

## **15A Power-Mate User Manual**

Congratulations on your purchase of the **Power-Mate**. You can now easily and safely, measure accurately many of the characteristics of the power requirements of a mains operated device. Another bonus is that you can finally have some control over your high electricity accounts. It is now possible to determine the actual running cost of an appliance or even identify a faulty appliance that is using more power than it should.

The **Power-Mate** will accurately measure & calculate to display the following information:

Power: ..... Watts/now..... Watts/peak..... Watts/min  
Voltage: ..... Volts/now..... Volts/peak..... Volts/min  
Current: ..... Amps/now..... Amps/peak..... Amps/min  
Energy: ..... kWh/actual..... kWh/hour..... kWh/quarter..... kWh/year  
Cost: ..... Cost/actual..... Cost/hour..... Cost/quarter..... Cost/year  
Greenhouse Gas: ..... Gas/actual produced..... Gas prod./hour..... Gas prod./quarter..... Gas prod./year

(Please refer to the glossary for an explanation of any terms used in this manual)

The Power-Mate does not use batteries; it uses a small amount of power (<1W) from the outlet it is plugged into.

### **Cautions against electric shock and improper use**

- The Power-Mate is intended for indoor use only.
- Do not use the Power-Mate if the case or cord is damaged.
- Do not use the Power-Mate if it becomes wet.
- Avoid using the Power-Mate in bathrooms or wet areas.
- Use the Power-Mate with sine-wave power sources only ie. mains power or inverters labeled as “pure sine wave”.
- Do not use the unit with “Quasi sine wave” or square wave inverters, as the Power-Mate is likely to be damaged.
- Do not expose the Power-Mate to excessive heat ie. a vehicle in direct sunlight, to avoid damage to the case.
- Do not dismantle the Power-Mate, there are no user serviceable parts inside and a shock hazard exists.

The Power-Mate has a maximum capacity of 15 Amps or 3.6 kilo-Watts. If you are unsure of the power required for an appliance, a power (or current) rating is usually written on the unit’s label or even cast into the plastic or metal of the appliance. Alternatively refer to the appliance’s user manual in the specification section or contact the manufacturer.

Avoid measuring multiple items using multi output power boards, the combined load must be less than 15Amps (3.6kW). Damaging the Power-Mate through overloading will not be covered under warranty. A red overload LED on the front panel will light if the load current exceeds 15Amps. Switch the power off and unplug the appliance from the Power-Mate and investigate. An appliance should not normally cause an overload condition unless it is faulty.

### **Using the Power-Mate**

Simply unplug the appliance to be measured from the power outlet, plug the Power-Mate 3 pin plug, into the outlet, and now plug the appliance into the 15Amp socket of the Power-Mate.

For accurate cost calculation, the Power-Mate must be set to your local kilo-Watt-hour rate. Check your last power account to obtain the rate. If for example the amount is 18.5c per kWh, this may just be referred to as 18.5c per unit but means per kilo-Watt-hour unit.

For some appliances, there are two types of power consumption to consider. One is standby power; the other is running power. For example, any appliance that can be turned on with a remote control uses a small amount of power whilst turned off. Power used when the unit is off is referred to as standby power and will usually be significantly smaller than the power consumed when the unit is turned on.

### **Setting the Rate or GreenhouseGas values**

Press “Mode” repeatedly until “SEtUP?” is displayed. Press “Enter”, the display now shows “rAtE”, press “Enter” again. The edit LED will light green and the rate value is now presented with the first digit flashing. The first digit can be altered with the “+” and “-“ keys, when the digit is correct press “Enter” again and the next digit will flash, continue setting the digits similarly until the rate value is correct, the last press of “Enter” returns you back to “rAtE” in the menu. If “Mode” is

now pressed, “G-Gas” can be entered in the same manner as the rate. When the menu has returned to G-Gas pressing “Mode” will exit back to the main menu.

### **Power-Mate Functions**

Each time the “Mode” key is pressed, the Power-Mate will advance to the next mode. The modes are Power, Cost, Energy, G-Gas, Volts and Amps (CUrr). Extra information is available in each mode by pressing one of the other 3 keys. When in Power, Volts or Amps modes, the Maximum or Minimum values since the test was started can be displayed.

In the Energy, Cost or G-Gas modes, hourly quarterly or yearly values can be displayed. The last two modes are “CLEAR?” and “SETUP?”. When Clear is selected, pressing the “Enter” key clears the totals for time, cost, energy and G-Gas. When Setup is selected, pressing the “Enter” key allows entry of the unit cost for energy (cents/kilo-Watt-hour), and the ratio of energy to G-Gas emission (1.2kg per kWh is a commonly accepted value).

Some appliances (such as mobile phone chargers) consume a very small amount of energy. In the Cost mode it could take many hours before even 1 cent has registered. When checking low power items, the Power-Mate’s display of cents to four digits is very useful and gives confidence that the Power-Mate is measuring.

When measuring low power items (say less than 5 watts) to calculate quarterly or yearly running cost, greater accuracy can be achieved by measuring the consumption for 24 hours. The Cost function will then of course display the actual cost in dollars to four decimal places. Multiplying the 24-hour result by either 91 or 364 will yield cost/qr. or cost/yr.

### **What is Power, Energy etc**

How do the power utilities charge you for their energy? Some of the terms used when discussing Energy are Volts, Amps and Power. Volts are a measure of the potential difference (PD) between two electric wires. This PD gives rise to the ability for current to flow if a load is connected between the two wires. Power is a direct result of the current that flows through the load and the PD that causes the current to flow.

Energy is the amount of power that flows during a given time, the Power-Mate displays energy as kilo-Watt-hours, the same units used by electricity utility companies. The PD for Australian households is 230V AC, although it is commonly referred to using the older term of 240V.

When the power utility produces Energy, a side effect is the production of Greenhouse Gases (G-Gas) which is mainly Carbon Dioxide (CO<sub>2</sub>). The ratio of Energy produced to the amount of CO<sub>2</sub> gas created varies between different generator fuel sources ie Coal, Diesel or Natural Gas. If the ratio of Energy to G-Gas is entered into the Power-Mate, it can display the amount of G-Gas that is created by the energy use of an appliance. The accepted value of greenhouse gas liberated per kilo-Watt-hour, for a fossil-fuelled electricity generator is 1.2kg per kWh. The actual accurate most recent Greenhouse Gas yield per kilowatt hour can be obtained from the Australian Greenhouse Office, Department of the Environment and Heritage at the following web-site address: <http://www.greenhouse.gov.au> in the factors and methods workbook.

### **Other Features of the Power-Mate**

When in Volts or Amps (CUrr) mode, the Power-Mate will display the maximum and minimum voltages or currents recorded whilst in use. This information can be very useful for engineers and service technicians.

The Voltage max and min feature can be used to determine the quality of voltage from the power outlet; a load does not need to be connected for this purpose.

### **Glossary**

Accumulated cost:	The total running cost of the item, from when the test started.
Accumulated time:	The time since the test was started. (Also called run time)
Hourly run cost:	The cost per hour to run the item based on the total power used for the total time of the test.
Quarterly run cost:	The cost per quarter to run the item based on the total power used for the total time of the test.
Yearly run cost:	The cost per year to run the item based on the total power used for the total time of the test.

## Menu Functions

<b>Mode</b>	<b>No Key Pressed</b>	<b>“+” Pressed</b>	<b>“-” Pressed</b>	<b>“Enter” Pressed</b>
Power	Power	Max Power	Min Power	
Cost	Actual Cost	Yearly Cost	Quarterly Cost	Hourly Cost
Energy	Actual Energy	Yearly Energy	Quarterly Energy	Hourly Energy
G-Gas	Actual G-Gas	Yearly G-Gas	Quarterly G-Gas	Hourly G-Gas
Hours	HH : MM : SS			
Volts	Volts Now	Max Volts	Min Volts	
Amps	Amps Now	Max Amps	Min Amps	
Clear?				Enter clears data
Setup?				Enter for setup

## Specifications

<b>Item</b>	<b>Range</b>
Watts	0 – 3,600.0 W
Cost & Cost Hr	0 – 99.9999 \$
Cost Qtr, Yr	0 – 9999.99 \$
Energy	0 – 999.999 kWh
G-Gas	0 – 999.999 kg
Run Time	99Hr, 59Min, 59Sec
Volts	170.0 – 270.0V RMS
Amps	00.000 – 15.000A RMS

Accuracy for all ranges is better than 1%, (typical accuracy is below 0.5%)

Note: A higher resolution model is available which will display an extra decimal point for Watts, Volts and Amps. The higher resolution model can display: 10 milli-Watts, 10 milli-Volts and 100 micro-Amps.

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# Energy Auditors Guide to the PowerMate

The PowerMate is a very useful energy-auditing tool, and is one of the key components of the Energy Auditing Toolkits that are available through Energy SA's Energy Friends Program. As an auditing tool, the PowerMate is particularly useful for measuring the amount of power drawn (wattage) by an electrical appliance; recording its electricity consumption, running costs & greenhouse gas emissions; and estimating its hourly, quarterly and yearly electricity consumption, running costs and greenhouse gas emissions.

This guide has been developed to assist Home Energy Auditors to understand the Power-Mate and to use it effectively. It is not intended to replace the PowerMate User Manual. You should read the PowerMate User Manual before using the Power-Mate. The Guide consists of 3 sections:

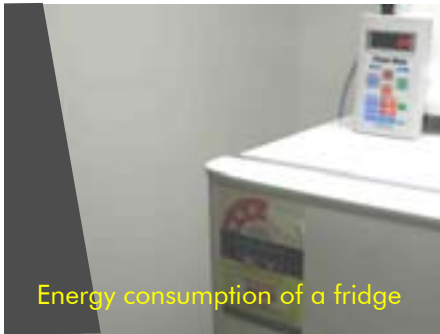
- Summary of PowerMate modes.
- Correctly estimating energy consumption, running costs and greenhouse gas emissions.
- Scrolling through the features for the first time.

## SUMMARY OF POWERMATE MODES

Mode	Units	When in "default mode"	After you press "+"	After you press "-"	After you press "ENTER"	Display Range
Power	Watts (W)	Instantaneous power draw (W)	Maximum power recorded during "run-time" (W)	Minimum power recorded during "run-time" (W)	N/A	0 – 2,500.0
Cost	Dollars (\$)	Cost of electricity consumed over "run-time" (\$)	Estimated yearly running cost (\$/year)	Estimated quarterly running cost (\$/quarter)	Estimated hourly running cost (\$/hour)	0 – 99.9999 (accumulated & hourly cost) 0 – 9999.99 (quarterly & yearly cost)
Energy	Kilowatt-hours (kWh)	Accumulated electricity consumption over run-time (kWh)	Estimated yearly energy consumption (kWh/year)	Estimated quarterly (kWh/quarter)	Estimated hourly (kWh/hour)	0 – 999.999
G-Gas	Kilograms of Carbon Dioxide equivalents (kg CO <sub>2</sub> -e)	Estimated greenhouse gas emissions resulting from electricity consumed over run-time (kg CO <sub>2</sub> -e)	Estimated yearly greenhouse emissions (kg CO <sub>2</sub> -e/year)	Estimated quarterly greenhouse emissions (kg CO <sub>2</sub> -e/ quarter)	Estimated hourly greenhouse emissions (kg CO <sub>2</sub> -e/hour)	0 – 999.999
Volts	Volts (V)	Instantaneous voltage of incoming electricity (V)	Maximum voltage recorded during "run-time" (V)	Minimum voltage recorded during "run-time" (V)	N/A	170.0 – 270.0
Current	Amps (A)	Instantaneous current (A)	Maximum current recorded during "run-time" (A)	Minimum current recorded during "run-time" (A)	N/A	00.000 – 10.000
Hours	Hours:Minutes:Seconds	The "run-time" (Hr:Min:Sec)	N/A	N/A	N/A	00:00:01 – 99:59:59
Clear	N/A	N/A	N/A	N/A	Clears the meter	N/A
Setup Rate	N/A	N/A	N/A	N/A	Allows you to edit electricity tariff & greenhouse coefficient	N/A

## THE MANY USES OF THE POWERMATE

The PowerMate can be used to measure many things, some examples include the...



Energy consumption of a fridge



Standby wattage of a microwave



Operating wattage of a TV

## ESTIMATING ENERGY CONSUMPTION, RUNNING COSTS AND GREENHOUSE GAS EMISSIONS

### Understanding how estimates are made

The Power-Mate measures the amount of electricity consumed in kilowatt-hours ("kWh") over the time it has been measuring a particular appliance (the "run-time").

This figure is then;

- extrapolated to estimate hourly, quarterly or yearly electricity consumption (in kWh), or
- multiplied by the inbuilt electricity tariff & then extrapolated to provide estimates of hourly, quarterly or yearly running costs in (\$), or
- multiplied by the inbuilt greenhouse coefficient & then extrapolated to provide estimates of hourly, quarterly or yearly greenhouse gas emissions.

Note: The PowerMate does not estimate energy consumption, cost or greenhouse gas emissions based on the instantaneous wattage drawn by an appliance as some other appliance meters do.

### Things to bear in mind when making estimates

It is important to understand how the PowerMate estimates these figures because it affects how you use it on certain appliances and in certain situations. In particular;

- in order to get an accurate consumption/cost/greenhouse estimate for appliances with a **variable power-draw** (such as fridges, air-conditioners and other thermostatically controlled devices), the PowerMate must be connected to the appliance long enough for it to record several on-off cycles. In the case of a fridge, 24 hours or more is ideal to account for daily variation, but 6 hours would give a rough estimate. Please note that this doesn't take into account seasonal variations (i.e. summer to winter).
- Accurate estimates for appliances with a **constant power-draw** (such a TV in standby mode, a table lamp, a fan-heater or a bar-radiator) can usually be made within a few seconds.
- You need to 'clear' the Power-Mate if you want to **estimate consumption for the same appliance in different operating modes**. E.g. If you install

the meter on a television, and want to measure the annual running cost in standby mode and then the hourly running cost in operating mode, you need take the measurements whilst on standby, then turn the TV on, then clear the meter, and then take the measurements in operating mode. If you don't clear the meter, the energy, cost and greenhouse estimates will combine the time spent in operating mode and the time spent in standby mode.

### Setting the electricity tariff?

The Power-Mate is set to a default electricity tariff of 18.00 cents/kWh. Please refer to the 'Setting the Rate or Greenhouse Gas Values' section of the manufacturer's User Guide for instructions on how to check and change the settings.

Many SA households are on the AGL default contract, so you may wish to change the electricity tariff to 19.00 cents/kWh, which is the average tariff across the whole year. However, when measuring air-conditioners and other 'summer' appliances, you may want to use the summer tariff of 20.59 cents/kWh, and similarly for heaters and other 'winter' appliances, you may want to use the standard tariff of 18.54 cents/kWh.

For households purchasing electricity from other retailers, you may need to find out the current tariff from their electricity bill. Note: Don't forget to include GST in order to get an accurate reflection of the real cost.

### Setting the greenhouse coefficient?

The Power-Mate is set to a default greenhouse co-efficient of 1.000kg CO<sub>2</sub>e/kWh. Please refer to the 'Setting the Rate or Greenhouse Gas Values' section of the manufacturer's User Guide for instructions on how to check and change the settings.

The greenhouse coefficient for mains electricity in South Australia as of September 2004 is 0.960kg CO<sub>2</sub>e/kWh (Source: Australian Greenhouse Office).


## SCROLLING THROUGH THE FEATURES FOR THE FIRST TIME

### Scrolling through the basic modes




1. Plug the appliance into the Power-Mate socket and turn the appliance on.  
The screen will show the power drawn by the appliance at that moment, measured in watts (W). The meter can measure appliances up to 2400 watts. The word "POUEr" flashes up on the display every 5 or so seconds to indicate the meter is in the **Power** mode. The values will change as the appliance draws more or less power.




2. Press   
"COST" will flash across the screen to indicate the meter is in **Cost** mode.  
The screen shows the cost of electricity consumed over the run-time in dollars (\$). This is automatically calculated by multiplying the amount of electricity consumed (kWh) by the electricity rate or tariff (\$/kWh) that the meter is set at. This is an accumulative figure and will increase the longer the meter is left running on the appliance.




3. Press   
You are now in **Energy** mode and "EnErGY" will flash across the screen to indicate so.  
The screen shows the actual amount of electricity consumed over the run-time, in kilowatt-hours (kWh). Similar to the cost function, this is an accumulative figure.




4. Press   
You are now in **Greenhouse Gas** mode and "G GAS" will flash across the screen.  
The screen shows the estimated volume of greenhouse gas produced at our local power stations in order to generate the electricity consumed by the appliance. It is shown in kilograms of carbon dioxide equivalent (kg CO<sub>2</sub>e). Like Energy and Cost, it is an accumulative figure. The calculation is based on the amount of electricity consumed and the greenhouse co-efficient that has been set into the meter.




5. Press   
The display now shows **Voltage** in volts (V) and "Volts" should flash across the screen.  
Mains electricity is typically around 240V (AS60038 specifies 216V–253V as acceptable voltage range). This is an instantaneous value and so can vary over time.





6. Press   
The display now shows **Current** in Amps (A), and "Curr" should flash across the screen.  
Like power and voltage, this is an instantaneous value.





7. Press   
"Hours" will flash up to indicate that the meter is in **Time** mode.  
The display now shows the how long the meter has been recording in **hours: minutes: seconds**, and is referred to as the "run-time". The run-time commences as soon as the meter is installed on an appliance, or as soon as it is cleared. During the run-time, the meter records accumulated **cost, energy** and also the **greenhouse gas** values, **minimum and maximum power, voltage** and **current** values.  
The meter can record for a total of 99 hrs: 59 mins: 59 secs.



8. Press   
The word "CLEAR?" will appear and stay on the screen (**Reset** mode).  
Pressing  will reset the meter so that it starts recording again.  
The time will restart from 00:00:00, and all recorded values will be cleared.



9. If you cleared the meter, the meter will have automatically scrolled to **Set-up** mode and the word "SETUP?" will be displayed. If not, press   
When in set-up mode, the electricity tariff and the greenhouse co-efficient can be changed.  
Please refer to the manufacturers User Guide for instructions on how to do so.  
Press  to return you to **Power** mode.

## Viewing figures for Minimum/Maximum Power, Voltage and Current

In **Power**, **Voltage** and **Current** modes, the Power-Mate stores the maximum and minimum value recorded during the run-time. Follow the instructions below to view the minimum and maximum value in **Power** mode, and simply repeat Steps 1 and 2 when in **Voltage** mode or **Current** mode to display maximum and minimum values.



1. In **Power** mode, press   
The term "P Hi" will flash up, followed by the **Maximum Power** recorded during the run-time.  
After 3 or so seconds, the term "POUEr" will flash up and the screen will return to instantaneous **Power** mode.




2. Similarly, press   
The term "P Lo" will flash up followed by the **Minimum Power** recorded during run time.  
The screen will return to instantaneous **Power** mode after 3 or so seconds.

## Viewing Yearly, Quarterly and Hourly Estimates for Cost, Energy and Greenhouse Gas Emissions

In **Energy**, **Cost** and **Greenhouse Gas** modes the Power-Mate can estimate yearly, quarterly and hourly amounts. Follow the instructions below to view the yearly, quarterly and hourly value in **Cost** mode, and then repeat steps 1 to 3 when in **Energy** and **Greenhouse Gas** modes:



1. When in **Cost** mode, press   
The term "C YEAr" will flash up, followed by an estimated **Annual Running Cost** (in \$/year).  
After 3 or so seconds "COSt" will flash up and the PowerMate will return to accumulated **Cost** mode.



2. Press   
"C Qtr" will flash up, followed by estimated **Quarterly Running Cost** (in \$/quarter).  
After 3 or so seconds "COSt" will flash up and the PowerMate will return to accumulated **Cost** mode.



3. Press   
"C Hour" will flash up, followed by estimated **Hourly Running Cost** (in \$/hour).  
After 3 or so seconds "COSt" will flash up and the PowerMate will return to accumulated **Cost** mode.

### <<< WARNING >>>

Please read the manufacturers User Guide before use. This guide is not intended to replace these instructions.

Please take care to avoid injury or damage when using the Power-Mate.

Turn power off at the wall before connecting or disconnecting the meter. Do not touch any damaged appliance plugs or frayed leads: advise the householder that they should be disposed of or repaired by a qualified electrician. Take care if moving appliances to access the plug and remember to turn the fridge back on!

### <<< DISCLAIMER >>>

Energy SA accepts no responsibility for the safety or accuracy of the Power-Mate or of any estimates of savings of electricity for the use of appliances derived from readings of the Power-Mate. Any such savings may vary depending on circumstances, including the level of use of particular appliances.