

**BetaGauge II™  
Pressure Calibrator**

*User Guide*



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# Introduction

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The BetaGauge II™ Pressure Calibrator is the most advanced and accurate handheld pressure calibrator available. This calibrator was engineered to perform in any industrial environment and is equipped with everything you need for maintaining your pressure instruments to your manufacturer's specifications.

## About this Guide

This guide provides complete information on the proper use and operation of the BetaGauge II. A brief description of each section follows:

**Section 1** provides general information regarding the BetaGauge II, as well as a description of the keyboard and menu. In addition, it provides information on standard and optional equipment.

**Section 2** describes the two types of input modules available for the BetaGauge II. It also explains how to install and remove modules and how to connect field devices to both module types.

**Section 3** explains how to perform basic BetaGauge II operations, such as specifying pre-programmed display units, zeroing displayed values, and programming trip detection.

**Section 4** explains how to set user preferences, such as viewing and programming owner and calibrator information, turning the keypad beep on and off, and setting LCD preferences.

**Section 5** explains how to set up user-defined display modes for both electrical and pressure units.

**Section 6** explains how to perform the possible calibration tests using the BetaGauge II.

**Section 7** explains how to use the BetaGauge II with third party software to provide automated computer aided calibration.

**Appendix A** provides the dangers, warnings, and cautions for using battery packs and explains other battery related information.

**Appendix B** lists the detailed specifications for the BetaGauge II.

**Appendix C** lists the pressure conversion factors for converting pounds per square inch (PSI) to other pressure units.

**Appendix D** describes the necessary service required for the BetaGauge II. In addition, it explains how to contact the factory for technical support and how to arrange for any needed servicing. This section also includes the Limited Warranty statement.

## Comments

Martel Electronics Corporation is interested in your response to our products and to this guide. If you have any comments or suggestions, you may contact us as follows:

**Mail:** Martel Electronics Corporation  
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P.O. Box 770  
Londonderry, NH 03053

**Voice:** Inside the United States  
1-800-821-0023  
Outside the United States  
1-603-434-1433

**E-Mail:** [sales@martelcorp.com](mailto:sales@martelcorp.com)

Please tell us how to contact you if we have any questions or follow-up to your inquiry.

## Factory Sales

To purchase optional items or additional modules for the BetaGauge II, please contact us at the numbers above.

You can also visit our web site to view our other calibration products, download product information and find out how to return calibrators for annual recertification.

See us at [www.martelcalibrators.com](http://www.martelcalibrators.com).

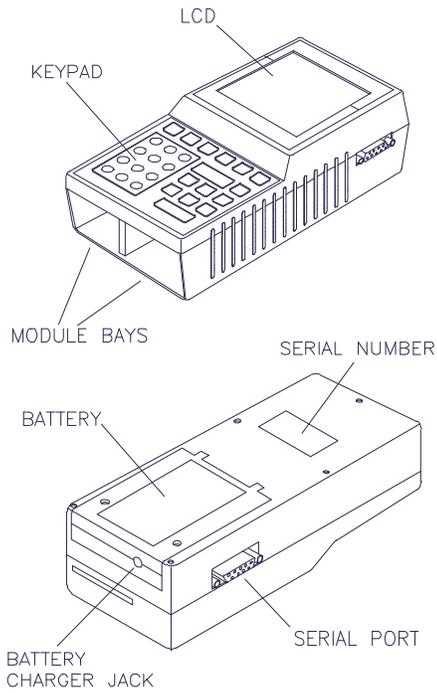
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# 1- General Description

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## Overview

The BetaGauge II pressure calibrator is the most advanced and accurate handheld pressure calibrator available today. Its 3½ inch diagonal liquid crystal display (LCD), membrane keypad, and user-prompt programming make the BetaGauge II easy to operate. An illustration is shown below:



**Figure 1-1 BetaGauge II**

## Carrying Case

The BetaGauge II comes with a two-section padded vinyl carrying case. It is recommended that you use the case at all times to protect the calibrator from damage due to chemicals, dust, and dirt. The carrying case is described below:

**Front Section.** The calibrator is secured in the front section of the case with an elastic strap that fits between the keypad and the display.

**Back Section.** The back section of the case provides space for carrying three modules, this user guide, and communications cables. There is also space for fittings or other connectors, if needed.

**Bottom Flap.** A flap at the bottom of the case is secured with Velcro™. You can loosen the flap to install and use modules while the calibrator is in the case. Keep the flap closed when the calibrator is not in use to keep foreign material out of the module bays.

**Front Flap.** The flap at the front of the case has a pouch for holding the calibrator test leads.

**Carrying Strap.** The carrying strap on the case may be adjusted for comfort as a shoulder strap (or you can remove the strap). It can also be used to hang the calibrator for use in the field.

## Standard Equipment

The BetaGauge II is supplied with the following standard equipment:

- One pressure calibrator hand held (HHU) unit
- One standard voltage/current DC input module
- One battery pack (nickel-cadmium, rechargeable)
- One set of test leads
- One battery charger
- One vinyl carrying case
- One 9-pin D shell to 9-pin D shell serial cable

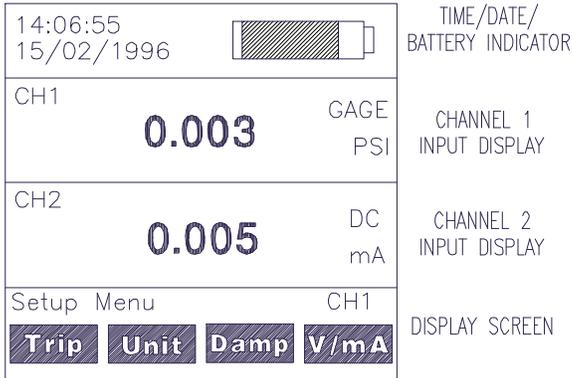
## Optional Equipment

The BetaGauge II is available with any of the following options:

- Additional standard input modules (28 pressure ranges to choose from)
- Vacuum and pressure pumps
- Quick charge battery pack (with internal conditioner)
- Intrinsically safe battery pack (for CSA Exia rated main units)
- Battery charger for quick charge battery pack
- Replacement test leads
- Additional battery packs (standard, intrinsically safe, and quick charge)

## BetaGauge II LCD

The BetaGauge II liquid crystal display is divided into four sections. These sections are described below in the order that they appear on the display from top to bottom. Refer to the illustration below:

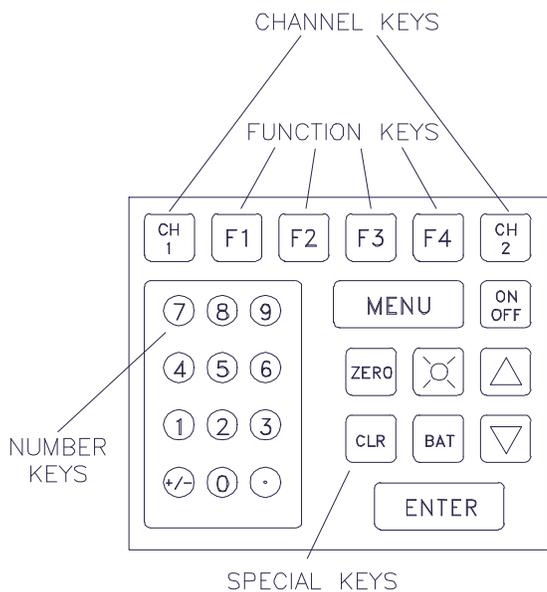


**Figure 1-2 BetaGauge II LCD**

- **Time/Date/Battery Indicator.** The calibrator's current time and date appears to the left of this section and the approximate battery voltage indicator appears to the right.
- **Channel 1 Input Information.** This section displays the current Channel 1 input reading in pressure units, Volts, or milliamps.
- **Channel 2 Input Information.** This section displays the current Channel 2 reading in pressure units, Volts, or milliamps.
- **Display Screen.** This section shows the current menu, the current menu items associated with the four function keys (**F1** through **F4**), and other displays depending on the current function you are performing.

## Keypad Description

The keypad on the BetaGauge II allows you to enter data, scroll through the menus, and select menu items. A sample keypad is shown below:



**Figure 1-3 BetaGauge II Keypad**

The BetaGauge II keypad consists of the following key groups:

- Channel keys
- Function keys
- Number keys
- Special keys

Each of the key groups are described on the following pages.

## Channel Keys

The channel keys (**CH1** and **CH2**), in the upper left and right corners of the keypad, allow you to select Channel 1 or Channel 2 for performing specific configuration or modification functions, such as damping or zeroing a module. Channel 1 data appears in the top half of the LCD display; Channel 2 data appears in the bottom half.

## Function Keys

The function keys (**F1** through **F4**), across the top of the keypad, allow you to select specific menu items. These menu items appear across the bottom row of the LCD. You can select menu items by pressing the function key directly beneath the selection you want to make. The function of each key changes depending upon the menu currently displayed.

## Number Keys

The number keys (**0** through **9**, **+/-**, and **.**), in the left portion of the keypad, allow you to enter values for various entry screens.

## Special Keys

The special keys, in the right portion of the keypad, allow you to perform specific BetaGauge II operations. These special keys are described below:

---

<b>Key</b>	<b>Allows you to ...</b>
MENU	Scroll forward through the menu items under the Setup menu and the Calibration menu.
ON/OFF	Turn the BetaGauge II on and off.
ZERO	Set any displayed value to zero.
(Starburst)	Toggle a display backlight on and off as needed. Refer to Section 4 for information on how to set the time delay for the backlight shut off.
CLR	Exit the current display screen and return to the previous menu.
BAT	Read the exact battery voltage.
(Up/Down Arrows)	Scroll through alphanumerical characters for data entry purposes.
ENTER	Accept keypad entries.

## Menus

The BetaGauge II Calibrator has two main menus:

- Setup menu
- Calib menu

See the BetaGauge II menu structure below:

### BetaGauge II Main Menu Structure

Top Level	Sub Menus (Shaded)			
	Program Selections (not shaded)			
<b>Setup Menu</b>				
<b>Trip</b> <sup>1</sup>	Dis.	Enab	Reset	
<b>Unit</b>				
<b>Damp</b>	0.0s	2.0s	5.0s	10.0s
<b>V/mA</b> <sup>1</sup>				
<b>Sys</b>	<b>(MasterCAL IMMS (SYS) Mode)</b>			
<b>Owner</b>				
<b>Beep</b>	Dis.	Enab		
<b>LCD</b>	LED			
	<b>Contrast</b>	Light	Dark	
<b>Off</b>	Dis.	Enab	Set	
<b>Mod</b>	CH1	CH2		
<b>time</b>	Sec	Min	Hrs	
<b>Date</b>	Day	Month	Year	
<b>Format</b>	dmy	mdy	ymd	12/24Hr
<b>Mode</b>	P/I	I/P	Other	
<b>User</b>				
<b>%Fnc</b>	P/I	I/P	Other	
<b>Calibrate Menu</b>				
<b>Main</b>				
<b>Info</b>	Prty	Ver.		

<sup>1</sup>Only Available on the DC Input Module.

## Setup Menu

The Setup menu contains the following menu items:

---

<b>Menu Item</b>	<b>Allows you to ...</b>
Trip	Detect trips from either wet or dry contacts using an installed DC module. Refer to Section 3 for more information.
Unit	Select the desired pressure units for display when using a BetaPort–P pressure module. Refer to Sections 3, 4, and 5 for more information.
Damp	Select the damping factor for fluctuating inputs. Refer to Section 3 for more information.
V/mA	Select voltage or milliamp measurements when using a BetaPort–DC module.
Sys	Access the BetaGauge II's Documenting Calibrator (SYS) Mode. Refer to Section 7 for more information.
Owner	View the owner identification, the serial number of the calibrator, and the last factory acceptance date of the calibrator. Refer to Section 4 for more information.
Beep	Enable or disable the keypad beep. Refer to Section 4 for more information.
LCD	Enable or disable the backlight off timeout mechanism and change the LCD contrast. Refer to Section 4 for more information.
Off	Enable or disable the auto shut off mechanism and set the auto shut off period. Refer to Section 4 for more information.

---

<b>Menu Item</b>	<b>Allows you to ...</b>
Mod	View module specific information such as serial number, range, and last calibration date. Refer to Section 3 for more information.
Time	Set the time. Refer to Section 4 for more information.
Date	Set the date. Refer to Section 4 for more information.
Format	Set the format for the time and date. Refer to Section 4 for more information.
Mode	Set up the calibrator for using advanced display modes such as user-defined pressure units, percent scale, percent error, etc. Refer to Section 5 for more information.
User	Define a unit name for a user-defined unit and for pressure units, the value with respect to one psi. Refer to Section 5 for more information.
%Fnc	Set up the calibrator for advanced display mode such as user-defined pressure units, percent scale, percent error, etc. Refer to Section 5 for more information.

## Calib Menu

The Calib Menu contains the following menu items:

---

Menu Item	Allows you to ...
Main	(Reserved for factory use.)
Info	Specify details on who owns the calibrator and view the version of firmware currently installed. Refer to Section 4 for more information.

### Accessing the Menu Items

The menus and menu items appear at the bottom of the LCD. When you first power up the calibrator, the bottom of the display appears as shown below:

Setup Menu	CH1		
Trip	Unit	Damp	V/ma

**NOTE:** The display automatically defaults to the Setup menu and shows the first four Setup menu items.

### Procedure

To access the Setup menu and the Calib menu:

1. Make sure the power is on. The first four items on the Setup menu display automatically.
2. To access the other Setup menu items, continue pressing the **Menu** key. When you have viewed all of the Setup menu items, the Calib menu appears.
3. To return to the Setup menu, press the **Menu** key again.

\*\*\*

## 2- Input Modules

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### Overview

The BetaGauge II is a two-channel, multi-range instrument. You can change ranges simply by plugging in new input modules, and you may install or remove modules even while the unit is powered up. The calibrator automatically recognizes the module types and displays the appropriate units.

There are two types of modules available for the BetaGauge II:

- BetaPort–DC electrical modules
- BetaPort–P pressure modules

You may combine these two module types in the following ways:

- One BetaPort–DC electrical module and one BetaPort–P pressure module, or
- Two BetaPort–P pressure modules

#### **WARNING**

Do not simultaneously install two BetaPort–DC electrical modules in the calibrator. The calibrator is not designed to permit operation with two electrical modules. Ground potential differences could cause high current flows through the calibrator which could damage the calibrator and/or cause bodily injury.

## Installing and Removing Modules

You may insert or remove a module while the calibrator is on or off. If the calibrator is on, the module will self-initialize within 3 seconds and a reading will display on the LCD.

When facing the calibrator, the left module bay corresponds to Channel 1, and the right module bay corresponds to Channel 2.

**CAUTION:** Use care when handling modules. It is recommended that you store unused modules in the carrying case supplied with the calibrator. Careless handling of a module could result in damage to the module's miniature data connector.

### Installation Procedure

Use the following procedure to install a module into the BetaGauge II:

1. Insert the connector end of the module into the appropriate module bay. Make sure the serial number label faces up.
2. Insert the module into the module bay until it is seated (approximately  $\frac{3}{4}$  inches of the module will be visible).

**CAUTION:** The keys and offsets on the module connector are designed so that the module can be inserted in one direction only. Excessive force could damage the module or the calibrator.

**NOTE:** For information on how to select a channel for performing specific functions, refer to Section 3.

## Removal Procedure

To remove a module from the BetaGauge II calibrator, place one hand on the calibrator and use the other hand to firmly grasp the module and pull directly out from the calibrator.

**NOTE:** If a BetaPort–P pressure module is removed or disconnected while the BetaGauge II is reading pressure units, the display will show an invalid pressure reading. After a few seconds, the calibrator will determine that the pressure module has been disconnected or has malfunctioned and the following message will appear: *NO MOD*.

## Input Module Connections

The following paragraphs describe how to connect the BetaGauge II to field instruments for measuring pressure and electrical signals.

### BetaPort–DC Electrical Modules

To make electrical connections to the BetaPort–DC module, use standard banana jacks on  $\frac{3}{4}$  inch (19 mm) centers.

The factory test lead connector is a dual banana connector with the common pin marked by a tab. Replacements are readily available from a variety of sources including Martel Electronics Corporation. (Consult Factory Sales for details.)

**CAUTION:** When connecting any electrical measuring device to an unknown circuit, it is best to de-energize the circuit before connecting the device. You can then energize the circuit from a safe location.

## Procedure

Use the following procedure to connect the BetaPort–DC electrical module to a field device:

**NOTE:** Install the module in the calibrator *prior* to connecting the module to field devices.

1. Insert the common pin (marked by a tab) on the dual banana connector into the negative (black) terminal marked with a "-" on the module.
2. Insert the opposite pin into the positive (red) terminal marked with a "+" on the side labeled "V" for voltage measurement and "mA" for milliamp measurement.

**NOTE:** The BetaPort–DC module is protected from damage against misconnection to high voltages up to 120 Volts. In the event that the module is misconnected to a high voltage, the module should be checked for correct operation by comparison with another device of known performance and similar or better accuracy.

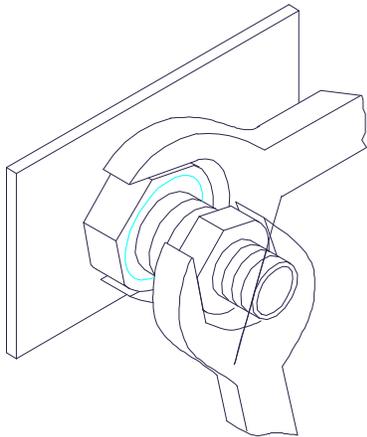
## BetaPort–P Pressure Modules

The BetaPort–P pressure modules are fitted with 316 S.S. 1/8" FNPT connections. A variety of connectors and adapters are available from third parties to allow connection to any type of field device.

It is recommended that you use an appropriate pipe thread seal (such as Teflon tape) with any connector. This improves thread sealing and reduces the likelihood of galling the threads.

### Procedure

When installing a connector on a module, always use a backup wrench to prevent damage to the module or calibrator. See the illustration below:



**Figure 2-1 Using a Backup Wrench**

**CAUTION:** Failure to use a backup wrench may damage the calibrator and/or the module and will void the product warranty.

Do not use the pressure connections to support the calibrator.

## **Pressure Module Media Compatibility**

BetaPort–P pressure modules consist of two basic types:

- non-isolated
- isolated

Consult the calibrator specifications (Appendix B) for details about which modules are isolated and which are non-isolated.

Modules with isolated sensors have an isolating diaphragm made of 316 stainless steel and may be used with any media compatible with 316 S.S., and are available for most pressure ranges.

**CAUTION:** Modules with non-isolated sensors may be used only in the presence of non-corrosive media such as clean, dry, non-corrosive air or gases. Certain acids may react with stainless steel and should not be introduced into the sensor. Consult with the media or substance manufacturer for further information.

**NOTE:** The ranges and the resolution of the various pressure modules are described in Appendix B, Specifications.

## Pressure Module Safety

Always use good safety practices when working with high pressures. Although liquids are considered non-compressible, dissolved and trapped gases can exist in the system and can store significant energy when compressed under high pressure. Always use good quality fittings that are rated for the pressures you are using and always use safety glasses or goggles.

### Overpressure Protection

The sensors used in BetaPort–P pressure modules have excellent overpressure specifications. However, it is possible to damage the sensor if you connect the module to *excessive* pressure.

**CAUTION:** Do not connect the BetaPort–P pressure module to a pressure source greater than the full scale range of the module. Doing so may damage the module.

If you suspect that a module has been subjected to excessive pressure, compare its performance with an equivalent device to verify its performance.

**CAUTION:** Using third party devices to provide external pressure relief is not recommended. A leaking pressure relief device may affect the measurement accuracy.

A module that has been exposed to excessive overpressures may indicate *stressed* on the calibrator LCD (or *EE ERR* for earlier versions of firmware). If this happens, you should return the module to the factory for service.

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## 3- Basic Operations

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### Overview

The BetaGauge II is a two-channel device. This means that two variables can be measured and displayed simultaneously. The display data for the channels 1 and 2 corresponds to the modules installed in the left and right module bays respectively. Channel 1 appears in the top half of the LCD display while Channel 2 appears in the bottom half.

The BetaGauge II uses pressure modules to measure pressure and DC modules to measure electrical signals. After you have properly installed and connected the input modules to your field instrument, you can begin to perform the following basic operations of the BetaGauge II:

- Select channel 1 or channel 2 for performing specific configuration or modification functions, such as damping or zeroing a module
- Specify pre-programmed display units for calibrating your field instrument
- Zero the displayed values for both pressure and DC modules
- Set the damping factor for channels 1 and 2
- View the serial number, the last calibration date for the modules currently installed, and full scale range for pressure modules
- Program trip detection

Each of the above listed operations are described on the following pages.

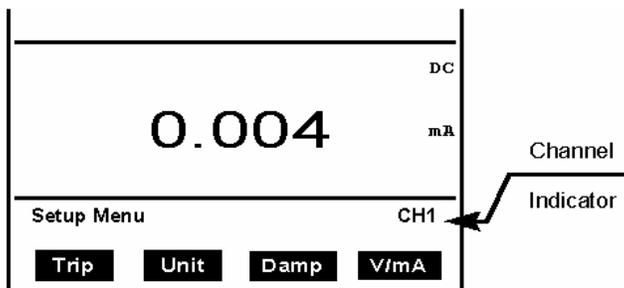
## Selecting a Channel for Specific Functions

Some functions, such as zeroing a module or setting a damping feature, require that you specify a channel prior to performing the function.

**NOTE:** All sample displays representing the LCD in this guide are depicted with a 0 to 30 PSI gauge pressure module and/or a DC module.

### Procedure

To select a channel for a specific function, press either the **CH 1** or **CH 2** key on the keypad. The selected channel appears in the lower right corner of the LCD display. A sample display is shown below:



## Selecting Pre-Programmed Display Units

The BetaGauge II allows you to use pre-programmed display units for calibrating your field instrument. For each module installed, the BetaGauge II allows you to select the units used to display data on the LCD. The following paragraphs describe how to select display units for both types of modules (BetaPort–DC and BetaPort–P pressure).

### BetaPort–DC Module

The BetaPort–DC module can measure in milliamps or Volts. Upon initialization, the BetaPort–DC module defaults to milliamp measurement.

Use the following procedure to specify a voltage measurement:

1. Press **CH 1** or **CH 2**, as appropriate, to select the BetaPort–DC module for modification.
2. Press the function key corresponding to V/mA. This function key is a toggle that alternates between Volts and milliamps. You can view the current selection in the LCD display for the appropriate channel.

**NOTE:** The BetaPort–DC module is auto-ranging and automatically selects the most appropriate range for the measured value. Refer to Appendix B, Specifications, for complete range information.

## BetaPort–P Pressure Module

The BetaPort–P pressure module can display in any of the following units:

- PSI
- mmHg
- bar
- kpcm
- InHg
- cmWC
- mbar
- MPa
- InWC
- kPa
- atm
- (User)

Upon initialization, the BetaPort–P pressure module defaults to PSI pressure units. Use the following procedure to select other pre-programmed pressure units:

1. Press **CH 1** or **CH 2**, as appropriate, to select the BetaPort–P pressure module for modification.
2. Press the function key corresponding to *Unit* to view the list of pre-programmed units. The  menu item allows you to scroll the menu for other selections.

**NOTE:** If you select *Unit* for a channel where the BetaPort–DC module is installed, the message *Invalid Selection* will appear. Press the function key corresponding to **Clear** to erase this message and return to the Setup menu.

3. When the pressure unit you want to use appears, press the corresponding function key to select the unit. You can view the current selection in the LCD display for the appropriate channel.

**NOTE:** If you select *InWC* or *cmWC*, refer to the section *Water Column Measurements* on the following page.

**NOTE:** The last selection in the list of pressure units is *User*, which allows you to define your own pressure unit for display purposes. Refer to Section 5 for more information.

4. To return to the Setup menu, press the **CLR** key.

### Selecting a Water Column Measurement

In the list of available display units for a BetaPort-P pressure module, *InWC* and *cmWC* are water column equivalent measurements. If you select a water column pressure unit, you must also select the appropriate temperature for water density correction. The available temperature selections and their recommended use are listed below:

<b>Temperature</b>	<b>Recommended Use</b>
4°C	Scientific applications
20°C	Industrial applications (ISA)
60°F	American Gas Association

If there is any question regarding temperature compensation, consult the proper engineering authority at your facility.

### Procedure

To select a water column pressure unit, do the following:

1. Follow the procedure for selecting pre-programmed pressure units, selecting *InWC* or *cmWC*, as appropriate. The display screen appears similar to the one shown below:

<b>CH2</b>	<b>InWC</b>
<b>4C</b>	<b>20C 60F</b>

2. Press the corresponding function key to select the appropriate temperature for the water density correction value you want to use. The display returns to the list of available units.
3. Press the **CLR** key to return to the Setup menu.

### Zeroing Modules

BetaGauge II pressure and DC modules may sometimes indicate an offset that requires a zeroing operation. These offsets typically occur under the following circumstances:

- Each time you turn the calibrator off and on.
- Each time you install a new module.
- Each time you select a new engineering unit (pressure module only).

## Zeroing Pressure Modules

The BetaGauge II has two different zeroing procedures for pressure modules, depending on the zero reference type installed. The two zero reference types include:

- **Gauge zero.** The gauge zero reference type modules have range labels with markings of PSIG, “H<sub>2</sub>O, or PSID.
- **Absolute zero.** The absolute zero reference modules have range labels with the marking of PSIA.

**CAUTION:** On initial power-up, if the pressure displayed by the module while vented to atmosphere exceeds the reference pressure by 1% of the module’s full scale pressure range, then the module’s performance should be verified against a pressure reference of equal or better accuracy prior to use in the field.

### Zeroing a Gauge Zero Reference Module

Use the following procedure to zero a gauge zero reference module:

1. Install the module in either module bay of the BetaGauge II.
2. Ensure that the BetaGauge II is on.
3. Ensure that the module is vented to the atmosphere. (In other words, ensure that the module’s sensor is exposed to the atmosphere by either disconnecting any tubing, or opening the pressure system to the atmosphere.)

4. Ensure that the BetaGauge II is displaying the first four Setup menu items (*Trip*, *Unit*, *Damp*, and *V/mA*).

**NOTE:** Only this menu display allows for both channel selection and **ZERO** key operation.

5. Press the channel select key corresponding to the module bay where the gauge zero reference module is installed (**CH1** for the left side, or **CH2** for the right side).
6. Press the **ZERO** key.
7. The pressure display should now be zeroed.

**NOTE:** The pressure display may drift slightly from zero in the first few minutes after initial power up. If so, press the **ZERO** key again while the appropriate channel is still selected.

### **Zeroing an Absolute Zero Reference Module**

Use the following procedure to zero an absolute zero reference module:

1. Install the module in either module bay (channel) of the BetaGauge II.
2. Ensure that the BetaGauge II is on.
3. Ensure that the module is vented to the atmosphere. (In other words, ensure that the module's sensor is exposed to the atmosphere by either disconnecting any tubing, or opening the pressure system to the atmosphere.)

4. Ensure that the BetaGauge II is displaying the first four Setup menu items (*Trip*, *Unit*, *Damp*, and *V/mA*).

**NOTE:** Only this menu display allows for both channel selection and **ZERO** key operation.

5. Press the channel select key corresponding to the module bay where the gauge zero reference module is installed (**CH1** for the left side, or **CH2** for the right side).
6. Press the **ZERO** key, and the lower portion of the LCD will prompt for *Password*.
7. Use the number keys to enter the zeroing code (found on the original Certificate of Calibration) for that module, then press the **ENTER** key. The display then prompts for the barometric pressure.
8. At the *Enter Actual Bar. P* prompt, use the keypad numbers to enter the barometric pressure in PSI as displayed by your barometric pressure reference, then press the **ENTER** key.

**NOTE:** The barometric pressure value entered must be in PSI, regardless of the pressure units currently selected for pressure display on the BetaGauge II.

The pressure display should now appear in barometric (atmosphere) pressure units. Note that the pressure display may drift slightly in the first few minutes after initial power up. If so, then repeat steps 6 through 8 while the appropriate channel is still selected.

## Zeroing DC Modules

The BetaGauge II has two different zeroing procedures for DC modules, depending on the type of electrical signal to be measured: Volts or milliamps.

### Zeroing the Volts Input

Use the following procedure to zero the Volts input on the DC module:

1. Install the module in either module bay (channel) of the BetaGauge II.
2. Ensure that the BetaGauge II is on.
3. Install the dual banana jack on the test leads into the positive Volts jack and the common jack.
4. Clip the alligator clips together. This process shorts the positive Volts jack to the common jack of the DC module.
5. Ensure that the BetaGauge II is displaying the first four Setup menu items (*Trip*, *Unit*, *Damp*, and *V/mA*).

**NOTE:** Only this menu display allows for both channel selection and **ZERO** key operation.

6. Press the channel select key corresponding to the module bay where the DC module is installed (**CH1** for the left side, or **CH2** for the right side).
7. Press the **ZERO** key.
8. The Volts display should now be zeroed.

**NOTE:** The Volts display may drift slightly from zero in the first few minutes after initial power up. If so, press the **ZERO** key again while the appropriate channel is still selected.

## Zeroing the Milliamp Input

Use the following procedure to zero the milliamp input on the DC module:

1. Install the module in either module bay (channel) of the BetaGauge II.
2. Ensure that the BetaGauge II is on.
3. Ensure that the module's milliamp jacks are open circuit. This is done by ensuring that no test leads are attached to either the positive milliamp jack or the common jack.
4. Ensure that the BetaGauge II is displaying the first four Setup menu items (*Trip*, *Unit*, *Damp*, and *V/mA*).

**NOTE:** Only this menu display allows for both channel selection and **ZERO** key operation.

5. Press the channel select key corresponding to the module bay where the DC module is installed (**CH1** for the left side, or **CH2** for the right side).
6. Press the **ZERO** key.
7. The milliamps display should now be zeroed.

**NOTE:** The milliamps display may drift slightly from zero in the first few minutes after initial power up. If so, press the **ZERO** key again while the appropriate channel is still selected.

## Setting the Damping Factor for Ch1/Ch2

The BetaGauge II allows you to enable a damping feature to reduce the display fluctuations caused by a noisy input signal (pressure or electrical).

**NOTE:** The BetaGauge II automatically measures (or reads) each module three times per second.

The following settings are available:

---

<b>Damping Setting</b>	<b>The BetaGauge II ...</b>
0.0 (Disabled)	Updates the displayed value with every measurement (three times per second).
2.0	Averages 7 measurements and updates the displayed value approximately once every 2 seconds.
5.0	Averages 16 measurements and updates the displayed value approximately once every 5 seconds.
10.0	Averages 31 measurements and updates the displayed value approximately once every 10 seconds.

## Reset Damping Guidelines

The following reset damping guidelines apply:

- The BetaGauge II automatically disables (resets to 0.0 seconds) the damping feature for both channels each time you turn the calibrator off and on.
- The BetaGauge II automatically disables (resets to 0.0 seconds) the damping feature for a particular channel each time you install, or re-install, a module into the module bay corresponding to that channel.

## Procedure

To enable and set the BetaGauge II damping feature for a specific module, do the following:

1. Press the channel select key corresponding to the module bay where the appropriate module is installed (**CH1** for the left side, or **CH2** for the right side).
2. Use the **Menu** key to locate the Setup menu item *Damp*, then press the corresponding function key. The lower portion of the LCD will appear similar to the example shown below:

<b>CHx</b>	<b>Damp</b>	<b>Factor</b>	<b>0.0</b>
<b>0.0</b>	<b>2.0</b>	<b>5.0</b>	<b>10.0</b>

In the above example:

x = the channel number of the module.

3. Press the function key corresponding to the damping setting you want to use, then press the **CLR** key to return to the Setup menu.

**CAUTION:** Enabling the damping feature affects your ability to accurately zero a module's displayed value. Therefore, prior to zeroing the displayed value of a module, disable the damping feature by setting the damping value to 0.0.

## Viewing Module Information

The BetaGauge II allows you to view the following information for the modules currently installed in the calibrator:

- Serial number
- Full scale range (pressure modules only)
- Last calibration date

### Procedure

To view module information, do the following:

1. Use the **Menu** key to locate the Setup menu item *Mod*, then press the corresponding function key to display the Module Info menu.
2. Press the function key corresponding to the channel you want to view. Remember that **CH1** represents the left module and **CH2** represents the right module. The lower portion of the LCD will appear similar to the examples shown below:

#### DC Module Example:

DC SN: 610006
---------------

Cal: 09/25/2005
-----------------

### Pressure Module Example:

GAGE SN: 000000003 FS= 15.00 PSI Cal: 04/16/2005
--

3. Press the **CLR** key to return to the Module Info menu.
4. Press the **CLR** key again to return to the Setup menu.

### Programming Trip Detection

The BetaGauge II has the ability to detect trips from either wet or dry contacts using a BetaPort–DC module. However, this trip detect feature is intended for use with pressure trip devices only.

**CAUTION:** Do not install two BetaPort–DC electrical modules in the calibrator simultaneously. The calibrator is not designed to permit operation with two electrical modules. Ground potential differences could cause high current flows through the calibrator which could damage the calibrator and/or cause bodily injury.

### Wet Contacts

The BetaGauge II will detect wet contact trips when the voltage input of the DC module crosses the 12 Volt threshold. The contact wetting voltage should not exceed 48 Volts, and should be a DC potential.

## Dry Contacts

To detect dry contact trips, you must connect dry contacts to the milliamp input of the calibrator's DC module. The BetaGauge II will detect a dry contact trip when the input resistance crosses the 800 Ohm threshold.

## Hints for Accurate Trip Measurements

There are three areas where it is helpful to have detailed knowledge before setting up a pressure trip detection:

- Selecting a field instrument (hand pump or pressure controller)
- Adjusting the pressure source
- Ramping the pressure signal

## Field Instrument Selection

You can use either a hand pump or a pressure controller as a pressure source for detecting pressure trips. Use the following guidelines when selecting either of these field instruments:

- **Hand Pump.** Select a hand pump with a Vernier adjustment knob so that you can make fine adjustments.
- **Pressure Controller.** Select a pressure controller that has an easy micro-adjustment method.

## **Pressure Source Adjustment**

Perform the following tasks to adjust the pressure source prior to starting a pressure trip test:

1. Learn the direction (low-going or high-going) in which the trip will occur and approximately where the device is expected to trip (in terms of pressure).
2. Use the coarse adjustment control of the pressure source to set the pressure 5 to 10% away from the trip point.
3. Use the fine adjustment control of the pressure source to ramp through the expected pressure trip point.

## **Pressure Signal Ramping**

The slower you ramp the pressure signal, the more accurate the captured trip value will be. This is due not only to the response time of the pressure trip instrument, but also to the operation of the BetaGauge II. The BetaGauge II takes a pressure reading three times a second, and in between these pressure readings, it performs background tasks such as monitoring the keyboard, updating the display, monitoring temperature, and performing internal calibrations and checks.

## Preliminary Setup

Use the following procedure to set up the BetaGauge II for trip detection:

1. Connect the alligator clip ends of the test leads (supplied with the BetaGauge II) to the contacts you want to monitor.
2. Do one of the following:
  - If the contacts are wet (have voltage on one or both sides), connect the dual banana jack to the voltage input of the DC module.
  - If the contacts are dry, connect the dual banana jack to the milliamp input terminals of the DC module (for monitoring resistance changes).

**NOTE:** The BetaGauge II detects wet or dry trips depending on where the test leads are connected to the DC module (V or mA jacks). It is not necessary to set the DC module units for Volts or milliamperes.

3. Connect a pressure source to both the installed pressure module *and* the pressure trip instrument under test.
4. Use the **Zero** key to zero the pressure module as needed while the pressure circuit is vented to the atmosphere.

To continue with the actual programming of a pressure trip detection, see the paragraphs below.

## Procedure

Use the following procedure to program a trip detection:

1. Press **CH 1** or **CH 2**, as appropriate, to activate the BetaPort–DC module.
2. Use the **Menu** key to locate the Setup menu item *Trip*, then press the corresponding function key to display a screen similar to the one shown below:

<b>CHx Trip Disabled</b>
<b>Dis. Enab Reset</b>

In the above example:

x = the channel number of the DC module.

3. To enable the trip detect status, press the function key corresponding to the menu item *Enab*, and the electrical signal display will read *READY*.
4. Close the pressure circuit of the trip instrument, then slowly re-apply pressure (or vacuum) to the pressure circuit.
5. The electrical signal display will continue to read *READY* until the calibrator detects a change of state from the contacts. Once this change of state occurs, the display will read *TRIP* and the pressure input display will freeze at the point of the trip.
6. Maintain the pressure (or vacuum) from the pressure source, then press the function key corresponding to *Reset*. The BetaGauge II will once again display *READY*, in preparation for detecting the reset point.

7. If possible, use the micro-adjustment of the pressure source to ramp towards the reset point of the pressure trip device. The display will again display *TRIP* when the BetaGauge II detects the reset point.
8. When you have completed trip detect testing, do the following:
  - Vent the pressure source.
  - Disconnect all test circuits.
  - Press the function key corresponding to *Dis.* to disable the trip detection feature.
  - Press the **CLR** key to return to the Setup menu.

## 4- User Preferences

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### Overview

There are many BetaGauge II preferences settings that you can program to meet your special needs. Although you can change these settings as often as you like, most users set them once when they acquire their calibrator.

The BetaGauge II user preferences settings are listed below:

- View and program the owner and calibrator information
- Turn the keypad beep on/off
- Set the LCD preferences
- Set the automatic shut off delay time
- Set and format the time display
- Set and format the date display

Each of the above listed operations are described on the following pages.

## Programming and Viewing Calibrator Information

The BetaGauge II allows you to enter the owner's name (or other identification) into the calibrator's non-volatile memory. You can then view this identification, as well as the following information, upon demand:

- Serial number of the calibrator
- Calibrator's last factory acceptance date

### Entering Owner Identification

To program the owner's name (or other identification) into the calibrator's non-volatile memory, do the following:

1. Press the **Menu** key repeatedly until the Calib menu appears.
2. Press the function key corresponding to the displayed menu item *Info*.
3. Press the function key corresponding to the menu item *Prty* to display the *Property of:* screen. A sample is shown below:

<b>Property Of:</b> <b>MARTEL</b>
--------------------------------------

4. Use the **CLR** key to erase the character to the left of the cursor and use the arrow keys on the keypad to scroll through the available character set. When the desired character is displayed, press the **ENTER** key to accept the character and move the cursor to the right. A maximum of 20 characters may be entered for identification.

**NOTE:** Pressing the **ENTER** key twice in a row ends editing. Therefore, to specify the same character consecutively, use the up and down arrow keys to select the second character.

## Viewing Calibrator Information

To view calibrator information, do the following:

1. Use the **Menu** key to locate the Setup menu item *Owner*, then press the corresponding function key. The following data appears in the lower portion of the LCD:
  - Owner's name
  - Serial number of the calibrator
  - Calibrator's last factory acceptance date

A sample is shown below:

MARTEL SN:17009 Cal. Date: 04/25/2006
---

2. To return to the Setup menu, press the **CLR** key.

## Turning the Keypad Beep On/Off

The BetaGauge II allows you to specify whether or not you will hear a beep when you press any key on the keypad.

### Procedure

To turn the keypad beep on/off, do the following:

1. Use the **Menu** key to locate the Setup menu item *Beep*, then press the corresponding function key. The lower portion of the LCD will appear similar to the example shown below:

Beep : Enabled
Dis. Enab

2. To disable the beep sound, press the function key corresponding to the menu item *Dis*.
3. To enable the beep sound, press the function key corresponding to the menu item *Enab*.
4. To clear the display and return to the Setup menu, press the **CLR** key.

## Setting LCD Preferences

The BetaGauge II allows you to set the following LCD variables:

- Specify the length of time the LCD backlight will remain illuminated
- Set the LCD contrast
- Perform a contrast recovery procedure to restore the display.

### Setting the Backlight Off Delay Time

The BetaGauge II has an integral backlight so that you can read the display in poorly-lighted conditions.

However, in order to reduce power consumption, you can configure the backlight to automatically turn off after a specified time.

**NOTE:** Press the **starburst** symbol on the keypad to turn the backlight on when ambient lighting is insufficient.

### Procedure

To specify the length of time the backlight will remain illuminated, do the following:

1. Use the **Menu** key to locate the Setup menu item *LCD*, then press the corresponding function key to display the LCD menu.

2. Press the function key corresponding to the menu item *LED*. The lower portion of the LCD will appear similar to the example shown below:

<b>Set backlit time</b>
<b>33    seconds</b>

3. Use the numbers on the keypad to enter a backlight display value between 0 and 3600 seconds, then press the **ENTER** key to return to the LCD menu.

**NOTE:** If you attempt to enter a value outside this range, an *Invalid Entry* message will appear.

To erase an existing entry or to correct a mistake, use the **CLR** key to erase the character to the left of the cursor.

4. From the LCD menu, press the **CLR** key to return to the Setup menu.

### Setting the LCD Contrast

The BetaGauge II is supplied with a variable contrast display that you can lighten or darken as necessary.

#### Procedure

To set the display contrast, do the following:

1. Use the **Menu** key to locate the Setup menu item *LCD*, then press the corresponding function key to display the LCD menu.
2. Press the function key corresponding to the menu item *Contrast*. The lower portion of the LCD will appear similar to the example shown below:

<b>Adjust Contrast</b>
<b>Light   Dark</b>

3. Press the menu items *Light* or *Dark* as many times as necessary to adjust the LCD contrast.
4. When you have completed setting the contrast, press the **CLR** key to return to the LCD menu.
5. Press the **CLR** key again to return to the Setup menu.

### Recovering the LCD Contrast

Extreme hot and/or cold temperatures can affect the LCD contrast. If your calibrator is exposed to either of these conditions, or if for any other reason, your LCD is too light or too dark, you can restore the display even if you cannot read it.

To recover the LCD contrast, do the following:

1. Turn the calibrator on and wait five seconds for initialization.
  2. Press the **MENU** key twice.
  3. Press the **F1** key.
  4. Press the **F2** key.
  5. Do one of the following:
    - If the display is dark, press **F1** repeatedly until the display is visible.
    - If the display is light, press **F2** repeatedly until the display is visible.
- NOTE:** The contrast will wrap around until it is visible, regardless of which function key you press.
6. Turn the calibrator off and on again to verify that the contrast has been recovered.

## Setting the Automatic Shut Off Delay Time

To prevent the battery pack from discharging while the calibrator is not in use, you can program the BetaGauge II to automatically shut off after a pre-defined period of idle time. Idle time is defined as a period with no key presses. You can also disable this feature if necessary.

### Procedure

To set the automatic shut off delay time, do the following:

1. Use the **Menu** key to locate the Setup menu item *Off*, then press the corresponding function key. The lower portion of the LCD will appear similar to the example shown below:

<b>Auto off Enabled</b>
<b>Dis. Enab Set</b>

2. To disable the automatic shut off, press the function key corresponding to the menu item *Dis*.
3. To enable the automatic shut off, press the function key corresponding to the menu item *Enab*.
4. To set the delay time for the automatic shut off feature, press the function key corresponding to the menu item *Set*. The lower portion of the LCD will appear similar to the example shown below:

<b>Set Auto Off time</b>
<b>200 seconds</b>

5. Use the numbers on the keypad to enter a delay value between 200 and 3600 seconds, then press the **ENTER** key to return to the Auto Off menu.

**NOTE:** If you attempt to enter a value outside this range, an *Invalid Entry* message will appear. To erase an existing entry or to correct a mistake, use the **CLR** key to erase the character to the left of the cursor.

6. From the Auto Off menu, press the **CLR** key to return to the Setup menu.

## Setting and Formatting the Time Display

The BetaGauge II allows you to manually set the time as well as format the time display. The calibrator time appears in the upper left portion of the LCD.

**NOTE:** Instrument maintenance software packages can set the calibrator's real time clock according to the computer time. The format of the time display is not affected.

### Setting the Time

To manually set the calibrator time, do the following:

1. Use the **Menu** key to locate the Setup menu item *Time*, then press the corresponding function key to display the Set time menu as shown below:

<b>Set time</b>		
<b>Sec</b>	<b>Min</b>	<b>Hrs</b>

2. Press the function key corresponding to the menu item *Sec* to display the Set Second screen as shown below:

**Set Second**

3. Use the number keys on the keypad to enter a value between 0 and 59 seconds, then press the **ENTER** key to return to the Set time menu.

**NOTE:** If you attempt to enter a value outside this range, an *Invalid Entry* message will appear. To erase an existing entry or to correct a mistake, use the **CLR** key to erase the character to the left of the cursor.

4. To set values for minutes and hours, repeat steps 2 and 3, pressing the appropriate function keys.

**NOTE:** To set a pm time for the hours value, enter the hour in 24-hour format. For example, enter the value *15* to specify 3 p.m.

5. Press the **CLR** key to return to the Setup menu.

### Formatting the Time

To specify whether you want the time to display in 12 or 24-hour format, do the following:

1. Use the **Menu** key to locate the Setup menu item *Format*, then press the corresponding function key. The lower portion of the LCD will appear similar to the example shown below:

**Format Date time**  
dmy mdy ymd 12Hr

2. The rightmost menu item allows you to toggle between 12 and 24-hour format. Press the function key corresponding to the menu item *12Hr* or *24Hr*, as appropriate.

**NOTE:** Notice how the display time in the upper left portion of the LCD changes between 12 and 24 hour format as you toggle between the two.

3. Press the **CLR** key to return to the Setup menu.

## Setting and Formatting the Date Display

The BetaGauge II allows you to manually set the date as well as format how the date will display. The calibrator date appears in the upper left portion of the LCD.

**NOTE:** Instrument maintenance software packages can set the calibrator's real time date according to the computer date. The format of the date display is not affected.

### Setting the Date

To manually set the calibrator date, do the following:

1. Use the **Menu** key to locate the Setup menu item *Date*, then press the corresponding function key to display the Set Date menu as shown below:

<b>Set Date</b>
<b>Day    Month    Year</b>

2. Press the function key corresponding to the menu item *Day* to display the Set Day screen as shown below:



3. Use the numbers on the keypad to enter the day of the month between 0 and 31, then press the **ENTER** key to return to the Set Date menu.

**NOTE:** If you attempt to enter a value outside this range, an *Invalid Entry* message will appear. To erase an existing entry or to correct a mistake, use the **CLR** key to erase the character to the left of the cursor.

4. To set values for month and year, repeat steps 2 and 3, pressing the appropriate function keys.

**NOTE:** If you set the year to a value of 90 or lower, the system will automatically prefix the value with *20*, i.e., 2090. The system will prefix all other values with *19*.

5. Press the **CLR** key to return to the Setup menu.

### **Formatting the Date**

You can specify the calibrator date to appear in any of the following formats:

- dmy (day, month, year)
- mdy (month, day, year)
- ymd (year, month, day)

## Procedure

To specify the date format, do the following:

1. Use the **Menu** key to locate the Setup menu item *Format*, then press the corresponding function key. The lower portion of the LCD will appear as shown below:

<b>Format Date time</b>
<b>dmy mdy ymd 12Hr</b>

2. The first three menu items allow you specify the date format you want to use. Press the function key corresponding to the menu item *dmy*, *mdy*, or *ymd*, as appropriate.

**NOTE:** Notice how the display date in the upper left portion of the LCD changes as you select different formats.

3. Press the **CLR** key to return to the Setup menu.

## 5- Advanced Display Modes

---

### Overview

The BetaGauge II allows you to define advanced display modes for both the BetaPort–P pressure and BetaPort–DC modules. This section describes how to set up these advanced display modes.

**NOTE:** For information on how to use pre-programmed display units, refer to Section 3.

### Programming a User Defined Pressure Unit

If none of the eleven (11) pre-programmed pressure units (listed in Section 3) meet your needs, the BetaGauge II allows you to program your own pressure unit. Before setting up a user defined pressure unit, make sure that the pressure module you wish to use is installed in the module bay of your choice.

**NOTE:** The procedure for programming a user defined pressure unit involves defining a label (name) for the pressure unit. For the following procedure, we will define an example user unit of *Feet of Water Column at 20°C*.

## Procedure

Use the following procedure to define a pressure unit of your choice:

1. Press **CH1** or **CH2** to indicate the appropriate bay in which the pressure module is installed.
2. Use the **MENU** key to locate the Setup menu item *User*, then press the corresponding function key to display the following screen:

CHx Ent. Unit: yyyy

In the above example:

**x** = the channel number of the pressure module,

**yyyy** = the current user unit label.

3. Specify a unit label by using the **CLR** key to erase the character (if any) to the left of the cursor and use the arrow keys on the keypad to scroll through the available character set. When the desired character is displayed, press the **ENTER** key to accept the character and move the cursor to the right. A maximum of 4 characters may be entered for identification.

**NOTE:** Pressing the **ENTER** key twice in a row ends editing. Therefore, to specify the same character consecutively, use the up and down arrow keys to select the second character.

For the example *Feet of Water Column at 20°C*, you would enter *FTWC*.

- When the unit label is satisfactory, press the **ENTER** key once again to display the following screen:

Ent. 1PSI =

- Use the numbers on the keypad to specify the 1 PSI equivalent value of your user unit, then press the **ENTER** key to return to the Setup menu.

**NOTE:** For the example *Feet of Water Column at 20°C*, you would enter 2.3108.

- Use the **MENU** key to locate the Setup menu item *Unit*, then press the corresponding function key to display a screen similar to the following:

CHx  
mmHg cmWC Kpa →

- Press the function key corresponding to → through as many screens as necessary until the unit you defined appears in the display.
- Press the function key associated with the pressure unit you defined in step 3 and the pressure will begin to display as specified.

**NOTE:** In the case of the example, the pressure will begin to display in *Feet of Water Column at 20°C*.

- Press the **CLR** key to return to the Setup menu.

## Programming Display Modes for BetaPort–DC Modules

The BetaGauge II allows you to define process signals for display using any of the following modes:

- engineering units
- percent scale
- percent error
- square root extraction

**NOTE:** Before performing any of the procedures for setting up display modes for BetaPort–DC modules, ensure that you are familiar with the input and output signal ranges of the field instrument you are calibrating.

The following paragraphs describe how to set up the display modes listed above.

### Engineering Unit Display

When you want to display electrical signals in engineering units, you must perform the following procedures:

- Define a unit label, or name.
- Define the type of field instrument you want to calibrate:
  - Pressure transmitter (P/I)
  - Electrical to pressure converter (I/P)
  - Other
- Define the engineering low and high values with respect to the expected field instrument output signals.

## Defining a Unit Label

To define a unit label, do the following:

1. Ensure that a BetaPort–DC module is installed in one of the module bays, then press **CH1** or **CH2** to indicate the appropriate bay in which the DC module is installed.
2. If necessary, use the *V/mA* Setup menu item to change the electrical units to match the field instrument's electrical signal.
3. Use the **Menu** key to locate the Setup menu item *User*, then press the corresponding function key to display the following screen:

CHx Ent. Unit: yyyy

In the above example:

**x** = the channel number of the DC module,  
**yyyy** = the current user unit label.

4. Specify a unit label by using the **CLR** key to erase the character (if any) to the left of the cursor and use the arrow keys on the keypad to scroll through the available character set. When the desired character is displayed, press the **ENTER** key to accept the character and move the cursor to the right. A maximum of 4 characters may be entered for identification.

**NOTE:** Pressing the **ENTER** key twice in a row ends editing. Therefore, to specify the same character consecutively, use the up and down arrow keys to select the second character.

5. When you have completed entering the unit label, press the **ENTER** key once again to return to the Setup menu.

## Defining the Field Instrument Type

To define the type of field instrument you want to calibrate, do the following:

1. Use the **Menu** key to locate the Setup menu item *Mode*, then press the corresponding function key to display the following screen:

<b>Calib Instr</b>		
<b>P/I</b>	<b>I/P</b>	<b>Other</b>

2. Press the corresponding function key to select the type of field instrument you want to calibrate: *P/I*, *I/P*, or *Other*.
3. If you select *Other*, the following screen will display:

<b>Instrument Input:</b>	
<b>CH1</b>	<b>CH2</b>

4. Do one of the following:
  - To indicate that you want the DC module to be the field instrument input, select the function button corresponding to the DC module's present channel.
  - To indicate that you want the DC module to be the field instrument output, select the opposite channel.

**NOTE:** Input and output references are with respect to the field instrument.
5. After you select the field instrument type, the main linearization screen displays. Use this screen to begin defining the engineering low and high values as described in the next procedure.

## Defining Engineering Low/High Values

To define the engineering low and high values with respect to the expected field instrument output signals, do the following:

1. After you define the field instrument type, the following main linearization screen displays:

<b>CHx Mode: yyyy</b>
<b>Std Eng Sqrt →</b>

In the above example:

**x** = the channel number of the DC module,

**yyyy** = the current linearization mode of the DC module channel.

2. Press the function key corresponding to *Eng* and the display screen prompts you for the field instrument's in/out low value. A sample screen is shown below:

<b>CHx Instr: Out Lo</b>
--------------------------

3. Use the keypad numbers to enter a value equal to the expected low electrical signal value of the field instrument, then press the **ENTER** key.
4. After you have specified an expected low electrical signal value, the display screen individually prompts you for the following field instrument values:
  - expected high electrical signal value
  - engineering low value
  - engineering high value

Repeat step 3 to enter values for each of the above prompts.

5. After you have specified all of the values in step 4, the display screen prompts you for the number of decimal places you want to display. A sample screen is shown below:

CHx Ent. Decimals:

6. Use the keypad numbers to enter the number of decimal places you want to appear on the display (from 1 to 3), then press the **ENTER** key to return to the Calib Instr menu.
7. Press the **CLR** key to return to the Setup menu. The BetaGauge II should now display the input electrical signals using the values defined for the engineering range.

### Percent Scale Display

The BetaGauge II will display either or both of a field instrument's input or output values in *percent of scale*.

When you want to display electrical signals in percent of scale, you must perform the following procedures:

- Define the type of field instrument you want to calibrate:
  - Pressure transmitter (P/I)
  - Electrical to pressure converter (I/P)
  - Other
- Define values equal to the expected low and high electrical signal values of the field instrument.

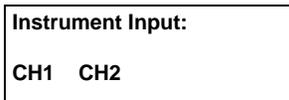
## Defining the Field Instrument Type

To define the type of field instrument you want to calibrate, do the following:

1. Ensure that a BetaPort–DC module is installed in one of the module bays, then press **CH1** or **CH2** to indicate the appropriate bay in which the DC module is installed.
2. Use the **Menu** key to locate the Setup menu item *%Fnc*, then press the corresponding function key to display the following screen:



3. Press the corresponding function key to select the type of field instrument you want to calibrate: *P/I*, *I/P*, or *Other*.
4. If you select *Other*, the following screen will display:



5. Do one of the following:
  - To indicate that you want the DC module to be the field instrument input, select the function button corresponding to the DC module's present channel.
  - To indicate that you want the DC module to be the field instrument output, select the opposite channel.

**NOTE:** Input and output references are with respect to the field instrument.

6. After you select the field instrument type, the main linearization screen displays. Use this screen to begin defining the expected low and high electrical signal values of the field instrument as described in the next procedure.

### Defining the Expected Low/High Values

To define the expected low and high electrical signal values of the field instrument, do the following:

1. After you define the field instrument type, the following main linearization screen displays:

```
CHx Mode: yyyy
Std Eng Sqrt →
```

In the above example:

**x** = the channel number of the DC module,

**yyyy** = the current linearization mode of the DC module channel.

2. Press the function key corresponding to the  menu item, and the following screen displays:

```
CHx Mode: yyyy
%Scal %Err →
```

3. Press the function key corresponding to *%Scal* and the display screen prompts you for the field instrument's in/out low value. A sample screen is shown below:

```
CHx Instr: In/Out Lo
```

4. Use the keypad numbers to enter a value equal to the expected low electrical signal value of the field instrument, then press the **ENTER** key. The display screen then prompts you for an expected high electrical signal value.
5. Repeat step 4 to enter a value for the expected high electrical signal value.
6. After you have specified values for both the expected low and high electrical signals, the display screen will return to the main linearization screen. At this point, you can do one of the following:
  - Press the opposite channel select key and program another linearization mode for the remaining module.
  - Press the **CLR** key to return to the Setup menu.

### **Percent Error Display**

The BetaGauge II will display a field instrument's output in *percent error* with respect to the field instrument's input.

When you want to display electrical signals in percent error, you must perform the following procedures:

- Define the type of field instrument you want to calibrate:
  - Pressure transmitter (P/I)
  - Electrical to pressure converter (I/P)
  - Other
- Define the expected signal values for both the low and high ends of the field instrument's input and output scales.

## Defining the Field Instrument Type

To define the type of field instrument you want to calibrate, do the following:

1. Ensure that a BetaPort–DC module is installed in one of the module bays, then press **CH1** or **CH2** to indicate the appropriate bay in which the DC module is installed.
2. Use the **Menu** key to locate the Setup menu item *%Fnc*, then press the corresponding function key to display the following screen:

<b>Calib Instr</b>		
<b>P/I</b>	<b>I/P</b>	<b>Other</b>

3. Press the corresponding function key to select the type of field instrument you want to calibrate: *P/I*, *I/P*, or *Other*.
4. If you select *Other*, the following screen will display:

<b>Instrument Input:</b>	
<b>CH1</b>	<b>CH2</b>

5. Do one of the following:
  - To indicate that you want the DC module to be the field instrument input, select the function key corresponding to the DC module's present channel.
  - To indicate that you want the DC module to be the field instrument output, select the opposite channel.

**NOTE:** Input and output references are with respect to the field instrument.

6. After you select the field instrument type, the main linearization screen displays. Use this screen to begin defining the expected low and high values for the field instrument's input and output scales as described in the next procedure.

### Defining the Expected Low/High Values

1. After you define the field instrument type, the following main linearization screen displays:

```
CHx Mode: yyyy
Std Eng Sqrt →
```

In the above example:

**x** = the channel number of the DC module,  
**yyyy** = the current linearization mode of the DC module channel.

2. Press the function key corresponding to the  menu item, and the following screen displays:

```
CHx Mode: yyyy
%Scal %Err →
```

3. Press the function key corresponding to *%Err* and the display screen prompts you for the field instrument's in/out low value. A sample screen is shown below:

```
CHx Instr: Out Lo
```

4. Use the keypad numbers to enter the value of the signal expected for the low end of the field instrument's output scale, then press the **ENTER** key.

5. The display screen individually prompts you for the following values:

- expected signal value for the high end of the field instrument's output scale
- expected signal value for the low end of the field instrument's input scale
- expected signal value for the high end of the field instrument's input scale

Repeat step 4 to enter values for each of the above prompts.

6. After you have specified all of the values in step 5, the display screen will return to the main linearization screen. At this point, you can do one of the following:

- Press the opposite channel select key and program another linearization mode for the remaining module.
- Press the **CLR** key to return to the Setup menu.

## Square Root Extraction

The BetaGauge II is capable of extracting square roots from flow transmitters or other devices that output a *squared* output signal.

Before setting up a square root extraction display, you must perform the following procedures:

- Define a unit label, or name.
- Define the expected output milliamp signal for flows that are equal to 0% and 100%, and define both the low and high end flow variables.

**NOTE:** For the following square root extraction procedures, you must install both a pressure module and a DC module into the calibrator.

### Defining a Unit Label

To define a unit label, do the following:

1. Press **CH1** or **CH2** to indicate the appropriate bay in which the DC module is installed.
2. Use the **Menu** key to locate the Setup menu item *User*, then press the corresponding function key to display the following screen:

CHx Ent. Unit: yyyy

In the above example:

**x** = the channel number of the DC module,

**yyyy** = the current user unit label.

3. Specify a unit label by using the **CLR** key to erase the character (if any) to the left of the cursor and use the arrow keys on the keypad to scroll through the available character set. When the desired character is displayed, press the **ENTER** key to accept the character and move the cursor to the right. A maximum of 4 characters may be entered for identification.

**NOTE:** Pressing the **ENTER** key twice in a row ends editing. Therefore, to specify the same character consecutively, use the up and down arrow keys to select the second character.

4. When you have completed entering the unit label, press the **ENTER** key once again to return to the Setup menu.

### Defining Output Milliamp Signal Values

1. Use the **Menu** key to locate the Setup menu item *Mode*, then press the corresponding function key to display the following screen:

<b>Calib Instr</b>		
<b>P/I</b>	<b>I/P</b>	<b>Other</b>

2. Press the function key corresponding to the *P/I* (pressure transmitter) menu item and the following main linearization screen displays:

<b>CHx</b>	<b>Mode:</b>	<b>yyyy</b>	
<b>Std</b>	<b>Eng</b>	<b>Sqrt</b>	<b>→</b>

In the above example:  
**x** = the channel number of the DC module,  
**yyyy** = the current linearization mode of the current DC module channel.

3. Press the function key corresponding to *Sqrt* and the display screen prompts you for the field instrument's expected output signal for a 0% flow. A sample screen is shown below:

<b>CHx Instr. Out Lo</b>
--------------------------

4. Use the keypad numbers to enter the value of the expected output milliamp signal when the flow is equal to 0% (typically 4 for a 4-20 milliamp output). Press the **ENTER** key.
5. The display screen individually prompts you for the following values:
  - expected output milliamp signal when the flow is equal to 100% (typically 20 for a 4 to 20 milliamp output)
  - number equal to the low end flow variable; for example, if the process was 2 to 300 GPM, you would enter 2.
  - number equal to the high end flow variable; for example, if the process was 2 to 300 GPM, you would enter 300.

Repeat step 4 to enter values for each of the above prompts.

6. After you have specified all of the values in step 5, the following display screen appears:

<b>CHx Ent. Decimals:</b>
---------------------------

7. Use the numbers on the keypad to enter the number of decimal places (1 to 3 ) you want to appear in the display, then press the **ENTER** key to return to the Calib Instr menu.
8. Press the **CLR** key to return to the Setup menu.

## 6- Application Notes

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### Overview

The BetaGauge II allows you to perform many different calibration tests. In addition, the configurations of these tests may vary, depending on whether you are using the conventional calibrator mode or documenting calibrator (SYS) mode of operation.

### Modes of Operation

The BetaGauge II has two modes of operation: the conventional calibrator mode and the documenting calibrator (SYS) mode.

In the conventional mode, the BetaGauge II monitors signals to and from a field instrument for the purposes of testing or calibrating that instrument. If you want to document the field instrument's input and output values using the conventional mode, you must manually record the information.

In the documenting calibrator (SYS) mode, the BetaGauge II prompts the user to apply input signals to the instrument, and then documents the instrument's output signal.

**NOTE:** For more information on how to use the documenting calibrator (SYS) mode, refer to Section 7.

## Other Necessary Equipment

When using the BetaGauge II to calibrate your field instruments, it is necessary that you have certain equipment at your disposal. This equipment must be capable and accurate to result in an accurate calibration. A list of the equipment that may be required, depending on the type of test you want to perform, is shown below:

- electrical source
- electrical measurement device
- pressure source
- pressure measurement device
- temperature source

**NOTE:** Each calibration test described in this section is accompanied by a graphical illustration. This illustration shows how the field instrument, the BetaGauge II, and the other necessary equipment must be connected for proper calibration. Refer to Section 2 for information on how to physically connect equipment to the BetaGauge II.

## Calibration Tests

You can perform many different calibration tests using the BetaGauge II. These tests are listed below:

- Electrical to Pressure
- Pressure to Electrical
- Electrical to Electrical (SYS mode using manual data entry only)
- Pressure to Pressure
- Temperature to Electrical (SYS mode using manual data entry only)
- Electrical Indicator (or Loops)
- Pressure Indicator (or Loops)
- Temperature Indicator (or Loops)  
(SYS mode using manual data entry only)

**NOTE:** For documentation purposes, you can use manual entries for a field instrument's input and output values while operating in SYS mode.

## Electrical to Pressure Test

You can perform an electrical to pressure calibration test using either the conventional mode or the SYS mode of operation. The following paragraphs describe all of the possible configurations, as well as, the other necessary equipment to perform an electrical to pressure test.

### Conventional Mode

#### You may perform this test if:

- Your field instrument has an electrical input range within the ability of the DC module on the BetaGauge II, and
- Your field instrument has a pressure output range within the ability of the pressure module on the BetaGauge II.

#### Field Instrument Setup

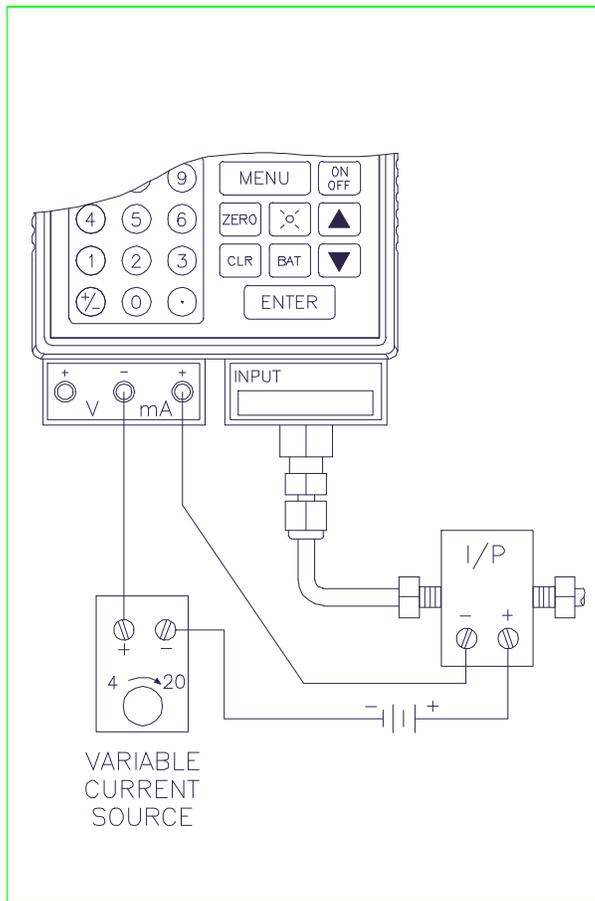
- Electrical input
- Pressure output

#### Other Necessary Equipment

- Electrical source

### Illustration

A graphical representation for configuring an electrical to pressure calibration test using the conventional mode of operation is shown below:



**Figure 6-1 Electrical to Pressure Calibration Test Using Conventional Mode**

## SYS Mode

There are two methods for configuring an electrical to pressure calibration test using SYS mode. The following table indicates which method to use.

	Use this method if...
<b>Method 1</b>	Your field instrument has a pressure output range within the ability of the pressure module on the BetaGauge II.
<b>Method 2</b>	Your field instrument has a pressure output range that exceeds the ability of the pressure module on the BetaGauge II.

**NOTE:** While in SYS mode, the BetaGauge II cannot measure the electrical input signals to the field instrument. You must manually enter the value of these signals on the BetaGauge II.

### Method 1

#### Software Instrument Setup

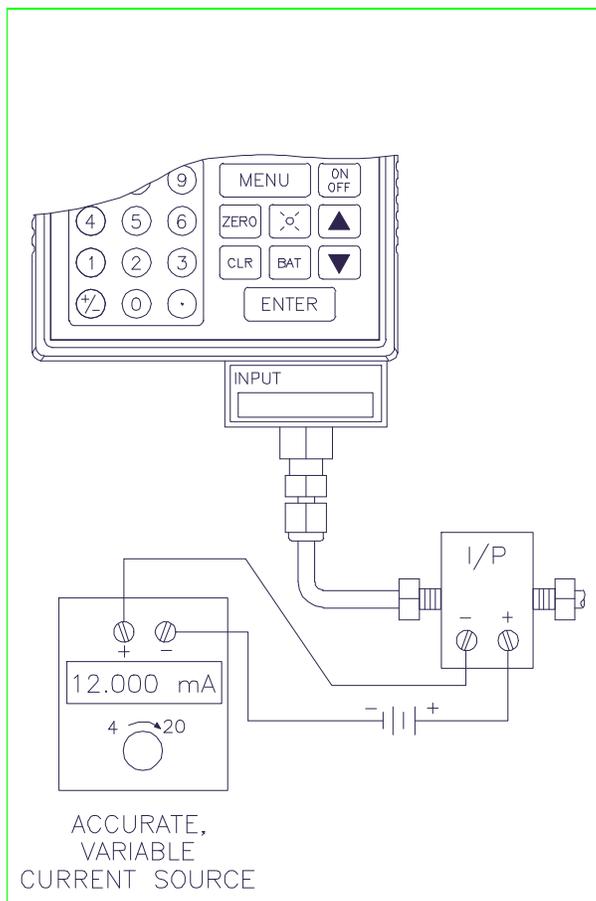
- Electrical input (requires manual entry on the BetaGauge II)
- Pressure output

#### Other Necessary Equipment

- Electrical source

**Illustration**

A graphical representation for configuring the Method 1 electrical to pressure calibration test using the SYS mode of operation is shown below:



**Figure 6-2 Electrical to Pressure Calibration Test Using SYS Mode (Method 1)**

## **Method 2**

### **Software Instrument Setup**

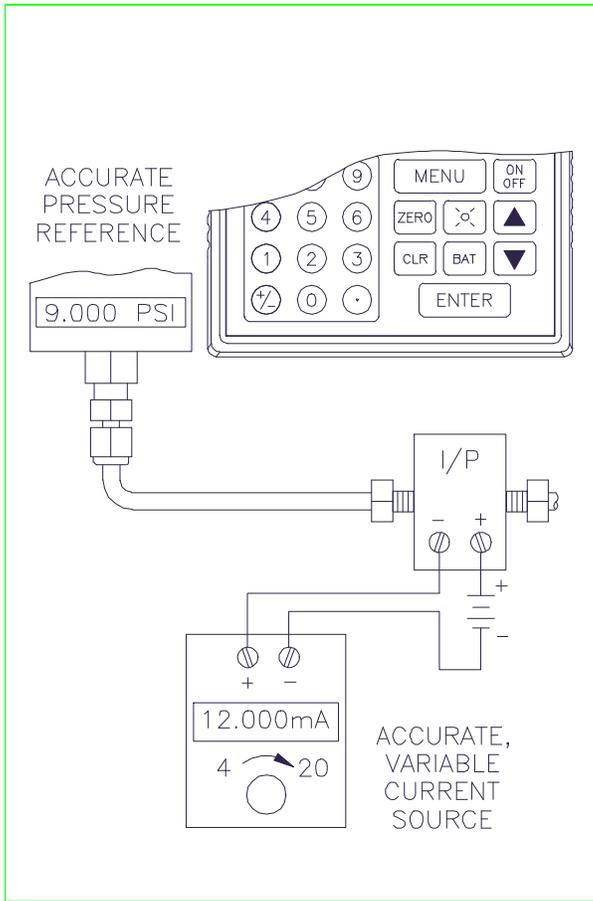
- Electrical input (requires manual entry on the BetaGauge II)
- Pressure output (requires manual entry on the BetaGauge II)

### **Other Necessary Equipment**

- Electrical source
- Pressure measurement device

**Illustration**

A graphical representation for configuring the Method 2 electrical to pressure calibration test using the SYS mode of operation is shown below:



**Figure 6-3 Electrical to Pressure Calibration Test Using SYS Mode (Method 2)**

## **Pressure to Electrical Test**

You can perform a pressure to electrical calibration test using either the conventional mode or the SYS mode of operation. The following paragraphs describe all of the possible configurations, as well as, the other equipment necessary to perform a pressure to electrical test.

### **Conventional Mode**

#### **You may perform this test if:**

- Your field instrument has a pressure input range within the ability of the pressure module on the BetaGauge II, and
- Your field instrument has an electrical output range within the ability of the DC module on the BetaGauge II.

#### **Field Instrument Setup**

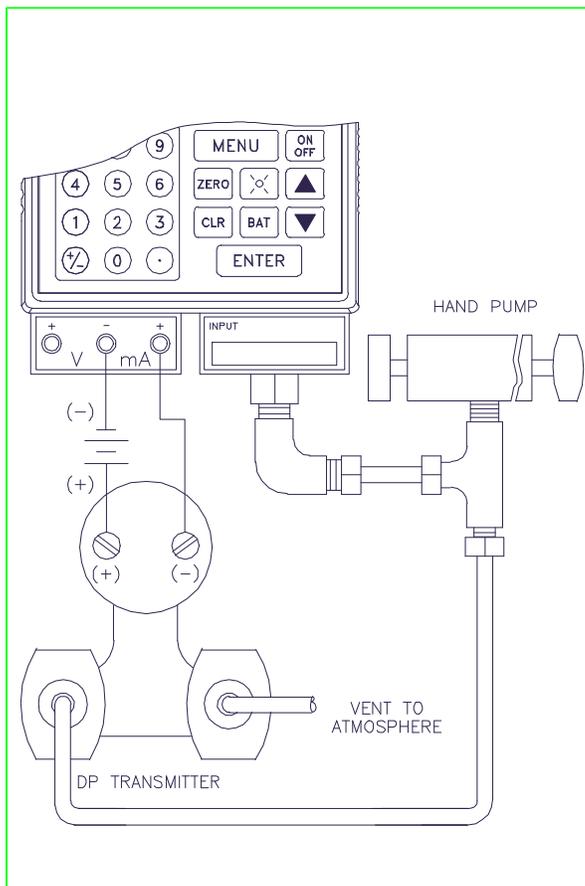
- Pressure input
- Electrical output

#### **Other Necessary Equipment**

- Pressure source

## Illustration

A graphical representation for configuring a pressure to electrical calibration test using the conventional mode of operation is shown below:



**Figure 6-4 Pressure to Electrical Calibration Test Using Conventional Mode**

## SYS Mode

There are four methods for configuring a pressure to electrical calibration test using SYS mode. The following table indicates which method to use.

	Use this method if...
<b>Method 1</b>	<ul style="list-style-type: none"><li>• Your field instrument has a pressure output range within the ability of the pressure module on the BetaGauge II, <i>and</i></li><li>• Your field instrument has an electrical output range within the ability of the DC module on the BetaGauge II.</li></ul>
<b>Method 2</b>	<ul style="list-style-type: none"><li>• Your field instrument has a pressure input range that exceeds the ability of the pressure module on the BetaGauge II, <i>and</i></li><li>• Your field instrument has an electrical output range within the ability of the DC module on the BetaGauge II.</li></ul>
<b>Method 3</b>	<ul style="list-style-type: none"><li>• Your field instrument has a pressure input range within the ability of the pressure module on the BetaGauge II, <i>and</i></li><li>• Your field instrument has an electrical output range that exceeds the ability of the DC module on the BetaGauge II.</li></ul>

	<b>Use this method if...</b>
<b>Method 4</b>	<ul style="list-style-type: none"><li>• Your field instrument has a pressure input range that exceeds the ability of the pressure module on the BetaGauge II, <i>and</i></li><li>• Your field instrument has an electrical output range that exceeds the ability of the DC module on the BetaGauge II.</li></ul>

## **Method 1**

### **Software Instrument Setup**

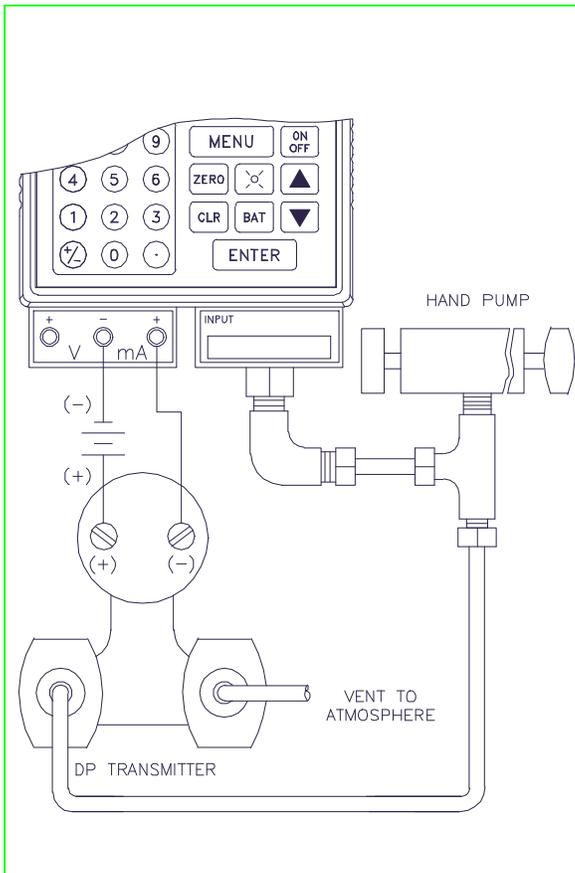
- Pressure input
- Electrical output

### **Other Necessary Equipment**

- Pressure source

## Illustration

A graphical representation for configuring the Method 1 pressure to electrical calibration test using the SYS mode of operation is shown below:



**Figure 6-5 Pressure to Electrical Calibration Test Using SYS Mode (Method 1)**

## **Method 2**

### **Software Instrument Setup**

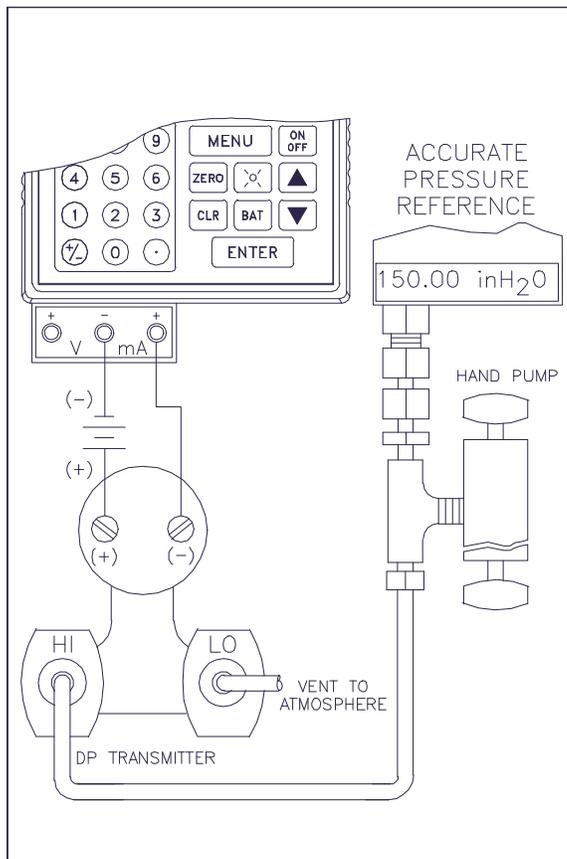
- Pressure input (requires manual entry on the BetaGauge II)
- Electrical output

### **Other Necessary Equipment**

- Pressure source
- Pressure measurement device

## Illustration

A graphical representation for configuring the Method 2 pressure to electrical calibration test using the SYS mode of operation is shown below:



**Figure 6-6 Pressure to Electrical Calibration Test Using SYS Mode (Method 2)**

## **Method 3**

### **Software Instrument Setup**

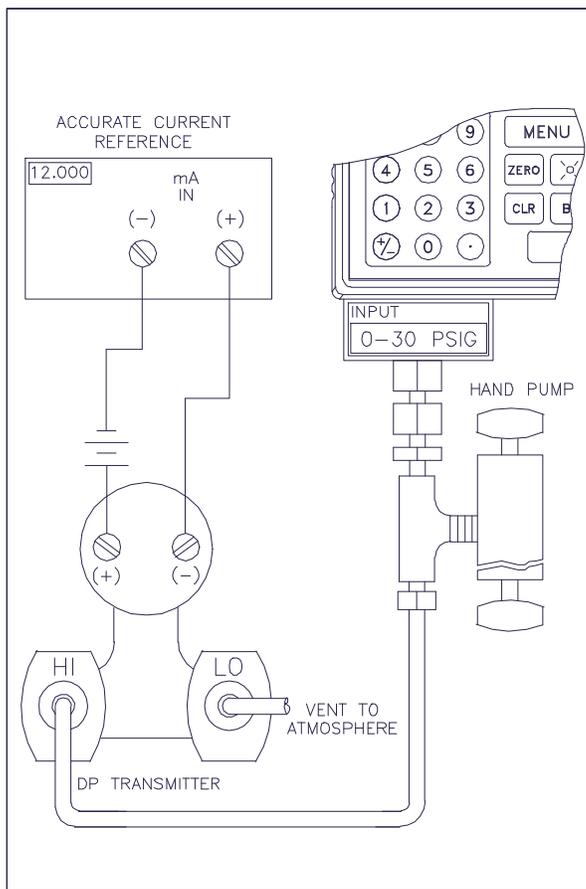
- Pressure input
- Electrical output (requires manual entry on the BetaGauge II)

### **Other Necessary Equipment**

- Pressure source
- Electrical measurement device

### Illustration

A graphical representation for configuring the Method 3 pressure to electrical calibration test using the SYS mode of operation is shown below:



**Figure 6-7 Pressure to Electrical Calibration Test Using SYS Mode (Method 3)**

## **Method 4**

### **Software Instrument Setup**

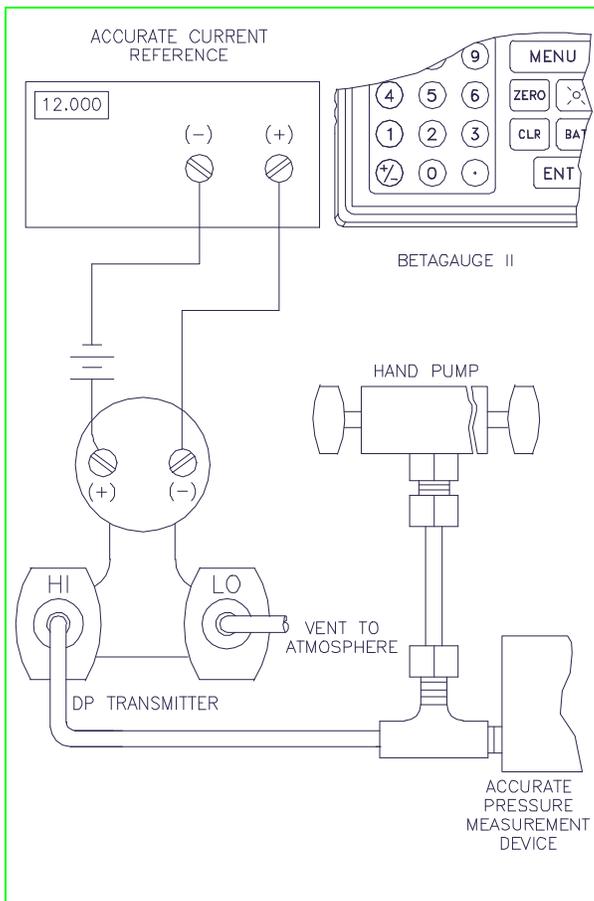
- Pressure input (requires manual entry on the BetaGauge II)
- Electrical output (requires manual entry on the BetaGauge II)

### **Other Necessary Equipment**

- Pressure source
- Pressure measurement device
- Electrical measurement device

## Illustration

A graphical representation for configuring the Method 4 pressure to electrical calibration test using the SYS mode of operation is shown below:



**Figure 6-8 Pressure to Electrical Calibration Test Using SYS Mode (Method 4)**

## **Electrical to Electrical Test**

You can perform an electrical to electrical calibration test using only the SYS mode of operation. The following paragraphs describe the possible configurations, as well as, the other equipment necessary to perform an electrical to electrical test.

## SYS Mode

There are two methods for configuring an electrical to electrical calibration test using SYS mode. The following table indicates which method to use.

	Use this method if...
<b>Method 1</b>	<ul style="list-style-type: none"><li>Your field instrument has an electrical output range within the ability of the DC module on the BetaGauge II.</li></ul>
<b>Method 2</b>	<ul style="list-style-type: none"><li>Your field instrument has an electrical output range that exceeds the ability of the DC module on the BetaGauge II.</li></ul>

**NOTE:** While in SYS mode, the BetaGauge II cannot measure the electrical input signals to the field instrument. You must manually enter the value of these signals on the BetaGauge II.

## **Method 1**

### **Software Instrument Setup**

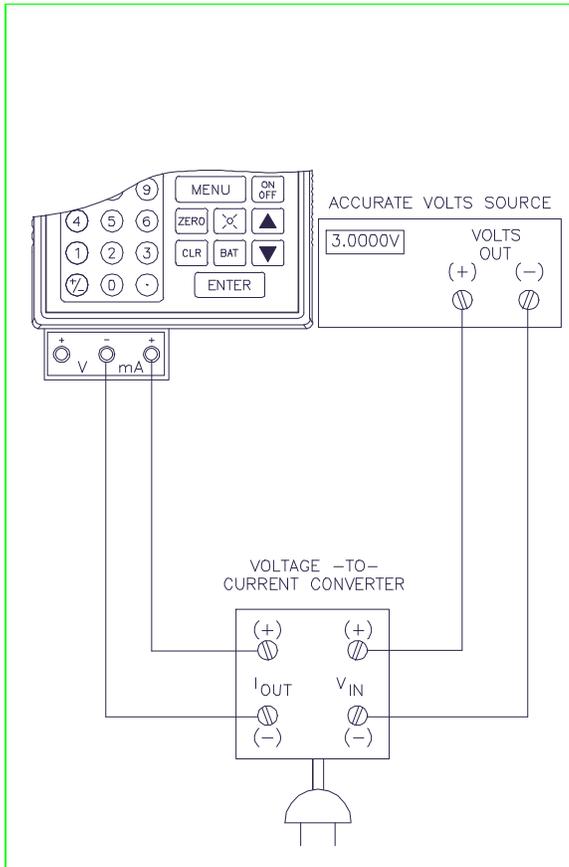
- Electrical input (requires manual entry on the BetaGauge II)
- Electrical output

### **Other Necessary Equipment**

- Electrical source

### Illustration

A graphical representation for configuring the Method 1 electrical to electrical calibration test using the SYS mode of operation is shown below:



**Figure 6-9 Electrical to Electrical Calibration Test Using SYS Mode (Method 1)**

## **Method 2**

### **Software Instrument Setup**

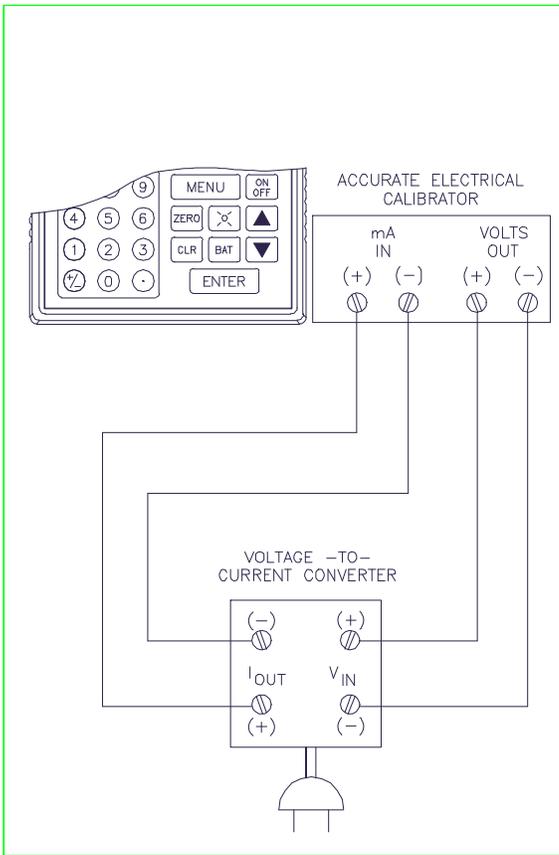
- Electrical input (requires manual entry on the BetaGauge II)
- Electrical output (requires manual entry on the BetaGauge II)

### **Other Necessary Equipment**

- Electrical source
- Electrical measurement device

## Illustration

A graphical representation for configuring the Method 2 electrical to electrical calibration test using the SYS mode of operation is shown below:



**Figure 6-10 Electrical to Electrical Calibration Test Using SYS Mode (Method 2)**

## Pressure to Pressure Test

You can perform a pressure to pressure calibration test using either the conventional mode or the SYS mode of operation. The following paragraphs describe all of the possible configurations, as well as, the other equipment necessary to perform a pressure to pressure test.

### Conventional Mode

#### You may perform this test if:

- Your field instrument has a pressure input range within the ability of one pressure module on the BetaGauge II, and
- Your field instrument has a pressure output range within the ability of the other pressure module on the BetaGauge II.

#### Field Instrument Setup

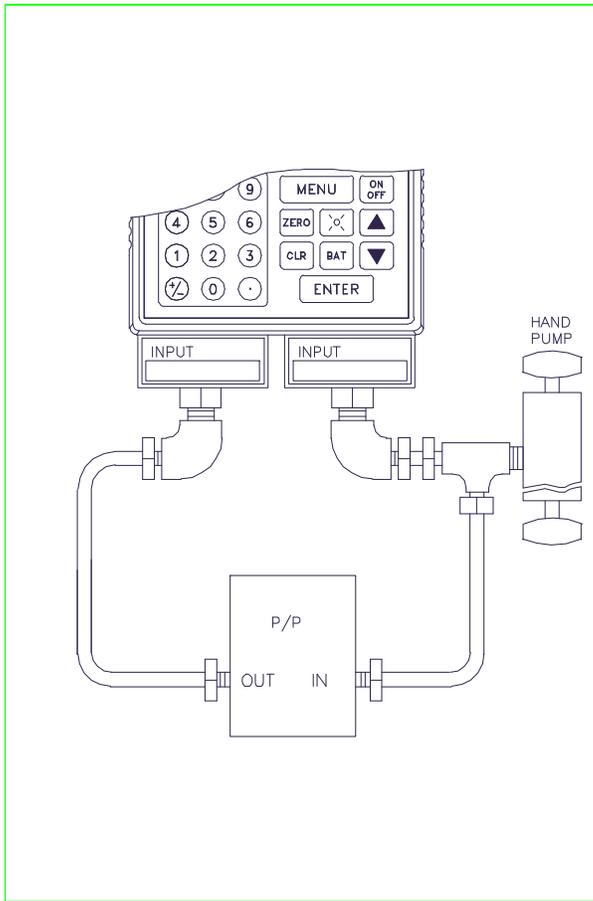
- Pressure input
- Pressure output

#### Other Necessary Equipment

- Pressure source

## Illustration

A graphical representation for configuring a pressure to pressure calibration test using the conventional mode of operation is shown below:



**Figure 6-11 Pressure to Pressure Calibration Test Using Conventional Mode**

## **SYS Mode**

There are three methods for configuring a pressure to pressure calibration test using SYS mode. The table on the following page indicates which method to use.

	Use this method if...
<b>Method 1</b>	<ul style="list-style-type: none"> <li>Your field instrument has a pressure input range within the ability of one pressure module on the BetaGauge II, <i>and</i></li> <li>Your field instrument has a pressure output range within the ability of the other pressure module on the BetaGauge II.</li> </ul>
<b>Method 2</b>	<ul style="list-style-type: none"> <li>Your field instrument has a pressure input range within the ability of one pressure module on the BetaGauge II, <i>and</i></li> <li>Your field instrument has a pressure output range that exceeds the ability of the other pressure module on the BetaGauge II.</li> </ul>
<b>Method 3</b>	<ul style="list-style-type: none"> <li>Your field instrument has a pressure input range that exceeds the ability of one pressure module on the BetaGauge II, <i>and</i></li> <li>Your field instrument has a pressure output range within the ability of the other pressure module on the BetaGauge II.</li> </ul>

## **Method 1**

### **Software Instrument Setup**

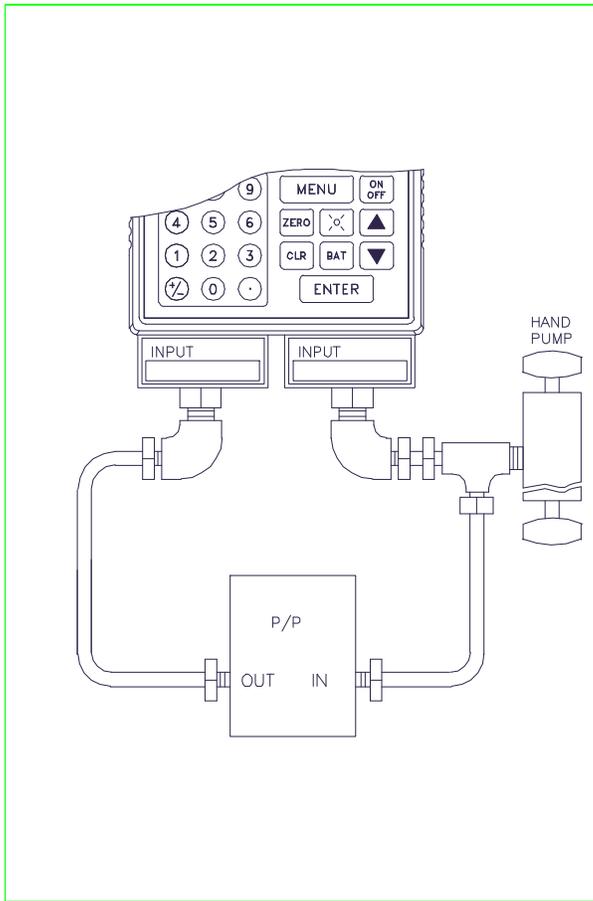
- Pressure input
- Pressure output

### **Other Necessary Equipment**

- Pressure source

## Illustration

A graphical representation for configuring the Method 1 pressure to pressure calibration test using the SYS mode of operation is shown below:



**Figure 6-12 Pressure to Pressure Calibration Test Using SYS Mode (Method 1)**

## Method 2

### Software Instrument Setup

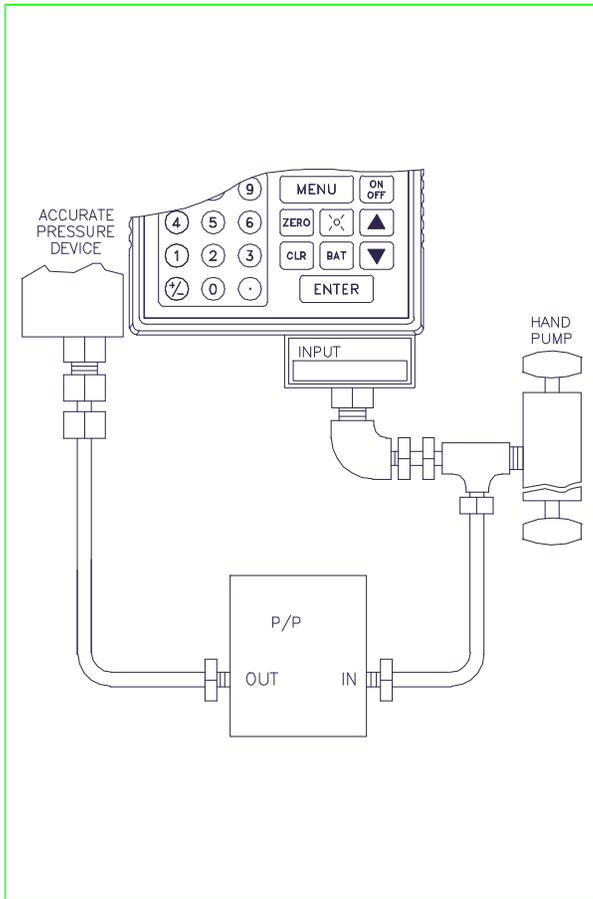
- Pressure input
- Pressure output (requires manual entry on the BetaGauge II)

### Other Necessary Equipment

- Pressure source
- Pressure measurement device

## Illustration

A graphical representation for configuring the Method 2 pressure to pressure calibration test using the SYS mode of operation is shown below:



**Figure 6-13 Pressure to Pressure Calibration Test Using SYS Mode (Method 2)**

## **Method 3**

### **Software Instrument Setup**

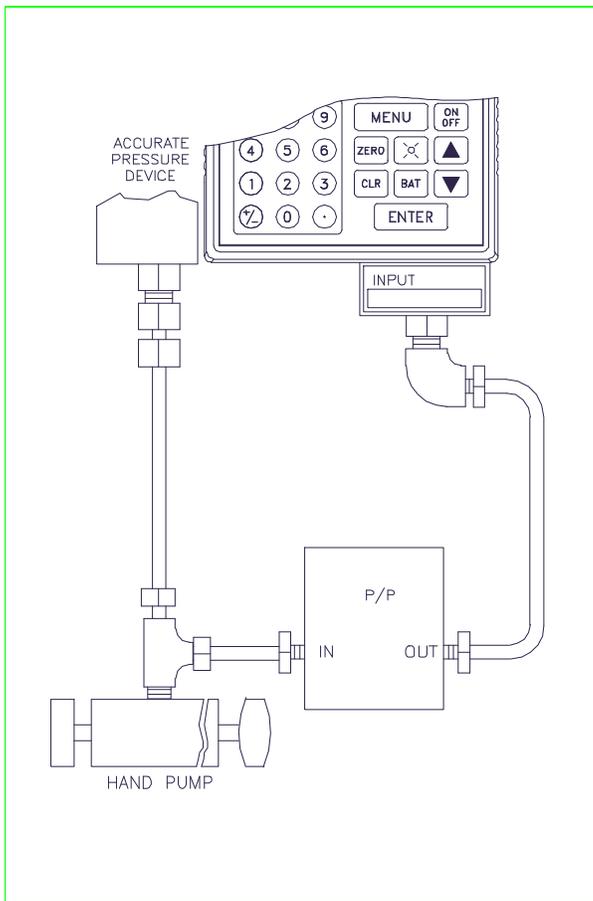
- Pressure input (requires manual entry on the BetaGauge II)
- Pressure output

### **Other Necessary Equipment**

- Pressure source
- Pressure measurement device

## Illustration

A graphical representation for configuring the Method 3 pressure to pressure calibration test using the SYS mode of operation is shown below:



**Figure 6-14 Pressure to Pressure Calibration Test Using SYS Mode (Method 3)**

## **Temperature to Electrical Test**

You can perform a temperature to electrical calibration test using only the SYS mode of operation. The following paragraphs describe the possible configurations, as well as, the other equipment necessary to perform a temperature to electrical test.

## SYS Mode

There are two methods for configuring a temperature to electrical calibration test using SYS mode. The following table indicates which method to use.

	Use this method if...
<b>Method 1</b>	<ul style="list-style-type: none"><li>Your field instrument has an electrical output range within the ability of the DC module on the BetaGauge II.</li></ul>
<b>Method 2</b>	<ul style="list-style-type: none"><li>Your field instrument has an electrical output range that exceeds the ability of the DC module on the BetaGauge II.</li></ul>

**NOTE:** The BetaGauge II cannot make direct temperature measurements.

## **Method 1**

### **Software Instrument Setup**

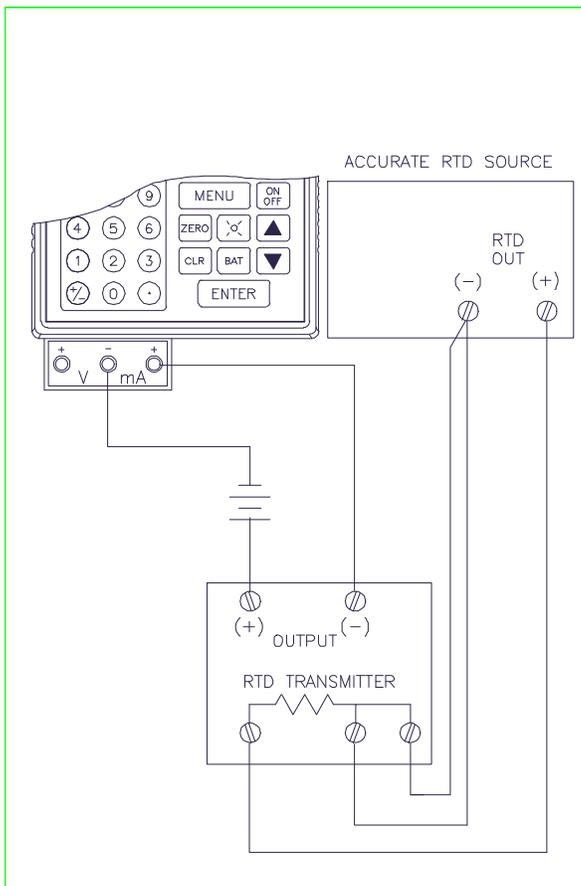
- Temperature input (requires manual entry on the BetaGauge II)
- Electrical output

### **Other Necessary Equipment**

- Temperature source

## Illustration

A graphical representation for configuring the Method 1 temperature to electrical calibration test using the SYS mode of operation is shown below:



**Figure 6-15 Temperature to Electrical Calibration Test Using SYS Mode (Method 1)**

## **Method 2**

### **Software Instrument Setup**

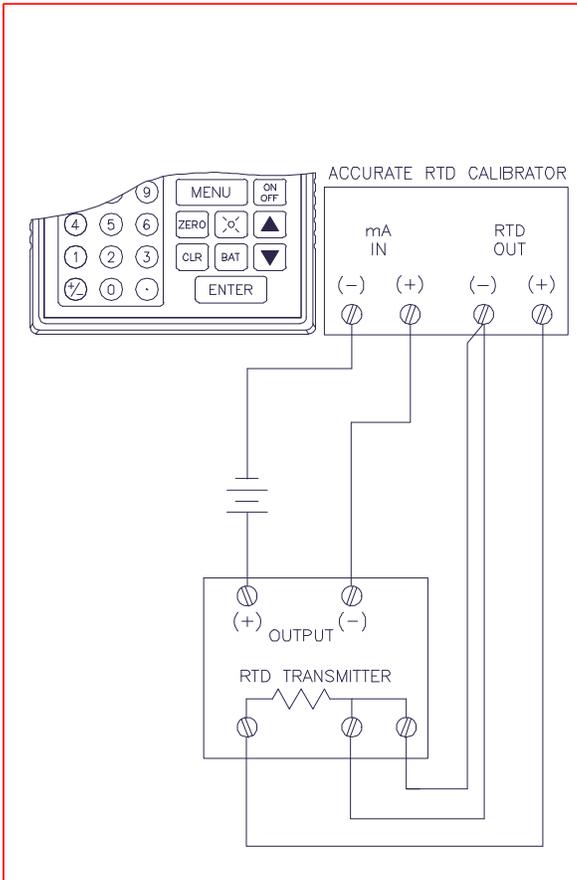
- Temperature input (requires manual entry on the BetaGauge II)
- Electrical output (requires manual entry on the BetaGauge II)

### **Other Necessary Equipment**

- Temperature source
- Electrical measurement device

## Illustration

A graphical representation for configuring the Method 2 temperature to electrical calibration test using the SYS mode of operation is shown below:



**Figure 6-16 Temperature to Electrical Calibration Test Using SYS Mode (Method 2)**

## **Electrical Indicator or Loop Test**

You can perform an electrical indicator or loop calibration using either the conventional mode or the SYS mode of operation. The following paragraphs describe all of the possible configurations, as well as, the other equipment necessary to perform an electrical indicator test.

### **Conventional Mode**

#### **You may perform this test if:**

- Your field instrument has an electrical input range within the ability of the DC module on the BetaGauge II.

#### **Field Instrument Setup**

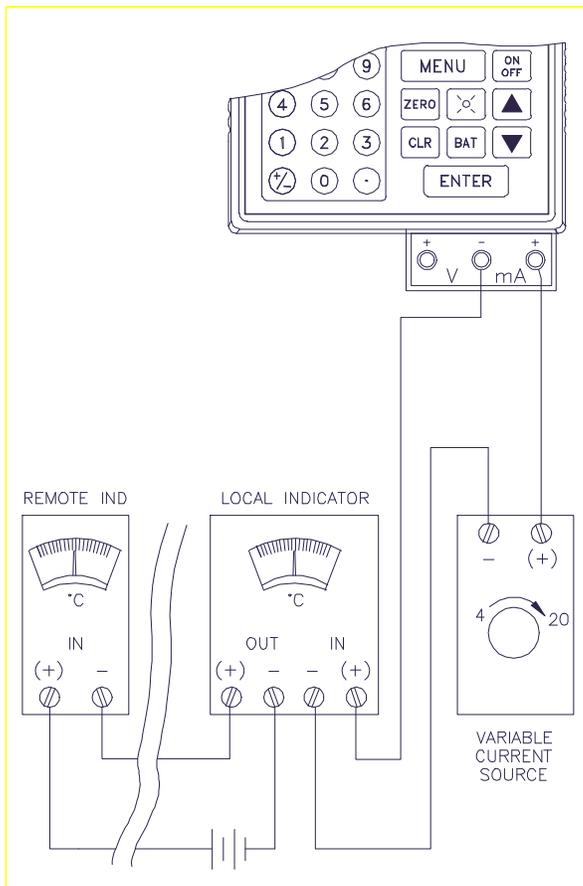
- Electrical input
- Electrical indicator output (requires manual entry on the BetaGauge II)

#### **Other Necessary Equipment**

- Electrical source

## Illustration

A graphical representation for configuring an electrical indicator or loop calibration using the conventional mode of operation is shown below:



**Figure 6-17 Electrical Indicator or Loop Calibration Using Conventional Mode**

## **SYS Mode**

### **You may perform this test if:**

- You are using either a local *or* remote electrical indicator to indicate the electrical input signal to the field instrument.

**NOTE:** While in SYS mode, the BetaGauge II cannot measure the electrical input signals to the field instrument. You must manually enter the value of these signals on the BetaGauge II.

### **Software Instrument Setup**

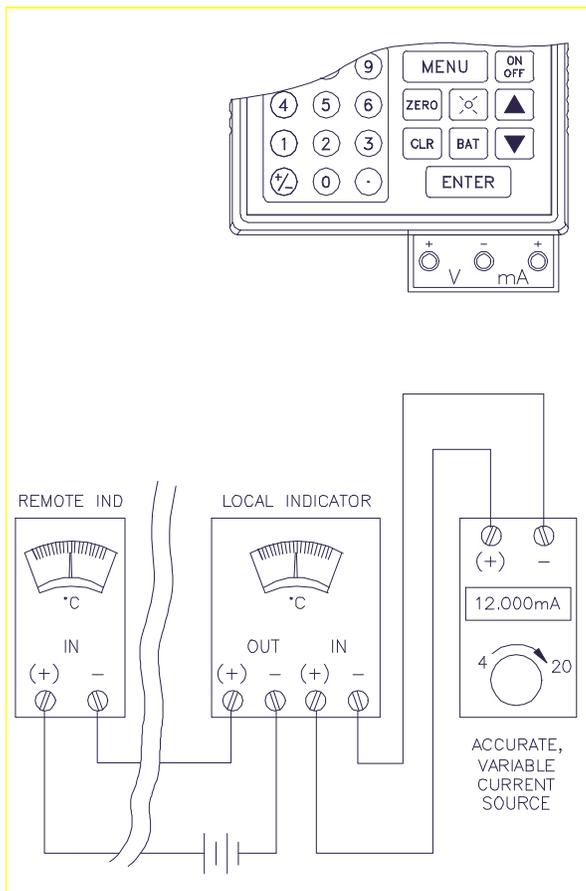
- Electrical input (requires manual entry on the BetaGauge II)
- Electrical indicator output (requires manual entry on the BetaGauge II)

### **Other Necessary Equipment**

- Electrical source

## Illustration

A graphical representation for configuring the electrical indicator or loop calibration using the SYS mode of operation is shown below:



**Figure 6-18 Electrical Indicator or Loop Calibration Using SYS Mode**

## Pressure Indicator or Loop Test

You can perform a pressure indicator or loop calibration using either the conventional mode or the SYS mode of operation. The following paragraphs describe all of the possible configurations, as well as, the other equipment necessary to perform a pressure indicator test.

### Conventional Mode

#### You may perform this test if:

- Your field instrument has a pressure input range within the ability of the pressure module on the BetaGauge II, and
- You are using either a local *or* remote pressure indicator to indicate the pressure input signal to the field instrument.

#### Field Instrument Setup

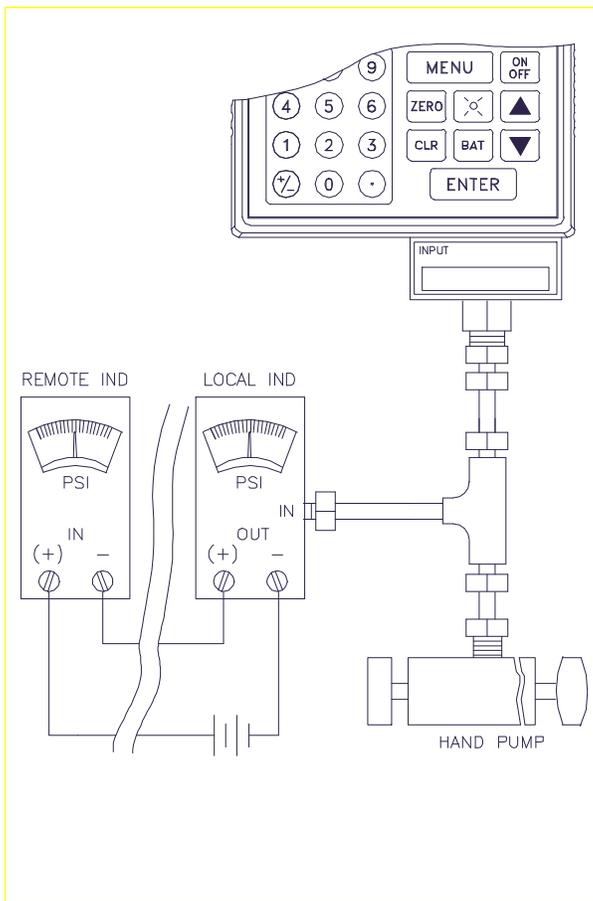
- Pressure input
- Pressure indicator output (requires manual entry on the BetaGauge II)

#### Other Necessary Equipment

- Pressure source

### Illustration

A graphical representation for configuring pressure indicator or loop calibration using the conventional mode of operation is shown below:



**Figure 6-19 Pressure Indicator or Loop Calibration Using Conventional Mode**

## SYS Mode

There are two methods for configuring a pressure indicator or loop calibration using SYS mode. The following table indicates which method to use.

	Use this method if...
<b>Method 1</b>	<ul style="list-style-type: none"><li>• Your field instrument has a pressure input range within the ability of the pressure module on the BetaGauge II, <i>and</i></li><li>• You are using either a local <i>or</i> remote pressure indicator to indicate the pressure input signal to the field instrument.</li></ul>
<b>Method 2</b>	<ul style="list-style-type: none"><li>• Your field instrument has a pressure input range that exceeds the ability of the pressure module on the BetaGauge II, <i>and</i></li><li>• You are using either a local <i>or</i> remote pressure indicator to measure the pressure output signal from the field instrument.</li></ul>

### Method 1

#### Software Instrument Setup

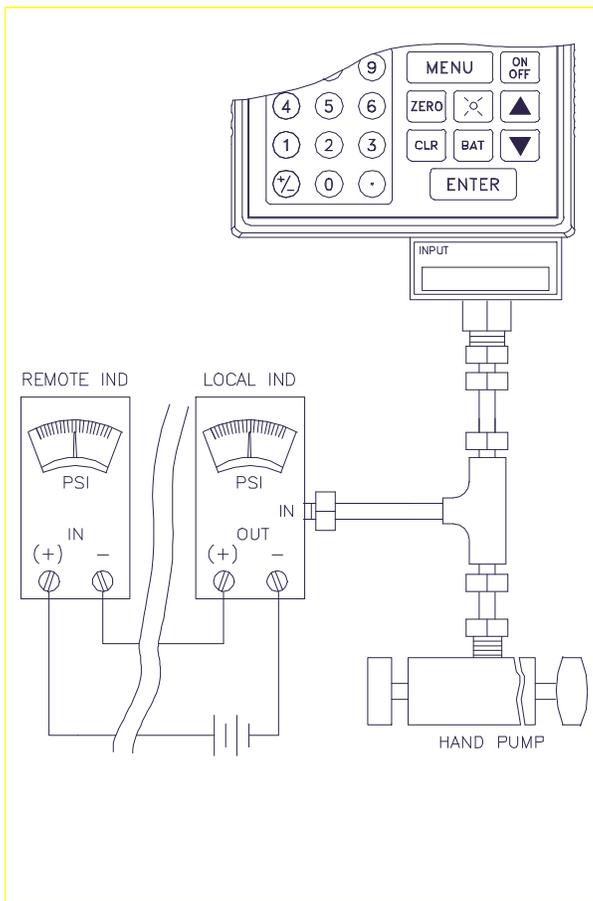
- Pressure input
- Pressure indicator output (requires manual entry on the BetaGauge II)

#### Other Necessary Equipment

- Pressure source

### Illustration

A graphical representation for configuring the Method 1 pressure indicator or loop calibration using the SYS mode of operation is shown below:



**Figure 6-20 Pressure Indicator or Loop Calibration Using SYS Mode (Method 1)**

## **Method 2**

### **Software Instrument Setup**

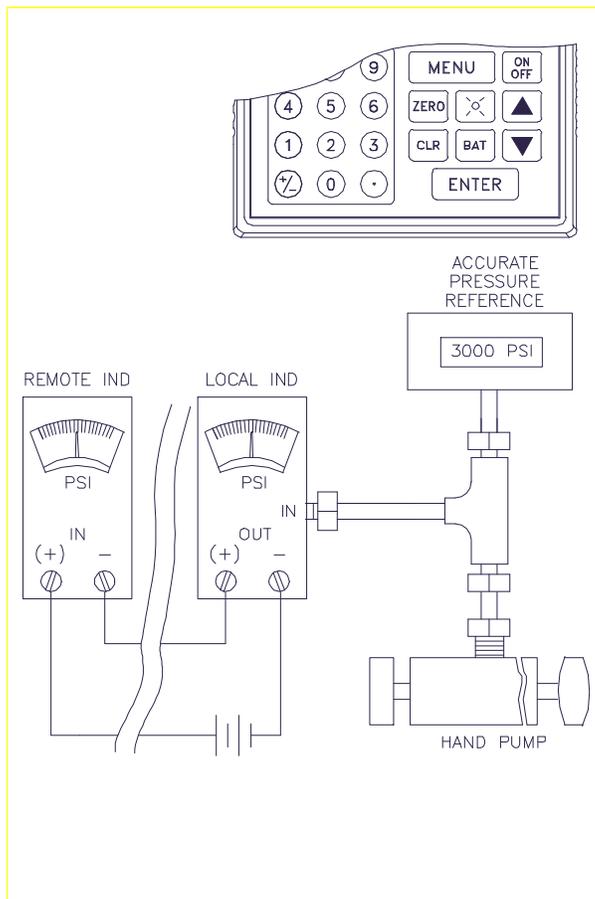
- Pressure input (requires manual entry on the BetaGauge II)
- Pressure indicator output (requires manual entry on the BetaGauge II)

### **Other Necessary Equipment**

- Pressure source
- Pressure measurement device

## Illustration

A graphical representation for configuring the Method 2 pressure indicator or loop calibration using the SYS mode of operation is shown below:



**Figure 6-21 Pressure Indicator or Loop Calibration Using SYS Mode (Method 2)**

## Temperature Indicator or Loop Test

You can perform a temperature indicator or loop calibration using only the SYS mode of operation. The following paragraphs describe the possible configurations, as well as, the other equipment necessary to perform a temperature indicator test.

### SYS Mode

#### You may perform this test if:

- You are using either a local *or* remote temperature indicator to indicate the temperature input signal to the field instrument.

**NOTE:** The BetaGauge II cannot make direct temperature measurements.

#### Software Instrument Setup

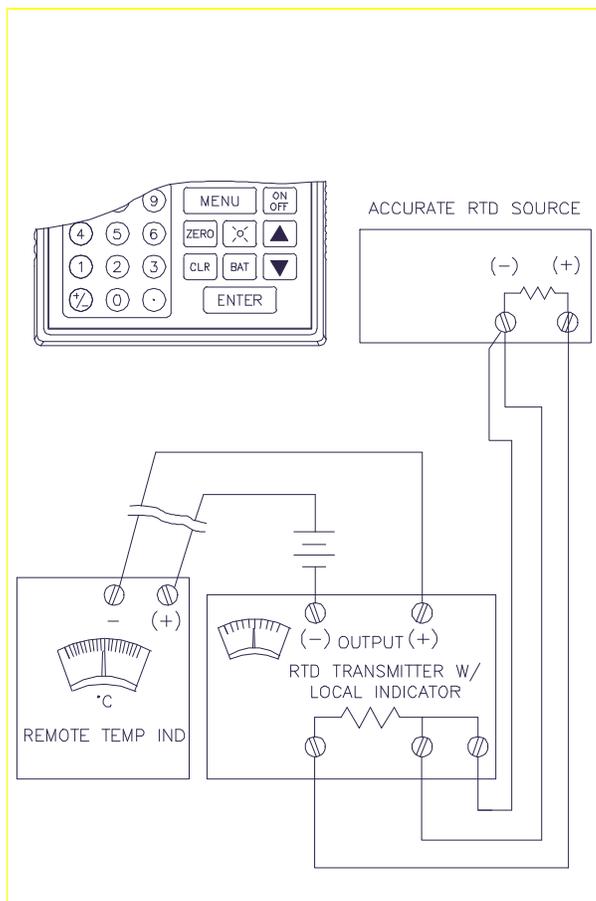
- Temperature input (requires manual entry on the BetaGauge II)
- Temperature indicator output (requires manual entry on the BetaGauge II)

#### Other Necessary Equipment

- Temperature source

### Illustration

A graphical representation for configuring the temperature indicator or loop calibration using the SYS mode of operation is shown below:



**Figure 6-22 Temperature Indicator or Loop Calibration Using SYS Mode**

☆☆☆

## 7- Documenting Calibrator (SYS) Mode

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### Overview

Typical instrument maintenance software packages allow you to track and maintain your facility's instruments and their calibration histories. Using the BetaGauge II SYS mode and an instrument maintenance software package, the calibrator automatically prompts you for pre-defined test points, then documents the instrument's output and input signals for later upload to a personal computer. Tests performed in the SYS mode offer two main advantages over those performed in the conventional mode:

- All tests performed on an instrument are performed in a consistent manner.
- The test data recorded is objective (in other words, not subject to your perspective).

### Acquiring Instrument Maintenance Software

If you do not own an instrument maintenance software package and are interested in more information or a free demonstration disk, please contact the Sales Department at Martel Electronics Corporation, or your local authorized Martel Sales Representative.

To contact Martel directly concerning instrument maintenance software:

**From the U.S. or Canada call:**

800-821-0023, or 603-434-1433

**From all other countries call:**

603-434-1433

## Before You Begin

Before you begin using the SYS mode to calibrate your field instrument(s), there are two tasks you must perform:

- Download Instrument Tests
- Connect Necessary Equipment

### Downloading Instrument Tests

Before you can access the BetaGauge II SYS mode, you must first download instrument tests from a software database on a personal computer to the BetaGauge II. These instrument tests are referred to as *tags*.

A tag defines the specifications of the field instrument you are calibrating, along with the output specifications to be used for displaying measurement readings on the BetaGauge II. In addition, a tag contains various test points of expected input and output measurements for actual calibration purposes. Typically, the tag name and number corresponds to an existing instrument's tag in your facility.

**NOTE:** Refer to your instrument maintenance software manual for specific instructions on how to download the tags to the BetaGauge II. The remainder of this section presumes that you have successfully downloaded the instrument tags you want to use for testing and/or calibration purposes.

## Connecting Necessary Equipment

Make sure that you have connected all of the necessary equipment required for the calibration test you want to perform. This equipment includes the field instrument you want to calibrate, the BetaGauge II, as well as, any other equipment necessary to performing a particular calibration test. For information on how to configure the equipment, refer to Section 6, *Application Notes*.

## SYS Mode Levels

The SYS mode has three primary levels of operation:

- Main
- Back Screen
- Execute

### Main Level

When you first access the BetaGauge II SYS mode, you are in the Main level. You can use the Main level to perform the following functions:

- Select a tag for testing or calibrating purposes.
- View the overall calibration status of a selected tag and its allowed tolerances.
- View specific test point details for a selected tag.
- View the results of the last test performed on a selected tag.
- Access the Back Screen level.

## Back Screen Level

You can access the Back Screen level via the Main level only. From the Back Screen level, you can perform the following functions:

- Access the Execute level (described below).
- Erase all the data recorded for a selected tag.

**NOTE:** The erase all data function is available only if calibration reset is allowed in your instrument maintenance software.

- Return to the Main level.

## Execute Level

You can access the Execute level via the Back Screen level only. From the Execute level, you can access the following screens:

- **Test Setup Screen.** Allows you to ensure that you have installed modules of the proper range and type, as well as, ensure that installed modules have not exceeded their calibration interval.
- **Zero Screen.** Allows you to zero the display reading for the currently installed modules prior to starting a test.
- **Execute Screen.** Allows you to execute the tests defined by the tag. This screen shows which test point is currently under calibration, as well as, live displays of the module inputs.
- **Post Test Status Screen.** Allows you to view the overall status of the tag, as well as, the date and time of the calibration test performed. You can also indicate whether the field instrument was adjusted or replaced, and specify the technician's identification number.

## Accessing the Main Level

To access the Main level of the SYS mode, use the **Menu** key to locate the Setup menu item *Sys*, then press the corresponding function key to display the Tag Status screen showing the first available tag. A sample display is shown below:

```
Tag 1:
BG2 TAGS Tag 1

Inst. OUT: mA
Inst. IN: PSI
Status: UNCAL
Time: 00:00:00
Date: 00/00/00
Error Tol: 0.0500
Alert Tol: 999999
Next: As Found
-----
Tag Status
Tag TP Rslt →
```

**NOTE:** If the display does not appear as shown above, then the instrument tags have not been loaded (or loaded incorrectly) into the BetaGauge II. Refer to your instrument maintenance software manual for specific instructions on how to download the tags to the BetaGauge II.

### Tag Status Screen Description

The Tag Status screen shows specific information about each tag present in the BetaGauge II. When you first access the SYS mode, the screen displays Tag 1 information. You can use the up and down arrow keys to view other tags in the system.

**NOTE:** The only way to access other tags in the system is via the Tag Status screen. Once you have proceeded to other screens in SYS mode,

you must return to the Tag Status screen to specify a different tag.

The Tag Status screen is divided into six sections. These sections are described below in the order that they appear on the screen from top to bottom:

**Tag Number/Area.** The current tag number and *area* is listed in the top portion of the screen.

**NOTE:** When using any instrument maintenance software packages, all tags may be assigned to an *area*. Refer to your instrument maintenance software manual for more information.

**Input/Output Types.** These two lines list the field instrument output type (mA in the example) and the field instrument input type (PSI in the example).

**Calibration Status.** This line indicates whether the tag has been calibrated, and if so, if it passed or failed.

**Time/Date.** These two lines indicate the time and date the calibration (if completed) was performed. If the test has not been performed, the lines read *00:00:00* (as shown in the example).

**Error/Alert Tolerances.** These two lines indicate the error and alert tolerances specified in the tag.

**Next.** Indicates the next test to be performed.

## Menu Items

The menu items shown on the bottom of the Tag Status screen are described below:

---

Menu Item	Allows you to ...
Tag	Specify a particular tag for viewing or calibration purposes.
TP	View the expected input and output measurements of each test point for the current tag.
Rslt	View the calibration or test results of the last test performed on the current tag.
→	Access the Back Screen level where you can access the Execute level, erase all data recorded for a particular tag, or return to the Main level.

## Viewing a Specific Tag

From the Tag Status screen, do one of the following to specify a particular tag for viewing or calibration purposes:

- Use the up and down arrow keys on the keypad to scroll to the tag you want to view.
- Press the function key corresponding to the menu item *Tag*, then use the number keys on the keypad to specify the tag number you want to view. Press the **ENTER** key.

## Viewing the Test Points for a Specific Tag

To view the test points for a specific tag on the Tag Status screen, do the following:

1. Specify the tag number associated with the test points you want to view.
2. Press the function key corresponding to the menu item *TP* to display the expected input and output measurement for the first six test points of the current tag. An example screen is shown below:

<b>Tag 2:</b>		
<b>BG2 TAGS Tag 2</b>		
<b>Inst. OUT: mA</b>		
<b>Inst. IN: PSI</b>		
<b>Pt.</b>	<b>Exp. IN</b>	<b>Exp. OUT</b>
<b>Un 1</b>	<b>3.0000</b>	<b>4.0000</b>
<b>Un 2</b>	<b>6.0000</b>	<b>8.0000</b>
<b>Un 3</b>	<b>9.0000</b>	<b>12.0000</b>
<b>Un 4</b>	<b>12.0000</b>	<b>16.0000</b>
<b>Un 5</b>	<b>15.0000</b>	<b>20.0000</b>
<b>Un 6</b>	<b>12.0000</b>	<b>16.0000</b>
<hr/>		
<b>Test Points</b>		
<b>PgDn</b>		

3. If there are additional test points you want to view, press the function key corresponding to the *PgDn* menu item to display the additional test points.
4. To return to the Tag Status screen, press the **CLR** key.

**NOTE:** You can exit the SYS mode by pressing the **CLR** key again.

## Viewing the Calibration Results for a Specific Tag

When you have completed calibrating a specific tag, you can view the calibration results on the BetaGauge II.

**NOTE:** The BetaGauge II will display the calibration results from the *last* calibration performed on the current tag. For information on how to calibrate test points, see the procedure titled *Tag Calibration* later in this section.

From the Tag Status screen use the following procedure to view the last calibration results for a specific tag:

1. Specify the tag number for the calibration results you want to view.
2. Press the function key corresponding to the menu item *Rslt* to display the Review Test Results screen. A sample is shown below:

<b>Tag 2:</b>		
<b>BG2 TAGS Tag 2</b>		
<b>Inst. OUT: mA</b>		
<b>Inst. IN: PSI</b>		
<b>Pt.</b>	<b>IN</b>	<b>OUT</b>
<b>Un 1</b>	<b>3.0000</b>	<b>4.0000</b>
<b>Un 2</b>	<b>6.0000</b>	<b>8.0000</b>
<b>Un 3</b>	<b>9.0000</b>	<b>12.000</b>
<b>Un 4</b>	<b>12.000</b>	<b>16.000</b>
<b>Un 5</b>	<b>15.000</b>	<b>20.000</b>
<b>Un 6</b>	<b>12.000</b>	<b>16.000</b>
<hr/>		
<b>Review Test Results</b>		
<b>PgDn</b>		

3. If there are additional test points you want to view, press the function key corresponding to the *PgDn* menu item to display the additional test points.

- To return to the Tag Status screen, press the **CLR** key.

**NOTE:** You can exit the SYS mode by pressing the **CLR** key again.

## Accessing the Back Screen Level

To access the Back Screen level of the SYS mode, press the function key corresponding to → on the Tag Status screen. A sample Back screen display is shown below:

<b>Tag 1:</b> <b>BG2 TAGS Tag 1</b>  <b>Inst. OUT: mA</b> <b>Inst. IN: PSI</b> <b>Status: UNCAL</b>  <b>Time: 00:00:00</b> <b>Date: 00/00/00</b> <b>Error Tol: 0.0500</b> <b>Alert Tol: 999999</b> <b>Next: As Found</b>
<b>Tag Status</b>
<b>Exe    Reset            →</b>

## Back Screen Description

The Back screen is exactly like the Tag Status screen except for the menu items that appear at the bottom of the screen. These menu items are described on the following page.

## Menu Items

The menu items shown on the bottom of the Back screen are described below:

---

<b>Menu Item</b>	<b>Allows you to ...</b>
Exe	Access the Execute level (described on the following pages).
Reset	Erase all recorded data for the selected tag. <b>NOTE:</b> The erase all data function is available only if calibration reset is allowed in your instrument maintenance software.
→	Return to the Main level.

## Erasing Data for a Specific Tag

To erase all recorded data for a specific tag on the Back screen, do the following:

**NOTE:** Recorded data exists only if you have performed calibration tests for the selected tag. For information on how to perform a calibration test, see the procedure titled *Tag Calibration* later in this section.

1. Specify the tag number for the data you want to erase.
2. Press the function key corresponding to the menu item *Reset* and the bottom of the back screen appears as shown below:

<b>Reset Cal.</b>
<b>Yes   No</b>

**NOTE:** The *Reset* menu item is displayed only if calibration reset capabilities are allowed in your instrument maintenance.

3. Do one of the following:
  - To erase all recorded data for the specified tag and return to the Tag Status screen, press the function button corresponding to the *Yes* menu item.
  - To cancel the operation and return to the Tag Status screen, press the function button corresponding to the *No* menu item.

**NOTE:** You can exit the SYS mode by pressing the **CLR** key.

## Accessing the Execute Level

To access the Execute level of the SYS mode, press the function key corresponding to *Exe* on the Back screen. The Test Setup screen appears as shown below:

Tag 2:		
BG2 TAGS Tag 2		
Inst. OUT:	mA	
4.0000	20.000	CH1
Inst. IN:	PSI	
3.0000	15.000	CH2
CH1		DC
09/25/1995		
CH2		GAGE
04/16/1995	15.00	
Modules Correct		
Ready		

The Test Setup screen is described below and on the following page.

### Test Setup Screen Description

The main purpose of the Test Setup screen is to indicate whether you have installed modules with the proper range for the assigned test point values of the current tag. In addition, you can ensure that the currently installed modules have not exceeded their calibration interval.

**NOTE:** You cannot proceed from the Test Setup screen until you have installed modules that will accommodate the assigned test point values for the current tag.

The Test Setup screen is divided into five sections. These sections are described below in the order that they appear on the screen from top to bottom:

**Tag Number/Area.** The current tag number and *area* is listed in the top portion of the screen.

**Low/High Test Point Values.** This section lists the lowest and highest test point values of the selected tag. These values include the minimum to maximum ranges for the field instrument's input and output measurements. Directly to the right of these values are the BetaGauge II module assignments (Channel 1/Channel 2) for the field instrument's input and output measurements.

**Calibration Intervals.** This section shows the calibration interval for each module (Channel 1 and Channel 2).

**Status Message.** This section indicates whether the currently installed modules can accommodate the assigned test point values for the field instrument's input and output measurements. If the appropriate modules are installed, the status reads *Modules Correct*. If one or more inappropriate modules are installed, the status reads *Wrong Module(s)*.

**Menu Item.** The *Ready* menu item appears at the bottom of the screen only when the status message reads: *Modules Correct*. You can use the *Ready* menu item to proceed to the Zero screen where you can zero the display readings for the currently installed modules.

## Choosing Appropriate Modules

In choosing the appropriate modules for the test point values of the current tag, you can use the following examples as guidelines.

### Example 1: Over-Pressure Protection

For those tags that require a pressure module, the BetaGauge II will accept a 5000 PSI module to perform a 5 PSI test. However, if you install a 5 PSI module for a test that requires 200 inches of water column, the status message will read *Wrong Module(s)*. This message ensures that you will not over-pressure a module.

### Example 2: Ensuring Proper Module Accuracy

To help you determine if you have installed a module with proper accuracy, you can use the Test Setup screen to view the highest and lowest test point values of the tag.

For example, a P/I instrument has an input pressure test point range of 3 to 15 PSI. Therefore, the BetaGauge II will display 3 for the minimum and 15 for the maximum. This information allows you to select a module that is as close to the maximum value as possible. For instance, (given the above mentioned test point range of 3 to 15 PSI) if you have a 30 PSI module and a 50 PSI module, then the best module to install is the 30 PSI module. Furthermore, a 15 PSI module would be an even more accurate module to install.

## Accessing the Zero Screen

When the *Modules Correct* status message appears on the Test Setup screen, you can access the Zero screen where you can zero the display readings of the installed modules.

To access the Zero screen, press the function key corresponding to the *Ready* menu item on the Test Setup screen. The Zero screen shows live input displays of the two modules currently installed. A sample is shown below:

Tag 2:		
BG2	TAGS	Tag 2
CH1		DC
0.0008	mA	
Inst. OUT		
CH2		GAGE
0.1103	PSI	
Inst. IN		
Zero Channel 1		
Ready	Zero	

### Zero Screen Description

The Zero screen is divided into four sections. These sections are described below in the order that they appear on the screen from top to bottom:

**Tag Number/Area.** The current tag number and *area* is listed in the top portion of the screen.

**NOTE:** When using an instrument maintenance software package, all tags must be assigned to an *area*. Refer to your instrument maintenance software manual for more information.

**Live Input/Output Measurements.** This section shows the live input and output measurements and measurement type for channels 1 and 2.

**System Prompt.** This section first prompts you to zero the display for channel 1, then follows with channel 2.

**Menu Items.** The menu items (*Ready* and *Zero*) that appear at the bottom of the screen allow you to zero the display for the current channel or bypass the zeroing operation for the current channel.

### **Zeroing the Display Readings**

From the Zero screen, use the following procedure to zero the display readings of the installed modules prior to starting a test.

**CAUTION:** Use the following practices to ensure that an offset does not occur when you initiate a zero sequence:

**Zeroing a Pressure Module.** Ensure that the module is vented to the atmosphere prior to initiating the zero sequence.

**Zeroing a Current Input.** Ensure that the milliamp inputs are open.

**Zeroing a Voltage Input.** Ensure that the voltage input is shorted.

1. Do one of the following:
  - To zero the module display of channel 1, press the function button corresponding to the *Zero* menu item. Proceed to step 2.
  - To bypass the zeroing option for channel 1, press the function button corresponding to the *Ready* menu item. Proceed to step 2.

2. After you select the *Zero* or *Ready* menu item for channel 1, the calibrator prompts you to zero channel 2. Repeat step 1 to zero the display for channel 2 or bypass the option.
3. After you select the *Zero* or *Ready* menu item in step 2, the calibrator displays the Execute screen. Refer to the paragraphs below for information concerning the Execute screen.

**NOTE:** You can exit the SYS mode by pressing the **CLR** key once to return to the Tag Status screen, then once again to return to the Setup menu.

### Accessing the Execute Screen

After you specify whether to zero the display readings for channel 1 and channel 2 on the Zero screen, the calibrator displays the Execute screen. A sample is shown below:

<b>Tag 2:</b>		
<b>BG2 TAGS Tag 2</b>		
<b>Inst. OUT: mA</b>		
<b>Inst. IN: PSI</b>		
<b>Pt.</b>	<b>IN</b>	<b>OUT</b>
<b>Un 1</b>	<b>3.0000</b>	<b>4.0000</b>
<b>Un 2</b>	<b>6.0000</b>	<b>8.0000</b>
<b>Un 3</b>	<b>9.0000</b>	<b>12.0000</b>
<b>Actual IN OUT</b>		
<b>1</b>	<b>0.0983</b>	<b>-0.0005</b>
<b>Appr. Input:</b>		<b>3.0000</b>
<b>Set &amp; press ENTER</b>		

The Execute screen is described on the following page.

## Execute Screen Description

The Execute screen is divided into six sections. These sections are described below in the order that they appear on the screen from top to bottom:

**Tag Number/Area.** The current tag number and *area* is listed in the top portion of the screen.

**NOTE:** When using an instrument maintenance software package, all tags must be assigned to an *area*. Refer to your instrument maintenance software manual for more information.

**Input/Output Types.** This section lists the field instrument output type (mA in the example) and the field instrument input type (PSI in the example).

**Calibration Status.** The calibration status appears to the left of each listed test point:

- **Un.** Uncalibrated
- **C.** Calibrated
- **CE.** Calibration Error

**Test Point Data.** This section shows the expected input and output measurements for the first three test points of the current tag.

**Actual Reading.** This section shows the test point that is currently under test, as well as, live displays of the module inputs.

**Instrument Input.** The bottom section prompts you to apply the required field instrument input value for the current test point.

## Tag Calibration

Before you begin the calibration process, it is important to know the following information:

- You must have already specified the tag number you want to calibrate on the Tag Status screen in the Main level. (In other words, you cannot specify a tag number from the Execute screen.)
- You can cancel the calibration test at any time during the process by pressing the **CLR** key to return to the Tag Status screen.

To perform tag calibration, do the following:

1. Access the Execute screen for the particular tag you want to calibrate. The BetaGauge II prompts you to apply the first test point measurement input.

<p><b>Appr. Input: X.XXXX</b> <b>Set &amp; Press ENTER</b></p>
--

2. Apply the required field instrument input value for the current test point.

**NOTE:** The BetaGauge uses the measured field instrument input to calculate the ideal field instrument output. It can then determine whether the measured field instrument output is within the allowed error tolerance specified in the tag. Keep in mind, however, that if you accept an input value that is one percent low, the BetaGauge II will expect the ideal field instrument output to be one percent low as well.

3. When the applied field instrument input value comes within the allowed pressure tolerance, the BetaGauge II beeps. When you hear the beep, press the **ENTER** key. (The system will not accept the **ENTER** key until you hear the beep.)

**NOTE:** If the *actual* field instrument output is within the allowed error tolerance of the calculated *ideal* output, the BetaGauge II will change the calibration status for that test point from **Un** to **C**.

If the *actual* measured field instrument output is outside the allowed error tolerance of the calculated *ideal* output, then the calibration status for that test point will read **CE**.

4. The BetaGauge II then increments the actual reading display to the next test point number, and again prompts you to apply the required field instrument input value for the current test point.
5. Repeat step 3 for each test point in the current tag. After you calibrate the third test point, the test point data scrolls to the next three chronological test points of the current tag. Continue this process until you have calibrated all test points.
6. After you have calibrated all test points for the current tag, the Post-Test Status screen displays.

**NOTE:** You can exit the SYS mode by pressing the **CLR** key once to return to the Tag Status screen, then once again to return to the Setup menu.

However, if you press the **CLR** key to exit the tag calibration process, all calibration results will be lost.

## Accessing the Post-Test Status Screen

After you have calibrated the last test point for the current tag, the BetaGauge II displays the Post-Test Status screen. A sample is shown below:

<b>Tag 2:</b>		
<b>BG2 TAGS Tag 2</b>		
<b>Inst. OUT: mA</b>		
<b>Inst. IN: PSI</b>		
<b>Status: PASS</b>		
<b>Time: 11:23:59</b>		
<b>Date: 10/07/96</b>		
<b>Error Tol: 0.0500</b>		
<b>Alert Tol: 999999</b>		
<b>Next: As Left 1</b>		
<hr/>		
<b>Adj. Instr.</b>		
<b>Yes</b>	<b>No</b>	<b>Rep</b>

### Post-Test Status Screen Description

The Post-Test Status screen is exactly like the Tag Status screen except for the menu items that appear at the bottom of the screen.

**NOTE:** Refer to the Tag Status screen description (earlier in this section) for a complete description of the screen data.

From the Post Test Status screen, you can perform the following functions:

- Use the menu items at the bottom of the screen to indicate whether the field instrument under test was adjusted (Yes), left alone (No), or replaced (Rep).
- Access another system prompt that allows you to indicate the identification number of the technician who performed the calibration. This entry is optional.

## Specifying Post-Test Status Information

**NOTE:** You must answer the post-test status prompts. If you press the **CLR** key prior to answering the post-test prompts, all calibration results will be lost.

To specify post-test status information, do the following:

1. From the Post-Test Status screen, use the function button corresponding to the appropriate menu item (*Yes*, *No*, or *Rep*) to indicate whether the field instrument was adjusted, left alone, or replaced.
2. After you have specified the field instrument adjustment status information, the BetaGauge II prompts you for an identification number of the technician who performed the calibration test.
3. Do one of the following:
  - Use the numbers on the keypad to specify a technician's identification number, then press the **ENTER** key.
  - Accept the 0 default value and press the **ENTER** key to bypass the entry.
4. After you have specified the identification number, or bypassed the prompt, the display returns to the Tag Status screen of the Main level. Do one of the following:
  - Press the **CLR** key to exit the SYS mode and return to the Setup menu.
  - View the results from the last calibration performed on the selected tag. (Refer to the section entitled *View the Calibration Results for a Specific Tag* earlier in this section.)
  - Select another tag.

☆☆☆

# A-Battery Care/Maintenance

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## Overview

Before handling the batteries used with the BetaGauge II, read the following danger, warning, and caution statements.

### **DANGER!**

Failure to carefully observe the following procedures and precautions can result in battery leakage, heat generation, bursting, and serious personal injury.

- Never dispose of a battery pack in a fire or expose a battery pack to high temperatures.
- Do not connect the two end terminals of the battery pack together with electrically conductive material, including lead wires. Do not transport or store the battery pack with the terminals uncovered or connected with a metal necklace or other conductive material.
- Charge the battery pack using Hathaway chargers only. Charge the battery pack only under the conditions specified on the label. Failure to follow proper charging procedures can result in damage to the battery pack.
- Never disassemble, modify, or reconstruct the battery pack.
- Never solder lead wires directly on the battery pack.

The batteries in the pack contain a strong colorless alkaline liquid. This alkaline liquid is extremely corrosive and will cause skin damage. If any liquid from the battery pack comes in contact with your eyes, immediately flush your eyes with clean water and consult a doctor. The strong alkaline liquid can damage your eyes and lead to permanent loss of eyesight.

## **WARNING!**

- Do not apply water, seawater, or other oxidizing agents to the battery pack, as this can cause rust and heat generation and can result in the battery pack bursting.
- Never use the battery pack if it is leaking, deformed, discolored, damaged, or is different from its original condition. External damage to the battery pack can be a sign of a malfunction.
- When the usage time for the battery pack becomes extremely short after charging, its operating life has ended and it should be replaced.

## CAUTION!

- Do not strike or drop the battery pack. Sharp impacts or concussions to the battery pack may result in leakage, heat generation, and bursting.
- Always follow the specified charging temperature ranges on the battery pack. Failure to observe the indicated temperatures may cause leakage, heat generation, and a decrease in performance or operating life of the battery pack
- After the battery pack has been removed from the BetaGauge II, store the battery pack in a dry place within the recommended storage temperature range. This will help preserve the battery pack performance and durability, and minimize the possibility of leakage or corrosion.
- If the battery pack terminals become dirty, clean them with a soft dry cloth prior to use. Dirt on the terminals can result in poor contact with the equipment and loss of power.
- If you detect heat generation or other abnormalities when using the battery pack, immediately stop using the pack.

## Battery Packs

The BetaGauge II uses rechargeable nickel–cadmium (NiCd) batteries that have high power-to-size-and-weight ratios. If properly maintained and cared for, they will provide years of excellent service. However, NiCd batteries are susceptible to damage under the following conditions:

- **Heat.** Protect the batteries from prolonged exposure to extremely hot temperatures.
- **Cold.** Protect the batteries from prolonged exposure to extremely cold temperatures. If possible, when batteries are cold, allow them to warm to room temperature before using them.
- **Charging.** Charge batteries at an ambient temperature of 0 to 45°C.
- **Overcharging.** Overcharging NiCd batteries is the most common cause of early failure. Do not charge the battery packs continuously. For a full charge, the trickle charger requires about 12 hours. (Never charge the batteries for more than 16 hours.) Approximately once a month, allow the batteries to fully discharge before recharging.
- **Storage.** Store battery packs at an ambient temperature of 0 to 35°C. If you must store a battery packs for a prolonged period (more than three months), you should discharge the battery pack prior to storage. The recommended method for discharging a battery pack is through use in a BetaGauge II calibrator.

## Guidelines for Using Batteries

It is recommended that you use the following guidelines when using batteries:

- When installing or removing a battery pack, do not touch or bend the battery connection terminals on the calibrator.
- When installing or removing a battery pack, do not short the terminals on the back of the battery. Doing so will damage the battery pack and may cause bodily injury.
- Dispose of unusable batteries as specified by local regulations. Because NiCd batteries contain hazardous chemicals and have the potential to explode, do not use fire as a means of disposal. You may return used batteries to Martel for disposal.

## Installing a Battery Pack

Use the following procedure to install a battery pack:

1. Before installing a battery pack, disconnect the pack from any charging device.
2. Hold the battery pack at a slight angle to the calibrator, then insert the two tabs of the pack into the slots on the calibrator.
3. Press the top of the battery pack into the calibrator and secure it by tightening the two captive screws on the back of the battery pack.

**CAUTION:** Overtightening the screws may damage the battery pack and the calibrator.

## Removing a Battery Pack

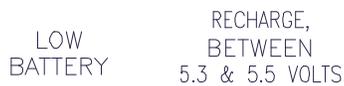
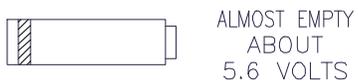
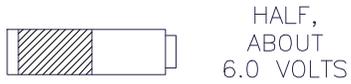
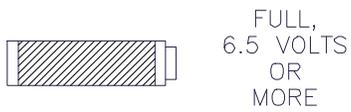
Use the following procedure to remove a battery pack:

1. Before removing a battery pack, turn off the calibrator and disconnect the charger.
2. Loosen the two captive screws on the back of the battery pack.
3. Pull the top of the battery pack away from the calibrator, lifting up and out.

## Viewing the Battery Voltage

There are two methods for viewing the current battery voltage:

- **Approximate reading.** A battery symbol, in the upper right corner of the LCD display, shows the approximate battery voltage. The highlighted (or dark) portion of the battery indicates the amount of available voltage. Refer to the examples below:



**Figure A-1 Viewing Approximate Battery Readings**

**NOTE:** The scale is 6.5 Volts when full and 5.5 Volts when empty. Nominal full charge is 7.00 Volts, and the calibrator shuts off at 5.3 Volts. The message *Low Battery* flashes when the battery voltage drops below 5.5 Volts.

- **Exact reading.** You can view the exact voltage of the current battery by pressing the **BAT** key on the keypad. When you press the **BAT** key, the battery voltage reading replaces the battery symbol in the upper right portion of the LCD. When the *Low Battery* message displays, the **BAT** key will not accurately display the actual battery voltage.

## Charging the Batteries

### Standard Pack

When the standard intrinsically safe (IS) battery pack is fully charged, the calibrator will operate continuously for 10 hours (nominal). A discharged battery pack requires 12 hours to reach a full charge. Each standard calibrator includes a standard IS battery pack and charger. Additional battery packs and chargers are available (contact Factory Sales for details).

You can charge the battery pack while the pack is installed or removed from the calibrator. See page A-10 for more information about IS battery packs.

### Procedure

To charge the standard intrinsically safe battery pack, plug the proper charger into the jack at the top of the battery pack. A red LED indicator illuminates indicating that power is available and the battery pack is charging.

## Quick Charge Pack (optional)

The quick charge battery pack is designed with special discharge circuitry that can cycle the battery to a discharged state before recharging. This cycling prevents battery failure due to the *memory* effect of NiCd batteries.

The quick charge battery pack requires the high capacity quick charger for proper charging. The charger for the quick charge battery pack is a high capacity charger that can fully charge the battery pack from a fully discharged state within 90 minutes. Quick charge battery packs are available for non-intrinsically safe BetaGauge II calibrators (contact Factory Sales for more information).

You can re-charge the quick charge battery pack while the pack is installed or removed from the calibrator.

### Procedure

To charge the quick charge battery pack:

1. Plug the proper charger into the jack at the top of the battery pack. A red LED indicator illuminates indicating that power is available to the battery pack, and that the battery pack is under fast charge.
2. After connecting the charger to the quick charge battery pack, initiate the discharge (or refresh) cycle by inserting a small non-conductive pin in the hole marked *Battery Refresh Enable*. This initiates the discharge cycle prior to charging.

**NOTE:** It is not necessary to perform the refresh on each charge cycle. The recommended interval for using the discharge cycle is about every 10 to 15 charges.

The status of the quick charge battery pack charge cycle is indicated by the LED indicator on the battery pack:

- **Steady On** indicates fast charging.
- **Rapid Flash** indicates charged.
- **Slow Flash** indicates discharging.
- **Off** indicates that the cycle is disabled or the battery pack is not receiving power from the AC adapter.

**NOTE:** The charger for the quick charge battery pack is different from the standard charger. The two should not be used interchangeably.

### **Intrinsically Safe Battery Pack**

The intrinsically safe battery pack is designed for safe use in hazardous areas where danger of explosion or fire exists.

#### **WARNING**

Do not remove or charge an intrinsically safe battery pack in a hazardous environment.

You can charge the battery pack while the pack is installed or removed from the calibrator.

**NOTE:** Use the trickle charger to charge the intrinsically safe battery pack.

### **Procedure**

To charge the intrinsically safe battery pack, plug the proper charger into the jack at the top of the battery pack. A red LED indicator illuminates indicating that power is available and the battery pack is charging.

# B-Specifications

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## Available Pressure Ranges

All ranges listed below are for a specific input module. Additional modules are available as options. Custom ranges outside the minimum and maximum ranges listed are also available as options.

### Non-isolated Gauge (PSIG)

0 to 0.3 (20 mBar)

0 to 1 (70 mBar)

### Isolated Gauge (PSIG)

0 to 5 (0 to 350 mBar) †

0 to 7.2 (0 to 500 mBar) (200" WC)††

0 to 10 (0 to 700 mBar) ††

0 to 30 (0 to 2 Bar)

0 to 50 (0 to 3.5 Bar)

0 to 100 (0 to 7 Bar)

0 to 150 (0 to 10 Bar)

0 to 300 (0 to 20 Bar)

0 to 1000 (0 to 70 Bar)

0 to 1500 (0 to 100 Bar)

0 to 3000 (0 to 200 Bar)

0 to 5000 (0 to 350 Bar)

0 to 10000 (0 to 700 Bar)

### Vacuum (PSIG) (Non-isolated)

0 to -5 (0 to -350 mBar) †

0 to -15 (0 to -1 Bar) ††

† Thermal and Pressure Hysteresis:

0.0030 PSI (2.068 mBar)

†† Thermal and Pressure Hysteresis:

0.0025 PSI (0.1724 mBar)

**Absolute (PSIA)**

0 to 15 (0 to 1 Bar) ††  
0 to 30 (0 to 2 Bar)  
0 to 50 (0 to 3.5 Bar)  
0 to 100 (0 to 7 Bar)

**Compound (PSIG)**

-15 to 15 (-1 to 1 Bar) ††  
-15 to -30 (-1 to 2 Bar)

**Differential (PSID) (Non-isolated) \*\***

0 to 5 (0 to 350 mBar) †  
0 to 30 (0 to 2 Bar)  
0 to 50 (0 to 3.5 Bar)

\*\* Maximum static pressure, 200 psig (14 Bar)

† Thermal and Pressure Hysteresis:  
0.0030 PSI (2.068 mBar)

†† Thermal and Pressure Hysteresis:  
0.0025 PSI (0.1724 mBar)

**NOTE: Gauge, Absolute, and Compound types are isolated and accept any media compatible with 316SS. Vacuum, Differential, and 0.3psig and 1psig types are compatible with pressure media that are clean, dry, non-corrosive air or gas.**

## Other Pressure Units (Keypad Selectable)

- $\text{kp/cm}^2$  (kilograms per sq. cm)
- Atmos (atmospheres)
- mbar (millibars)
- bar
- kPa (kiloPascals)
- MPa (MegaPascals)
- InHg (inches Mercury)
- mmHg (millimeters Mercury)
- InWc 4°C, 20°C, 60°F (inches of water column)
- cmWC 4°C, 20°C, 60°F (cm of water column)
- One user-defined unit

**NOTE:** Choice of engineering unit may be restricted by available resolution.

## Available Electrical Ranges

All ranges listed below are for a specific input module. Additional modules are available as options. Custom ranges outside the minimum and maximum ranges listed are also available as options.

### Voltage

>1M Ohms input impedance

Autoranging: 0 to  $\pm 249.99$  mVdc  
0 to  $\pm 2.4999$  Vdc  
0 to  $\pm 24.999$  Vdc

### Current

5 Ohms input impedance

Autoranging: 0 to  $\pm 24.999$  mA dc  
0 to  $\pm 149.99$  mA dc

# Accuracy

## Pressure

Range Gauge (PSIG)	Accuracy	Overpressure	Notes
0 to 0.3 (0 to 20mBar)	±0.1%	400 %	
0 to 1 (0 to 67mBar)	±0.05%	400 %	
0 to 5 (0 to 350 mBar)	±0.025%	400 %	9
0 to 7.2 (0 to 500 mBar)	±0.035%	300 %	4 & 7
0 to 10 (0 to 700 mBar)	±0.025%	300 %	9
0 to 30 (0 to 2 Bar)	±0.025%	300 %	
0 to 50 (0 to 3.5 Bar)	±0.03%	300 %	
0 to 100 (0 to 7 Bar)	±0.025%	300 %	
0 to 150 (0 to 10 Bar)	±0.035%	200 %	4
0 to 300 (0 to 20 Bar)	±0.025%	200 %	
0 to 500 (0 to 34 Bar)	±0.05%	200 %	
0 to 1000 (0 to 70 Bar)	±0.05%	200 %	6
0 to 1500 (0 to 100 Bar)	±0.05%	200 %	4
0 to 3000 (0 to 200 Bar)	±0.05%	200 %	
0 to 5000 (0 to 340 Bar)	±0.05%	200 %	
0 to 10000 (0 to 700 Bar)	±0.05%	120 %	
<b>Vacuum (PSIG)</b>			
0 to -5 (0 to -350 mBar)	±0.025%	400 %	9
0 to -15 (0 to -1 mBar)	±0.025%	300 %	7
<b>Absolute (PSIA)</b>			
0 to 15 (0 to 1 Bar)	±0.025%	300 %	7
0 to 30 (0 to 2 Bar)	±0.025%	300 %	
0 to 50 (0 to 3.5 Bar)	±0.03%	300 %	
0 to 100 (0 to 7 Bar)	±0.025%	300 %	
0 to 300 (0 to 20 Bar)	±0.025%	200 %	
<b>Compound (PSIG)</b>			
-15 to 15 (-1 to 1 Bar)	±0.025%	300 %	7
-15 to 30 (-1 to 2 Bar)	±0.025%	300 %	
<b>Differential (PSID) (Note1)</b>			
0 to 5 (0 to 350 mBar)	±0.025%	400 %	5 & 8
0 to 30 (0 to 2 Bar)	±0.025%	300 %	5
0 to 50 (0 to 3.5 Bar)	±0.03%	300 %	5

Notes:

1. Accuracy is percent of full scale range, over the 15 °C to 35 °C temperature range. Includes the pressure/temperature hysteresis in psi. The accuracy statement shown in the specification table is the base accuracy from 15 °C to 35 °C. Outside this temperature range, add an additional  $\pm 0.0015\%$  of FS per °C. (For the 0.3 and 1psi ranges add an additional  $\pm 0.005\%$  of FS per °C) To calculate the allowed deviation of a particular BETA Pressure Module, use the following formula: Deviation =  $\pm\%FS$  ,  $\pm T/P H$  ,  $\pm tempco$  Where  $\pm T/P H$  = thermal/pressure hysteresis in psi where applicable, And  $\pm tempco$  =  $\pm 0.0015\%$  FS/°C when the temperature is outside the 15-35 °C temperature range
2. The Gauge, Vacuum, and Compound type range measurements are relative to atmospheric pressure. The Absolute type is a measurement made relative to absolute zero (perfect vacuum). The Differential type is a measurement made relative to the pressure applied to the low-pressure port of the module.
3. Units for display: pounds per square inch (psi), millibars (mbar), kilopond per square centimeter (kp/cm<sup>2</sup>, also kg/cm<sup>2</sup>), atmospheres physical (Atmos), kiloPascals (kPa), MegaPascals (MPa), inches of Mercury @ 0 °C (InHg), millimeters of Mercury @ 0 °C (mmHg), inches of water column (InWC), centimeters of water column (cmWC), or one user-defined pressure unit.
4. These extended ranges are derated because the calibrated range of the module does not match the range of the sensor.
5. The maximum static pressure is 200 psig (14 bar).
6. Relative to the calibration standard.
7. ADD thermal and pressure hysteresis = 0.0025 PSI (0.1724 mBar)
8. ADD thermal and pressure hysteresis = 0.0030 PSI (0.2068 mBar)
9. 0 to 7.2 PSI, 0 to 150 PSI, and 0 to 1500 PSI are extended ranges.
10. Gauge, Absolute, and Compound types are isolated and accept any media compatible with 316SS. Vacuum, Differential, and 0.3psig and 1psig types are compatible with pressure media that are clean, dry, non-corrosive air or gas

## Electrical

$\pm 0.01\%$  FS +  $\pm 0.01\%$  Rdg (15°C to 35°C) for 12 months

## Environmental

### Temperature

-20°C to 50°C (operating)

0°C to 35°C (storage with battery packs)

-30°C to 70°C (storage without battery packs)

### Relative Humidity

0 to 95% non-condensing

### Effects

**Pressure:**  $\pm 0.0015\%$  Range/°C outside 15°C to 35°C

**Electrical:**  $\pm 0.002\%$  Range/ °C outside 15°C to 35°C

### Overpressure

#### Non-isolated Sensors

0 to 5 psi      400% of sensor range

>5 psi        300% of sensor range

150 psi       200% of sensor range

#### Isolated Sensors

200% of sensor range

### Alarm Trip Detect

#### Wet contact input

12 Vdc  $\pm 10\%$  threshold, 48 Vdc maximum

#### Dry contact input

800 Ohm  $\pm 200$  Ohm threshold,  
4 mA maximum excitation current

### Damping Factor

Programmable 2, 5, or 10 seconds response time for all inputs (running average)

## Display

128 x 128 pixel LCD with LED backlight; two inputs simultaneously displayed with a maximum of 5 digits resolution

## Power Supply

### Rechargeable NiCad external battery pack:

6V, 1.0 Ah, 10 hours nominal operation time at 25°C; extra battery packs available; battery charger (trickle) standard

### Charging:

16 hours maximum for standard and intrinsically safe battery packs;

90 minute minimum for fast charge battery packs

## Circuit Protection

Voltage and current input protected for connection to 120 VAC

## Pressure Connections

1/8 inch FNPT 316SS

## Electrical Connections

Standard banana jack on 3/4 inch centers

## Weight

<3.3 lbs. (1.5 kg.) with carrying case and accessories (typical)

## Size

4.3 inch x 7.5 inch x 2.4 inch (110 mm x 190 mm x 60 mm)

**NOTE:** Specifications subject to change without notice.

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## C- Conversion Factors

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### Overview

The following table contains the conversion factors for converting pounds per square inch (PSI) to other pressure units, i.e., multiply pressure values in PSI by the following numbers to obtain the pressure values in the corresponding units.

<b>Pressure In</b>	<b>(Conversion Factor) x (Pressure In PSI)</b>
atmospheres (physical)*	0.068046
bar	0.068947
cm Hg (0°C)	5.17149
cm Hg (60°C)	5.1861
dynes/cm <sup>2</sup>	68,947.57
feet H <sub>2</sub> O (4°C)	2.306724
feet H <sub>2</sub> O (20°C)	2.3108
feet H <sub>2</sub> O (60°C)	2.308967
inches H <sub>2</sub> O (4°C)	27.68069
inches H <sub>2</sub> O (20°C)	27.7296
inches H <sub>2</sub> O (60°C)	27.70761
inches Hg (0°C)	2.03602
inches Hg (60°C)	2.04177
inches sea water	26.9484
kg/cm <sup>2</sup>	0.070307
kiloponds/cm <sup>2</sup> (kpcm)	0.070307
meters H <sub>2</sub> O (4°C)	0.703089
meters H <sub>2</sub> O (20°C)	0.704330
meters H <sub>2</sub> O (60°C)	0.703760

<b>Pressure In</b>	<b>(Conversion Factor) x (Pressure In PSI)</b>
meters sea water	0.684482
millibar	68.94757
mm Hg (0°C)	51.7149
Newtons/m <sup>2</sup>	6,894.757
Pascals	6,894.757
Torr	51.7149

**\*NOTE:** 1 atmosphere (physical) = 14.69595 psi = 760  
Torr = 101,325 Pascals

## D-Service Information

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### Service Schedule

Martel recommends that you return the following equipment for re-calibration and/or re-certification as follows:

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<b>Equipment</b>	<b>Service Schedule</b>
Calibrators	Not required
DC Modules	Once yearly
Pressure Modules	Once yearly

**NOTE:** Martel calibrates and certifies according to precision standards that are traceable to the National Institute of Standards and Technology.

## **Return Information**

All equipment returns should include the RMA form obtained from our web site. It has full instructions about how and where to return equipment for annual recertification or repairs either warranty or non-warranty. Note: for warranty repairs a dated proof of purchase may be required.

To obtain an RMA form, please visit our web site: [www.martelcalibrators.com](http://www.martelcalibrators.com) and click on "Customer Service." You may also call at either 800-821-0023 or 1-603-434-1433 to have a form faxed to you.

## **Packaging**

Carefully pack your calibrator for return shipping to avoid damage or loss. We recommend that you only use a traceable means of shipment. Do not use 1<sup>st</sup> Class mail.

**Ship freight prepaid only. Martel will not accept freight collect shipments.**

### **Limited Warranty**

Martel Electronics Corporation warrants this product to be free from all latent defects in material and workmanship under normal use and service. Should this product be found within one (1) year from date of shipment to be defective, Martel Electronics Corporation will repair such part and return to buyer FOB destination or will furnish FOB destination a similar part to replace it, provide written notice of such defect is given to Martel Electronics Corporation within ten (10) days after discovery of such defect and provided the original part is returned to Martel Electronics Corporation's plant with transportation charges prepaid.

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

### **Product Registration**

You may register your Martel product on our web site [www.martelcalibrators.com](http://www.martelcalibrators.com) or by returning the registration card that came with your calibrator.

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