

User's Guide

EnergyPro EP600i

6 channel Energy Analyzer



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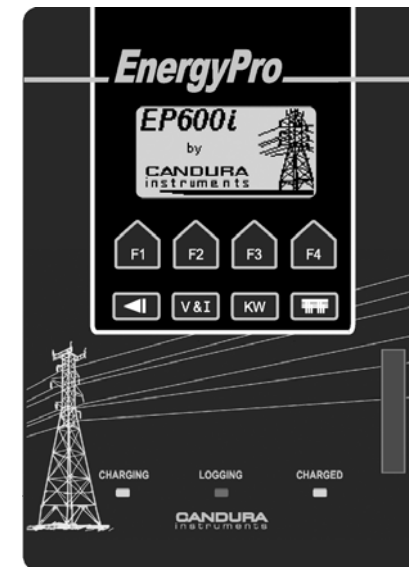
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Introduction

The **EnergyPro** represents leading edge technology in operator interfaces. Data can be viewed in real time on the front panel, or for more detail, CANDURA Instruments' PowerView software can be used to examine data collected by the **EnergyPro**.

The **EnergyPro**:

- Record RMS voltage, current, power (real and reactive), true power factor, energy, THD, harmonics and three phase unbalance.
- Has graphical display.
- CSA certified 600V CAT IV.



The **EnergyPro** is a 6 channel data logger. It monitors 3 phases of voltage and current and calculates the neutral current.

A memory card interface is used to store recorded data on a removable memory card. The **EnergyPro** will not begin a survey without a memory card installed. Once a survey has been started the memory card may not be removed until the survey has been stopped.

Safety

Although this instrument is designed to be as safe as possible, safety is ultimately the responsibility of the operator. This instrument should only be operated by suitably qualified and authorized personnel.

Please read and UNDERSTAND the following information before operating this instrument

- The **EnergyPro** uses a membrane keypad that could be damaged if a sharp object is brought into contact with it.
- Frequently inspect the test leads and the instrument for damage. If the instrument shows any signs of physical damage or functions improperly, it should not be used.
- Never work alone with high voltage circuits. Ensure that a qualified observer is mindful of your activities.
- When performing any measurements involving high voltage circuits, all connections should be made to the circuits while the power is off. To ensure personal safety, the test leads and related connectors should not be handled while the circuit is energized.
- Do not attempt to measure any voltage higher than the maximum rating of 600V RMS. Failure to observe the maximum rating could result in damage to the equipment or personal injury.
- Refer servicing of this instrument to qualified personnel only. Potentially lethal voltages may be present inside the case. If any of the protective circuitry is improperly repaired, the safety of this product could be compromised. Disconnect supply power before servicing.
- Do not expose the **EnergyPro** *directly* to outdoor elements.
- If the unit requires cleaning, use only a slightly dampened towel. Disconnect supply power before cleaning.
- The following international symbol is used on the equipment and in this manual:



See explanation in manual to find out the nature of the potential HAZARD and any actions to be taken.

Firmware Features

Connection Check

Before a survey is started the user can set the voltage and current connections from the hook-up screen (press the  button). See the Hook-Up Configuration section of this manual for more details.

RMS Data Storage

The **EnergyPro** stores RMS data at set intervals which can be adjusted from 1 second to 30 minutes. The minimum, maximum and average values are stored at the end of each storage interval. The averaged values are calculated from the sum of the RMS values (updated every second) over the preceding storage interval. The minimum and maximum values are updated every second over the storage interval.

Power Calculations

The power calculations are updated every second. The average values of power are recorded. Power factor displayed is the true power factor (not the displacement power factor) and is calculated as the ratio of the real power (KW) divided by the apparent power (KVA).

Frequency

The system frequency is measured from the signal on V1 input and is updated every second. The minimum, maximum and average values are stored at the end of each storage interval.

Total Harmonic Distortion (THD)

THD is calculated as the ratio between the square root of the squared sum of the harmonic magnitudes (for harmonics 2...16) divided by the fundamental value. The THD calculations are updated every second. The minimum, maximum and average values are stored at the end of each storage interval. The individual harmonic information is stored with the data and is available for viewing in software.

Three Phase Voltage and Current Unbalance

Unbalance is calculated as the ratio of the negative sequence component divided by the positive sequence component. The unbalance calculations are updated every second. The minimum, maximum and average values are stored at the end of each storage interval.

Firmware Features

Energy Usage Display

The **EnergyPro** displays the total energy usage during the survey. The total KWHR and the average KW/HR are displayed.

Logger Connection

Connection panel



The voltage and current connections are colour coded according to individual phases.

Either clamp CT's or Flex CT may be used to monitor current.

The **EnergyPro** is powered from the voltage between V1 and V2 (between 115V and 600 Vac). If a single phase voltage is being measured then V2 should be connected to neutral in order to receive power from the measured voltage. The **EnergyPro** has an internal battery that will supply power to the instrument when there is no voltage between V1 and V2. The internal power supply will power the instrument when V1-V2 is between 115V and 150V but will not charge the battery. To charge the battery when the voltage is less than 150V the **EnergyPro** must be turned off.

LED Indicators

Green Charging LED indicator

The Green Indicator will come on when the internal power supply is operating.

Red Logging LED Indicator

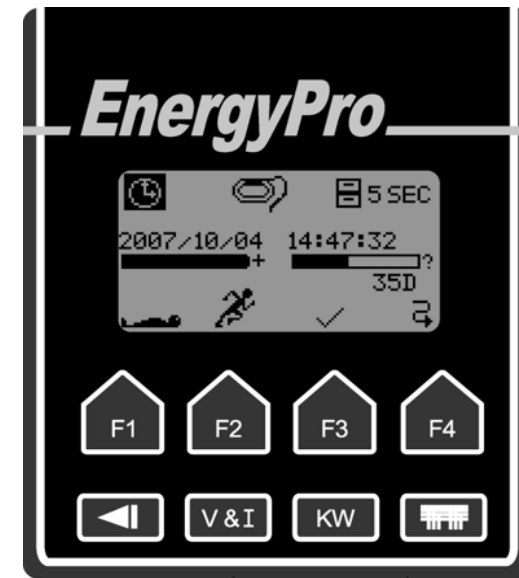
This Red LED will flash when the logger is recording data.

Green Charged LED indicator

This Green LED will come on when the internal battery of the logger is fully charged.

Logger Operation

Main Screen



The main screen of the **EnergyPro** is a collection of icons that provide access to various configuration setup screens. It also displays general status of the logger such as battery charge state, available memory, and logging status.

The top row of keys change function depending on the active screen on the display. In the main screen, the scroll key $\rightarrow$ (F4) is used to navigate the top row of icons on the display. When an icon is highlighted pressing the checkmark key $\checkmark$ (F3) selects the function. This enables setting the time, the CT range (clamp CT only), and the storage rate.

In the middle section of the main screen, there are two status bars displayed below the date and time field. The right status bar indicates memory used, and the left status bar indicates battery charge state. Below the memory status bar is the maximum survey duration in number of days. This number will change depending on the storage rate and memory card size.

Logger Operation

The three icons in the top row of the main screen access the basic configurations of the logger:

-  ▪ Clock icon - Set clock.
-  ▪ Clamp CT icon - Set clamp CT range. This setting must match the clamp range being used.
-  ▪ Not range adjustable, measurement range is 0.2A to 2500A. Flex CT connection is automatically detected when the Flex CT is plugged in.
-  ▪ Filing cabinet icon - Set storage rate,

The main screen displays the CT range and storage rate beside their respective icons. Once a change is made, the value beside the icon will be updated automatically. For changes in storage rate, the maximum survey duration display under the memory status bar will also be updated automatically.

Example: The main screen display shown at the beginning of this section indicates that the logger is set for Flex CT and 5 seconds storage rate. The survey duration is 35 days.

The bottom row of keys have fixed functions:

-  ▪ Return to the main screen.
-  ▪ Display voltage, current, power factor, frequency, THD, and Unbalance.
-  ▪ Display real, reactive and apparent power, total energy consumption (KWHR).
-  ▪ Display the hook-up configuration.

Logger Operation

Turning On and Off

The logger is turned on by pressing any key on the keypad for 1 second. Once the logger is on, a title screen will appear on the display, followed by the main screen.

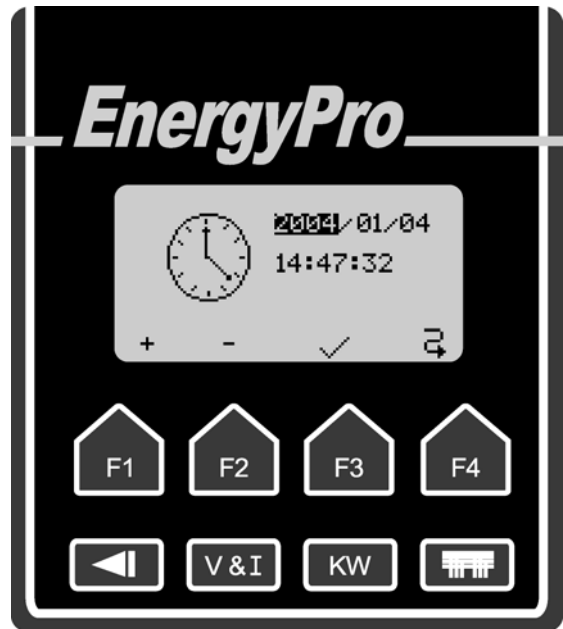
The logger is turned off by pressing the sleep key  (F1) from the main screen.

The **EnergyPro** will shut itself off after 2 minutes of keypad inactivity if it is not recording. While recording the **EnergyPro** will turn off the LCD after 2 minutes of keypad inactivity.

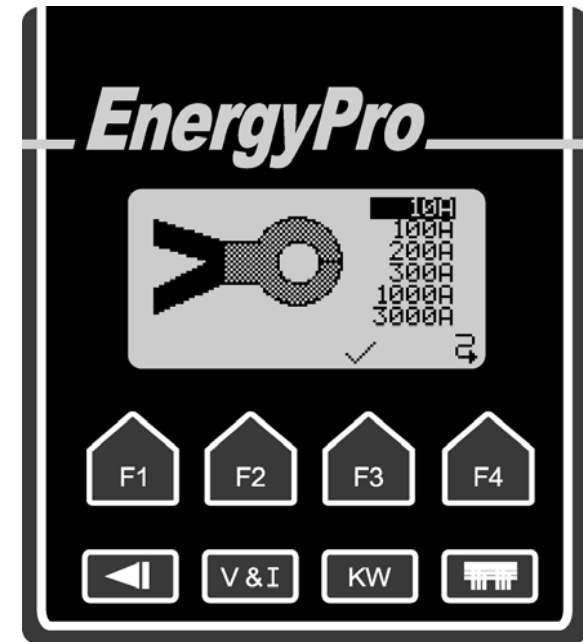
Memory Card

If there is no memory card the **EnergyPro** will not record data and the 'running' icon will not appear on the main screen. When a memory card is inserted the 'running' icon will appear and the **EnergyPro** is ready to record data. When recording is started the **EnergyPro** reformats the memory card and any data from a previous survey will be erased.

The memory card should NEVER be removed while data is being recorded. ALWAYS stop recording before removing the memory card, otherwise data on the card may be corrupted.

Logger Operation**Clock Setup**

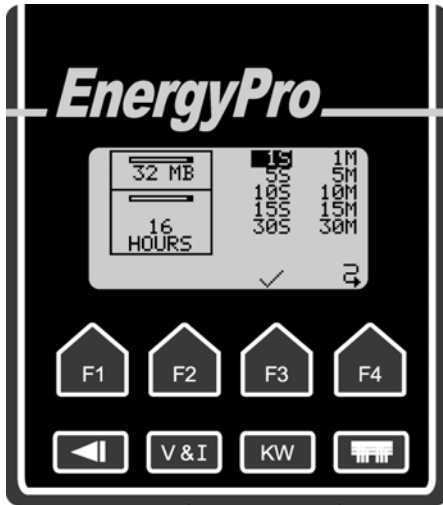
The clock setup screen will appear when the clock icon on the main screen has been selected. The scroll key (F4) is used to scroll through the fields: year, month, day, hour, minute or second. The + and - signs (F1 and F2) are used to increase or decrease the value. Press the checkmark key (F3) to confirm changes and return to the main screen.

Logger Operation**Clamp CT Setup**

The CT setup screen will appear when the CT icon on the main screen has been selected. The scroll function key (F4) is used to select the desired CT range. The checkmark key (F3) is used to confirm the selection and return to the main screen.

Logger Operation

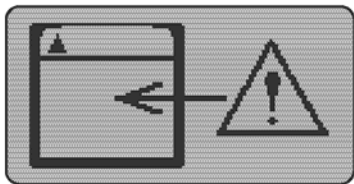
Storage Rate Setup



The storage rate setup screen will appear when the filing cabinet icon on the main screen has been selected. The scroll key (F4) is used to select the storage rate for the survey. The maximum survey duration, displayed in the lower drawer of the filing cabinet, will change when the storage rate is changed. The checkmark key (F3) is used to confirm the change and return to the main screen.

The length of the maximum survey period for each storage rate is calculated based on the size of the memory card. For example, a 1GB memory card can have the following survey durations:

Storage rate	Maximum Survey duration
1 Second	7 Days
5 Seconds	35 Days
10 Seconds	70 Days
15 Seconds	105 Days
30 Seconds	210 Days
1 Minute	420 Days
5 Minutes	999 Days
10 Minutes	999 Days
15 Minutes	999 Days
30 Minutes	999 Days

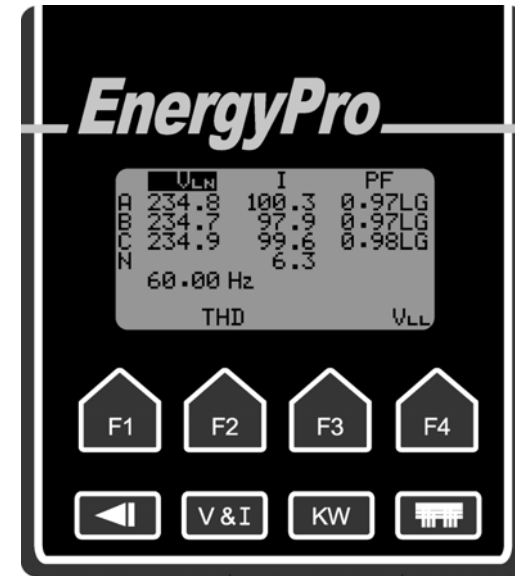


Memory card warning

This graphic will appear if there is a write error or if a memory card not supported by the logger is inserted.

Logger Operation

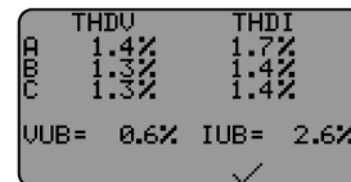
Voltage / Current / Power Factor Display



The voltage/current/power factor screen will appear after pressing the **V&I** button. It displays RMS voltage, RMS current, and power factor for each phase. Switch between Line-to-Neutral voltage (V_{LN}) and Line-to-Line voltage (V_{LL}) by pressing F4. Note that V_{LL} is not present in the 1P2W configuration.

Leading power factor is displayed with "LD" and lagging power factor is displayed with "LG". It also displays frequency and calculated neutral current.

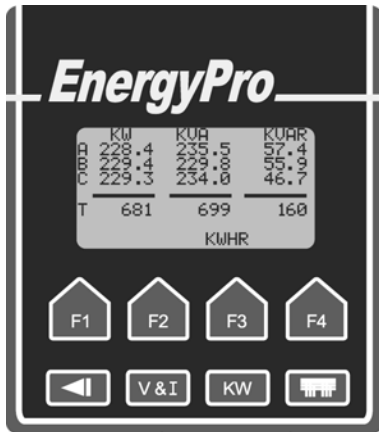
THD / Unbalance Display



THD and Unbalance measurement are displayed by pressing F2 in the V&I screen.

Logger Operation

Power Display



The Power screen will appear when the **KW** button is pressed. It displays real, apparent and reactive power for each phase.

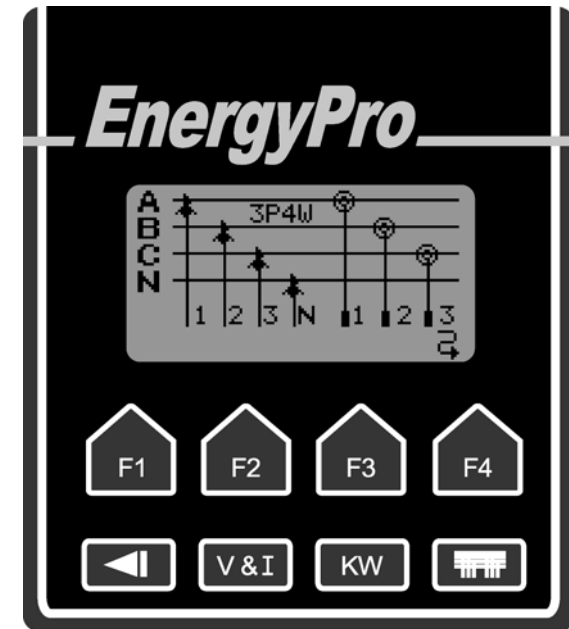


The KWHR key (F3) selects the total energy consumption screen.

The total energy consumption screen is zeroed at the start of each survey. The maximum KWHRs that can be accumulated is 9,999,999 KWHR.

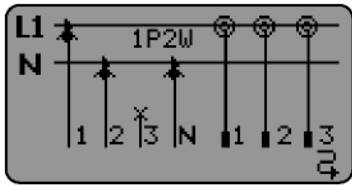
Logger Operation

Hook-up Configurations



The hook-up screen will appear when the **Hook-up** button is pressed. Before a survey is started this screen can be used to set the type of connection. There are five different connection types available: 1P2W, 1P3W, 3P3W, 2.5E and 3P4W. Press 'F4' to scroll through different connection types.

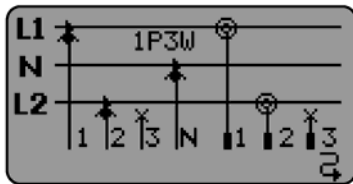
Logger Operation



1P2W

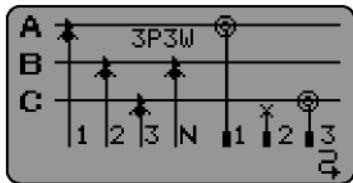
This is for a single phase circuit. The **EnergyPro** assumes that V1 and CT1 (and CT2, CT3 if used) are connected to the same phase. The 1P2W mode allows the use of CT2 and CT3 for monitoring multiple

single phase loads. **V2 is connected to neutral for the internal power supply.**



1P3W

This is for a split phase circuit. Usually 120V from each line - neutral and 240V from line - line.



3P3W

This is a three phase circuit that does not have a neutral (delta system). For direct connection the voltages are connected. A-B (ch1) and C-B (ch3) and the CTs are

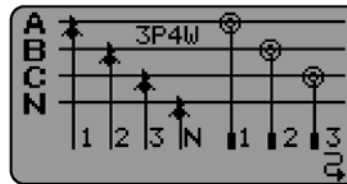
connected to A (ch1) and C (ch3). V_{ca} is calculated from the two voltage measurement and I_b is calculated from the two current measurements.

Note 1. V2 and neutral are both connected to Phase B. V2 is connected for the internal power supply and neutral is connected for measurement purposes.

Note 2. For direct connection in a delta system the 3P4W connection can be used with the neutral connection floating or connected to ground.

Note 3. If the voltage and current inputs are connected to external CTs and PTs, then the external PTs must be connected A-B and C-B and the external CTs connected to A and C. The **EnergyPro** should be configured for 3P3W, V1 connected to A secondary, V3 connected to C secondary, V2 and neutral connected to the PT secondary common.

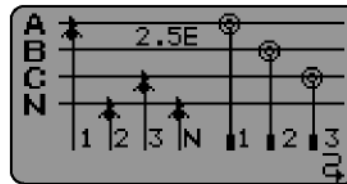
Logger Operation



3P4W

This is for a three phase circuit where three voltages, line to neutral, and three currents are measured. If a neutral connection is not available the neutral input may be left floating or

connected to ground. Line - Line voltage measurements are available on the **EnergyPro** front panel and in software.



2.5E

Used when there are two voltage (line - neutral) measurements and three phase current measurements.

EnergyPro assumes that the two voltage measured are phases A and

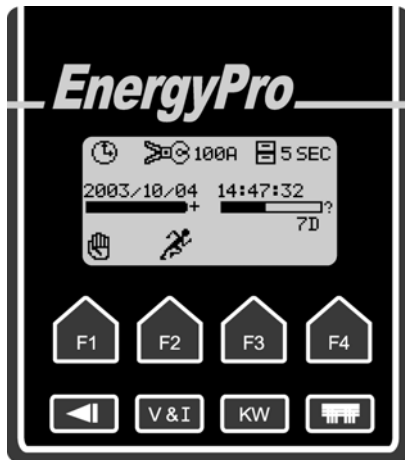
C, and the voltage for phase B is calculated from measurements of phase A and C. **V2 is connected to neutral for the internal power supply.**

Logger Operation

Start and Stop logging

Before logging, make sure that all connections from the voltage leads and current clamps are secured to the **EnergyPro**. Remember to insert a memory card and make sure all configurations are set properly.

To start recording press and hold the F2 key while in the main screen (under the 'running' icon) for 5 seconds. The 'checkmark' icon and the 'scroll' icon will disappear and the 'sleep' icon will be replaced by a 'stop' icon.



The **EnergyPro** starts recording on an even minute. While waiting for the recording to synchronize to the time the 'running' icon will be animated to 'run' on the spot. After the first record is recorded the 'running' icon will be animated to move across the bottom of the screen and the red 'logging' LED will flash.

To stop recording press and hold the F1 key while in the main screen (under the 'stop' icon) for 5 seconds. When the recording has stopped the main screen will return to the normal setup display.

Data Download

Use a memory card reader to open the data file (*.TSE) with PowerView. The data file will be processed and save on the computer. For more details, see manual '**PowerView for EP600**'.

Specifications

Measurement

	Specifications	Comment
V1, V2, V3 0 - 600 VAC	0.5 % of full scale	-
I1, I2, I3 0 - 1V (Clamp) 0 - 100mV (Flex)	0.5% of full scale	CT's are voltage output
Sampling	32 sample/cycle	45 - 65Hz

Recording

	Specifications	Comment
Storage Rate	1, 5, 10, 15, 30 sec or 1, 5, 10, 15, 10, 30 min	-
Memory	32M - 1G removable memory card	Maximum recording duration 18 hours up to 20000 days

Power Supply and Battery Charger

	Specifications	Comment
Internal Power Supply	Input (V1-V2): 100-600 VAC 50-60 Hz, 10.5mA	-
Battery Run Time	48 hours	-

Specifications

Environmental

	Specifications	Comment
Operating Temperature	-20°C to 60°C	-
Humidity	Max 80% relative non condensing	-
Altitude	Max 2000m	-

Safety

	Specifications	Comment
Approval	CAN/CSA-C22.2 No. 61010-1-04	-
	Pollution Degree 2	Normally only non-conductive pollution occurs. However, temporary conductivity caused by occasional condensation must be expected.
	600V CAT-IV	Measurement category IV is for measurements performed in the building installation.

Notes