Voltech

PM1000+

Precision Power Analyzer

Versatile, Accurate, Fully Featured and Easy-to-Use

- Easy to use.
- 0.1% basic accuracy.
- Special standby power, inrush, and W-hr integration modes.
- Comprehensive high-speed interfacing for automated use.
- Ideal for the design and test of all electrical products.
- Now with pre-compliant IEC 61000-3 harmonics and flicker.

The No Compromise Power Analyzer

Driven by consumer demand and energy efficiency legislation, tomorrow's electrical and electronic products must operate with ever-greater efficiency and employ increasingly complex control methods such as a low-power standby operation. The accurate measurement of electrical power has never been more important than it is today.

The Voltech PM1000+ is the first power analyzer to combine bench instrument accuracy with sophisticated energy consumption features and low-power standby measurements at an affordable price. The PM1000+ measures power consumption from milliwatts to megawatts, providing accurate power and harmonic data on products ranging from the tiniest cell phone charger to the latest electric hybrid bus.

Designed and built using over 20 years of Voltech know-how. The PM1000+ is the most powerful, accurate, no-compromise power and energy analysis tool for the design and test of tomorrow's products.

Features and benefits…

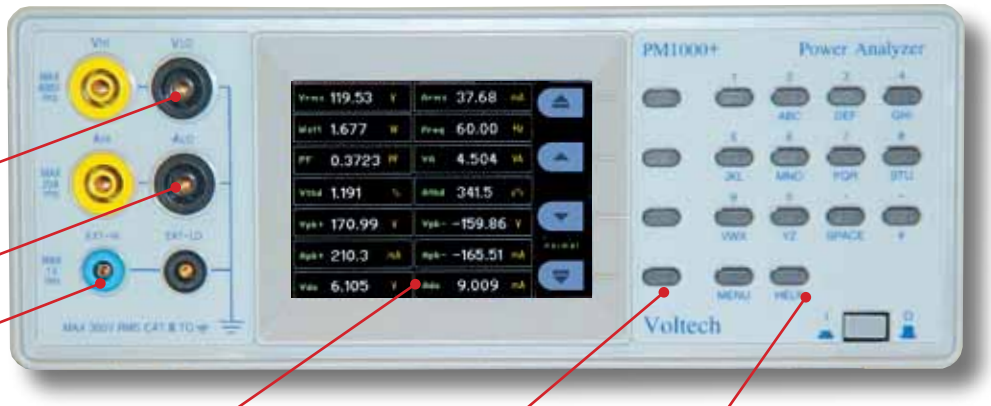
- Direct connection – no CT errors.
- Accurate up to Crest Factors of 20 – no compromise specification on distorted waveforms.
- Rugged analog design-stands overloads up to 5kV.
- Discrete Fourier Transform provides harmonics more accurately than FFT.
- Voltech proprietary frequency detection avoids problems with zero crossing detection.
- Built with low power standby in mind- no special accessories or channels required.
- High sample rate captures all the data and avoids aliasing problems.
- Full color clear and versatile display.
- Great interfacing with USB and RS232 as standard. GPIB and Ethernet optional.
- Optional USB host support for flash drives and printers.

1986 The world's first digital power analyzer, the Voltech PM1000.

When you really want to be sure, you can trust Voltech.

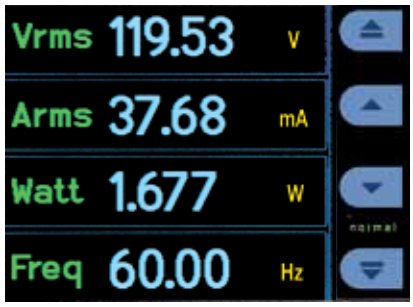
For more information or to request a no-obligation trial of a PM1000+, please see our website at www.voltech.com

Measurement Functions - Selectable From Menu



Volts	0 to 600V RMS & +/-900V Peak Direct Input
Current	0 to 20A RMS & +/-100A Peak Direct Input
Power Watts	0 to 90kW Direct Input
Apparent Power	0 to 90kVA Direct Input
Reactive Power	90kVAr Direct Input
Frequency	DC + 10Hz to 1MHz
Power Factor	-1.000 to + 1.000
Crest Factor	1 to 20.00
Ballast Mode	50/60/400Hz Input Up to 500kHz Output
Harmonics	0 to 50 Voltage and Current
THD	0 to 999%
Energy Whr	Programmable Timer
Inrush Current	Up to 100A peak
Low Power Standby	1 to 300 second window
Impedance	5mΩ to 1MΩ

Basic Accuracy 0.1% Reading +0.1% of Range



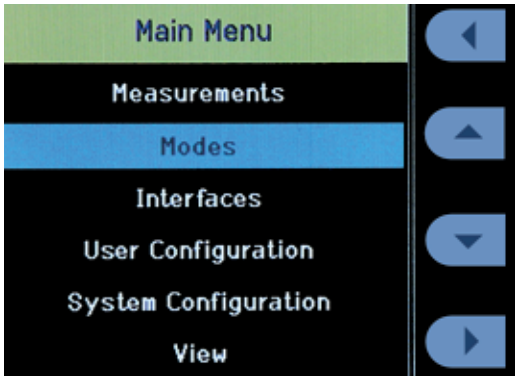
4 Parameter Measure Mode

14 Parameter Measure Mode

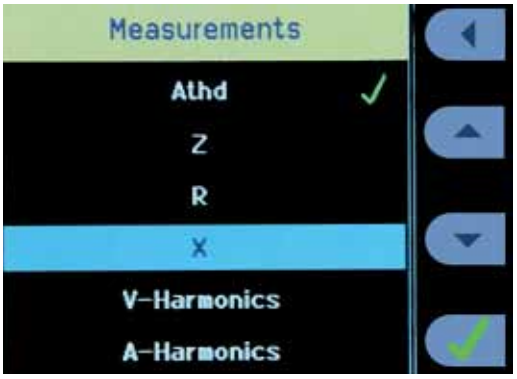
Measurement Selection

Modes of Operation - Applications

- Harmonics Display
- Energy Integrator
- Wave Form Display
- Standby Power
- Lighting Ballast
- Normal
- Inrush Current
- Pre-compliance IEC 61000-3



Main menu, with modes selected

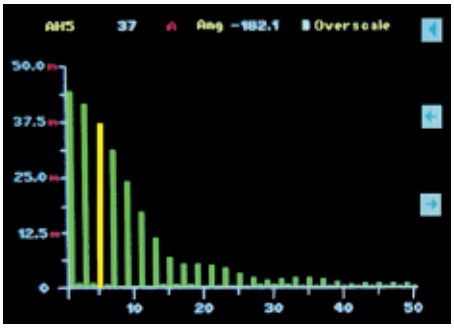


Measurement Parameter

Modes with standby selected

Harmonics and Distortion

- Up to the 50th harmonic
- Amplitude and phase from trouble-free DFT
- THD Total Harmonic Distortion
- Accurate DC measurements in the presence of AC
- 450kHz bandwidth for harmonics
- Harmonic bargraph display with cursor selection



Harmonic barchart

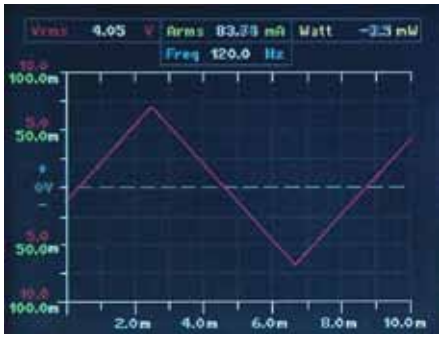
Modes of Operation - Applications

Energy Measurement

The power consumption of everyday home and office electrical appliances is of importance to consumers and generators of electricity alike.

When the power consumption varies over time, then integration of the power (W-hr integration) is required.
The PM1000+ provides comprehensive integration features suitable for Energy Star measurements and for low-power measurements in accordance with international directives, eg. IEC 62301 which also requires crest factor measurements up to 8 and 50 harmonics.

- Precision Graphical Watt-Hour and VA-Hour Measurements
- Clock



Waveform Display

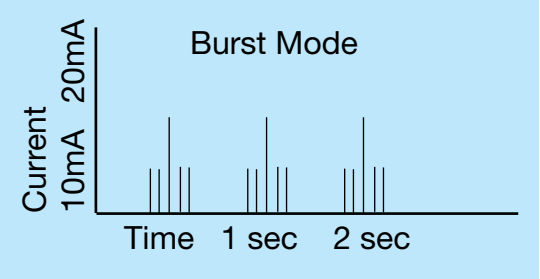
- **Display voltage & current waveforms**
- **Cursor readout: Volts RMS & Amps RMS**

Modes of Operation - Applications

Low-Power Standby

The first power analyzer developed with low power measurements built-in as standard.

- Special mode averages and captures power supplies in burst mode to provide accurate measurements in the shortest possible time.
- Very low current range (< 1mA with Voltech universal break-out box)
- Average power and accumulated energy measurements
- Crest factor up to 20
- Resolution better than 10mW
- Free PC software



Lighting Ballasts

Special operating mode measures the output of electronic ballasts. For 50Hz, 60Hz, 400Hz lighting systems

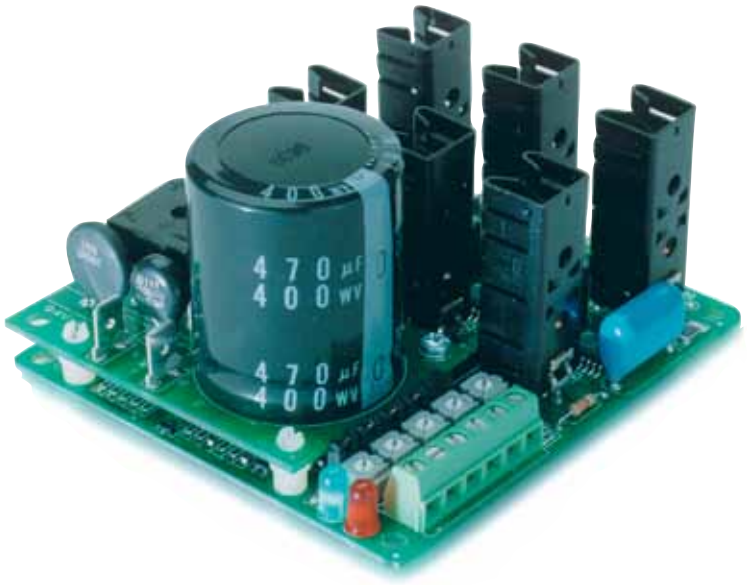
Voltech Ballast Current Transformer

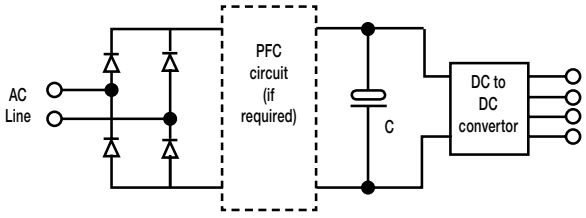
- Isolates common mode switching voltages
- 5mA to 1A RMS in 2 ranges
- 5kHz to 1MHz bandwidth
- Accuracy (20 kHz to 500kHz) 1%
- Current phase better than 1^0
- Voltage phase better than 3^0

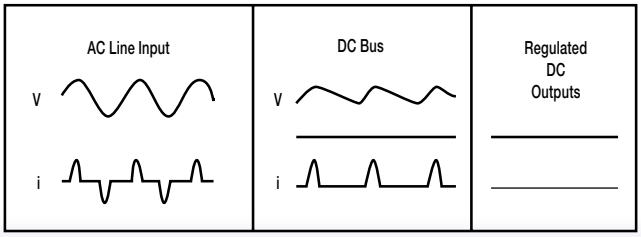
Modes of Operation - Applications

Power Supplies

Ideal for measurements on power supplies, from wall chargers to UPS and high-power converters, the PM1000+ makes accurate measurements on all waveforms including those heavily distorted by the rectification and smoothing at power supply inputs.





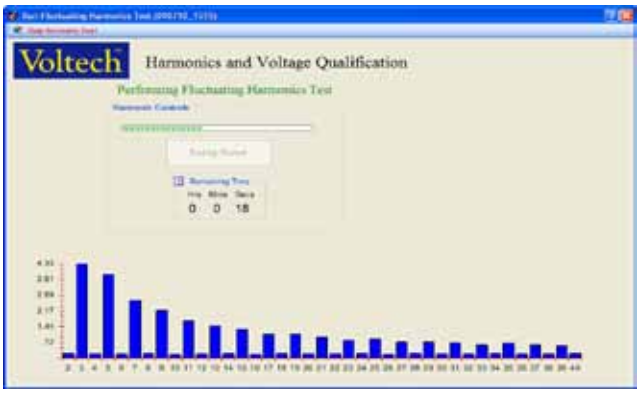


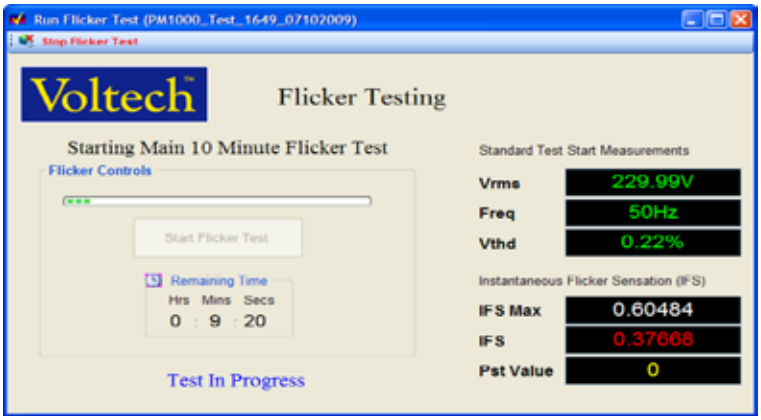
Measurements	
W	Input and Output power
Vrms	Line regulation, drop-out voltage, testing power fail circuits
Arms	Conductor and fuse rating
VA	Apparent power for supply rating
Apk MAX	Inrush Current Verification of inrush limiting circuit design Qualified fuse rating
PF	Power Factor (W/ VA) for verification of power factor control circuits
A harm	Amps harmonics for testing to harmonic standards
A THD	Distortion of input current
V THD	Distortion of supply or AC output
Integrator	Low-power standby measurements

Modes of Operation - Applications

IEC 61000-3 Harmonics & Flicker Testing

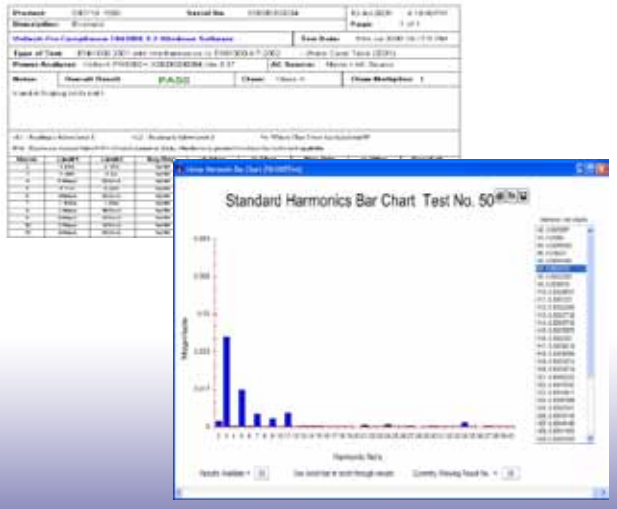
Until today, the accurate measurement of harmonics and flicker for 'CE' marking of products has been the domain of expensively equipped EMC labs. The Harmonics and Flicker measuring option for the Voltech PM1000+ power analyzer is a revolution in the way these measurements will be made. For the first time engineers designing and testing electrical products will have a compact, bench-top solution that will enable them to test their product at every stage of development. This will give engineers a high degree of confidence before they ultimately submit their product for full compliance testing. Testing with the PM1000+ will help highlight potential problems, significantly reducing time-to-market and minimizing expensive EMC lab re-test.





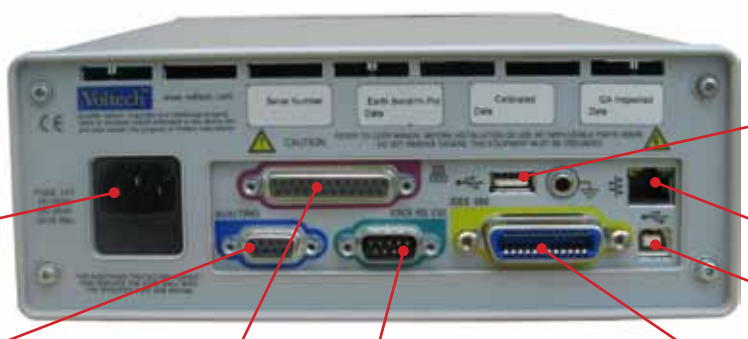
Using algorithms from the certified PM6000 power analyzer (as used by leading EMC labs) the PM1000+ analyzer provides many of the key measurements in one cost effective bench-top instrument. The results are obtained using proprietary software in the analyzer and processed and presented by PC software. The PC software configures the instrument automatically and provides detailed diagnostic results similar to those from an EMC lab, showing results against the limits of IEC61000-3-2 and IEC61000-3-3. The measurements are right up-to-date with the standards, including the measurement of inter-harmonic groups and flicker. Such measurements will help identify problems during the early stages of a development, instead of at the final EMC certification.

- Harmonics to EN61000-3-2 (pre-compliance)
- Flicker to EN61000-3-3 (pre-compliance)
- Harmonics including inter-harmonic groups to EN61000-4-7
- AC source and impedance network not required (pre-compliance)
- Check compliance at every design stage
- Avoid expensive EMC lab re-test
- PASS / FAIL result and comprehensive diagnostic reports
- PC software operates over USB (all models) or GPIB (communications model)



Connectivity/Accessories

Rear panel connections and interface options



Accessories

Clamp-on Current Transformers

- Accuracy better than 1%
- Connect to the PM1000+ via safety leads and normal current input
- CL100 100:1 ratio. 1A to 100Arms range
- CL1000 1000:1 ratio. 0.1A to 1200Arms range
- CL3000 3000:3 ratio. 1A to 3600Arms range

CT1000 –Dual Ratio Precision Current Transformer

- Accuracy (23°C ± 5°C): ± 0.2% of specified ratio
- Frequency range: 45Hz to 1kHz
- Current range: 100:1 ratio: 10A to 120A rms 1000:1 ratio: 100A to 1200A rms
- Maximum input current: 1000A continuous 2000A for 1 hour
- Phase error (23°C ± 5°C): Better than ± 0.1° at 50Hz

PS1000 - Inrush Switch

Solid-state switch for energizing loads (up to 200Apk) at either the peak or the zero crossing of AC voltage. Ideal for inrush current testing.

Ballast CT

Purposely designed for lighting applications, this device overcomes problems that are usually found when using conventional or Hall effect CTs.

- Convenient: No need to feed cables through a CT core.
- Better than 1% accuracy: Trifilar wound toroidal core.
- 5kHz to 1MHz bandwidth .
- 5mA to 1A measurement range

Specification

VOLTAGE	RANGES	900, 215, 46, 10 Vpk
	Frequency range	10Hz to 1MHz
	Peak continuous	1500 Vpk (over voltage)
	Peak < 1 second	5000 Vpk (over voltage)
	Input Impedance	1 MΩ
	Display	4.5 Digits
	Crest Factor	20 (Peak/RMS)
RMS	Accuracy	0.1% of rdg + 0.1%of range + 4mV + (0.02 * F)% of rdg
DC	Accuracy	0.1% of rdg + 0.4% of range + 5mV
VOLTAGE +/- PEAK	Accuracy	0.5% of rdg + 0.5% of range + (0.02 * F)% of rdg
CURRENT	RANGES	100, 25, 6.25, 1.6, 0.4, 0.1 Apk
	Frequency range	10Hz to 1MHz
	Peak continuous	20Arms
	Peak < 1 second	60Arms (over current)
	Input resistance	12.5 mΩ
	Crest Factor	20 (Peak/RMS)
RMS	Accuracy	0.1% of rdg + 0.1% of range + 1mA + (0.02 * F)% of rdg
DC	Accuracy	0.1% of rdg + 0.4% of range + 1mA
CURRENT +/- PEAK	Accuracy	0.5% of rdg + 0.5% of range + (0.02 * F)% of rdg
WATTS	RANGES	1W to 90kW
	Frequency range	10Hz to 1MHz
	Accuracy	0.2% rdg + 0.1% range + 4mW + ((0.05/PF) * F)% of rdg
VA	RANGES	1VA to 90kVA
	Frequency range	10Hz to 1MHz
	Accuracy	0.2% rdg + 0.1 % of range +4mVA + (0.05 * F)% of rdg
VAr	RANGES	1VAr to 90kVAr
	Frequency range	10Hz to 1MHz
	Accuracy	0.2% rdg + 0.1% range + 4mVAr + ((0.05/1-PF) * F)% of rdg
POWER FACTOR	Range	-1.000 to +1.000
	Accuracy	+/-0.002 +/- ((0.001/PF) * F)
FREQUENCY	Range	DC and 10Hz to 1MHz
	Accuracy	0.1%

F = Measured frequency in kHz

Specification

VOLTAGE CREST FACTOR	RANGE	1.00 to 20.0
	Accuracy	%Vpk error + % Vrms error
CURRENT CREST FACTOR	RANGE	1.00 to 20.0
	Accuracy	%Apk error + % Arms error
PEAK INRUSH CURRENT	RANGE	100Apk
	Accuracy	2% of range +/- 20mA
HARMONIC ANAYLSIS	Number of Voltage & Current Harmonics	50
	Maximum Harmonics Frequency	450kHz
	Accuracy	0.2% of Reading + 0.1% of range +0.04% per kHz of Harmonics
	Frequency Range	10Hz to 450kHz
THD		
Total Harmonic Distortion	Range & Accuracy	Range 0-999% Accuracy 0.4% + (0.1 * F)% of reading
	Formula	Series or difference
STANDBY POWER	Time Window	1-300 sec
	Resolution	1 second
IMPEDANCE	Range	0.005Ω to 1MΩ
	Accuracy	0.2% of Reading +0.1% of range +5mΩ + ((0.05/PF) * F)% of reading
RESISTANCE	Range	0.005Ω to 1MΩ
	Accuracy	0.2% of reading + 0.1% of range +5mΩ + ((0.05/PF) * F)% of reading
REACTANCE	Range	0.005Ω to 1MΩ
	Accuracy	0.2% of Reading + 0.1% of range +5mΩ + ((0.05/1-PF) * F)% of reading
EXTERNAL SHUNT	Input Range	+/- 1250 mVpk
Scaling		0.0001 to 100000
MECHANICAL CE		1/2 rack size. Rack height 85mm W = 224mm. Height including feet 103mm D = 285mm. Weight 3.21Kg (7lbs.)

F = Measured frequency in kHz

Voltech

www.voltech.com

Distributor

Voltech Instruments Inc.
11637 Kelly Road, Suite 306
Fort Myers, FL 33908
USA
Tel: (239) 437 0494
Fax: (239) 437 3841
Email sales@voltech.com

Voltech Instruments Ltd.
148 Harwell Science Campus
Didcot, Oxon. OX11 0TR
UK
Tel: +44 (0) 1235 834555
Fax: +44 (0) 1235 835016
Email: sales@voltech.co.uk

Voltech Instruments (Nantong) Ltd
No.18 Xingtai Road.
Nantong City
Jiangsu
China 226002
Tel: 0086 513-853-00652
Fax: 0086 513-853-00658
Email: sales@voltech.com.cn

VPN 86-618 Issue 4