PCL819
Handheld Pressure Calibrator
with Integral Electric Pressure Pump

ΩE OMEGA®

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OMEGA PCL819
Reference Manual

1. Introduction

The OMEGA PCL819 is designed to be a simple to use yet very versatile pressure calibrator. Its internal pressure sensor combined with an innovative electrically powered pump along with inputs for mA, voltage, switch contacts and an RTD probe allow the PCL819 to calibrate virtually any pressure device. The model PCL819-300 uses a manual pump to reach higher pressures up to 300 psi. An external pressure module option allows an even wider range of pressure calibration options including absolute and differential.

1.1 Customer Service

OMEGA Engineering

Tel: (203) 359-1660
Fax: (203) 359-7900

www.omega.com
email: info@omega.com

1.2 Standard Equipment

Check to see if your calibrator is complete. It should include: OMEGA PCL819 Calibrator, instruction manual, test leads, calibration hose kit with fittings, carrying case, calibration certificate with data.

1.3 Safety information

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
∼	AC (Alternating Current)
≈	AC-DC
▮	Battery
CE	CE Complies with European Union Directives
⎓	DC
▣	Double Insulated

Symbol   Description

Electric Shock

Fuse

PE Ground

Hot Surface (Burn Hazard)

Read the User's Manual (Important Information)

Off

On

Canadian Standards Association

The following definitions apply to the terms "Warning" and "Caution".

• "Warning" identifies conditions and actions that may pose hazards to the user.

• "Caution" identifies conditions and actions that may damage the instrument being used.

Use the calibrator only as specified in this manual, otherwise injury and damage to the calibrator may occur.

⚠ *Warning*

To avoid possible electric shock or personal injury:

• Do not apply more than the rated voltage. See specifications for supported ranges.

• Follow all equipment safety procedures.

• Never touch the probe to a voltage source when the test leads are plugged into the current terminals.

• Do not use the calibrator if it is damaged. Before you use the calibrator, inspect the case. Look for cracks or missing plastic. Pay particular attention to the insulation surrounding the connectors.

• Select the proper function and range for your measurement.

• Make sure the battery cover is closed and latched before you operate the calibrator.

• Remove test leads from the calibrator before you open the battery door.

• Inspect the test leads for damaged insulation or exposed metal. Check test leads continuity. Replace damaged test leads before you use the calibrator.

- When using the probes, keep your fingers away from the probe contacts. Keep your fingers behind the finger guards on the probes.
- Connect the common test lead before you connect the live test lead. When you disconnect test leads, disconnect the live test lead first.
- Do not use the calibrator if it operates abnormally. Protection may be impaired. When in doubt, have the calibrator serviced.
- Do not operate the calibrator around explosive gas, vapor, or dust.
- When measuring pressure, make sure the process pressure line is shut off and depressurized before you connect it or disconnect it from the pressure module.
- Disconnect test leads before changing to another measure or source function.
- When servicing the calibrator, use only specified replacement parts.
- To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator appears.

⚠ *Caution*

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

- Use the proper jacks, function, and range for your measurement or sourcing application.

2. Calibrator Interface

Figure 1 shows the location of the pressure controls, connection port and electrical inputs.

External Pressure Module Connector

RTD Probe Connector

Pressure/Vacuum Selector Knob

Vent Knob

Pressure Port

Electrical Connections mA, Volts Switch Test

Pressure Vernier Adjust

Firmware Programming Connector (Factory use only)

Pump Clean-out Valve

Pressure/Vacuum Selector
+ = Pressure
− = Vacuum

Vent
○ = Open
● = Close
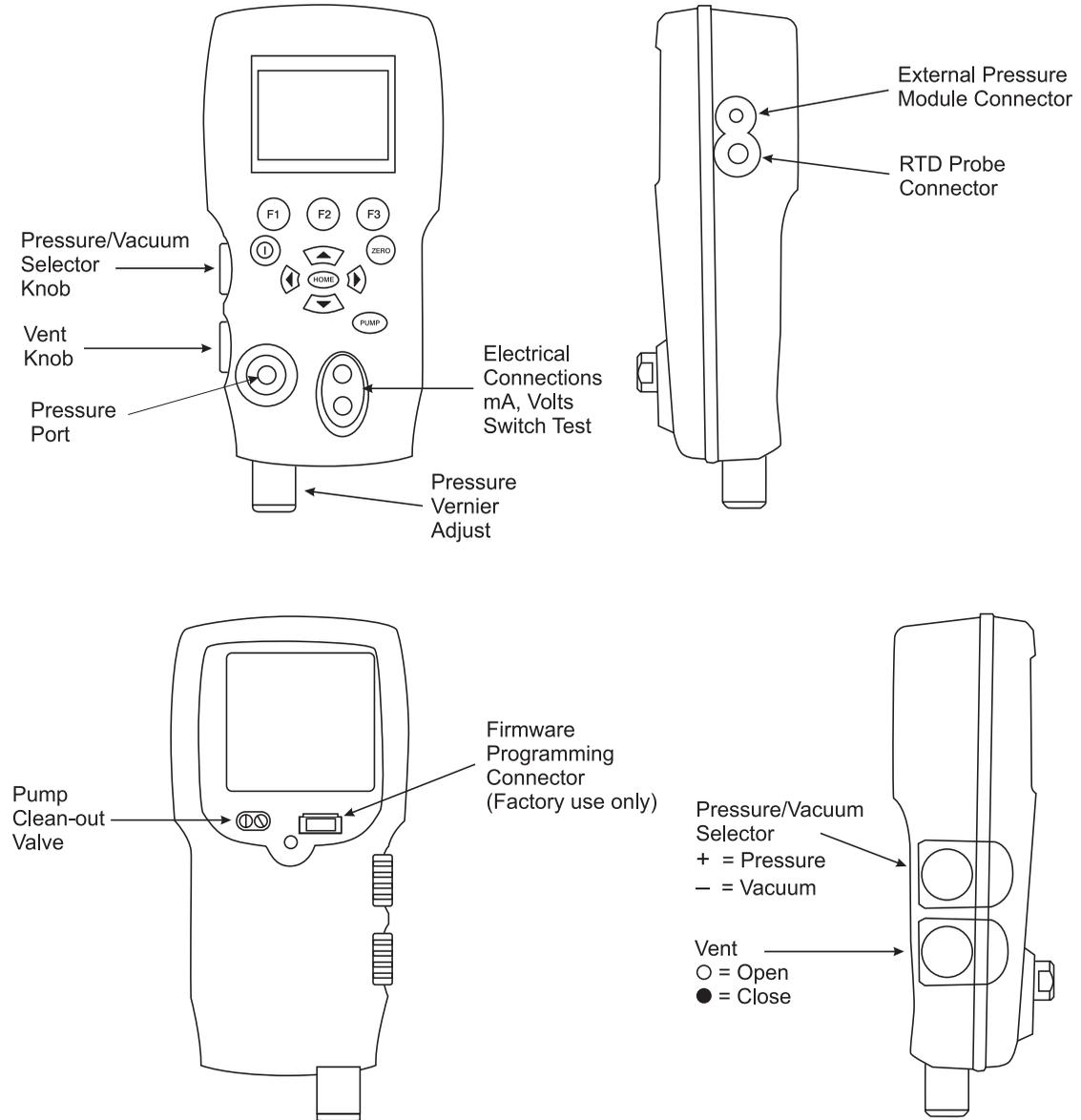
Figure 1

Figures 2A and 2B show the location of the keys. Table 2 describes the function of each key.
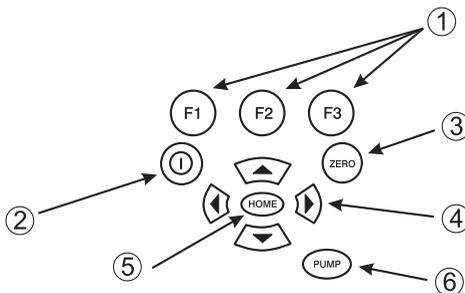
Figure 2A
Keypad (Electric Pump Versions)
Table 2 Key Functions

No.	Name	Description
1	Function Keys	These are soft keys used to configure the calibrator
2	ON/OFF Key	This key is used to turn the calibrator on and off
3	ZERO Key	This key is used to zero pressure measurements
4	Arrow Keys	Used to control mA source/sim. and to set pump and % error limits
5	Home Key	Return to main menu screen
6	Pump Key	Push to run pump (Electric pump version)
6	Backlight	Figure 2B only - for manual pump version

Note: When the calibrator is turned on by pressing the ON/OFF key, it will go through a short startup self-check routine. During that routine, the display shows the current firmware revision level, auto shutdown status and the range of the internal pressure sensor. The calibrator requires a maximum of 5 minutes warm-up to rated accuracy. Large changes in ambient temperature may require a longer warm-up period. See section 2.3 for instructions on zeroing the pressure sensor displays. Pressure ranges should be zeroed each time the calibrator is started.
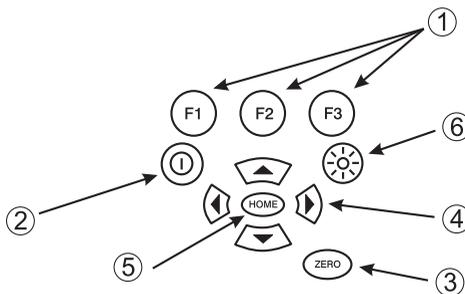
Figure 2B
Keypad (Manual Pump Version)

2.1 Calibrator Display

The Calibrator Display consists of two regions: The menu bar (located along the bottom of the screen) is used to access a menu system. The main display (the rest) consists of up to three process measurement sub-regions. These sub-regions will henceforth be referred to as the UPPER, MIDDLE and LOWER displays. Figure 3 shows the location of the different display fields while table 3 describes them.
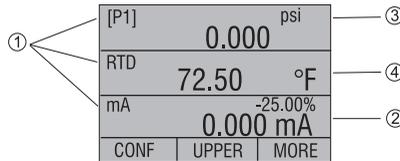
Figure 3
Display

Table 3 Display Functions

No.	Name	Description
1	Primary Parameters	Indicates what is being measured.
2	Span Indicator	Indicates the percent of the 4 to 20 mA span. (For mA and mA Loop functions only)
3	Pressure Units	Indicates one of 15 pressure units available for display.
4	Units	Indicates the unit of measure for the display.

2.1.1 Top Level Menu Functionality

There are three options for this menu: MENU, {Active Display}, and LIGHT. The Top Level Menu is home for the menu display.

2.1.1.1 Using the MENU Option

The MENU option is the gateway to the rest of the menu system.

2.1.1.2 Using the Active Display Option

The active display is indicated by the center option on the Top Level Menu. It is used to select the display to which the ZERO key will apply.

2.1.1.3 Using the LIGHT OPTION

The backlight can be toggled on and off using this key.

2.1.2 Main Menu Functionality

There are three options on the Menu, CONFIG, {Active Display} and MORE. The Main Menu is home for the menu display.

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2.1.2.1 Setting the Active Display

The active display is indicated by the center option on the Main Menu, pressing the F2 key will toggle the active display.

2.1.2.2 Setting Active Display Parameters

To set the parameters of the active display use the CONFIG option to get to the Display Configuration Menu.

SELECT	NEXT	DONE

Here the SELECT option will toggle through the choices for each parameter. The first parameter is MODE. Since voltage, current and switch test modes all use the same jacks, two of these functions cannot be used concurrently. The ability to select certain functions is limited based on what is already selected in another display. The NEXT option is used to change to the second parameter. Only RTD and Pressure modes have a second parameter, RTDs can be read in Celsius or Fahrenheit and Pressures can be read in 11 engineering units.

With a single display the following modes are available:

P[1] = Pressure internal sensor.

[EXT] = Pressure with external pressure module.

P[1] ST = Switch Test with left side sensor.

[EXT] ST = Switch Test with external pressure module.

Note: mA functions are only available on the Lower Display.

    mA measure = Milliamps measure without loop power.

    mA w/24V = Milliamps measure with loop power.

    mA source = Milliamps source.

    mA sim = Milliamps simulate using an external supply from the UUT.

VOLTS = Voltage Measure.

RTD = RTD Temperature Measurement (if a probe is connected).

The following table shows which functions are available concurrently.

An X in a column indicates that the mode in the active display will not be available for selection if the mode in that row is in use in any other display.

Table 4 Mode Concurrency

		CURRENT DISPLAY							
		P[1]	[EXT]	P[1] ST	[EXT] ST	mA	mA Loop	VOLTS	RTD
OTHER DISPLAYS	P[1]								
	[EXT]								
	P[1]ST			X	X	X	X	X	
	[EXT]ST			X	X	X	X	X	
	mA			X	X		X	X	
	mA Loop			X	X	X		X	
	Volts			X	X	X	X		
	RTD								

X = Not a valid mode

2.1.1.3 Accessing Other Menus

Use the MORE option on the Main Menu to access the other menu functions.

2.2 Using the Backlight

The backlight is controlled by the LIGHT softkey on the main menu on the models with electric pump. The PCL819-300 psi has a dedicated backlight key. It toggles on and off when the key is pressed; this is one of the few functions that cannot be controlled by the serial interface. There are no user configuration settings for the backlight.

2.3 Using the Zero Function

When the ZERO KEY is pressed, the calibrator will zero the **active display** if a pressure mode is selected, and the pressure is within the zero limit. The zero limits are within 10% of the full scale range of the selected sensor. If the display indicates "OL," the zero function will not operate." **Note:** The ZERO KEY is only used for pressure.

2.3.1 Internal Sensor and Pressure Module (non-absolute)

When a sensor or module is selected on the active display and the ZERO KEY is pressed the calibrator subtracts the current reading from the output. The zero limits are within 10% of the full scale range of the selected sensor. If the display indicates "OL," the zero function will not operate.

2.3.2 Absolute Pressure

When an absolute pressure range is selected on the active display and the ZERO KEY is pressed the calibrator prompts the user to enter the barometric reference pressure. This is done using the arrow keys (F2 and F3 Keys). The sensor port should be open (vented) to atmosphere while performing this procedure.

```
PRESSURE REF          psi
            14.469
DONE SET   |
```

2.4 Other Menu Controlled Functions

There are 12 'sub-main' menus that can be accessed through the MORE option of the Main Menu. A 'sub-main' menu contains three options. The first option is unique to the function. The second and third options of a 'sub-main' menu are always the same. The NEXT option leads to the next 'sub-main' menu and the DONE option returns home . For the last 'sub-main' menu the NEXT option wraps around to home. See Figure 4 for a detailed mapping of the menu structure.

A note on naming convention:

If a 'sub-main' menu has subordinate menus, it will henceforth be referred to as {function} Main Menu. E.g. the display contrast sub-main menu will be called the Contrast Main Menu. If not it will be called the {function} menu.

2.4.1 Setting the Contrast

From the Contrast Main Menu choose the CONTRAST option to access the Contrast Adjustment Menu.

CONTRAST	NEXT	DONE

Use the F2, F3 keys to adjust the display contrast to the desired level and then use the CONTRAST DONE option to return home.

CONTRAST DONE	↑	↓

2.4.2 Locking and Unlocking Configurations

Use the LOCK CFG or UNLOCK CFG option of the Configuration Lock Menu to lock or unlock the display configuration.

LOCK CFG	NEXT	DONE

When the LOCK CFG option is chosen the menu display returns home and the CONFIG option on the Main Menu indicates that it is locked. Also all menus are locked out with the exception of the Min Max Menu, Contrast Adjustment menus and the Configuration Lock Menu. When the UNLOCK CFG option is chosen the configuration is unlocked and the menu display continues to the next sub-main menu.

2.4.3 Saving and Recalling Setups

The calibrator will automatically save the current set-up for recall at power-up. Additionally 5 set-ups can be accessed through the SETUPS menu. Select the SETUPS option from the Setups Main Menu.

SETUPS	NEXT	DONE

Choose SAVE to save a set-up , RECALL to recall the set-up, or DONE to do nothing and return home.

SAVE	RECALL	DONE

Top Level
| MENU | DISPLAY | LIGHT |

Main Menu
| CONFIG | DISPLAY | MORE |

Parameter Selection
| SELECT | NEXT | DONE |

Back to Top Level

% Error Main Menu
| %ERROR | NEXT | DONE |

Back to Top Level

Min Max Main Menu
| MINMAX | NEXT | DONE |

Back to Top Level

Max Display Menu
| MAX | CLEAR | DONE |

Back to Top Level

Min Display Menu
| MIN | CLEAR | DONE |

Back to Top Level

% Error Main Menu
| CONFIG | LIGHT | EXIT |

Back to Top Level

Pressure Port Select Menu
| SELECT | NEXT | DONE |

Back to %Error Main Menu

Loop Power Select Menu
| ON | OFF | NEXT |

Unit Select Menu
| SELECT | NEXT | DONE |

Back to %Error Main Menu

100% Select Menu
| DONE SET | ↑ | ↓ |

0% Select Menu
| DONE SET | ↑ | ↓ |

Back to %Error Main Menu

Contrast Main Menu
| CONTRAST | NEXT | DONE |

Back to Top Level

Contrast Adjust Menu
| CONTRAST | DONE | ↑ | ↓ |

Back to Top Level

Lock Config Menu
| LOCK CONFIG | NEXT | DONE |

Back to Top Level

Back to Top Level — Yes — **If Config Locked** — No

Setups Main Menu
| SETUPS | NEXT | DONE |

Back to Top Level

Save/Recall Menu
| SAVE | RECALL | DONE |

Back to Top Level

Auto Off Main Menu
| AUTO OFF | NEXT | DONE |

Back to Top Level

Setup Select Menu
| RCLSETUP | ↑ | ↓ |

Back to Top Level

Auto Off Adjust Menu
| AUTO OFF | DONE | ↑ | ↓ |

Back to Top Level

Display Main Menu
| DISPLAY | NEXT | DONE |

Back to Top Level

Display Select Menu
| ON/OFF | LOWER | DONE |

Back to Top Level

Probe Type Main Menu
| PROBE TYPE | NEXT | DONE |

Back to Top Level

Probe Type Select Menu
| SELECT | DONE |

Back to Top Level

Damp Main Menu
| DAMP | NEXT | DONE |

Back to Top Level

Damp Select Menu
| ON | OFF | DONE |

Back to Main Menu

Hart Main Menu
| HART | NEXT | DONE |

Hart Select Menu
| DONE SELECT | ↑ | ↓ |

Back to Top Level

Pump Limit Main Menu
| PUMP | NEXT | DONE |

Back to Top Level

**Pump Limit Select Menu**
| DONE SET | SELECT |

10

Figure 4
Menu Map

If SAVE or RECALL is selected use the arrow keys to select the set-up location. Then use the save option to store the current set-up into the selected location or the recall option to recall the set-up stored in the selected location. The display menu will automatically go home.

SAVE SETUP 1	↑	↓

RCL SETUP 1	↑	↓
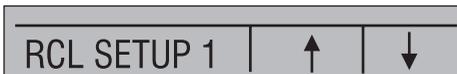
2.4.4 Setting AutoShut-off Parameters

The calibrator can be set to automatically shut-off after a selected number of minutes; this function can also be disabled. To set the auto shut off parameters select the AUTO OFF option on the Auto Shut Off Main Menu.

AUTO OFF	NEXT	DONE

Use the F2, F3 keys to select the number of minutes before the calibrator turns off or disable auto shut-off by scrolling all the way down.

AUTO SHUTDOWN		ON
	15	
AUTO OFF DONE	↑	↓
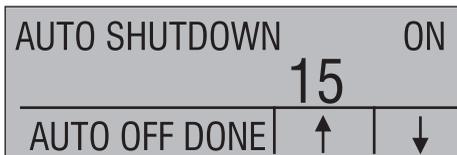
Use the AUTO OFF DONE option to set the parameters and return home. The auto shut off time is reset whenever a key is pressed.

2.4.5 Activating and Deactivating a Display

Use the DISPLAY option on the Display Selection Main Menu to access the Display Activation Menu.

DISPLAY	NEXT	DONE

The {display} option can be used to select which display to act upon. The ON/OFF option turns the selected display on or off. The selected display and current on/off state are displayed in the lower display.

MIDDLE		ON
ON/OFF	MIDDLE	DONE
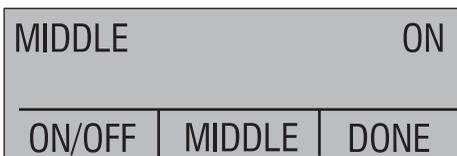
Use the DONE option to save the changes and return home. When a display is deactivated its configuration is retained. When the display is activated its configuration is checked against the configurations of the other currently active displays, if the configurations are in conflict the recalled display's configuration is modified to avoid the

conflict. If all three displays are deactivated the LOWER display will come on automatically

2.4.6 Setting the RTD probe type

Use the PROBE TYPE option of the RTD Probe Type main menu to access the RTD Probe selection menu.

```
PROBE TYPE │ NEXT │ DONE
```

There are four probe types to select from P100-385, P100-392, P100-JIS and CUSTOM. Use the SELECT option to select the desired probe type and the DONE option to store the change and return home.

Note: The default probe type is PT100-385.

```
SELECT RTD PROBE TYPE
      P100-385
SELECT  │        │  DONE
```
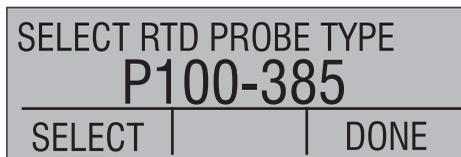
2.4.7 Damping

Damping can be turned ON or OFF using the Damping menu selection. When damping is ON, the calibrator displays an running average reading of ten measurements. The calibrator makes approximately 3 readings per second.

2.4.8 Pump Limits

To prevent overpressure of sensitive devices the maximum pressure (pump limit) can be set. When in this mode use the arrow keys to set the maximum pressure.

2.4.9 HART® Resistor

An internal 250 ohm HART Resistor can be enabled when the OMEGA PCL819 is operated in the "mA Measure-24V" mode. This allows a HART Communicator to be connected across the mA terminals and eliminates the need for adding an external resistor.

Note : When the HART resistor is on the maximum load driving capacity is 750 ohms.

3. Initial Setup and Basic Pressure Generation

1. The Omega PCL819 is supplied with a special low volume calibration hose kit to facilitate faster pumping to pressure and quick pressure stabilization. the kit also comes with the required "quick-fit" hose connectors and a BSP adapter for non-NPT applications. It is highly recommended that this type of hose is used to achieve the best performance of the product. Once the fittings are installed and the calibrator is connected to the unit under test (UUT) the calibrator is ready for use. Figure 5 shows a typical setup.

2. Before generating pressure make sure you have the PCL819 configured for your application. If needed review section 2 of the manual again to select the proper configuration.

3. Make sure that the pressure vacuum knob is set for the function you want to perform (+ for pressure and − for vacuum).

4. Close the vent knob.

5. Press the pump key (or manually stroke the pump on the 300psi/20 bar model) and watch the pressure (or vacuum) increase until you reach the desired pressure.

Note: **On the electric pump version the motor speed will start slowly when pressure is low (<15psi) to allow better control at low pressures.**

6. Use the fine adjustment vernier to fine tune the pressure/vacuum reading as needed.

7. To reduce or bleed off the pressure entirely **slowly** rotate the vent knob to the open position. Doing this step carefully will allow you to control the pressure bleed rate to a high degree and will facilitate taking down-scale pressure readings.

3.1 Electric Pump Considerations

The Omega PCL819 incorporates a small, lightweight, battery powered pneumatic pump that allows the user, in the case of the 150 to build relatively high pressure up to 150psi (10Bar) quickly and with good control. Because the pump has an upper pressure generation limit of 160psi there may be atmospheric conditions where it cannot achieve the full scale pressure of 150psi. High altitude use (about 3000 ft or 1000 meters) or use at cold temperatures may limit the pump to about 135psi (9 Bar). In these cases the vernier adjustment can be used to generate the additional pressure needed if full scale pressure must be generated.

In these situations the user should begin the calibration with the vernier in the full counter clockwise position and then when the electric pump reaches its limit turn the vernier in the clockwise direction to raise the pressure and to set the desired reading.
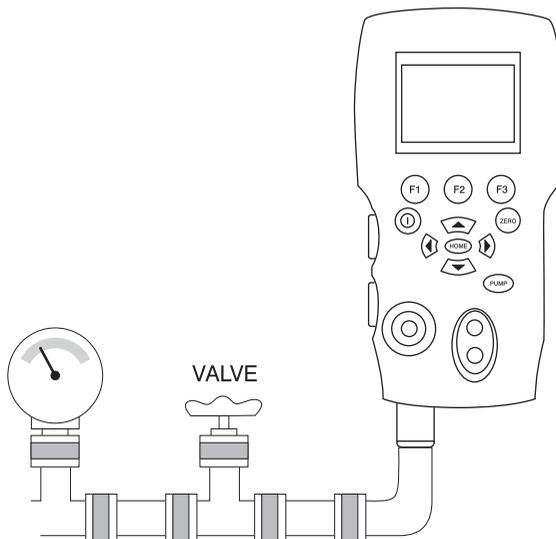

Figure 5

4. Measuring Pressure

To measure pressure, connect the calibrator using an appropriate fitting. Choose a pressure setting for the display being used. The calibrator is equipped with one internal sensors and many optional external sensors (EPMs) are available. Be sure to choose the sensor based on working pressures and accuracy.

⚠ Note:

Pressure sensors may be damaged and/or personnel injury may occur due to improper application of pressure. Please refer to the table of ranges and resolutions at the back of this manual for information on overpressure and burst pressure ratings. Vacuum should not be applied to any gauge pressure sensor. The calibrator display will indicate "OL" when an inappropriate pressure is applied. If "OL" is observed on any pressure display, the pressure should be reduced or vented immediately to prevent damage or possible personnel injury. "OL" is displayed when the pressure exceeds 110% of the nominal range of the sensor or when a vacuum in excess of 2 PSI is applied on gauge range sensors.

Use the (ZERO) key to zero the pressure sensor when vented to atmospheric pressure.

Important NOTE: To protect sensor integrity and prevent damage to the sensor, the calibrator will display OL [overload] when the applied pressure exceeds 110% of the full scale calibrated range of the sensor.

Important NOTE: To ensure accuracy of the calibrator it is critical to zero the calibrator before a device is calibrated. See section 2.3.

4.1 Media Compatibility

The Omega PCL819 feature a unique user accessible valve cleaning port to facilitate servicing the pump. Section 16.3 shows how to clean these valves. Even though servicing the pump is easy, care should be taken to only expose the calibrator to clean, dry gases.

4.2 Measuring Pressure with External Modules

The calibrator provides a digital interface to External Pressure Modules. These modules are available in various ranges and types including gauge, vacuum, differential and absolute. The modules work seamlessly with the calibrator. Simply plug them into the interface and select [EXT] (external sensor). Since the interface between the calibrator and the module is digital all the accuracy and display resolution is derived from the module.

[EXT]   psi
30.000
CONFIG   LOWER   MORE

VALVE

Pressure Module
Adapter

PRESSURE
MODULE
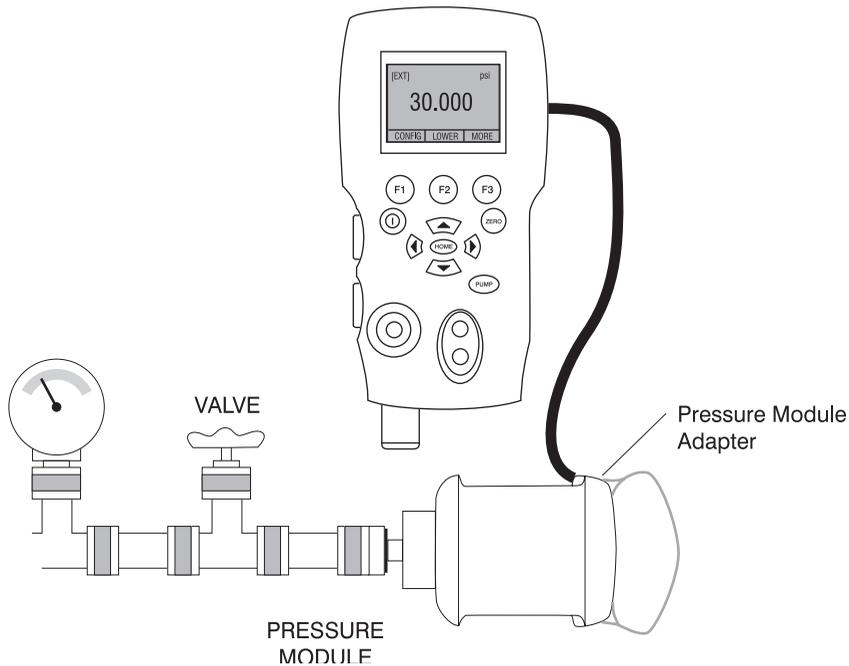
Figure 6

5. Measuring and Generating Current (4 to 20 mA)

1. To measure current use the input terminals in the front of the calibrator. Select the mA function on the lower display. Current is measured in mA and percentage of range. The range on the calibrator is set to 0% at 4 mA and 100% at 20 mA.

   For example:

   If the current measured is displayed as 75% then the mA value is 16 mA.

   Note: The display will indicate "OL" when the measured current exceeds the nominal range of current measurement (24 milliAmps).

2. To source current the same connections are used. From the configuration screen select mA source or mA Sim-2W.

3. **Note** that this function can only be done on the **LOWER** screen. Also in the source mode the calibrator will generate 0 to 24 mA using its own internal 24 volt supply whereas in the simulate mode the calibrator acts as a 2 wire transmitter and requires an external 24 volt supply.

4. Pressing any of the arrow keys will start the output mode and allow you to use the arrow keys to adjust the mA output. The function keys can also be used to step the output in either 25% steps (4, 8, 12, 16, 20 mA) or 0% (4 mA) and 100% (20 mA).

5. While in the mA output mode if the loop is opened or the compliance is exceeded the unit will flash "OL" .

mA MEASURE	75.00%
16.000 mA	
CONFIG	LOWER	MORE

Figure 7-1

mA SOURCE	100.00%
20.000 mA	
MENU	LOWER	LIGHT

Figure 7-2

mA SIM-2W	100.00%
20.000 mA	
MENU	LOWER	LIGHT

Figure 7-3

mA MEAS/24V	100.00%
20.000 mA	
MENU	LOWER	LIGHT
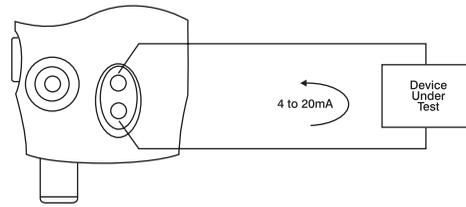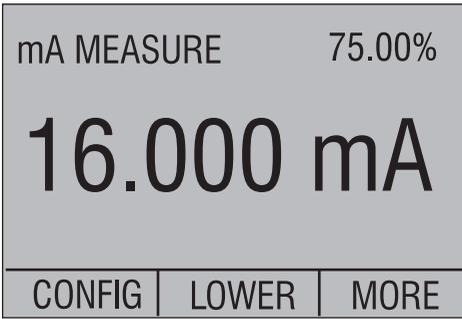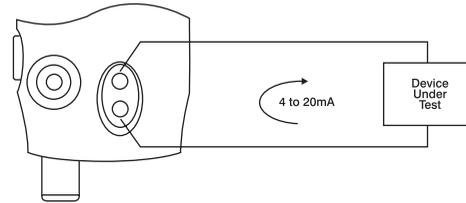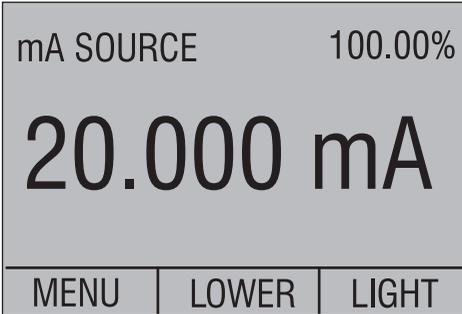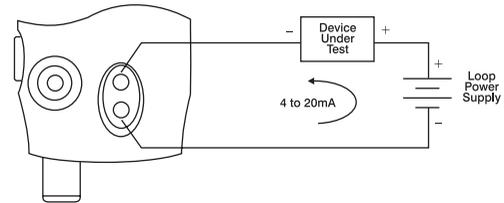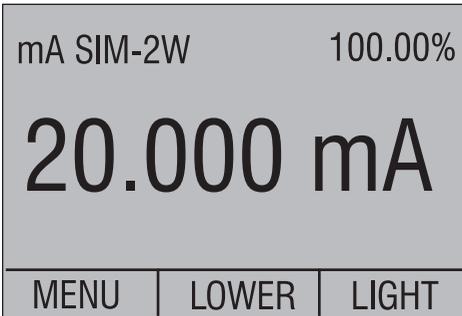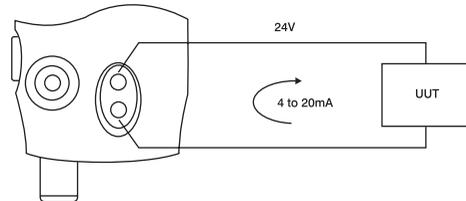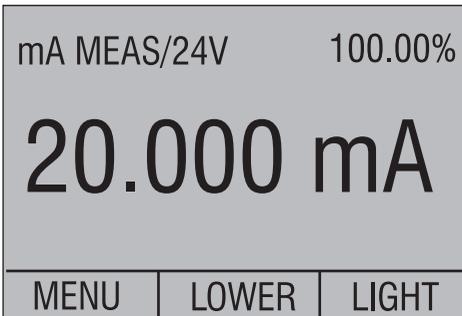
Figure 7-4

6. Measuring Voltage

To measure voltage use the input terminals in the front of the calibrator. Select the Volts function on one of the displays. The calibrator can measure up to 30V.

Note: The display will indicate "OL" when the measured voltage exceeds the nominal range of voltage measurement (30 V).
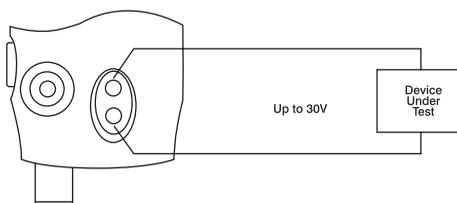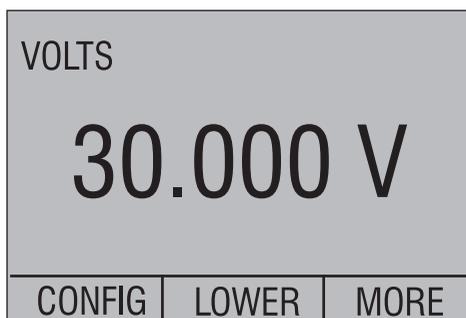
Figure 8

7. Measuring Temperature with an RTD

To measure temperature using an RTD probe you must select the RTD function on one of the displays. Make sure the proper probe type is selected. There are 4 probe types supported, P100-385, P100-392, P100-JIS and CUSTOM. The standard probe has a 10" insertion depth with a 1/4" diameter stainless steel sheath.

**Note**: The factory default type is PT100-385 so if the PCL819 is being used with the PCL340-RTD probe you do not have to set the probe type. Simply plug the probe into the PCL819 and configure the display to read temperature.

Note: The display will indicate "OL" when the measured temperature is outside the nominal measurement range of the RTD function (below -40°C or above 150°C).

If a custom probe is being used, the entering of R0 and coefficients is handled through the serial interface (see section 13).
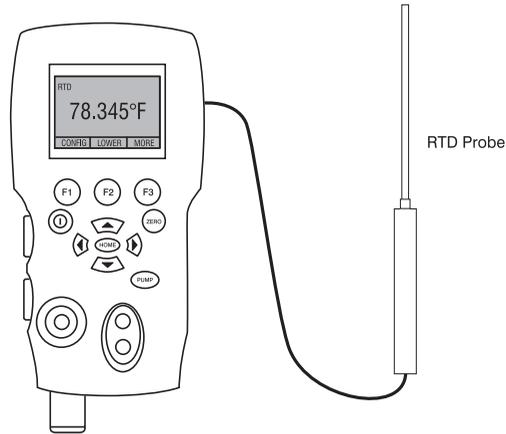
Figure 9

8. Performing a Pressure Switch Test
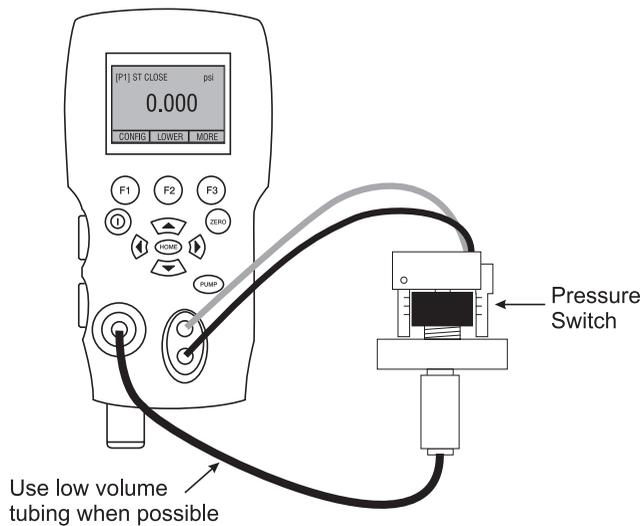
Figure 10

To perform a switch test, follow these steps:

1. Change the setup to Setup 4 (default switch test).

    Setup 4: The upper display is set to [P1] ST, all other displays are off.

    Important NOTE: The pressure Switch Test can be performed with the following functions[P1] ST, or EXT ST.

2. Connect the calibrator to the switch using the pressure switch terminals. The polarity of the terminals does not matter. Then connect the pump to the calibrator and the pressure switch.

3. Make sure the vent on the pump is open. Zero the calibrator if necessary. Close the vent after zeroing the calibrator.

4. The top of the display will read "CLOSE".

```
[P1] ST CLOSE            psi

          0.000

CONFIG   |   LOWER   |   MORE
```
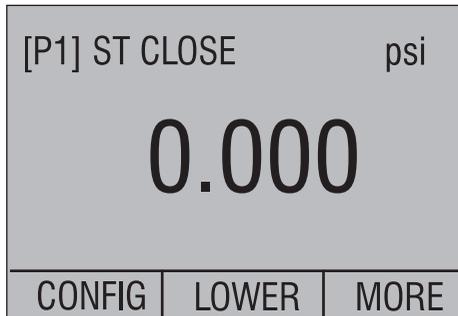
5. Apply pressure with the pump slowly until the switch opens.

Important NOTE: In the switch test mode the display update rate is increased to help capture changing pressure inputs. Even with this enhanced sample rate pressurizing the device under test should be done slowly to ensure accurate readings.

6. Once the switch is open, "OPEN" will be displayed, bleed the pump slowly until the pressure switch closes.

```
[P1] ST OPEN             psi

         30.000

CONFIG   |   LOWER   |   MORE
```
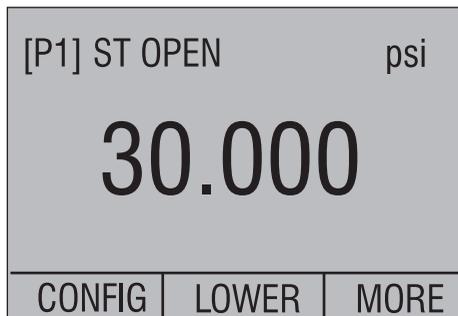
7. At the top of the display it will now read, "SW OPENED AT" and give you the pressure that the switch opened at.

```
SW OPENED AT             psi

         30.000

NEW TEST  |   NEXT   |   DONE
```
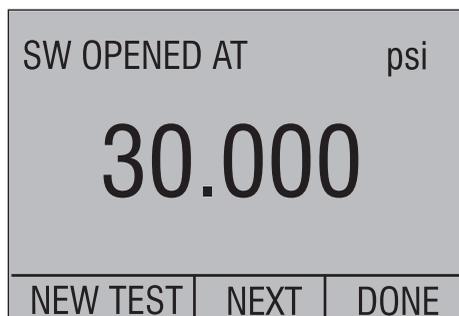
8. Press the "NEXT" option to view when the switch closed, and the dead band.

```
┌─────────────────────────────────┐
│  SW CLOSED AT           psi      │
│                                  │
│         29.595                   │
│                                  │
│                                  │
│  NEW TEST │  NEXT  │  DONE        │
└─────────────────────────────────┘
```

```
┌─────────────────────────────────┐
│  SW DEADBAND            psi      │
│                                  │
│         0.405                    │
│                                  │
│                                  │
│  NEW TEST │  NEXT  │  DONE        │
└─────────────────────────────────┘
```
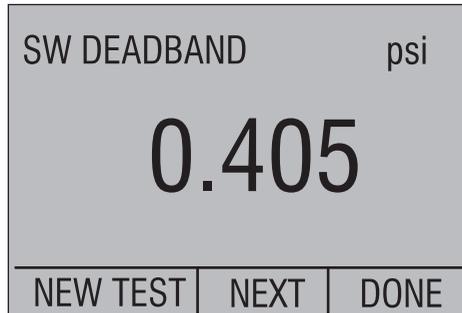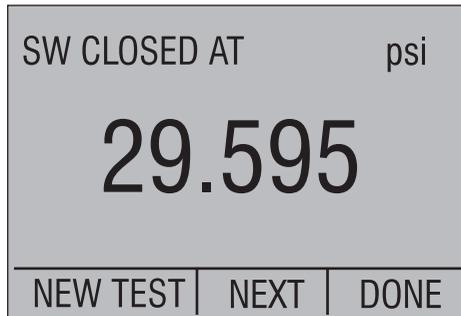
9. Press the "NEW TEST" option to clear the data and perform another test.

10. Press the "DONE" option to end the test and return to the standard pressure setting.

   Example:

   [P1] ST will return to [P1].

Important NOTE: The previous example uses a normally closed switch. The basic procedure is still the same for a normally open switch, the display will just read "OPEN" instead of "CLOSE".

9. Calibrating Transmitters

9.1 Using the mA Input Function

The mA input function allows the user to read back the 4-20 mA output from the device being calibrated. This can be done in one of two ways.

1) Passively – Where the device under test directly generates 4-20 mA and can be read by the calibrator.

2) Actively – Where the calibrator supplies 24 VDC loop power to the device under test to power the device while reading the resulting 4-20 mA signal.

```
┌─────────────────────────────────────┐
│ [P1]                          psi    │
│              30.000                  │
├─────────────────────────────────────┤
│ mA MEASURE              100.00%      │
│           20.000 mA                  │
├──────────┬──────────┬───────────────┤
│ CONFIG   │  LOWER   │  MORE         │
└──────────┴──────────┴───────────────┘
```

```
┌─────────────────────────────────────┐
│ [P1]                          psi    │
│              30.000                  │
├─────────────────────────────────────┤
│ mA MEAS/24V             100.00%      │
│           20.000 mA                  │
├──────────┬──────────┬───────────────┤
│ CONFIG   │  LOWER   │  MORE         │
└──────────┴──────────┴───────────────┘
```

9.2 Calibrating a Pressure-to-Current Transmitter

To calibrate a pressure-to-current transmitter (P/I), perform the following steps:

1. Connect the calibrator and the pump to the transmitter.
2. Apply pressure with the pump.
3. Measure the current output of the transmitter.
4. Ensure the reading is correct. If not, adjust the transmitter as necessary.

Use low volume tubing when possible
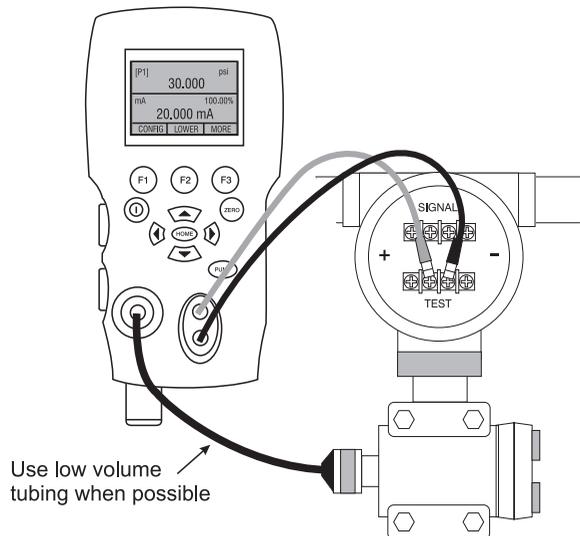
Figure 11.

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9.3 Percent Error Function

The calibrator features a unique function which can calculate pressure vs. milliamp error as a percentage of the 4 to 20 mA loop span. The percent error mode uses all 3 screens and has a unique menu structure. It simultaneously displays pressure, mA and percent error.
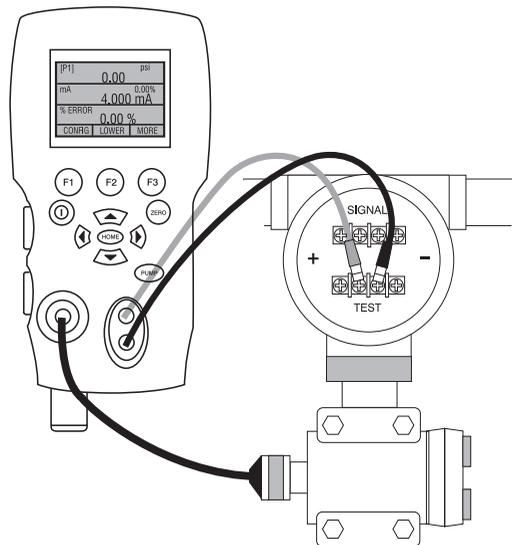
Figure 12.

Example:

Suppose a pressure transmitter under test is 30 psi (2 Bar) Full Scale and outputs a corresponding 4 to 20 mA signal. The user can program in a 0 to 30 psi pressure span into the calibrator and the calibrator will calculate and display the deviation or % Error from the expected 4 to 20 mA output. This eliminates the need for manual calculations and also helps if it becomes difficult to set an exact pressure with an external pump.

To use the %ERROR function proceed as follows:

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Now press the F1 key to activate the %ERROR option.

2. Press the F1 key to select the CONFIG option.

3. The first option is setting the Port, use the select option to scroll through the port choices, when finished select the NEXT option.
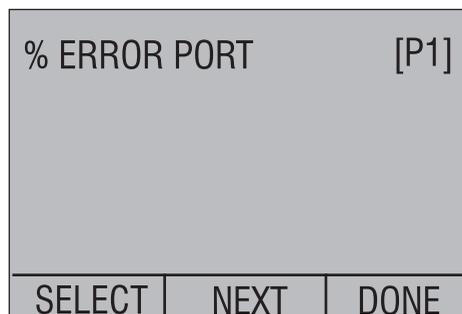
4. LOOP POWER can be toggled on/off, select NEXT when done.

```
LOOP POWER              OFF




  ON      |   OFF    |  NEXT
```

5. Use SELECT to toggle through the UNIT options, and select NEXT to move on.

```
SET UNIT                psi




 SELECT  |  NEXT   |  DONE
```

6. Use the arrow keys to set the 100% point of the desired pressure range, select DONE
   SET when finished.

```
SET 100% BELOW          psi

        30.000

 DONE SET  |
```

7. Again, use the arrows to set 0% point and select DONE SET when finished and the
   %ERROR mode will be ready to use.

```
SET 0% BELOW            psi

        0.000

 DONE SET  |
```

Note: The 0% and 100% point will be saved in non-volatile memory until they are changed again by the user for the internal sensors, and external pressure modules. When using an external module the 0% and 100% are set to low and full scale of the module until the user changes it, or if it was previously saved.

```
┌─────────────────────────────────────┐
│ [P1]                          psi    │
│            0.0000                    │
├─────────────────────────────────────┤
│ mA measure            −25.00%        │
│           0.000 mA                   │
├─────────────────────────────────────┤
│ % Error                              │
│           -25.00%                    │
├──────────┬──────────┬───────────────┤
│ CONFIG   │  LIGHT   │   EXIT         │
└──────────┴──────────┴───────────────┘
```

10. Minimum and Maximum Storage Capability

The PCL819 Series Pressure Calibrators have a min/max feature for capturing the minimum and maximum values of any displayed parameter.

The min/max function can be accessed by stepping through the menu options until "min/max" is shown on the display above the F1 key. At this time, pressing the F1 key will toggle the display through the min/max values that are stored in the min/max registers. These readings are live so that the new min/max values will be recorded while in this mode.

```
┌─────────────────────────────┐   ┌─────────────────────────────┐
│ [P1]                psi      │   │ [P1]                psi      │
│         −0.003              │   │         30.000              │
├─────────────────────────────┤   ├─────────────────────────────┤
│ mA            −25.00%        │   │ mA            −25.00%        │
│      4.000 mA               │   │      20.001 mA              │
├────────┬────────┬───────────┤   ├────────┬────────┬───────────┤
│  MIN   │ CLEAR  │  DONE      │   │  MAX   │ CLEAR  │  DONE      │
└────────┴────────┴───────────┘   └────────┴────────┴───────────┘
```

To reset the min/max registers simply press the clear key. These registers are also cleared at power-up or when the configuration is changed.

11. Factory Setups

The Calibrator is loaded with five factory commonly used setups. These setups are shown below. *Note:* **Any of these setups can be changed and saved by the user.**

Setup 1: The upper display is set to [P1] mode and the lower is set to mA, middle is off.

```
[P1]                        psi
              0.00
mA measure          −25.00%
              0.000
   MENU  |  LOWER  |  LIGHT
```

Setup 2: The upper display is set to [P1] mode and the lower is set to RTD, middle is off.

```
[P1]                        psi
              0.00
RTD
           23.50 °C
   MENU  |  LOWER  |  LIGHT
```

Setup 3: The upper display is set to [P1] mode and the middle is set to RTD, lower is mA.

```
[P1]         0.00    psi
RTD          23.50 °C
mA measure          −25.00%
              0.000
   MENU  |  LOWER  |  LIGHT
```

Setup 4: The lower display is set to [P1] switch test, the other displays are off.

```
┌─────────────────────────────────┐
│ [P1] ST CLOSE            psi     │
│                                  │
│         0.000                    │
│                                  │
│                                  │
├──────────┬──────────┬───────────┤
│  CONFIG  │  LOWER   │   MORE     │
└──────────┴──────────┴───────────┘
```

Setup 5: The upper display is set to [P1], the middle display is set to [EXT] and the lower display is set to RTD.

```
┌─────────────────────────────────┐
│ [P1]          0.00      psi      │
├─────────────────────────────────┤
│ [EXT]         0.00      psi      │
├─────────────────────────────────┤
│ RTD          23.50 °C            │
├──────────┬──────────┬───────────┤
│  MENU    │  LOWER   │  LIGHT     │
└──────────┴──────────┴───────────┘
```

12. Custody Transfer / Flow Calibration

The Model PCL819 is ideal for flow computer calibration. Every manufacturer of flow computers has a different calibration procedure, but most call for calibration of three parameters: static pressure, differential pressure and temperature. To facilitate these measurements recall setup #5 on the PCL819.

1. Connect the calibrator to your static and differential pressures. ([P1], EXT) Then connect the RTD sensor to the calibrator.

2. Using the reading of your RTD, static, and differential pressures make sure the flow computer has the correct reading. If not, adjust the flow computer as necessary.

13. Remote Operation

13.1 Remote Interface

The calibrator can be remotely controlled using a PC terminal, or by a computer program running the calibrator in an automated system. It uses an RS-232 serial port connection for remote operation. **NOTE: To use the remote control option a custom RS232 cable must be purchased (LEM232). To contact Omega refer to Section 1.1 of this manual.** With this connection the user can write programs on the PC, with Windows languages like Visual Basic® to operate the calibrator, or use a Windows® terminal, such as

Hyper Terminal, to enter single commands. Typical RS-232 remote configurations are shown in Figure 13.

COM PORT
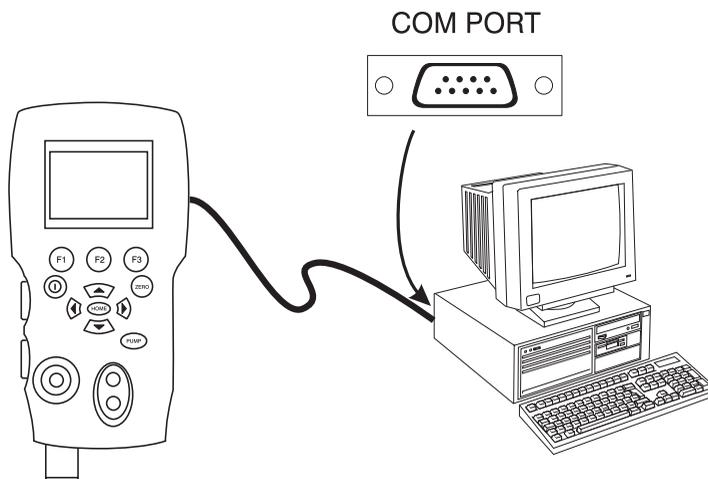
Figure 13. Calibrator-to-Computer Connection

13.2 Setting up the RS-232 Port for Remote Control

Note: The RS-232 connection cable should not exceed 15m unless the load capacitance measured at connection points is less than 2500pF.

Serial parameter values:

9600 baud

8 data bits

1 stop bit

no parity

Xon/Xoff

EOL (End of Line) character or CR (Carriage Return) or both

The LEM232 cable is used for RS-232 communications from the calibrator to a computer. If the computer only has USB type ports, a USB to RS-232 converter will be needed. These can be obtained from most office supply and computer stores. To connect the calibrator to the computer, attach the LEMO connector end of the cable to the pressure module port on the right side of the calibrator and the DB-9 connector to the RS-232 port on the computer. The calibrator should be turned off prior to making the connection and then turned on.

To set up remote operation of the calibrator on the Windows Hyper Terminal, connected to a COM port on the PC as in Figure 23, use the following procedure:

1. Start Hyper Terminal (located in Accessories/Communications of the Windows Start menu)
2. Select New Connection.
3. For Name enter PCL819. Select the serial port that the calibrator is connected to.
4. Enter the above information for port settings.

5. Select ASCII setup from File/Properties/Settings and mark these choices:

      Echo typed characters locally

      Wrap lines that exceed terminal width

6. Select Ok

7. To see if the port works enter *IDN?. This command will return information on the calibrator.

13.3 Changing Between Remote and Local Operation

There are three modes of operation of the calibrator, Local, Remote, and Remote with Lockout. Local mode is the default mode. Commands may be entered using the keypad on the calibrator or using a computer. In Remote mode the keypad is disabled, and commands may only be entered using a computer, but choosing [GO TO LOCAL] from the menu on the calibrator display will restore keypad operation. In Remote with Lockout, the keypad can not be used at all. To switch modes proceed as follows:

1. To enable Remote mode, type in the serial command REMOTE at the computer terminal.

2. To enable Remote with Lockout, type in "REMOTE LOCKOUT" in either order.

3. To switch back to local operation enter LOCAL at the terminal. This command also turns off LOCKOUT if it was on. For more information on commands refer to the Remote Commands section.

13.4 Using Commands

13.4.1 Command types

Refer to the Section 10.5 on Remote Commands for all available commands.

The calibrator may be controlled using commands and queries. All commands may be entered using upper or lower case. The commands are divided into the following categories:

Calibrator Commands

Only the calibrator uses these commands. For example

      VAL?

asks for the values displayed on the calibrator display.

Common Commands

Standard commands used by most devices. These commands always begin with an "*". For example

      *IDN?

tells the calibrator to return its identification.

Query Commands

Commands that ask for information, they always end with a "?". For example:

      FUNC?

Returns the current modes of the calibrator displays.

Compound Commands

Commands that contain more than one command on one line. For example;

> RTD_TYPE PT385_100;RTD_TYPE?

Sets the calibrator to RTD type PT385_100 and queries it to verify. It will return:

> PT385_100

13.4.2 Character Processing

The data entered into the calibrator is processed as follows:

- ASCII characters are discarded if their decimal equivalent is less than 32 (space), except 10 (LF) and 13 (CR):
- Data is taken as 7-bit ASCII
- The most significant data bit is ignored.
- Upper or lower case is acceptable.

13.4.3 Response Data Types

The data returned by the calibrator can be divided into four types:

Integer

For most computers and controllers they are decimal numbers ranging from -32768 to 32768. For example:

> FAULT? could return 110

Refer to the Error Codes table (Table 8) for more information on error codes.

Floating

Floating numbers have up to 15 significant figures and exponents. For example:

> CPRT_COEFA? returns 3.908300E-03

Character Response Data (CRD)

Data returned as keywords. For example:

> RTD_TYPE? returns PT385_100

Indefinite ASCII (IAD)

Any ASCII characters followed by a terminator. For example:

> *IDN? returns OMEGA, PCL819, 250, 1.00

13.4.4 Calibrator Status

Error Queue

If an error occurs due to invalid input or buffer overflow, its error code is sent to the error queue. The error code can be read from the queue with the command FAULT?. The error queue holds 15 error codes. When it is empty, FAULT? returns 0. The error queue is cleared when power is reset or when the clear command *CLS is entered.

Input Buffer

Calibrator stores all received data in the input buffer. The buffer holds 250 characters. The characters are processed on a first in, first out basis.

13.5 Remote Commands and Error Codes

The following tables list all commands, and their descriptions, that are accepted by the calibrator.

Table 5: Common Commands

Command	Description
*CLS	(Clear status.) Clears the error queue.
*IDN?	Identification query. Returns the manufacturer, model number, and firmware revision level of the Calibrator.
*RST	Resets the calibrator to the power up state.

Table 6: Calibrator Commands

Command	Description
CPRT_COEFA	Sets the custom RTD coefficient A
CPRT_COEFA?	Returns the custom RTD coefficient A
CPRT_COEFB	Sets the custom RTD coefficient B
CPRT_COEFB?	Returns the custom RTD coefficient B
CPRT_COEFC	Sets the custom RTD coefficient C
CPRT_COEFC?	Returns the custom RTD coefficient C
CPRT_R0	Sets the custom RTD R0 resistance
CPRT_R0?	Returns the custom RTD R0 resistance
DAMP	Turns Damp on or off.
DAMP?	Returns if DAMP is on/off
DISPLAY	Turns on/off the displays specified in the command
DISPLAY?	Returns which displays are on/off
ERROR_LOOP	Turns loop power on or off in percent error mode
ERROR_LOOP?	Returns the current state of loop power in error mode
ERROR_MODE	Turns percent error mode on or off
ERROR_MODE?	Returns whether percent error mode is on or off
ERROR_PORT	Set the pressure port for percent error mode
ERROR_PORT?	Returns the pressure port for percent error mode
FAULT?	Returns the most recent error code
FUNC	Sets the display mode as specified in the command
FUNC?	Returns the current mode of the upper, middle, and lower display
HART_ON	Turns the hart resistor on.
HART_OFF	Turns the hart resistor off.
HART?	Returns the current state of the Hart resistor.
HI_ERR	Sets the 100% of span limit for percent error mode
HI_ERR?	Returns the 100% of span limit for percent error mode

IO_STATE	Set the calibrator's mA state.
IO_STATE?	Return the calibrator's mA state.
LOCAL	Returns user to manual operation of the calibrator
LOCKOUT	Locks out the keypad of the calibrator in remote operation
LO_ERR	Sets the 0% of span limit for percent error mode
LO_ERR	Returns the 0% of span limit for percent error mode
MOTOR_ON	Turns the motor on.
MOTOR_OFF	Turns the motor off.
MOTOR?	Returns the current state of the Hart resistor
OHMS?	Returns ohms value measured from the RTD
OUT	Set the calibrator to output the requested current.
OUT?	Returns the value of the current being simulated.
PRES_UNIT	Set the pressure unit for the indicated display
PRES_UNIT?	Returns the pressure from the indicated display
PUMP_LIMIT	Sets the approximate value at which the pump will turn off.
PUMP_LIMIT?	Returns the approximate value at which the pump will turn off.
REMOTE	Puts the calibrator in remote mode
RTD_TYPE	Sets the RTD type
RTD_TYPE?	Returns the RTD type
SIM	Set the calibrator to simulate the requested current.
SIM?	Returns the value of the current being simulated.
ST_CLOSE?	Returns pressure value at which the switch closed
ST_DEAD?	Returns pressure value of the deadband of the switch
ST_OPEN?	Returns pressure value at which the switch opened
ST_START	Starts a switch test
TEMP_UNIT	Set the RTD to read in °F or °C on the indicated display
TEMP_UNIT?	Returns the unit the RTD is set to read on the indicated display
VAL?	Returns the measured values
ZERO_MEAS	Zeros the pressure module
ZERO_MEAS?	Returns the zero offset of the pressure module

Table 7: Parameter units

Units	Meaning
CEL	Temperature in degrees Celsius
CUSTOM	Custom RTD type
DCI	Current function
DCV	Voltage measure function
EXT	External pressure measurement function
FAR	Temperature in degrees Fahrenheit

LOWER	Designates Lower display
MA	Milliamps of current
MEASURE	Measure state
MEAS_LOOP	Measure with loop power state
MIDDLE	Designates Middle display
OHM	Resistance in ohms
PCT_ERR	Percent Error
PERCENT	Percent
PT385_100	100 Ohm 385 Platinum RTD type
PT392_100	100 Ohm 392 Platinum RTD type
PTJIS_100	100 Ohm JIS Platinum RTD type
P1	P1 pressure measurement function
RTD	Temperature measure function
ST_P1	Switchtest mode with P1
ST_EXT	Switchtest mode with external module
SOURCE	Source state
SIM	Simulate state
UPPER	Designates Upper display
V	Voltage

Table 8: Error Codes

Error Number	Error Description
100	A non-numeric entry was received where it should be a numeric entry
101	Too many digits entered
102	Invalid units or parameter value received
103	Entry is above the upper limit of the allowable range
104	Entry is below the lower limit of the allowable range
105	A required command parameter was missing
106	An invalid command parameter was received
107	Pressure not selected
108	Invalid sensor type
109	Pressure module not connected
110	An unknown command was received
111	Bad Parameter received
112	The serial input buffer overflowed
113	Too many entries in the command line
114	The serial output buffer overflowed

13.6 Entering Commands

Commands for the calibrator may be entered in upper or lower case. There is at least one space required between the command and parameter, all other spaces are optional. Almost all commands for the calibrator are sequential; any overlapped commands will be indicated as such. This section will briefly explain each of the commands and describe their general use, which will include any parameters that may be entered with the command as well as what the output of the command is.

13.6.1 Common Commands

*CLS

Clears the error queue. Also terminates all pending operations. When writing programs, use before each procedure to avoid buffer overflow.

*IDN?

Returns the manufacturer, model number, and firmware revision of the Calibrator. For example:

*IDN? will return OMEGA, PCL819, 0, 1.00

13.6.2 Calibrator Commands

CPRT_COEFA

This command is used for entering a custom RTD into the calibrator. The numeric value entered after the command will be set as the first coefficient of the polynomial used by the custom RTD.

For example:

CPRT_COEFA 3.908300E-03   enters 3.908300e-3 as coefficient A.

CPRT_COEFA?

Returns the number that was entered for the first coefficient of the polynomial used in the custom RTD. Using the example above CPRT_COEFA? Would return:

3.908300E-03

CPRT_COEFB

This command is used for entering a custom RTD into the calibrator. The numeric value entered after the command will be set as the second coefficient of the polynomial used by the custom RTD.

For example:

CPRT_COEFB –5.774999E-07 enters –5.774999E-07 as coefficient B.

CPRT_COEFB?

Returns the number, which was entered for the second coefficient of the polynomial used in the custom RTD. Using the example above, CPRT_COEFB? Would return:

-5.774999E-07

CPRT_COEFC

This command is used for entering a custom RTD into the calibrator. The numeric value entered after the command will be set as the first coefficient of the polynomial used by the custom RTD.

For example:

CPRT_COEFC –4.183000E-12 enters –4.183000E-12 as coefficient C.

CPRT_COEFC?

Returns the number that was entered for the third coefficient of the polynomial used in the custom RTD. Using the example above CPRT_COEFC? Would return:

–4.183000E-12

CPRT_R0

Sets the 0° resistance, R0, in the custom RTD. The value must be entered with a units label. Refer to the Parameter Units table for assistance.

For example:

CPRT_R0 100 OHM sets R0 to 100 ohms.

CPRT_R0?

Returns the value for the resistance in custom RTD. The above example would return:

1.000000E+02, OHM

DAMP

Turns the dampening function on or off.

For example:

If you send DAMP ON this will turn the dampening function on.

DAMP?

Returns the current state of the dampening function.

For example:

If you send DAMP? It will return ON if the dampening function is on.

DISPLAY

Turns the indicated display on or off.

For example:

If you send DISPLAY LOWER, ON this will turn the lower display on.

DISPLAY?

Returns the current state of the each of the displays.

For example:

> If you send DISPLAY? It will return ON, ON, ON if the all the displays are on.

FAULT?

Returns the error code number of an error that has occurred. The command may be entered when the previous command did not do what it was meant to do.

For example, if a value for current output is entered that is bigger than the supported range (0-24mA) FAULT? Would return:

> 103 which is the code number for an entry over range.

Refer to the Error Codes table for more information on error code numbers.

ERROR _LOOP

Turns loop power on or off in percent error mode.

For example:

> To set loop power on send ERROR_LOOP ON.

ERROR _LOOP?

Returns the current state of loop power in percent error mode.

For example:

> If you send ERROR_LOOP? It will return ON if loop power is on in error mode.

ERROR_ MODE

Turns percent error mode on and off.

For example:

To turn on percent error mode send ERROR_MODE ON.

ERROR _ MODE?

Returns the current state of percent error mode.

For example:

> If you send ERROR_MODE? It will return ON if the calibrator is in percent error mode.

ERROR_ PORT

Sets the pressure port for percent error.

For example:

> To set the pressure port for percent error to [P1] send ERROR_ PORT P1.

ERROR _ PORT?

Returns the current pressure port for percent error mode.

For example:

> If you send ERROR _PORT?, it will return P1 if the pressure port in percent error is [P1].

FUNC

Sets the display indicated in argument one to the function indicated in argument 2.

For example:

> To set the lower display to RTD mode send FUNC LOWER,RTD.

FUNC?

Returns the current mode of all displays. For example if the calibrator is set to [P2] ST on the upper display, [P1] on the middle, and RTD on the lower, FUNC? Would return:

ST_P2,P1,RTD

HART_ON

Turns the Hart resistor on.

HART_OFF

Turns the Hart resistor off.

HART?

Returns the state of the Hart resistor.

For example:

> If the Hart resistor was on HART? Would return ON.

HI_ERR

Sets the 100% point for the percent error mode calculation in the current engineering units.

For example:

> To set the 100% point to 100 psi send HI_ERR 100.

HI_ERR?

Returns the 100% point for the percent error mode calculation.

For example:

> If the 100% point is set to 100 psi, HI_ERR? would return 1.000000E+02, PSI .

IO_STATE

Sets the input/output/simulate state of the mA function of the calibrator. Does not put the calibrator in mA if it is not in it already.

For example:

> If the calibrator is in mA simulate mode sending IO_STATE MEASURE would put it in measure mode.

IO_STATE?

Returns the input/output/simulate state of the mA function of the calibrator.

For example:

> If the calibrator was in mA simulate mode IO_STATE? Would return SIM.

LOCAL

Restores the calibrator to local operation if it was in remote mode. Also clears LOCKOUT if the calibrator was in lockout mode.

LOCKOUT

Sending this command sets the lockout state, when the unit is in REMOTE or goes to remote it prohibits use of the keypad completely. The lockout state can only be cleared by sending the LOCAL command.

LO_ERR

Sets the 0% point for the percent error mode calculation in the current engineering units.

For example:

> To set the 0% point to 20 psi send LO_ERR 20.

LO_ERR?

Returns the 0% point for the percent error mode calculation.

For example:

> If the 0% point is set to 20 psi, LO_ERR? would return 2.000000E+01, PSI .

MOTOR_ON

Turns the motor on.

MOTOR_OFF

Turns the motor off.

MOTOR?

Returns the state of the motor.

For example:

> If the motor was on MOTOR? Would return ON.

OHMS?

Returns the raw Ohm value from the RTD.

For example:

> If when measuring a P100-385 at 0 degrees cel sending OHMS? would return 1.000000E+02, OHM .

OUT

This command also switches the calibrator into mA output mode. A number and a unit must be entered after the command.

For example:

> OUT 5 MA sets the current output at 5 mA

OUT?

Returns the output of the calibrator.

Using the above example, OUT? Would return: 5.000000E-03, A

PRES_UNIT

Used to set the pressure unit for the indicated display

For example:

> To set the pressure unit to psi on the lower display send PRES_UNIT LOWER, PSI.

PRES_UNIT?

Returns the pressure unit used when measuring pressure for each of the 3 displays.

PUMP_LIMIT

Sets the approximate pressure in psi at which the pump will turn off.

For example:

> PUMP_LIMIT 50 sets the approximate value that the pump will shutoff at to 50 psi

PUMP_LIMIT?

Returns the pump limit. Using the above example, PUMP_LIMIT? Would return:

50.000

REMOTE

Puts the calibrator in remote mode. From the remote mode the user can still use the keypad to get back to local unless the command LOCKOUT was entered before REMOTE. Then the keypad is totally locked out, and the user has to send the LOCAL command to get back to local operation.

RTD_TYPE

Sets the RTD type. The following is a list of RTD types the way they should be entered after the command:

PT385_100;   PT392_100;   PTJIS_100;   CUSTOM;

For Example:

RTD_TYPE PT385_100 sets RTD type to PT100-385

RTD_TYPE?

Returns the RTD type.

For Example:

If the RTD type is PT385_100, RTD_TYPE? Will return PT100_385.

SIM

Sets the output for current simulation. This command also switches the calibrator into mA simulation mode. A number and a unit must be entered after the command.

For example:

SIM 5 MA sets the current simulation at 5 mA

SIM?

Returns the output of the current simulation. With the example above, the output would be: 5.000000E-03, A

ST_START

Starts a switch test.

ST_CLOSE?

Returns the pressure that the switch closed at in the current pressure units.

ST_OPEN?

Returns the pressure that the switch opened at in the current pressure units.

ST_DEAD?

Returns deadband of the switch in the current pressure units.

TEMP_UNIT

This command is used to set the temperature unit used when measuring temperature.

The first argument indicates which display to apply the change to. The second argument is the unit, either CEL for Celsius or FAR for fahrenheit.

For example:

> To set the temperature unit to fahrenheit on the lower display send TEMP_UNIT LOWER, FAR.

TEMP_UNIT?

Returns the temperature unit, (CEL or FAR) used when measuring RTDs for each of the 3 displays.

VAL?

Returns the value of any measurement taking place on the upper and lower display. For example, if the upper display is measuring 5mA, and the lower display is measuring 10V, then VAL? will return:

5.000000E-03, A, 1.000000E+01, V

ZERO_MEAS

Zeroes the attached pressure module. Enter the zeroing value in PSI after the command when zeroing an absolute pressure module.

ZERO_MEAS?

Returns the zero offset or the reference value for absolute pressure modules.

14. *Specifications* (15°C to 35°C unless otherwise noted.)

General

Instrument Setup Recall	5; last used on power-up

Environmental
   Operating Temperature
   Storage Temperature
	
	-10 °C to +50 °C
	-20 °C to +60 °C

Power Requirements Battery	12 VDC Eight (8) AA alkaline, Lithium or NiMh cells

Physical
   Dimensions
   Weight
	
	8" H x 4" W x 2.375" D
	2.5 lbs. (1.2 kg)

EMI/RFI Conformance	EN50082-1: 1992 and EN55022: 1994 Class B
Safety	IEC 1010 Low Voltage Directive
Connectors/Ports	Pressure - one, 1/8" NPT PCL-PMA pressure module adapter; RTD probe
Included Accessories	Soft case, batteries, manual, certified certificate, test leads and hose kit.

Ranges

-12 to 30.000 psi/psia -12 to 150.00 psi/psia -12 to 300.00 psi	
mA	0 to 24.000 mA
Volts	0 to 30.000 VDC
RTD	-40.0°C to 150.0°C (-40.0°F to 302.0°F)
Engineering Units	psi, bar, mbar, kPa, MPa, kgcm2, mmH$_2$O @ 4°C, mmH$_2$O @ 20°C, cmH$_2$O @ 4°C, cmH$_2$O @ 20°C, inH$_2$O @ 4°C, inH$_2$O @ 20°C, inH$_2$O @ 60°F, mmHg @ 0°C, inHg @ 0°C

Accuracy

Pressure All Ranges	6 months: .025% F.S. 1 year: .035% F.S.
mA	±0.015% of rdg ±0.002mA
Volts	±0.015% of reading ±0.002V
RTD (ohms)	±0.015% of rdg ±0.02 ohms; or ±0.1°C @ 0°C for Pt100

Temperature Effect (all functions)
   No effect on accuracy on all functions from 15°C to 35°C
  Add ±0.002% F.S./°C for temps outside of 15°C to 35°C	

Optional LPT100A Probe	Meets PT-100 ALPHA 385 Class "A" Specifications

15. Maintenance

15.1 Replacing Batteries

Replace batteries as soon as the battery indicator turns on to avoid false measurements. If the batteries discharge too deeply the PCL819 will automatically shut down to avoid battery leakage.

Note: Use only AA size alkaline or Lithium batteries or optional rechargeable NiMh cells.

15.2 Cleaning the Unit

Warning

To avoid personal injury or damage to the calibrator, use only the specified replacement parts and do not allow water into the case.

Caution

To avoid damaging the plastic lens and case, do not use solvents or abrasive cleansers.

Clean the calibrator with a soft cloth dampened with water or water and mild soap.

15.3 Valve Cleaning Procedure

Occasionally, the PCL819 may not work properly due to dirt or other contamination of the internal valve assembly. Use the following procedure for cleaning the valve assembly. If this procedure does not fix the problem, a repair kit (part number 1010043) may be ordered.

1. Using a small screwdriver, remove the 2 valve retention caps located in the battery compartment area (see Figure 1, page 4).
2. After the caps have been removed, gently remove the spring and o-ring assembly.
3. Set aside the valve assemblies in a safe area and clean out the valve body using a cotton swab soaked in IPA (isopropyl alcohol).
4. Repeat the process several times using a new cotton swab each time until there is no remaining evidence of contamination or dirt.
5. Operate the pump handles several times and recheck for contamination.
6. Clean the o-ring assembly and the o-ring on the retention caps with IPA and inspect the o-rings closely for any damage or excessive wear. Replacements are included in the repair kit, if needed.
7. Inspect the springs for wear or loss of tension. They should be approximately 8.6 mm long in the relaxed state. If shorter, they may not provide sufficient sealing tension. Replace if needed.
8. Once all parts have been cleaned and inspected, reinstall the o-ring and spring assembly into the valve body.
9. Reinstall the retention caps and gently tighten each cap.
10. Seal the output port and operate the pump to at least 50% of capacity.
11. Release the pressure and repeat several times to ensure that the o-rings seat properly.

15.4 Service Center Calibration or Repair

Only qualified service personnel should perform calibration, repairs, or servicing not covered in this manual. If the calibrator fails, check the batteries first, and replace them if needed.

OMEGA PCL819 Ranges and Resolutions

Range (PSI)		30 PSI / 2.0 Bar	150 PSI / 10 Bar	300 PSI / 20 Bar
Burst Pressure (PSI)		300	300	2000
Proof Pressure (PSI)		60	200	600
Engineering Unit	Factor			
Psi	1	30.000	150.00	300.00
bar	0.06894757	2.0684	10.3421	20.684
mbar	68.94757	2068.4	10342.1	20684
kPa	6.894757	206.84	1034.21	2068.4
MPa	.00689476	0.2068	1.03421	2.0684
kg/cm2	0.07030697	2.1092	10.5460	21.092
cmH2O @ 4°C	70.3089	2109.3	10546.3	21093
cmH2O @ 20°C	70.4336	2113.0	10565.0	21130
mmH2O @ 4 °C	703.089	21093	N/A	N/A
mmH2O @ 20°C	704.336	21130	N/A	N/A
inH2O @ 4°C	27.68067	830.42	4152.1	8304.2
inH2O @ 20°C	27.72977	831.89	4159.5	8318.9
inH2O @ 60°F	27.70759	831.23	4156.1	8312.3
mmHg @ 0°C	51.71508	1551.5	7757.3	15515
inHg @ 0°C	2.03602	61.081	305.40	610.81

• Proof pressure - maximum allowable pressure without a shift in calibration

• Burst pressure - sensor damaged or destroyed; some risk of personnel injury

• Absolute ranges - the data for the 30 PSI / 2.0 Bar, 150 PSI / 10 Bar and 300 PSI / 20 Bar ranges also applies to the absolute pressure versions of those ranges.

WARRANTY/DISCLAIMER

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

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

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

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

RETURN REQUESTS/INQUIRIES

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

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

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

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

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

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

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

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