



**LIVING SYSTEMS**  
INSTRUMENTATION  
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# PORTABLE PRESSURE MONITOR

PM-P-1

USER'S MANUAL

**DOC-269**  
**Rev. 1.1**

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NOTES

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## CHAPTER 1 | INTRODUCTION

The Portable Pressure Monitor (PM-P-1) is a battery powered device designed to display the pressure (in mmHg) sensed by a remotely situated and cable connected pressure transducer on a Liquid Crystal Display (LCD).

The PM-P-1 also provides an analog output voltage that is proportional to the applied pressure. This analog output voltage signal can be used for remote pressure data monitoring or recording.

Pressure data recording from the PM-P-1 can easily be accomplished with the LSI iWorx Data Acquisition product line of hardware and software such as the LSI Part # DAQ-IWORX-404.

### Specifications:

#### Limits -

Frequency Response:	0-5Hz / up to 300BPM
Pressure Input:	-50 mmHg — + 300 mmHg
Analog Output:	-0.5 VDC — +3.0 VDC
	<ul style="list-style-type: none"><li>• 10 mV/mmHg</li><li>• 1.0 mA (max) current into a high impedance load input</li><li>• Built-in continuous short circuit protection</li></ul>

(Also refer to notes regarding AO voltage limits in Chapter 3 – Interfaces, page 5 and ZERO (tare), page 6)

### Requirements:

Pressure Transducer:	LSI Part # PT-F
DC Power Supply:	3.0 VDC (nominal)
	<ul style="list-style-type: none"><li>• from 2 x AA Size (1.5VDC) Batteries</li></ul>

### Battery Life Estimate:

Typical battery service life exceeds 60 days of continuous operation.

### Size:

6.49 in L X 4.72 in W X 1.87 in H  
16.5 cm L X 12 cm W X 4.75 cm H

### Weight:

0.94 lb / 425 g (with batteries installed)

## CHAPTER 2 | HARDWARE

The Portable Pressure Monitor (PM-P-1) has two connectors and a power switch along the top edge of the device. The RJ14 Type modular connector links the PM-P-1 with the LSI Part # PT-F pressure transducer. The BNC connector outputs the analog voltage. The power switch turns the PM-P-1 unit power ON and OFF.

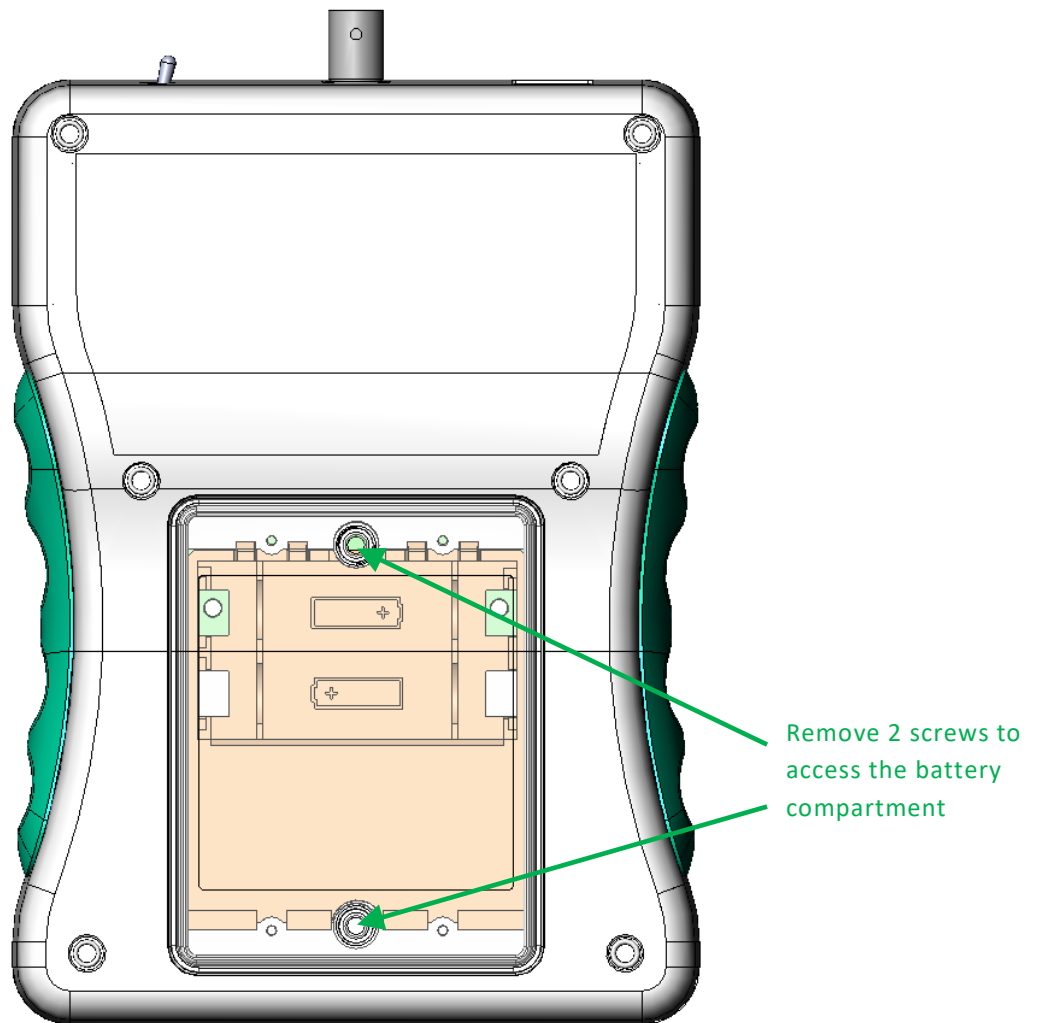
Figure 2.1 – PM-P-1 Portable Pressure Monitor



Before the PM-P-1 can be used, it is necessary to install two AA batteries in the battery compartment. Ensure that the batteries are installed correctly per the battery orientation indications inside the battery compartment as shown in Figure 2.2 below.

**Note:** Batteries should be removed from the PM-P-1 before any long periods of storage to prevent damage from discharged batteries.

*Figure 2.2 – Rear View of PM-P-1 and Open Battery Compartment*



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## CHAPTER 3 | OPERATION

### Display Modes

The PM-P-1 has a 3-½ digit Liquid Crystal Display (LCD) that displays pressure in the range -50 to 300 mmHg with a resolution of 1 mmHg. Positive pressure will be displayed as an integer. Negative pressure is shown with a preceding minus sign (-) symbol. The various display modes are described below:

#### Normal Mode

In “Normal” mode the display shows the applied pressure in mmHg calculated from the input voltage signal received from the transducer. The display will be in a steady-state condition with no blinking of the displayed digits. The instrument will enter this mode when powered ON.

#### User Input Mode

In “User Input” mode the displayed digits blink on and off at a rapid rate (about 2 times per second). The PM-P-1 still displays a valid pressure from the transducer while waiting for a user button press.

#### Over/Under Range Conditions

When the calculated pressure from the transducer input signal exceeds the calibrated minimum or maximum transducer limits; the display goes into a slow blink mode. The “**OVER**” indicator on the LCD also illuminates to indicate an over or under range applied pressure condition.

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**NOTE:** The transducer input signal is being compared to a pre-defined Volts per Unit value and, therefore, can cause the OVER indicator and pressure display to go into the slow blink mode several mmHg before or after the specified pressure range values of -50mmHg and 300 mmHg.

This is normal operation and does not affect the accuracy of the display.

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See also the ZERO (tare) section, page 6, for more operation details related to the Over and Under Range Conditions when the PM-P-1 has been tared with an applied positive or negative pressure present.

#### Low Battery Condition

When the battery voltage is sensed by the PM-P-1 as being below a certain value, the “**LO BAT**” indicator on the LCD will be illuminated. While the PM-P-1 is designed to operate accurately for several more hours, it is best to replace both batteries at the next convenient opportunity.

If the battery voltage is allowed to continue declining below a critical value required for function, the PM-P-1 unit will shut down completely and the LCD will blank out.

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**NOTE:** If the power switch is turned OFF for a period of time, the battery voltage may recover to a point where the unit can be powered ON again and have a visible display. However, the batteries should still be replaced as soon as convenient.

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## User Controls

### Power Switch

The Power Switch is located along the top edge of the PM-P-1. This toggle type switch moves from side to side (left = OFF / right = ON) as noted on the legend that appears in the upper right hand corner of the front panel.

The power switch completely disconnects the battery power from the internal circuitry when switched OFF, thereby removing any drain on the batteries and extending their operational life.

### Push Buttons

There are three push buttons on the front of the PM-P-1 instrument that are used to tare (ZERO) and calibrate (SCALE) the device. These buttons are labeled “Z”, “-” and “+”, from left to right across the center of the PM-P-1 front panel.

In order to use any of these front panel buttons, it is first necessary to press any one of the buttons to place the device into the “User Input” mode. It is then ready to respond to further button presses. This mode entry sequence prevents unintentional operation of the calibration or tare functions. The device will stay in “User Input” mode for up to 5 seconds initially and an additional 5 seconds after each subsequent button is pressed. If there are no further button presses within 5 seconds, the PM-P-1 will return to “Normal” mode.

## Interfaces

### Transducer Input

The Transducer Input jack is located along the top edge of the PM-P-1 and its position is as noted on the legend that appears in the upper left hand corner of the front panel. This input jack provides the connection of excitation power to and pressure signal from the pressure transducer supplied with the PM-P-1 pressure monitor.

This input jack will accept the RJ14 type plug on the LSI pressure transducer. To connect the pressure transducer, orient the plug so the locking tang is toward the back of the PM-P-1 and insert it into the transducer jack on the PM-P-1 until the locking tang snaps into position. To remove the transducer plug from the jack, squeeze the locking tang tightly against the body of the jack then carefully pull the transducer plug out from the jack.



**Analog Output**

The Analog Output connector is located along the top edge of the PM-P-1 and its position is as noted on the legend that appears in the upper center of the front panel. This BNC type connector provides the connection of the analog output DC voltage to other devices such as voltmeters and data acquisition recorders.

The legend that appears in the upper center of the front panel gives specifics on the scale of the analog output voltage, which is 10mV/mmHg of applied pressure and the range of the analog output voltage, which is -0.5 VDC to +3.0 VDC, as well as the polarity of the BNC connector, which is shell negative (-) and center positive (+).

Refer to the Input Offset Removal section below and the Gain Calibration (see Chapter 4) for additional information on the actual analog output voltage under certain operating circumstances.

**ZERO (tare)**

During normal operation of the PM-P-1 it will often be required to remove input offsets. This is done to remove system offsets present in the transducer or instrument, or to establish a new reference point. The tare process subtracts the input currently received and redefines this input as the zero reference point. These offsets are removed through the use of the front panel “Z” button.

When the instrument is first powered up with a transducer attached and the transducer is exposed to ambient pressure, there will most likely be a residual system offset which will be displayed as a non-zero value in the range -10 to +10 mmHg. This small offset is easily removed by pressing the “Z” button.

As described in the Push Buttons section (page 5), the first “Z” button press is used to put the device into “User Input” mode and the second and subsequent button presses perform the function(s). So it is necessary therefore to press the “Z” button twice to tare the device and remove the initial offset.

After being tared it is normal to see the device display values between -1 and 1 mmHg, due to minor signal variations.

During use of the PM-P-1 instrument, it might be deemed necessary to establish a new zero reference for measurement purposes despite the fact that the pressure transducer is currently subject to a pressure other than the ambient atmospheric pressure. This can be achieved at any time by performing the tare process described above.

**Note:** The LSI Part # PT-F pressure transducer has been factory calibrated and is only guaranteed accurate within its calibrated range of -50 to +300 mmHg.

If the zero reference point is moved from the transducer's absolute zero to another pressure value, it will change the available measurement range of the instrument. For example, if the instrument is showing a pressure of 200 mmHg and the ZERO operation is performed, the new available displayable pressure range will be -250 to +100 mmHg.

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When the user performs a tare function and resets the pressure display to zero, the analog voltage output will also be reset to 0.0 VDC.

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**Note:** The absolute analog output voltage limits are -1.0 VDC to +3.0 VDC.

If the PM-P-1 is tared in order to zero the displayed pressure with more than 100 mmHg of applied pressure and the applied pressure is then reduced, the analog output will only track in the negative direction to -1.0 VDC; at which point the analog output will stop tracking the displayed pressure.

After that point the displayed pressure may accurately continue to decline, but the analog output voltage will remain constant at -1.0 VDC.

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## CHAPTER 4 | GAIN CALIBRATION (SCALE)

After removing the system offset, as discussed in the ZERO (tare) section (page 6), the user may want to calibrate the gain (SCALE) of the transducer and instrument. This will be necessary if the user wants to be certain that a reading of 300 mmHg on the instrument is equal to 300 mmHg according to the calibrated reference device being used.

Note that the Analog Output is scaled at the same time that the displayed reading is adjusted to agree with the pressure reference.

The calibration process is as follows:

1. Using an accurate calibrated device like a manometer (LSI Part# CAL-PRESSURE-TRANS), for example, apply a pressure of 295 mmHg to the transducer attached to the PM-P-1 pressure monitor.
2. Note the reading on the display of the PM-P-1 pressure monitor and the analog output voltage if pertinent.
3. If the reading is 295, and the analog output is 2.95 VDC, then the gain calibration is complete and the following steps may be skipped.
4. If the reading is less than 295, then press the “+” button once to enter the “User Input” mode (see User Controls, page 5) and then press the “+” button as many times as is necessary to raise the output display until it matches the pressure of the external reference (e.g. 295).
5. If the reading is greater than 295, then press the “-” button to enter the “User Input” mode and then press the “-” button as many times as is necessary to bring the display value down to 295.

Any adjustment made in Step 4 or 5 above should have also been reflected simultaneously in the analog output voltage, if measured/monitored.

Once the display value, and the analog output voltage, matches the applied pressure, the gain calibration process is complete. After approximately 5 seconds with no further button presses, the PM-P-1 will return to the “Normal” mode of operation automatically.

## APPENDIX A | CONTACT INFORMATION

Please contact Living Systems Instrumentation for information regarding any of our products.

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