

Experiments to Try

- Examine the cost of running different wattage appliances.
- Connect a trailing socket to the *Power – Energy – Cost Meter* and switch on a 40 W, 60 W and 100 W bulb in turn and look at the steepness of the energy/time graph i.e. examine the rate at which they use energy.
- Connect a TV and find the running cost. Now put the TV on standby and examine the cost.
- Derive the relationship between current, voltage and power.
- Derive the relationship between power, energy and time.
- How much does it cost to boil water to make a pot of tea? Estimate how much extra water is boiled in a day and not used? How much energy and money is wasted?
- Examine the variation in mains voltage over a few days.

Technical Specifications

Display Quantities

- Voltage: 200 – 255V ac, true RMS, accuracy better than $\pm 1.25\%$.
 - Current: 20mA – 13A, true RMS, accuracy better than $\pm 4\%$ above 100mA.
 - Power: 0 – 3kW, true RMS, accuracy better than $\pm 5\%$.
 - Unit cost: 0 – 99.99 pence or cents.
 - Cost/hr: 0 – 99.99 pence or cents, accuracy better than $\pm 2.5\%$
 - Energy: 0 – 9999.9 kJ, accuracy better than $\pm 2.5\%$
 - Time: 0 – 99999 s, accuracy better than $\pm 0.05\%$
- The software runs on MS Windows 98, 98SE, ME, NT4 with SP6, 2000 and XP.

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The *Power – Energy – Cost Meter* is a micro-controller based instrument. Domestic electrical appliances connected to this instrument can have the following quantities displayed:

- mains voltage (RMS)
- current (RMS)
- power (RMS)
- running cost/hour
- energy consumed
- time since switch-on or since reset

The *Power – Energy – Cost Meter* can be used as a stand-alone instrument or it may be connected to the PC with a serial link if data logging, graphical output and/or analysis are required.

Installing the Software

If you intend to use the *Power – Energy – Cost Meter* with a PC then you must install the ALBA software. Place the CD-ROM in your drive. If the installation does not start type D:\setup.exe from the “run” command in the Start menu (where D is the letter of your CD-ROM drive). Further comments on the ALBA software are on page 7 – Additional Comments section.

Stand - Alone Operation

Connect the mains plug of the unit and switch on. The display will be as shown for 2 seconds then it changes to the next screen:

```
<S>elect mode
then <E>nter
```

The <S> and <E> keys are used by pressing the <S> key to select the option or value that you require then pressing <E> to enter the option or value.

```
Go
                                <S> <E>
```

After three seconds the display changes.

Selecting <S> changes the display.

```
Change Values
                                <S> <E>
```

The values that can be changed are:

- currency: pence or cents
- cost of a unit of electricity

Press <E>nter to change the values.

Currency=Pence
<S> <E>

Press <S>elect to toggle the currency between pence and cents and pence. When it shows pence, press <E>nter, since this is the currency that we wish to work with.

Unit Cost 06.87p
<S> <E>

For the moment leave the cost on the *Power – Energy – Cost Meter* at the value displayed – it may be different from that shown above. Changing the unit cost will be covered later in the manual. Press <E>nter to accept the displayed value.

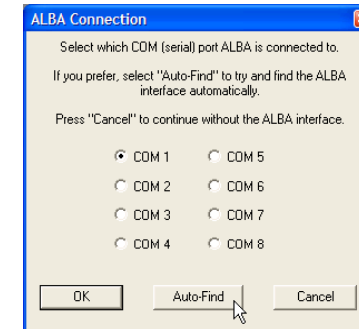
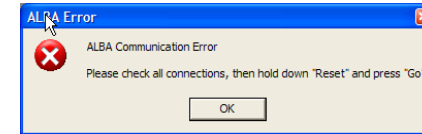
Go
<S> <E>

Since Go is selected press <E>nter. The display then shows the message *Busy, please wait*. After a few seconds it changes to display the RMS Voltage, Current and Power.

V=242V I=0.000A
P=00W <D>

Now connect a 60 W lamp to the *Power – Energy – Cost Meter* and switch it on. Watch as the display updates itself every 5 seconds.

If you run the software without connecting the serial cable to the *Power – Energy – Cost Meter* then you will receive an error message since the instrument cannot be found.



Connect the serial cable and click Auto Find and software will automatically identify which serial port you are using.

Additional Comments

If you are running the ALBA software with any other hardware connected e.g. the ALBA Ranger, the ALBA Interface and Logger etc, then close down the software and re-launch it with the *Power – Energy – Cost Meter* connected.

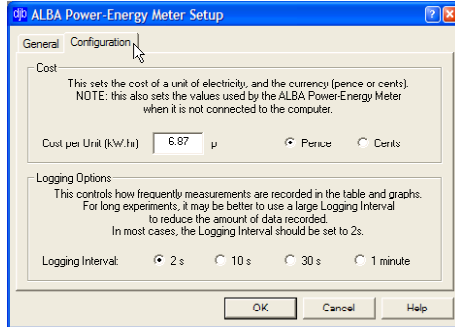
The ALBA software was designed and developed to run with the ALBA Interface and Logger. It is a data capture and analysis package. Data can be entered into blank tables from which graphs can be drawn. If you wish to know more you will find a copy of the ALBA manual in the ALBA installation folder along with demonstration files that are required for the tutorials in the manual.

The *Power – Energy – Cost Meter* is intended for domestic use where the electrical loads are unity power factor. Large inductive and/or capacitive loads will give erroneous results.

Power – Energy – Cost Meter

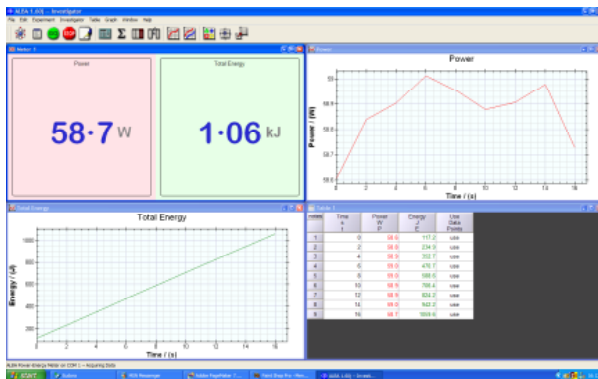
Select the quantities that interest you and how they are to be displayed. Note that any quantities selected for a graphical display will automatically be included in the Table.

Select the Configuration Tab.



The PC reads the currency and cost of a unit of electricity from the *Power – Energy – Cost* Meter. If required, change the values. Any changes made to the currency and cost will be written back to the *Power – Energy – Cost* Meter.

The logging rate of 2s is suitable for most experiments. Only consider changing this value if you are logging over several days. Typical results are shown below.



If the serial cable is disconnected then control automatically passes, after a short delay, to the *Power – Energy – Cost* Meter.

Power – Energy – Cost Meter

Hold down the <D>isplay switch until you see the message Release key.

The cost per hour of running the lamp that is connected to the *Power – Energy – Cost* Meter is displayed on the screen.

```
Cost/hr = 0.41p
          <D>
```

Hold down the <D>isplay key until you again see the message Release key. The screen now displays the cost of a unit (kWh) of electricity.

```
Unit Cost=06.87p
          <S> <E>
```

Hold down the <D>isplay switch until you again see the message Release key. The screen now displays the total Energy consumed and the time since Go was selected.

```
Energy = 610J
Time = 10s <D>
```

Note that the time increments in 5 second intervals. If the lamp is switched off, the time will keep increasing and the total energy will remain at the last displayed value before the lamp was switched off.

Similarly if a different wattage lamp is connected without restarting the *Power – Energy – Cost* Meter then the cumulative energy will be displayed.

To re-cycle through all the display options press the <D>isplay switch as before.

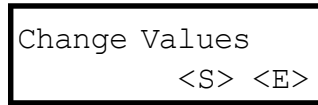
Resetting the *Power – Energy – Cost* Meter

There are two ways to reset the *Power – Energy – Cost* Meter:

- 1) Switch the power to the unit off then on.
- 2) Hold down <S>elect and then pressing <D>isplay - in that order. Note that this works once the user has passed the 'Go' screen.

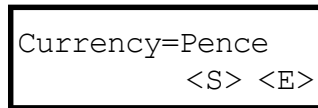
Setting the Unit Cost

Reset the *Power – Energy – Cost* Meter by switching it off and on at the mains switch.
Press the <S>elect switch – the display is now as shown.

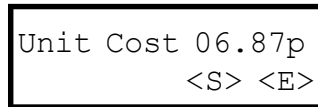


Now press <E>nter to confirm the selection.

<S>elect toggles between pence and cents. Press <E>nter for the currency that you want to use.



The display then looks similar to that shown.



As an example, to change the unit cost to 28.54 pence, carry out the following steps: Press <S>elect once and the 0 scrolls to a '1', press again and it changes to a '2'. Press <E>nter and the cursor moves to the next character on the display. Keep pressing the <S>elect until you see the required digit then press <E>nter. Continue in this way until all four characters are at the required values.

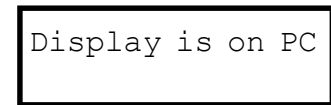
When you are finished this example it is recommended that you return the cost of the unit of electricity to the value charged by your supplier.

Connecting to the PC

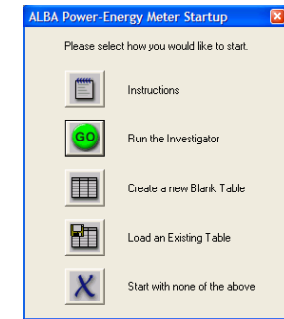
To run the ALBA software carry out the following steps in the following order:

- Switch on the *Power – Energy – Cost* Meter.
- Connect the serial cable between your PC and the *Power – Energy – Cost* Meter.
- Launch the ALBA software – it must be version 1.7 or greater.

The display on the *Power – Energy – Cost* Meter changes.



The display on the PC offers you several choices.



Click the GO icon to run the Investigator. The next screen displays the Setup options.

