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# User Manual

A trusted leader in measurement  
and calibration solutions.

## M104 Series: Digital Manometer: 0.25 % of Full Scale



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## General information

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## *Glossary*

Words and phrases with their definitions.

### **Absolute Isolated pressure (AN)**

Absolute pressure is equal to the sum of these two:

1. Gauge pressure.
2. Atmospheric pressure (also known as barometric pressure).

### **Key**

A **key** always refers to hardware push-buttons on the keyboard that you can press.

### **Compound Non-Isolated pressure (CN)**

A compound gauge can display both positive and negative (vacuum) pressures.

1. A pressure sensor.
2. A vacuum sensor.

### **Meriam Calibration**

Meriam calibration refers to any calibration completed at Meriam with *Meriam traceability*. Meriam calibration includes:

- Oven calibration.
- Multipoint Meriam adjustment.

### **User Calibration**

User calibration refers to any calibration done outside of Meriam with *non-Meriam traceability*. User calibration includes:

- Multipoint user calibration or adjustment.

# General warnings and cautions

## Preventing injury



Failure to follow all instructions could result in injury:

- Read the entire manual before using the M104 Digital Manometer.
- Understand the contents before using the M104.
- Follow all safety warnings and instructions provided with this product.
- Meet or exceed your employer's safety practices.

## Safety Symbols

The following table defines the safety symbols, signal words, and corresponding safety messages used in the manual. These symbols:

- Identify potential hazards.
- Warn you about hazards that could result in personal injury or equipment damage.

Safety Symbols	Explaining the symbols
	This is the <b>Read Instruction Manual</b> symbol. This symbol indicates that you must read the instruction manual.
	Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.
	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.
	Indicates information essential for proper product installation, operation or maintenance.

# Keypad

## *Single Keypad Functions*

### ON/OFF Key

The ON/OFF key, represented by the standard ON/OFF symbol, turns the M104 ON or OFF (note: the ON/OFF key must be held until the display turns on or off). Upon power on, the M104 performs a self-test, display all segments for approximately 1-2 seconds, then go into the normal pressure measure mode using the last pressure units selected.

To view the calibrated accuracy and firmware revision, press and hold the ON/OFF key for approximately 2 seconds upon power on. The display alternates between the calibrated accuracy and firmware revision for as long as the ON/OFF key is held.

### BACKLIGHT Key

The BACKLIGHT key, represented by the standard light-bulb symbol, turns the green display backlight on and off. The backlight remains on for approximately 20 seconds if not manually turned off. To temporarily override the auto shut off feature, press and hold the BACKLIGHT key for approximately 2 seconds (until the backlight turns on-off-on).

### FUNC Key

The FUNC key selects the functional mode of the M104. Detailed instructions are provided on the back of the unit and in the following sections.

### UNIT Key

The UNIT key selects the engineering unit of measure when the M104 is in NORMAL or TEMP mode.

## *Zeroing the M104*

To Zero the M104, first turn off pressure sources and vent pressure ports to atmosphere. Then simultaneously press and hold the FUNC and UNIT keys until F.CAL is displayed. The display reads dashes "----" during the zeroing process. The process is complete when the display changes from "----" to a **zero** reading.

**Note:** The M104 can only be zeroed if the measured zero is within  $\pm 2.5\%$  (of FS) of the factory calibrated zero limit. Further details are provided under [Field Recalibration](#).

## *Functional Modes*

The Digital Manometer supports NORMAL and TEMP modes. The NORMAL mode of operation has an additional sub-mode referred to as **REC** or [record mode](#).

### **For Pressure measurements:**

- The red backlight lights up when the M104 is measuring pressure values outside its calibrated range. When the red backlight is on, the accuracy of these measurements is uncharacterized.
- Beyond 110 % of the calibrated range, dashes "----" display. The red backlight lights up in both cases.

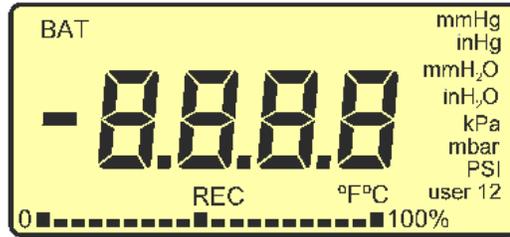
**Note:** *The minimum and maximum **pressure** that the M104 has measured is permanently recorded for factory warranty issues.*

### **For Temperature measurements:**

- Selecting the TEMP mode (the °F or °C icon) displays the internal ambient temperature of the M104.
- The UNIT key toggles between °F and °C

**Note:** *The minimum and maximum **temperature** that the M104 has measured is permanently recorded for factory warranty issues.*

## LCD Display



The LCD displays the:

- Pressure or Temperature measurement with large digits,
- Pressure measurement via bar graph, and
- Pressure or Temperature engineering units with icons.

A low battery warning (the BAT icon) is displayed when the batteries require replacement. Approximately 2 hours of run time is available immediately following a low battery warning.

The bar graph at the bottom of the display always shows a reading of the currently applied pressure as a percent of the full scale of the M104.

### The LCD uses two backlights:

- A **green backlight** lights up when you press the BACKLIGHT key.
- A **red backlight** lights up automatically during an error/over-range condition.

### Overrange condition

During an error or overrange condition, the red backlight **overrides** the green backlight. However, once the error or overrange condition is corrected, the green backlight is restored to its previous state (if the backlight auto-off timer did not expire).

### To save battery power

Turn off the backlight when you need to conserve battery power. The backlight feature is reduced when the M104 is in low battery mode.

## *Engineering Units Select*

### For pressure measurements:

- mmHg (at 0 °C)
- inHg (at 0 °C)
- inH<sub>2</sub>O (at 20 °C)
- mmH<sub>2</sub>O (at 20 °C)
- kPa
- mbar
- bar
- PSI
- user 1 (optional)
- user 2 (optional)

### **NOTICE**

*If a given engineering unit cannot display the correct number of digits, the M104 automatically advances to the next displayable unit.*

*When you turn on the M104, it defaults to the last selected pressure engineering unit.*

### Change pressure units

To change the pressure units, press the UNIT key while in NORMAL mode.

### User 1 and User 2

**User 1** and **User 2** are reserved for custom user defined **units of measure**. Contact Meriam if this support is required.

### For temperature measurements

- °F
- °C

## Change temperature units

To change the temperature units, press the UNIT key while in TEMP mode.

**Notes:** When the TEMP mode is selected, the M104 defaults to the last selected temperature engineering units.

## Record Mode

The M104 can store up to 240 pressure measurements (also called values or points) in a single record (REC) session. For maximum flexibility, a REC session can be:

- **Automatic** - the current value is automatically stored every 5 seconds, for up to 20 minutes
- **Manual** - the current value is stored every time the UNIT key is pressed, up to 240 times

Both types of REC sessions can store between 1 and 240 measurements. The measurement data is preserved in non-volatile memory until another REC session is started.

### *REC Data*

1. In NORMAL mode, enter **REC Data** mode by pressing both the BACKLIGHT and FUNC keys until the **REC** icon begins flashing.
2. Choose the type of REC session: **Automatic** or **Manual**.

#### **Automatic**

To start an **automatic** REC session, press the FUNC key. This deletes the previously stored pressure measurement and store the current pressure measurement. Then, every 5 seconds, the current pressure value is stored.

#### **Manual**

To start a **manual** REC session, press the UNIT key. This deletes the previously stored session and store the current pressure measurement. Then, every time the UNIT key is pressed, the current pressure value is stored.

3. To stop and exit **REC Data** mode, press both the BACKLIGHT and FUNC keys. All previously stored REC session data is saved and the M104 returns to NORMAL mode (the REC icon goes off). This step can be done anytime the REC icon is flashing.

## ***REC View***

First, set the M104 to NORMAL mode (no functional mode icons on). Then enter REC View mode by pressing both the BACKLIGHT and UNIT keys until the REC icon lights up.

4. Second, press the UNIT key to cycle through the stored values. The pressure value on the LCD blanks briefly every time a sample is displayed, and after all the recorded samples have been viewed, dashes "----" display and the following step (stop and exit REC View mode) happens automatically.

Third, to stop and exit REC View mode, press both the BACKLIGHT and UNIT keys. The M104 returns to NORMAL mode (the REC icon goes off). This step can be done anytime the REC icon is on.

## **Auto Shut-Off**

To conserve battery life, the M104 automatically turns off after 30 minutes of keypad inactivity.

## Field Recalibration

The M104 can be recalibrated in the field for zero and span. The proper primary standards must be available prior to calibrating the unit. These standards should meet the accuracy requirements for your company or industry. Meriam Process Technologies follows the guidelines established by ANSI/NCSL Z540 which requires that the primary standard be 4 times more accurate than the unit under test.

The field recalibration is not intended to replace the Factory calibration procedure. It is intended to trim the factory calibration curve fit to accommodate slight changes in sensor characteristics over time.

### *Zero*

To Zero the M104, first turn off pressure sources and vent pressure ports to atmosphere. Then simultaneously press and hold the FUNC and UNIT keys until F.CAL is displayed. The process is complete when the display changes from "----" to a **zero** reading.

**Note:** The M104 can only be zeroed if the measured zero is within  $\pm 2.5\%$  (of FS) of the factory calibrated zero.

At this point, the M104 can be zeroed.

**Note:** The above process applies only to gauge and differential pressure instruments. To recalibrate the zero on an absolute pressure instrument, the applied pressure must be within 10 times the full scale accuracy term of the original factory calibrated zero. 200 microns is Meriam's standard vacuum reference for all absolute pressure sensors.

**Note:** It should be noted that if the zero reference source used to recalibrate any pressure instrument is not accurate, the M104 zero can be recalibrated to a maximum discrepancy of 2.5 % of the original factory zero. This can create a 2.5 % offset in all pressure measurements after the recalibration of zero.

If this procedure generates a new value outside this limit, the red backlight flashes to indicate the procedure failed and the previous value was retained.

## ***SPAN***

1. First, before the M104 can be spanned, it must be zeroed.
2. Second, to Span the M104, a calibration specific pressure must be applied. If this Span pressure is known (because the unit has been spanned previously), skip the next step.

**Note:** To determine the Span pressure, make sure the pressure sources are still vented (i.e. still at zero), then press and hold the ON/OFF and BACKLIGHT keys until F.CAL is displayed. Immediately following F.CAL is the value of the pressure that should be applied. The red backlight flashes to indicate the M104 was not spanned (since there was no pressure applied).

Third, apply the Span pressure to the M104 and let the pressure stabilize. Then press and hold the ON/OFF and BACKLIGHT keys until F.CAL is displayed. Immediately following F.CAL is the value of the pressure that should be applied. The LCD display changes to dashes "----" during the spanning process. The process is complete when the display changes from "----" dashes to the Span pressure reading.

**Note:** The M104 can only be spanned if the calculated measured span is within 5 times full scale accuracy of the original factory calibrated span pressure.

For example, given:

Accuracy = 0.25 % FS, FS = 100 psi, and Span = 70 psi the Measured Span must be within  $\pm 1.25$  psi of 70 psi.

**Note:** If the span pressure source used to recalibrate any pressure instrument is not accurate, the M104 span can be recalibrated to a maximum discrepancy of 1.25 % of the original factory span calibration pressure. This can create a 1.25 % gain error in all pressure measurements after the recalibration of span.

If this procedure generates a new value outside this limit, the **red backlight** flashes to indicate the procedure failed and the previous value was retained.

## Restore Factory Defaults

The factory calibration defaults can be restored in the M104 by simultaneously pressing the ON/OFF and FUNC and UNIT keys until dashes display "----". The process is complete when the display changes from "----" dashes to the current pressure reading.

# Specifications

## *Type, Range, and Accuracy*

All sensors are non-isolated.

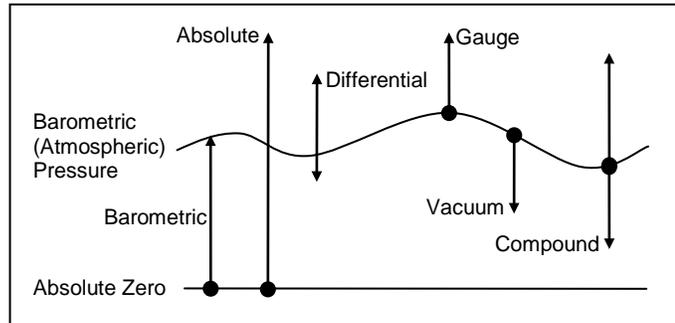
Model number	Pressure range	Accuracy
<b>Absolute</b>		
ZM104-AN0015-1	15 psi (755 mmHg)	0.25 %
ZM104-AN0030-1	30 psi (1551 mmHg)	0.25 %
ZM104-AN0050-1	50 psi (2585 mmHg)	0.25 %
<b>Differential</b>		
ZM104-DN0028-1	28" H <sub>2</sub> O	0.25 %
ZM104-DN0138-1	138" H <sub>2</sub> O	0.25 %
ZM104-DN0416-1	416" H <sub>2</sub> O	0.25 %
ZM104-DN0832-1	832" H <sub>2</sub> O	0.25 %
ZM104-DN2000-1	2000" H <sub>2</sub> O	0.25 %
<b>Gauge</b>		
ZM104-GN0005-1	5 psi	0.25 %
ZM104-GN0015-1	15 psi	0.25 %
ZM104-GN0030-1	30 psi	0.25 %
ZM104-GN0050-1	50 psi	0.25 %
ZM104-GN0100-1	100 psi	0.25 %

**Note: Why are the available units different between a 15-psi and 100-psi?**

If a given engineering unit cannot display the correct number of digits, the M104 automatically advances to the next displayable unit.

## Accuracy

- $\pm 0.25$  % of Full Scale
- Includes the combined effects of temperature, linearity, repeatability, hysteresis and resolution.



## Temperature

- Storage:  $-40$  °C to  $60$  °C ( $-40$  °F to  $140$  °F).
- Operating:  $-10$  °C to  $50$  °C ( $14$  °F to  $122$  °F).
- Reading: Inside product at  $\pm 1$  °C.

## Media Compatibility

- Clean, dry, non-corrosive gases only.

## Pressure Limits

- D –  $3 \times$  FS range on high side only or 200 psi, whichever is less.
- G or A –  $3 \times$  FS range or 200 psi, whichever is less.

## Battery Type

3 x AA alkaline batteries: you can replace these in the field.

### Suggested brands:

- Duracell, PC1500, 1.5 V, 2000 mAh
- Duracell, MN1500, 1.5 V, 2000 mAh
- Varta, 4906, 1.5 V, 2600 mAh

## *Battery Operation*

- > 300 hours continuous use without backlight on, 1-year shelf life, auto power off set at 30 minutes, low battery warning giving approximately 2 hours of run time.

## *Enclosure*

- 6.5" × 3.2" × 1.1" Polycarbonate, Permanently Static Dissipative, ESD Protection
- Enclosure with Boot: 6.8" × 3.5" × 1.3"

## *Display Resolution*

- Range     0-9    0-99    0-999   0-9999
- Display    x.yyy   xx.yy   xxx.y   xxxx

**Note:** Some pressure units may display differently depending upon full scale range and accuracy.

## *Display Warnings*

- ° **HI** = The temperature of M104 above valid calibration range/field recalibration value.
- ° **LO** = The temperature of M104 below valid calibration range/field recalibration value.
- **P HI** = Pressure applied to M104 above valid calibration range/field recalibration value.
- **P LO** = Pressure applied to M104 below valid calibration range/field recalibration value.

## Certification

The following label defines the certification and area classification for the M104 Series pressure instrument.



# Safety notifications and warnings

## *Changing batteries*

### Low battery condition

#### **NOTICE**

- The M104 is powered by three, 1.5 volt AA size batteries. When the output of the batteries drop below a normal level, the display activates the BAT icon, indicating a low battery condition.
- A low battery condition may affect performance and therefore, the unit should not be used to measure pressure. All three batteries should be replaced.

### Replace batteries

1. To replace the batteries locate the battery compartment in the bottom rear of the M104. See the figure below.



2. Remove two screws. One is located at the top center and one is located at the bottom center of the battery cover. You must turn them counterclockwise until they are fully disengaged from the M104 base.
3. Lift the cover from the back of the unit.

#### **NOTICE**

*Do not remove the pink antistatic foam that is attached to the inside of the battery cover. This foam is necessary to properly secure the batteries under specified shock and vibration conditions.*

4. Remove the batteries by pulling the positive side first straight out of the battery compartment.

5. Notice the positive (+) and negative (-) battery polarity markings at the bottom of the compartment. See the figure below.



6. Install the three batteries by sliding them into the bottom of the battery slots, making sure the polarity markings on the batteries align with the markings shown in the battery compartment.

**Note:** *The battery compartment has stand offs molded into the side of the compartment. When a battery is installed with the polarity reversed, the stand offs prevent the negative battery terminal from contacting the positive terminal in the battery compartment. The unit does not turn on when a battery is installed this way. Should this happen, simply reverse the battery to correct the polarity.*

7. With the batteries secured in the battery compartment, replace the compartment cover. The cover has only one orientation for correct alignment.
8. To secure the cover, torque the screws clockwise to 1.6 in-lbs. Do not overtighten.

## Connections

Connection: 1/8" female NPT, 316SS. The pressure connections (P1 and P2) are marked on top of the keypad as you can see on page 1.

### Differential Models (DN)

**DN** or Differential models have 2 used pressure ports. P1 is the high pressure connection and P2 is the low pressure connection (as shown below).



### Absolute (AN) and Gauge (GN) Models

- **GN** Gauge and **AN** Absolute models have one used pressure port, P1.
- P2 is used to vent enclosure/sensor to atmosphere. (see the figure above)

### Attaching the bulkhead fitting

#### **NOTICE**

- Connecting to the incorrect pressure port may cause damage to the pressure sensor. Once this sort of damage occurs, you must return the unit to the factory for sensor replacement.
- You must use bulkhead fitting hex surface when attaching to your 1/8" NPT fitting.
- When making mechanical connections, **do not** apply torque to the bulkhead fitting. That causes the fitting to turn or twist the plastic enclosure.
- Do not over tighten.

- If you apply torque to the bulkhead fitting, that damages the product and voids the warranty

# Help

## *Returning for repair or calibration*

If the M104 cannot be zeroed, spanned, or is damaged, it must be returned to the factory for servicing.

All M104 Series pressure instruments recalibrated at the factory are returned with certificates of NIST traceability.

### First — Request a Number

In the event that an M104 requires service and must be returned, please contact Meriam using one of the methods listed in the following table to request a **Return Material Authorization (RMA)** number:

Method	Information
<b>Website</b>	<a href="http://www.meriam.com/resources/service-repair-authorization/">http://www.meriam.com/resources/service-repair-authorization/</a> Complete the information online and submit the form.
<b>Fax</b>	If you printed and completed the Service & Repair Authorization form, then fax it to: US and International Customers <b>+ 1 216 281 0228</b>
<b>E-mail</b>	We need the following information in the email: <ul style="list-style-type: none"> <li>• Look on the M104 label to find the model number &amp; the serial number.</li> <li>• Give a brief description of the problem.</li> <li>• Send the e-mail to: <a href="mailto:returnforms@meriam.com">returnforms@meriam.com</a></li> </ul>

### Return Material Authorization

Do not send any unit for repair unless you contacted Meriam for a Return Material Authorization (RMA) number.

Important: If you have not received this number and have not clearly marked it on the package being shipped back, we will return the unit at your expense.

The Meriam Service & Repair Department will provide you with this number when you complete the website form, fax or e-mail your information.

An RMA number must accompany all incoming packages to insure proper tracking, processing, and repair work.

Questions? Call Meriam

**US Customers**

(800) 817-7849

**International customers**

+ 1 216 281 1100

Ship the box to

**Meriam**

10920 Madison Avenue

Cleveland, Ohio 44102

USA

## ***Meriam Contact Information***

### **Address**

Meriam  
10920 Madison Avenue  
Cleveland | Ohio | 44102 | USA

### **Telephone**

US customers	(800) 817-7849
International customers	+ 1 216 281 1100

### **Fax**

US & International customers + 1 216 281 0228

### **E-mail addresses**

Return Material Authorization / Service & Repair Department

[returnforms@meriam.com](mailto:returnforms@meriam.com)

Sales

[sales@meriam.com](mailto:sales@meriam.com)

### **Website**

[meriam.com](http://meriam.com)

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<http://www.meriam.com/representatives-map/>