

# Energy / Power Meter

## Digital



**LB1829-001 Low Voltage**

### Description:

The IEC **Energy/Power Meter** is specially designed for use in the classroom. It is powered from 220/240V.AC. 50/60Hz mains and is fitted with a removable flexible mains cable for ease of storage.

It can be connected into circuit with any low voltage AC or DC experiment to measure accurately the energy (in Joules) or power (in Watts) consumed or liberated by the experiment. An analogue output of 0-10V.DC. is provided for plotting or logging.

Press button operation for setting the mode from Energy to Power and for setting the range from amps to milliamps (the current flow expected). Small LED indicates the mode and range selected.

The instrument is protected against overload by electronic circuitry and a red LED indicates the condition. A press button is provided for resetting the 'overload'. A press button is supplied for forcing the display to zero to start an experiment.

An 'offset' control permits the removal of very small errors that might be computed by the circuitry and to null any drift that might be evident.

Length: 238mm	Width: 140mm	Height: 110	Weight: 1.63kg
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## Using the Instrument:

### The MODE button:

This selects to read either Energy in Joules or Power in Watts. In the case of Energy, the display accumulates with time and the display shows the unit being measured. The reading will auto-range over 3 decades, the unit (mJ, J, mW, W) will alter and the decimal point will shift automatically in the display. The tables on page 3 show the shunt ratings and the auto-ranging limits.

**Note:** If the display unit is changed from watts of power to joules of energy, the joules count will always begin at zero joules.

### The RANGE button: (selects current shunts)

This selects the current rating to suit your load requirements. As the button is pressed, notice the small LEDs indicating the current range. If you are performing an experiment where a heavy current will pass, select the 10A shunt. If the current exceeds the shunt rating by more than about 10%, the instrument will shut down and self protect so that internal current shunts cannot be damaged by overload.

### The ZERO button:

Before the experiment is performed, there will probably be numbers present in the digital display. The ZERO button forces the display to read zero. Refer also to information on the OFFSET control.

### The O/LOAD button:

When the current through any selected shunt exceeds the rating by about 10%, the overload protection open circuits the load to protect the shunt from damage. A small red LED indicates the overload condition. This button resets the automatic overload protection and reconnects the external circuit.

### The OFFSET control: (rotary knob)

When voltage only is applied to the INPUT sockets from your low voltage power source there should be no watts or energy value on the display. However, a slow energy count or a small wattage might be evident on the display. This error count must be stopped by carefully turning the OFFSET control in the required direction. When the error count is stopped, the display is reset to zero by pressing the ZERO button.

### The SOCKETS: (input, output & monitor)

The INPUT sockets are connected to the low voltage power source that is to be used for the load. The power source can be either AC or DC. Blue and black colours are used for the input terminals because polarity is not important. The INPUT and OUTPUT terminals of the same colour are common, that is, they are joined together internally.

**Note:** The maximum voltage ratings on the instrument. Do not use a power source of a higher voltage. The OUTPUT sockets are connected to the load under test.

The MONITOR sockets are polarised + and - and can be connected to a recorder or oscilloscope to monitor Watts. On all ranges, 10V.DC. at these terminals represents the maximum Watts of that range as indicated on the front panel. For example: If the 1A shunt is selected, then at 20 Watts reading on the display, the Monitor output will be 10V.DC.



### The Ranges of Energy and Power:

The following table lists the Energy and the Power that can be measured on each shunt selected. Note that each shunt's current range is provided with a 3 step auto-range for Energy.

SHUNT	ENERGY	STEPS	POWER
1mA	999.9mJ by	0.1mJ	20.00mW
	9.999J by	1mJ	
	99.99J by	10mJ	

Auto-ranges three times from 0.1mJ to 99.99J

SHUNT	ENERGY	STEPS	POWER
10mA	9.999J by	1mJ	200.0mW
	99.99J by	10mJ	
	999.9J by	100mJ	

Auto-ranges three times from 1mJ to 999.9J

SHUNT	ENERGY	STEPS	POWER
1A	999.9J by	100mJ	20.00W
	9.999kJ by	1J	
	99.99kJ by	10J	

Auto-ranges three times from 100mJ to 99.99kJ

SHUNT	ENERGY	STEPS	POWER
10A	9.999kJ by	1J	200.0W
	99.99kJ by	10J	
	999.9kJ by	100J	

Auto-ranges three times from 1J to 999.9kJ

### Operation of Instrument:

Connect the mains cable of the Energy/Power meter to a 220/240V.AC power source. Display should illuminate.

#### Select ENERGY or POWER by the MODE button.

In the display, observe the unit change as you select either Energy or Power units.

Select the shunt milliamps / amps RANGE to suit your circuit. Connect the low voltage power source to the INPUT sockets. Polarity of connection is not important. At this time there is zero current flowing and, if Power is selected the display should be reading zero and if Energy is selected, the display should not be accumulating. Rotate the OFFSET control to be sure the above conditions are met. Then press ZERO button to zero the digital display. Now connect your external circuit to be measured.

If POWER is selected, the Watts dissipated in the load will be updated each second.

If ENERGY is selected, it accumulates and the units of measurement will show in the display.

To finish an experiment, TURN OFF the power source to the INPUT sockets or UNPLUG one of the cables to the INPUT or OUTPUT sockets.

### Basic Theory: Power and Energy.

Power in Watts is the product of Volts and Amps. It does not relate to time, so the reading on the display indicates Watts of the load at any moment and the display is updated each second.

Energy in Joules is the product of Power (in watts) and Time (in seconds). It is the accumulation of power over time and the display can be seen to count up as time passes.

1 Joule = 1 Watt Second.



## Experiments:

### Examples That Can Use The Energy / Power Meter:

- 1) **Joule's Calorimeter.** This is a classic use because the name Joule is the unit of energy. The Energy Meter is used to measure the electrical energy passing into the water to raise the temperature the required number of degrees.
- 2) **Energy stored in a capacitor.** A capacitor is charged from a power source through the meter and then, using the capacitor as the power source, the capacitor is discharged through the Energy Meter. The energy stored in the capacitor can be compared with the energy used during the charging. The stored energy can be checked against the calculation of capacitance in microfarad and voltage applied.
- 3) **Measure the energy used by a motor** to do work in lifting an object from the floor to the bench top. Calculate the energy theoretically then calculate the efficiency of the motor.

## Features of the IEC Energy / Power Meter:

### Reliable:

The unit is complete with electronic current overload protection and indication of overload fault.

### Useful:

It can measure energies and powers over a large range from 0.1mJ to 999kJ and 0.01mW to 200W. Circuit currents can be as low as 0.01mA up to 10 amps. Frequency can be from 1kHz to 50Hz and DC. Voltage can be up to 15V.AC. or 20V.DC. maximum.

### Easy To Use:

For simplicity there are only four press buttons and, to avoid confusion and the need for calculations, the exact unit being measured is always visible in the display.

### Intelligent:

As the digital reading increases, the instrument changes its range automatically and the decimal point and the unit being measured changes as required. The display is always showing the correct value and unit.

### Versatile:

The unit reads either Energy in Joules or Power in Watts. Special output sockets permit the plotting of the Power against time on a chart recorder or monitoring Watts on an oscilloscope. When plotted, the Energy can be calculated as the area under the graph (Joules = Watts x Seconds).

### Safe:

Designed to measure only low voltage external circuits for student safety in the classroom.

### Compatible:

The advanced model Energy Meter (LB1829-002) is similar to the standard model but it has extra sockets on the rear panel to power and run the IEC Slave Display (LB1675-001) for classroom viewing and also provides a computer serial interface.

Designed and manufactured in Australia