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CLARKE - HESS MODEL 2330

SAMPLING V-A-W METER

HIGHLY ACCURATE • EXTREMELY BROADBAND • NIST TRACEABLE



HIGH ACCURACY

TRUE RMS/REALLY BROADBAND

The Model 2330 Sampling Volt-Ampere-Watt Meter is a precision, high accuracy, auto-ranging instrument which simultaneously measures and displays true rms Voltage, true rms Current and true mean Power over a frequency range from dc to more than 600kHz. Full scale Current and Voltage inputs are typically measured within ±0.1% of the reading in amplitude to at least 400kHz. The corresponding Power is typically measured to within ±0.1% of the input Volt-Amperes to 200kHz and to within ±0.2% of the input Volt-Amperes to 400kHz for loads of any Power Factor.

MULTI-FUNCTION

In addition to the rms Voltage, rms Current, and mean square Power the Model 2330 also simultaneously measures the peak Voltage, the peak Current and the Frequency and calculates the Volt-Ampere product, the Power Factor and the Energy accumulated over a period of time from 1-99 hours. These functions may be displayed or may be read over the IEEE-488.2 interface.

UNPARALLELED HIGH FREQUENCY ACCURACY

The Model 2330 allows broadband and high accuracy measurements of both sinusoidal and highly distorted wave shapes. The Current, Voltage, Power, and Power Factor accuracies to 400kHz of the Model 2330 far exceed any other sampling Volt-Ampere-Watt Meter, or for that matter, with respect to Current or Voltage, almost all conventional multimeters. Although reduced by a factor of two, excellent accuracy is maintained to 600kHz. Full scale Power ranges exist for loads with impedances from (0.6V/1.5A) = 0.4W to (600V/1.5mA) = 400kW.

WIDE MEASUREMENT RANGE

The Model 2330 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 600V) 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, Finished Transformers, 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 from DC to 600kHz, and the Characteristics of Electric Automobile Drives.

EASY TO CALIBRATE AND MAINTAIN

The Model 2330 is an all solid state instrument with optically isolated input channels. All integrated circuits are in sockets. 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 without screwdriver adjustments.

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UNIQUE SAMPLING APPROACH / ISOLATED INPUTS

The Voltage and Current inputs of the Model 2330 are simultaneously sampled (with 16 bit resolution), converted to digital form, and transmitted via optical links to the main chassis. This allows both the Current and Voltage inputs to be completely isolated from each other and from the main chassis. 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 prevents "beats" with their accompanying jitter in the displayed values.

IEEE-488.2 BUS CONTROL

The Model 2330 is equipped with an IEEE-488.2 interface which incorporates all of the Common Commands and Queries. Any function that can be entered via the front panel can be controlled via the IEEE bus. In addition, any or all of the functions which can be displayed, can be queried and sent simultaneously to the Controller over the bus. The status (e.g. Current range, Voltage range, etc) of the instrument may also be queried and sent over the bus. The bus address is set from the front panel and is displayed at turn-on and when the Local key is pressed. A Remote lamp indicates that the Model 2330 has been placed in its Remote state by the Controller.

SPECIFICATIONS

VOLTAGE

FULL SCALE RMS VOLTAGE	CALIBRATED PEAK RANGE	RESOLUTION	INPUT IMPEDANCE
2.000V	0 - 6V	1mV	1.05MW/15pF
20.00V	0 - 60V	10mV	1.01MW/15pF
200.0V	0 - 600V	100mV	1.00MW/15pF
2000 V*	0 - 850V	1 V	1.00MW/15pF

*The 2000V range is useable to 600V rms

Uncertainty: (rms)	±0.10% of reading±2 digits	dc, 5Hz to 200kHz
	±0.20% of reading ±4 digits	200kHz to 400kHz
	±0.40% of reading ±8 digits	400kHz to 600kHz
Uncertainty: (peak)	±0.10% of reading ±4 digits	dc, 5Hz to 200kHz
	±0.20% of reading ±8 digits	200kHz to 400kHz
	±0.40% of reading ±16 digits	400kHz to 600kHz
Isolation:	1000V peak between LO Terminal and Chassis	

CURRENT

FULL SCALE RMS CURRENT	CALIBRATED PEAK RANGE	RESOLUTION	INPUT IMPEDANCE
5.000mA	0 - 15mA	1µA	20
50.00mA	0 - 150mA	10µA	2Ω
500.0mA	0 - 1500mA	100µA	0.33 Ω
5000 mA	0 - 15A	1mA	0.04 Ω
EXTernal	0 - 300mV	-	20Ω

The Display on the EXT range is factory settable to read any value up to 5000, with any positioning of the decimal point, for a 100mV input.

Uncertainty: (rms)	±0.10% of reading ±5 digits	dc, 5Hz to 200kHz
	±0.20% of reading ±10 digits	200kHz to 400kHz
	±0.40% of reading ±20 digits	400kHz to 600kHz
Uncertainty: (peak)	±0.10% of reading±10 digits	dc, 5Hz to 200kHz
	±0.20% of reading ±20 digits	200kHz to 400kHz
	±0.40% of reading ±40 digits	400kHz to 600kHz
	The 5000mA range is speecified to only 400kHz.	
Isolation:	1000V between LO Voltage Terminal and Chassis	

POWER AND POWER x10

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. The Px10 range may be selected when both the Peak Current and the Peak Voltage are less than 0.316 of their Calibrated Peak Range values.

Resolution: 1 part in 10000 of the Full Scale range

Uncertainty: (any PF)	±0.10% of V-A ±10 digits	dc, 5Hz to 200kHz
	±0.20% of V-A ±20 digits	200kHz to 400kHz
	±0.40% of V-A ±40 digits	400kHz to 600kHz
	(V-A is the Volt-Ampere product)	

FREQUENCY

Frequency of Voltage or Current from 5.0000Hz to 640.00kHz with five digits of resolution and an uncertainty of ±100ppm ±1 digit.

VOLT-AMPERES

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

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 ±0.001 ±10 digits up to 200kHz and ±0.002 ±20 digits from 200kHz to 400kHz .

ENERGY

Calculated as the integral over time of the Power consumed by the Device under test multiplied by a 100msec time increment. Positive Energy has a resolution of 6 digits while negative Energy has a resolution of 5 digits. Energy may be accumulated for up to 99 hours in 1 hour increments.

DISPLAYS

Three LED (10.9mm/.43 inch high) Displays. Two four digit displays for Current and Voltage and a six digit display for Power and the other functions.

IEEE-488.2 INTERFACE SUBSETS: SH1, AH1, T6, L4, SR1, RL1, PP0, DT0, DC1

DISPLAY UPDATE . . . . . 10 times a second

SETTLING TIME . . . . . 5 seconds to reach 0.1% of Full Scale

TEMPERATURE RANGE

Operating . . . . . 0°C to 40°C
Within Specifications . . . . . 18°C to 25°C
Storage . . . . . -40°C to 75°C
Derate specifications by a factor of 2 when operating outside the 18°C to 25°C temperature bracket.

RELATIVE HUMIDITY . . . . . Less than 90%

WARM-UP TIME . . . . . Thirty minutes for all specifications

POWER REQUIREMENTS

100V ±10%, 120V ±10%, 220V ±10%, 240V ±10% (Rear Panel switch selectable) 50Hz to 400Hz. 1/2A AGC Fuse for 120V operation.
Power Consumption less than 24W (60Hz-120V).

PHYSICAL

Rack Mount kit available as an option
Weight: 6.85kilograms (15pounds)
Size: . . . . . 43.2cm x 13.3cm x 33.0cm (17" x 5.25" x 13")

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