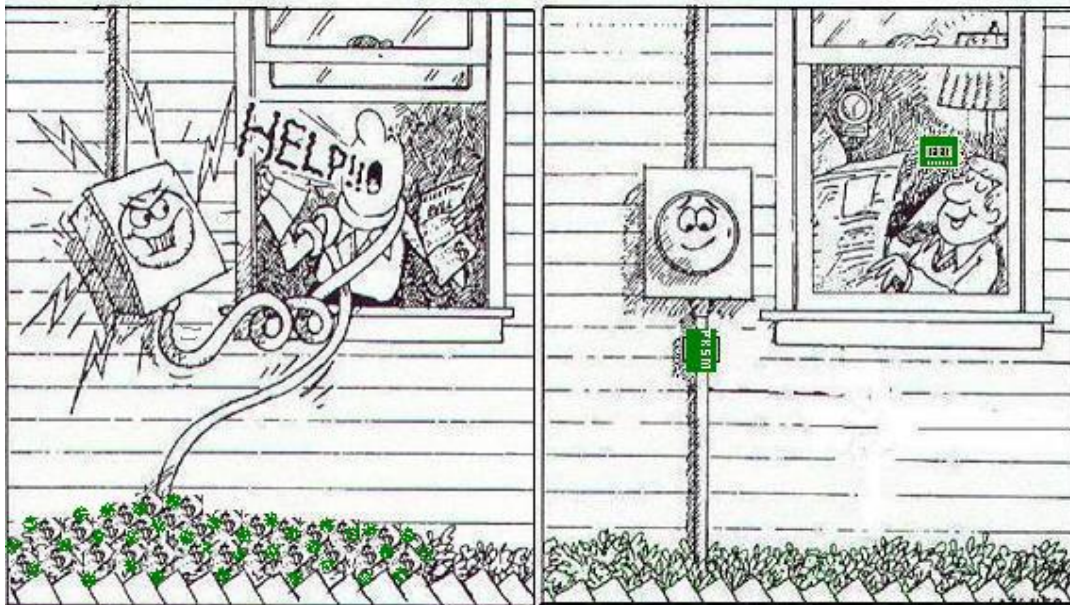
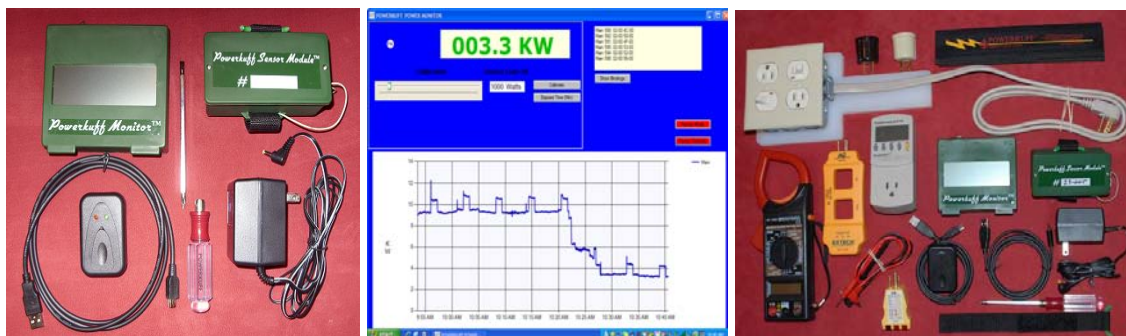


POWERKUFF MONITOR SYSTEM® PKMS1.8/ 3.6 Owners and Teachers Manual

Powerkuff LL has created and patented an easy to install sensor and energy monitoring system to audit your home or small business. This equipment is also designed to be a tool for energy audits and energy teaching curriculum. See www.powerkuff.com.



BRING YOUR POWER METER INSIDE AND SAVE 20% BY USING THE POWERKUFF MONITOR TO CONTROL YOUR ELECTRIC USE AT HOME!



Powerkuff Monitor \$99.95 Powerkuff Teaching System \$259.95

A safe and simple teaching aid which will foster an understanding of basic principles of electricity and allow teacher and student to explore energy use, energy audits and conservation concepts. Please read this manual carefully before using the equipment.

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INTRODUCTION

The Powerkuff monitor is a remote electric power monitoring system which you can install without special tools or licenses. You simply place the sensor module on the wire which brings electricity into the (14-3) extension cord or in from the home or small business electric meter using the hook and eye strap.



The Powerkuff monitoring system is designed with the latest Cypress wireless technology to allow you to walk around the classroom or home with the monitor in hand and see the amount of electric power that each light bulb or small appliance is using. Knowing the scale of electric consumption is the first step in understanding electric usage and therefore conservation.

Once you get a feel for the information that streams from the Powerkuff display you will gain a greater understanding and control of your electricity and be able to apply the skills learned to home and school energy audits. The new energy auditors will report power consumption based on observation they make. They will learn to run the house at an efficient level of consumption and understand wasteful and unsafe appliances.

The Powerkuff monitor measures total electric power traveling in the 14-3 extension cord or the large service entrance cable which feeds the home or business. Powerkuff will report power flowing in both directions, so you can use it with solar panels and an AC windmill. You can monitor the wire coming from the meter or in the conduit.



If you see 000.8 on the monitor your home is using 0.8 kilowatts or 800 watts of power right then. The Powerkuff monitor system is not a billing meter nor was it designed to be. Powerkuff monitor is more like an electric speedometer for the home or small business and tells you how fast you are using electric power.

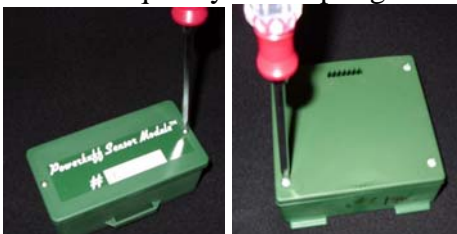
Powerkuff monitor system consists of the following:

- A) POWERKUFF display unit (stand up or wall mounted) uses 3 AA batteries (not included), USB cable to link it to your computer or 120 volt wall plug.
- B) POWERKUFF Sensor Module uses 3 AA batteries (not included), hook and eye strap, external power supply 4.5 volt with wall plug and weather cap with tether. Double ended Powerkuff screw driver and this manual.
- C) Access to free software on www.powerkuff.com .

LET'S GET STARTED:



- A) Check that all the parts are present.
 B) If you want to use the Powerkuff on battery power then remove the sensor and display back covers. Battery power is only good for one or two days because of the frequency of sampling.



- C) Install three AA batteries (not included) in the display unit. **Make sure they are seated with good contact.**



- D) Turn on the switch on top of the display. If you are using battery power and there is good contact the display will illuminate and show 8888, 0 or 1 then 3.6.
 E) Install three AA batteries in the sensor module and watch the display. The display will show bind then o00.0 once the two units have bound.
 F) Close the battery covers and **finger tighten** the screws (**do not over-tighten**).



- G) If you prefer to use the Powerkuff plugged into 115 volt electric power then you have the option of using batteries or not. Battery power will only be used when the switch on top of the display unit **is turned on** and the USB cable **is not powered** and plugged in. Both the display and / or the sensor unit will operate without installing batteries if you use their respective external power supply. Make sure you have a

good connection for the external or battery power by getting the bind response on the display. If no bind shows up, roll the plug 180 degrees and wait for the bind signal.



H) Place the sensor module and the display unit about three to six feet apart for one minute so they may bind electronically. **When you turn on the display with the switch on top (battery) or power it up with the USB cable it will show 1, then 3.6. When you turn on the sensor with batteries or the external power supply the display will show “bind”, then 000.0. If signal is coming from the sensor the first zero will flip up and down every second. If power is sensed then the numbers will start appearing. If you are out of range or the signal has quit the first zero will stop flipping.**



WHERE TO PLACE THE SENSOR MODULE



Place the sensor module on the flat portion of the electric cable that leaves the teaching extension cord. Secure the sensor module to the cable and around the extension cord handle with the hook and eye strap. If the lights are turned on or an appliance is plugged in and running the display will show power in use (see calibration). The same principle will apply to monitoring a home or business. Place the sensor on the service entrance cable (flat portion) leaving the meter and if the meter wheel is turning and power is flowing into your home then the monitor will show how much power is flowing.



Strap the sensor module on the cable coming out of the meter before it enters the circuit breaker box.



For conduit use two hook and eye straps as shown above and find the strongest signal.



Take the display inside and demonstrate that the Powerkuff monitor system is reading the power coming into your home simply by turning on or off a light or appliance and watch the numbers change with power consumption.

Always place Powerkuff products on the wire that enters the house **after** leaving the electric meter. The property owner can place **any** instruments on the wire on the home owner's side of the meter. If the meter reader removes the sensor module, file a formal complaint with the utility and the police for the theft. Some homes have their electric cable encased in metal or plastic pipe. The signal is decreased but can still be read. If you can not find a place where the electric cable is readable or out of protective pipe then you may want to install the sensor module on the two wires in the circuit breaker pan as outlined below.

The Powerkuff sensor module may also be placed in the circuit breaker panel box around the two main wires feeding the circuit breaker panel main bus, but a licensed electrician should be used in all potentially harmful situations and external power supply should be used so you are not in and out of the circuit breaker pan changing batteries. Once the circuit breaker pan is closed if the signal is low review the calibration instructions.



The Powerkuff sensor can be used on the conduit either metal or plastic but the signal will be diminished so you have to rotate the sensor around until you get the highest reading then recalibrate. Secure the sensor by using a double hook and eye strap technique. Remember to point the weather cap down.



POWERKUFF monitor system may be used on 60 (USA) or 50 (European) cycle per second power, 110-240-440-880 volt systems, single phase (residential) or three phase (industrial) power. Industrial power should only be accessed by a licensed electrician.

The Powerkuff monitor display has a USB port into which you may: Plug the USB cable into a computer for power and to use the Powerkuff data logging program. The program is free to download from www.powerkuff.com



Plug the USB cable into a wall plug power module or computer to save battery life and record power use.

The on /off switch on top of the display is for battery power in the **portable** mode only, it will not turn off the display when the monitor is plugged into a **live** USB port from the computer or wall plug. **Plugging in external powers to either the sensor or the display will override the battery in that component (it is advisable to remove the batteries from these units when you use external power). If your system hangs up when changing from battery to external power then take out the batteries and restart the system. Always start the display first then the sensor last. The weather cap (shown below) is placed over the receptacle on the sensor module when it is used with batteries only and should be pointed down to avoid water seeping into the unit.**



External power for sensor module.



External power for sensor module.

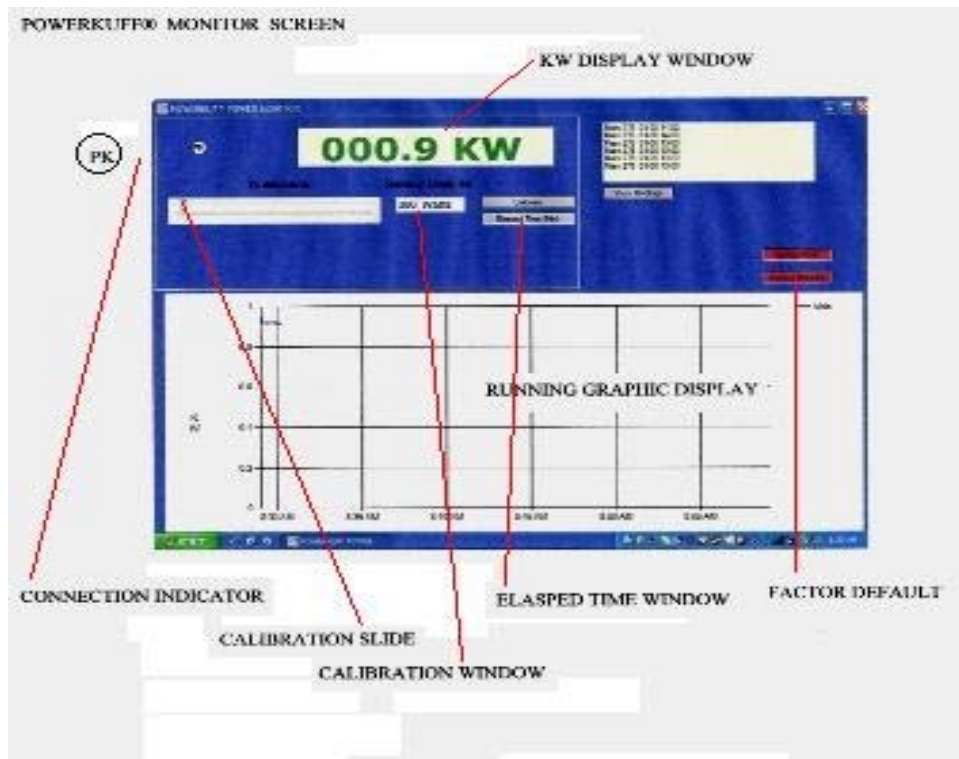


USING POWERKUFF MONITOR AS A DATA LOGGER and Calibration.

To use the Powerkuff monitor as a data logger (record power readings from the monitor on your computer) you must **download the program and license** (free) from www.powerkuff.com

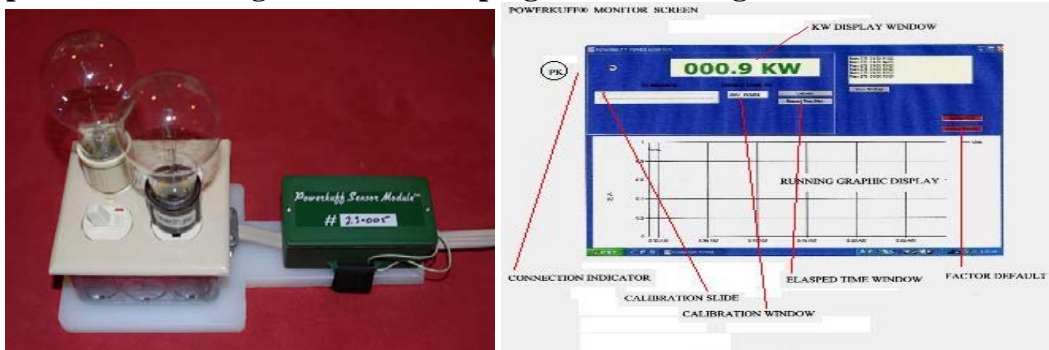
Go to powerkuff.com click on downloads and select zipped PKMS 1.8/ 3.6 program and license. The Microsoft 3.5 human interface program and license will take the longest to load so be patient. When asked where to save it, select your desk top. Highlight the zipped file on your desk top and **right** click on it. Select extract all. The wizard will unzip the file and ask where you want it saved. Again save the file to your desk top. Follow Microsoft install 3.5 instruction which takes the longest, then the Powerkuff Wizard instructions and the PK file should appear on your desktop.

Turn the battery switch on the monitor to the off position. Connect the Powerkuff Monitor to your computer with the USB cable. You should hear an audible chime and the found new hardware wizard window will appear. Click on the PK icon and open the program the number from the display should start and the PK symbol in the left **upper corner should stretch and shrink**. If the program does not do this disconnect the Powerkuff display close the program and try again. Follow the steps outlined and you should have a continuous running graphic of power coming into your classroom, use or business.



The Powerkuff is calibrated to the large wire (240 volt SE) that enters the house from the meter but you can change the calibration if you have a known load or want to run your own experiment.

Calibration: Once you have established communication between your PC and the Powerkuff display using the Powerkuff software, then establish a known load i.e.: place a 100 watt light bulb in each plug of the teaching extension cord.

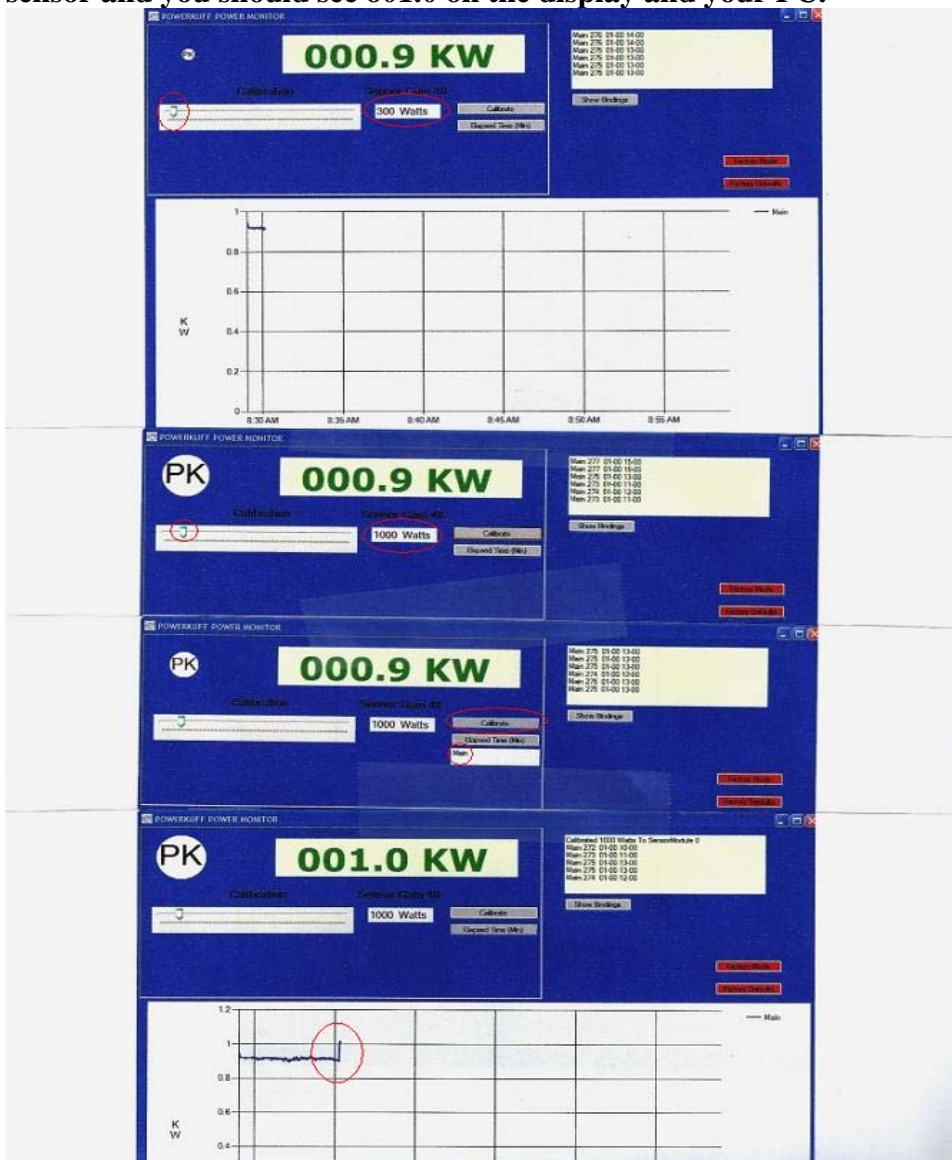


Turn them both on. If you read 000.2 then you are calibrated for that load. If the reading is high or low check the sensor module security and position, then look at the reading again. If it is still off then click and drag the calibration slide over until 200 appears in the calibration box then press calibrate, select main sensor and 000.2 will appear on the display and you PC. The sensor will bind and recalibrate with the new scale. You will see bind request then a bind acknowledge in the show binding window.

To calibrate a house you have to turn off all power except a known, balanced 120 volt load. Place the sensor module on the Service Entrance Cable leaving the meter.



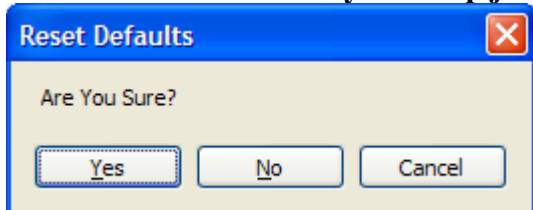
Turn on plug-in electric lights in several rooms. Measure their loads with the Kill A Watt meter or add up the bulb wattage and try to get 1,000 watts going (remember to include the PC if it's plugged in). With the Powerkuff monitor and software running, click and drag the calibration slide over to 1000 press calibrate select main sensor and you should see 001.0 on the display and your PC.



You are done now go turn off those lights. Walk around the house with the display on battery power or carry the lap top and display and get a feel for the information gathering ability of the Powerkuff monitor system. The display must be connected to the PC to log data or change calibration but once that is done you can disconnect the display from the computer and the calibration will stay until you reset it with the PC and Powerkuff® program.

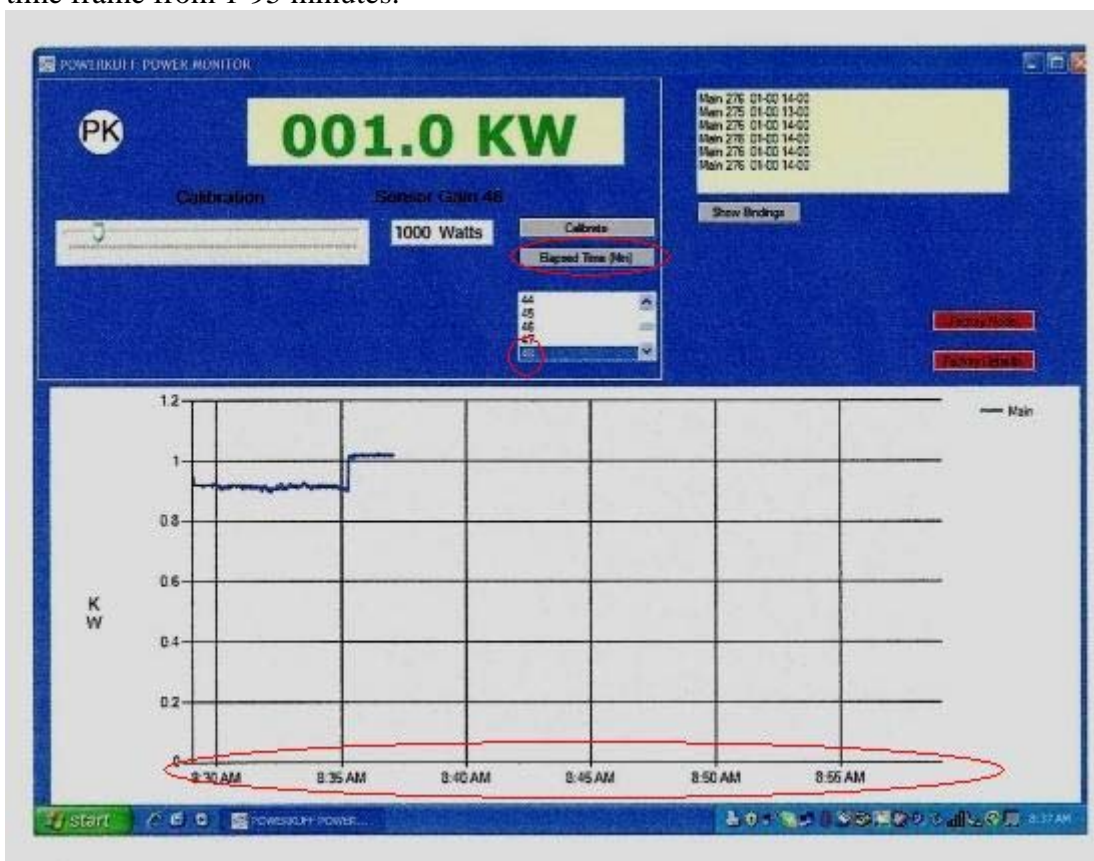
Defaults

By clicking on the factory defaults button you will generate a small window to reset the Powerkuff sensor, display and software to factory loaded calibration. To maintain the calibration you set up just press cancel.

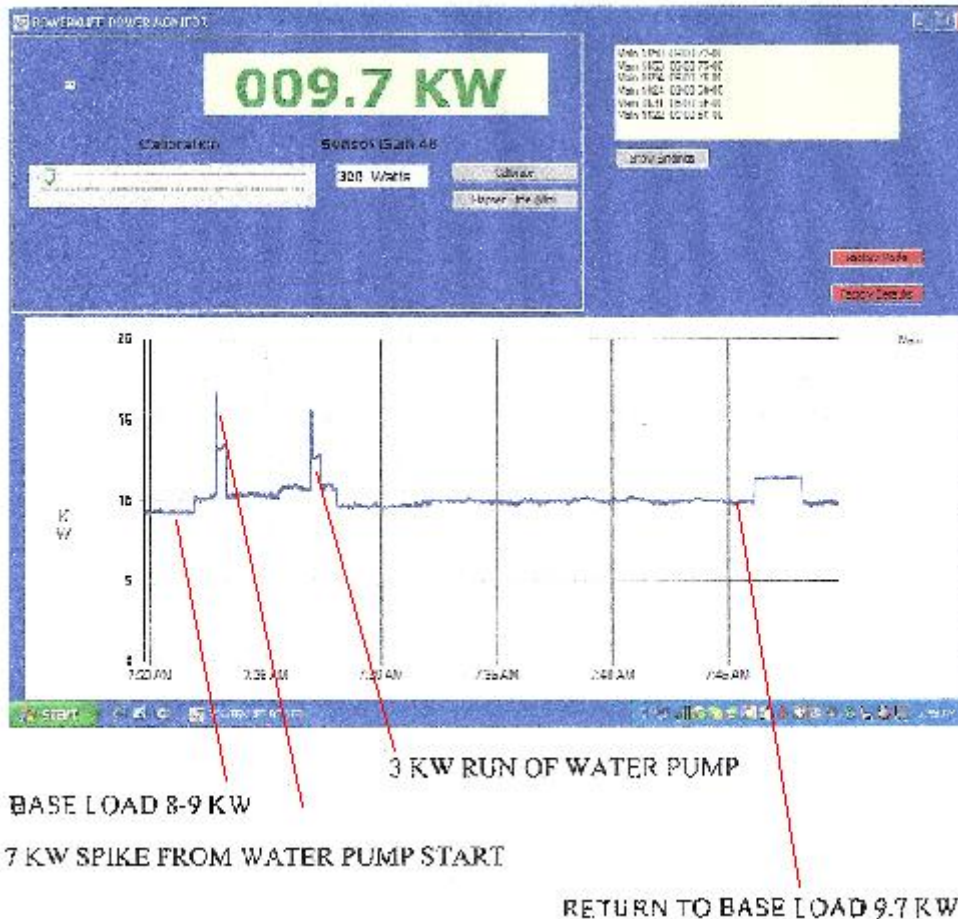


By clicking on Factor Mode you will open a box that requires a password. Close this box by placing the cursor over it and pressing Esc.

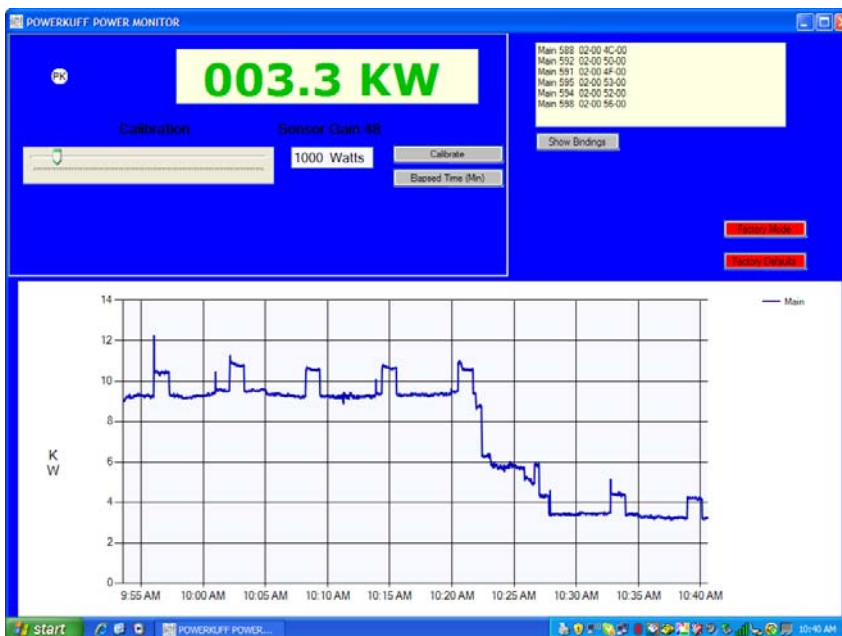
Elapsed Time (Min) button allows you to reset the data run by selecting 48 or change the time frame from 1-95 minutes.



To save the data run press Ctrl-Alt-Prnt Scrn miniaturize the Powerkuff® window and open Microsoft Word the select paste from Edit menu and you have a copy of your study.

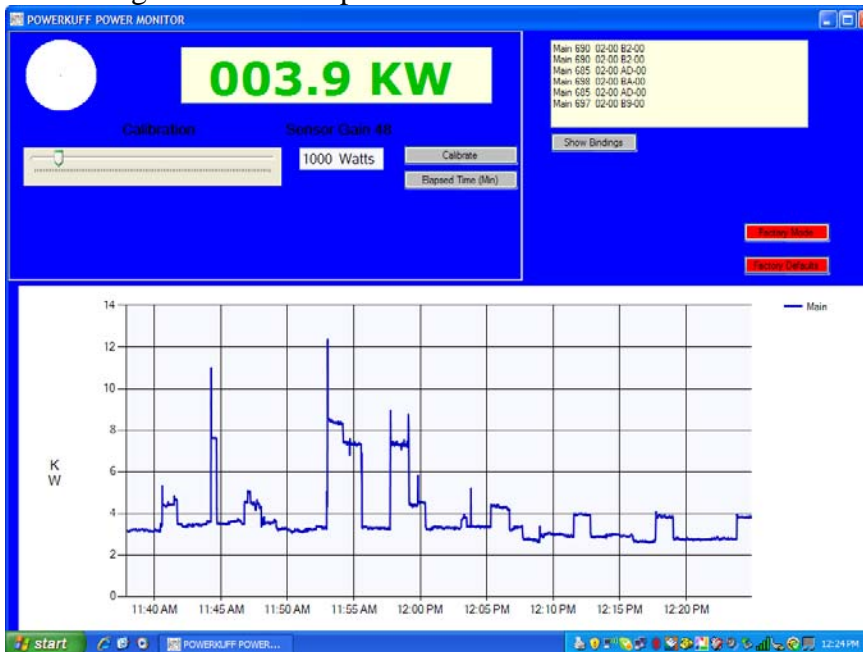


When you measure power drawn by a **motor**, note that the monitor will show about three times more power in the first second then it will level off. The signal will vary because your house or small business has many appliances running at all times. Some have resistive power use such as stoves, baseboard electric heaters, and light fixtures. Some appliances have reactive loads (motors) such as fans, pumps and freezers and refrigerators. Powerkuff is sampling many times each second. Wide fluctuation in power is generally from appliances with **reactive** loads. To **slow** some of the wide variation turn off fans and pumps and let the numbers calm down then you can look at one set of lights or one appliance by turning that appliance or room on and off. The main purpose of the Powerkuff monitor is to make you aware of the total electric power you are consuming. By keeping an eye on the big numbers you will learn to appreciate how you can best reduce your total consumption and how much certain appliances use. Then start accumulating data on your lap top so you can spot trends or excessive use throughout the day.



Powerkuff® monitor run with baseline power starting at 9.7 KW with spikes to 10.5-12 from large refrigerator freezer. Stair step reduction in baseline power by turning off deck top computer and printer, stand-by power on two entertainment centers excessive lights in basement and bedrooms. Baseline power now 3.3 KW with spikes again seen by refrigerator.

Data may be captured by pressing Ctrl-Alt-Prnt Scrn all at once then open Microsoft Word Program and select paste from the Edit menu. Save this document as you wish.



Baseline power 2.8 KW with sharp leading edge refrigerator peaks occurring every 6 minutes. Central vacuum peaks 4 KW on three times to clean out base and back of refrigerator. Once the refrigerator is cleaned and but back the entire baseline is down to 2.4 KW and the peaks are less sharp and less frequent.

Important points to remember:

- 1) The monitor unit is designed for indoor use only.
- 2) The sensor module may be used indoor, outdoors, or in the circuit breaker panel. The unit may be powered by battery or external power supply. Please use the weather cap to protect the external power plug receptacle when not in use.
- 3) Completely review and understand this manual before you use the Powerkuff monitoring system.
- 4) Dispose of batteries appropriately.
- 5) If you have any questions about the monitoring system please contact us at powerkuff.com.

Estimating appliance and home electric energy use. Make a list of all appliances.

If you are trying to decide whether to invest in a more energy-efficient appliance or you'd like to determine your electricity loads, you may want to measure and estimate appliance energy consumption.

The original sales sticker has yearly energy estimate on it. If you discarded it then use the formula below and Powerkuff measurements to see if your appliance is performing above or below standard.

Formula for estimating energy consumption:

Watts x Hours used per day divided by 1,000 equals Daily Kilowatt-hour (kWh) consumed and multiplied by the number of days used yearly gives the annual consumption.

1 kilowatt (1 kW equals 1,000 watts)

The key is to look at the watts being used by that appliance as it compares to the original specifications and the appliances duty cycle.

Example:

Wall fan, 200 Watts run 4 hours daily x 120 days = 394 kWh per year. But if it is old and pulling 400 Watts then it will cost twice as much to operate.

The wattage is not listed on many appliance data plates. Rather the amperage is listed so do a simple math formula of volts (say 115 or measure with Kill A Watt), times amps, times one for power factor and you have the wattage for a plug-in appliance running on 115 volts. Example: wall fan states 2 amps on data plate then $2 \times 115 \times 1 = 230$ watts. For large appliances use 230 volts times amps times one. Electric cloth dryer data plate stated 10 amps then $10 \times 230 \times 1 = 2300$ watts.

Examples of power usage: watts used

Aquarium 50-1200

Clock radio 10

Coffee maker 900-1200

Clothes washer 350-500

Electric clothes dryer 1800-4500 (If you are pulling more than 5000 watts clean out the entire undercarriage and fan duct work of lint then re-measure the dryer) There are 15,000 cloth dryer related fires in the US yearly.

Dishwasher 1200-2400

Dehumidifier 800

Electric blanket single/ double 60/100

Fans

Ceiling 65-175
 Window 55-250
 Furnace 750
 Whole house 240-750
 Hair dryer 1200-1875
 Heater (portable) 750-1500
 Clothes iron 1000-1800
 Microwave oven 750-1100
 Computer CPU awake/ asleep 120/30
 Monitor awake / asleep 150/30
 Laptop 50
 Entertainment center 70-900
 Refrigerator frost free 16 cubic foot 600-900
 Television 19" up to 50 "flat screen 65-200
 Toaster 800-1400
 Toaster over 1225
 VCR/ DVD 17-25
 Vacuum cleaner 1000-1450
 Electric water heater (40 gallon) 4500-5500
 Water pump (deep well) 250-1100

These are a few exercises you can do with the Powerkuff Teaching Kit.



Set up a standard load such as these **two** 100 watt light bulbs and measure amps, volts cycles per second and calculate watts in use. See how close the instruments are to one another. Remember Volts multiplied by Amps multiplied by co-sign Theta equals watts. The Kill A Watt shows 1.65 amps, the clamp-on LEM 1.5 amps. Split the difference so 120 volts X 1.6 X 1 = 182 watts. Powerkuff is reading 0.2 or 200 watts. From here you can recalibrate the Powerkuff or try the next experiment.



Use the light bulb adapters with one 75 watt incandescent bulb and one new 18 watt florescent bulb. Plug the extension card into the Kill A Watt meter and turn on each bulb separately and look at the consumption. The florescent will pull about 18 amps as compared to the incandescent which pulls 75 watts. The interesting thing to note is that the Powerkuff is a CVT or current to voltage transformer and it picks up the voltage signal from the florescent bulb. This signal will settle down as the bulb is warming up. These finding points out the different methods of monitoring electromagnetic fields vs. electrostatic fields and points out that a florescent bulb should be used where you need light for long spells not just to turn on and off when you walk in a room. The clamp-on amp probe can be used to check the Kill A Watt meter since it is a closed core or CT (current transformer and measures only electromagnetic fields).

The Powerkuff Monitor System can derive power from batteries or a USB port from the computer or the wall plug. This allows you flexibility in designing your experiments.

Let's crank it up a notch and look at larger loads.



Remember the extension cord is rated for 15 amps but you may have plugged it into a plug which is only rated for ten (10) amps, so choose your loads well. Above is shown an 1800 watt space heater. First turn it on to low setting. The heater pulls 800-900 watts but on high it pulls 1600-1700 watts. The fan-on feature needs only 50 watts. The idea here is to see the variability in design of a small appliance. The next step is to repeat the same experiment but this time use a light weight extension cord between the heater and the Kill A Watt Meter. Observe the voltage drop and wattage change as the heater makes that light weight cord heat up. You should only run this experiment for five or ten minutes. The lesson here is appropriate sizing of electric equipment to optimize power consumption and safety.

Solar panel systems are very interesting to monitor. The Powerkuff will see the total power flow in the wire. First check the house with the solar array off then turn the array on. You will notice when you are producing more power than you are using that the display and PC graphics will reverse. So when the total power showing is 6.0 and you turn on the dryer the display will read 2.0 indicating that you are using 4.0 of your solar power before it goes to the grid or meter.

The Kill a Watt meter is a great learning tool and can be used on small loads (under 1500 watts) to understand the basic measurements of power.



The line checker is included to emphasize the importance of proper wire technique and again safety.



The EXTECH splitter allows the student to investigate larger 120 volt appliances without pulling off panels and exposing wires.



Checking current

Checking voltage

The multimeter and clamp-on amp probe start opening the world of 240 volt power measurement and management.



Measure current on a 240 volt main cable in a home. Amp probe vs. Powerkuff
 Note the ease with which the Powerkuff sensor derives the power measurement without opening the electrical panel.

The Powerkuff Wire Wraps are simple slap-bracelets which the student can take home to investigate where they would access the main wire coming off the meter at home. They can take a picture with their cell phone and show the class that they know how to access their power before taking the Powerkuff monitor to do an audit and print out the results.



The Powerkuff monitor system is designed to allow safe access the electric power that flows into our homes and businesses. Powerkuff data logging program can be used to store home audit studies.



As you are investigating the house it becomes evident that an appliance that is on all the time is going to rack up cost fast! So look for the baseboard heater you left on last winter or all the little battery changing wall blocks that draw 5 watts each and every day. Check that all extension cords are not hot or under size for the load.

Next, try to zero out the home's electric use and reduce the base load. Turn off **all** non-critical appliances and do it during the day light and two hours after opening any refrigerator, freezer or using hot water. The Powerkuff monitor should read 000.0 if the utility meter wheel is not moving. This is a difficult exercise because there is **always** something you forgot or something is leaking. The hot water faucet in the basement or the refrigerator with the bad door seal. Once you identify the culprit fix it and move toward replacing appliances that measure high consumption values or frequent inappropriate cycles. Cleaning refrigerators and filters will improve their efficiency. Placing 8 bags of ice in the freezer will reduce the freezer's duty cycle and you will be ready for the next party. The Powerkuff monitor will help you monitor for leaking appliances and wasteful habits. Keep a list and compare utility bills month to month and year to year.

Unique features:

This is the only power monitoring system which monitors power at the main cable even through conduit (plastic or metal) without splitting the wire into separate cables or connecting directly to the wire.

- 1) This is the only monitor which the consumer can install without special licenses, tools or skills.
- 2) The portability of the monitor unit allows you to wander throughout the home or business and instantly see the power usage of various appliances as they go through their duty cycles, or go room to room to identify high power users. Whether it's the Air conditioner left on or the base board heater forgotten from last winter. Each will contribute to a high reading on the Powerkuff monitor. As you find these energy users and turn them off, you will see the numbers on the monitor go down.
- 3) This is the only non-invasive power monitoring system which can communicate with your home computer and record trends so you can control them.
- 4) The Powerkuff system is wireless like your garage door opener. It communicates on 2.4 GHz frequency like many home remote control devices but it should not interfere with those other devices. Multiple Powerkuff monitor systems may operate in the same vicinity because they operate on separate encoded channels. If you have several Powerkuff units make sure the sensor and display have the same serial number.
- 5) The sensor module and monitor require 3 AA batteries each. (not included)
- 6) The system is designed to conserve battery life. Please use the USB wall plug supplied (wall wart) or USB computer plug when possible to conserve the battery life of the monitor and the external power supply for the sensor module to prolong reading time. **Remember to turn on the battery switch when you want to be mobile with the display. Batteries will only last one to two days because of intensity of data gathering.**

A WORD ABOUT SAFETY

We have taken every precaution in designing this monitoring system to ensure that it is as safe as we can make it. But safe operation depends on you, the operator. We recommend that you follow these simple safety rules:

- 1) Always place the sensor module on insulated cable or wire. Never place the sensor module on bare or frayed wire.
- 2) Always secure the cover of the sensor module and monitor unit before using.
- 3) If you are installing the sensor module in the circuit breaker panel to monitor power make sure you are careful not to touch any of the live circuits since this will result in injury, damage and even death. You may want to hire an electrician for this type installation.
- 4) Make sure if you unplug or turn off a circuit breaker of a vital appliance such as a freezer or refrigerator to test its power usage that you plug it back in and make sure it is operational.
- 5) Never replace the batteries while the monitor unit is plugged into any USB plug or while it is operational.
- 6) Never replace the sensor module batteries while it is on the wire.

WARNING ABOUT ELECTRICITY

USE EXTREME CAUTION IN THE USE OF THIS DEVICE. IMPROPER USE OF THIS DEVICE CAN RESULT IN INJURY AND DEATH, FOLLOW ALL SAFEGUARDS SUGGESTED IN THIS OWNER'S MANUAL IN ADDITION TO NORMAL SAFTY PRECAUTIONS IN DEALING WITH ELECTRICAL CIRCUITS. DO NOT USE THIS DEVICE IF YOU ARE UNFAMILIAR WITH ELECTRICAL CIRCUITS.

TO REDUCE THE RISK OF DAMAGE TO THIS UNIT DO NOT EXPOSE THE MONITOR OR OPEN SENSOR MODULE TO WATER OR RAIN.

ENGINEER'S NOTE

This monitor system is fully calibrated to NM and SE cable and tested up to 200 Amp at 240 volts 60 or 50 cycles per second. Under normal use, no further adjustment should be necessary. If you wish to calibrate against a known load see calibration or email cwagner@powerkuff.com for special instructions. Powerkuff response is linear after 100 watts and there is no ohmic connection to the wire monitored.

RANGE

Wireless 100 ft line of site 2.4 GHz

Max load single phase 200 Amp. Three phase 400 Amps.

50 or 60 cycle per second AC power.

120, 240, 440, and 880 volt systems have been measured using this sensor.

ACCURACY

+/- 10% true power

SENSITIVITY

100 Watt

MISCELLANEOUS

Operating temperature 32-120 F/ (0-44 C)

Power Source Three AA batteries, 4.5 volt 200MA external power supply.

Dimensions (HWD) Monitor 4 x 4 1/4 x 1 1/8 Inches

Weight Monitor and sensor module with battery 12.5 ounces
 Teaching System Accessories:
 Teaching extension cord with sensor loop. USB power cord for sensor module. Light bulb adaptors



Clam-on multimeter Kill A Watt Meter 120 volt line splitter



Line checker Wire locator wraps Dual hook and eye strap

SOLAR POWER

If you are producing power the total flow in the cable will appear on the display and your use of power will show up as a negative graphic. So if you are generating 6 kw and using 1kw 5kw will show on the graphic. When you turn on the electric cloth dryer that uses 3kw your display will show 2kw and a negative graphic.

CARE: Keep the monitor unit dry: if it gets wet, wipe it dry immediately. Use and store the monitor unit in normal temperature environments. Handle the monitor and sensor module carefully, do not drop them. Keep the monitor and open sensor away from dust and dirt.

CLEANING

To keep the Monitor system looking new, occasionally wipe it with a cloth slightly dampened with water. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the monitor or sensor module.

WARNING ABOUT WATER

- 1) DO NOT LET ANY WATER DRIP INSIDE THE MONITOR OR SENSOR MODULE WHILE CLEANING THEM.
- 2) MAKE SURE THE MONITOR AND SENSOR MODULE ARE COMPLETELY DRY BEFORE USING THEM.

TROUBLE SHOOTING

The sensor module will send a signal every second if the monitor unit is on and requests a reading. When you turn the monitor unit back on it may take moment start sending information again. If there is no response after one minutes then check the

batteries and external power supplies. Check that you have not wandered out of range since last receiving data. Once bound together it is better for the sensor and monitor to be at least three feet apart.

If the unit does not work at all check the battery contacts to make sure the spring is pushing the contacts together. Check the connection into the sensor and make sure it binds.

While watching the monitor unit you see repeated 300 to 500 watt swings all the time. This is caused by reactive power swings in motors. Motors are in heat pumps, air conditioners, ceiling fans and pumps for water and pools. Continuous swings in power are an indication that an appliance motor is beginning to fail and needs service. If you want to calm the numbers down see which appliance is causing the swing and turn it off. The numbers should calm down so you can look at other appliances. Once you are finished looking at other appliances you need to restart the motor you turned off or make an active decision to leave it off. (Make sure you do not turn off the freezer and forget to restart it.)

You will also notice that the house will settle down at night. The power usage will be lowest early in the morning before all the occupants start using electricity again. Keep your eye on the big number that's the one you want to reduce in order to save money and power usage.

You may place the sensor module on any insulated wire feeding an appliance and monitor its consumption, if you want to record the water pump or the hot water heater or how often a TV is used.

LOW BATTERY WARNING:

The Powerkuff monitor will indicate " LOBA" when the **sensor** batteries are failing. Change the batteries in the sensor module. Change the 3 AA batteries in the display monitor or go to USB power or wall power and try again. If the display monitor unit has a low battery the unit will lock up or fail. Either add new batteries or use USB power from the wall plug or computer. You may run both the sensor and display without batteries if they are plugged into external power. Always start the display first then start the sensor module.

Limited 90 Day Warranty

This product is warranted by Powerkuff, LLC against manufacturing defects in material and workmanship under normal use for 90 (ninety) days from date of purchase from Powerkuff, LLC or its authorized franchise and dealers. EXCEPT AS PROVIDED HEREIN, Powerkuff, LLC MAKES NO EXPRESS WARRANTIES AND ANY IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE DURATION OF THE WRITTEN LIMITED WARRANTIES CONTAINED HEREIN, EXCEPT AS PROVIDED HEREIN, Powerkuff, LLC SHALL HAVE NO LIABILITY OR RESPONSIBILITY TO CUSTOMER OR ANY OTHER PERSON OR ENTITY WITH RESPECT TO ANY LIABILITY, LOSS OR DAMAGE CAUSED DIRECTLY OR INDIRECTLY BY USE OR PERFORMANCE OF THE PRODUCT OR ARISING OUT OF ANY BREACH OF THIS WARRANTY, INCLUDING, BUT NOT LIMITED TO, ANY DAMAGES RESULTING FROM INCONVENIENCE, LOSS OF TIME, DATA, PROPERTY, REVENUE, OR PROFIT OR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, EVEN IF Powerkuff LLC HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations may not apply to you.

In the event of a product defect during the warranty period, contact Powerkuff, LLC at powerkuff.com or call 302-684-2008. Powerkuff, LLC will, at its option, unless otherwise provided by law; (a) correct the defect by product repair without charge for parts, labor, and shipping; (b) replace the product with one of similar design; or (c) refund the purchase price. All replaced parts and products, and products on which a refund is made, become the property of Powerkuff LLC. New or reconditioned parts and products may be used in the performance of the warranty service. Repaired or replaced parts and products are warranted for the remainder of the original warranty period. You will be charged for repair or replacement of the product made after the expiration of the warranty period.

This warranty does not cover: (a) damage or failure caused by or attributable to an act of God, abuse, accident, misuse, improper or abnormal usage, failure to follow instructions, improper installation, maintenance, alteration, lightning or other incidence of excess voltage or current; (b) any repair other than provided by Powerkuff, LLC Authorized Service Facility; (c) consumables; such as fuses and batteries; (d) cosmetic damage; (e) cost of product removal, installation, set-up service adjustment or reinstallation.

This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

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