eyePower Web Browser Interface

Version 1.0

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SAFETY NOTICE

End users must be made aware that power outlets are remote controlled

This unit is not certified for safety isolation of the electrical supply

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Web Browser Interface

eyePower Mains Distribution Units (MDU), fitted with optional Ethernet port on the rear panel, have an inbuilt web server to provide a sophisticated Web Browser Interface (WBI) for control and monitoring across a network.

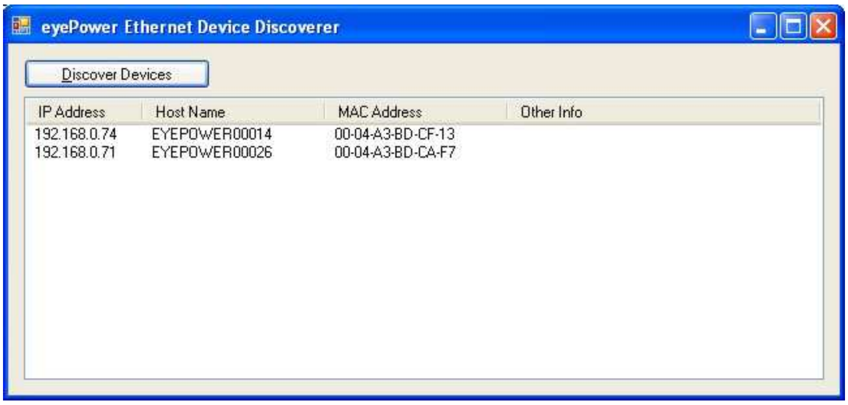
The eyePower MDU is shipped with DHCP enabled and will pick up an IP address from your DHCP server automatically. Where no DHCP server is found, the MDU has a default fixed IP address set to 192.168.10.100, so you can connect your computer directly by plugging an Ethernet cable between the two. The MDU Ethernet interface is auto-MDIX hence you do not need a crossover cable. However, you will need to set your computer to be on the same IP range (192.168.10.xxx).

Currently the only way to disable DHCP or set your own fixed IP address is to use the eyePower Windows™ Software. The ability to change IP address settings via the WBI will be added in a future firmware revision. However, the Windows™ software will likely need to be used anyway to set up the sequencing and control of outlets, when shipped from the factory MDUs will sequence on/off with the front panel soft switch.

The eyePower Windows™ Software and the eyePower Discovery Program mentioned below can be downloaded from the Bryant Unlimited website; http://www.bryant-unlimited.co.uk/eyepower-downloads.html.

Connecting to the eyePower MDU

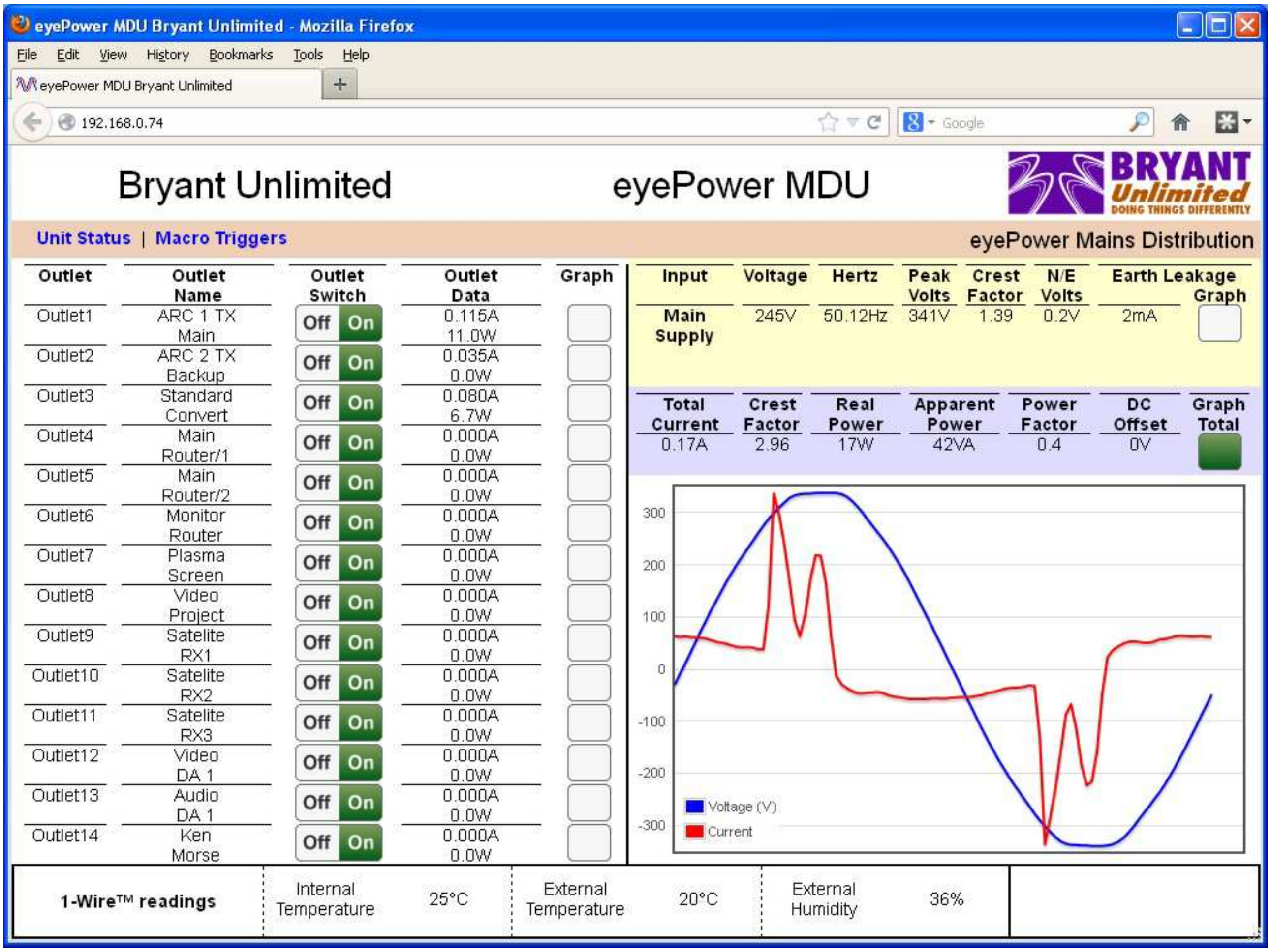
If you know the IP address or host (NetBIOS) name of the eyePower MDU, then you can type that into your browser address bar and press Return. Alternatively, run the eyePower Discovery Program, which will display the IP address and NetBIOS name of any eyePower MDU connected to the local network.



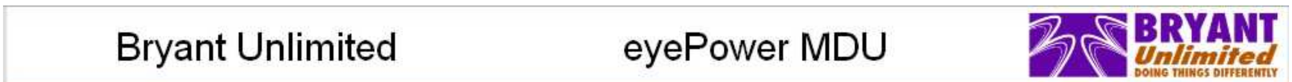
Click on the unit name to highlight it and then click again to open the WBI in your default browser.

eyePower MDU WBI Unit Status Screen

The eyePower WBI Unit Status screen is shown below. We hope that the screen is self explanatory, but detailed information regarding the various sections is given.



Header:



Unit Location: Default "Bryant Unlimited".
This can be changed to give user a descriptive location. i.e. "Main CAR".

Unit Name: Default "eyePower MDU".
This can be changed to give user a descriptive name. i.e. "Rack 3B".

Menu Bar:

Below the unit name, the menu bar offers access to different pages of the WBI. The current firmware version offers the detailed MDU status and an initial demonstration of triggering MDU macros, for example to turn on/off or power cycle a particular combination of outlets. See the eyePower Software manual for details of the comprehensive macro language that controls outlets and responds to or sets GPIs. The number of pages available on the menu bar will increase with future releases of firmware.

Outlet Section:

This section gives information about individual outlets.

Outlet: The channel number of the outlet.

Outlet Name: Default “Name 1” etc, using eyePower Windows™ Software this can be changed to a descriptive name e.g. “Video DA 1”.

Outlet Switch: These buttons display the current status of the outlet and can be clicked to turn the outlet on or off. Clicking on a button will turn it orange to show that the command has been sent to the MDU. Once the MDU confirms that the command has been received, the button will turn green or possibly red if there is a fault condition.

The buttons will also show if there is an alarm state with its respective outlet such as “Fuse Fail”; “Over Current” etc.

Outlet Data: Displays the outlet data for the channel, which is current and real power in this release of firmware. Alternatively an alarm is described.

Graph: Clicking the Graph button will display a graph of the current draw waveform of the equipment plugged into the channel outlet. (See below under Graph Panel.)

Input Section:

This section gives information about the inlet. If a dual inlet auto-changeover unit is connected, then information regarding the backup inlet is also displayed.

Input	Voltage	Hertz	Peak Volts	Crest Factor	N/E Volts	Earth Leakage	Graph
Main Supply	244V	50.03Hz	339V	1.39	0.2V	2mA	

Voltage:	The RMS Voltage of the mains input.
Hertz:	The Frequency of the mains input
Peak Volts:	The Peak Voltage of the mains input.
Crest Factor:	The Crest Factor of the mains input
N/E Volts:	The Voltage between the Neutral and Earth of the mains input.
Earth Leakage:	The Earth Leakage, more accurately Residual Current, of the mains input.
Graph:	Clicking the Graph button will display a graph of the earth leakage current of the selected input. (See below under Graph Panel.)

Bus Section:

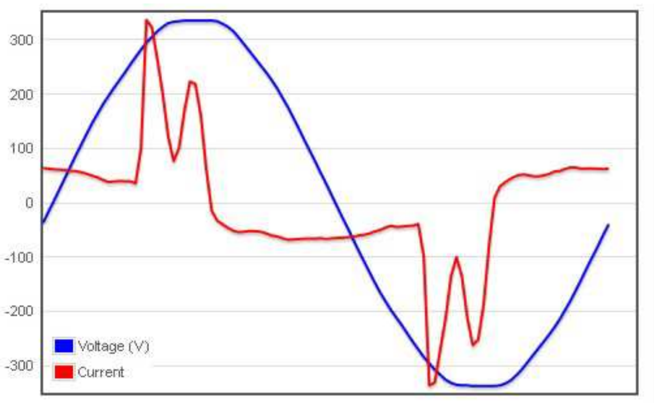
This section gives information about the internal distribution bus in the MDU

Total Current	Crest Factor	Real Power	Apparent Power	Power Factor	DC Offset	Graph Total
0.18A	3.12	17W	43VA	0.41	0V	

Total Current:	Total current draw through the MDU.
Crest Factor:	The Crest Factor of total current.
Real Power:	The Real Power being taken through the MDU.
Apparent Power:	The Apparent Power being taken through the MDU.
Power Factor:	The Power Factor.
DC Offset:	DC Offset of the L/N supply.
Graph:	Clicking the Graph button will display a graph of the total bus current (See below under Graph Panel.)

Graph Panel:

The graph displays two waveforms; the bus peak voltage (blue) and the selected current waveform (red). The current waveform shown can be selected by clicking on any of the Graph buttons mentioned above.



Units on the left are Volts, no units are shown for current which is auto-ranging. The graph is provided so that the shape of the waveform can be considered, absolute values are a distraction.

1-Wire™ readings:

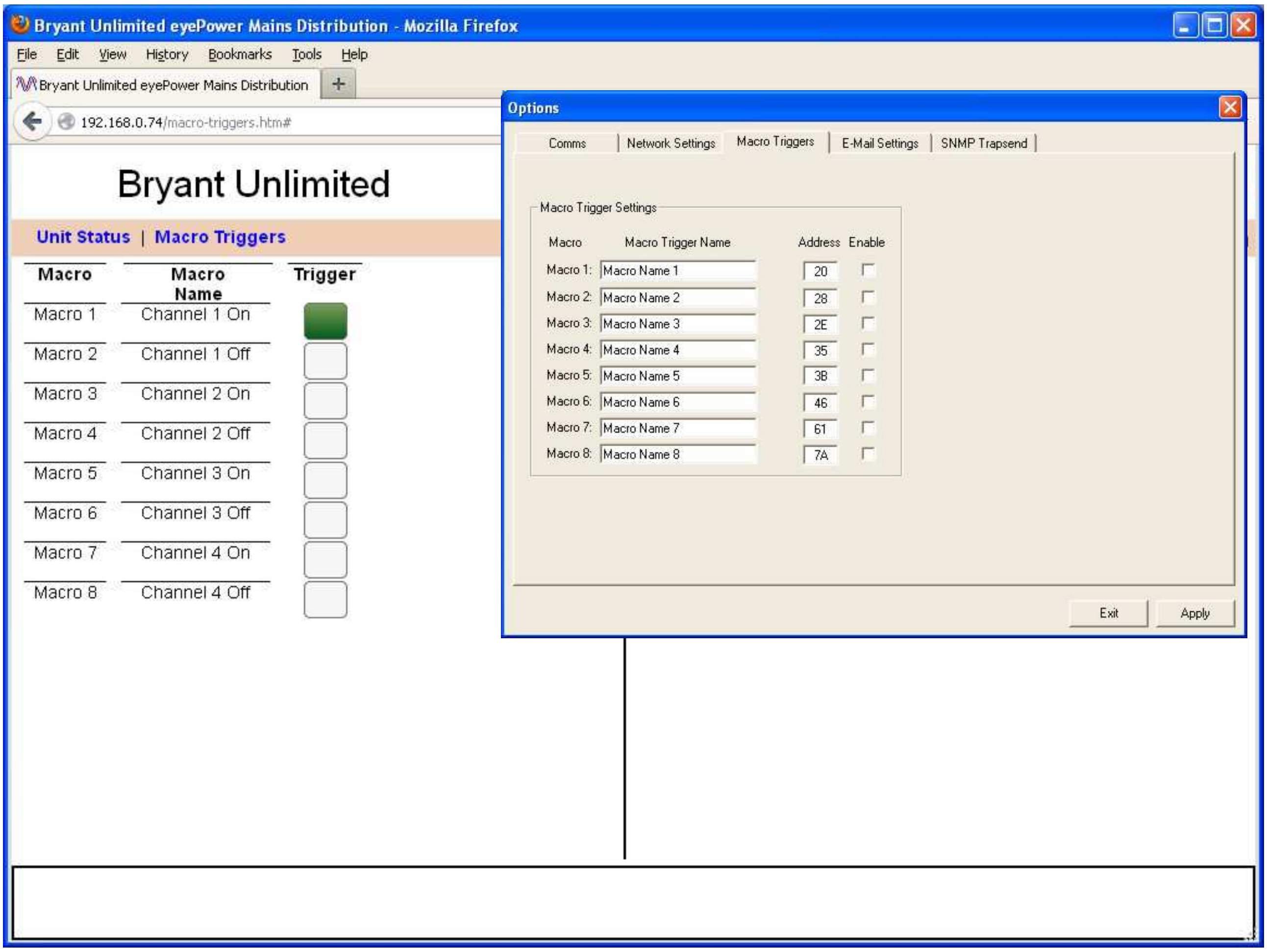
This section displays environmental readings from the MDU's internal temperature sensor and any optional Dallas/Maxim 1-Wire™ sensors plugged into the rear RJ45 connector. (Currently limited to one temperature/humidity module).

1-Wire™ readings	Internal Temperature	25°C	External Temperature	20°C	External Humidity	36%

Internal Temperature:	This is the temperature of the internal circuit board close to heat generating components, representing worst case temperatures. Air temperature inside the unit will be little different to ambient, would have looked better but is of little real use.
External Temp:	The current version of software supports a single Dallas/Maxim DS18B20 temperature sensor, the next version will support twenty sensors on the same bus. Alternatively a combined temperature/humidity sensor (contact Bryant Unlimited for details) can be used.
External Humidity:	Relative humidity in percent where a combined temperature/humidity sensor is connected.

eyePower MDU WBI Macro Triggers Screen

The eyePower MDU has a sophisticated macro programming language built into each unit allowing you to pre-program relay on-off sequences using the eyePower Windows™ software. The Macro Triggers screen will allow you to run the specified sequence by clicking a button in the web browser interface. Macro names and the macro program address associated with each trigger are programmed in the Windows™ software, see the "Installing eyePower Software & Options" manual. The Windows™ options page is overlaid on the WBI screen below.



Basic Definitions for Measurements

RMS (root mean square) voltage of an AC supply is a simplistic measurement that equates to the DC voltage required to produce a given power in a resistive load. RMS current follows the same principle.

Crest factor of an AC voltage is the ratio of peak voltage to RMS voltage, value 1.41 for an ideal sinusoidal waveform. Crest factor of an AC current is the ratio of peak to RMS current, values of four may be seen for cheap, small switched mode power supplies.

Real power is the average of instantaneous voltage multiplied by current, at points where voltage and current are not in phase this deducts from the total as energy flows back into the mains supply.

Apparent power is RMS voltage multiplied by RMS current. For a simple, resistive load this will be the real power that is consumed. Complex loads draw larger currents for low voltages or when the voltage is out of phase, both consuming less power in the unit itself but I2R heating losses in the supplying cable will be increased by the current draw.

Power factor is the ratio of real power to apparent power. Less important on very small loads, low power factors indicate current has been drawn from the supply for no useful effect.

Detail - Supply Voltage

An ideal AC mains supply is sinusoidal with equal positive and negative half cycles with no DC content. The reality is rarely a perfect sine wave and does sometimes have a DC offset. The simple measurement of RMS (root mean square) voltage of an AC supply equates to the DC voltage required to produce a given power in a resistive (e.g. heating) load. Current draw of technical loads will usually be complex unlike resistive heating elements and RMS voltage alone is a poor indicator of required supply quality or issues with locally powered equipment. eyePower provides a number of useful voltage measurements beyond the norm.

The high cost of copper and large size of linear power supplies dictates that most medium to large power supplies are now switched mode. Switched mode PSUs first rectify the mains before charging a DC input capacitor, then an oscillator up to 1MHz transforms the voltage using a much smaller transformer than would be required at the original 50Hz supply frequency. The DC input capacitor will only charge when the mains supply is above a certain voltage, switched mode PSUs are therefore more affected by the peak voltage of the AC waveform. Due to the source impedance of the mains supply, notably cable resistance, large current draw will lower the measured supply voltage. With many switched mode PSUs connected and drawing power only near the peak of the sine wave, it is not unusual for the peak to be lost altogether and the supply becomes "flat topped".

For switched mode PSUs a more relevant measure than RMS voltage is peak voltage, although the peak might be short duration for an ideal sinusoid or long duration for a flat top. A switched mode might charge more fully with 325V peak flat top than 325V achieved momentarily by an ideal 230VRMS supply. Peak voltage as a figure conveys very little while the human eye can easily recognise the state of the mains supply by looking at the graph offered by eyePower. Also consider that just as switched mode PSUs "take a bite" from the supply peaks, linear power supplies can be seen to take a bite from the waveform falling from its peak to zero. This information is not conveyed by the peak voltage figure.

Crest factor is simply the ratio of peak to RMS voltage and is 1.41 (root 2) for an ideal sine wave. Correct functioning of power supplies relies on absolute voltage levels, information that is lost with the crest factor ratio. However crest factor's unit-less value does allow different mains supplies' deformation from the ideal to be compared if one accepts only peak and RMS values are referenced. Degradation of supply will normally lower crest factor and, given the crest factor of DC is 1.00, even small changes from 1.41 are significant. It should be noted some reconstructed supplies, for example UPS, will aim to give good RMS, peak and crest factor figures for test purposes but the underlying waveform can be far from ideal.

eyePower's voltage graph is a good, qualitative way for the user to interpret supply issues. Quantitatively harmonic analysis can be useful although maximum limits on harmonic content are surprisingly tolerant. Harmonic analysis may be expected from eyePower in due course, although more likely in the Windows™ software than eyePower's embedded web browser.

There are simple units available that measure maximum voltage as if this were useful fault logging. Mains supplies are permitted to peak and trough to surprising degrees hence overvoltage or sag measurements are only useful when accompanied by details of duration and frequency. eyePower can measure peaks of 2500V and, as user requirements develop over time, more data will be available on supply perturbations.

Supply frequency of 50Hz (60Hz eyePower units special order) will tend to vary to a small extent that will not effect linear or switched mode power supplies. The small variation means measurements accurate to 0.01Hz are preferred, however changes of this amount are irrelevant. Gross variations of frequency, for example a rare drop to 45Hz, will affect all types of power supplies' ability to operate from one mains peak to the next.

eyePower measures neutral/earth voltage which should be nominally zero for the environments in which the MDU is installed and would perhaps be 230V for live/neutral reversal. However measuring neutral/earth was not included simply to check live/neutral reversal - eyePower measures fuse and relay state with respect to earth and will show supply failure if live and neutral are reversed. Many faulty installations have been diagnosed this way using eyePower's predecessor. Instead neutral/earth measurement is offered because large installations often have a small neutral/earth voltage worth monitoring. Imagine neutral and earth bonded some distance from the MDU, with perhaps 0.1 Ohms of neutral cable resistance over that distance. In this basic example, 10 Amps of current flowing live/neutral with negligible current in the earth will develop 1 Volt across that length of neutral cable and 0 Volts on the earth cable. The MDU will measure neutral/earth at 1V, a fact which isn't very useful on its own. More useful is to monitor this voltage over time where an increased neutral/earth difference without increased load might reflect increased source impedance due to a fault. Equally useful, a sudden fall in neutral/earth voltage can indicate that earth and neutral have inadvertently been bonded locally. This has been seen a number of times and is often a mis-wired power lead where the effect can be devastating, potentially leading to fire. Current previously flowing live/neutral for an entire area will flow live/earth via the wiring error, stressing earth connections not intended for large currents such as the badly wired lead and connected equipment, also raising the touch voltage (touch current) of earthed equipment. No fuses will blow, the live supply is not aware the return is via earth rather than neutral.

"Earth leakage" measurement is included as standard, technically speaking the measurement is residual current, the difference between live and neutral current flow. Earth leakage is preferred by many as short hand for residual current although true earth leakage measures current flow to earth. Where there are multiple mains supplies or incorrectly wired single supplies, residual current might be measured where current flows between supplies or circuits with no leakage to earth. Fixed technical installations rarely have residual current breakers but it is still important to monitor for excessive live/neutral current imbalance. It is not unusual to find an earth leakage meter on a mains distribution panel serving an entire technical area, nor unusual to measure several amps due to suppression components, but eyePower offers a rack level view of residual current. Excessive leakage due to a faulty suppression capacitor may be a fire risk, faulty neutral/earth wiring may be a shock risk. All the reasons for using an RCD in domestic environments still apply even where no RCDs are fitted in a technical environment to ensure continuity of supply. Where RCDs are used, for example on outside broadcast vehicles, eyePower may give early warning of increased residual current likely to trip an RCD.

Having characterised the AC voltage supply, eyePower includes a rare measurement for DC offset or "DC on the mains". Measuring millivolts DC in the presence of 230V AC is a task beyond most measurement equipment but DC offset is an important measurement. Small amounts of DC will saturate mains transformers of linear power supplies, causing transformers to hum, under-perform and possibly overheat. Locally generated DC is also a good indicator of a problem load which is drawing current only on the positive or negative half of the supply cycle, loading and lowering the voltage of only that half cycle. Technical equipment should draw equally from positive and negative half cycles, if not there may be a design fault or failed input rectifier. DC offset of several hundred millivolts can be easily demonstrated with a hairdryer with half speed setting that relies on the bad practice of half wave rectification using a diode. In that case the load is only a few hundred watts, similar to that drawn by a lot of technical equipment.

Detail - Measuring Currents

eyePower offers a resolution of 1mA for smaller loads but can measure peaks of 70A. It would be impossible to claim mA accuracy over this current range (more likely a few mA plus 1%-2% of reading, comparable to expensive digital voltmeters) but this resolution allows subtle detail to be viewed. For example, switched mode PSUs recharge their input capacitors as required which means current draw can vary between cycles of mains. Minor changes of displayed current do typically reflect actual changes in current draw of connected equipment and it is possible to measure current and resulting power with such resolution that an equipment's state of running can often be determined. eyePower graphs of current show detail that cannot be predicted from basic figures such as crest factor, some power supplies for example have a very high di/dt (ie steep graph) as input capacitors are charged. High di/dt represents high frequencies which can affect the wider electrical installation. It is also surprising how different types of load can add together and produce highly complex (non ideal) current draw. Only three loads produced the "double spike" current waveform shown in the WBI examples above, without the graph this distorted waveform would remain hidden.

Detail - Measuring Power

eyePower displays individual outlet power to 0.001W (one milliWatt) for smaller loads although, as for current, absolute accuracy at this resolution cannot be guaranteed. We have seen some distribution products that claim "accuracy better than 1%" while even our expensive reference meters costing much more are not that accurate across their range. Accuracy for test equipment is often quoted not only with a number of least significant digits and percentage of reading, but AC measurements will depend on the frequency and crest factors involved. The "double spike" current waveform above is an example of a complex waveform with energy concentrated in narrow spikes that affect accuracy, particularly when current is multiplied by voltage for instantaneous power measurements.

Despite this caution about absolute accuracy, eyePower's high resolution is still useful for comparative measurements. These might be to detect subtle variations in load caused by missing internal cards or what stage equipment has reached during start-up or reboot. Minor changes over a longer period may be due to ageing of the equipment, particularly the power supply. Whether current or power is the best measure of equipment degradation depends on the equipment. A linear power supply will draw more current and use more power when supply voltage increases, a switched mode supply will draw less current and typically consume the same power. Bryant Unlimited have already conducted many tests and will be releasing various firmware enhancements over time to take advantage of this knowledge.

eyePower does not currently display total power consumed, like a multi-channel electricity meter, as it is expected this function if required would be performed by external logging software. However, this facility could be included if required.