Panametrics
a Baker Hughes business

TMO2D Digital Display

User's Manual

Panametrics

TMO2D Digital Display

User's Manual

BH044C11 Rev. E
August 2023

panametrics.com

Copyright 2023 Baker Hughes company.

This material contains one or more registered trademarks of Baker Hughes Company and its subsidiaries in one or more countries. All third-party product and company names are trademarks of their respective holders.

[no content intended for this page]

Services

Panametrics provides customers with an experienced staff of customer support personnel ready to respond to technical inquiries, as well as other remote and on-site support needs. To complement our broad portfolio of industry-leading solutions, we offer several types of flexible and scalable support services including: Training, Product Repairs, Service Agreements and more. Please visit www.bakerhughes.com/panametrics/panametrics-services for more details.

Typographical Conventions

Note: *These paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.*

IMPORTANT: These paragraphs provide information that emphasizes instructions that are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.

CAUTION! **This symbol indicates a risk of potential minor personal injury and/or severe damage to the equipment, unless these instructions are followed carefully.**

WARNING! **This symbol indicates a risk of potential serious personal injury, unless these instructions are followed carefully.**

Safety Issues

WARNING! **It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.**

Attention European Customers!To meet CE Marking requirements for all units intended for use in the EU, all electrical cables must be installed as described in this manual.

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area

WARNING! **Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.**

WARNING! **Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on this equipment.**

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

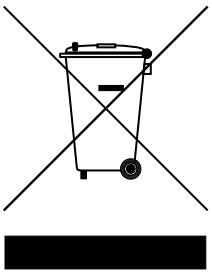
Environmental Compliance

RoHS

The TMO2D fully complies with RoHS regulations (Directive 2011/65/EU).

Waste Electrical and Electronic Equipment (WEEE) Directive

Panametrics is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative (Directive 2012/19/EU).



The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Certification and Safety Statements

Product safety issues and special installation requirements are documented in this product's Certification and Safety Statement (CSS) document, available for download from the Product Support Portal.

EU Declaration of Conformity

The EU Declaration of Conformity (EU DoC) and other compliant documents can be downloaded from the Product Support Portal.

Chapter 1. Features and Capabilities

1.1 Overview 1
1.2 Introduction 1

Chapter 2. Installation

2.1 Overview 3
2.2 Mounting the Electronic Display 3
2.3 Wiring Transmitters to the TMO2D Display 3
2.3.1 TMO2 Transmitter 3
2.3.2 XMO2 Transmitter 7
2.3.3 TMO2-TC Transmitter 10
2.3.4 XMTC Transmitter 12
2.3.5 RS-232C Serial Port 15
2.4 Wiring Other Components to the TMO2D Display 15

Chapter 3. Operation

3.1 Introduction 19
3.2 Powering Up 19
3.3 The User Interface 19
3.3.1 The LCD Display 19
3.3.2 The Keypad 20
3.4 RS-232C Serial Port 20

Chapter 4. Basic Programming

4.1 Introduction 21
4.2 Entering Data into the User Program 21
4.2.1 Key Functions 22
4.3 Programming the TMO2D Using the Display 22
4.3.1 Display Navigation 22
4.3.2 Menu Navigation 23
4.4 The Setup Menu 23
4.4.1 Set Time? 24
4.4.2 Set Date? 24
4.4.3 Set Gas/Units/Scaling? 24
4.4.4 Set Backlight? 25
4.4.5 Set Contrast? 26
4.4.6 Set Display? 26
4.4.7 Set Communications? 27
4.4.8 Set Error Handling? 29
4.5 The Outputs Menu 30
4.6 The Relays Menu 31
4.6.1 Autocalibration Type 32
4.6.2 Alarm Type 32
4.7 The Tests Menu 35
4.7.1 DVM Test? 35
4.7.2 Output Test? 37
4.7.3 Relays Test? 37
4.8 The Calibration Menu 38
4.8.1 Select Response? 39
4.8.2 Select Compensation? 39
4.8.3 Gas Calibration? 39
4.8.4 Pressure Calibration? 41
4.8.5 Auto Cal Parameters 42
4.9 The System Log Menu 53
4.9.1 Viewing the System Log 54
4.9.2 Print System Log 55

Chapter 5. Advanced Programming

5.1 Introduction 57
5.2 Entering Data into the Factory Setup Program 57
5.3 Set Significant Digits? 58
5.4 Select Background? 58
5.5 Select Tracking? 59
5.6 Select Tertiary? 59
5.7 Response Parameters? 59
5.8 LabCal Outputs? 60
5.9 Manual Offset? 61
5.10 Change AutoCal Limits? 61

Chapter 6. Specifications

6.1 Performance 63
6.2 Functional 63
6.3 Physical 64
6.4 Ordering Information 65

Appendix A. Outline and Installation Drawings

Appendix B. Menu Maps

Chapter 1. Features and Capabilities

1.1 Overview

This chapter presents the features and capabilities of the TMO2D Digital Display. It also includes a brief list of Panametrics transmitters that can be used with the TMO2D Digital Display.

1.2 Introduction

The TMO2D Digital Display offers a number of important features:

- 24 VDC 1A maximum power supply for the transmitter.
- A single isolated 0/4–20 mA output, with the option to add a second 0/4–20 mA output.
- Up to four field-programmable alarm contacts with the option of being hermetically sealed for Division 2 applications. Each alarm can be programmed for both a high and a low setpoint, and also for either failsafe or non-failsafe operation.
- Optional automatic calibration of Panametrics transmitters.
- A fault alarm in the event of either a transmitter problem or a calibration error. The fault alarm can be programmed for either failsafe or non-failsafe operation.
- A 2-line x 24-character backlit LCD display.

The TMO2D Digital Display supports any of the following Panametrics transmitters:

- XMO2 or TMO2 thermoparamagnetic oxygen transmitters
- XMTC or TMO2-TC thermal conductivity transmitters
- O2X1 oxygen transmitter

Note: *For information on specific transmitters, please consult their respective manuals.*

[no content intended for this page]

Chapter 2. Installation

2.1 Overview

This chapter describes how to mount and wire the TMO2D Digital Display. It also contains information on connecting the TMO2D to optional system components. The following topics are discussed:

- Mounting the **TMO2D** digital display.
- Wiring various Panametrics transmitters to the TMO2D display.
- Connecting to other components.

WARNING! **To ensure the safe operation of the TMO2D, it must be installed and operated as described in this manual. In addition, be sure to follow all applicable safety codes and regulations for installing electrical equipment in your area. All installation procedures should be performed by trained service personnel.**

2.2 Mounting the Electronic Display

The electronic display comes in six mounting configurations: bench, rack, panel, fiberglass NEMA 4X, 304 stainless steel NEMA 4X and explosion-proof. (See Appendix A for mounting dimensions).

No special mounting requirements are needed for the display. If you have a bench mount, simply put the display in a convenient location, connect the wires from the transmitter, and connect the power. If you have a rack or panel mount, insert the display into the rack or panel, connect the wires from the transmitter, and connect the power. The weatherproof and explosion-proof models are wall mounted.

IMPORTANT: For compliance with the EU's Low Voltage Directive (2006/95/EC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit. The power cord is the main disconnect device.

2.3 Wiring Transmitters to the TMO2D Display

This section explains how to interconnect the TMO2D display with four different Panametrics transmitters: TMO2, XMO2, TMO2-TC and XMTC.

2.3.1 TMO2 Transmitter

This section describes how to interconnect the TMO2 and TMO2D. The TMO2 can be wired for internal or external compensation. Each type of compensation requires a different cable. Before you make any connections, make sure you have the appropriate cable. Please check the TMO2 calibration sheet to determine if your TMO2 has internal or external compensation.

- Internal compensation offers a single 4–20mA output for O_2 concentration that is compensated for either background gas or atmospheric pressure variations.
- External compensation offers dual 4–20mA outputs, one for uncompensated O_2 concentration and the other for either background gas or pressure compensated O_2 concentration. This type of compensation is normally used with the TMO2D Display, which can be programmed to provide microprocessor-based background gas or pressure compensation of the O_2 signal.

2.3.1.1 Cable Requirements:

- Internal compensation: X3(*) or Y3(*) 3-wire 22-AWG cable.
- External compensation: X4(*) 4-wire 22-AWG cable.

The X3(*) and X4(*) cables can be used for distances up to 450 ft (130 m). For longer distances, each cable can be supplied as 18-AWG that can be located up to 1,050 ft (320 m). If you are using your own cable, refer to Table 1 below for cable requirements.

Table 1: Cable Requirements for TMO2

MAX. CABLE LENGTH		CABLE SIZE	
Feet	Meters	AWG	Sq. mm
450	130	22	0.35
700	200	20	0.6
1050	320	18	1.0
1700	500	16	1.2
2800	850	14	2.0
4000	1200	12	3.0

For longer cable lengths, consult the factory.

2.3.1.2 Wiring:

Use the following steps to interconnect the TMO2 to the TMO2D.

1. Route the cable into the TMO2 transmitter through one of the 3/4" conduit holes on the side of the transmitter.

WARNING! Be sure to plug the unused conduit/cable entry hole on the transmitter, in order to meet specifications and to maintain the appropriate weatherproof or explosion-proof rating.

2. Unplug TB1 on the TMO2 transmitter PC board (PCB) by carefully pulling it directly up without bending the pins attached to the PCB.
3. Loosen the TB1 side screws and insert the colored wires into the corresponding openings on top of TB1. See Table 2 below for color-coded pin designations, and Figure 1 on page 5 for the TB1 location.

Table 2: Wiring the TMO2 with a 4-Wire Cable

Wire Connections	Color	TMO2 Transmitter TB1	TMO2D Display TB5
Power +24 VDC	Red	Pin 1	+24 V
Power Return	Black	Pin 2	RTN
Oxygen	White	Pin 3	GAS
External Compensation*	Blue or Green	Pin 4	COMP
*For external compensation, you must use a 4-wire cable to make this connection			

WARNING! Make sure that the +24 VDC wire (red) is connected to terminal TB1-1. Connecting +24 VDC to any other other terminal could cause bodily harm. It could also cause damage to the TMO2 PCB, requiring factory repair.

4. Tighten the side screws, and carefully plug TB1 back onto the TMO2 PCB.
5. Connect the other end of the cable in a similar manner to the TMO2D. Refer to Figure on page 17 for TB1 location.

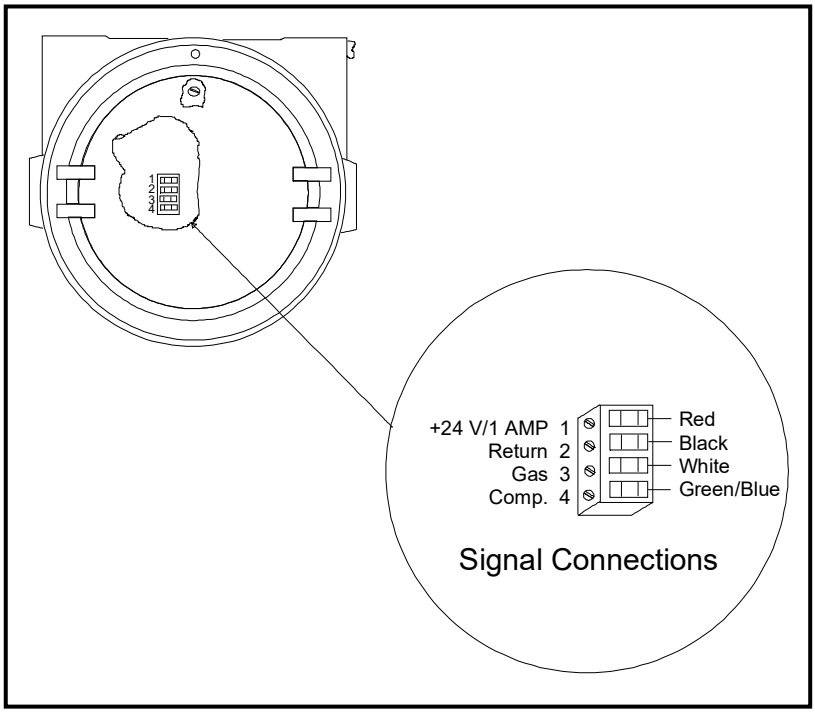


Figure 1: Wiring Connections to TB1 Block

CAUTION! **Do not make any connections to unassigned or unused terminals.**

2.3.1.3 CE Mark Compliance

IMPORTANT: CE Mark compliance is required only for units used in EU countries.

For CE Mark compliance, you must use shielded cable and connect the shield to the stand off as shown in Figure 2 below. After you make all the necessary electrical connections, seal the unused cable entry holes with standard conduit plugs or their equivalent.

Note: *If you make the modifications as discussed here, your unit will comply with the EMC Directive 2014/30/EU.*

Note: *For CE compliance, the I/O cables must be shielded. The shields are to be grounded within the TMO2D to the closest location. Shielded cable is not required when installations include metal conduit.*

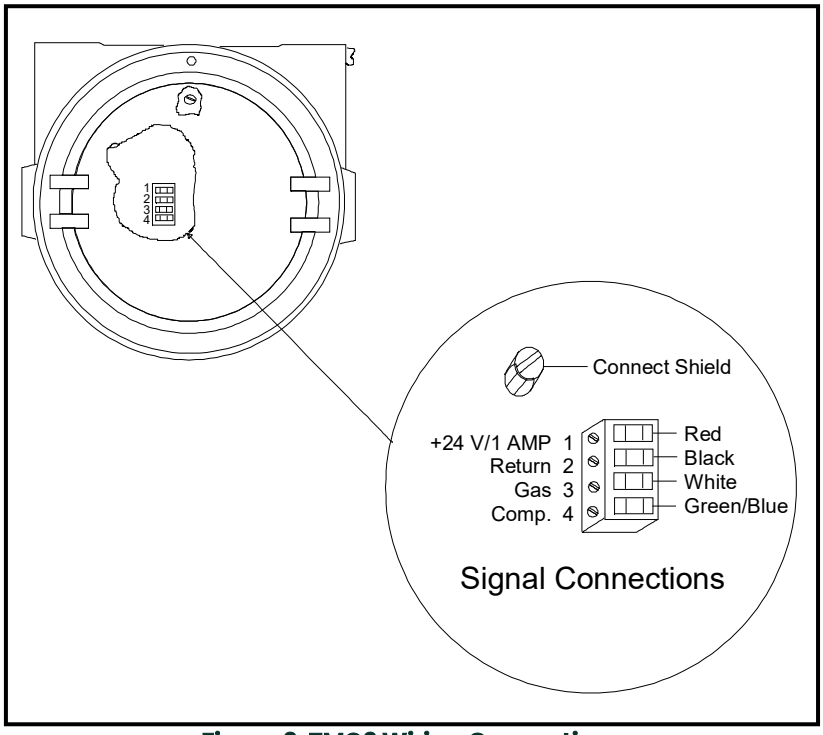


Figure 2: TMO2 Wiring Connections

2.3.2 XMO2 Transmitter

Wiring the XMO2 oxygen transmitter to the TMO2D display requires use of the X4(*) cable, which can support distances up to 450 ft (130 m). For longer distances, each cable can be supplied as 18-AWG that can be located up to 1,050 ft. (320 m). If you are using your own cable, refer to Table 3 below for cable requirements.

Table 3: Cable Requirements for XMO2

MAX. CABLE LENGTH		CABLE SIZE		MAX. CABLE LENGTH		CABLE SIZE	
Feet	Meters	AWG	Sq. mm	Feet	Meters	AWG	Sq. mm
450	130	22	0.35	1,700	500	16	1.2
700	200	20	0.6	2,800	850	14	2.0
1,050	320	18	1.0	4,000	1,200	12	3.0

For longer cable lengths, consult the factory.

2.3.2.1 Wiring:

Use the following steps to interconnect the XMO2 to the TMO2D.

1. Route the 4-wire power/analog output cable through a cable gland as shown in Figure 3 below.
2. After terminating the shield as shown, assemble the three gland pieces together and tighten the gland to secure the cable and the shield.

IMPORTANT: The cable shield must be terminated in the cable gland as shown in Figure 3 below.

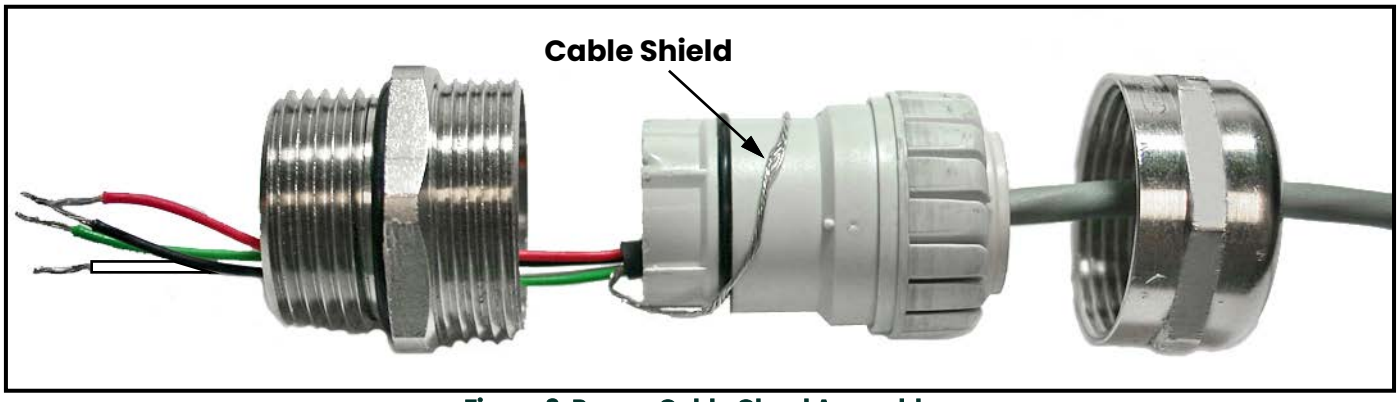


Figure 3: Proper Cable Gland Assembly

3. Route the cable into the XMO2 transmitter through one of the 3/4" conduit holes on the side of the transmitter.

WARNING! **Be sure to plug the unused conduit/cable entry hole on the transmitter, in order to meet specifications and to maintain the appropriate weatherproof or explosion-proof rating.**

4. Unplug terminal block TB1/TB2 on the XMO2 transmitter PC board (PCB) by carefully pulling it directly up without bending the pins attached to the PCB. (See Figure 4 on page 8.)
5. Loosen the TB1 side screws and insert the colored wires into the corresponding openings on top of TB1. See Table 4 on page 7 for color-coded pin designations.

Table 4: Wiring the XMO2 with 4-Wire Cable

Wire Connections	Color	XMO2 Transmitter TB1	TMO2D Display TB5
Power +24 VDC	Red	Pin 1	+24 V
Power Return	Black	Pin 2	RTN
+ mA Signal	White	Pin 3	GAS
–mA Signal	Blue or Green	Pin 4	RTN

WARNING! **Make sure that the +24 VDC wire (red) is connected to terminal TB1-1. Connecting +24 VDC to any other terminal could cause bodily harm. It could also cause damage to the XMO2 PCB requiring factory repair.**

6. Tighten the side screws, and carefully plug terminal block TB1/TB2 back onto the XMO2 PCB.
7. Connect the other end of the cable in a similar manner to the TMO2D. Refer to Figure on page 17 for the TB1 location.

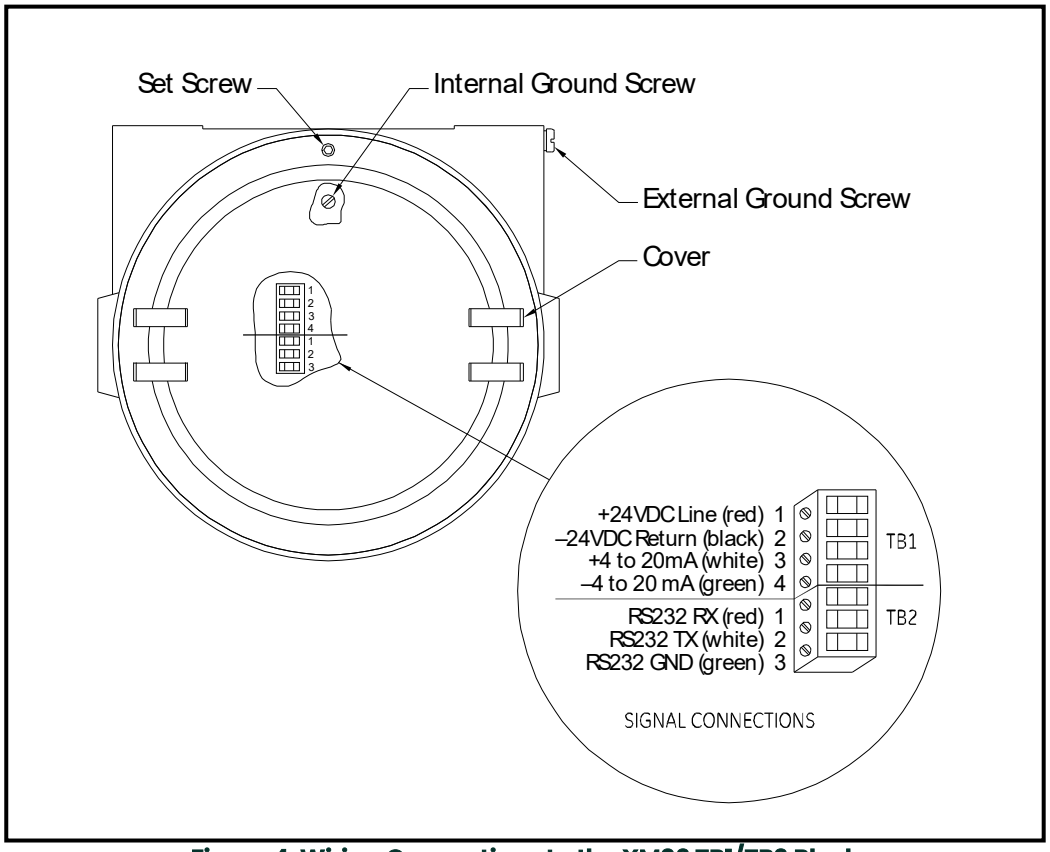


Figure 4: Wiring Connections to the XM02 TB1/TB2 Block

CAUTION! **Do not make any connections to unassigned or unused terminals.**

2.3.2.2 CE Mark Compliance

IMPORTANT: CE Mark compliance is required only for units used in EU countries.

For CE Mark compliance, you must use shielded cable and connect the shield to a cable gland (see Figure 3 on page 7). After you make all the necessary electrical connections, seal the unused cable entry holes with standard conduit plugs or their equivalent.

Note: *If you make the modifications as discussed here, your unit will comply with the EMC Directive 2004/108/EC.*

Note: *For CE compliance, the I/O cables must be shielded. The shields are to be grounded within the TMO2D to the closest location. Shielded cable is not required when installations include metal conduit.*

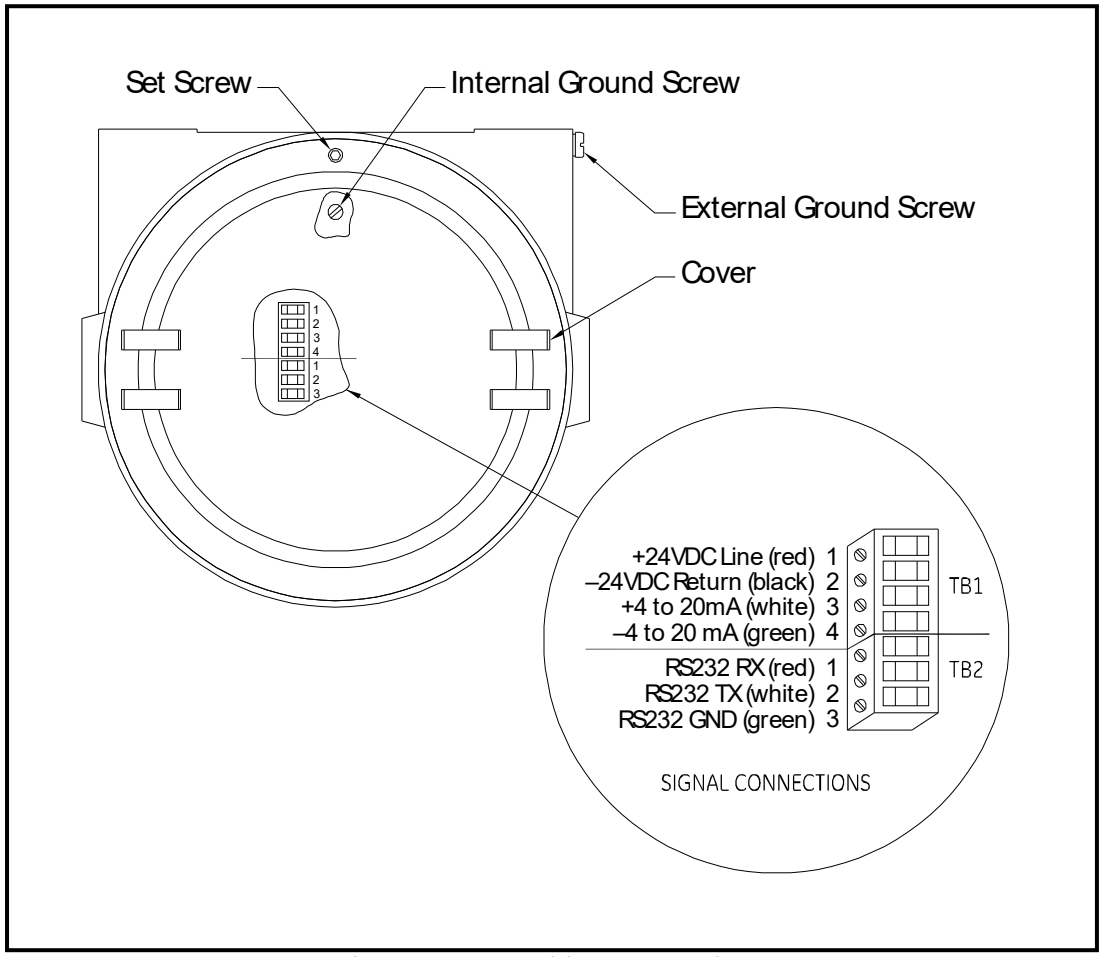


Figure 5: XMO2 Wiring Connections

2.3.3 TMO2-TC Transmitter

Connecting the TMO2-TC thermal conductivity transmitter to the TMO2D requires use of the X3(*) or Y3(*) cables. The X3(*) cable can be used for distances up to 450 ft (130 m). For longer distances, each cable can be supplied as 18-AWG that can be located up to 1,050 ft (320 m). If you are using your own cable, refer to Table 5 below for cable requirements.

Table 5: Cable Requirements for TMO2-TC

MAX. CABLE LENGTH		CABLE SIZE	
Feet	Meters	AWG	Sq. mm
450	130	22	0.35
700	200	20	0.6
1,050	320	18	1.0
1,700	500	16	1.2
2,800	850	14	2.0
4,000	1,200	12	3.0

For longer cable lengths, consult the factory.

2.3.3.1 Wiring:

Use the following steps to interconnect the TMO2-TC to the TMO2D.

1. Route the cable into the TMO2-TC transmitter through one of the 3/4" conduit holes on the side of the transmitter.

WARNING! Be sure to plug the unused conduit/cable entry hole on the transmitter, in order to meet specifications and to maintain the appropriate weatherproof or explosion-proof rating.

2. Unplug TB1 on the TMO2-TC transmitter PC board (PCB) by carefully pulling it directly up without bending the pins attached to the PCB. See Figure 6 on page 11.
3. Loosen the TB1 side screws and insert the colored wires into the corresponding openings on top of TB1. Refer to Table 6 below for color-coded pin designations.

Table 6: Wiring the TMO2-TC with 3-Wire Cable

Wire Connections	Color	TMO2-TC Transmitter TB1	TMO2D Display TB5
Power +24 VDC	Red	Pin 1	+24 V
Power Return	Black	Pin 2	RTN
+mA Signal	White	Pin 3	GAS
No Connection			

WARNING! Make sure that the +24 VDC wire (red) is connected to terminal TB1-1. Connecting +24 VDC to any other terminal could cause bodily harm. It could also cause damage to the TMO2-TC PCB, requiring factory repair.

4. Tighten the side screws, and carefully plug TB1 onto the PCB.
5. Connect the other end of the cable in a similar manner to the TMO2D. Refer to Figure on page 17 for TB1 location.

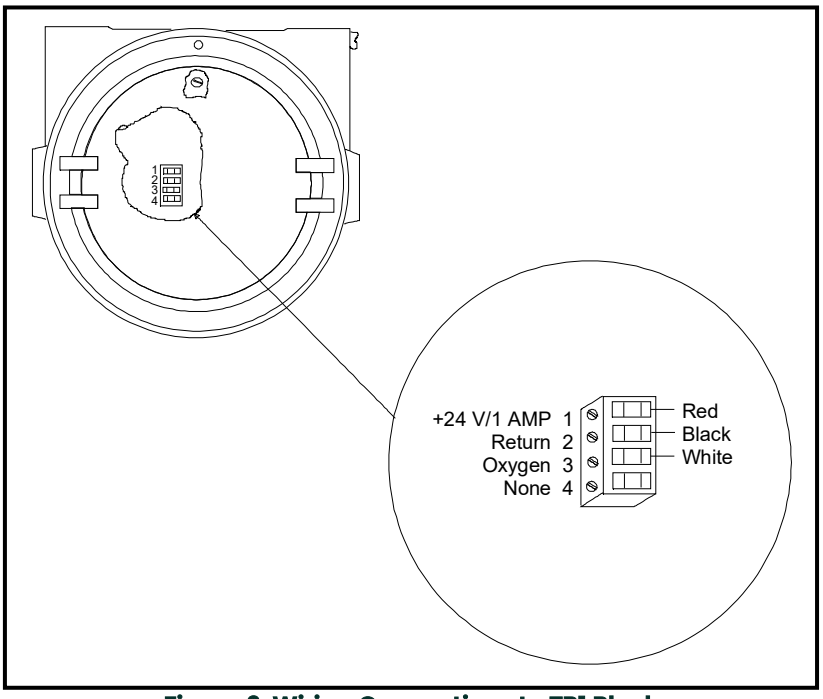


Figure 6: Wiring Connections to TB1 Block

CAUTION! **Do not make any connections to unassigned or unused terminals.**

2.3.3.2 CE Mark Compliance

IMPORTANT: CE Mark compliance is required only for units used in EU countries.

For CE Mark compliance, you must use shielded cable and connect the shield to the stand off as shown in Figure 7 on page 12. After you make all the necessary electrical connections, seal the unused cable entry holes with standard conduit plugs or their equivalent.

Note: *If you make the modifications as discussed here, your unit will comply with the EMC Directive 2004/108/EC.*

Note: *For CE compliance, the I/O cables must be shielded. The shields are to be grounded within the TMO2D to the closest location. Shielded cable is not required when installations include metal conduit.*

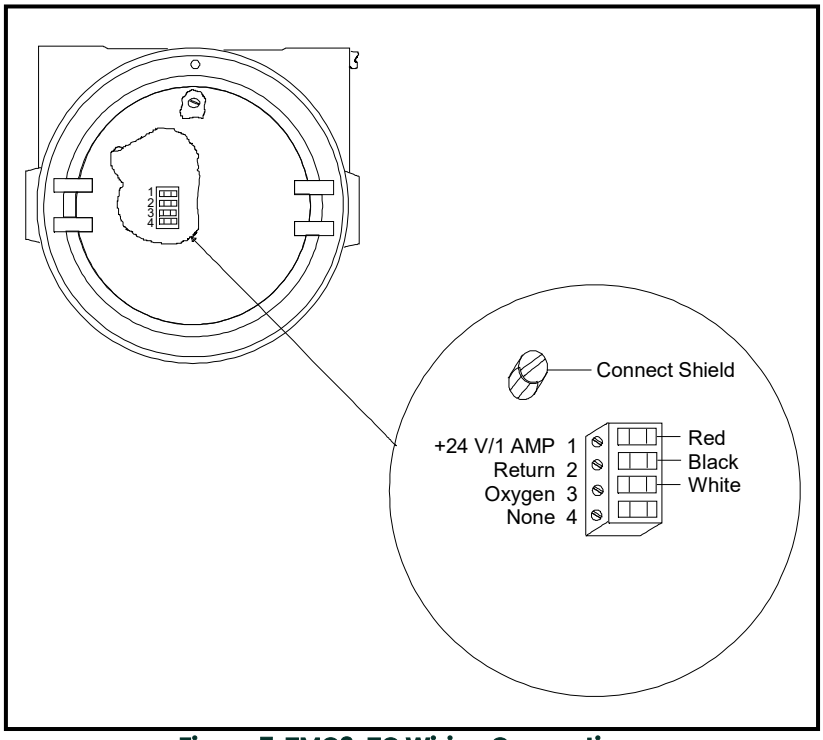


Figure 7: TMO2-TC Wiring Connections

2.3.4 XMTC Transmitter

Connecting the XMTC thermal conductivity transmitter to the TMO2D requires use of the X4(*) or Y4(*) cables. The X4(*) cable can be used for distances up to 450 ft (130 m). For longer distances, each cable can be supplied as 18-AWG that can be located up to 1,050 ft (320 m). If you are using your own cable, refer to Table 7 below for cable requirements.

Table 7: Cable Requirements for XMTC

MAX. CABLE LENGTH		CABLE SIZE	
Feet	Meters	AWG	Sq. mm
450	130	22	0.35
700	200	20	0.6
1,050	320	18	1.0
1,700	500	16	1.2
2,800	850	14	2.0
4,000	1,200	12	3.0

For longer cable lengths, consult the factory.

2.3.4.1 Wiring:

Use the following steps to interconnect the XMTC to the TMO2D.

1. Route the cable into the XMTC transmitter through one of the 3/4" conduit holes on the side of the transmitter.

WARNING! **Be sure to plug the unused conduit/cable entry hole on the transmitter, in order to meet specifications and to maintain the appropriate weatherproof or explosion-proof rating.**

2. Unplug TB1 on the XMTC transmitter PC board (PCB) by carefully pulling it directly up without bending the pins attached to the PCB. See Figure 8 below.
3. Loosen the TB1 side screws and insert the colored wires into the corresponding openings on top of TB1. Refer to Table 8 below for color-coded pin designations.

Table 8: Wiring the XMTC with 4-Wire Cable

Wire Connections	Color	XMTC Transmitter TB1	TMO2D Display TB5
Power +24 VDC	Red	Pin 1	+24 V
Power Return	Black	Pin 2	RTN
+mA Signal	White	Pin 3	GAS
–mA Signal	Blue or Green	Pin 4	RTN

WARNING! **Make sure that the +24 VDC wire (red) is connected to terminal TB1-1. Connecting +24 VDC to any other terminal could cause bodily harm. It could also cause damage to the XMTC PCB, requiring factory repair.**

4. Tighten the side screws, and carefully plug TB1 back onto the XMTC PCB.
5. Connect the other end of the cable to the TMO2D. Refer to Figure on page 17 for TB1 location.

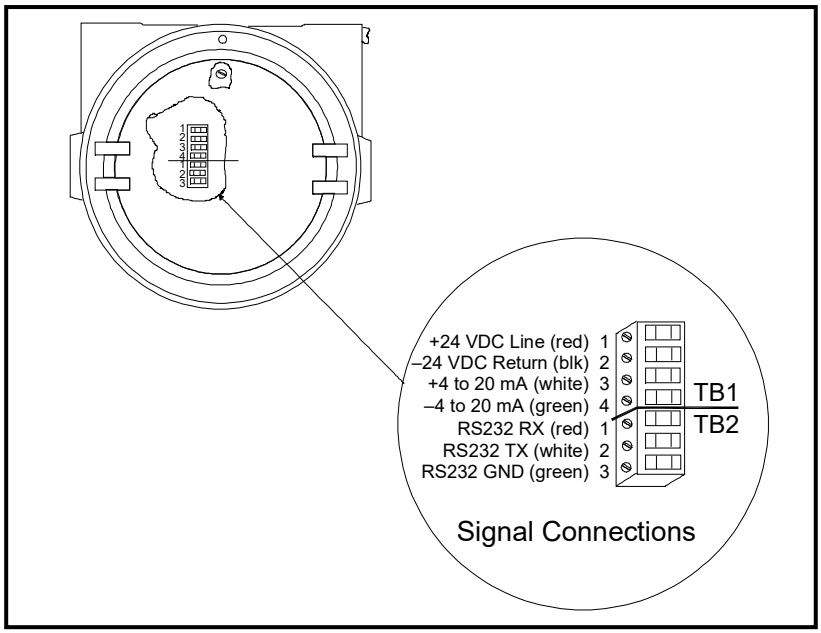


Figure 8: Wiring Connections to TB1 Block

CAUTION! **Do not make any connections to unassigned or unused terminals.**

2.3.4.2 CE Mark Compliance

IMPORTANT: CE Mark compliance is required only for units used in EU countries.

For CE Mark compliance, you must use shielded cable and connect the shield to the stand off as shown in Figure 9 below. After you make all the necessary electrical connections, seal the unused cable entry holes with standard conduit plugs or their equivalent.

Note: *If you make the modifications as discussed here, your unit will comply with the EMC Directive 2004/108/EC.*

Note: *For CE compliance, the I/O cables must be shielded. The shields are to be grounded within the TMO2D to the closest location. Shielded cable is not required when installations include metal conduit.*

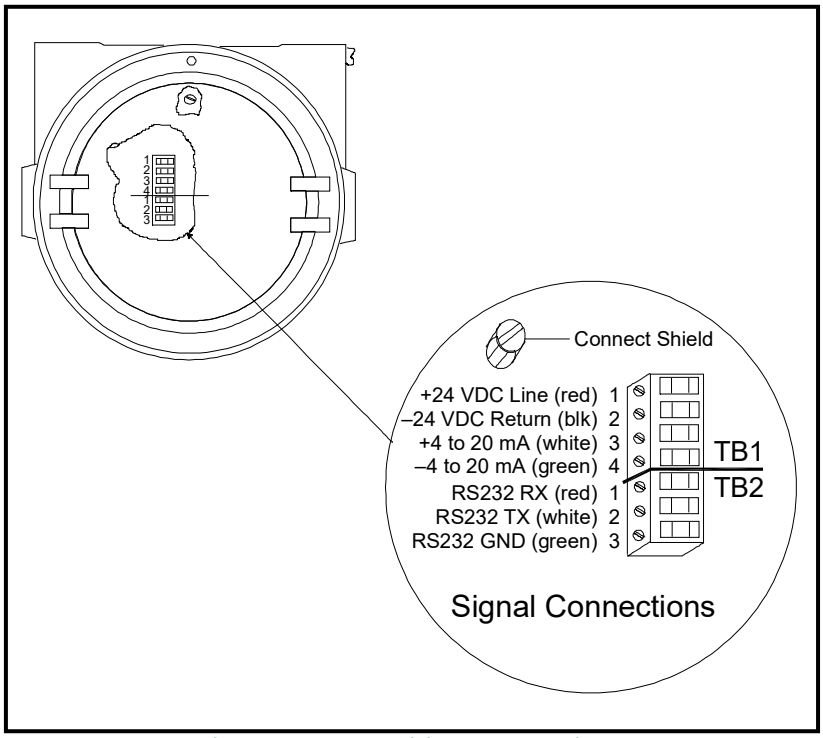


Figure 9: XMTC Wiring Connections

2.3.5 RS-232C Serial Port

The TMO2D has a bi-directional, industry-standard RS-232C serial port (#J8) that can be connected to a terminal or computer that supports the RS-232C protocol. Connect the RS-232C from the computer or terminal to the rear of the TMO2D using a 25-pin connector. (See Figure 10 below for the RS-232 wiring pin connections, and Chapter 3 for the corresponding key chart.)

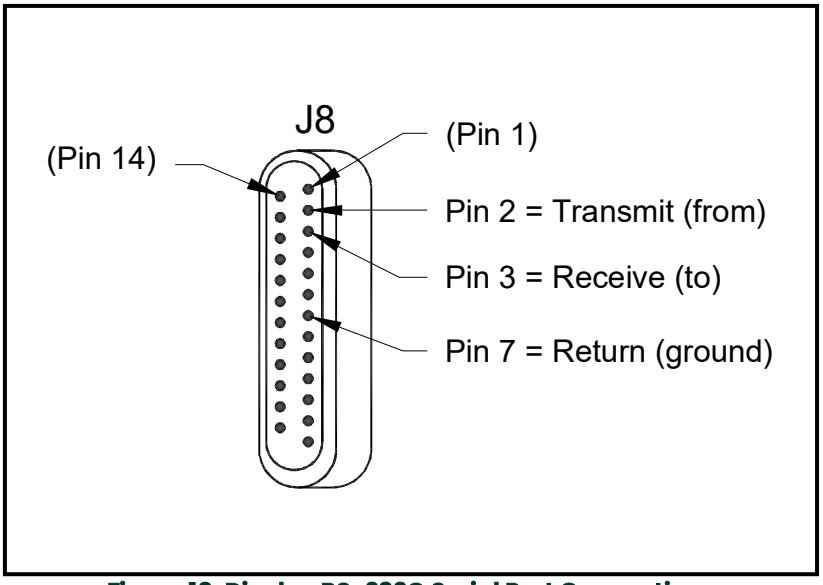


Figure 10: Display RS-232C Serial Port Connections

2.4 Wiring Other Components to the TMO2D Display

If desired, the TMO2D Analyzer can be wired to 4-20mA outputs, AutoCal systems, and alarms. Figure on page 17 shows the possible wiring connections.

[no content intended for this page]

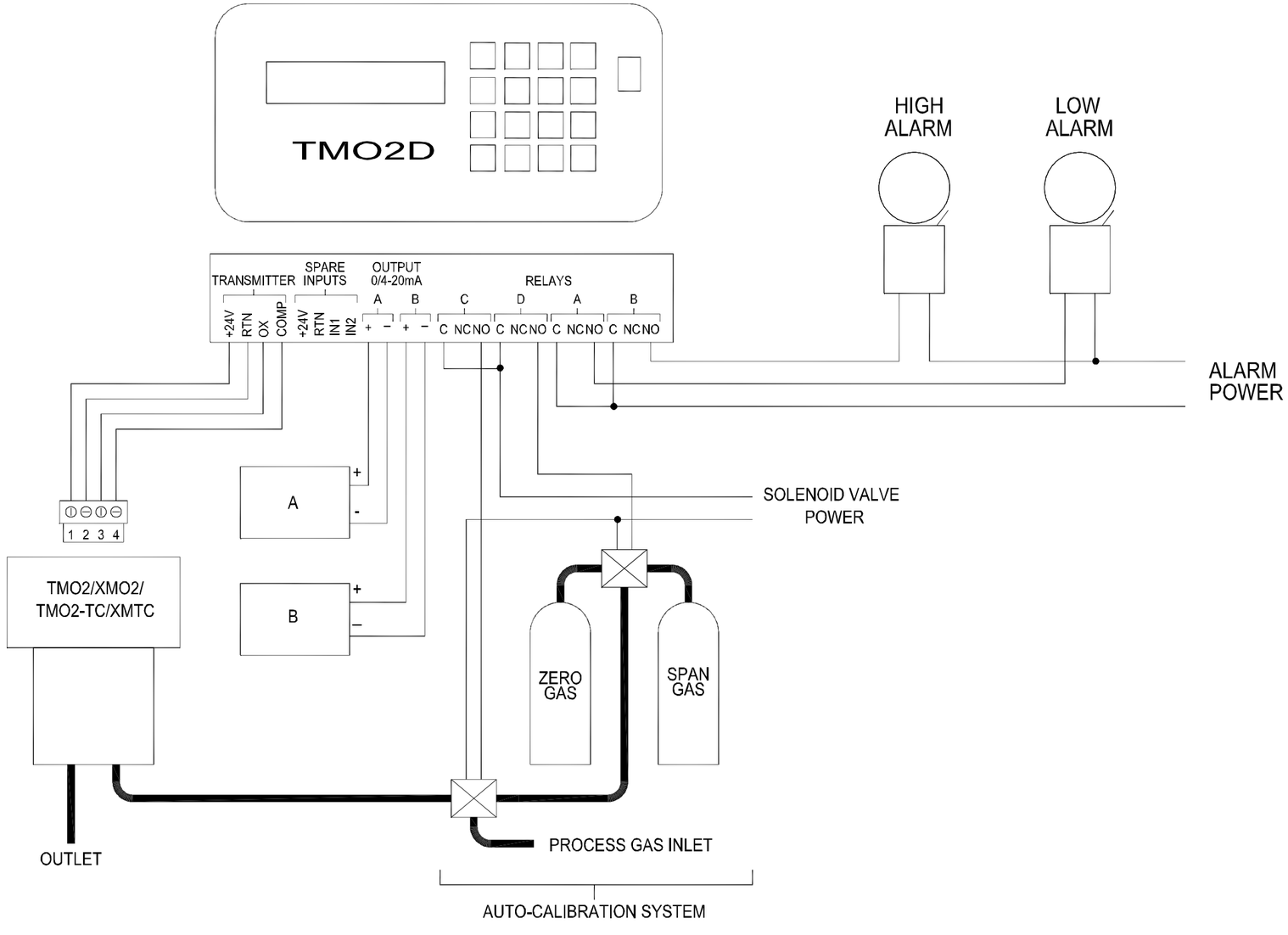


Figure 11: TMO2D Transmitter and Display Wiring Options (ref. dwg #701-030, sht 2)

Chapter 3. Operation

3.1 Introduction

This chapter provides information on operating the TMO2D Display. If you have not already done so, please read Chapter 2, *Installation,* for details on mounting and wiring the TMO2D display.

WARNING! **To ensure safe operation of the TMO2D, you must install and operate it as described in this manual. In addition, be sure to follow all applicable safety codes and regulations for installing electrical equipment in your area. All installation procedures should be performed by trained service personnel.**

3.2 Powering Up

CAUTION! **The interconnecting wiring between the transmitter and display must be completed before powering up.**

To power up the benchtop TMO2D, press the red power key to the right of the display. Other TMO2D models have no power switch, and begin operating when the external power to which they have been connected has been turned on.

3.3 The User Interface

The electronic display unit contains a 2-line by 24-character backlit Liquid Crystal Display screen (LCD). On power-up, the display unit tests its memory (RAM), then searches for valid calibration data from the display as well as input from the transmitter.

If calibration data has already been entered into the display, the unit immediately begins taking measurements from the transmitter and the LCD begins displaying the gas concentration.

If valid calibration data has not been entered and stored in the display, or if the transmitter is not hooked up to the display, the LCD will display erroneous readings. (Chapter 4, *Programming the TMO2D Display,* explains how to enter data into the display.)

The TMO2D is operated using the keypad. To facilitate operation, you should familiarize yourself with the display and keypad functions.

3.3.1 The LCD Display

The first line of the LCD screen displays the current measurement or menu title and a real-time clock. The second line of the LCD screen displays the measured data on the left and the current alarm condition on the right.

Note: *The LCD contains an electroluminescent (EL) panel to enhance readability of the screen during operation. To activate the EL panel, press any key except the [NO] key.*

3.3.2 The Keypad

For operational purposes, the keypad (Figure 12 below) includes digits 0-9, a minus sign, a decimal point, and four special operations keys:

- [YES]
- [NO]
- [◀]
- [▶]

Note: *For details on how to use the keypad to program the display, see Chapter 4.*

Figure 12: The TMO2D Display

3.4 RS-232C Serial Port

The TMO2D contains a bidirectional, industry-standard RS-232C serial port which can be connected to a terminal or computer that supports the RS-232C protocol (see *The Outputs Menu* on page 30.)

All keypad and most display operations can be performed remotely through this serial port.

Table 9 below lists terminal/computer keys and how they correspond to the keys on the Display keypad.

Table 9: RS-232C Serial Port Corresponding Keys

TMO2D Keypad	ASCII	Computer Keyboard	TMO2D Keypad	ASCII	Computer Keyboard
0	030	0	8	038	8
1	031	1	9	039	9
2	032	2	t	008	BACKSPACE
3	033	3	u	020	SPACE
4	034	4	•	02E	"."
5	035	5	–	02D	"–"
6	036	6	YES	00D	ENTER
7	037	7	NO	01B	ESCAPE

Chapter 4. Basic Programming

4.1 Introduction

The TMO2D display contains an interactive, user-friendly program that enables the user to change operating parameters as desired.

This user program has six main menus. Use the front panel keypad and display to check or change the settings for current operating parameters. The TMO2D stores data in memory and will retain it for several years if the main power is lost. New data overrides any previously entered data.

The user program consists of six main menus:

- Setup
- Outputs
- Relays
- Tests
- Calibration
- System Log

Note: *The TMO2D can function as a display package for a variety of Panametrics transmitters. As an example, this chapter describes TMO2D programming when the TMO2D is used with a TMO2 or XMO2 oxygen transmitter.*

4.2 Entering Data into the User Program

To enter data into the user program or to check previously entered values, enter the Menu Mode. When the power is turned on, the TMO2D enters the Operate Mode. To enter the Menu Mode:

1. Press the [NO] key.
2. Key in the code [1] [2] [3]. The TMO2D will display an asterisk (*) after you enter each digit.

If an incorrect code is entered or a non-numeric ([YES]/[NO] or arrow) key is pressed rather than 1 2 3, the LCD will automatically resume displaying data, and you must press [NO] to re-attempt the code. Once all three digits have been entered correctly, the display will cease collecting data and the LCD will switch to Menu Mode.

The LCD screen now displays the Setup Menu, the first of the six main menus. At this display, press [YES] to enter this menu, or [NO] to scroll to the next menu. Pressing [NO] repeatedly scrolls through all six main menus.

Note: *The first six options are main menus, while the* RESUME *prompt enables users to exit the Menu Mode and return to Operate Mode.*

4.2.1 Key Functions

The [YES] key enables you to confirm numeric entries or to select a displayed menu option.

The [NO] key enables you to clear a numeric entry or to scroll forward through the menu options.

The [◀] key has two functions:

- It serves as a backspace key during numeric entry. At each press of [◀], the display erases the last digit on the right of the entry.
- It also enables you to step backward through a list of menu options.

The [▶] key enables you to scroll forward through the menu options; it is equivalent to pressing the [NO] key in the Menu Mode.

4.3 Programming the TMO2D Using the Display

This section briefly explains display and menu navigation, and then takes you step-by-step through the programming procedure.

4.3.1 Display Navigation

On power-up, the first line of the LCD screen contains the current measurement parameter and a real-time clock. The second line of the LCD contains the measured data on the left and the current alarm condition on the right (see Figure 13 below).

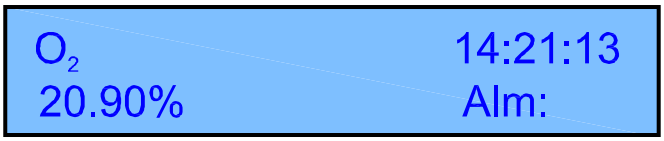


Figure 13: TMO2D Display

While displaying the gas concentration, the display will ignore all keys except the [NO] key. If you press [NO], the LCD will begin displaying *Enter Code*: and you must enter the program entry code ([1] [2] [3]). During code entry, the display continues to update the data display, alarm status, and recorder output.

4.3.2 Menu Navigation

After you enter the passcode, the LCD switches to Menu Mode, which enables you to program the display, setting parameters and calibration data as well as performing relay and output tests. While in Menu Mode, the display suspends data collection, and relay status and outputs hold their current values.

In Menu Mode, the first line of the LCD shows the title of the current menu in capital letters. The second line displays the current menu options.

Enter data in the Menu Mode through the [YES]/[NO] and Selector ([◀] and [▶]) keys. Pressing [YES] selects the displayed option, while pressing [NO] skips that option and displays the next option in the list. The Selector keys enable users to choose between two or three possible options in the menu.

Note: *The menu lists are circular; skipping over the last option in the list returns you to the first option in the list.*

The following sections describe the programming procedure and menu navigation in detail, one menu at a time. (Appendix B supplies flow diagrams of each menu.)

4.4 The Setup Menu

The Setup Menu contains eight submenus:

- Set Time?
- Set Date?
- Set Gas/Units/Scaling?
- Set Backlight?
- Set Contrast?
- Set Display?
- Set Communications?
- Set Error Handling?

These submenus allow you to alter operating parameters. Once entered, these values remain in the display memory until you change them. (Appendix B offers a flow diagram of the Setup Menu in Figure 26 on page 82.)

4.4.1 Set Time?

After you enter the Setup Menu, *Set Time?* enables you to set the current time in 24-hour format. For example, to enter 1:15 pm (13.15 in 24-hour time):

MAIN MENU Setup?	Press [YES] to enter the Setup Menu.
SETUP MENU Set Time?	Press [YES] to set the time.
Enter 24 hour time: HH.MM [XX.XX]: 13.15	Use the numeric keys to enter a 1, 3, . , 1 and 5. (The X's represent the previous time entered.)
Enter 24 hour time: HH.MM [13.15]:	Press [YES] to confirm the entry. Press [YES] again to exit.
SETUP MENU Set Time?	Press [NO] to proceed to the next submenu.

4.4.2 Set Date?

TThe *Set Date?* submenu is used to set the current date in USA (month, day, year) format. For example, to enter February 24, 2002:

SETUP MENU Set Date?	Press [YES] to set the date.
Enter Date (MM.DD.YY): [XX.XX.XX]:2.24.02	Use the numeric keys to enter a 2, 24 and 02. (The X's represent the previous date entered.)

Note: *A period (.) must be used to separate the numbers.*

Enter Date (MM.DD.YY): [2.24.02]	Press [YES] to confirm the entry, and [YES] again to exit.
SETUP MENU Set Date?	Press [NO] to proceed to the next submenu.

4.4.3 Set Gas/Units/Scaling?

The *Set Gas/Units/Scaling?* submenu enables you to program the gas label to be displayed, the measurement units in ppm or %, the input scale (if used with an O2X1), and the measurement units and input range for the input gas.

SETUP MENU Set Gas/Units/Scaling?	Press [YES] to set the input gas, units and scale.

Select Gas Units percent [PPM]	Use the [NO] or arrow keys to move the brackets to the desired units. Press [YES] to confirm the entry.

- If you select percent, the program goes to the "Select Input Gas" window.
- If you select PPM, an additional window appears.

Input Range Maximum ppm: 10 [100] 1,000 10,000	Use the [NO] or arrow keys to move the brackets to the desired entry. Press [YES] to confirm the entry.

Select Input Gas: [units]O2 ‰	Use the [NO] or arrow keys to move the brackets to the desired entry. The program offers six choices: O2, H2, N2, SO2, CO2 and OTHER. Press [YES] to confirm the entry.

If you have selected one of the five preprogrammed gases, the program returns to the *Set Gas/Units/Scaling?* submenu. However, if you have selected *OTHER*, the TMO2D asks for a gas label. A specific label can contain up to 8 characters.

Gas Label: [ ] t@ABCDEFGHIJKLM[NO]u	Use the arrow keys or the keypad numbers (see Table 10 below) to move the cursor to the desired character in the list. When you have reached the desired character, press the [YES] key to add it to the label. Repeat this procedure to complete the entire label. If you need to change any characters, use the [–] key on the keypad to move the cursor to the desired position in the label; then use the arrow keys to select a new character from the list. When you have finished editing the label, press the [.] key on the keypad. If you need to delete extra characters in the label, use the [–] key on the keypad to move the cursor to the character, and hit the [NO] key to delete it.

Table 10: Character Set for Gas Labels

Entry Line	Characters
[1]	! " # $ % & ' ( ) * + , – . /
[2]	0 1 2 3 4 5 6 7 8 9 : ; < = > ?
[3]	@ A B C D E F G H I J K L M N O
[4]	P Q R S T U V W X Y Z [¥] ^ _
[5]	\ a b c d e f g h i j k l m n o
[6]	p q r s t u v w x y z { 2 L H x

SETUP MENU Set Gas/Units/Scaling?	Press [NO] to proceed to the next submenu.

4.4.4 Set Backlight?

The LCD contains an electroluminescent (EL) panel to enhance the readability of the screen in dim light. EL panels have a finite life span, and eventually dim with use. To maintain the life of the EL backlight, the display will automatically turn the backlight off after a predetermined time period. The Backlight time-out period can be set

from (but never on) 0 to 60 minutes. The default time-out is three minutes. Example, to set the backlight time to 10 minutes:

SETUP MENU Set Backlight?	Press [YES] to set the backlight.
SETUP MENU Remain ON (min) [X]: 10	Use the numeric keys to enter 10. (The X's represent the previous time entered.)
SETUP MENU Remain ON (min) [10]:	Press [YES] to confirm the entry, and [YES] again to exit.
SETUP MENU Set Backlight?	Press [NO] to proceed to the next submenu.

4.4.5 Set Contrast?

The Set Contrast? submenu enables you to adjust how vividly the LCD appears in the prevailing light. To adjust the contrast for maximum visibility:

SETUP MENU Set Contrast?	Press [YES] to set the contrast.
Adjust LCD Contrast [INCR] decr done	Use [NO] or the right arrow key to scroll through the three selections. Press [YES] at the INCR or DECR selections, and continue pressing [YES] until you have adjusted the contrast to your conditions. Then select DONE and press [YES] to exit.
SETUP MENU Set Contrast?	Press [NO] to proceed to the next submenu.

4.4.6 Set Display?

Although this feature is not commonly used, the TMO2D, when used with the TMO2, can display compensation values for pressure or the percentage of background gas. For the analyzer to display these values, the TMO2 must include external compensation. In addition, you must enable either background or pressure compensation through the *Calibration* menu (see page 38) in the *Select Compensation* submenu (page 39). If neither pressure nor background compensation is enabled, a "Comp not enabled" message will appear.

SETUP MENU Set Display?	Press [YES] to set the display.
Display Compensation [[NO]NE] pres bkgd	Use the [NO] or arrow keys to move the brackets to the desired entry. Press [YES] to confirm the entry and exit.
SETUP MENU Set Display?	Press [NO] to proceed to the next submenu.

4.4.7 Set Communications?

Baud Rate: The display contains a bi-directional, industry-standard RS-232C serial port that enables users to operate the instrument remotely with a keypad or computer that supports the RS-232C protocol. All keypad operations, and most display operations, can be performed remotely through this port. (See page 20 for operation instructions.)

The display supports the communication rates of 9600, 4800, 2400, 1200 and 300 baud. The default setting is 9600 baud. Other parameters are fixed at 8 bits, 1 stop bit, no parity.

Note: *The 300-baud setting is provided for compatibility with older equipment; however, the use of 300 baud greatly limits the computation speed of the TMO2D, and its use is not recommended.*

The *Set Communications?* submenu enables you to select both the baud rate and the update rate, when they communicate with the TMO2D through the RS-232 port.

SETUP MENU Set Communications?	Press [YES] to enter the submenu.
SET COMMUNICATIONS Set Baud Rate?	Press [YES] to enter the baud rate.
SELECT BAUD RATE 9600 baud?	Use the [NO] or arrow keys to scroll through the choices.
SELECT BAUD RATE 4800 baud?	
SELECT BAUD RATE 2400 baud?	
SELECT BAUD RATE 1200 baud?	
SELECT BAUD RATE 300 baud?	Press [YES] to select the desired baud rate and exit.
SET COMMUNICATIONS Set Baud Rate?	Press [NO] to proceed to the next submenu.

Note: *The baud rate can be changed using a terminal connected to the RS-232C port. However, this is not recommended, as the TMO2D will immediately change to the new baud rate. Display and keyboard operation will not be correct until the baud rate of the terminal is changed to match the new baud rate set in the TMO2D.*

SET COMMUNICATIONS Set Update Rate?	Press [YES] to set the update rate.

Update Rate: This option is used to change the interval at which data goes to the serial port. The current data interval will appear in brackets, and users can enter a new data interval.

Data intervals range from 0 to 300 seconds. A data rate of zero will prevent data from passing to the serial port.

SET COMMUNICATIONS Data Interval [X]: 180	For example, enter 1, 8 and 0 for a 180 sec (3 min) interval. (The X represents the previously entered data interval.).
SET COMMUNICATIONS Data Interval [180]:	Press [YES] to confirm the entry, and [YES] again to exit.
SET COMMUNICATIONS Set Update Rate?	Press [NO] to proceed to the next submenu.
SET COMMUNICATIONS Set Time Stamp?	Press [YES] to determine if you want the record printed with a time stamp. If you select this option, the date and time for each data point will go to the serial port.
Print Time Stamp: YES [NO]	Use the [NO] or arrow keys to indicate whether a time stamp will be printed. Then press [YES] to confirm the selection.
SET COMMUNICATIONS Set Time Stamp?	Press [NO] to proceed to the next submenu.
SET COMMUNICATIONS Done?	Press [YES] to return to the main Setup Menu.
SETUP Menu Set Communications?	Press [NO] to proceed to the next submenu.

4.4.8 Set Error Handling?

The *Set Error Handling?* submenu enables the TMO2D to handle inputs it receives that are outside its measurement range. Based on directions it receives, the TMO2D can show the errors on the display and force an output high or low.

SETUP MENU Set Error Handling?	Press [YES] to enter the Error Handling submenu.
Enable Error Handling [YES] no	Use the [NO] or arrow keys to select [YES] to enable Error Handling. Press [YES] to confirm the selection. (Selecting [NO] returns the display to the Setup Menu.)
System Error Effects Set Display Response?	Press [YES] to enter the Display Response submenu.
Display System Error? [YES] no	Use the [NO] or arrow keys to select if the display will show errors. Press [YES] to confirm the selection.
System Error Effects Set Display Response?	Press [NO] to proceed to the next submenu.
SYSTEM ERROR EFFECTS Set Output Response?	Press [YES] to enter the Output Response submenu.
Select Output Effect: No effect? Force high? Force low? Force to value? Hold last value?	Use [NO] or the arrow keys to scroll through the choices for output responses. When you have reached the desired response, press [YES] to confirm the selection.

If you select any choice except *Force to Value?*, the program returns to the *Set Output Response?* entry. The *Force to Value?* selection enables you to choose a value to which the output will go when a system error occurs. The mA value must be set between 0 and 25 mA. If you select *Force to Value?*, the program asks for two more entries.

Output A, Error Value: mA Value [X.XX]:	Use the numeric keys to enter the desired value. (The number in brackets represents the previously entered value.) Press [YES] to enter the value, and [YES] again to confirm the entry.
Output B, Error Value: mA Value [X.XX]:	Use the numeric keys to enter the desired value. Press [YES] to enter the value, and [YES] again to confirm the entry.
System Error Effects Set Output Response?	Press [NO] to proceed to the final submenu.

System Error Effects Done?	Press [YES] to return to the Setup Menu, or [NO] to continue scrolling through the System Error Effects submenu.
SETUP MENU Set Error Handling?	Press [NO] to exit the Error Handling menu.
SETUP MENU Done?	Press [YES] to exit the Setup Menu and return to the Main Menu. Press [NO] to return to the "Set Time?" prompt.

You have completed the Setup Menu. At the Main Menu prompt, press [NO] to leave the Setup Menu and progress to the Outputs Menu.

4.5 The Outputs Menu

The second main menu, the *Outputs Menu*, enables users to select which 4-20 mA output (A or B) to adjust, and to enter all necessary information for either or both outputs.

The TMO2D provides a choice of one isolated 0/4-20 mA output, or two isolated 0/4-20 mA outputs. You can set both options for a 0 to 20-mA or a 4-20 mA response, and scale the output anywhere within the range of the transmitter.

Note: *The display is programmed to accept settings for two outputs; however, if only a single isolated output is used, only output A is effective.*

The steps in the following example illustrate how to set up outputs. In this instance, output A will have a 0 to 20-mA range, with 0 mA equal to 0% oxygen and 20 mA equal to 100% oxygen. (Appendix B offers a flow diagram of the *Outputs Menu* in Figure 1 on page 5.)

MAIN MENU Setup?	Press [NO] to proceed to the Output Menu.
MAIN MENU Outputs?	Press [YES] to enter the Output Menu.
Select Output to set: [A] B done	Use the [NO] or arrow keys to move the brackets to "A," and press [YES] to confirm the selection.
A Output Range (mA): [0-20] 4-20	Use the [NO] or arrow keys to select the desired output range, and press [YES] to confirm the choice.
Output A 0 mA Value %O_2 [X.XX]:	Use the numeric keys to enter the low end value. (The X's represent the previously entered value for 0 mA.)
Output A 0 mA Value %O_2 [0.00]:	Then press [YES] to confirm the entry and [YES] again to proceed to the high end value.

Output A 20 mA Value %0_2 [100%]:	Use the numeric keys to enter the high end value. Press [YES] to enter the value, and [YES] again to confirm the entry.

Repeat this procedure to program Output B, if desired. After entering the necessary values:

Select Output to set: A B [DONE]	Use the [NO] or arrow keys to select "DONE." Press [YES] to exit.

MAIN MENU Outputs?	Press [NO] to proceed to the next Main Menu title — Relays.

4.6 The Relays Menu

The third main menu is the Relays Menu. The TMO2D includes two or four single-pole double throw (SPDT) relays for use in activating alarm devices or driving automatic calibration solenoid valves. The display addresses the relays as A, B, C or D. You can configure each relay as either an alarm or as an automatic calibration relay.

If the relay is configured as an alarm, it can be programmed to trip on up to five functions, listed below, and in either Failsafe or Non-Failsafe mode:

- Low Gas Reading
- High Gas Reading
- System Fault Indicator
- Auto Calibration Error Indicator
- New Auto Calibration Data

If the relay is configured as an Auto-Calibration relay, the TMO2D offers two options:

- Process/Cal Relay
- Zero/Span Relay

If the transmitter requires a one gas offset or one gas span calibration, you need to set only one relay for Auto-Calibration, with the Process/Cal option. However, if it requires a two-gas zero and span calibration, you must set two relays for Auto-Calibration, one to Process/Cal and the other to Zero/Span.

Refer to Figure 2 on page 6 for a flow diagram of the Relays Menu.

MAIN MENU Setup?	Press [NO] to scroll through the Main Menu until the Relays Menu appears.
MAIN MENU Relays?	Press [YES] to enter the Relays Menu.
Select Relay to set: [A] B C D done	Use the [NO] or arrow keys to select the relay, and press [YES] to confirm the selection.
Relay type: [ALARM] autocalibration	Use the [NO] or arrow keys to select the relay type and press [YES] to confirm the selection.

4.6.1 Autocalibration Type

If you select Autocalibration, the TMO2D asks for the Auto-Calibration option:

Auto-Cal Relay Type: [PROC/CAL] zero/span	Use the [NO] or arrow keys to select the autocalibration type, and press [YES] to confirm the selection.

For either selection, the program returns to the *Select Relay to Set?* entry. Refer to *Auto Cal Parameters* on page 42 to define autocal parameters.

4.6.2 Alarm Type

If you select Alarm, the program displays a series of entries.

ALARM FEATURES Set Low Alarm Function?	Press [YES] to set the low alarm function.
Trip on Low%? [NO] yes	Use the [NO] or arrow keys to indicate whether or not you wish the alarm to trip on the low percentage, and press [YES] to confirm the selection. (Selecting [NO] returns the program to the Set Low Alarm Function? entry.)
Alarm X, LOW Setpoint %O_2 [XX.X]	Use the numeric keys to enter the desired value. Then press [YES] to enter the data, and [YES] again to confirm the entry. (The X's represent the previously entered setpoint.)
ALARM FEATURES Set Low Alarm Function?	Press [NO] to proceed to the high alarm function.

ALARM FEATURES Set High Alarm Function?	Press [YES] to set the high alarm function.
Trip on High%? [NO] yes	Use the [NO] or arrow keys to indicate whether or not you wish the alarm to trip on the high percentage, and press [YES] to confirm the selection. (Selecting [NO] returns the program to the Set High Alarm Function? entry.)
Alarm X, HIGH Setpoint %O_2 [XX.X]:	Use the numeric keys to enter the desired value. Then press [YES] to enter the data, and [YES] again to confirm the entry. (The X's represent the previously entered setpoint.)
ALARM FEATURES Set High Alarm Function?	Press [NO] to proceed to the system fault action entry.
ALARM FEATURES Set System Fault Action?	Press [YES] to enter the system fault action function. Signal faults occur if the signal from the transmitter drops below 1 mA or exceeds 24 mA.
Trip On System Faults? [NO] yes	Use the [NO] or arrow keys to indicate whether or not you wish the alarm to trip on system faults, and press [YES] to confirm the selection.
ALARM FEATURES Set System Fault Action?	Press [NO] to proceed to the cal error action entry.

The calibration error could occur if the TMO2D performs an autocal on a transmitter and the amount of drift exceeds a programmed limit. You can set the limits in *Change AutoCal Limits?* on page 61.

ALARM FEATURES Set Cal Error Action?	Press [YES] to enter the cal error action function.
Trip On Auto Cal Errors? [NO] yes	Use the [NO] or arrow keys to indicate whether or not you wish the alarm to trip on autocalibration errors, and press [YES] to confirm the selection.
ALARM FEATURES Set Cal Error Action?	Press [NO] to proceed to the cal occurred action entry.

The Cal occurred alarm trips if autoverification is enabled and an automatic calibration is performed on a transmitter. If the amount of drift exceeds the limits programmed, the TMO2D stores the new drift calibration data and trips an alarm to indicate the change. For further details, refer to page 43 and *Change AutoCal Limits?* on page 61.

ALARM FEATURES Set Cal Occurred Action?	Press [YES] to enter the cal occurred action function.
Trip On New Cal Data? [NO] yes	Use the [NO] or arrow keys to indicate whether or not you wish the alarm to trip on new calibration data, and press [YES] to confirm the selection.
ALARM FEATURES Set Cal Occurred Action?	Press [NO] to proceed to the normal/failsafe mode function.

Users can configure the TMO2D alarms for either normal or failsafe mode. For normal alarm configuration, the alarm contact remains de-energized until an alarm condition occurs. For failsafe mode, the alarm contact remains energized until an alarm condition occurs, when it becomes de-energized.

ALARM FEATURES Normal/Failsafe Mode?	Press [YES] to enter the normal/failsafe mode function.
Failsafe Alarm? [NORMAL] failsafe	Use the [NO] or arrow keys to indicate whether or not you wish the alarm to act as a normal or failsafe alarm, and press [YES] to confirm the selection.
ALARM FEATURES Normal/Failsafe Mode?	Press [NO] to exit the normal/failsafe mode function.
ALARM FEATURES Done?	Press [YES] to leave the Alarms submenu.
Select Relay to set: [A] B C D done	Use the [NO] or arrow keys to select another relay, or select Done to leave the Relays Menu. Press [YES] to confirm the selection.
MAIN MENU Relays?	Press [NO] to proceed to the next menu — the Tests Menu.

4.7 The Tests Menu

The fourth main menu, the Tests Menu, provides assistance in testing and troubleshooting the inputs and outputs of the TMO2D.

The Tests Menu contains three submenus:

- DVM Test
- Output Test
- Relays Test

(Refer to Figure 27 on page 83, for a flow diagram of the Tests Menu.)

4.7.1 DVM Test?

In the DVM Test mode, the display operates as a simple digital voltmeter to measure, in milliamps, the transmitter's gas and, if appropriate, the compensation signals. The test updates the display approximately 20 times per second, facilitating transmitter connection and calibration.

Follow the steps below to test the gas signal input from the transmitter.

MAIN MENU Setup?	Press [NO] to scroll through the menu until the Tests Menu appears.
MAIN MENU Tests?	Press [YES] to enter the Tests Menu.
TESTS DVM Test?	Press [YES] to select the DVM submenu.
Select DVM Input: Gas Input?	Press [YES] to select the "GAS" input test.
GAS DVM TEST X.XX mA	The display will show the gas signal. (The X's represent the milliamp signal, which will update continuously during the test.) Press any key to return to the DVM submenu.
Select DVM Input: Gas Input?	Press [NO] to proceed to the compensation signal test.
Select DVM Input: Comp Input?	Press [YES] to enter the compensation signal test.

The compensation signal input is only used on a TMO2 oxygen transmitter with external background gas or external atmospheric pressure compensation.

COMP DVM TEST X.XX mA	Press any key to return to the DVM submenu.

4.7.1.1 Done?

Select DVM Input: Done?	Press [NO] to scroll to “Done?” and press [YES] to exit the DVM test.

TESTS DVM Test?	Press [NO] to proceed to the Output submenu.

4.7.2 Output Test?

The Output Test? submenu enables the display to send a %Gas value to the output.

For example, to send a %Gas output of 36.39 to Output A:

TESTS Output Test?	Press [NO] to scroll through the Tests Menu, and then press [YES] to select the Output Test submenu.
Select Output to test: [A] B done	Use the [NO] or arrow keys to select A, and press [YES] to confirm the selection.
Set Output A to: %Gas [XX.XX]:	Use the numeric keys to enter 3, 6, ., 3, and 9, and press [YES] to confirm the entry. (The X's represent the previously entered setpoint.)
Set Output A to: %Gas [36.39]:	Press [YES] to return to the calibration submenu.
Select Output to test: A B [DONE]	Use the [NO] or arrow keys to select DONE, and press [YES] to exit the submenu.
TESTS Output Test?	Press [NO] to proceed to the next submenu — Relays Test.

4.7.3 Relays Test?

The *Relays Test?* menu enables you to trip and reset the relays using the keypad to test the operation of external devices.

For example, to test relay A:

TESTS Relays Test?	Press [NO] to scroll through the Tests Menu, and then press [YES] to select the Relays Test submenu.
Select Relay to test: [A] B C D done	Use the [NO] or arrow keys to select A, and press [YES] to confirm the selection.

Note: *If you select a calibration relay to test, the TMO2D displays the following warning:*

Warning! Cal-Relay, Test? [NO] yes	Use the [NO] or arrow keys to choose to continue (or not) with the test, and press [YES] to confirm the selection.

The program rejoins the main Relays Test menu.

Turn Relay A: [ON] off done	Use the [NO] or arrow keys to select "ON." Press [YES] to confirm the ON selection.

Note: *Upon selecting the OFF option and pressing [YES], the relay will turn off, and the selection brackets will skip to ON. Upon selecting the ON option, the relay turns on, and the selection brackets skip to OFF.*

Turn Relay A: on [OFF] done	Use the [NO] or arrow keys to select "DONE." Press [YES] to confirm the selection.
Select Relay to test: [A] B C D done	Use the [NO] or arrow keys to select "DONE" again, and press [YES] to confirm the selection and exit.
TESTS Relays Test?	Press [NO] to exit the Relays Test.
TESTS Done?	Press [YES] to exit the submenu.
MAIN MENU Tests?	Press [NO] to proceed to the next Main Menu title — the Calibration Menu.

4.8 The Calibration Menu

The fifth main menu, the Calibration Menu, enables you to enter measurement parameters and calibration data into the TMO2D.

The Calibration Menu includes five submenus:

- Select Response?
- Select Compensation?
- Gas Calibration?
- Pressure Calibration?
- Auto Cal Parameters?

(Refer to Figure 28 on page 84 and Figure 29 on page 85 for a flow diagram of the Calibration Menu.)

4.8.1 Select Response?

In the *Select Response?* submenu, you can choose between a *Fast* and a *Damped* response for measuring gases. The *Fast* response uses software to extrapolate a reading from existing data before the transmitter has completed the measurement. The *Damped* response displays the actual readings from the transmitter without any software enhancements. The factory default response is *Damped*.

Note: DO NOT *use fast response in conjunction with pressure or background compensation. Also, do not use fast response without tuning the response in the Advanced Menu (see page 59).*

MAIN MENU Calibration?	Press [YES] to enter the Calibration Menu.
CALIBRATION MENU Select Response?	Press [YES] to enter the Select Response submenu.
Set System Response: [FAST] damped	Use the [NO] or arrow keys to scroll between the Fast and Damped choices, and press [YES] to confirm the selection.
CALIBRATION MENU Select Response?	Press [NO] to proceed to the next submenu.

4.8.2 Select Compensation?

The *Select Compensation?* submenu enables you to select submenus to compensate for pressure or background gases; a "None" selection is also available for applications that require no compensation.

Note: *The TMO2 oxygen transmitter is the only device where compensation may be set to a value other than None.*

CALIBRATION MENU Select Compensation?	Press [YES] to enter the "Select Compensation?" submenu.
Select Compensation: [NONE] pres bkgd	Use the [NO] or arrow keys to select the type of compensation desired. Then press [YES] to confirm the selection.
CALIBRATION MENU Select Compensation?	Press [NO] to proceed to the "Gas Calibration?" submenu and enter data.

4.8.3 Gas Calibration?

The *Gas Calibration?* submenu enables you to enter data from the transmitter calibration sheet. Depending on the selection made in the *Select Compensation?* submenu, the display will present appropriate prompts for none, pressure, or background compensation.

Refer to the following sections, depending on the type of compensation you have selected:

- None — see below.
- Pressure — refer to page 40.
- Background — refer to page 41.

CALIBRATION MENU Gas Calibration?	Press [YES] to enter the "Gas Calibration?" submenu. The menu will vary according to the selection made in the "Select Compensation?" submenu.

4.8.3.1 No Compensation:

If you have selected NONE for compensation:

GAS GRID ENTRY # of Points [X]:	Use the numeric keys to enter the number of points in the gas calibration curve, then press [YES] twice to confirm the entry.
Point # 1 Gas [XX.XX]:	Use the numeric keys to enter the percent gas concentrations for each of the points in the curve, and then press [YES] to confirm each entry.

Note: *Percent gas concentrations MUST be in ascending order, with Point #1 the lowest concentration.*

XX.XX %Gas Gas mA [XX.XX]:	After entering all the points, use numeric keys to enter the corresponding mA values for the given percent gas concentration. Press [YES] twice to confirm each entry.

The menu will then display the "Working . . ." message before returning to the *Gas Calibration?* submenu.

CALIBRATION MENU Gas Calibration?	Press [NO] to proceed to Pressure Calibration.

4.8.3.2 Pressure Compensation:

In the TMO2D, pressure (PRES) compensation is typically used only with a TMO2 oxygen transmitter. Pressure compensation will correct the oxygen readings for any changes in atmospheric pressure. If you have selected pressure compensation, you must enter both transducer data and pressure grid data.

PRESSURE GRID ENTRY # of Curves?[X]:	Use the numeric keys to enter the number of pressure curves, then press [YES] twice to confirm the entry.
Curve # 1 mmHg [XXX.X]:	Use the numeric keys to enter the pressure in mmHg for the first curve, and press [YES] twice. Repeat this process for the other curves.
PRESSURE GRID ENTRY # of Points?[X]:	Use the numeric keys to enter the number of oxygen points per pressure curve, then press [YES] twice to confirm the entry.
Point # 1 %O_2 [XX.XX]	Use the numeric keys to enter the percent of oxygen for the given point, then press [YES] twice to confirm the entry. Repeat this process for the other points.

The display will briefly show "Working . . ." before proceeding to the next question.

X.XX% O_2 , XXX.X mmHg Enter Point? [[YES]] no	The display will show the data entered for Curve #1, and ask if you wish to enter a point. Use the [NO] or arrow keys to scroll between choices, and press [YES] to confirm either a [YES] or [NO] selection. (If you select [NO], the menu proceeds to the next point entered.)

.

X.XX% %O_2, XXX.X mmHg O_2 mA [X.XX]:	Use the numeric keys to enter the corresponding mA value for the given point, then press [YES] twice to confirm the entry. Repeat this process for the other points.

The display again shows "Working . . ." before returning to the start of the *Gas Calibration?* submenu.

4.8.3.3 Background Compensation:

Background gas compensation in the TMO2D is typically used with a TMO2 oxygen transmitter to correct the readings for changes in background gas concentrations. If you have selected background compensation (BKGD), you must enter background grid data.

O_2 GRID ENTRY # of Curves [X]:	Use the numeric keys to enter the number of background gas curves, then press [YES] twice to confirm the entry.
O_2 GRID ENTRY # of Points [X]:	Use the numeric keys to enter the number of oxygen points per curve, and press [YES] twice to confirm the entry.

Note: *Each curve must have AT LEAST TWO entered data points.*

Point #1: %O_2 [X.XX]:	Use the numeric keys to enter the percent gas concentrations for each point, then press [YES] twice to confirm the entry.

Note: *Percent gas concentrations MUST be in ascending order, with Point #1 the lowest concentration.*

The display shows "Working . . ."

X.XX% O_2 , Curve #1 Enter Point? [YES] no	The display will show the data entered for Curve #1, and ask if you wish to enter a point. Use the [NO] or arrow keys to scroll between choices, and press [YES] to confirm either a [YES] or NO selection. (If you select [NO], the menu proceeds to the next point entered.)
X.XX % O_2, Curve #X O2 mA [X.XX]	Use the numeric keys to enter the corresponding O_2 input milliamp value for the given point, then press [YES] twice to confirm the entry.
X.XX % O_2, Curve #X Bkgd mA [X.XX]:	Use the numeric keys to enter the corresponding background gas compensation input milliamp value for the given point. Press [YES] twice to confirm the entry, and repeat the procedure for every point in the background grid.

The display will then show "Working . . ." before returning to the *Gas Calibration* submenu.

CALIBRATION MENU Gas Calibration?	Press [NO] to proceed to the *Pressure Calibration* submenu.

4.8.4 Pressure Calibration?

The *Pressure Calibration?* submenu enables users to directly calibrate the pressure transducer. While this menu option is always displayed, it should only be programmed and used when the TMO2D is used with a TMO2 calibrated for atmospheric pressure compensation.

CALIBRATION MENU Pressure Calib?	Press [YES] to enter the "Pressure Calibration?" submenu.
PRES XDUCER CURVE ENTRY # of Points [X]:	Use the numeric keys to enter the number of points, and press [YES] twice to confirm the entry.
Point # 1 mmHg [XXX.X]:	Use the numeric keys to enter the pressure in mmHg for the given point, and press [YES] twice to confirm the entry.
Point # 1 Pres mA [X.XX]:	Use the numeric keys to enter the corresponding mA value for the point, and press [YES] twice.

Repeat this sequence for the remaining points. After you have entered the data, the display will show "Working . . ." and return to the start of the submenu.

CALIBRATION MENU Pressure Calib?	Press [NO] to proceed to the Auto Cal submenu.

4.8.5 Auto Cal Parameters

You can program the TMO2D to perform an automatic calibration procedure (Auto Cal) at specified time intervals ranging from minutes to months.

By performing measurements on either one calibration gas (offset or span) or on two calibration gases (zero and span), the unit can correct for changes in the response of the transmitter without operator intervention.

At the specified time interval, the TMO2D activates a solenoid valve on a sampling system using one of the relays provided. This procedure isolates the transmitter from the process stream and connects the transmitter to one of the calibration gases. After a programmable time, during which the calibration gas replaces the process gas, the transmitter takes measurements of the calibration gas.

The analyzer then activates a second solenoid valve, using a second relay, to connect the transmitter to the other calibration gas. The transmitter then equilibrates as the second calibration gas replaces the first gas, and takes measurements of the second calibration gas.

After taking span and zero gas measurements, the TMO2D reconnects the transmitter to the process stream. Then a final settling time takes place while the process gas replaces the calibration gas.

Once settling has been completed, if no error has occurred, the analyzer calculates the amount of drift and applies the calculated drift to the factory calibration data. The factory calibration data remains unchanged. The TMO2D stores the corrections to the calibration data as the Drift Curve.

If the Auto Cal measurements are beyond the preprogrammed limit, the unit disregards the data and uses the drift curve already stored in memory. If you have enabled Auto Cal Error Handling (see page 48), the display and outputs will respond as programmed. If any alarm relays have been assigned to trip on Auto Calibration Errors, they will be tripped. Contact the factory to expand the AutoCal drift limits. The default limits are 25% of full scale per calibration and 40% of full scale total drift.

Alternately, the automatic calibration can be performed in an offset or span correction manner using a single calibration gas and one solenoid valve. When calibration is active, the autocalibration status replaces the display of pressure or background:

- Cal:ok (no errors and no new cal data applied)
- Cal:new (no errors and new data applied)

- Cal:err (total or per reading drift error)

Follow the steps below to enter the Auto Cal Parameters submenu.

CALIBRATION MENU Auto Cal Parameters?	Press [YES] to enter the Auto Cal Parameters submenu.
Enable AutoCal: [YES] no	Press [YES] to enable the AutoCal function.
AUTO CALIBRATION MENU Set Auto Verification?	Then use the [NO] or arrow keys to scroll through the ten options within the submenu.
AUTO CALIBRATION MENU Set Time Interval?	
AUTO CALIBRATION MENU Set AutoCal Mode?	
AUTO CALIBRATION MENU Set Cal Gas Data?	
AUTO CALIBRATION MENU Set Settling Time?	
AUTO CALIBRATION MENU Set Error Handling?	
AUTO CALIBRATION MENU Perform AutoCal?	
AUTO CALIBRATION MENU Reset Drift?	
AUTO CALIBRATION MENU View Drift Curve?	
CALIBRATION MENU Done?	Press [YES] to exit the Calibration Menu and return to the Main Menu.

4.8.5.1 Set Auto Verification?

Auto verification is similar to automatic calibration. The solenoids are still tripped to allow the calibration gases to flow to the transmitter. However, if the calculated drift is less than a preprogrammed amount, the TMO2D will not store the new drift data into memory. If the drift is beyond the verification limit and no cal error occurs, then the TMO2D applies new calibration data and sets a new calibration flag.

Auto Cal Verification disabled [ENABLED]	Use the [NO] or arrow keys to select enabling or disabling of auto cal verification. Press [YES] to confirm your entry.
AUTO CALIBRATION MENU Set Auto Verification?	Press [NO] to proceed to the Time Interval option.

4.8.5.2 Set Time Interval?

The *Set Time Interval?* option enables you to set the time interval at which an Auto Cal or Verification will occur. *Set Time Interval?* enables you to set an interval of either hours or days. You can enter hours as fractions (i.e., 90 minutes = 1.5 hours), up to a maximum of 24 hours.

Days can range from 0 to 99; however, the display does not accept fractional days. An interval of zero days prevents Auto Cal from occurring. (You can still perform a manual field calibration through the Perform AutoCal option.) If you enter a number of days (other than zero), the display will prompt for the time of day when the Auto Cal should occur. For example, to set the time interval for 12 hours:

AUTO CALIBRATION MENU Set Time Interval?	Scroll through the submenu, and press [YES] to enter the time interval option.
Select AutoCal Interval: [HOURS] days	Use the [NO] or arrow keys to select *HOURS*. Press [YES] to confirm the selection.
Auto-Cal Interval: Hours [XX.XX]:	Use the numeric keys to enter the number of hours. Press [YES] twice to confirm the entry. Press [NO] to proceed. (The X's represent the previously entered hours.)
AUTO CALIBRATION MENU Set Time Interval?	The display returns to the Time Interval option.

To set the time interval for a given number of days:

AUTO CALIBRATION MENU Set Time Interval?	Press [YES] to enter the Time Interval option.
Select AutoCal Interval: hours [DAYS]	Use the [NO] or arrow keys to select "DAYS" and press [YES].
Auto-Cal Interval: Days [XX.XX]:	Use the numeric keys to enter the number of days, and press [YES] twice to confirm the entry. Press [NO] to proceed. (The X's represent the previously entered days.)

To enter a time of day at which the display performs Auto Cal:

AutoCal at Time: HH.MM [XX.XX]:	Use numeric keys to enter the time (in 24-hour format). Press [YES] twice to confirm the entry. Press [NO] to proceed. (X's represent previously entered hours.)
Auto-Cal Interval: Days to Next Cal:[XX.XX]	Use the numeric keys to enter the number of days until the next auto cal , and press [YES] twice to confirm the entry. Press [NO] to proceed. (The X's represent the previously entered days.)

Note: *The number of days entered at this prompt can be no higher than the number of days entered at the "Days" prompt above.*

AUTO CALIBRATION MENU Set Time Interval?	Press [NO] to proceed to the "Set AutoCal Mode?" option.

4.8.5.3 Set AutoCal Mode?

Most transmitters will have the best accuracy with a two-point zero and span calibration. Transmitters such as the O2X1 oxygen transmitter have a fixed zero point, so only a one-gas span (slope) calibration is required. *Set AutoCal Mode?* enables you to determine whether the display calibrates for both zero and span gases (two points) or simply for one gas, either on offset or span (slope). To enter this option:

:

AUTO CALIBRATION MENU Set AutoCal Mode?	Scroll through the submenu, and press [YES] to enter the AutoCal Mode option.
Set AutoCal Type: [1 GAS CAL] 2 gas cal	Use the [NO] or arrow keys to scroll to the desired selection, then press [YES].

If you select 1 gas cal, the following prompt appears:

Set 1Gas Auto Cal Type [OFFSET-CAL] span-cal	Use the [NO] or arrow keys to scroll to the desired selection, then press [YES].
AUTO CALIBRATION MENU Set AutoCal Mode	Press [NO] to proceed to the "Set Cal Gas Data?" option.

Set Cal Gas Data?

In the "Set Cal Gas Data?" option, you can program the zero, span or offset gases. If you select the "2 gas cal" mode, the prompts ask for zero and span gas data. But if you select the "1 gas cal" mode, the prompt asks for data for either the offset or span gas, depending on the mode selected in the *Set AutoCal Mode?* on page 46.

For an oxygen transmitter, if 100% nitrogen is used for the zero gas, the concentration would be zero. If a mixture is used, you should enter the oxygen concentration of the mixture. The default concentration is 0% oxygen.

After you enter the gas concentration, the display will automatically prompt for the equilibration time for the zero gas. The equilibration time should allow for the distance the calibration gas must travel, and for the settling time of the transmitter cell.

Note: *For a successful auto calibration, the equilibration time should be at least 3 minutes.The default is 5 minutes. For testing purposes, the equilibration time can be as low as 0 seconds. The maximum equilibration time is 90 minutes.*

For example, to set the zero gas in a 2-gas cal mode for 0.00% oxygen for an equilibration time of 3 minutes:

AUTO CALIBRATION MENU Set Zero Gas?	Scroll through the submenu, and press [YES] to enter the Set Zero Gas option.

Zero Gas % O2 [XX.XX]	Use the numeric keys to enter the percentage of oxygen (in this case, 0, ., 0 and 0). Press [YES] twice to confirm the entry. (The X's represent the previously entered percentage.)
Zero Gas ON for: MM.SS [XX.XX]:	Use the numeric keys to enter the number of minutes and seconds needed for equilibration time (in this case, 3, ., 0 and 0, or simply 3). Then press [YES] twice to confirm the entry. (The X's represent the previously entered minutes and seconds.)
AUTO CALIBRATION MENU Set Zero Gas?	Press [NO] to proceed to the Set Span Gas option.

In the 2-gas cal mode, the Set Span Gas option enables you to enter the oxygen concentration and the equilibration time for the span gas. The default concentration for the Span Gas is 20.93%, the concentration of oxygen in air. The procedure to set the span gas is identical to that for setting the zero gas.

To set a span gas of 100% oxygen for 2 minutes and 35 seconds:

AUTO CALIBRATION MENU Set Span Gas?	Scroll through the submenu, and press [YES] to enter the Set Span Gas option.
Span Gas % O_2 [XX.XX]	Use the numeric keys to enter the percentage of oxygen (here 1,0,0, ., and 0,). Press [YES] twice to confirm the entry. (The X's represent the previously entered percentage.)
Span Gas ON for MM.SS [XX.XX]:	Use the numeric keys to enter the minutes and seconds for the equilibration time (in this case 2, ., 3 and 5). Press [YES] twice to confirm the entry. (The X's represent the previously entered time.)
AUTO CALIBRATION MENU Set Span Gas?	Press [NO] to proceed to the Set Settling Time option.

Note: *In the 1-gas cal mode, entering offset gas data is similar to entering the zero or span gas data described above.*

4.8.5.4 Set Settling Time?

In the Set Settling Time option, you can enter (in minutes and seconds) the settling time, the amount of time the process gas should remain on before the TMO2D resumes taking measurements and reactivates the recorder output. (During an autocal, the recorder output from the TMO2D has been locked to the last value it had sent directly before the autocal began.)

AUTO CALIBRATION MENU Set Settling Time?	Scroll through the submenu, and press [YES] to enter the Set Settling Time option.
Settling Time: MM.SS [XX.XX]:	Use the numeric keys to enter the minutes and seconds for settling time, and press [YES] twice to confirm the entry. Press [NO] to proceed.(The X's represent the previously entered time.)
AUTO CALIBRATION MENU Set Settling Time?	Press [NO] to proceed to the "Set Error Handling?" option.

4.8.5.5 Set Error Handling?

Use the *Set Error Handling?* option to program the display and the recorder outputs to respond to any error (invalid measurement) that occurs during Auto Cal. Errors occur if the measured drift values exceed preprogrammed limits (as explained on page 42). To program alarm relays to respond to calibration errors, go to the Relays Menu (page 31).

Follow these steps to enable error handling, set the display screen, and select the output responses.

AUTO CALIBRATION MENU Set Error Handling?	Scroll through the submenu, and press [YES] to enter the Set Error Handling option.
Enable Error Handling [YES] no	Use the [NO] or arrow keys to scroll to [YES], and press [YES] to confirm the selection.
AUTOCAL ERROR EFFECTS Set Display Response?	Press [YES] to set the Display Response.
Display AutoCal Error? [YES] no	Use the [NO] or arrow keys to make the desired selection, and then press [YES] to confirm the entry.
AUTOCAL ERROR EFFECTS Set Display Response?	Press [NO] to proceed to the next item.
AUTOCAL ERROR EFFECTS Set Output Response?	Press [YES] to set the Output Response.
Set Output Response No Effect?	Use the [NO] or arrow keys to scroll through the choices, then press [YES] at the desired output response.

Set Output Response Force High?

Set Output Response Force Low?

Set Output Response Force to Value?

Set Output Response Hold Last Value?

If you select any choice except *Force to Value?*, the program returns to the *Set Output Response?* entry. The *Force to Value?* selection enables users to choose a value to which the output will go when a system error occurs from 0 to 25 mA. If you select *Force to Value?*, the program asks for two more entries.

Output A, Error Value: mA Value [X.XX]:	Use the numeric keys to enter the desired value. (The number in brackets represents the previously entered value.) Press [YES] to enter the value, and [YES] again to confirm the entry.
Output B, Error Value: mA Value [X.XX]:	Use the numeric keys to enter the desired value. Press [YES] to enter the value, and [YES] again to confirm the entry.
AUTOCAL ERROR EFFECTS Set Output Response?	Press [NO] to proceed to the next item.
AUTOCAL ERROR EFFECTS Done?	Press [YES] to exit the Error Effects submenu.
AUTO CALIBRATION MENU Set Error Handling?	Press [NO] to proceed to the *Perform Auto Cal?* option.

4.8.5.6 Perform AutoCal?

The *Perform AutoCal?* option can activate the Auto Cal procedure without waiting for the specified Auto Cal interval. To set Auto Cal to begin automatically, refer to page 42.

When the TMO2D performs an Auto Cal, either upon user command or at a prespecified time, it performs several operations.

- The Process/Cal relay will trip to the Cal position, and the Zero/Span relay will trip to the Span position. Refer to the Relays Menu (page 31) to configure relays for calibration control.

For a 1 gas cal configuration:

- The first line of the display reads either "AutoCal: Span Gas is ON" or "AutoCal: Offset Gas is ON" (depending on the active mode) along with the equilibration time, which counts down to zero.

You can interrupt the Auto Cal at this point by pressing [NO]. The Display will prompt *Abort AutoCal?* You have two choices.

- Press [NO] to resume the countdown.
- Press [YES] to return the display to the beginning of the *Perform Auto Cal?* option.

When the equilibration time reaches zero, the display will read *Measuring . . .* and count down the measurement time. At the end of the Auto Cal procedure, the Process/Cal relay will reset to the Process position and the settling time will count down to zero. The display will then read *AutoCal in Progress* and the TMO2D will return to the start of the *Perform Auto Cal?* option.

For a 2-gas-cal configuration:

- The first line of the display reads "AutoCal: Span Gas is ON" along with the equilibration time, which counts down to zero.

You can interrupt the Auto Cal at this point by pressing [NO]. The Display will prompt *Abort AutoCal?* You have two choices.

- Press [NO] to resume the countdown.
- Press [YES] to return the display to the beginning of the *Perform Auto Cal?* option.

When the equilibration time reaches zero, the display will read "Measuring . . ." and count down the measurement time. At the end of the measurement, the display changes to "AutoCal: Zero Gas is ON", along with its equilibration time, which also counts down to zero.

At the end of the Auto Cal procedure, the Process/Cal relay will reset to the Process position and the settling time will count down to zero. The display will then read "AutoCal in Progress" and the TMO2D will return to the start of the *Perform Auto Cal?* option.

To manually activate the Auto Cal procedure:

AUTO CALIBRATION MENU Perform Auto Cal?	Press [YES] to activate Auto Cal.
AutoCal: Span Gas is ON XX.XX mA XX:XX	
AutoCal: Span Gas is ON Measuring . . .	
AutoCal: Zero Gas is ON XX.XX mA XX:XX	
AutoCal: Zero Gas is ON Measuring . . .	

If you press [NO] while any of these screens are on, the display will show:

Abort AutoCal?	Pressing [NO] sends the display back to the previous screen, while pressing [YES] sends the display ahead to "Settling . . ." and then back to the start of the option.
AutoCal:Settling . . . XX.XX XX:XX	The display then counts down the settling time.

If you press [NO] while the Settling screen is on, the display will show:

Abort AutoCal?	Pressing [NO] sends the display back to the previous screen, while pressing [YES] sends the display back to the start of the option.
AUTO CALIBRATION MENU Perform AutoCal?	After counting down the settling time, the display returns to the start of the "Perform Auto Cal?" option. Press [NO] to proceed to the "Reset Drift?" option.

4.8.5.7 Reset Drift?

Selecting the "Reset Drift?" option prompts the display to reset the Auto Cal drift curve to the original calibration data.

AUTO CALIBRATION MENU Reset Drift?	Press [YES] to enter the "Reset Drift?" option.
Reset Drift? [YES] no	Use the [NO] or arrow keys to select the desired entry. Select and press [YES] to reset the Auto Cal drift curve.
Working . . .	
AUTO CALIBRATION MENU Reset Drift?	After resetting the curve (or if you press [NO] to cancel the process), the display returns to the Auto Cal Menu. Press [NO] to proceed to the next option.

4.8.5.8 View Drift Curve?

Selecting this option enables the user to view the Auto Cal drift curve.

AUTO CALIBRATION MENU View Drift Curve?	Press [YES] to enter the View Drift Curve option.
Drift Values: X.XX % Gas, X.XX mA	Press [YES] to scroll through the values of the drift curve.

Note: *If the unit is uncalibrated and/or has not undergone the Auto Cal procedure (no calibration data has been previously entered), the drift values will all be 0.00 mA.*

AUTO CALIBRATION MENU View Drift Curve?	After it goes through the points, the display returns to the View Drift Curve option. Press [NO] to exit the option.
AUTO CALIBRATION MENU Done?	Press [YES] to return to the Calibration Menu.
CALIBRATION MENU Auto Cal Parameters?	Then press [NO] to exit the Auto Cal Parameters submenu.

4.8.5.9 Done?

CALIBRATION MENU Done?	Press [YES] to exit the Calibration Menu and return to the Main Menu.
MAIN MENU Calibration?	Press [NO] to proceed to the System Log menu.

4.9 The System Log Menu

The TMO2D maintains a System Log in battery-backed memory. Among other things, this log indicates the nature of any fault signaled by the fault alarm relay by recording the type, date, and time of the relevant events.

The System Log can record up to 25 events of the following types:

- factory initialization
- system power on
- system RESET
- RAM checksum failure (memory corruption)
- Transmitter cell under range
- Transmitter cell over range
- no calibration curve
- return to normal operation
- AutoCal Tot drift error
- AutoCal Drift/Cal error

Note: *Testing the fault alarm does not appear in the System Log.*

The TMO2D stores only the 25 most recent events in its memory. When additional events occur, the TMO2D discards the oldest event from the log to make room for the new event. Refer to Figure 29 on page 85, for a flow diagram of the System Log menu.

4.9.1 Viewing the System Log

The System Log may be viewed on the TMO2D display, or transmitted to a computer, printer or other data acquisition system using the RS232 serial port. To view the System Log on the TMO2D display, scroll through the Main Menu until you reach the following prompt:

MAIN MENU System Log?	Press [YES] to enter the System Log menu.
SYSTEM LOG MENU Display System Log?	Press [YES] to view the most recent event in the System Log.
03: Normal Operation: 04/04/02 10:21:58	The TMO2D displays the most recent event in the System Log.

At the above prompt, use the arrow keys to scroll through the logged events ([◀] for the previous event, [▶] for the next event). When done, press [NO] to exit the System Log. See Figure 14 below for a description of the components of the System Log screen.

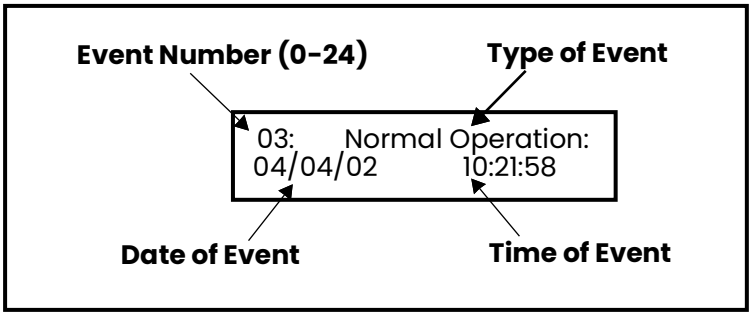


Figure 14: System Log Display Screen

SYSTEM LOG MENU Display System Log?	Press [NO] to proceed to the Print System Log? prompt.

4.9.2 Print System Log

To print the System Log or transmit it over the RS232 serial port:

SYSTEM LOG MENU Print System Log?	Press [YES] and the TMO2D transmits the entire log using the RS232 serial port.

A System Log printout appears similar to the example shown in Figure 15 below.

```
00: Factory Init at 10/02/2001 09:34:32
01: Cell Under Range at: 10/02/2001 09:34:33
02: No Calibration at: 10/05/2001 10:14:44
03: Normal Operation: 10/05/2001 10:21:58
```

Figure 15: A Typical System Log Printout

After printing or transmitting the log, the TMO2D reboots and returns to taking measurements.

4.9.2.1 Done?

To exit the System Log menu, proceed as follows:

SYSTEM LOG MENU Print System Log?	Press [NO].
SYSTEM LOG MENU Done?	Press [YES] to leave the System Log menu.
MAIN MENU System Log?	Press [NO].
MAIN MENU Resume?	Press [YES] for the TMO2D to resume taking measurements.

[no content intended for this page]

Chapter 5. Advanced Programming

5.1 Introduction

In addition to its basic program, the TMO2D analyzer contains a factory setup program that enables the user to perform more advanced operations on the parameters that have been first installed at the factory. This program has eight main menus. Use the front panel keypad and display to check or change the settings for current operating parameters. New data overrides any previously entered data.

IMPORTANT: Consult Panametrics before changing any parameters in this menu.

The user program consists of eight main menus:

- Set Significant Digits
- Select Background
- Select Tracking
- Select Tertiary
- Response Parameters
- Labcal Outputs
- Manual Offset
- Change AutoCal Limits

5.2 Entering Data into the Factory Setup Program

To enter data into the program or to check previously entered values, enter the Factory Setup Menu Mode. When you turn the power on, the TMO2D enters the Operate Mode. To enter the Factory Setup Menu Mode:

1. Press the [NO] key.
2. Key in the code [3] [6] [9]. The TMO2D will display an asterisk (*) after you enter each digit.

If you enter an incorrect code or press a non-numeric ([YES]/[NO] or arrow) key rather than 3 6 9, the LCD will automatically resume displaying data, and you must press [NO] to re-attempt the code. Once all three digits have been entered correctly, the display will cease collecting data and the LCD will switch to the Factory Setup Menu Mode.

The LCD screen now displays the Set Significant Digits? menu, the first of the eight main menus. At this display, press [YES] to enter this menu, or [NO] to scroll to the next menu. Pressing [NO] continuously scrolls through all eight main menus. Refer to Figure 30 on page 86 for a flow diagram of the Factory Setup Menu.

Note: *The first eight options are main menus, while the "RESUME" prompt enables you to exit the Factory Setup Menu Mode and return to Operate Mode.*

5.3 Set Significant Digits?

The first option in the Factory Setup Menu, *Set Significant Digits?*, enables you to modify the resolution of the gas reading on the TMO2D display, when you select display in PPM ranges. You can select values from 2 to 4; the default setting of 3 suppresses one significant digit, a setting of 2 suppresses two digits, and a setting of 4 displays the full resolution of the calculated gas reading. However, while the Significant Digits option affects the display, the analog outputs retain full resolution at all times.

Note: *This option applies only if you select display in ppm ranges. If the TMO2D is set up for the 10 ppm range, it defaults to 2-digit resolution. However, you can change the significant digits in this menu.*

FACTORY SETUP MENU Set Significant Digits?	Press [YES] to set the number of digits desired.
Significant Digits: 2-4 [3]:	Use the numeric keys to enter the desired number of digits. Press [YES] to enter the number, and [YES] again to confirm the entry.
FACTORY SETUP MENU Set Significant Digits?	Press [NO] to proceed to the Set Background option.

5.4 Select Background?

The *Select Background?* option enables you to select a background gas label if background compensation is active and the LCD has been programmed to display the background gas.

Note: *Background compensation and display apply only for a TMO2 oxygen transmitter. If the Auto Calibration mode is active, the TMO2D displays calibration status instead of the background gas.*

FACTORY SETUP MENU Select Background?	Press [YES] to select the background gas label.
Select Background Gas: %Bkgd?	Use the [NO] or arrow key to move brackets to the desired entry. The program offers five label choices: Bkgd, H2, N2, SO2, and CO2. Press [YES] to confirm the entry.
FACTORY SETUP MENU Select Background?	Press [NO] to proceed to the Select Tracking? option.

5.5 Select Tracking?

If you use a background gas, the Select Tracking? option enables the TMO2D to use the last data point as the starting point for the calculation.

FACTORY SETUP MENU Select Tracking?	Press [YES] to select tracking.
Turn Tracking: [ON] off	Use the [NO] or arrow keys to scroll to the desired option. Press [YES] to confirm the entry.
FACTORY SETUP MENU Select Tracking?	Press [NO] to proceed to the Select Tertiary? option.

5.6 Select Tertiary?

When activated, the *Select Tertiary?* option enables the TMO2D to calculate the ratio of background gases in the process.

Note: *This option applies only for a TMO2 oxygen transmitter.*

FACTORY SETUP MENU Select Tertiary?	Press [YES] to select tertiary calculation.
Turn Tertiary: [ON] off	Use the [NO] or arrow keys to scroll to the desired option. Press [YES] to confirm the entry.
FACTORY SETUP MENU Select Tertiary?	Press [NO] to proceed to the Response Parameters? option.

5.7 Response Parameters?

If the system response on the TMO2D is set to FAST (see *Select Response?* on page 39), you can program the settings for the Fast Response algorithm.

IMPORTANT: If you wish to use Fast Response, consult the factory.

FACTORY SETUP MENU Response Parameters?	Press [YES] to set the parameters for the Fast Response algorithm.

The first setting, Tau (up), is the tau value for calculations while the measured gas concentration is increasing. Increasing the Tau (up) reading increases the transmitter's response speed.

Note: *Be careful when setting the Tau (up) or (down) values. Values that are too high may cause the TMO2D readings to overshoot the actual end point.*

FACTORY SETUP MENU Tau (up) [XX.XX]:	Use the numeric keys to enter the desired value. Press [YES] to enter the number, and [YES] again to confirm the entry.

The next setting, Tau (down), is the tau value for calculations while the measured gas concentration is decreasing. Increasing the Tau (down) reading increases the transmitter's response speed.

FACTORY SETUP MENU Tau (down) [XX.XX]:	Use the numeric keys to enter the desired value. Press [YES] to enter the number, and [YES] again to confirm the entry.
FACTORY SETUP MENU Thresh (%) [XX.XX]:	Use the numeric keys to enter the desired value. Press [YES] to enter the number, and [YES] again to confirm the entry.
FACTORY SETUP MENU Smooth (%) [XX.XX]:	Use the numeric keys to enter the desired value. Press [YES] to enter the number, and [YES] again to confirm the entry.
FACTORY SETUP MENU Window (%) [XX.XX]:	Use the numeric keys to enter the desired value. Press [YES] to enter the number, and [YES] again to confirm the entry.
FACTORY SETUP MENU Response Parameters?	Press [NO] to proceed to the LabCal Outputs? option.

5.8 LabCal Outputs?

The *LabCal Outputs?* option enables you to calibrate (or trim) the analog outputs. After you select the output (A or B) to calibrate, the output is driven to 20 mA. You can input the actual output value (as shown by a multimeter or connected control device) and adjust the output. The output is then driven to 4 mA, and you can make a similar adjustment.

FACTORY SETUP MENU LabCal Outputs?	Press [YES] to calibrate the analog outputs.
Output to LabCal: [A] B done	Use the [NO] or arrow keys to scroll to the desired output. Press [YES] to confirm the entry.
Output A 20 mA Output Enter mA [20.00]:	Use the numeric keys to enter actual output value (as read by a multimeter or control device). Press [YES] to enter the number, and [YES] again to confirm the entry.
Output A 4 mA Output Enter mA [4.00]:	Use the numeric keys to enter actual output value (as read by a multimeter or control device). Press [YES] to enter the number, and [YES] again to confirm the entry.
Output to LabCal: A [B] done	Use the [NO] or arrow keys to scroll to another output to repeat the calibration procedure. Press [YES] to confirm the entry. If you have completed calibration, scroll to "Done" and press [YES].
FACTORY SETUP MENU LabCal Outputs?	Press [NO] to proceed to the Manual Offset? option.

5.9 Manual Offset?

The *Manual Offset?* option enables you to apply a manually-entered offset (in percent or PPM) to the gas calculations.

FACTORY SETUP MENU Manual Offset?	Press [YES] to apply a manual offset to the gas calculations.
FACTORY SETUP MENU % Offset: [X.XX]:	Use the numeric keys to enter the desired value (in % or ppm). Press [YES] to enter the value, and [YES] again to confirm the entry.
FACTORY SETUP MENU Manual Offset?	Press [NO] to proceed to the Change AutoCal Limits? option.

5.10 Change AutoCal Limits?

The *Change AutoCal Limits?* option enables you to adjust the error handling limits for auto calibration. (To program basic auto cal parameters, refer to "Auto Cal Parameters" on page 42.) The TMO2D has default values for error handling:

- Total Calibration Drift Limit: 40% of input range (6.40 mA)
- Drift per Calibration Limit: 25% of input range (4.00 mA)
- Verification Mode Drift Limit: 10% of input range (1.6 mA)

FACTORY SETUP MENU Change AutoCal Limits?	Press [YES] to change the error handling limits for auto calibration.
AUTOCAL DRIFT LIMITS Edit Tot Drift Limit?	Press [YES] to edit the total calibration drift limit.
Set Total Cal Drift: Drift mA [X.XX]:	Use the numeric keys to enter the desired limit. Press [YES] to enter the value, and [YES] again to confirm the entry.
AUTOCAL DRIFT LIMITS Edit Tot Drift Limit?	Press [NO] to proceed to the drift per calibration limit.
AUTOCAL DRIFT LIMITS Edit per cal Limit?	Press [YES] to edit the drift per calibration limit.
Set Max Drift Per Cal: Drift mA [X.XX]:	Use the numeric keys to enter the desired limit. Press [YES] to enter the value, and [YES] again to confirm the entry.
AUTOCAL DRIFT LIMITS Edit per cal Limit?	Press [NO] to proceed to the verification mode drift limit.

AUTOCAL DRIFT LIMITS Edit Verification Limit?	Press [YES] to edit the verification mode drift limit.
Set Verification Limit: Drift mA [X.XX]:	Use the numeric keys to enter the desired limit. Press [YES] to enter the value, and [YES] again to confirm the entry.
AUTOCAL DRIFT LIMITS Edit Verification Limit?	Press [NO] to exit the verification mode drift limit.
AUTOCAL DRIFT LIMITS Done?	Press [YES] to exit the AutoCal Drift Limits window. (Pressing [NO] returns the option to the Edit Tot Drift Limit prompt.)
FACTORY SETUP MENU Change AutoCal Limits?	Press [NO] to exit the Change AutoCal Limits? option. (Pressing [YES] returns the option to the Edit Tot Drift Limit prompt.)
FACTORY SETUP MENU Resume?	Press [YES] to exit the Factory Setup Menu and resume taking measurements. (Pressing [NO] returns the menu to the Set Significant Digits? prompt.)

Chapter 6. Specifications

6.1 Performance

Accuracy: ±0.1% of span (electronics only)

Ambient Temperature Effect: ±0.05% of full scale per °F (°C)

6.2 Functional

Analog Output: Dual, isolated 0/4-20 mA, 500 ohm maximum, 12-bit resolution, field programmable

Alarms:

- Standard: Two Form C, SPDT, 2 A maximum @ 115 VAC, field programmable, 0.01% setpoint resolution, 0.05% of span dead band
- Optional: Two hermetically sealed relays for Class I, Division 2 hazardous (classified) locations
- Two standard or hermetically sealed relays for automatic calibration (Auto Cal)

Digital Output: RS-232C serial port

Display: 2-line x 24-character backlit LCD

Analog Input:

- One 4-20 mA from any transmitter
- Optional second 4-20 mA input

Power: 100/115/230/240 VAC ±10%, 50/60 Hz, 35 watts max., provides 24 VDC, 1.2 A max. to transmitter

Fuses:

- 110/120 VAC: 0.5 A, Slo-Blo
- 220/240 VAC: 0.25 A, Slo-Blo.

Temperature:

- *Operating*: 0 to +50°C (+32 to +122°F)
- *Storage*: -20 to +70°C (-4 to +158°F)

6.3 Physical

Dimensions (H x W x D):

- *Rack Mount*: 5.25 x 19 x 9.25 in. (133 x 483 x 235 mm)
- *Bench Mount*: 5.25 x 9 x 9.25 in. (133 x 229 x 235 mm)
- *Panel Mount*: 5.25 x 9 x 9.25 in. (133 x 229 x 235 mm)
- *Weatherproof, fiberglass*: 11.25 x 9.38 x 4.38 in. (286 x 238 x 111 mm)
- *Weatherproof, stainless steel*: 11:37 x 8.93 x 4.00 in. (289 x 227 x 102 mm)

Weight:

- *Rack Mount*: 5.4 lb (2.4 kg)
- *Bench Mount*: 7.4 lb (3.4 kg)
- *Panel Mount*: 4.7 lb (2.1 kg)
- *Weatherproof, fiberglass*: 6.5 lb (3.0 kg)
- *Weatherproof, stainless steel*: 12 lb (5.4 kg)

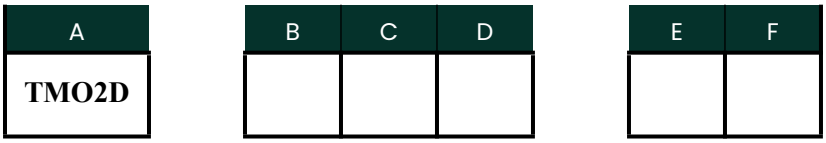
Environmental:

- *Rack, Bench, Panel Mount*: General-purpose
- *Weatherproof, fiberglass*: NEMA 4X, IP65
- *Weatherproof, stainless steel*: NEMA 4X
- *Explosion-proof*: Consult factory.

European Compliance:
This unit complies with EMC Directive 2004/108/EC and 2006/95/EC Low Voltage Directive. (Installation Category II, Pollution Degree 2)

6.4 Ordering Information

TMO2D Display



B - Design Package

1. Rack Mount*
2. Bench Mount
3. Panel Mount*
4. Weatherproof enclosure, fiberglass, NEMA 4X
5. Weatherproof (NEMA 4X, stainless steel*)

C - Power

1. 100 VAC, 50-60 Hz
2. 115 VAC, 50-60 Hz
3. 230 VAC, 50-60 Hz
4. 240 VAC, 50-60 Hz

D - Output

2. Dual, isolated 0/4-20 mA

E - Alarm Relays

1. Dual alarm relays (standard)
2. Dual alarm relays, hermetically-sealed for Class I, Div. 2
3. Dual alarm relays and autocal**
4. Dual alarm relays and autocal**, hermetically-sealed for Class I, Div. 2

F-Analyzer

1. For use with oxygen analyzer
2. For use with gas analyzer

*Approved for Division 2 with Division 2 alarms
**Dual automatic calibration relays (autocal)

[no content intended for this page]

Appendix A. Outline and Installation Drawings

- Figure 16: Rock Mount Outline
- Figure 17: Bench Mount Outline
- Figure 18: Panel Mount Outline
- Figure 19: Panel and Rack Mounting Dimensions
- Figure 20: Fiberglass Weatherproof Outline
- Figure 21: Stainless Steel Weatherproof Outline
- Figure 22: Oxygen Display PC Board Assembly
- Figure 23: Oxygen Display PC Board Schematic, sht 1
- Figure 24: Oxygen Display PC Board Schematic, sht 2
- Figure 25: Oxygen Display PC Board Schematic, sht 3

[no content intended for this page]

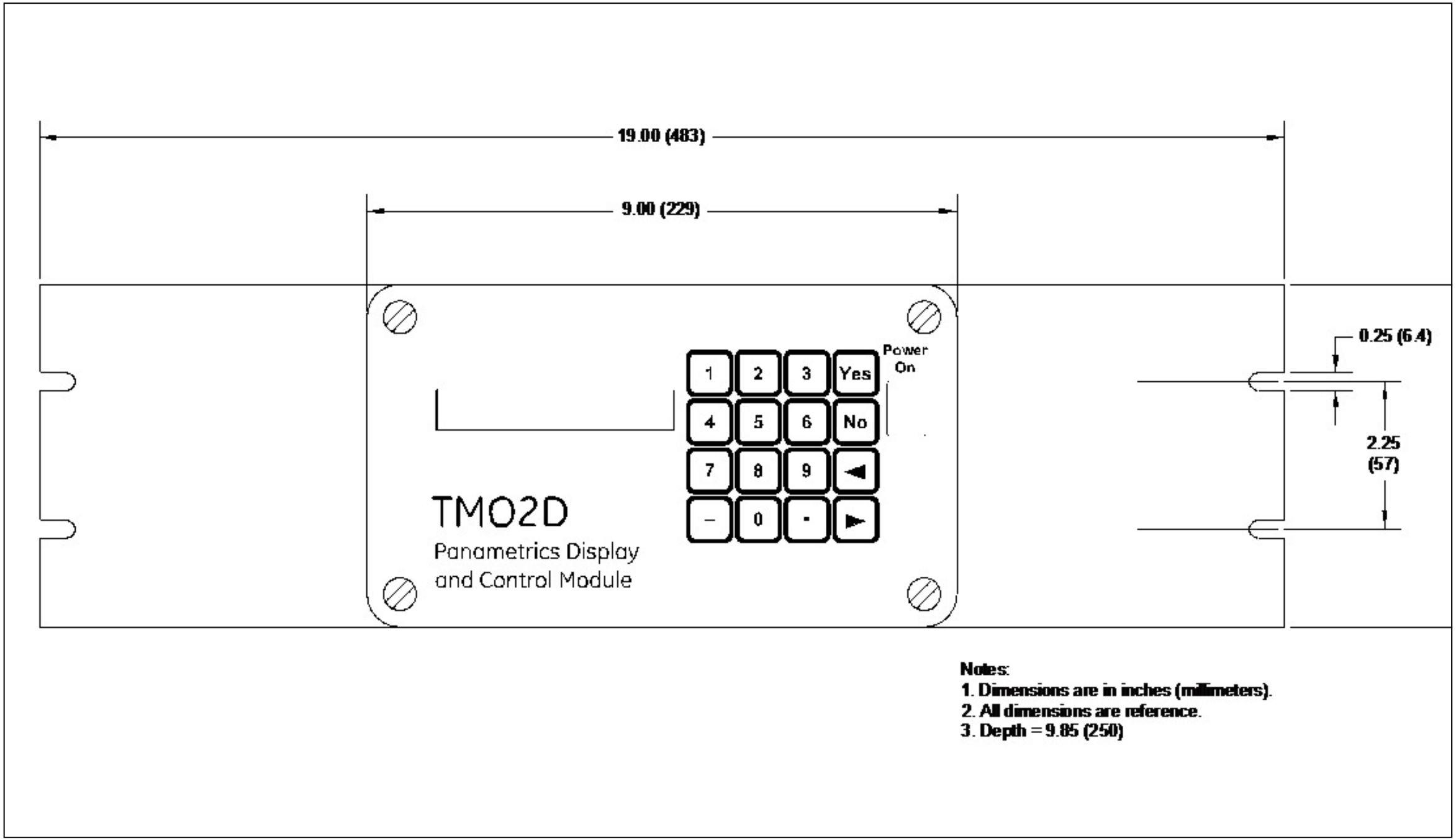


Figure 16: Rack Mount Outline (ref. dwg #712-220)

Notes:
1. Dimensions are in inches (millimeters).
2. All dimensions are reference.
3. Depth = 9.85 (250)

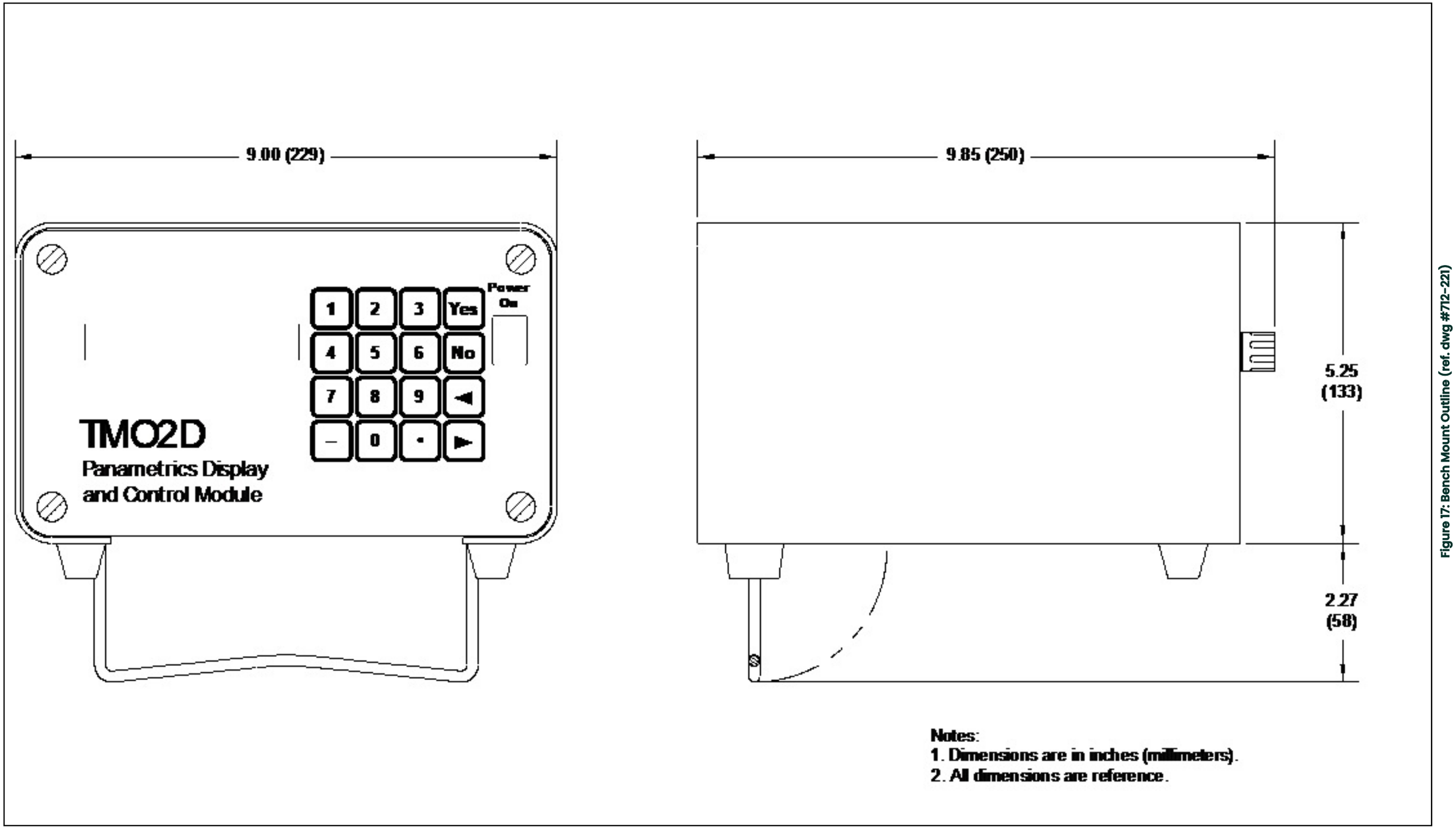
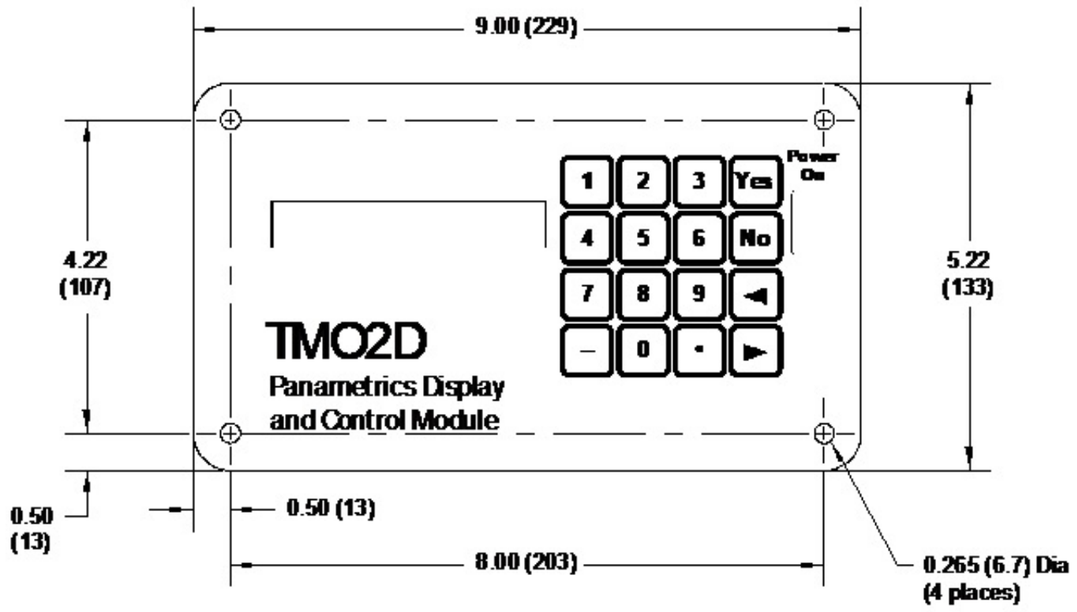
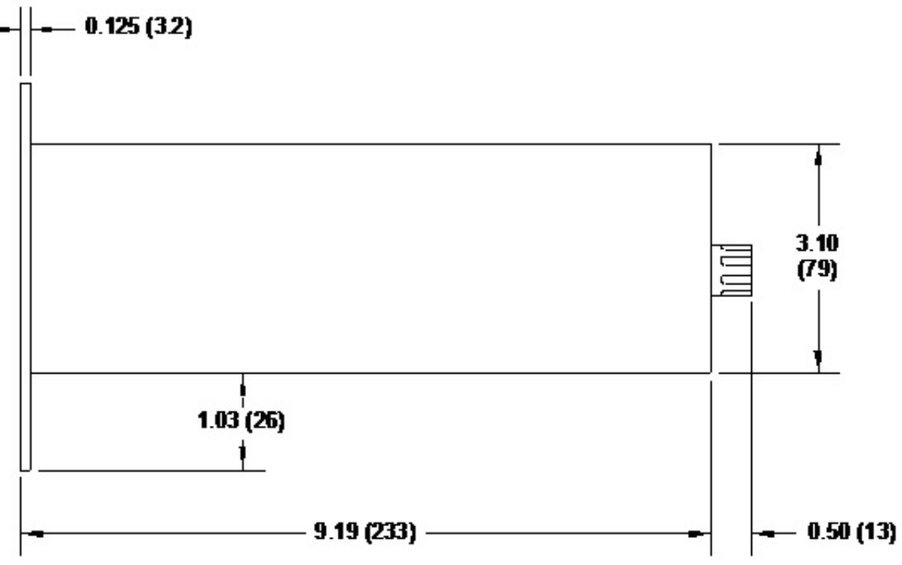


Figure 17: Bench Mount Outline (ref. dwg #712-221)





Note: Dimensions are in inches (millimeters).

Figure 18: Panel Mount Outline (ref. dwg #712-222)

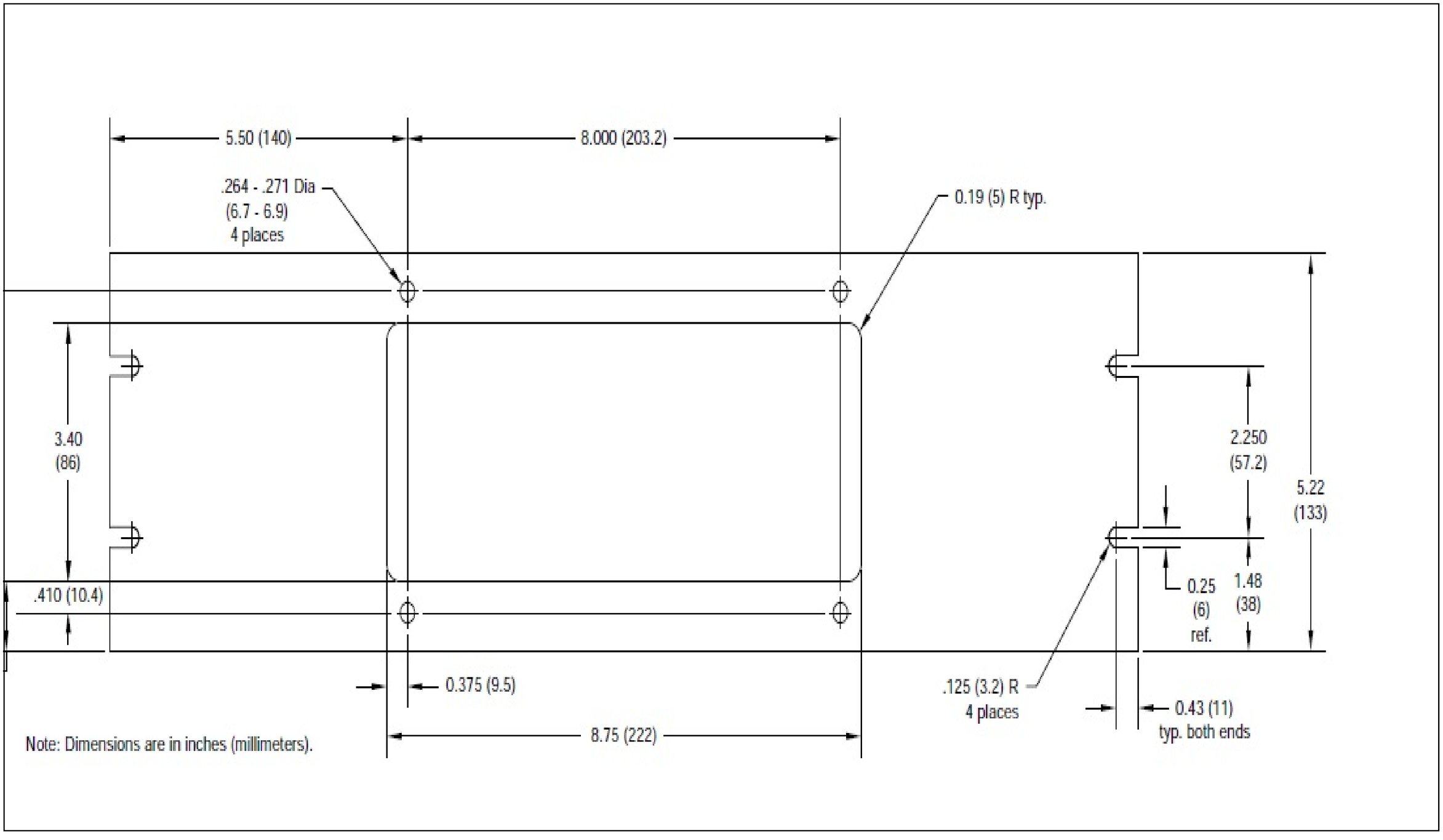


Figure 19: Panel and Rack Mounting Dimensions (ref. dwg #712-255)

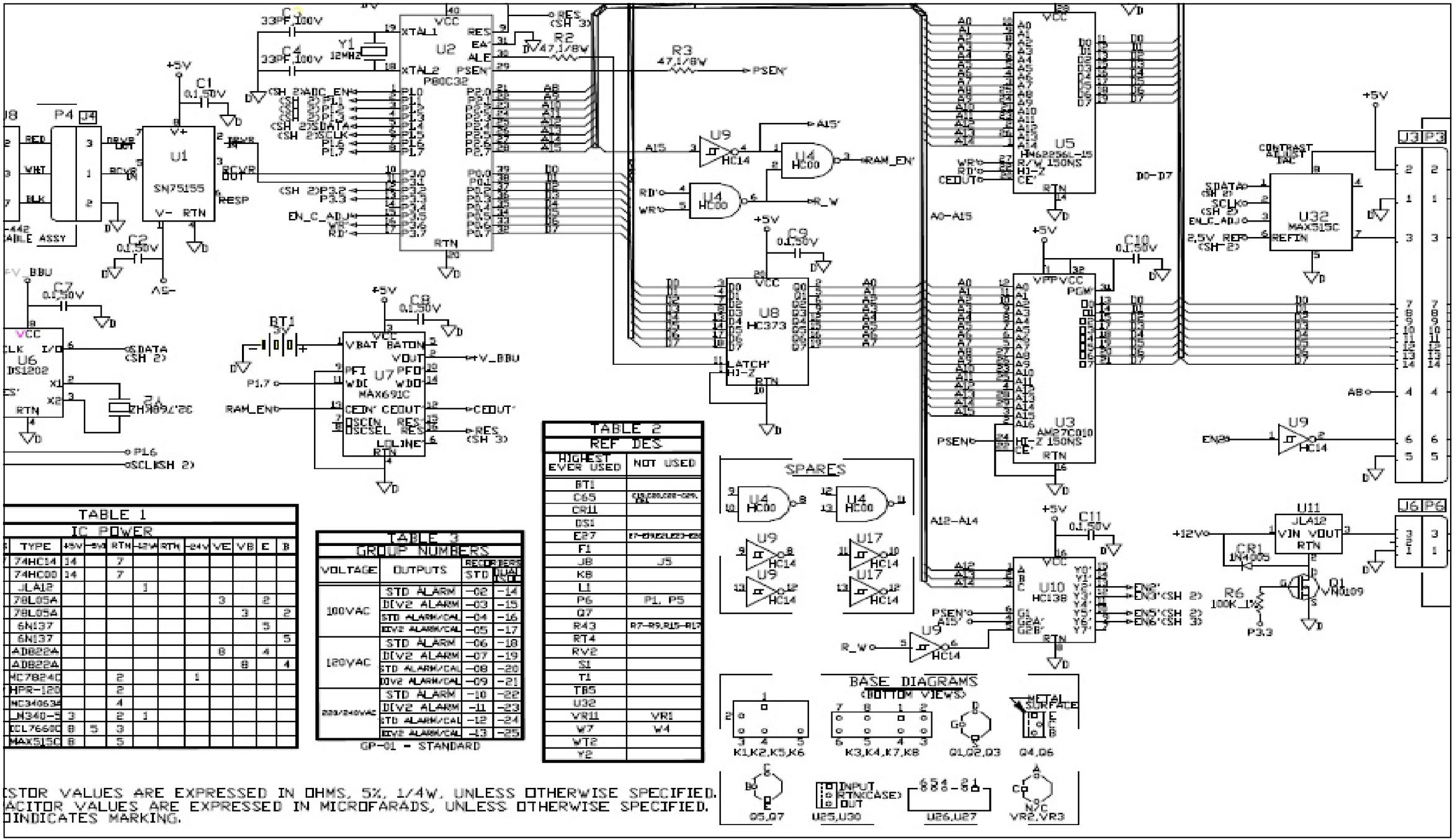
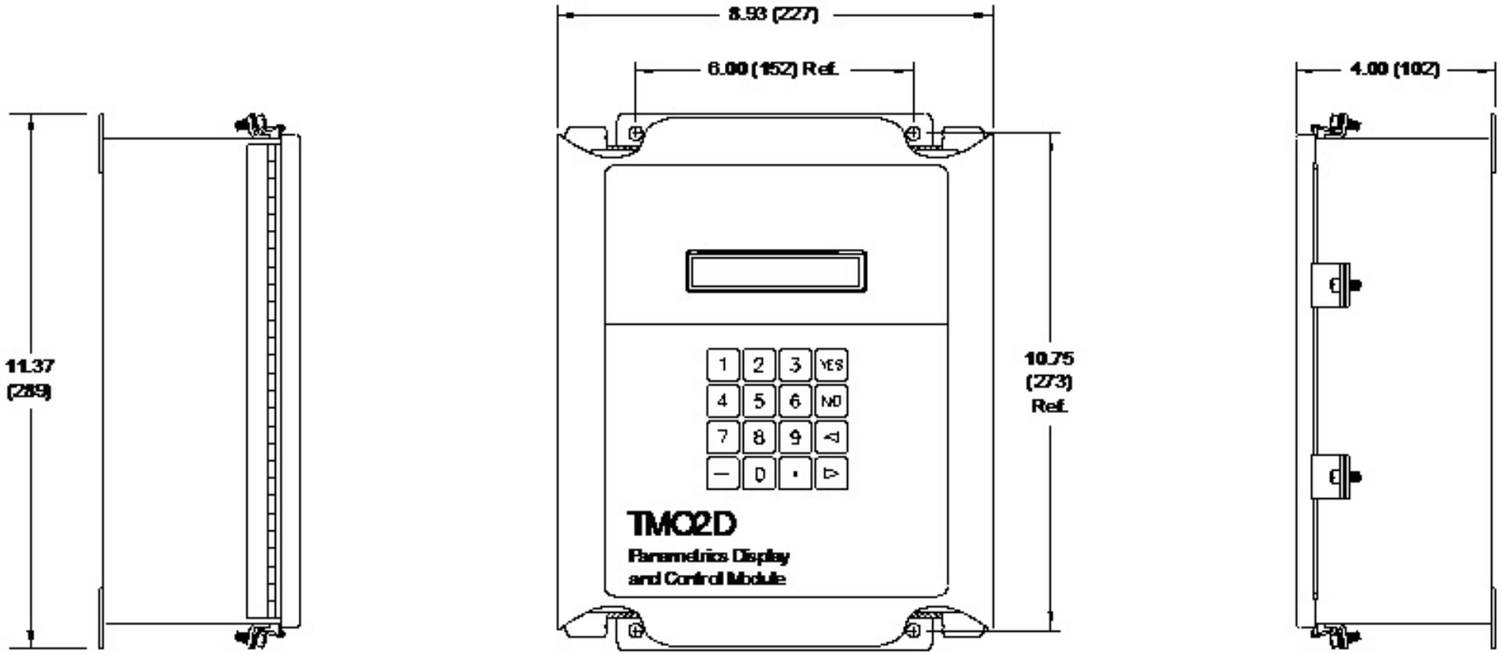


Figure 20: Fiberglass Weatherproof Outline (ref. dwg #701-030)



Note: Dimensions are in inches (millimeters).

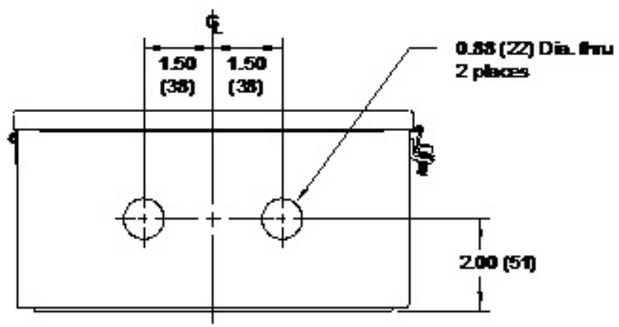


Figure 21: Stainless Steel Weatherproof Outline (ref. dwg #712-1123)

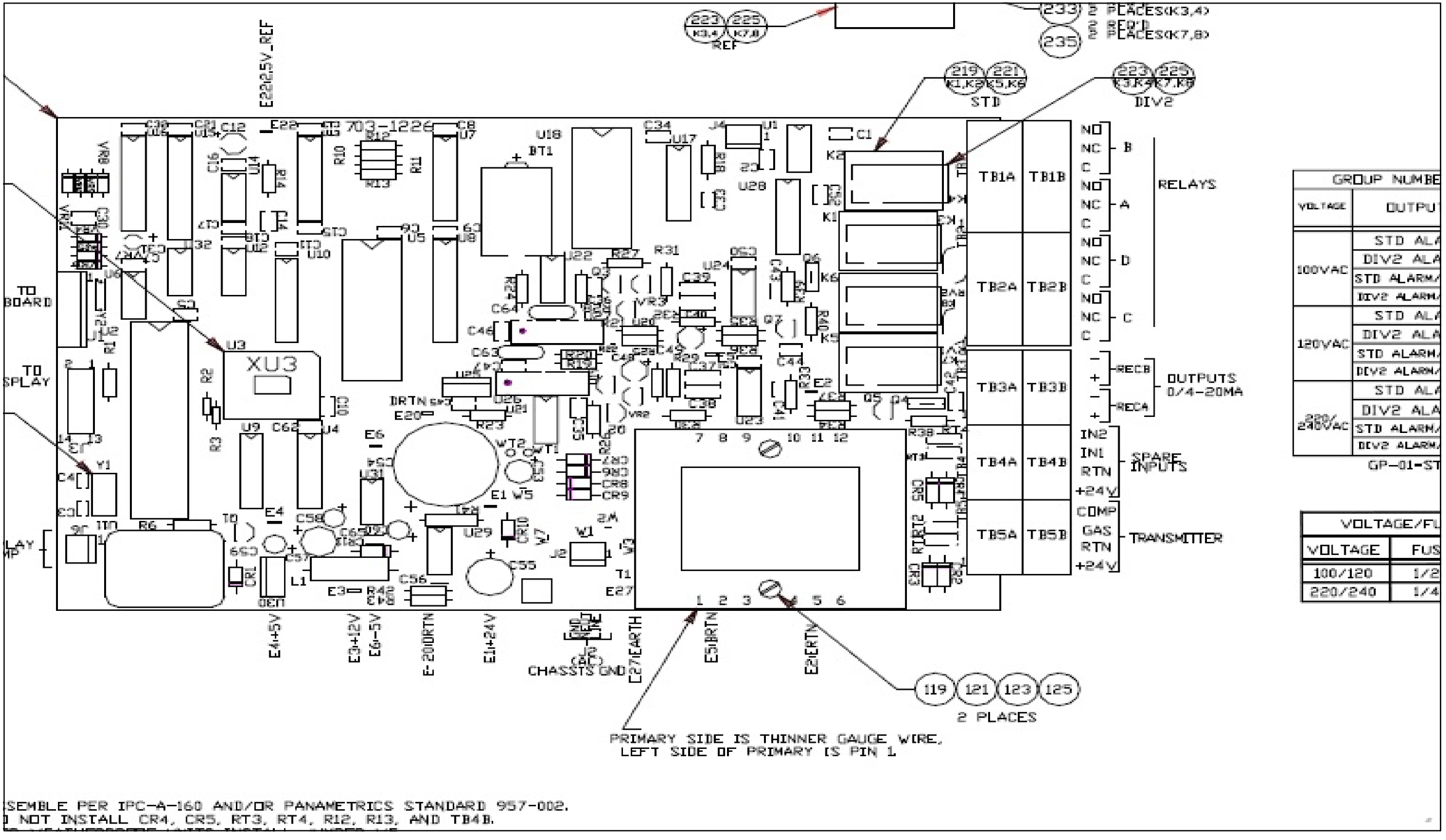


Figure 22: Oxygen Display PC Board Assembly (ref. dwg #703-1226)

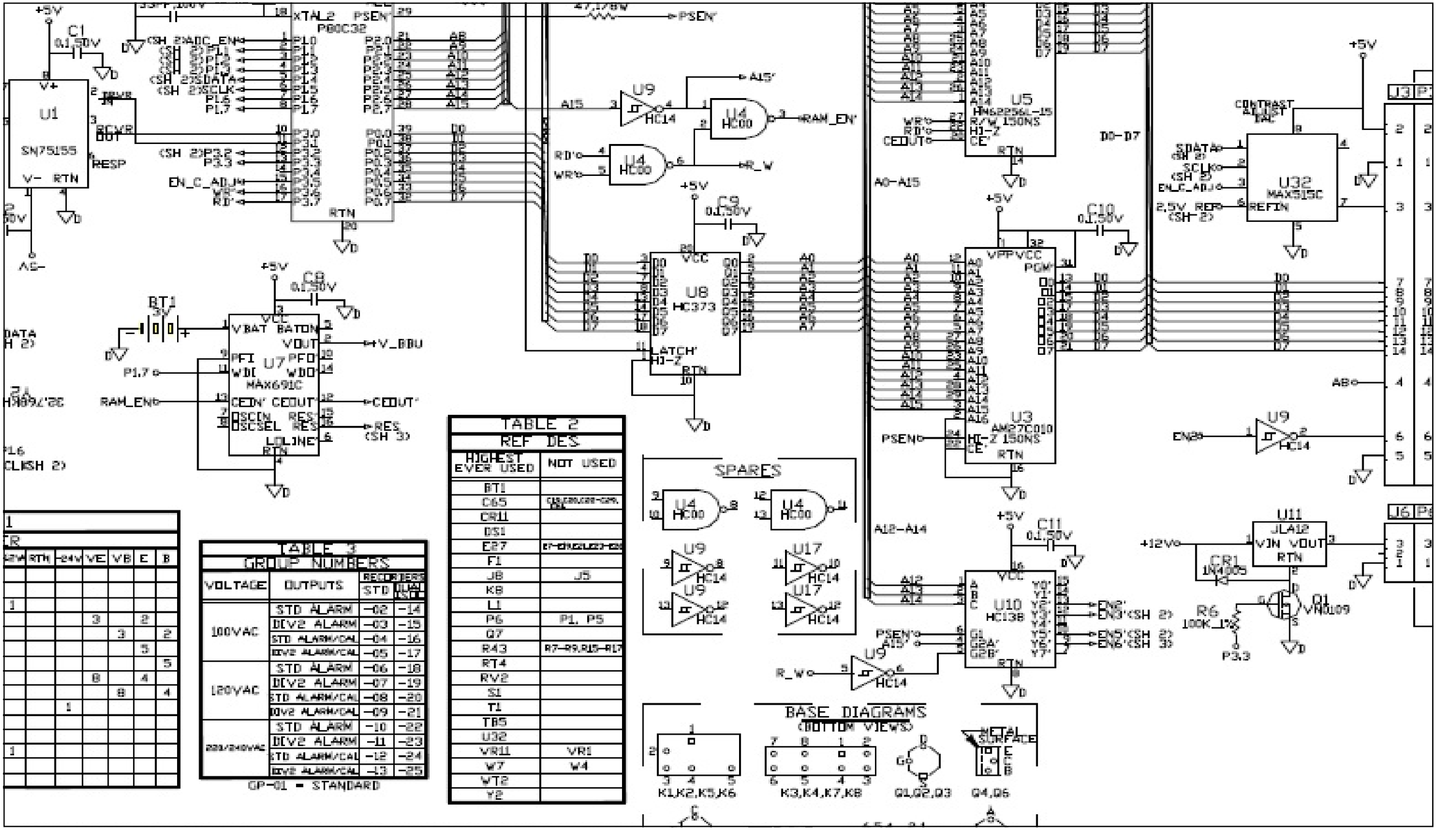


Figure 23: Oxygen Display PC Board Schematic (ref. dwg #700-1226, sht 1)

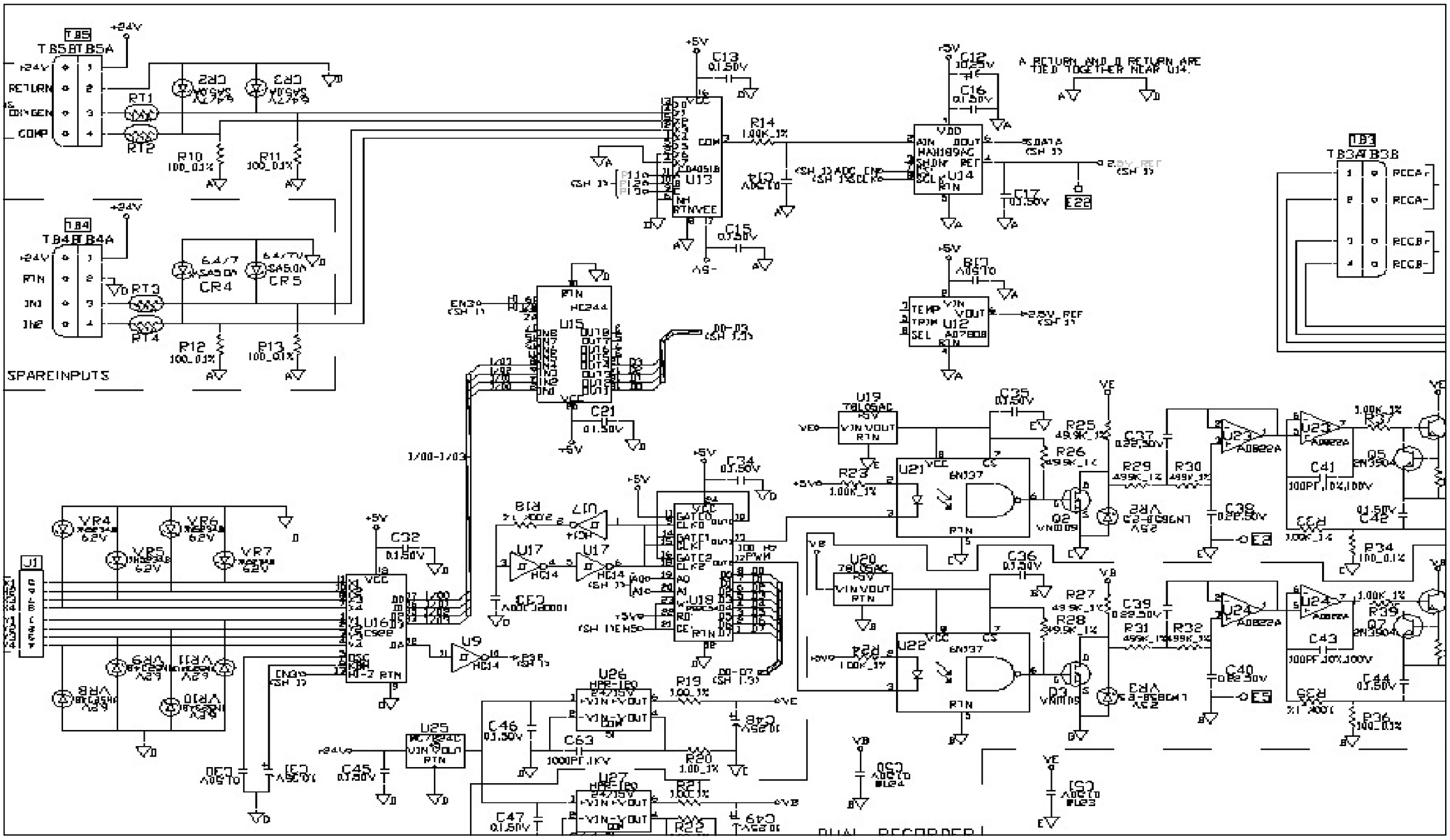


Figure 24: Oxygen Display PC Board Schematic (ref. dwg #700-1226, sht 2)

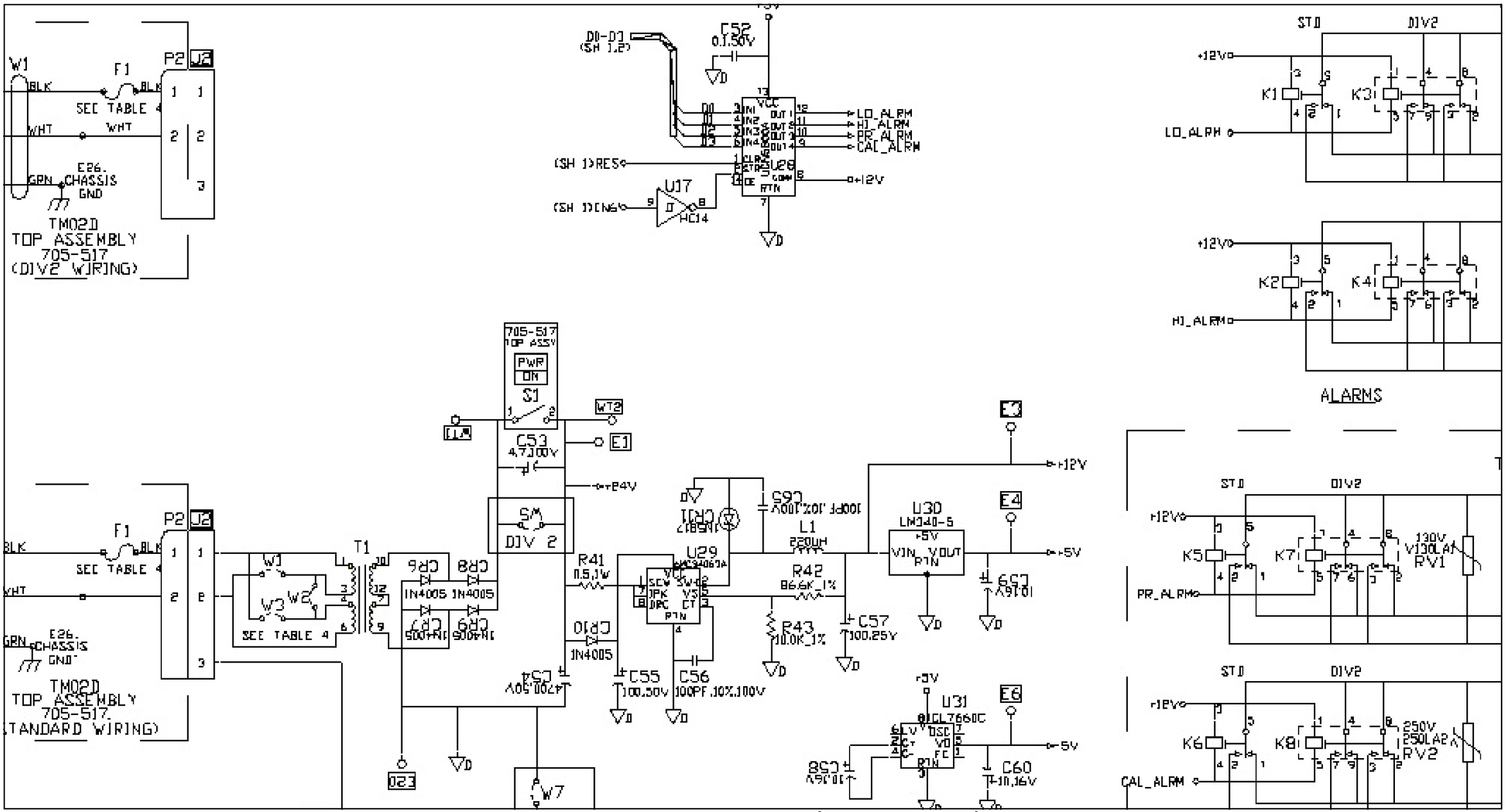


Figure 25: Oxygen Display PC Board Schematic (ref. dwg #700-1226, sht 3)

Appendix B. Menu Maps

- Figure 26: Main Menu: Setup and Outputs
- Figure 27: Main Menu: Relays and Tests
- Figure 28: Main Menu: Calibration Menu
- Figure 29: Main Menu: Calibration (AutoCal Param.), System Log & Resume
- Figure 30: Factory Setup Menu

[no content intended for this page]

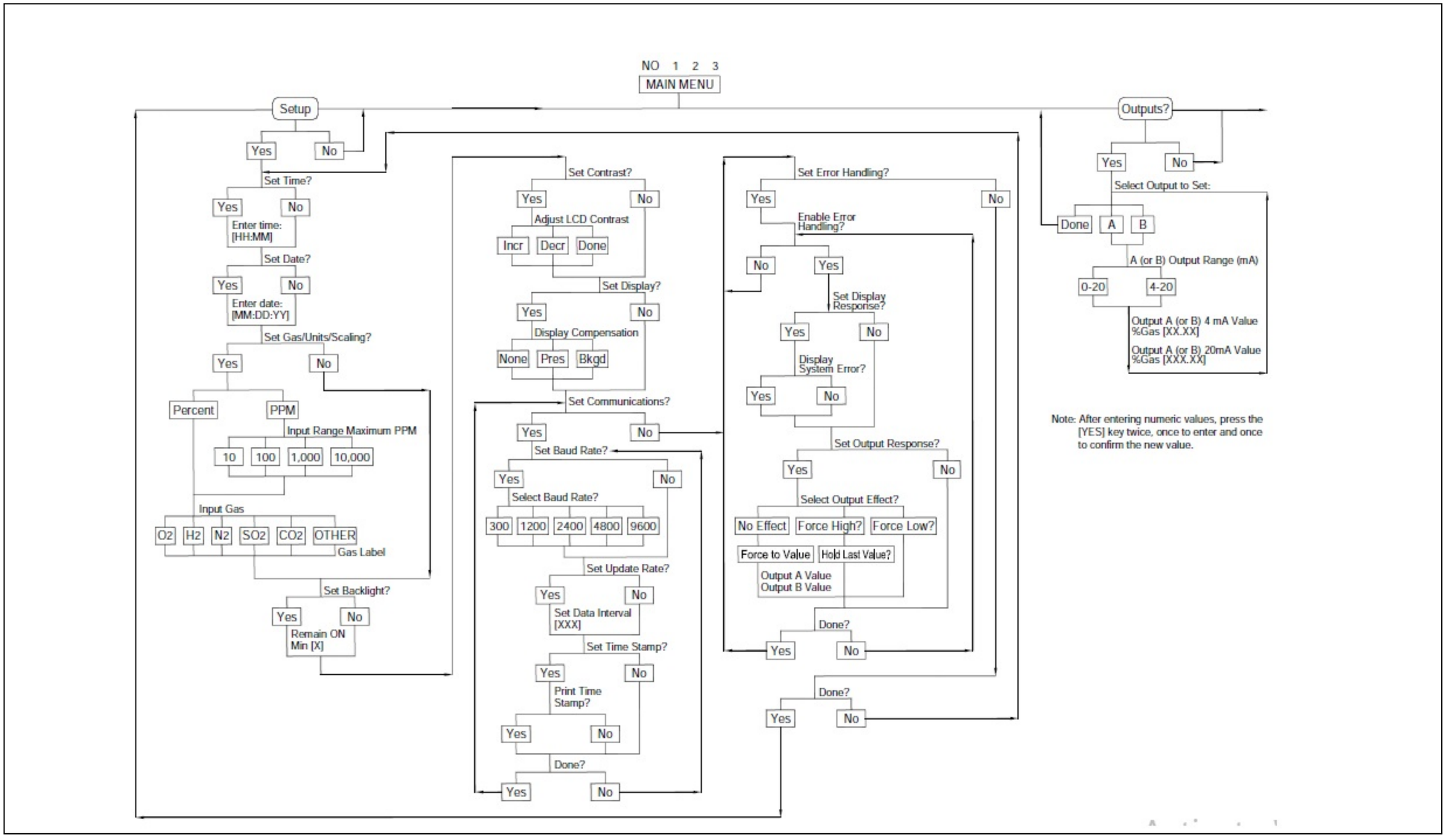


Figure 26: Main Menu: Setup and Outputs

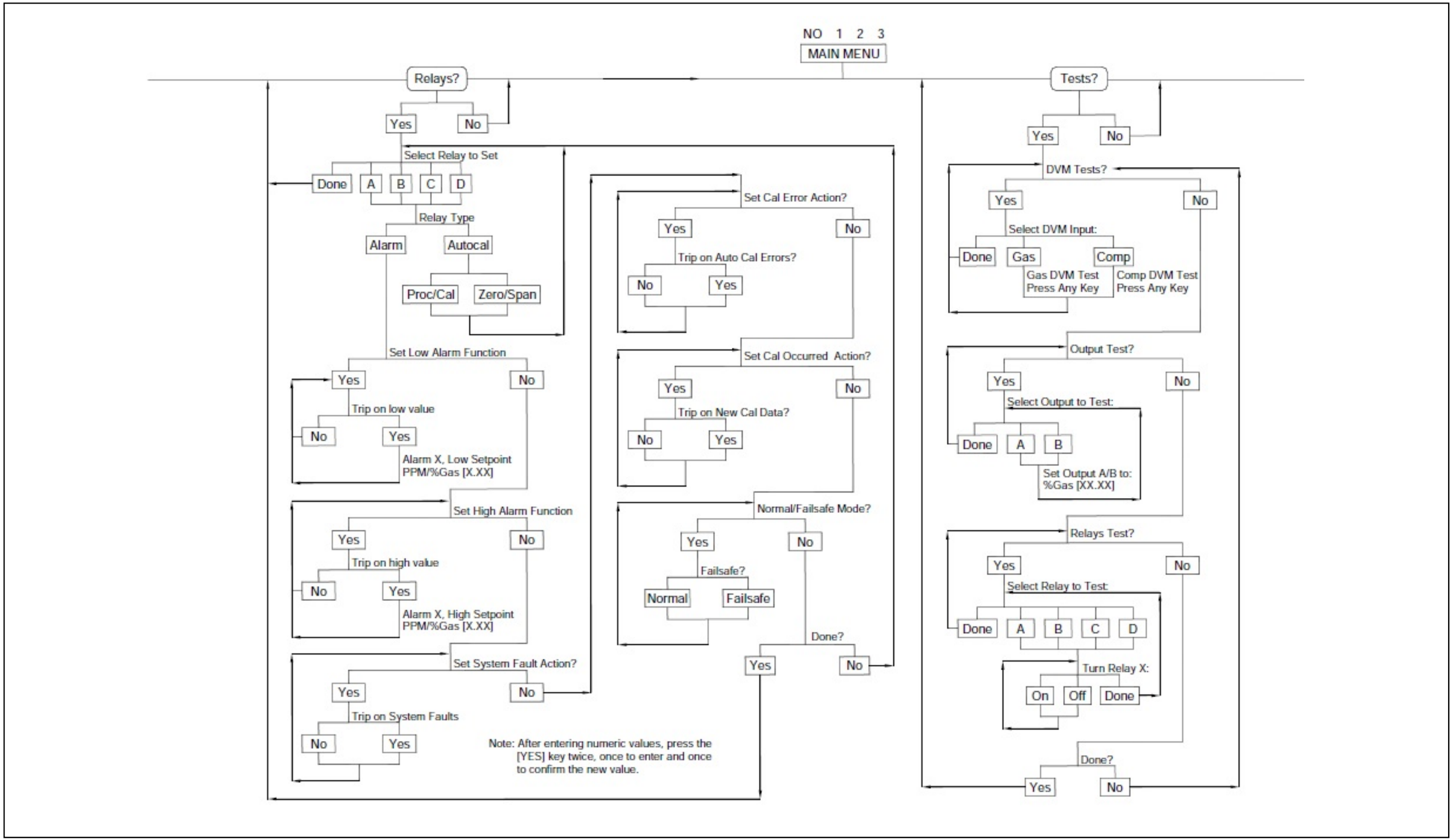


Figure 27: Main Menu: Relays and Tests

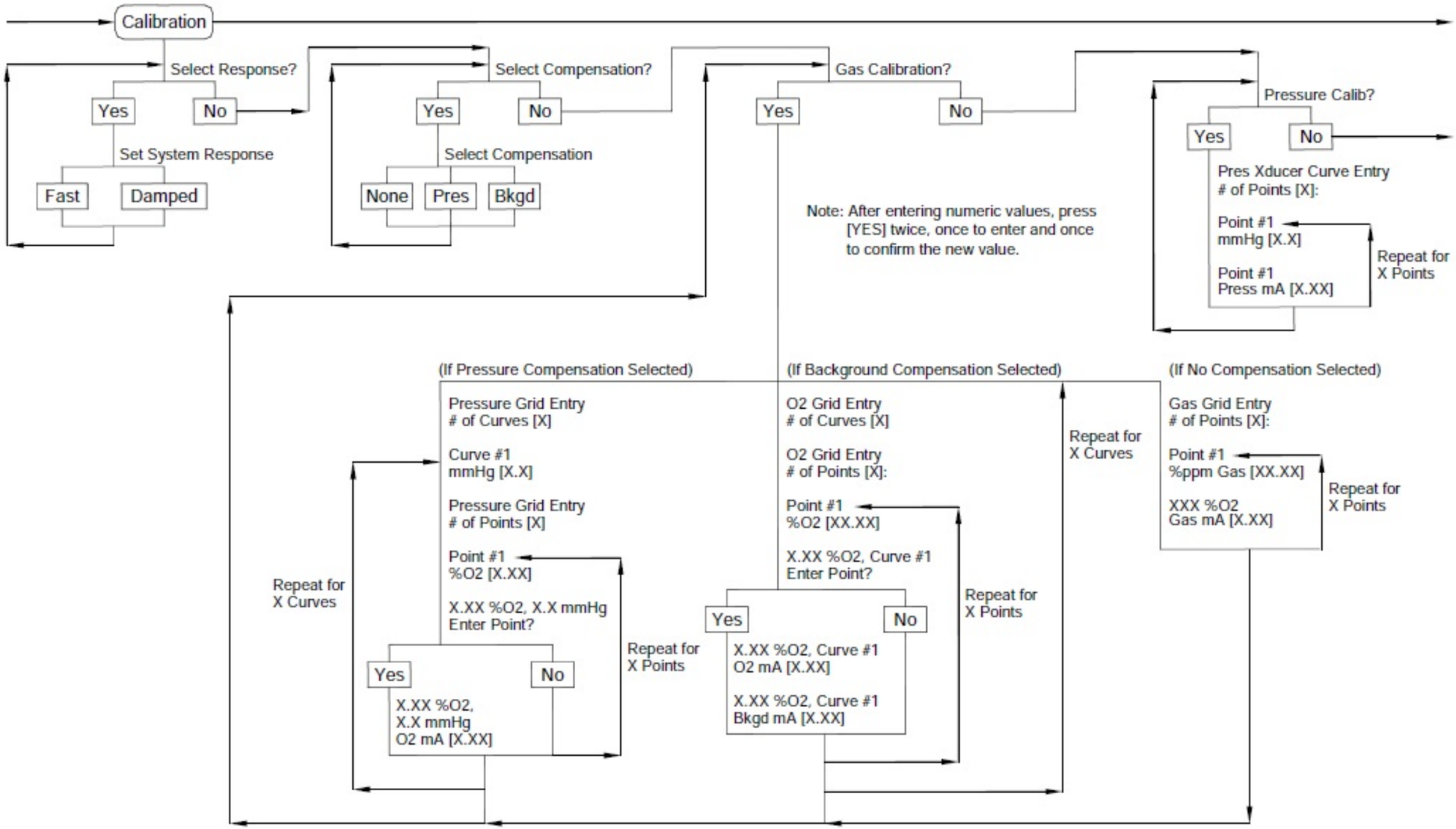


Figure 28: Main Menu: Calibration Menu

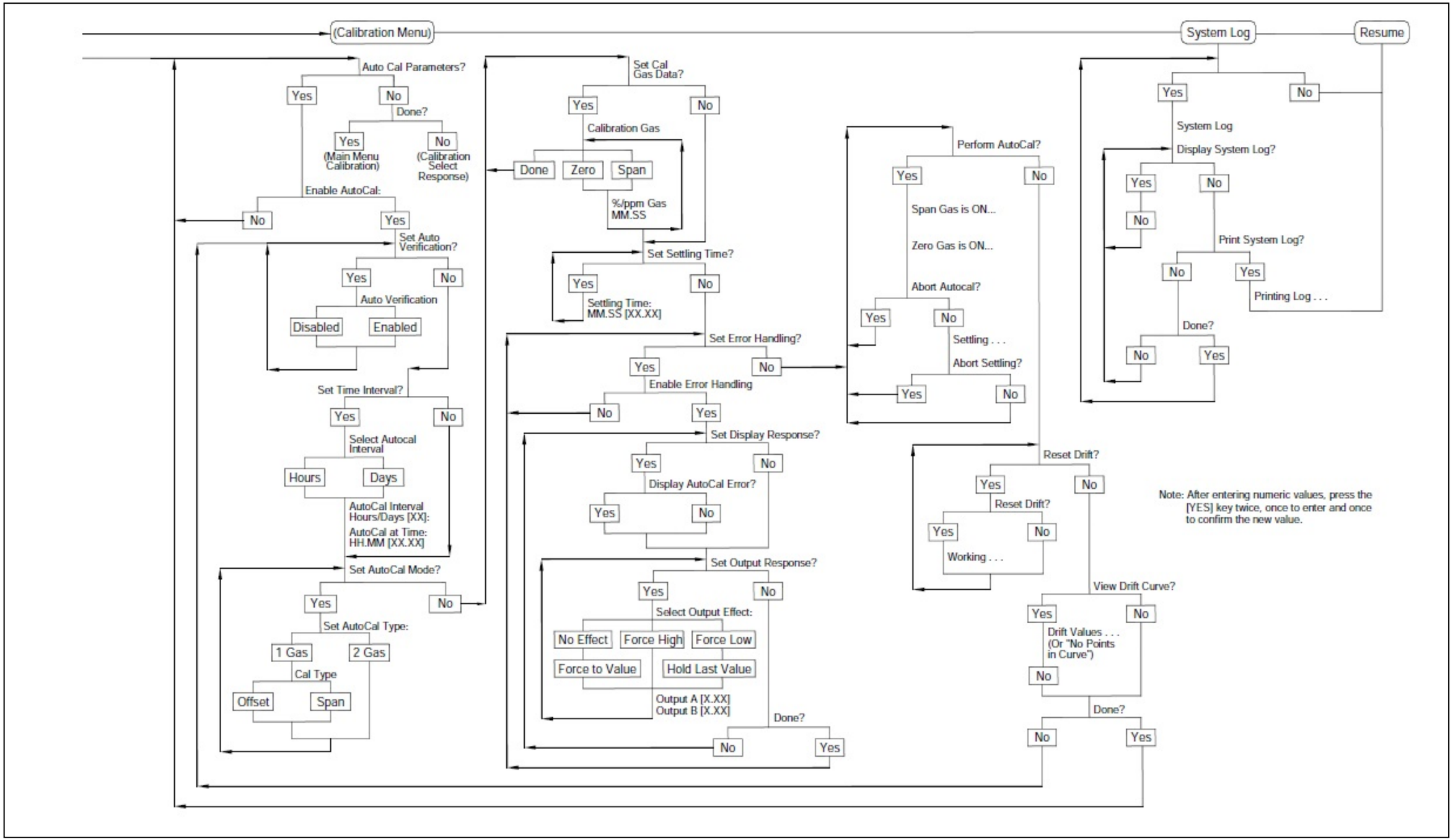


Figure 29: Main Menu: Calibration (Auto Cal Param.), System Log, & Resume

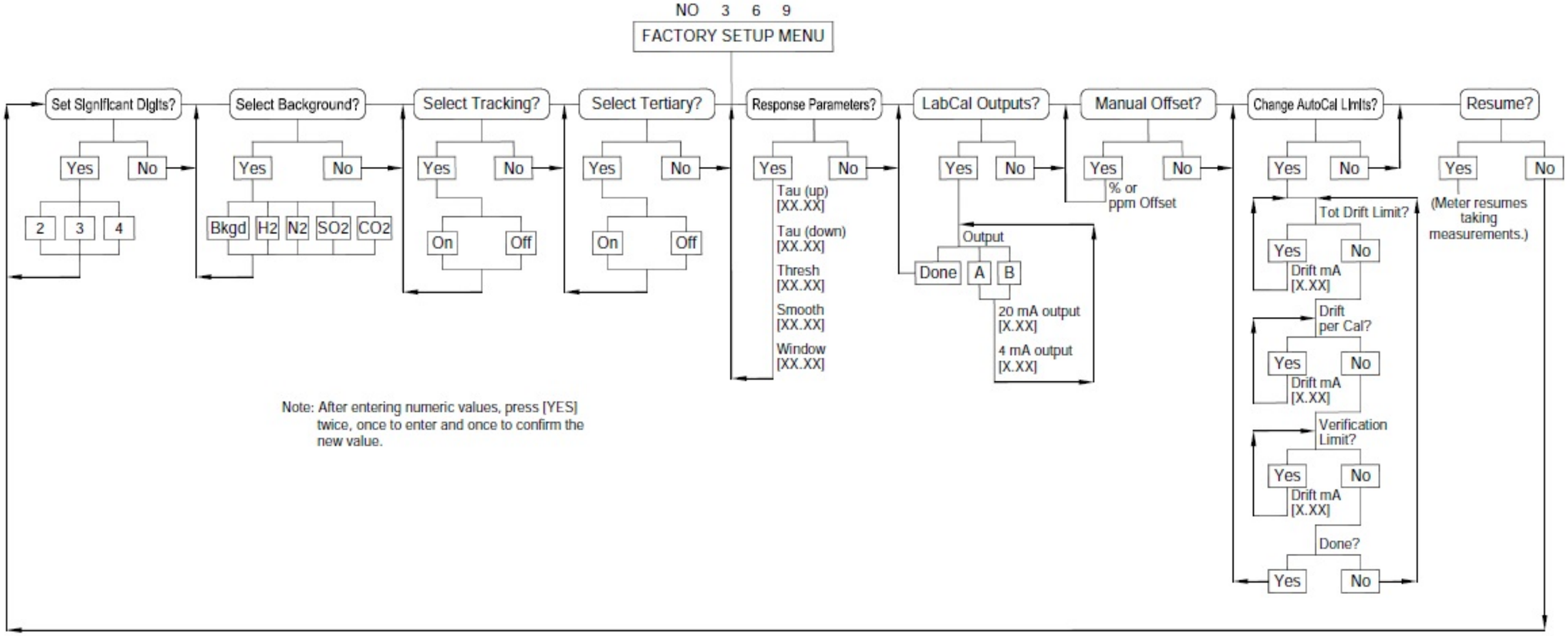


Figure 30: Factory Setup Menu

A

Accuracy, TMO2D Display 61
Alarms, TMO2D Display 61
Ambient Temperature Effect 61
Analog Output, TMO2D Display 61
Analog Outputs, Calibrating 58
Auto Cal Parameters 42, 43
- Menu Map 82
- Set AutoCal Mode? 45
- Set Error Handling? 47
- Set Settling Time? 46
- Set Zero Gas? 45
- View Drift Curve? 51

AutoCal, Changing Limits 59

B

Background Compensation 40
Backlight, Setting 26
Bench Mount, Outline 68

C

Cable Requirements
- External Compensation 4
- Internal Compensation 4
- TMO2 4
- TMO2-TC 10
- XMO2 7
- XMTC 12

Calibrating Analog Outputs 58
Calibration Menu 37
- Auto Cal Parameters 42, 43
- Gas Calibration? 39
- Menu Map 81
- Pressure Calibration? 41
- Select Compensation? 38
- Select Response? 38

CE Mark Compliance
- Requirements for 6, 9, 11, 14

Change AutoCal Limits? 59
Communications, Setting 27
Connecting TMO2 to TMO2D 4
Contrast, Setting 26

D

Damped Response 38
Date, Setting 24
Digital Output, TMO2D Display 61
Dimensions
- Bench Mount 68
- Fiberglass Weatherproof 71
- Panel Mount 69
- Rack Mount 67
- Stainless Steel Weatherproof 72

Display Navigation 22
Display, Setting 27
Drift, Resetting 51
DVM Test? 35

E

Entering Data into the User Program 21, 55
Environmental Compliance iv
Error Handling, Setting 29, 30
External Compensation
- Cable Requirements 4
- Wiring 3

F

Factory Setup
- Menu Map 83
- Menu Mode 55
- Program, Entering Data 55

Fast Response 38
- Parameters 57

Features and Capabilities 1
Fiberglass Weatherproof, Outline 71
Fuses, TMO2D Display 61

G

Gas Calibration 39, 40

I

Information Paragraphs iii
Installation, TMO2D 3
Internal Compensation
- Cable Requirements 4
- Wiring 3

K

Key Functions 22
Keypad for TMO2D 20

L

LabCal Outputs? 58
LCD Display, TMO2D 19, 61

M

Manual Offset? 59
Menu Map
- Auto Cal Parameters 82
- Calibration 81
- Factory Setup 83
- Relays and Tests 80
- Setup and Outputs 79
- System Log and Resume 82

Menu Mode 21
- Data Collection Status 23

Menu Navigation 23
Menu, Factory Setup 55
Mounting the TMO2D Display 3

O

Operate Mode 21, 55
Outline
- Bench Mount 68
- Fiberglass Weatherproof 71
- Panel Mount 69
- Rack Mount 67
- Stainless Steel Weatherproof 72

Output Test 36
Outputs Menu 30
- Menu Map 79

P

Panel Mount, Outline 69
Physical Specifications 62
Power, TMO2D Display 61
Powering Up TMO2 19
Pressure Calibration? 41
Pressure Compensation 40
Programming the TMO2D 22

R

Rack Mount, Outline 67
Relays Menu 31
  Menu Map 80
Relays Test 36
Reset Drift? 51
Response Parameters (for Fast Response) 57
Resume Menu Map 82
Return Policy 89
RS-232C Serial Port
  Correspondence of Keys 20
  Remote Operation 20

S

Safety
  Auxiliary Equipment iii
  General Issues iii
  Personal Equipment iii
Select Background? 56
Select Compensation? 38
Select Response? 38
Select Tracking? 57
Set AutoCal Mode? 45
Set Error Handling? 47
Set Settling Time? 46, 47
Set Significant Digits? 56
Set Span Gas? 46
Set Time Interval? 44
Set Zero Gas? 45
Setup Menu 23
  Menu Map 79
  Set Backlight? 26
  Set Communications? 27
  Set Contrast? 26
  Set Date? 24
  Set Display? 27
  Set Error Handling? 29, 30
  Set Time? 24
Specifications
  Physical 62
Stainless Steel Weatherproof, Outline 72
System Log Menu Map 82

T

Temperature, TMO2D Display 61
Tests Menu 34
  Menu Map 80
  Output Test 36
  Relays Test 36
Time, Setting 24
TMO2 Transmitter
  Cable Requirements 4
  Powering Up 19
TMO2D
  Configurations 3
  Installation 3
  LCD Display 19
  Wiring to Other Components 15
TMO2D Display
  Accuracy 61
  Alarms 61
  Ambient Temperature 61
  Analog Output 61
  Digital Output 61
  Dimensions 62
  Environmental 62
  European Compliance 62
  Fuses 61
  Key Functions 22
  Keypad 20
  LCD Display 61
  Mounting 3
  Ordering Information 63
  Physical Specifications 62
  Power 61
  Programming 22
  Temperature 61
  Weight 62
TMO2-TC Cable Requirements 10
TMO2-TC Transmitter
  Wiring to TMO2D 10
Tracking 57

U

Update Rate in Setup Menu 28
User Program, Entering Data 21, 55

V

View Drift Curve? 51

W

Warranty 89
WEEE Directive iv
Wiring
  External Compensation 3
  Internal Compensation 3
  TMO2D to Other Components 15

X

XMO2 Cable Requirements 7
XMTC Cable Requirements 12
XMTC Transmitter
  Wiring to TMO2D 12

Warranty

Each instrument manufactured by Panametrics is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of Panametrics. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If Panametrics determines that the equipment was defective, the warranty period is:

- one year from delivery for electronic or mechanical failures
- one year from delivery for sensor shelf life

If Panametrics determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by Panametrics, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a Panametrics instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify Panametrics, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, Panametrics will issue a RETURN AUTHORIZATION NUMBER (RAN), and shipping instructions for the return of the instrument to a service center will be provided.
2. If Panametrics instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, Panametrics will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If Panametrics determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

[no content intended for this page]

Customer Support Centers

U.S.A.
The Boston Center
1100 Technology Park Drive
Billerica, MA 01821
U.S.A.
Tel: 800 833 9438 (toll-free)
978 437 1000
E-mail: panametricstechsupport@bakerhughes.com

Ireland
Sensing House
Shannon Free Zone East
Shannon, County Clare
Ireland
Tel: +353 (0)61 470200
E-mail: panametricstechsupport@bakerhughes.com

Copyright 2023 Baker Hughes company.

This material contains one or more registered trademarks of Baker Hughes Company and its subsidiaries in one or more countries. All third-party product and company names are trademarks of their respective holders.

BH044C11 EN E (08/2023)

Baker Hughes