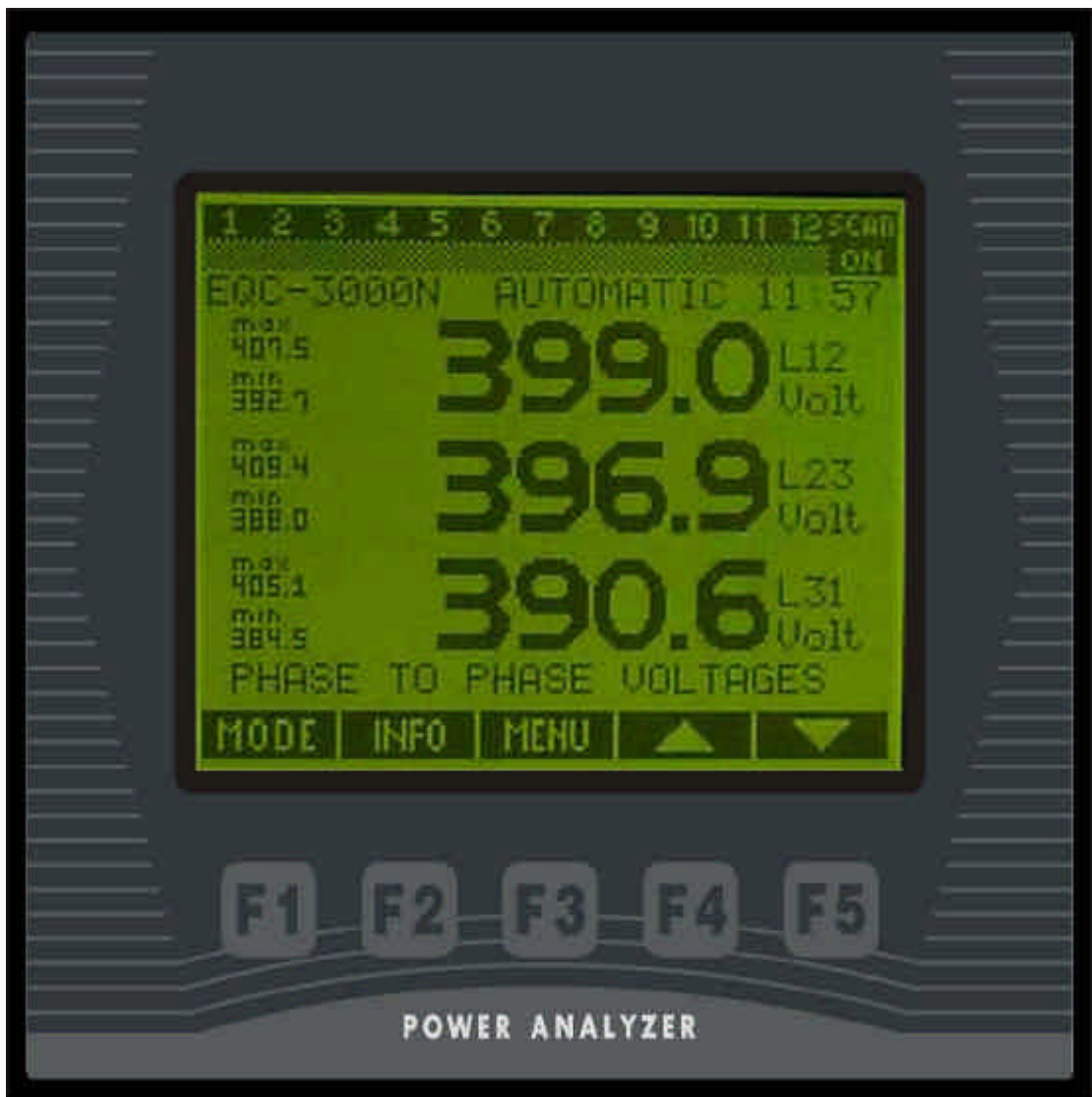


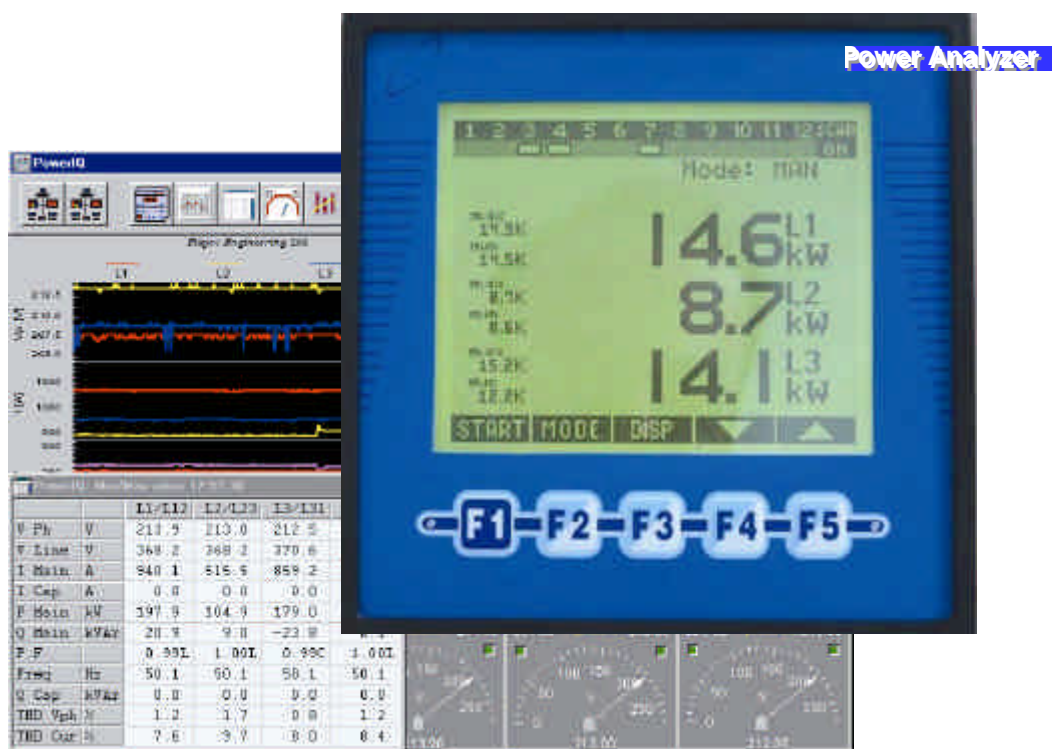
Power Analyser

Power Analysers and PowerIQ Software
Detailed Description



Measured Parameters

Parameter	Display	N° of Phases	N° of Loads	N° of Harmonics	Total N° of Parameters
Power Factor	√	4	2	1	8
Harmonics Power Factors	√	4	2	63	504
Frequency	√	1	1	1	1
Phase Voltages	√	3	1	1	3
Harmonics Phase Voltages	√	3	1	63	189
Phase to Phase Voltage	√	3	1	1	3
Harmonics Ph-Ph Voltages		3	1	63	189
Currents	√	3	2	1	6
Harmonics Currents	√	3	2	63	378
Active Power	√	4	2	1	8
Harmonics Active Powers		4	2	63	504
Reactive Power	√	4	2	1	8
Total Power		4	2	1	8
THD, Phase Voltage		3	1	1	3
THD, Ph-Ph Voltage		3	1	1	3
THD, Currents	√	3	2	1	6
Integrated Power Factor	√	4	2	1	8
Active Energy	√	4	2	1	8
Reactive Energy		4	2	1	8
Total Energy		4	2	1	8
Total					1853



THE POWER ANALYSER

General

This new series of Power Analysers are the ultimate network analysers, providing all necessary real-time information for both basic and sophisticated users. In addition to all the basic power parameters, they measure harmonics up to the 63rd, neutral voltage and current, and provide waveform display. The same device can monitor both single and three phase networks – either 3 wire or 4 wire.

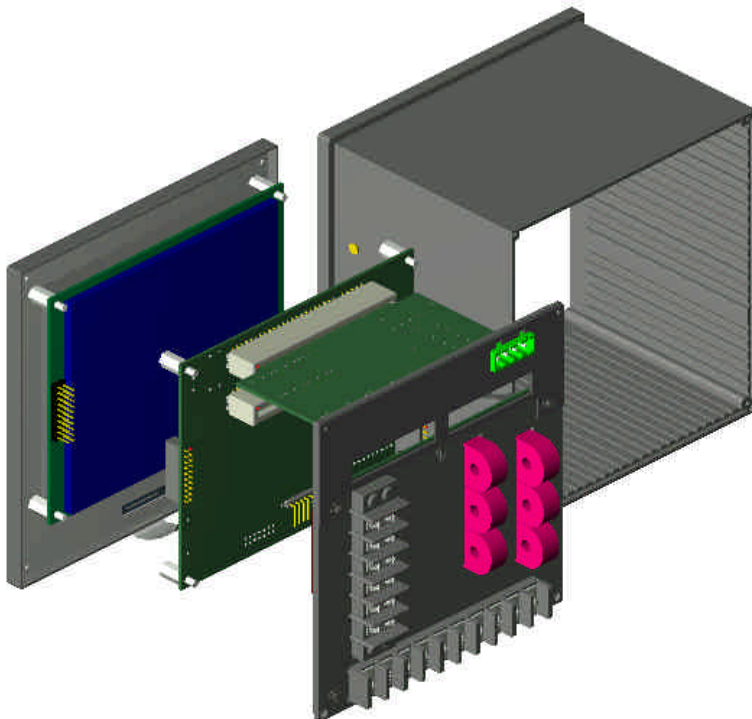
The unique 'Automatic Limits Warning Feature' provides an alarm whenever any parameter exceeds a pre-defined value. This feature can typically be used to monitor harmonic content (according to IEEE 519) and is available even on models without harmonics measurements.

The clear graphic LCD has a large digits display of key parameters – allowing the instrument to be read at a distance – plus supplementary information (such as minimum/maximum values) in smaller characters for further analysis. The PowerIQ™ software allows on-line use via a PC as well as data recording.

Up to 2048KB of memory, used for on-board data logging, allows for long-term network analysis with display either in real-time or off-line of historic data.

For maximum isolation, the current inputs require no physical connection – the Analyser uses special current transformer for input.

The Power Analyser is designed for maximum flexibility. All internal firmware is stored in Flash Memory and can be updated via the communication port. There are two expansion cards, similar to PCI cards, allowing easy upgrade of the instrument and the addition of extra functions and I/O.



Measurement

General

Based on a 12 bits A/D converter, the measurement system has a resolution of 1:2048, allowing measurement below 0.5% of full scale with high accuracy. A Fast Fourier Transform (FFT) algorithm is used to measure the harmonics of all network parameters and calculations are carried out in real time (within one cycle).

Measurements Formulas

The measurements are based on the following formulas:

Direct Phase Measurements :

$$V_i = \frac{1}{\sqrt{2}} \sqrt{\sum_n V_{n,i}^2}$$

$$I_i = \frac{1}{\sqrt{2}} \sqrt{\sum_n I_{n,i}^2}$$

Mains Power and Power Factor Computations :

$$P_i = \frac{1}{2} \sum_n V_{n,i} \cdot I_{n,i} \cdot \text{Cos}j_{n,i}$$

$$Q_i = \frac{1}{2} \sum_n V_{n,i} \cdot I_{n,i} \cdot \text{Sin}j_{n,i}$$

$$\text{Cos}j_i = \frac{P_i}{\sqrt{P_i^2 + Q_i^2}}$$

$$\sum P = \sum_i P_i$$

$$\sum Q = \sum_i Q_i$$

$$\text{Cos}j_{aver} = \frac{\sum P}{\sqrt{\sum P^2 + \sum Q^2}}$$

THD Computations :

$$\text{THD}(X_i) = \frac{\sqrt{\sum_{n,n \neq 1} X_{n,i}^2}}{X_{1,i}}$$

Consumption Recording :

$$kWh_i = \int_{t_1}^{t_2} P_i(t) dt \cong \Delta t \cdot \sum_{n_1}^{n_2} P_{n,i}$$

$$kVARh_i = \int_{t_1}^{t_2} Q_i(t) dt \cong \Delta t \cdot \sum_{n_1}^{n_2} Q_{n,i}$$

$$\text{Cos}j_{con,i} = \frac{kWh_i}{\sqrt{kWh_i^2 + kVARh_i^2}}$$

Legend :

i - phase index

n - harmonic index

$X_{n,i}$ - value of n^{th} harmonic at phase *i*

X_i - RMS value at phase *i*

$\sum X$ - Total value for all phases

$\text{THD}(X_i)$ - THD of parameter *X* at phase *i*

Communication

The Power Analyser can be fitted with two communication ports, each with a different communication settings.

Protocol is either ECom, for ultra fast throughput, or MODBUS/RTU for medium to fast throughputs.

Model Comparison

There are four different models of the Power Analyser – S, E, H & L. The table below summarises the functions that are available on each model.

Option	S	E	H	L
Full Instrumentation	●	●	●	●
RS-422/485 Communication Port		○	○	●
RS-232 Communication Port	○	○	○	
Programmable Analogue Outputs 0-20mA, 4-20mA or ±1mA			○	○
Wiring Diagnostics	●	●	●	●
ANSI C12.16 Accuracy	●	●	●	●
Current, per Phase	●	●	●	●
Current, Neutral conductor		●	●	●
Volts, Line to Line	●	●	●	●
Volts, Line to Neutral	●	●	●	●
Volts, Neutral to Ground		●	●	●
True Power (kW)	●	●	●	●
Reactive Power (kvar)	●	●	●	●
Apparent Power (kVA)	●	●	●	●
Power Factor (True & Displacement)	●	●	●	●
Frequency	●	●	●	●
True Energy (kWh)		●	●	●
Reactive Energy (kvarh)		●	●	●
Apparent Energy (kVAh)		●	●	●
Energy Accumulation Modes for the above: Signed, Unsigned, Import & Export		●	●	●
THD (Voltage and Current)		●	●	●
K-Factor (Circuit derating Factor)		●	●	●
Harmonics (Current, Volts L-L & Volts L-N) up to 63 rd			●	●
Harmonic Power Direction Flow			●	●
Network Asymmetry		●	●	●
Waveforms (Current, Volts L-L & Volts L-N)			●	●
Integral Alarms			●	●
Min/Max Readings	●	●	●	●
External Outputs		○	○	○
Automatic Warnings (THD, Neutral Current, etc.)	●	●	●	●
Date/Time Stamping	●	●	●	●
System Log	●	●	●	●
Event Log			●	●
Data Log				●
Event/Data Customizing				●
Time of Use (Tariffs, Profiles etc.)				●
Flash Memory (Kbytes)	128	128	256	1024

(● - Included, ○ - Optional):

Display

Each display screen consists of three sections:

- **Status** Top of screen
Operating mode and instrument status
- **Measurement** Centre of Screen
There are three types of measurement displays:
Digital, harmonic (histogram) and waveform display.
Each of the Digital display screens shows the real-time values of three measured parameter (either three phases or three different values such as V, I and PF) using large characters, together with minimum and maximum values and legends in a smaller font.
Waveform and Histogram screens feature a cursor, allowing selection of a specific harmonic (or position on a waveform) for detailed analysis.
- **Keyboard** Bottom of screen
Explains the function of each key.

Current Measurements



Voltage Measurements



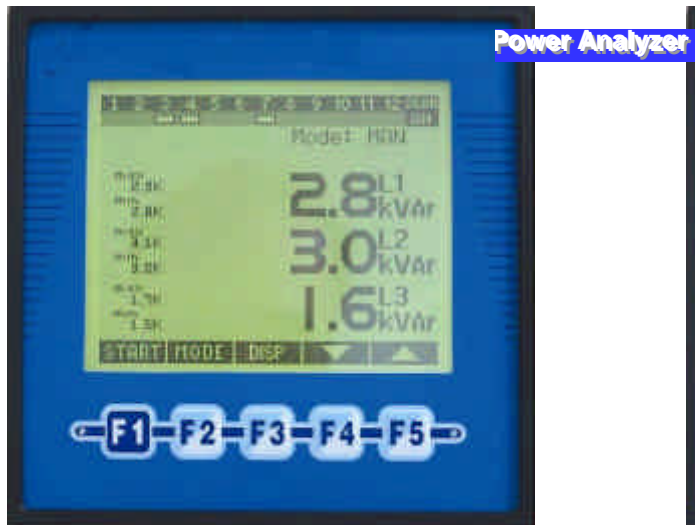
Power Factor Measurements



Active Power (kW) Measurements



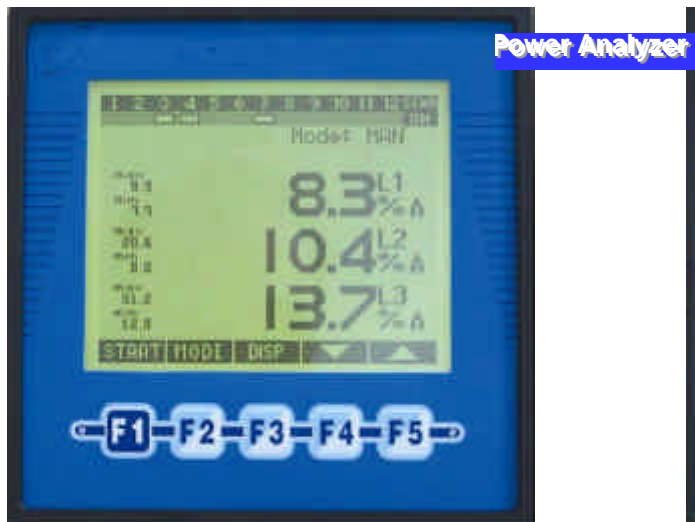
Reactive Energy (kVAr) Measurements



Harmonic Histogram Display



Total Harmonic Distortion (THD) Display



Waveform Display



Power IQ Software

General

PowerIQ is the ultimate network analysis software, allowing complete control over the Power Analysers and allowing access additional information.

PowerIQ includes four different configurations:

Express	Instrument remote control only.
Standard	Access to all instantaneous measurements.
Professional	Adds long term and event logging.
Network	Adds network support to the above.

Enhanced Network Analysis

The new Data Logger and Data Monitor software modules include Channel Recording, Report generation and a Report Viewer. For ease of use, a 'Quick Report Generator' and a 'Quick Report Viewer' are included. Access is also provided to many additional parameters and instrument functions.

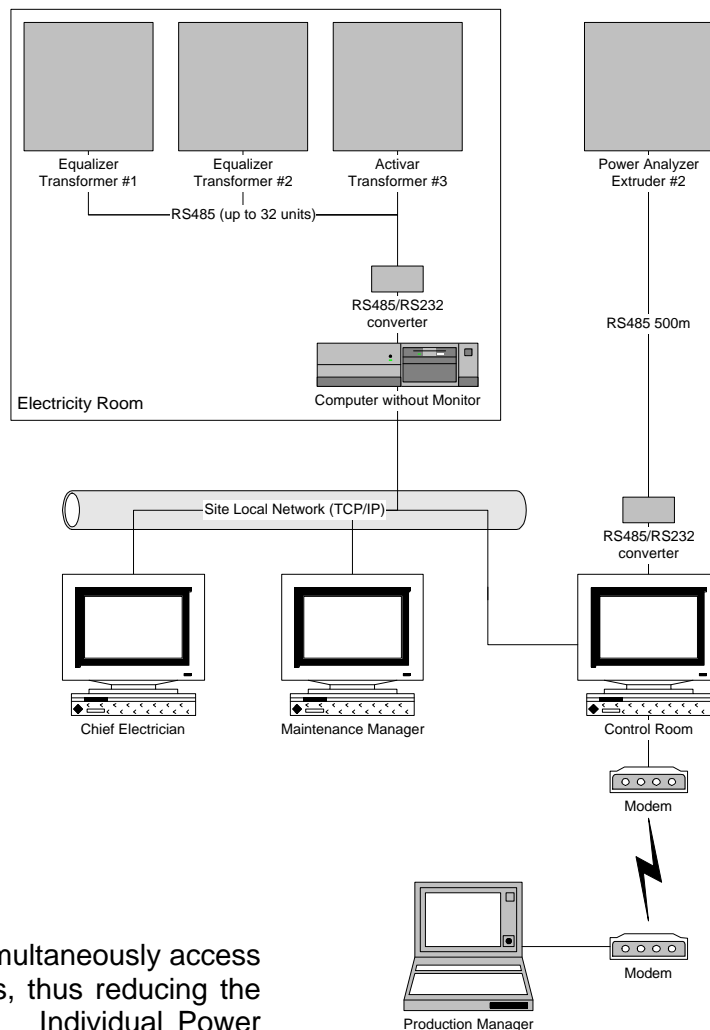
The Date Logger allows logging of approximately 2000 different parameters, selected according to different criteria such as time limits or parameter values. For example, upon detecting an event such as a voltage drop, the program can store 20 samples before the event and 100 after.

Integral links between the Data Logger and the Data Monitor enables monitoring the data while logging in real time or in demo mode (for later viewing and analysis).

Network Support

One of the most powerful features of PowerIQ is full Network Support. The system can fully operate over a network, either LAN (such as Novell or Windows 95/98/NT/2000) or WAN (such as the Internet). Using Windows Dial Up networking and MODEMS, remote Power Analysers can be easily accessed and controlled.

In addition, a single computer can simultaneously access multiple devices in multiple locations, thus reducing the need for long communication lines. Individual Power Analysers located on a networked site need only to be connected to the closest network computer; long cables to one central location are not required.



PowerIQ User Interface

The operator interface has been specifically designed for ease of use, by both new users and the experienced engineer. The following are included to help the user control the software:

- All graph-based applications are based on the same graphic computer designed tool. After mastering one graphic application, all others appear the same.
- The application has a built-in help file for easy assistance.
- Where applicable, speed button, hints and status lines were added.

PowerIQ Measured Parameters

The software can read approximately 2000 different parameters in each cycle of the electrical network.

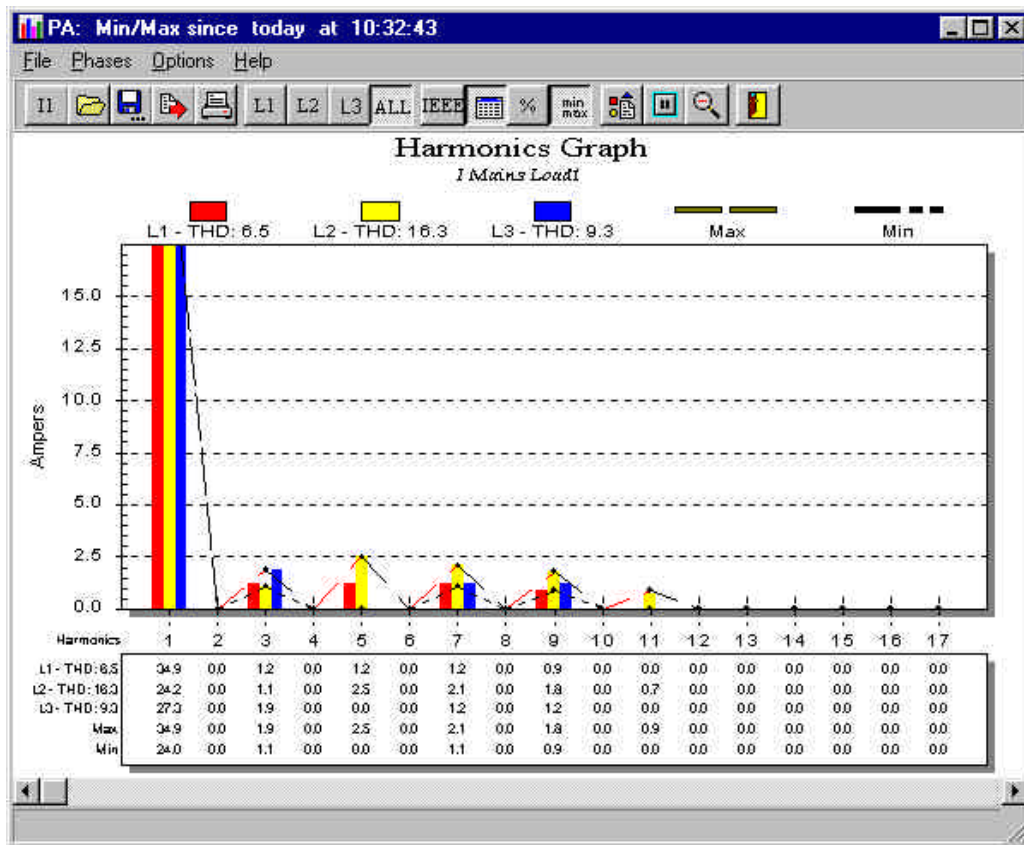
The main parameters are listed below. Where applicable, these are available per phase and as summed 3 ϕ values. Optionally, analysers can be provided to measure two separate loads, say supply and a capacitor bank, for all three phases:

- System initialization parameters.
- Control system status.
- Power Factor.
- Harmonics of Power Factor.
- Frequency.
- Phase voltage.
- Phase Voltage Harmonics.
- Phase Voltage THD.
- Phase to Phase Voltage.
- Current.
- Current Harmonics.
- Current THD.
- Active energy.
- Active Energy Harmonics.
- Reactive Energy.
- Reactive Energy Harmonics.
- Consumed Power Factor.
- Consumed Active Energy.
- Consumed Reactive Energy.
- Date and Time.
- Consumed Parameters Reset Time.
-

PowerIQ Function Summary

Remote Control	Allows both viewing of the status of the Power Analyser and full remote control of the instrument. Also adds a few supporting features.
Date & Time	Setting the internal date and time
Parameters	Viewing and modification of internal system parameters, including backing up and restoring.
Calibration	Allows calibration of the Power Analyser, either manually (using a general purpose external reference standard) or automatic with a custom calibrator.
Relay Setup	Alarm relay setup.
PF / Cap Summary	Display of power factor, reactive energy and control box status.
Table	Display of real time measurements values in a table view, including minimum and maximum values.
Gauge	Display network parameters in the form of an analogue meter.
Harmonics	Monitor network harmonic spectrum and Total Harmonic Distortion (THD) as a table, a graph or mixed graph and table.
Parameter Analysis	Display single parameter information: rms, Minimum, Maximum, THD, Waveform, Crest Factor, etc.
Consumption	Measurement of consumed Power Factor, Energies and Peak Demand. Allows reset of these values.
Waveform	Display the input waveform as a digital scope display, with level or THD (spikes) triggering. Available for more than one cycle.
Data Logger	Logging and historical analysis of measured values, including events capture (e.g. voltage sags). Up to 1800 different values can be recorder for each network cycle.
Data Monitor	Viewing data collected by the Data Logger, either in real time or as post-processing.
File Converter	Allows file conversion to and from the compressed binary files and the tab delimited ASCII files. Supports both data files and summary files.
MinMax Viewer	Display Data Summary file in a minimum, maximum and average format.
Report Generator	Combine the Data Summary, Data Format and Data Monitor into one integrated application that can generate reports from Data Logger files. The report includes average, minimum and maximum values for each parameters.
Season & Time Tariffs	Logs Energy Consumption and analyses it (by time and date) according to used defined profiles seasonal Tariff Profiles. A cost calculation module (by time, date, season, Power Factor, etc) is provided.

Harmonics



Scope View

