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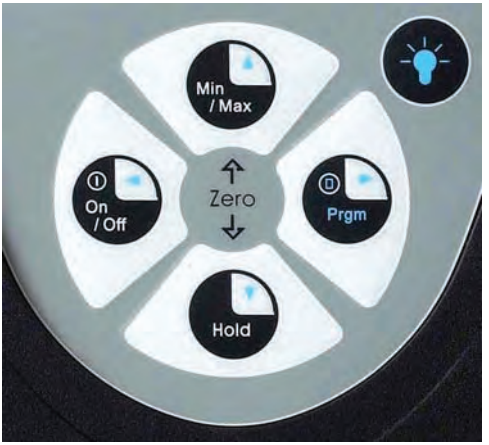
USER MANUAL
SMART MANOMETER

The Smart Manometer products are microcontroller based pressure sensing devices used to directly measure pressure. Differential, Gauge, Absolute and Wet/Wet pressure sensors are supported (see Specification section for supported types and pressure ranges). Pressure can be displayed in selectable engineering units of measure.

Features include Min/Max capture, display Hold, sensor Zero, Leak Test, Record/View (up to 240 points), user selectable damping and field recalibration. The manometer is powered by four AA alkaline batteries for more than 100 hours of use.

Table of Contents

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 ▲ ARROW 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 ▼ ARROW 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.

2. Zeroing the Manometer

To zero the manometer, first turn off pressure sources and vent pressure ports to atmosphere. The display should read close to zero. Press the **MIN/MAX** and **HOLD** keys at the same time and then release. This begins the zeroing process. The top line of the display reads "ZERO IN PROGRESS" while 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 interfere with the 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.

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 ▲ or ▼ 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 ▼ arrow key.	Bottom line reads "EXIT".
6. Press the PRGM key.	Display returns to Measure Mode in new engineering units.

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 H2O" will be shown in the following steps, using the conversation factor of 1 PSI = 2.30894 FT H2O.

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 ▲ or ▼ 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 ▲ arrow key until the first digit reads 2.	Top line reads "USER UNIT VALUE". Bottom line reads "20000000".
7. Press the ▶ 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 ◀ arrow key to move the cursor back to the incorrect digit. Then press ▲ or ▼ arrow keys to display the correct value.	The digit that is corrected is blinking.
10. Press the PRGM key until the display changes. *See note 1 at bottom of*	Top line reads "VALUE=". Bottom line reads "CHANGE?: YES".

this table.	
11. Press the PRGM key.	Top line reads "USER UNIT NAME".
12. Follow steps 6-8 above to enter "FT H2O".	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 ▼ arrow key.	Bottom line reads "EXIT".
15. Press the PRGM key.	Manometer returns to Measure Mode. Units Display shows "FT H2O".

Note 1: If at steps 4 or 10 the "VALUE=" is the desired value, press the ▲ or ▼ 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 read out 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:

$F_c = Q \div DP^{\square}$

where: F_c = Flow constant

Q = Flow rate (from flow element calculation sheet)

DP = Differential pressure corresponding to Q

Example: If the DP is 25 units 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:

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

The User Info Select registers are designed to provide the user with information on the hardware and software in the manometer. This register provides read only information on the sensor's serial number, software version and date of manufacture. 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 shown on the following page.

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 ▲ arrow key twice	Bottom line changes to "USER INFO SELECT".
3. Press the PRGM key.	Bottom line shows serial number.
4. Press the ▲ arrow key.	Software version number shown.
5. Press the ▲ arrow key.	Manufacture date shown.
6. Press the ▲ 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 ▲ arrow key. Instructions for using LOCKOUT are on page 12.	Top line reads "LOCKOUT CODE" and bottom line reads "ENTER TO SELECT".
8. Press the ▲ arrow key. Instructions for editing the Header are on page 13.	Top line reads "HEADER NAME" and bottom line reads "text". The cursor flashes at bottom left.
9. Press the ◀ 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 limits the manometer to being turned off by using the ON/OFF key only.

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 ▲ or ▼ 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 ◀ arrow key twice.	Returns to Measure Mode.

Note: The "Auto Shut-Off" timer is suspended during Data Logging and Leak Test sessions to prevent accidental loss of information. Auto Shut-Off is 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, the user must first enter the "password" (two-digit Lockout Code) within approximately 40 seconds when prompted. 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 the 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 ▲ arrow key twice.	Bottom line reads "USER INFO SELECT".
3. Press the ▶ arrow key then the ▲ arrow key four times.	Top line reads "LOCKOUT CODE" and bottom line reads "ENTER TO SELECT".
4. Press the ▶ arrow key, then press the ▲ or ▼ arrow keys to change the first digit. Press the ▶ arrow key to proceed.	Bottom line shows the old Lockout Code. The cursor flashes at the first position while the value is changed, the cursor moves to the right position once the right arrow key is pressed.
5. Press the ▶ arrow key when the desired code is set. Lockout is activated.	Top line reads "LOCKOUT CODE" and bottom line reads "ENTER TO SELECT".
6. Press the ◀ 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 ▲ arrow key twice.	Bottom line changes to “USER INFO SELECT”.
3. Press the PRGM key.	Bottom line shows serial number.
4. Press the ▲ arrow key five times.	Top line reads “HEADER NAME” and bottom line reads “text”. 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 ◀ arrow key.	Returns to Measure Mode.
7. Press the ▲ or ▼ 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 ▶ 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 ▶ 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 ◀ 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 ▲ arrow key three times.	Bottom line reads "CONTRAST SELECT".
3. Press the PRGM key.	Top line reads "CONTRAST SELECT" and bottom line shows a numerical value.
4. Press the ▲ or ▼ 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 ◀ 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 ▲ 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.

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 the 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 ▼ 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 ▲ , ▼ & ▶ 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 ▲ 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 current pressure reading.

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. The factory 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, the factory 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 manometer.

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 form 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 the re-calibration data to the factory defaults.

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 ▲ 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 ▲ or ▼ arrow keys to edit the selected digit. Use the ◀ or ▶ 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 ▶ 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 ◀ 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 ▲ or ▼ arrow keys to edit the selected digit. Use the ◀ or ▶ 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 ▶ 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 ▶ 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 ▲ arrow key until START is displayed on the bottom line. OR To exit without performing the 5-point re-cal press the ◀ 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-CALALIBRATION – 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 ▲ 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 ▲ 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 ▶ 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 ▶ 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 ▲ or ▼ 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 ◀ 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 ▲ 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 ▲ and ▼ 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 ◀ arrow key.	Returns to Measure Mode.

Specifications

Type and Range and Display Resolution:

Differential Non-Isolated Types:

28 inH2O (1 psid) – XX.YYY
200 inH2O (7.21 psid) – XXX.YY
2000 inH2O (72.1 psid) – XXXX.Y

Gauge Isolated Types:

15 psig – XX.YYY
30 psig – XX.YYY
200 psig – XXX.YY
300 psig – XXX.YY
2000 psig – XXXX.Y

Absolute Isolated Types:

17 psia (900 mmHg) – XXX.YY
38 psia (2000 mmHg) – XXX.YY

Wet/Wet Types:

1 and 5 psid – X.YYYY
15, 30 and 50 psid – XX.YYY
100, 300 and 500 psid – XXX.YY

Accuracy:

±0.025% of Full Scale or ±0.05% of Full Scale
(±0.1% of Full Scale for 28 inH2O Differential range)
Includes the combined effects of temperature, linearity, repeatability, hysteresis and resolution.
Warm up time = 5 minutes.
Zero unit at working ambient temperature before use.

Temperature:

Storage = -40°C to +60°C (-40°F to +140°F)
Operating = -5°C to +50°C (23°F to +122°F)

Media Compatibility:

PORTS:

DN: Differential pressure non-isolated sensors for use with clean, dry, non-corrosive gases only.
DI, GI , AI: Differential, Gauge, or Absolute pressure sensors for use with gases and liquids compatible with 316L SS (and O-ring material on DI wet/wet differential sensors)

O-RING Material (for DI sensors only):

Standard: Viton
Available options: Buna-N, Neoprene or Ethylene-Propylene

Pressure Limits:

DN units: 2 □range when pressurized on high side only. 150 PSI (10.5 Kg/cm□) static when applied to both sides of sensor simultaneously
GI and AI units: 2 □range
DI units: 5 PSI: 4 □range on high side only. >5 PSI: 3x

range on high side only. 1000 PSI (70.3 Kg/cm□) static when applied to both sides of sensor simultaneously

Connection:

1/8" female NPT, 316L SS. P1 is the high pressure connection and P2 is the low pressure connection. Differential port shown below.

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.

Battery Type:

4 each AA alkaline batteries.

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")

Certification/Safety/Warnings

This manometer is for general purpose use only.

Note the following **WARNINGS and requirements**:

- Substitution of components may impair operation
- Do not use or service in the presence of explosive atmospheres.
- Do not replace batteries in the presence of explosive atmospheres.
- 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 to the plastic enclosure while installing 1/8" NPT fittings.

Changing the Batteries

Adherence to the Specifications and Certification/Safety/Warnings sections of this manual shall be enforced when changing batteries.

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 the 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 bottom of the battery slot. 3) Then push in (-) end of the battery until it is 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.

User Connections

Connection: 1/8" female NPT, 316L SS. P1 is the high pressure connection and P2, 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 page 1). The second marking is stamped into the pressure connection fitting, next to the pressure connections, as shown here.

DN

GI or AI

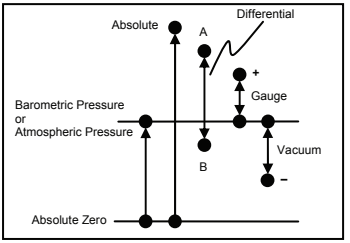
DN w/ PTR

DI

DI w/ FP

NOTES:
PTR is a "Push to Read Valve" offered as an option for the product.
FP is a "Flushing Port" design offered as an option for wet / wet DI models.

"G" and "A" models have only one used pressure port. The unused port vents the enclosure/sensor P2 to atmosphere (a sintered plug or vent is installed in either P1 or P2 as appropriate).



Warning ➔ Connection to the incorrect pressure port on DN or DI differential pressure modules may cause damage to the pressure sensor. If this sort of damaged occurs, the unit must be returned to the factory for sensor replacement.

WARNING ➔ 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.

Contact Information

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

All Smart Manometers recalibrated at the factory are returned with certificates of NIST traceability.

MADE IN USA

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

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