

Model 2335A Wideband Power Analyzer



- DC to more 500kHz or 1MHz
- Inputs up to 10A and 1000V
- 0.2% Uncertainty
- Isolated inputs
- Low Power Factor accuracy

- Harmonic analysis
- Total Harmonic Distortion
- Low current ranges
- USB and IEEE interface
- Graphical display

TRUE RMS/WIDE BANDWIDTH

The Model 2335A Power Analyzer is a precision, high accuracy, auto-ranging instrument which measures and displays true rms and peak Voltage, true rms and peak Current, and true mean Power over a frequency range from dc to more than 1MHz. Full scale Current and Voltage inputs are typically measured within $\pm 0.1\%$ of the amplitude reading to at least 500kHz. The corresponding Power is typically measured to within $\pm 0.1\%$ of the input Volt-Amperes to 250kHz and to within $\pm 0.2\%$ of the input Volt-Amperes to 500kHz for loads having any Power Factor.

MULTI-FUNCTION

In addition to the primary functions, the Model 2335A measures the input

Frequency, the phase angle between the current and voltage inputs, and the harmonic amplitudes, up to 50, for both the current and voltage inputs. It also calculates the Power Factor, the Volt-Amperes, and the Energy (if it has been selected). These functions may be displayed or read over the IEEE-488 or USB interface.

LOW POWER FACTOR ACCURACY

Five digits or resolution combined with excellent phase matching between the current and voltage channels make the Model 2335A an exceptionally good instrument for making low power factor measurements up to 500kHz or 1MHz. This ability makes the instrument ideal for high frequency core loss measurements which have inherently low power factors.

UNPARALLELED HIGH FREQUENCY ACCURACY

The Model 2335A allows broadband and high accuracy measurements of both sinusoidal and highly distorted wave shapes. The Current, Voltage, Power, and Power Factor accuracies to 1MHz of the Model 2335A-01 far exceed any other Watt Meter or Power Analyzer, or for that matter, with respect to Current or Voltage, almost all conventional multimeters.

WIDE MEASUREMENT RANGE

The Model 2335A has full scale Power ranges from 1.0000mW to 10000W. With external shunts or current to voltage transducers, the upper range may be extended by a factor of ten or one hundred. Full scale Voltage from 2.000V to 2000V (usable to 1000V) and full scale Current ranges from 5.000mA to 5.000A (all rms values) cover a wide range of load impedances. Full scale Current and Voltage inputs may have crest factors up to three while smaller inputs may have even higher crest factors. Sinusoidal inputs with rms values of twice the nominal Full Scale value may be measured with no loss in accuracy.

POSSIBLE MEASUREMENT USES

Measurement of Ultrasonic Equipment of all types and power levels, Ferrite Core Loss, Transformer Core Material, Switching Power Supplies, Fluorescent Lamp Ballasts of all types, Mercury Arc Lamp Circuits, Sodium Lamp Ballasts, Speed Controlled Motors of all types, Efficiency of any device with an electrical input and an electrical output, SCR Controlled Devices of all types, High Frequency and/or Distorted Currents from any source, Voltage Response of any device, and the

Characteristics of Electric Automobile Drives.

EASY TO CALIBRATE

The Model 2335A has isolated input channels. DC coupling in both channels allows calibration and/or verification with high accuracy dc sources. Internal software calibration routines allow most recalibrations to be accomplished in just a few minutes **without opening the instrument and without screwdriver adjustments.**

UNIQUE SAMPLING APPROACH

The Voltage and Current inputs of the Model 2335A are simultaneously sampled (with 16 bit resolution), converted to digital form, and transmitted via isolated links to the control board on the main chassis. This allows both the Current and Voltage inputs to be completely isolated from each other and from the main chassis ground. The asynchronous sampling frequency is controlled by the system microprocessor in such a fashion that neither it nor any of its harmonics can come close to the measured input frequency or any of its harmonics. This precaution permits sampling at frequencies that are significantly below the Nyquist rate.

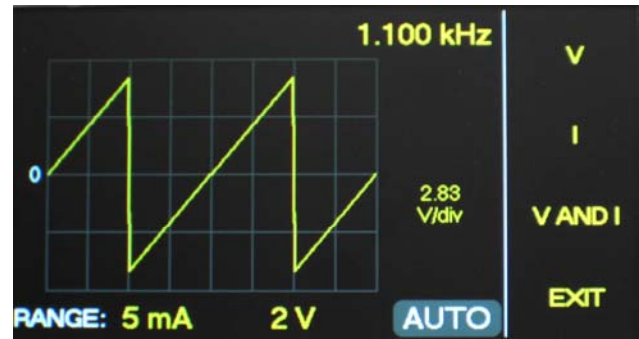
REMOTE CONTROL

The Model 2335A is equipped with an IEEE-488.2 interface and a USB interface which both incorporate all of the IEEE-488.2 Common Commands and Queries as well as the commands and queries required for device operation. Any function that can be entered via the front panel can be controlled via either interface. A menu item selects either the IEEE-488 or the USB interface to be active.

CURRENT, VOLTAGE, AND POWER



OSCILLOSCOPE



PHASE, PF, AND VOLT-AMPERES



HARMONICS



SPECIFICATIONS

CURRENT AND VOLTAGE

Range, Resolution and Input Impedance (Voltage Channel)

| Full Scale Voltage | Max. Peak Value | Resolution | Input Impedance |
|--------------------|-----------------|------------|-----------------|
| 2.000V | 6V | 1mV | 1.05M/30pF |
| 20.00V | 60V | 10mV | 1.05M/30pF |
| 200.0V | 600V | 100mV | 1.00M/30pF |
| 2000 V | 3000V | 1 V | 1.00M/30pF |

The 2000V range is useable to 1000V rms

Range, Resolution and Input Impedance (Current Channel)

| Full Scale Voltage | Max. Peak Value | Resolution | Input Impedance |
|--------------------|-----------------|------------|-----------------|
| 5.000mA | 15mA | 1uA | 2.0 Ω |
| 50.00mA | 150mA | 10uA | 2.0 Ω |
| 500.0mA | 1500mA | 100uA | 0.034 Ω |
| 5000 mA | 15A | 1mA | 0.034Ω |

| | | | |
|------------------|-------|---|-------|
| EXTERNAL (100mV) | 300mV | - | 100kΩ |
|------------------|-------|---|-------|

Uncertainty (rms) Current and Voltage (double uncertainty spec for peak readings)

| | 5% - 100% of Full Scale | 100% - 200% of Full Scale |
|------------------|----------------------------|---------------------------|
| Frequency | ±(% of Reading+% of Range) | % of Reading |
| dc | ±(0.10 + 0.10) | ±0.20 |
| 5Hz - 250kHz | ±(0.10 + 0.10) | ±0.20 |
| 250kHz - 500kHz | ±(0.20 + 0.20) | ±0.40 |
| *500kHz - 1.0MHz | ±(0.40 + 0.40) | ±0.80 |

* Specify option -01

ISOLATION: 500V peak may be placed between the LO Voltage Terminal and Chassis

POWER AND POWER x 10:

Ranges Eight decade Full Scale ranges from 1.0000mW to 10,000W. The ranges are all combinations of a Full Scale Current range multiplied by a Full Scale Voltage range plus a corresponding set of combinations with ten times the sensitivity which occur when the Px10 range is activated.)

Resolution 1 part in 10000 of the Full Scale range

Uncertainty Power

| | 5% - 100% of Full Scale | 100% - 200% of Full Scale |
|------------------|-------------------------|---------------------------|
| Frequency | ±(% of V-A+% of Range) | % of V-A |
| dc | ±(0.20 + 0.10) | ±0.30 |
| 5Hz - 250kHz | ±(0.20 + 0.10) | ±0.30 |
| 250kHz - 500kHz | ±(0.40 + 0.20) | ±0.60 |
| *500kHz - 1.0MHz | ±(0.80 + 0.40) | ±1.20 |

(for any Power Factor) (V-A is the Volt-Ampere product) * Specify option -01

POWER X 10: Any Px10 range may be selected when both the Peak Current and the Peak Voltage are less than 0.316 of their Peak Range values.

VOLT-AMPERES:

Volt-Amperes is calculated as the product of the rms Current and the rms Voltage. It has the same Full Scale ranges, resolution and uncertainty as POWER.

POWER FACTOR:

Power Factor is calculated as the ratio of Power to Volt-Amperes. It has a range from 0 to ±1.0000 and a resolution of .0001 for Volt-Ampere products greater than 7.5% of Full Scale. The resolution decreases as the Volt-Ampere product decreases. The uncertainty is ±0.002 ±10 digits up to 250kHz, ±0.004 ±20 digits from 250kHz to 500kHz, and ±0.008 ±40 digits from 500kHz to 1000kHz with option -01.

PHASE ANGLE:

The resolution of the phase angle between the current and the voltage is 0.01. The uncertainty is $\pm 0.17^\circ$ up to 250kHz, $\pm 0.34^\circ$ from 250kHz to 500kHz, and $\pm 0.68^\circ$ from 500kHz to 1000kHz with option -01.

HARMONICS:

The Harmonic amplitude is specified for the harmonic frequency below 1MHz. For this case, the specified uncertainty is that of the current or the voltage at the harmonic frequency and the range is that of the fundamental (the first harmonic). The uncertainty of the harmonic phase is three times greater than the uncertainty of the phase angle between the current and the voltage

FREQUENCY:

Frequency of Voltage or Current from 5.0000Hz to greater than 1MHz with five digits of resolution and an uncertainty of $\pm 100\text{ppm} \pm 1$ digit.

DISPLAY: High resolution graphical TFT

DIGITAL INTERFACE: USB, IEEE-488

DISPLAY UPDATE: 80ms

TEMPERATURE RANGE:

Operating 0°C to 40°C
Within Specifications $23^\circ\text{C} \pm 5^\circ\text{C}$
Storage -40°C to 75°C

RELATIVE HUMIDITY: Less than 90%

WARM-UP TIME: Thirty minutes for all specifications

POWER REQUIREMENTS: 100 to 260V rms, 47 to 63Hz, 30VA max.

PHYSICAL:

19" Rack Mountable, 3-1/2" high (2U)
Weight: (11pounds)
Size: 48.3cm x 8.90cm x 33.0cm (19" x 3.5" x 13")



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