

M1001 Series

Single-Phase Power Analyzer

$\pm 800 V_{peak}$ / $\pm 200 A_{peak}$



M1001 Series: Compact Single-Phase AC & DC Power Analyzer

Designed using state-of-the-art Digital Signal Processing, this power analyzer supports gap-less measurement of voltage and current at **sampling rates up to 409.6kHz**.



Multiple voltage and current ranges allow for **optimal resolution and accuracy** when making measurements providing support for a wide range of power test applications.

Key Features

- 6 Voltage Ranges up to $\pm 800 V_{pk}$ / $500 V_{rms}$
- 18 Current Ranges up to $\pm 200 A_{pk}$ / $20 A_{rms}$
- DC, 20 ~ 1000Hz
- AC or DC Measurement Modes
- Numeric and Graphical Data Display Modes
- Voltage & Current Harmonics Measurements
- VTHD and ITHD Measurements
- Automatic Current Inrush Measurements with Programmable On and Off Phase Angles
- Scope Display of Inrush Current Waveform
- Energy Star / IEC62301 Compliant Standby Power Measurement mode
- IEC 61000-3-2 Harmonics Measurements
- Query Vrms, Irms, Watts, Power Factor, VTHD and ITHD with a single bus command
- Power ON/OFF Cycling with Programmable On and Off Phase Angles
- Bench Use or 2U Height, 1/2 Rack Mount

Advantages:

- Unique test modes not found in run of the mill power analyzers in this price range include automated current inrush measurement using programmable On and Off phase angle settings thanks to an internal electronic switch.
- A minimum power measurements resolution of 0.1 picoWatt and 0.03W standby power integration mode support product testing for compliance with **ENERGY STAR / IEC62301 standards**.
- The internal shunt is rated at 20Arms / 200Apk. An external shunt may be used for higher current or power level requirements.
- For three-phase power applications, two or three M1001 meters can be used to measure all phase voltages, currents and power.

Available Operating Modes

The M1001 offers common measurement capabilities like voltage, current, and power. Beyond that, it also offers several unique measurement modes and tests using an internal phase angle controlled, fast electronic switch.

An overview of available functions and features is shown on this page using associated setup and data display screens.

MAIN MENU

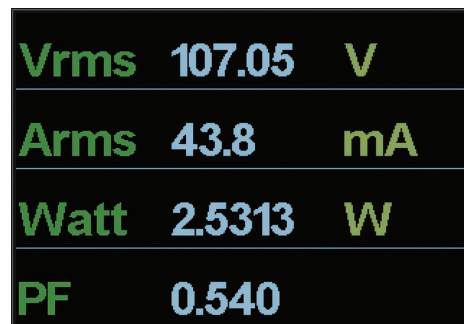
Key functions or test modes are easily selected from the Main Menu shown to the right.

Main Menu (Enter 0~7)

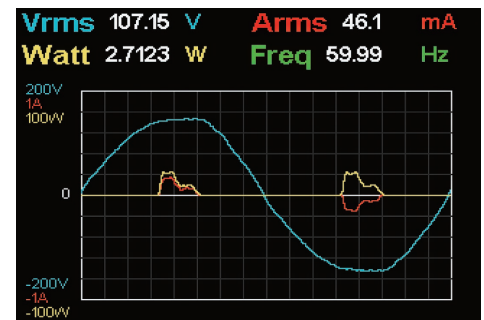
- 0. System
- 1. Meter Mode
- 2. Harmonic Mode
- 3. Inrush Current
- 4. AC Whr Standby Power
- 5. DC Ahr/Whr Accumulator
- 6. Data Logger
- 7. ON/OFF Cycling

Meter Mode

In METER MODE, measurement data can be displayed in either numeric or graphical format. Graphs display can show any combination of Voltage, Current and Watt using an oscilloscope display.



Meter Mode Numeric Display



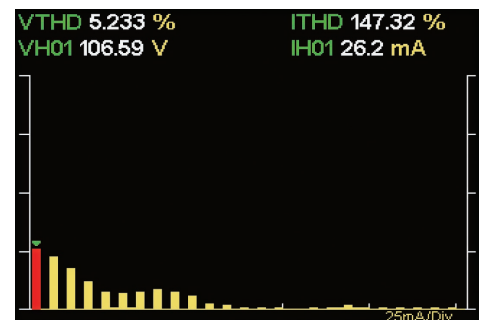
Meter Mode Scope Display of V, I and W

Harmonics Mode

Even and Odd Harmonics of the fundamental AC frequency for both voltage and current are measured up to the 50th harmonic and can be display in table or graphical formats.

VH01	107.23 V	VH02	0.04 V
VH03	5.22 V	VH04	0.01 V
VH05	1.10 V	VH06	0.02 V
VH07	1.33 V	VH08	0.00 V
VH09	0.74 V	VH10	0.00 V
VH11	0.15 V	VH12	0.02 V
VH13	0.24 V	VH14	0.03 V
VH15	0.19 V	VH16	0.03 V

Voltage Harmonics Table Display



Current Harmonics Bar Chart Display

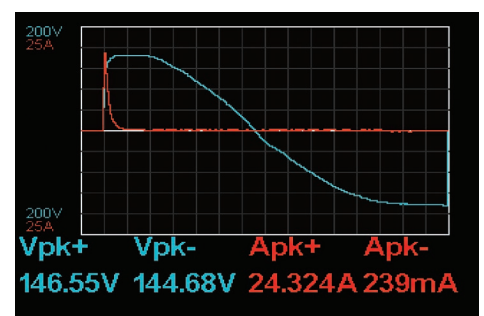
Inrush Current Mode

The internal electronic switch allows precise control over the voltage turn-on and turn-off phase angle allowing for the measurement of inrush current under various start phase angle conditions. Finding an EUT's worst case inrush current is made easy and fast.

Inrush Set

Graph Scroll(0~100ms)	000.00 ms
V_Range	20V, 40V, 80V, 200V, 400V, 800V
I_Range	10A, 20A, 40A, 50A, 100A, 200A
On Degree(0~359)	090°
Off Degree(0~359)	000°

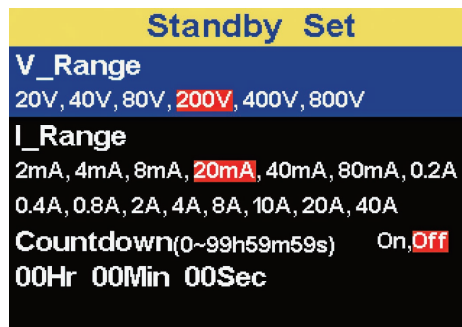
Inrush Current Setup Screen



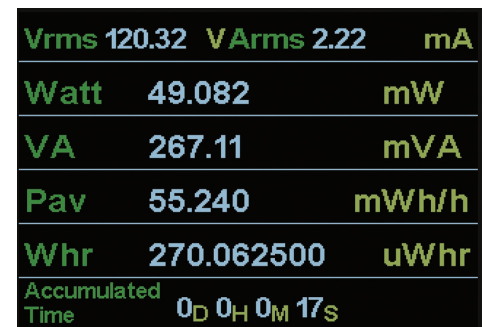
Inrush Current Measurement Display

Standby Power Measurement Mode

With so many electrical devices and chargers in the world, standby power adds up to an enormous amount of electricity use in the world. Designing products with very low standby current is important to minimize waste. The standby power measurement mode of the M1001 allows certification to the ENERGY STAR / EN62301 standard.



Range and Time Interval Setup Screen

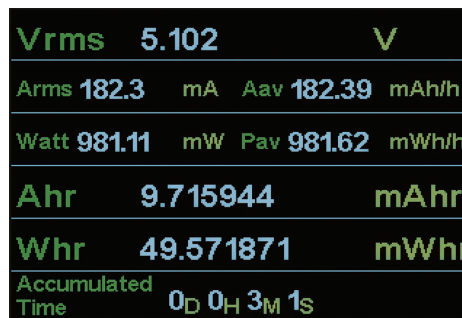


Standby Power Result Display

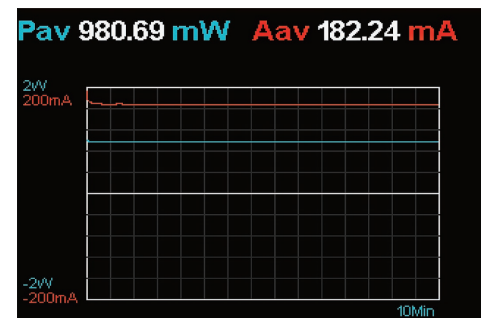
DC Ahr/Whr Accumulator Mode

The Accumulator mode integrates power consumption over time. The Watt reading is the instantaneous power value. The Pav reading is the cumulative energy divided by the accumulated time.

Pav and Vac graphic display shows the integration time for power and current use of the EUT.



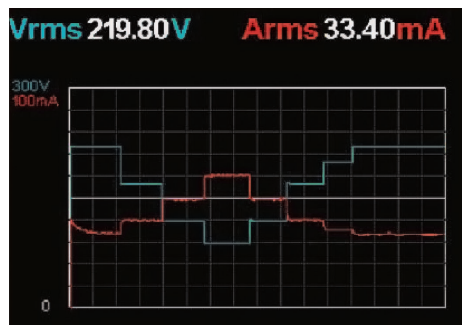
Accumulator Digital Display Mode



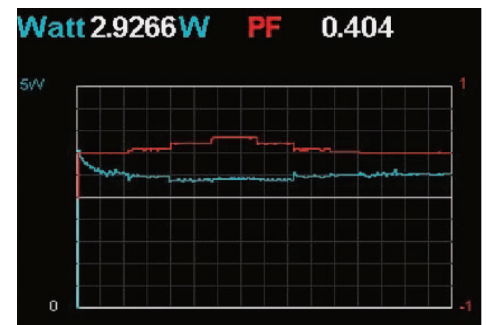
Accumulator Graphical Display Mode

Data Graph Display Mode

Data graph displays are useful for recording test data or product burn-in runs. This mode display V and I or W and PF parameters in a graphical form. The digital control interface may be used to query data to a Windows PC for long term quality control or product burn-in requirements using user developed software .



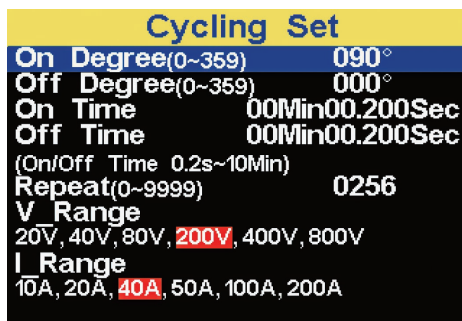
Data Log Strip Chart Display for V & I



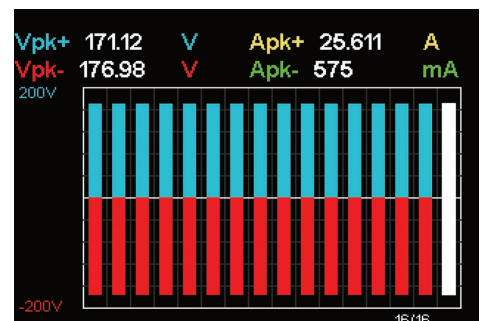
Data Log Strip Chart Display for W & PF

Power On/Off Cycling Mode

Power On/Off cycling is used to turn-on behavior and turn-off behavior of a unit under test. This continuous power cycling of product under development or test can pinpoint design issues or quality issues by stressing components. Programmable on/off phase angles allow testing under worst-case conditions.



Power Cycling Setup Screen



Power Cycling Strip Chart Display

Ease of Use

Front panel operation of the Power Analyzer is simple using the cursor keypad to move through any menu or display screen and a 0-9 numeric keypad to enter setting values as needed. The red MENU key

always returns to the main menu.

The rear panel contains all EUT connections as well as the internal power switch phase angle Sync BNC input connector.



M1001 Front Panel View

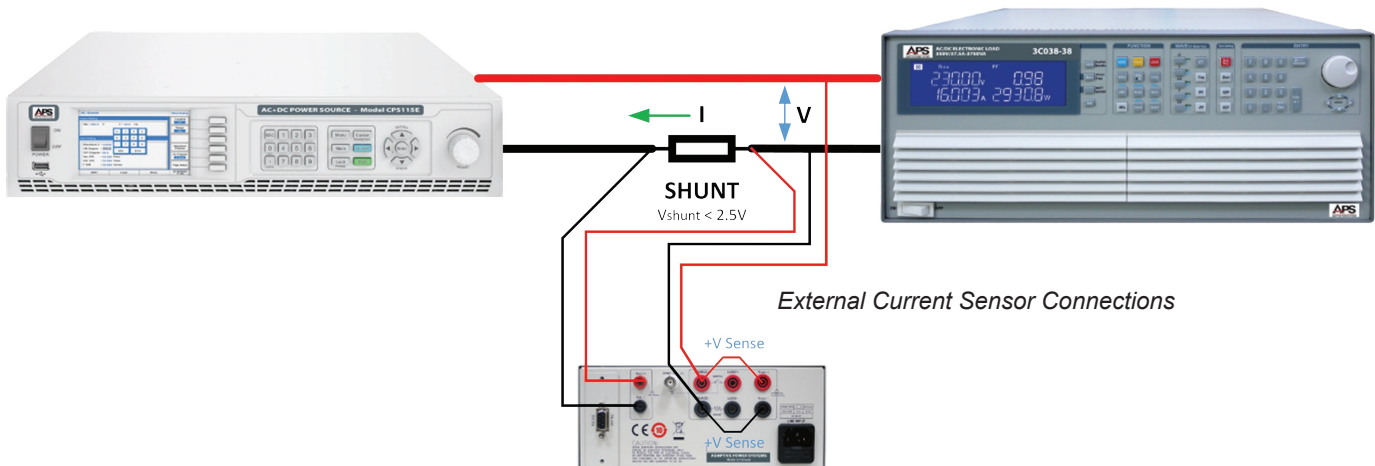


M1001 Rear Panel View

Using External Shunts or Current Transducers

The external current shunt or current transducer input will accept an input voltage up to 2.5V to support larger current ranges than supported by the internal

shunt. This allows Hall Effect and Current Transformers with a burden resistor or direct current shunts to be used with the M1001 as shown below.

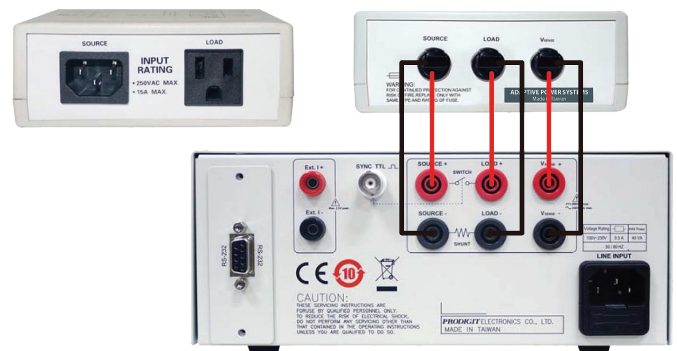


External Current Sensor Connections

Test Fixture Box Accessory

The available Test Fixture Box allows easy connection of the M1001 Power Analyzer to any IEC 60320 standard line cord connected US product or appliance.

The source side connects to a US outlet or programmable AC Source and the EUT line cord plugs into the load outlet. All V and I connections are brought out in the back of the test box using color coded banana plugs into the back of the M1001 Power Analyzer as shown below.



Power Analyzer & Fixture Interconnects

Instrument Rack Installation

The M1001 Power Analyzer can be installed in a 19" wide instrument rack using the available M1001-RMK1 Rack Mount Kit accessory. This Kit supports one unit in a 2U / 3.5" rack space.



TECHNICAL SPECIFICATIONS

PARAMETER			SPECIFICATION						
MEASUREMENTS									
AC & DC VOLTAGE Vac, Vdc, Vrms, Vpk+, Vpk-, Vmax, Vmin, V Harmonics		Range	20Vpk	40Vpk	80Vpk	200Vpk	400Vpk	800Vpk	
		Resolution	0.001V	0.001V	0.01V	0.01V	0.01V	0.1V	
		Max. Input	80Vpk / 50Vrms			800Vpk / 500Vrms			
		Input Imp.	> 100 kΩ			> 1 MΩ			
		Accuracy	± 0.1% (Reading + Range) ± 0.5% (Reading + Range) for Vpk+, Vpk-, Vmax, Vmin						
AC & DC CURRENT Aac, Adc, Arms, Apk+, Apk-, Amax, Amin, I Harmonics	Shunt 0.05A (10Ω)	Range	0.002Apk	0.004Apk	0.008Apk	0.02Apk	0.04Apk	0.08Apk	
		Resolution	0.1uA	0.1uA	0.001mA	0.001mA	0.001mA	0.01mA	
		Max. Input	0.08Apk / 0.05Arms						
	Shunt 0.5A (1Ω)	Range	0.2Apk		0.4Apk		0.8Apk		
		Resolution	0.01mA		0.01mA		0.1mA		
		Max. Input	0.8Apk / 0.5Arms						
	Shunt 5A (0.04Ω)	Range	2.0Apk		4.0Apk		8.0Apk		
		Resolution	0.1mA		0.1mA		0.001A		
		Max. Input	8.0Apk / 5.0Arms						
	Shunt 20A (0.005Ω)	Range	10Apk	20Apk	40Apk	50Apk	100Apk	200Apk	
		Resolution	0.001A	0.001A	0.001A	0.001A	0.01A	0.01A	
		Max. Input	200Apk / 20Arms						
	Ext. Input	Input Imp.	10 kΩ						
		Range	0 ~ ± 2.5 Vpeak						
		Scaling	1.00 ~ 10,000.00						
Accuracy		± 0.1% (Reading + Range) ± 0.5% (Reading + Range) for Peak Current							
AC & DC POWER Watts	Range / Accuracy		V range * I range / ± 0.2% (Reading + Range)						
POWER FACTOR PF	Range / Accuracy		± 0.001 ~ 1.000 / ± 1.0% (Reading + Range) corresponds to V and I						
	Resolution		0.001						
FREQUENCY Hz	Range / Accuracy		DC, 20 Hz ~ 1000 Hz / ± 0.1 Hz						
V/I HARMONICS	Range / Accuracy		1 ~ 50th / ± 0.5% (Reading + Range)						
V/I THD	Range / Accuracy		0% ~ 255% / ± 0.5% (Reading + Range)						
	Resolution		0.001%						
LOW PASS FILTER (V & I)			50 kHz						
SPECIAL MODE MEASUREMENTS									
Inrush V/I	Voltage	Range	Same as Aac and Adc						
	Current	Range	Same as Aac and Adc. (20A, 5 mΩ Shunt)						
	Accuracy		± 2.0% (Reading + Range)						
	Measurement window		100 msec						
AC ON/OFF Programmable Out-put Switch	Range		0 ~ 359°						
	Accuracy		±1.0° Max. @ 50/60 Hz						
	Resolution		1.0°						
Standby Power	Accumulated Time		0D : 0H : 0M : 0S ~ 9999D : 23H : 59M : 59S						
	WHr Range		0.000000 ~ 999.999999 WHr / 1.000 9999.999 kWhr						
	Counter Range		0H : 0M : 0S ~ 99H : 59M : 59S						
	Accuracy		± 0.2% (Reading + Range)						
DC Ahr / WHr Accumulator	Accumulated Time		0D : 0H : 0M : 0S ~ 9999D : 23H : 59M : 59S						
	WHr & Ahr Range		0.000000 ~ 999.999999 WHr / 1.000 9999.999 kWhr						
	Counter Range		0H : 0M : 0S ~ 99H : 59M : 59S						
	Accuracy		± 0.2% (Reading + Range)						
ON/OFF Cycling	Range	ON & OFF	0M : 0.200S ~ 10M : 0S						
		Repeat Cycle	0 ~ 9999						

PARAMETER	DESCRIPTION
AC INPUT	
AC Input Voltage	100 ~ 230Vac $\pm 10\%$, 1 Phase
Input Frequency	50Hz or 60Hz $\pm 3\text{Hz}$
Power Consumption	40 VA
Line Fuse	250V / 0.5A (6 x 30 mm)

PARAMETER	DESCRIPTION
GENERAL SYSTEM	
Display	3.5" TFT LCD, 320 x 240 RGB Color
Keyboard	Numeric 0~9, MENU, Graph, ON/OFF
Sampling Rates	4096 sample/period @ 50Hz/60Hz
V/I ADC Converters	Dual 16-bit, 500 ksp/s ADCs w/DSP

PARAMETER	DESCRIPTION
ENVIRONMENTAL CONDITIONS	
Operating Temperature	0° C ~ +40° C / +32° F ~ +104° F
Storage Temperature	-20° C ~ +60° C / -4° F ~ +140° F
Max. Operating Altitude	2000 meters / 6562 feet
Max. Relative Humidity	80% for temperatures up to 31° C (88° F) decreasing linearly to 50% relative humidity at 40° C (104° F)

PARAMETER	DESCRIPTION
SHUNT PROTECTION FUSES	
0.05A, 10 Ω Shunt	3.6 x 11 mm, 250Vac, 0.2A Fast
0.5A, 1 Ω Shunt	3.6 x 11 mm, 250Vac, 1.0A Slow

ORDERING INFORMATION

Line Item 1: APS Model M1001
Add Interface Option, e.g. M1001-LAN for Ethernet.

Line Item 2, 3: Add M1001-TFB and/or M1001-RMK as additional line items as needed.

WORLDWIDE SERVICE AND SUPPORT

Adaptive Power Systems' customer support is second to none. Our Customer Support Program provides the training, repair, calibration, and technical support services that our customers value. Customers can rely on us for excellent support before, during and after the sale with support and service centers around the world.

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PARAMETER	DESCRIPTION
DIMENSIONS & WEIGHT	
Size (H x W x D)	99.4 x 213 x 304 mm (incl. feet)
	3.9" x 8.4" x 12.0"
Shipping Size	200 x 290 x 390 mm
	7.9" x 11.4" x 15.4"
Net Weight	3.5 Kg / 8.4 lbs
Shipping Weight	9.0 Kg / 19.8 lbs

PARAMETER	DESCRIPTION
REMOTE CONTROL INTERFACE OPTIONS	
-USB	USB Serial Interface
Connector	USB Type-B, Rear Panel
Baud Rate	115200 bps
-LAN	Ethernet Interface
Connector	RJ45, Rear Panel
-GPIB	GPIB / IEEE-488.1 Interface
Connector	24-pin Amphenol, Rear Panel
-RS232	RS232 Serial Interface
Connector	DB9, Rear Panel
Baud Rate	115200 bps
Parity	None
Data Bits	8
Stop Bits	1

OPTIONS	DESCRIPTION
-GPIB	GPIB Interface
-LAN	Ethernet Interface
-USB	USB Serial Interface
-RS232	RS232 Serial Interface
M1001-TFB	Test Fixture Box
M1001-RMK1	19' Rack Mount Kit for single unit

New Product Warranty: One (1) year.

Complete calibration and repair services are offered at our US, European and Chinese manufacturing facilities. Calibrations are to original factory specifications and are traceable to NIST (National Institute of Standards and Technology).

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