



Pressure Monitor BP-1

Analog single-channel transducer signal conditioner



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INSTRUCTION MANUAL

Serial No. _____

083101

World Precision Instruments

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DECLARATION OF CONFORMITY

We: World Precision Instruments, Inc.
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as the manufacturers of the apparatus listed, declare under sole responsibility that the product(s):

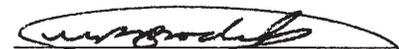
Title: BP1 (including Pressure Simulator: Model PRSIM)

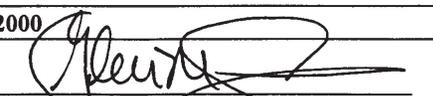
to which this declaration relates is/are in conformity with the following standards or other normative documents:

- Safety:** EN 61010-1:1993 (IEC 1010-1:1990)
- EMC:** EN 50081-1:1992
EN 50082-1:1992

and therefore conform(s) with the protection requirements of Council Directive 89/336/EEC relating to electromagnetic compatibility and Council Directive 73/23/EEC relating to safety requirements.

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Introduction

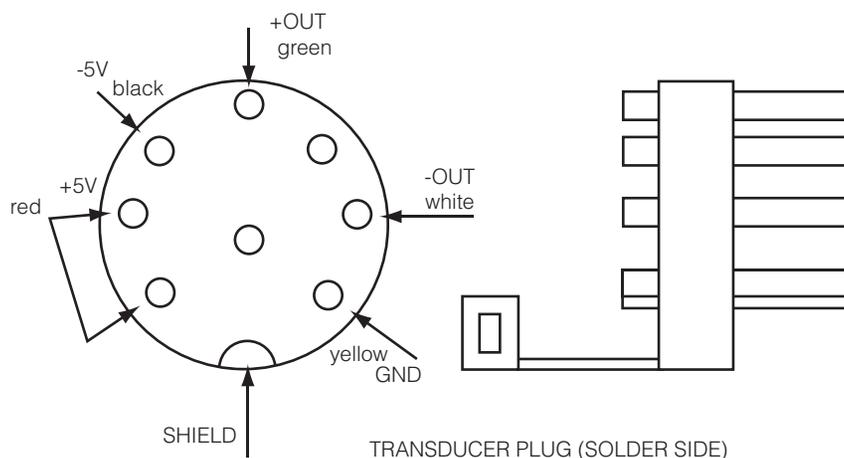
Designed to monitor animal arterial or venous blood pressure, pressure monitor model BP-1 is an analog single channel transducer signal conditioner. The instrument can also monitor force, temperature and other physical parameters using the appropriate transducers.

- A modulated audible tone whose pitch and intensity vary with the instantaneous amplitude of the transducer signal.
- A digital LCD display of average or peak signal values.
- A recorder output connector to allow direct connection of the amplified signal to a pen recorder, oscilloscope or computer data acquisition system.

The signal average is obtained by filtering fluctuations of the transducer signal and may not be exactly identical to the MEAN BP as defined in classical physiology texts (*e.g.*, *Human Physiology: The Mechanisms of Body Functions*, A.J. Vander, J.H. Sherman, D.S. Luciano. 4th Ed. (1970) McGraw-Hill, chapter 11, pages 334-335).

Operation

Model BLPR, or any of the many transducers configured as a resistive bridge, can be connected to the 8 pin input connector on the front panel. For transducers not manufactured by WPI a spare 8 pin plug is provided with which the user may wire any commercially available transducer to access this instrument. The pin configuration of this plug is shown in the figure below:



WARNING....DC POWER IS SUPPLIED DIRECTLY TO THE TRANSDUCER RECEPTACLE. SHORT CIRCUIT OF THIS POWER MAY RESULT IN DESTRUCTION OF THE 2 LED INDICATOR LAMPS AND WILL BLOW THE POWER FUSE.

Positioning the Output to Zero

Insert a pressure (or other) transducer plug into the eight pin receptacle on the instrument's front panel and switch the AUDIO switch to OFF and the line POWER switch to ON. Two red lamps over the receptacle will light indicating that DC power is being supplied to the transducer. Select x10 on the GAIN switch and AVERAGE on the Digital Meter selector switch. With no pressure applied, the POSITION control will produce a zero reading on the digital panel meter. Note: it is best to have the transducer filled with the appropriate fluid when setting the output to zero. Instructions for filling are given below.

Warranty

WPI (World Precision Instruments, Inc.) warrants to the original purchaser that this equipment, including its components and parts, shall be free from defects in material and workmanship for a period of one year* from the date of receipt. WPI's obligation under this warranty shall be limited to repair or replacement, at WPI's option, of the equipment or defective components or parts upon receipt thereof f.o.b. WPI, Sarasota, Florida U.S.A. Return of a repaired instrument shall be f.o.b. Sarasota.

The above warranty is contingent upon normal usage and does not cover products which have been modified without WPI's approval or which have been subjected to unusual physical or electrical stress or on which the original identification marks have been removed or altered. The above warranty will not apply if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electric power, air conditioning, humidity control, or causes other than normal and ordinary usage.

To the extent that any of its equipment is furnished by a manufacturer other than WPI, the foregoing warranty shall be applicable only to the extent of the warranty furnished by such other manufacturer. This warranty will not apply to appearance terms, such as knobs, handles, dials or the like.

WPI makes no warranty of any kind, express or implied or statutory, including without limitation any warranties of merchantability and/or fitness for a particular purpose. WPI shall not be liable for any damages, whether direct, indirect, special or consequential arising from a failure of this product to operate in the manner desired by the user. WPI shall not be liable for any damage to data or property that may be caused directly or indirectly by use of this product.

Claims and Returns

- Inspect all shipments upon receipt. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. All claims for shortage or damage must be made within 10 days after receipt of shipment. Claims for lost shipments must be made within 30 days of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim settles. In some instances, photographic documentation may be required. Some items are time sensitive; WPI assumes no extended warranty or any liability for use beyond the date specified on the container.
- WPI cannot be held responsible for items damaged in shipment en route to us. Please enclose merchandise in its original shipping container to avoid damage from handling. We recommend that you insure merchandise when shipping. The customer is responsible for paying shipping expenses including adequate insurance on all items returned.
- Do not return any goods to WPI without obtaining prior approval and instructions (RMA#) from our returns department. Goods returned unauthorized or by collect freight may be refused. The RMA# must be clearly displayed on the outside of the box, or the package will not be accepted. Please contact the RMA department for a request form.
- Goods returned for repair must be reasonably clean and free of hazardous materials.
- A handling fee is charged for goods returned for exchange or credit. This fee may add up to 25% of the sale price depending on the condition of the item. Goods ordered in error are also subject to the handling fee.
- Equipment which was built as a special order cannot be returned.
- Always refer to the RMA# when contacting WPI to obtain a status of your returned item.
- For any other issues regarding a claim or return, please contact the RMA department.

Warning: This equipment is not designed or intended for use on humans.

* Electrodes, batteries and other consumable parts are warranted for 30 days only from the date on which the customer receives these items.

Specifications

Amplification.....	x1, x10, x100 and variable (x5 to x1000)
Bandwidth, small signal (-3dB)	300 kHz (x1), 30 kHz (x10), 3 kHz (x100)
	0.3 kHz (x1000)
Output Voltage Swing.....	± 5 volts
Maximum Amplifier Output Current.....	2 mA
Input Impedance, each input	100 K Ohms .01 µF
Peak Reading, Accuracy.....	± 1999 millivolts
	± 5% max error from 1 Hz -20 Hz
Applied Volts and Current	10 V nominal, varies with load. 25 mA, max.
Digital Panel Meter	0 to 1999 mV

Transducer Calibration

BP-1 provides 3 fixed decade steps of amplification plus a variable gain step. Most often, the user requires the instrument to read in direct physical units for example grams or mm of Hg. The transducer's conversion factor is often not known precisely and varies with the voltage applied to the sensor (approximately 10 volts from BP-1). Thus, it will be necessary to calibrate the system using known forces, pressures or displacements. This will scale the output of BP-1 to the physical parameter desired.

Example: A typical pressure transducer like the WPI BLPR, is nominally rated at 5 microvolts output per volt of excitation per mm of Hg pressure. To compute the approximate output from BP-1 for this transducer.....

$$5 \mu\text{V/V} \bullet 10 \text{ V} \bullet \text{Amplification} = \text{Output } \mu\text{V per mm Hg}$$

Thus, if we had selected x20 Amplification, the Output per mm Hg would be approximately 1 mV per mm Hg. Since the nominal sensitivity of 5 µV per volt is not exact, and the bridge excitation voltage is approximate, the transducer should be calibrated by using a calibrated hydrostatic pressure source.

Calibration Procedure

To calibrate a pressure transducer it will usually be necessary to select and use for measurements the ADJ amplification position on the Gain selector switch rather than the other gain positions. With no external pressure applied, the AVERAGE should be carefully zeroed using the Position knob. Tighten the concentric collar of this knob to lock the zero setting. Apply a known constant pressure to the pressure transducer and adjust the ADJ potentiometer with a screwdriver until the digital panel meter reads the appropriate value eg. 100 on the meter for 100 mm of Mercury pressure. Release the pressure. The meter should return to zero. If not, readjust the Position knob slightly until it does. Note that for this example, the maximum pressure that the panel meter can indicate will be ± 1999 mm of Hg and the resolution will be 1 mm Hg. If greater resolution is required, an external digital meter or recorder with greater resolution can be connected to the Output connector. Alternatively, the ADJ potentiometer could be advanced so that for 100 mm of pressure, a 1000 (millivolts) reading is obtained (the decimal point in the reading of 100.0 mm Hg must be inferred). For this case, the maximum pressure that the panel meter can indicate will be 199.9 mm of Hg but the resolution will now be 0.1 mm Hg. Note that the Output connector voltage can swing ± 5 volts, 2.5 times the limit of the digital panel meter. Therefore the user is not necessarily limited by the excursion range of the panel meter if a separate meter or recorder is available.

Audio Monitor

Model BP-1 includes an audio monitor. A warbling tone is emitted in response to low frequency signals produced by pressure or other transducers. A suppressed audible carrier frequency is simultaneously amplitude and frequency modulated by the transducer's signal. When the Audio selector switch is placed in the AC position the carrier is modulated by varying signals only. The DC level of the baseline can also be made audible if the DC position is selected. The Audio Monitor is deactivated when the Audio selector switch is in the Off position.

Meter Select Switch

The panel digital meter has four different reading modes:

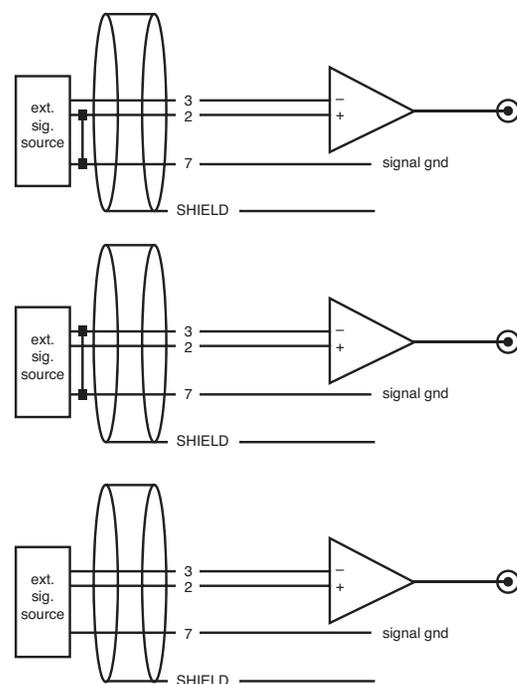


Figure 2 BP 1 connected to an external signal source. Upper, single ended, inverting. Middle, single ended, non-inverting. Lower, differential.

Average filters fluctuation of the transducer signal so as to obtain a mean signal level. In this reading mode, the digital reading changes very slowly. (See Note on page 1 for definition of average.)

+ and - Peak samples and holds the transducer signal at maxima or minima. The principle by which the peak detector works is to differentiate the signal to determine signal maxima and minima and then to trigger a sample and hold circuit at the appropriate instant so as to sample the peak. The signal is filtered so that signal peaks in the 1 to 20 Hz frequency range are optimized. This is done to avoid spurious responses that might occur with signals including multiple peaks or noise.

Output: The digital meter displays the raw transducer signal in this mode. If the signal is varying the digital meter reading will fluctuate. This mode is best used to quickly position the baseline of the transducer.

General Amplification

For transducer types other than resistive bridges, such as active transistor circuits, magnetic, photocell or piezoelectric devices, the instrument differential amplifiers may be used for signal amplification in differential and single ended modes (see Figure 2 for suggested input wiring). Note particularly when recording differentially, that pin 7, instrument ground, must be connected to the circuit ground of the input source to achieve effective amplification. Careful shielding of signal generating devices will result in lower noise "pick-up" by the signal input wiring.

Transducer Filling Instructions

The BLPR is filled by syringe injection of the appropriate fluid. Be sure to remove any air bubbles by gently tapping the transducer on the open palm. Do not tap the transducer with metal objects such as hemostats to purge air bubbles. Finally, zero balance the transducer to atmospheric pressure by opening the three-way stopcock provided with the system and connected to the subject side of the BLPR unit. The transducer is now ready to be calibrated.

Notes

Fuses: Safety fuses (including 1 spare fuse) are installed in the rear Power connector assembly. The correct replacement fuse is 1/8 Ampere, Slow blow for 110 Volt operation; 1/16 Ampere Slow blow for 220 Volt operation.

One spare 8-pin DIN transducer plug is provided with each Pressure Monitor to allow the user to rewire transducers other than those manufactured by WPI to access the front panel receptacle.

The WPI model **PM 015** can be used as a laboratory reference for performing a hydrostatic pressure calibration of the BP-1 and BPLR system.