M2 – Series Smart Manometer

USER'S MANUAL

Meriam Process Technologies' M2 Series Products (M200 Smart Manometer, M200-DI Wet / Wet Smart Manometer, M200LS Lab Standard Smart Manometer and M201 Rotary Gas Meter Tester) are microcontroller based devices used to directly measure and display pressure. Differential (dry/dry), Differential (wet/wet), Gauge, Compound and Absolute type pressure sensors are supported. Pressure can be displayed in user-selected engineering units. Differential units also have a square root flow unit selection. Data Logging and Leak Test functions are standard.

M2 Series models are available for general purpose use or with optional Intrinsically Safe certification to the specification shown below (all models except M200LS).

Optional ATEX rating (not available on M200LS models):
CE 0539 II 1 G; DEMKO 06 ATEX 0615699
Ex ia IIC T4
(Tamb. -5ºC to +50ºC)
IP40

meriam process technologies
a Scott Fetzer company

Safety Information

Failure to follow all instructions could result in injury. Read, understand and follow all safety warnings and instructions provided with this product. Also, meet or exceed your employer's safety practices.

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/misuses, therefore all persons involved in commissioning, using or maintaining this product must satisfy themselves that each intended application is acceptable.

Safety Warnings

The table below defines the safety symbols, signal words and corresponding safety messages used in the manual to identify potential hazards and are intended to warn persons about hazards that could result in personal injury or equipment damage.

	This is the Read Instruction Manual symbol. This symbol indicates that you must read the instruction manual.
	This is the Safety Alert symbol. This symbol indicates a WARNING. Warnings alert you to actions that can cause personal injury or pose a physical threat. Please read these carefully.
	This is the Safety Glasses symbol. This symbol indicates that you must wear approved safety glasses during the task.
	This is the Safety Gloves symbol. This symbol indicates that you must wear approved safety gloves during the task.
	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.

Information in this document is subject to change without notice. Check the Meriam web site (www.meriam.com) for the latest manual revision.

For customer assistance please call your local Meriam representative or Meriam directly.

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Certification/Safety/Warnings

All M2 Series models are available for general purpose use (non-hazardous areas). Optional Intrinsically Safe (I.S.) certification for hazardous area use is available for all models except the M200LS.

General Purpose (G.P.) versions are identified by the name plate located on the rear of the unit under the protective rubber boot. A sample of the General Purpose name plate is shown below:

Intrinsically Safe versions are identified by the name plate located on the rear of the unit under the protective rubber boot. A sample of the I.S. name plate is shown below:

Intrinsically Safe versions are shipped with Dwg. No. 9R000056 "M2 Series Intrinsically Safe Control Document". Refer to this document for details of the certification, a list of warnings and a list of approved batteries for use in Intrinsically Safe versions.

⚠ DANGER For Intrinsically Safe M2 Series

Use Intrinsically Safe versions in accordance with Dwg. No. 9R000056 "M2 Series Intrinsically Safe Control Document" only. This document accompanies each I.S. unit. Failure to

use the unit in accordance with this document will void the certification and may cause potentially dangerous conditions.

⚠ WARNING For Intrinsically Safe M2 Series

- Restrictions apply to the use of Intrinsically Safe models in hazardous areas. Refer to the Intrinsic Safety Control Drawing No. 9R000056 for more information.
- Substitution of components will void the Intrinsically Safe Certification and may impair operation and safety. Do not substitute components. Repairs must be made at the factory to retain the Intrinsically Safe Certification.
- Service only in safe areas. Customer service is limited to battery replacement and field recalibration only. All other service must be provided by the factory to retain the Intrinsically Safe Certification.
- To prevent ignition of flammable or explosive atmospheres, disconnect power before servicing in a safe area.
- To prevent ignition of flammable or explosive atmospheres,
  - **DO NOT** open or service unit, including battery compartment, in flammable or explosive atmosphere
  - **DO NOT** rub, clean or wipe the surface of the membrane keypad as it may build a static charge
  - **DO NOT** mix old batteries with new or mix batteries from different manufacturers
  - **DO NOT** replace batteries in explosive or hazardous atmosphere
  - **DO NOT** use any battery type other than those listed on Dwg. No. 9R000056 “M2 Intrinsically Safe Control Document”.

⚠ DANGER For General Purpose M2 Series

Fire/Explosion Hazard. Do not use General Purpose versions in hazardous areas. DO NOT use General Purpose versions in areas that may contain flammable gas or vapors, combustible dusts or ignitable fibers where an unintended spark can cause a fire/explosion.

⚠ CAUTION **For General Purpose M2 Series**

- Substitution of components may impair operation and safety.
- Disconnect power before servicing.
- The product should not be powered with a combination of new and old batteries.
- The product should not be powered with a combination of batteries from different manufacturers.

⚠ WARNING **For All Models**

Do not exceed the Pressure Limits listed in the Specifications section of this manual. Failure to operate within the specified pressure limit could result in minor or moderate injury.

NOTICE **For All Models**

User must use a wrench on the pressure manifold when installing user's 1/8" NPT fitting. Do not tighten the fitting without using a wrench on the pressure manifold. Failure to use a wrench on the manifold will damage the plastic enclosure and void warranty No torque should be applied to the manifold with respect to plastic enclosure.

User Interface

1. Keypad Functions

On/Off & ◀ (backspace) Key

Turns the manometer on and enters the unit into the **Measure Mode.** Pressing the key while in the **Measure Mode** turns the unit off. It also serves as a backspace key when editing in the **Program Mode.** The ◀ key takes the user out of a programmable register without changing the previous setting. Pressing this key repeatedly will return the user to the **Measure Mode** and then shut off the manometer.

Min/Max & ▲ (up) Key

In the **Measure Mode** activates the **Min/Max** function of the manometer. When activated the minimum value is displayed on the upper left of the display and the maximum value on the upper right. This key also deactivates and resets this function. The ▲ key is used to scroll through the programmable registers when the unit is in the **Program Mode**. Once a programmable register is selected the ▲key can be used to edit that register.

Hold & ▼ (down) Key

In the **Measure Mode** toggles on/off the display **Hold** function. This freezes the value displayed. If the **Min/Max** function is activated, those values are also frozen. With HOLD activated, the letter "**H**" appears in the lower left of

the display. The ▼ key is used to scroll through programmable registers with the unit in the **Program Mode**. Once a programmable register is selected the ▼ key can be used to edit that register.

Prgm & ▶ (enter) KEY

Puts the manometer into the **Program Mode** from the **Measure Mode**. When in the **Program Mode**, pressing this key selects the programmable register to be edited (with prompt for password if **Lockout** is set). After the register has been edited, pressing the PRGM key enters the new setting into the manometer's non-volatile memory. This key also acts as a ▶ key when editing user input such as the header name and user units.

Backlight Key

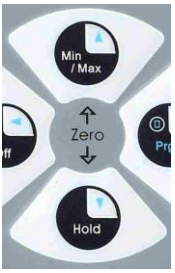
The BACKLIGHT key, represented by the standard light bulb symbol, toggles the display backlight between green and off.

NOTICE The backlight consumes additional battery energy. Turn the backlight off to optimize battery life.

2. Zeroing the Manometer

To Zero DN, DI, GI or CI Type Manometers

Disconnect from pressure sources and vent the pressure port(s) to atmosphere (do not remove the factory installed P2 plug if present). The display should read close to zero. Press the **Min/Max** and **Hold** keys at the same time (see inset photo below) and then release. The top line of the display reads "ZERO IN PROGRESS" and the bottom line counts down from 9. The process is complete when the unit returns to Measure Mode. The lockout function, if enabled, does not prevent zeroing of the manometer.



NOTE: The smart manometer can only be zeroed if the new zero value is within +/-5% (of FS) of the original factory calibrated zero. If the zero procedure generates a new zero value outside this limit a "ZERO RANGE ERROR" message appears indicating that the procedure failed. Factory service may be required.

To Zero AI (Absolute) Type Manometers

Start with the unit turned **OFF** and use the following keystroke sequence:

Keystroke	Display
1. Press ON/OF button.	The display briefly shows header name and full scale range in the last engineering unit selected. Then goes into the **Measure Mode** to display pressure
2. Connect the M200 to a vacuum source capable of a vacuum of 100 microns absolute pressure or less.	
3. Pull a full vacuum.	Display should read close to zero. (See note on next page)
4. Press Min/Max and Hold keys at the same time. (See figure 1 above.)	Top line of display reads "ZEROING SOURCE:" Bottom line of display reads "REF TO ABS ZERO"
5. Press the PRGM key.	Top line of display reads "ZERO IN PROGRESS" while bottom line counts down from 9. Zeroing is complete when unit returns to Measure Mode.

3. Program Mode

The program mode is used to configure the manometer for Measure Mode operation. After the **PRGM** key is pressed in Measure Mode, the top line of the display reads "PROGRAM MODE". The bottom line reads "UNITS SELECT". Press the ▲ or ▼ arrow keys to scroll through the Program Mode to the desired register. The configurable registers that are found in **Program Mode** are **Units Select, Damp Rate Select, User Info Select, Contrast Select, Data Logging, Leak Test and Exit**. Two sub-modes under "Units Select" are provided: **User Unit Select and Flow Unit Select**. Press the **PRGM** key to select either of these sub-modes and set up their respective function. The manometer can be put into Program Mode at any time during Measure Mode operation by pressing the **PRGM** key. If Lockout is set, the correct code must be entered when prompted.

Units Select

The standard engineering units available on the Smart Manometer are:

PSI
inH_20 (@20°C, 60°F and 4°C)
Kg/cm^2
kPa
mbars
Bars
cmH_2O (@ 20°C)
inHg (@ 0°C)
mmHg (@ 0°C)
User Units
Flow Units

To change the engineering units the manometer should be "ON" and in Measure Mode. Then follow these steps:

Keystroke	Display
1. Press the PRGM key.	Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".
2. Press the PRGM key.	Top line reads "UNITS SELECT" and bottom line shows current engineering units.
3. Press the up or down arrow key until desired engineering unit is displayed.	Engineering units on bottom line of display change.
4. Press the PRGM key to select the engineering unit.	Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".
5. Press the down arrow key.	Bottom line reads "EXIT".
6. Press the PRGM key.	Display returns to Measure Mode in new engineering unit.

User Unit Select

Engineering units not included in the standard selection can be programmed into the manometer using the Units Select register in the program mode. The value programmed into this register is used to calculate the desired unit of measure. An example of converting to "Feet of H_2O" will be shown in the following steps, using the conversation factor of 1 PSI = 2.30894 FT H_2O.

Keystroke	Display
1. Press the PRGM key.	Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".
2. Press the PRGM key.	Top line reads "UNITS SELECT" and bottom line shows current engineering units.
3. Press the up or down arrow key until "USER UNIT SELECT" is displayed.	Top line reads "UNITS SELECT" Bottom line reads "USER UNIT SELECT".
4. Press the PRGM key. *See note 1 at bottom of this table.*	Top line reads "VALUE=". Bottom line reads "CHANGE?: YES".
5. Press the PRGM key to change the value.	Top line reads "USER UNIT VALUE".
6. Start entering the conversion factor by pressing the up arrow key until the first digit reads 2.	Top line reads "USER UNIT VALUE". Bottom line reads "20000000".
7. Press the right arrow key to enter the value "2" and advance the cursor to the next digit.	Cursor flashes to the right of the "2". Now numbers, decimal point or blank space can be entered.
8. Repeat step 6 and 7 until bottom line reads 2.30894	Bottom line reads "2.30894". Last digit "4" is blinking.
9. If an error is made use the left arrow key to move the cursor back to the incorrect digit. Then press up or	The digit that is corrected is blinking.

down arrow keys to display the correct value.	
10. Press the PRGM key until the display changes. *See note 1 at bottom of this table.*	Top line reads “VALUE=”. Bottom line reads “CHANGE?: YES”.
11. Press the PRGM key.	Top line reads “USER UNIT NAME”.
12. Follow steps 6-8 above to enter “FT H_2O”.	Bottom line reads “FT H2O”. Last letter “O” is blinking.
13. Press the PRGM key.	Top line reads “PROGRAM MODE”. Bottom line reads “UNITS SELECT”.
14. Press the down arrow key.	Bottom line reads “EXIT”.
15. Press the PRGM key.	Manometer returns to Measure Mode. Units Display shows “FT H_2O”.

Note 1: If at steps 4 or 10 the “VALUE=” is the desired value, press the up or down arrow key. This will toggle the bottom line from the default “CHANGE?: YES” to “CHANGE?: NO”. Step 5 would then jump to step 10. Step 11 would then jump to step 13.

Flow Unit Select

Smart Manometers that use differential pressure sensors can be programmed to display flow measurement units such as CFM or L/min. The primary element must be a differential pressure - square root - type device such as a pitot tube, orifice plate or venturi.

The flow constant and flow units description are programmed into the manometer using the same keystrokes used in the User Unit Select programming. At step 3 choose “FLOW UNIT SELECT” instead of “USER UNIT SELECT”.

Calculate the Flow constant from the following equation:

$F_c = Q \div DP^{½}$

where: F_c = Flow constant

Q = Flow rate (from the flow element

calculation sheet), any flow unit
DP = Differential pressure corresponding to Q,
unit must be inches H_20 @20°C

Example: If the DP is 25 inches H_20 @20°C when the flow rate is 10,000 units, then the Flow constant is 2,000.

Damp Rate Select

Adjustable exponential type damping is available to steady the display when measuring pulsating pressure or flow. The Smart Manometer has a range of damping rates; 0.1, 0.2, 0.5, 1, 2, 5, 10, or 25 seconds. Exponential damping shows approximately 70% of a step change in pressure upon the next display update. When set for 5 second time constant, it takes 5 seconds from the time of the step change until the manometer displays the full value of the new pressure.

To set the damp rate, follow the steps below:

Keystroke	Display
1. Follow the steps on page 4 to put the unit in Program Mode	Top line reads PROGRAM MODE" and bottom line reads "UNITS SELECT".
2. Press the ▲ arrow key.	Bottom line reads "DAMP RATE SELECT".
3. Press the PRGM key.	Top line reads "DAMP RATE SELECT".
4. Press the ▲ or ▼ arrow key until the desire desired damp rate is displayed on the bottom line.	Bottom line shows damp rate in seconds.
5. Press the PRGM key.	Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".
6. Press the ▼ arrow key.	Bottom line reads "EXIT".
7. Press the PRGM key.	Returns to Measure Mode.

User Info Select (Accuracy, SW version, Mfr date, SN)

The User Info Select registers are designed to provide the user with information about the manometer's hardware and software. This register provides read only information on the sensor's accuracy, software version, date of manufacture and serial number. It also allows the user to edit the Auto Shut-Off, Lockout and Start-Up Header Name features.

To configure the User Info Select registers, follow the steps below.

Keystroke	Display
1. From the Measure Mode press the PRGM key.	Top line reads "PROGRAM MODE" and bottom line reads "UNITS SELECT".
2. Press the up arrow key twice	Bottom line changes to "USER INFO SELECT".
3. Press the PRGM key.	Bottom line shows accuracy in % of Full Scale
4. Press the up arrow key.	Bottom line shows software version number.
5. Press the up arrow key.	Bottom line shows sensor manufacture date.
6. Press the up arrow key. Instructions to set AUTO SHUT-OFF are in this manual.	Top line reads "AUTO SHUT OFF" and bottom line reads "ENTER TO SELECT".
7. Press the up arrow key.	Bottom line shows serial number of the manometer.
8. Press the up arrow key. Instructions for using LOCKOUT are on page 12.	Top line reads "LOCKOUT CODE" and bottom line reads "ENTER TO SELECT".
9. Press the up arrow key. Instructions for editing the Header are on page 13.	Top line reads "HEADER NAME" and bottom line reads "MERIAM". The cursor flashes at bottom left.
10. Press the left arrow key to go back to "USER INFO SELECT" screen.	Top line reads "PROGRAM MODE" and bottom line reads "USER INFO SELECT".

Auto Shut-Off

Enabling the Auto Shut-Off feature allows the manometer to turn itself off after a user selected period of keypad inactivity. Selectable options include DISABLED, 10 Minutes (which is the factory shipped default), 20 Minutes, 30 Minutes, 45 Minutes and 60 Minutes. Disabling this feature requires the manometer to being turned off manually using the **On/Off** key.

To configure auto shut-off follow these steps:

Keystroke	Display
1. Follow steps 1-6 in the User Info Select table.	Top line reads “AUTO SHUT-OFF” and bottom line reads “ENTER TO SELECT”.
2. Press the PRGM key, then the up or down arrow keys, until the desired shut-off time is shown.	Top line reads “AUTO SHUT-OFF” and bottom line toggles to “DISABLED”, “10”, “20”, “30”, “45” and “60” minutes .
3. Press the PRGM key.	Desired Auto Shut-Off time is selected, top line reads “AUTO SHUT-OFF” and bottom line reads “ENTER TO SELECT”.
4. Press the left arrow key twice.	Returns to Measure Mode.

The “Auto Shut-Off” timer is suspended during Data Logging and Leak Test sessions to prevent accidental loss of information. Auto Shut-Off is automatically re-instated after completion of Data-Logging or Leak Test sessions.

Lockout Select

Enabling the Lockout feature prevents unauthorized users from making changes to the configuration of the manometer. To enter the Program Mode when Lockout is active, the user must first enter the “password” (two-digit Lockout Code) within approximately 40 seconds of the display prompt. Failure to enter the correct two digit code within approximately 40 seconds will return the unit to Measure Mode. Any two-digit numeric code can be programmed. The factory Lockout Code of 00 (which is the default as shipped from the factory) disables the Lockout.

To set the Lockout Code, follow these steps:

Keystroke	**Display**
1. From Measure Mode press the PRGM key. (If the Lockout is set, enter the correct “password” when prompted.)	Top line reads “PROGRAM MODE” and bottom line reads “UNITS SELECT”.
2. Press the up arrow key twice.	Bottom line reads “USER INFO SELECT”.
3. Press the right arrow key then the up arrow key five times.	Top line reads “LOCKOUT CODE” and bottom line reads “ENTER TO SELECT”.
4. Press the right arrow key, then press the up or down arrow keys to change the first digit. Press the right arrow key to proceed to second digit.	Bottom line shows the old Lockout Code. The cursor flashes at the first position while the value is changed, then cursor moves to thesecond position once the right arrow key is pressed.
5. Press the right arrow key when the desired code is set.	Top line reads “LOCKOUT CODE” and bottom line reads “ENTER TO SELECT”. Lockout is activated.
6. Press the left arrow key twice.	Returns to Measure Mode.

Header Name

Follow the steps below to edit the Header Name.

Keystroke	Display
1. From the Measure Mode press the PRGM key.	Top line reads “PROGRAM MODE” and bottom line reads “UNITS SELECT”.
2. Press the up arrow key twice.	Bottom line changes to “USER INFO SELECT”.
3. Press the PRGM key.	Bottom line shows serial number.
4. Press the up arrow key six times.	Top line reads “HEADER NAME” and bottom line reads “MERIAM”. The cursor flashes at bottom left.
5. If header is correct press backspace key. If editing is desired proceed to step 7.	Top line reads “PROGRAM MODE” and bottom line reads “USER INFO SELECT”.
6. Press the left arrow key.	Returns to Measure Mode.
7. Press the up or down arrow keys to set the correct alpha-numeric value.	Displays a number between 0 and 9, a letter from A to Z, / or a blank space.
8. Press the right arrow key to accept entry.	Cursor advances one space to right.
9. Repeat steps 8 and 9 until the desired Header is shown.	
10. If an error is made press the back arrow key until the cursor is over the incorrect value. Follow step 8 to correct. Press the right arrow key to advance the cursor without changing values.	
11. When the Header is complete press the PRGM key until header accepted.	Top line reads “PROGRAM MODE” and bottom line reads “UNITS SELECT”.
12. Press the left arrow key.	Returns to Measure Mode.

Contrast Select

The Contrast Select register allows the user to adjust the character contrast of the LCD display to provide the best visibility for the ambient light conditions.

To adjust the contrast, follow these steps:

Keystroke	Display
1. From the Measure Mode press the PRGM key.	Top line reads “PROGRAM MODE” and bottom line reads “UNITS SELECT”.
2. Press the up arrow key three times.	Bottom line reads “CONTRAST SELECT”.
3. Press the PRGM key.	Top line reads “CONTRAST SELECT” and bottom line shows a numeric value.
4. Press the up or down arrow keys to increase or decrease the contrast value. A low number gives maximum contrast and a high number gives minimum contrast.	LCD lightens or darkens depending on the value set.
5. Press the PRGM key.	Top line reads “PROGRAM MODE” and bottom line reads “UNITS SELECT”.
6. Press the left arrow key.	Returns to Measure Mode.

If an error is made during the contrast adjustment, pressing the ◄ key returns the display to the previous contrast setting.

Data Logging

Data Logging can be used to record pressure measurements. Two record modes are supported; automatic and manual. In automatic mode, a pressure value is captured every 5 seconds for 20 minutes, resulting in 240 stored values. In manual mode, a pressure value is captured each time the PRGM key is pressed up to 240 values. The data collected during a logging session can be viewed upon completion.

Keystroke	Display
1. From the Measure Mode press the PRGM key.	Top line reads “PROGRAM MODE” and bottom line reads “UNITS SELECT”.
2. Press the up arrow key four times.	Bottom line reads “DATA LOGGING”.
3. Press the PRGM key.	Top line reads “DATA LOGGING” and bottom line reads “RECORD”.
4. Press the PRGM key.	Top line reads “RECORD MODE” and bottom line reads “AUTO” or “MANUAL”.
5. Press the PRGM key at AUTO to start automatic logging or at MANUAL to start manual logging mode.	Top line reads “RECORDING X” and bottom line reads “XX.XX UNITS”. AUTO records value every 5 seconds. Manual records value each time PRGM key is pressed.
6. To stop recording values at any time, press the ◄key.	Top line reads “DATA LOGGING” and bottom line reads “RECORD”.
7. To access recorded values, press the ▲ key.	Top line reads “DATA LOGGING” and bottom line reads “VIEW”.
8. To view recorded values, press the PRGM key.	Top line reads “DATA LOG: 1” and bottom line displays the value. Continue pressing the ▲ key to view all values.
9. Press the ◄key 3 times.	Returns to Measure Mode.

NOTICE The “Auto Shut-Off” timer is disabled for Data Logging sessions. Be sure to end the session to re-enable the Auto Shut-Off timer.

Leak Test

The Leak Test feature allows the user to determine the leak rate in the pneumatic system being monitored. Once configured, Leak Test monitors the measured pressure over time and displays the leak rate in “pressure units per minute” at the conclusion of the test. The maximum configurable leak test period is 1440 min (1 day). Pressing any key during the leak test will abort the test.

To enable Leak Test follow these steps:

Keystroke	Display
1. From the Measure Mode press the PRGM key.	Top line reads “PROGRAM MODE” and bottom line reads “UNITS SELECT”.
2. Press the down arrow key twice.	Bottom line reads “LEAK TEST”
3. Press the PRGM key.	Top line reads “LEAK TEST” and bottom line reads “CONFIGURE”.
4. Press the PRGM key.	Top line reads “Leak Test Period” & bottom “X.X MIN”.
5. Use the up, down & right keys to input test period	Bottom line reads desired period; Ex. “ 20.0 MIN”.
6. Press the PRGM key.	Top line reads “LEAK TEST” and bottom line reads “CONFIGURE”.
7. Press the up arrow key once.	Top line reads “LEAK TEST” and bottom line reads “PRGM TO START”.
8. Press the PRGM key.	Top line displays MIN/MAX pressure values at left/right. Bottom line reads the current pressure value and units. At end of test period, top line displays the leak rate in units per minute. Bottom line shows the live pressure reading.

NOTICE The “Auto Shut-Off” timer is disabled for Leak Test sessions. Be sure to end the session to re-enable the Auto Shut-Off timer.

Re-Calibration

The Manometer can be re-calibrated in the field for zero, span, and linearity. The proper primary standards must be available prior to calibrating the Manometer. 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 which requires that the primary standard be 4 times more accurate than the unit under test.

The re-calibration is not intended to replace the Factory Lab Calibration Procedure. It is intended to correct the curve fit if the actual sensor characteristics change slightly over time.

For sensors up to 200 PSI, Meriam recommends a ±0.0015% of reading deadweight tester. For sensors 200 PSI and above, a ±0.0030% of reading deadweight tester is recommended. If calibrating using inches of water units, be sure to match the reference temperature of water in both the unit under test and the M2. Note that AI type M200 manometers require Absolute referenced dead weight testers or standards for field recalibration.

1-point (within upper 50% of Full Scale), 5-point (nominal values of 0%, 25%, 50%, 75% & 100% of Full Scale), and restore factory default re-calibration options are offered. For the 5-Point re-calibration, points 2, 3 and 4 can be adjusted within ±1% of reading around the nominal values. Point #5 can be adjusted within -1% of reading around nominal. Point #1 is fixed.
For example: for a 2000 inH2O sensor, Point # 2 (25%) can be edited from 495 to 505 inH2O. Point #5 (100%) can be edited from 1980 to 2000 inH2O.

The unit can only be re-calibrated if the calibration points are within 5 times the accuracy of the original factory calibration (e.g. @ 0.05% accuracy, the point limit is ±0.25% of Full Scale). If the re-calibration procedure generates a new value outside this limit the procedure will fail. In this case the unit would need to be returned to the factory for service.

Once a re-calibration has been performed (either 1-point or 5-point) the unit will continue to allow future re-calibrations only with that type of re-calibration. In order to enable the other re-calibration type, the user must first “Restore Factory Defaults” and then choose the desired re-calibration method.

Re-Calibration – 1 Point EDIT and START

To perform a 1-point re-calibration, apply a pressure between 50% and 100% of Full Scale and then follow these steps:

Keystroke	Display
1. With unit OFF, press and hold the MIN/MAX key, turn the unit on by pressing the ON/OFF key, then release MIN/MAX.	Top line reads “RE-CAL”. Bottom line reads “EDIT”.
2. Press the up arrow key until “START” is displayed on the bottom line.	Top line reads “RE-CAL”. Bottom line reads “START”.
3. Press the PRGM key.	Top line reads “RE-CAL START”. Bottom line reads “1-POINT”.
4. Press the PRGM key.	Top line reads “CAL POINT” and bottom line displays the cal point value.
5. Press the up/down arrow keys to edit the selected digit. Use the left/right arrow keys to change the cursor position. Value entered must be 50-100% of FS.	Bottom line displays the cal point value. The cursor flashes at the first position while the value is changed, then moves to the right position when the right arrow key is pressed.
6. Press the right arrow key while on the right most digit to proceed.	Top line reads “APPLY:” Bottom line displays the “CAL POINT” value.
7. Apply the input pressure indicated using an appropriate reference standard; press PRGM key.	Top line reads “RE-CAL”. Bottom line reads “START”, Manometer has been recalibrated.
8. Press the left arrow key.	Returns to Measure Mode

Re-Calibration – 5 Point EDIT

To edit the calibration points for a 5 Point re-calibration follow the steps below.
NOTE: If the factory default values are acceptable, skip this section and proceed to the re-calibration 5-Point START procedure.

Keystroke	Display
1. With unit OFF, press and hold the MIN/MAX key, turn the unit on using the ON/OFF key, then release	Top line reads “RE-CAL”. Bottom line reads “EDIT”.
2. Press the PRGM key.	Top line reads “CAL POINT 1”. Bottom line displays the cal point value.
3. Press the up/down arrow keys to edit the selected digit. Use the left/right arrow keys to change the cursor position. *Note: For 0% go directly to step 4.*	Bottom line displays the cal point value. The cursor flashes at the first position while the value is changed, then moves to the right position when the right arrow key is pressed.
4. Press the right arrow key while on the right most digit to proceed.	Top line reads “CAL POINT 2”. Bottom line displays the cal point value.
5. Repeat steps 3 and 4 for CAL POINTS 2, 3, 4 and 5.	Top line reads “CAL POINT 2/3/4/5”. Bottom line displays the cal point value.
6. After editing CAL POINT 5 press the right arrow key while on the right most digit to proceed.	Top line reads “RE-CAL”. Bottom line reads “EDIT”.
7. To perform the 5-point re-cal, press the up arrow key until START is displayed on the bottom line. OR To exit without performing the 5-point re-cal press the left arrow key	Top line reads “RE-CAL”. Bottom line, “START”. Continue with 5-Point Re-calibration procedure at step 3 on next page. OR Returns to Measure Mode.

Re-Calibration – 5 Point START

To begin the 5-point re-calibration procedure, turn the unit OFF and follow the steps below.

Keystroke	Display
1. Press and hold the MIN/MAX key and turn the unit on by pressing the ON/OFF key.	Top line reads “RE-CAL”. Bottom line reads “EDIT”.
2. Press the up arrow key until “START” is displayed on the bottom line.	Top line reads “RE-CAL”. Bottom line reads “START”.
3. Press the PRGM key.	Top line reads “RE-CAL Bottom line reads “1-POINT”.
4. Press the up arrow key until “5-POINT” is displayed on the bottom line.	Top line reads “RE-CAL START”. Bottom line reads “5-POINT”.
5. Press the PRGM key.	Top line reads “POINT 1 – ZERO:” Bottom line displays live applied pressure.
6. Vent P1 and P2 ports to atmosphere and simultaneously press the MIN/MAX and HOLD keys, then release.	Unit takes new zero. Top line reads “ POINT 1 - ZERO:” Bottom line displays live applied pressure. POINT 1 has been taken.
7. Press the right arrow key while on the right most digit to proceed.	Top line reads “ POINT 2 - APPLY:”. Bottom line displays the cal point value to apply.
8. Apply the indicated calibration point pressure using external pressure standards. After pressure is stable, press the right arrow key.	Top line reads “ POINT 3 - APPLY:”. Bottom line displays the cal point value to apply.
9. Repeat step 8 for CAL POINTS 4 and 5.	Top line reads “POINT 4/5 - APPLY” Bottom line displays the cal point value.

10. Use up or down arrow keys to select NO or YES when asked “Save?” the Re-Calibration data.	Top line reads “SAVE?”. Bottom line reads “NO” or “YES”.
11. Press the PRGM key at YES to save the Re-Calibration data or at NO to exit without saving.	Top line reads “RE-CAL”. Bottom line reads “START”. Re-cal is complete.
12. Press the left arrow key.	Returns to Measure Mode.

Re-Calibration – Restore Factory Defaults

To restore the re-calibration data to the factory defaults, follow these steps:

Keystroke	Display
1. With unit OFF, press and hold the MIN/MAX key, turn the unit on using the ON/OFF key, then release.	Top line reads “RE-CAL”. Bottom line reads “EDIT”.
2. Press the up arrow key twice.	Top line reads “RE-CAL”. Bottom line reads “RESTORE DEFAULTS”.
3. Press the PRGM key.	Top line reads “RESTORE DEFAULTS”. Bottom reads “YES” or “NO”.
4. Use the up and down arrow keys to select YES or NO when asked to restore defaults.	Top line reads “RESTORE DEFAULTS”. Bottom reads “YES” or “NO”.
5. Press the PRGM key at YES to restore the Factory Default Calibration data or at NO to exit without restoring.	Top line reads “RE-CAL”. Bottom line reads “RESTORE DEFAULTS”. Factory defaults have been restored.
6. Press the left arrow key.	Returns to Measure Mode.

Specifications

Type, Range and Display Resolution

Differential Non-Isolated Types (M200, M200LS, M201):

10 inH_2O (0.35 psid) – XX.YYY (M200 only)
28 inH_2O (1 psid) – XX.YYY
200 inH_2O (7.21 psid) – XXX.YY
415 inH_2O (15.0 psid) – XXX.YY (M200 only)
2000 inH_2O (72.1 psid) – XXXX.Y (M200 & M200LS only)

Gauge Isolated Types (M200 & M200LS)

15 psig – XX.YYY (M200 only)
30 psig – XX.YYY
50 psig – XX.YYY
100 psig – XXX.YY
300 psig – XXX.YY (M200 only)
500 psig – XXX.YY
1000 psig – XXXX.Y (M200 only)
3000 psig – XXXX.Y (M200 only)

Compound Isolated Types (M200 only)

-15 to +15 psig – XX.YYY
-15 to +30 psig – XX.YYY
-15 to +50 psig – XX.YYY
-15 to +100 psig – XXX.YY
-15 to +300 psig – XXX.YY
-15 to +500 psig – XXX.YY
-15 to +1000 psig – XXXX.Y
-15 to +3000 psig – XXXX.Y

Absolute Isolated Types (M200 & M200LS):

17 psia (900 mmHg) – XX.YYY
38 psia (2000 mmHg) – XX.XXY
100 psia (52000 mmHg) – XXX.YY (M200 only)
1000 psia (52000 mmHg) – XXXX.Y (M200 only)

Differential Isolated (Wet/Wet) Types (M200-DI only):

1 psid – X.YYYY
5 psid – X.YYYY
15 psid – XX.YYY
30 psid – XX.YYY
100 psid – XXX.YY
300 psid – XXX.YY
500 psid – XXX.YY

Accuracy: M200, M200-DI, M201

±0.05% of Full Scale or optional ±0.025% of Full Scale
(±0.05% F.S. only for M200-DN0010 [10" H_2O range])

Accuracy: M200LS

±0.01% of Full Scale
(±0.02% F.S. for M200LS-DN0028 [28" H_2O range])

Accuracy statements include the combined affects of linearity, repeatability, hysteresis and temperature over the specified operating temperature range.

Warm up time = 5 minutes.

Unit should be zeroed at working ambient temperature before use.

Temperature: M200, M200-DI, M201

Storage = -40°C to +60°C (-40°F to +140°F)
Operating = -5°C to +50°C (23°F to +122°F) I.S. models
-20°C to +50°C (-4°F to +122°F) G.P. models

Temperature: M200LS

Storage = -40°C to +60°C (-40°F to +140°F)
Operating = +15°C to +30°C (+59°F to +86°F)

Media Compatibility

Pressure Types

DN: Differential pressure, non-isolated sensors for use with clean, dry, non-corrosive gases only.

DI: Differential pressure, isolated sensors for use with gases and liquids compatible with 316L SS and Viton o-rings (optional o-ring material: buna-N, neoprene, kalrez

GI, CI, AI: Gauge, Compound or Absolute pressure sensors for use with gases and liquids compatible with 316L SS

Pressure Limits

GI, CI and AI units: 2x range
DN units: 2x range when pressurized on high side only. 150 PSI (10.5 Kg/cm²) static when applied to both sides of sensor simultaneously.
DI units: 1000 PSI common mode, P1 (HI) only is 3x range, P2 (LO) only is 3x range or 150 PSI, whichever is less.

Connection

1/8” female NPT, 316L SS.

DN and DI Types: P1 is the high pressure connection, P2 is the low pressure connection.

GI, CI & AI Types: P1 is the pressure connection and P2 is plugged with factory fitting.

Standard DN & DI manifold

GI, CI & AI manifold

Battery Type

4 each AA alkaline batteries.

⚠ DANGER ATEX certified models require the use of approved batteries to maintain the ATEX certification. Refer to Dwg. No. 9R000056 “M2 Intrinsically Safe Control Document” for a list of batteries approved for hazardous atmospheres. A copy of this drawing accompanies each unit shipped.

⚠ WARNING Remove and / or replace batteries in non-hazardous areas only.

Battery Operation

>100 hours continuous use, 1 year shelf life, auto power off programmable at Disabled, 10, 20, 30, 60 or 90 minutes

Enclosure

(6.9” × 3.8” × 2.3”) Polycarbonate, Permanently Static Dissipative, ESD Protection

Enclosure with Boot

(7.2” × 4.2” × 2.5”)

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Changing the Batteries

⚠ DANGER ATEX certified models require the use of approved batteries to maintain the ATEX certification. Refer to Dwg. No. 9R000056 “M2 Intrinsically Safe Control Document” for a list of batteries approved for hazardous atmospheres. A copy of this drawing accompanies each unit shipped.

⚠ WARNING Remove and / or replace batteries in non-hazardous areas only. Also see the Certification/Safety/Warnings section of this manual for additional important information.

The manometer is powered by four, 1.5 volt AA size batteries. When the output of the batteries under load drops, the display will alternate between “LOW POWER DETECT” and “REPLACE BATTERY”. Low power may affect performance. The unit should not be used to measure pressure in this condition. All four batteries should be replaced.

To replace the battery locate the battery compartment at the bottom rear of the manometer, as shown here.

Remove the two screws on either side of the battery cover by turning them counterclockwise until fully disengaged from the manometer base. Lift the cover from the back of the unit.

Remove the batteries by pulling the positive side first straight out of the battery compartment. Note the positive (+) and negative (-) battery polarity markings at the bottom of the compartment, as shown here.

To install the four batteries: 1) Make sure polarity of battery matches the markings in the compartment. 2) 1st place the (+) end of the battery into the battery slot. 3) Then push in the (-) end of the battery until seated in the bottom of the battery slot. 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 will not power up when a battery is installed this way. Should this happen, simply reverse the battery to align the polarity.

With the batteries secured in the battery compartment, replace the compartment cover. The cover has only one correct alignment. The "WARNING DO NOT OPEN IN EXPLOSIVE ATMOSPHERE" statement on the battery cover must be visible and aligned in the middle of the manometer case.

To secure the cover, torque the screws clockwise to 1.6-1.8 in-lbs. Do not over tighten.

NOTICE To prevent internal damage to circuitry, do not substitute screw lengths for the factory supplied screws.

User Connections

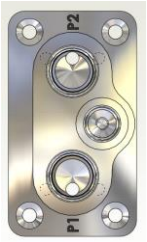
Connection: 1/8” female NPT, 316L SS.
P1 is the high pressure connection.
P2 is the low pressure connection.

The pressure connections are marked in two locations, identified as P1 and P2. One location is the top of the keypad (shown on cover photo). The second marking is stamped into the pressure manifold, next to the pressure connections, as shown below.

DN

GI, CI or AI

M201 w/ PTR



DI

DI w/ FP

NOTES:

PTR is a “Push to Read Valve” offered as an option for the M201 Rotary Gas Meter product.

FP is a “Flushing Port” design offered as an option for M200-DI wet / wet models.

P1 is the high pressure connection

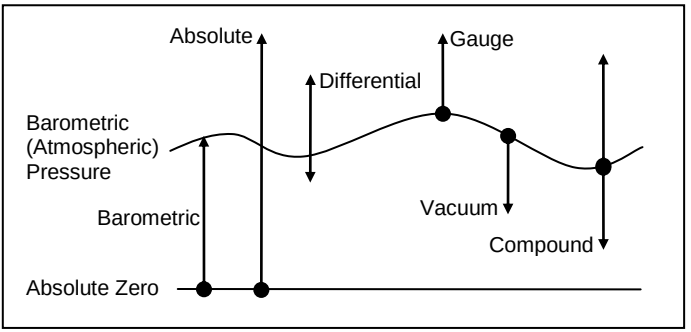
P2 is the low pressure connection for DN and DI units (P2 is plugged at factory for GI, CI and AI units. Do not remove a factory installed P2 plug.)

GI, CI and AI models use only the P1 pressure port. The unused P2 port vents the enclosure to atmosphere (a vent plug is factory installed in the P2 port).

NOTICE Connection to the incorrect pressure port on DN or DI differential pressure modules may cause damage to the pressure sensor. See the Specifications section of this manual for over pressure limits. If over pressure damage occurs, the unit must be returned to the factory for sensor replacement.

NOTICE User must use a wrench on the pressure manifold when installing user's 1/8" NPT fitting. Do not tighten the fitting without using a wrench on the pressure manifold. Failure to use a wrench on the manifold will damage the plastic enclosure and void warranty No torque should be applied to the manifold with respect to plastic enclosure.

Pressure Reference Chart



Service and Calibration

If the M2 cannot be zeroed, recalibrated or is damaged, it must be returned to the factory for servicing. In this case, contact the Meriam Process Technologies representative in your area or call the factory at the numbers listed below for a Return Material Authorization (RMA) number.

DO NOT send any unit in for service without first contacting Meriam for a Return Material Authorization (RMA) number. If this number has not been obtained and clearly marked on the return packaging, the unit will be returned at the shipper's expense. An RMA number will be provided by the Meriam Repair Department when you call, fax or e-mail your information. Certification for Non-Hazardous Materials will also be required. The RMA number must accompany all incoming packages to insure proper tracking, processing and repair work.

To assist us in processing your service request, please have the Model & Serial Number of the unit available when you call. This information is located on the product label.

Meriam Process Technologies
10920 Madison Ave.
Cleveland, OH 44102
Ph. (216) 281-1100 FAX (216) 281-0228
E-mail sales@meriam.com
Web www.meriam.com

Appendix 1: Rotary Gas Meter Tester Instructions

The M201 Rotary Gas Meter Test has unique firmware designed for natural gas distribution companies performing drop tests across positive displacement (rotary vane) meters in the field. This model uses the same pressure sensor technology and packaging as other M2 Series products but uses custom firmware to provide a mathematically averaged pressure from test start to test stop. The user determines the test duration. A number of the standard M2 Series programming options are eliminated from the M201 firmware.

See Addendum No. 9R124-IR “M201 Rotary Gas Meter Tester” for unique information on model M201.

Appendix 2: M200-DI Application Notes

Zeroing for Position Sensitivity

M200-DI (wet/wet) units have liquid filled, sealed sensor assemblies. The fill fluid will apply hydrostatic head pressure to the DP sensor in uniform ways depending on the orientation of the handheld during measurement sessions.

Horizontal plane (yaw axis): No zero offset
Vertical plane (pitch axis): No zero offset
Roll axis: Zero offset occurs. When the unit is rotated about its roll axis in the horizontal plane or any less-than-vertical plane, the fill fluid in the highest side imparts a greater hydrostatic pressure to the DP sensor. The result is a zero offset in either the + or – direction depending on the roll direction.

Zeroing: with no pressure applied to either the P1 or P2 ports, place the unit in the orientation it will be used in when making measurements. Then use the Zero function keys to null out the position effect on zero. Measurement stability is excellent at any fixed position.

M200-DI0001 and M200-DI0005 ranges: These ranges are most sensitive to roll axis position because the affect is a greater percentage of full scale range than in higher ranges. Small changes in position about the roll axis will register on the display as significant pressure changes. Therefore these two ranges will need to be held still while taking measurements or they may need to be placed on a bench or other stationary support prior to making measurements.

Zeroing for Static Pressure Effect on Zero

M200-DI models are available in measurement ranges from 1 to 500 PSID for common mode static pressures up to 1000 PSID. The zero reading on these units is linearly offset by the static pressure of the service. This offset is easily zeroed out using the zero function. Meriam recommends applying normal static pressure to the subject DI model using a 3-valve equalizing manifold to properly pressurize the M200-DI. The DI model should be zeroed under normal static pressure conditions, with the equalizing valve open (common mode pressure on P1 and P2 ports), to assure proper zeroing.

Appendix 3: M200LS Lab Standard Smart Manometer

The M200LS models provide greater accuracy than the standard M200 for users in controlled or temperate climates. Typical accuracy is ± 0.01% FS over the temperature range of 59º F to 86º F (15º C to 30º C). Accuracy is not certified outside this reduced temperature range.

The display for all M200LS pressure ranges is 6 digits for PSI units of measure. 6 digit display of pressure in other engineering units is supported whenever possible. Consult the M200LS "Accuracy & Resolution Tables for all Engineering Unit Choices" Application Note available at www.meriam.com for specific details.

All M200LS models are for general purpose, non-hazardous environment use only.