



www.omega.com
info@omega.com
1-800-826-6342

User Manual

HHP460

Smart Manometer

With Altimeter and Air Speed Tester



CE

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General Information

Notification Statements

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Design Patent D769,141 for the Smart Manometer's LCD display.

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Glossary

Words and phrases with their definitions or explanations.

Words & phrases	Definitions or explanations
Blinking	<ul style="list-style-type: none"> It indicates the active edit field on an edit screen. It indicates the displayed value is not actively changing (like Hold or stopped Test).
FS	<ul style="list-style-type: none"> FS is the abbreviation of Full Scale.
Home	<ul style="list-style-type: none"> Home is the first screen that displays after turning on the Smart Manometer. It's the screen with measurements and units on it. After you press the Home key in many other screens, the Smart Manometer returns you to Home.
Key and button	<ul style="list-style-type: none"> A <i>key</i> refers to hardware push-buttons on the keypad that you can press. A <i>button</i> refers to an area in HHP400 Suite that you can tap or click to select functions.
Isolated	<ul style="list-style-type: none"> The word <i>isolated</i> refers to the sensing element being separated from the media. It is commonly used in the phrases Absolute Isolated (AI) pressure and Compound Isolated (CI) pressure.
Customer Calibration	<ul style="list-style-type: none"> Customer calibration refers to any calibration done outside of Omega with non-Omega traceability. Customer calibration includes: Multipoint calibration or adjustment.
Omega Tethered Sensor	<ul style="list-style-type: none"> An Omega Tethered Sensor always refers to an external pressure sensor P2.
-- P1 --	<ul style="list-style-type: none"> P1 on the display always refers to the internal sensor.
-- P2 --	<ul style="list-style-type: none"> P2 on the display always refers to the external pressure sensor.
P1 P2	<ul style="list-style-type: none"> Data from the internal and external pressure sensors display in two lines on the Smart Manometer at the same time.

Words & phrases	Definitions or explanations
P I	<ul style="list-style-type: none"> Data from the internal pressure sensor and Omega Tethered Sensors temperature RTD sensor display on the Smart Manometer at the same time.
DIFF P1-P2	<ul style="list-style-type: none"> The displayed result of the external pressure measurement subtracted from the internal pressure measurement.
DIFF P2-P1	<ul style="list-style-type: none"> The displayed result of the internal pressure measurement subtracted from the external pressure measurement.
- -out -	<ul style="list-style-type: none"> - -out - displays on the process readout when the information readout is providing information about exiting tests.
*P I	<ul style="list-style-type: none"> The asterisk displays when you enable the Sea Level Correction offset or enable the Altitude Correction offset.

General warnings and cautions

Preventing injury

Failure to follow all instructions could result in injury:







- Read the entire manual before using the Smart Manometer.
- Understand the contents before using the Smart Manometer.
- Follow all safety warnings and instructions provided with this product.

Safety symbols

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

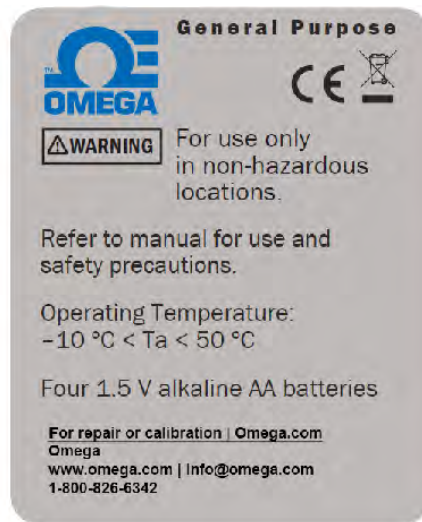
- Identify potential hazards.
- Warn you about hazards that could result in personal injury or equipment damage.

Safety symbols	Explaining the symbols
	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.

Sample label for General Purpose Smart Manometers

All HHP400 Series models are available for general-purpose use.

General Purpose (GP) 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:



Fire or 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 or explosion.

For General Purpose Series



Substitution of components may impair operation and safety.

- Disconnect power before servicing.
- Do not power the Smart Manometer with a combination of new and old batteries.
- Do not power the Smart Manometer with a combination of batteries from different manufacturers.

Do not exceed pressure limits



- **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.

Sensors

Overview of Sensors

This Smart Manometer can display two measurements: one from the internal sensor and one from the optional tether sensor.

NOTICE

- P1 on this Smart Manometer always refers to the internal sensor.
- P2 on this Smart Manometer always refers to the external sensor.

Use two wrenches to install or remove pressure connections

Connection: 1/8 in. female NPT, 316L SS.

- Always use a 3/4 in. wrench on the pressure manifold when you install or remove the 1/8 in. NPT fitting.
- Applying torque to the manifold can damage the plastic enclosure and voids the warranty.
- Do not over tighten.

Carefully equalize the pressure

Avoid these two issues with **differential sensors**:

1. Connecting pressure to the incorrect pressure port on DN or DI differential pressure modules may cause damage to the pressure sensor.
2. Applying pressure to either port before both connections are made.

NOTICE

Apply pressure to both differential ports at the same time.

Note: See Overrange limit in the section called Specifications concerning overrange pressure limits. If over pressure damage occurs, you must return the Smart Manometer to the factory for sensor replacement.

Omega Tethered Sensors

Overview of the temperature and pressure sensors

1. The P2 sensor sensor can be displayed with the P1 sensor.
2. When two sensors are displayed, no **Units** are displayed and the **Units** key is disabled.
3. The **Zero** key is also disabled.
4. When a single sensor is selected it displays the measurement units that were selected in HHP400 Suite.

Make an electrical connection

- Align the red dot on the Smart Manometer with the red dot on the Tether cable and push in.
- Align the red dot on the Omega Tethered Sensors with the red dot on the Tether cable and push in.

How to zero Absolute Sensors

Overview of the zeroing Absolute Sensors

The Smart Manometer is a stable and precise instrument. However, on occasion the Smart Manometer should have a new zero taken. The new zero removes a zero drift that can occur after the Smart Manometer was last zeroed. The Smart Manometer can be zeroed only if the new applied zero is within $\pm 1\%$ FS of the original factory calibration zero. This prevents accidental zeroing at atmospheric pressure or other relatively high pressures. If the Smart Manometer is outside this limit, the Smart Manometer cannot zero.

1. **Referenced to Absolute Zero** - This traditional and preferred method takes a snapshot of the measured pressure when a vacuum of less than 100 microns Absolute is applied to the sensor.
2. **Restore Factory Zero** - This method restores the calibration curve to the original zero taken at the factory.

Note: This feature is intended for comparison purposes, and should not be used for real pressure measurement. This feature does not compensate for any zero drift.

3. **User Defined Offset (Zero)** - With this method, you can enter any pressure value when a known reference is applied (for example: the local barometric pressure). The Smart Manometer compares its actual measured value with the

entered value and calculate a new zero reference based on the offset.

Steps for zeroing Absolute Sensors

You can zero the Smart Manometer in one of three ways. The following may appear in a different order depending on which arrow key you press. When an absolute sensor displays on-screen as P1 or P2, press the **Zero** key to see one of the three sets of characters below and the following three messages

On-screen message	Explanations
TAP ✓ TO CHOOSE REF	<ul style="list-style-type: none"> Tapping the Accept key selects the displayed reference.
ARROWS TO CHANGE REF	<ul style="list-style-type: none"> Tapping an Arrow key changes the displayed reference.
X CANCELS	<ul style="list-style-type: none"> Tapping the Cancel key cancels the zero request.
ABS 0	<ul style="list-style-type: none"> This is the on-screen abbreviation for Absolute Zero.
dFLT	<ul style="list-style-type: none"> This is the on-screen abbreviation for Default. If you want to restore the Factory Zero on a sensor, press the Accept key when you see these characters appear.
USER 0	<ul style="list-style-type: none"> This refers to User Defined Offset (Zero). You can set an absolute reference point other than zero.

How to zero DN, DI, or CI sensors

1. Disconnect from a pressure source and vent the pressure port to atmosphere.

1. Do not remove the factory installed P2 plug if it is present.
2. The display should read close to zero.

2. Press the **Zero** key.
The top line displays dashes -----.



3. The process is complete when the Smart Manometer returns to the **Home** (Measurement Units) screen.
4. If someone has turned on the **Password Required For Future Access** feature in HHP400 Suite, the password feature does not prevent you from zeroing the Smart Manometer.

Note: You can only zero the Smart Manometer if the new zero value is within $\pm 5\%$ (of FS) of the original factory calibrated zero. If the zero procedure generates a new zero reference outside this limit, the procedure fails. Factory service may be required.

5. You can turn off the **Zero** function in **HHP400 Suite** by deselecting **Allow zero adjust (Ø)** in the Display Functions list.

Altitude and Indicated Air Speed

ALT FEET or BEYOND MAX

When **BEYOND MAX** appears on screen

When **BEYOND MAX** appears on-screen instead of **ALT FEET**, the calculated altitude exceeds 36,000 feet.

*Note: Don't confuse **BEYOND MAX** with an overrange condition. If the sensor is outside the calibrated range, the HHP400 displays **MEAS ERROR** and the sensor may be damaged.*

Display altitude in feet or meters

1. Press the **Backward** key to display **ALT FEET** (Altitude in Feet).



2. Press the **Units** key when **ALT FEET** is on-screen to switch between **FEET** and **METER** and back to **FEET**.



IAS MPH

When you display **IAS MPH** (**KNOTS** or **KM/H**) on-screen, the current, ambient pressure—the uncorrected barometric pressure—is measured and is the reference pressure used for calculating air speed.

When you switch from the **IAS MPH** screen to one of the other display functions, the HHP400 does not hold that measurement in memory. When you switch back to the **IAS MPH** screen, a new pressure measurement is recorded and used as the reference barometric pressure in the **IAS MPH** calculated air speed.

Switching from the **IAS MPH** screen to another display function, and then switching back to the **IAS MPH** screen again while in motion ($IAS > 0$), displays the wrong speed since **IAS** is reset to zero (current measured pressure to reference barometric pressure).

1. Press **Backward** two times from the home screen to display **IAS MPH** (mi/h).



2. Press **Units** key when **IAS MPH** is on-screen to switch from **MPH** to **KNOTS** to **KM/H** and back to **MPH**.



Altitude Correction in Feet (Meters)

This **User Defined Altitude** function is useful in determining an elevation change from a map elevation reference or from a survey trig marker elevation. Follow the on-screen instructions to set up the HHP400 to display altitude based on data you enter.

1. Press the **Backward** key three times from the home screen to display ALTITUDE CORRECTION IN FEET TAP $\sqrt{\quad}$ TO CHANGE.



2. Press the **Accept** ($\sqrt{\quad}$) key to enter the change screen.



3. The HHP400 displays the following message:
ENABLE ALTITUDE OFFSET? $\sqrt{\quad}$ -YES X-NO

1. Pressing the **Cancel** (X) key returns you to the ALTITUDE CORRECTION IN FEET TAP $\sqrt{\quad}$ TO CHANGE screen.



2. Pressing the **Accept** ($\sqrt{\quad}$) key displays **Altitude Offset** options:

*Note: When you **Enable** the Altitude Offset, an asterisk (*) appears on the Home, the ALT FEET, and IAS MPH screens to indicate that either an Altitude Offset or Sea Level Offset has been set or both of Offsets have been set. Pressing the **Information** key displays ON or OFF for each active offset so you can easily determine which offsets are active.*

4. The HHP400 displays the following message:
ALT OFFSET IN FEET $\sqrt{\quad}$ SAVES X CANCELS 0 CLEARS
 1. Pressing the **Up** or **Down** arrows on the keypad changes the first digit and pressing the **Right** or Left arrows moves the blinking cursor right or left. Enter your **Defined Altitude** data by using the arrow keys.
 2. *Information: 0 Clears* refers to the **Zero** key. Pressing it clears any numbers you entered after pressing the Up or Down arrow keys.



3. *Information:* Pressing the **Cancel** (X) key returns you to the ALTITUDE CORRECTION IN FEET TAP ✓ TO CHANGE screen.
4. *Information:* The **Accept** key saves your ALT OFFSET IN FEET data.

Sea Level Correction in Meters

Important: You can't change from meters to feet; Sea Level Correction is always in meters.

1. Press the **Backward** key four times from the home screen to display the following message:
SEA LEVEL CORRECTION IN METERS TAP ✓ TO CHANGE.



1. ENABLE SEA LEVEL OFFSET? ✓-YES X-NO
2. NO returns you to the SEA LEVEL CORRECTION IN METERS TAP ✓ TO CHANGE screen.
3. YES takes you to the edit screen. Pressing the **Up** or **Down** arrows on the keypad changes the first digit and pressing the **Right** or Left arrows moves the blinking cursor right or left. Enter your **Sea Level Correction** data by using the arrow keys.
4. While in the edit screen, the HHP400 displays the following message: SEA LEVEL CORRECTION ✓ SAVES X CANCELS 0 CLEARS

5. *Information:* **0 Clears** refers to the **Zero** key. Pressing it clears any numbers you entered after pressing the Up or Down arrow keys.



6. *Information:* Pressing the **Cancel (X)** key returns you to the ALTITUDE CORRECTION IN FEET TAP $\sqrt{\quad}$ TO CHANGE screen.
7. *Information:* The **Accept** key saves your ALT OFFSET IN FEET data.

Note: Barometric pressures provided by the National Weather Service and used at airports are always corrected to sea level.

*Note: When you **Enable** the SEAL LEVEL CORRECTION Offset, an asterisk (*) appears on the Home, the ALT FEET, and IAS MPH screens to indicate that either an Altitude Offset or Sea Level Offset has been set or both of Offsets have been set.*

Switch to Omega Tethered Sensor

1. Attach an Omega Tethered Sensor to the HHP460.
2. From the Home screen, press the **Up** arrow to view all the available information and options for the Omega Tethered Sensor.
3. Use the optional **HHP400 Suite** application to configure, calibrate, and update the Smart Manometer and use Data Log for the Omega Tethered Sensors.

The following display functions are not available for the Omega Tethered Sensor:

1. SEA LEVEL CORRECTION IN METERS TAP ✓ TO CHANGE
2. ALTITUDE CORRECTION IN FEET TAP ✓ TO CHANGE
3. IAS MPH
4. ALT FEET (Altitude Display) or BEYOND MAX.

Smart Manometer

Battery and USB power

When you turn on the Smart Manometer, it draws power from the batteries and the battery icon displays in the bottom row. When you press the information button, it displays **Batt %**.

When you turn on the Smart Manometer and plug in the USB cable to the computer, the Smart Manometer switches to the power supplied by the USB cable. The battery icon disappears from the bottom row. When you press the information button, it displays **USB POWER**.



Do not use the USB in hazardous locations.

Batteries



Remove and replace batteries in non-hazardous (safe) areas only.

Turn off the backlight

- Turn off the backlight when you need to conserve battery power.
- The backlight is dimmed when the Smart Manometer is in low battery mode.

Suggested brands of batteries

The following is a suggested list of batteries.

- Duracell MN1500
- Duracell PC1500
- Energizer EN91
- Panasonic LR6XWA
- Rayovac 815
- Varta 4906

Note: The Smart Manometer is powered by four 1.5 volt AA size batteries.

Know your batteries

- **Never** mix batteries—not by manufacturer or by size, by capacity, or by chemistry.
- **Never** mix old and new batteries.
- **Remove** all four batteries in the Smart Manometer at the same time.
- **Replace** all four batteries with batteries from the same package or with the same expiration date.

Install the batteries

1. Turn over the Smart Manometer so the display faces down.
2. Remove the two screws on the battery cover with the Phillips-head screwdriver by turning them counterclockwise.
3. Insert the four AA batteries.

Note: Pay attention to the positive (+) and negative (–) battery polarity markings at the bottom of the compartment.

4. Replace the battery cover.
5. To secure the cover, torque the screws clockwise 2 in. lb. maximum.
6. Do not over tighten.

NOTICE

To prevent internal damage to circuitry, do not substitute screws with lengths that are different from the screws Omega provided to you.

Watch for the low battery indicator

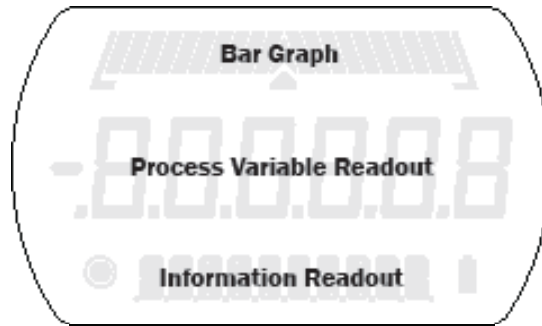
The battery indicator on the display shows the current charge.

Note: Be prepared to change batteries when you see the outline of the battery icon and the outline of the battery icon flashes. You have approximately 2 hours of run time following a low battery warning.

Refer to battery manufacturers' instructions

Visit the website of the battery manufacturer to learn more about the care, storage, shipping, use, disposal, and recycling of your batteries.

The display



The bar graph

The bar graph displays a live indication of the current pressure or temperature applied to a sensor as a percent of FS.

Note: When you press the Information key, the bar graph displays the remaining state of the charge for the batteries.

Display functions for the internal sensor

The Smart Manometer has sixteen display functions. It ships with nine display functions active (they appear in bold below). You can change which displays are active with HHP400 Suite.

Press the **Forward** (or **Backward** in reverse order) key to view these modes.
















1. **Home** is the default view with measurement units.
2. **MIN** (Minimum).
3. **MAX** (Maximum).
4. RELIEF VALVE TEST TAP ✓ START TO BEGIN.
5. **+ / -** (Accuracy).
6. **T.OFF, T.ON** (Tare).
7. AVG (Average).
8. RATE.
9. **DATA LOG.**
10. Temperature & Time (internal sensors *only*).
11. LEAK TEST TAP ✓ START TO BEGIN.
12. LEAK TEST DURATION TAP ✓ TO CHANGE.
13. **SEA LEVEL CORRECTION IN METERS TAP ✓ TO CHANGE.**
14. **ALTITUDE CORRECTION IN FEET TAP ✓ TO CHANGE.**
15. **IAS MPH.**
16. **ALT FEET** (Altitude Display) or **BEYOND MAX.**


Display functions NOT appearing on the Omega Tethered Sensor

The following display functions do not appear on an Omega Tethered Sensor.

1. Temperature & Time (not on external sensor)
2. SEA LEVEL CORRECTION IN METERS TAP ✓ TO CHANGE
3. ALTITUDE CORRECTION IN FEET TAP ✓ TO CHANGE
4. IAS MPH
5. ALT FEET (Altitude Display) or BEYOND MAX.

Keypad: Description of the keys

Name	Key	Description
Backward		<ul style="list-style-type: none"> It cycles backward through menu options.
Home		<ul style="list-style-type: none"> Home key returns you to the Measurement and Units screen. Home key is disabled during tests and edits
Forward		<ul style="list-style-type: none"> It cycles forward through menu options.
Units		<ul style="list-style-type: none"> Select a measurement unit.
Start		<ul style="list-style-type: none"> Start key begins a test or data log.
Stop		<ul style="list-style-type: none"> Stop or Hold (Freeze) key.
Up arrow		<ul style="list-style-type: none"> It increases digits by one. It switches between the P1 and P2 sensors displays.
Left arrow		<ul style="list-style-type: none"> It moves the blinking cursor one space at a time to the left.
Zero & Tare		<ul style="list-style-type: none"> Zero key resets pressure values to zero. It resets min max values. It sets edit values to zero. It resets relief valve test. As a Tare key, it turns off or turns on the Tare function.
Right arrow		<ul style="list-style-type: none"> It moves the blinking cursor one space at a time to the right.
Down Arrow		<ul style="list-style-type: none"> It decreases digits by one. It switches between the P1 and P2 sensors displays.
Cancel or Esc		<ul style="list-style-type: none"> Cancel any editing or changes without saving. It also stops tests.
Accept		<ul style="list-style-type: none"> Accept applies all editing and changes, and then saves them. It also stops tests.
Power		<ul style="list-style-type: none"> Turns the Smart Manometer on or off.
Information		<ul style="list-style-type: none"> Displays information about the Smart Manometer, internal sensor, attached Omega Tethered Sensors and the firmware.

Name	Key	Description
Backlight		<ul style="list-style-type: none"> It provides three levels of brightness and off.

The Information key and the Home screen

The Information menu provides you with details about the Smart Manometer and sensors.



Depending on what is attached to the Smart Manometer and depending on what is selected in the bottom row in the LCD display, determines what data appears.

1. **Batt %** displays the percentage on the bar graph and in digits or it displays the words **USB POWER**.
2. **SEA LEVEL CORRECTION:** On or Off
3. **ALTITUDE CORRECTION:** On or Off
4. If you have an Omega Tethered Sensors attached to the Smart Manometer.
-- P1 -- or -- P2 --

Note: the bottom row indicates sensor (or measurement type): compound, absolute, or differential. All the following sensor information describes the sensor indicated by P1 or P2.

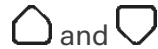
5. **CAL DATE**
6. **USL** is an abbreviation for *upper sensor limit*.
7. **LSL** is an abbreviation for *lower sensor limit*.
8. **LT MAX %** displays the Life-Time Maximum that has been reached on the sensor.
9. **SENSOR F/W VERS** F/W is an abbreviation for *firmware (this message scrolls to display the information)*.
10. **SENSOR S/N** S/N is an abbreviation for *serial number (this message scrolls to display the information)*.

*Note: **SNSR NAME** appears only with an Omega Tethered Sensors (this message scrolls to display the information).*

11. **DEV F/W VER** DEV is an abbreviation for *device*; it refers to the Smart Manometer (*this message scrolls to display the information*).
12. **DEV S/N** (*this message scrolls to display the information*).
13. **DEV NAME** (*this message scrolls to display the information*).

Up and Down Arrows

In the edit mode, the **Up Arrow** increases the digit each time you press it. The **Down Arrow** decreases the digit



1. **Up Arrow:** 0 to 1 to 2 to 3 to 4 to 5 to 6 to 7 to 8 to 9.
2. **Down Arrow:** -0 to -1 to -2 to -3 to -4 to -5 to -6 to -7 to -8 to -9.
3. The negative symbol in the display appears in front of the first digit when it is required.

The backlight

White backlight

The white backlight has an automatic time out. If you do not press any keys while the backlight is on, it automatically turns off after 1 minute.

Note: You can configure the backlight timeout using HHP400 Suite.

Levels of backlight intensity

Press the Backlight key to cycle through these choices:

- Low.
- Medium.
- High.
- Off.

Flashing red backlight

The flashing red backlight indicates an error condition. Possible error conditions are:

- Pressure has exceeded the calibrated accuracy of the Smart Manometer.
- Pressure has fallen below the stated accuracy of the Smart Manometer.

Note: The red backlight overrides the white backlight.

Overrange condition

During an error or overrange condition, the red backlight **overrides** the white backlight.

However, once the error or overrange condition is corrected, the white backlight is restored to its previous state (if the backlight **Auto Off** timeout did not expire).

Measurement units

A measurement unit doesn't display

NOTICE

If a given measurement unit cannot display the correct number of digits, the Smart Manometer automatically advances to the next displayable unit.

Note: When you turn on the Smart Manometer, it defaults to the last selected measurement unit.

Measurement units are stored on a sensor

The HHP400 Suite application gives you the ability to configure specific measurement units on specific sensors.

A total of 32 measurement units are available in HHP400 Suite. When the Smart Manometer is shipped, 12 measurement units are active. The 12 units appear in **bold type** in the following list.

Standard Measurement Units (non-custom)

1. PSI	12. CMW4C	23. KG/M2
2. INW20C	13. CMW60F	24. PA
3. INW4C	14. MW2OC	25. HPA
4. INW60F	15. MW4C	26. KPA
5. FTW2OC	16. MW60F	27. MPA
6. FTW4C	17. INHG0C	28. BAR
7. FTW60F	18. MGH0C	29. MBAR
8. MMW20C	19. CMGH0C	30. ATM
9. MMW4C	20. MMHG0C	31. OZ/IN2
10. MMW60F	21. TORR	32. LB/FT2
11. CMW2OC	22. KG/CM2	

Damping

Damping rate

*Select a **Time Constant**:* 1 second, 2 seconds, 4 seconds, 8 seconds, or 16 seconds.

- When set for 4 second time constant, it takes 4 seconds from the time of the step change until the Smart Manometer displays the full value of the new pressure.

Damping types

*Select a **Type**:* Exponential, Smart Quick, Smart Normal, or Smart Slow.

- Use adjustable **Exponential** type damping to steady the display when you measure pulsating pressure or flow.
- **Exponential** damping displays approximately 70 % of a step change in pressure at the next display update.

Data Logging

Review settings before starting a data log

To review the settings on the Smart Manometer before starting a new data log, follow these steps:

1. From the **Home** screen, press the **Backward** or **Forward** key until you see DATA LOG.
2. Press the **Information** key to view these seven settings:

Description	Information	Information
<i>VERS.</i>	PRO (optional)	LITE
<i>AVAIL.PTS</i>	maximum number of points 100 000	maximum number of points 240
<i>AVAIL.LOG</i>	maximum number of logs 128	maximum number of logs 1
<i>TYP.</i>	MEAS, AVG, AVG+PK, DEMAND	MEAS
<i>INTERVAL</i>	seconds are expressed in decimal points	seconds are expressed in decimal points
<i>PTS.CFG.</i>	100 (when time is configured, points is blank)	n/a
<i>TIME.CFG.</i>	----- (when points are configured, time is blank)	n/a

Starting a data log

1. From the Home screen, press the **Backward** or the **Forward** keys until you see *DATA LOG* on screen.
2. Press and hold the **Start** key until -- *STARTING* -- appears in the display. Data Logging continues for the defined time or the defined number of points.
3. *SNSR ERROR* - means one of the sensors reported an error after the test began. This will stop the Data Log. **Sensor Error** will appear in the Data Log Pro log.
4. While *DATA LOG* is running, you may press the **Information** key to see how much time is remaining for the active log.

Stopping a data log

To stop the Data Log at any point or at any time, press and hold the **Stop** key until -- *STOPPING* -- appears.

Leak Test

The Leak Test determines the leak rate in the system you are monitoring.

NOTICE

The timeout setting for **Auto Off** (Automatic Shut Off) is automatically suspended during a Leak Test session.

Review or change the LEAK TEST DURATION setting

Starting from the **Home** screen:

1. Press the **Backward** key to view the **Leak Test Duration** screen.
2. If you want to change the duration, follow the on-screen instructions *LEAK TEST DURATION TAP ✓ TO CHANGE*.



3. *TAP ✓* - Pressing the **Accept** key starts the first digit blinking.
4. Use the **Right Arrow** key to move the blinking cursor to the first zero you want to change.

Note: The on-screen scrolling message reminds you to enter a number from 0.1 - 1440 (1440 minutes is 24 hours).

5. Press the **Up Arrow** key until you see the number you need and continue to use the **Right Arrow** and **Up Arrow** keys until you have the total number of minutes you require.
6. You have three choices after entering minutes for duration:
 1. ✓ *SAVES* (the **Accept** key).
 2. X *CANCELS* (the **Cancel** key).
 3. □ *CLEAR5* to start over (the **Zero "0"** key).
7. After reviewing or changing these settings, press the **Backward** key to go to the screen to start the Leak Test.

Fix a RANGE ERR issue

1. The first zero digit is blinking.
2. Press the **Zero "0"** key to reset all numbers to zeros and enter a valid number of minutes from 0.1 - 1440.



Start the Leak Test

Starting from the **Home** screen:

1. Press the **Backward** key a second time if you do not want change the duration and *TAP START TO BEGIN*. (*START* is referring to the **Start** key).



2. The numbers blink to indicate when the test has stopped. This screen displays the results of the Leak Test with the calculated leak rate in units per minute.
3. After the test has stopped, press the **Forward** key to review the MIN value, and then the MAX value, and then you can select an *~ ~ 0.00 ~* option to exit the test by pressing either the **Cancel** or **Accept** keys.

Note: MIN is the minimum pressure measured during the test. MAX is the maximum pressure measure during the test.

*Note: Starting a Data Log is different than starting a Leak Test. Data Log requires pressing and holding the **Start** key until you see the word **Starting**. In a Leak Test press and release the **Start** key (the on-screen message refers to this action as *TAP*).*



Stop a Leak Test

It stops automatically when it counts down to zero

1. After the Leak Test counts down to zero, the digits begin to blink to indicate the Leak Test has stopped.
2. Press the **Forward** key to cycle through these options:
 1. *MIN*
 2. *MAX*
 3. *✓ OR X TO EXIT TEST*
3. Press the **Home** key to exit Leak Test.

Exit the test during the count down to zero

1. Press the **Cancel** key or the **Accept** key to exit the test.
2. Press the **Home** key to return to the Home screen.

Relief Valve Test

Starting the Relief Valve Test

To start the Relief Valve Test follow these steps:

1. Press the **Forward** key until you see *RELIEF VALVE TEST TAP START TO BEGIN*



2. *MAX TEST P* displays when the test begins. (MAX is the maximum pressure measured during the test.)
3. Press the **Forward** key to see *MIN TEST P* value. (MIN is the minimum pressure measured after reaching MAX and pressure starts releasing. If a new MAX is reached, MIN resets.)
4. Press the **Forward** key and you see *- - 0.00 -*.

Note: At this point, you see options available to you during the Relief Valve Test.

1. *✓ OR X TO EXIT TEST* (use either option to exit)



2. *0 TO RESET MIN + MAX* (the **Zero** key)



3. *STP-FREEZE* When you press the **Stop** key, *HOLD.ON* briefly appears and the current value remains on-screen blinking.



Press the **Zero** key and *HOLD.OFF* appears and new values continue to display.

5. Press the **Forward** key to see *MAX TEST P* value.

Stopping the Relief Valve Test

At any time during the test you may

1. Press the **Stop** key and the *HOLD ON* message appears. The digits continue to blink to indicate the hold status.
2. Press the **Zero** key to turn off the hold status and the *HOLD OFF* message appears. The test restarts.
3. Press the *✓ OR X* to exit the test. The results are lost when you use these keys.

Display information from two sensors

When you first turn on the Smart Manometer, you see the **Home** screen and only the internal sensor information displays.

- Press the **Up arrow** and external sensor information displays.
- Press the **Up arrow** again and information for both the internal and external sensors displays. The internal sensor displays in large characters while external sensor information displays in small characters.
- Press the **Up arrow** and *Diff P1-P2 scrolls* with P1 Units (internal measurement units).
- *Note: Differential displays are not available if either pressure sensor is a differential sensor or tethered sensor is a temperature sensor.*
- Press the **Left or Right arrow** and *Diff P2-P1 scrolls* with P2 units (external measurement units).
- Press the **Left or Right arrow** and *Diff P1-P2 scrolls* with P1 units (internal measurement units).
- Press the **Down arrow** to reverse the sequence.
- Press the **Home** key at any point to return to the **Home** screen.

Auto Off (Automatic shut off)

How long will the Smart Manometer remain on if I leave it unattended?

- The default setting is **Always On**.
- You can configure the timeout for the Auto Off with HHP400 Suite.

NOTICE

- The Auto Off timeout is suspended during **Data Logging** and **Leak Test sessions** to prevent accidental loss of data.
- Auto Shut-Off automatically restarts after Data Logging or Leak Test sessions stop.

What does the Zero (∅) key do?

In normal measure mode

If the sensor is within a tolerance band around zero, press and hold the **Zero** key to zero the pressure measurement and to reset the Min and Max measurements.

Note: The tolerance band is approximately $\pm 1\%$ of the FS pressure value of the sensor.

In Min or Max mode

Press and hold the **Zero** key to reset the MIN and MAX measurement. However, this does not zero the pressure measurement.

In Tare mode

When the Tare is off (T.OFF), press and hold the **Zero** key to turn on Tare (T.ON) and to set the Tare value at the current pressure measurement.

Likewise, when the Tare is on (T.ON), press and hold the **Zero** key to turn off the Tare mode.

In Average mode

Press and hold the **Zero** key to restart the rolling average.

Holding the Zero key

The key must be held to perform the Zero or Tare mode. The displayed value(s) dashes out during the zero or tare process.

HHP400 Suite application

How does HHP400 Suite benefit you?

Note: HHP400 Suite is not required to operate the HHP400.

- You can configure your Smart Manometer or sensor to display information the way your company needs to use it.
- You can configure data logging requirements and Data Log Pro.
- You can perform your own calibration.
- You can update the Smart Manometer in the field.

HHP400 Suite and USB Drivers required

First—Install HHP400 Suite

1. Download [HHP400 Suite](#).
2. Run the installer (setup.exe).
3. Follow the on-screen instructions to complete the installation.

Second—Install USB Drivers

1. Read the [USB Drivers Installation Instructions](#), on the **Downloads** page on www.Omega.com.
2. The instructions have links that you can click to download the required USB Driver.
3. Follow the on-screen instructions.

Tips for using HHP400 Suite

USB cable and your computer



For use only in non-hazardous locations (safe locations)

Connect the USB cable to your Smart Manometer and to your computer to configure any sensors you wish to include.



Use only the supplied USB cable when you connect to the USB port.

Close HHP400 Suite first, then turn off your Smart Manometer



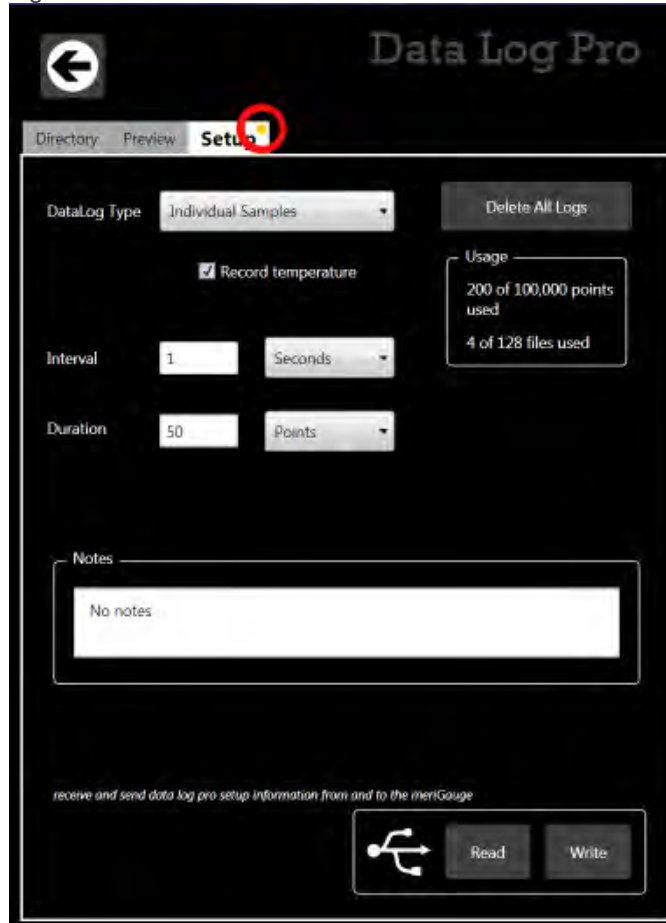
Do not turn off the power on the Smart Manometer while it is communicating with HHP400 Suite. The Smart Manometer displays dashes and the words *USB ACTIVE* while HHP400 Suite is communicating with a Smart Manometer or sensor.

- Close HHP400 Suite first, disconnect the USB, and turn off your Smart Manometer.
- As long as *USB ACTIVE* remains visible, Auto Off is suspended.

Watch for a yellow dot on an active tab

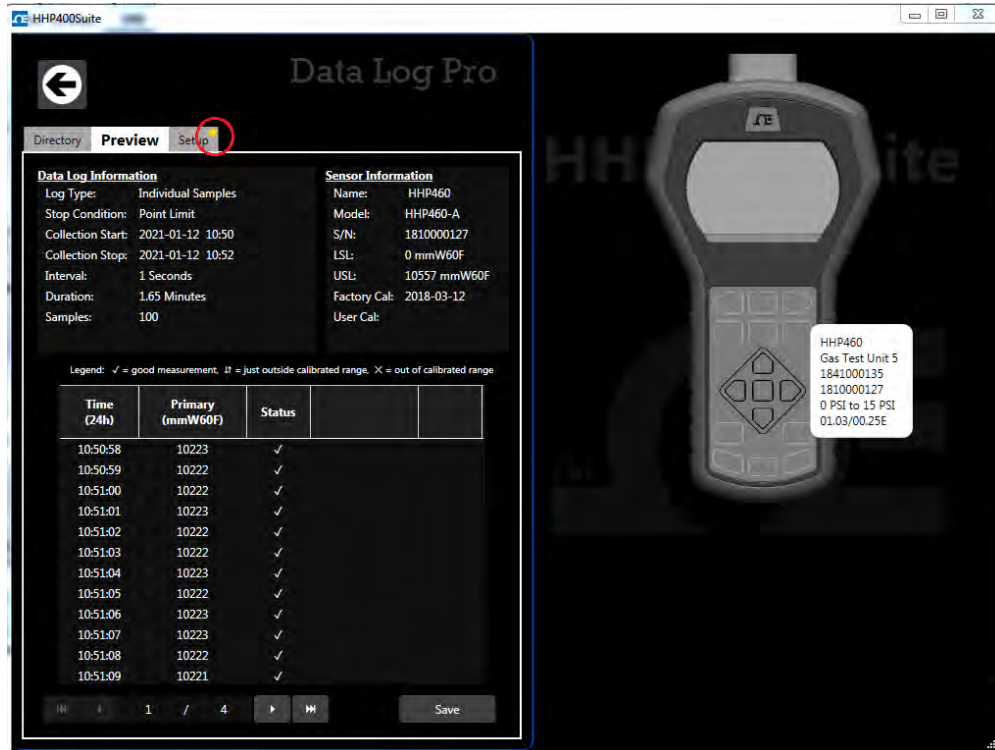
- A yellow dot appears on a tab in HHP400 Suite to indicate that you have made changes to settings but you have not saved them yet. See Figure 1 and Figure 2 below.
- You may click the **Write** button to save the changes you made.

Figure 1: Yellow dot on an active tab. See the red circle in the figure below.



Watch for a yellow dot on an inactive tab

Figure 2: Yellow dot on an inactive tab. See the red circle in the figure below.



Year-Month-Date format

- The HHP400 Suite application displays the date in year-month-day format.
- For example: 2016-04-22 (YYYY-MM-DD).

Hours:Minutes:Seconds format

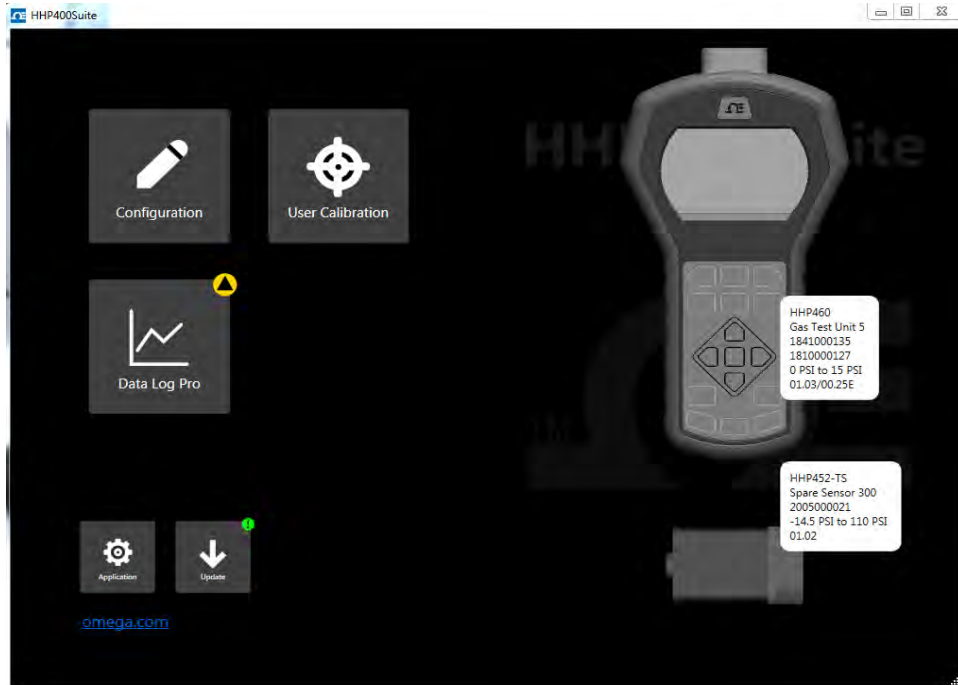
- The HHP400 Suite application displays the time in 24-hour format.
- You may choose from Time Zones:

Universal Coordinated Time (UTC)	US - Arizona -7:00
US - Eastern -5:00	US - Pacific-8:00
US - Central -6:00	US - Alaska -9:00
US - Mountain -7:00	US - Hawaii -10:00
- For example: 15:05:45 UTC (hours:minutes:seconds).

Connection status

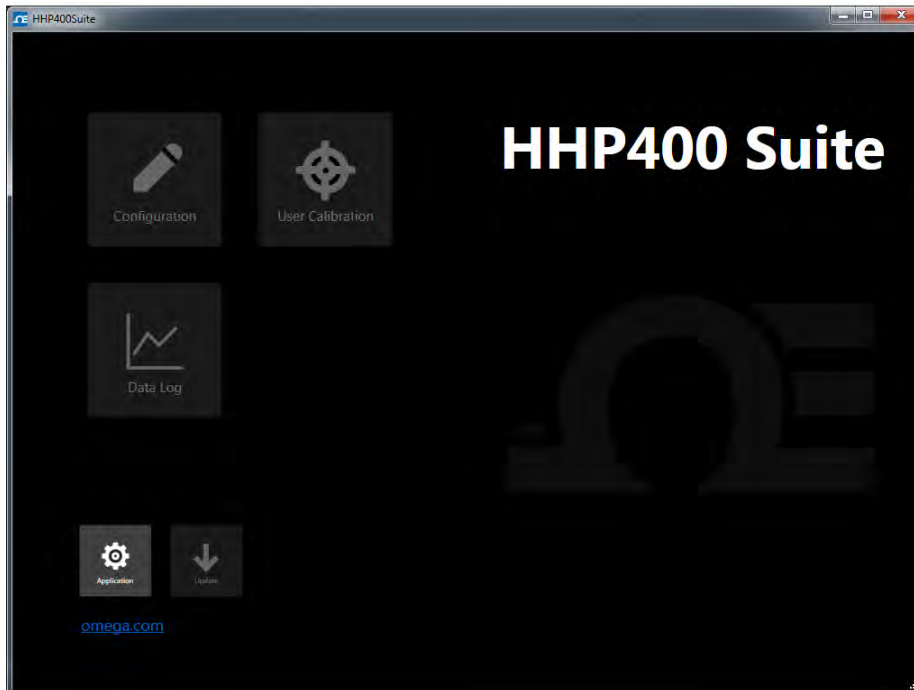
Attached devices

The HHP400 Suite application displays the figures of the Smart Manometer and tethered sensor. Descriptions appear alongside both of them. See the figure below.



No attached devices

The HHP400 Suite application displays no figure of devices on the right side. See the figure below.



No tethered sensor attached

Notice the figure of the Smart Manometer and description. See the figure below.



Configuration button

Overview of the Configuration button

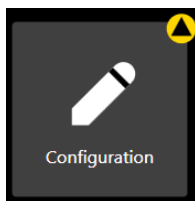


The **Configuration** button displays a window with two tabs if a tethered sensor is attached:

- The first tab displays the Smart Manometer name or the name you assigned to it.
- *Optional: this second tab displays the tethered sensor name or the name you assigned to it.*

Note: These tabs offer you various settings to configure the Smart Manometer and each sensor.

Notification about unsaved settings



It displays a **yellow alert icon** to indicate you have changed a setting and you have not yet saved the setting.

Passwords

Overview of passwords

Passwords are never required to use a Smart Manometer or any sensor.

- The passwords are turned off when the Smart Manometers and sensors are shipped.
- Each device can have its own unique 16-character password. You may use from 1-16 characters: letters, numbers, or symbols, and uppercase and lowercase.
- An internal sensor and a tethered sensor have their own separate passwords.
- Each device can have its password turned on or turned off independently from any other tethered sensor.
- HHP400 Suite retrieves the passwords stored on the devices.

HHP400 Suite uses the password

If you choose to select the **Password Required For Future Access**, then HHP400 Suite requests a password for the following actions:

- To modify a configuration.

Note: This action includes writing to or reading from a device.

- To update the firmware on a device or the application.
- To calibrate a device.
- To access the Setup tab of Data Log Pro.

HHP400 Suite remains unlocked

- Once HHP400 Suite accepts a password for one of those actions, the device remains unlocked until it is disconnected from HHP400 Suite.
- If you enter the password on one window, HHP400 Suite unlocks that Smart Manometer or sensor on its other windows as well.

Data Log Lite has no password

HHP400 Suite does not use a password for Data Log Lite since it cannot make any changes to the device.

Request a recovery password from Omega

Forgot the password for a device or sensor?

- If you forget a password, contact Omega to generate a recovery password for you to unlock the device.
- A recovery password disables the password until you create a new password.
- You must have the serial number of the device or sensor to request a recovery password.
- Call 1-800-826-6342 or send an e-mail to info@Omega.com.

Recovery password valid for one date

When you call Omega to generate a recovery password, you may select a date that is convenient for you. If you do not specify a date, the request date is used.

Common features for a Smart Manometer and sensor(s)

The Names field

You can assign your own company designations to each device.

As Left / As Found Configuration Report button

- You can review a summary of the configuration of the Smart Manometer or sensor when it is first connected and the changes you made.
- The **As Found / As Left Report** cannot report changes made in HHP400 Suite unless you save those new configurations to the device.

Read and Write Configurations

- **Read** and **Write** refer to reading configuration data from a Smart Manometer or sensor or writing new data to them.

NOTICE

Save your configuration changes before you click the **Read** button. After you click the **Read** button, all changes on-screen are replaced with the configuration that is on the device.

Configuring devices

Sync PC time to Gauge

- Click to update the Smart Manometer time and date with your computer.
- The LCD display and data logging use this time and date.

Timeouts

- Backlight.
- Auto Off (Automatic Off).

Display Functions

- Min/Max.
- Accuracy.
- Tare.
- Average.
- Rate of Change.
- Relief Valve Test.
- Time & Temp.
- Data Log.
- Allow zero adjust (Ø).
- Leak Test.

Configuring sensors

Enabled Units

Select or deselect measurement units to view them on the Smart Manometer. They are saved on each sensor.

- The **All** button selects all measurement units.
- The **None** button deselects all measurement units.
- You must select at least one unit before you can **Write** to the sensor.

Two User Defined Units

You can define the **Name**, **Multiplier**, **Offset**, and **Function** for two non-standard or unsupported display units.

Note: Flow type does not use Offset.

Note: $(\text{multiplier} \times \text{PSI}) + \text{Offset} = \text{the displayed value for linear type.}$

Damping

No settings on the Smart Manometer

You cannot set the Damp Rate on the Smart Manometer. You have to click the **Configuration** button in **HHP400 Suite** to change the Damp Rate.

Damping rate

Select a **Time Constant**: 1 second, 2 seconds, 4 seconds, 8 seconds, or 16 seconds.

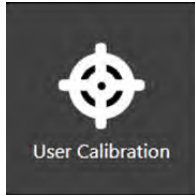
- When set for 4 second time constant, it takes 4 seconds from the time of the step change until the Smart Manometer displays the full value of the new pressure.

Damping types

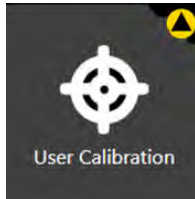
Select a **Damp Type**: Exponential, Smart Quick, Smart Normal, or Smart Slow.

- Use adjustable **Exponential** type damping to steady the display when you measure pulsating pressure or flow.
- **Exponential** damping displays approximately 70 % of a step change in pressure at the next display update.

User Calibration button



The **User Calibration** button displays options to calibrate the sensor.



The **User Calibration** button displays a **yellow alert icon** to indicate you have changed a setting and you have not yet saved the setting to the Smart Manometer.

User Calibration: For authorized personnel only

What does "Calibration Enabled" refer to?

- With a check mark in the box, Calibration Enabled displays the **Live Reading** with your current user calibration applied.
- Without a check mark in the box, it displays **Live Reading** without your user calibration.

Restore Factory Defaults

This button clears your user calibration from the sensor.

Choose Calibration Unit

- Select the calibration reference units.
- This does not affect or depend on the configuration units.

Begin button...Apply button

1. Click **Begin**.
2. Select the point.
3. Apply reference pressure within the range shown.
4. Enter the reference value.
5. Save the point.
6. Repeat steps 2-5 until you are done. (You have to change at least one point.)
7. Click the **Apply** button.

Customer calibration

You can calibrate the manometer in the field for

1. Zero.
2. Span.
3. Linearity.

The customer calibration does not 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, Omega recommends a ± 0.0015 % of reading deadweight tester. For sensors 200 psi and above, a ± 0.0030 % of reading deadweight tester is recommended. Note that AI type sensor requires absolute referenced deadweight testers or standards for field calibration. The options are:

1. 2-point (within upper 50 % of FS)
2. 5-point (nominal values of 0 %, 25 %, 50 %, 75 % and 100 % of FS).
3. Restore factory default calibration.

For the 5 Point 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.

The unit can only be calibrated if the calibration points are within 5 times the accuracy of the original factory calibration

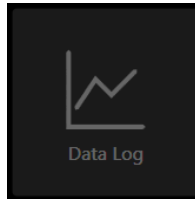
For example: at 0.05 % accuracy, the point limit is ± 0.25 % of FS.

If the calibration procedure generates a new value outside this limit the procedure fails. In this case the unit would need to be returned to the factory for service.

After a calibration has been performed (either 2-point or 5-point), the sensor uses only that calibration. To turn on another calibration type, you must first **Restore Factory Defaults** and then choose another calibration method.

Data Log button

Overview of Data Log buttons



Data logging displays three different buttons depending on what you order or on what you add-on at a later time.

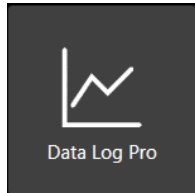
The **Data Log** button is always *unavailable* until the USB cable is attached to the computer with HHP400 Suite.

Data Log Lite



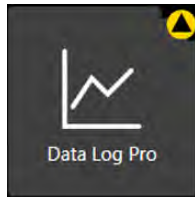
The **Data Log Lite** button displays when you attach a Smart Manometer. Data Log Lite is the free version of data logging. It has ***no options***.

Data Log Pro



The **Data Log Pro** button displays when Data Log Pro is activated on the Smart Manometer that is attached to HHP400 Suite.

Data Log Pro alert



The button displays a **yellow alert icon** to indicate you have changed a setting and you have not yet saved the setting to the Smart Manometer.

Data Log Lite

Preview tab

Preview the data log

The Preview tab displays the first 10 samples so you can confirm the data to save. If you have fewer than 10, it displays all of your samples.

Status and pressure for logs

The Status symbols for pressure and temperature.

The ✓ symbol corresponds to readings that are within the calibrated range.

- The ↓↑ and × symbols indicate an abnormal condition.
- The ↓↑ symbol indicates readable data.
- The × symbol indicates dashes and no readable data.

The Pressure

The pressure indicates the reading at each 15-second interval in the data set.

The Temperature

- The Omega Tethered Sensors displays when it is attached (pressure or temperature).
- Temperature displays *only* when the Omega Tethered Sensors RTD is attached.

TSV file format

Overview

Configuration, Data Log Lite, and Data Log Pro provide you with the option to save Configuration Reports and Data Log files in TSV file format.

Two ways to open TSV files

Double click a TSV file

Double click a TSV file in Windows Explorer and if it opens in a spreadsheet application, then you do not need to do anything additional.

Examples of spreadsheet applications: *Microsoft Excel, Google Sheets, and OpenOffice Calc.*

Drag and drop a TSV file into a spreadsheet

Drag and drop TSV files to open them. The following steps are similar for these spreadsheet applications: Microsoft Excel, OpenOffice Calc, and Google Sheets.

1. Open **File Explorer** (Windows 8 and 10). Keep File Explorer small enough to see Excel in the background.

Note: Depending on which version of Windows you have, File Explorer may be known as Windows Explorer, File Manager, or My Computer.

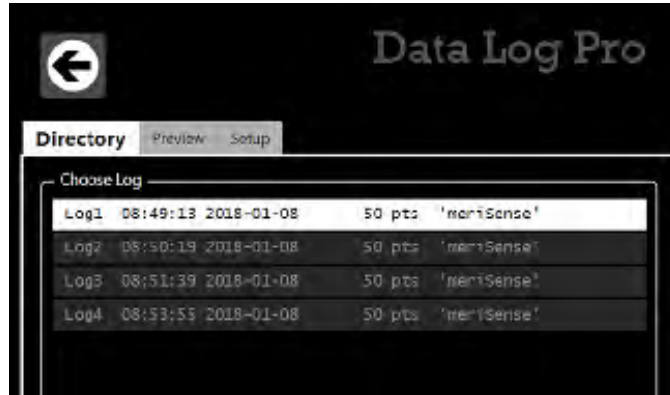
2. Open **Excel**. It can have a blank spreadsheet or an existing spreadsheet. Drag and drop creates a new spreadsheet.
3. Switch to **File Explorer** and navigate to the location where you saved the TSV file.
4. Select the file and drag-and-drop it in the middle of the blank spreadsheet.
5. Save it as an **Excel** file.

Directory tab

View the list of logs on the Smart Manometer

The **Directory** tab displays all the logs in the memory of the connected Smart Manometer. Two ways to open a log:

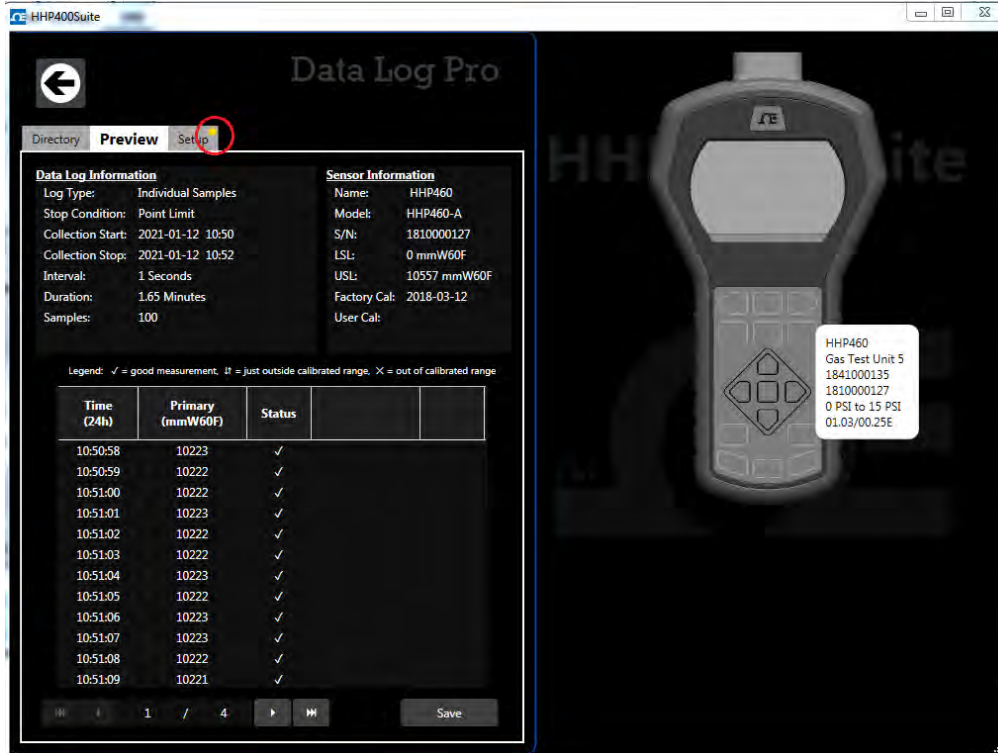
- Double click a log to open it in the **Preview** tab.
- Or, you may select a log from the list and click the **Preview** tab to view it.



Preview tab

Overview of the Preview tab

When you double click a log in the **Directory** tab, the **Preview** tab opens.



The Preview tab contains seven areas of information:

1. Data Log Information list.
2. Sensor Information list.
3. Notes.
4. Legend.
5. Samples table.
6. Navigation bar.
7. Save button.

Details about the Preview tab

1. Data Log Information list

A description of items in this list:

1. **Log type** indicates the type that was selected in the Setup tab when the log was created.
2. **Stop condition** indicates why the log stopped.

List of stop conditions: Manual Stop, Data Complete, Time Limit, Point Limit, Storage Limit, Low Power, Sensor Removed, PC Connection, or Sensor Error

3. **Collection Start** indicates the day and time the log began.
4. **Collection Stop** indicates the day and time the log ended.
5. **Interval** is how often data is saved but the interval does not display with the *On Demand* option.
6. **Duration** displays how long the log actually recorded data. This may or may not be the Duration you selected in the Setup tab. Check the Stop condition.
7. **Samples** indicate the number of readings in the log. They reflect how many data points were saved.

2. Sensor Information list

- All information in this list was retrieved from the internal sensor (and from an Omega Tethered Sensors if one was attached) at the time the Smart Manometer recorded this particular log.

3. Notes

- Any information that displays here comes from the text you enter in the **Notes** box in the Data Log Pro **Setup** tab.

4. Legend for the status columns

The samples table has two columns for Status. The legend provides three symbols to indicate the level of confidence for pressure or temperature measurements.

1. The ✓ symbol corresponds to readings that are within the calibrated range.
2. The ↓↑ and × symbols indicate an abnormal condition.
3. The ↓↑ symbol indicates readable data but it is out of range.
4. The × symbol indicates dashes on the Smart Manometer and no readable data.

6. Navigation bar

- This bar provides you with buttons to jump to the first log or to the last log.
- The bar also provides you with buttons to navigate to the previous log or next log.
- The numbers in the bar indicate which log out of the total number of logs on the Smart Manometer that you are currently viewing.

7. Save button

Click the **Save** button on the right side and the **Save As** box appears. You can save the file in two file formats:

- PDF.
- TSV.

Setup tab

Overview of the Setup tab

- The Setup tab lists parameters you may change. It gives you usage statistics and it displays three action buttons.
- A yellow dot appears on this tab after you changed a setting and have not saved it.

Parameter Choices

Four data logging types

1. **Individual Samples** refers to actual measurements taken at fixed intervals.
2. **Average only** refers to average measurements over the intervals you selected. It takes measurements every 200 ms.
3. **Average with peaks** refers to average measurements over the intervals you selected. It also saves the maximum and minimum measured values during the interval you saved. It takes measurements every 200 ms.
4. **On Demand** refers to manually recording actual measurements rather than at fixed intervals.

Interval types

You can select **Seconds**, **Minutes**, or **Hours** from a drop-down menu and enter a number.

Duration types

- You can select: **Minutes**, **Hours**, **Days**, **Forever**, or **Points** and enter a number.
- Selecting **Forever** makes the number box disappear.

*Note: **Forever** is limited by the remaining number of points on the Smart Manometer. Look for these numbers on the Usage box to the right of Interval.*

Notes edit box

Notes you enter in this edit box appear in the Preview tab, the TSV file, and the PDF file. This field is limited to 64 characters.

Usage statistics

Usage presents the amount of memory available on the Smart Manometer for data logging in two ways:

1. The number of data points used out of a maximum of 100 000.
2. The number of logs used out of a maximum of 128.

Delete All Logs

This button deletes all the logs on the Smart Manometer. This does not affect the files you saved to the computer in the **Preview** tab.

*Note: If the Smart Manometer has a password, then clicking this button requires you to enter a password. This password was created in the **Configuration** tab for a sensor.*

Read

NOTICE

Save your configuration changes before you click the **Read** button. After you click this button, all changes on-screen are replaced with the configuration that is on the Smart Manometer.

*Note: If the Smart Manometer has a password, then clicking this button requires you to enter a password. This password was created in the **Configuration** tab for internal sensor.*

Press this button, Data Log Pro reads the parameters from the Smart Manometer and displays them in the **Setup** tab.

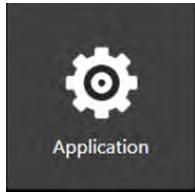
Write

This button remains unavailable until you make a change in the **Setup** tab. It saves the new setup parameters to the Smart Manometer and overwrites the parameters stored on the Smart Manometer.

*Note: If a sensor has a password, then clicking this button requires you to enter a password. This password was created in the **Configuration** tab.*

Application button

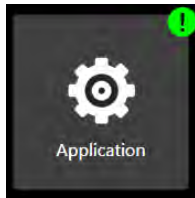
Overview



The Application button displays a window with three sections about the **HHP400 Suite** application:

- About.
- Available Update.
- Language Selection.

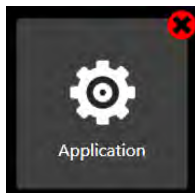
Application notifies you of available updates



It displays a green alert icon with an exclamation mark to indicate an *Available Update*. After clicking this button, it displays the following message:

*"PLEASE BE ADVISED! If you choose to install the update at this time, you will lose unsaved configuration information or data log setup changes. Be sure to save that information to a file or **Write** it to the connected device."*

Application notifies you of no internet connection

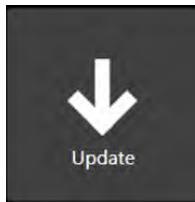


It displays a red alert icon with an "x" to indicate:

"There is no connection to the update server. This is usually caused by the PC not having internet connectivity or the server may be temporarily unavailable."

Update button

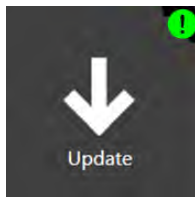
Overview



The **Update** button displays a window with multiple sections:

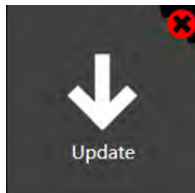
- The **first** section alerts you to updates for the sensor and the Smart Manometer.
- The **second** section alerts you to updates for **each** sensor that you attach to the Smart Manometer.

Update notifies you of available updates



It displays a **green alert icon** to indicate an update is available for the firmware in the sensor or the Smart Manometer.

Update notifies you that you have no internet connection



It displays a **red alert icon** to indicate:

“There is no connection to the update server. This is usually caused by the PC not having internet connectivity or the server may be temporarily unavailable.”

Omega Tethered Sensors: type and range

Omega Tethered Sensors

<i>Model number</i>	<i>Pressure range</i>		
Absolute Isolated (AI)			
HHP460-A	0 psi	to	15 psi
HHP460-B	0 psi	to	30 psi

Omega Tethered Sensors: type and range

Omega Tethered Sensors

Model number	Pressure range		
Differential Non-Isolated (DI)			
HHP452-A-TS	-1 psi	to	1 psi
HHP452-B-TS	-5 psi	to	5 psi
HHP452-K-TS	-14.5 psi	to	15 psi
HHP452-L-TS	-14.5 psi	to	50 psi
HHP452-C-TS	-14.5 psi	to	100 psi
Compound Isolated (CI)			
HHP452-D-TS	-14.5 psi	to	15 psi
HHP452-T-TS	-14.5 psi	to	30 psi
HHP452-U-TS	-14.5 psi	to	50 psi
HHP452-V-TS	-14.5 psi	to	100 psi
HHP452-W-TS	-14.5 psi	to	300 psi
HHP452-X-TS	-14.5 psi	to	500 psi
HHP452-Y-TS	-14.5 psi	to	1000 psi
HHP452-Z-TS	-14.5 psi	to	3000 psi
Absolute Isolated (AI)			
HHP452-Q-TS	0 psi	to	15 psi
HHP452-I-TS	0 psi	to	30 psi
HHP452-R-TS	0 psi	to	100 psi

Pressure measurements

- Accuracy Specification
- $\pm (0.02 \% \text{ of FS} + 0.005 \% \text{ of Rdg})$ from 0% to 110% of FS.
- For Compound sensors only:
 - Vacuum $\pm (0.02 \% \text{ of FS})$
 - Vacuum = -14.5 psi
- Accuracy statements include the combined effects of linearity, repeatability, hysteresis, and temperature over the specified operating temperature range.
- Warm up time: 5 minutes.
- You should zero the sensor at working ambient temperature before using it.

Overrange limit

- Overage pressure or temperature means the value is outside the calibrated upper or lower range.
- Above 100 %, the red backlight turns on automatically.
- Above 120 %, the red backlight turns on and displays OVER RANGE in place of pressure reading.

Temperature

- Storage: -20 °C to 70 °C (-4 °F to 158 °F)
- Operating: -10 °C to 50 °C (14 °F to 122 °F)

Relative Humidity

- 95 % non-condensing.

Vibration

- 1 meter drop test.

Ingress specifications

- IP52 for the HHP400.
- IP54 for the Omega Tethered Sensors.

Altitude specifications

Altitude MIN and MAX display values

- -2000.0 ft to 36 000.0 ft.
- -609.6 m to 10 972.8 m.

Indicated Air Speed specifications

Indicated Air Speed MIN and MAX display values

- 0 knots to 660 knots.
- 0 mph to 760 mph.
- 0 km/h to 1223 km/h.

Note: The barometric pressure value is captured when IAS MPH (KNOTS or KM/H) appears on screen. It determines the maximum indicated air speed.

Keypad

- Sealed membrane 16 domes.

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 316LSS and Viton O-rings
- **CI, AI:** Compound or Absolute pressure sensors for use with gases and liquids compatible with 316LSS

Pressure Limits

- **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.

Battery Type

- 4 AA alkaline batteries of the same battery type.

EMC compliance



Conformity to EN 61326-1:2016

This product has been evaluated to EN 61326-1:2016 the EMC General requirements for electrical equipment for measurement, control and laboratory use. This evaluation demonstrated that when the product is exposed to Radiated Radio Frequency energy in the frequency range 130-1000 MHz and 1.6-2.1 GHz, the pressure and temperature readings may fluctuate beyond the published tolerance of each respective value being measured. In the event of such a phenomenon occurring, the operator should move away from (or have removed) any source of strong RF emissions such as radio transmitters, cell-phones, etc., and repeat the measurement, or reconnect to a PC.

Electrostatic discharge (ESD)

This unit is sensitive to ESD discharges that may result in the unit re-starting of the operating system, or interruption of a PC connection. In the unlikely event of such an occurrence, users should ensure they discharge any static charge they may be carrying by touching a known grounded conductive surface prior to operating the equipment .

Dimensional specifications

Weight

- Smart Manometer: 1000 g (35.2 oz. or 2.2 lb.)
- Omega Tethered Sensors pressure module: 148 g or 0.33 lb.

Enclosure

Polycarbonate / ABS alloy.

Maintenance and cleaning

Cleaning

- Clean the Omega Tethered Sensors and its cable with a soft, damp cloth.

Prepare the Smart Manometer for storage

Remove the batteries to store the Smart Manometer

- We recommend that you remove the batteries from the Smart Manometer if you are storing it for an extended time period.
- Follow the battery manufacturer's instructions for storing your batteries.

Store the Smart Manometer

- The recommended storage temperature for the Smart Manometer is between: $-20\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$ ($-4\text{ }^{\circ}\text{F}$ to $158\text{ }^{\circ}\text{F}$).

Register your product

We want you to get the most out of your purchase, and that starts with a few, easy registration steps.

1. Go to www.Omega.com
2. In the **Product Registration** section, click **Register a product**.

Find downloads and documents

1. Go to www.Omega.com.
2. In the **Technical Resources** section, click **Learn More**.
3. Select one of these categories to find the files you need:

Product manuals | *User Manuals and Quick Start Guides*

Downloads | *Applications (software), firmware, updates, installation instructions*

Certifications | *Certifications and approvals*

SDS (MSDS) | *Safety Data Sheets*

Control Drawings | *Intrinsically Safe Drawings*

Help

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

First — Request a number

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

Method	Provide the following information
Website	http://www.omega.com Complete the information online and submit the form.
Fax	If you printed and completed the Service & Repair Authorization form, then fax it to: US and International Customers 1-800-826-6342
Email	We need the following information in the email: <ul style="list-style-type: none"> ▪ Look on the product label to find the model number & the serial number. ▪ Give a brief description of the problem. ▪ Send the e-mail to: info@omega.com

Return Material Authorization

- Do not send any unit for repair unless you contacted Meriam for a Return Material Authorization (RMA) number.
- Important: If you have not received this number and have not clearly marked it on the package being shipped back, we will return the unit at your expense.
- The Meriam Service & Repair Department will provide you with this number when you complete the website form, fax or e-mail your information.
- An RMA number must accompany all incoming packages to insure proper tracking, processing, and repair work.

Questions? Contact Omega

Call (800) 826-6343

Email..... info@omega.com