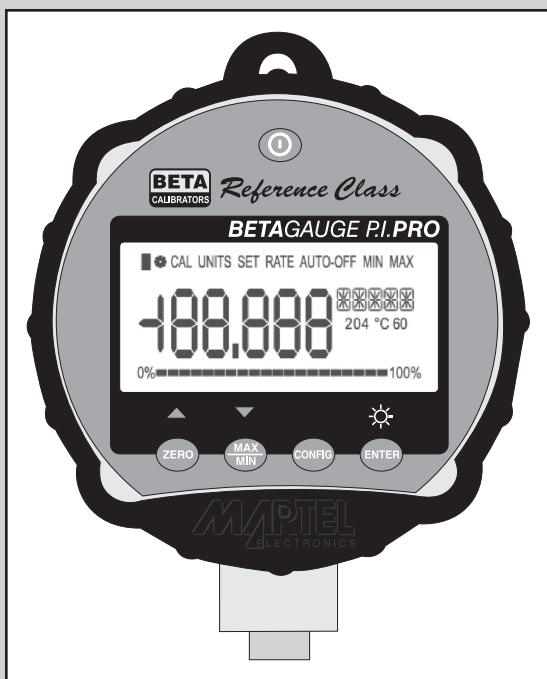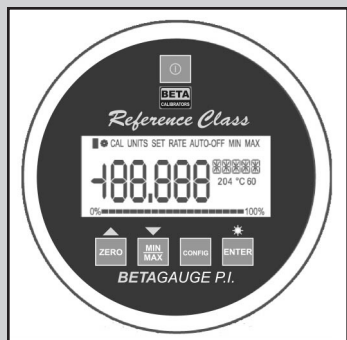# BetaGauge PI & PI PRO

Reference Class

High Accuracy Digital Pressure Test Gauge

User Reference Manual

This document includes information for both the **CSA and CSA/ATEX** certified versions of the BetaGauge PI.

MARTEL ELECTRONICS

1. Introduction

The BetaGauge PI *Reference Class (PIR)* combines the high accuracy of digital electronics with the convenience and ease of use of an analog test gauge. Accurate to $\pm$ 0.04% of *reading*, the BetaGauge *PIR* can be used as a calibration reference, or in any application where high accuracy pressure measurement is required.

Many user configurable functions have been designed into the BetaGauge *PIR* including sampling rate, TARE, damping, auto shut off, and min-max. Once the gauge is configured, settings can be locked and password protected to prevent unauthorized changes to configuration.

1.1 Customer Service

Corporate Office:

www.martelcalibrators.com

e-mail: sales@martelcorp.com

Tel: (603) 434-1433   800-821-0023   Fax: (603) 434-1653

Martel Electronics
3 Corporate Park Drive
Derry, NH 03038

1.2 Standard Equipment

Check to see that your BetaGauge *PIR* has arrived intact. Batteries are factory installed unless you have purchased the optional 24V powered version, in which case batteries are not supplied or installed. Save the packing materials at least until you have verified that there is no concealed damage.

1.3 Safety information

A Warning identifies conditions and actions that pose hazard(s) to the user; a Caution identifies conditions and actions that may damage the Calibrator or the equipment under test.

Symbols Used

The following table lists the International Electrical Symbols. Some or all of these symbols may be used on the instrument or in this manual.

Symbol	Description
O	Power OFF
I	Power ON
⏚	Earth ground
⚠	Risk of Danger. Important information. Refer to manual.
🔋	Battery
⚡	Hazardous Voltage
⟨Ɛx⟩	Conforms to ATEX requirements
ᴄ🆂🅿️ᵤₛ	Certified by CSA as conforming to relevant Canadian and USA standards
CE	Conforms to relevant European Union directives.
🗑	Wheeled bin, conforms to EC directive 2002/96/EC

Hazard Location Information/Approvals

⚠ Ex Hazardous Areas ⚠

An Ex-hazardous area as used in this manual refers to an area made hazardous by the potential presence of flammable or explosive vapors. These areas are also referred to as hazardous locations, see NFPA 70 Article 500.

ᴄ🆂🅿️ᵤₛ ® LR110460

Class I, Div. 2, Groups A-D

⟨Ɛx⟩ II 3 G EEx nA IIB T6
KEMA 06ATEX0014 X
Ta=−10°C... +55°C

CE

⚠ WARNING ⚠

Only gauges powered by batteries are approved for use in hazardous areas. 24V versions are not approved for hazardous use.

Special Conditions for Safe Use:
⚠ Misuse ⚠

Should the BetaGauge *PIR* be exposed to overpressure or sudden physical shock (i.e. being dropped) it should be examined for any damage that may cause a safety concern. If in doubt please return the unit for evaluation to Martel Electronics. Please refer to the Customer Service Section for contact information.

⚠ *WARNING* ⚠

The Beta Gauge *PIR* is not intended for use with flammable substances and is intended for installation only in locations providing adequate protection against the entry of solid foreign objects or water capable of impairing safety.

⚠ *Caution* ⚠

To avoid possible damage to calibrator or to equipment under test:

- If the message changes to "OL" the range limit is exceeded and the pressure source must immediately be removed from the BetaGauge *PIR* to prevent damage to the pressure transducer inside.

- Maximum torque allowed is 13,5 Nm = 10 ftlbs. NEVER exceed the torque allowed.

2. BetaGauge PI Reference Class Display and Controls

Turns Power on/off

Enters set-up and configuration menus

Zeros the display, Scrolls forward through menu displays

Recalls min and max readings. Scrolls backwards through menu displays

Pressure display

Engineering Units

0 - 100% bar graph

Selects an action in configuration. Also turns the back-light on/off

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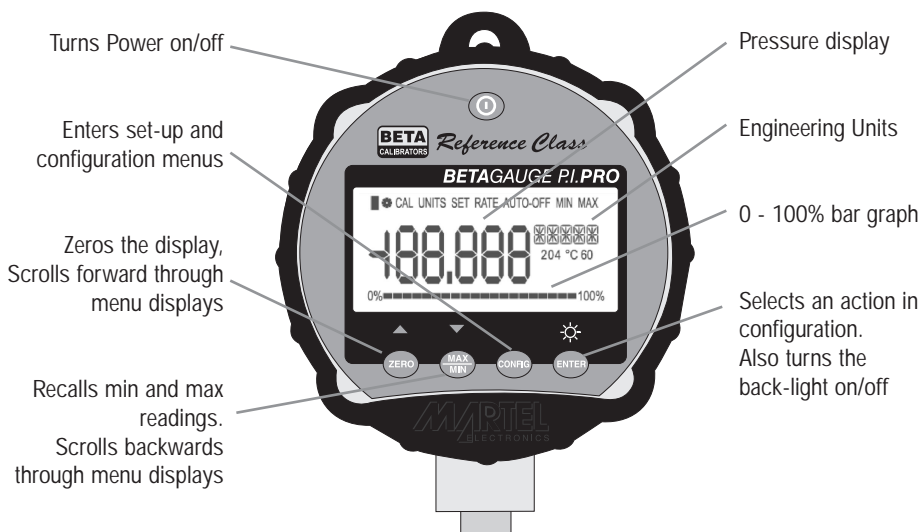
3. Operation

Power: The standard BetaGauge *PIR* is supplied with 3 AA batteries installed. If you purchased the optional 24Volt powered version, batteries are not installed. Connect a 24V power supply to the terminal block on the rear of the gauge, noting proper polarity. **Do not** install batteries when external power will be used.

Push the power button momentarily to turn the unit on. Push it again to turn it off.

Set-up and configuration:

Push the CONFIG button to access the user-settable functions on the gauge. Each time the CONFIG button is pressed; the display advances to the next function. Once a function has been set, press ENTER to exit the configuration menu, or CONFIG to continue with further configuration. In order, the configuration menu and operation is as follows:

1. **Engineering Units set**. The unit is shipped configured to display PSI. By pressing the ▲ and ▼ (ZERO and MAX/MIN) keys you can scroll forward and backwards through the 18 standard engineering units plus a one custom unit/scale. When the desired unit is displayed, press ENTER or CONFIG. Pressure will now be displayed in the chosen engineering units.
See the Specifications section of this manual for a list of available engineering units. See the Supervisory Mode section for details on setting up custom units.

2. **Set Auto Off**. The auto-shut off can be set in 1 minute increments from 1 to 30 minutes or "off" (continuous operation). The unit is shipped set for 30 minutes. Use the ▲ and ▼ keys to set the desired interval. The "off" setting is at the low end of the choices, below 1 minute.

3. **Display battery voltage**. Actual voltage and a percent of life bargraph indicate battery condition

4. **Display actual temperature**. The BetaGauge *PIR* is temperature compensated, this displays the temperature measured by the internal sensor. The value can be set to degrees F or degrees C using the arrow keys.

5. **Set damping**. Choices are "on" and "off" set with the ▲ and ▼ keys. Turning damping on will smooth readings from pulsating pressure sources.

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6. **Set sample rate**: This determines how often pressure is sampled and the display is updated. Choices are 0.5, 1, 3, and 10 samples/second. Note that 10/sec provides the fastest response time.

7. **Set TARE**. This allows you to set a constant offset value, which is then subtracted from the measured pressure. For example if a TARE is set at 30 PSI, and the measured pressure is 37 PSI, the displayed value will be 7 PSI. A pressure of 27 PSI would be displayed as –3 PSI.

   The tare value is set manually with the ▲ and ▼ keys, and is based on the engineering units and resolution selected for display. TARE value can be set to the maximum range of the gauge.

   The bar graph will always display the actual pressure based on the full range of the gauge regardless of the tare setting. This is done for safety to insure that even with a "0" reading that pressure is being applied to the gauge.

8. **Function Lock**: Access to each of the settable parameters above can be turned "off" once set, to prevent unauthorized changes to configuration. This is accomplished through a password protected "supervisory mode". Press ENTER to access the supervisory mode, or CONFIG to return to normal operation.

4. Supervisory Mode

Press ENTER when "FUnC LOCK" is displayed, 0PWRD will be displayed on the gauge. The password to enter supervisory mode is 101, set using the ▲ and ▼ keys. Holding a key continuously will cause the display to advance more quickly for faster setting. The password is factory set and cannot be changed

1. Your BetaGauge *PIR* is shipped from the factory with all setting access "unlocked" or available to be changed.

2. In supervisory mode each of the parameters can be locked or unlocked using the ▲ and ▼ keys. Select LOC (lock) for those parameters you do not want to be accessible, and UnLOC (unlock) for those can be accessed.

3. In order, the functions that can be unlocked, locked or accessed are:
   • Zero function (enable/disable)
   • Set pressure units (enable/disable)

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- Auto shutdown adjustment (enable/disable)
- Damping settings (enable/disable)
- Sample rate setting (enable/disable)
- Tare setting (enable/disable)
- Custom engineering units (set scale factor)

4. Use the CONFIG key to scroll through the above choices, and the ▲ and ▼ keys to lock and unlock features. Press CONFIG to continue scrolling through the parameters, pressing ENTER at any point saves your settings and returns the gauge to normal operation.

    When a function is "locked, it cannot be accessed or changed from its current state. To change a locked function, enter the supervisory mode, and unlock the function. Once it is changed, you may enter supervisory mode to lock access again.

5. Setting a custom engineering unit or scale: The last menu choice in supervisory mode is SET FACTR. This allows you to set a multiplier factor from 0.001 to 100, creating a custom scale. The set factor will be multiplied by the PSI measured, the result will be displayed.

    For example: 40 PSI is the equivalent of 1000 lbs of product in a tank. You want to display the product weight , using a 100 PSI gauge. By setting a factor of 25, a 40 PSI pressure would display as 1000 (40 x 25). The engineering unit displayed on the BetaGauge *PIR* will be "Cust".

5. Normal Operation

Turning the backlight on and off: Press the ENTER button.

Zeroing the display: Press and hold the ZERO button.

MAX/MIN: The BetaGauge *PIR* stores minimum and maximum pressure values in memory. Pressing the MAX/MIN button once will display the minimum pressure from memory. Pressing the MAX/MIN button again will display the maximum pressure from memory. After about 2 seconds, the gauge returns to normal (live display) operation. To clear the MAX/MIN memory registers, press and hold the MAX/MIN button for 2 or more seconds until "CLr" is displayed.

The analog bar graph at the bottom of the display indicates the applied pressure level relative to the full range of the gauge. Keep in mind that if a TARE value has been programmed into the

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gauge, the displayed pressure will not reflect the true pressure applied.

6. Changing the Batteries

⚠️ **WARNING** ⚠️

Explosion hazard
Batteries must only be changed in an area known to be non-hazardous.

BetaGauge PI

Grasp the face ring on the BetaGauge **PIR**, turn it approximately ¼ turn counterclockwise and remove. **Note:** For ATEX certified versions remove the two screws on the rear of the case to release the front plate. The face of the gauge can now be lifted to expose the battery holder. Take off the battery hold clip and remove the batteries. Install three AA alkaline batteries noting proper polarity. Note: Use **ONLY** AA alkaline batteries and be sure to reinstall the battery holder retaining clip. Reassemble the case making certain that the face is properly oriented.

If you purchased the optional 24 Volt powered version, the terminals for power input are located on the rear of the gauge. To apply power simply connect 24 volts to the rear terminal block taking care to observe proper polarity.

BetaGauge PIR PRO

Loosen the captive screw on the battery door, then remove the battery door to expose the 3 AA batteries. Replace the batteries as required and then reinstall the battery door and teighten the captive screw.

⚠️ **WARNING** ⚠️

Gauges ordered with the external power option will not come with batteries installed. Batteries MUST NOT be installed when operating on external power. External power option gauges are not approved for hazardous location use.

Battery life

Battery life is about 1500 hours (60 days) of continuous use with the backlight off. With intermittent use, batteries could last a year or more. There is a low battery icon in the upper left of the display. It will appear when battery level is low. Replace batteries per recommendations found in the specifications section of this manual.

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RS-232 Interface

An RS-232 interface is standard on the BetaGauge *PIR*. Serial communication can be used for configuration, calibration, and to transfer measurement data from the gauge. For detailed specifications on the interface and software communication, see pages 14 and 15 in this manual.

⚠️ **WARNING** ⚠️

The RS-232 interface must not be used in hazardous areas.

7. Cleaning

To clean the BetaGauge *PIR* use a cloth with a mild cleaning solution.

8. Specifications

All specifications cover the temperature range from 0°C to +50°C, unless otherwise noted.

Available Input Ranges

See page 13 for a table of available ranges in PSI plus equivalent ranges and resolution for all engineering units

Accuracy

Positive Pressure: ±0.04% of reading ±0.01% of full scale

Vacuum: ±0.1% of the full scale vacuum measurement (15 PSI or 1 Bar)

For gauges with full scale ranges equal to, or less than 100 psi (2 BAR), vacuum operation is limited to -5psi (-350 mBar (except or the compound range of -15 to 30 PSI (-1 to 2 Bar).

Over Pressure Protection:

See table of Ranges and Resolutions, page 13.

Temperature Compensation

0°C to +50°C (32°F to +122°F) to rated accuracy

Note: For temperatures from –10 °C to 0 °C and 50 °C to 55 °C add .005% F.S./°C

Standard Engineering Units

See Table of Ranges and Resolutions, page 13, plus

One custom unit (user programmable)

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Media Compatibility

All ranges except the compound range:

Liquids and gases compatible with 316 stainless steel

Compound range: clean, dry, non-corrosive gas

Environmental

Operating Temperature -10 °C to +55 °C (14°F to 131°F)

Storage -20 °C to +70 °C (-4 °F to +158 °F)

Humidity   10% to 95% RH Non-condensing

Pollution Degree II

Mechanical

Dimensions 4.5″ (diameter) x 2.2″ (depth) x 5″ (height)
   (11.4cm x 5.6cm x 12.7cm) (PIR PRO depth is 1.5″ or 3.7cm)

Pressure Connection: ¼″ NPT Male

Housing: Stainless steel, meets NEMA 4/IP65
            (PIR PRO: cast Z_NAL)

Display

5-1/2 Digits, 0.65″ (16.53 mm) high

20-Segment bar graph, 0 to 100%

Power

Battery three (3), size AA alkaline batteries, optional 24 VDC power.

Battery Life 1,500 hours without backlight (continuous on)

2,000 hours at slow sample rate

Low Battery Indicator icon is displayed near the end of battery life

Appendix 1: BetaGauge *PIR* Calibration Procedure

Overview

Calibration adjustment of the BetaGauge *PIR* is performed electronically via internal software with the case closed. There are no mechanical adjustments; all calibration commands and adjustments are done via the keypad, using the display to guide the user through the calibration process.

Eight calibration points are used in the adjustment program, working from full scale to zero at pressures equaling 100%, 87.5%, 75%, 62.5%, 50%, 37.5%, 25%, 12.5%, and 0% of full scale plus vacuum.

Note: This is an ambient temperature calibration, and should be performed at an ambient temperature of 23° C ± 3° C (72° F ± 5° F). Calibration outside this temperature range will invalidate the temperature compensation program in the BetaGauge *PIR*.

Calibration Interval

You should check performance of the BetaGauge *PIR* at the interval required by your calibration program. We recommend adjustment when measurement deviates by more than 75% of the specified accuracy, or 0.04%

Test Equipment

Verification and calibration of the BetaGauge *PIR* requires pressure and/or vacuum standards able to produce and indicate pressures from vacuum to the full-scale range of the unit under test. In order to maintain the specified accuracy of the BetaGauge *PIR*, standards should have a TUR of 4:1 or better.

Connections:

The BetaGauge *PIR* uses a 1/4 NPT male connection in the pressure input port. Various adapters may or may not be needed to connect to the pressure standard. Always make sure the hose, tubing, and fittings etc have a rated working pressure at or above the pressure of the unit. Also it is important that there be no leaks when performing calibration; use Teflon tape where appropriate.

Entering Calibration Mode:

After you have made your connections, turn the power on while holding the CONFIG key. Use the arrow keys to enter the password. The password is 101. If you have entered calibration mode correctly the display should look as shown below. The pressure value displayed will be the full-scale value of the gauge.

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Procedure:

Screens shown in this manual represent the displays shown with a 500 psi Gauge. The BetaGauge *PIR* will prompt the technician for the appropriate pressure at each calibration point.

```
                              PSI
        500.00
CAL MODE
```

Use the Pressure Standard to output 500.00 psi (100%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show ————-. When the readings are complete the screen should look as shown in the illustration that follows.

```
                              PSI
        437.50
CAL MODE
```
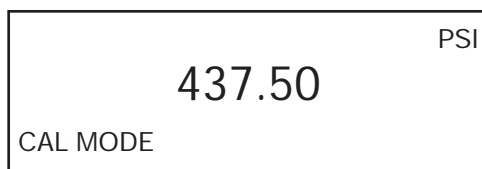
Use the Pressure Standard to output 437.50 psi (87.5%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show ————-. When the readings are complete the screen should look as shown below.

```
                              PSI
        375.00
CAL MODE
```
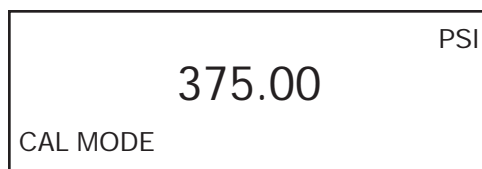
Use the Pressure Standard to output 375.00 psi (75%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show ————-. When the readings are complete the screen should look as shown below.

```
                              PSI
        312.50
CAL MODE
```

Use the Pressure Standard to output 312.50 psi (62.5%). After the output has stabilized, press the ENTER key to continue. As the

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unit takes readings, the screen will show ————-. When the readings are complete the screen should look as shown below.

```
                              PSI
       250.00
  CAL MODE
```

Use the Pressure Standard to output 250.00 psi (50%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show ————-. When the readings are complete the screen should look as shown below.

```
                              PSI
       187.50
  CAL MODE
```
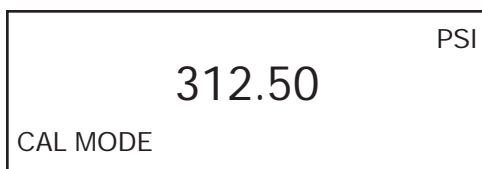
Use the Pressure Standard to output 187.50 psi (37.5%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show ————-. When the readings are complete the screen should look as shown below.

```
                              PSI
       125.00
  CAL MODE
```

Use the Pressure Standard to output 125.00 psi (25%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show ————-. When the readings are complete the screen should look as shown below.
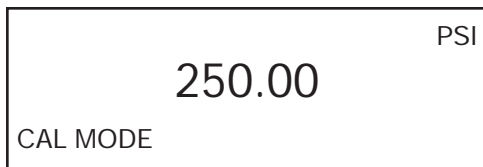
```
                              PSI
       62.50
  CAL MODE
```

Use the Pressure Standard to output 62.50 psi (12.5%). After the output has stabilized, press the ENTER key to continue. As the unit takes readings, the screen will show ————-. When the readings are complete the screen should look as shown below.

```
                                          PSI
              0.00
  CAL MODE
```

Use the Pressure Standard to output 0.00 psi. After the output has
stabilized, press the ENTER key to continue. As the unit takes
readings, the screen will show ————-. When the readings are
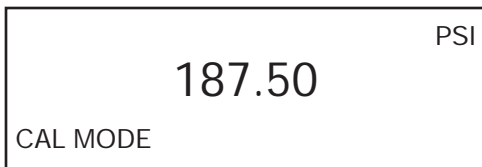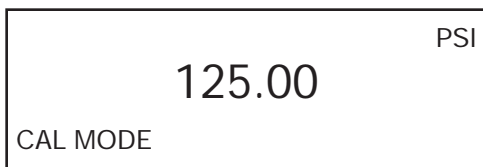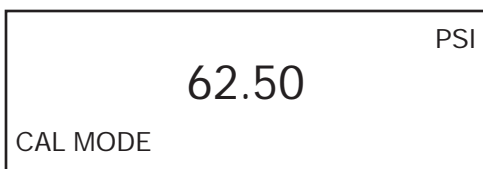complete the screen should look as shown below.

```
                                          PSI
             -12.00
  CAL MODE
```

Note: Only some ranges use vacuum calibration. If your gauge is
not one, than this step will be automatically skipped and
calibration will be complete.
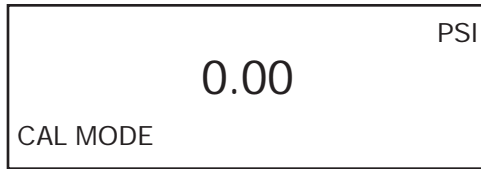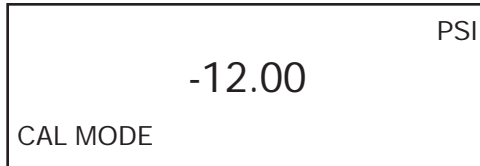
Use the Pressure Standard to output -12.00 psi. After the output
has stabilized, press the ENTER key to continue. As the unit takes
readings, the screen will show ————-. When the readings are
complete the unit will reset and power up in normal mode.

BetaGauge PI Reference Class Ranges and Resolutions

Pressure range		0.4	1	15	30	15	30	100	300	500	1000	2000	3000	5000	10000	15000
Range Type		compound	compound	compound	compound	gauge absolute	gauge absolute	gauge** absolute	gauge** absolute	gauge**	gauge	gauge	gauge	gauge	gauge	gauge
Burst Pressure		3	5	90	90	500	500	1000	2000	2000	10000	10000	10000	10000	15000	20000
Proof Pressure		1	3	60	60	60	60	200	600	1000	2000	3000	6000	10000	15000	20000
Engineering Unit	**Factor**															
psi	1	0.4000	1.0000	15.000	30.000	15.000	30.000	100.00	300.00	500.00	1000.0	2000.0	3000.0	5000.0	10000	15000
bar	0.06894757	0.0276	0.0689	1.0342	2.0684	1.0342	2.0684	6.8948	20.684	34.474	68.948	137.90	206.84	344.74	689.48	1034.2
mbar	68.94757	27.579	68.948	1034.2	2068.4	1034.2	2068.4	6894.8	20684	34474	68948	*	*	*	*	*
kPa	6.894757	2.7579	6.8948	103.42	206.84	103.42	206.84	689.48	2068.4	3447.4	6894.8	13790	20684	34474	68948	*
Mpa	0.006894757	0.0028	0.0069	0.1034	0.2068	0.1034	0.2068	0.6895	2.0684	3.4474	6.8948	13.790	20.684	34.474	68.948	103.42
kg/cm2	0.07030697	0.0281	0.0703	1.0546	2.1092	1.0546	2.1092	7.0307	21.092	35.153	70.307	140.61	210.92	351.53	703.07	1054.6
mmHg @ 0°C	51.71507	20.686	51.715	775.73	1551.5	775.73	1551.5	5171.5	15515	25858	51715	*	*	*	*	*
inHg @ 0°C	2.03603	0.8144	2.0360	30.540	61.081	30.540	61.081	203.60	610.81	1018.0	2036.0	4072.1	6108.1	10180	20360	30540
cmH2O @ 4°C	70.3089	28.124	70.309	1054.6	2109.3	1054.6	2109.3	7030.9	21093	35154	70309	*	*	*	*	*
cmH2O @ 20°C	70.4336	28.173	70.434	1056.5	2113.0	1056.5	2113.0	7043.4	21130	35217	70434	*	*	*	*	*
mmH2O @ 4°C	703.089	281.24	703.09	10546	21093	10546	21093	70309	*	*	*	*	*	*	*	*
mmH2O @ 20°C	704.336	281.73	704.34	10565	21130	10565	21130	70434	*	*	*	*	*	*	*	*
mH2O @ 4°C	0.703089	0.2812	0.7031	10.546	21.093	10.546	21.093	70.309	210.93	351.54	703.09	1406.2	2109.3	3515.4	7030.9	10546
mH2O @ 20°C	0.704336	0.2817	0.7043	10.565	21.130	10.565	21.130	70.434	211.30	352.17	704.34	1408.7	2113.0	3521.7	7043.4	10565
inH2O @ 4°C	27.68067	11.072	27.681	415.21	830.42	415.21	830.42	2768.1	8304.2	13840	27681	55361	83042	*	*	*
inH2O @ 20°C	27.72977	11.092	27.730	415.95	831.89	415.95	831.89	2773.0	8318.9	13865	27730	55460	83189	*	*	*
inH2O @ 60°F	27.70759	11.083	27.708	415.61	831.23	415.61	831.23	2770.8	8312.3	13854	27708	55415	83123	*	*	*
ftH2O @ 4°C	2.306726	0.9227	2.3067	34.601	69.202	34.601	69.202	230.67	692.02	1153.4	2306.7	4613.5	6920.2	11534	23067	34601
ftH2O @ 20°C	2.310814	0.9243	2.3108	34.662	69.324	34.662	69.324	231.08	693.24	1155.4	2310.8	4621.6	6932.4	11554	23108	34662
ftH2O @ 60°F	2.308966	0.9236	2.3090	34.634	69.269	34.634	69.269	230.90	692.69	1154.5	2309.0	4617.9	6926.9	11545	23090	34634
ft Sea Water	2.24719101	0.8989	2.2472	33.708	67.416	33.708	67.416	224.72	674.16	1123.6	2247.2	4494.4	6741.6	11236	22472	33708
m Sea Water	0.68494382	0.2740	0.6849	10.274	20.548	10.274	20.548	68.494	205.48	342.47	684.94	1369.9	2054.8	3424.7	6849.4	10274
Torr	51.71507	20.686	51.715	775.73	1551.5	775.73	1551.5	5171.5	15515	25858	51715	*	*	*	*	*

1. Cells noted with * will not be displayed due to limitations on display resolution. In all cases, resolution is limited to 100,000 counts.
2. Ranges denoted with ** can also be used in limited compound applications to -12psi (-0.8bar)

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9. BetaGauge PIR Serial Interface Instructions

Initiating Communication

The terminal communications can be setup using terminal communication software on a PC. The terminal settings need to be set as follows:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None
- Local echo on

List of Commands

Command	Description
CAL_START	Puts the calibrator in calibration mode
*CLS	Clears the error queue.
FAULT?	Returns an error code from the error queue
*IDN?	Identification query. Returns the manufacturer, model number, and firmware revision level of the Calibrator.
TARE	Tares the offset pressure of the reading on the calibrator
TARE?	Returns the current tare value
PRES_UNIT?	Returns the pressure unit for the upper display.
PRES_UNIT	Sets the pressure unit for the display
ZERO_MEAS	Zeros pressure of the calibrator
ZERO_MEAS?	Returns the current zero offset value
MINMAX_RST	Resets the minimum and maximum recorded values.
MIN?	Returns the minimum recorded value
MAX?	Returns the maximum recorded value
HC_OFF	Turns unit off
HC_DFLT	Sets auto off defaults
TEMP?	Returns temperature in the chosen units
HC_COMP_OFF	Turns temperature compensation off.
HC_COMP_ON	Turns temperature compensation on.
HC_COMP?	Returns state of temperature compensation.
HC_RD_2410?	Return 2410 ADC counts.

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HC_SI_OFF	Turns SI mode off.
HC_SI_ON	Turns SI mode on.
CAL_STORE	Stores calibration data.
HC_AUTO_OFF	Turns auto shutdown off
HC_AUTO_ON	Turns auto shutdown on
CUST_MULT?	Sets the multiplier for the custom unit type
STREAM_OFF	Turns streaming data off
STREAM_ON	Turns streaming data on
HC_TEMP?	Same as TEMP?
VAL?	Returns the measured pressure value in selected units
HC_CMD_LIST	Prints out a command list
TEMP_UNIT	Used to set temperature unit
TEMP_UNIT?	Returns temperature unit

Parameter Units

Units	Meaning
Psi	Pressure in pounds per square-inch
Bar	Pressure in bars
mBar	Pressure in millibars
Kg/cm2	Pressure in kilograms per centimeter squared
InH2O4C	Pressure in inches of water at 4°C
InH2O20C	Pressure in inches of water at 20°C
InH2O60F	Pressure in inches of water at 60°F
mH2O4C	Pressure in meters of water at 4°C
MH2O20C	Pressure in meters of water at 20°C
cmH2O4C	Pressure in centimeters of water at 4°C
cmH2O4C	Pressure in centimeters of water at 20°C
ftH2O4C	Pressure in feet of water at 4°C
ftH2O20C	Pressure in feet of water at 20°C
ftH2O60F	Pressure in feet of water at 60°F
Inhg0C	Pressure in inches of mercury at 0°C
mmhg0C	Pressure in millimeters of mercury at 0°C
kpal	Pressure in kilopascals
Far	Temperature in Farenhiet
Cel	Temperature in Celcius

Error Codes

Error	Description
101	A non-numeric entry was received where it should be a numeric entry
102	Too many significant digits entered
103	Invalid units or parameter value received
105	Entry is above the upper limit of the allowable range
106	Entry is below the lower limit of the allowable range
108	A required command parameter was missing
109	An invalid pressure unit was received
117	An unknown command was received
120	The serial input buffer overflowed
121	Too many entries in the command line
122	Pressure module not connected

10. Warranty

Martel Electronics Corporation warrants all products against material defects and workmanship for a period of twelve (12) months after the date of shipment. Problems or defects that arise from misuse or abuse of the instrument are not covered. If any product is to be returned, a "Return Material Authorization" form can be obtained from our website www.martelcorp.com under customer service. You can also call 1-800-821-0023 to have a form faxed. Martel will not be responsible for damage as a result of poor return packaging. Out of warranty repairs and recalibration will be subject to specific charges. Under no circumstances will Martel Electronics be liable for any device or circumstance beyond the value of the product.

⚠ **WARNING** ⚠

Substitution of components may impair suitability
for hazardous locations.

To order parts and items, go to

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