(s) to the NOA-332, remember that all field wiring must conform to the *National Electric Code*, NFPA 70, Article 501-4(b) for installations within the United States or the *Canadian Electric Code* for installations within Canada. Local wiring ordinances may also apply. All field wiring must have a wire range of 22 to 14 AWG and terminal block screws must be tightened to a minimum torque of 5 to 7 in-lbs. to secure the wiring within the terminal block. Only personnel who are experienced with field wiring should perform these procedures.

Modem Use with the NOA-332

Communications Port #2, when configured as an RS-232 port is suitable for use with modem equipment. However, because the NOA-332 does not provide hardware handshaking, the modem must be configured or communications will not be possible. The NOA-332 sends a sequence of AT Commands to the modem to initialize it for use. These commands perform the following actions

- Turns OFF the echo feature
- Ignores DTR
- Disables DTE/DCE flow control
- Sets the number of rings to auto-answer
- Stores the active profile in memory

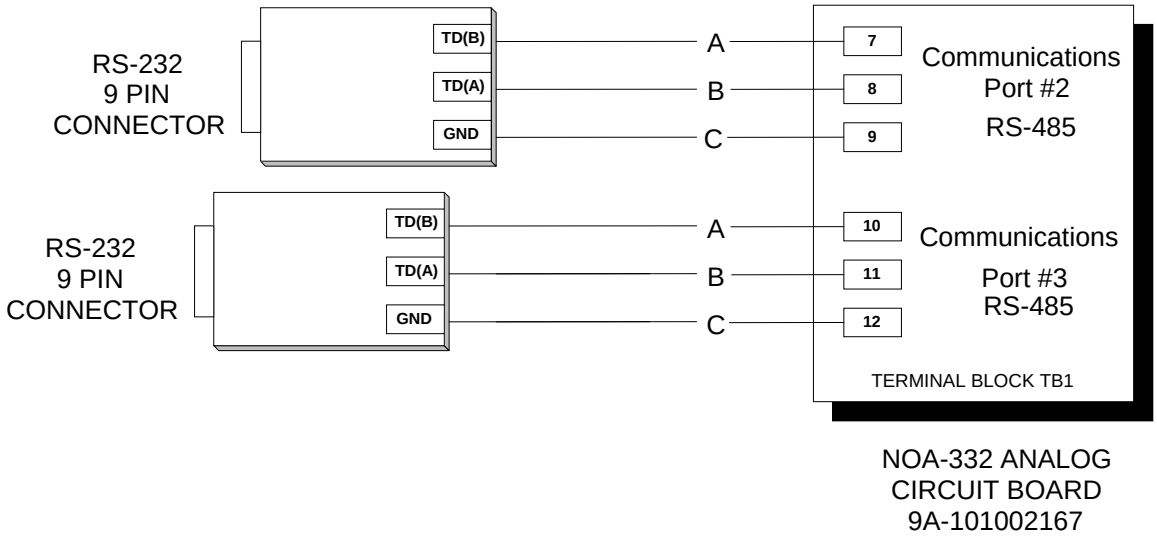
The initialization string is not configurable. Although these are generic AT Commands, some modems may not recognize these commands. If the user wishes to use a modem with the NOA-332, they should contact their local Cameron's Measurement Systems Division sales representative to determine the compatibility of their modem with the NOA-332.

RS-232 / RS-485 Converters

Computers commonly use RS-232 serial communications. This method limits the cable length to a relatively short distance, allows only one device to be connected, and requires several wires. This is the method used to communicate via Communications Port #1.

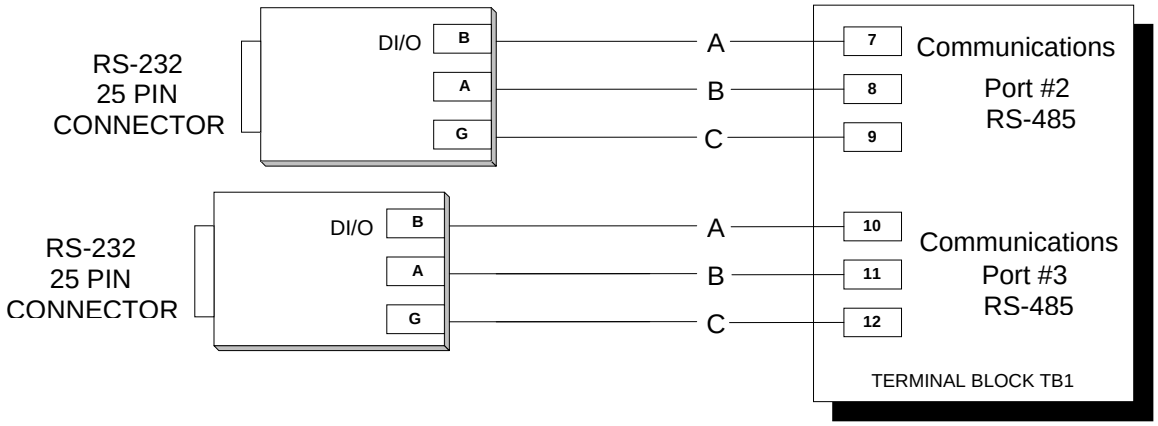
The RS-485 method of serial communications does not have these limitations and is therefore commonly used to communicate to multiple instruments that are "daisy-chained" together using the same two wires. The NOA-332 offers two RS-845 communications ports for this reason. However, the RS-485 will need to be "converted" back to RS-232 in order to talk to a computer. The NOA-332 has been tested with two such converters and their connections are shown below to assist the user. These converters require no handshaking or external power to operate.

- Part No. 9A-101283116



NOA-332 ANALOG
CIRCUIT BOARD
9A-101002167

- Part No. 9A-100025195



NOA-332 ANALOG
CIRCUIT BOARD
9A-101002167

Modbus Protocol

The data registers in the NOA-332 operating system are treated as PLC Holding Registers (Function 03). Each register has a specific address and holds 16 bits (2 bytes) per register as defined in the Modicon Modbus Protocol Reference Guide published by MODICON, Inc. The register address shown in the NOA-332 Protocol Manual is the actual address that appears in the Modbus message. When using most Modbus Drivers for SCADA systems, the register address must be offset by +1 for insertion into the SCADA system Modbus tables (Modbus uses zero addressing). For example - the System Time is in register 257 in the NOA-332 Register Table. For most SCADA Systems, the register address specified in the internal Modbus table would need to be register 258.

Reading or writing to register locations that do not exist in the table will result in an error code returned in the message. The specific error codes are as follows:

01 – Illegal Function
02 – Illegal Data Address
03 – Illegal Data Value
04 – Failure in the NOA-332
05 – Acknowledge
06 – Busy, Message Rejected

Modbus Function 03 is the only valid Modbus Function that can read or write data to the NOA-332. Diagnostic Function 08 is not supported, but will simply echo the message back to the Host to acknowledge that the NOA-332 is functioning. No other Modbus Functions are valid for the NOA-332.

Due to the nature of SCADA communications, the NOA-332 has no security restriction when accessed via the communications ports. Users who do not employ security access to their SCADA communications may wish to implement some security features available in the NOA-332 system. For additional assistance with this issue, please contact your local Cameron's Measurement Systems Division sales representative.

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