

# MultiCal

## bar/PSI Pressure Module

PN: 1527, 206 bar/ 3000 PSI

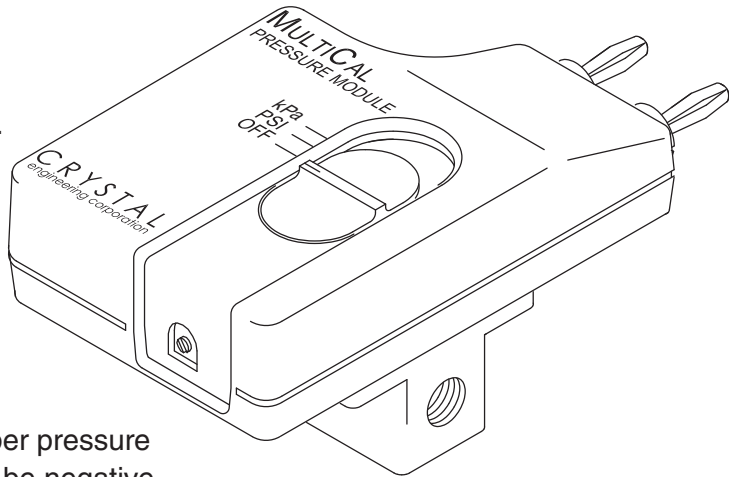
### INSTRUCTION SHEET

#### Introduction

The MultiCal™ pressure modules can be used to measure almost any type of pneumatic or hydraulic pressures, up to 3000 PSIG. It can also be used to measure vacuum..

The module does not have a display. Instead, the MultiCal converts pressure (or vacuum) to millivolts. The module must be used with a device capable of measuring millivolts DC, such as a digital multimeter (DMM).

The MultiCal is calibrated to convert pressure units (bar or PSI) to 1 mV per pressure unit. Vacuum readings will of course be negative.



Pressure is measured by connecting your pressure source to the 1/8" female NPT fitting of the pressure transducer. Any gas or liquid compatible with 316 stainless steel may be applied to the module as the pressure source.

The three-position switch acts as a power switch as well as selecting inches PSI or bar scaling for the output. Also, the OFF position allows you to read the battery condition via the external multimeter.

The module performs best when used with high accuracy multimeters. We recommend any of the following meter:

Fluke 70 series, 80 series, Model 45

Any meter with 10M or greater input impedance and 4mm banana jacks on 3/4" centers.

**Typical uses.** for the module are to calibrate pressure gauges and pressure transmitters.

**When used with a high performance multimeter, the pressure adapter becomes more than just a "digital pressure gauge."** For example, use the datalogging features built-in to the Fluke 87 and you'll have a system that can measure and record peak (high) pressures, peak low and average pressures of varying or unstable pressure source.

## ***Use and Operation***

The internal pressure sensor measures the difference between a sealed atmospheric reference pressure, and the pressure (or vacuum) applied to the pressure port. The pressure being measured can be either liquid or gaseous, providing it is compatible with the materials listed in the specification section.

### **CAUTION:**

**THE SENSOR DIAPHRAGM IS VERY THIN AND CAN BE DAMAGED OR DESTROYED BY SOLID OR SHARP OBJECTS. NEVER INSERT ANY OBJECT INTO THE INLET OF THE TRANSDUCER FITTING. CLEANING OF THE SENSOR MUST BE DONE WITH APPROPRIATE SOLVENTS, ONLY.**

Teflon tape or other suitable sealing compound should be used with any fitting connected to the 1/8" female NPT fitting.

### **Pressure Measurement**

Follow this procedure to correctly use the MultiCal pressure module.

1. Plug the MultiCal into the retractile cord set and plug the cord set into the DV volts input of the multimeter.
2. Set the multimeter to the mV (DC) range.
3. ***Check the battery condition: With the MultiCal still in the OFF position, the multimeter must indicate a minimum reading of 100 mV.*** Readings less than 100 mV indicate the battery measurements are accurate, always check the battery condition first, and replace the battery if necessary.
4. Turn on the MultiCal by sliding the switch to the range you intend to use.
5. "Zero" the MultiCal. With a small screwdriver adjust the small trimming potentiometer on the end of the MultiCal until your meter reads precisely zero.

***Prior to taking measurements, and recommended when changing scales, the module should be "zeroed" at barometric pressure.***

Some multimeters have a "relative" or "offset" button. This will have the same effect as adjusting the zero knob and accuracy of your measurements will not be degraded. However, rezeroing the MultiCal *will be required when changing scales.*

Most multimeters "forget" the "relative" setting when changing from mV to any other scale, even just to Volts. Some meters autorange from mV to Volts and then lose the "relative" value. In these cases, the zero knob may be more convenient than the "relative" button on the multimeter.

***The zero reading may also shift when the MultiCal is shifted from a vertical to a horizontal orientation.*** This is due to the oil filling that transmits the pressure signal from the stainless diaphragm to the silicon sensor. The effect of the shift is not significant and can be eliminated by any of the zero adjustment techniques noted above.

- Apply pressure to the MultiCal. If the meter reads overrange, change the multimeter range to DC volts (instead of mV). Note: The decimal place will be for volts. Multiply the reading by 1000. For example, 0.800 V would be 800 PSI.

### Battery Replacement

- Set the power switch to the OFF position.
- Disconnect the MultiCal from the DMM and any pressure connections.
- Turn the MultiCal so the power switch is facing down. Remove the single screw located between the banana plugs.
- Grasp the one case half in each hand. Pull the two halves apart, beginning at the end with the banana plugs.
- Remove and replace the battery.
- Reassemble the MultiCal. To reassemble, mate the two case halves at the end opposite the banana plugs, then “snap” the two halves together.

### Specifications:

The following specifications apply at  $23 \pm 5$  °C for 1 year after calibration and for use with devices having 10M input impedance. Accuracy specification requires the module to be “zeroed” prior to taking reading.

#### Pressure

Range	Accuracy
0 to 3000 PSI	$\pm$ (0.1% of reading + 0.2 PSI)
0 to 206 PSI	$\pm$ (0.1% of reading + 0.02 bar)

#### Vacuum

Range	Accuracy
0 to -14.7 PSI	$\pm$ (0.5% of reading + 0.2 PSI), typical
0 to -1 PSI	$\pm$ (0.1% of reading + 0.2 bar), typical

**Maximum Working Pressure: 3000 PSI**

**Burst Pressure: 5000 PSI**

#### Operating Environment

Temperature	Humidity
-10 to 10 °C	Uncontrolled Humidity
10 to 30 °C	0 to 95% Relative Humidity
30 to 40 °C	0 to 75% Relative Humidity
40 to 50 °C	0 to 45% Relative Humidity
50 to 55 °C	0 to 35% Relative Humidity

**Temperature derating:**

Range	Humidity
28 to 55 °C	0.016% x ( °C -28°)
18to 28 °C	No Derating
0 to 18 °C	0.048% x (18° - °C)
-10 to 0 °C	0.264% x (9° - °C)

(Add to Basic Accuracy Specification, °C = ambient temperature)

**Wetted Materials:**

316 stainless steel

**General**

<b>Weight</b>	<b>230 grams (8.1 oz) w/battery</b>
Overall length	118 mm (4 5/8")
Pressure Fitting	1/8" NPT
Battery	NEDA #1604, 6F22, 006P
Battery Life	400 Hours typ. w/alkaline battery
Output	1mV/unit into 10 Mohm load
Storage	-51 to 71 °C

**MultiCal Calibration:**

A calibration cycle of 1 year is recommended to maintain the MultiCal within specifications. Recommended equipment is listed in Table 1.

**Table 1 : Recommended Equipment**

Instrument	Minimum Specification	Recommended Model
Pressure Standard	± 0.025% of Reading	Pressurements Dead weight gauge
Digital Voltmeter	± 0.025% of reading, 10 Mohm input impedance	Fluke 45

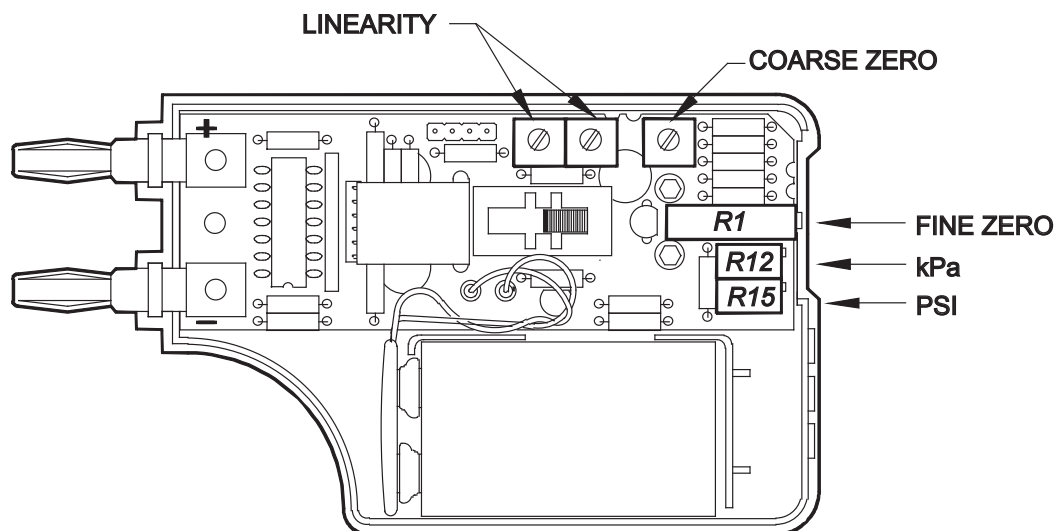
You do not need to use a reference multimeter if the MultiCal will be used with only one multimeter. In those cases, your overall accuracy may be better if it is calibrated as a set with the matching multimeter.

The recommended Digital Voltmeter listed in Table 1 has 10M input impedance - as do many handheld multimeters. Your reference multimeter should have the same input impedance as the multimeters the module will be used with. In some cases this may mean that the reference multimeter will need to have its input impedance lowered.

For example, a Flike 8840A is an excellent reference meter but has an input impedance 10000M . If the meters the module will be used with are Fluke 87s, connect a 10M resistor in parallel with the input to the 8840A.

## Procedure

1. Connect the MultiCal to the pressure calibration system and to the multimeter. Be sure that the pressure calibration system and the connection to the MultiCal is leak free.
2. Allow the MultiCal to stabilize at room temperature, away from drafts, for at least 30 minutes before proceeding with calibration. Turn on the multimeter and allow it to warm up per the multimeter operating instruction. Set the multimeter to the appropriate DC volt or millivolt scale.
3. Verify the condition of the battery and replace the battery if necessary. Follow the Battery Replacement procedure to disassemble the MultiCal, but do not remove the battery or reassemble the MultiCal.
4. Set the switch on the MultiCal to the PSI position (switch in position closest to the banana plugs). Allow the MultiCal to warm up for two minutes.
5. The FINE ZERO potentiometer (R1) should be set to the center of its rotational range. Adjust the COARSE ZERO pot until the output is as close to zero as possible. Trim in the final reading to  $0\text{ mV} \pm 0.02\text{ mV}$  with the FINE ZERO potentiometer.
6. Check the PSI pressure points shown on Table 2. Adjust R12 if necessary to bring the readings to within the tolerances shown on Table 2.



**Figure 1: Potentiometer locations**

7. Set the switch on the MultiCal to the PSI position. Vent the system and readjust zero if necessary.
8. Test the MultiCal at the 206 bar point. The reading should be within the tolerance shown in Table 2.

9. In the unlikely event that you are unable to adjust the MultiCal so that all of the points meet the tolerances of Table 2, contact Customer Service for assistance. Do not readjust linearity. The linearity adjustment is factory set and should never require readjustment, unless the sensor is replaced.

**Table 2: Readings in mV**

<b>True Pressure</b>	<b>Acceptable Output (mV)</b>
1500 PSI	1498.3 to 1501.7
3000 PSI	2996.8 to 3003.2
206 PSI	205.774 to 206.226

## Warranty

Crystal Engineering Corporation warrants MultiCals to be free from defects in material and workmanship under normal use and service for one (1) year from date of purchase to the original purchaser. It does not apply to batteries or when the product has been misused, altered or damaged by accident or abnormal conditions of operation.

Crystal Engineering will, at our option, repair or replace the defective device free of charge and the device will be returned, transportation prepaid. However, if we determine the failure was caused by misuse, alteration, accident or abnormal condition of operation, you will be billed for the repair.

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If calling, have ready the model number, serial number, date of purchase and reason for return. You will receive instructions for returning the device to Crystal Engineering.

Send your comments to: [feedback@crystalengineering.net](mailto:feedback@crystalengineering.net)

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