



M4 Handheld Pressure and Loop Calibrator



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Thank you for purchasing this product. Meriam has been providing innovative, reliable, cost effective measurement and calibration solutions for 100 years. The M400 Single Sensor or M402 Dual Sensor Handheld Pressure Transmitter Calibrator continues this legacy and is the first of its kind for the process measurement industry.

Certification/Safety/Warnings



Fire/Explosion Hazard. This instrument is not intrinsically safe. DO NOT use in areas that may contain flammable gas or vapors, combustible dusts or ignitable fibers where an unintended spark can cause a fire/explosion.



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



- 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.



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.

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

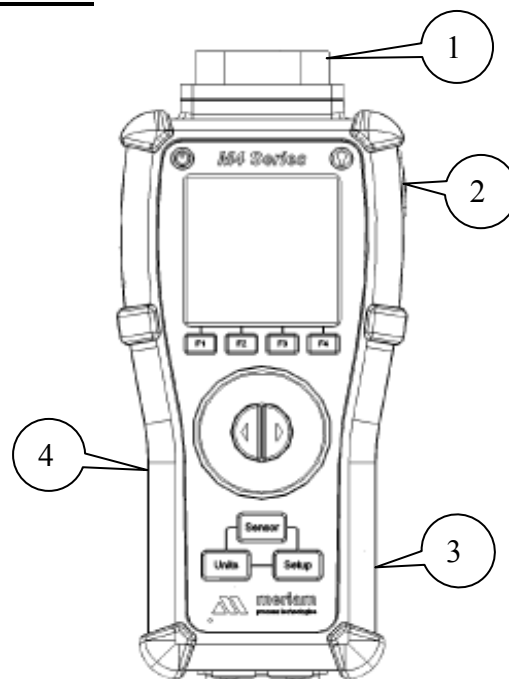
The table below defines the safety symbols, signal words and corresponding safety messages used in the manual to identify potential hazards and are intended to warn persons about hazards that could result in personal injury or equipment damage.

	This is the 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.

Product Overview







Number	Name	Description
	Pressure Manifold Connection	Connects the calibrator to a pressure source via 1/8" NPT Female. M400 = One Pressure Sensor M402 = Two Pressure Sensors
	USB Connection	Connects the calibrator to a computer using a USB Mini Type B to USB Standard Type A cable.
	Measure Volts/mA Source Volts/mA Terminals	Input terminals for measuring or sourcing both Volts and mA DC. 50VDC and 100mA max.
	SD Card Access	Data storage card for data logging. Card is located in battery compartment.

Figure 1: M4 Input and Outputs

Keys and Functions

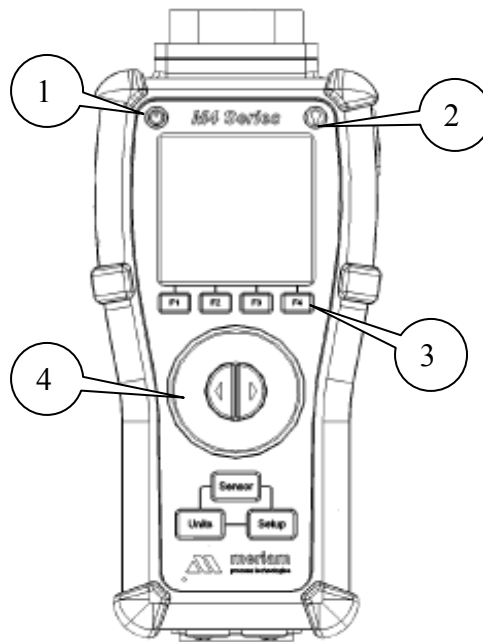










Figure 2: Key Functions

Number	Key	Description
		Turns the power On and Off.
		Turns green backlight On and Off.
		Function Keys F1 – F4 Changes depending on Operation Mode
		Adaptive interface wheel scrolls up and down through menu options or increments or decrements a value.

Keys and Functions

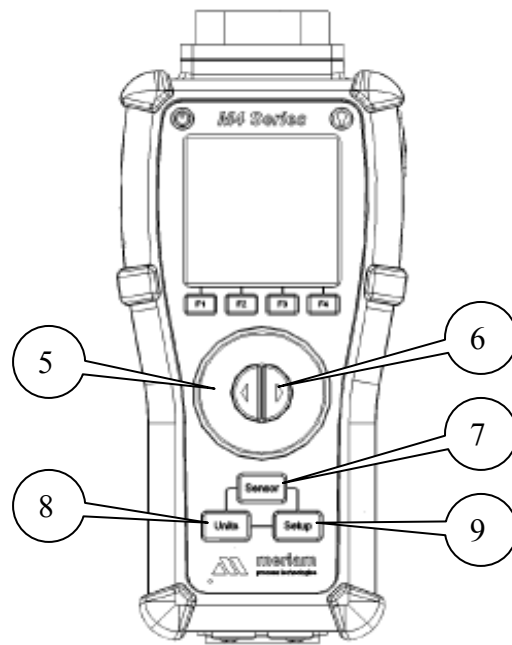







Figure 3: Key Functions

Number	Key	Description
5		Left Arrow –Navigates back out of menu or moves cursor
6		Right Arrow – Navigates further into menu structure, moves cursor, or selects value
7		Sensor – Selects sensor of interest for configuring or viewing settings
8		Units – Changes engineering units of a pressure sensor that is selected or highlighted
9		Setup – Selects available options for the unit or individual sensor that is selected or highlighted

Measure Mode Display

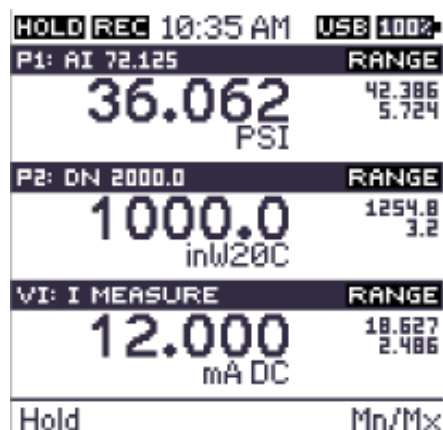


Figure 4: Typical Measure Mode Display with Icons Displayed

Icon or Reference	Function
HOLD	Freezes the display for reference
REC	Datalogging function is On and calibrator is recording information
USB	USB cable is connected to the calibrator
100%	Battery life as a percentage value
P1: Type XXX	Pressure Sensor #1, Type, and Full Scale Range in units selected. See specifications for further details.
P2: Type XXX	Pressure Sensor #2, Type, and Full Scale Range in units selected. See specifications for further details. M400 units will have N/A displayed on the screen.
VI: Mode	Voltage/mA Sensor, and current operation mode selected
▲▼	Maximum and Minimum measured value
ZERO	Zero's the sensor once selected or highlighted
RANGE	Unit is operating with a soft or hard over range limit. See over and under range table.
MN/MX	Resets the maximum and minimum value

Main Setup Display

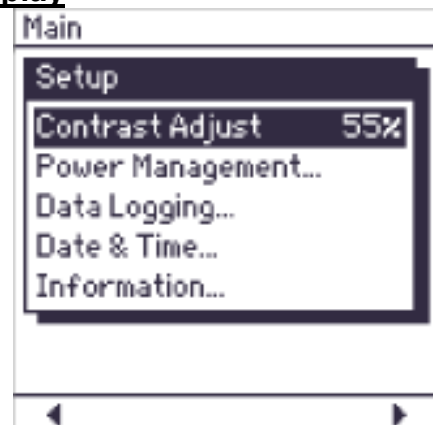
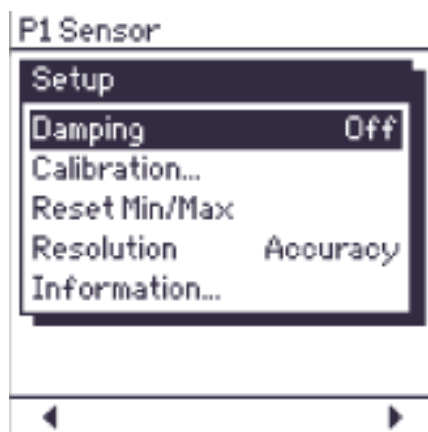


Figure 5: Typical Main Unit Setup Mode Display

Icon or Reference	Function
Contrast Adjust	Adjust contrast of display. Active setting shown on right.
Power Management	Adjust Auto Off Timer, Backlight Timer, or Backlight Intensity to improve battery life.
Data Logging	Start, Stop, and setup parameters for a log session
Date & Time	Adjust date and time if necessary
Information	Lists Product ID, Serial #, and Firmware Version

Pressure Sensor Setup Display

*Figure 6: Typical Pressure Setup Mode Display*

Icon or Reference	Function
Damping	Enable or disable damping and adjust value. Active setting shown to the right.
Calibration	Zero, Field Calibrate, or Restore Factory Defaults
Reset Min/Max	Resets Min/Max values
Resolution Accuracy	Choose Accuracy or Precision resolution on display for selected sensor. Active setting shown to the right.
Information	Lists Sensor Type, Accuracy, Calibration Date, Serial #, and Range

Volts/mA Sensor Setup Display



Figure 7: Typical VMA Setup Mode Display

Icon or Reference	Function
Mode	Choose Volts Measure, I Measure, 24V Source, Volts Source, I Source, or I Sink
Damping	Adjust or turn Damping value On or Off
Calibration	Perform a Zero, Field Calibration, or Restore Factory Defaults
Reset Min/Max	Resets Min/Max value
Resolution Accuracy	Choose Accuracy or Precision resolution on display for selected sensor. Accuracy shows accurate digits to the right of decimal place. Precision shows the maximum number of digits to the right of decimal place.
Information	Lists Sensor Type, Accuracy, Calibration Date, Serial #, and Range

Changing Batteries

Need to add what types can be used.

Loosen the two screws in the battery cover and lift off cover. Remove the batteries by gently applying pressure to the positive side and pull upward. To install batteries insert the negative side against the spring and gently apply pressure to lock in the positive side. The positive (+) and negative (-) battery polarity markings are located in the bottom of the case for the lower batteries and on the top of case for the upper batteries, as shown in the illustration. Once the batteries are secured in the battery compartment, replace battery cover and tighten the two flat head screws. The battery door is universal and can be installed in either direction.

Figure 8: Changing Batteries

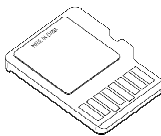
Warning – To avoid erratic readings replace batteries when warning message appears.





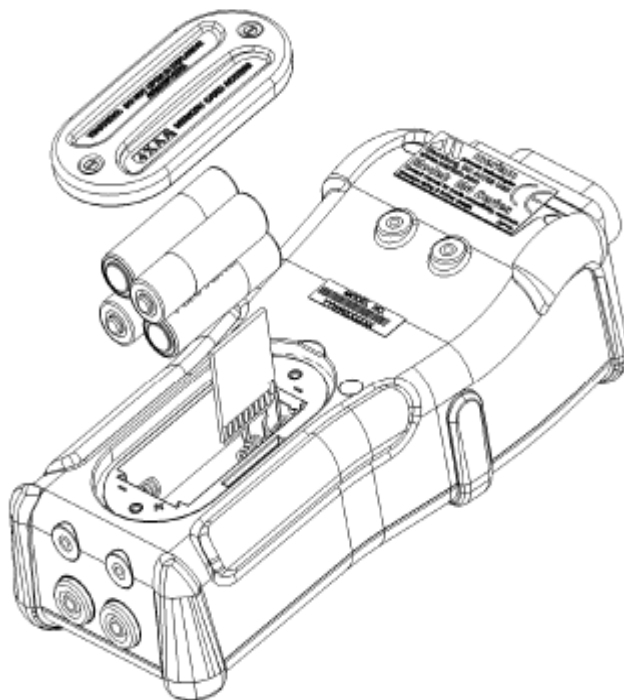
Accessing SD Card

To install the SD™ card simply insert the card in the slot and press down until you hear a click. The card has only one orientation for correct alignment. Please make sure you are inserting a SANDISK P/N SDSDB-2048-A11 or equivalent. Further details on the card are provided under the specification section.



Please note there is a Lock located on the side of the SD™ card. When the Lock is pressed down information can only be read from the card. To write or save information to the card make sure it is Unlocked before installing.

Figure 9: Accessing SD Card



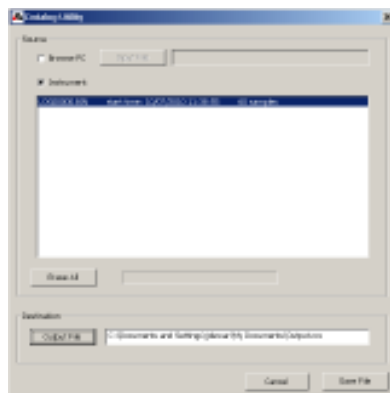
Downloading Data Using USB Interface

The M4 has the capability to download the information stored on the SD card to a computer via the USB cable provided with the unit or via an SD card reader. The Meriam Setup Utility which allows you to download the data is provided on the CD or available at www.meriam.com. Please install the USB drivers before installing the program. The USB Interface is for the exchange of data only. **Measurements taken while powered up by USB are for reference use only.**

The data file is downloaded as a .bin file and converted over to a .csv file for direct use in Microsoft Excel™. Select Device Native Output (USB) and press the Find Device button to find the M4.



Once the device is found press the Data Log Utility button and follow screen instructions.

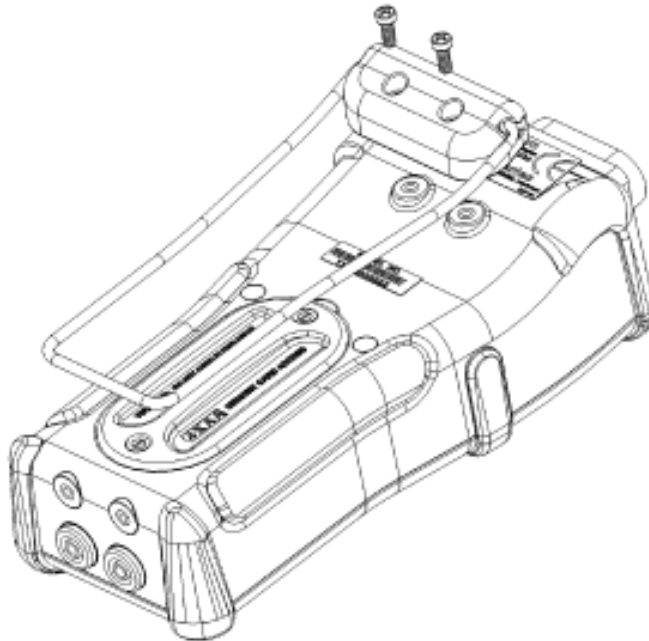


Installing Wire Stand

All **M4** units come standard with an installed rear hand strap and a separate wire stand. To install the wire stand first pull down on the loose end of the Velcro strap to separate it, then carefully pull the strap through the lower bracket. Next remove the two Phillips screws that secure the top metal bracket.

Locate the plastic bag that contains the wire stand, rubber mounting bracket, and two Phillips screws. Align the plastic mounting holes with the two brass inserts. Please make sure the straight edge is facing upward toward the pressure manifold as shown in the illustration. Secure the plastic mounting block to the enclosure by tightening the screws.

Figure 10: Installing Wire Stand



Specifications – Range

TYPE & RANGE	+/- 0.025% of Full Scale unless otherwise noted below. 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
DN0010	0 TO 10 in H ₂ O Differential, Non-isolated. ($\pm 0.05\%$)
DN0028	0 TO 28 in H ₂ O Differential, Non-isolated.
DN0200	0 TO 200 in H ₂ O Differential, Non-isolated
DN0415	0 TO 415 in H ₂ O Differential, Non-isolated
DN2000	0 TO 2000 in H ₂ O Differential, Non-isolated
DI0001	0 TO 1 PSI Differential, Isolated
DI0005	0 TO 5 PSI Differential, Isolated
DI0015	0 TO 15 PSI Differential, Isolated
DI0030	0 TO 30 PSI Differential, Isolated
DI0100	0 TO 100 PSI Differential, Isolated
DI0300	0 TO 300 PSI Differential, Isolated
DI0500	0 TO 500 PSI Differential, Isolated
GI0015	0 TO 15 PSI Gauge, Isolated
GI0030	0 TO 30 PSI Gauge, Isolated
GI0050	0 TO 50 PSI Gauge, Isolated
GI0100	0 TO 100 PSI Gauge, Isolated
GI0300	0 TO 300 PSI Gauge, Isolated
GI0500	0 TO 500 PSI Gauge, Isolated
GI1000	0 TO 1000 PSI Gauge, Isolated
GI3000	0 TO 3000 PSI Gauge, Isolated
CI0015	-15 TO +15 PSI Compound, Isolated
CI0030	-15 TO +30 PSI Compound, Isolated
CI0050	-15 TO +50 PSI Compound, Isolated
CI0100	-15 TO +100 PSI Compound, Isolated
CI0300	-15 TO +300 PSI Compound, Isolated
CI0500	-15 TO +500 PSI Compound, Isolated
AI0017	0 TO 17 PSIA Absolute, Isolated (0-900 mm Hg)
AI0038	0 TO 38 PSIA Absolute, Isolated (0-2000 mm Hg)
AI0100	0 TO 100 PSIA Absolute, Isolated (0-5200 mm Hg)
AI1000	0 TO 1000 PSIA Absolute, Isolated (0-52000 mm Hg)

Specifications - Over and Under Range

Sensor Type	Hard Under Range	Soft Under Range	Certified Range (F.S.)	Soft Over Range	Hard Over Range
DN	Under -20% ¹	-20 to 0%	0 to 100%	100 to 120%	Over 120%
DI	Under -20% ²	-20 to 0%	0 to 100%	100 to 120%	Over 120%
GI	Under -20% ³	-20 ³ to 0%	0 to 100%	100 to 120%	Over 120%
CI	NA ⁴	NA ⁴	0 to 100%	100 to 120%	Over 120%
AI	NA ⁵	NA ⁵	0 to 100%	100 to 120%	Over 120%

Notes:

¹ DN units will measure to -20% (or -10 PSID, whichever is greater pressure relative to absolute zero) and +120% of full scale pressure. Calibration certification is for 0 – F.S. (Full Scale Only).

² DI units will measure to -20% (or -150 PSI, whichever is greater pressure relative to absolute zero) and +120% of full scale pressure. Calibration certification is for 0 – F.S. (Full Scale Only).

³ GI units will measure to -20% (or -10 PSIG, whichever is greater pressure relative to absolute zero) and +120% of full scale pressure. Calibration certification is for 0 – F.S. (Full Scale Only).

⁴ CI units will measure to negative barometric pressure (typically -14.7 PSIG) and to +120% of full scale pressure. Calibration certification is for -14.5 PSIG to F.S. (Full Scale Only).

⁵ AI units will measure to +120% of full scale pressure. Calibration certification is for 0 PSIA to F.S. (Full Scale Only).

Hard Over & Under:

Display will read "- - -" (Under -20% or Over 120%).

Soft Over & Under:

Display will turn Red at ($\pm 20\%$).

Certified Range:

Display will indicate "Range" (Under 0% or Over 100%).

Specifications

Pressure:

Accuracy: $\pm 0.025\%$ of Full Scale

Temperature Performance: Accuracy includes all affects of temperature from -20° to +50° C (-4° to +122° F)

Engineering Units: 31 user selectable pressure units

Pressure Limits:

DN sensors: 2x range when pressurized on P1 (HI) side only, 150 PSI when applied simultaneously to P1 (HI) and P2 (LO) sides.

DI sensors: 3x range when pressurized on P1 (HI) side only, 3x range or 150 PSI (whichever is less) on P2 (LO) side only 1000 PSI when applied simultaneously to P1 (HI) and P2 (LO) sides.

GI, CI, & AI sensors: 2x range

Media Compatibility:

DN sensors: Non-isolated for clean, dry, non-corrosive gases only (Brass, 316L SS, Silicon gel)

DI sensors: Isolated for fluids compatible with 316L SS and Viton

GI, CI, AI sensors: Isolated for fluids compatible with 316L SS

Connections:

Pressure: $\frac{1}{8}$ " NPT (female)

Electrical: Standard banana jacks on $\frac{3}{4}$ " centers

Loop Power:

Accuracy: 24VDC $\pm 10\%$ (22 mA maximum)

Voltage & Current Measurement:

DC Voltage Range: -50 to +50V auto-ranging

DC Current Range: -100 to +100 mA

Accuracy: ($\pm 0.015\%$ of Reading +2 counts)

Accuracy of DC mA and 24 V Loop power: ($\pm 0.02\%$ of Reading ± 2 counts)

Resolution: 0.001 V, 0.001 mA, 0.0001 V, 0.0001 mA

Temperature Performance: Included in accuracy specification

Voltage & Current Source:

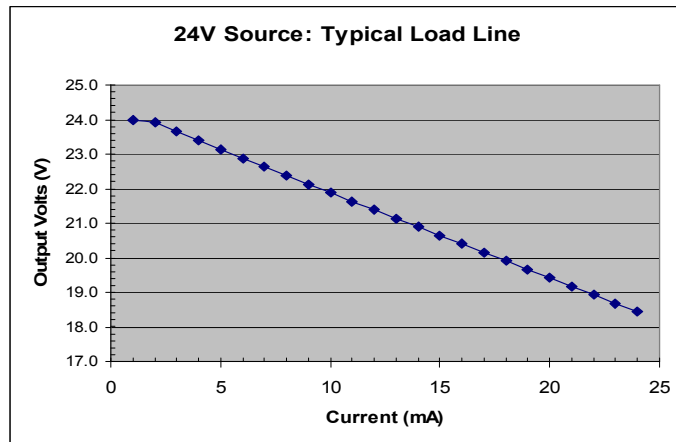
DC Voltage Range: 0 – 24 V

DC Current Range: 1 – 24 mA

Accuracy: ($\pm 0.015\%$ of Reading ± 2 counts)

Resolution: 0.001 V, 0.001 mA

Temperature Performance: Included in accuracy specification



Power: Four (4) AA 1.5 volt alkaline batteries provide 30+ hours of continuous service. Meriam recommends the unit be powered up for a minimum of 10 minutes for optimum results.

Display: 128 x 128 pixel (2" x 2" viewable) monochrome display with backlight

Enclosure: 8.5" L x 3.75" W (max.) x 2.25" D (max.), polycarbonate case, Softflex[®] over-molded bumpers, IP40

M4 single sensor: 1.5 – 1.8 lbs, M4D dual sensor: 1.8 lbs

Specifications

Environmental Conditions:

Calibrated: -4 to 122°F (-20 to 50°C)

Storage: -40 to 140°F (-40 to 60°C)

Humidity: 5 – 95%, non-condensing

Altitude: Operating 2000 Meters, Storage 1000 Meters

Safety:

EMC: EN 61326-1, Class A

IEC 61010-1, CAT-1 Voltage Protection

Environmental: RoHS, WEEE, Pollution Degree 2

Shock: 1 Meter Drop Test per IEC 61010-1

This instrument is intended for a temporary connection to industrial low-voltage current loops and not intended for a permanent connection.

“This product complies with the essential requirements of the European Directives for Low Voltage, EMC, RoHS, & WEE and carries the CE marking accordingly”.

Cleaning: Clean product with mild soap and damp rag. To avoid damaging the plastic lens and case do not use solvents or abrasive cleansers.

Firmware Features: Sensor zero, sensor damping, averaging, Minimum/Maximum value capture, units select, selectable automatic power off timer, selectable automatic back light off timer, keypad interface wheel for numeric selection and menu navigation,

Field Recalibration: All sensors can be recalibration in the field using suitable reference standards

Engineering Units: (Selectable 32) PSI, inW20C, inW4C, inW60F, ftW20C, ftW4C, ftW60F, mmW20C, mmW4C, mmW60F, cmW20C, cmW4C, cmW60F, mW20C, mW4C, mW60F, inHg0C, mHg0C, cmHg0C, mmHg0C, torr, kg/cm2, kg/m2, Pa, hPa, kPa, MPa, Bar, mBar, ATM, oz/in2, lb/ft2, User 1, User 2

Zeroing Sensors and Field Recalibration

To maintain the accuracy of the M4 it is recommended that both the pressure and Volts/mA sensor be zeroed prior to use. Zero is located on the main measure screen once the sensor is selected or under the Sensor setup screen. Differential and Gauge sensors shall be vented to atmosphere before executing a zero. Absolute pressure sensors must be pulled down to a complete vacuum of 200 microns or less for optimum results.

To zero the Volts/mA sensor the shorting plug included with the unit must be installed across the banana jacks. Follow the instructions on the screen to perform the zero.

Periodic recalibration of M4 may be needed to maintain optimum performance. The calibration menu is located under each sensor in the setup menu. Simply follow the screen and apply the values requested.

Field recalibration should only be executed by qualified personnel using suitable primary standards. These standards should meet the accuracy requirements of your company or industry. Meriam recommends using

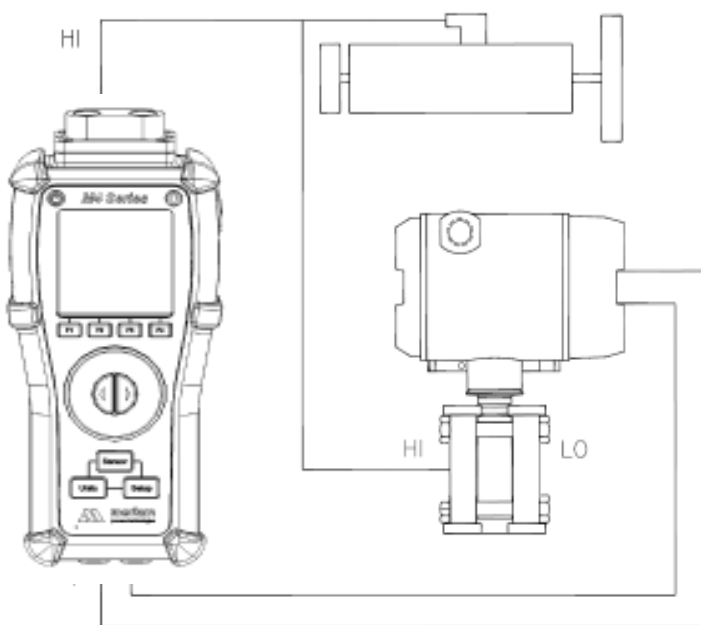
primary standards at least 4 times more accurate than the unit under test.

For pressure transmitters up to 200 PSI, Meriam recommends a deadweight tester of at least $\pm 0.0015\%$ of reading for field recalibration. For transmitter ranges of 200 PSI and above, a deadweight tester of at least $\pm 0.0030\%$ of reading. When calibrating using a dead weight tester referenced to inches of water, be sure the M4's inches of water reference temperature matches that of the dead weight tester.

If an error is made during field recalibration the restore factory defaults option is located under the sensor in the setup menu.

Applications

The M4 is designed to power up a transmitter to calibrate the pressure channel and mA output. The unit under test should be isolated from the process and taken out of the loop before starting the calibration. Please make sure you have the proper sensor and range before starting the calibration. The Full Scale range of the sensor is displayed next to the sensor location in the current engineering units.

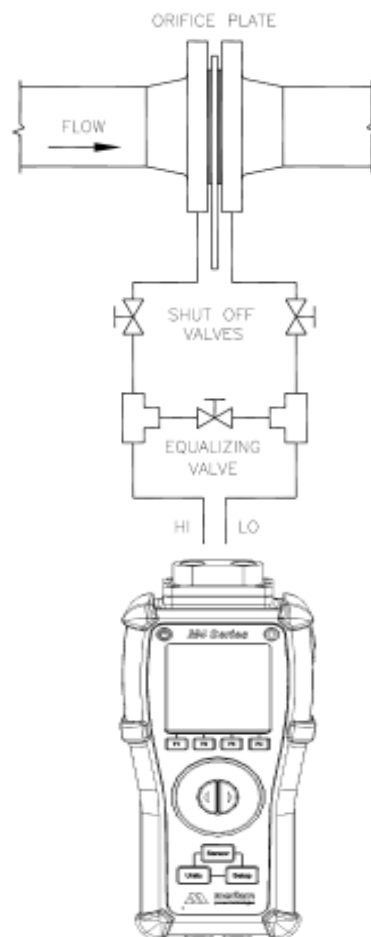


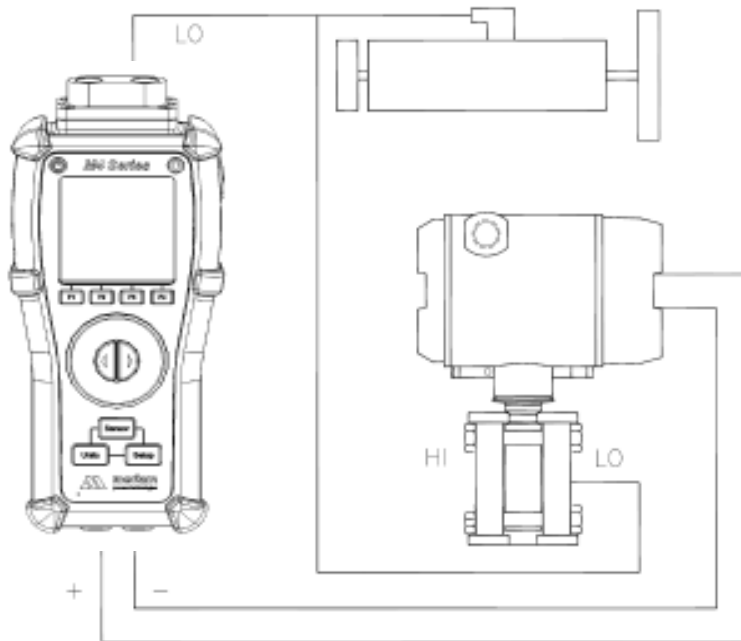
To calibrate the transmitter under test, insert test leads into the bottom of the M4. Observe loop polarity using the color coded standard banana jacks (Red +) and (Black -). If the loop requires power, the M4 will source 24V and measure the mA in the loop. The 24V source mode is located under the VMA setup menu. Field devices with compliance voltage about 19V may not be able to be calibrated. See the load line curve under specifications.

Applications (continued)

If you are using a DN or DI (Differential Pressure Sensor) the high pressure port (P1) is teed into the pressure source and transmitter high side (H) and low pressure port is vented to atmosphere. If you are using a GI or CI (Gauge Sensor) there is only one pressure connection.

In addition to reading gauge pressure the M4 can also be used to measure pressure drop across a pressurized system. Examples include orifice plates, pitot tubes, filters, or valves. A push to read, three valve, or five valve manifold is recommended to avoid damage to the sensor.



Applications (continued)

Vacuum calibration can be performed by venting the high pressure connection (P1) and applying vacuum to the lower pressure connection (P2). Atmospheric pressure is the reference for all vacuum measurements.

Absolute pressure calibrations use an AI sensor which has an internal absolute zero reference. You will notice when powering up an M4 with an AI sensor, it will read the local barometric pressure. Simply connect the vacuum (or pressure) source to the single port of the manifold. To zero an absolute sensor a full vacuum of 200 micron or less must be applied.

Contact Meriam

In the event an M4 requires service or must be returned for repair, please contact Meriam at the numbers listed below.

DO NOT send any unit in for repair 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 repair request, please have the Model & Serial Number of the unit available when you call. This information is located on the M4 label.

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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