

**FLUKE**®

**Biomedical**

# **DPM2 Plus**

Digital Pressure Meter

## Operators Manual

PN 2572323

March 2006

© 2006 Fluke Corporation, All rights reserved. Printed in USA  
All product names are trademarks of their respective companies.

# ***Warranty and Product Support***

Fluke Biomedical warrants this instrument against defects in materials and workmanship for one full year from the date of original purchase. During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you return the product, shipping prepaid, to Fluke Biomedical. This warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification by other than Fluke Biomedical. **IN NO EVENT SHALL FLUKE BIOMEDICAL BE LIABLE FOR CONSEQUENTIAL DAMAGES.**

Only serialized products and their accessory items (those products and items bearing a distinct serial number tag) are covered under this one-year warranty. **PHYSICAL DAMAGE CAUSED BY MISUSE OR PHYSICAL ABUSE IS NOT COVERED UNDER THE WARRANTY.** Items such as cables and non-serialized modules are not covered under this warranty.

Recalibration of instruments is not covered under the warranty.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state, province to province, or country to country. This warranty is limited to repairing the instrument to Fluke Biomedical's specifications.

## ***Warranty Disclaimer***

Should you elect to have your instrument serviced and/or calibrated by someone other than Fluke Biomedical, please be advised that the original warranty covering your product becomes void when the tamper-resistant Quality Seal is removed or broken without proper factory authorization. We strongly recommend, therefore, that you send your instrument to Fluke Biomedical for factory service and calibration, especially during the original warranty period.

## ***Notices***

---

### **All Rights Reserved**

© Copyright 2006, Fluke Biomedical. No part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language without the written permission of Fluke Biomedical.

---

### **Copyright Release**

Fluke Biomedical agrees to a limited copyright release that allows you to reproduce manuals and other printed materials for use in service training programs and other technical publications. If you would like other reproductions or distributions, submit a written request to Fluke Biomedical.

---

## Unpacking and Inspection

Follow standard receiving practices upon receipt of the instrument. Check the shipping carton for damage. If damage is found, stop unpacking the instrument. Notify the carrier and ask for an agent to be present while the instrument is unpacked. There are no special unpacking instructions, but be careful not to damage the instrument when unpacking it. Inspect the instrument for physical damage such as bent or broken parts, dents, or scratches.

---

## Technical Support

For application support or answers to technical questions, either email [techservices@flukebiomedical.com](mailto:techservices@flukebiomedical.com) or call 1-800- 648-7952 or 1-425-446-6945.

---

## Claims

Our routine method of shipment is via common carrier, FOB origin. Upon delivery, if physical damage is found, retain all packing materials in their original condition and contact the carrier immediately to file a claim. If the instrument is delivered in good physical condition but does not operate within specifications, or if there are any other problems not caused by shipping damage, please contact Fluke Biomedical or your local sales representative.

---

## Standard Terms and Conditions

### Refunds and Credits

Please note that only serialized products and their accessory items (i.e., products and items bearing a distinct serial number tag) are eligible for partial refund and/or credit. Nonserialized parts and accessory items (e.g., cables, carrying cases, auxiliary modules, etc.) are not eligible for return or refund. Only products returned within 90 days from the date of original purchase are eligible for refund/credit. In order to receive a partial refund/credit of a product purchase price on a serialized product, the product must not have been damaged by the customer or by the carrier chosen by the customer to return the goods, and the product must be returned complete (meaning with all manuals, cables, accessories, etc.) and in “as new” and resalable condition. Products not returned within 90 days of purchase, or products which are not in “as new” and resalable condition, are not eligible for credit return and will be returned to the customer. The Return Procedure (see below) must be followed to assure prompt refund/credit.

### Restocking Charges

Products returned within 30 days of original purchase are subject to a minimum restocking fee of 15 %. Products returned in excess of 30 days after purchase, but prior to 90 days, are subject to a minimum restocking fee of 20 %. Additional charges for damage and/or missing parts and accessories will be applied to all returns.

### Return Procedure

All items being returned (including all warranty-claim shipments) must be sent freight-prepaid to our factory location. When you return an instrument to Fluke Biomedical, we recommend using United Parcel Service, Federal Express, or Air Parcel Post. We also recommend that you insure your shipment for its actual replacement cost. Fluke Biomedical will not be responsible for lost shipments or instruments that are received in damaged condition due to improper packaging or handling.

Use the original carton and packaging material for shipment. If they are not available, we recommend the following guide for repackaging:

- Use a double-walled carton of sufficient strength for the weight being shipped.
- Use heavy paper or cardboard to protect all instrument surfaces. Use nonabrasive material around all projecting parts.
- Use at least four inches of tightly packed, industry-approved, shock-absorbent material around the instrument.

**Returns for partial refund/credit:**

Every product returned for refund/credit must be accompanied by a Return Material Authorization (RMA) number, obtained from our Order Entry Group at 1-800-648-7952 or 1-425-446-6945.

**Repair and calibration:**

To find the nearest service center, goto [www.flukebiomedical.com/service](http://www.flukebiomedical.com/service) or

In the U.S.A.:

Cleveland Calibration Lab

Tel: 1-800-850-4606

Email: [globalcal@flukebiomedical.com](mailto:globalcal@flukebiomedical.com)

Everett Calibration Lab

Tel: 1-800-850-4606

Email: [service.status@fluke.com](mailto:service.status@fluke.com)

In Europe, Middle East, and Africa:

Eindhoven Calibration Lab

Tel: +31-402-675300

Email: [ServiceDesk@fluke.com](mailto:ServiceDesk@fluke.com)

In Asia:

Everett Calibration Lab

Tel: +425-446-6945

Email: [service.international@fluke.com](mailto:service.international@fluke.com)

---

## Certification

This instrument was thoroughly tested and inspected. It was found to meet Fluke Biomedical's manufacturing specifications when it was shipped from the factory. Calibration measurements are traceable to the National Institute of Standards and Technology (NIST). Devices for which there are no NIST calibration standards are measured against in-house performance standards using accepted test procedures.

---

## WARNING

Unauthorized user modifications or application beyond the published specifications may result in electrical shock hazards or improper operation. Fluke Biomedical will not be responsible for any injuries sustained due to unauthorized equipment modifications.

---

## Restrictions and Liabilities

Information in this document is subject to change and does not represent a commitment by Fluke Biomedical. Changes made to the information in this document will be incorporated in new editions of the publication. No responsibility is assumed by Fluke Biomedical for the use or reliability of software or equipment that is not supplied by Fluke Biomedical, or by its affiliated dealers.

---

## Manufacturing Location

The DPM2 Plus Digital Pressure Meter is manufactured in Everett, WA, U.S.A.

# **Table of Contents**

<b>Title</b>	<b>Page</b>
Abbreviations.....	iii
Introduction .....	1
Safety Information .....	2
General Specifications .....	2
Service Information .....	3
Part Numbers .....	3
Meter Features .....	4
Making Measurements.....	5
Zeroing.....	5
Connecting the Equipment under Test.....	6
Pressure Measurements.....	6
Measuring Gas and Gaseous Mixtures.....	6
Measuring Liquid Mediums.....	6
Voltage Output Jack.....	7
Battery Replacement.....	8
Compatible Agents .....	8
Pressure Conversion .....	10

## ***List of Tables***

<b>Table</b>	<b>Title</b>	<b>Page</b>
1.	Switch Positions.....	5
2.	Compatible Agents .....	8
3.	Pressure Conversion Chart.....	10

## ***List of Figures***

<b>Figure</b>	<b>Title</b>	<b>Page</b>
1.	Front panel controls and indicators.....	4
2.	Setup for Measuring Liquid Medium .....	7

## ***Abbreviations***

<b>atm</b>	atmosphere
<b>c</b>	centi- ( $10^{-2}$ )
<b>cm</b>	centimeter
<b>cm H<sub>2</sub>O</b>	centimeters of water
<b>H<sub>2</sub>O</b>	water
<b>Hg</b>	mercury
<b>in</b>	inch
<b>lb</b>	pound
<b>LCD</b>	liquid crystal display
<b>m</b>	-meter
<b>m</b>	milli- ( $10^{-3}$ )
<b>mm</b>	millimeter
<b>mmHg</b>	millimeters of mercury
<b>psi</b>	pounds per square inch
<b>V</b>	volt





# ***DPM2 Plus Digital Pressure Meter***

## ***Introduction***

### **⚠ Warning**

#### **Read “Safety Information” before you use the Meter**

Many healthcare devices used in hospitals incorporate positive and negative pressures that may range from one atmosphere or greater (negative or positive) in either liquid or gaseous form. The DPM2 Plus Digital Pressure Meter (hereafter “the Meter”) is designed to measure these pressures to assist in repair and quality control of medical instrumentation.

Specific applications include dialysis equipment, ophthalmic lasers, automatic tourniquets, surgical suction, ventilators, and others.

The Meter can be used to measure and verify the positive or negative pressures from pneumatic as well as hydraulic sources. Some of the Meter applications are:

- Checking static cuff pressure and cuff pressure variations of pneumatic tourniquets, noninvasive blood pressure monitors, sphygmomanometers, etc.
- Measuring positive pressures of compressor outputs in ventilators, respirators, compressor pumps, etc.
- Checking occlusion, operating, and purge pressures in volumetric infusion pumps.
- Verifying negative pressures in diagnostic and surgical suction equipment such as thermotic drainage.
- Verifying vacuum levels in eye surgery equipment such as extraction and irrigation systems.
- Checking dialysate pressure in kidney dialysis machines.
- Sending output to a strip chart recorder to keep long-term records of applied pressure as a function of voltage.

## **Safety Information**

### **⚠ Caution**

**To avoid personal injury and possible damage to the Meter:**

- **Use the Meter only with gases and liquids found in Table 2 of this manual.**
- **Use appropriate safety precautions when working with hazardous liquids and gases.**
- **Be aware of the direction of gas flow to avoid hazardous conditions during bleed-off procedure.**
- **For pressures above 5 psi and vacuum pressures of -5 psi, use only securely clamped reinforced tubing.**

## **General Specifications**

<b>Power Requirements</b> .....	One 9-volt battery, NEDA 6LR61, IEC 1604A
<b>Battery Life</b> .....	60 hours of continuous use
<b>Operating Temperature</b> .....	0 °C to 30 °C (32 °F to 86 °F)
<b>Overpressure</b> .....	Not to exceed 110 psi
<b>Pressure Connection</b> .....	Male Luer-Lok
<b>Ranges</b> .....	-698 to +802 mmHg -949 to +1090 cm H <sub>2</sub> O -374 to +429 in H <sub>2</sub> O -13.50 to +15.50 psi -13.5 to +100.0 psi
<b>Accuracy</b> .....	±1 % of full scale at all ranges
<b>Voltage Output</b> .....	0.1 V/psi on all ranges except 100 psi, which is 0.01 V/psi
<b>Voltage Output Accuracy</b> .....	5 % of range
<b>Display</b> .....	0.5-in LCD with LO BATT Negative polarity indication
<b>Dimensions</b> .....	14.61 × 9.14 × 4.83 cm (5.75 × 3.6 × 1.9 in)

## **Service Information**

The Meter should be returned to the factory yearly for calibration. For return instructions, see the section titled *Returns for service/repair/calibration*.

### **Part Numbers**

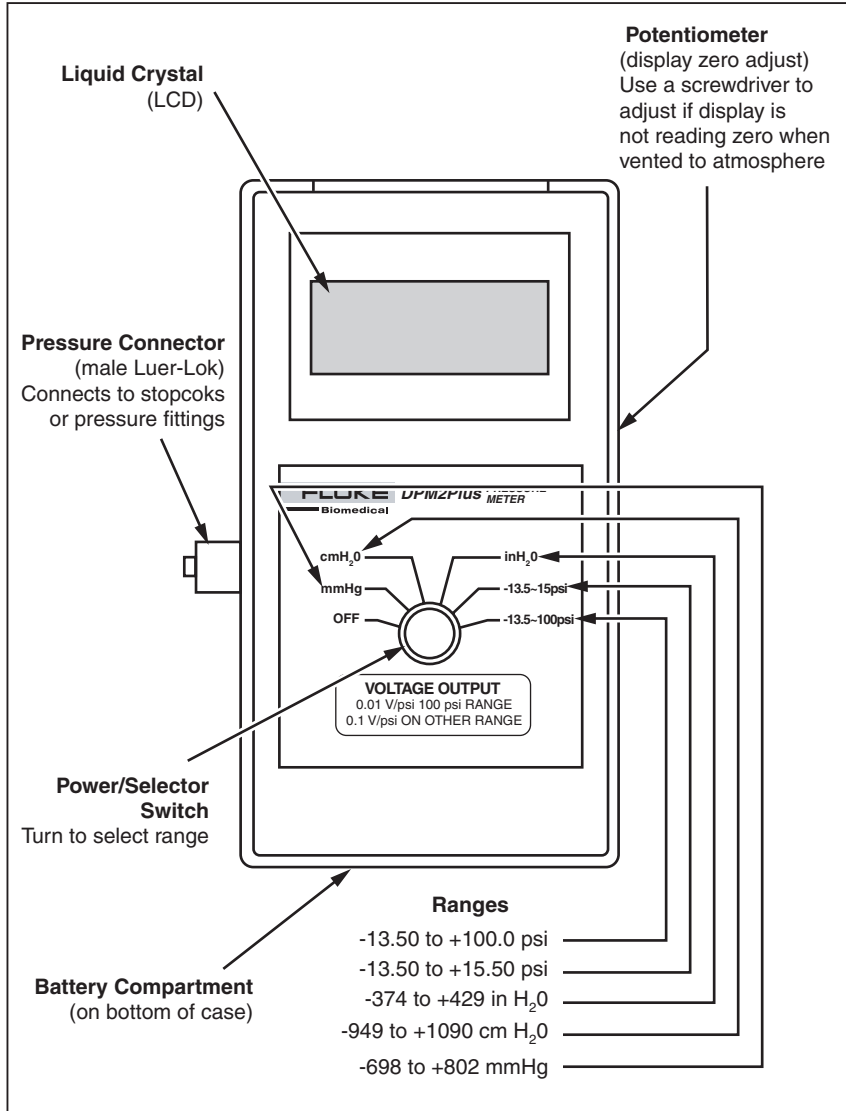
#### **Standard**

	<b>Fluke Part #</b>
• Operators Manual	2572323
• Catheter Adapter	2242653
• Battery, 9-volt alkaline (NEDA 6LR61, IEC 1604A)	614487

#### **Optional**

• Calibration Manual	2577835
----------------------	---------

## Meter Features



ehg1.eps

**Figure 1. Front panel controls and indicators**

**Table 1. Switch Positions**

<b>Switch Position</b>	<b>Function</b>
Off	Turn off power to the Meter
mmHg	Pressure from -698 to +802 millimeters of mercury
cmH <sub>2</sub> O	Pressure from -949 to +1090 centimeters of water
inH <sub>2</sub> O	Pressure from -374 to +429 inches of water
-13.5~15 psi	Pressure from -13.5 to +15.50 pounds per square inch
-13.5 ~ 100 psi	Pressure from -13.5 to +100 pounds per square inch

## ***Making Measurements***

The Meter has a large 0.5–inch liquid crystal display (LCD) to indicate the pressure at the Luer-Lok input. This male Luer-Lok provides the external connection for stopcocks or pressure fittings.

### *Note*

*It may take a few seconds for the display to settle to zero when the Meter is initially turned on and vented to atmosphere.*

The Meter has five different range measurement units as indicated on the front panel overlay in Figure 1. Two of the ranges measure psi, one of which allows measurements of up to 100 psi. This selection option allows the operator greater accuracy at lower psi ranges while maintaining the option to read higher psi levels.

## ***Zeroing***

Select the desired range for the pressure measurements to be taken.

For best accuracy, make sure the pressure meter reads zero when vented to atmosphere. Allow the Meter display to settle (due to changes in environment it may take a few seconds for the display to read zero).

If the display will not read zero, use a small screwdriver to adjust the potentiometer located on the side of the Meter until the display reads zero.

## **Connecting the Equipment under Test**

The Meter has a male Luer-Lok fitting that serves as the pressure sensing input port. For connecting different diameter tubing, use a stopcock or a male-to-female Luer-Lok fitting.

### *Note*

*Normally, you can use hospital grade tubing for all connections between the pressure source and the Meter. However, rigid tubing should be used for negative(vacuum) pressure measurements.*

## **Pressure Measurements**

Connect the source of pressure to the Luer-Lok input of the Meter. This may require a stopcock or a male-to-female Luer-Lok connector.

Once the connection is made, the display indicates the pressure being measured.

If the display shows a 1 in the far left position with all other digits blank, this means the limits of the selected range have been exceeded.

## **Measuring Gas and Gaseous Mixtures**

No special procedures are necessary when using the Meter to measure air pressure. However, when measuring gases other than air, you must purge all air from the tube connecting the source to the Meter. Let the gas bleed from the end of the tubing before connecting to the Meter to remove atmosphere. This ensures a homogenous medium for pressure measurements.

## **Measuring Liquid Mediums**

The pressure sensor in the Meter has a thermoplastic polyester (GE-Valox) housing. Therefore you can measure water or other liquid (solvent) pressure, provided the pH of the liquid is between 6.5 and 7.5.

### **⚠ Caution**

**When measuring a gas pressure, errors can result if there is liquid in contact with the pressure sensor.**

To avoid getting liquids in direct contact with the pressure sensor, place the Meter above the liquid and allow a short column of air between the liquid and the sensor input. See Figure 2-2.

Should the Meter pressure chamber come into contact with a liquid that may contain corrosive solutes (salts), the Meter pressure chamber should be flushed with water. Use an ordinary syringe to flush the chamber.

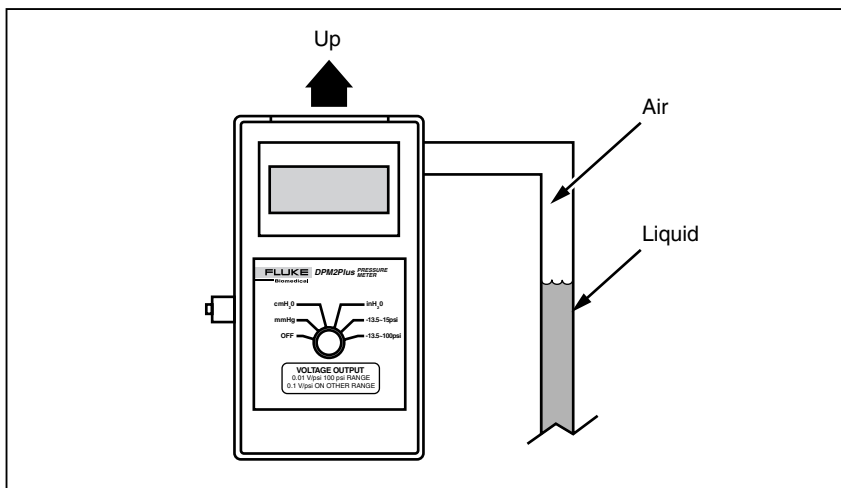


Figure 2. Setup for Measuring Liquid Medium

ehg2.eps

### ***Voltage Output Jack***

The voltage output jack is located on the right side of the Meter case. The Meter generates a DC voltage directly proportional to the pressure or vacuum applied at its input port. This DC voltage is 0.1 volt/psi on all ranges except the 100 psi selection which is 0.01 volt/psi.

You can connect a data-logging device (strip chart recorder) to this voltage output and graph profiles from a wide range of pressure or vacuum sources. For example, you can measure peak pressures and cycling intervals generated by rotating tourniquets.

## **Battery Replacement**

When the LCD display reads LO BATT, replace the battery with an equivalent 9-volt alkaline battery located in the battery compartment on the back of the Meter.

## **Compatible Agents**

**Table 2. Compatible Agents**

<b>Agent</b>	<b>Temperature/Concentration</b>
Acetic Acid	Room temperature 5 %
Acetone	Room temperature 100 %
Ammonia	Room temperature 30 % – 35 %
Benzaldehyde	Room temperature 100 %
Benzyl Alcohol	Room temperature 100 %
Water	60 °C 100 %
Ethyl Alcohol	Room temperature 100%
Ethylene Glycol	Room temperature 100 %
Ethylene Oxide	Room temperature 88 % Freon 12, 12 % Eto
Formaldehyde	60 °C 37 %
Formalin	Room temperature 15 % methyl alcohol, 37 % formaldehyde



**Table 2. Compatible Agents (cont)**

<b>Agent</b>	<b>Temperature/Concentration</b>
Hydrochloric Acid	Room temperature 10 %
Hydrogen Peroxide	Room temperature 10 %, 30 %
Methanol Vapor	Room temperature 100 %
Methyl Alcohol	Room temperature 100 %
Oleic Acid	Room temperature 100 %
Potassium Permanganate	Room temperature 25 %
Sodium Hydroxide	Room temperature 10 %
Sodium Hypochlorite	Room temperature 10 %
Steam	300 °F, dry heat

## Pressure Conversion

**Table 3. Pressure Conversion Chart**

<i>from</i> <i>to</i>	PSI	in Hg	in H <sub>2</sub> O	mmHg	mm H <sub>2</sub> O	ATM	TORR
	lb/in <sup>2</sup>	@0 °C	@20 °C	@0 °C	@4 °C		
<b>PSI</b> lb/in <sup>2</sup>	1	0.49118	3.6062 ×10 <sup>-2</sup>	1.9337 ×10 <sup>-2</sup>	1.4223 ×10 <sup>-3</sup>	14.696	1.9337 ×10 <sup>-2</sup>
<b>in Hg</b> @0 °C	2.0359	1	7.3419 ×10 <sup>-2</sup>	3.9368 ×10 <sup>-2</sup>	2.8959 ×10 <sup>-3</sup>	29.920	3.9368 ×10 <sup>-2</sup>
<b>in H<sub>2</sub>O</b> @20 °C	27.73	13.620	1	0.53622	3.9440 ×10 <sup>-2</sup>	407.52	0.53622
<b>mmHg</b> @0 °C	51.714	25.401	1.8649	1	7.3558 ×10 <sup>-2</sup>	760.00	1
<b>mm H<sub>2</sub>O</b> @4 °C	703.05	345.32	25.353	13.595	1	1.0332 ×10 <sup>4</sup>	13.595
<b>ATM</b>	6.8045 ×10 <sup>-2</sup>	3.3422 ×10 <sup>-2</sup>	2.4538 ×10 <sup>-3</sup>	1.3158 ×10 <sup>-3</sup>	9.6788 ×10 <sup>-5</sup>	1	1.3158 ×10 <sup>-3</sup>
<b>TORR</b>	51.714	25.401	1.8649	1	7.3558 ×10 <sup>-2</sup>	760.00	1