GE Panametrics

System 3A Hygrometer

July 2003

Process Control Instruments

System 3A Hygrometer

User's Manual *910-003G*

GE Panametrics

Warranty

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

- one year for general electronic failures of the instrument
- one year for mechanical failures of the transducers

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

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

Return Policy

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

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

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

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

Table of Contents

General Information

The GE Panametrics *System 3A Hygrometer* is a single-channel moisture analyzer designed to measure water content in both gases and liquids. It operates over a range of -110°C to +60°C dew/frost point, which is equivalent to 1 ppb_v to 200,000 ppm_v in gases at 1 atm.

The *System 3A* displays one of four parameters at any given time:

- dew/frost point
- ppm_v
- ppm_w
- temperature (optional order as F2 only)

An order for the *System 3A Hygrometer* may include one moisture measurement unit which is factory assigned to Function 1 (F1), and a second optional moisture measurement unit or a temperature unit which is factory assigned as Function 2 (F2).

The following measurement units are presently available for the *System 3A*:

Moisture units:

- DP °C
- DP °F
- ppm_v x10
- ppm_v x100
- ppm_v x1000
- ppm_w x10
- ppm_w x100
- ppm_w x1000

Temperature units:

- TEMP °C
- TEMP °F

During operation, the measurement displayed on the front panel LCD is also output as a current or voltage signal on a rear barrier strip.

Safety Considerations

Without the use of external barrier protection, the *System 3A* is **not intrinsically safe**. Intrinsic safety **can be obtained** through the use of external zener barriers. We recommend the ZBS761 and ZBP788 zener barriers and bus housing. These zener barriers are certified for use in most hazardous areas. For specific certification information for your application and location, contact the nearest GE Panametrics company office (see the back page of this manual for a listing of company offices). While GE Panametrics zener barriers are certified, their use in the *System 3A* does not imply intrinsic safety certification by an independent agency for the entire system.

Class I Div. 2 Operation

For use in Class I Div. 2 locations, the *System 3A* must be ordered with Class I Div. 2 electronics modifications (low energy internal switching and bypassed power switch) or with case modifications to meet ISA specifications for type Z purging.

Aluminum Oxide Probe

The moisture probe contains a patented GE Panametrics moisture sensor. This sensor consists of a specially anodized strip of aluminum providing a porous oxide layer over which a very thin coating of metal is evaporated. The coating forms the two electrodes of what is essentially an aluminum oxide capacitor (see Figure 1 below).
A detailed discussion of the sensor can be found in *Basic GE Panemetrics Hygrometry Principles* User's Guide (916-064).

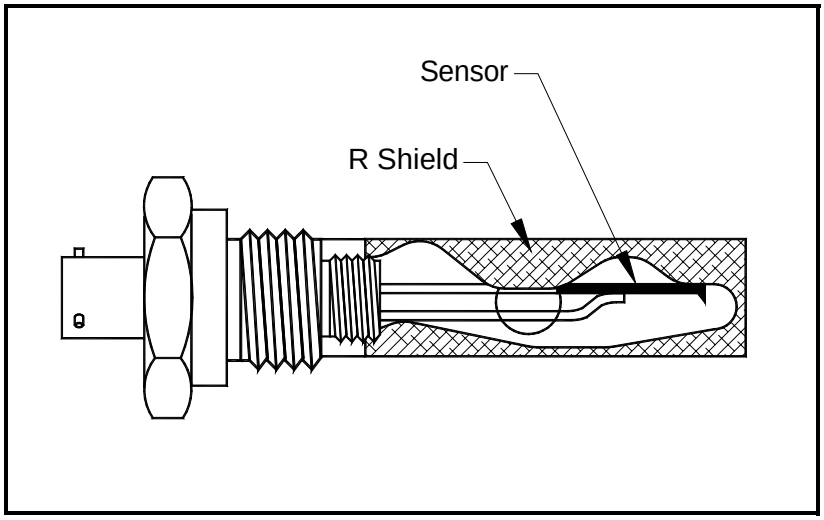

Figure 1: Moisture Probe

Probe Connections - Cables

The *System 3A* moisture sensor probes must be connected to the hygrometer with a GE Panametrics #237-020 four-wire, shielded cable as shown in Figure 2 below. If the connectors are removed from the cable for any reason, be sure that the shield leads do not break or short at either end. A defective cable will cause data errors.

Normal precautions must be taken with cables to protect them from excessive physical strain (bending, pulling, twisting, or otherwise straining them). Do not subject the cables to temperatures above +65 °C or below –50 °C.

Standard cable assemblies (including connectors) can be ordered from GE Panametrics in any length up to 2,000 feet.

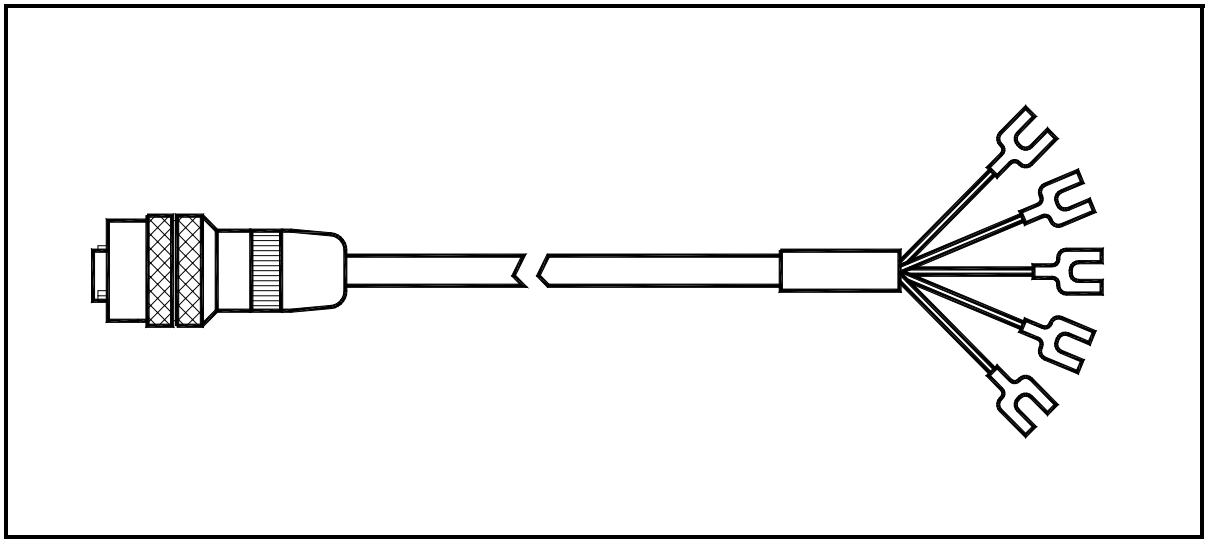

Figure 2: Probe Cable

Installation

The *System 3A RBP* can be used in a relay rack, on a bench, or in a custom-cut panel. Special mounting hardware is available. (Consult your GE Panametrics sales representative for mounting option information). For installation outline dimensions see the drawings on pages 29-31.

Note: *For information regarding component locations and/or wiring connections in a* Weatherproof *enclosure, see pages 23-28.*

Checking the New System

To check a new hygrometer, remove the two screws on each side of the RBP case, lift the cover off, and verify the following:

- there is no shipping damage.
- the correct line voltage is being used.
- the power fuse is good.
- the probe cable is properly connected and not shorted or open.
- U101, the EPROM on the main circuit board, is plugged firmly into its socket (see Figure 18 on page 32 to locate U101) and the socket lock shows ON.

If there is evidence of shipping damage, report this to the shipper and to GE Panametrics immediately. If there is no evidence of damage, proceed with the installation.

You should check the calibration of the *System 3A* (see *Calibration* on page 14) before it is first put into service, after any repairs are made, or if for any reason there is uncertainty as to the hygrometer's accuracy. Internal reference standards (dummy probe values) built into the *System 3A* simplify calibration.

Checking the Power Supply

A power supply check should be performed in the event that the *System 3A* has been repaired. If adjustments are made, perform a **calibration check** and re-calibrate if necessary (see *Calibration* on page 14). Remove the two screws on each side of the RBP case, lift the cover off, and proceed as follows:

1. Verify that there is only one line voltage jumper installed and it is in the correct position (see Table 1 on page 5).
2. Verify that fuse **F1** is installed, of the correct value, and is good (see Table 1 on page 5).
3. Connect the *System 3A* line cord.

Checking the Power Supply (cont.)

4. Plug in the line cord and turn the power switch on. Use a digital voltmeter (DVM) for the following measurements.

Table 1: Fuse and Jumper Data

Voltage	F1 Value	Jumper Position
100 VAC	1/4 A	W1
120 VAC	1/4 A	W2
220 VAC	1/8 A	W3
240 VAC	1/8 A	W4

5. Connect the DVM COMMON lead to test point E15 (see Figure 18 on page 32). Connect the DVM POSITIVE lead to the indicated test points. Check the voltages at the test points as shown in Table 2 below. Adjust the voltages at E17 and E18 if they are out of specification.

Table 2: Power Supply Voltages

Test Point	Voltage	Tolerance (Adj.)
E14	+5.00 V	±.3 V
E16	-5.00 V	±.35 V
E13	+14.00 V*	±3.0 V*
E17	+2.00 V	±.005 V (R39)
E18	-2.00 V	±.005 V (R41)
**Voltage at E13 may be as high as 21V if 100VAC line is used.*		

Installing the Probe

Figure 3 below shows two typical probe installations. The upper illustration shows a probe mounted directly in a pipe and the lower illustration shows a probe mounted in a sample cell. (GE Panametrics can supply custom-made sample cells to your specifications.). Probe mounting dimensions can be found in Figure 21 on page 35.

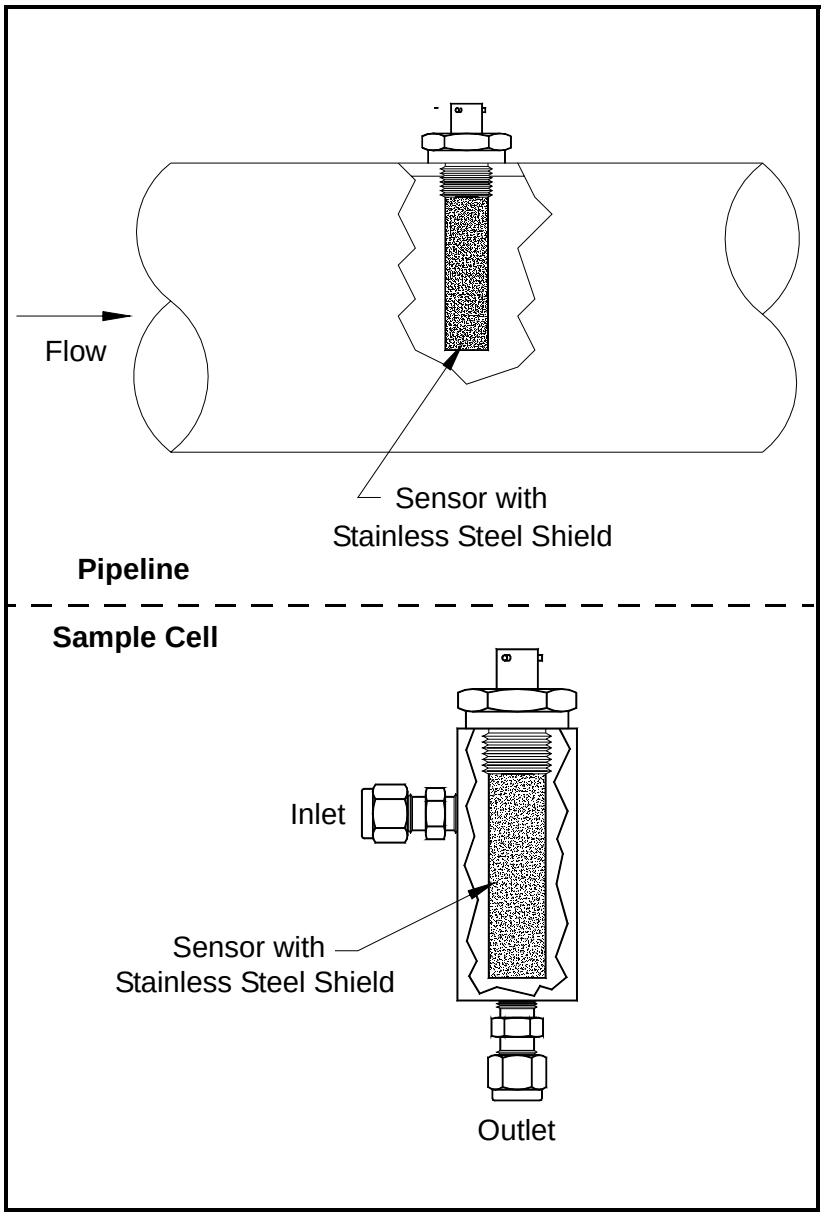

Figure 3: Typical Moisture Probe Installations

Note: *Before mounting the moisture probe we recommend that you read* Basic GE Panametrics Hygrometry Principles User's Guide *(916-064).*

Installing the Probe (cont.)

To install the probe, screw the probe into the receptacle fitting, being careful not to cross the threads, and tighten it down securely. For maximum protection of the aluminum oxide sensor, the stainless steel end cap should always be left in place. In addition, the sensor should be oriented so that it is perpendicular to the sample flow (see Figure 3 on page 6).

When the probe is in place, connect the cable to the probe.

Next connect the probe cable to the hygrometer rear-panel barrier strip TB-1 as shown in Figure 4 below. Make sure the correct color wire is connected to each terminal.

Note: *For information regarding component locations and/or wiring connections in a* Weatherproof *enclosure, see pages 23-28.*

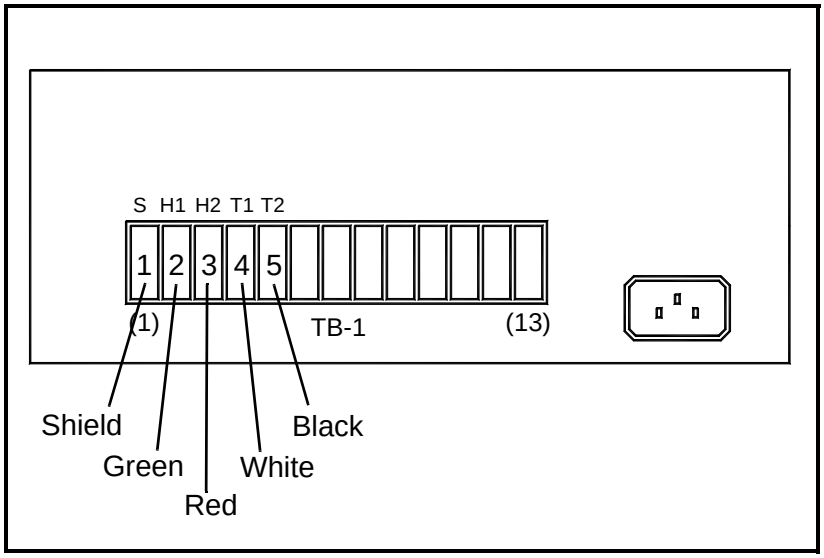

Figure 4: Rear Panel Probe Connections

Note: *If your System 3A* ***does not*** *have the F2 temperature option installed, connect the probe cable as shown in Figure 4. Also connect terminals 4 and 5 to terminal 1 using jumper wires.*

IMPORTANT: *Each* System 3A *probe must be used together with its matching EPROM. Each EPROM is identified with a serial number corresponding to the probe. When a probe is replaced or recalibrated, its EPROM must also be replaced.*

!WARNING!
Turn the power off when replacing EPROMs.

Replacing the EPROM

Because the probe and EPROM comprise a matching set, the EPROM must be replaced whenever the probe is changed or recalibrated. The EPROM can be found on the Hygrometer PC Board inside the unit (see Figure 5 below).

Caution!
Static electricity may damage the EPROM. Be sure to observe proper grounding and handling procedures before continuing.

1. Disconnect the main power source.

!WARNING!
Do not continue with these steps until the main power has been disconnected.

2. Remove the two screws on each side of the case and lift the cover off. The EPROM is locked into its socket with a locking screw.

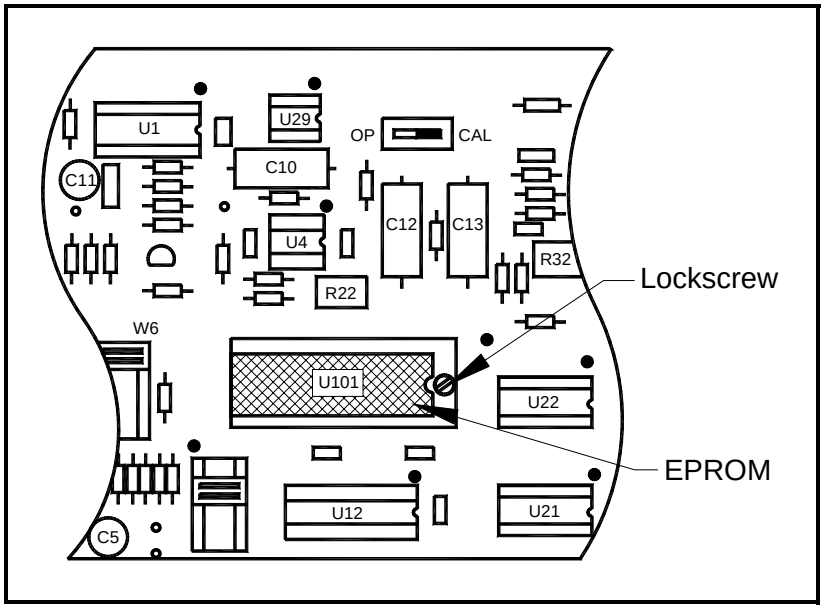

Figure 5: EPROM on the Hygrometer PC Board

3. Using a small screwdriver, turn the lock screw counter-clockwise to the "**O**" (for open) position. The EPROM will lift out of the socket freely.

IMPORTANT: *The serial number on the new EPROM must match the serial number on the moisture probe.*

4. Replace the old EPROM with the new one, being sure to orient the new EPROM in the same direction as the old.

Replacing the EPROM (cont.)

Caution!
Be certain the notch on the EPROM is facing the lock screw. Otherwise you may destroy the EPROM and void the warranty.

5. Turn the lockscrew clockwise to the "**C**" (for closed) position. Ensure that the EPROM is locked in its socket.
6. Replace the unit's cover and hardware. The procedure is complete.

Installing the Temperature Sensor (optional)

If the temperature measurement option has been ordered, an additional circuit is included on the Hygrometer Printed Circuit Board and a thermistor is mounted in the probe.* The installation and configuration of the temperature option is done at the factory.

* A separate thermistor probe may be used. (Consult your GE Panametrics Representative.)

Powering Up the System

Plug the *System 3A* into a power outlet and press the red power pushbutton. The LCD display will show a reading, and one or two of the LEDs on the light bar module (bargraph) will light. There are five pushbuttons on the control panel and, if you ordered Function 2 as a temperature option, there is also a slide switch labeled CAL/OP just below the pushbuttons.

Note: *For information regarding switch locations in a* Weatherproof *enclosure, see pages 23-28.*

Front Panel Switches

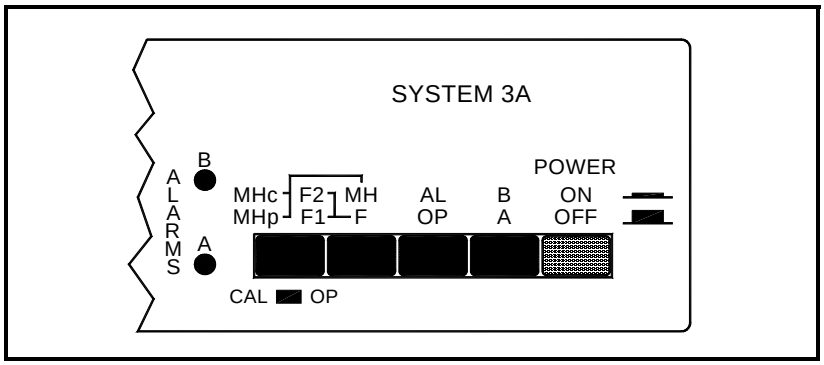

Figure 6: Front Panel Switches

Note: *The panel is marked on the right to show the pushbutton down (depressed) and up (released). Selections are identified by the labels above the respective buttons. The function of the* MHc/MHp *button depends on the position of the* MH/F *button.*

Table 3: Front Panel Switches

SWITCH	FUNCTION
ON OFF	Turns power on and off.
B A	Selects dummy probe A or B in the calibration process, or sets Alarm A or B in the alarm set mode.
AL OP	Selects alarm set mode or operate mode
MH F	Selects MH or function mode.
MHc MHp	Selects one of two MH modes or one of two function modes, depending on the position of MH/F.
CAL OP*	Selects Function 2 as temperature in the OP position, and moisture in the CAL position.

The* CAL/OP *switch occurs only on hygrometers ordered with Function 2 specified as* ***temperature**. The Function 2 temperature option was described in* General Information *on page 1.*

Measurement Units

Normally the *System 3A* is operated in the measurement mode (with the MH/F switch in the F position).

Note: *For information regarding component locations and/or wiring connections in a* Weatherproof *enclosure, see pages 23-28.*

The System 3A comes set up to measure one, two, or three measurement units, according to the specifications for Functions 1 and 2 at the time of purchase. Any available measurement units, with the exception of temperature, can be specified for either Function 1 or Function 2. Temperature can only be specified for Function 2.

Select the measurement units you wish to use by setting the MH/F button to F and using the MHc/MHp button to select either Function 1 or Function 2. If F2 is optionally specified to measure temperature, F2 is further subdivided into temperature and another moisture measurement unit by the position of the CAL\OP switch.

The light bar module (bargraph) located to the right of the LCD indicates which measuring unit the hygrometer is currently reading.

If you selected only Function 1 at the time of purchase, then both Functions 1 and 2 will operate as Function 1.

Options

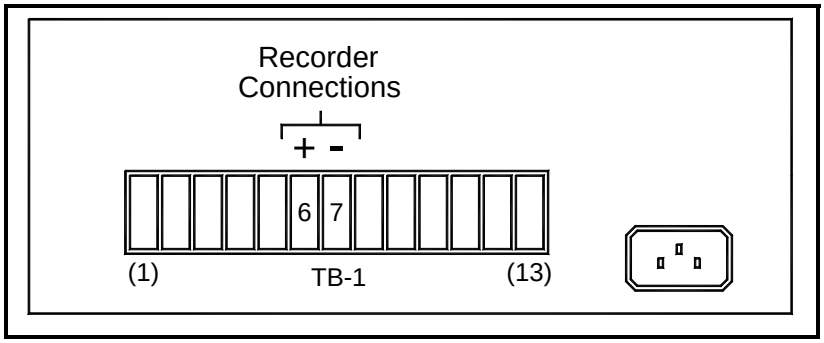

Figure 7: Rear Panel Recorder Connections

Recorder Output Option

The *System 3A* has one (optional) recorder output. Connect a recorder to this output using the rear panel terminal strip TB-1 (see Figure 7 above). During operation, this output corresponds to the the function selected. The recorder output can be supplied from the factory as 0-20 mA, 4-20 mA, or 0-100 mV. This may be changed in the field by changing resistors as shown in Table 4 below.

Table 4: Resistance - Current Loop vs. Voltage Outputs

RECORDER OUT	R47	R48	R73
0 - 20 mA	100 Ω	100 Ω	Open
4 - 20 mA	100 Ω	100 Ω	Open
0 - 100 mV	499 Ω	499 Ω	49.9 Ω

Alarms Option

The alarms option provides two alarm relays (A and B), which have 2 A, 28 VDC contacts. Each alarm relay can be set to trip at one value for one measurement unit.

Note: *For information regarding component locations and/or wiring connections in a* Weatherproof *enclosure, see pages 23-28.*

Selecting the Right Combination

A set of two jumpers is available on each of two sockets on the main printed circuit board (see Figure 8 below and Figure 18 on page 32). To select the combination desired, move the set of jumpers to the appropriate position on each socket as required (see Table 5 below).

Table 5: Alarm Settings

Alarm A (Socket W6)				**Alarm B (Socket W7)**			
Moisture		Temperature		Moisture		Temperature	
High	Low	High	Low	High	Low	High	Low
1-16 2-15	5-12 6-11	3-14 4-13	7-10 8-9	1-16 2-15	5-12 6-11	3-14 4-13	7-10 8-9

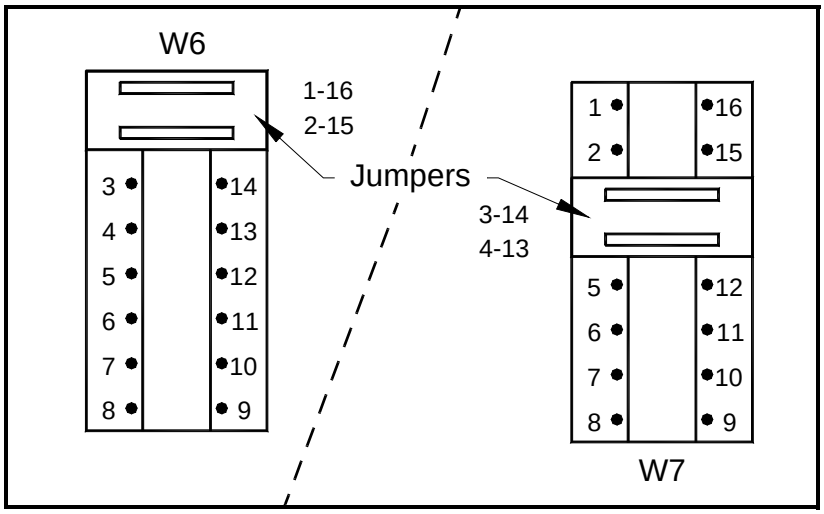

Figure 8: Alarm Sockets on Main PC Board

Setting the Alarms

Refer to Figure 6 on page 10 for the following adjustments:

Note: *For information regarding component locations and/or wiring connections in a* Weatherproof *enclosure, see pages 23-28.*

To set the alarms, select the desired function (**F1** or **F2**) and then set the AL/OP pushbutton to **AL**. If you have the temperature option and are setting an alarm for moisture, set the CAL/OP slide switch to **OP**. If you are setting an alarm for temperature, set the CAL/OP slide switch to **CAL**.

To set alarm A or B, insert a screwdriver in the front panel hole for the alarm you wish to adjust. Adjust the calibration screw until the desired trip point value is displayed on the LCD.

Connecting the Alarms

Connect the alarms to the *System 3A* TB1 Barrier Strip on the rear panel (see Figure 9 below). Pins 8, 9 and 10 are for Alarm A connections, and pins 11, 12 and 13 are for Alarm B connections. Note that pin 9 (A1) is the **common** for alarm relay A, and pin 12 (A2) is the **common** for alarm relay B.

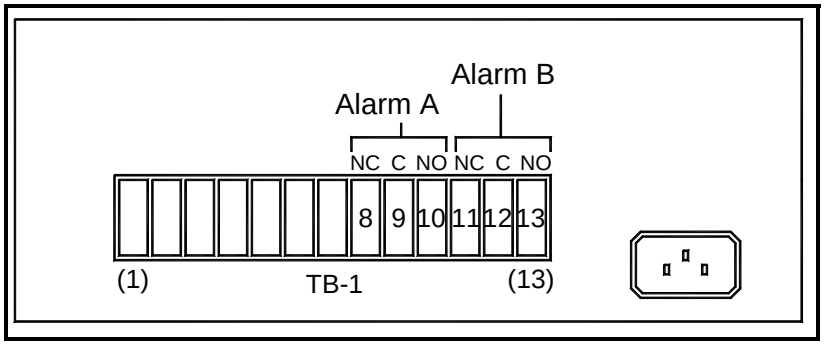

Figure 9: Rear Panel Alarm Connections

Battery Option

An optional battery pack can be ordered. It is installed beneath the hygrometer printed circuit board (see Figure 20 on page 34), and will operate continuously for 24 hours on a full charge. When the battery pack needs to be recharged, a minus sign (–) is displayed on the upper left side of the LCD. Battery operation starts automatically when the power switch is turned on with the line cord unplugged.

The batteries are automatically charged whenever the line cord is plugged into a live AC power line. Recommended charging time is sixteen hours for a full recharge.

Calibration

All calibration adjustments are made at the factory. However, recalibration might be necessary if:

- Any potentiometer is accidentally turned.
- The power supply is adjusted.
- Certain components are replaced.
- There is reason to doubt the accuracy of the moisture or temperature measurement.

To check the moisture and temperature circuits, follow Steps 1 through 6 in each of the following sections, *Calibrating the Moisture Function* on page 15 and *Calibrating the Temperature Circuit* on page 16, **without turning any potentiometer**. In either case, if the electronics check out properly, the problem must be in the sampling process, the probe cable, or the probe itself.

!WARNING!
To ensure safe operation, the System 3A must be installed and operated as described in this manual. In addition, be sure to follow all local safety codes and regulations for installing electrical equipment which apply. All procedures should be performed by trained service personnel.

Before performing the calibration procedures,

- ensure that the power supply voltages are within specification (see *Checking the Power Supply* on page 4),
- write down the switch settings you are using before you begin. You will want to restore these settings after calibration.

Note: *For information regarding component locations and/or wiring connections in a* Weatherproof *enclosure, see pages 23-28.*

Calibrating the Moisture Function

To calibrate the moisture function:

1. Ensure that the EPROM (U101) is plugged firmly into its socket and the lock on the socket indicates **ON**. (See Figure 18 on page 32 to locate U101).

2. Push the power switch **ON**, and allow at least a 10- minute warm-up for the hygrometer.

3. Set the switches per Table 6 below (see Figure 6 on page 10). For the Weatherproof model, see Figure 12 on page 26 to locate the switches.

Table 6: Moisture Function Switch Settings

Standard Model Switch	Weatherproof Model Switch	Switch Setting Selection
MH F	F MH	**MH**
MHc MHp	F1 F2 MHp MHc	**MHc** (MH Cal references option)
AL OP	OP AL	**OP** (Operate mode)
CAL OP (if installed)	CAL OP (if installed)	**CAL** Applies only to units equipped with temperature option.

4. Set the B/A switch to **B** (this places the LOW MH internal reference on the input). The LCD display should read 0.174 ±0.002. If not, adjust potentiometer R22 until it does.

Note: *Make small adjustments to potentiometer R22. To increase the LCD display reading, or if the reading is* **LL**, *turn R22 clockwise. Allow about one second after each adjustment for the LCD display to update its reading. (Since the potentiometer resolution may be finer than the EPROM data, some potentiometer movements may produce no LCD display change.)*

5. Set the B/A switch to **A** (this places the HIGH MH internal reference on the input). The LCD display should read H0.975 ±0.020. If not, adjust potentiometer R15 until it does.

Note: *Turn the potentiometer counterclockwise to reduce the LCD display reading or if the reading is* **HH**.

Calibrating the Moisture Function (cont.)

6. The two previous steps interact; therefore, repeat steps 4 and 5 as many times as necessary to get both readings in range.

7. When both readings are in range, the hygrometer circuit is calibrated. Return all switches to their previous operating position.

Caution!
If your *System 3A* hygrometer is equipped with the Temperature option, **be sure the CAL/OP switch is returned to the OP position after calibration.**

Calibrating the Temperature Circuit

The following describes the calibration procedure for *System 3A* hygrometers supplied with the temperature option.

1. Ensure that the EPROM (U101) is plugged firmly into its socket and that the lock on the socket indicates **ON**. (See Figure 18 on page 32 to locate U101.)

2. Push the power switch **ON**, and allow at least a 10-minute warm-up for the hygrometer.

3. Set the switches per Table 7 below (see Figure 6 on page 10). For the Weatherproof model, see Figure 12 on page 26 to locate the switches.

Table 7: Moisture Function Switch Settings

Standard Model Switch	Weatherproof Model Switch	Switch Setting Selection
MH F	F MH	**MH**
MHc MHp	F1 F2 MHp MHc	**MHc** (MH Cal reference option)
AL OP	OP AL	**OP** (Operate mode)
CAL OP	CAL OP	**OP** (Temperature mode)

Note: *The LED mode indicator will now remain in the* MH *position throughout this procedure.*

Calibrating the Temperature Circuit (cont.)

4. Set the B/A switch to **B** (this places the LOW TEMP internal reference on the input). The LCD Display should read –27.0 on Centigrade units (–16.6 on Fahrenheit units). If not, adjust potentiometer R32 until it does.

Note: *Make small adjustments to potentiometer R32. To increase the LCD display reading, or if the reading is **LL**, turn R32 clockwise. Allow about one second after each adjustment for the LCD display to update its reading. (Since the potentiometer resolution may be finer than the EPROM data, some potentiometer movements may produce no LCD display change.)*

5. Set the B/A switch to **A** (this places the HIGH TEMP internal reference on the input). The LCD Display should read 69.0 on Centigrade units (156 on Fahrenheit units). If not, adjust potentiometer R34 until it does.

Note: *Turn the potentiometer counterclockwise to reduce the LCD display reading, or if the reading is **HH**.*

6. The two previous steps interact; therefore, repeat steps 4 and 5 as many times as necessary to get both readings in range.

7. When both readings are in range, the temperature circuit is calibrated. Return all switches to their previous operating positions.

Caution!
If your *System 3A* hygrometer is equipped with the Temperature option, **be sure the CAL/OP switch is returned to the OP position after calibration.**

Calibrating the Recorder Output

The following describes the calibration procedure for *System 3A* hygrometers supplied with the Recorder option. It is assumed that the Calibration procedures outlined in *Powering Up the System* on page 10 have been successfully completed.

1. Ensure that the EPROM (U101) is plugged firmly into its socket and the lock on the socket indicates **ON** (see Figure 18 on page 32 to locate U101).

2. Push the power switch **ON**, and allow at least a 10-minute warm-up for the hygrometer.

Calibrating the Recorder Output (cont.)

3. Set the switches per Table 8 below (see Figure 6 on page 10). For the Weatherproof model, use pages 23-28 to locate the switches.

Table 8: Moisture Function Switch Settings

Standard Model Switch	Weatherproof Model Switch	Switch Setting Selection
MH F	F MH	**MH**
MHc MHp	F1 F2 MHp MHc	**MHc** (MH Cal references option)
AL OP	OP AL	**OP** (Operate mode)
CAL OP (if installed)	CAL OP (if installed)	**CAL** Applies only to units equipped with temperature option.

4. Set the B/A switch to **B** (this places the LOW MH internal reference on the input). The LCD display should read 0.174 ±0.002 (if not, perform the calibration procedure in *Powering Up the System* on page 10 before continuing). This reading corresponds to the low end of your moisture parameter range.

5. Adjust potentiometer R43 until the recorder trace lines up with the grid line, or with the trace position representing the low moisture value of your range.

6. Set the B/A switch to **A** (this places the HIGH MH internal reference on the input). The LCD Display should read H0.975 ±0.020 (if not, perform the calibration procedure in the section entitled *Overview* before continuing). This reading corresponds to the high end of your moisture parameter range.

7. Adjust potentiometer R45 until the recorder trace lines up with the grid line, or with the trace position representing the high moisture value of your range.

8. Return to step 4 above and recheck the low value recorder reading. If an interaction is noted, repeat steps 4 through 7 above. When both the low and high value trace positions are correct, the recorder output is calibrated. Return all switches to their previous operating positions.

Note that the recorder output on F2 will calibrate automatically if F2 is properly calibrated.

Specifications

General Specifications

AC Power Supply:

100, 120, 220 or 240 VAC, 50/60 Hz, 5 W at maximum output

Dew/Frost Point, ppm_v and ppm_w Ranges:

Table 9: Available Ranges

Category	Range Options	
Dew/Frost Point: 100°C span at 1.0°C increments	-40°C to +60°C	-90°C to +10°C
	-60°C to +40°C	-100°C to 0°C
	-80°C to +20°C	-110°C to -10°C
Dew/Frost Point 50°C span at 0.5°C increments	+10°C to +60°C	-70°C to -20°C
	-10°C to +40°C	-80°C to -30°C
	-30°C to +20°C	-90°C to -40°C
	-40°C to +10°C	-100°C to -50°C
	-50°C to 0°C	-110°C to -60°C
	-60°C to -10°C	
Parts per Million by Volume (gas at specified pressure)	0.1-10 ppm_v @0.1 ppm_v increments	
	1-100 ppm_v @1.0 ppm_v increments	
	10-1,000 ppm_v @10.0 ppm_v increments	
	100-10,000 ppm_v @100.0 ppm_v increments	
Parts per Million by Weight (liquid)	0.1-10 ppm_w @0.1 ppm_w increments	
	1-100 ppm_w @1.0 ppm_w increments	
	10-1,000 ppm_w @10.0 ppm_w increments	
	100-10,000 ppm_w @100.0 ppm_w increments	

Accuracy:
Less than ±1% of full scale

Readability:

Less than ±1% of reading

Operating Temperature (Electronics Only):

–20° to 60°C (–4° to 140°F)

General Specifications (cont.)

Alarm Option:

SPDT, Contact rating is 2 A at 28 VDC or 120 VAC

Set Point Accuracy:

±1°C (±1.8°F)

Temperature Option Accuracy:

±1°C (Range –30° to +70°C; –22° to +158°F)

Warm Up Time:

Will meet specified accuracy within 3 minutes of turn on.

Calibration:

Internal references are provided to check calibration.

Protection Circuit:

The input is diode protected against transients.

Outputs:

Optional (DP, Temp, ppm_v or ppm_w) 20 mA full scale at 500 Ω max. load.

Table 10: Outputs

Resistance	Output	Load Resistance
Current Output	0-20mA	500Ω MAX
	4-20mA	500Ω MAX
Voltage Output	0-100mV	10KΩ MIN

Battery Pack Option:

Eight 1.2 V NiCad rechargeable batteries provide 500 mA-h of energy. A fully charged battery pack will last a minimum of 8 hours. Charging time is 40 hours.

Physical Characteristics:

Table 11: Physical Characteristics

Type	Dimensions (Nominal)	Reference	Weight
Rack Mount	19”Wx3.5”Hx10.5”D	Figure B-1	4 lbs
Bench Mount	8.5”Wx2.8”Hx10.5”D	Figure B-2	4 lbs
Panel Mount	9.5”Wx4.0”Hx10.5”D	Figure B-3	4 lbs
Weatherproof	8.8”Wx11.5”Hx4.4”D	Figure A-2	10 lbs

Moisture Probe Specifications

Type:

Aluminum Oxide Moisture Sensor Element
(GE Panametrics RM Series)

Dimensions:

See Appendix B, Figure B-7

Material Construction:

See *Basic GE Panametrics Hygrometry Principles* User's Guide (916-064).

Input Voltage:

1 volt

Impedance Range:

2 MΩ to 50 KΩ @ 77 Hz (depends on vapor pressure of water)

Calibration:

Each sensor is factory calibrated against moisture standards.

Dew/Frost Point Range:

+60° to –110°C (+140° to –170°F)

Accuracy:

±2°C (±3.6°F) in range of +60° to –65°C (140° to –85°F)

±3°C (±5.4°F) in range of –65° to –110°C (–85° to –166°F)

Repeatability:

±0.5°C (±0.9°F) in range of +60° to –65°C (140° to –85°F)

±1°C (±1.8°F) in range of –65° to –110°C (–85° to –166°F)

Operating Temperature:

–110° to +70°C (–166° to +158°F)

Storage Temperature:

Maximum of +70°C (+158°F)

Operating Pressure: Depends on fitting

M1 = 5 microns Hg to 75 psig

M2 = 5 microns Hg to 5,000 psig

Moisture Probe Specifications (cont.)

Flow Rate*:

Gases: from Static to 5,000 cm/sec linear velocity @ 1 atm
See the Conversion Chart in *Basic GE Panametrics Hygrometry Principles* User's Guide (916-064).

Liquids: from Static to 5 cm/sec @ density of 1 gm/cc
See the Conversion Chart in *Basic GE Panametrics Hygrometry Principles* User's Guide (916-064).

*See flow rate tables in *Basic GE Panametrics Hygrometry Principles* User's Guide (916-064).

Response Time:

Reading will change 63% in less than 5 seconds after a step change in moisture content in either wet up or dry down cycles.

Note: *Consult the factory for specifications of other moisture sensor probes available for special applications.*

Temperature Sensor Specifications

Type:

Non-linear thermistor network

Maximum Operating Temperature:

+70°C (+158°F)

Range:

–30° to +70°C (–22° to +158°F)

Accuracy:

±0.5°C (±0.9°F) overall

Time Constant, Maximum:

1 second in well stirred oil, 10 seconds in still air

Weatherproof Version

The *System 3A Weatherproof Hygrometer* uses the same basic circuit boards as the System 3A rack-bench-panel but is mounted in a weatherproof NEMA-4 (British IP-55) type enclosure. Since case integrity is a prime consideration in a weatherproof design, only the FUNCTION/MH switch is brought out to the front panel (see Figure 10 below).

Except as noted in the following sections, operation and calibration of the *System 3A Weatherproof Hygrometer* is the same as for the System 3A rack-bench-panel version.

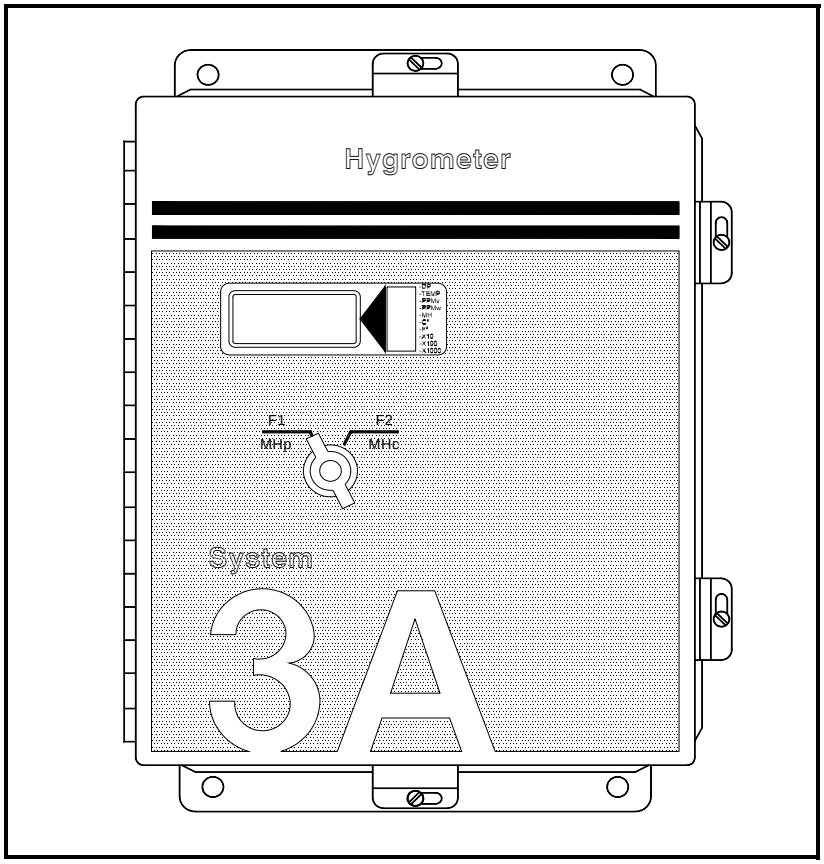

Figure 10: System 3A Weatherproof Hygrometer

Installation

Install the *System 3A Weatherproof Hygrometer* as you would any weatherproof instrumentation (see Figure 11 on page 24).

Caution!

When mounting the *System 3A Weatherproof Hygrometer* use the flange mountings on the case. Use caution when drilling holes in the case. Be sure to use appropriate weatherproof hardware when connecting power and probe wiring.

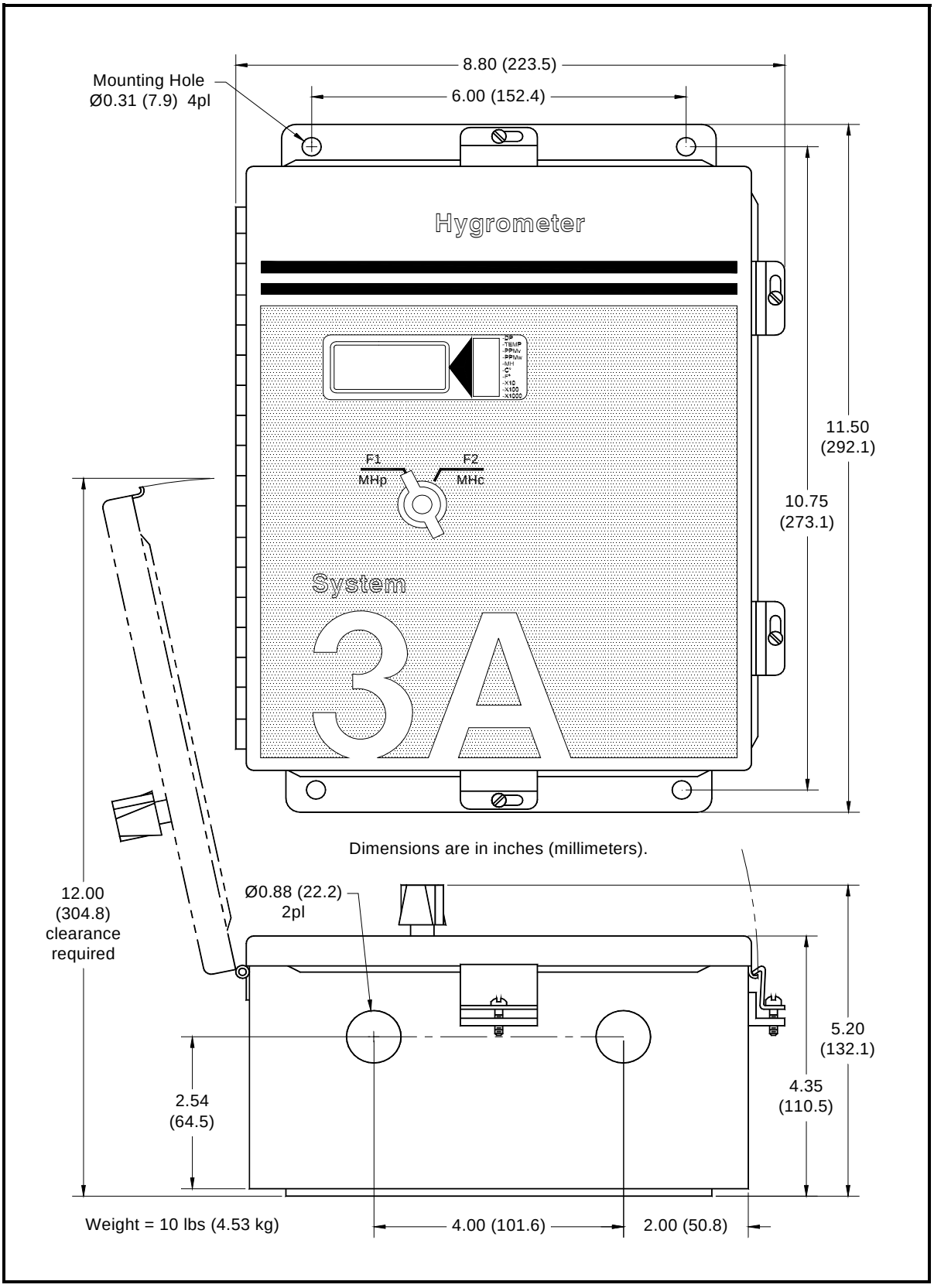

Figure 11: Outline and Mounting Dimensions - Weatherproof Version

Operation

Operation of the *System 3A Weatherproof Hygrometer* is basically the same as the System 3A rack-bench-panel versions except for the switch locations. The F1/F2 - MHp/MHc switch is mounted on the front cover of the enclosure. All other switches are located on the MAIN printed circuit board and can be reached by opening the case.

For help in setting the switches, see Figure 12 on page 26, Figure 13 on page 27 and Table 12 below. A switch and connection diagram label is attached to the inside of the front cover. Set the switches according to the operator's needs, then close and secure the cover.

Note: *If the* System 3A Weatherproof Hygrometer *fails to operate, check to see that the POWER SWITCH ON THE MAIN PRINTED CIRCUIT BOARD is turned ON.*

Table 12: Switch Summary

SWITCH	LOCATION	FUNCTION
OFF ON	PC Board	Turns power on and off.
A B	PC Board	Selects dummy probe A or B in the calibration process, or sets Alarm A or B in the alarm set mode.
OP AL	PC Board	Selects alarm set mode or operate mode.
F MH	PC Board	Selects MH or function mode.
F1/MHp F2/MHc	Front Cover	Selects one of two function modes or one of two MH modes.
CAL/OP	PC Board	Required for calibration.

Caution!
If the hygrometer does not have the temperature option, be sure the CAL/OP switch is ALWAYS on CAL.

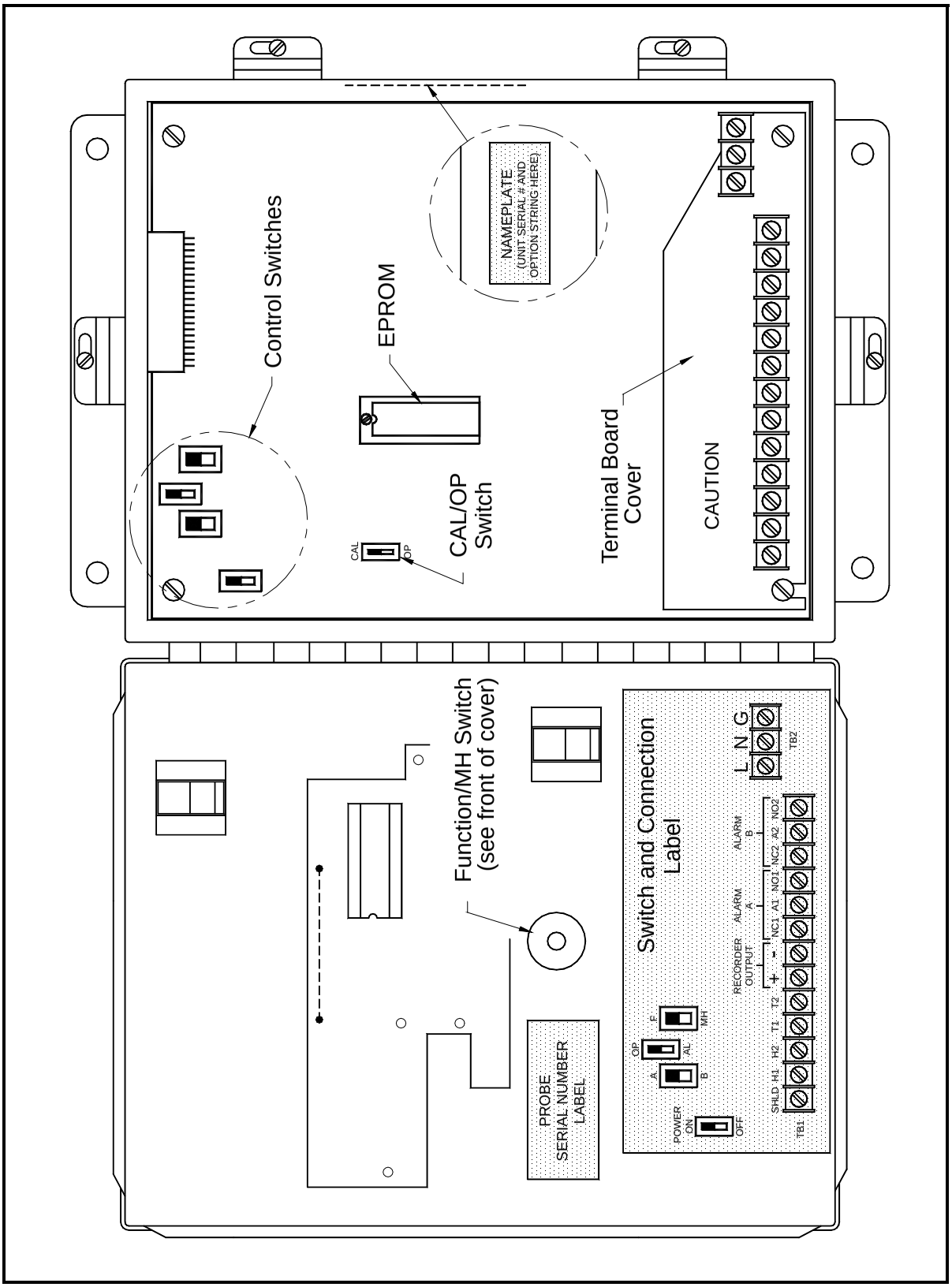

Figure 12: Switch, Connection and Label Locations

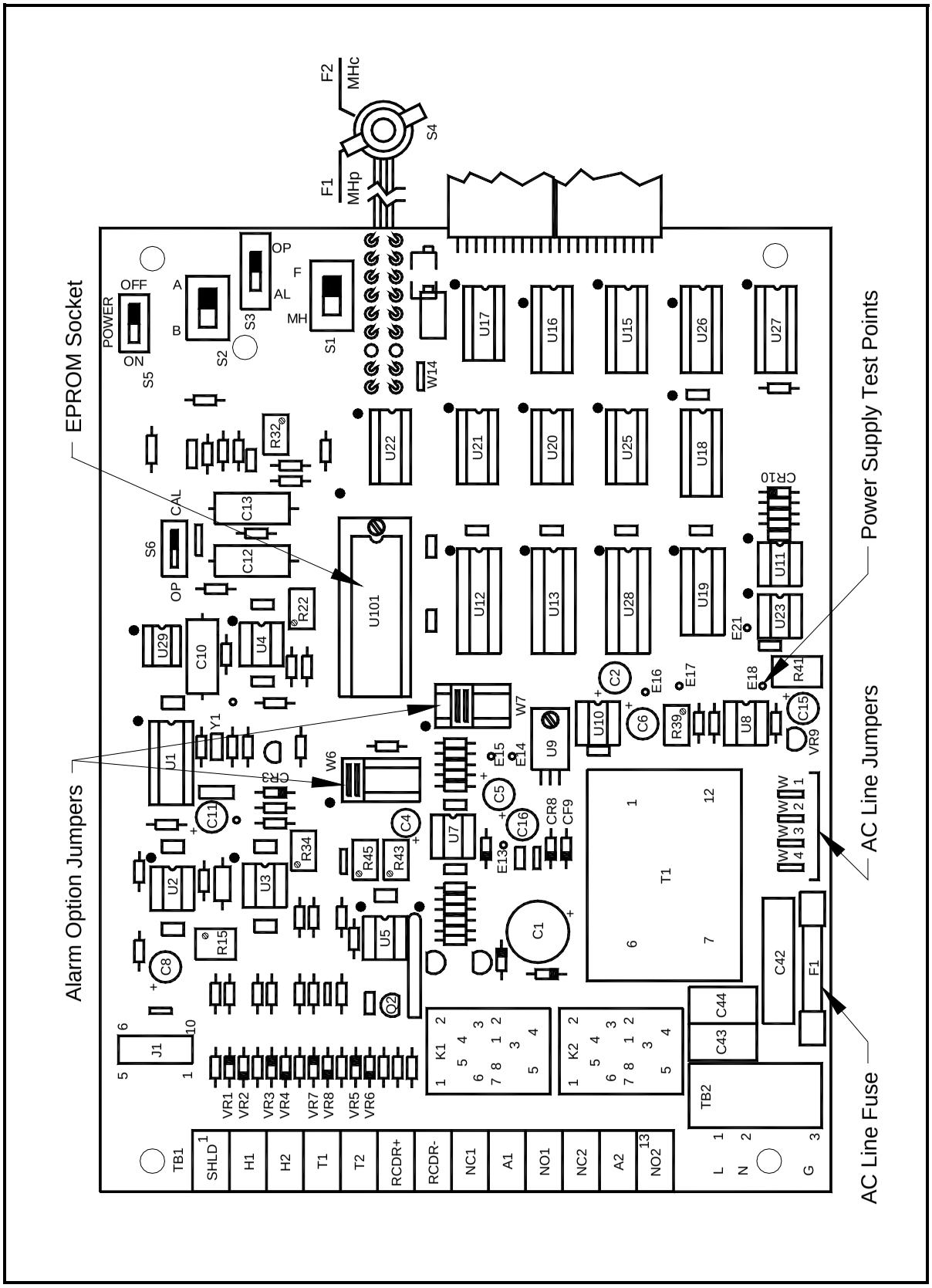

Figure 13: Main Printed Circuit Board - Weatherproof Version

Battery Option

An optional battery pack may be ordered. The battery pack is mounted below the main printed circuit board (see Figure 14 below).

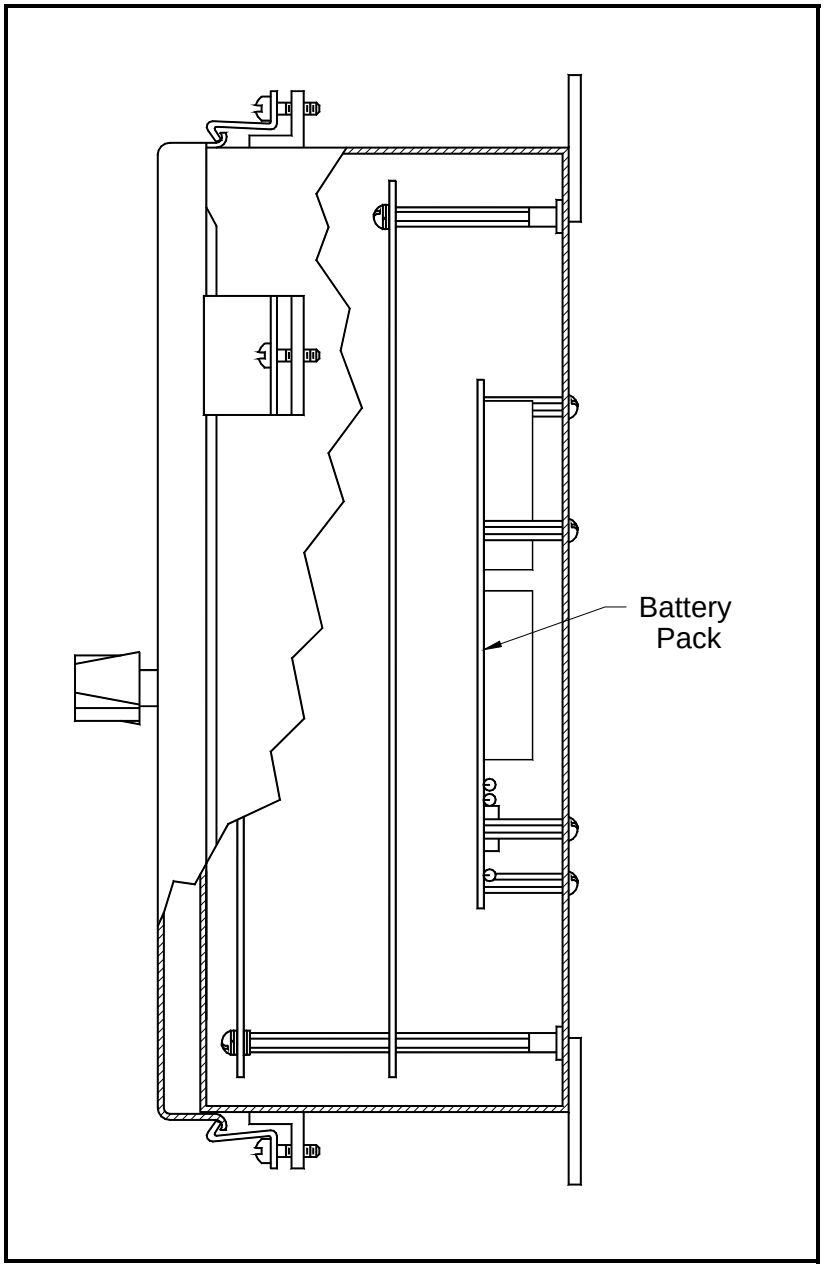

Figure 14: Battery Pack Option

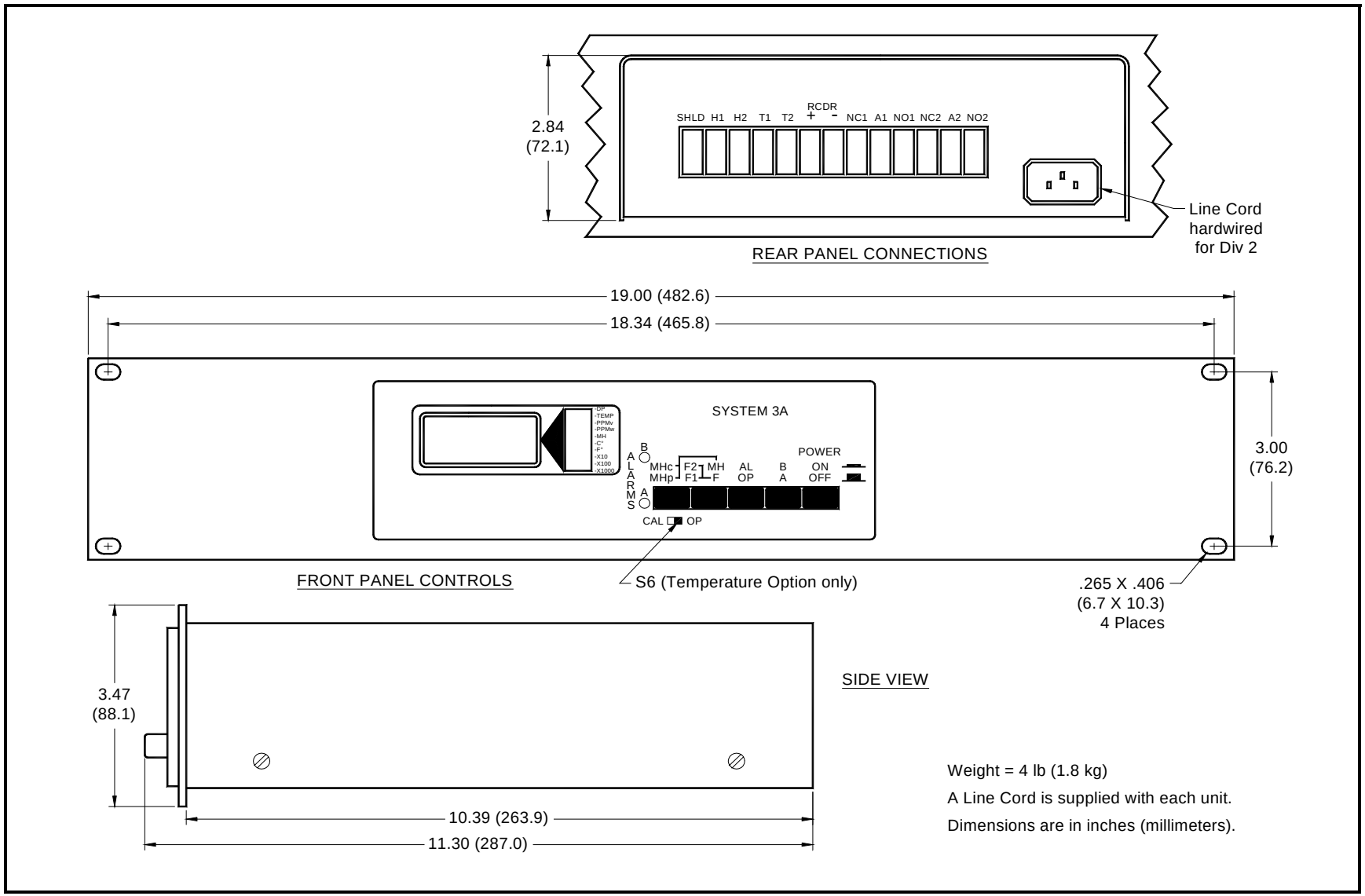

Figure 15: Outline and Mounting Dimensions - Rack Mount Version

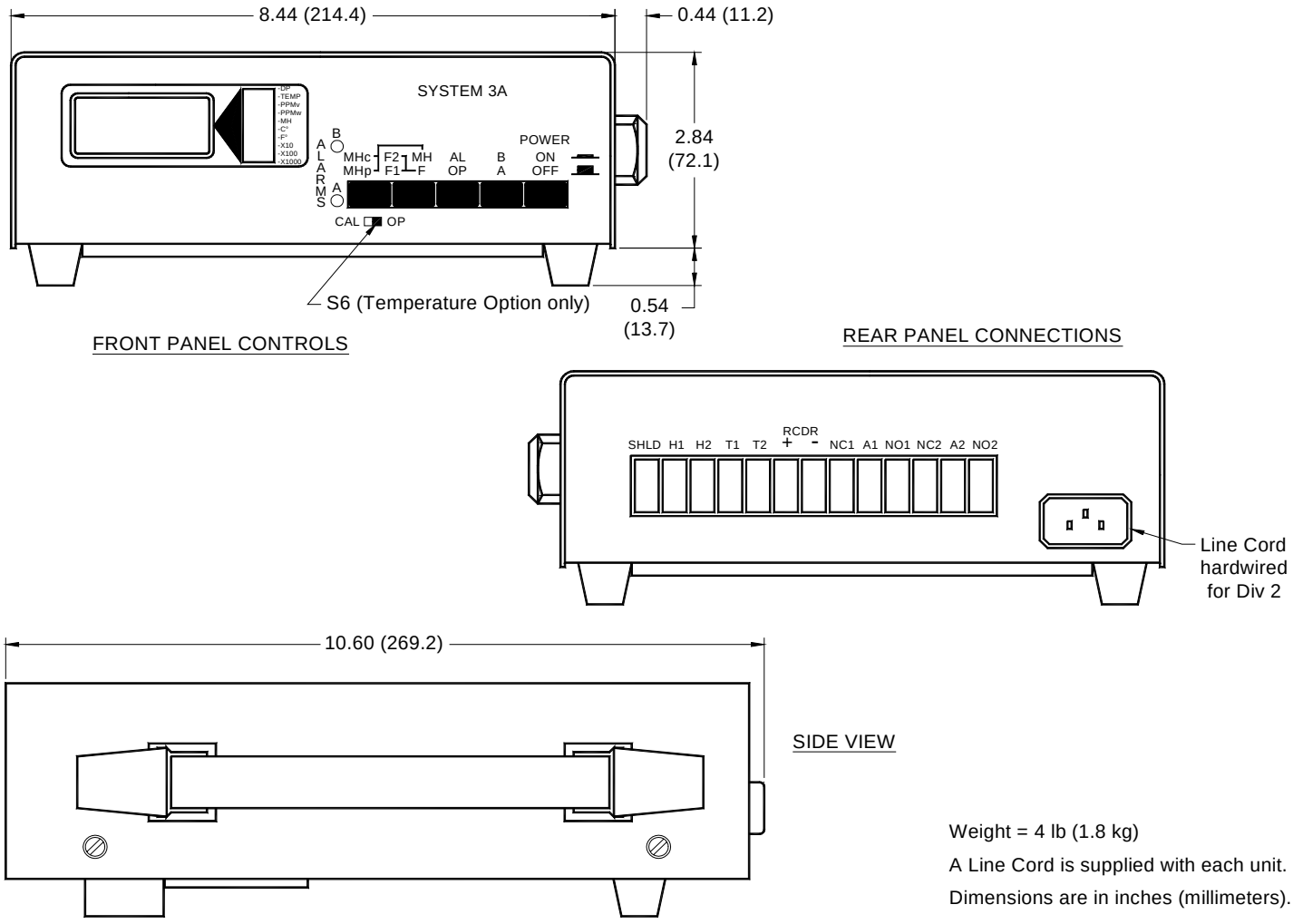

Figure 16: Outline and Mounting Dimensions - Bench Mount Version

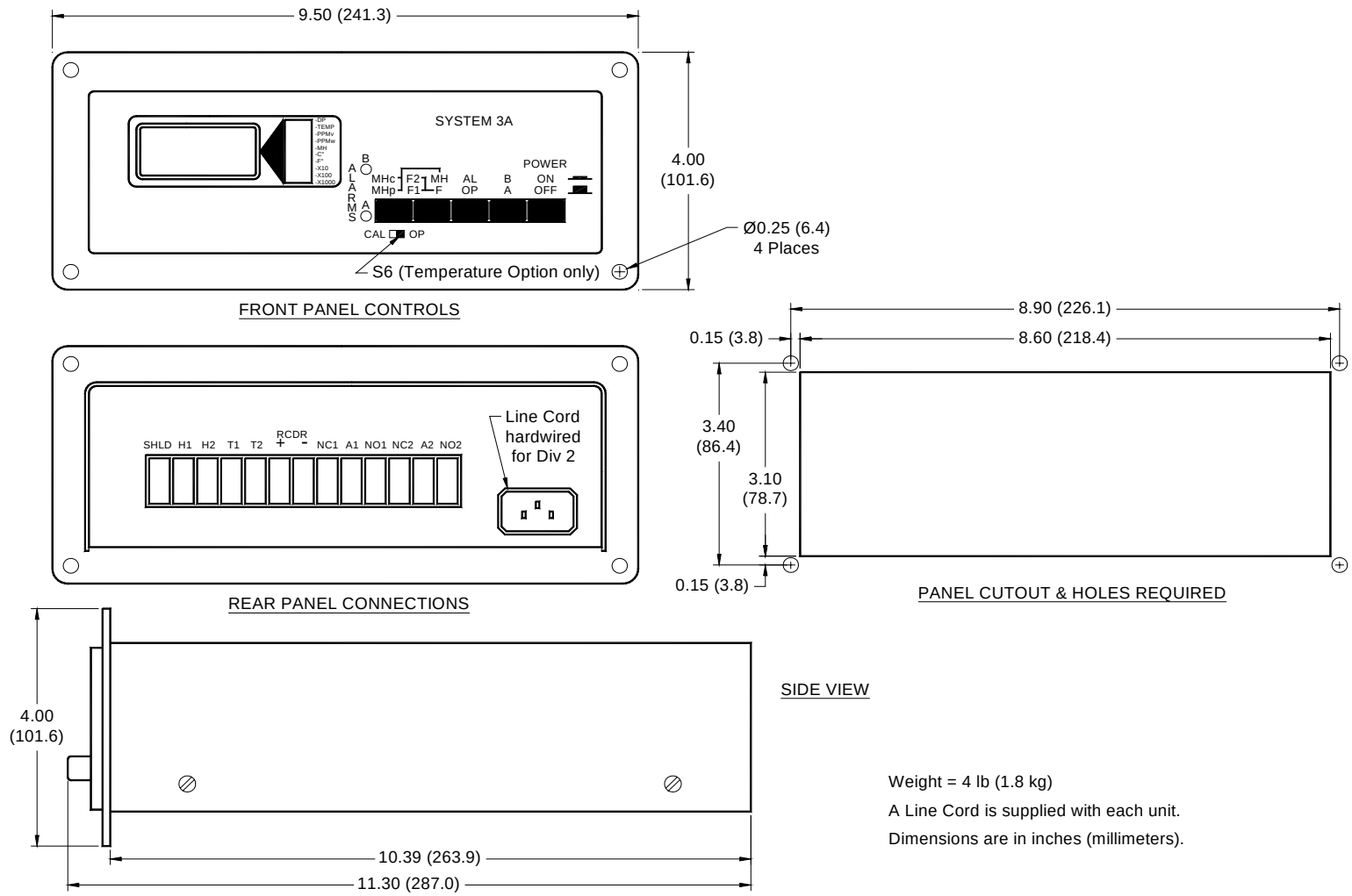

Figure 17: Outline and Mounting Dimensions - Panel Mount Version

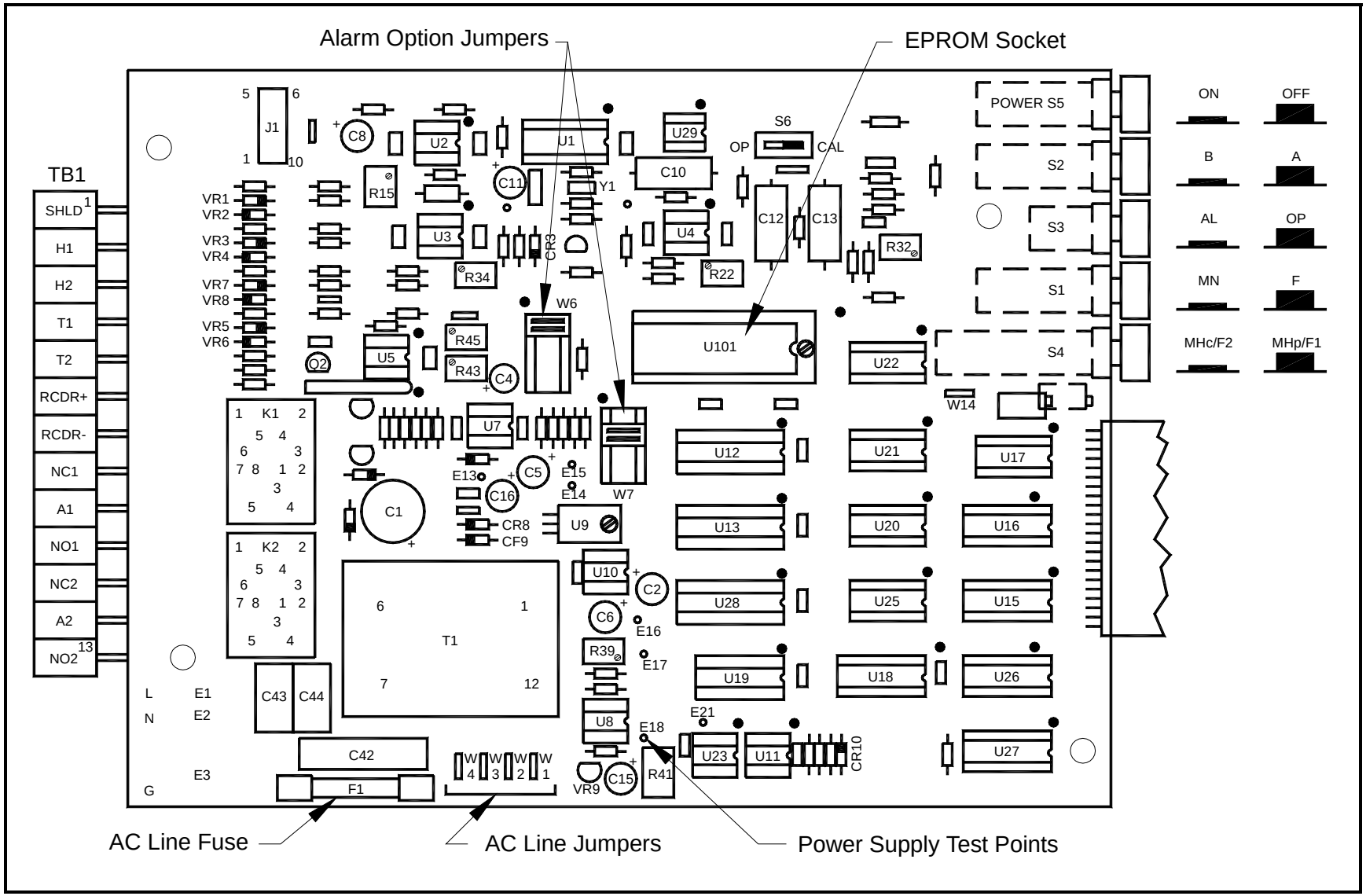

Figure 18: Main Printed Circuit Board - RBP Version

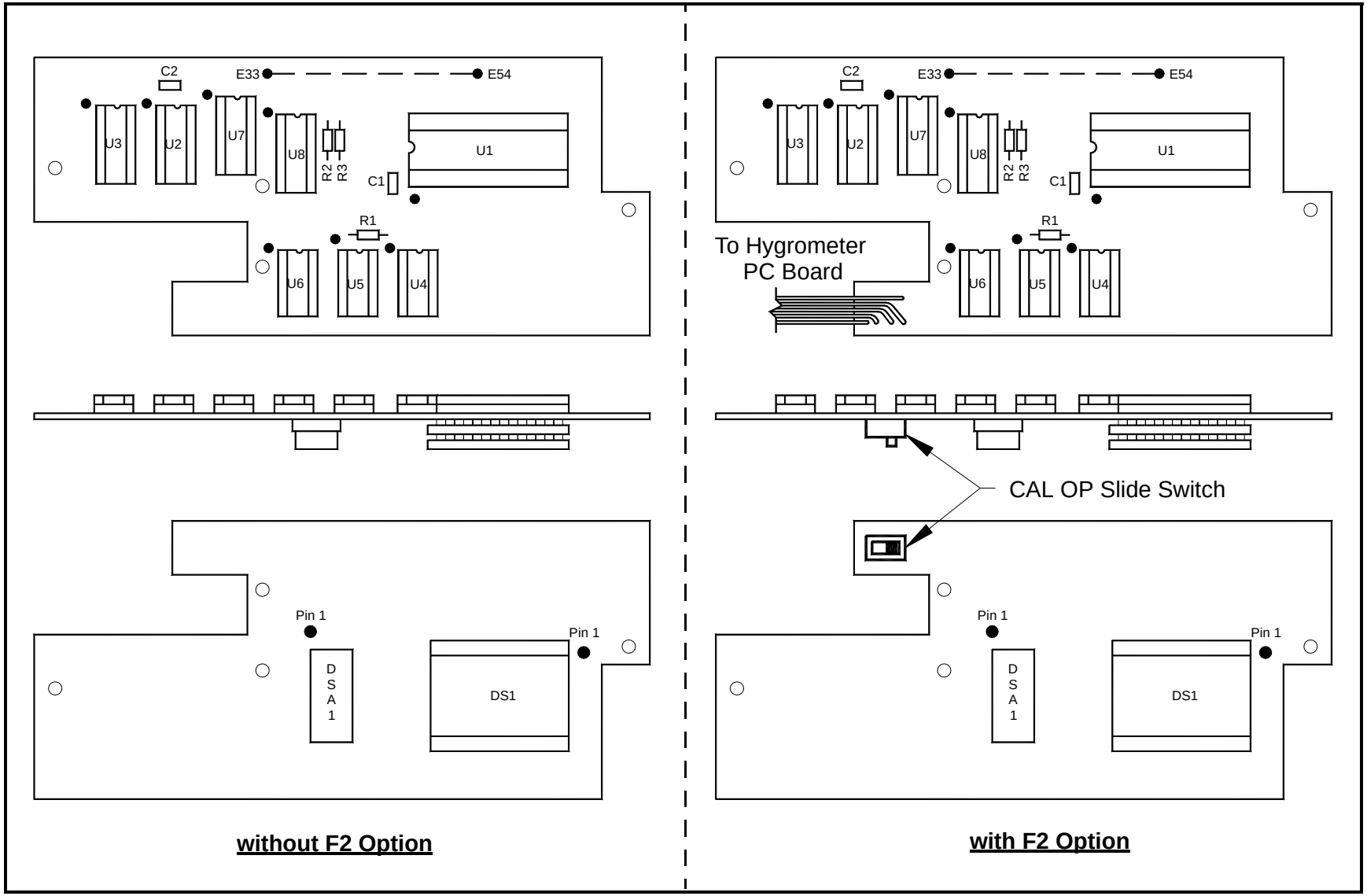

Figure 19: Display Printed Circuit Board #703-728

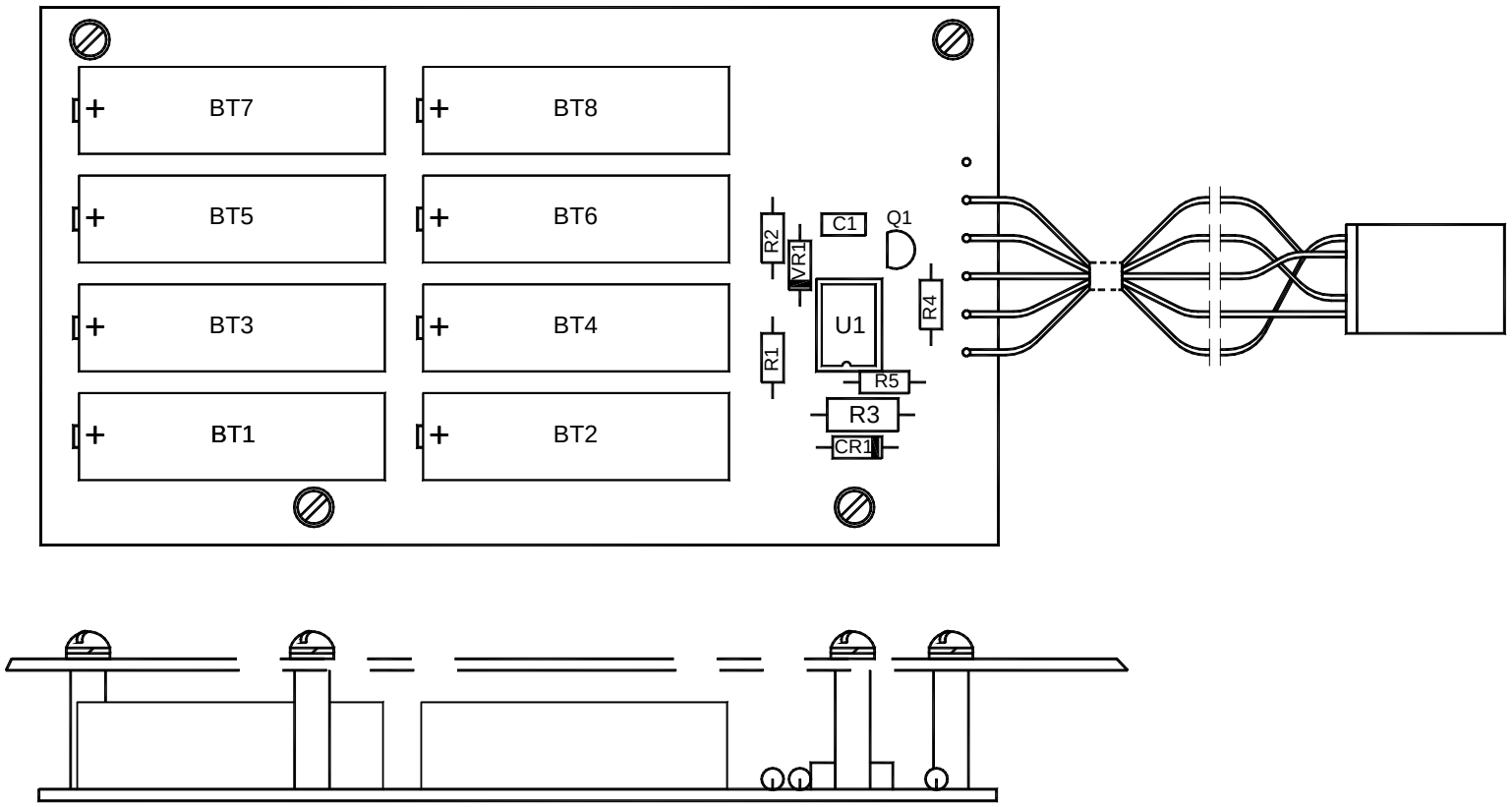

Figure 20: Battery Option Printed Circuit Board

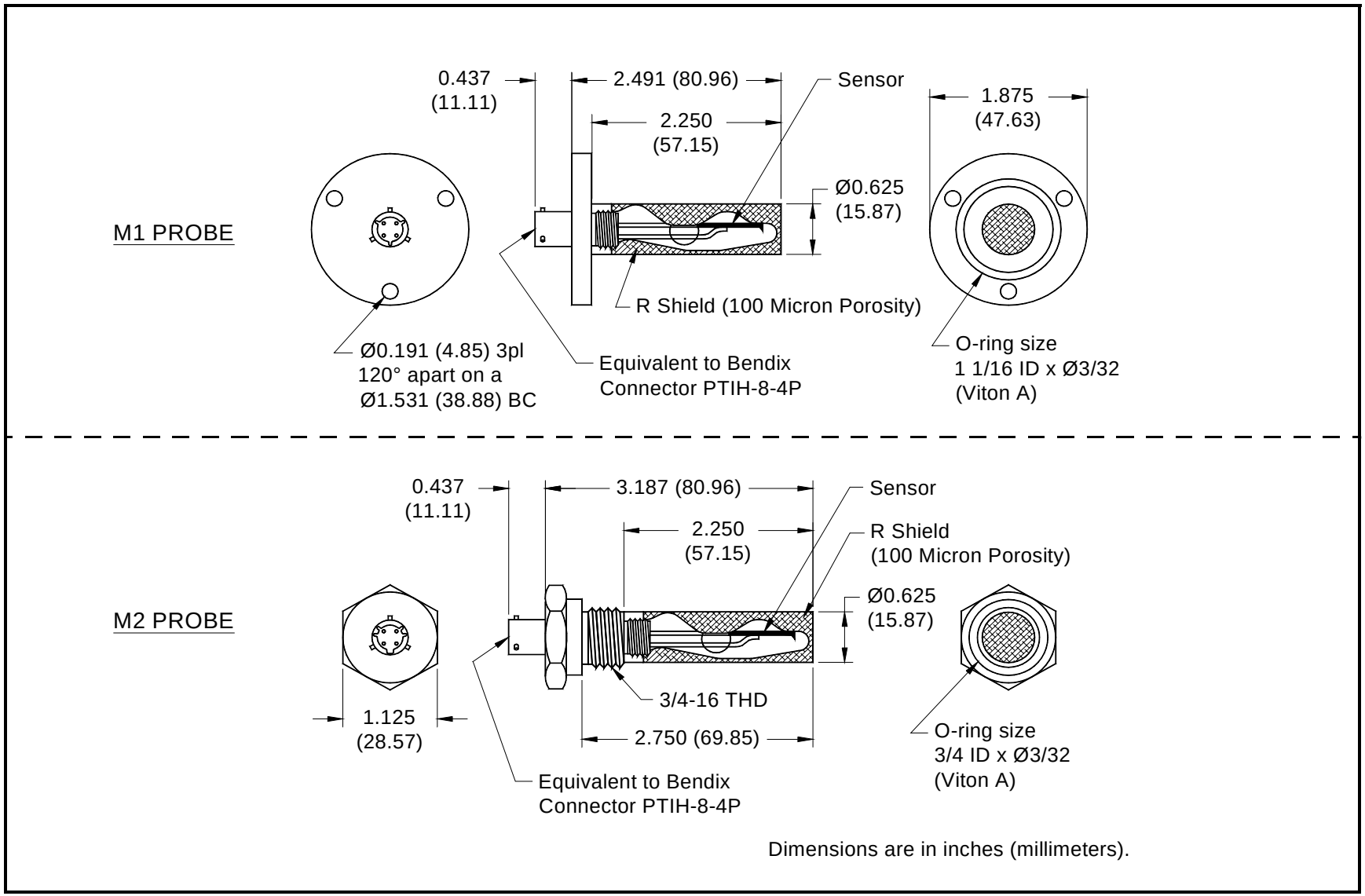

Figure 21: M1 and M2 Probes

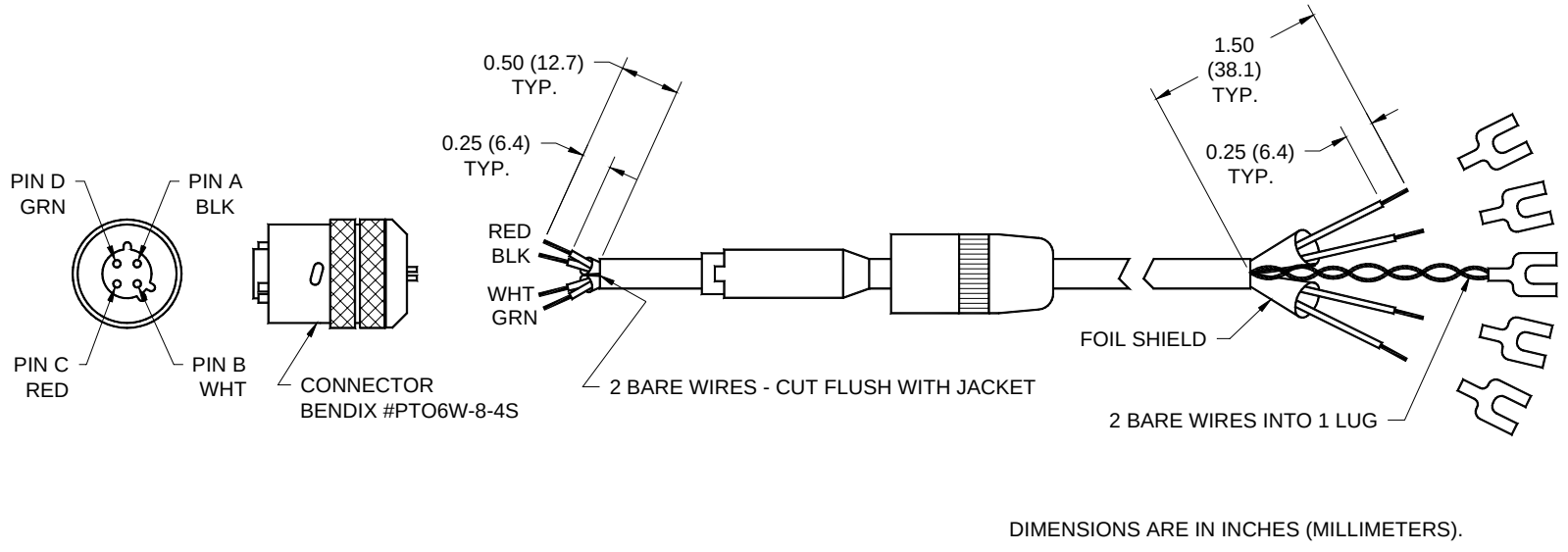

Figure 22: Probe Cable Assembly

Hygrometer PC Board Parts

Basic

Table 13: Hygrometer PC Board - Basic Parts

Reference Designation	Part Number	Qty	Description
U1	147-137	1	IC 4060B Counter
U2-4, 8, 11, 23, 29	148-074	5	IC 7621, Dual OP Amp 8P
U10	147-178	1	IC 7660 Voltage Conv 8P
U5	148-078	1	IC OP220H 2xMOP 8P
U9	148-007	1	IC 7805 Regulator +5V 3P
U12	147-159	1	IC 7545 12 Bit DAC 20P
U13	147-172	1	IC 74C374 Tri-State octal latch 20P
U15	147-033	1	IC 4019B CMOS and/or select 16P
U16	147-162	1	IC 4555 2x4 DEC 16P
U17	147-087	1	IC 4013 Flip Flop Dual D 14P
U18	147-100	1	IC 4040B Binary Cntr 16P
U19	147-101	1	IC 7524 DAC 8 Bit CMOS 16P
U20	147-116	1	IC 4012 2x4 NAND 14P
U21, U25	147-032	2	IC 4011 CMOS 2 input NAND 14P
U22	147-117	1	IC Hex Inverter 14P
U26, U27	147-201	2	IC 74HC138 3 to 8 Line Decoder 16P
U28	147-200	1	IC 74HC373 Octal D-Type Latch 20P
Q1	142-015	1	Transistor J113 PNP
Q2	140-006	1	Transistor 2N3904 NPN
CR3, CR10	145-001	2	Diode, Signal 1N4148/1N914
CR8, CR9	143-001	2	Diode 1N4001
F2, F3	193-024	2	Fuse 1/16A
F1	193-018	1	Fuse 1/8A
Y1	194-010	1	Crystal 78.8KHZ
VR1-VR4	144-048	4	Diode, Zener 3.3V 5% 1N746A
VR9	144-046	1	Diode, Zener 1.2V LM385Z

Hygrometer PC Board Parts (cont.)

Temperature Option

Table 14: Hygrometer PC Bd - Temperature Option Parts

Reference Designation	Part Number	Qty	Description
VR5-VR8	144-001	4	Diode, Zener, 5.1V 10% 1N751
F4, F5	193-024	2	Fuse, 1/16A

Standard Alarms

Table 15: Hygrometer PC Board - Standard Alarms Parts

Reference Designation	Part Number	Qty	Description
U7	148-078	1	IC OP220H 2xMOP 8P
K1, K2	191-001	2	Relay, SPDT 12V

Sealed Alarms

Table 16: Hygrometer PC Board - Sealed Alarms Parts

Reference Designation	Part Number	Qty	Description
U7	148-078	1	IC OP220H 2xMOP 8P
K1, K2	191-001	2	Relay, Hermetically Sealed 12V

Digital Display PC Board Parts

Table 17: Digital Display PC Board Parts

Reference Designation	Part Number	Qty	Description
U1	147-160	1	IC 7211A 4 digit display DEC/drivers 40P
U2	147-076	1	IC 4042 CMOS Quad Clk "D" 16P
U3	147-162	1	IC 4555B Decoder 16P
U4, U5	147-161	2	IC 4070B 2 Input EX/OR 14P
U6	147-104	1	IC 4071 2 Input or Gate 14P
U7, U8	147-070	2	IC CD4050BE Hex Buffer 16P
DSA1	182-031	1	LED MV57164 Bar Graph Display

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