



10920 Madison Ave
Cleveland | Ohio | 44102 | USA
+ 1 216 281 1100
www.Meriam.com
(800) 817-7849

User Manual

A trusted leader in measurement
and calibration solutions.

M104 Series: Digital Manometer: 0.1 % of Full Scale



Content

M104 Series: Digital Manometer:	1
0.1 % of Full Scale	1
<i>Content</i>	2
General information	4
<i>Glossary</i>	5
General warnings and cautions	6
<i>Preventing injury</i>	6
<i>Safety Symbols</i>	6
Keypad	7
<i>Single Keypad Functions</i>	7
<i>Functional Modes</i>	8
<i>Zeroing the M104</i>	8
<i>For pressure measurements</i>	9
<i>For temperature measurements</i>	10
LCD Display	11
Engineering Units	13
REC View	15
REC Mode (Record Mode)	16
<i>Maximum of 240 pressure measurements</i>	16
<i>REC Data</i>	16
Auto Shut-Off	17
Field Recalibration	17
<i>ZERO</i>	17
<i>SPAN</i>	18

Specifications	20
<i>Type, Range, and Accuracy</i>	20
<i>Accuracy</i>	21
<i>Temperature</i>	21
<i>Media Compatibility</i>	21
<i>Pressure Limits</i>	21
<i>Battery Type</i>	21
<i>Battery Operation</i>	22
<i>Enclosure</i>	22
<i>Enclosure with Boot</i>	22
<i>Display Resolution</i>	22
<i>Display Warnings</i>	22
Certification	23
Safety Notifications and Warnings	24
<i>Changing batteries</i>	24
<i>Low battery condition</i>	24
<i>Replace batteries</i>	24
Connections	26
Help	28
<i>Returning for repair or calibration</i>	28
<i>Meriam Contact Information</i>	30

General information

Disclaimer

Every precaution has been taken in the preparation of this manual. Nevertheless, Meriam assumes no responsibility for errors or omissions or any damages resulting from the use of the information contained in this publication, including, without limitation, incidental, special, direct or consequential damages. MERIAM MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS HEREOF AND SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. Meriam reserves the right to revise this publication and to make changes from time to time in the content hereof without obligation to notify any person of such revision or changes.

In no event shall Meriam be liable for any indirect, special, incidental, consequential, or punitive damages or for any lost profits arising out of or relating to any services provided by Meriam or its affiliates.

It is not possible for Meriam to identify all foreseeable uses or misuses, therefore all persons involved in commissioning, using, or maintaining this product must satisfy their self that each intended application is acceptable.

Copyright

This publication is proprietary to Meriam and no ownership rights are transferred. Neither this manual, nor any of the material contained herein, may be reproduced without the prior written consent of Meriam.

Trademark information

All other trademarks are the property of their respective owners.

Glossary

Words and phrases with their definitions.

Absolute Non-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 Digital Manometer.
- 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 Read Instruction Manual 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). After you turn the power on, the M104 performs a self-test, displays all segments for approximately 1-2 seconds, then goes 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 when turning the M104 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. There are 5 functional modes:

1. NORMAL (pressure measure).
2. HOLD.
3. MIN/MAX.
4. AVE and
5. TEMP.

Note: Pressing *FUNC* repeatedly cycles through these modes in the order listed.

UNIT Key

The UNIT key selects the engineering unit of measure desired when the M104 is in NORMAL and HOLD modes. The UNIT key selects MIN or MAX in MIN/MAX mode, resets/restarts in AVE mode, and selects °C or °F in TEMP mode.

Functional Modes

NORMAL

Normal (pressure measure mode) is the default mode when you turn on the M104 and is active when the following modes are not displayed on the LCD.

HOLD

Freezes the pressure measurement on the display, however, the bar graph is still active.

MIN/MAX

Displays the MIN and MAX pressures.

AVE

Displays a filtered average of the pressure measurements.

TEMP

Displays the internal ambient temperature of the M104. (°F or °C)

Note: The NORMAL mode has an additional sub mode referred to as REC or [record mode](#).

Zeroing the M104

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

Note: The M104 can only be zeroed if the applied pressure is within $\pm 1\%$ of the full scale range. Further details are provided under Field Recalibration.

For pressure measurements

- Select the HOLD mode (HOLD icon) to freeze the displayed pressure measurement.
- Select the MIN/MAX mode (the MAX or MIN icon) to display the MAX and MIN pressures since the power was turned on or since the MAX and/or MIN value was Zeroed.
- The UNIT key toggles between the MAX and MIN pressure measurement.
- The Zero function (FUNC and UNIT) zeros (or resets) the MAX and/or MIN values individually.
- Select the AVE mode (AVE icon) to begin averaging the pressure measurements. While you are in this mode, the displayed pressure is the average of all the pressure measurements since you entered AVE mode or since you restarted AVE mode. You can use the AVE mode to display a stable pressure reading that may be fluctuating or noisy.
- The UNIT key restarts (or resets) the averaging.

Red Backlight

- 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 turns on in both cases.

Minimum and maximum recorded

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

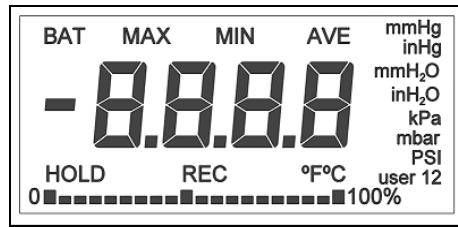
For temperature measurements

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

Minimum and maximum recorded

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

LCD Display



The LCD displays the:

- Current Functional Mode with icons.
- Pressure or Temperature measurement with large digits.
- Pressure measurement with a bar graph.
- Pressure or Temperature engineering units with icons.

Low battery indicator

A low battery warning (the BAT icon) appears when the batteries need to be replaced. You have approximately 2 hours of run time following a low battery warning.

Bar Graph

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.

LCD backlights

The LCD uses two backlights:

1. A **green backlight** turns on when you press the BACKLIGHT key.
2. A **red backlight** turns on automatically during an error or overrange condition.

Overrange condition

During an error or over-range 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).

Turn off the backlight

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

Pressure measurements

- mmHg (at 0 °C)
- inHg (at 0 °C)
- inH₂O (at 20 °C)
- mmH₂O (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 the pressure units

Press the UNIT key while in NORMAL or HOLD modes to change the pressure units.

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.

Temperature measurements

- °F
- °C

Change the temperature units

Press the UNIT key while in TEMP mode to change the temperature units.

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

REC View

1. First, set the M104 to NORMAL mode (No functional mode icons appear). To turn on the **REC View** mode, press both the BACKLIGHT and UNIT keys until the REC icon displays.
2. Second, press the UNIT key to cycle through the stored values. The pressure value on the LCD disappears briefly every time a sample is displayed, and after all the recorded samples have been viewed, "----" dashes display and the stop and exit REC View mode takes place automatically.
3. Third, to stop and exit REC View mode, press both the BACKLIGHT and UNIT keys. The M104 returns to NORMAL mode (the REC icon disappears). You may stop and exit REC View mode anytime the REC icon displays.

REC Mode (Record Mode)

Maximum of 240 pressure measurements

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, for up to 240 times.

Note: *Both types of REC sessions can store between 1 and 240 measurements. The M104 stores measurement data in memory until you start another REC session.*

REC Data

1. First, set the M104 to NORMAL mode (no functional mode icons displayed). Then enter REC Data mode by pressing both the BACKLIGHT and FUNC keys until the REC icon begins flashing.
2. Second, choose the type of REC session.
 - a. To start an **automatic** REC session, press the FUNC key. This deletes the previous pressure measurement and stores the current pressure measurement. Then, every 5 seconds, the current pressure value is stored.
 - b. To start a **manual** REC session, press the UNIT key. This deletes the previous session and stores the current pressure measurement. Then, every time you press the UNIT key, the current pressure value is stored.
 - c. For both types of REC session, the pressure value on the LCD goes blank briefly every time a sample is stored. After 240 measurements have been recorded, then the stop and exit REC Data mode take place automatically.
3. Third, to stop and exit **REC Data** mode, press both the BACKLIGHT and FUNC keys. All stored REC session data is saved and the M104 returns to NORMAL mode (the REC icon

disappears). You may stop and exit anytime the REC icon is flashing.

Auto Shut-Off

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

Field Recalibration

- You can recalibrate the M104 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 Z540-1-1994 that requires the primary standard to be 4 times more accurate than the unit under test.
- The field recalibration is not intended to replace the original factory calibration. 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 "----" dashes to a **zero** reading.

Note: You can zero the M104 only if the applied pressure is within 1 % of the full scale range.

The zeroing 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 1.0 % of the

original factory zero. This can create a 1.0 % 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 first 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.
 - a. 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).
3. 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 displays 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 term of the original factory calibrated span pressure

For example, given:

- Accuracy = 0.1 % FS.
- FS = 100 psi.
- Span = 70 psi.
- The Measured Span must be within ± 0.5 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 0.5 % of the original Meriam span

calibration pressure. This can create a 0.5 % gain error in all pressure measurements after the recalibration of span.

Red backlight

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 Meriam factory defaults

You can restore the Meriam factory calibration defaults in the M104 by pressing these three the ON/OFF and FUNC and UNIT keys until the LCD display dashes "----". 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.

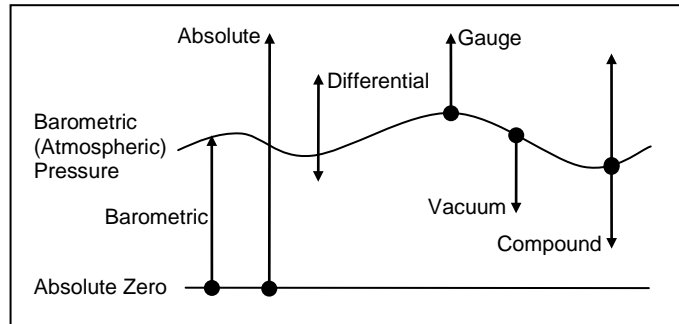
Model number	Pressure range	Accuracy
Absolute		
ZM104-AN0015-2	15 psi (755 mmHg)	0.10 %
ZM104-AN0030-2	30 psi (1551 mmHg)	0.10 %
ZM104-AN0050-2	50 psi (2585 mmHg)	0.10 %
Differential		
ZM104-DN0028-2	28" H ₂ O	0.10 %
ZM104-DN0138-2	138" H ₂ O	0.10 %
ZM104-DN0416-2	416" H ₂ O	0.10 %
ZM104-DN0832-2	832" H ₂ O	0.10 %
ZM104-DN2000-2	2000" H ₂ O	0.10 %
Gauge		
ZM104-GN0005-2	5 psi	0.10 %
ZM104-GN0015-2	15 psi	0.10 %
ZM104-GN0030-2	30 psi	0.10 %
ZM104-GN0050-2	50 psi	0.10 %
ZM104-GN0100-2	100 psi	0.10 %

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

- ± 0.10 % 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 ± 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 the backlight.
- 1-year shelf life.
- Auto-off is set at 30 minutes.
- Low battery warning gives 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 of 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 LCD displays the BAT icon, indicating a low battery condition.
- A low battery condition may affect performance, and 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)

Differential or **DN** models have two used pressure ports.

- P1 is the high-pressure connection.
- P2 is the low-pressure connection (see the figure 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 the 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 overtighten.

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

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

Sales

sales@meriam.com

Website

meriam.com

Find a local Meriam representative

Use this map to help you find a Meriam representative.

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