

Energy Measurement Using a Single-Phase Meter

The “Multicomp Pro” single-phase meter is a handy device that can be used to measure the power and energy consumption of computers, docking stations and items of lab equipment that use a standard UK 3-pin plug. The meter plugs into the wall socket and the piece of equipment plugs into the meter.



Figure 1: Picture of single-phase meter

How to use it

The meter can measure power (W), current (A), voltage (V) and energy (kWh). What we are interested in is the energy consumption over time, so the meter should be set to kWh as shown in figure 3 below. This can be done by repeatedly pressing the “Function” button until you see “KWh” on the screen. Note that the single-phase meter always appears blank unless plugged into a socket and the socket switched on.

If the intention is to measure a collection of items, then you can use a multi-way extension block to connect them altogether and plug the extension into the meter (note that the maximum limit of a collection of items is no more than 13 A / 3 kW and sometimes less if the extension lead has a lower limit). A computer setup for researchers might be two monitors and a laptop or two monitors and a desktop CPU box and if desired these could be measured together through a multi-way extension and one meter.



Figure 2: Single phase meter measuring power (W)



Figure 3: Single phase meter measuring energy (KWh)

Periodicity of readings ⓘ

It is advised to take readings four times a week in a pattern like this:

- Monday morning
- Monday evening
- Tuesday morning
- Friday evening

The thinking behind this pattern is so that we can determine:

- The energy consumption for a working day (Monday in this case), which is determined by subtracting the reading on Monday morning from the reading on Monday evening
- The overnight energy usage (Monday night in this case), which is determined by subtracting the reading on Monday evening from the reading on Tuesday morning
- The energy usage for a full working week, which is determined by subtracting the reading on Monday morning from the reading on Friday evening
- The weekend energy usage, which is determined by subtracting the reading on Friday evening from the reading on Monday morning of the following week

The above measurement of “full day” is actually not 24 hours, but rather a working day (something like 9am-6pm). To understand how much is saved by fully powering down a computer or similar item when not in use, it may be helpful to measure each morning and evening to generate overnight consumption of each night.

Tips along the way

It is advisable to measure for 3-4 weeks to observe the weekly pattern and get an assurance that the weekly pattern is consistent.

What we have learned from monitoring some computers in Department of Electrical and Electronic Engineering.



1. Computers of different ages have quite different energy consumption sleep or standby modes.
2. Typically, older computer setups use about 4.77 kWh weekly and 0.76 kWh daily, which amounts to approximately 2.7 times as much energy as the newer ones, which consume about 1.76 kWh weekly and 0.27 kWh daily with a lot of the difference attributed to higher energy consumption in standby mode.
3. Although older desktop computing equipment has higher standby power, one has to bear in mind that replacing it causes a large volume of emissions from manufacturing and shipping the new item which will show up in Imperial's Scope 3 emissions. It is probably better to carry on using the old computer until the end of its useful life but make sure that it is shut down completely when not in use.