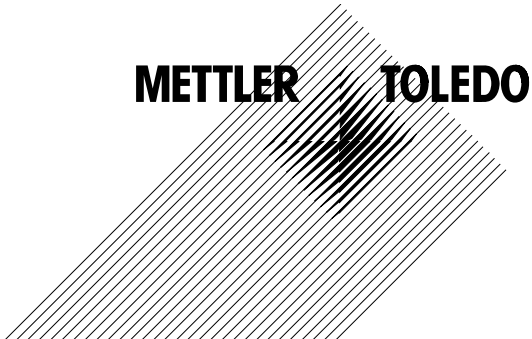
THORNTON
Leading Pure Water Analytics

Part No. 84337

200pH
pH/ORP
Instrument
Instruction Manual



IMPORTANT SAFETY INFORMATION

Please read and observe the following:

INSTALLATION: This instrument must be installed by trained instrumentation personnel in accordance with relevant local codes and instructions in this manual. Observe all instrument specifications and ratings.

SHOCK HAZARD: Make sure power to all wires is turned off before proceeding with installation or service of this instrument. High voltage may be present on the input power and relay wires.

RELAY CONTROL ACTION: Relays will always de-energize on loss of power, equivalent to normal state, regardless of relay state setting for powered operation. Configure any control system using these relays with fail-safe logic accordingly.

PROCESS UPSETS: Because process safety conditions may depend on consistent operation of this instrument, take appropriate action to maintain conditions during sensor cleaning, replacement or sensor or instrument calibration.

This manual includes safety information with the following designations and formats:

WARNING: POTENTIAL FOR PERSONAL INJURY.

CAUTION: possible instrument damage or malfunction.

NOTE: important operating information.

TABLE OF CONTENTS

CHAPTER 1: GETTING STARTED

INTRODUCTION

The 200pH is an analytical and process control instrument for measuring pH or ORP (oxidation-Reduction or Redox Potential). A 1 line x 16 character Liquid Crystal Display (LCD) module conveys measuring data and setup information. The display is backlit for viewing in all lighting conditions. The menu structure allows the operator to modify all operational parameters by using keys on the front panel. A menu-lockout feature, with password protection, is available to prevent the unauthorized use of the meter. The 200pH is configured with up to four relays for process control.

The 200 pH instrument architecture allows two channels of pH and/or ORP measurement in most applications. Conventional preamp circuit isolation eliminates the effects of modest solution potential differences. However, large differences in potential between two sensor locations may affect the measurement stability and/or cause significant errors. Factors that increase solution ground potential difference are:

- Close proximity of sensors to different alloys in systems with metal pipe or tanks.
- Long distance between sensors in a plastic piped system.
- Electrical currents running through piping, as in electroplating, electrodeionization, etc.

Where these or similar conditions exist, use Thornton 1200-series preamplifiers with detachable sensors.

The 200pH instrument is equipped with a communication interface that can be configured as either an RS422 or an RS232. This interface provides real-time data output and complete instrument configuration capabilities for central monitoring via Personal Computer (PC) or Programmable Logic Controller (PLC). An external isolator for the digital communications signal is required. For coverage of communications, see Manual 84422.

FEATURES

Display: 1 line x 16 character backlit LCD.

Measurements: pH, °C, °F, ORP (Oxidation-Reduction or Redox Potential).

Measurement Channels: two.

Signal Inputs per channel: 2 (total of 4 signals for measurement).

Measurement Cycle Time: 1 second (4 measurements processed per second).

Programmable: all setup information is stored in a non-volatile memory.

Setpoints (alarms): 4 independent alarms programmable as high or low limits.

Relays: 2 standard; 4 relays optional. All have programmable delay time and hysteresis.

Outputs: 2 isolated analog outputs (4-20mA, may be re-calibrated for 0-20 mA), optional.

Communications: RS232/RS422 interface, bi-directional; external isolation required.

Security: keypad lockout with password.

Calibration: complete instrument, output, and sensor calibration. Calibration can be NIST traceable.

Watchdog Timer: with a power supply monitor, to prevent unexpected instrument lockup.

Built-In Diagnostics: several self tests performed automatically and can be initiated at any time.

OVERVIEW OF OPERATION

When power is applied to the 200pH, the initialization process begins. The instrument will perform a number of self tests. Any problems detected during these tests will be reported by a displayed message.

Next, all setup parameters (setpoints, states, relay conditions, etc.) are restored from non-volatile memory.

The meter will then begin the measurement process. A complete measurement cycle is performed once per second and consists of the following:

1. Measure signals and compute measurements.
2. Check setpoints against the measurements.
3. Control the relays.
4. Update analog output signals.
5. Transmit measurement data over the communication port.
6. Display data (if not displaying menu).

At any time during this process the menus can be accessed by pressing one of the menu keys. The display of a menu will not affect the measurement process.

INSTALLATION & SETUP PROCEDURE

The following guideline shows the steps necessary to install a 200pH meter and begin operation.

1. Follow the meter installation procedure for physically mounting the meter, as outlined in Chapter 2: Installing the 200pH. The meter may be mounted in a panel, on a pipe, or on a wall.

   Optional: rear cover is required for wall and pipe mounting.
2. Make all necessary electrical connections to the meter after it is physically mounted. The wiring procedure is outlined in Chapter 2.
3. Required wiring: input power and sensor patch cord.
4. Optional wiring: relays, analog outputs, and serial port.
5. Set appropriate power line frequency to reduce measurement noise. See Chapter 4: Making Measurements.
6. Connect the sensor to the patch cord.
7. Select the desired measurement as shown in Chapter 4: Making Measurements.
8. Enter sensor constants as outlined in Chapter 9: Sensor Calibration.
9. Optional: program the analog outputs as shown in Chapter 7: Using Analog Outputs.
10. Optional: program the setpoints as shown in Chapter 5: Using Setpoints.
11. Optional: program the relays as shown in Chapter 6: Using Relays.
12. Optional: program other features such as averaging, special functions, etc.

CHAPTER 2: INSTALLING THE 200pH

UNPACKING

Each 200pH is packed in an individual biodegradable carton. Customers are advised to retain the packaging in the event that the instrument must be returned to Thornton for service or calibration. Open the carton carefully to insure that the product is not damaged or dropped.

This carton should contain:

1-200pH Instrument

1-200pH Startup Sheet

1-200pH Instruction Manual

1-Certificate of Calibration

1-Panel Mounting Kit-gasket, screws, etc.

INSTALLATION

The 200pH can be mounted in a panel, on a pipe or attached to a wall.

Panel Mounting Cutout and Installation

The panel cutout should measure 7.56 inches wide by 3.780 inches high (192 mm X 96 mm). Drill four holes for the #10 mounting screws. See Figure 14.3 for panel cutout size and mounting screw hole spacing. When mounting multiple instruments on the same panel, note the front flange dimensions in Figure 14.2 in order to allow enough space between instruments.

Panel cutouts should be clean and free of burrs and sharp edges. The proper dimensions allow an instrument to slide freely into the cutout.

Install the panel gasket (supplied with instrument) on the instrument as shown in Figure 14.5. Slide the instrument into the cutout and secure it with the mounting screws.

CAUTION: Do not over tighten the screws as this may crack the case.

If the rear cover is used in a panel mounted installation, the 200pH unit must be installed in the panel opening before the rear cover is installed.

Wall Mounting

The 200pH can be easily mounted to a wall when the rear cover is installed. The flanges on the ends of the cover contain holes for screws to fasten the assembly to the wall. A template for drilling mounting holes is included in the wall mount kit.

Pipe Mounting

The 200pH can be mounted to a pipe with the pipe mounting accessory kit (shown in Figure 14.7. The assembly procedure is shown in Figure 14.6.

ELECTRICAL CONNECTIONS

All electrical connections are made at terminal blocks at the rear of the 200pH case which can accept 12 to 28 AWG wires.

WARNING: MAKE SURE POWER TO ALL WIRES IS TURNED OFF BEFORE PROCEEDING WITH THE INSTALLATION. HIGH VOLTAGE MAY BE PRESENT ON THE INPUT POWER WIRES AND RELAY WIRES.

CAUTION: To prevent electrostatic discharge (ESD) from damaging the instrument during installation, the installer must be electrically grounded, i.e., wear a conductive wrist strap connected to earth ground.

Input Power and Relay Connections

Terminal block TB4 contains connections for the input line power and TB1 relay contacts respectively. Depending upon the model number, the 200pH will have either 2 or 4 relays. Table 2.1 shows the wiring sequence.

All relays have “dry contacts”; they are potential-free and require external power to be wired in series with the load and instrument terminals. Relays 3 and 4, if specified, are solid state AC-only relays (triacs) and require a minimum current of 10 mA to switch reliably. With very small loads such as a neon bulb, test meter or PLC, a load resistor is required in parallel with the load, e.g. a 10K ohm, 2 watt resistor, for operation with 115 VAC.

TB4	**Input Power**
L	115V/230 VAC Line Power
N	115V/230VAC Neutral
⊕	Earth Ground
TB1	**Relay Function**
NC1	Relay1: Normally Closed
C1	Relay1: Common
NO1	Relay1: Normally Open
NC2	Relay 2: Normally Closed
C2	Relay 2: Common
NO2	Relay 2: Normally Open
C3	Relay 3: Common
NO3	Relay 3: Normally Open
C4	Relay 4: Common
NO4	Relay 4: Normally Open

Table 2.1: Input Power and Relay Connections

WARNING: MISWIRING THE AC POWER MAY DAMAGE THE INSTRUMENT AND WILL VOID ALL WARRANTIES

Setting Input Voltage for 115 VAC or 230 VAC

The input voltage for a 200pH can be set for either 115 VAC or 230 VAC operation. The input voltage is preset at the factory and is indicated on the label on the side of the unit. Jumpers on the printed circuit board can be changed to change the input voltage. See Figure 14.9. W4 jumper pins are located between the power transformer and the fuse. For 115 VAC operation jumper pins 1-2 and 3-4 must be used. For 230 VAC operation only a jumper on pins 2-3 must be installed. The jumpers can be accessed by removing two screws from the back panel and carefully lifting the panel off.

WARNING: IF THE INPUT VOLTAGE JUMPERS ARE CHANGED YOU MUST LABEL THE UNIT WITH THE NEW VOLTAGE REQUIREMENT. ALSO, THE FUSE MUST BE CHANGED TO THE PROPER TYPE TO AVOID RISK OF FIRE HAZARD

Fuse requirements:

For 115 VAC: 1/8 Amp. SB, 250 VAC

For 230 VAC: 1/16 Amp, SB, 250 VAC

Setting Input Voltage for 24 VDC

The 200pH can be operated from a 24 VDC power supply instead of the typical 115 VAC or 230 VAC source.

NOTE: The 24 VDC power must be isolated from earth ground and from other instruments.

Remove any AC power connections from terminal block TB1.

1. Move circuit board jumper W6 to the 24V position (left two pins) as shown in Figure 14.9.
2. Connect + 24 VDC power to the connection labeled PS+ on terminal block TB3. Connect the power supply ground to the connection labeled PS- on TB3.

WARNING: AC POWER CONNECTIONS MUST BE REMOVED WHEN USING THE +24V POWER INPUT.

NOTE: The 24 VDC input is not fused within the meter. An external fuse is recommended.

Output Connections

Connections for all outputs are made to terminal block TB2. The serial port can be configured as an RS232 port (shown in Table 2.2.) or an RS422 port (shown in Table 2.3). An external signal isolator is recommended when using the serial port to prevent ground loop from affecting measurements.

TB2 Label	RS232 Function
GND	Ground
TXD+	Not Used
TXD-	Transmit Data
RXD+	Not Used
RXD-	Receive Data

Table 2.2: RS232 Connections

TB2 Label	RS 422 Function
GND	Ground
TXD+	Transmit Data Positive
TXD-	Transmit Data Negative
RXD+	Receive Data Positive
RXD-	Receive Data Negative

Table 2.3: RS422 Connections

Each analog output has + and – connections. Analog outputs are self-powered with maximum load resistance of 500 ohms. These signals are isolated from earth ground and from the measurements.

CAUTION: Do not connect analog outputs to circuits supplying power.

CAUTION: Do not connect analog output cable shield(s) to the adjacent GND terminal. Connect shields only to the earth ground terminal next to AC line power.

NOTE: Separate power and relay wiring from signal wiring as much as possible.

TB2 Label	Analog Output Function
AO2-	Output 2 (-)
AO2+	Output 2 (+)
AO1-	Output 1 (-)
AO1+	Output 1 (+)

Table 2.4: Analog Output Connections

Sensor Connections

The sensor is connected to terminal block TB3. Either set (or both) of six terminals plus the +5 V terminal, grouped as Channel A or Channel B can be used for the sensors. Patch cords for the 200pH have a connector on one end and tinned leads on the other end. The tinned leads are numbered to match the numbers on TB3 except the blue (7) wire which must go to the +5 V terminal. Table 2.5. shows the wiring pattern for sensors.

NOTE: Patchcord wire #7 (blue) must be used with this meter. It is necessary to remove the clear shrink tubing holding it to the cable

WARNING: MISWIRING PATCH CORDS MAY DAMAGE SENSORS AND WILL VOID ALL WARRANTIES. ALL WIRES MUST BE CONNECTED. EACH SENSOR PATCH CORD WIRE IS NUMBERED TO MATCH A NUMBER ON THE REAR LABEL. TO VERIFY WIRE COLOR AND NUMBER, CHECK TABLE.

TB3 Label	Wire Color	Sensor Connection
GND (6)	Black	
SIG5 (5)	Red	
SIG4 (4)	Green	Channel B Sensor
SIG3 (3)	White	Connections
SIG2 (2)	Clear	
SIG1 (1)	Wht/Blue	
+5V	Blue	
GND (6)	Black	
SIG5 (5)	Red	
SIG4 (4)	Green	Channel A Sensor
SIG3 (3)	White	Connections
SIG2 (2)	Clear	
SIG1 (1)	Wht/Blue	
+5V	Blue	

Table 2.5: Sensor Connections

CHAPTER 3: USING THE 200pH

APPLYING POWER TO THE 200pH

After applying power to the meter, the display will show an introduction message for three seconds and then begin making measurements. This message shows the model number and the software version number as follows:

3XXpH Ver X.XX

While the message is being displayed the instrument is performing self diagnostics. Various circuits are tested during this process and any failure will be noted with a message. The diagnostics can be repeated at any time via the menus.

The default measurement display is the pH and temperature reading from the sensor on channel A as shown below:

A10.13pH 23°C

Set the AC Power frequency as described in Chapter 4.

All 200pH meters are calibrated from the factory but QA requirements may call for calibration after installation. The calibration procedure will correct the measurements for any minor errors due to circuit variations, patch cord length, and other factors. See Chapter 8 for more information on meter calibration.

THE DISPLAY

The 200pH uses a 1 line by 16 character alphanumeric display to convey all measurement and setup information. This instrument will display one or two measurements, each with channel indication and unit of measure. A typical display of both channel measurement data is:

A10.13pH B.000xx

This display indicates that channel A is measuring 10.13pH and channel B is not used. The display of the other measurements can be achieved by pressing the UP or DOWN keys.

In the menus, an underline cursor and flashing characters will indicate a field that can be changed. A typical menu appears as follows:

SP1=9.000 _ High

This menu indicates that setpoint #1 is programmed at a value of 9 pH and is set as a high limit. The cursor is under the digit “9” indicating that the UP and DOWN keys can be used to change it. The UP and DOWN keys will move the cursor to the next previous field.

Display Contrast Adjustment

The contrast quality of the display can change with ambient temperature. The display contrast is adjusted from the factory for operation at standard room temperature (25°C). If the meter is operated at an ambient temperature that is much different then it may be necessary to make an adjustment. A potentiometer is accessible from the back side of the instrument to change the contrast. Use a small slotted screwdriver to gently turn the potentiometer. A counter-clockwise turn will increase the contrast and a clock-wise turn will decrease the contrast. The rear panel is shown in Figure 3.1.

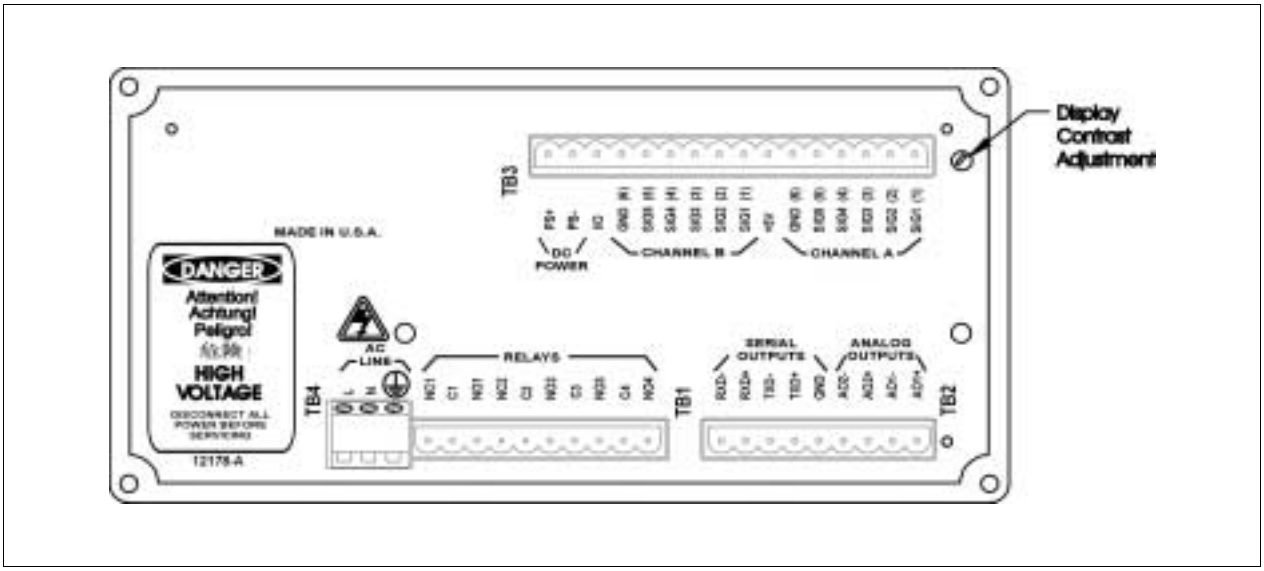


Figure 3.1: 200pH Rear Panel

THE KEYPAD

The 200pH is equipped with an 11-key keypad as shown in Figure 3.2.

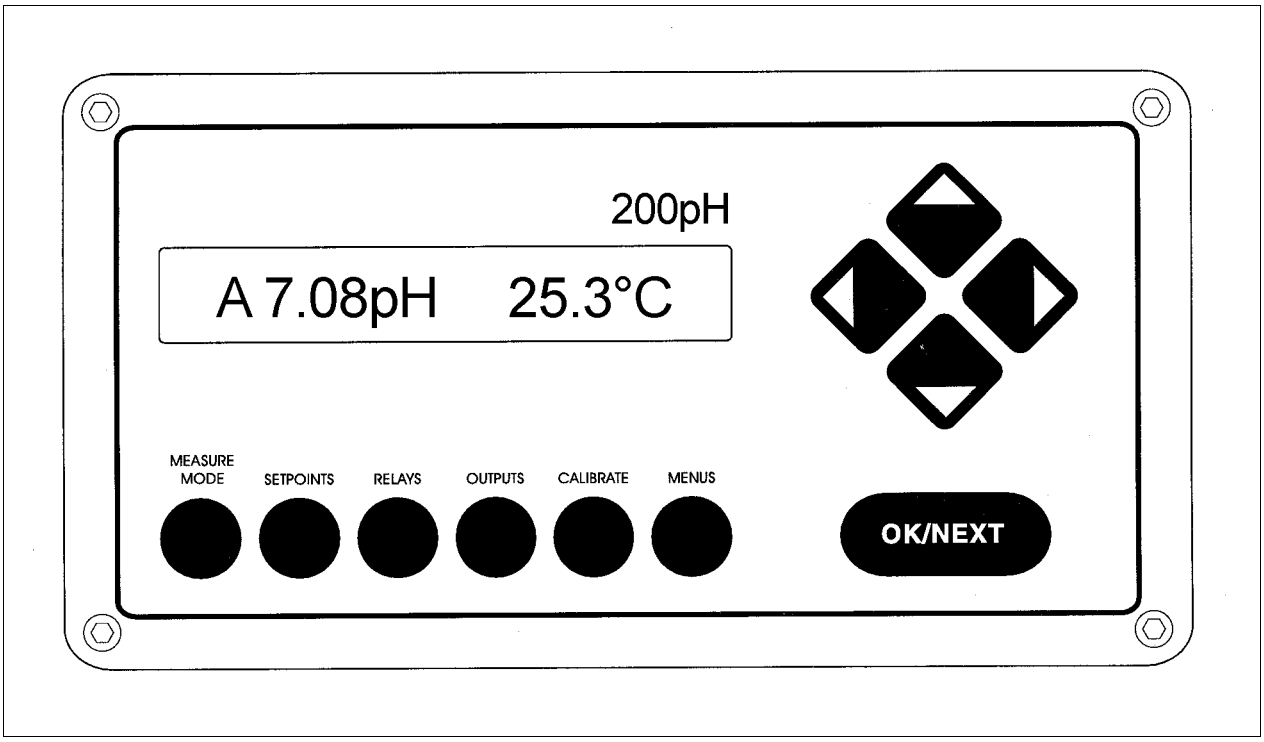


Figure 3.2: 200pH Front Panel

The keypad has 6 keys that provide direct access to specific menus as follows:

1. **MEASURE** - menus to change measurement modes.
2. **SETPOINTS** - menus for programming setpoints.
3. **RELAYS** - menus for programming relays.
4. **OUTPUTS** - menus for programming outputs.
5. **CALIBRATE** - menus to perform calibration.
6. **MENUS** - all other menus (sensor constants, security, averaging, etc.).

The other keys are referred to as control keys and are used to make changes within a menu.

1. **OK/NEXT** Key - used to accept a selection and proceed to the next menu level.
2. **UP** Key - up arrow is used to scroll up through a list of options.
3. **DOWN** Key - down arrow is used to scroll down through a list of options.
4. **LEFT** Key - left arrow is used to move the cursor to the left within a menu.
5. **RIGHT** Key - right arrow is used to move the cursor to the right within a menu.

USING THE MENUS

There are six menu keys across the bottom of the 200pH front panel. The first five of these keys (MEASURE, SETPOINTS, RELAYS, OUTPUTS, AND CALIBRATION) are used to enter specific menus. These menus allow the modification of parameters most frequently used by the operator. The sixth key labeled MENUS allows access to all other menus for various functions such as setting special pH functions, security levels, etc.

The UP and DOWN arrow keys scroll vertically through the menus. Part or all of the display changes to the next option whenever an UP or DOWN arrow key is pressed. A field is defined as a section of the display that can be changed. The characters of the field will also blink. The LEFT and RIGHT arrow keys move the underline cursor across the display from one field to the next. Pressing the OK/NEXT arrow key causes the instrument to accept the options that are displayed and move to the next menu.

Numbers are set one digit at a time using the arrow keys. The LEFT and RIGHT arrow keys are used to position the underline cursor below the digit to be changed. The UP and DOWN arrow keys are then used to change the value of the digit. Each digit can be scrolled through the values: .(decimal point), 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 The first digit of any number can also be set to a negative sign (-).

To exit the menus either scroll completely through a set of menus with the OK/NEXT key or press any of the six menu keys at any time. The meter will display a prompt asking if the recent changes should be saved.

Save Changes **Yes**

To save the changes press the OK/NEXT key with “Yes” on the display. To discard the changes use the UP or DOWN arrow keys to change “Yes” to “No”, then press the OK/NEXT arrow key.

If the instrument is displaying a menu and a key is not pressed for two minutes, *the instrument will automatically exit the menus without saving any changes*. When performing a calibration the operator may need to wait for a measurement to stabilize so the menu time out feature will automatically be disabled.

Menu Example

Press the MEASURE key and the display will show:

A=**pH ( )**

This menu indicates that the Channel A primary measurement is set for pH. The section “**pH**” is the field to be changed and will be flashed as long as the cursor is under it. Pressing the UP arrow key will change the “**pH**” to “**°C**”.

The OK/NEXT key is used to accept the entry and move to the next menu. When the last menu level is reached the following message is displayed:

Save Changes **Yes**

Pressing the OK/NEXT key will save the changes and exit the menus. The UP and DOWN arrow keys can be used to change the "Yes" to "No". Pressing the OK/NEXT key with "No" will discard the changes and exit the menus.

INSTALLING A SENSOR

Each pH sensor is equipped with a pH probe and with built in temperature sensor. Each of these elements have a calibration constant (or cell constant) that must be programmed into the meter for proper operation. The alternative is to perform a standard buffer solution calibration. The factors are printed on the sensor. They may look like this:

```
pH M=1.0034  pH A=0.210
TEMP M=1.0015
```

pH M is the pH multiplier, pH A is the pH adder and TEMP M is the temperature sensor constant. See **Chapter 9: Sensor Calibration** for information on entering sensor constants.

MEASUREMENT DESIGNATIONS

The 200pH instrument can measure four fundamental signals during each measurement cycle. These measurements are the pH and temperature, or ORP of the sensor on channel A and the pH and temperature, or ORP of the sensor on channel B (ORP sensors do not include temperature measurement). The 200pH can process and display four calculated measurements. They are referred to as A primary, A secondary, B primary and B secondary. These measurements are designated by a single letter as follows:

A = channel A primary measurement
a = channel A secondary measurement

B = channel B primary measurement
b = channel B secondary measurement

Note the upper case letters are used to indicate the primary measurements and lower case letters are used to indicate the secondary measurements.

Each of the four calculated measurements can be one of the following:

1. pH
2. ORP (voltage)
3. Degrees C
4. Degrees F
5. Difference (A-B or B-A)
6. Ratio (A/B or B/A)

DISPLAYING MEASUREMENTS

Changing the Display of Measurements

The 200pH's display can show either one or two measurements at a time. The display of measurements can be changed by using the UP or DOWN arrow keys. Pressing one of these keys will cause the meter to change the display mode (show an alternative set of data).

The display modes are:

Mode # 1: A Primary and A Secondary:

```
A 7.76  25.1 °C
```

Mode #2: B primary and B Secondary:

```
B 7.19  25.1 °C
```

Mode #3: A primary and B primary (three significant digits displayed for each parameter):

```
AS 7.76 pH  B8.11 pH
```

Mode #4: A secondary and B secondary:

```
a 25.2°C  b 25.1°C
```

Note that when two measurements from the same channel are displayed, the secondary measurement indicator (a or b) is not displayed.

The default display setting (after a system reset) is mode #1 (A Primary & A Secondary).

The display modes for one measurement per line are:

Mode #1: A Primary:

A 7.62 pH

Mode #3: A Secondary:

a 26.2°DegC

Mode #2: B Primary (ORP):

B 129.3 m volts

Mode #4: B Secondary:

b 24.8°DegC

Setting the Number of Measurements per Display Line

The 200pH can be set to display either one or two measurements per line.

To change this feature:

Press the MENUS key and the following menu will appear:

Menus use arrows

Press the UP arrow key until “Display Menus” is displayed.

Display Menus

Press the OK/NEXT key to access this menu. Use the Up or DOWN keys to toggle the field until “Disp Format” appears. Press OK/NEXT to access this menu.

Set: **Disp Format**

Use the UP and DOWN keys to toggle the field between “1” and “2”.

Measure per Line = **1**

Press OK/NEXT when done. The meter will ask if changes should be saved.

Save Changes **Yes**

Press OK/NEXT key to save the changes and return to the display of measurement data.

Measurement Display Scrolling

The 200pH has an automatic display scrolling feature for measurement data. With this feature enabled, the display will show channel A data for 5 seconds and then show channel B data for 5 seconds. This process is repeated indefinitely.

To enable or disable this feature:

Press the MENUS key and the following menu will appear:

Menus use arrows

Press the UP arrow key until “Display Menus” is displayed.

Display Menus

Press the OK/NEXT key to access this menu.

Set: **A**uto Scroll

Use the Up or Down arrow keys to toggle the field until “Auto Scroll” appears. Press OK/NEXT to access this menu.

Auto Scroll = **off**

Use the UP or DOWN arrow keys to toggle the field from “Off” to “On”. Press the OK/NEXT key when done. The meter will ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

ALARM INDICATIONS

A setpoint can be programmed as either a high limit or low limit. When a measurement is higher than a high point (or lower than a low point) then the setpoint is considered to be in an alarm state. This condition is indicated by flashing the corresponding measurement value on the display.

CHAPTER 4: MAKING MEASUREMENTS

MEASUREMENT PROCESS

The 200pH will process two measurements from each of the two channels. The measurements of each channel are referred to as the primary and the secondary measurement. The instrument will process a total of four different measurements per cycle.

Measurements are designated as follows:

A = channel A primary measurement

a = channel A secondary measurement

B = channel B primary measurement

b = channel B secondary measurement

Note that upper case letters are used to indicate the primary measurements and lower case letters are used to indicate the secondary measurements.

MEASUREMENT TYPES

Each of the four measurements (channel A primary, etc.) can be programmed as one of the following

1. pH
2. ORP (Voltage)
3. Degrees C
4. Degrees F
5. Difference (A-B or B-A)
6. Ratio (A/B or B/A)

pH

pH is expressed in conventional pH units defined by NIST (National Institute of Standards and Technology) standard pH buffer solutions.

ORP

ORP (Oxidation-reduction or redox potential) is the millivolt value measured between a noble metal electrode and a reference electrode, usually contained in the same probe. Oxidizing materials such as chlorine, raise the potential and reducing materials such as bisulfite or carbon beds lower the potential.

Temperature

Temperature can be measured in degrees Celsius (°C) or degrees Fahrenheit (°F). The 200pH normally works with a 1000 ohm DIN platinum RTD sensor which is built into most Thornton sensors. For manually entered temperature, see **Chapter 11:Other Functions**.

Difference (A-B or B-A)

The difference measurement is computed as:

Difference on channel A = A-B.
or
Difference on channel B = B-A.

When the difference is assigned to one channel, the meter will measure the same type of measurement mode of the other channel as a basis. For example, if channel A is set to measure the difference and channel B is measuring pH, then the 200pH will measure pH on both channels before computing the difference.

Ratio (A/B or B/A)

This measurement is similar to the difference measurement.

Ratio on channel A = A/B.

Ratio on channel B = B/A.

SELECTING A MEASUREMENT TYPE

To set or change a measurement type for each of the four measurements:

Press the MEASURE key and the display will show the measurement type assigned to channel A primary. The display may appear as:

A = pH ( )

This menu indicates that channel A primary measurement is set for pH. The section "**pH**" is the first field to be changed and will be flashed as long as the cursor is under it. Pressing the UP arrow key will change the "**pH**" to "**°C**".

A = DegC ( )

Use the UP and DOWN arrow keys to select the desired measurement type.

The OK/NEXT key is used to accept the entry for channel A primary and move to the next menu for setting channel a secondary. Press the OK/NEXT key a third and fourth time to set the measurement types for channel B primary and channel b secondary, respectively.

When the last menu level is reached (after setting channel b secondary), the following message is displayed:

Save Changes **Yes**

Pressing the OK/NEXT key will save the changes and exit the menus. The UP and DOWN arrow keys can be used to change the "Yes" to "No". Pressing the OK/NEXT key with "No" will discard the changes and exit the menus.

SENSOR CONSTANTS

Each pH sensor is pre-calibrated with a set of calibration constants called sensor constants. There are two sensor constants: a **Multiplier** and an **Adder**. They are used to derive an accurate measurement from the sensor's output signal. The output of a pH sensor can be represented by the following equation:

pH = x/M + A

Where:

x = pH electrode signal

M = multiplier (slope or span)

A = adder (standardize offset or zero)

For a pH sensor the multiplication factor (M) is near 1 and the additive factor (A) is near 0. For ORP the values are exactly 1 and 0 respectively.

The calibration constants can be modified via the menus. For more information see **Chapter 9: Sensor Calibration**.

TEMPERATURE COMPENSATION

The 200pH Instrument provides two types of pH temperature compensation described in the following sections. In addition, if a temperature sensor is not included in a special electrode, manual temperature setting may be used in place of the measured value. See **Chapter 11: Other Functions**.

With ORP measurement, temperature is not measured or compensated.

Conventional Electrode Temperature Compensation

Electrode temperature compensation (Nernst Response) is provided in most pH instruments. All pH electrodes produce a millivolt signal with gain proportional to the absolute temperature. Electrode temperature compensation normalizes that variable millivolt output to give pH values. The default and normal operating settings of the instrument have this compensation active. Some specialized measurements may need to disable it by accessing the "Compensation" setting via the MENUS key. Compensation for each channel may be individually turned on or off.

Solution Temperature Compensation

The solution temperature coefficient (STC) is a setting for compensation of the variable ionization of pure waters. The change is so small in more conductive waters that it is usually ignored, but for high purity water, it is significant. It is used in addition to the conventional (Nernst) compensation which is normally active. Solution temperature compensation is used primarily with power plant and other pure water samples less than 30 µS/cm conductivity. It references the pH of pure water to 25°C. All other applications

should leave the STC set to its default value of zero.

For pure makeup water or boiling water reactor samples, the STC should be set to 0.016 pH/°C. For ammonia, phosphate and/or amine-treated samples, the STC should be set to 0.033 pH/°C. The appropriate setting for other pure water compositions may be determined by developing temperature vs. pH data for the particular sample with the STC set at zero. The negative slope of this data becomes the STC value.

Because Solution Temperature Compensation is unique to the type of sample and is different for buffer solutions, it must be disabled during buffer calibration. The 200pH automatically ignores the STC whenever the Hold function is active. See **Chapter 9: Sensor Calibration**.

The STC is accessed via the MENUS key/Spec pH Function/ STC=0.000 pH/C.

Isopotential Point

IP is left at the default setting of 7.0 for all Thornton and conventional pH sensors. Special purpose electrodes with zero potential at values other than 7 pH will have this identified in their instruction manuals. A different IP setting will allow proper temperature compensation of these special electrodes. The IP setting is accessed via MENUS key/Spec pH Function/IP = 7.000 pH.

AC POWER FREQUENCY

The 200pH meter was designed to reduce fluctuations in measurements by eliminating noise pickup from the AC power line. The meter can be set to filter either 50Hz or 60Hz power.

Setting 50/60 Hz Operation

To set the appropriate filter, press the MENUS key and the following menu will appear:

Menus use arrows

Press then DOWN arrow key until the “Set Freq” menu is displayed.

Set Frequency

Press the OK/NEXT key to access this menu.

Frequency = **60**

Use the UP or DOWN arrow keys to set the desired frequency. Press the OK/NEXT key when done. The meter will ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement.

CHAPTER 5: USING SETPOINTS

OVERVIEW

A setpoint is a limit or alarming condition applied to a measurement. A setpoint can be programmed as either a high limit or a low limit. When the measurement value is higher than a high setpoint, or lower than a low setpoint, a setpoint error condition exists. The meter will indicate this condition by blinking the measurement on the display. The 200pH can also be programmed to control a relay upon this error condition. Refer to Chapter 6 for more information on relays.

Four setpoints are available and can be assigned to any of the four measurements (A, a, B and b). More than one setpoint can be assigned to the same measurement and more than one setpoint can activate a relay.

The following parameters can be programmed for setpoint operation:

1. The assigned signal: which signal (A, a, B, or b) is monitored by the setpoint.
2. The setpoint value: the measurement value that triggers the setpoint error condition.
3. The setpoint type: High, Low or Off.
4. The assigned relay: which relay will be controlled when a setpoint error occurs (this is optional).
5. Operation on overrange: Whether or not the setpoint will be active when the measurement is outside its range -- yes or no.

SETPOINT SIGNAL

The setpoint signal is the measurement that will be monitored by the setpoint. The signal can be either:

1. A - Channel A primary
2. a - Channel a secondary
3. B - Channel B primary
4. b - Channel b secondary

SETPOINT VALUE

The setpoint value is the limit that will trigger a setpoint error condition.

SETPOINT TYPE

The setpoint type can be either “High”, “Low”, or “Off”. A setpoint error condition exists when the measurement is above the high limit or below the low limit.

ASSIGNED RELAY

The assigned relay will change state according to the setpoint condition. When a setpoint error condition exists, the assigned relay will change state. If the relay is normally activated, then it will be de-activated.

Default settings after a system reset: Setpoints are disabled, no signals assigned, no relays assigned and values are zero.

PROGRAMMING A SETPOINT

Press the SETPOINT key to access the first setpoint menu. This menu is used to assign a measurement to each of the four setpoints.

The cursor is under the setpoint number field. Use the UP and DOWN arrow keys to select the desired setpoint number (1 to 4). Use the RIGHT arrow key to move the cursor to the signal field. Then use the UP and DOWN arrow keys to select the desired signal. The signal can be set to “-” which indicates that the setpoint is not assigned to a signal (disabled).

To change the assigned signal of another setpoint, move the cursor back to the setpoint number. Change the setpoint number, then move the cursor back to the assigned signal field.

SP**1 = .0000 _off**

Press the OK/NEXT key when done to proceed to the next menu.

The cursor is initially under the setpoint number field. Select the desired number then move the cursor to the numerical field. Set the desired value.

Move the cursor over to the setpoint type field. To turn the setpoint on, select either High or Low. Press the OK/NEXT key when done to proceed to the next menu.

The next menu is used to assign a relay to the setpoint. The menu will appear as:

SP**1** use Relay #_

After selecting the desired setpoint number, move the cursor to the relay field. The choices are: 1 - 4 and "_". The "_" indicates that there are not any relays assigned to the setpoint.

Note: Some models of the 200pH are equipped with only 2 relays and will allow settings of only #1 and #2.

Press the OK/NEXT key when done to proceed to the next menu.

SP**1** over-range **Yes**

This menu selects whether the setpoints will be active when the measurement is out of range, which could be due to process upset, loss of fluid at the sensor, disconnected sensor leads, etc. Use the arrow keys to select Yes or No for each setpoint.

Press the OK/NEXT key when done. The meter will ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

Example: Setup a Setpoint

Program setpoint #2 with the following conditions:

1. Assigned to channel A secondary signal ("a").
2. A value of 40.0°C.
3. Set as a high limit.
4. Use relay #2.
5. Disabled when out of range.

Press the SETPOINT key.

Use the arrow keys to select setpoint #2 and signal "a". The display will appear as follows:

SP**2** on signal: **a**

Press the OK/NEXT key:

Use the arrow keys to set the value at 40.0°C and the type to high. The display will appear as follows:

SP**2 = 40.00 _ High**

Press the OK/NEXT key:

Use the arrow keys to set the relay number to 2. The display will appear as follows:

SP**2** use Relay #**2**

Press the OK/NEXT key:

Use the arrow keys to set the over-range to No, resulting in the following display:

SP**2** over-range **No**

Press the OK/NEXT key. The meter will ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

CHAPTER 6: USING RELAYS

DESCRIPTION

The 200pH is equipped with up to four relays. Each relay can be programmed to activate when a setpoint is exceeded (defined as a setpoint error condition). The programmable parameters for a relay are:

1. Delay Time: up to 999 seconds.
2. Hysteresis (deadband) Value: up to 99% of setpoint value.
3. Activation State: relay operation can be normal or inverted.

ELECTRICAL CONNECTIONS

For units equipped with two (mechanical) relays, each has a common connection, a normally open connection and a normally closed connection. Solid state relays have only a common connection and a normally open connection as shown in Table 2.1.

DELAY TIME

Delay time can be used to eliminate false alarms or control action caused by measurement noise or fluctuations. Delay time is the length of time that the setpoint must be exceeded continuously (in a setpoint error condition) before activating the relay. When the setpoint error condition occurs, the delay timer is started. If during the delay time the setpoint error condition no longer exists, the delay timer is reset and the relay will not be activated. The maximum delay time is 999 seconds (16 minutes and 39 seconds).

HYSTERESIS

Hysteresis is used to prevent unwanted relay activity when the measurement varies around the setpoint value. The hysteresis or deadband value is entered as a percentage of the setpoint value. For a high setpoint, the measurement must fall more than this percentage point below the setpoint value before the relay returns to its non-error condition. With a low setpoint, the measurement must rise at least this percentage above the setpoint value before the relay returns to its non-error condition.

For example: a high setpoint is set at 10 and the measurement is currently above this value so the setpoint error condition exists. If the hysteresis value is 10% then the measurement must fall below 9 before the relay is deactivated.

RELAY ACTIVATION STATE

The relay can be programmed for normal or inverted operation. When the relay is in the inverted state, the relay operation is reversed. When there is no setpoint error condition the relay is activated. The normally open contacts are closed.

WARNING: RELAYS WILL ALWAYS DE-ENERGIZE ON LOSS OF POWER, EQUIVALENT TO NORMAL STATE, REGARDLESS OF RELAY ACTIVATION STATE SETTING. HOWEVER, THE SETTING IS RETAINED ON RESTORATION OF POWER.

Default settings after the system reset:

1. Relay is disabled.
2. Delay is 0 seconds.
3. Hysteresis is 0%
4. Relay activation state is normal

PROGRAMMING A RELAY

To enable or modify a relay:

Press the RELAYS key. The first relay menu is used to set the delay time.

R**1** Delay = 000 sec

In this menu, the cursor is initially under the relay number. Use the UP and DOWN arrow keys to select the desired relay number (1 to 4). Use the RIGHT arrow key to move the cursor to the

delay time field. Then use the UP and DOWN arrow keys to set the delay time (000 to 999 seconds).

To change the delay time of another relay, move the cursor back to the relay number. Change the relay number, then move the cursor back to the relay time field.

Press the OK/NEXT key when done to proceed to the next menu.

R**1** Hyster = 00%

Select the desired relay number then move the cursor to the hysteresis value field. Enter the hysteresis value (00 to 99%).

Press the OK/NEXT key when done to proceed to the next menu.

R**1** State = Normal

Select the desired relay number, then move the cursor to the relay state field. Use the DOWN arrow key to select either Normal or Invert. Press the OK/NEXT key when done. The meter will ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

Example: Setup a Relay

Program relay #2 with the following conditions:

1. Delay of 60 seconds.
2. A hysteresis of 10%.
3. Inverted state.

Press the RELAYS key.

Use the arrow keys to select relay #2 and set a delay time of “060”. The display will appear as follows:

R**2** Delay =**060** sec

Press the OK/NEXT key.

Use the arrow keys to set the hysteresis value to “10%”. The display will appear as follows:

R**2** Hyster = **10%**

Press the OK/NEXT key.

Use the arrow keys to set the state to inverted. The display will appear as follows:

R**2** State = **Invert**

Press the OK/NEXT key. The meter will now ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

CHAPTER 7: USING ANALOG OUTPUTS

DESCRIPTION

An analog output is an isolated current signal that is proportional to a measurement. The 200pH's two analog outputs have a minimum value of 4mA and a maximum value of 20mA. The signal can be re-calibrated to 0-20 mA when needed. See **Calibrating Analog Outputs** later in this chapter. Each output can be scaled to a range of a measurement signal.

To use analog outputs, the following parameters must be programmed:

1. Assigned Signal - The analog output will be proportional to the value of the assigned signal. Any of the four measurements (A, a B, b) can be assigned to the output.
2. Minimum Value - This is the measurement reading that will correspond to an output of 4mA (or known re-calibrated value).
3. Maximum Value - This is the measurement reading that will correspond to an output of 20mA.

The analog outputs can be scaled for their minimum and maximum values. This programming process is independent from any measurement. See **Scaling the Analog Outputs** for details.

ELECTRICAL CONNECTIONS

Connections to the analog output signals are made at terminal block TB2. Each analog output channel has a signal line (labeled AO1+ or AO2+) and a common line (labeled AO1- or AO2-). Table 2.4 shows the electrical connections.

The analog outputs are isolated from line power, sensors and earth ground. Each analog output channel can drive a resistive load up to 500 ohms.

SCALING THE ANALOG OUTPUTS

Default settings have Output 1 assigned to Channel "A", scaled for 0 to 14 pH and Output 2 assigned to Channel "a" for 0 to 100°C.

To setup an analog output channel, press the OUTPUTS key:

Output: **Analog**

Press the OK/NEXT key to access this menu. The next menu is used to assign a measurement signal to the output. The choices are: A, a, B, b, and _. The selection of "_" is used to disable the output by not assigning a signal to the output. The output will remain at 4mA when it is disabled. The menu may appear as:

Aout**1** signal = A

In this menu the cursor is initially under the output number. Use the UP or DOWN keys to select the desired output number (1 or 2). Press the RIGHT arrow key to move the cursor under the assigned field.

Aout1 signal = **A**

Use the UP or DOWN arrow keys to change the assigned measurement. Press the OK/NEXT key to accept it and proceed to the next menu.

Aout**1** Min = .0000_

This menu is used to set the measurement value that will correspond to a 4mA output. Press the RIGHT arrow key to move the cursor under the number field and set the desired value. The last position in this menu is the units multiplier which should set to "_" for pH or "m" for ORP in millivolts.

After setting the desired value, press the OK/NEXT key to accept minimum value and proceed to the next menu.

Aout**1** Max = 1.000_

This menu is used to set the measurement value that will correspond to an output of 20mA. Repeat the process as described above for setting the minimum value. Press the OK/NEXT key to accept the maximum value. The meter will ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

Example: Set Up an Analog Output

Set analog output #2 with the following parameters:

1. Assigned to channel A primary measurement
2. Minimum value of 2 pH
3. Maximum value of 12 pH

Press the OUTPUTS key. The display will show:

Output: **Analog**

Press the OK/NEXT key.

Use the arrow keys to select analog output #2 and assign measurement B to this output. The display will appear as follows:

Aout**2** signal = **A**

Press the OK/NEXT key.

Use the arrow keys to set the minimum value to 2 pH. The display will appear as follows:

Aout**2** Min = **2.000_**

Press the OK/NEXT key.

Use the arrow keys to set the maximum value to 12 pH. The display will appear as follows:

Aout**2** Max = **12.00**

Press the OK/NEXT key.

Save Changes **Yes**

Press the OK/NEXT key to save changes and return the display of measurement data

ANALOG OUTPUT CALIBRATION

The analog output signals have been factory calibrated to specifications. They may be re-calibrated in a two step process where 4mA and 20mA levels are adjusted. A current meter is connected in series with the output. The arrow keys are then used to adjust the current output for the appropriate level (4mA, then 20mA).

The signal can be re-calibrated to 0 -20 mA where needed. With a 500 ohm resistor across the output terminals, a 0-10 VDC signal may also be obtained.

For NIST traceability, the outputs can be calibrated with any NIST calibrated current meter.

Procedure: Connect the meter in series with the output signal.

Press the CAL key and the display will show:

Calibrate **Sensor**

Use the UP and DOWN keys to change the display until the “Analog” option is displayed:

Calibrate **Analog**

Press the OK/NEXT key to proceed to the next menu.

Cal Analog Ch**1**

Use the UP and DOWN keys to select the desired output channel number (1 or 2). Press the OK/NEXT key to proceed to the next menu.

Use the UP and DOWN keys to adjust the output current for a 4mA level (as measured by the current meter). The number displayed is an arbitrary value proportional to the analog output signal, near 10,000 for 4 mA and near 55,000 for 20 mA. Adjusting a more significant digit of this number will change the output signal level faster.

Adjust a less significant digit for closer resolution.

Press the OK/NEXT key when done adjusting the 4mA. The next menu is for adjusting the 20mA output.

1:Adj 4mA=10641

Adjust the 20mA level in a similar manner. Press the OK/NEXT key when done adjusting the 20mA. The meter will ask if changes should be saved.

1:Adj 20mA=54091

Press the OK/NEXT key to save the changes and return to the display measurement data.

Save Changes **Yes**

CHAPTER 8: METER CALIBRATION

OVERVIEW

The 200pH meter is factory calibrated within specifications. It is not normally necessary to perform meter re-calibration unless extreme conditions cause an out of spec operation shown by Calibration Verification (see **Calibration Verification** later in this chapter). Periodic verification/re-calibration may also be necessary to meet Q.A. requirements. The 200pH meter is re-calibrated by installing known voltage and resistance values in place of the sensor and using the calibration menus to complete the process. The meter is equipped with two internal ranges of measurement on each channel. Each range is calibrated separately. The ranges are referred to as:

1. Voltage, used to measure pH and ORP electrode signals.
2. Temperature (Temp), used to measure temperature signals.

Each of these measurement ranges may be calibrated with a 1-point process (use one known voltage or resistance value) or a 2-point process (use two known voltage or resistance values). A 2-point process will provide the most accurate calibration over the full range.

Recommended calibration points (optional):

1. Voltage (Volts) = 1st point at +500 mV, 2nd point at -500 mV.
2. Temperature (Temp.): 1st point at 1,000Ω, 2nd point at 1,400Ω.

NOTE:200pH meter voltage calibration cannot be performed at zero mV.

Standards for these calibrators are available as NIST-Traceable volt meters with power supplies, and decade boxes. Connect per Figure 14.11, shown for channel A, or similarly for channel B.

NOTE: To display the actual value of a calibration device use the Calibration Verification menu as described in the next section.

CAUTION: Do not use Thornton plug-in resistance calibrators intended for 200CR conductivity/resistivity instruments. Damage to the instrument would result.

WARNING: INSTALLING A CALIBRATION INPUT ON A CHANNEL MAY TRIGGER ALARM STATES AND RELAYS.

CALIBRATION PROCEDURE

Voltage Calibration

Step 1: Select the Meter Calibration

Press the CAL key and the display will show:

Calibrate **Sensor**

Use the UP and DOWN keys to change the display until it reads:

Calibrate **Meter**

Press the OK/NEXT key to proceed to the next menu.

Step 2: Select the channel

Cal Meter Ch **A**

Use the UP and DOWN keys to select channel B if desired. Press the OK/NEXT key to proceed to the next menu.

Step 3: Select the signal to calibrate:

Cal A #1: Volts

Use the UP and DOWN keys to select the signal to be calibrated. The choices are: “Volts”, or “Temp”. Press the OK/NEXT key when ready to proceed to the next menu.

Step 4: Enter the calibration voltage:

A Volts = **500.00m**

This menu is used to enter the calibrator value. The display will show a nominal value but the actual value of the calibration must be entered.

Use the UP and DOWN keys to change the digit. Use the RIGHT and LEFT arrow keys to move the cursor to the next digit. The last character on the display is the multiplier, which appears after the value on the calibrator. m = millivolts.

When the value of the calibration is entered, press the OK/NEXT key when ready to proceed to the next menu.

Step 5: Install the calibration voltage source per Figure 14.11:

A = 500.3 mV **ok?**

The instrument will display the value of the calibration as measured by the meter. It is important to wait for this displayed measurement to stabilize. The reading may fluctuate slightly but the changes should be no more than + 1 digit (least significant). It is recommended that you wait at least 30 seconds to be certain that the measurement has settled.

To discontinue the calibration, press any of the menu keys. To proceed with the calibration process (after the readings have stabilized), press the OK/NEXT key.

Step 6: Perform the calibration:

The calibration process may take a few seconds to complete. When the instrument is done, the following message will be displayed.

Done, press ok_

Step 7: Proceed to the 2nd calibration point:

Press the OK/NEXT key to complete the calibration of the first point. The meter will display the following menu:

Do point #2 **No**

Press the OK/NEXT key to save the new calibration factor and return to the measurement mode. Use the UP and DOWN arrow keys to change the “No” to “Yes” and press the OK/NEXT key to perform the 2nd calibration point. The meter will display the following menu, requesting the value of the 2nd calibration point:

Step 8: Enter the calibration value (point #2)

A Volts = -500.0m

Enter the value of the 2nd calibration and press the OK/NEXT key when ready to proceed.

Step 9: Install the calibration voltage source:

As with the 1st calibration point, the meter will now display the measured value as follows:

A = -500.8 mV **ok?**

When the reading has stabilized, press the OK/NEXT key. The meter will perform the calibration and display the following message:

Step 10: Perform the calibration (point #2):

The calibration process may take a few seconds to complete. When the instrument is done, the following message will be displayed:

Done, press ok_

Press the OK/NEXT key. The meter will ask if the changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

The calibration process is complete for one channel. Repeat this process for the other channel if necessary. Reminder: due to entered sensor constants and temperature compensation, the meter will only read the actual calibration values in the “Verify” mode.

Temperature Calibration

Using 0°C (1000 ohm) and 104°C (1400 ohm) resistances, do a two point temperature calibration. Attach the 0°C (1000 ohm) calibrator to Ch. A per Figure 14.11. Press the CALIBRATE key on the 200pH. The display will show the following:

Calibrate **Sensor**

Use the up arrow key to toggle to:

Calibrate **Meter**

Press the OK/NEXT key:

Cal Meter Ch **A**

Press the OK/NEXT key:

Cal A #1: **Volts**

Press the up arrow key until “Temp” appears.

Cal A #1: **Temp**

Press the OK/NEXT key.

A Temp = 1.0000K

Change the displayed value with the arrow keys to match the exact temperature resistance. For example:

A Temp = 999.4

Press OK/NEXT.

A = 1.023KTΩ OK?

Wait for 15 seconds for this reading to stabilize. This is the value the meter is reading before calibration. Press OK/NEXT and the calibration will be performed:

Done, press OK/NEXT

Press the OK/NEXT key.

DO point #2? **Yes**

Press the OK/NEXT key,

A Temp = 1.400 **OK**

Disconnect the 0°C (1000 ohm) calibrator from Ch. A and attach a 104°C (1,400 ohm) calibration resistance onto Ch. A. Change the displayed value with the arrow keys to match the exact temperature resistance value connected. For example:

A Temp = 1.40**2**K

Press the OK/NEXT key.

A = 1.4002KTΩ OK?

Wait for 15 seconds for this reading to stabilize. This is the value the meter is reading before calibration. Press OK/NEXT and the calibration will be performed:

Done, press OK/NEXT

Press the OK/NEXT key.

Save Changes **Yes**

To accept the calibration value, press OK/NEXT. Normal operation will resume.

Repeat the above procedures for channel B.

CALIBRATION VERIFICATION

The calibration verification menu can be used to quickly confirm the meter’s performance. A calibration or verification device is installed on a channel and this menu is used to display the actual voltage or resistance value of the device. The verification menu can be found in two locations, either in the calibrate menu or under the menus option. When using the calibrate menu, press the CALIBRATE key, then select “verify calibration”. This option is included on two separate menu trees to allow the calibration menu to be locked yet still allow operators to verify calibrations.

Press the MENUS key and the following menu will appear:

Menus use arrows

Press the DOWN arrow key until the “Verify Calibrate” menu is displayed.

Verify Calibrate

Press the OK/NEXT key to access this menu.

Verify Cal: Ch **A**

Use the UP arrow key to select the desired channel. Press the OK/NEXT key when set. The

meter will now display the actual values input to the instrument. A typical display may appear as:

A-.060V 1.086KΩ

The first number is the measured value of the pH input and the second number is the measured value of the temperature input. Compare these numbers with the actual values of the input. Press any key to end this menu.

CHAPTER 9: SENSOR CALIBRATION

OVERVIEW

Periodic pH calibration is necessary because the sensors have some variation in output which can change over time, especially under harsh or contaminating process conditions. The frequency of calibration must be determined by experience with a particular application. For example, begin with daily calibration, then extend to weekly, then to monthly, bi-monthly, etc. as allowed by the drift experienced and process accuracy requirements. Such a sequence is also appropriate since new sensors will show some initial drift as they acclimate to the process. The accuracy of calibration is determined by the accuracy and traceability of the standard buffer solutions used.

At initial sensor installation, acceptable performance can be usually obtained by entering the factory-documented sensor constants from the sensor label as described in **Entering/Editing Calibration Constant** later in this chapter. This allows startups without standard buffer solutions. However, if accuracy must be optimized and for subsequent calibration, the regular procedures must be followed.

Calibration is accomplished by entering the known value into the instrument and instructing it to perform the calibration. When a one-point calibration is performed, the instrument computes a new Adder (standardize offset or zero) constant. With a two-point calibration, the instrument computes new Adder and Multiplier (slope or span) constants. It should be noted that a non-functional sensor can always be calibrated at one point. Response to a changing process or a second calibration point are needed to ensure the sensor is functioning.

For ORP measurement, no sensor calibration is recommended although it is possible. It is recommended that the instrument read in absolute millivolts established in meter calibration. The Adder constant is left at 0 and the Multiplier at 1.0. Standard ORP solutions are available for checking operation of sensors, however, their tolerance under process conditions is generally too wide to be useful for calibration.

Two methods are used for pH sensor calibration: buffer and grab sample. In some situations, it is most convenient to do a grab sample calibration on a routine basis. A two-point buffer calibration may be performed at less frequent intervals to provide full adjustment to sensor response.

Buffer calibration requires removal of the sensor from the process and immersing it in standard buffer calibration solution. It may be done at one or two points and gives the most direct traceability to the standard(s). The sensor should be rinsed well with deionized or distilled water before immersing in each standard.

With the sensor removed from the process during buffer calibration, analog outputs and alarm relays would be uncontrolled. A Hold function can be activated before sensor removal for a set period of minutes to maintain these outputs at their process conditions until timeout after the sensor has been returned to the process. When the Hold function is active, the message “Hold timer at XX” will periodically flash on the display as a reminder. The XX is the Hold time remaining in minutes.

Grab sample calibration allows the sensor to remain in the process but is limited to a one-point procedure. A sample is removed and measured by a portable pH system that has been previously calibrated in standard buffer solutions. For pure water samples (<20 µS/cm conductivity), the “grab sample” should be a flowing side stream not exposed to air before the measurement to minimize contamination.

The steps for grab sample calibration are as follows:

1. Record the displayed pH at the time the grab sample is taken.
2. Measure the grab sample pH.
3. Calculate the difference of the grab sample pH minus the recorded pH, retaining the sign (positive or negative).
4. Add the difference value to the current displayed pH and immediately enter the result as the calibration standard value in the procedure.

Example:

1. The 200pH Instrument reads 6.50 pH when the grab sample is taken.
2. The grab sample measures 6.20 pH on the portable system.
3. The difference is -0.30 pH.
4. The current 200pH Instrument reading is 7.00 pH so 6.70 pH is the value entered for one-point calibration.

BUFFER CALIBRATION PROCEDURE

Use the first 4 steps only for buffer calibration to activate Hold:

1. Press the CALIBRATE key and the display will show:

Calibrate **Sensor**

2. Press the DOWN Arrow key and the display will show:

Hold output **time**

3. Press OK/NEXT key and using the arrow keys, enter the length of time in minutes needed to complete the calibration, for example:

Hold time = 0**6** min

4. Press the OK/NEXT key twice.

Press the CALIBRATE key and the display will show:

Calibrate **Sensor**

Press the OK/NEXT key to proceed to the next menu.

Cal Sensor Ch **A**

Use the UP arrow key to select the desired channel. Press the OK/NEXT key when set.

Cal Ch A #1: **pH**

Use the UP arrow key to select the measurement to be calibrated. The choices are: pH, Volts, °C and °F. Press the OK/NEXT key when set.

The next menu will allow the known value of the signal (or solution) to be entered.

A pH = **4.000**_

Using the arrow keys and OK/NEXT, enter the solution value.

The meter will now display the uncalibrated reading. For example, a typical display may appear as:

A = 3.925 OK?

When the reading has stabilized, press the OK/NEXT key to perform the calibration. The calibration process may take a few seconds to complete.

The meter will display the menu for performing the second calibration point.

Do point #2 **Yes**

If doing a one-point calibration, then use the UP key to change the “Yes” to “No”. Press the OK/NEXT key to perform the 2nd calibration point or to exit the menus.

If the Hold function is still active after completing calibration and the sensor is back in the process, deactivate Hold by pressing CALIBRATE, DOWN Arrow and OK/NEXT. Set the time to 00 and press OK/NEXT. Otherwise, the Hold condition will continue until it times out.

NOTE: Performing a sensor calibration will modify the calibration constants such that they will not match the constants written on the sensor label. This is normal.

ENTERING/EDITING CALIBRATION CONSTANTS

Upon the installation of a sensor, the calibration constants for the particular sensor may be entered into the meter if standard buffer solutions are not available. The same menu is also used to read the constants. Channel A has two sensor constant types: one for the pH/ORP sensor and one for the temperature sensor. These constants are referred to as “A Cell” and “A Temp”, respectively. Each of these types has a multiplier and adder constant. Channel B has similar constants (“B Cell” and “B Temp”). Only the multiplier factor is used for temperature. The adder factor is left at zero.

The procedure to enter and read the constants is as follows:

Press the MENUS key and the following menu will appear:

Menus use arrows

Press the UP arrow key until “Edit Sensor Cal ” menu is displayed.

Edit Sensor Cal

Press the OK/NEXT key to access this menu

A Cell M=1.0000_

The cursor is initially under the channel/type field. Use the UP arrow key to select the desired channel/type (either “A Cell”, “A Temp”, “B Cell”, “B Temp”).

Use the RIGHT arrow key to move the cursor to the next field which is for selecting either the multiplier or adder factor. Use the UP arrow key to change this field.

A Cell **M**=1.0000_

Use the RIGHT arrow key to move the cursor to the number field. Although the arrow keys can be used to modify the constants, this should not be done (except at startup) or sensor re-calibration will be necessary.

SENSOR DIAGNOSTICS

The Adder and Multiplier constants described previously in **Entering/Editing Calibration Constants** can provide valuable preventive maintenance information about sensors.

The **Adder** factor (zero or standardize offset) is an indication of how far the sensor has drifted from the nominal zero starting point, in pH units. It is recalculated after every calibration. Drift in this value is usually due to aging or contamination of the reference electrode portion of the sensor.

An offset of more than ±2.5 pH units is an indication that the sensor should be replaced soon. The Adder factor “A” can be viewed at any time in the Edit Sensor Cal menu. However, the value must not be changed in this menu or the sensor will have to be recalibrated.

Because the 200pH meter is auto-ranging, when the Adder Factor is very small, it may be displayed in milli-pH units with an “m” following the numeric value. In this case, the value is very near the nominal zero offset.

For ORP measurement, the Adder is in volts but is normally left at zero unless a calibration is performed

The **Multiplier** (slope or span) is an indication of the sensitivity of the sensor to changes in pH. It has a nominal value near 1 and is recalculated after every 2-point calibration. Reduction in this value is usually due to aging, coating or hot caustic attack of the glass measuring membrane of the sensor.

A sensor with Multiplier value less than 0.80 should be replaced soon. The Multiplier “M” can be viewed at any time in the Edit Sensor Cal menu. The value must not be changed in this menu (except at startup) or the sensor will have to be re-calibrated.

For ORP measurement, the Multiplier should always be exactly 1.000.

CHAPTER 10: SECURITY/LOCKOUT

SECURITY FEATURES

All menus, or only specific ones, can be protected from unauthorized use by using the lockout feature. When enabled, the menu(s) will be inaccessible unless the proper five digit password is entered. Each menu key on the front panel can be locked out individually. The functions that can be locked are:

1. MEASURE MODE: locks the measure mode key
2. SETPOINTS: locks the setpoint key.
3. RELAYS: locks the relays key.
4. OUTPUTS: locks the output key.
5. CALIBRATE: locks the calibrate key.
6. MENUS: locks the menu key.
7. DISPLAY: locks the arrow keys such that the display mode for measurements cannot be changed.

The password can be changed at any time, although the current password must be entered before the change is allowed. The password and lockout state is retained through a power-down sequence and a system reset.

All units shipped from the factory are set with the password of “00000”. It is suggested that this password be changed to another five digit sequence before using the lockout feature.

CHANGING THE PASSWORD

To change the password, press the MENUS key and the following menu will appear:

Menus use arrows

Press the UP arrow key until the “Change Password” menu is displayed.

Change Password

Press the OK/NEXT key to access this menu. The next menu will request the current password.

Old Pass = **0**0000

After setting the current password, press the OK/NEXT key. If the current password is not properly set, then the following message will be displayed before exiting the menus:

Invalid Password

If the password was properly entered, then the meter will request the new password:

New Pass = **0**0000

After setting the new password, press the OK/NEXT key. The meter will ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

ENABLING THE LOCKOUT

To enable the lockout, press the MENUS key and the following menu will appear:

Menus use arrows

Press the UP key until the “Set/Clr Lockout” menu is displayed.

Set/Clr Lockout

Press the OK/NEXT key to access this menu. The next menu will request the current password.

Password = **0**0000

After setting the password, press the OK/NEXT key. If the correct password has been entered, then the following menu will allow the enabling or disabling of the lockout feature.

Enable Lockout **N**

If “N” is selected then the lockout is disabled and the meter will exit the menus. If “Y” is selected the next menu will allow each menu to be individually locked out.

Lock **Measure** Y

The first field lists the functions to be locked. Use the UP and DOWN arrow keys to access the list. The choices are: MEASURE, SETPOINT, RELAYS, OUTPUTS, CALIBRATE, MENUS, DISPLAY. When the desired function is selected, move the cursor to the next field to change the state. A “Y” indicates that this function is locked and an “N” indicates that the function is not locked. use the LEFT arrow key to move the cursor back to the function field to select another key for lockout. When done setting all the functions, press the OK/NEXT key. The meter will ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

NOTE: If the lockout feature is used, it is recommended that the MENUS key also be locked to prevent any indirect changes to the meter's setup.

ACCESSING A LOCKED MENU

If the lockout feature is enabled and a key is pressed that is also locked, the following message will be displayed:

Password = **00000**

If the proper password is entered, then access to that menu will be allowed. This menu key will operate as normal. When the menu is exited, the lockout will be re-enabled.

CHAPTER 11: OTHER FUNCTIONS

AVERAGING

The 200pH has various levels of measurement averaging or damping, each for specific applications. The options are: low, medium, high and special. Each channel can be assigned an averaging level. The assigned averaging will apply to both the primary and secondary measurements of that channel.

Low averaging is useful in applications that require a fast response to changes in the system. Medium and high averaging helps to reduce display fluctuations. The special averaging setting is recommended for most applications. This method provides reduction in display fluctuations but gives fast response.

Special averaging is also self-adjusting. If a large change in the measurement is detected, then the meter will respond immediately to the change (does not use any averaging). Small changes to the measurement (i.e., system noise) will be averaged. However, if system noise is greater than 0.15 pH or 15 mV, special averaging should not be used.

To set the averaging, press the MENUS key and the following menu will appear:

Menus use arrows

Press the UP arrow key until the “Set Averaging” menu is displayed.

Set Averaging

Press the OK/NEXT key to access this menu.

A: Average = High

The cursor is initially under the channel field. Use the UP and DOWN keys to change the channel if desired. Use the RIGHT arrow key to move the cursor to the level field. The display will appear as:

A: Average = **Spec**

Use the UP and DOWN arrow keys to change the averaging level. Press the OK/NEXT key when done. The next menu will show the averaging level for channel B. Press the OK/NEXT key after setting channel B. The meter will ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

SYSTEM RESET

CAUTION: A system reset will set all operational parameters to their default conditions and may require extensive reprogramming.

1. A Primary Measurement Mode: pH
2. A Secondary Measurement Mode: Temperature (DegC)
3. B Primary Measurement Mode: pH
4. B Secondary Measurement: Temperature (DegC)
5. Display Mode: Mode #1 (A primary and A secondary)
6. Setpoints (all): Off, value = 0, no relay assigned, active on over-range
7. Relays (all): Delay = 0, hysteresis = 0, state = normal
8. Serial Port: Data output off.
9. Analog Outputs: #1 assigned to “A”, min = 0, max = 14; #2 assigned to “a”, min = 0, max = 100.
10. Manual temperature: Off
11. Compensation: On
12. Cell Constants: Multiplier = 1.0, temperature multiplier = 1.0, all adders = 0.
13. Auto Display Scroll: Off.
14. Solution Temperature Coefficient: STC = 0
15. Isopotential Point: IP=7.0

A system reset will not change the password, lockout state, meter calibration, analog output calibration, or line power frequency.

To reset the meter, press the MENUS key and the following menu will appear:

Menus use arrows

Press the UP arrow key until “System Reset” is displayed.

System Reset

Press the OK/NEXT key to access this menu.

Reset Unit? **Yes**

Press the OK/NEXT key to perform the reset. The meter will display a confirmation message for three seconds then exit the menus.

Unit is Reset

SETTING A MANUAL TEMPERATURE

A manual temperature is a fixed value that can be used instead of the actual temperature measurement from a sensor. This feature must be used when a sensor does not have a temperature sensor built-in or if it is desirable to compensate a measurement based on a fixed temperature. A setting of “Off” uses measured temperature, if available. A setting of “On” uses the manually entered temperature.

To set a manual temperature, press the MENUS key and the following menu will appear:

Menus use arrows

Press the UP arrow key until the “Set temperature” menu is displayed.

Set Temperature

Press the OK/NEXT key to access this menu.

A: T=25.00 °C Off

The cursor is initially under the channel field. Use the UP or DOWN arrow keys to change the channel if desired. Use the RIGHT arrow key to move the cursor to the temperature value field. The display will appear as follows:

A: T=**2**5.00 °C Off

Set the desired temperature value then use the RIGHT arrow key to move the cursor to the “Off” field. Use the UP key to toggle this field to “On”.

Press the OK/NEXT key when done. The next menu will show the manual temperature setting for channel B. Press the OK/NEXT key after setting channel B. The meter will ask if changes should be changed.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

NOTE: In all cases, the “COMPENSATION” setting accessed by the menus key must be “ON”.

SENDING DATA TO A PRINTER OR COMPUTER

The 200pH can be set to output measurement data automatically to a printer or computer at a fixed time interval. The time interval can be set from 1 second up to 255 seconds. The data is transmitted as a string of ASCII characters, terminated with a carriage return character. All four measurements are contained in the string. To use this feature, the baud rate, parity, and output timer must be set as follows:

Setting the Baud Rate and Parity

Press the MENUS key and the following menu will appear:

Menus use arrows

Press the UP arrow key until the “Set Serial Port” menu is displayed.

Set Serial Port

Press the OK/NEXT key to access this menu. A typical menu may appear as:

Baud = 9600 P = Even

The cursor is initially under the baud rate setting. Press the UP or DOWN arrow keys to change the baud rate. Use the RIGHT arrow key to move the cursor to the parity field. The parity setting can be switched between even parity and no parity.

Press the OK/NEXT key when done. The meter will ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

Setting the Data Output Timer

Press the OUTPUTS key.

Output: **Analog**

Press the UP arrow key until “Serial” is displayed. Press the OK/NEXT key to access this menu.

Output **off** > 001s

Press the UP arrow key to toggle the serial output from “Off” to “On”. Setting the serial out feature to “On” enables the automatic data output. Use the RIGHT arrow key to move the cursor to the time field.

Output On > **0**01s

Use the arrow keys to set the desired time interval in seconds.

NOTE: Entering a value greater than 255 seconds will automatically set the timer interval to 255 seconds.

Press OK/NEXT when done. The meter will ask if changes should be saved.

Save Changes **Yes**

Press the OK/NEXT key to save the changes and return to the display of measurement data.

CHAPTER 12: TROUBLESHOOTING

OFF-LINE SELF-DIAGNOSTICS

A number of diagnostic and self test functions are available via the menus. The following functions can be tested:

1. ROM: the program memory is tested for any changes in it's contents. If one or more bits have changed, then the test has failed.
2. RAM: the data memory is tested for reading and writing.
3. AOUT1: analog output channel #1 is tested by driving the output current from 4mA to 20mA in incremental steps.
4. AOUT2: analog output channel #2 is tested by driving the output current from 4mA to 20mA in incremental steps.
5. A/D: the analog to digital converter circuit (used for making measurements) is tested for functionality.
6. COMM: the communication port is tested for its ability to receive and transmit data. A jumper wire is connected from the transmit line to the receive line before conducting the test.
7. NVRAM: the non-volatile memory is tested for functionality. This memory is used to hold setup information in case of a power down condition (or low line voltage).
8. DISPLAY: the display is tested by writing various patterns. This is a visual test conducted by the operator.

To perform any of these tests, press the MENUS key and the following menu will appear:

Menus use arrows

Press the UP arrow key until the "Diagnostic" menu is displayed.

Diagnostic Menu

Press the OK/NEXT key to access this menu.

Test? ROM

The cursor is under the first field which indicates the test to be conducted. The choices are: ROM, RAM, AOUT1, AOUT2, A/D, COMM, NVRAM, DISPLAY, KEYPAD or exit. Use the RIGHT arrow key to select the desired test. Press the OK/NEXT key to perform the test. Select "Exit" to exit this menu.

The test results are displayed with the following messages (for example, the ROM test):

ROM: Passed **ok**

or

ROM: Failed **ok**

ON-LINE DIAGNOSTICS

Error, Over-range & Sensor Error Indications

A measurement that cannot be properly measured or computed or is over-range will show asterisk characters ("*") in place of the allocated digits.

An example:

A *****pH *****°C

In this display, both the A primary and secondary measurements could not be measured or computed properly.

Sensor Alarm Messages

The 200pH constantly monitors the condition of the sensors on each channel. If a defective sensor or broken sensor cable is detected then the measurement number will be replaced with asterisks. This will also be displayed when a cell is not connected to a channel.

A ***** B2.11pH

"Check Setup" Message

The 200pH constantly checks the condition of the setup data (setpoints, compensation methods, etc.). If the meter detects an unauthorized change in this data (i.e., corrupted data) then a message will be displayed every few seconds as follows:

Check Setup

This message can be cleared by exiting any menu. Possible sources of electrical noise or interference should be investigated and corrected.

TROUBLESHOOTING

Problem	Possible Cause
1. Display is blank	• no power to unit • blown fuse • loose or improperly connected display cable • display contrast potentiometer needs adjustment • display circuit board failure
2. Wrong readings	• blue wire of patch cord not connected to +5V terminal • sensor improperly installed • incorrect multiplier or adder entered • meter improperly calibrated • temperature compensation incorrectly set or disabled • sensor patch cord defective • defective sensor • circuit board failure • high potential difference between two sensor locations; use 1200-series preamp
3. Keypad not functioning	• keypad cable connector loose or broken • defective keypad
4. Readings fluctuate too much	• wrong line power frequency selected • sensors and/or cables installed too close to equipment that generates high levels of electrical noise • too low averaging selected
5. Data not sent out to serial port	• serial port wiring wrong • wrong baud rate and/or parity • automatic data output not enabled • data output timer set too high

RECOVERY PROCEDURE

If the meter is unable to make valid measurements, then the following procedure may help to resolve the problem.

1. Check sensor patch cord wiring. Look for loose wires at the terminal block or wrong wiring.
2. Perform a system reset as outlined in **Chapter 11: Other Functions**.
3. Re-calibrate or re-enter the cell constants as shown in **Chapter 9: Sensor Calibration**. Set the desired measurement mode and multiplier as shown in **Chapter 4: Making Measurements**.
4. Re-calibrate the meter as outlined in **Chapter 8: Meter Calibration**.
5. Check that the proper temperature compensation is selected.

CHAPTER 13: SERVICE

FUSE REPLACEMENT

The 200pH is protected from accidental voltage overloading, short circuits, and related damage by a 1/4 amp time-delayed fuse (for 115 VAC units only). The 230 VAC unit uses a 1/8 amp time-delayed fuse. The fuse is located on the printed circuit board (PCB) inside of the case.

WARNING: FOR CONTINUED PROTECTION AGAINST RISK OF FIRE, REPLACE ONLY WITH FUSE OF THE SPECIFIED TYPE AND CURRENT RATING.

To replace the fuse:

1. Disconnect all power to the 200pH unit before proceeding.
2. Remove the two screws from the center of the rear panel.
3. Slowly pull the rear panel assembly out of the unit, no more than 1".
4. Disconnect the two cables connecting the case to the PCB.
5. The fuse is located near the transformer. Remove the old fuse and replace it with one with the same rating as indicated above.
6. Position the PCB near the case and connect the two cables to the PCB. Make sure each cable is properly seated and oriented.
7. Gently push the rear panel assembly back into the case. Make sure the four mounted posts align with the holes in the assembly.
8. When the assembly is properly seated, reinstall the two mounting screws.
9. Reconnect power to the meter.

REDUCING 200PH PATCH CORD LENGTH

200pH patch cords are available in a variety of standard lengths. Occasionally it is necessary to reduce standard cord lengths to accommodate system design. The following procedure outlines how to terminate the end of the cable to assure accurate system operation. The 200pH patch cords include two (2) drain (bare) wires. It is essential that these wires never make contact with each other. Place insulating tubing over these wires.

CAUTION: If the wires are touching, it will cause the readings to be inaccurate. Be sure that the wires never make contact with each other.

Tools required:

Cable cutters, wire strippers, insulating tubing, soldering iron & solder, wire markers (optional)

Procedure:

1. Measure the cable from the end connector to the desired length and cut.
2. Strip outer jacket and shield 2-1/2 inches from the end.
3. Cut at the jacket the blue, orange, yellow and all white wires that are outside the inner shield. DO NOT CUT the drain (bare) or the wires enclosed inside the inner shield.
4. Strip the inner shield all the way to the jacket.
5. Strip all leads 1/4 inch and tin the inner shield.
6. Place insulating tubing over the inner drain (bare) wire. Tuck the insulating tubing under the jacket. THIS WIRE MUST NEVER TOUCH THE OUTER SHIELD OR OUTER DRAIN WIRE.
7. Solder the outer drain (bare) wire to the black wire.
8. Place insulating tubing over the outer drain (bare) and black wires. Tuck the tubing under the jacket. THIS WIRE MUST NEVER TOUCH THE INNER SHIELD OR INNER DRAIN WIRE.
9. Place wire markers on leads if desired.
10. Wire the cable to the 200pH as indicated. See Figure 14.10.

SPARE PARTS LIST

Description	Recommended QTY	Part #
1. Fuse (5 x 20mm):		
For 115VAC (Type 2AG, 1/8 Amp SB, Littlefuse® #218.125)	1	35088
For 230VAC (Type 2AG, 1/16 Amp SB, Littlefuse® #218.063)	1	35091
2. Display Assembly	1	06235
3. Power Selection Jumper(s):		
For 115VAC	2	25242
For 230VAC	1	25242
4. Panel Mounting Kit (gasket, screws, nuts included with instrument)	-	02181
5. Plug-in connector for TB1 (10-pin)	1	22626
6. Plug-in connector for TB2 (9-pin)	1	22617
7. Plug-in connector for TB3 (16-pin)	1	22624

ACCESSORIES

Description	Part #
Back Cover for rear NEMA 4X, IP65 rating (also required for wall mounting)	1000-62
Pipe Mounting Kit for 1-1/2 to 4” pipe (also requires back cover, above)	1000-63
Patch Cord, 1 ft	1001-66
Patch Cord, 5 ft	1005-66
Patch Cord, 10 ft	1010-66
Patch Cord, 25 ft	1025-66
Patch Cord, 50 ft	1050-66
Patch Cord, 100 ft	1110-66
Patch Cord, 150 ft	1115-66
Patch Cord, 200 ft	1120-66
Preamp/BNC Adaptor – 6 in (0.15 m) cable (allows connection of any pH probe or simulator with BNC connector)	1000-77
Preamp/K9 Adaptor – 3 ft (1 m) cable (allows connection of any pH probe or simulator with K9 connector)	1000-85
Preamplifiers for VP, S8 and BNC electrode connections	1200-XX series

CHAPTER 14: TECHNICAL ILLUSTRATIONS

- 14.1: Menu Trees
- 14.2: Overall Dimensions
- 14.3: Panel Cutout
- 14.4: Exploded Assembly
- 14.5: Panel Mounting
- 14.6: Pipe Mounting
- 14.7: Pipe Mounting Bracket
- 14.8: Rear Cover Assembly
- 14.9: Printed Circuit Board Layout
- 14.10: Rear Panel Wiring & Patch Cords
- 14.11: Meter Calibration Connections Using Decade Box & Voltage Source

MENU TREES

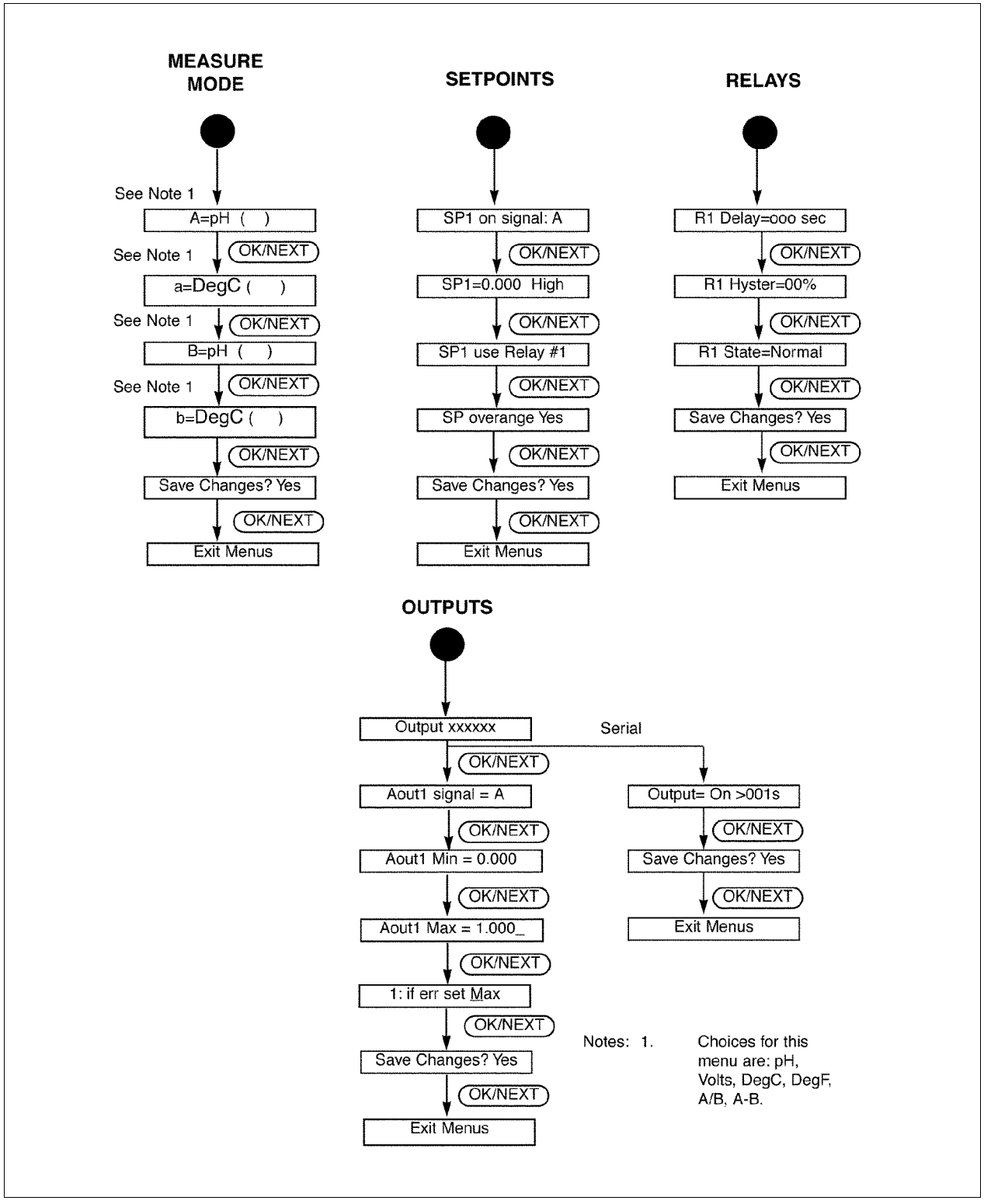


Figure 14.1a: Menu Trees

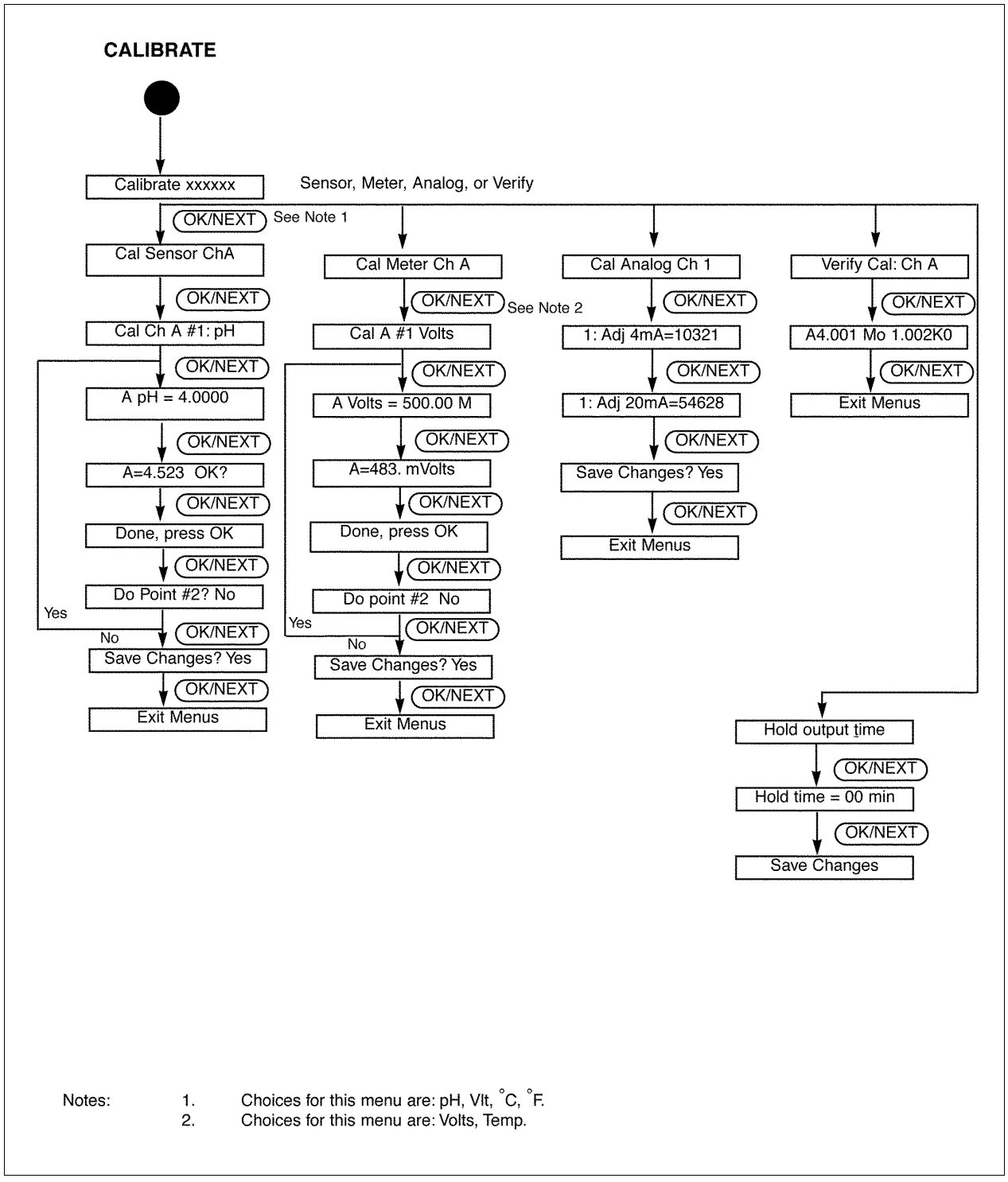


Figure 14.1b: Menu Trees

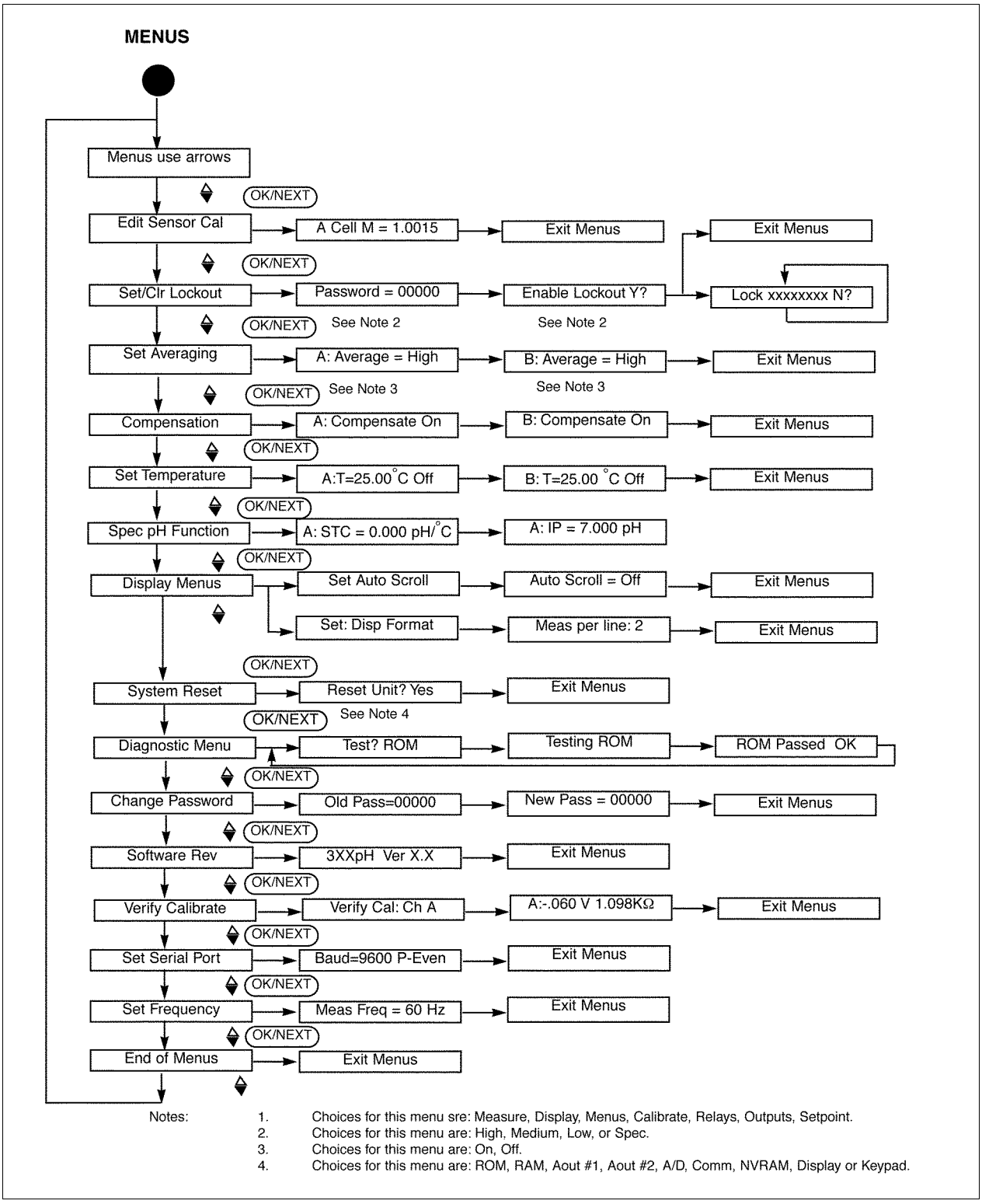
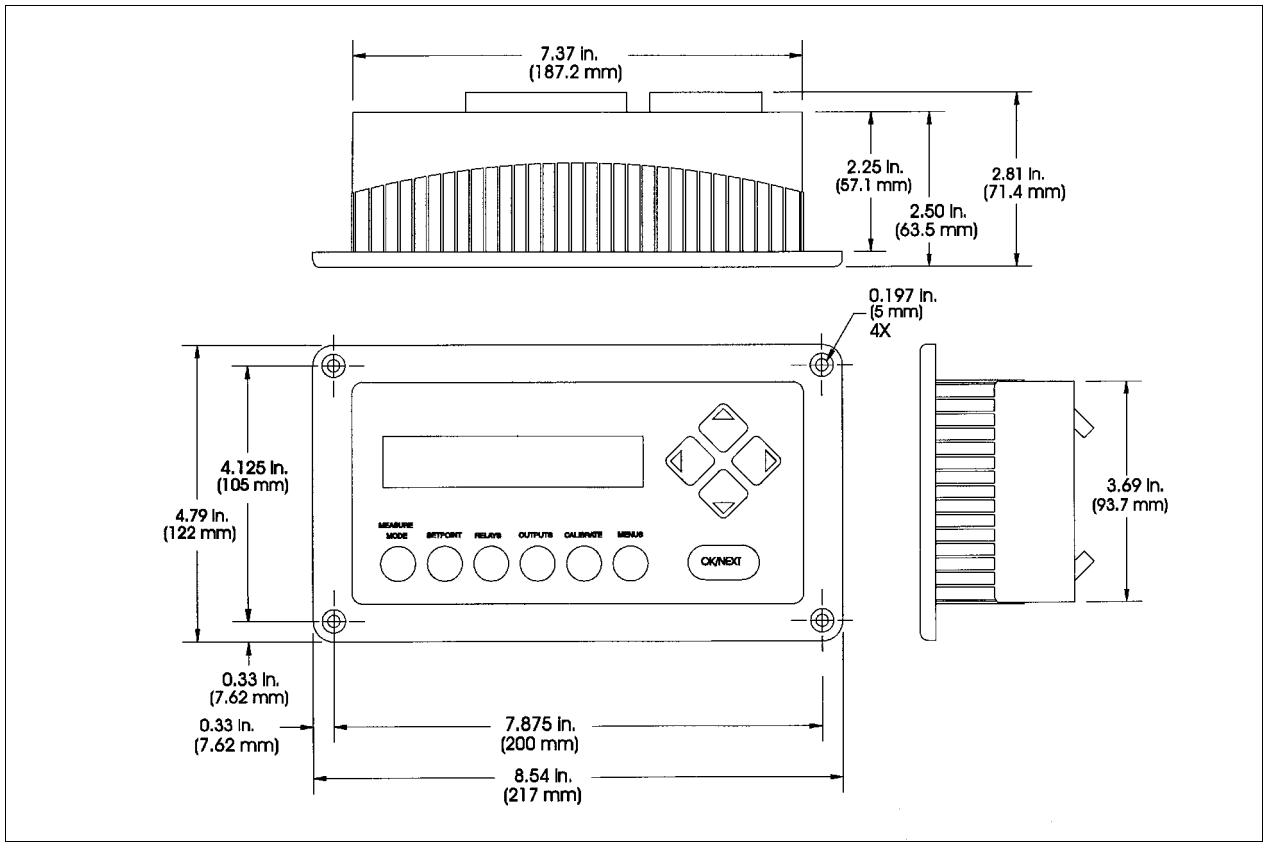


Figure 14.1c: Menu Trees

OVERALL DIMENSIONS

Panel Mounting



Wall Mounting

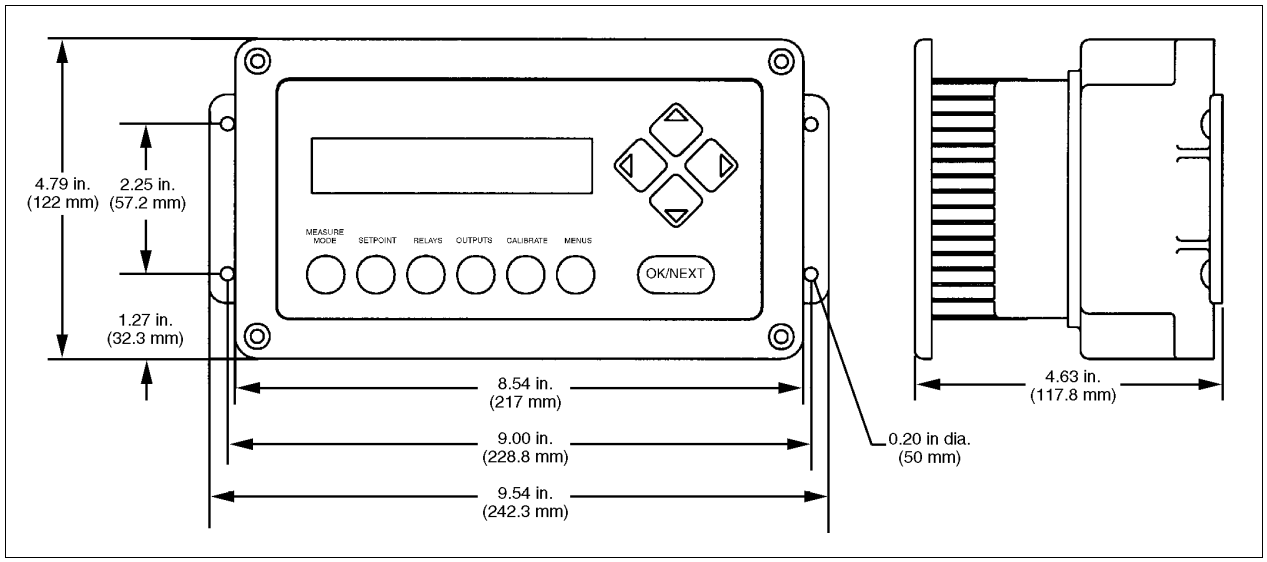


Figure 14.2: Overall Dimensions

PANEL CUTOUT

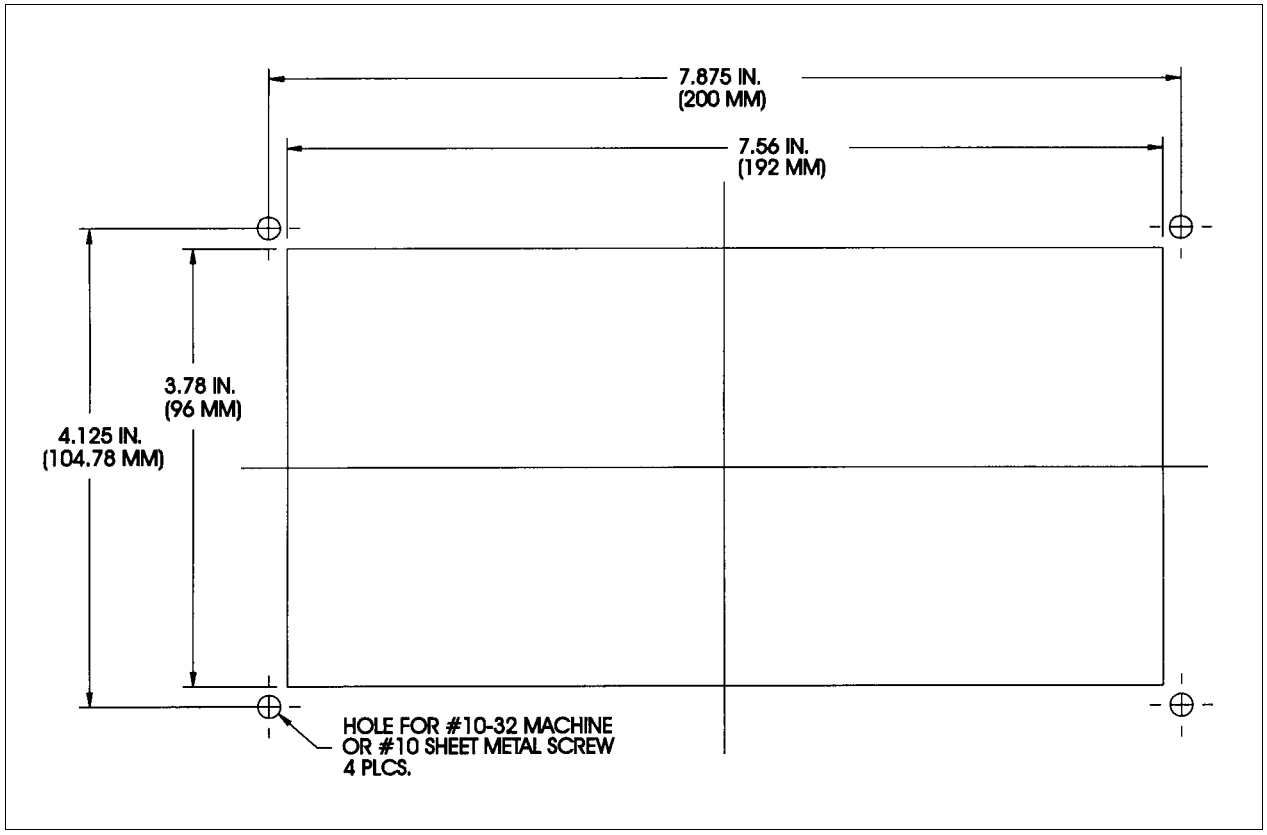


Figure 14.3: Panel Cutout

EXPLODED ASSEMBLY

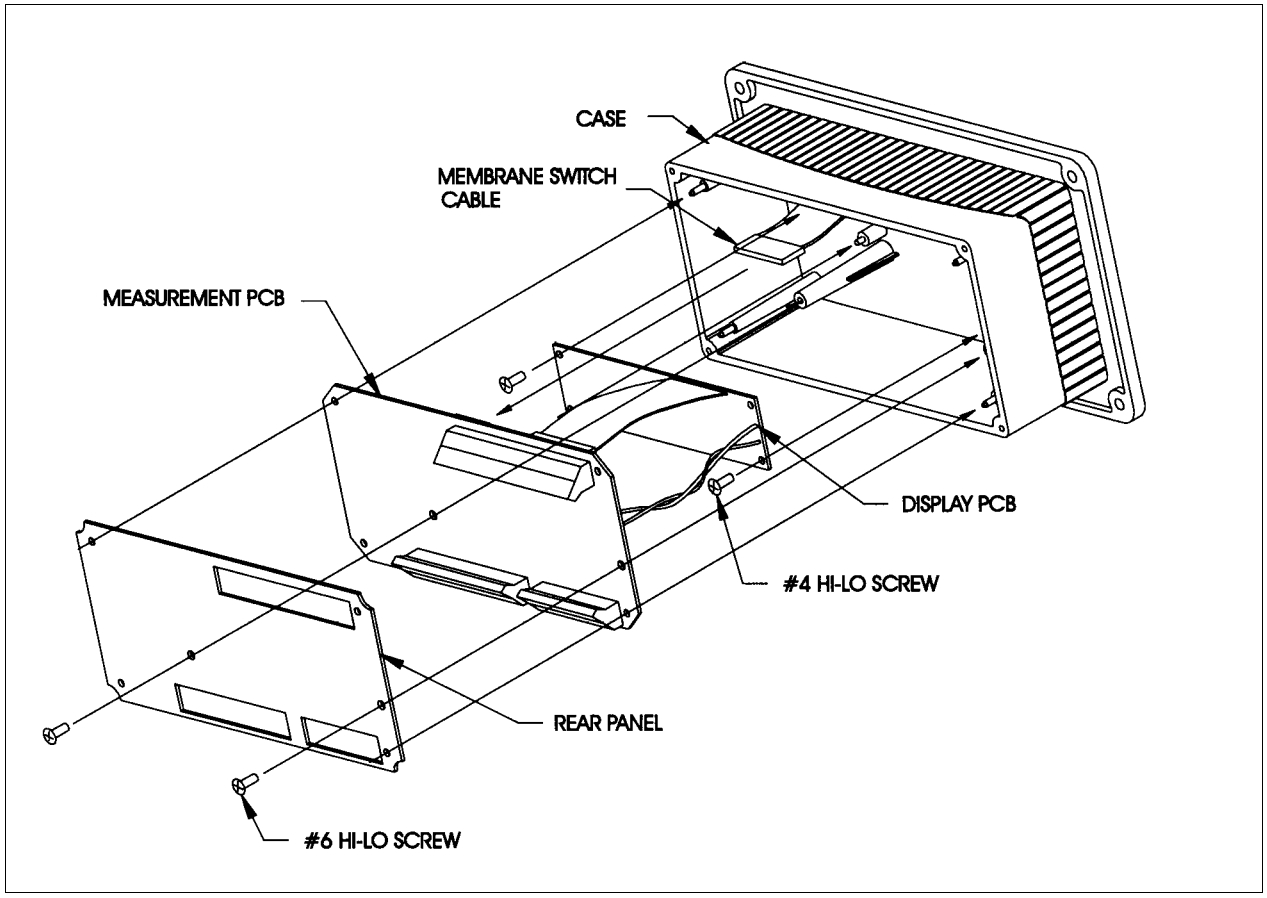


Figure 14.4: Exploded Assembly

PANEL MOUNTING

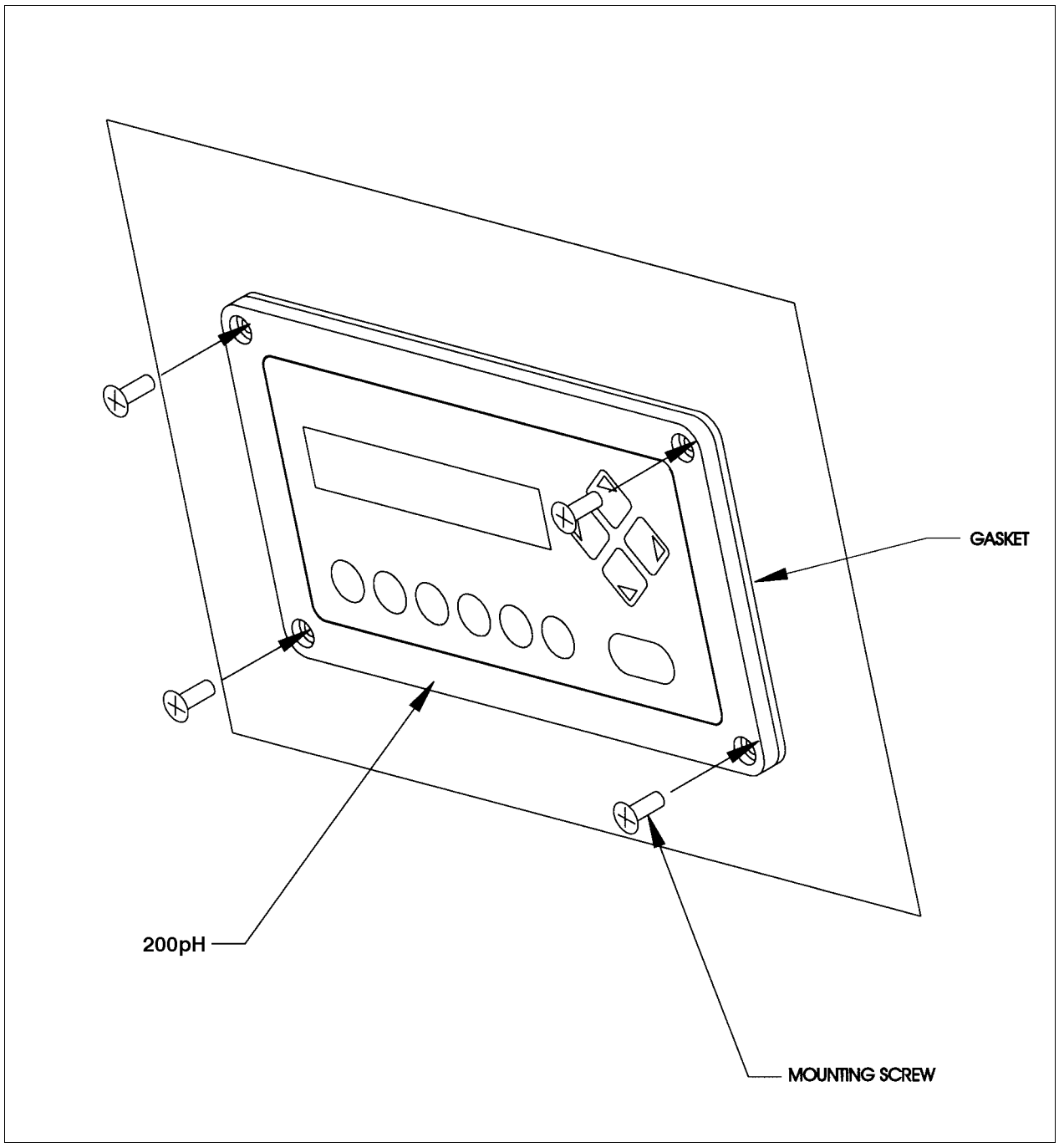


Figure 14.5: Panel Mounting

PIPE MOUNTING

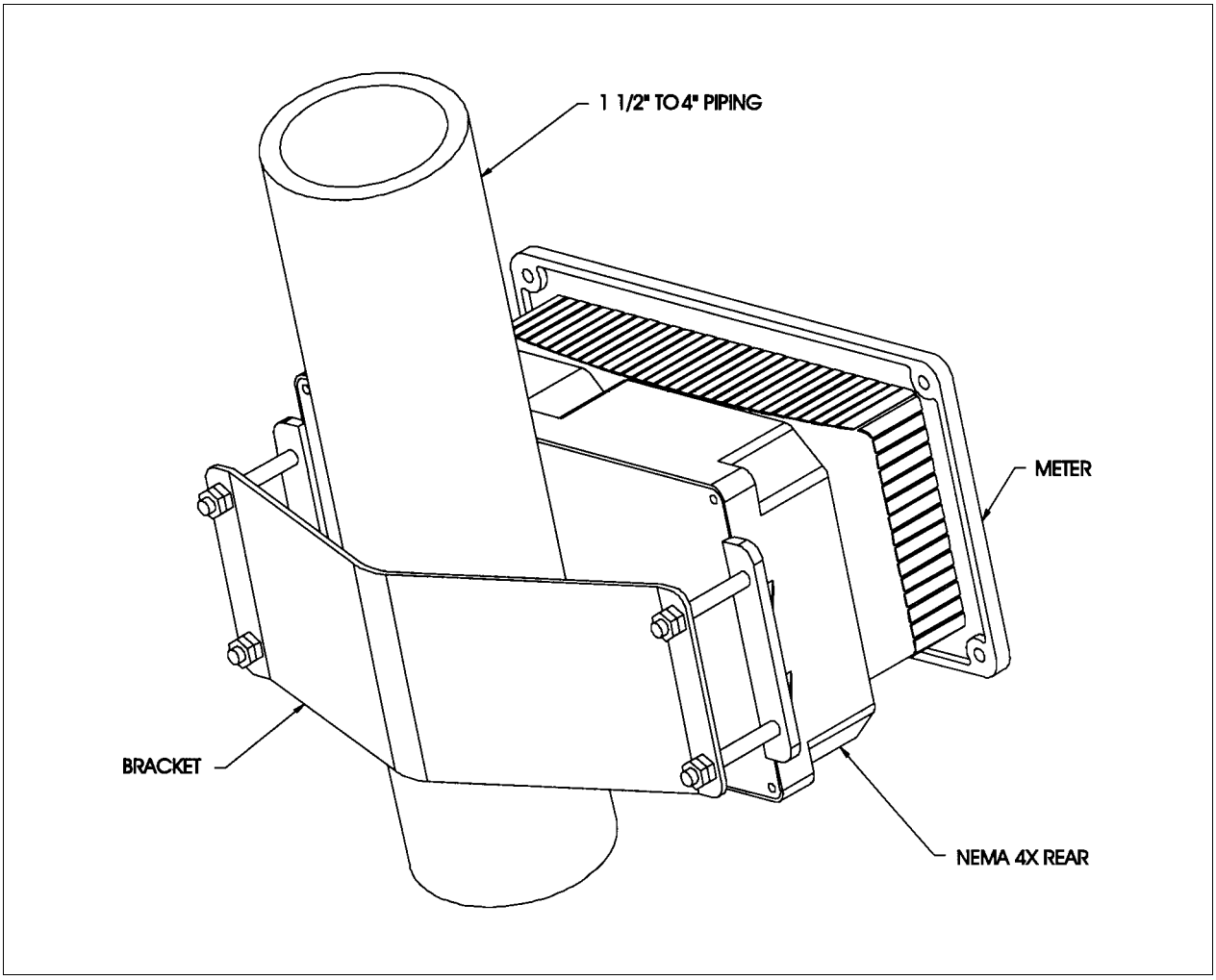


Figure 14.6: Pipe Mounting

PIPE MOUNTING BRACKET

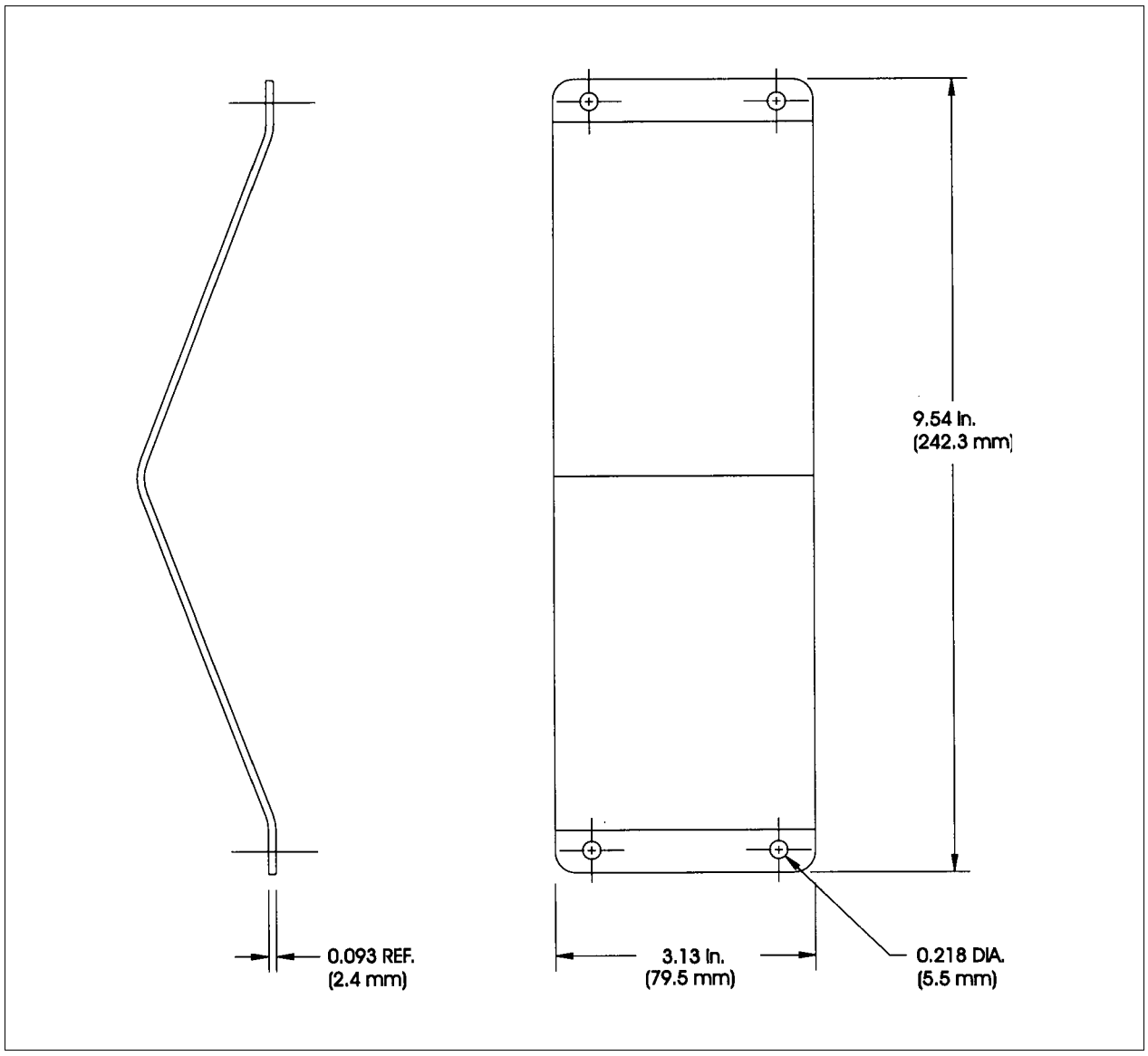


Figure 14.7: Pipe Mounting Bracket

REAR COVER ASSEMBLY

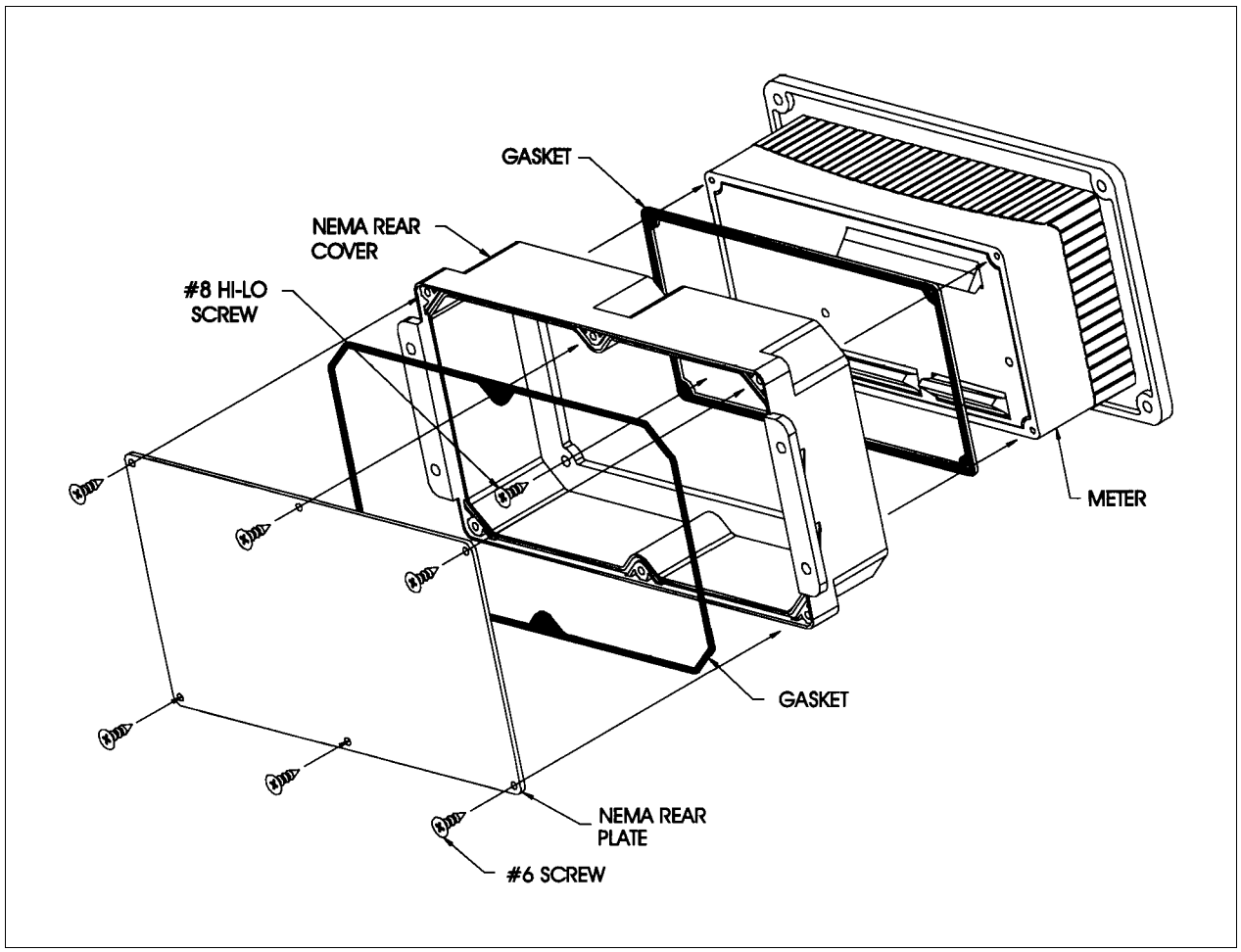


Figure 14.8: Rear Cover Assembly

PRINTED CIRCUIT BOARD LAYOUT

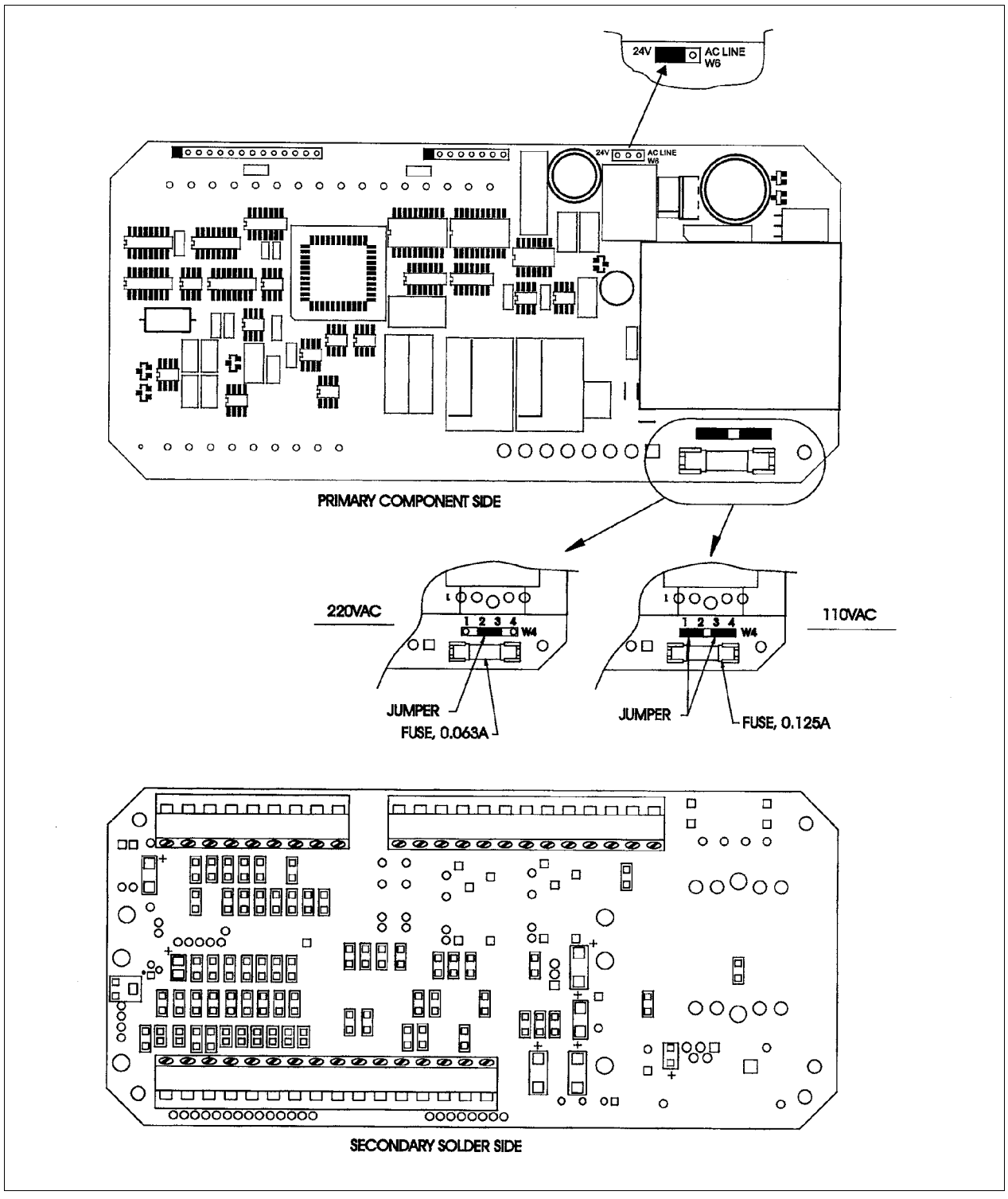


Figure 14.9: Printed Circuit Board Layout

REAR PANEL WIRING & PATCH CORDS

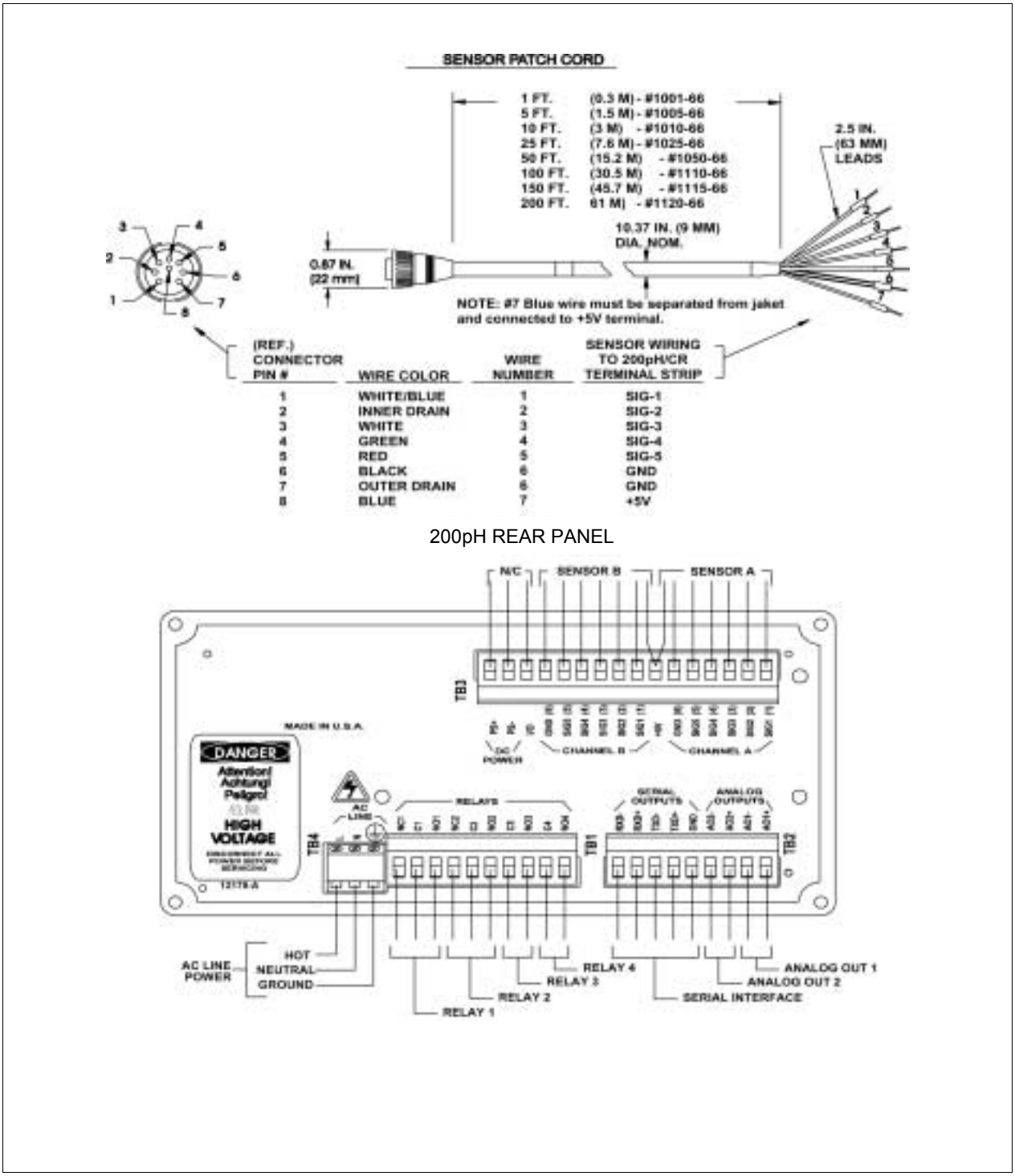


Figure 14.10: Rear Panel Wiring & Patch Cords

METER CALIBRATION CONNECTIONS USING DECADE BOX & VOLTAGE SOURCE

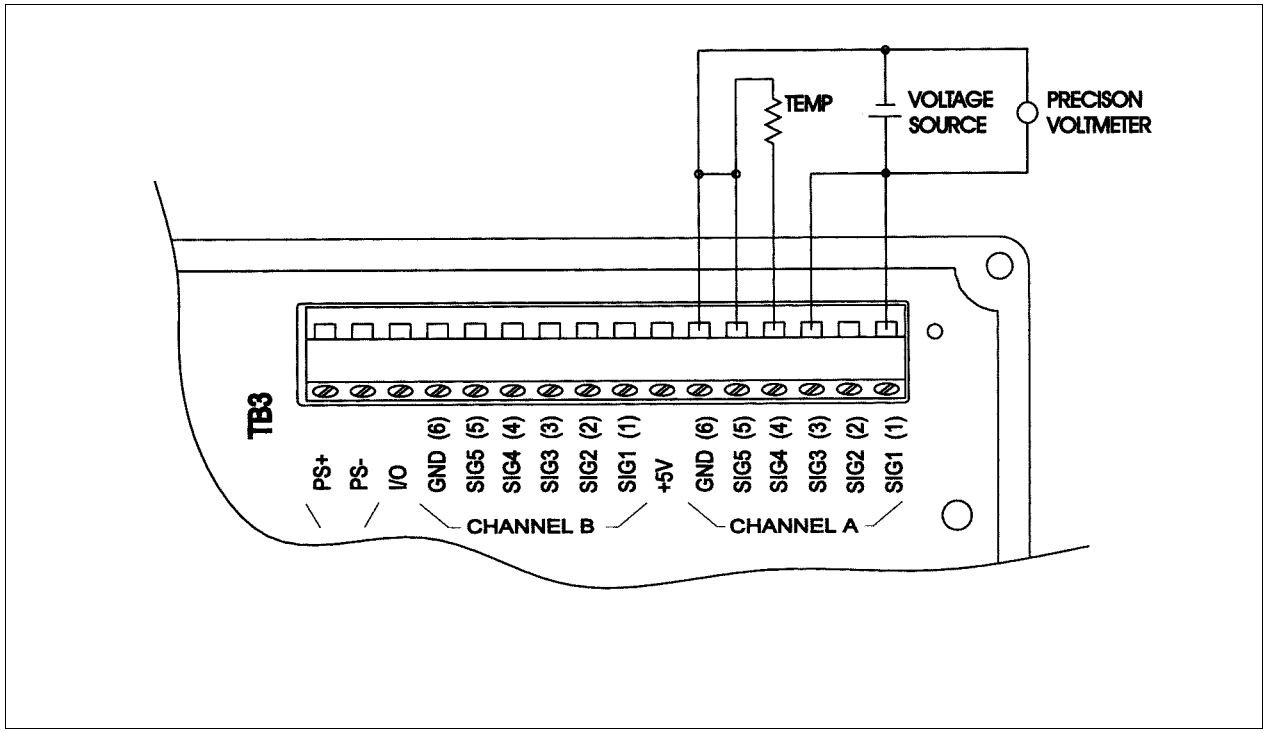


Figure 14.11: Meter Calibration Connections Using Decade Box & Voltage Source

200pH SPECIFICATIONS

Functional

Ranges	
pH	-1.00 to 15.00 pH
ORP	±1500 mV
Temperature	-40.0 to 140.0°C (-40.0 to 284.0°F)
Resolution	Fixed at 0.01 pH, 1 mV, 0.1°C
Input:	From pH or ORP sensor with Thornton preamp and Pt1000 RTD, via accessory patch cord
Temperature compensation:	Conventional (Nernst) electrode pH temperature compensation plus adjustable solution temperature coefficient for high purity water ionization effects

Outputs

Setpoints/Alarms:	Four controlled setpoints can be set as high or low limits. Any relay can be activated by multiple setpoints.
Relays:	2 SPDT, 5 amp at 250 VAC or 30 VDC resistive load, standard; Optional additional: 2SPDT solid state, 5 amp at 250 VAC resistive load, 10 mA minimum. All relays have individually adjustable delay and hysteresis (deadband)
Analog output Signals:	Two optional powered 4-20 mA outputs (recalibratable to 0-20 mA), 500 ohm load maximum, freely scalable to any pH, ORP or temperature range; isolated from input and from earth ground. Not for use in powered circuits.
Serial output:	RS232, maximum distance of 50 feet (15 m); RS422, maximum distance of 4000 feet (1220 m); field selectable up to 19.2 kbaud. Requires external isolation from earth ground.

Performance

Accuracy:	±0.02 pH, ±2 mV, ± 0.3°C
Repeatability:	±0.01 pH, ±1 mV, ± 0.2°C
Update Rate:	All measurements and outputs, once per second
Ratings/approvals:	CSA/NRTL, UL listed, CE compliant
Analog output accuracy:	± 0.05 mA within 15 to 35 °C ambient

Environmental

General:	If the equipment is not used in a manner specified by Mettler-Toledo Thornton, Inc., the protection provided by the equipment may be impaired. For indoor use, pollution degree 1.
Storage temperature:	-40 to 70°C (-40 to 158°F)
Operating temperature	-10 to 55°C (14 to 131°F)
Humidity:	0 to 95% RH, non-condensing
UL electrical environment:	Installation (overvoltage) Category II

Enclosure

Display:	16 character backlit LCD (4.8 x 9.6 mm)
Keypad	11 flush, tactile feedback keys
Material:	ABS-PC alloy
Panel cutout:	3.78 x 7.56” (96 x 192 mm) DIN
Wall mount:	Available with accessory back cover
Pipe mount:	For 1-1/2 to 4” pipe, available with accessory kit and back cover

Weight:	1.9 lb (0.9 kg)
Rating:	NEMA 4X, IP65 panel mount and accessory back cover
Sensor max distance:	200 feet (61 m)

Power

Line:	90-130 VAC or 180-250 VAC, 12W maximum, 50-60 Hz or nominal 24 VDC, 300 mA steady state, 600 mA inrush. DC power must be isolated from earth ground.
Memory retention:	On power loss all stored values are retained in non-volatile memory without batteries

200pH MODELS

Part No.	Relays	Analog Outputs	Power
6320-1	2 SPDT	0	110 VAC (24 VDC)
6320-2	2 SPDT	0	220 VAC (24 VDD)
6322-1	2 SPDT	2	110 VAC (24 VDC)
6322-2	2 SPDT	2	220 VAC (24 VDC)
6342-1	2 SPDT and 2 solid state AC	2	110 VAC (24 VDC)
6342-2	2 SPDT and 2 solid state AC	2	220 VAC (24 VDC)

CE Declaration of Conformity

Mettler-Toledo Thornton, Inc., 36 Middlesex Turnpike, Bedford, MA 01730, USA declares that the 200pH pH/ORP Instruments, Models 6320-1, 6320-2, 6322-1, 6322-2, 6342-1, and 6342-2, 6320K1, 6322K1 and 6342K1 meet the intent of Directive 89/336/EEC for Electromagnetic Compatibility and Directive 73/23/EEC for Low Voltage.

Compliance was demonstrated to the following specifications:

EN 55011 Emissions: Radiated and Conducted, Class A

EN 50082-1 Immunity

IEC 61010-1 Safety

CSA and NRTL/C Certification

Mettler-Toledo Thornton, Inc., 36 Middlesex Turnpike, Bedford, MA 01730, USA has obtained Certification of Compliance from the Canadian Standards Association for the 200pH pH/ORP Instruments, Models 6320-1, 6320-2, 6322-1, 6322-2, 6342-1, 6342-2, 6320K1, 6322K1 and 6342K1.These models bear the NRTL/C and CSA marks, signifying that the products have been evaluated to the applicable ANSI/UL and CSA Standards for use in the U.S. and Canada. NRTL, i.e. Nationally Recognized Testing Laboratory, is a designation granted by the U.S. Occupational Safety and Health Administration (OSHA) to laboratories which have been recognized to perform certifications to U.S. Standards.

Class
Class 2252 01 - Process Control Equipment, Ordinary Locations
Class 2252 81 - Process Control Equipment

Applicable Requirements

CSA Std C22.2	No. 0-M1982	General Requirements - Canadian Electrical Code, Part II
	0.4-M1982	Bonding and Grounding of Electrical Equipment (Protective Grounding)
	142-M1987	Process Control Equipment
UL Std	No. 916	Energy Management Equipment

WARRANTY

Mettler-Toledo Thornton, Inc. warrants products it manufactures against defects in materials and workmanship for 18 months from the date of shipment from Thornton. Some non-Thornton manufactured resale items may have shorter warranties. Thornton honors only the warranty period of the original manufacturer. Consumable items such as pH and ORP sensors and TOC UV lamps are warranted for a period of 6 months from shipment in normal use and service.

Catalog descriptions, although accurate, should not be taken as a guarantee or warranty. Thornton's obligation under the warranty shall be to repair at its facility or replace any products which Thornton finds to be defective. Items returned for warranty must be properly packaged, shipped prepaid and insured, and must be accompanied by a Return Materials number assigned by Thornton Customer Service. Proper return packaging for pH, ORP and dissolved oxygen sensors includes their original storage boot, chamber or alternative packaging containing a small amount of water to keep the sensor tip from drying out.

Note: Substitution, modification or mis-wiring of cables voids all warranties.

THE ABOVE WARRANTY IS THE ONLY WARRANTY MADE BY METTLER-TOLEDO THORNTON, INC. AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THORNTON SHALL NOT BE LIABLE FOR ANY LOSS, CLAIM, EXPENSE OR DAMAGE CAUSED BY, CONTRIBUTED TO OR ARISING OUT OF THE ACTS OR OMISSIONS OF THE BUYER OR THIRD PARTIES, WHETHER NEGLIGENT OR OTHERWISE. IN NO EVENT SHALL THORNTON'S LIABILITY FOR ANY CAUSE OF ACTION WHATSOEVER EXCEED THE COST OF THE ITEM GIVING RISE TO THE CLAIM, WHETHER BASED IN CONTRACT, WARRANTY, IDEMNITY, OR TORT (INCLUDING NEGLIGENCE).

Mettler-Toledo Thornton, Inc.
36 Middlesex Turnpike
Bedford, MA 01730
(781) 301 8600
www.thorntoninc.com

Toll-Free: 800-510-PURE
Fax: 781-271-0214
info@thorntoninc.com
Part # 84337
Rev. F 11/03