

Vacuum Calibrator

CPG2500





Warning

This Warning symbol indicates that danger of injury for persons and the environment and/or considerable damage (mortal danger, danger of injury) will occur if the respective safety precautions are not taken.



Caution

This Caution symbol indicates danger for the system and material if the respective safety precautions are not taken.



Notice

This Notice symbol does not indicate safety notices but information for a better understanding of the facts.

Table of Contents

1. General Information	6
1.1 Warranty	6
1.2 Important Notice	6
1.3 FCC Radio Frequency Emission Notice	6
1.4 Trademarks and Copyrights	7
1.5 Software License Agreement	7
1.6 Mensor Service Plus	7
1.6.1 After the Warranty	7
1.6.2 Calibration Services	7
1.6.3 Certifications and Accreditations	7
1.7 Packaging for Shipment	7
2. Safety	9
2.1 User Responsibilities	9
2.2 General Safety Notices	9
2.3 Warnings and Caution Notices	10
3. General Description	11
3.1 Features	11
3.2 Turning On	12
3.3 Front Panel	12
3.4 Display	13
3.5 Chassis Assembly	13
4. Specifications	14
4.1 Transducer Specification	14
4.1.1 Measurement & General Specifications	14
5. Installation	16
5.1 Unpacking the Instrument	16
5.2 Dimensions (inches)	17
5.3 Mounting	18
5.4 Rear Panel	18
5.4.1 Pressure/Vacuum Port	18
5.5 Remote Communication Connections	19
5.5.1 Remote Transducer Port	19
5.6 Power Up	19
5.7 Vacuum Pump Accessory Kit Connections	19
6. Local Operation and Setup	21
6.1 General Operation	21
6.1.1 Setup Applications	21

6.1.2	Display Screen Features	21
6.2	Initial Setup	22
6.2.1	Contact and Version Information Application	22
6.2.2	Language Selection	22
6.3	Application Selection and parameter inputs	23
6.4	Applications:	24
6.4.1	Measure Application	24
6.4.1.1	Auxiliary Displays	25
6.4.1.2	Zero Button	25
6.4.2	Settings Application	27
6.4.2.1	Languages	27
6.4.2.2	Brightness	28
6.4.2.3	Volume	28
6.4.2.4	User base units / Base units multiplier	29
6.4.2.5	Barometer Units	29
6.4.2.6	Configuration	29
6.4.3	Transducer Application	31
6.4.3.1	Transducer Filter	31
6.4.3.2	Transducer Resolution	32
6.4.3.3	Auxiliary Displays	33
6.4.4	Remote Application	34
6.4.4.1	Remote Command Set	34
6.4.4.2	Remote Communication Settings	35
6.4.5	Info Application	36
6.4.6	Leak Test Application	37
6.4.7	Troubleshooting Application	37
6.4.8	Logging Application	38
6.4.8.1	Remote Logging	38
6.4.8.2	Pressure Logging	39
6.4.9	Service Application	40
6.4.10	Unlocked Service Application	41
7.	Remote Operation	42
7.1	Command Set	42
7.2	IEEE-488	42
7.2.1	IEEE-488.2 Commands	42
7.3	Ethernet	43
7.4	Serial	44
7.4.1	Serial Cable Requirements	44

7.5	Mensor Command Set	45
7.6	Command and Query Format	45
7.7	Command Set Definitions	45
7.8	Output Formats	46
7.9	CPG2500 Commands and Queries	46
7.9.1	Units Command Syntax for Measurement Units	52
7.9.2	CPG2500 Error Codes	53
7.9.3	GPIB Capability Codes	53
7.9.4	Interface Functions	53
8.	Accessories	54
8.1	External Pressure Sensor Connection Cable	54
8.2	Vacuum Pump Accessory Kit	54
9.	Maintenance	55
9.1	Beyond the Warranty	55
10.	Calibration	56
10.1	Environment	56
10.2	Pressure Standards	56
10.3	Media	56
10.4	Service Application	57
10.4.1	Service Application (unlocked)	58
10.5	Calibration Data	59
10.6	One Point Cal Application	59
10.7	Two Point Cal Application	59
10.8	Linearization	60
10.9	Head Pressure	61
11.	Appendix	62
11.1	Conversion Factors, PSI	63
11.2	Conversion Factors, Millitorr	64
11.3	Conversion Factors, Pascal	66

1 General Information

1.1 Warranty

All products manufactured by Mensor are warranted to be free of defects in workmanship and materials for a period of two years from the date of shipment. No other express warranty is given, and no affirmation of Seller, by words or actions, shall constitute a warranty. SELLER DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSES WHATSOEVER. If any defect in workmanship or material should develop under conditions of normal use and service within the warranty period, repairs will be made at no charge to the original purchaser, upon delivery of the product(s) to the factory, shipping charges prepaid. If inspection by Mensor or its authorized representative reveals that the product was damaged by accident, alteration, misuse, abuse, faulty installation or other causes beyond the control of Mensor, this warranty does not apply. The judgment of Mensor will be final as to all matters concerning condition of the product, the cause and nature of a defect, and the necessity or manner of repair. Service, repairs or disassembly of the product in any manner, performed without specific factory permission, voids this warranty.

MENSOR MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MANUAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Mensor shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

1.2 Important Notice

The product specifications and other information contained in this manual are subject to change without notice.

Mensor has made a concerted effort to provide complete and current information for the proper use of the equipment. If there are questions regarding this manual or the proper use of the equipment, contact Mensor at:

Mensor
201 Barnes Drive
San Marcos, Tx 78666
Tel: 1.512.396.4200
1.800.984.4200 (USA only)
web site: www.mensor.com
fax: 512.396.1820
e-mail: sales@mensor.com
tech.support@mensor.com

WIKA Alexander Wiegand SE & Co. KG
Alexander-Wiegand-Straße 30
D-63911 Klingenberg / Germany
Tel: (+49) 93 72/132-9986
web site: www.wika.de
fax: (+49) 93 72/132-8767
e-mail: testequip@wika.de

1.3 FCC Radio Frequency Emission Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

USE SHIELDED CABLES TO CONNECT EXTERNAL DEVICES TO THIS INSTRUMENT TO MINIMIZE RF RADIATION.

1.4 Trademarks and Copyrights

Mensor is a registered trademark of Mensor, LP. All other brand and product names are trademarks or registered trademarks of their respective companies. ©2007, Mensor, LP. All rights reserved.

1.5 Software License Agreement

This product contains intellectual property, i.e., software programs, that are licensed for use by the end user/customer (hereinafter “end user”).

This is not a sale of such intellectual property.

The end user shall not copy, disassemble or reverse compile the software program.



Notice

The software programs are provided to the end user “as is” without warranty of any kind, either express or implied, including, but not limited to, warranties of merchantability and fitness for a particular purpose. The entire risk of the quality and performance of the software program is with the end user.

Mensor and its suppliers shall not be held to any liability for any damages suffered or incurred by the end user (including, but not limited to, general, special, consequential or incidental damages including damages for loss of business profits, business interruption, loss of business information and the like), arising from or in connection with the delivery, use or performance of the software program.

1.6 Mensor Service Plus

If you have problems and you don't find the answer in this manual, contact Mensor at 1.800.984.4200 (USA only) or 1.512.396.4200 for personal assistance, or at any of the contact addresses listed on the rear cover of this manual. We are ready to help.

1.6.1 After the Warranty

Mensor's concern with the performance of this instrument is not limited to the warranty period. We provide complete repair, calibration and certification services after the warranty for a nominal fee.

1.6.2 Calibration Services

In addition to servicing our own products Mensor can perform a complete pressure calibration service, up to 30,000 psi, for all of your pressure instruments. This service includes an accredited calibration.

1.6.3 Certifications and Accreditations

Mensor is registered to ISO 9001:2015. The calibration program at Mensor is accredited by A2LA, as complying with both the ISO/IEC 17025:2017 and the ANSI/NCSL Z540-1-1994 standards.

1.7 Packaging for Shipment

If the product must be shipped to a different location or returned to Mensor for any reason through a common carrier it must be packaged properly to minimize the risk of damage.

The recommended method of packing is to place the instrument in a container, surrounded on all sides with at least four inches of shock attenuation material such as styrofoam peanuts.

Strictly observe the following when shipping the instrument:

All instruments delivered to WIKA or Mensor must be free from any kind of hazardous substances (acids, bases, solutions, etc.) and must be cleaned before being returned.

Vacuum Calibrator CPG2500



WARNING!

Physical injuries and damage to property and the environment through residual media
Residual media in the dismantled instrument can result in a risk to persons, the environment and equipment.
With hazardous substances, include the material safety data sheet for the corresponding medium.

When returning the instrument, use the original packaging or a suitable transport packaging.

To avoid damage:

Wrap the instrument in an anti-static plastic film.

Place the instrument along with shock-absorbent material in the packaging.

Place shock-absorbent material evenly on all sides of the transport packaging.

If possible, place a bag containing a desiccant inside the packaging.

Label the shipment as a highly sensitive measuring instrument.

Instruments with lithium ion rechargeable batteries or lithium metal batteries

The included lithium ion rechargeable batteries or lithium metal batteries are subject to the requirements of the dangerous Goods Act. For shipping, special packaging and labelling requirements must be observed. A dangerous goods expert must be consulted when preparing the item to be shipped. Do not send any damaged or defective rechargeable batteries. Cover open contacts with adhesive tape and package the rechargeable battery such that it cannot move inside the package and short circuits are prevented. The different requirements of the relevant transport carriers as regard to the Dangerous Goods Act and also additional national regulations must be observed.



Information on returns can be found under the heading "Service" on our local website.

2 Safety

2.1 User Responsibilities

To ensure safety, the user must make sure that:

- The system is used properly, no dangerous media are used and that all technical specifications are observed.
- The system is operated in perfect operating condition.
- This operation manual is legible and accessible to the user at the system's location.
- The system is operated, serviced and repaired only by authorized and qualified personnel.
- The operator receives instruction on industrial safety and environmental protection, and is knowledgeable of the operating instructions and the safety notices contained therein.

2.2 General Safety Notices



Notice

The system should only be operated by trained personnel who are familiar with this manual and the operation of the instrument.



Warning

WARNING: A condition for trouble-free and safe operation of this system is proper transport, proper storage, installation, assembly and proper use as well as careful operation and maintenance.

Any operation not described in the following instructions should be prohibited. The system must be handled with care required for an electronic precision instrument (protect from humidity, impacts, strong magnetic fields, static electricity and extreme temperatures). Do not insert any objects into the instrument.

The system is powered via the power cable with a voltage that can cause physical injury. Even after disconnecting the system from the power supply, dangerous voltages can temporarily occur due to capacitance.

Extreme care must be taken with pressure connections when using hazardous or toxic media.

Repairs must only be performed by authorized service personnel.



Notice

Additional safety notices are found throughout this manual.

2.3 Warnings and Caution Notices



Warning

WARNING: NOT EXPLOSION PROOF! Installation of this instrument in an area requiring devices rated as intrinsically safe is not recommended.



Warning

WARNING: POSSIBLE INJURY! The tubing, valves, and other apparatus attached to the gauge must be adequate for the maximum pressure which will be applied, otherwise physical injury to the operator or bystanders is possible.



Caution

CAUTION: USE THE PROPER PRESSURE MEDIUM! Use only clean, dry, non-corrosive gases unless otherwise specified by Mensor. This instrument is not designed for oxygen use.



Caution

CAUTION: As with most sensitive electronic equipment, switch the power switch off before connecting or disconnecting to a power source to prevent data loss. Do not position the equipment so that it is difficult to disconnect the DC power jack.



CAUTION: ESD PROTECTION REQUIRED. The proper use of grounded work surfaces and personal wrist straps are required when coming into contact with exposed circuits (printed circuit boards) to prevent static discharge to sensitive electronic components.

Additional Warning and Caution notices are found throughout this manual.

3 General Description

The CPG2500 Vacuum Calibrator is a precision vacuum indicator and calibrator designed to test and calibrate absolute pressure transducers and indicators. The CPG2500 has a precision vacuum transducer capable of measuring vacuum pressure with 1 mTorr accuracy.



Figure 3.1 - CPG2500 Vacuum Calibrator

3.1 Features

Here is a short list of significant features designed into the CPG2500:


- One internal highly stable vacuum transducer, connection for device under test through RS-232 port.
- Storage of calibration data for up to 32 device under tests.
- Automatic detection of device information upon connection.
- 7" Color LCD with touch screen with dual display for vacuum transducer and device under test.
- One button Zero function when a DUT is installed
- Multiple languages; change the language for on-screen text and number/date formats by simply touching one of the "national flag" icons available in the setup screen.
- Local Operation, or command and read remotely through RS-232, USB, Ethernet and IEEE-488.

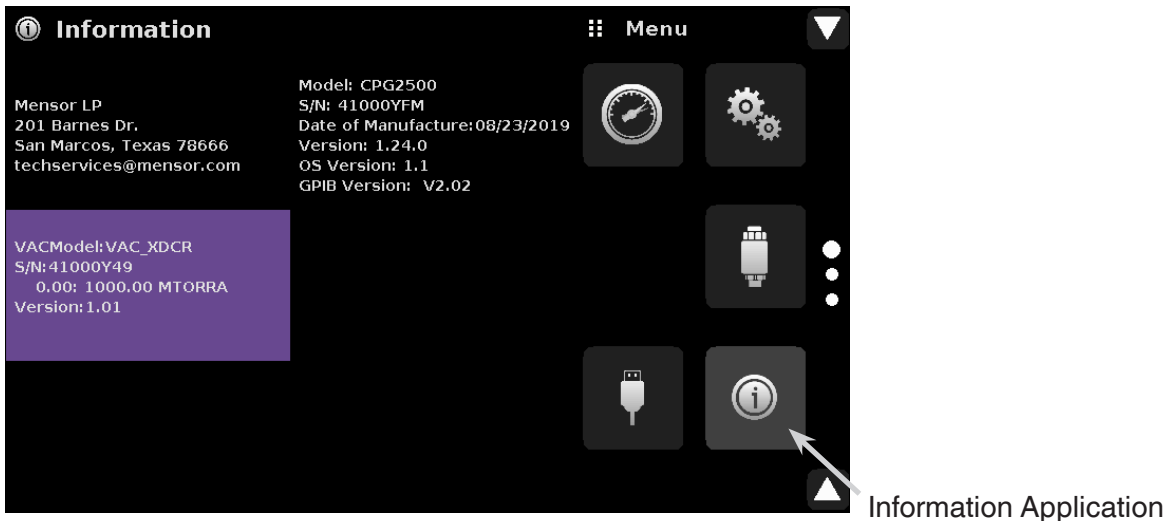
Vacuum Calibrator CPG2500

3.2 Turning On

You can confirm that your CPG2500 is operational right now. Apply power to the power connector on the rear of the instrument with the included power adapter, remove any plastic plugs from the rear panel pressure ports, and press the power switch to ON. The system will go through an initialization process, which takes about 45 seconds, and then a display will appear similar to the screen shown below.



To see information about the configuration of your new CPG2500, touch the Information Application (App) icon on the menu and a window will appear listing the Mensor customer service contact, model number and the internal transducer that are installed. Press the Measure App [] to return to the main screen.

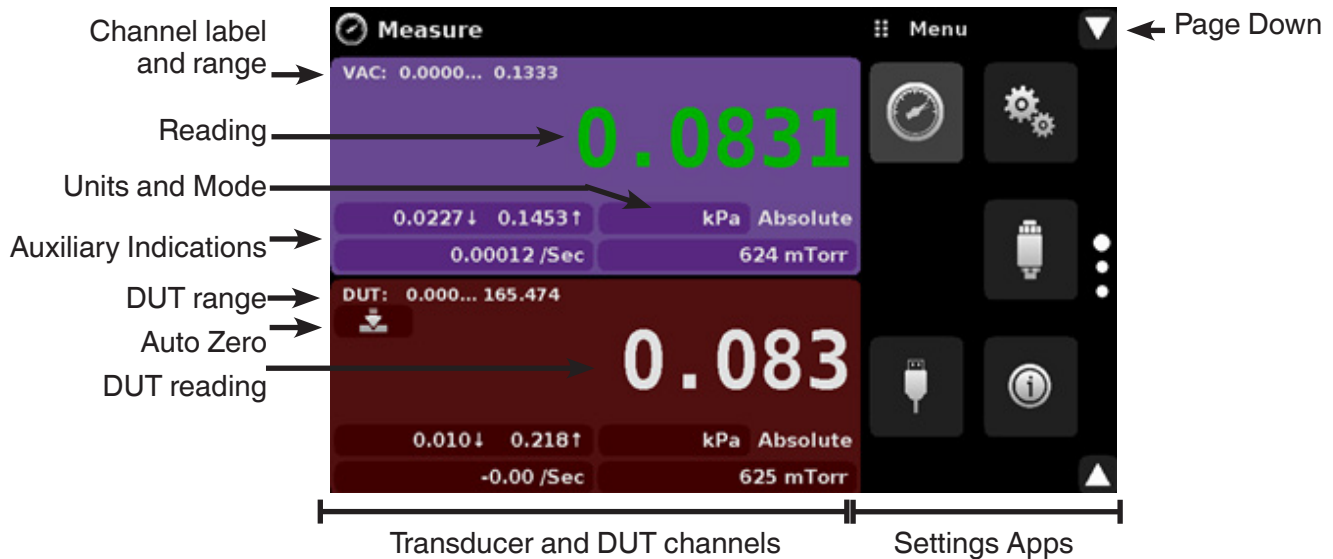


3.3 Front Panel

The CPG2500 front panel includes a 7" color LCD with touch screen. Operator input is accomplished by pressing the words or App icons presented on the display. There is a single discrete on/off button and a USB on the right hand side. The front panel also shows the model number designation and brand logos.

3.4 Display

The display is made up of two sections. In the main screen (“Measure Application”), the left two thirds shows the internal and DUT channels, along with the pressure reading, units, mode (absolute), channel label, an auto zero button (only on DUT channel) and any auxiliary indications that have been chosen. The right one third of the screen has Application Icons (“Apps”) for setting viewing options, sensor settings, communication settings plus a “Page Down” button [▼] that, when pressed, shows a second and third page of icons for calibration, remote communication and error checking.



Buttons, Labels and Windows: The CPG2500 touch screen has many buttons with relevant graphic icons or text which, when pressed, will open a related window where changes can be made or information viewed. Some of these buttons will toggle from one state to another, others present choices or display a numerical data entry screen. Text or icons that are displayed, but do not respond to being touched, are called labels or windows. Operators will quickly become accustomed to the particular characteristics of the frequently used buttons.

Main Screen: The main screen or “Measure Application”, appears after power-up. This screen contains the channel frames and settings button. It will remain as configured after a power cycle.

Transducer/DUT Channel Frame(s): The transducer channel frames (left 2/3 of the screen) contain information specific to a channel. The channel frames are color coded with internal vacuum channel - lavender and remote DUT channel - red. The channel frame contains the pressure reading, units, and mode(absolute) plus any auxiliary displays that have been chosen.

3.5 Chassis Assembly

The chassis assembly is the housing for the system and the internal transducer. The system has no user-serviceable parts, and therefore the chassis should not be opened except by qualified repair personnel at Mensor or certified service locations for any reason except to change the removable transducers.

4 Specifications

Accuracy specifications presented herein are obtained by comparison with primary standards traceable to a national metrology institute or recognized international standard organization. These specifications are obtained in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). The calibration program at Mensor is accredited by the American Association of Laboratory Accreditation (A2LA) as complying with both the ISO/IEC 17025:2017 and the ANSI/NCSL Z540-1-1994 standards. If there is an exception to the requirements and recommendations of Z540 during a calibration the exception is noted on the individual calibration certificate.

Mensor reserves the right to change specifications without notice.

4.1 Transducer Specification

Vacuum Transducer

Accuracy ⁽¹⁾	4 mTorr or less
Pressure range	100 ... 1,000 mTorr
Pressure type	Absolute
Calibration interval	365 days
Pressure media	Clean dry air or Nitrogen (ISO 8573-1:2010 class 5.5.4 or better)
Reading rate	33 readings/second
Calibration orientation	Horizontal

⁽¹⁾ It is defined by the total measurement uncertainty, with the coverage factor ($k = 2$) and includes the intrinsic performance of the instrument, the measurement uncertainty of the reference instrument, long-term stability, influence of ambient conditions, drift and temperature effects over the compensated range.

4.1.1 Measurement & General Specifications

Basic Instrument

Instrument

Instrument version	Table top with tilt feet
Dimensions	See technical drawing
Weight	12.5 lbs./ 5.7 kg (with all internal options)
Warm-up time	Approximately 15 minutes

Display

Screen	7" color LCD
Resolution	Selectable from 4 to 7 digits
Data entry	Touch screen keypad
Languages	English, German, Spanish, French, Italian, Portuguese, Polish, Russian, Chinese, Japanese, Korean

Connections

Pressure connection	1/4" NPT female
Pressure adaptors	Standard: 1/4" NPT male to 8 mm tube adaptor
Overpressure limits	4 psi max

Voltage supply

Power input requirements	AC 100 ... 120 V, 50/60 Hz; AC 220 ... 240 V, 50/60 Hz
--------------------------	--

Switching power supply	Output: 12 VDC, 1.7 A (includes 4 region specific plugs adapters)
------------------------	---

Permissible ambient conditions

Storage temperature range	0 to 70 deg C
Operating environment	0 ... 95 % RH (relative humidity, non-condensing)
Operating temperature range	15 ... 40 deg C

Communications

Remote interface	IEEE 488, RS-232, USB and Ethernet
Communication to DUT	RS-232 through Remote Transducer port
Command sets	Mensor

Optional Vacuum Pump

Flow rate	6 CFM
Max Vacuum	10 micron
Power input requirements	AC 100 ... 120 V, 50/60 Hz; AC 220 ... 240 V, 50/60 Hz
Stages	Two

CE conformity and certificates

CE compliance	EN61326-1:2013 electromagnetic compliance EN61010-1:2010 safety/CB scheme
RoHS directive	2011/65/EU, article 4
Calibration	Calibration certificate per ISO/IEC 17025:2017. Accreditation is by the American Association for Laboratory Accreditation (A2LA).

5 Installation

5.1 Unpacking the Instrument

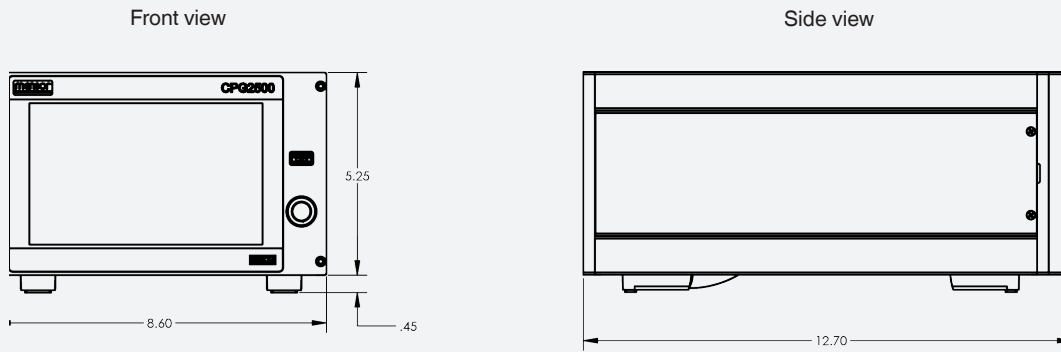
In addition to functional testing, each unit is inspected for appearance prior to leaving the factory. Upon receipt, please examine the instrument for shipping damage. Report any apparent damage to the carrier immediately.

In addition to this manual you should have:

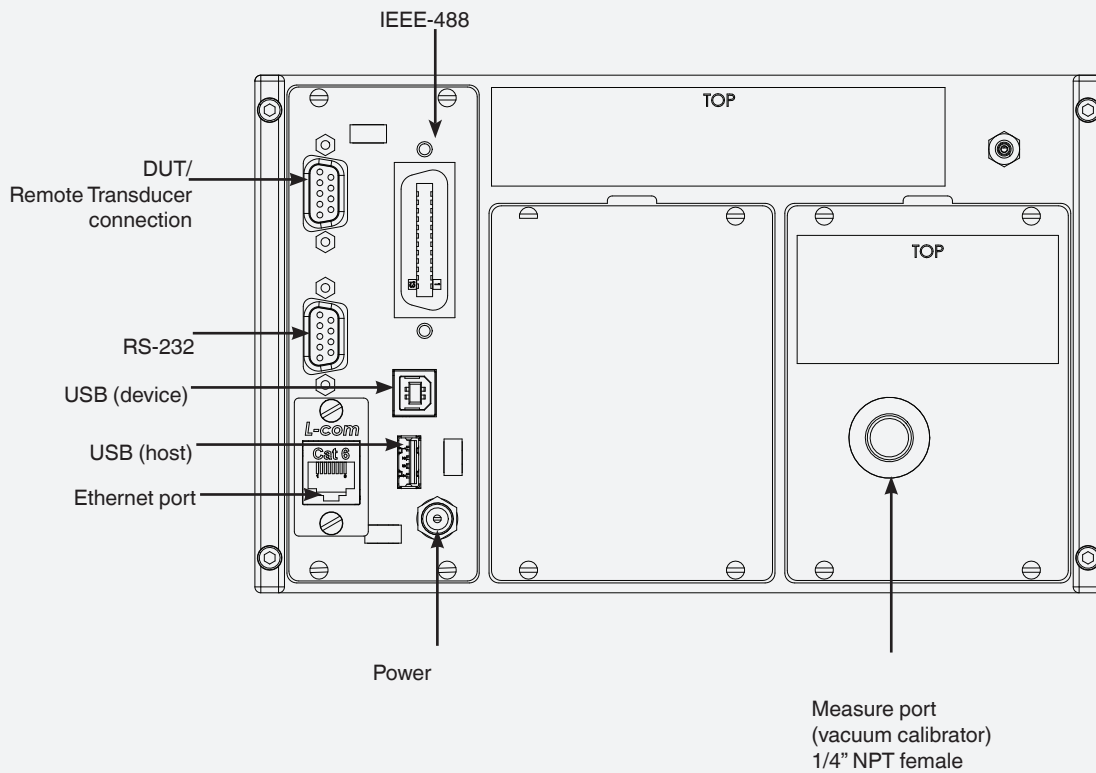
- CPG2500 Vacuum Calibrator;
- Power Supply;
- DB-9 connector cable for DUT communication,
- Fitting adapters ordered;
- Any accessories ordered (vacuum pump, pressure hoses, needle valve);
- An envelope containing the calibration certificate.

5.2 Dimensions (inches)

Desk top case



Rear Panel



Vacuum Calibrator CPG2500

5.3 Mounting

The instrument is set up on a desk top.

The vacuum transducer built in the CPG2500 is sensitive to vibration, to further assure stability and accuracy, avoid mounting the instrument on surfaces subject to excessive motor or machinery vibration.

5.4 Rear Panel

The measure port for the vacuum calibrator is located at the rear panel of the CPG2500. Positioned on the left side is the remote transducer connection which can , the RS-232, Ethernet, IEEE-488, USB device connections for communication, the USB host connection and the 12 VDC power input.



Figure 5.4 - Rear panel

5.4.1 Pressure/Vacuum Port

The CPG2500 will precisely measure the pressure/vacuum connected to the pressure port with a 1/4" female NPT fitting (optional adapter: 1/4" NPT male to 8 mm tube) up to the maximum range of the internal transducer.



Caution

CAUTION: The CPG2500 Vacuum Calibrator requires a stable and regulated vacuum source for optimal performance of the internal vacuum transducer.

5.5 Remote Communication Connections

See Section 7, Remote Operation, for connections and commands for operation over IEEE-488, Ethernet, USB or RS-232 ports.

5.5.1 Remote Transducer Port

The Remote Transducer Port is used to connect the Device Under Test (DUT) to the CPG2500 Vacuum Calibrator. This is a RS-232 port at the top left of the chassis and connects to the corresponding DB-9 connection on the DUT (Eg: CPT6100). Once connected, the CPG2500 reads and communicates with the CPT6100 seamlessly.



Caution

CAUTION:The CPG2500 Vacuum Calibrator only supports remote communication with the DUT when the DUT is having a baud rate of 57600. Follow instructions in DUT operating manual to set this baud rate prior to connection.

5.6 Power Up

Apply power to the power connector on the rear of the instrument using the power adaptor included, and switch the power switch on the front of the unit ON. The instrument will go through an initialization process and system check. As soon as the system check is completed the system will default to a screen similar to the one shown in Section 6.1.2 - Display Screen Features. The main measurement screen may be configured in many different ways but initially it will be in a default configuration. Subsequently, the unit will power up in the configuration that it was in when last powered off. Allow at least 15 minutes of warm up before performing critical pressure measurements.

5.7 Vacuum Pump Accessory Kit Connections

Connect the optional vacuum pump accessory kit including the pressure hoses and needle valve to the CPG2500 vacuum calibrator and the DUT. The steps below detail the process of installation:

- Ensure the needle valve is connected to the vacuum pump.
- Connect both of the 8 mm tubes provided as part of the kit to either end of the 8 mm T-fitting on the vacuum pump as shown in Figure 5.7-A.
- Connect the other end of one of the tubes to the Measure Port of the CPG2500 vacuum calibrator with the 1/4" MNPT Male to 8 mm tube adaptor.
- Connect the other end of the second tube to the Pressure Port of the DUT (Absolute CPT6100).
- Ensure all connections are secure before powering on the vacuum pump (Figure 5.7-B).

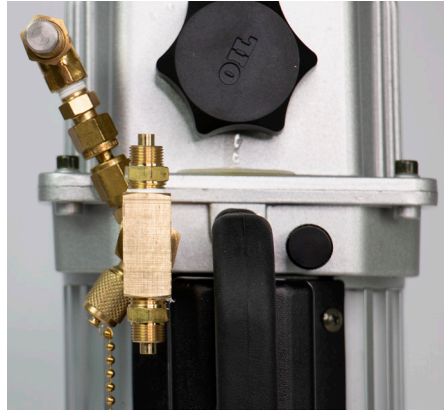


Figure 5.7-A T-fitting on Vacuum Pump

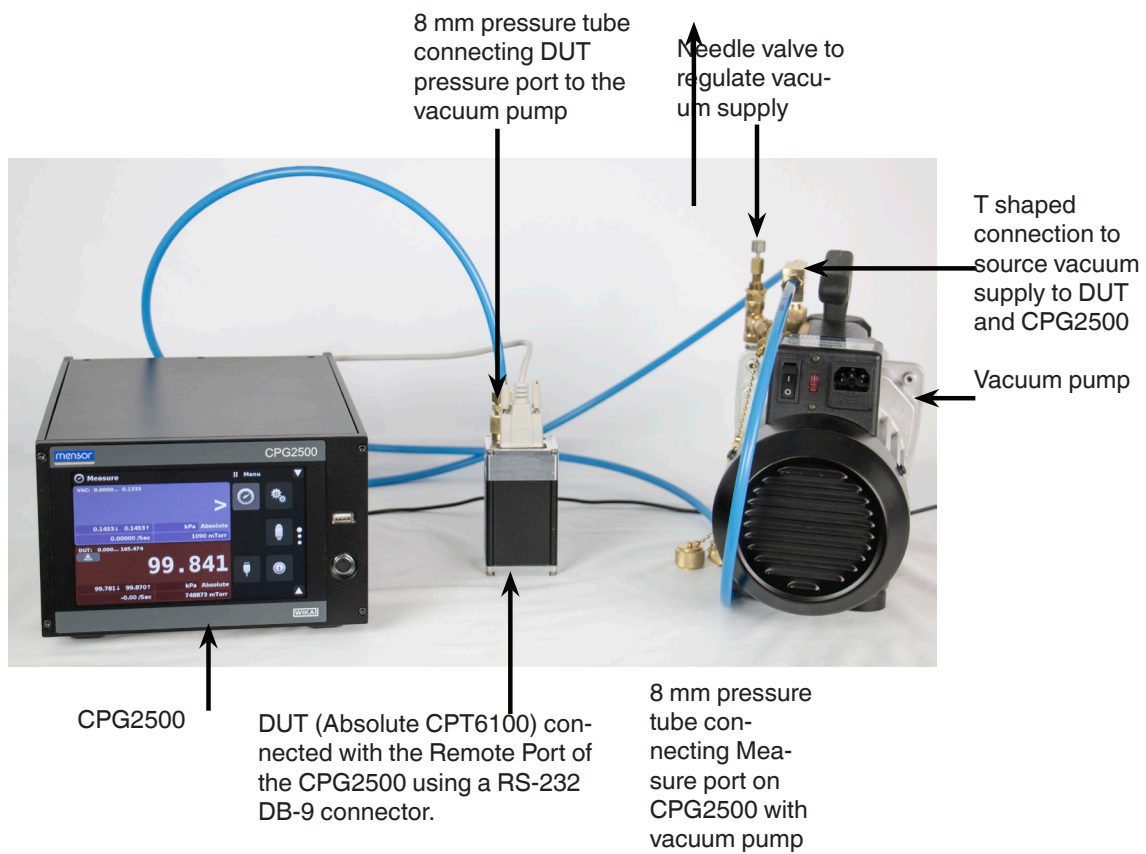


Figure 5.7-B Installation Setup with Vacuum Pump Accessory Kit and DUT

6 Local Operation and Setup

6.1 General Operation

This section describes the procedures for operating the CPG2500 from the front panel. Instructions for operating the device remotely from an external computer are covered in Section 7, Remote Operation. By following the procedures provided in these two sections and Section 10, Calibration, you can expect your CPG2500 to deliver maximum accuracy and dependability for many years of useful service.

6.1.1 Setup Applications

Configuration of the CPG2500 is achieved by changing settings accessed through the Application (“App”) buttons. Local operation is accomplished by observing the data presented in the display. The appearance and functionality of the display can be changed by pressing the App button for the related function. After an app has been chosen, a set of related parameters will appear on the left. After choosing one of these parameters, a set of selections related to that parameter will appear on the right or a data entry keypad. The desired selection or data can be entered here.

6.1.2 Display Screen Features

The screen shown below provides a brief description of the features shown on display after initialization. The left two thirds of the display contains the area where information is displayed (in this case the Measure Application) and the right one third contains the selection icons for each application. Channels are color coded: Internal vacuum channel is lavender and DUT (remote) channel is red. Color coding persists throughout all channel-specific screens. The pressure reading on the internal vacuum channel goes “green” when there is stable vacuum pressure between 0.08 and 0.0867 kPa. If the vacuum pressure is above 0.133 kPa, the display will read >. A zero button (DUT only) and auxiliary displays (auxiliary units, rate and peak) will appear in the Measure App if activated. All of the CPG2500 screen features are described in more detail throughout this manual.

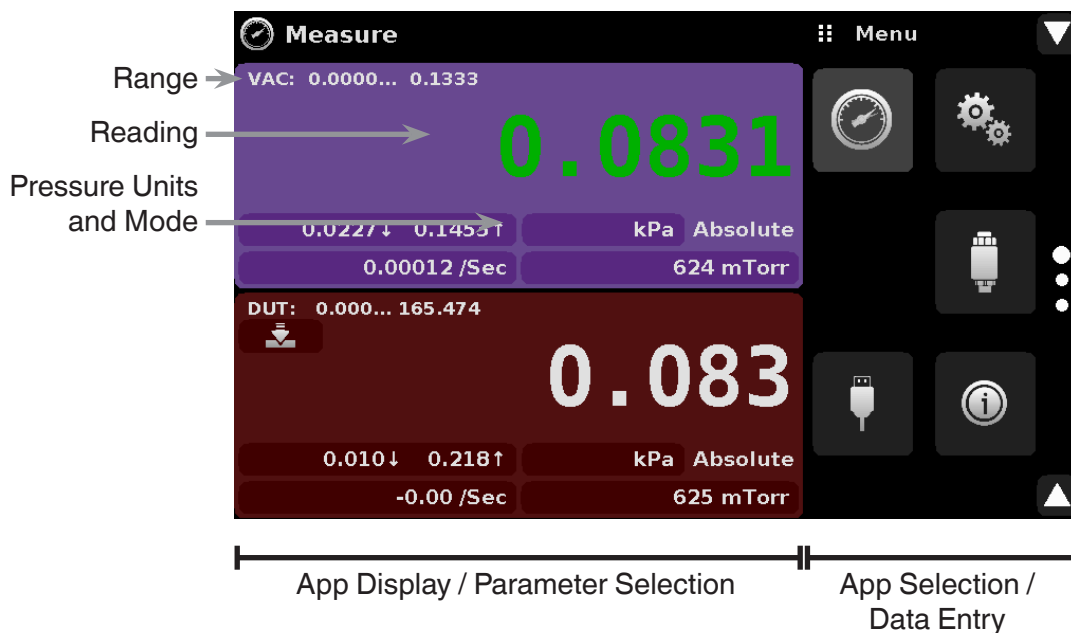



Figure 6.1.2 - Display Screen Features

Vacuum Calibrator CPG2500

6.2 Initial Setup

Section 6.2.1 and 6.2.2 are provided first so that the operator can initially check the information screen to verify the installed components and to change the language if needed.

6.2.1 Contact and Version Information Application

 Press this application button to display Mensor contact, instrument and software version information.

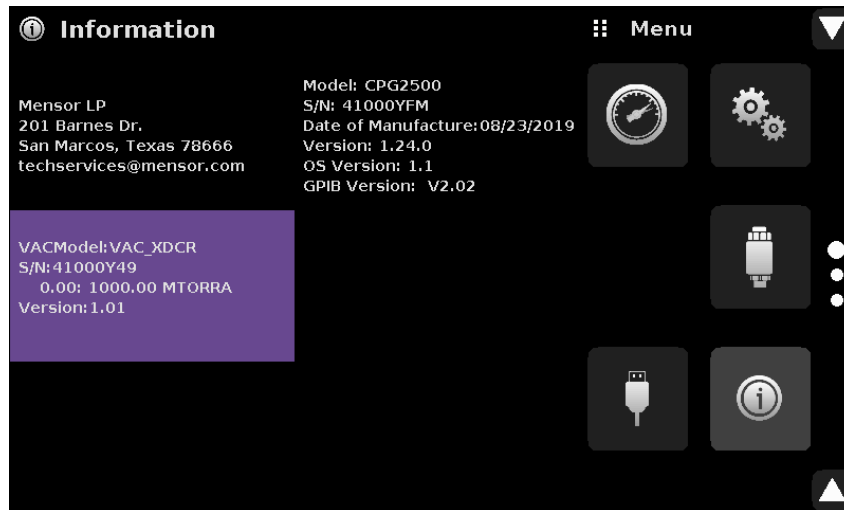


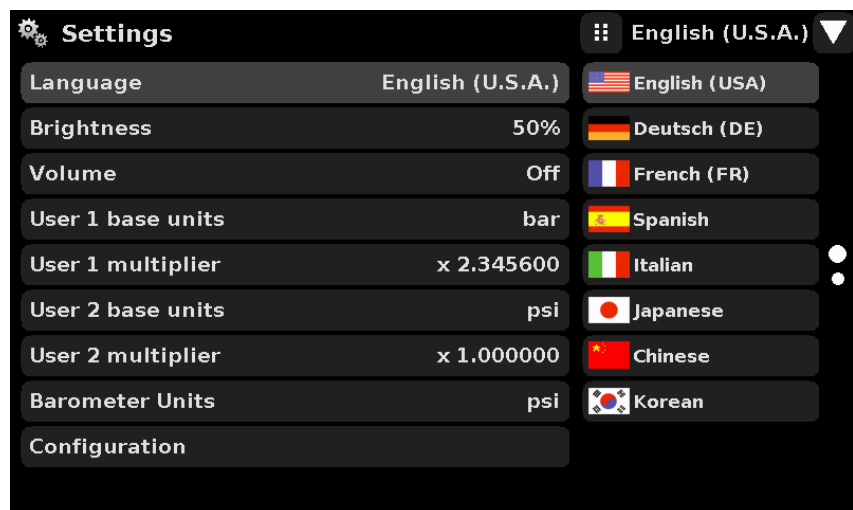


Figure 6.2.1 - Information



6.2.2 Language Selection

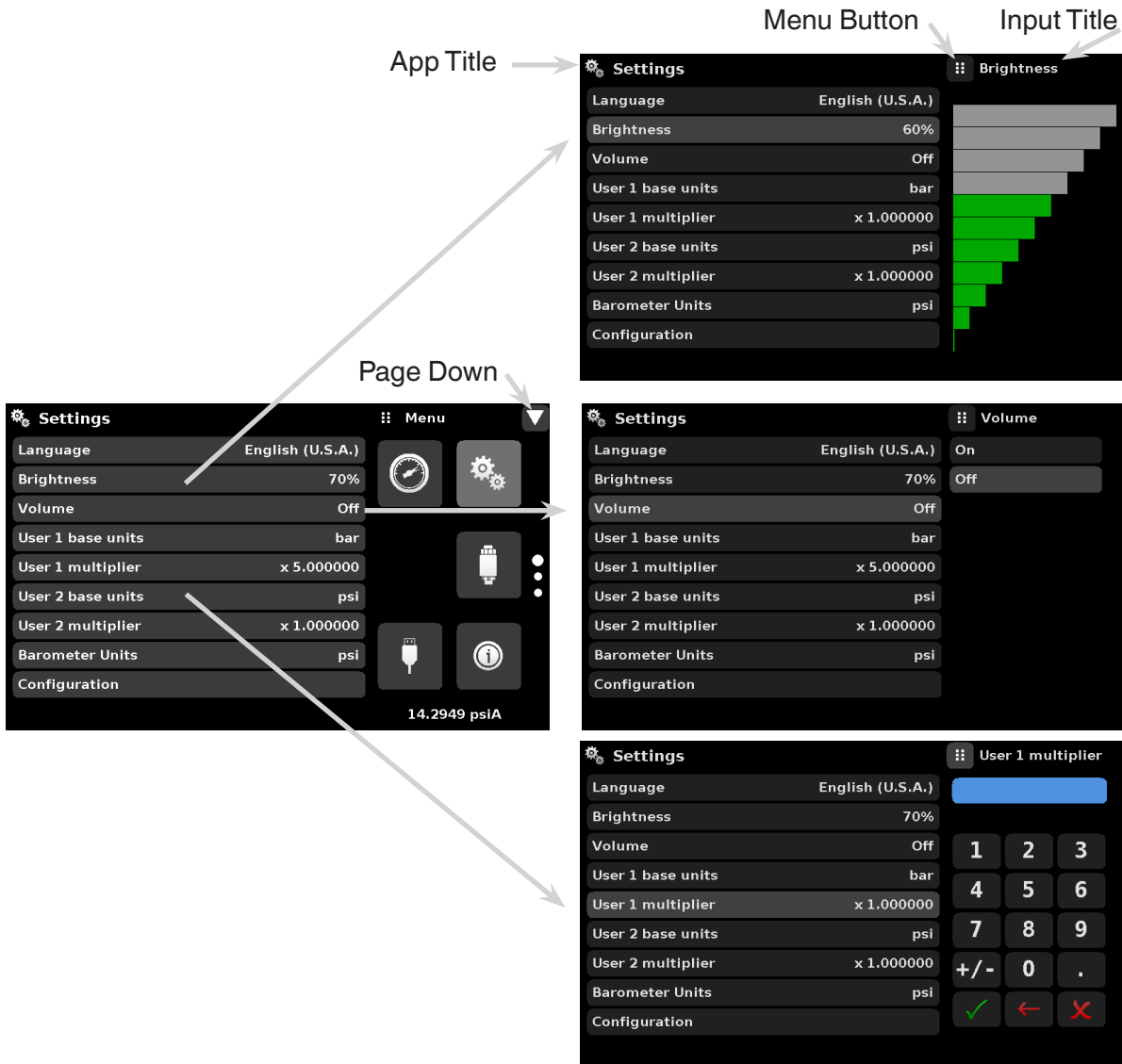
 Pressing the settings application button will open a screen where the language, display brightness, volume, user base units/multiplier and configuration loading/saving, can be changed. The current language selections available are shown in the table below. Additional language choices will appear on the screen after pushing the Page Down button []:

Language	Country
English	USA
German	Germany
French	France
Spanish	Spain
Italian	Italy
Chinese	China
English	Great Britain
German	Switzerland
French	Switzerland
Spanish	Mexico
Russian	Russia
Korean	Korea
English	Canada
French	Canada
Polish	Poland
Japanese	Japan



6.3 Application Selection and parameter inputs

The application selection area on the right one third of the screen (see Figure 6.1.2 - Display Screen Features) is the area where setup, information and calibration Apps can be chosen. A second and third page of application selections can be accessed by pressing the page down button []. A series of vertically placed circles on the center right indicates the active page by a larger circle. As each App is chosen, related application parameters will appear on the left two thirds of the screen along with the name of the application, and a reduced size icon in the top title section. When a parameter is chosen, related selections, sliding scales or a data entry key pad will appear in the input area on the right where the application selection buttons were previously displayed. An example of each type of input is shown below. To return to the App selection menu, simply press the menu button [] above the input area. The purpose and use of each selection and menu is intuitively apparent and will become second nature with minimal exposure to the menu structure.



6.4 Applications:

6.4.1 Measure Application



The Measure App is the normal operation screen referred to in previous instruments as the 'main screen'. This application is different from the others in that it is not used to setup the configuration but is used to monitor the pressure applied to the installed transducers.

The screen in figure 6.4.1-A shows the basic Measure App in the instrument. The units button is always present in each channel. When the units button is pressed a selection of imperial and metric units will be displayed on the right (figure 6.4.1-B); notice that the Units button has a lighter background when the selection menu is active. Any unit of measure can be selected for any channel.

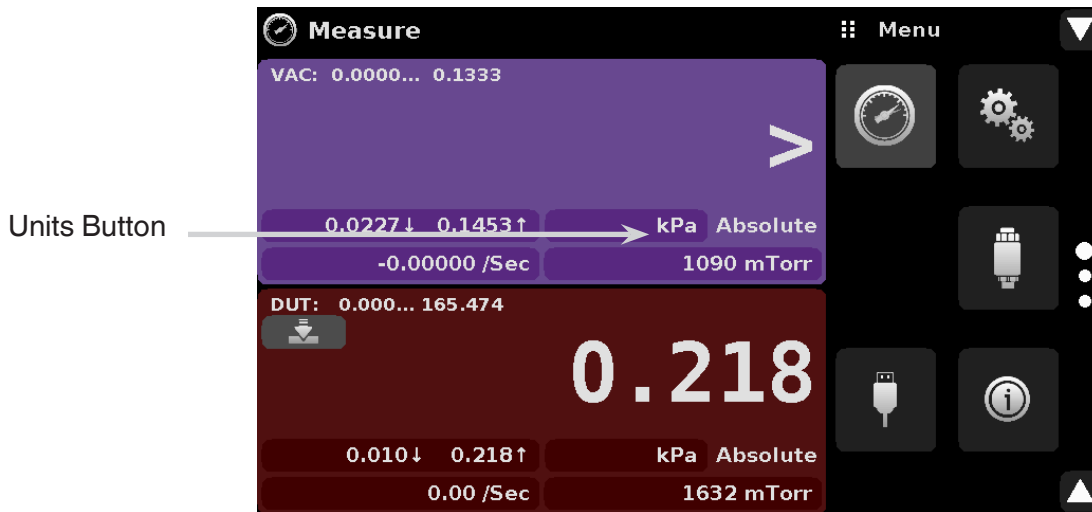


Figure 6.4.1-A Basic Measure App

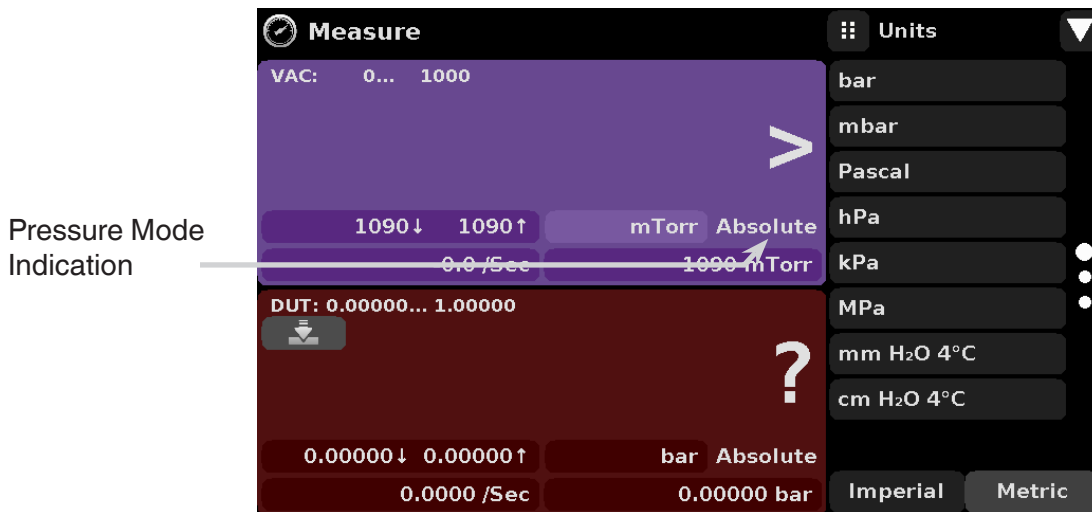


Figure 6.4.1-B - Units Change

6.4.1.1 Auxiliary Displays

The screen in figure 6.4.1.1 shows all of the possible auxiliary display items that can be included in the Measure App. The auxiliary display item includes “Alternate Units”, “Peak” and “Rate”. Additional “Zero” calibration function appears on the DUT (remote) channel. These auxiliary features will appear in the Measure App when selected from the Transducer App (section 6.4.3.3).

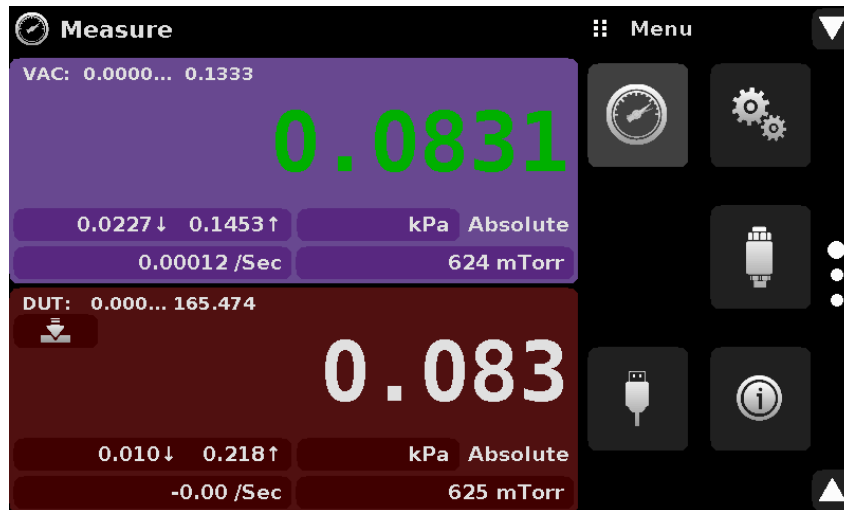


Figure 6.4.1.1 - Three channel Measure App with auxiliary displays



Auxiliary buttons can be placed in three different parts of the screen depending on how they are set in the Transducer Application. Each auxiliary display can be modified by pressing the displayed button.

Peak: Pressing the Peak button will reset the upper and lower peak value to the current reading, subsequent negative or positive divergence from that reading will be recorded in the button.

Rate: Pressing the Rate button will display a choice of rate time units for the rate denominator.

Units: Pressing the Auxiliary Units button will display the same set of units available for the primary units. To change auxiliary units (ie. kPa to mTorr), press the auxiliary unit you want to change and select which unit you want displayed.

6.4.1.2 Zero Button

The Zero Cal Button appears on the DUT channel, this button is greyed out [] when there is no DUT connection detected and when the reading from the vacuum transducer is outside the recommended zeroing range (Figure 6.4.1.2-A). The Zero Cal Button can be pressed when a DUT is connected and the vacuum reading is stable and in between 0.08 to 0.0867 kPa (Vacuum channel reading turns “green”). The calibrator would then perform a one point zero calibration on the DUT. Status messages for the zeroing process are shown in right one-thirds of the screen. Upon successfully zeroing, click check box [] to exit the zeroing menu (Figure 6.4.1.2-B & C).

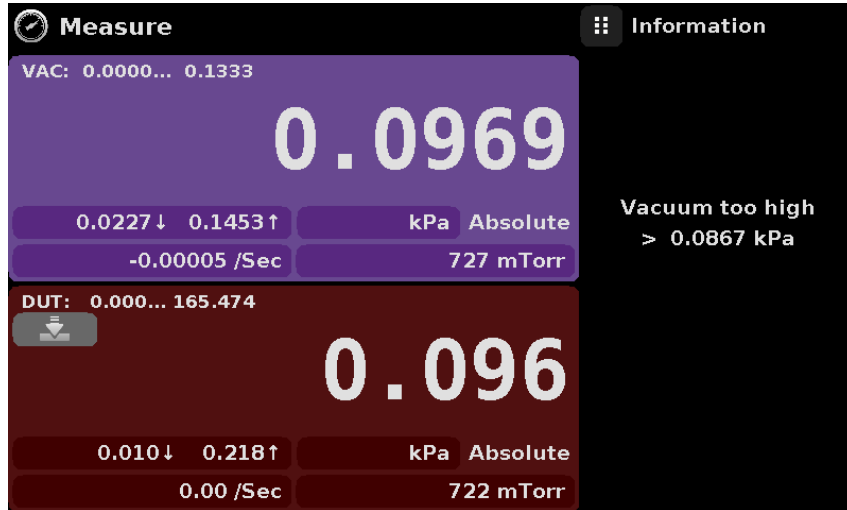


Figure 6.4.1.3-A - Zero Grayed. Vacuum Too High



Figure 6.4.1.3-B - Zeroing

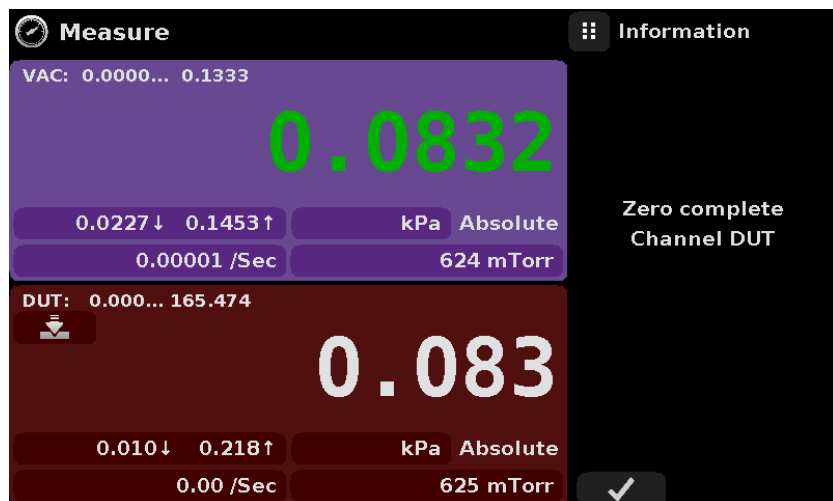


Figure 6.4.1.3-C - Zero Successful

6.4.2 Settings Application



The Settings App is used to set up general settings for the display. Settings parameters include Language, Brightness, Volume, User 1 base units, User 1 multiplier, User 2 base units, User 2 multiplier, Barometer units, and Configuration. Figure 6.4.2 shows these parameters as indicated when the Settings App has been chosen. As each parameter is pressed, an input screen will appear on the right where selections can be made.

The Settings App provides a place to change the language, display brightness, volume, user units, and barometer units. Configuration settings of the unit can also be saved within this application plus the default configuration can be activated.

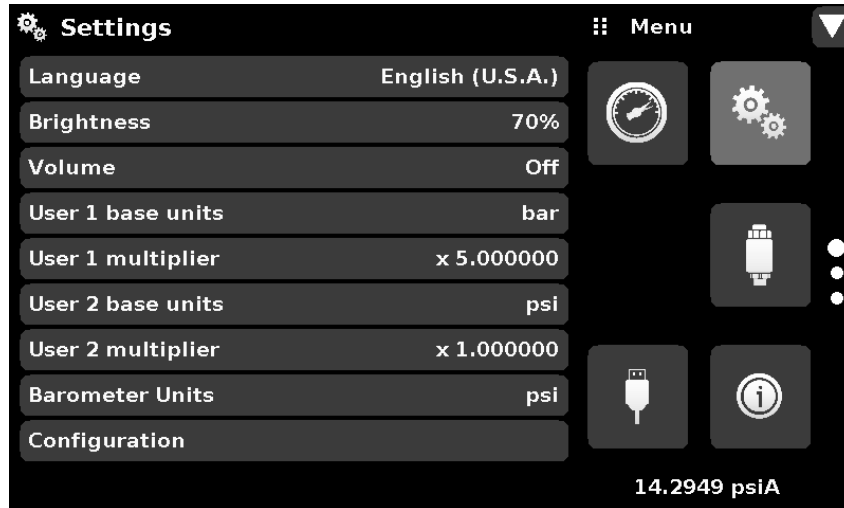


Figure 6.4.2 - Settings application

6.4.2.1 Languages

The Language parameter provides a selection of different languages. Once a language is chosen all words within all menus will appear in the chosen language and the radix character (decimal mark) will change from a dot (.) to a comma (,) depending on the language chosen.

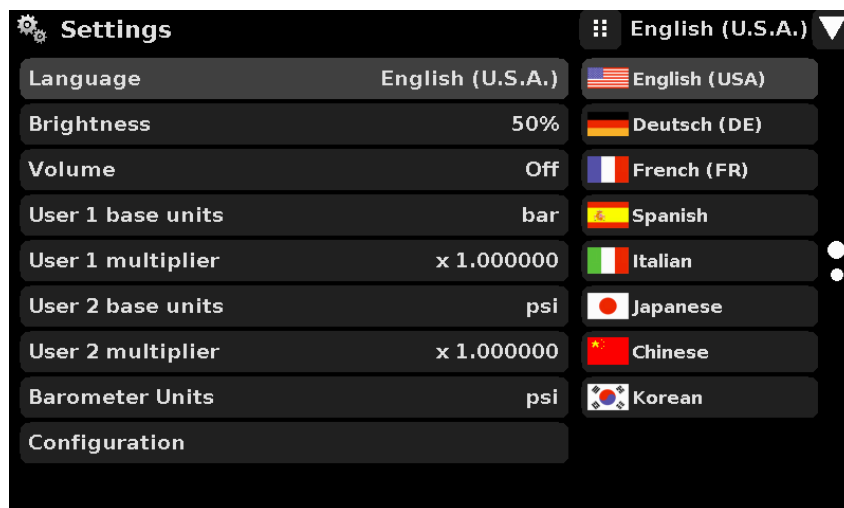


Figure 6.4.2.1 - Languages

6.4.2.2 Brightness

The Brightness setting provides a sliding scale to increment the screen brightness in all screens. Sliding your finger along the bar graph or touching anywhere in the bar graph will change the brightness of the screen. After the setting is made and your finger is removed from the screen the menu will revert back to the basic settings menu.

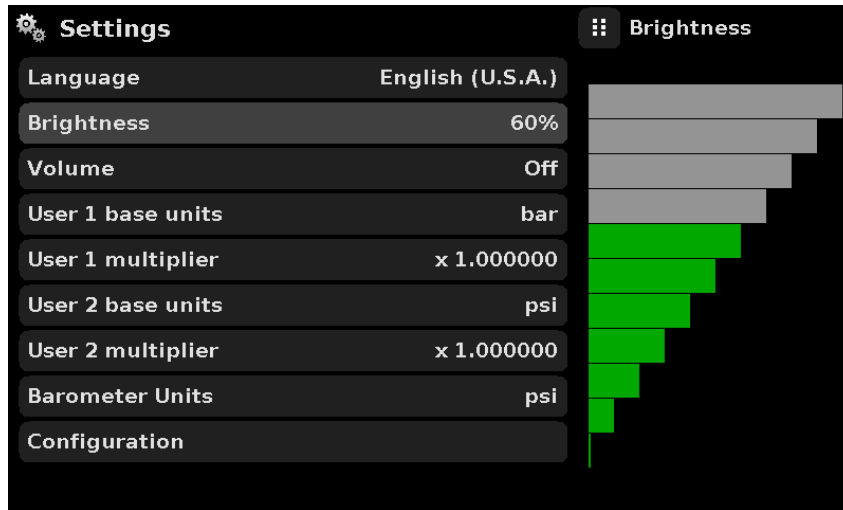


Figure 6.4.2.2 - Brightness

6.4.2.3 Volume

The Volume setting provides a way to turn on or off the touch screen audio feedback.

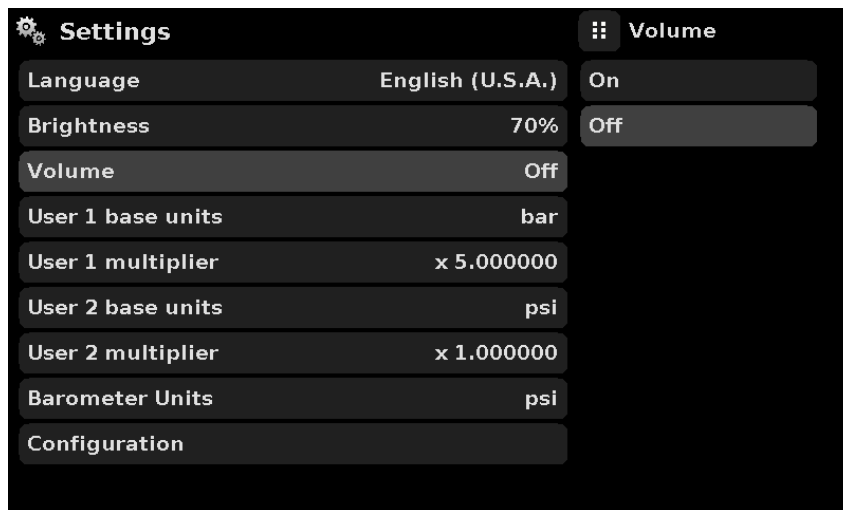


Figure 6.4.2.3 - Volume

6.4.2.4 User base units / Base units multiplier

When choosing a unit of measure from the Measure Application (main screen), standard units can be chosen in addition to two user defined units. User units 1 and 2 are defined in the Settings App using “User 1 base units”, “User 1 multiplier” and / or “User 2 base units”, “User 2 multiplier”. For example, if the display of one atmosphere (atm) was needed, then psi could be chosen as the “User 1 base unit” and the “User 1 multiplier”, in this case, would be 0.068045. When set this way and the user 1 unit has been chosen, the user 1 unit will now display the pressure in atm.

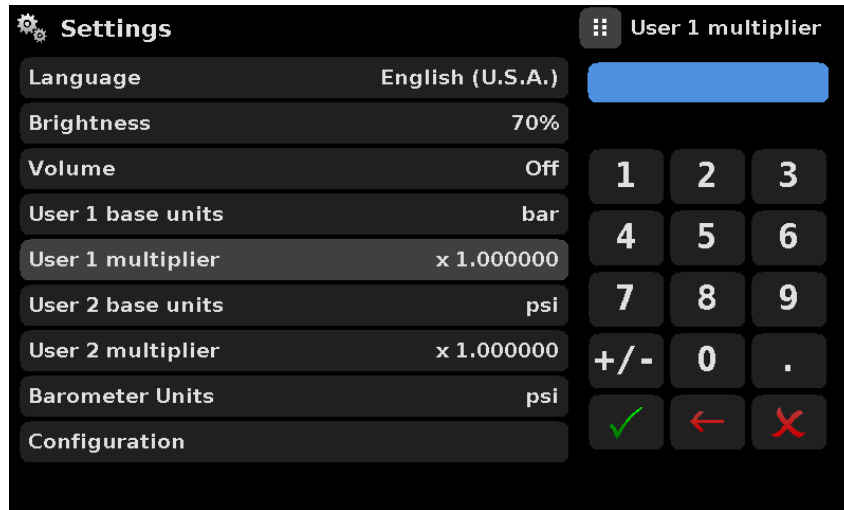


Figure 6.4.2.4 - User base units / Base units multiplier

6.4.2.5 Barometer Units

Not used in this instrument.

6.4.2.6 Configuration

Configuration is the last parameter in the Settings App. It allows the operator to save instrument settings and load them, as needed, in the future. Parameters that are set in the Settings App, the Transducer App, and the Remote App can be saved using the Configuration “Save” button and recalled using the Configuration “Load” button. Simply set all desired parameters then go to Settings-Configuration, press one of the numbered Configuration buttons then press the “Save” button. This will save the current configuration in that button. To reload a saved configuration at a later time, go to Settings-Configuration and press the numbered configuration button corresponding to the saved configuration and then press the “Load” button.

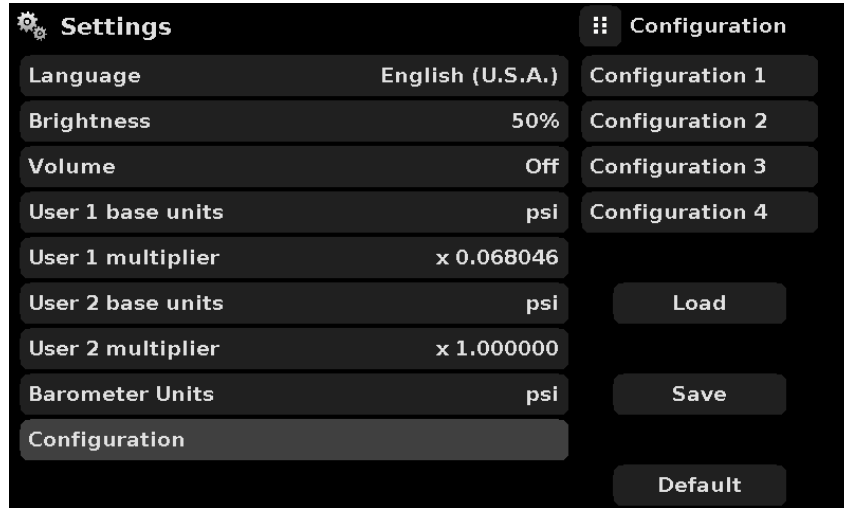


Figure 6.4.2.6 - Configuration

The instrument default configuration can be activated simply by pressing the “Default” Button.

6.4.3 Transducer Application



For the internal vacuum channel, the Transducer Application provides a way to set the filter for the reading to reduce fluctuations due to electrical noise, and to set the resolution of the reading. In addition, the auxiliary display functions can be specified here.

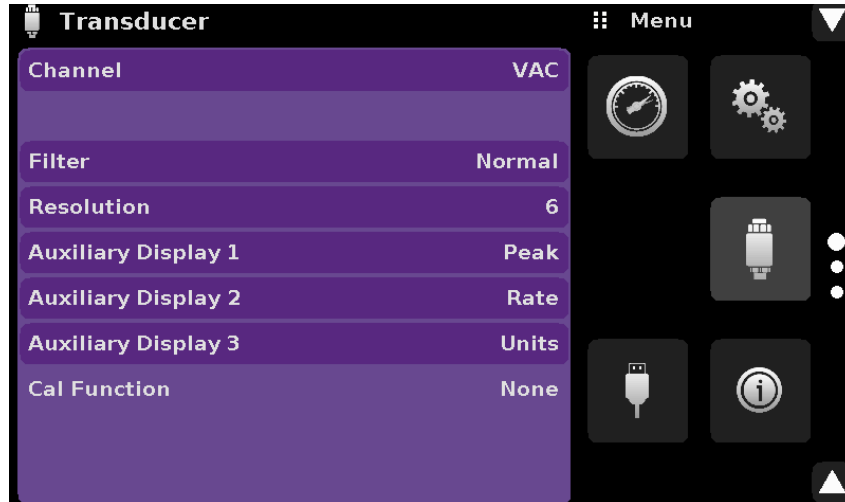


Figure 6.4.3 - Transducer Application

6.4.3.1 Transducer Filter

The Filter is an electronic filter to smooth out the pressure readings. Because of differences in resolution, greater filtering may display a more stable reading for some pressure units. Turn off the Filter by selecting “Off”, select varying degrees of filtering for the current units by selecting “Low”, “Normal” or “High”.

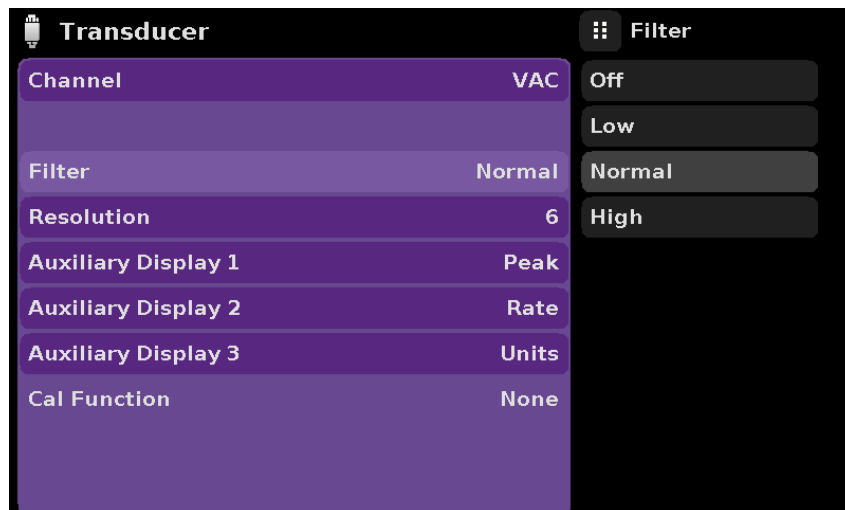


Figure 6.4.3.1 - Transducer Filter

6.4.3.2 Transducer Resolution

The resolution of each transducer channel can be set in the Transducer Application using the resolution parameter. The resolution can be set to 4, 5, or 6 digits.

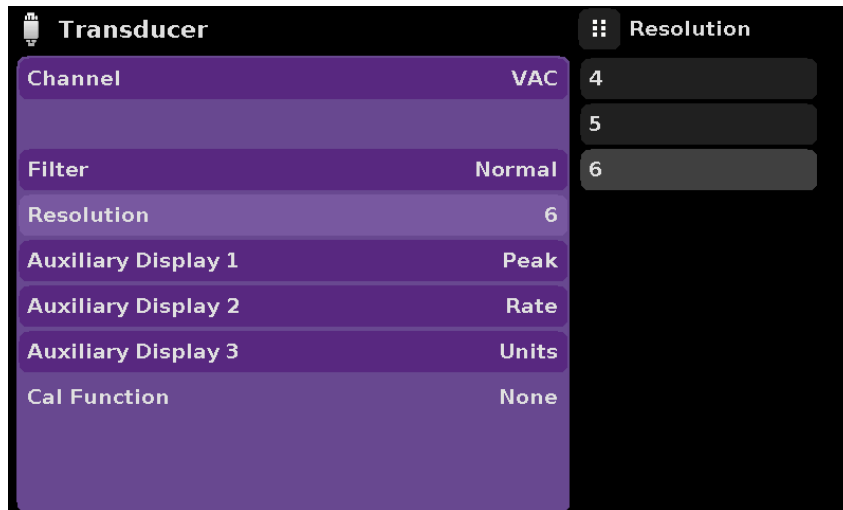


Figure 6.4.3.2 - Transducer Resolution

6.4.3.3 Auxiliary Displays

The Transducer Channel Auxiliary Display(s) can be set in the Transducer App by selecting Auxiliary Display 1, 2 or 3 and selecting from, None, Peak, Rate or Units. Figure 6.4.3.3-A shows auxiliary display 1, 2 and 3 set for units, peak and rate respectively. Auxiliary displays will appear in the Measure App as seen in Figure 6.4.3.3-B.

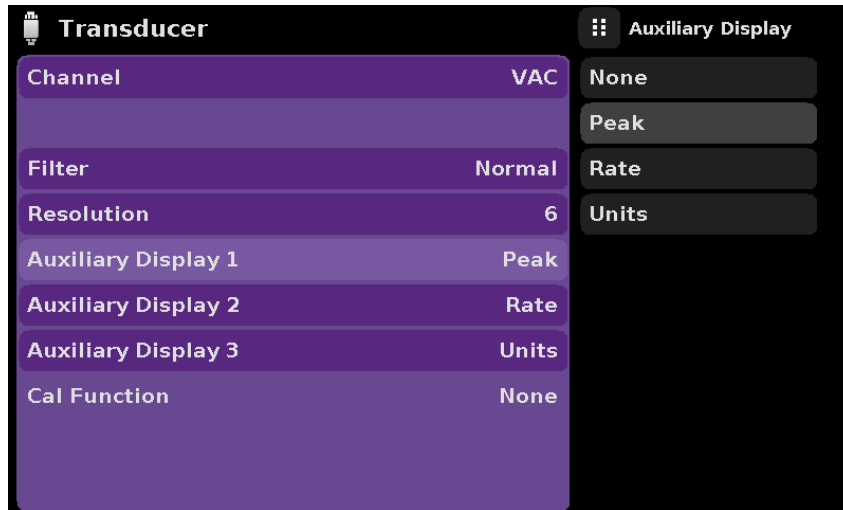


Figure 6.4.3.3-A - Transducer channel aux displays set to Units, Peak and Rate

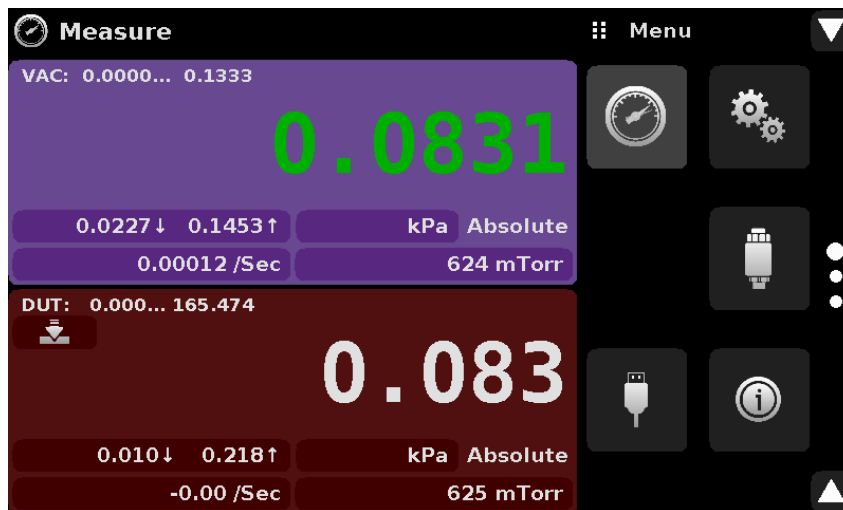


Figure 6.4.3.3-B - Auxiliary displays as seen in the Measure App

6.4.4 Remote Application

With the remote application you can select the remote command set for all interfaces. The GPIB address, Ethernet network parameters and Serial parameters can also be set here.

Details about the Remote Operation (command sets, cable requirements, etc.) can be found in Section 7, Remote Operation.

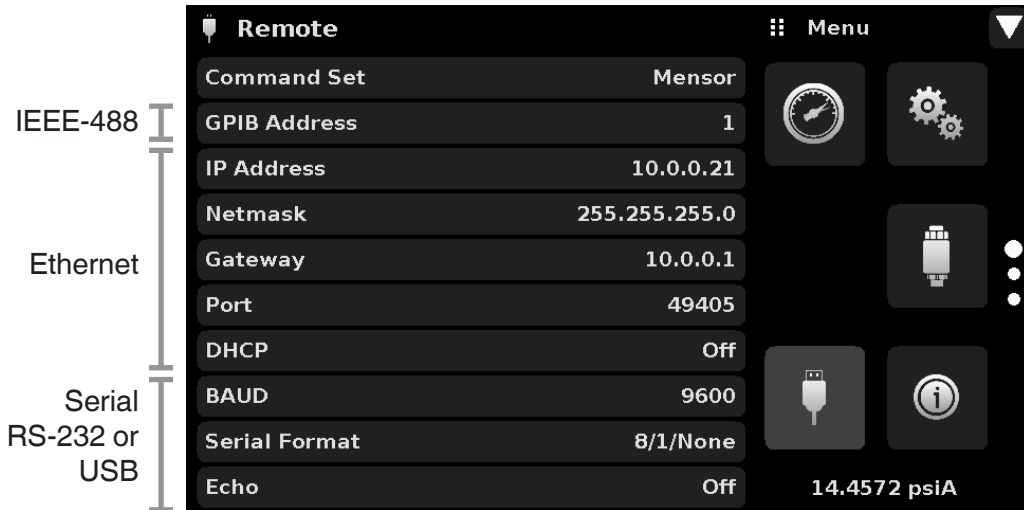


Figure 6.4.4 - Remote Application

6.4.4.1 Remote Command Set

The remote command set parameter provides a choice of the Mensor command set. The commands are listed in Section 7, Remote Operation.

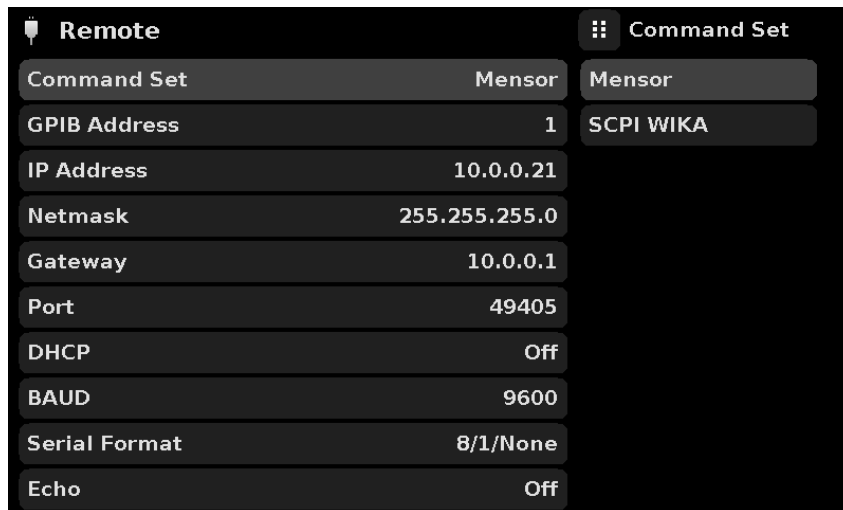


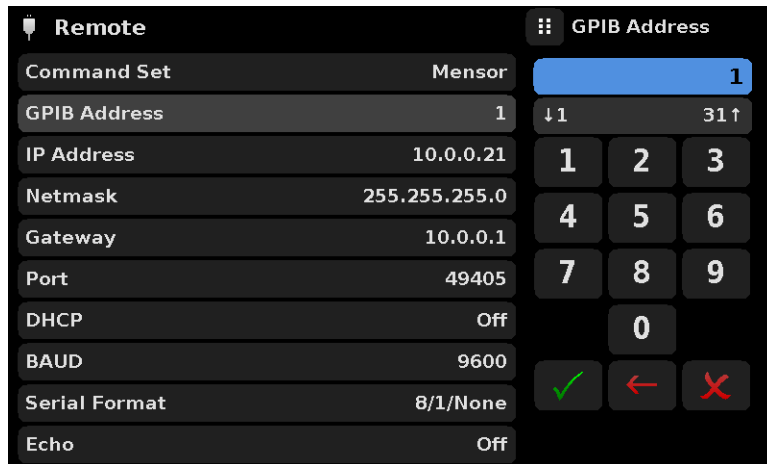
Figure 6.4.4.1 - Remote Command Set



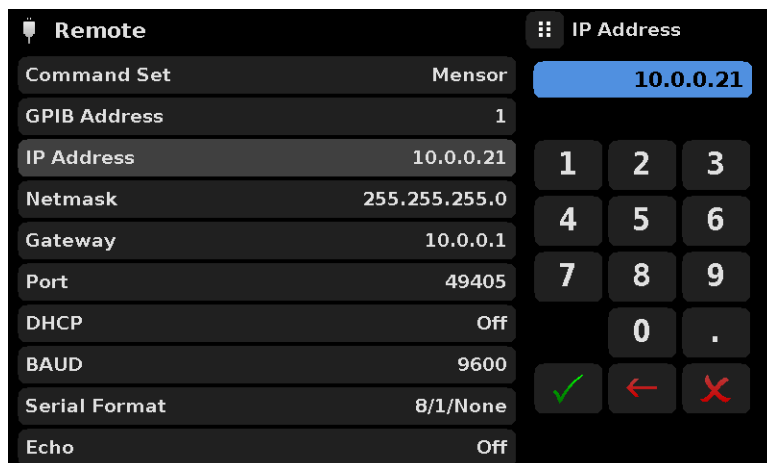
WARNING: Prior to connecting the DUT to the vacuum calibrator, ensure the DUT is set at a baud rate of 57600. This can be done by accessing serial information on the DUT.

6.4.4.2 Remote Communication Settings

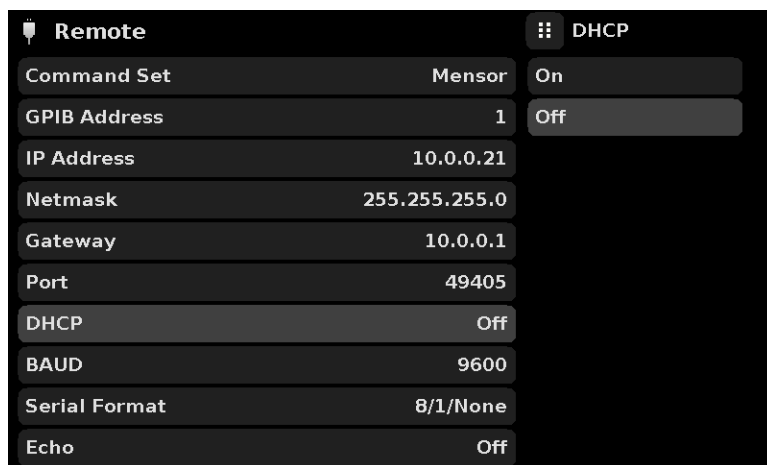
The remainder of the Parameters in the Remote Application present the choice of a numeric entry, a numeric address entry, or a radio button selection. The parameters that require a numeric entry will present a numeric keypad with min and max limits for the variable. The parameters that require a numeric address (for example an IP address) will also present a keypad. Address entries should conform to the format of the parameter selected. The three screens below show examples of each type.



Numeric entry



Numeric address entry



Radio button selection



Setting the Ethernet DHCP to yes will have a short delay while the DHCP server is contacted. If a DHCP server is not found, an error will be indicated. If DHCP is enabled, the IP address, Netmask and Gateway are greyed out and locked, these are controlled by the DHCP server.

Figure 6.4.4.2 - Remote Communication Settings

6.4.5 Info Application



The Info application displays information about the instrument, including:

- Mensor address, and email
- Model number, serial number and operating software version.
- Internal Sensor model number, serial number, range, software version

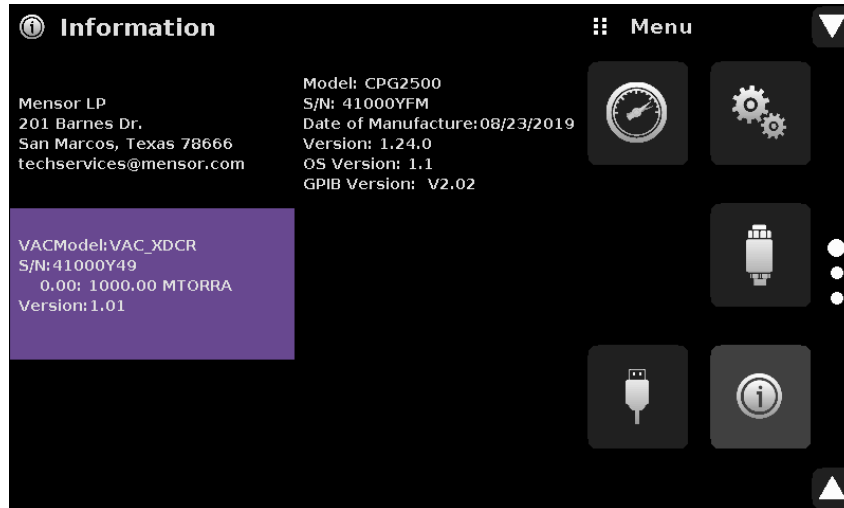


Figure 6.4.5 - Info Application

6.4.6 Leak Test Application



The Leak Test application does not function with this model of the instrument.

6.4.7 Troubleshooting Application



The Troubleshoot Application will display information about error conditions and remote communications. Within the troubleshoot screen (Figure 6.4.7-B), push the Error button to display any errors that have occurred in the instrument due to a communication or network error. Push the Remote button to show commands and responses that have been sent over the remote communication connection.

If there are any errors in the error queue an error symbol [] will appear in all screens (Figure 6.4.7-A) of the instrument. Pressing this error button from any screen will open the Troubleshoot application where the error can be viewed.

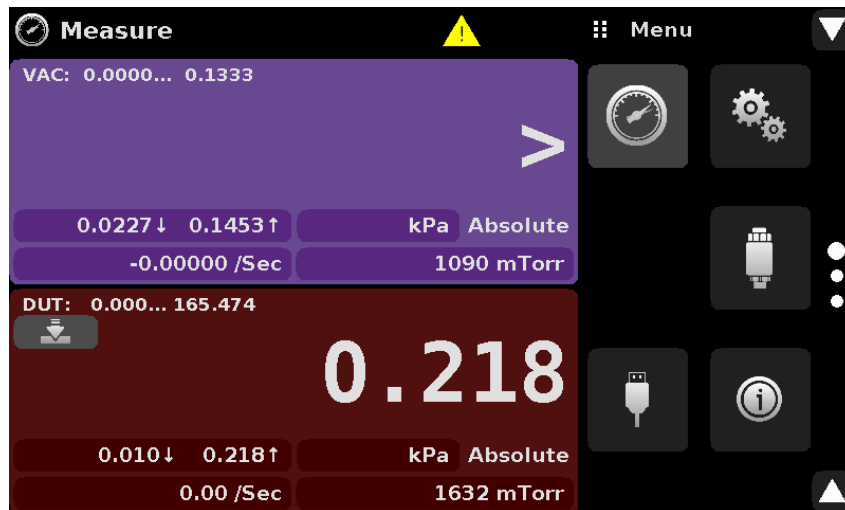


Figure 6.4.7-A - Error indication

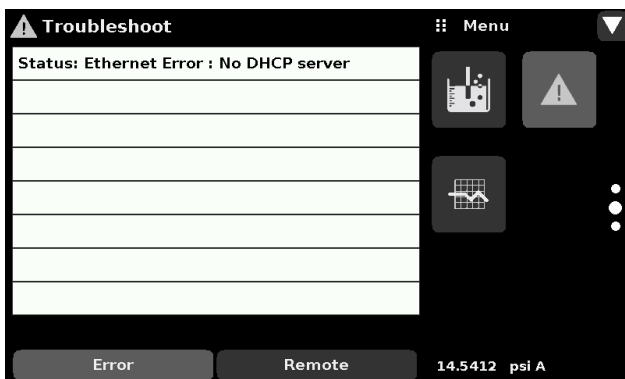
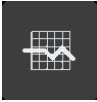


Figure 6.4.7-B - Troubleshoot error and remote

6.4.8 Logging Application



The logging application enables real-time storage of internal transducer output and state in a USB device plugged to the front panel of the CPG2500. The application also provides a means to log any remote communication (commands and responses) to the instrument. The primary objective of this application is to provide test data for troubleshooting purposes.



Note: The Logging Application is only visible when a compatible USB device is plugged to the front panel of the CPG2500. The Application is greyed out in the absence of a USB device.

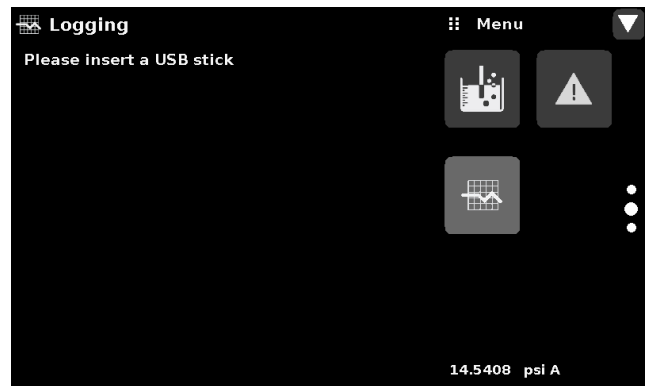
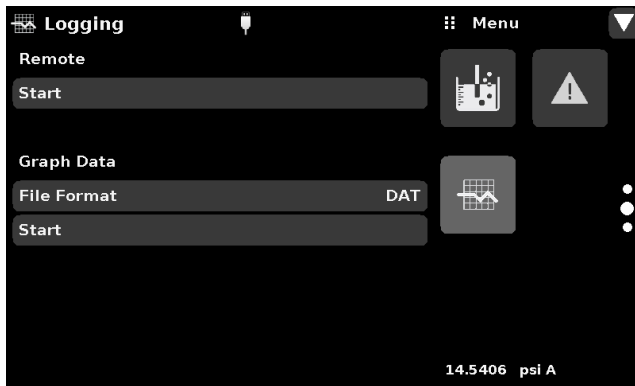



Figure 6.4.8-A Logging Application with USB (left) and without USB (right)

6.4.8.1 Remote Logging

The queries and responses sent over the remote communication can be logged on to the USB device using the remote logging feature. This feature allows monitoring communication and any erroneous responses from the instrument. The logging can be started by pressing the “Start” line, this would bring a keypad on the screen (Figure 6.4.9.1) for entering the file name to store the logging data. The extension of this file is set to “.txt” by default. Click [] to exit the keypad. This will automatically generate the file on the USB device and start logging the remote commands. The log function continues to run in the background while the instrument is operated locally or remotely. To stop logging, press the “Stop” line.

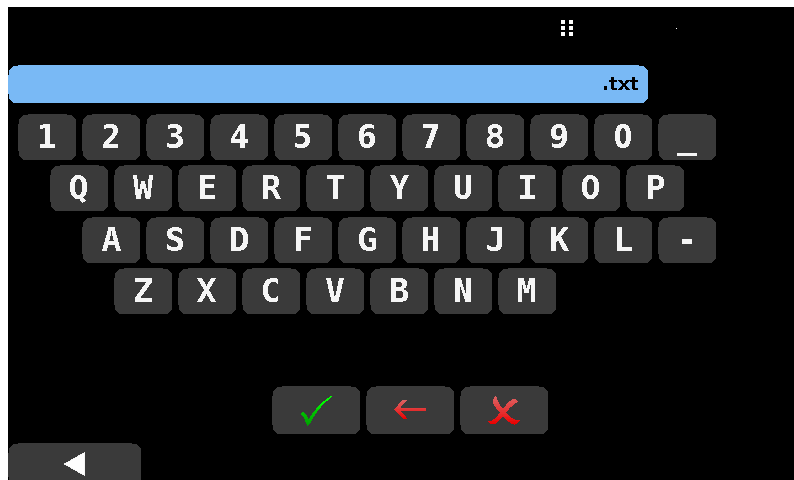



Figure 6.4.8.1 File Name Keypad

6.4.8.2 Pressure Logging

The Logging App allows the storage of the time interval, active pressure and rate reading from all channels of the instrument to a file. The “File format” button provides selection of “.DAT” or “.CSV” file type. The logging is started by pressing the “Start” line, entering a file name on the alpha numeric keypad (Figure 6.4.9.2-A) and clicking []. The values are continuously written to the file until “Stop saving to” line is pressed (Figure 6.4.9.2-B).

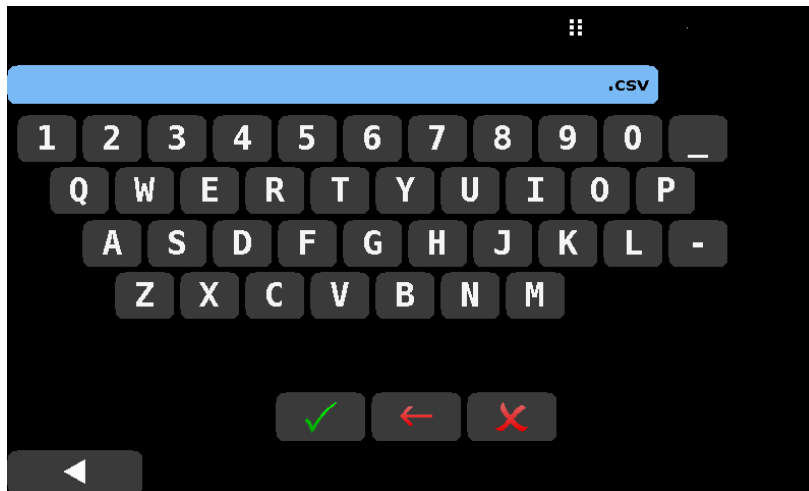


Figure 6.4.8.2-A File name keypad with “.csv” format

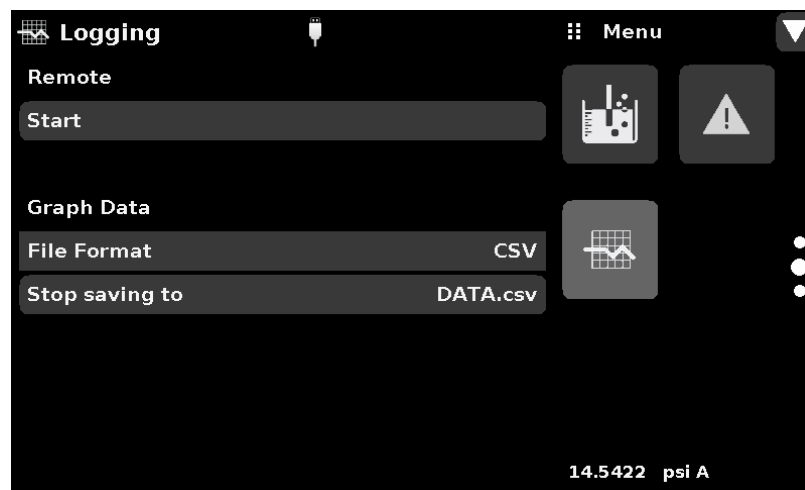


Figure 6.4.8.2-B Pressure logging active



Note: Once all the activity inside the Logging Application is over, press the USB icon in the top bar of display and click “Remove USB Device” to safely disconnect the USB device.



Note: Data logging for DUT is only available through Remote Communication. Follow instructions in Section 7, Remote Communication for details.

6.4.9 Service Application



The service application is a password protected area where calibration of all connected sensors can be accomplished. In addition, this is where the password for entering this area can be changed.

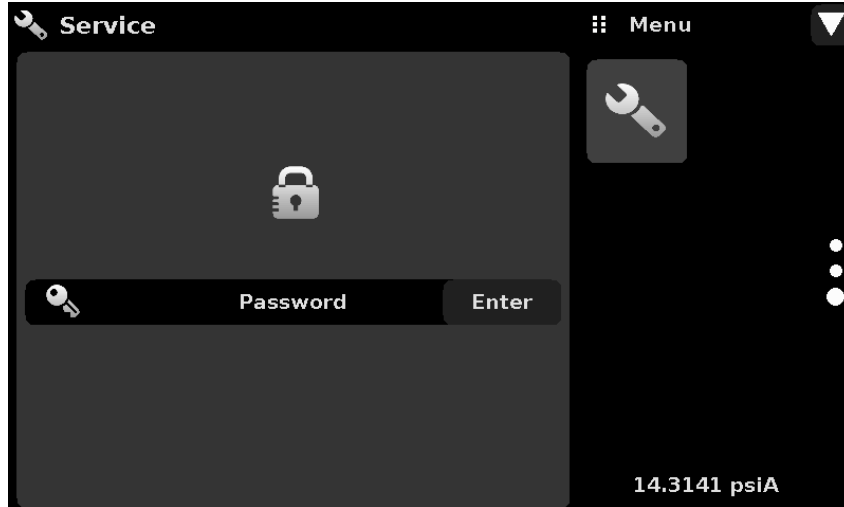



Figure 6.4.9-A - Service Application (locked)

Press the Enter button to show the numeric keypad to enter a password. This will unlock other applications. Default password is 123456. Enter 123456 and press the check mark [] to unlock the Service Application.

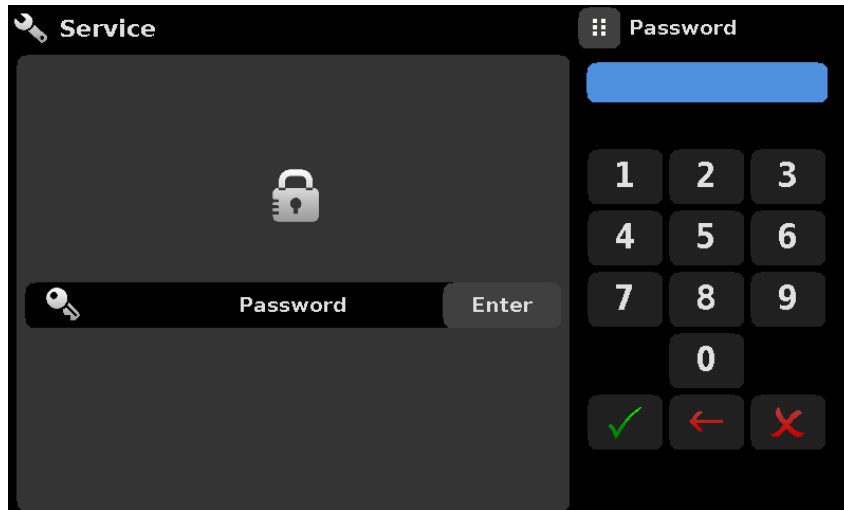


Figure 6.4.9-B - Service Application (Enter Password)



Note: The default Password is 123456. After entering this for the first time, the password can be changed.

6.4.10 Unlocked Service Application

After the Password has been entered, the unlocked Service Application will appear (Figure 6.4.10). To re-lock this screen, press the lock button.

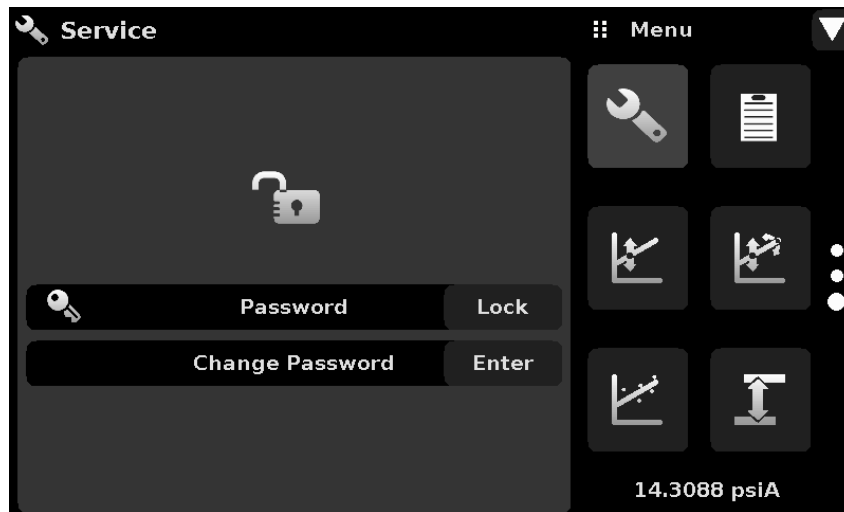



Figure 6.4.10 - Unlocked Service Application

From the Unlocked Service Application, the Password can be changed by pressing the Enter button next to the Change Password label. This will open a keypad where a new password can be entered and accepted by pressing the Check Mark [].



Note: Please make note of a password change and save the new password in a secure location.

The Unlocked Service Application is the access point to all calibration screens described in Section 10 of this manual.



Note: Recommended calibration setup and explanation of calibration screen applications is covered in Section 10 of this manual.

7 Remote Operation

Use the screens in Section 6.4.4 Remote Application to set the operating parameters for the instrument command set, Ethernet, Serial (RS-232) and IEEE-488 (GPIB) information.

7.1 Command Set

Command Set button – Users' can select which model remote protocol they would like to emulate for simulation and testing purposes. Selections may include the following or may be added per customers' specifications:

- Mensor (default)

7.2 IEEE-488

IEEE-488 address button – Allows the user to set the GPIB address by inputting a numeric value utilizing the touch screen.

7.2.1 IEEE-488.2 Commands

Command or Query	Response / Function
*IDN?	Returns identification string
*RST	Reset to known state (default+psi)
*TST?	Returns 1
*OPC	Operation completed
*WAI	Returns operation completed state
*CLS	Clear status and error queue
*ESE	Enable status event
*ESE?	Returns enable status even value
*ESR	Event status register
*ESR?	Returns even status register value
*SRE	Service request enable
*SRE?	Returns service request enable value
*STB?	Returns status byte

7.3 Ethernet

The Ethernet function allows the user to set the following by inputting a numeric value in each separate field:

- IP
- Netmask
- Gateway
- Port
- DHCP settings

Set the Ethernet communication parameters as described in Section 6.4.5.



Caution

CAUTION: Please contact your network administrator for proper settings.



Caution

CAUTION: Please consult your computer resources department prior to connecting this instrument to your network to verify there are no conflicts with existing IP addresses.

The Ethernet communication port allows the CPG2500 to communicate with computers using 10/100Based-T specifications.

Before using Ethernet communication, four parameters must be set up: IP, Netmask, Gateway, and Port.

7.4 Serial

Set the Serial communication parameters as shown in Section 6.4.5 Remote Application. The serial communication port allows the CPG2500 to communicate in RS-232 format with computers, terminals, PDAs, or similar hosts.

These parameters should be set to match your host computer. Default settings are: 57600 baud, 8 data bits, 1 stop bit, no parity, and no echo.

If echo is ON, the CPG2500 will immediately echo back characters sent over the serial port. The Serial function allows the user to set the RS-232 serial port settings by selecting from the choices provided:

- Baud
 - 9600
 - 19200
 - 38400
 - 57600
 - 115200
- Data Bits
 - 7
 - 8
- Stop Bits
 - 1
 - 2
- Parity
 - Even
 - Odd
 - None
- Echo settings
 - On
 - Off

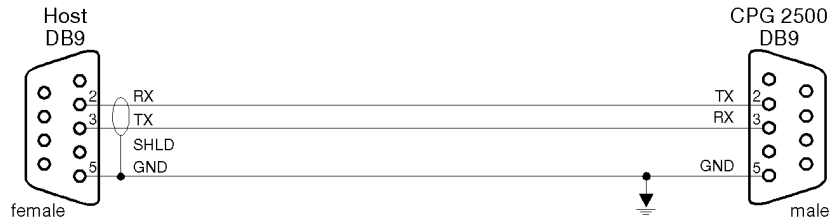
7.4.1 Serial Cable Requirements

RS-232 communications are transmitted over a three conductor, shielded cable terminated in a standard DB9 connector on the instrument end, and a different gender connector on the host end. The proper pin-outs are shown in the following illustration.



Caution

CAUTION: When replacing an older model DPG 2100, the serial cable should be replaced with a straight cable or a null-modem inserted in the line.



7.5 Mensor Command Set

This Mensor command set is the default on the CPG2500. For queries (ending with a ?), the Data column represents the response of the CPG2500. All response strings begin with a space character or an “E” representing that there is an error in the error queue. All response strings are terminated with a <CR> and a <LF>. The error queue holds the last 10 errors identified.

For all commands (no ?), the data column represents the required parameters to be sent to the CPG2500 following the string in the command column. For any command that requires multiple parameters to be sent, the parameters must be separated by commas.

7.6 Command and Query Format

Commands must be sent in ASCII format and terminated with either a carriage return (<cr>), linefeed (<lf>), or both. Commands are not case sensitive. Each query returns a response. If an error is detected the response will include an error flag.

Command or Query field: Unless otherwise specified, commands are typically converted to queries by appending a question mark to the command. Table 7.9 lists all of the CPG2500 command or query keywords.

Data field: The data field is either in ASCII {string} or numeric {value} form. In the case of multiple data fields, commas are required to separate the fields. Queries do not have a data field. String (text) or value (numeric) data are acceptable in any of the following formats:

Examples of {string} data: ON, OFF, mBar, inHg

Examples of {value} data: 1, 1.0, -5.678, 25.68324e-5

7.7 Command Set Definitions

In this manual a data entry made up of alpha characters is defined as a string, as opposed to data containing only numbers, such as “Enter 1 for ON or 0 for OFF” where 1 and 0 are defined as values.

Command: Any command or query listed in Table 7.9. For commands that take boolean data the following strings are acceptable:

0	1
False	True
No	Yes
Off	On

Separator: Space (SP).

Data: ASCII representations of numbers, {value}, or alpha characters, {string}, data as defined above. When sending code a literal variable replaces the brackets and the enclosed character(s) shown in the following examples.

Termination: Linefeed (LF) or carriage return (CR) is used to signal the end of a command statement. For IEEE-488.2 operation “EOI” is an acceptable alternative.

Always send commands in one of the following formats:

1. [Command] [Termination];
2. [Command] [Separator] [Data] [Termination];
3. Queries are special instructions in the form: [Command?] [Termination] where the question mark, “?”, immediately precedes the terminator.

When a valid query is received, the CPG2500 will return {data} terminated by CR and LF. Floating point data is returned in the current engineering units in exponential format.

7.8 Output Formats

Pressure readings are returned in exponential notation in a format according to the OUTFORM command as follows. Outform applies to both pressure channels.

1. <sp> pressure value <cr><lf>
2. <sp> pressure, units number,STANDBY <cr><lf>
3. <sp> pressure, pressure rate <cr><lf>
4. <sp> pressure, minimum peak, maximum peak <cr><lf>

7.9 CPG2500 Commands and Queries

Table 7.9 lists all of the current CPG2500 commands and queries.



Notice

**Channel specific commands are sent to only the active channel.
See 'CHAN' command.**

Optional emulation modes are available in which a CPG2500 can emulate remote functions of different brands of pressure gauges. Please contact Mensor for more details.

Table 7.9 - CPG2500 Commands and Queries

Command	Data	Response/Function
?	See Table Below	Returns data per the current output format
VAC?	<sp>n.nnnnne+nn<cr><lf>	Returns the A channel pressure reading
Accuracyst?	<sp>cccccccc<cr><lf> Ex: 0.010% IS-50	Returns the accuracy string of the sensor on the active channel.
Acquire?	15 char string. Ex: Acquire? Test_stand_1 Returns: <sp>(YES or NO), CCC... CCC<cr><lf>	This command is used when multiple computers would like to control the instrument. Yes if acquisition is successful. No if instrument is being controlled with another computer. See: Release? and Unlock
Address	1-31	Sets the GPIB Address
Address?	<sp>nn<cr><lf>	Returns the GPIB Address
Asset_tag	16 char string	General purpose string for customer use.
Auxdisp<sp><n>, <s>	n, s	Sets the auxiliary display function where "n" is the auxiliary display to be set (1,2, or 3) and "func" is the function (none, peak, rate,units)
Auxdisp?<sp><n>	s	Returns the auxiliary display function specified by "n" for the active channel

Brightness	f	Brightness f Set screen brightness between 0 and 100%
Brightness?	<sp>n.nnnnnE+nn<cr><lf>	Read the screen brightness
Asset_tag?	<sp>sssssssss<cr><lf>	Return customer asset tag string
Caldisable	YES,NO	Sets whether or not the ability to calibrate the sensors is disabled
Caldisable?	<sp>(YES or NO)<cr><lf>	Returns whether or not the ability to calibrate the sensors is disabled
Cal_Interval?	<sp>nnn<cr><lf>	Returns the calibration interval in days for the sensor on the active channel
Cerr	None	Clears the error queue
Certificate	<sp>CCCCC...<cr><lf>	Set the certificate string for the sensor on the active channel
Certificate?	<sp>CCCCC...<cr><lf>	Returns the certificate string for the sensor on the active channel
Chanfunc	n, func<cr><lf>	Sets the auxiliary display function where “n” is the auxiliary display to be set (1,2, or 3) and “func” is the function (none, peak, rate, units)
Chanfunc? <n>	<sp>CCCCC...<cr><lf>	Returns the auxiliary display function specified by “n” for the active channel
Cmdset?	<sp><CCCCC...<cr><lf>	Returns active command set identifier
Decpt?	<sp>n<cr><lf>	Returns the number of decimal points (see Resolution)
Default	None	Sets the default values
DHCP	ON or OFF	Reserved for DHCP setup
DHCP?	<sp>(YES or NO)<cr><lf>	Reserved for DHCP setup
DOC	mm/dd/yyyy	Sets the date of cal for the active channel’s sensor
DOC?	<sp>mm/dd/yyyy<cr><lf>	Returns the date of cal for the active channel’s sensor
DOM?	<sp>mm/dd/yyyy<cr><lf>	Returns the date of manufacture
Error?	<sp> text description <cr><lf>	Returns the next error in the error queue
Filter	OFF, LOW, NORMAL, HIGH	Sets the reading filter 0, 80%, 92%, 95%
Filter?	<sp> (filter)<cr><lf>	Returns the reading filter
Gasdensity	Value in lb/cuft, or “NITROGEN” or “DRYAIR”	Sets the head pressure gas density in lb/cuft. Only set for currently active channel. See alias command MEDIADENSITY

Vacuum Calibrator CPG2500

Gasdensity?	<sp>+n.nnnnnE+nn<cr><lf>	Gets the head pressure gas density in lb/cuft. Only set for currently active channel. See alias command MEDIADENSITY?
Gastemp	Value in degrees	Degrees in ∞F or ∞C depending on selected units category. See HEADUNITS? channel. See alias command MEDIATEMP
Gastemp?	<sp>+n.nnnnnE+nn<cr><lf>	Gets the head pressure gas temperature. Degrees in ∞F or ∞C depending on selected units category. See HEADUNITS? Only set for currently active channel. See alias command MEDIATEMP?
Gateway	nnn.nnn.nnn.nnn	Sets the Ethernet gateway address
Gateway?	<sp>nnn.nnn.nnn.nnn<cr><lf>	Gets the Ethernet gateway address
HeadChanAll	ON or OFF	When changing a head pressure correction setting, determines if the change applies to all channels, or only the currently active channel. When off, only applies to the active remote channel (see CHAN?). The head pressure correction setting include media density (see MEDIADENSITY?), media temperature (see MEDIATEMP?), and head height (see HEIGHT?).
HEADUNITS	METRIC/IMPERIAL/ENGLISH	Sets head pressure units category to metric of imperial
HEADUNITS?	METRIC or IMPERIAL	Sets head pressure units category
Height	Value in inches	Sets the head pressure height in inches
Height?	<sp>+n.nnnnnE+nn<cr><lf>	Gets the head pressure height in inches
Id?	<sp>MENSOR, CPG2500, ssssss, v.v.vv<cr><lf>	ssssss is the serial number, v.v.vv is the CPG2500 software version
IP	nnn.nnn.nnn.nnn	Sets the IP address of the instrument
IP?	<sp>nnn.nnn.nnn.nnn<cr><lf>	Returns the IP address of the instrument
Keylock	YES or NO	Locks or unlocks the entire touch screen
Keylock?	<sp>(YES or NO)<cr><lf>	Returns Yes or No

LANGUAGE	XXXX	Set the displayed language. String to be sent may be ENGLISH, ENGLISH GB, ENGLISH CA, GERMAN, FRENCH, FRENCH CH, FRENCH CA, SPANISH, SPANISH LA, ITALIAN, POLISH, PORTUGUESE, PORTUGUESE BR, RUSSIAN, JAPANESE, CHINESE, KOREAN
LANGUAGE?	<sp>XXXX<cr><lf>	Returns the displayed language
List?	<sp>PRI,1<cr><lf>	Legacy query
Listcal?	<sp>PRI, {sn},1,{mmdyy}<cr><lf>	Returns the calibration date of the active sensor
Listrange?	<sp>PRI,1,min,max<cr><lf>	Returns the range of the active sensor
ListSN?	<sp>PRI,1,SSSSSSSS<cr><lf>	Returns the serial number of the sensor on the active channel
Localgravity	Value in ft/s ²	Sets the local gravity in feet/sec ²
Localgravity?	<sp>+n.nnnnnE+nn<cr><lf>	Returns the local gravity in feet/sec ²
Loudness	Integer 0 to 100	Set the speaker volume to ON or OFF. Greater than 50 sets on, less than or equal to 50 turns off
Loudness?	<sp>NNN<cr><lf>	Returns the speaker volume, between 0 and 100
MACADDR?	<sp>XX-XX-XX-XX-XX-XX<cr><lf>	Returns MAC address for the instrument's ethernet interface.
MEDIADENSITY	Value, or ìNITROGENî or ìDRYAIRî	Set the media density. If value is sent, lb/cuft while in Imperial units, and kg/m ³ while in Metric units. See HEADUNITS? for units category.
MEDIADENSITY?	<sp>+n.nnnnnE+nn<cr><lf>	Returns the head pressure media density
MEDIATEMP	Value in degrees	Sets the head pressure gas temperature (only applicable while media type set to Pneumatic). Value returned in corresponding degrees ∞F or ∞C depending on selected units category. See HEADUNITS?
MEDIATEMP?	<sp>+n.nnnnnE+nn<cr><lf>	Gets the head pressure gas temperature (only applicable while media type set to Pneumatic). Value must be in corresponding degrees ∞F or ∞C depending on selected units category. See HEADUNITS?
Netmask	nnn.nnn.nnn.nnn	Sets the Ethernet network mask
Netmask?	<sp>nnn.nnn.nnn.nnn<cr><lf>	Gets the Ethernet network mask
OSVersion?	<sp>n.n<cr><lf>	Returns the operating system version

Vacuum Calibrator CPG2500

Outform	1 to 4 – see Section 7.9	Sets the output format
Outform?	<sp>X<cr><lf>	Returns the output format – see table below
Peakmax?	<sp>n.nnnnnE+nn<cr><lf>	Returns the maximum pressure since peakreset was sent
Peakmin?	<sp>n.nnnnnE+nn<cr><lf>	Returns the minimum pressure since peakreset was sent
Peakreset	None	Resets the peak values.
Port	nnnnn	Sets the Ethernet port of the instrument
Port?	<sp>nnnnn<cr><lf>	Returns the Ethernet port of the instrument
RangeMax?	<sp>n.nnnnnE+nn<cr><lf>	Returns the maximum range of the active transducer in the current units
RangeMin?	<sp>n.nnnnnE+nn<cr><lf>	Returns the minimum range of the active transducer in the current units
Rate?	<sp>n.nnnnnE+nn<cr><lf>	Returns the rate reading of the instrument in current units/current time unit (see: Runits)
Rdecpt?	<sp>n<cr><lf>	Returns the number of rate decimal points (see: Resolution)
Release?	15 char string. Ex: Release? Test stand 1 Returns: <sp>(YES or NO), CCC... CCC<cr><lf>	This command is used to release control of the instrument in a multiple computer environment. Yes if release is successful No if instrument is being controlled with another computer CCC... = name of controlling computer or AVAILABLE See: Acquire? and Unlock
Resolution	<n>	Sets the number of significant digits (see: decpt)
Resolution?	<sp>n<cr><lf>	Returns the number of significant digits (see: decpt)
Runits	SEC, MIN, HOUR, 3HOUR	Set the rate time units
Runits?	<sp>XXXX<cr><lf>	Returns the pressure per rate time units, i.e. BAR/SEC
Save_cal		Save calibration values
Sbaud	9600, 19200, 38400, 57600, 115200	Sets the serial baud rate
Sbaud?	<sp>XXXX<cr><lf>	Returns the serial baud data
Sdata	7 or 8	Sets the serial data bits
Sdata?	<sp>n<cr><lf>	Returns the serial data bits number
Sensorid?	<sp>Mensor,SN XXXXXX, VN.NN	Returns the active sensor's serial number and firmware version
Sparity	Even, ODD, NONE	Sets the serial parity

Sparity?	<sp>CCCC<cr><lf>	Returns the serial parity
Sstop	1 or 2	Sets the serial stop bits
Sstop?	<sp>X<cr><lf>	Returns the serial stop bits
SUBUNITS?	<sp>XXXX<cr><lf>	Returns the instrument auxiliary display units in a text string
Transfer_factory_to_linearity		Copy factory linearity coefficients to customer
Units	units code or text in table below	Sets the instrument engineering units
Units?	<sp>CCCC<cr><lf>	Returns the instrument units in a text string
Unlock	None	Releases Acquire locks (see: Acquire?) or (see: Release?)
Window	Value in current units	Sets the exponential filter window for the active sensor
Window?	<sp>n.nnnnnE+nn<cr><lf>	Returns the exponential filter window for the active sensor
Zerolog? i	Ex: zerolog? 0 Returns SN XXXXXX, SN XXXXXX, ZOFFS, n.nnnnnE+nn, unit, VAC, n.nnnnE+nn, unit <cr><lf>	This command outputs the zero log from the calibrator for the zero calibrated DUTs (where i=0 is the first DUT and i=31 is the last DUT's data stored). The string output results in SN of the calibrator, SN of the DUT, zero offset of the DUT, units of the offset and the vacuum calibrator reading followed by it's units.
Zerolog_clear	Deletes the log	Erases the current internal zero log information for all 32 DUT's.

7.9.1 Units Command Syntax for Measurement Units

n	Description	Output Format	Type
1	pounds per square inch	PSI	Imperial
2	inches of mercury @ 0°C	INHG	Imperial
3	inches of mercury @ 60°F	INHG	Imperial
4	inches of water @ 4°C	INH2O	Imperial
5	inches of water @ 20°C	INH2O	Imperial
6	inches of water @ 60°F	INH2O	Imperial
7	feet of water @ 4°C	FTH2O	Imperial
8	feet of water @ 20°C	FTH2O	Imperial
9	feet of water @ 60°F	FTH2O	Imperial
10	millitorr	MTORR	Metric
11	inches of sea water @ 0°C	INSW	Imperial
12	feet of sea water @ 0°C	FTSW	Imperial
13	atmospheres	ATM	Imperial
14	bars	BAR	Metric
15	millibars	MBAR	Metric
16	millimeters of water @ 4°C	MMH2O	Metric
17	centimeters of water @ 4°C	CMH2O	Metric
18	meters of water @ 4°C	MH2O	Metric
19	millimeters of mercury @ 0°C	MMHG	Metric
20	centimeters of mercury @ 0°C	CMHG	Metric
21	torr	TORR	Metric
22	kilopascals	KPA	Metric
23	pascals	PA	Metric
24	dynes per square centimeter	DY/CM ²	Metric
25	grams per square centimeter	G/CM ²	Metric
26	kilograms per square centimeter	KG/CM ²	Metric
27	meters of sea water @ 0°C	MSW	Metric
28	ounce per square inch	OSI	Imperial
29	pounds per square foot	PSF	Imperial
30	tons per square foot	TSF	Imperial
32	micron of mercury @ 0°C	mHG	Metric
33	tons per square inch	TSI	Imperial
34	hectapascals	HPA	Metric
36	megapascals	MPA	Metric
37	millimeters of water @ 20°C	MMH2O	Metric
38	centimeters of water @ 20C	CMH2O	Metric
39	meters of water @ 20°C	MH2O	Metric

7.9.2 CPG2500 Error Codes

Code	Serial Poll Byte	Description	Error String Returned
E00	00h	No errors	NO ERRORS
E05	45h	Parameter error	EGPIB PARAMETER ERROR: String that was sent
E07	47h	Syntax error	EGPIB SYNTAX ERROR: String that was sent

7.9.3 GPIB Capability Codes

SH1	Full source handshake capability
AH1	Full acceptor handshake capability
T6	Talker with serial poll and unaddress if MLA
L4	Listener with unaddress if MTA
SR1	Full service request capability
L1	Full remote/local capability including LLO
PO	No parallel poll capability
DC1	Full device clear capability
DT1	Full device trigger capability
C0	No controller capability
E2	Tri-state outputs

7.9.4 Interface Functions

The CPG2500 responds to the following IEEE.488.2 interface functions:

- SRQ Service Request: A service request is asserted whenever an error is encountered. When the bus controller issues a serial poll the error will be cleared. If the host IEEE board includes automatic serial polling capability, turn this feature off in order to view all errors.
- LLO Local Lockout: The front panel keyboard of the CPG2500 may be locked by sending LLO or the command KEYLOCK ON.
- GET Group Execute Trigger: When this message is received, the CPG2500 will save the current readings until the next time it is addressed as a talker.
- GTL Go To Local: A GTL message will cause the CPG2500 to return to local operation and unlock the keyboard.
- DCL Device Clear: When this message is received, the CPG2500 will clear all errors and buffers and remain in the Remote mode.
- SDC Selected Device Clear: The effect is the same as DCL.
- EOI End or Identify: May be used as a command or query terminator in the place of, or concurrent with, a terminating linefeed.

8 Accessories

- Remote Transducer Cable
- Vacuum Pump Accessory Kit

8.1 External Pressure Sensor Connection Cable

A shielded ribbon cable is required to connect an external transducer (DUT) and can be supplied. The CPT6100/6180 part number is: 4060090001.

8.2 Vacuum Pump Accessory Kit

A vacuum pump accessory kit can be ordered as an option to the CPG2500 Vacuum Calibrator to ensure optimal vacuum source for the internal transducer and the DUT. The accessory kit includes:

- A compact vacuum pump
- Two 6 feet long 8 mm pressure tubes
- A needle valve
- A 8mm pressure T-fitting

For detailed installation instructions, refer Section 5.7.

The pressure generated from the vacuum pump is displayed on the internal transducer in the Measure App. In order to perform “zero” calibration on the DUT, the vacuum pressure must be within 0.08... 0.0867 kPa. If the vacuum pressure is outside this range (Figure 8.2-A), regulate the vacuum supply using the knob on the needle valve. The knob must be rotated gently counter clockwise to increase pressure or clockwise to decrease vacuum pressure in the system. Figure 8.2-B shows the adjustment knob.

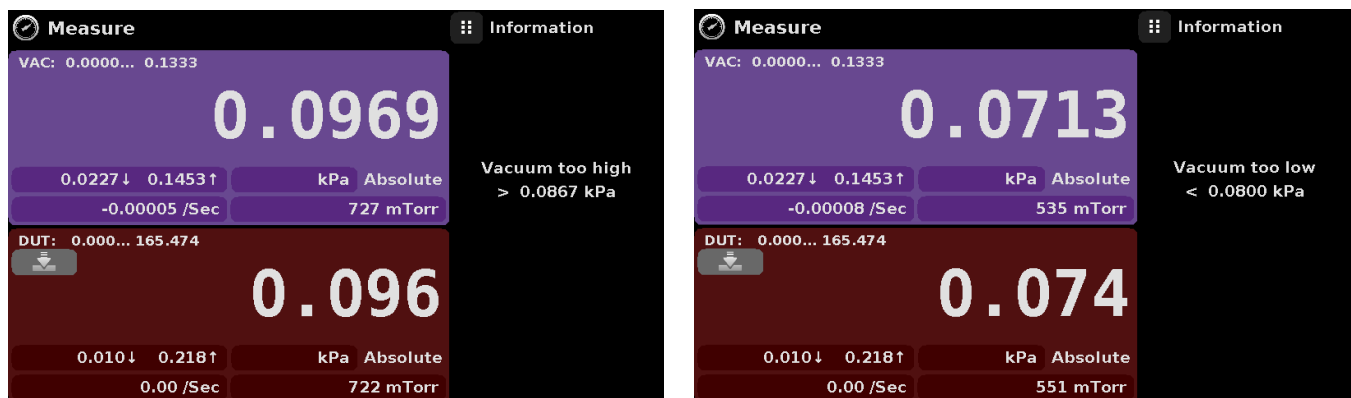


Figure 8.2-A Vacuum Too High and Low Error Message

Adjustment
knob



Figure 8.2-B Vacuum Adjustment Knob

9 Maintenance

The CPG2500 was designed for maintenance-free operation. User maintenance is not recommended. If you have questions not covered by this manual, call 1.800.984.4200 (USA only), or 1.512.396.4200 for assistance, or send an e-mail to tech.support@mentor.com.

9.1 Beyond the Warranty

Take advantage of Mensor's expert product care. Mensor provides complete maintenance and calibration services, available for a nominal fee. Our service staff is knowledgeable in the innermost details of all of our instruments. We maintain units that are in operation in many different industries and in a variety of applications, and by users with a wide range of requirements. Many of these instruments have been in service for over twenty years, and continue to produce excellent results. Returning your instrument to Mensor for service benefits you in several ways:

- Our extensive knowledge of the instrument assures you that it will receive expert care.
- In many cases we can economically upgrade an older instrument to the latest improvements.
- Servicing our own instruments which are used in "real world" applications keeps us informed as to the most frequent services required. We use this knowledge in our continuing effort to design better and more robust instruments.

10 Calibration

The CPG2500 automatically adjusts the pressure reading for the effects of temperature and non-linearity within the calibrated temperature range of 15-40°C. The process is referred to as dynamic compensation because each reading is so adjusted before it is output to the display or to a communication bus. Thus, a calibrated CPG2500 operated within its temperature band, and with proper zero and span adjustments, will provide accurate pressure measurements.

The CPG2500 should have the calibration verified periodically to insure stability. The recommended calibration cycle is one year.

10.1 Environment

For maximum accuracy, allow the CPG2500 to warm up a minimum of 15 minutes in ambient temperature within the compensated range prior to a calibration. In addition, the instrument should be at rest on a stable platform that is free of excessive vibration and shock.

10.2 Pressure Standards

Mensor recommends the use of appropriately accurate primary pressure standards when calibrating this instrument. Such standards should be sufficient so that when the techniques of the ISO Guide to the Expression of Uncertainty in Measurement (GUM) are applied, the instrument meets its accuracy statements as required by ISO/IEC 17025:2017, or other applicable standards.

10.3 Media

The recommended calibration medium is dry nitrogen or clean dry instrument air.

10.4 Service Application



The Service application is a password protected area where calibration of all connected sensors can be accomplished. In addition, this is where the password for entering this area can be changed.

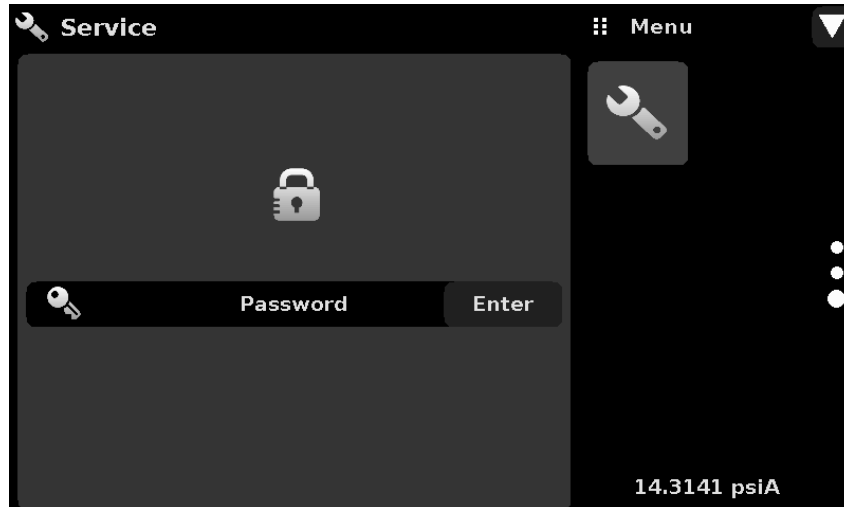



Figure 10.4-A - Service Application (locked)

Press the Enter button to show the numeric keypad to enter a password. This will unlock other applications. The Default password is 123456. Enter 123456 and press the check mark [] to unlock the Service Application.

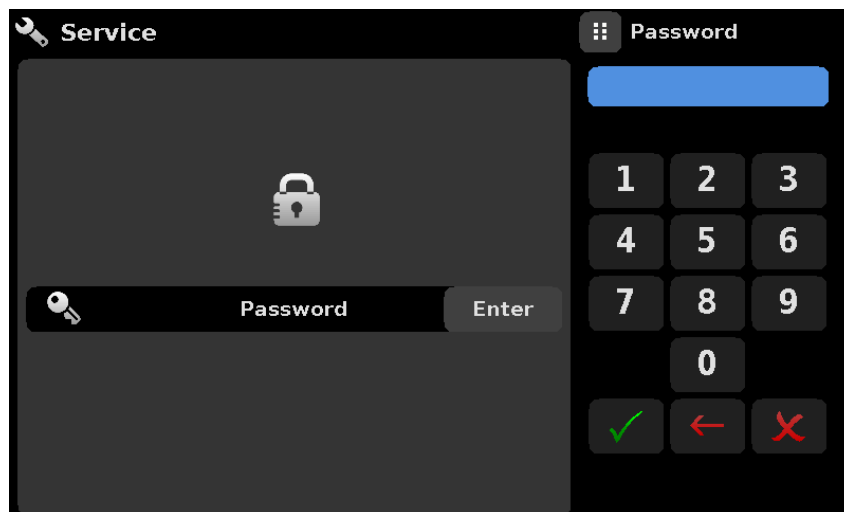


Figure 10.4-B - Service Application (Enter Password)



Note: The default Password is 123456. After entering this for the first time, the password can be changed.

10.4.1 Service Application (unlocked)

After the Password has been entered, the unlocked Service Application will appear (Figure 10.4.1). To re-lock this screen, press the Lock button.

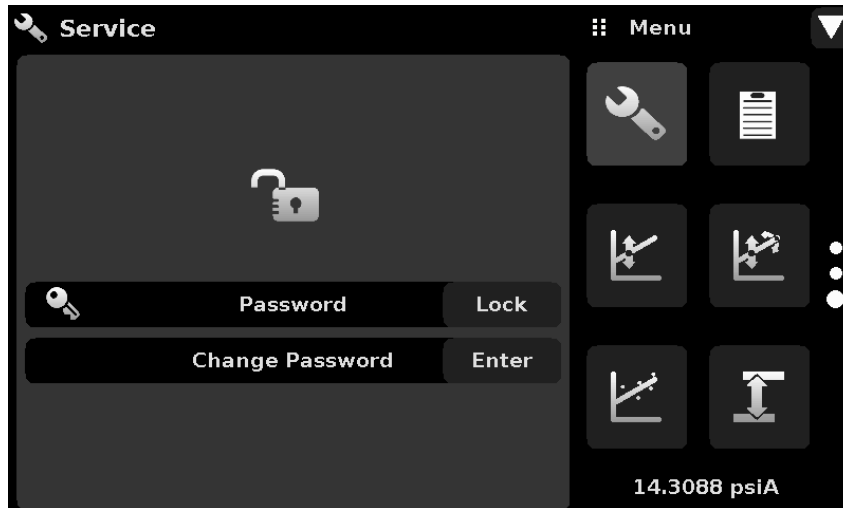



Figure 10.4.1 - Unlocked Service Application


From the unlocked Service Application, the Password can be changed by pressing the Enter button next to the Change Password label. This will open a keypad where a new password can be entered and accepted by pressing the Check Mark [].



Note: Please make note of a password change and save the new password in a secure location.

The Unlocked Service Application is the access point to all calibration screens described below.

10.5 Calibration Data

The Calibration Data Application is where the calibration data for each transducer is stored and amended. The Serial number (S/N), Zero offset (Zero) and Span offset (Span) can be seen in this screen. The date of calibration, the calibration interval and the certificate number can be entered by pressing the corresponding button, then saved by pressing the Check [] button. To revert back to the factory calibration, press the “Restore Factory Cal” button. To view the calibration data for each transducer press the “Channel” button at the top and choose a transducer from the resulting channel selection menu.

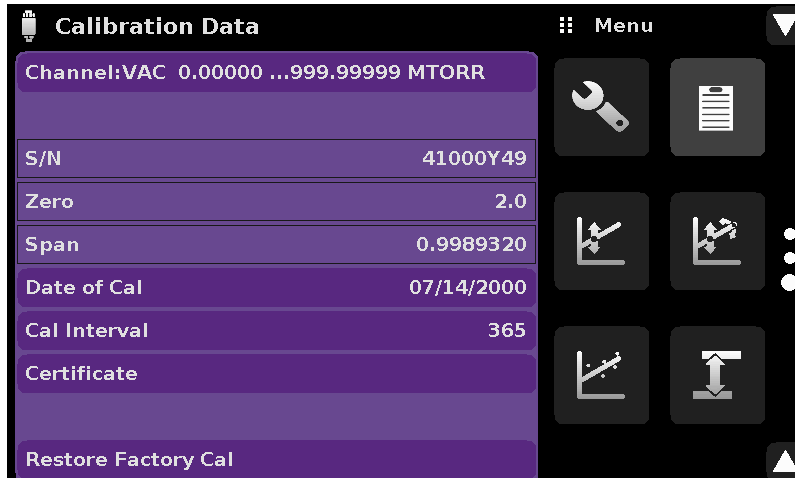
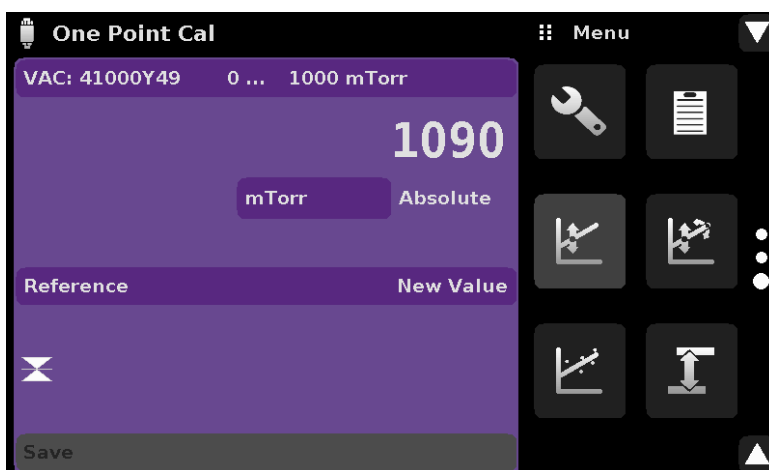


Figure 10.5 - Calibration Data

10.6 One Point Cal Application

A single point calibration (usually a zero point calibration) of the internal transducer can be accomplished in the “One Point Cal” App. It is recommended to consult factory for performing the one point calibration on this instrument.




Notice the reference symbol [], this is a reference indication giving a constant reference point for the level of the internal sensor.

Figure 10.6 - One Point Cal Application

10.7 Two Point Cal Application



The Two Point Cal Application provides a place to adjust the Transducer Zero and Span (sometimes referred to as the offset and slope). It is recommended to consult factory for performing the one point calibration on this instrument.

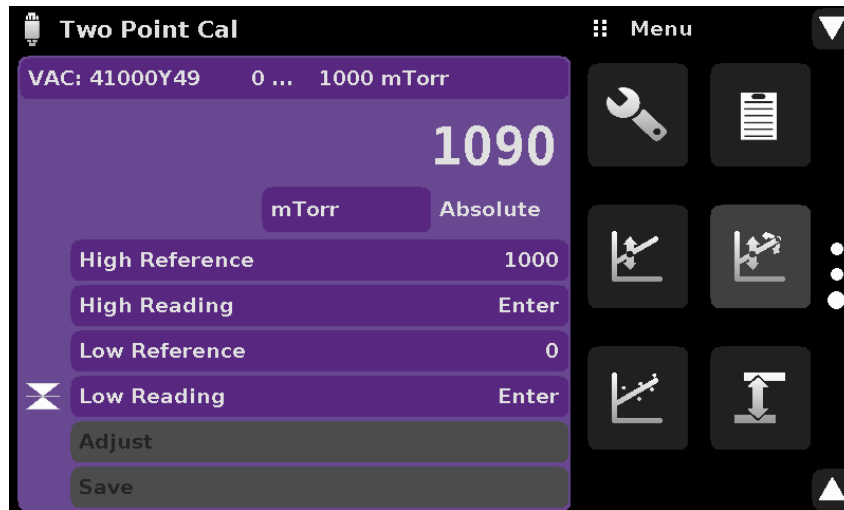


Figure 10.7 - Two Point Cal Application

10.8 Linearization



The Linearization Application is not applicable to this instrument.

10.9 Head Pressure

The Head Pressure Application provides an automated way to calculate the head pressure offset between a device being tested and the CPG2500 sensor, based on:

- Local Gravity
- Media: pneumatic
- Height: the difference between the device under test and the sensing element in the transducers (internal and external) in the CPG2500. Height difference = CPG2500-DUT
As an example, if the device under test (DUT) is 10 inches above the CPG2500, enter - 10 inches in the “Height” button.
- Media Density: the media density of the pressure media. Choices for pneumatic media are Nitrogen or Dry Air.
- Media Temperature: Only applicable with pneumatic media.

The Head Pressure application is placed under the password protected area of the operator interface to safeguard against inadvertent activation. It is intended to be used to accurately measure the pressure at an external source that is at a different elevation from the CPG2500 transducer sensing that pressure. The four parameters are used to calculate the pressure that is a result of the different elevations. It should not be used when calibrating CPG2500 transducers. The Head height should be set at zero before calibrating the transducers of the CPG2500.



Notice

The Head Pressure should not be active when calibrating CPG2500 transducers. The Head height should be set at zero before calibrating the transducers of the CPG2500. Difference in height between the laboratory standard and the CPG2500 during calibration should be factored into the uncertainty analysis.

Figure 10.9-A shows the Head Pressure pneumatic screen. The height, media density (Nitrogen or dry air), media temperature and local gravity can be entered here based on the specific setup of the system.

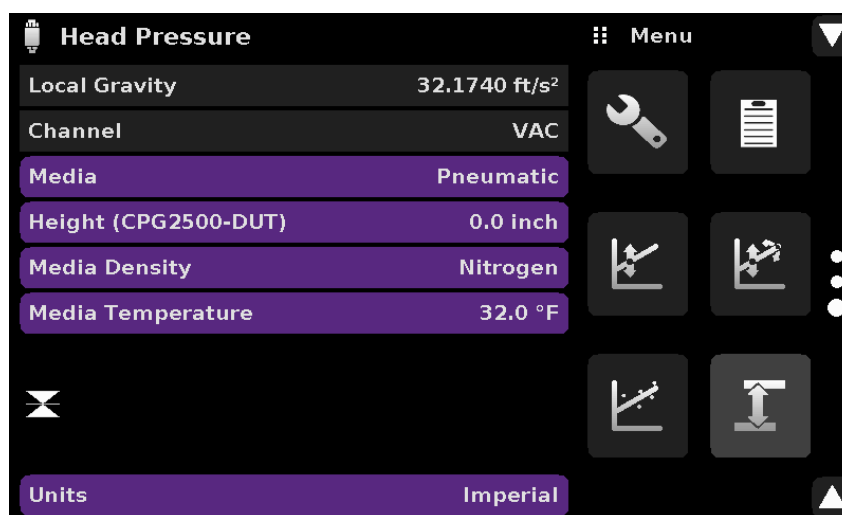


Figure 10.9-A - Head Pressure, Pneumatic

11 Appendix

Table 11.1 - Measurement Units (unitno)

Code	Description	Output Format
1	pounds per square inch	PSI
2	inches of mercury @ 0°C	inHg 0°C
3	inches of mercury @ 60°F	inHg 60°F
4	inches of water @ 4°C	inH2O 4°C
5	inches of water @ 20°C	inH2O 20°C
6	inches of water @ 60°F	inH2O 60°F
7	feet of water @ 4°C	ftH2O 4°C
8	feet of water @ 20°C	ftH2O 20°C
9	feet of water @ 60°F	ftH2O 60°F
10	millitorr	mTorr
11	inches of seawater @ 0°C 3.5% salinity	inSW
12	feet of seawater @ 0°C 3.5% salinity	ftSW
13	atmospheres	ATM
14	bars	Bar
15	millibars	mBar
16	millimeters of water @ 4°C	mmH2O 4°C
17	centimeters of water @ 4°C	cmH2O 4°C
18	meters of water @ 4°C	MH2O 4°C
19	millimeters of mercury @ 0°C	mmHg 0°C
20	centimeters of mercury @ 0°C	cmHg 0°C
21	torr	Torr
22	kilopascals	kPa
23	pascals	PA
24	dyne per square centimeter	Dy/cm2
25	grams per square centimeter	gm/cm2
26	kilograms per square centimeter	kg/cm2
27	meters of seawater @ 0°C 3.5% salinity	MSW
28	ounce per square inch	OSI
29	pounds per square foot	PSF
30	tons per square foot	TSF
31	percent of full scale	%FS
32	micron HG @ 0°C	μHg 0°C
33	ton per square inch	TSI
34	n/a	n/a
35	hectopascals	hPa
36	megapascals	MPa
37	millimeters of water @ 20°C	mmH2O 20°C
38	centimeter of water @ 20°C	cmH2O 20°C
39	meters of water @ 20°C	MH2O 20°C

n/a	User Units 1	User defined
n/a	User Units 2	User defined

11.1 Conversion Factors, PSI

The values listed in the column “To convert from PSI” are the values imbedded in the instrument program. The values listed under “To convert to PSI” are internally calculated approximations based on the imbedded values.

Table 11.2 - Conversion Factors, PSI

Code	Pressure Unit	To convert from PSI	To convert to PSI
1	PSI	1	1
2	inHg 0°C	2.036020	0.4911544
3	inHg 60°F	2.041772	0.4897707
4	inH2O 4°C	27.68067	0.03612629
5	inH2O 20°C	27.72977	0.03606233
6	inH2O 60°F	27.70759	0.03609119
7	ftH2O 4°C	2.306726	0.4335149
8	ftH2O 20°C	2.310814	0.4327480
9	ftH2O 60°F	2.308966	0.4330943
10	mTorr	51715.08	0.00001933672
11	inSW 0°C 3.5% salinity	26.92334	0.03714250
12	ftSW 0°C 3.5% salinity	2.243611	0.445710
13	ATM	0.06804596	14.69595
14	Bar	0.06894757	14.50377
15	mBar	68.94757	0.01450377
16	mmH2O 4°C	703.0890	0.001422295
17	cmH2O 4°C	70.30890	0.01422295
18	MH2O 4°C	0.7030890	1.422295
19	mmHg 0°C	51.71508	0.01933672
20	cmHg 0°C	5.171508	0.1933672
21	Torr	51.71508	0.01933672
22	kPa	6.894757	0.1450377
23	PA	6894.757	0.0001450377
24	Dy/cm2	68947.57	0.00001450377
25	gm/cm2	70.30697	0.01422334
26	kg/cm2	0.07030697	14.22334
27	MSW 0°C 3.5% salinity	0.6838528	1.462303
28	OSI	16	0.0625
29	PSF	144	0.006944444
30	TSF	0.072	13.88889
31	%FS	(PSI / RANGE) x 100	(% FS x RANGE) / 100
32	μHg 0°C	51715.08	0.00001933672
33	TSI	0.0005	2000
35	hPa	68.94757	0.01450377

Vacuum Calibrator CPG2500

36	MPa	0.006894757	145.0377
37	mmH2O 20°C	704.336	0.001419777
38	cmH2O 20°C	70.4336	0.01419777
39	MH2O 20°C	0.704336	1.419777

11.2 Conversion Factors, Millitorr

The following table lists factors which should be used as multipliers when converting other pressure units to or from millitorr.

Table 11.3 - Conversion Factors, millitorr

Code	Pressure Unit	To convert from millitorr	To convert to millitorr
1	PSI	0.0001933672	51715.08
2	inHg 0°C	0.0003936995	25400.08909
3	inHg 60°F	0.0003948117	25328.53093
4	inH2O 4°C	0.0005352534	1868.273977
5	inH2O 20°C	0.0005362028	1864.966281
6	inH2O 60°F	0.0005357739	1866.458778
7	ftH2O 4°C	0.0004460451	22419.25773
8	ftH2O 20°C	0.0004468356	22379.59744
9	ftH2O 60°F	0.0004464783	22397.50637
10	mTorr	1.0	1.000000000
11	inSW 0°C 3.5% salinity	0.0005206091	1920.827359
12	ftSW 0°C 3.5% salinity	0.0004338408	23049.92831
13	ATM	0.00001315786	760002.2299
14	Bar	0.00001333220	750063.6259
15	mBar	0.001333220	750.0636259
16	mmH2O 4°C	0.0135954	73.5540997
17	cmH2O 4°C	0.001359544	735.5409971
18	MH2O 4°C	0.00001359544	73554.09971
19	mmHg 0°C	0.001	1000.000000
20	cmHg 0°C	0.0001	10000.00000
21	Torr	0.001	1000.000000
22	kPa	0.0001333220	7500.636259
23	PA	0.1333220	7.500636259
24	Dy/cm2	1.333220	0.750063626
25	gm/cm2	0.001359506	735.561166
26	kg/cm2	0.000001359506	735561.166
27	MSW 0°C 3.5% salinity	0.00001322347	75623.11663
28	OSI	0.0003093875	3232.1992
29	PSF	0.002784488	359.132477
30	TSF	0.000001392244	718265.0575
32	μHg 0°C	1.0	1.000000000
33	TSI	0.0000000966836	103430160.00
35	hPa	0.001333220	750.0636259

36	MPa	0.0000001333220	7500636.259
37	mmH2O 20°C	0.01361955	73.42388114
38	cmH2O 20°C	0.001361955	734.2388114
39	MH2O 20°C	0.00001361955	73423.88114

11.3 Conversion Factors, Pascal

The following table lists factors which should be used as multipliers when converting other pressure units to or from Pascal.

11.4 - Conversion Factors, Pascal

Unit No.	Pressure Unit	To convert from Pascal	To convert to Pascal
1	PSI	1.450377E-04	6.894757E+03
2	inHg 0°C	2.952997E-04	3.386390E+03
3	inHg 60°F	2.961339E-04	3.376850E+03
4	inH2O 4°C	4.014741E-03	2.490820E+02
5	inH2O 20°C	4.021862E-03	2.486410E+02
6	inH2O 60°F	4.018645E-03	2.488400E+02
7	ftH2O 4°C	3.345622E-04	2.988980E+03
8	ftH2O 20°C	3.351551E-04	2.983692E+03
9	ftH2O 60°F	3.348871E-04	2.986080E+03
10	mTorr	7.500636E+00	1.333220E-01
11	inSW 0°C 3.5% sal	3.904899E-03	2.560885E+02
12	ftSW 0°C 3.5% sal	3.254082E-04	3.073062E+03
13	ATM	9.869230E-06	1.013250E+05
14	Bar	1.00000E-05	1.00000E+05
15	mBar	1.00000E-02	1.00000E+02
16	mmH2O 4°C	1.019744E-01	9.806378E+00
17	cmH2O 4°C	1.019744E-02	9.806378E+01
18	MH2O 4°C	1.019744E-04	9.806378E+03
19	mmHg 0°C	7.500636E-03	1.333220E+02
20	cmHg 0°C	7.500636E-04	1.333220E+03
21	Torr	7.500636E-03	1.333220E+02
22	kPa	1.00000E-03	1.00000E+03
23	PA	1.00000E+00	1.00000E+00
24	Dy/cm2	1.00000E+01	1.00000E-01
25	gm/cm2	1.019716E-02	9.806647E+01
26	kg/cm2	1.019716E-05	9.806647E+04
27	MSW 0°C 3.5% sal	9.918444E-05	1.008222E+04
28	OSI	2.320603E-03	4.309223E+02
29	PSF	2.088543E-02	4.788025E+01
30	TSF	1.044271E-05	9.576052E+04
32	µHg 0°C	7.500636E+00	1.333220E-01
33	TSI	7.251885E-08	1.378951E+07
35	hPa	1.00000E-02	1.00000E+02
36	MPa	1.00000E-06	1.00000E+06
37	mmH2O 20°C	1.021553E-01	9.789017E+00
38	cmH2O 20°C	1.021553E-02	9.789017E+01
39	MH2O 20°C	1.021553E-04	9.789017E+03



Mensor

201 Barnes Drive
San Marcos, Texas 78666
Tel: 512-396-4200
Website: www.mensor.com
Fax: 512-396-1820
Email: sales@mensor.com



WIKA Alexander Wiegand SE & Co. KG
Alexander-Wiegand-Straße 30
D-63911 Klingenberg / Germany
Tel: (+49) 93 72/132-5015
Website: www.wika.de
Fax: (+49) 93 72/132-8767
Email: CTsales@wika.de