APT Power Quality Sensor Meter

Multi-Function Service Entrance Metering

PS-EH

ADVANCED POWER TECHNOLOGIES

Operations Manual

ADVANCED POWER TECHNOLOGIES

PROVIDING A COMPREHENSIVE APPROACH TO RELIABLE POWER

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WARNING

Read the instructions in this manual before performing installation and take note of the following precautions:

- **Ensure that all incoming AC power and other power sources are turned OFF before performing any work on the instrument. Failure to do so may result in serious or even fatal injury and/or equipment damage.**
- **Before connecting the instrument to the power source, check the labels on the back of the instrument to ensure that your instrument is equipped with the appropriate power supply voltage, input voltages and currents.**
- **Under no circumstances should the instrument be connected to a power source if it is damaged.**
- **To prevent potential fire or shock hazard, do not expose the instrument to rain or moisture.**
- **The secondary of an external current transformer must never be allowed to be open circuit when the primary is energized. An open circuit can cause high voltages, possibly resulting in equipment damage, fire and even serious or fatal injury. Ensure that the current transformer wiring is secured using an external strain relief to reduce mechanical strain on the screw terminals, if necessary.**
- **Only qualified personnel familiar with the instrument and its associated electrical equipment must perform setup procedures.**
- **Do not open the instrument under any circumstances when it is connected to a power source.**
- **Do not use the instrument for primary protection functions where failure of the device can cause fire, injury or death. The instrument can only be used for secondary protection if needed.**
- **Read this manual thoroughly before connecting the device to the current carrying circuits. During operation of the device, hazardous voltages are present on input terminals. Failure to observe precautions can result in serious or even fatal injury or damage to equipment.**

Table of Contents

This manual provides PS-EH Power Sensor series front panel information, default settings, and operating procedures.

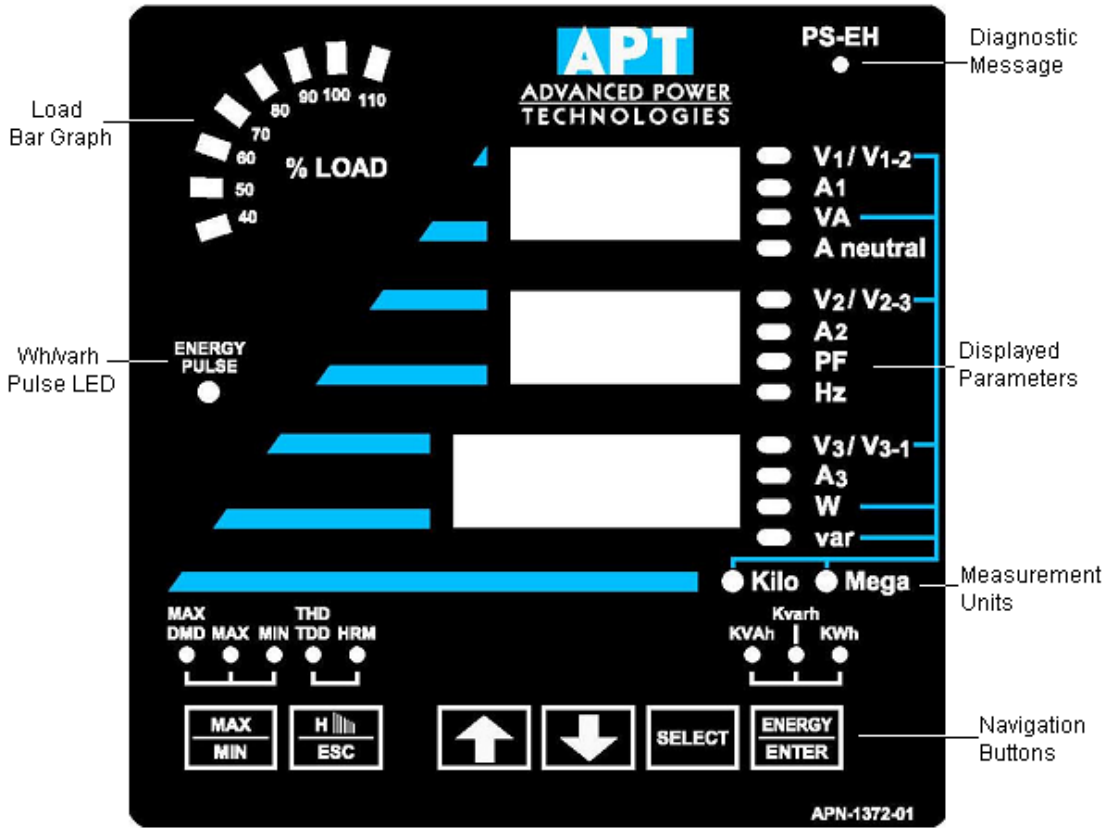

Figure 0.1: Power Sensor Unit

1. Indicators and Controls

1.1 Device Diagnostics

After applying power to the Sensor, a one-digit start-up diagnostic code is shown for 1 second on all LEDs. Code 8 indicates a normal Power-up sequence. You can observe the list of device diagnostic codes recorded during restart and Sensor operation via the *Status Display*.

When the Sensor records a diagnostic message, the diagnostic LED flashes until you reset the device diagnostics via the *Status Display*. The diagnostic LED can be disabled or enabled via the *Display Setup* menu.

1.2 Numeric LED Display

The Sensor has a simple user interface that allows you to view numerous measurement parameters by scrolling through different display pages. The numeric LED display shows up to three parameters at a time. Small

rectangular or round LEDs at the right and below the display indicate the displayed parameters and their measurement units.

The display layout may change depending on the sensor type and mode of operation.

There are three modes of display operation:

- Data display
- Status display
- Programming mode display.

1.3 Load Bar Graph

The load bar graph displays the amount, in percent (40% to 110%), of the present current load with respect to user-defined nominal load current. The reference nominal current can be set up in amps through the *Display Setup* menu. If it is set to 0 (default), the current load is referenced to the specified CT primary current.

1.4 Energy Pulse LED

The Power Sensor has a red “Energy Pulse” LED. It flashes at a constant rate when a load is applied to the Sensor.

There are two modes of LED operation:

- **Normal mode**: the LED pulses indicate imported Wh at a rate of 1,000 pulses per kWh
- **Test mode**: the LED pulses indicate either imported Wh, or imported (inductive) varh at a rate of 10,000 pulses per kWh/kvarh

  The energy test mode can be enabled through the *Device Options* menu. When in test mode, the energy and demand accumulators do not account for consumed energy.

1.5 Navigation Buttons

The Power Sensor is provided with six push buttons that are normally used to navigate between different measurement displays.

In programming mode, the buttons access the device setup menus where the default factory-set device settings can be changed.

2. Data Display

In data mode, the display is normally updated once every second. You can adjust the display update rate via the *Display Setup* menu.

2.1 Display Features

2.1.1 Measurement Units

The Power Sensor has a selectable resolution for volts, amps and powers presented on the front display and via communications. See *Device Options* for information on selecting the data resolution in the Power Sensor.

Low Resolution Option

Currents are displayed in whole amperes below 10,000 A, and in kilo amperes above 10,000 A.

Measurement units for voltage and power depend on the voltage connection scheme:

- For direct wiring (PT=1) or wiring via PT with the PT ratio up to and including 4.0, voltages are displayed in volts, and Power in kilowatts.
- For the PT ratio above 4.0, voltages are displayed in kilovolts with three decimal places, and Power in megawatts with three decimal places.

High Resolution Option

Currents are displayed in amperes with up to two decimal places below 10,000 A, and in kilo amperes above 10,000 A.

Measurement units for voltage and power depend on the voltage connection scheme:

- When direct wiring is used (PT=1), voltages are displayed in volts with one decimal place, and Power in kilowatts with three decimal places.
- When wiring via PT is used with the PT ratio up to and including 4.0, voltages are displayed in volts, and Power in whole kilowatts.
- For the PT ratio above 4.0, voltages are displayed in kilovolts with three decimal places, and Power in megawatts with three decimal places.

The small round “Kilo” and “Mega” LEDs light up showing the appropriate measurement units for a displayed page.

2.1.2 Primary and Secondary Volts

Volts can be displayed in primary (default) or secondary units. The volts display mode can be changed through the *Display Setup* menu.

2.1.3 Phase Power Readings

In configurations with the neutral wire, in addition to total three-phase powers, the Sensor can show per-phase power readings. By default, they are disabled. See *Display Setup* on how to enable per-phase power readings in your Sensor.

2.1.4 Fundamental Component

The Power Sensor can display total displacement power factor and active power for the fundamental component if it is enabled through the *Display Setup* menu.

When phase power readings are allowed, the Power Sensor also displays per-phase displacement power factor and active power for the fundamental component.

2.1.5 Auto Return

If no buttons are pressed for 30 seconds while the display Auto Return option is enabled, the display automatically returns to the main screen from any other measurement display.

The Auto Return option can be enabled through the *Display Setup* menu.

2.1.6 Auto Scroll

If no buttons are pressed for 30 seconds while in the common measurements display, and the Auto Scroll option is enabled in the Sensor, the display automatically scrolls through all available pages. The scroll interval can be adjusted through the *Display Setup* menu.

To stop auto scrolling, press briefly the **UP** or **DOWN** button.

2.1.7 Brightness

The Power Sensor display has a 3-level adjustable brightness. It is normally preset at the factory to the highest level. You can adjust the display through the *Display Setup* menu.

2.2 Navigation Buttons

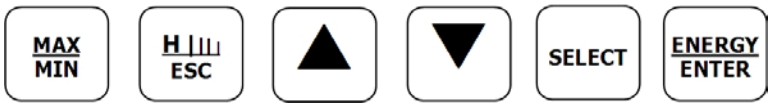

Figure 2.1: Navigation Buttons

In Data Display mode, the navigation buttons function as follows.

- The **MAX/MIN** button switches to the Min/Max and Maximum Demands display pages. When briefly pressed again, it switches back to the common measurements display.
- The **H/ESC** button on the Power Sensor switches between the Total Harmonics and Individual Harmonics pages. When briefly pressed once again, it switches back to the common measurements display.

- The **UP** and **DOWN** arrow buttons, labeled by arrowheads, scroll forwards and backwards through the display pages. Pressed briefly, they move one page forward or backward. If you hold down the button, the display pages are scrolled at a rate of twice per second.

  Pressing both the **UP** and **DOWN** arrow buttons together will return you to the first page within the current display.

- The **SELECT** button operates once it is released. The button has two functions:

  - When pressed briefly, it switches to programming mode.

  - When pressed together with the **ENTER** button for more than 5 seconds, it resets Min/Max registers, maximum demands, or energies depending on the currently displayed page. If the Sensor is password protected and a simple reset of data from the display is not allowed, the action has no effect.

- The **ENERGY** button switches to the Energy display. If TOU registers are configured in the Sensor, you can repeatedly press this button to scroll through all available TOU registers. When briefly pressed once again, it switches back to the common measurements display:

2.3 Simple Reset of Accumulated Data

You can reset the Min/Max registers, maximum demands and energies from the data display mode without accessing the reset menu. This is accomplished by using the simple “two-button” reset option if the Sensor is not password protected or the Sensor security is overridden by the “two-button” reset mode setting, see *Display Setup*:

1. Select a display page where the data you want to reset is displayed:

   - **Min/Max log**: select a Min/Max page from the Min/Max Display

   - **Ampere and volt maximum demands**: select the Ampere or Volt maximum demand page from the Min/Max Display.

   - **Power maximum demands**: select the Power maximum demand page from the Min/Max Display.

   - **Total and phase energies**: select a total energy, or phase energy page from the Energy Display.

2. While holding the **SELECT** button down, press and hold the **ENTER** button for about 5 seconds.

   The displayed data is reset to zero.

2.4 Common Measurements Display

Scroll through pages with the ▲ **UP** and ▼ **DOWN** arrow buttons.

Table 1: Common Measurements (Main Display)

1	**L**	V12 V23 V31	Line-to-line volts
2	**P**	V1 V2 V3	Line-to-neutral volts (in 4LN3, 3LN3, 3BLN3 configurations)
3		I1 I2 I3	Amps
4		kVA/MVA PF kW/MW	Total VA Total PF Total W
5		In Hz kvar/Mvar	Neutral current Frequency Total var
6		**Ph.L1** PF kW/MW	Phase L1 Powers (if enabled)
7		kVA/MVA **Ph.L1** kvar/Mvar	Phase L1 Powers (if enabled)
8		**Ph.L2** PF kW/MW	Phase L2 Powers (if enabled)
9		kVA/MVA **Ph.L2** kvar/Mvar	Phase L2 Powers (if enabled)
10		**Ph.L3** PF kW/MW	Phase L3 Powers (if enabled)
11		kVA/MVA **Ph.L3** kvar/Mvar	Phase L3 Powers (if enabled)
12		**H01** PF kW/MW	Fundamental total Powers (Power Sensor, if enabled)
13		**H1.L1** PF kW/MW	Fundamental phase L1 Powers (Power Sensor, if enabled)
14		**H1.L2** PF kW/MW	Fundamental phase L2 Powers (Power Sensor, if enabled)
15		**H1.L3** PF kW/MW	Fundamental phase L3 Powers (Power Sensor, if enabled)
16		**U.Unb** V% unb	 Voltage unbalance, percent

17		**C.Unb** I% unb	 Current unbalance, percent

2.5 Min/Max and Maximum Demand Display

Figure Error! No text of specified style in document.**-1: MAX/MIN Button**

1. Press the **MAX/MIN** button.

   The **MIN**, **MAX**, or **MAX DMD** LED is illuminated when in the MIN/MAX display.

2. Use the ▲ **UP** and ▼ **DOWN** arrow buttons to scroll through the Min/Max and Max. Demand pages.

To see the time and date of the event occurrence:

1. Press simultaneously the **SELECT** and **UP** buttons.

2. Use the **UP** and **DOWN** arrow buttons to scroll through the parameters displayed on the page. A corresponding LED at the right is illuminated showing the parameter for which the timestamp is displayed.

The time is displayed in format hh.mm, and the date in format MM-DD-YY (default) or in any other format you can select via the *Display Setup* Menu.

Note that Volts readings are line-to-neutral in 4LN3, 3LN3 and 3BLN3 wiring modes, and line-to-line in other modes.

Table 2: Min/Max and Maximum Demands

1	**MIN**	V1/V12 V2/V23 V3/V31	Minimum volts
2	**MIN**	I1 I2 I3	Minimum amps
3	**MIN**	kVA/MVA PF kW/MW	Minimum total VA Minimum total PF (absolute) Minimum total W
4	**MIN**	In Hz kvar/Mvar	Minimum neutral current Minimum frequency Minimum total var
5	**MAX**	V1/V12 V2/V23 V3/V31	Minimum volts
6	**MAX**	I1 I2	Maximum amps

		I3	
7	**MAX**	kVA/MVA PF kW/MW	Maximum total VA Maximum total PF (absolute) Maximum total W
8	**MAX**	In Hz kvar/Mvar	Maximum neutral current Maximum frequency Maximum total var
9	**MAX** **DMD**	V1/V12 V2/V23 V3/V31	Maximum volt demands
10	**MAX** **DMD**	I1 I2 I3	Maximum ampere demands
11	**MAX** **DMD**	kVA/MVA PF kW/MW	Maximum VA demand PF at maximum VA demand Maximum W demand
12	**MAX** **DMD**	A neut. var	Maximum neutral current demand Maximum var demand

2.6 Harmonics Display

Figure Error! No text of specified style in document.**-2: H/ESC Button**

1. Press the **H/ESC button**.

   The THD/TDD LED is illuminated.

2. Use the ▲ **UP** and ▼ **DOWN** arrow buttons to scroll through total harmonics measurements.

3. Press the **H/ESC** button again to move to the individual harmonics.

Note that voltage harmonics readings are line-to-neutral in the 4LN3, 3LN3, 3BLN3 wiring modes, and line-to-line in all other modes.

Table 3: Total Harmonics

1	**thd.**	V1/V12 THD V2/V23 THD V3/V31 THD	Voltage THD
2	**thd.**	I1 THD I2 THD I3 THD	Current THD
3	**tdd.**	I1 TDD I2 TDD I3 TDD	Current TDD
4	**HF**	I1 K-Factor I2 K-Factor I3 K-Factor	Current K-Factor

Table 4: Individual Voltage Harmonics

1	**3.**	V1/V12 HD% V2/V23 HD% V3/V31 HD%	Order 3 harmonic distortion
2	**5.**	V1/V12 HD% V2/V23 HD% V3/V31 HD%	Order 5 harmonic distortion
19	**39.**	V1/V12 HD% V2/V23 HD% V3/V31 HD%	Order 39 harmonic distortion

Table 5: Individual Current Harmonics

1	**3.**	I1 HD% I2 HD% I3 HD%	Order 3 harmonic distortion
2	**5.**	I1 HD% I2 HD% I3 HD%	Order 5 harmonic distortion
19	**39.**	I1 HD% I2 HD% I3 HD%	Order 39 harmonic distortion

2.7 Energy Display

Figure 2.2: Energy Button

1. Press the **ENERGY** button.

   The kVAh, kvarh, or kWh LED is illuminated.

2. If TOU registers are configured in the Sensor, press the button again to scroll through all active TOU registers.

3. Use the **UP** and DOWN arrow buttons to scroll through energy pages.

Along with total energies, per phase energy accumulators are displayed if phase energy calculation is enabled in the *Device Options* menu.

Table 6: Total and Phase Energies

1		**Ac.i** 1234 56789	Total kWh import
2		**rE.i** 1234 56789	Total kvarh import
3		**AP.** 1234	Total kVAh

		56789	
4		**Ac.E** 1234 56789	Total kWh export
5		**rE.E** 1234 56789	Total kvarh export
6		**Ac.i 1** 1234 56789	Phase L1 kWh import
7		**rE.i 1** 1234 56789	Phase L1 kvarh import
8		**AP. 1** 1234 56789	Phase L1 kVAh
9		**Ac.i 2** 1234 56789	Phase L2 kWh import
10		**rE.i 2** 1234 56789	Phase L2 kvarh import
11		**AP. 2** 1234 56789	Phase L2 kVAh
12		**Ac.i 3** 1234 56789	Phase L3 kWh import
13		rE.i 3 1234 56789	Phase L3 kvarh import
14		AP. 3 1234 56789	Phase L3 kVAh

Table 7: TOU Energy Register 1

1		**r1.t1** 1234 56789	Tariff 1 reading kWh
2		**r1.t2** 1234 56789	Tariff 2 reading kWh
4		**r1.t4** 1234 56789	Tariff 4 reading kWh

Table 8: TOU Energy Register 4

1		**r4.t1** 1234 56789	Tariff 1 reading kWh
2		**r4.t2** 1234 56789	Tariff 2 reading kWh

4		**r4.t4** 1234 56789	Tariff 4 reading kWh

3. Status Display

The Sensor has a separate status information display accessible through the primary device menu. For information on navigating in the menus, see *Using the Menus*. The Status Display shows rarely used information that is especially helpful for troubleshooting or when connecting the Sensor to an external equipment.

To access the Status Display:

1. From the *Data Display* menu, press the **SELECT** button to access the primary device menu.

   The **StA** window is highlighted.

4. Press **ENTER** to access the Status Display.

5. Use the **UP** and **DOWN** arrow buttons to scroll through the status pages.

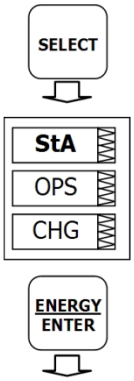

Figure 3.1: Status Display

To exit the Status Display:

1. Press **ESC** to return to the primary device menu.

2. Press **ESC** to return to the Data display.

Table 9: Status Display Parameters

1		**PhS** **rot** POS/nEG/Err	Phase rotation order
2	**A.**	V1 angle V2 angle V3 angle	Voltage angles (±180°, referenced to V1)
3	**A.**	I1 angle I2 angle I3 angle	Current angles (±180°, referenced to V1)
4		**rEL** **1.2** 00	Relay status (with a digital I/O module)
5		**St.In** 1.2.3.4 0000	Status inputs (with a digital I/O module)
6		**Cnt.1** **<hour>** 12345	Counter #1 value (a time counter – in 0.1 hour units)
7		**Cnt.2** **<hour>** 12345	Counter #2 value (a time counter – in 0.1 hour units)
8		**Cnt.3** **<hour>** 12345	Counter #3 value (a time counter – in 0.1 hour units)
9		**Cnt.4** **<hour>** 12345	Counter #4 value (a time counter – in 0.1 hour units)
10		**Alar** **SP.<**Setpoint Number**>** **<**Alarm Trigger **>**	Setpoint alarms (see Alarm Display below)
11		**diAG** **<**Diagnostic Code**>** **<**Diagnostic Message**>**	Device diagnostics (see Diagnostics Display below)
12		**SEr.n** 1 23456	Device serial number
13		**SoFt** 11. 01.01	Firmware version number

3.1 Pulse and Time Counters

The 5-digit Sensor counters count setpoint events, external pulses, or setpoint operation time.

Time counters have the hour label in the middle window and display the setpoint operation time at a 0.1-hour resolution.

You can clear a counter using the simple “two-button” reset option if the Sensor is not password protected, or if the Sensor security is overridden by the “two-button” reset mode setting (see *Display Setup*).

To clear a counter:

1. Select a counter page.

2. While holding the **SELECT** button, press and hold the **ENTER** button for about 5 seconds.

   The displayed data is reset to zero.

3.2 Alarm Display

The alarm display shows a list of operated alarm setpoints along with the alarm trigger labels if there are alarms recorded during Sensor operation.

Use the **UP** and **DOWN** arrow buttons to scroll through the alarm list.

The setpoint status is latched into a non-volatile register, which is not affected by loss of Power and may only be cleared via communications or from the Sensor display.

To clear alarms:

1. Select an alarm page.

2. While holding the **SELECT** button, press and hold the **ENTER** button for about 5 seconds until the alarm code is reset to none.

3.3 Diagnostics Display

The diagnostics display shows a list of the device diagnostic codes recorded as a result of the Sensor self-test diagnostics during start-up and operation. When there are recorded diagnostic messages, the diagnostic LED on the front display briefly flashes two times to indicate that the Sensor may require servicing.

The diagnostic LED can be disabled or enabled via the *Display Setup* menu.

Use the **UP** and **DOWN** arrow buttons to scroll through the diagnostic message list.

Frequent hardware failures may be the result of excessive electrical noise in the region of the device. If the Sensor continuously resets itself, contact your local distributor.

A configuration reset may also be a result of the legal changes in the Sensor configuration when other configuration data is affected by the changes.

To clear the Sensor diagnostics:

1. Select a diagnostics page.

2. While holding the **SELECT** button, press and hold the **ENTER** button for about 5 seconds until the diagnostic message is reset to **none**.

4. Using the Menus

4.1 Navigation Buttons

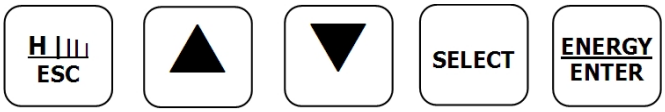

Figure 4.1: Navigation Buttons

The Power Sensor has a menu-driven setup. To access the menus, press and release the **SELECT** button.

The **SELECT** button selects (highlights) an active window in which you can select or change a required menu item. The button operates once it is briefly pressed and released.

The **UP** and **DOWN** arrow buttons scroll through menu items in the highlighted window. It allows changing a highlighted item when entering numbers.

The **ENTER** button confirms the selection of a menu item or a number in the highlighted window, thus allowing to access a submenu or to store a changed item.

The **ESC** button is "Escape" leaving the highlighted item unchanged or returning to the upper level menu.

4.2 Selecting Menus

To access the Sensor menus, press and release the **SELECT** button. The primary Sensor menu is displayed as shown in *Figure* .

The menu has three entries:

- **StA**: Status Display entry (see the *Status Display* section)
- **OPS**: Main setup menu entry allowing to review setup options
- **CHG**: Main setup menu entry allowing to change setups

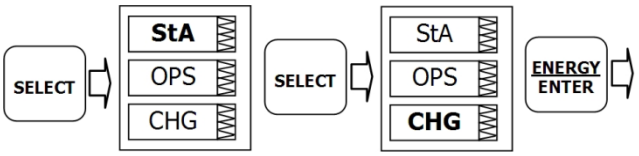

Figure 4.2: Menu Entries

To access the Status Display:

1. If the **StA** window is not highlighted, use the **SELECT** button to activate it.
2. Press the **ENTER** button to access the Status Display

To review the Sensor setup options:

1. Press the **SELECT** button to activate the OPS window.

2. Press the **ENTER** button to access the main menu.

To change the Sensor setup, or to clear the accumulated values:

1. Press the **SELECT** button to activate the **CHG** window.

2. Press the **ENTER** button to access the main menu.

4.3 Entering the Password

The Setup Change menu can be secured by a four-digit user password.

The Sensor is primarily shipped with the password preset to 0 and password protection disabled.

You can change the password and enable password protection through the Access Control menu (see the *Sensor Security* section).

If authorization is not required, just press the **ENTER** button to move to the Main menu; otherwise you should enter a correct password to be authorized to access the Sensor setup.

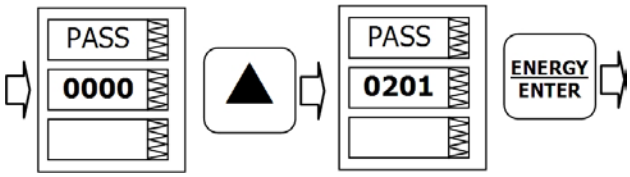

Figure 4.3: Sensor Setup

To access the password:

1. Adjust the first digit with the **UP** and **DOWN** arrow buttons.

2. Press the **SELECT** button to advance to the next digit.

3. Adjust the remaining password digits in the same manner.

4. Press **ENTER** to confirm the password.

If the password entered is correct, move to the Main menu, otherwise return to the previous menu.

Selecting the **OPS** or **CHG** entry moves you to the Main menu that is represented by two entries:

- the upper window displays a secondary menu list
- the bottom item acts as an assisting exit window.

4.4 Selecting a Menu Entry

To select a menu entry from the menu list:

1. Highlight the upper item by pressing the **SELECT** button.

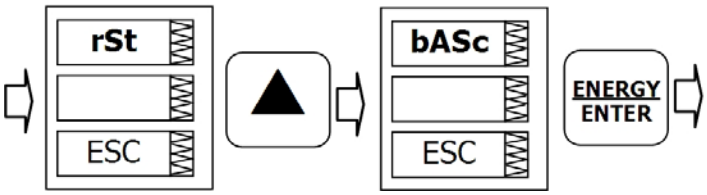

Figure 4.4: Selecting a Menu Entry

2. Scroll through the menu list by pressing briefly the **UP** and **DOWN** arrow buttons until the required menu entry appears.

3. Press the **ENTER** button.

4.5 Viewing and Changing Setup Items

A second level menu normally consists of three items:

- the upper static window - indicates the menu name
- the middle window - represents a list of setup parameters you can scroll through
- the lower item - shows the present parameter value.

To select a parameter you want to view or change:

1. Highlight the middle window by pressing the **SELECT** button.

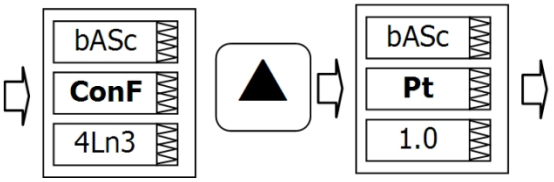

Figure 4.5: Selecting a Parameter

2. Scroll through the parameter list with the **UP** and **DOWN** buttons until the required parameter name appears.

To change the selected parameter:

1. Press the **SELECT** button to highlight the lower item.

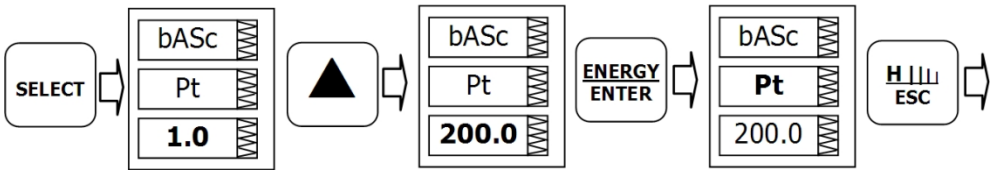

Figure 4.6: Changing a Parameter

2. Adjust the number to the required value with the **UP** and **DOWN** arrow buttons if a number represents the parameter.

   When briefly pressed, the button increments or decrements the number by one.

   When the button is pressed continuously, the number is changed approximately twice per second.

3. If a name represents the parameter, select the required option with the **UP** and **DOWN** arrow buttons.

4. To store your new selection, press the **ENTER** button.

5. To leave the parameter unchanged, press the **ESC** button.

6. Return to the parameter list to select another parameter or return to the main menu.

7. Press **ESC** to exit the menu.

5. Menu Operations

5.1 Basic Device Settings

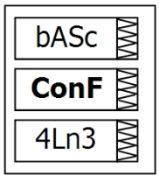

Figure 5.1: Basic Device Settings

The **Basic Device Settings** menu allows you to configure the basic Sensor settings that define the general operating characteristics of the device.

To access the Basic Device Settings menu:

1. Select the **baSc** entry from the main menu.

2. Press the **ENTER** button.

Using a shortcut to the Basic Setup menu:

From the Data Display, press and release the **SELECT** button to enter the primary Sensor menu (see *Selecting Menus*), and then simultaneously press the **SELECT** and **UP** buttons. You are directly moved to the CT setting entry.

The shortcut is not operational if the Sensor is password protected.

To select a setup option:

1. Press the **SELECT** button to activate the middle window.
2. Use the **UP** and **DOWN** arrow buttons to scroll to the required option.

To change the option:

1. Press the **SELECT** button to activate the lower window.
2. Use the **UP** and **DOWN** arrow buttons to select the required option.
3. Press **ENTER** to confirm your changes and to store your new setting or press **ESC** to discard changes.

To exit the menu, press ESC.

Table 10 lists the Basic Device Settings options.

Table 10: Available Options

Label	Parameter	Options	Default	Description
ConF	Wiring connection (configuration) mode	See Installation Manual	4Ln3	The wiring connection of the device
Pt	PT ratio	1.0-6500.0	1.0	The phase potential transformer's primary to secondary ratio
Pt.F	PT Ratio multiplier	×1, ×10	×1	PT Ratio multiplication factor. Used in extra high voltage networks to accommodate the PT ratio for 500 kV and higher networks.
Ct	CT primary current	1-50000 A	5 A	The primary rating of the phase current transformer
d.P	Power block demand period	1, 2, 3, 5, 10, 15, 20, 30, 60 min, E=external sync	30 min	The length of the demand period for Power demand calculations. If the external synchronization is selected, a pulse front on the digital input DI1 denotes the start of the demand interval.
nd.P	The number of blocks in the sliding window	1-15	1	The number of blocks to be averaged for sliding window demands
Ad.P	Ampere and volt demand period	0-1800 sec	900 sec	The length of the demand period for ampere, volt and THD demand calculations
Freq	Nominal frequency	50,60,25, 400 Hz	60 Hz	The nominal line frequency
LoAd	Maximum demand load current	0-50000 A	0	The maximum demand load current (0 = CT primary)

⚠ Always specify the wiring mode and transformer ratings prior to setting up setpoints and analog outputs.

The maximum value for the product of the phase CT primary current and PT ratio is 57,500,000. If the product is greater, Power readings are zeroed.

5.2 Device Options

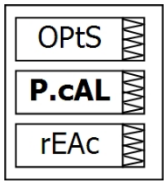

Figure 5.2: Device Options

The **Device Options** menu allows changing user-configurable device options or putting the Sensor into energy test mode.

To access the Device Options menu:

1. Select the **OPtS** entry from the main menu.
2. Press the **ENTER** button.

To select a setup option:

1. Press the **SELECT** button to activate the middle window.
2. Use the **UP** and **DOWN** arrow buttons to scroll to the required option.

To change the option:

1. Press the **SELECT** button to activate the lower window.
2. Use the **UP** and **DOWN** arrow buttons to select the required option.
3. Press **ENTER** to confirm changes and to store new settings or press **ESC** to discard changes.

To exit the menu, press ESC.

Table 11 lists available options.

Table 11: Available Device Options

Label	Parameter	Options	Default	Description
P.cAL	Power calculation mode	rEAc (reactive Power), nAct (non-active Power)	Reactive	The method used for calculating reactive and apparent Powers.

Label	Parameter	Options	Default	Description
roLL	Energy roll value	10.E4=10,000 10.E5=100,000 10.E6=1,000,000 10.E7=10,000,000 10.E8=100,000,000 10.E9=1,000,000,000	10.E8	The value at which energy counters roll over to zero
Ph.En	Phase energy option	diS = disabled En = enabled	Disabled	Enables phase energy calculations
U.Str	Starting voltage	1.5-5.0%	1.5	The device starting voltage in percent of FS (120V or 400V)
U.ScL	Voltage scale, secondary volts	10-828 V	144 V	The maximum voltage scale allowed.
C.ScL	Current scale, secondary amps	1.0-10.0 A	2 × CT secondary	The maximum current scale allowed.
rESL	Device resolution	Lo Hi	Lo	The voltage, current and Power resolution on the front display (see *Measurement Units*) and in communications (see the appropriate section in the communication guides)
tESt	Energy test mode	OFF = disabled Ac.Ei = Wh pulses rE.Ei = varh pulses	Disabled	Setting this option puts the Sensor into the energy test mode

5.3 Communication Ports

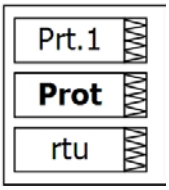

Figure 5.3: Communication Ports Options

The **Communication Ports Options** menus allow you to configure parameters for communication ports COM1 and COM2.

To access the menu:

1. Select **Prt.1** for COM1 or **Prt.2** for COM2 from the main menu

2. Press the **ENTER** button.

To select a setup option:

1. Press the **SELECT** button to activate the middle window.

2. Use the **UP** and **DOWN** arrow buttons to scroll to the required option.

To change the option:

1. Press the **SELECT** button to activate the lower window.

2. Use the **UP** and **DOWN** arrow buttons to select the required option.

3. Press **ENTER** to confirm changes and to store new settings or press **ESC** to discard changes.

4. Press ESC to exit the menu.

Table 12 and *Table 13* list COM port settings.

Table 12: COM1 Settings

Label	Parameter	Options	Default	Description
Prot	Communications protocol	ASCII rtu = Modbus RTU dnP3 = DNP3	Modbus RTU	The communications protocol supported by the port
rS	Port interface	485 = RS-485	RS-485	
Addr	Device address	Modbus RTU: 1-247 DNP3: 0–65532	1	Device network address
bAud	Baud rate	300-115200 bps	9600 bps	The port baud rate
dAtA	Data format and parity	7E, 8N, 8E	8N	7E data format should not be used with the Modbus RTU and DNP3 protocols

Table 13: COM2 Settings

Label	Parameter	Options	Default	Description
Prot	Communications protocol [1]	rtu = Modbus/TCP dnP3 = DNP3/TCP PrFb = Profibus DP	Modbus/TCP	The communications protocol supported by the port
rS	Port interface	Eth.= Ethernet PrFb = Profibus DP	Eth.	Not changeable; automatically detected by the Sensor
Addr	Device address	Modbus: 1-247 DNP3: 0–65532 Profibus DP: 0-126	1	Device network address

5.4 Network Address

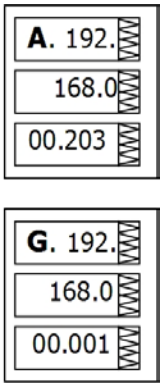

Figure 5.4: Network Address

The Network Address entry appears only if the Sensor is ordered with the optional Ethernet module.

The **Network Address** menu allows you to configure the device IP address and the default gateway address for the Ethernet port.

To access the Network Address menu:

1. Select **nEt** from the main menu.
2. Press the **ENTER** button.

To change the IP Address and Default Gateway:

1. To change the device IP address, select the **A** entry in the upper window using the **UP** and **DOWN** arrow buttons.
2. To change the default gateway address, select the **G** entry.
2. Press the **SELECT** button to activate the first address digit.
3. Use the **UP** and **DOWN** arrow buttons to adjust the digit.
4. Press the **SELECT** button to advance to the next digit.
5. Adjust the remaining address digits.
6. Press **ENTER** to confirm the new setting or press **ESC** to discard changes.

5. Press ESC to exit the menu.

5.5 Relay Output Setup

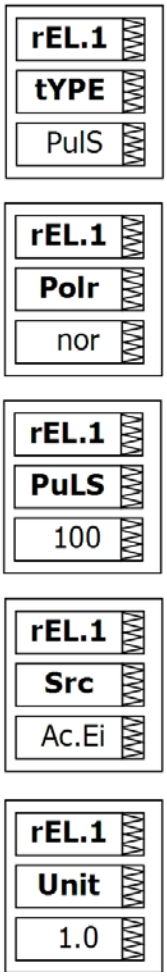

Figure 5.5: Relay Output Setup

The Relay Output Setup entry appears only if the Sensor is ordered with the optional digital I/O module.

To access the Relay Output Setup menu:

1. Select the **rEL** entry from the main menu.
2. Press the **ENTER** button.
3. Use the **UP** and **DOWN** arrow buttons to scroll to the required relay.

To select a relay parameter:

1. Press the **SELECT** button to activate the middle window.
2. Use the **UP** and **DOWN** arrow buttons to scroll to the required parameter.

To change the parameter value:

1. Press the **SELECT** button to activate the lower window.
2. Use the **UP** and **DOWN** arrow buttons to select the required value.
3. Press **ENTER** to confirm the new parameter setting or press **ESC** to discard changes.
4. You are returned to the middle window to select and configure another parameter or confirm the settings.
5. Exit the menu.

To store your new settings:

1. Press the **ENTER** button when the middle window is highlighted.
2. You are returned to the upper window to select another relay or exit the menu.
3. Press ESC to exit the menu.

Table 14 lists available relay options.

Table 14: Available Digital Input Options

Label	Parameter	Options	Default	Description
tYPE	Operation mode	UnLt = Unlatched Ltch = Latched PLS.A = Pulse PLS.C = KYZ pulse	UnLt	See *Using Relay Outputs* in *Chapter 4*
Polr	Polarity	nor = Normal (N.O.) InS = Inverting (N.C.)	nor	See *Using Relay Outputs* in *Chapter 4*
PuLS	Pulse width	20-1000 ms	100 ms	The actual pulse width is a multiple of the 1-cycle time rounded to the nearest bigger value. The pause time between pulses is equal to the pulse width.
Src	Pulse source	nonE Ac.Ei = kWh IMP Ac.EE = kWh EXP rE.Ei = kvarh IMP rE.EE = kvarh EXP rE.Et = kvarh TOT AP.Et = kVAh	NONE	Links a pulse relay to the internal energy pulse source. The relay must be set into either pulse, or KYZ mode.
Unit	Pulse rate, kWh/Pulse	0.1-1000.0	1.0 kWh/Pulse	Defines the pulse weight in kWh units per pulse

5.6 Counters Setup

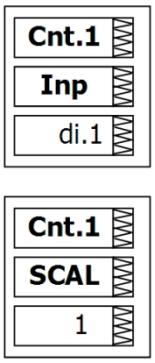

Figure 5.6: Counters Setup

The Counters Setup entry appears only if the Sensor is ordered with the optional digital I/O module.

The PS-EH has four six-digit counters that can count pulses delivered through the device digital inputs with a programmable scale factor. The **Counters Setup** menu allows linking digital inputs to the counters and defining a pulse multiplier for each counter.

To access the Counters Setup menu:

1. Select the **Cnt** entry from the main menu.
2. Press the **ENTER** button.
3. Use the **UP** and **DOWN** arrow buttons to scroll to the required counter.

To select a counter parameter:

1. Press the SELECT button to activate the middle window.
2. Use the UP and DOWN arrow buttons to scroll to the required parameter.

To change the parameter value:

1. Press the **SELECT** button to activate the lower window.
2. Use the **UP** and **DOWN** arrow buttons to select the required value.
3. Press **ENTER** to confirm the new parameter setting or press **ESC** to discard changes.
4. You are returned to the middle window to select and configure another parameter, or confirm the settings.
5. Exit the menu.

To store your new settings:

1. When the middle window is highlighted, press the **ENTER** button.

2. You are returned to the upper window to select another counter or exit the menu.

3. Press ESC to exit the menu.

Table 15 lists available counter options.

Table 15: Available Counter Options

Label	Parameter	Options	Default	Description
InP	Pulse source input	None = disabled di.1 = DI1 di.2 = DI2 di.3 = DI3 di.4 = DI4	None	Links a digital input to the counter
SCAL	Multiplier	1-9999	1	The value added to the counter when a pulse is detected on the pulse source input

5.7 Alarm/Control Setpoints Setup

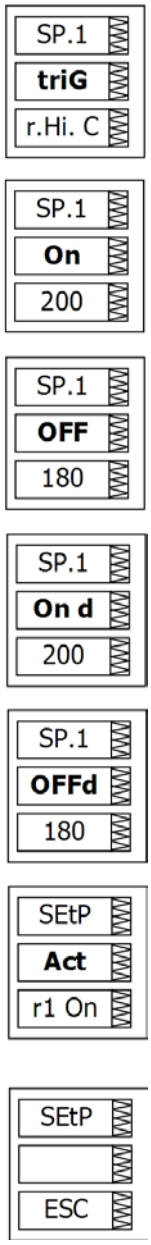

Figure 5.7: Alarm/Control Setpoints Setup

The Power Sensor provides 16 alarm/control setpoints with programmable operate and release delays. For a list of available setpoint triggers and actions, see the **Setpoint Triggers and Actions Manual.**

To access the setpoint setup menu:

1. Select the **SEtP** entry from the main menu.

2. Press the **ENTER** button.

3. Use the **UP** and **DOWN** arrow buttons to scroll to the required setpoint.

To select a setpoint parameter:

1. Press the SELECT button to activate the middle window.
2. Use the UP and DOWN arrow buttons to scroll to the required parameter.

To change the parameter value:

1. Press the **SELECT** button to activate the lower window.
2. Use the **UP** and **DOWN** arrow buttons to select the required value.
3. Press **ENTER** to confirm the new parameter setting or press **ESC** to discard changes.
4. You are returned to the middle window to select and configure another parameter or confirm the setpoint settings.
5. Exit the menu.

To store your new setpoint settings after you configured all setpoint parameters:

1. Press the **ENTER** button when the middle window is highlighted.
2. You are returned to the upper window to select another setpoint or to exit the menu.
3. Press **ESC** to exit the menu.

Table 16 lists available setpoint options. For a list of available setpoint triggers and actions, see the **Setpoint Triggers and Actions Manual.**

Table 16: Available Setpoints Options

Label	Parameter	Options	Description
TriG	Trigger parameter	See Appendix C	The analog or digital value that is used as an argument in a logical expression
On	Operate limit		The threshold (in primary units) at which the conditional expression would be evaluated to true. Not applicable for digital triggers.
OFF	Release limit		The threshold (in primary units) at which the conditional expression would be evaluated to false. Defines the hysteresis for analog triggers. Not applicable for digital triggers.
On d	Operate delay	0-999.9 sec	The time delay before operation when the operate conditions are fulfilled
OFFd	Release delay	0-999.9 sec	The time delay before release when the release conditions are fulfilled
Act	Setpoint action	See Appendix C	The action performed when the setpoint expression is evaluated to true (the setpoint is in operated state)

5.8 Display Setup

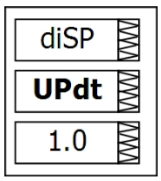

Figure 5.8: Display Setup

The **Display Setup** menu allows configuring options for the Sensor display, or running the Sensor Flash Loader.

To access the Display Setup menu:

1. Select the **diSP** entry from the main menu.
2. Press the **ENTER** button.

To select a setup option:

1. Press the **SELECT** button to activate the middle window.
2. Use the **UP** and **DOWN** arrow buttons to scroll to the required option.

To change the option:

1. Press the **SELECT** button to activate the lower window.
2. Use the **UP** and **DOWN** arrow buttons to select the required option.
3. Press **ENTER** to confirm your changes and to save the new setting or press **ESC** to discard changes.
4. Press **ESC** to exit the menu.

Table 17 lists available options.

Table 17: Display Setup Options

Label	Parameter	Options	Default	Description
UPdt	Display update rate	0.1-10.0 sec	1 sec	Defines the interval between display updates
ScrL	Auto scroll interval	None, 2-15 sec	None	Defines the scroll interval for the main data display or disables auto scroll
rEtn	Auto return to the main screen	diS = disabled, En = Enabled	Enabled	Enables automatic return to the main display if no buttons are pressed for 5 minutes
bAr	Reference load current for LED bar graph	0-10,000A (0 = CT primary current)	0	Defines the nominal load (100%) level for the bar graph display
Uolt	Primary/Secondary volts units	Pri, SEc	Primary	Selects primary or secondary units for volts display
Ph.P	Phase Powers display mode	diS, En	Disabled	Disables or enables phase Powers in the main display

Label	Parameter	Options	Default	Description
Fund.	Fundamental component display mode	diS, En	Disabled	Disables or enables fundamental values in the main display
dAtE	Date order	dnY, ndY, Ynd (d=day, n=month, y=year)	mm.dd.yy	Defines the date order in the RTC display
rSt	Simple reset mode	PASS = password protected En = always enabled	PASS	PASS = the simple reset is not allowed if password protection is enabled En = enables the simple reset buttons regardless of password protection
brGt	Brightness	1-3	3	Sets the LED brightness
diAG	Diagnostic LED	diS, En	Disabled	Enables the diagnostic LED
SoFt.	Flash Loader call	N/A	N/A	Launches the Flash Loader

5.9 Sensor Security

The password in your Sensor is preset to 0 at the factory, and password protection is disabled.

The **Access Control** menu allows changing the user password and enabling or disabling password protection.

To access the menu:

1. Select the **AccS** entry from the main menu.
2. Press the **ENTER** button.

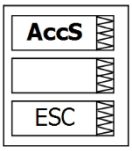

Figure 5.9: AccS Entry

To change the password:

1. Select the **PASS** entry in the upper window with the **UP** and **DOWN** arrow buttons.

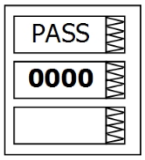

Figure 5.10: PASS Entry

2. Press the **SELECT** button to activate the first password digit.
3. Use the **UP** and **DOWN** arrow buttons to adjust the digit.
4. Press the **SELECT** button to advance to the next digit.
5. Adjust the remaining password digits.
6. Press **ENTER** to confirm the new password.

⚠ The new password is effective for both the display and communication ports.

To enable or disable password protection:

1. Select **CtrL** in the upper window using the **UP** and **DOWN** arrow buttons.

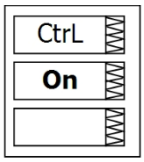

Figure 5.11: CtrL Entry

2. Press the **SELECT** button to activate the middle window.

3. Use the **UP** and **DOWN** arrow buttons to select the required option.

   ON enables password protection and **OFF** disables password protection.

4. Press **ENTER** to confirm your new setting, or **ESC** to discard changes.

5. Press **ESC** to exit the menu.

⚠ When password protection is enabled, you are not able to change the device settings through the display or communications unless you provide a correct password.

If you cannot provide a proper password, contact your local distributor for the appropriate password to override password protection.

5.10 Setting the Device Clock

The **Device Clock** menu allows setting up the device clock and configuring the local time zone settings.

To access the Device Clock menu:

1. Select the **rtc** entry from the main menu.

2. Press the **ENTER** button.

3. Use the **UP** and **DOWN** arrow buttons from the upper window to select a setup option.

To change the time, date, or daylight savings setting:

1. Highlight an item you want to change by pressing briefly the **SELECT** button.

   When you access the time setup display, the hours and minutes are frozen allowing you to adjust the time.

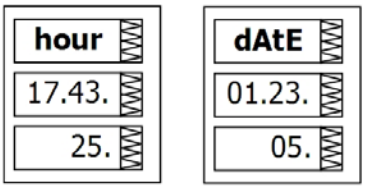

Figure 5.12: hour and dAtE Entries

2. Adjust the selected item with the **UP** and **DOWN** arrow buttons.

3. Highlight the next item to change and adjust in the same manner.

4. Press **ENTER** to confirm your changes or press **ESC** to leave the clock settings unchanged.

   If you confirm the time change while the seconds are highlighted, the seconds are zeroed; otherwise they stay unchanged.

5. Press **ESC** to exit the menu.

Table 18 lists available options.

Table 18: Hour, Date, and Day Options

Label	Option	Format/Range	Description
hour	Time	hh.mm.ss	The time is displayed as hh.mm.ss, where the hours and minutes are shown in the middle window separated by a dot, and the seconds - in the lower window.
dAte	Date	YY.MM.DD, MM.DD.YY, DD.MM.YY	The date is displayed as per the user definition, where the first two items are shown in the middle window, and the last one - in the lower window. See *Display Setup* for instructions on how to select the date format.
dAY	Day of week	Sun = Sunday Πon = Monday tuE = Tuesday WEd = Wednesday thu = Thursday Fri = Friday Sat = Saturday	The day of the week is displayed in the lower window. It is set automatically when you change the date.
dSt	Daylight saving time option	diS = disabled En = enabled	When DST is disabled, the RTC operates in standard time only. When enabled, the device automatically updates the time at 2:00 AM at the pre-defined DST switch dates.
dSt.S	DST start date	Month-week-weekday Week = 1, 2, 3, 4 or L (last week of the month)	The date when Daylight Saving Time begins. The DST switch point is specified by the month, week of the month and weekday. By default, DST starts at 2:00 AM on the first Sunday in April of each year.
dSt.S Hour	DST start hour	1-6	The time when Daylight Saving Time begins.
dSt.E	DST end date	Month-week-weekday Week = 1, 2, 3, 4 or L (last week of the month)	The date when Daylight Saving Time ends. The DST switch point is specified by the month, week of the month and weekday. By default, DST ends at 2:00 AM on the last Sunday in October of each year.
dSt.E Hour	DST end hour	1-6	The time when Daylight Saving Time ends.
SYnC	Clock synchronization input	None di.1 = DI1 di.2 = DI2 di.3 = DI3 di.4 = DI4	The external port receiving the time synchronization pulses.

5.11 Resetting Accumulators and Maximum Demands

The **Reset** menu allows separately resetting minimum/maximum log records, maximum demands, counters and device diagnostics.

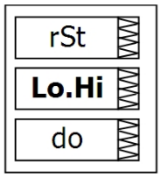

Figure 5.13: Reset Menu

To access the Reset menu:

1. Select the **rst** entry from the main menu.
2. Press the **ENTER** button.

To reset the required registers:

1. Highlight the middle window by pressing briefly the **SELECT** button.
2. Select the required entry by scrolling through the list with the **UP** and **DOWN** arrow buttons until the required entry appears.
3. Press the **SELECT** button briefly to highlight the lower item.
4. Press and hold the **ENTER** button for 5 seconds.
5. Release the button.

   The **do** entry is replaced with **done** showing the operation is complete.

Table 19 shows the Reset Menu options.

Table 19: Reset Menu Options

Label	Description
EnrG	Clears all total energies
dnd	Clears all maximum demands
P.dnd	Clears maximum Power demands
A.dnd	Clears maximum ampere and volt demands
Lo.Hi	Clears Min/Max log
Cnt	Clears all counters
Cnt1 – Cnt4	Clears counter #1-#4
diAG	Clears device diagnostics